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Damage Assessment for different hazards using the Basic European Assets Map

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BEAM BASICS

Estimating damages and risks arising from hazardous events requires the possibility to estimate the monetary values of areas and objects exposed to these hazardous events. For that purposes the medium scale dataset BEAM has been developed. BEAM is the Abbreviation for **B**asic **E**uropean **A**ssets **M**ap. It is a geospatial dataset designed for modelling potential damages as a consequence of hazards as expressed in intensities.

The data attributes are expressed in values per m² for an easy use in any Geographic Information system. Assets are understood in the sense of monetary values for the following sectors and set set of layers:

- Private housing: buildings and equipment (urban immobile assets)
- Household goods (urban mobile assets)
- Vehicle assets
- Industry: buildings and equipment (industrial net asset value, immobile)
- Industry: stock in trade (industrial mobile assets)
- Service and trade: buildings and equipment (service net asset value, immobile assets)
- Service and trade: stock in trade (service mobile assets)
- Agriculture: buildings and equipment (agricultural net asset value, immobile assets)
- Agriculture: stock in trade without livestock (agricultureal mobile assets)
- Agriculture: livestock assets

Additionally, BEAM contains one combined layer that covers asset values for:

- Arable land
- Grassland
- Forest
- Road network
- Green urban areas and sport areas

BEAM also includes, as a non-monetary value, the population density.

The data are provided as shape files or other formats on request; an example is given in Figure 1.

gis_area_sqm	nuts0	nuts2	nuts_label	ln_value	label_ln	popdensity	building	household	vehicles	nav_agr	nav_ind	nav_service	livestoc
1066543.75569372	BG	41	Yugozapaden	31'200	Coniferous forest								
310109.480558578	BG	41	Yugozapaden	32'400	Transitional woodland-shrub								
2025289.43037431	BG	41	Yugozapaden	31'300	Mixed forest								
1192051.95108309	BG	41	Yugozapaden	32'100	Natural grasslands					0.01406258			0.02966
2278997.21625602	BG	41	Yugozapaden	23'100	Pastures					0.01406258			0.02966
791255.194266286	BG	41	Yugozapaden	32'400	Transitional woodland-shrub								
727525.040225216	BG	41	Yugozapaden	32'400	Transitional woodland-shrub								
663472.599333148	BG	41	Yugozapaden	11'200	Discontinuous urban fabric	0.00211882537	16.4847998	9.3867376441	8.06902778	0.10566442	1.1270295	2.5662537193	0.06173
581861.634484682	BG	41	Yugozapaden	31'300	Mixed forest								
915221.294142795	BG	41	Yugozapaden	21'100	Non-irrigated arable land					0.01406258			
44739785.4884643	BG	41	Yugozapaden	32'100	Natural grasslands					0.01406258			0.02966
0.181784810677922	BG	41	Yugozapaden	12'210	NAVTEQ_Streets_RT>4								
8319.206506123	BG	41	Yugozapaden	12'210	NAVTEQ_Streets_RT>4								
518646.013733125	BG	41	Yugozapaden	11'200	Discontinuous urban fabric	0.00211882537	16.4847998	9.3867376441	8.06902778	0.10566442	1.1270295	2.5662537193	0.06173
235893.178412255	BG	41	Yugozapaden	11'200	Discontinuous urban fabric	0.00211882537	16.4847998	9.3867376441	8.06902778	0.10566442	1.1270295	2.5662537193	0.06173
2.93828853215801	BG	42	Yuzhen tsentralen	12'210	NAVTEQ_Streets_RT>4								
453642.740306711	BG	34	Yugoiztochen	31'300	Mixed forest								
678544.706988854	BG	34	Yugoiztochen	22'100	Vineyards					0.01163986			
488993.491799541	BG	41	Yugozapaden	11'210	NAVTEQ_AdminBndy5	0.00211882537	16.4847998	9.3867376441	8.06902778	0.10566442	1.1270295	2.5662537193	0.06173
115853.877844032	BG	41	Yugozapaden	11'210	NAVTEQ_AdminBndy5	0.00211882537	16.4847998	9.3867376441	8.06902778	0.10566442	1.1270295	2.5662537193	0.06173

Figure 1: Example screen shot showing the content of the BEAM data set

In reality the value of many objects and areas comprise of much more than only the monetary value. Functionalities and the importance of objects are referred to by a table of so called “elements at risk” and these are handled as a supplementary object catalogue to be used either with BEAM or any similar assets map product.

BACKGROUND OF DEVELOPMENT

BEAM was created primarily within the FP7 project SAFER (Assmann & Müller, 2012) and has now been updated within FP7 IncREO. It is focused on a scale of about 1:100 000 and the intended use are national and European scales. One idea behind the concept is to have a common and comparable assets map layer for all of Europe. It can be used for cross border projects as well as a calibrator for national datasets with the ability to compare different more detailed studies. To facilitate such a dataset, the concept relies mainly on regularly updated and harmonized baseline datasets like CORINE Land Cover (CLC) as well as on statistical data from sources as Eurostat or OECD.

DATA MODELING

Monetary values are calculated by using the statistical figures and subsequent disaggregation to land use or land cover units by auxiliary values like number of employees or urban area. Landuse units of the final dataset can contain information for more than one asset component, for example roads can have a value for the road asset itself and also for the cars using it. The figure below illustrates a sub-section of the modelling of BEAM data values for vehicles.

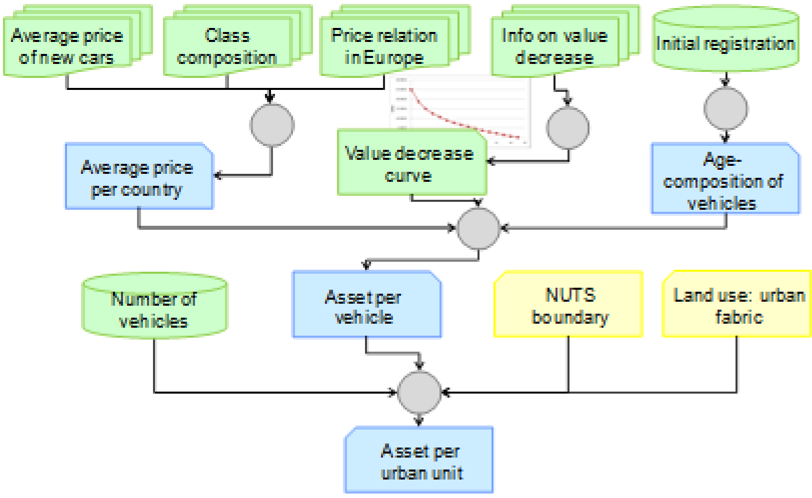

Figure 2: Example Scheme for the processing of the different input data to gain the area per unit value in Euro/m².

Data modelling is automated in the Relational Database Management System PostgreSQL.

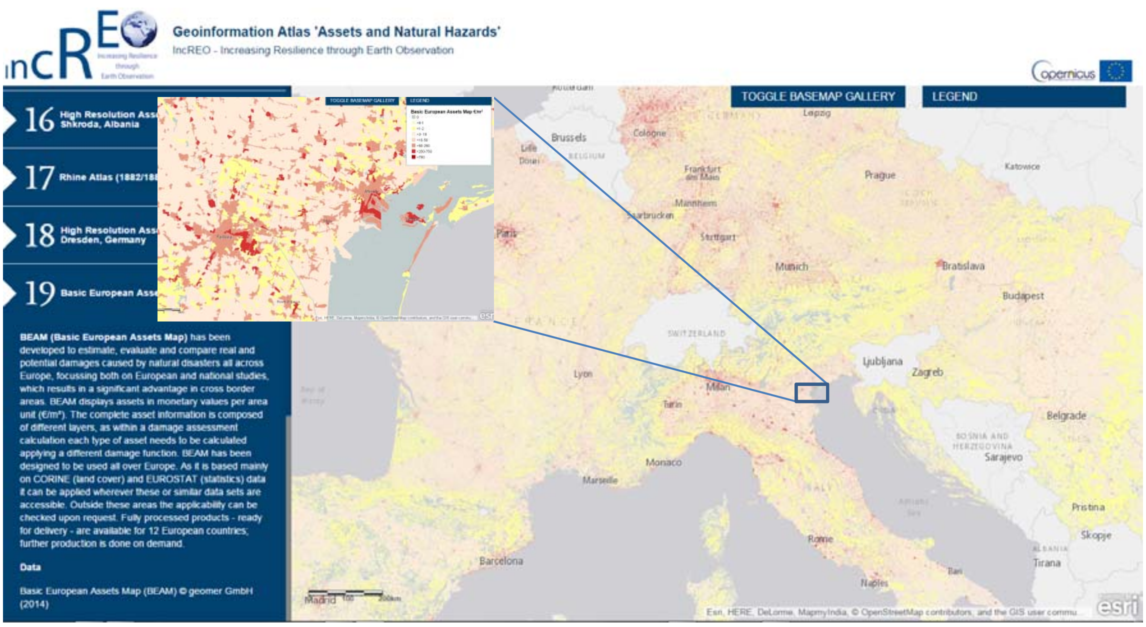

Figure 3: current BEAM Europe coverage as displayed on the Geoinformation Atlas of the IncREO project, enlarged section shows the area between Venice and Padova (Source: increo.geomer-maps.de).

UTILIZING BEAM

The dataset can be used for damage assessment of different natural hazards. However, most of the past applications were flood projects like the Elbe/Labe (*Community Initiative LABEL, 2012*) and Danube flood risk atlases (*Danube Atlas 2012 and Danube Floodrisk Project Partners, 2012*). Within the IncREO project it also has been applied for assessment of potential earthquake, landslide and storm surge damages.

The dataset is available off the shelf for 12 European countries (see Figure 3) and can be produced within a short period for every country covered by the CORINE Land Cover dataset. The dataset will be updated once a new CORINE Land Cover dataset has been released. The next release is expected end of 2014 or beginning of 2015. The reference year is 2012, so the changes in assets during the period of 6 years will be documented.

Version 2 of BEAM also makes use of the more detailed data of the Urban Atlas project and considers some additional information, such as different quality of agricultural land and forest, also rail networks have been added and the road network is handled in more detail.

To simplify the use of the BEAM dataset various damage functions for different types of natural hazards have been collected and harmonized. These functions are accessible via a web application that allows for a detailed search for damage functions. The functions can be exported using standard formats. For running a damage calculation for each of the layers in the chosen assets map a dedicated damage function is needed, the selection of damage functions needs to take into account the detailed definition and scale of the landuse layer to be used and needs to be compatible to it (see figures below). Technically, calculating the damages for individual hazard scenarios is simple, because the damage is just the result of multiplying a specific asset value with the respective normalized value of the damage function.

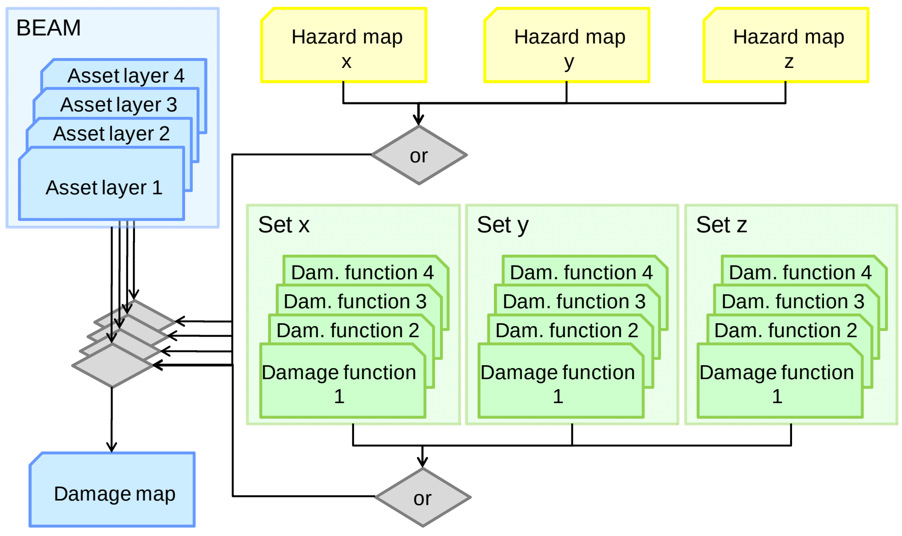

Figure 4: scheme showing the application of the BEAM data set: For each layer and natural hazard a different damage function is needed to calculate the expected damage for this layer. The total damage for a certain scenario is obtained by adding the damages of all the layers

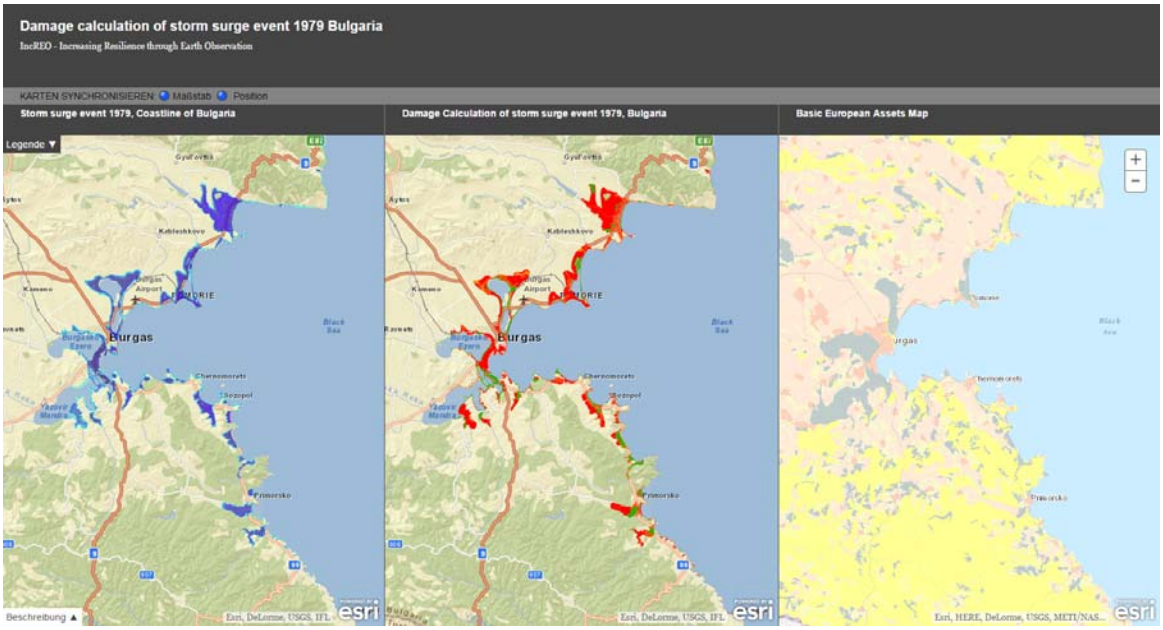

Figure 5: damage calculation for a storm surge event on the Bulgarian coast. Left: hazard intensity information, centre: derived damages, right: BEAM (displayed is the total asset value per m²).

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