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A Basin Wide "Transnational Action Program" for Preventive Flood Protection for the Oder

Jürgen Neumüller, Oliver Gretzschel, Sven Friedrich & Martin Reents

INFRASTRUKTUR & UMWELT, Prof. Böhm und Partner, Potsdam, Germany

Kurzdarstellung

Ein "Transnationales Aktionsprogramm" zum Hochwasserschutz an der Oder. Das Ziel des INTERREG III B Projekts "Transnational Action Program – Spatial Planning for Preventive Flood Protection in the Oder Catchment Area (OderRegio)", ist die Entwicklung alternativer Strategien zum Hochwasserschutz in Teilen des Oder-Einzugsgebietes. Zu diesem Zweck wird im Hinblick auf die Reduktion hochwasserbedingter Schadenspotentiale eine Wirkungsanalyse erstellt. Das Prinzip dieses Prozesses ist die aktive Kooperation, sowie die Einbindung der Hauptakteure der drei am Projekt beteiligten Länder. Repräsentanten sämtlicher regionaler Planungs- und Wasserwirtschaftsbehörden in der Oder Region sind involviert. Wichtige Schritte sind sowohl die Entwicklung von Hochwasser- und Schadenspotentialkarten, als auch die Bestandssicherung der wichtigsten Hochwasserschutzmaßnahmen.

Streszczenie

Projekt "Transgraniczny program działań" w celu prewencyjnej ochrony przeciwpowodziowej w regionie ujścia Odry. Projekt "Transgraniczny program działań - Prewencyjna ochrona przeciwpowodziowa w regionie ujścia Odry (OderRegio)", finansowany przez INTERREG III B, przyczynia się do rozwoju alternatywnej strategii ochrony przedpowodziowej na obszarach ujścia Odry. Analiza skutków powodzi ma na celu redukcję potencjalnych szkód spowodowanych powodziami. Aby osiągnąć ten cel, zakłada się aktywną współpracę i włączenie głównych aktorów z Niemiec, Polski i Czech. Te trzy kraje uczestniczą już w realizacji projektu. W proces ten zaangażowani są przedstawiciele wszystkich ważnych władz odpowiedzialnych za planowanie przestrzenne oraz zarządzanie wodą w regionie Odry. Nieodzownym jest sporządzenie map zawierających miejsca zagrożone powodzią i szkodami oraz wykazu najważniejszych przedsięwzięć przeciwpowodziowych.

1 The Need For Transnational Actions

1.1 The Initial Situation

Over the past decades and centuries extreme flooding has often occurred in the Oder valley causing considerable damage. The most severe event, the summer flooding in 1997, is still in memory of those who were affected; it caused enormous economic damage and unfortunately also loss of life (IKSO 1999, European Commission 1999). This extreme event illustrates clearly the risks which individuals take whenever they encroach upon flood endangered areas. At the same time this 1997 event also sparked new ideas on how the course and impacts of flooding could be influenced. In this respect – as in other river basins – a common understanding has evolved that an integrated approach to the problem is needed. This means that one must consider the whole river basin and various policy areas when developing new strategies to avert the danger (Heiland/Dapp 2001).

1.2 OderRegio: The Project and its Aims

Under the leadership of the Joint State Planning Department of Berlin-Brandenburg, several institutional partners from Germany, Poland and the Czech Republic set up the OderRegio project, co-financed by the European Union's INTERREG III B program (see <http://www.oderregio.org>). This three-year project has a budget of approximately three million euros; it is scheduled to run up to (and through) December 2006. The main aim of OderRegio is to establish a transnationally agreed spatial planning program of preventive flood measures for the complete Oder catchment area among the three countries traversed by the Oder, namely, the Czech Republic, Poland and Germany. The project partners will develop concrete, feasible actions such as spatial planning measures to enlarge retention areas (e.g. the building of polders, further reclamation of land and relocation of dikes), further measures to protect areas endangered by flooding, and measures to sensitise relevant actors, especially those impacted by the proposed changes.

National investment programs will be co-ordinated with the OderRegio program to prepare future activities related to protection from flooding in the complete Oder River catchment area. For various activities, priorities and responsibilities will be defined, costs will be determined and financing will be discussed. To achieve the overall goal some subordinate (technical) requirements have to be fulfilled:

- the generation of basic regional planning information to articulate the needs more precisely in the preparation and implementation of flood prevention measures;
- the creation of regional standards for flood prevention and protection from flooding (e.g. developing common legends);
- the improvement of data and the decision-making basis for preventive flood protection (viz., in particular, the damage potential from flooding);
- the identification of measures which can effectively reduce damage potential.

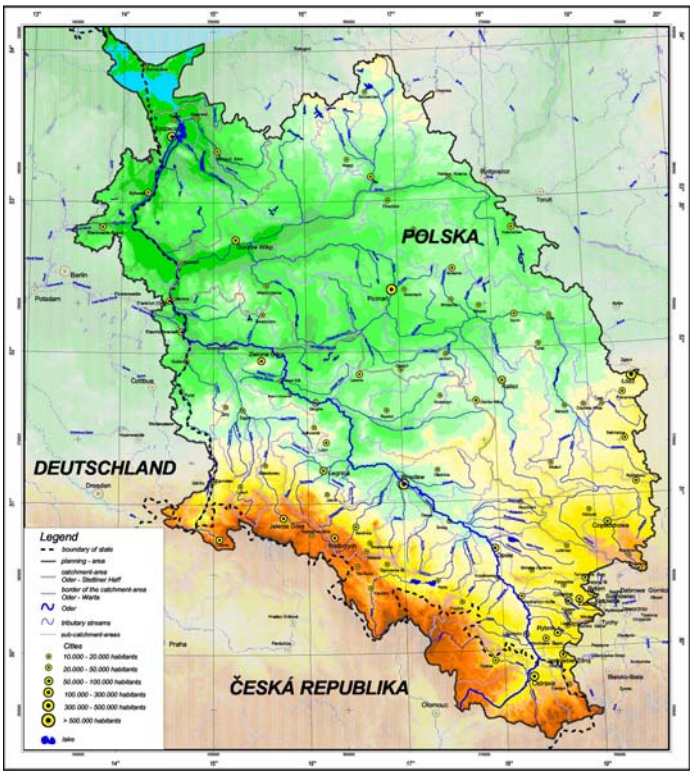

Figure 1: The Oder catchment (scale 1:750.000)

2 Information on Potential Flood Damage

The Oder has a total length of 854 km of which 742 km are in the Republic of Poland. Various regulations and measures over the last two centuries have resulted in the length of the Oder being reduced by about 20% from its original, natural state. The whole catchment covers an area of 118,861 km², of which 89% (106,821 km²) belong to the Republic of Poland, 5.4% (6,453 km²) are within the borders of the Czech Republic and 4.7% (5,587 km²) are in the Federal Republic of Germany. The river has its source at an altitude of 634 m NN in the Oder Mountains (Oderské Vrchy) of the Czech Republic. Many of the tributaries have their upper reaches in mountainous areas and therefore pose a special risk of flooding. Of particular concern here are the rivers in the Czech Republic as well as the tributaries Bóbr (Bober) and Nysa Klodzka (Glatzer Neiße) (see <http://www.mkoo.pl>). An overview of the catchment is given in figure 1. More than thirty towns have been identified as particular danger points (hot spots) along the Oder and its tributaries (Neumüller et al. 2003). These potentially endangered areas are shown in figure 2; their identification is based upon stream geomorphology of the catchment. In a next step these areas must be specified with the help of GIS- and model-based techniques and illustrated in more detailed flood danger maps.

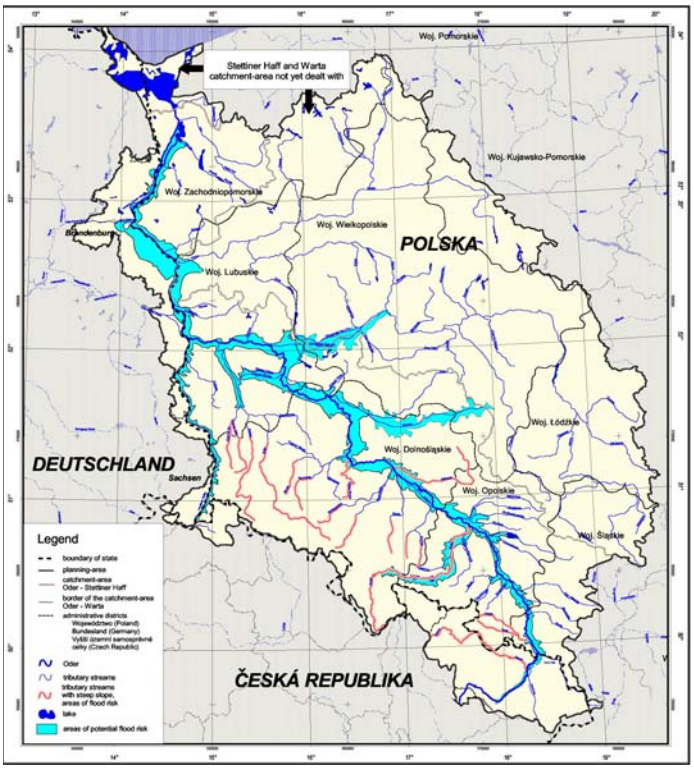

Figure 2: Areas of potential flood risk in the Oder catchment (scale 1:750.000)

2.1 Flood Danger Maps

One of the main tasks of OderRegio will be to produce flood danger maps for the whole length of the Oder River. These maps will be produced on a scale of 1:50,000; this will result in approximately 100 maps for the whole watercourse. The content of the maps will be flood areas for different flood scenarios like HQ-10, HQ-100 and HQ-extreme, and flooding depths for extreme events.

These maps have different functions and target groups. Flood danger maps represent, for example, an important source of information for *persons living within the potential flood areas* to sensitise them to the risks of flooding; thus the maps serve an educational purpose. Furthermore such maps provide the basic input for *regional planning* to determine which areas should be kept free of construction because of the flood risk. Flood danger maps are therefore an important tool to be used in preventive

flood protection and planning activities. Another target group for flood danger maps are *local public authorities*. As policymakers these agencies should be sensitised to areas at risk of potential flooding.

The development of flood danger maps will be achieved in several steps:

- First, water levels must be calculated. Relevant features of the river will be documented using hydro-technical constructions in the river itself, cross-sectional data, runoff data, and water-level gauge readings for the analysed flood scenarios (HQ-10, HQ-100 and HQ-extreme). These data will provide the input for developing a 2D water-level model (MIKE 11) for the Oder.
- The water levels thus calculated (on average a value should be produced for every 500 m of river length) will be used in conjunction with the GIS-based hydrodynamic software tool, "Flood Area", to determine which areas will flood. To this end, a complete digital elevation model is necessary. (Because of the transnational character of OderRegio data acquisition is a sensitive and difficult task for the project. Furthermore, data for the various countries are not always available in the same quality. This is the case especially concerning existing digital elevation models.)

The result of these series of steps will be maps indicating the flood areas for each of the three scenarios (HQ-10, HQ-100 and HQ-extreme). Thus potentially affected areas in the case of a flooding event can be can be made clearly visible for those persons who likely to be affected.

The hydrodynamic calculation for flood areas is done under the assumption that no pre-existing technical flood protection measures have been implemented. Thus the flood danger maps indicate a potential for flooding which might occur locally, rather than actually showing an entire flooded area in a real event.

What constitutes an extreme flood will be defined by water management experts. Different possibilities exist such as using HQ-500 based upon gauge statistics or comparison to a real event like the flooding in 1997, supplemented by a figure of, say, 0.5 m for the corresponding high water levels. A further aspect which has to be considered is occasional ice blockage in the Oder during the winter, because this factor can lead to augmented water levels greater than 0.5 m, compared to ice-free periods.

Real flood danger maps for the Oder are not yet available, but the *Rheinatlas* (Rhine Atlas) (IKSR 2001) provides a good example of how such maps appear. Figure 3 shows a typical Rheinatlas flood danger map.

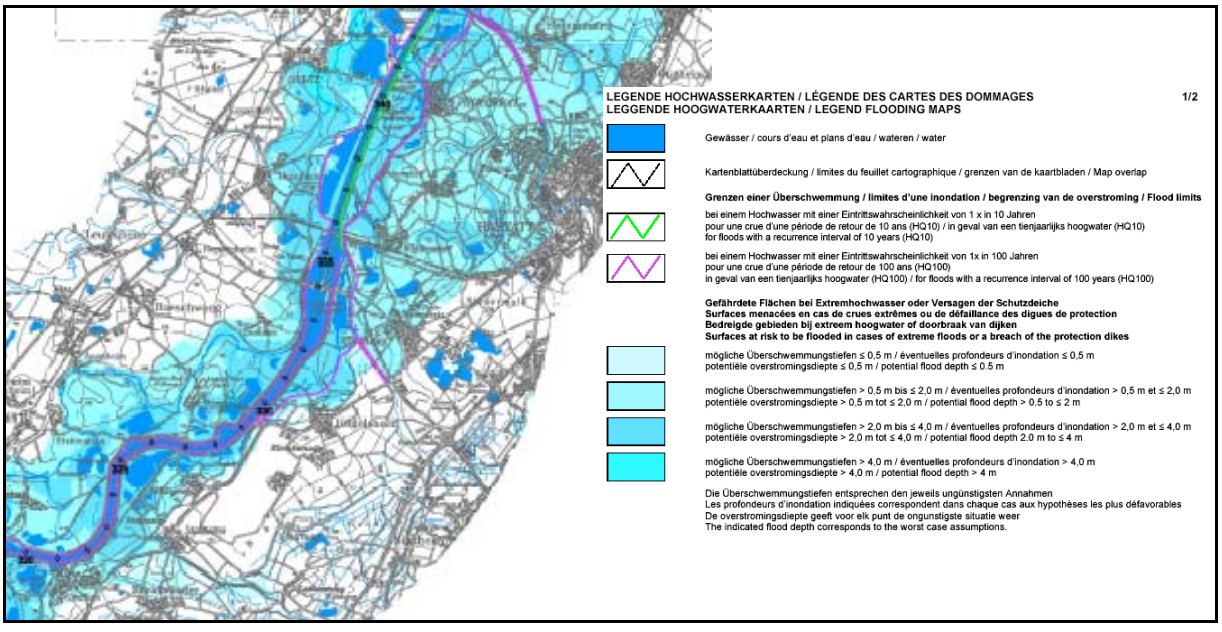

Figure 3: Example of a flood danger map in the Rheinatlas (IKSR 2001)

2.2 Calculation of Flood Damage

The purpose of this task is to calculate damage potential for the whole Oder River under the assumption that all flood protection facilities would collapse in an extreme event. Just as in the case for the flood danger maps, flood damage maps do not indicate that the whole Oder Valley would be affected in the way shown; rather they present a comprehensive picture suggesting which areas and what possible damages could theoretically occur. Data essential carrying out this task include the following:

- land-use characteristics in the affected flood plain,
- flood plain boundaries and depths of the HQ-extreme event,
- information on the population(s) which would be affected,
- determination of capital stocks from economic statistics for the different countries and land-use categories,
- regionalized damage functions for different land-use categories.

The types of land use which would be impacted by flooding are derived from real land use data, namely, from the so-called CORINE land-cover data. A total of forty-four established land-use categories were combined and condensed to yield six general categories which provide a sufficiently differentiated picture for flood damage consideration purposes. The six categories are: residential areas, industrial areas, infrastructure, agriculture, forest and other areas.

The intersection of the land-use data with potential flood areas provides the possibility to estimate flood danger potential. Economic statistics and damage functions permit an approximate calculation of damages for the different land-use categories. Figure 4 shows a section of a flood damage map taken from the *Rheinatlas* (IKSR 2001). The *Rheinatlas* flood damage maps are the model upon which future OderRegio flood damage maps (not yet available) will be based.

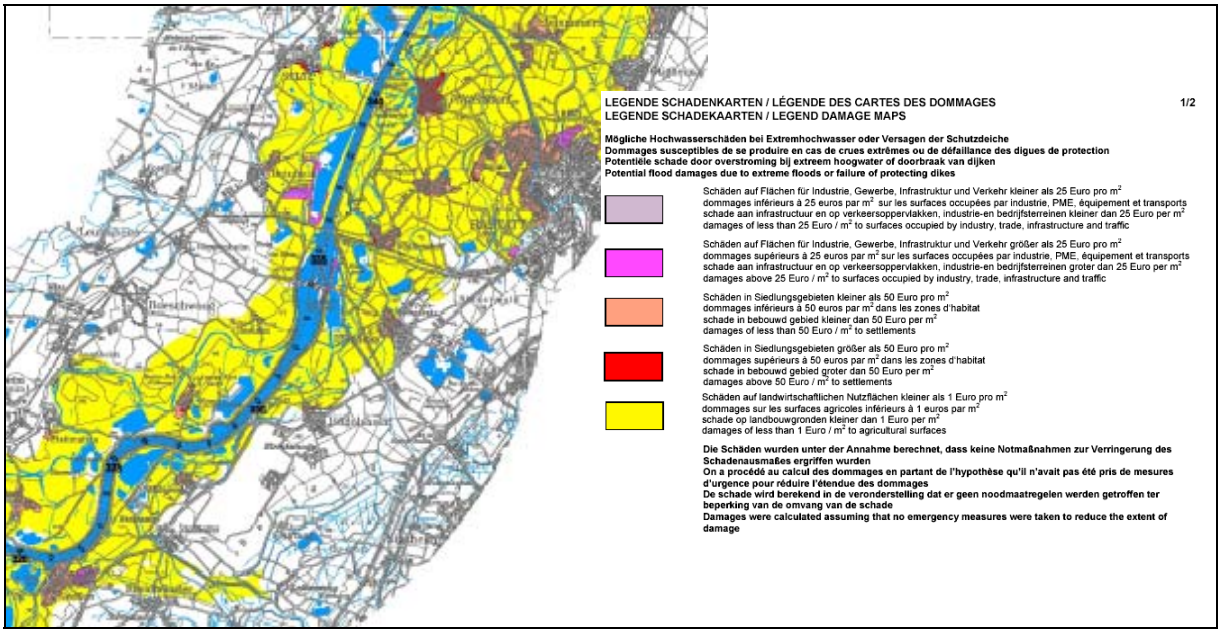

Figure 4: Example of a flood damage map taken from the *Rheinatlas* (IKSR 2001)

3 Action Program for Preventive Flood Protection

3.1 Fields of Action

The reduction of the flooding danger must take the impact interrelations and the various action possibilities into account. Here one must differentiate between various expert disciplines and expert administrations. Particular importance lies with spatial planning and water management. The task of

spatial planning is to use the control of land use and infrastructure and settlement development to reduce the occurrence of flooding and particularly to reduce the associated damage potential (compare MKRO 2000). Spatial planning can thus effectively support water management which in the past has carried the main responsibility for flood protection by providing technical flood protection measures. The six main fields of action are summarised in table 1 including criteria for a first evaluation of the flood protection potential. All these fields of action have to be pursued consequently and considered as a whole to reach an effective flood protection.

Table 1: Fields of action and measures for preventive flood protection

Field of Action		Initial Evaluation Criteria
1.	Retention of precipitation in the area where it falls (areal retention) 	➢ Degree of gradient ➢ Share of forest and agricultural areas ➢ Degree of soil erosion ➢ Share of settled areas with a potential for unsealing and rain water management
2.	Retention through technical flood prevention/protection measures 	➢ Degree of gradient ➢ Size of catchment area ➢ Suitability of location
3.	Preservation and safeguarding of current retention areas 	➢ Share/area/number/volume of current retention areas ➢ Degree of usage competition
4.	Creation and extension of retention areas 	➢ Share/area/number of extension possibilities for retention areas ➢ Degree of usage competition
5.	(Object) protection by using technical flood prevention/protection measures 	➢ Number of objects to be protected (including danger to living beings) ➢ Extent of the endangered areas
6.	Minimising damage potential 	➢ Extent of potential damage occurrence at present, especially in settled areas

3.2 Action Areas

In OderRegio the Oder catchment will be split into different action areas depending on special characteristics. The possible action areas, illustrated in figure 5 (below), are summarised as follows:

A. *Czech tributaries:* The area of the Czech tributaries covers the Opava in the West, the Olše in the East and the upper valley of the Oder itself. These relatively steep-gradient, fast-flowing tributaries represent a considerable dynamic and short-term flood danger because this mountainous region is characterised by scarp-faced inclines. What is recommended for this area is improvement in technical measures for flood prevention (e.g. reservoirs, retention basins), better retention of precipitation in the region, extension of the flood reporting system and local improvements to better protect buildings, other objects and living beings.

B. *Polish tributaries (Sudetes Mountains)*: This action area covers the Oder tributaries from the Sudetes Mountains, from the Nysa Kłodzka in the Southeast to the Bóbr in the Northwest. These relatively steep-gradient tributaries, because of their dynamic, present a considerable flood danger. This mountainous region is characterised by steep inclines which determine the amount of runoff and flood formation. The region of the Kotlina Kłodzka is treated as a separate action area, B1. Extremely severe floods with very short warning periods occur in this valley enclosed by mountains. Currently, the flood protection system consists of only two dry storage basins. In the upper partial catchment area of the Bóbr (action area B2) the gradient is very steep, resulting in frequent and considerable rises in the water level. The existing flood protection system, a combination of small reservoirs, dry basins and dikes, is already relatively well developed. Recommendations for this area include the improvement of technical flood prevention measures (e.g. reservoirs, retention basins), better retention of precipitation in the region, extension of the flood reporting system and local improvements in the protection of buildings, other objects and living beings.

C. *Lusatian Neisse*: The Lusatian Neisse action area is hydrologically a part of the Oder catchment area. It stretches from the source of the Lusatian Neisse to its mouth in the Oder. The source is located in the western part of the Sudetes Mountains; the river flows into the upper Oder valley through a region with a steep gradient. Here, too, the main focus of recommended actions is on technical retention measures (reservoirs, retention basins), but some precautionary measures are also necessary. These include control of land use, precautionary building and construction measures and measures designed to modify human behaviour.

D. *Ostrava-Opole (Oder)*: The potentially flood-endangered areas of the Oder between the towns of Ostrava and Opole, and the lower course of the Opava and Olše are important for this action area. These tributaries tend to have only slight to medium gradients. The first priority of recommendations is to keep and safeguard the current retention areas. In addition to this, further retention space must be created. The construction of a new reservoir near Racibórz is deemed to provide particularly effective protection for that town as well as for Opole and indeed also Wrocław. Further recommendations include the extension of the flood reporting system, improved protection of objects and rainwater management measures to ensure retention of precipitation in the downfall area.

E. *Opole-Wrocław (Oder)*: The medium-density population in the area between Opole and Wrocław is endangered by floods. This action area lies along the Oder between the two towns and also includes the lower valley of the Nysa Klodzka. The area is characterised by only slight gradients. For this area it is considered necessary and thus recommended that the already numerous, existing retention basins be extended and that flood reporting be expanded. The high degree of damage potential must be significantly reduced using special flood protection concepts for the Wocławski Węzeł Wodny.

F. *Wrocław to the mouth of the Lusatian Neisse*: The potentially flood endangered area on the Oder and the lower valley of the Bóbr are included together in this action area which is characterised by extensive agricultural use, a moderate population density and only a slight gradient on the Oder. In addition to maintaining and safeguarding natural retention areas, it is particularly recommended that additional, close-to-natural retention areas be created. An expansion of the flood reporting system is necessary and damage potential must be further reduced based upon a preventive flood protection concept focussing on precautionary measures in the surrounding area and in buildings.

G. *Mouth of the Lusatian Neisse-Szczecin (Oder)*: The action area between the mouth of the Lusatian Neisse and Szczecin covers an area along the Oder, which is potentially flood-endangered, including the Oderbruch floodplain. This action area contains particularly large segments of land used for agriculture, just behind the dikes, and also several municipal centres. For this area it is recommended that the current retention areas be preserved and safeguarded and that the possibilities for creating new retention space be exploited.

It is the objective of OderRegio to carry out more detailed analyses for some exemplary urban areas in order to point out the possibilities in preventive flood protection and to give some examples of best practice, such as properly informing local citizens and integrating them into the prevention/protection process.

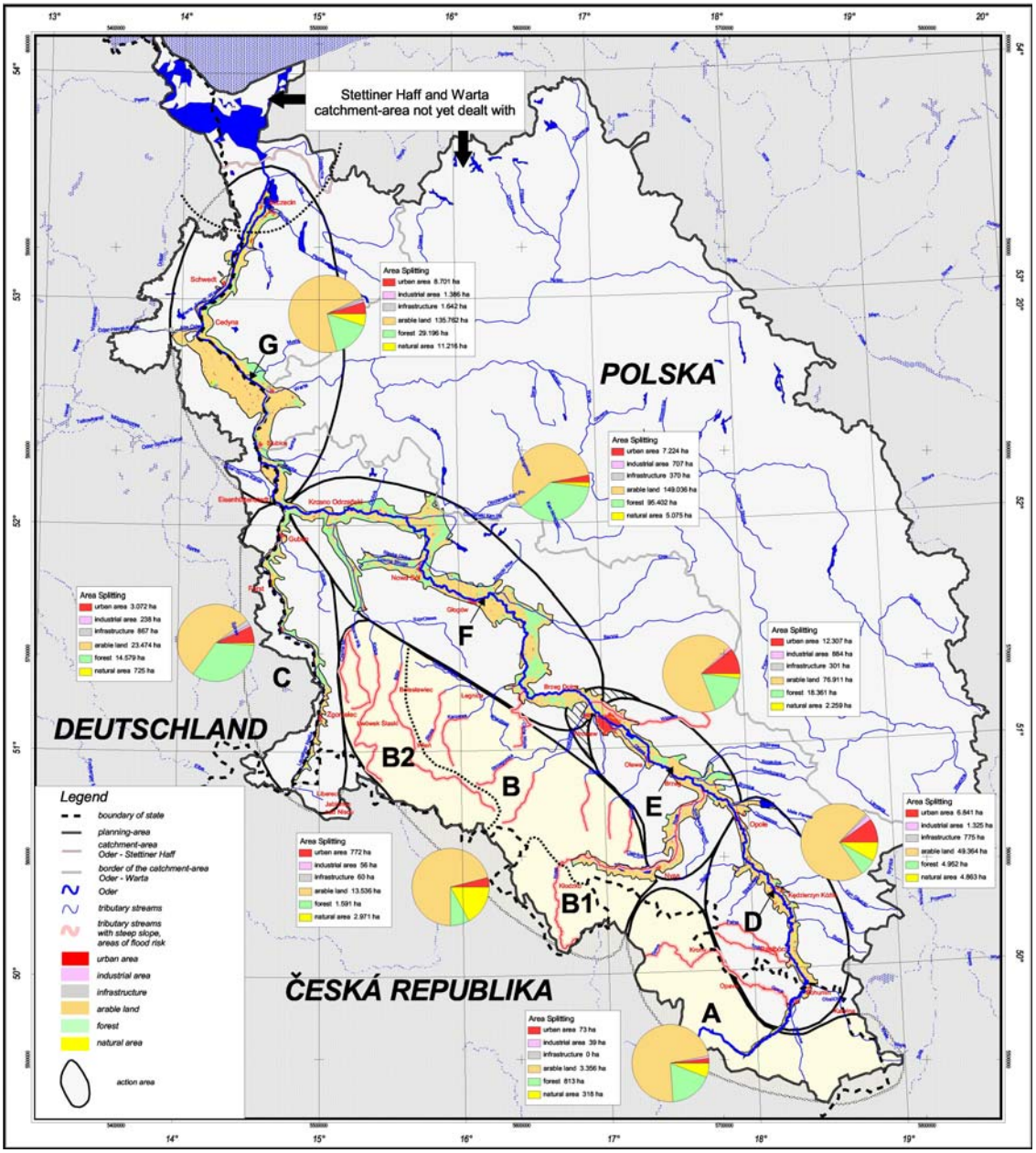

Figure 5: Action areas and land use in the potential flooded areas derived in OderRegio

3.3 The Action Programs

The International Commission for the Oder (IKSO) established a working group, "flood protection", which set up the "Action Program Flood Protection in the Oder Catchment". This program outlines a flood protection scheme which is designed to be achieved in three stages up to 2030 (IKSO 2004). The program has also drafted an initial list of measures to be taken in order to reach the goals defined. It is now the job of OderRegio to specify in greater detail, further articulate and justify this action program. Therefore the above-mentioned analyses, including a consideration of further potential measures, will be crucial to fulfilling this task.

The "Transnational Action Program" will become a viable reality through concrete measures and requirements including:

- alternative strategies for flood protection developed for partial areas,
- analysis of impacts with regard to the goal of reducing flood damage potential, and, finally,
- preparation and implementation of the most effective measures summarised within the action program.

To this end, a database has been built up, containing all of those already implemented measures as well as planned technical flood protection measures for the Oder catchment. Moreover, an extensive inquiry using the assistance of the responsible local authorities and/or agencies is being carried out.

Central flood protection measures are defined within the "Oder 2006 Program", a national reconstruction and modernisation program whose main task is the reconstruction and modernisation of flood-affected municipal infrastructures and the flood control infrastructures (Zaleski & Dendewicz 2003, ODRA 2001). This program was adopted by the Polish Government after violent floods in 1997, 1998 and 2001. Beyond this program many additional studies and inquiries have been carried out in the Oder catchment countries, since 1997. The proposed measures must be synthesised, discussed, refined and selected.

For this process of synthesis, discussion, refinement and selection, the principle is to establish active cooperation and involvement of the main actors from all three countries involved in the project - Germany, Poland and the Czech Republic. Representatives of all regional spatial planning authorities and water management authorities in the Oder region are involved. They are augmented by representatives from the fields of nature conservation, agriculture and forestry. Within this interdisciplinary group different possibilities and proposals for various combinations of measures will be developed and discussed. The final action program will contain a prioritisation of measures and measure packages which will have to be accomplished in the short-, middle- and long-term respectively. Furthermore the program will allocate responsibilities and specify costs and financing options.

In order to guarantee maximum workability and success of these jointly developed measures , the intended results of the project should be agreed upon politically. In addition target-group oriented, comprehensive public relations work will serve to promote the interests of flood protection.

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Address

Dr. Jürgen Neumüller
INFRASTRUKTUR & UMWELT
Prof. Böhm und Partner,
Gregor-Mendel-Str. 9
D-14469 Potsdam

E-mail: juergen.neumueller@iu-info.de