SITE1.1

Local environment

Objective

Our objective is to protect the building and its users from the impact of negative environmental influences and extreme events, and to improve the resilience of buildings to any influences that might be present in the local environment.

Benefits

Natural hazards arise depending on the geographical conditions of the site. The intensity and frequency of these hazards generally cannot be changed and are hard to predict. This makes it all the more important to classify them correctly and to compensate for or to eliminate any potential adverse effects for the people in and around the building. Taking into account the likelihood and potential severity of each of these occurrences at the planning stage reduces the cost of any retrofitting work that might be necessary. Resilient buildings that are tailored to their environment are sustainable in many aspects.

Contribution to overriding sustainability goals

	CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS (SDGS) OF UNITED NATIONS (UN)		CONTRIBUTION TO THE GERMAN SUSTAINABILITY STRATEGY	
Significant	11.b	Implement policies for inclusion, resource efficiency and disaster risk reduction		
	11.5	Reduce the adverse effects of natural disasters		
	13.1	Strengthen resilience and adaptive capacity to climate related disasters		
Moderate	3.4	Reduce mortality from non-communicable diseases and promote mental health	3.2.a/b	Air pollution
	3.9	Reduce illnesses and death from hazardous chemicals and pollution		

Outlook

While the content of this criterion is tailored to DGNB System application for districts, it also applies within an international context. For applications within Germany, various platforms are being developed, including platforms geared to adapting to climate change. In the medium term, additional results will be incorporated into the criterion.

Share of total score

	SHARE	WEIGHTING FACTOR
Office **Education** **Residential** **Hotel** **Consumer market** **Shopping centre** **Department stores** **Logistics** **Production** **Assembly buildings**	**1.1%**	**2**

EVALUATION

In total, 14 topics are listed with their relevant indicators to evaluate the environmental risks in the local environment. For the first 11 indicators (indicators 1–11), only the top three most relevant environmental risks are evaluated, classified according to their relevance. Reasons for the individual choices with regard to natural disasters must be given. As a rule, the likelihood of natural disasters occurring is analysed for the purpose of the evaluation. Any auxiliary safety measures implemented on, around or for the building will also be reflected positively in the evaluation. Based on the individual natural disasters, points can be awarded for compensation measures in the surrounding area, up to the maximum number of points permitted for the indicator. Indicators 12, 13 and 14 must be evaluated. In this criterion, a maximum of 100 points can be awarded.

NO.	INDICATOR	MOST AND SECOND MOST RELEVANT X 1.0	THIRD MOST RELEVANT X 0.5
1	**Earthquake**		**Max. 20**
1.1	**Earthquake hazard level**		Max. 20
	Hazard level (earthquake intensity, hazard, 475-year event)		
	■ High (> 8)	0	0
	■ Average (> 5)	5	2.5
	■ Low (< 5)	10	5
	■ Very low (< 1)	20	10
1.2	**Earthquake compensation measures**		Max. 10
1.2.1	There is a regional early warning system for earthquakes and a concept for the district indicating what measures must be taken if a warning is issued.	+5	+2.5
1.2.2	There are dedicated earthquake-proof shelters.	+5	+2.5
1.2.3	A risk analysis has been carried out for the building.	+5	+2.5
1.2.4	The safety measures proposed in the risk analysis have been implemented.	+5	+2.5
2	**Volcanic eruption**		**Max. 20**
2.1	**Volcanic eruption hazard level**		Max. 20
	■ Last volcanic eruption was more than 20 years ago or there is a known, acute risk	5	2.5
	■ Last volcanic eruption was more than 50 years ago	10	5
	■ Last volcanic eruption was more than 100 years ago or no volcanic eruption	20	10
2.2	**Volcanic eruption compensation measures**		Max. 10
2.2.1	There is a regional early warning system for volcanic eruptions and a concept is developed for the district, indicating what measures must be taken if a warning is issued.	+5	+2.5

NO.	INDICATOR	MOST AND SECOND MOST RELEVANT X 1.0	THIRD MOST RELEVANT X 0.5
2.2.2	The building is situated on a site that is normally not directly affected adversely by lava and/or debris.	+5	+2.5
2.2.3	A risk analysis has been carried out for the building.	+5	+2.5
2.2.4	The safety measures proposed in the risk analysis have been implemented.	+5	+2.5
3	**Avalanches**		**Max. 20**
3.1	**Avalanche hazard level**		Max. 20
	■ Red (Seriously vulnerable area during an avalanche)	0	0
	■ Blue (Rare avalanches; structural measures must be implemented, danger primarily outside)	5	2.5
	■ Yellow (low hazard)	10	5
	■ White (no hazard or negligible hazard)	20	10
3.2	**Avalanche compensation measures (with a direct impact on the building)**		Max. 10
3.2.1	Structural measures to protect against avalanches (e.g. supporting structures, avalanche dams, avalanche galleries or physical protection to stop avalanches)	+5	+2.5
3.2.2	A risk analysis has been carried out for the building.	+5	+2.5
3.2.3	The safety measures proposed in the risk analysis have been implemented.	+5	+2.5
4	**Storm**		**Max. 20**
4.1	**Storm hazard level**		Max. 20
	"Winter storm, hazard, 50-year event"		
	■ > 50	0	0
	■ > 25	10	5
	■ < 25	20	10
4.2	**Storm compensation measures (with a direct impact on the building)**		Max. 10
4.2.1	There are no adjacent large open spaces without vegetation or water areas.	+5	+2.5
4.2.2	90% of all the surrounding buildings have no more than four storeys (because the wind load on a facade increases exponentially in relation to its height).	+5	+2.5
4.2.3	A risk analysis has been carried out for the building.	+5	+2.5
4.2.4	The safety measures proposed in the risk analysis have been implemented.	+5	+2.5
5	**Floods**		**Max. 20**
5.1	**Flood hazard level**		Max. 20
	■ Very high (flood hazard every 10 to 50 years)	0	0
	■ Medium (flood hazard every 50 to 100 years)	5	2.5
	■ Low (flood hazard less than every 100 years)	10	5
	■ No flood hazard	20	10

NO.	INDICATOR	MOST AND SECOND MOST RELEVANT X 1.0	THIRD MOST RELEVANT X 0.5
5.2	**Flood compensation measures (with a direct impact on the building)**		Max. 10
5.2.1	Flood protection concept based on usage requirements	+5	+2.5
5.2.2	(Temporary) structural measures for flood protection (e.g. dam)	+3	+1.5
5.2.3	Safe distance of the ground floor (> 15 cm) above the water level of a 50-years flood event	+3	+1.5
5.2.4	Enlargement of retention areas within the project area	+3	+1.5
5.2.5	A risk analysis has been carried out for the building.	+5	+2.5
5.2.6	The safety measures proposed in the risk analysis have been implemented.	+5	+2.5
6	**Heavy rain**		**Max. 20**
6.1	**Heavy rain hazard level**		Max. 20
	If available, local storm rainfall event catalogue published in a country can be used as reference for the evaluation of this indicator. The evaluation is based on a storm rainfall event (mm of rainfall in 1 hour):		
	■ ≥ 36 mm rain in 1 hour or ≥ 50 mm rain in 6 hours (extreme weather warning); recurs every 10 years	10	5
	■ ≥ 32 mm rain in 1 hour or ≥ 45 mm rain in 6 hours (severe weather warning); recurs every 10 years	15	7.5
	■ ≥ 28 mm rain in 1 hour or ≥ 40 mm rain in 6 hours	20	10
	■ Heavy rain events could not be assigned to hazard maps in the project as these are not available	0	0
6.2	**Heavy rain compensation measures (with a direct impact on the building)**		Max. 10
6.2.1	There is a heavy precipitation expert report containing site-specific statements on precipitation depths and rates based on the duration of the precipitation and the recurrence interval (in years), (e.g. in accordance with a locally available storm rainfall event catalogue).	+5	+2.5
6.2.2	A risk analysis has been carried out for the building.	+5	+2.5
6.2.3	The safety measures proposed in the risk analysis have been implemented.	+5	+2.5
7	**Hail**		**Max. 20**
7.1	**Hail hazard level**		Max. 20
	The evaluation is based on the classification of locally available "hail zones" hazard maps (e.g. ESPON risk maps)		
	■ High zone	0	0
	■ Elevated zone	5	2.5
	■ Moderate zone	15	7.5
	■ Low zone	20	10
7.2	**Hail compensation measures**		Max. 10
7.2.1	A risk analysis has been carried out for the building.	+5	+2.5
7.2.2	The safety measures proposed in the risk analysis have been implemented.	+5	+2.5

NO.	INDICATOR	MOST AND SECOND MOST RELEVANT X 1.0	THIRD MOST RELEVANT X 0.5
8	**Landslide/subsidence**		**Max. 20**
8.1	**Landslide/subsidence hazard level**		Max. 20
	■ Hazardous due to the sloping location (incline of over 20 degrees) or location in a mining region and/or due to civil engineering measures (construction of underground railway or similar)	0	0
	■ Not at risk	20	10
8.2	**Landslide/subsidence compensation measures (with a direct impact on the building)**		Max. 10
8.2.1	Analysis and assessments of the soil conditions, involving the relevant geology and mining authorities in collaboration with geologists possessing local knowledge. The following topics must be analysed:		
	■ Research on maps showing tunnels and shafts		
	■ Research on historical tunnels		
	■ Groundwater levels (maximum levels)		
	■ Slope instability		
	■ Cartographic review of the topography, morphology, geological strata and source horizons.		
	■ Check for moisture infiltration and penetration into soils on sloping locations		
	■ Karstification of soils as a risk	+5	+2.5
8.2.2	Structural protection measures, e.g.:		
	■ Installation of drainage systems, either on the surface or deep into the subsoil (e.g. drainage anchors)		
	■ Preventive installations in the vulnerable subsoil – similar to torrent and avalanche shoring systems		
	■ Short-term stabilisation of moving slopes by means of concrete and steel reinforcement (e.g. military anti-tank obstacles)		
	■ Extensive coverage of critical slopes by tarpaulins in order to prevent further penetration of rainwater	+5	+2.5
8.2.3	A risk analysis has been carried out for the building.	+5	+2.5
8.2.4	The safety measures proposed in the risk analysis have been implemented.	+5	+2.5
9	**Storm surge/tsunami**		**Max. 20**
9.1	**Storm surge/tsunami hazard level**		Max. 20
	By allocation to the "Tsunami/storm surge" hazard map		
	■ Very high risk	5	2.5
	■ Moderate risk	10	5
	■ Low risk	20	10
9.2	**Storm surge/tsunami compensation measures**		Max. 10
9.2.1	There is a regional early warning system for storm surges/tsunamis and a concept		

	for the surrounding district is developed, indicating what measures must be taken if a warning is issued.	+5	+2.5

NO.	INDICATOR	MOST AND SECOND MOST RELEVANT X 1.0	THIRD MOST RELEVANT X 0.5
9.2.2	The surrounding district is on a site that is normally not directly affected by storm surges/tsunamis (e.g. mountaintop).	+5	+2.5
9.2.3	A risk analysis has been carried out for the building.	+5	+2.5
9.2.4	The safety measures proposed in the risk analysis have been implemented.	+5	+2.5
10	**Extreme climates**		**Max. 20**
10.1	**Hazard level for extreme climates/temperatures in accordance with ESPON map or with other comparable hazard maps**		Max. 20
	■ High risk	5	2.5
	■ Moderate risk	10	5
	■ Low risk	20	10
10.2	**Extreme climates compensation measures**		Max. 10
10.2.1	Structural measures to alleviate the effects of extreme climates	+5	+2.5
10.2.2	Organisational measures to alleviate the effects of extreme climates	+5	+2.5
10.2.3	A risk analysis has been carried out for the building.	+5	+2.5
10.2.4	The safety measures proposed in the risk analysis have been implemented.	+5	+2.5
11	**Forest fires**		**Max. 20**
11.1	**Forest fire hazard level**		Max. **20**
	■ Last forest fire was more than 10 years ago in the immediate vicinity of the building/district	5	2.5
	■ Last forest fire was more than 20 years ago in the immediate vicinity of the building/district	10	5
	■ Last forest fire was more than 50 years ago or no forest fires in the immediate vicinity of the district	20	10
11.2	**Forest fire compensation measures**		Max. 10
11.2.1	There is a regional early warning system for forest fires and a concept for the district indicating what measures must be taken if a warning is issued.	+5	+2.5
11.2.2	The district is situated on a site that is normally not directly affected by forest fires.	+5	+2.5
11.2.3	A risk analysis has been carried out for the building.	+5	+2.5
11.2.4	The safety measures proposed in the risk analysis have been implemented.	+5	+2.5

NO.	INDICATOR	POINTS
12	**Air quality**	**Max. 20**
12.1	**Compliance with legally required limit values for air quality characteristics** In the surrounding area, the particulate matter (PM_{10}) and nitrogen dioxide (NO_2) limit values are exceeded with the following frequencies in one year:	Max. 20
		+Max. 10
	■ PM_{10} exceeded on no more than 35 days	5
	■ PM_{10} not exceeded	10
		+Max. 10
	■ NO_2 exceeded on no more than 18 three-hours-intervals (over the one-hour-daily maximum value)	5
	■ NO_2 not exceeded	10
12.2	**Air quality compensation measures**	Max. **10**
12.2.1	Positive change in the emission level in the surrounding area, e.g. as a result of facade greening, the creation of ventilation corridors, photocatalysis on the facade	+5
12.2.2	A risk analysis has been carried out for the building.	+5
12.2.3	The safety measures proposed in the risk analysis have been implemented.	+5
13	**Outdoor noise**	**Max. 20**
13.1	**Outdoor noise level**	Max. **20**
	Noise level specified in accordance with table 1 or with comparable local minimum requirements for noise protection or country-specific noise maps. The worst value e.g. on map is considered for the evaluation of this indicator.	
	■ > 75 dB(A) (noise level range VI and VII in accordance with table 1)	0
	■ < 75 dB(A) (noise level range IV and V in accordance with table 1)	10
	■ < 65 dB(A) (noise level range II and III in accordance with table 1)	15
	■ < 55 dB(A) (noise level range I in accordance with table 1)	20
	Reduction factor from air traffic: Aircraft noise is recorded and mapped as part of the noise mapping of environmental noise done throughout Europe (EU Directive 2002/49/EC). These noise maps, or other comparable local maps for non-EU countries, can be used for the purpose of this criterion. The allocation of points and the associated downgrading of the protection zones are based on the noise protection zones prescribed in a country. For this purpose, the location of the building and its surrounding must be examined and classified with regard to noise pollution caused by air traffic.	

COLUMN LINE	1 NOISE LEVEL RANGE	2 RELEVANT EXTERNAL NOISE LEVEL	3 ROOM TYPES	4	5
			BEDROOMS IN HOSPITALS AND SANATORIA (CONVALESCENT HOMES)	COMMON ROOMS IN APPARTMENTS, OVERNIGHT ROOMS IN ACCOMMODATION SITES, CLASSROOMS AND SIMILAR	OFFICE ROOMS [1] AND SIMILAR
			REQUIRED $R'_{W,RES}$ OF THE EXTERNAL BUILDING COMPONENT IN DB		
1	I.	up to 55	35	30	-
2	II.	56 up to 60	35	30	30
3	III.	61 up to 65	40	35	30
4	IV.	66 up to 70	45	40	35
5	V.	71 up to 75	50	45	40
6	VI.	76 up to 80	[2]	50	45
7	VII.	> 80	[2]	[2]	50

[1] The requirements do not apply to external building components of rooms, which only make a minor contribution to the interior noise level, and are operated in order to carry out activities in the room.

[2] The requirements to be determined here vary depending on local conditions.

[3]

Table 1 - Airborne sound insulation minimum requirements for external building components - Source: German DIN 4109-89 Table 8

13.2	**Outdoor noise compensation measures**	Max. 10
13.2.1	Building oriented/positioned so as to minimise the noise level in common areas both indoors and outdoors (noise protection development).	+5
13.2.2	The floor plans have been drawn up so as to incorporate noise protection, so that the required indoor noise levels can be achieved without implementing active measures.	+5
13.2.3	An expert report has been drawn up for the planned building and the outdoor areas; optimisation measures have been implemented.	+5
13.2.4	The optimisation measures proposed in the expert report have been implemented.	+5

NO.	INDICATOR	POINTS
13.3	**Reduction factors for air traffic noise:** NOTE: L_{den} = overall noise indicator (or also day-evening-night noise indicator) as described in the Environmental Noise Directive EU 2002/49/EC	Reduction factor for 13.1 und 13.2
	■ Noise protection zone 1: L_{den} higher than 75 dB(A). Generally no new apartments or facilities in need of protection should be constructed in protection zone 1.	- 75%
	■ Noise protection zone 2: L_{den} 67 to 75 dB(A). No facilities in need of protection, e.g. schools, hospitals, etc., may be constructed in protection zone 2. Apartments are only possible with special sound insulation	

requirements, but they are still severely impaired by noise since the sound insulation only applies to the interior and the exterior is still seriously affected. -50%

- Noise protection zone 3: L_{den} 62 to 67 dB(A). Protection zone 3 corresponds to the limit value for road and rail traffic in a business area. -20%

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14 Radon

14.1 **The radon concentration in the indoor air is determined based on the requirements of the relevant local standards.** **Max. 10**
Note: Limit values Q2 a/b listed in the WHO International Radiation Project (IRP) can be also considered.

- Radon ground air concentration is accurately assessed **+5**
- If the radon concentration exceeds 100 Bq/m³ appropriate remediation measures must be carried out in the building to prevent or significantly hinder seepage of radon from the ground. +5

SUSTAINABILITY REPORTING AND SYNERGIES

Sustainability reporting

The environmental effects determined in indicators 1 to 12 and their units are good key performance indicators (KPIs) to report.

NO.	KEY PERFORMANCE INDICATORS (KPIS)	UNIT
KPI 1	Classification of the environmental risks in accordance with the evaluation (indicators 1–12)	[-]

Synergies with DGNB system applications

- **DGNB DISTRICT:** Indicators 1–11 correspond to the content of criterion ENV1.6, the environmental risks from the schemes for urban districts, business districts and industrial sites.

APPENDIX A – DETAILED DESCRIPTION

I. Relevance

The following benefits for companies, municipalities and/or users can be achieved:

- Increased safety for residents and users of the district against natural disasters
- Avoidance of follow-up costs for natural disasters (e.g. temporary flood protection dams, technical conversions, dismantling of buildings and/or infrastructure)
- Value stability of buildings, circulation areas and open spaces

II. Additional explanation

The number of natural disasters across the world has risen steeply over the last few years (see figure 1).
The social, economic and ecological impacts of these disasters are enormous and are impossible to quantify.

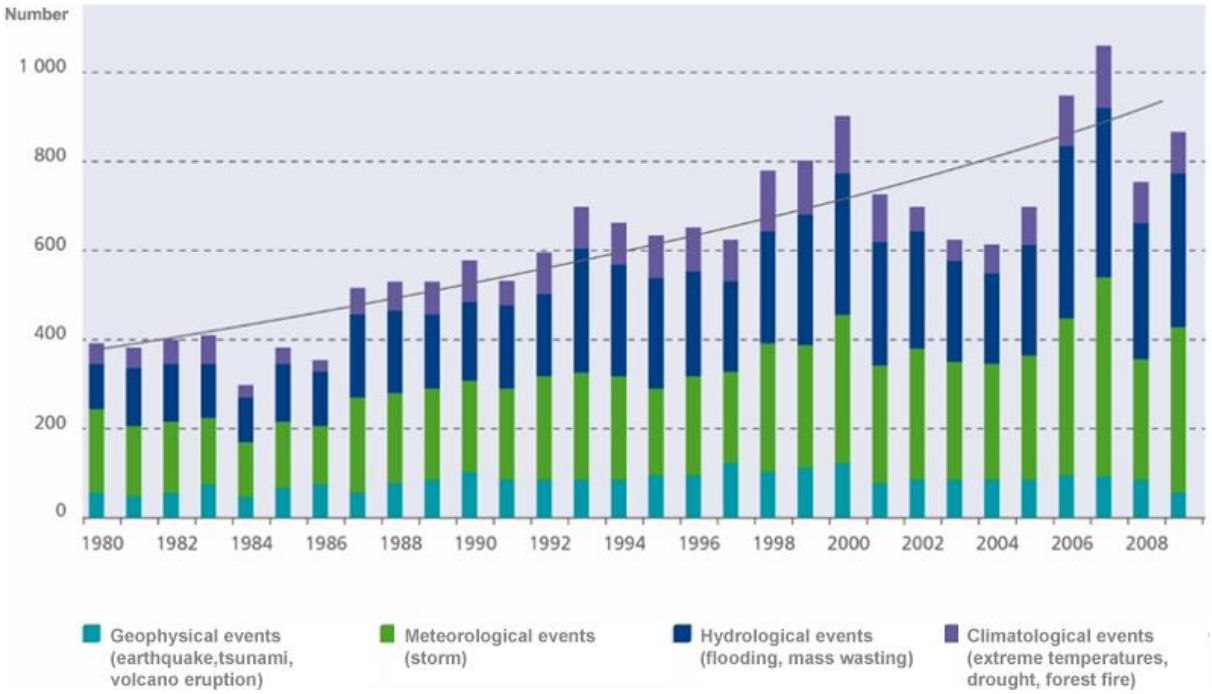

Figure 1 Number of natural disasters worldwide between 1980 and 2009 with trend line; source: Our own graph in accordance with Munich RE: "Wetterextreme, Klimawandel, Cancun 2010 Elektronische Pressemappe" [Extreme weather, climate change, Cancun 2010 Electronic press map], as of 2.11.2010

Due to the limited availability of land suitable for settlement, it will be difficult in the future to completely avoid expanding settlements onto areas exposed to certain hazards. For this reason, both organisational and structural measures must be implemented to protect people in these areas.

NOTE: the evaluation of some of the SITE1.1 indicators is based on the respective risk maps provided by the European Spatial Design Observation Network (ESPON). The ESPON maps are available online to download (see “Liter-

ature”).

For countries not covered by ESPON maps, the auditor will be required to identify alternative sources of risk data. After consultation with DGNB regarding already existing alternative sources, it is agreed that the alternative data will not use the same categorisation of risks. The points for the checklist must be recalibrated to suit the different number of risk categories in the alternative source.

III. Method

The likelihood of occurrence of natural disasters is analysed for the purpose of evaluation. Compensation measures can be credited for some natural disasters.

The criterion is evaluated based on the following indicators:

(1) Environmental risk 1 – most relevant: Factor x 1.0

(2) Environmental risk 2 – second most relevant: Factor x 1.0

(3) Environmental risk 3 – third most relevant: Factor x 0.5

The regional relevance of the natural environmental risks listed below for the district in which the building is situated must be determined (by scoping) in an initial step. For this purpose, the three most relevant environmental risks must be determined based on the described methods. The choice must be explained. This method is designed to reduce the amount of work involved (such as evaluating the risk of an avalanche on lowlands, the risk of flooding far from any bodies of water or the risk of heavy rain events).

In addition, in order to comply with the EU-Taxonomy requirements (environmental goal: mitigation of climate change), it must be specified separately in the verification process and accordingly confirmed that all physical climate risks have been analysed and in the risk analysis as well as the mitigating measures that may result from this Indicators the future climate development scenarios have been used.

The following environmental risks are considered:

Indicator 1: Earthquake

Earthquakes are regarded as measurable vibrations of the ground. Severe earthquakes can destroy houses, buildings and other structures, trigger tsunamis and landslides, and kill people and animals.
The earthquake hazard map published by the ESPON can be used (see figure 2). If available, more detailed hazard maps can generally also be used.

EMS INTENSITY	DEFINITION OF THE INTENSITY	DESCRIPTION OF THE MAXIMUM IMPACT
0–5	Imperceptible – highly perceptible	Buildings and hanging objects sway significantly, no objects are shifted from their original positions.
5–6	Highly perceptible – minor damage to buildings	Buildings in poor condition sustain minor damage (e.g. cracks appear in the walls, plastered areas fall off).
6–7	Minor damage to buildings	Sturdy buildings sustain moderate damage (e.g. small cracks appear in the walls, plaster falls off, chimney fragments fall off).
7–8	Major damage to buildings	Simple buildings sustain major damage (e.g. sections of gables and roof cornices collapse).

> 8	Destruction	Common, sturdy structures exhibit major damage (e.g. load-bearing building components collapse).

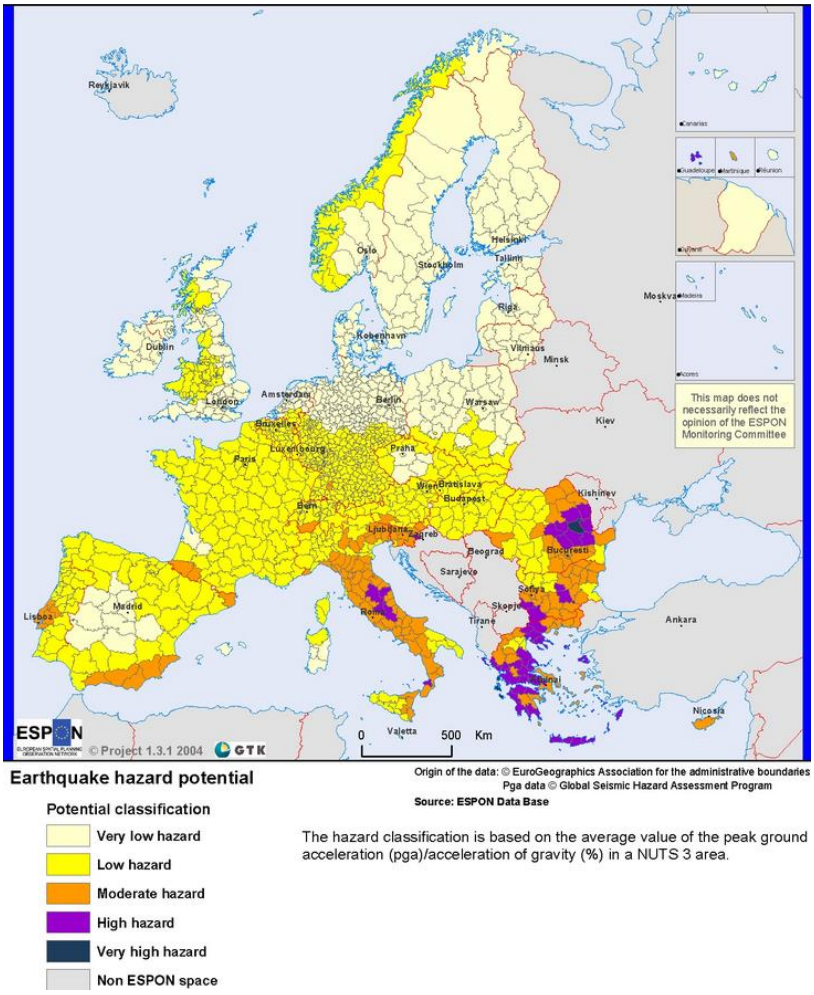

Figure 2 Earthquake hazard potential map, ESPON

Indicator 2: Volcanic eruption

Volcanic eruptions represent a serious environmental risk in some regions of the world. The risk of being affected by volcanic eruptions is assessed based on the length of time since the most recent volcanic eruption. In Europe, the volcanic hazard map published by the ESPON can be used to assess the risk. If available, more detailed hazard maps can generally also be used.

Indicator 3: Avalanches

Avalanches are defined as large masses of snow or ice which break loose from mountain slopes and slide or rush down into a valley. Avalanches that cause significant injury and damage to property and the environment are classified as natural disasters. The risk of avalanches is particularly high in the foothills of the Alps (see figure 3).

The evaluation assesses the hazard level and the measures put in place to protect against avalanches. The hazard level is determined based on the regional and current avalanche hazard map (combination of intensity and likelihood of occurrence) containing the categories 0 (no risk, white), 1 (low risk, yellow), 2 (occasional risk, blue) to 3 (considerable risk, red), which is published by the municipalities in question, if relevant to the region.
As a rule, the evaluation should be carried out using local detailed avalanche maps. If these maps are not available, the ESPON avalanche hazard map can be used (see figure 4).

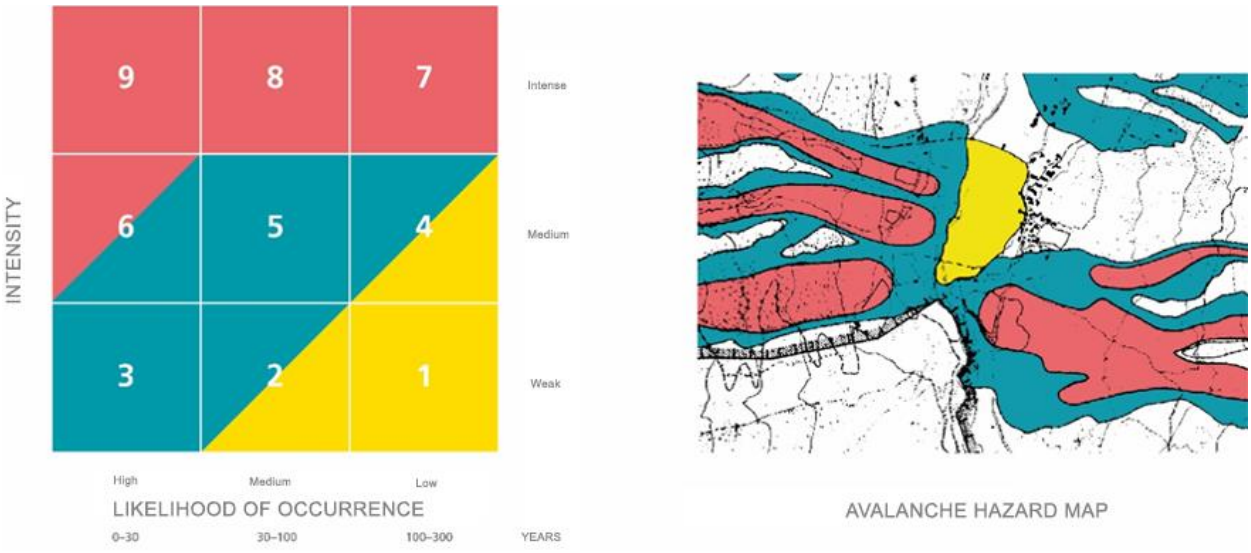

Figure 3

Likelihood of occurrence (left) – Source: *VKF Wegleitung Objektschutz gegen gravitative Naturgefahren* [Association of Swiss Canton Fire Insurance Companies guide: Local protection against gravitational natural hazards].
Avalanche hazard map (right) – Source: *Bundesamt für Umwelt: Richtlinien zur Berücksichtigung der Lawinengefahr bei raumwirksamen Tätigkeiten* [Ministry of the Environment Guidelines for taking into consideration the risk of avalanches in the context of land-use-related activities]. Formerly *Bundesamt für Forstwesen und Eidg. Institut für Schnee- und Lawinenforschung* [Federal Agency for Forestry and Federal Institute for Snow and Avalanche Research], Bern, 1984.

REGIONS	RISK
White	No risk or negligible risk
Yellow	Low risk
Blue	Rare / moderate avalanches (structural measures must be implemented, risk primarily outdoors, building permits are therefore linked to conditions and evacuation plans are required for the residents)
Red	Critically (high / very high) vulnerable area (destroyed buildings can be expected after an avalanche) No new construction zones may be drawn in the red zone. In addition, no buildings or facilities may be constructed or extended.)

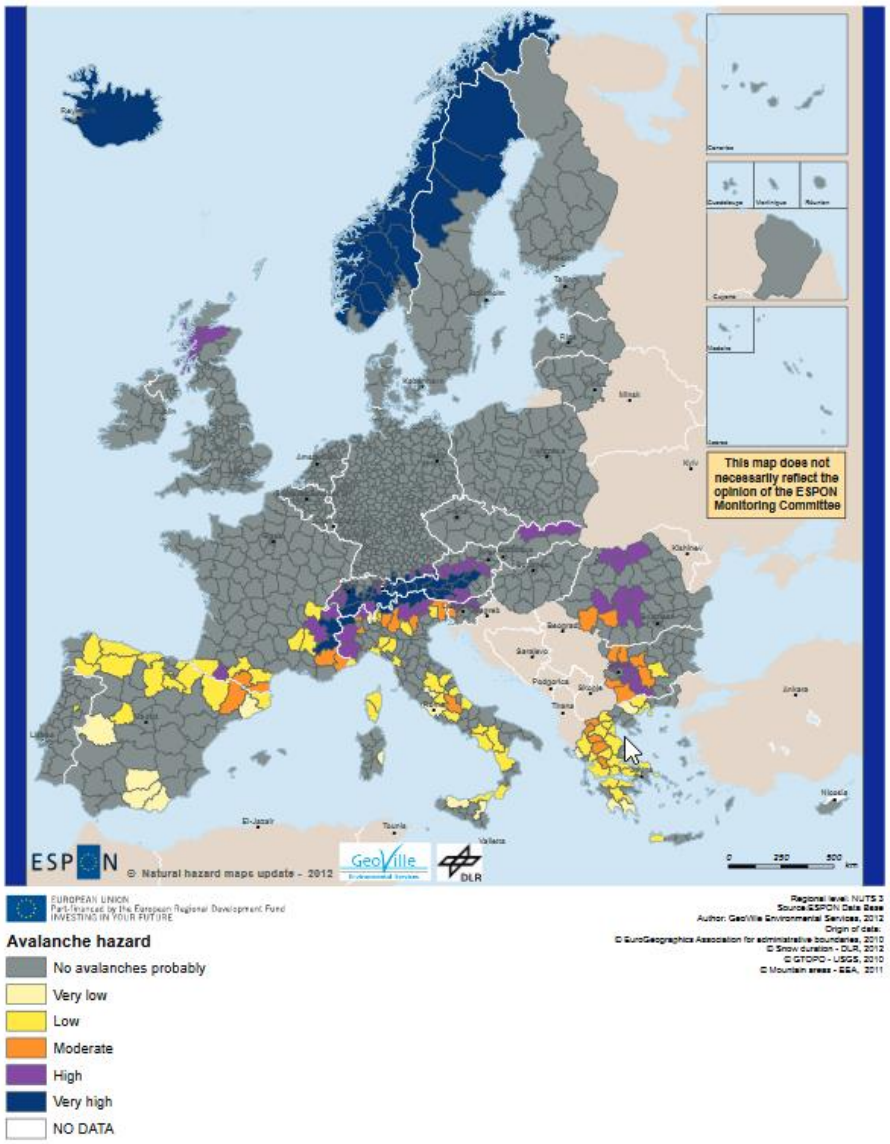

Figure 4 Avalanche hazard potential map, ESPON

Indicator 4: Storm

A storm is defined as wind with speeds of at least 20.8 m/s (74.9 kph) or 9 on the Beaufort Scale. Direct storm damage primarily affects roof coverings and other objects that can be carried by the wind; in heavily forested areas, damage also occurs due to uprooted or snapped trees. Indirect damage is also significant, for example as a result of sand deposited on agricultural land in a sandstorm or as a result of hailstones.
The evaluation assesses the storm damage risk and the measures in place to increase protection against storms. The storm damage risk is determined using the storm hazard map published by the ESPON (see figure 5). If available, more detailed hazard maps can generally also be used.

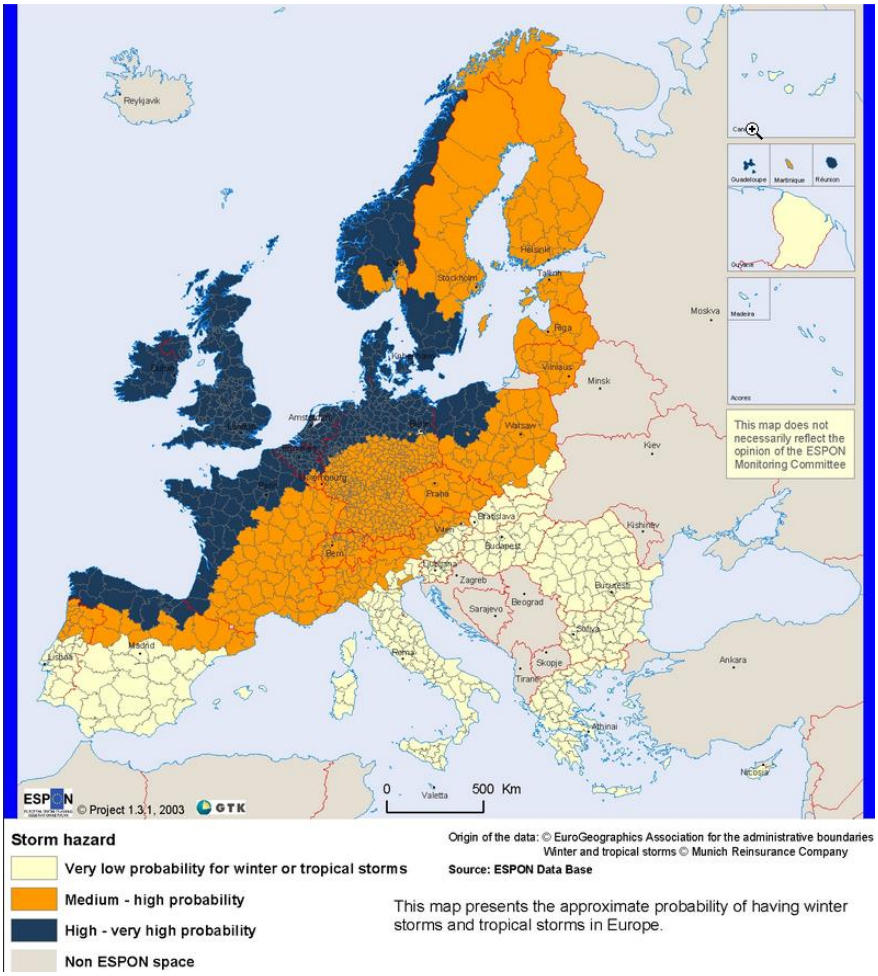

Figure 5 Storm hazard map, ESPON

AVERAGE WIND SPEED	DEFINITION	DESCRIPTION OF THE MAXIMUM IMPACT
21–24 m/s	Storm	Minor damage to houses (roof tiles come loose)
25–28 m/s	Severe storm	Wind snaps trees, major damage to buildings
29–32 m/s	Violent storm	Wind uproots trees, propagates storm damage
> 33 m/s	Hurricane	Major devastation

Indicator 5: Floods

Flooding is generally a natural occurrence. It is classified as a disaster (flood disaster) when human lives are affected. The more intensively the land is used, the larger the amount of area exposed to the risk of flooding. This increased threat of flooding is despite the improvement of flood prevention measures developed over the centuries. The evaluation assesses the risk of flooding and the flood prevention measures in place. The risk of flooding is

determined based on the flood hazard map of the relevant German federal state. Four flood scenarios are shown on the maps: High probability of flooding (HQ 10–50), medium probability of flooding (HQ 100), extreme events with partial failure of the flood defences (HQ 200) and no risk of flooding.
In principle, the evaluation should be carried out using local detailed flood maps (see example in Figure 6). If these maps are not available, the ESPON database can be used (flood recurrence map, precipitation contributing to flood risk).

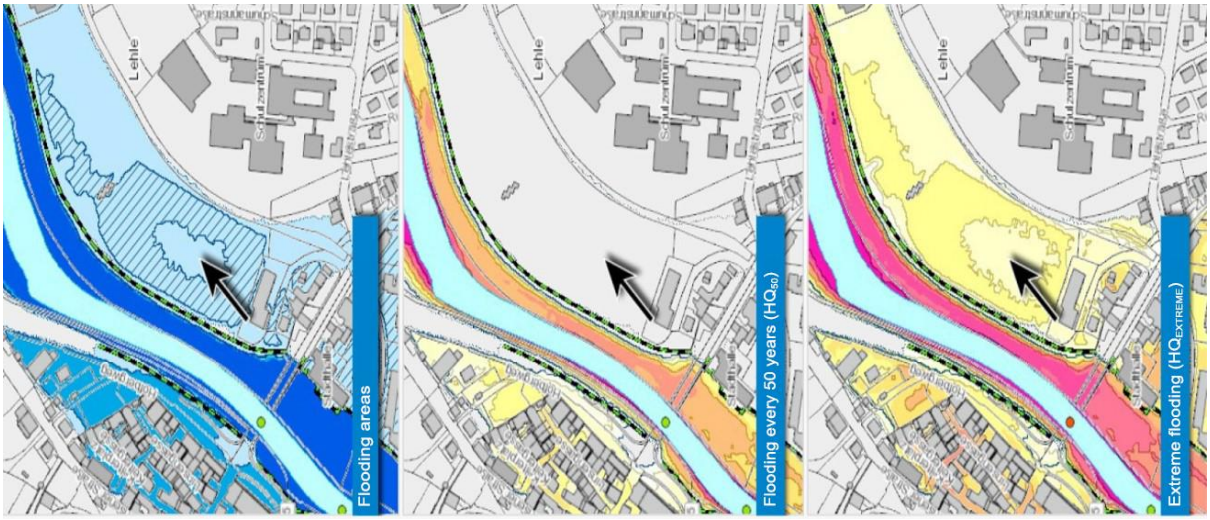

Figure 6 Extract from the Baden-Württemberg flood risk map; source: Data from the *Räumlichen Informations- und Planungssystem* (RIPS) [Land-use information and planning system] of the *Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg* [Baden-Württemberg State Institute for the Environment, Measurements and Nature Conservation]; 14.09.2017. Link: http://www.lubw.baden-wuerttemberg.de. For basic data: "*Geobasisdaten* [Basic geographic data] © *Landesamt für Geoinformation und Landentwicklung Baden-Württemberg* (LGL) [Baden-Württemberg State Office for Geographic Information and Land Development], www.lgl-bw.de, ref.: 2851.9-1/19"

Indicator 6: Heavy rain

Heavy rain events result in flash floods or deluges when the rainwater can no longer infiltrate into the ground, or when the volume of rainwater is too much for the drainage system or bodies of water to accommodate and drain away. This is affected by the topography of the area in which the plot of land is situated, its soil sealing factor, any rainwater retention systems in place and the dimensions of the drainage system (appropriate compensation measures can be used to counteract the effects of heavy rain).

The following factors have a particularly negative impact in this regard:

- Risks to the plot of land due to surface runoff from adjacent roads or land
- Ground-level entrances or terraces
- Pavements, driveways, parking spaces are at an incline with respect to the building
- Water can flow from the adjacent road into the underground garage

The evaluation should be carried out using local detailed flood maps (see example in figure 7).

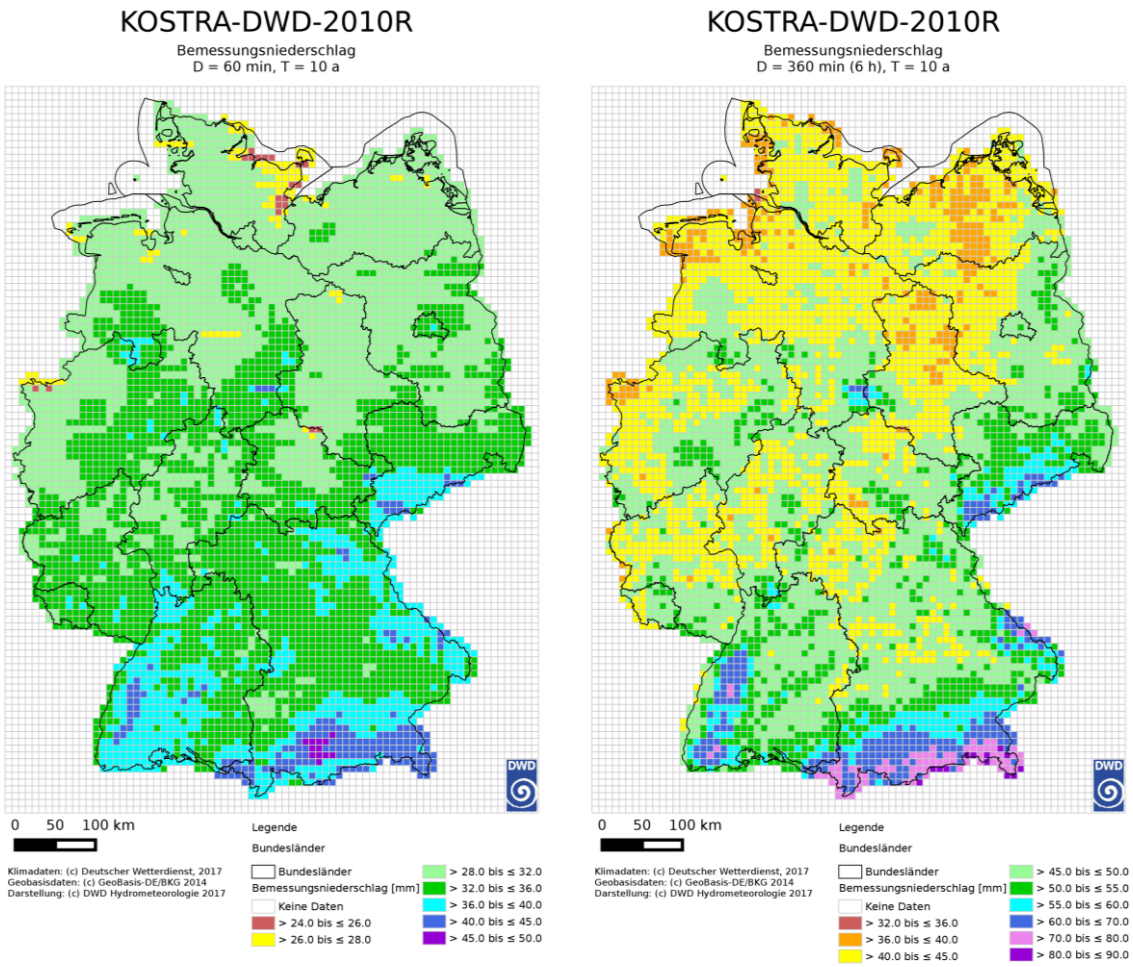

Figure 7 Coordinated heavy rain regionalisation and analysis by German Meteorological service (KOSTRA-DWD) 2010R (updated data set) for one hour (left) and six hours (right) and a recurrence interval of 10 years. Source: *Deutscher Wetterdienst (DWD)* [German weather service – Hydrometeorology department]

Indicator 7: Hail

There is currently insufficient information about small scale extreme weather events such as hail. In Europe, the ESPON map for extreme precipitations - heavy rainfall and hail can be used to assess the risk. If available, more detailed hazard maps can generally also be used (see examples in figures 8 to 10).

Figure 8 Hail zones low – high. Source: German Federal office of Civil Protection and Disaster Assistance (BBK), https://www.bbk.bund.de/SharedDocs/Bilderstrecken/BBK/DE/2017/Sturmsicher_bei_Unwetter/PM_Sturmsicher_bei_Unwetter.html

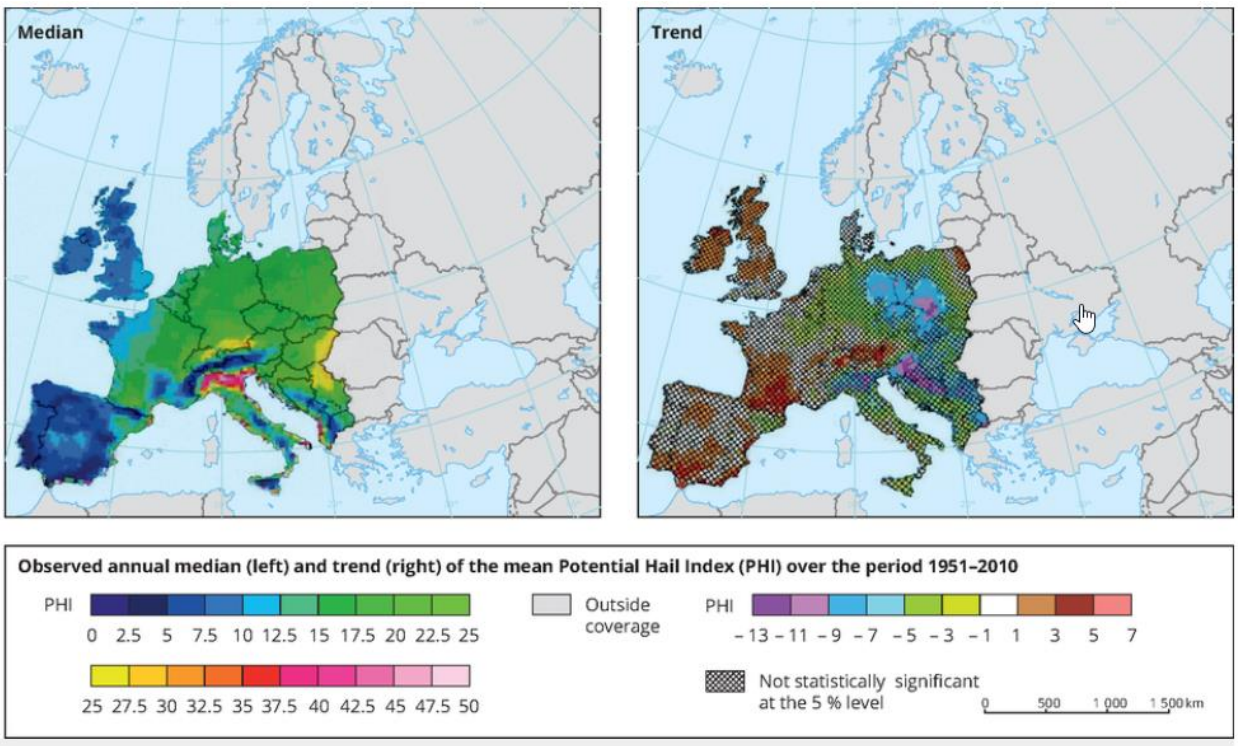

Figure 9 Observed annual median and trend of the Mean Potential Hail Index (PHI) over the period 1951-2010 – Source: Based on the logistic hail model (Mohr, Kunz, and Geyer, 2015) and reanalysis data from NCEP-NCAR

(Kalnay, et al., 1996). https://www.eea.europa.eu/data-and-maps/indicators/hail/assessment

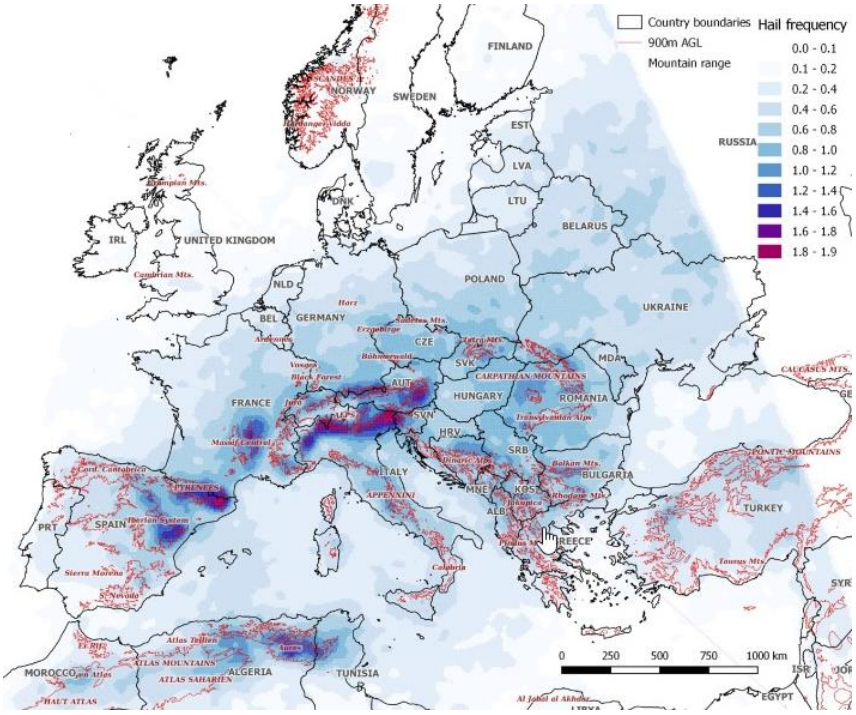

Figure 10 Hail frequency estimation – Source: Hail frequency estimation across Europe based on a combination of overshooting top detections and the ERA INTERIM reanalysis. Authors: H. J. Punge, K. M. Bedka, M. Kunz, A. Reinbold

Indicator 8: Landslide/subsidence

A landslide is regarded as the flow of large masses of earth and rock, mostly triggered by heavy rainfall (long-lasting rain or heavy rain) and the resulting penetration of water between previously bound soil layers.
The risk (e.g. due to mining in the past, a sloping location or civil engineering measures) and the compensation measures are evaluated. The ESPON landslide hazard map can be used to establish whether the issue of landslides/subsidence might be relevant to the district. If available, more detailed hazard maps can generally also be used.

Indicator 9: Storm surge/tsunami

Tsunamis and storm surges represent a serious environmental risk in some regions of the world.
The risk of being affected by tsunamis and/or storm surges is evaluated in Europe by means of the hazard maps published by the ESPON (tsunami hazard map, storm surge hazard map). If available, more detailed hazard maps can generally also be used.

Indicator 10: Extreme climates

Extreme climates (heat waves/cold waves) represent a serious environmental risk in some regions of the world. The risk of being affected by extreme climates is evaluated in Europe by means of the extreme temperature hazard map

published by the ESPON. If available, more detailed hazard maps can generally also be used.

Indicator 11: Forest fires

The risk of forest fires is becoming greater due to increasing prolonged dry periods. The risk of being affected by forest fires is assessed based on the length of time since the most recent forest fire. In Europe, the risk maps published by the ESPON (wildfire hazard map, length of dry spell affecting forest fires) can be used to assess the risk. If available, more detailed hazard maps can generally also be used.

Indicator 12: Air quality

The air quality at the site is evaluated in relation to traffic, the main source of pollution. For this purpose, measurements are taken to determine whether the particulate matter (PM_{10}) and nitrogen dioxide (NO_2) levels at the site comply with the legal limit values. The planned building must also not increase the emission level in the surrounding area to such an extent that the limit values are expected to be exceeded.

(1) Assessment of the initial situation based on the limit values specified in table 2.
(2) Improvement of air quality as a result of planning – an emission forecast is used for the evaluation. The procedure is described in more detail in the Evaluation section.

AIR POLLUTANTS	[µG/M³]	DESCRIPTION
Particulate matter PM_{10} Annual average	20	Emission limit value averaged over a calendar year for the protection of human health
Particulate matter PM*10* Daily average	50	Emission limit value averaged over 24 hours for the protection of human health with 35 permitted instances of exceedance per calendar year
Nitrogen dioxide NO_2 annual average	40	Emission limit value averaged over a calendar year for the protection of human health
Nitrogen dioxide NO_2 Max. 1-hour value	200	With 18 permitted instances of exceedance per calendar year

Table 2 – Limit values for particulate matter (PM_{10}) and nitrogen dioxide (NO_2) – Source: 39_{th} German Federal Pollution Control Ordinance (*39. BImSchV*)

For the evaluation of particulate matter, the most up-to-date publicly available table of World Health Organization (WHO) can be also used (e. g. https://www.who.int/data/gho/data/themes/air-pollution/who-air-quality-database). For

the assessment of the PM_{10}-value the auditor has to select the country and city nearest to the project site and assign the checklist points according to the associated particulate matter values.

Compensation measures for indicator 12: Air quality

Active measures to improve the air quality on the facade or in the building's outdoor area will be reflected positively in the evaluation. Points will be awarded when clear evidence can be provided, e.g. in the form of measurements, that these measures directly result in the improvement of air quality. Measures to improve the air quality include for example façade greening and/or the use of proven air-purifying materials.

Indicator 13: Outdoor noise

Outdoor noise comprises of a combination of noise sources from the area surrounding the building: Noise from road traffic, from business and industry, and from rail and air traffic. Noise level maps or measurements that indicate the level of noise exposure on the property are used for the purposes of calculation and awarding points. The value is categorised based on the "relevant outdoor noise level" in accordance with table 1 of this criterion (airborne sound insulation requirements for external building components). The noise level used for the evaluation should be the worst noise level on the plot of land.

If the area is very noisy to begin with, this can be significantly improved by implementing compensation measures. Implementing the points below will be reflected positively in the evaluation.

Planning options:

- Large distance from the noise source
- Design that incorporates an intrinsic shielding effect
- Use of natural shielding measures (soil embankments, etc.)
- Smaller building apertures and openings exposed to the noise source (driveways, courtyard openings, windows, loggias, etc.)
- Other passive shielding measures (noise barrier, baffles, etc.)
- Cleverly configured floor plan

Indicator 14: Radon

Radon seeps out of soil and into buildings through cracks and holes in the foundation slabs and walls or through cable and pipe conduits. If buildings are not sufficiently ventilated, radon can accumulate e.g. in building basement and in decreasing concentrations in subsequent storeys. Unlike most chemical pollutants it is not possible to smell or taste radon; therefore the only way to know whether there is radon in a building and how much of it is present is to measure it.

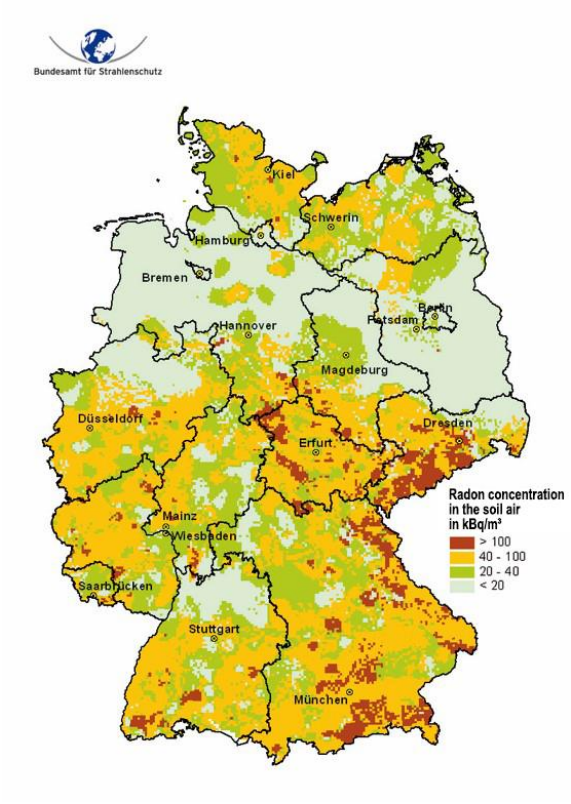

Figure 11 Overview of the radon concentration in the soil air at a depth of 1 metre - Source: *Bundesamt für Strahlenschutz* [German Federal Office for Radiation Protection]

If the radon concentration in the building area exceeds 100 Bq/m³ remediation measures must be carried out. The extent of these measures depends on the extent to which this value is exceeded. Simple measures should be tried first. If these measures do not achieve the desired target, more extensive procedures must then be considered. They may include changes to the building; therefore these must be planned and carried out by experienced specialists. Example of remediation measures are listed below:

- Simple measures
  - Air ventilation for five to ten minutes several times a day by opening windows opposite each other in each storey including the basement
  - Sealing of all supply and sewage lines, small cracks and doors between the basement and the subsequent storey
  - Installation of a ventilator, for example to create a slight vacuum or overpressure, or vent air through an unused flue

- Extensive measures
  - Ensure the basement is well sealed off from the subsequent storey, for example by fitting particular airtight doors
  - Sealing of floors, walls, ceilings using foil or other materials that are resistant to radon penetration
  - Installation of ventilation systems to increase the air exchange rate
  - Installation of radon wells or lay drainage beneath the foundations to draw off the air containing radon

Compensation measures -all indicators-

Compensation measures can be considered for some environmental risks. Possible compensation measures are described in the "Evaluation" section.

APPENDIX B – DOCUMENTATION

I. Required documentation

Examples of possible evidence include the following items. The documentation submitted for the evaluation of individual indicators should comprehensively and clearly demonstrate compliance with the relevant requirements.

DESCRIPTION	SHORT CODE
Credible declaration of intent that measures will be implemented/ assessment of the evaluation	A
Brief explanation, photos/plans of the implemented measures/concepts and, if necessary, mapping in an overall plan	B
Project design	C
Localisation of the project area on risk maps and evaluation	D
Statement by a qualified expert or by a public institution stating whether the site is affected by the particular risk	E

ENVIRONMENTAL RISKS/COMPENSATION MEASURES	PRE-CERTIFI-CATE	CERTIFI-CATE
1. Earthquake	A, B, D	B, D
2. Volcanic eruption	A, B, D	B, (D), E
3. Avalanches	A, B, D	B, D
4. Storm	A, B, C, D	B, C, D
5. Floods	A, B, D	B, D
6. Heavy rain	A, B, D	B, D
7. Hail	A, B, D	B, D
8. Landslide/subsidence	A, B, D	B, (D), E

9. Storm surge/tsunami	A, B, D	B, D or E
10. Extreme climates	A, B, D	B, D or E
11. Forest fires	A, B, D	B, D or E
12. Air quality	A, D	
13. Outdoor noise	B, D	
14. Radon	B, D	B, E

APPENDIX C – LITERATURE

I. Version

Change log based on version 2020

PAGE	EXPLANATION	DATE
663	General: scheme “assembly buildings” has been added	16.09.2021
all	Evaluation: editorial amendment to the “max. Points"	16.09.2021
675	Method - overarching: Note on EU taxonomy compliance	16.09.2021
685	Indicator 12: Designation of alternative compensation measures	16.09.2021

II. Literature

- Risk maps published by the European Spatial Design Observation Network (ESPON): www.espon.eu.
- Sustainable Development Goals icons, United Nations/globalgoals.org.
- Environmental Noise Directive EU 2002/49/EC: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002L0049&from=EN
- External air quality (some examples from WHO-Website):
    - https://gateway.euro.who.int/en/indicators/enhis_24-population-weighted-annual-mean-pm10-in-cities/visualizations/#id=21390
    - https://gateway.euro.who.int/en/indicators/enhis_24-population-weighted-annual-mean-pm10-in-cities/visualizations/#id=21390&tab=table
    - http://www.who.int/airpollution/data/AAP_database_summary_results_2018_final2.pdf?ua=1
    - http://www.who.int/airpollution/data/cities/en/
- WHO International Radiation Project (IRP): http://www.who.int/ionizing_radiation/env/radon/IRP_Survey_on_Radon.pdf
- A healthier home: but how?: https://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/3085.pdf
- What is radon?: http://www.bfs.de/EN/topics/ion/environment/radon/introduction/introduction.html