6.53 Groundwater exploitation index

Project Name: NAIAD (Grant Agreement no. 730497)

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Groundwater Exploitation Index (GEI)	**Water management** **Natural and Climate Hazards**
Description and justification	Provides an indication of the pressure of water demand on groundwater availability and the sustainability of the abstractions regime.The GEI addresses directly the good quantity mandate of the European Water Framework Directive. The GEI can be used as a tool to support water management with different purposes both within a particular GB or AV or at River basin scale: to achieve sustainable/desirable exploitation rates; to monitor the expected evolution of available groundwater resources; to monitor the temporal and space changes of both groundwater input and groundwater abstraction; to compare the situation in a set of GB/AV; to provide knowledge to understand socio-economic changes linked to agrarian activities; to support environmental policies related to groundwater ecosystems and to surficial groundwater dependent ecosystems, and their respective services; etc.
Definition	Ratio between total groundwater input to a particular groundwater body (GB) or aquifer volume (AV) and groundwater abstraction from the same GB or AV in a given lapse of time (usually one year). Usually given as ratio, but can also be given as %.
Strengths and weaknesses	+ It is a simple and easy to understand indicator of groundwater use sustainability. - Usually, the best figures that can be obtained for both groundwater input to and abstraction from a particular BG or AV have significant uncertainties. For this reason, the

	index should better be used accompanied by its estimated combined uncertainty (Example:1.4 +- 0.7).
Measurement procedure and tool	Groundwater input is usually quantified by a combination of empirical and numerical hydrological methods (estimation or modelling of groundwater recharge from rainfall, of groundwater lateral transfer from nearby geological formations, of excess irrigation water infiltration, and of surface water infiltration through river beds). Groundwater abstractions are quantified by empirical methods (pumping measurement through meters; accounting irrigation surfaces with particular crops and assigning irrigation provisions; deduction from accurate aquifer water balances). Both terms of GEI can also be estimated from the calibration of accurate groundwater flow models (i.e., the Medina del Campo Groundwater Body iMOD groundwater model, in NAIAD). Tools: simple spreadsheets and specific modelling software.
Scale of measurement	Groundwater-body/aquifer scale. It can also be applied to a particular aquifer volume, whose limits must be accurately defined.
Data source	
Required data	To estimate groundwater input: climatic data (rainfall, air temperature); edaphic data (field capacity, wilting point, evapotranspiration); hydrologic and hydrogeologic data (runoff, porosity, specific yield, infiltration, recharge; piezometry; hydraulic gradients). To quantify groundwater abstraction: groundwater pumped (per well and year); surface irrigated with particular crops, type of crops, water provision per crop. Data can be retrieved from public institutions (national/regional meteorological surveys; water management authorities); groundwater users; public and private research institutions.
Data input type	Total water input and total groundwater abstraction (hm^3/yr).
Data collection frequency	Though the GEI is used on a yearly base, it should be calculated with monthly data.
Level of expertise required	To calculate the indicator: expert level on hydrogeology. To understand the rationale behind it: low to medium expert level on hydrogeology.
Synergies with other indicators	With Surface Water Availability (SWA), due to the surface-groundwater relationships in areas where there are water-table aquifers and rivers, lagoons, and/or wetlands.

	With Trend of Piezometric Levels (TPL).
Connection with SDGs	With SDG 6
Opportunities for participatory data collection	Many types of people can participate in collecting data needed to calculate and/or monitor the GEI. Precipitation and air temperature data can be collected by students of different age and by employees from public and private institutions; groundwater abstraction can be measured by wells' owners. PIEZOMETRIC RECOVERING.
Additional information	
References	NAIAD, Deliverable D6.2, From hazard to risk: models for the DEMOs. Part 1: Spain–Medina del Campo. SC5-09-2016 Operationalising insurance value of ecosystems. Grant Agreement nº 730497

6.54 Calculated drinking water provision

Project Name: URBAN GreenUP (Grant Agreement no. 730426)

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Calculated drinking water provision	**Water Management** **Natural and Climate Hazards**
Description and cation	Drinking water is commonly stored in dams and water wells, and distributed from them to the consumers. This KPI evaluates the available drinking water in damps or other fonts, and the water which is actually distributed to the consumers in a city or in defined area of a city.
Definition	Measurement method for the drinking water supplied to the consumers, or/and available water provision.
Strengths and weaknesses	+ Each consumer has their own meters, so it is possible to measure the provision in terms of amount of water per flat, building and/or any other facilities - This KPI may require permission to access data
Measurement procedure and tool	Domestic consumption of water is measured by water flow meters, so it can be monitor by the water company/service. With this detailed monitoring consumption of the water can be calculated as m^3 * ha^{-1} * $year^{-1}$. Apart from supplied water, volume of available drinking water is calculated with the measurement of height of water in dams and water wells. Dimensions of