

# Geodiversity – culture relationships within the concept of geosystem services / abiotic ecosystem services



Lucie Kubalíková  
Institute of Geonics of the Czech Academy of Sciences, Drobného 28, 602 00 Brno, Czechia  
[Lucie.Kubalikova@ugn.cas.cz](mailto:Lucie.Kubalikova@ugn.cas.cz), [Luc.Kubalikova@gmail.com](mailto:Luc.Kubalikova@gmail.com)

Paola Coratza  
Department of Chemical and Geological Sciences, University of Modena and Reggio Emilia, Via Campi 103, 41125 Modena, Italy  
[paola.coratza@unimore.it](mailto:paola.coratza@unimore.it)



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MODENA E REGGIO EMILIA

**Goal:** to explore geodiversity and culture's relationships within the concept of ecosystem services (ES), analyse these links and anchor them in the context of geosystem / abiotic ecosystem services.

**Geodiversity** has multiple functions and provides numerous services and benefits to human society. Besides this, it has an intrinsic value that exist independently on these functions. These functions and benefits can be identified, described and analysed within the concept of ecosystem services. The geodiversity and culture relationships are best visible within cultural ecosystem services, however, within other groups of ecosystem services, this relationship is relevant too. In addition, there are less visible aspects, e.g. links between geodiversity / language, geodiversity / toponyms or geodiversity / medicine.

**Culture** is an extremely popular and complex multi-level concept which has been studied and used in a wide range of social sciences. Despite the concept of culture is centuries old and several attempts to define it and quantify its various aspects can be traced back in time, in literature a common agreement on the definition of it has not yet been reached. UNESCO defines culture as the set of distinctive spiritual, material, intellectual and emotional features of society or a social group, that encompasses, not only art and literature, but lifestyles, ways of living together, value systems, traditions and beliefs.

**Geosystem / abiotic ecosystem services** are benefits that abiotic components of ecosystems provide to society. It usually follows the traditional scheme of ES as provided already in Millenium Ecosystem Assessment: supporting, regulating, provisioning and cultural services.

**Regulating services:** defined as ways in which natural processes regulate the environment.

**Provisioning services:** defined as materials and goods valued by human society; fuels, food and drink, medical resources, industrial or construction materials and others. Provisioning services may be closely linked to the industrial history of regions and may become a part of geo-mining heritage.

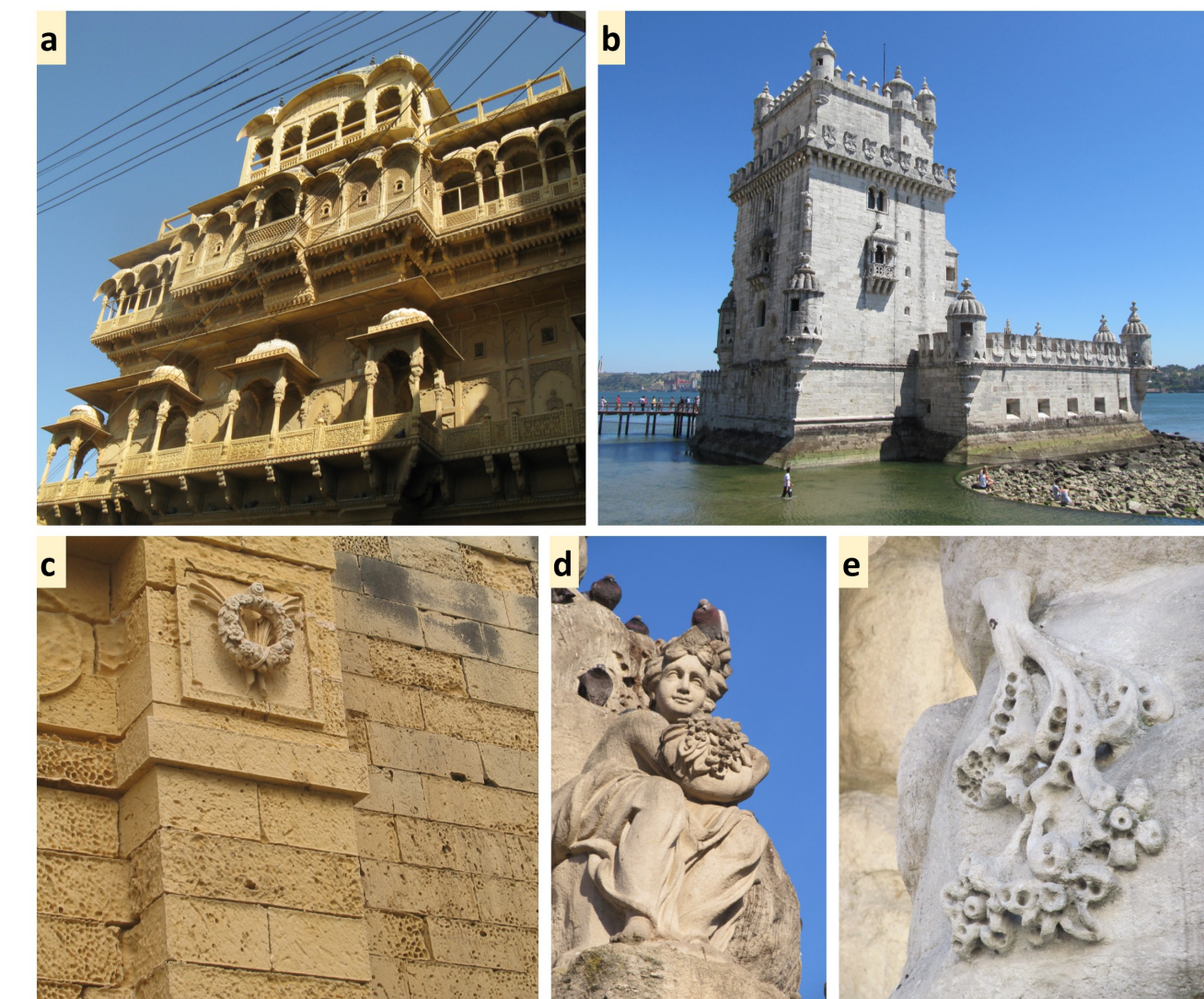
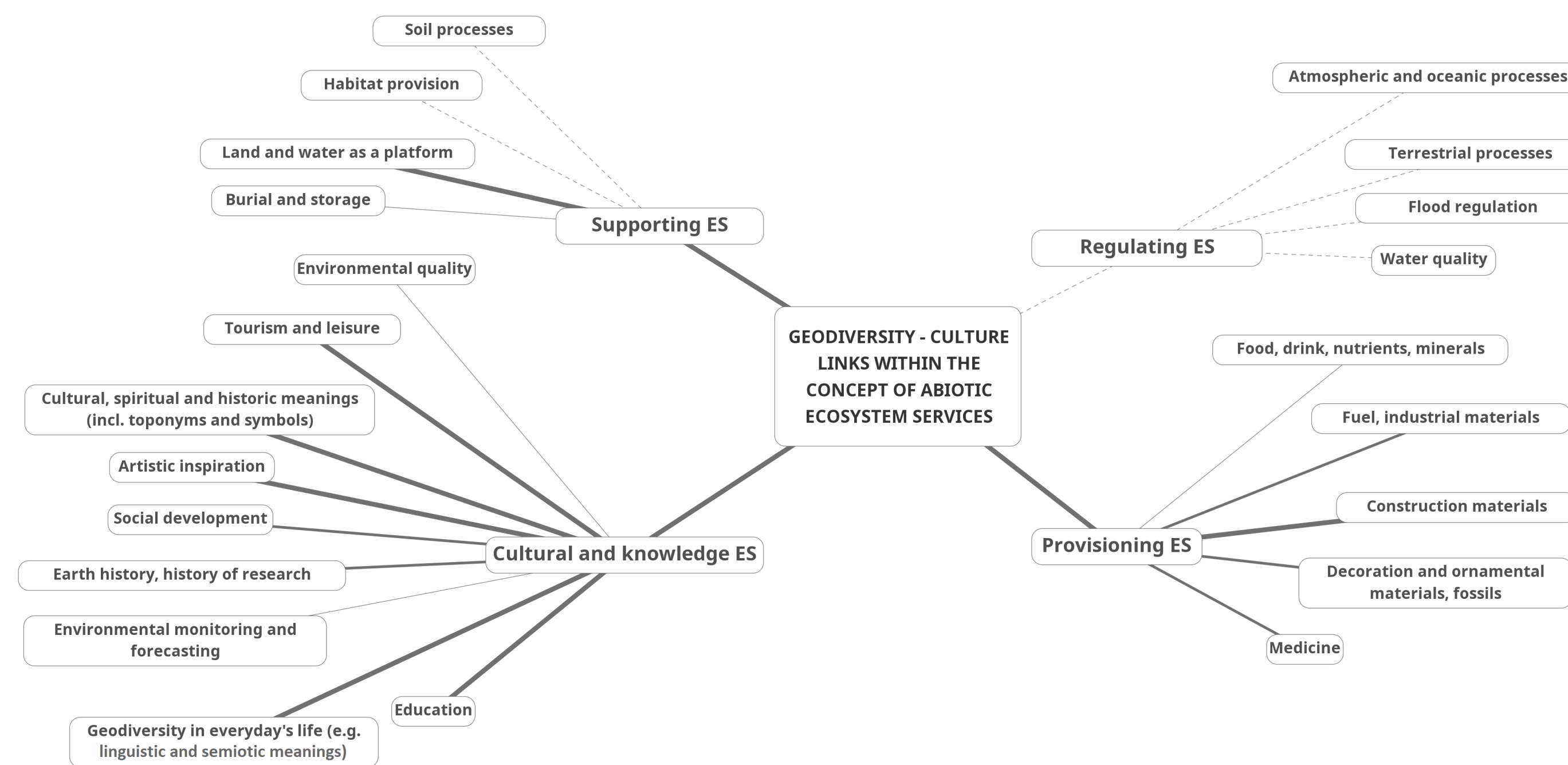
**Supporting services:** defined not only as those that provide living spaces for plants or animals, but also as those that offer an environment and base for different human activities; use of landforms (caves, passes, valleys, elevations), use of subsurface etc.

**Cultural and knowledge services:** defined as the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences. Geodiversity is a basis for geoeeducation and geotourism and contributes to the better understanding of the Earth's history.



**Landforms and their supporting ES:** a) Meteora Monasteries, Greece (situated on the steep conglomerate rock tower); b) Ait Benhaddou, Morocco (a fort situated on an elevation which enable a wide overview of surrounding landscape); c) Quebrada de las Flechas, Argentina (a pass used by Ruta 40); d) Bardi Castle, Parma Apennines, Italy (strategically placed on a rise made up of basalts and red jaspers, it is still a lofty stronghold at the junction of roads linking the Ligurian western coast to the Via Emilia); e) Vranov nad Dyjí Castle, Czechia (situated on rock outcrop above the Dyje River).

**Reflections and relevance of geodiversity – culture links within the concept of abiotic ecosystem (or geosystem) services**  
The thickness of a line connecting particular nodes represents an intensity of the relation (thin line – low intensity, medium-sized line – moderate intensity, thick line – high intensity). The dashed line represents a very limited relevance of geodiversity – culture links to the particular ES.

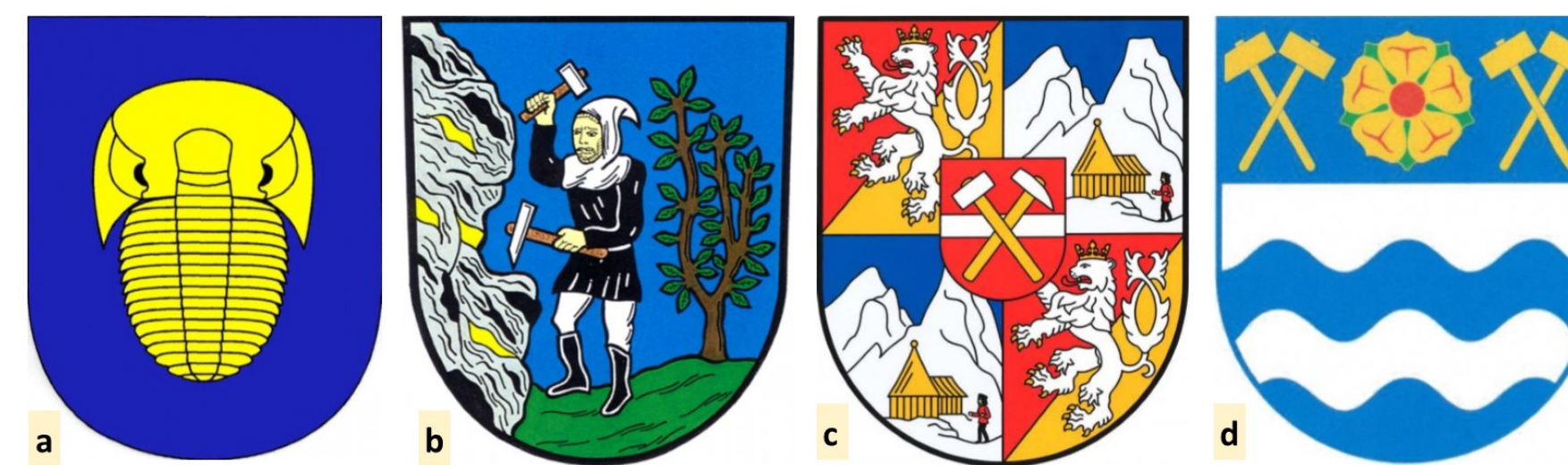


**Geodiversity – culture relationships reflected in provisioning ecosystem services:** geodiversity as a resource of building stone: a) Jaisalmer, Rajasthan, India (thanks to the bright yellow colour of Jaisalmer limestone which was used for numerous building, the city bears the nickname “Golden City”); b) Torre Belén (Belén Tower), Lisbon, Portugal (built of recognized Global Heritage Stone “Pedra Lioz”, type of limestone extracted around Lisbon); c) Honeycomb weathering of Globigerina limestone, listed as Global Heritage Stone (Valletta, Malta); d) and e) Use of Crinoidea limestone as decorative stone, Brno, Czechia (an iconic material for medieval architecture of the city).



**Other examples:**  
Literature, poetry (International Institute of Geopoetics, Scottish Centre for Geopoetics, <https://www.geopoetics.org.uk/>)  
Geom mythology, Film industry  
Societal development: citizen science, community participation  
Language (idioms, metaphors)

**Devil's toponyms** reflecting the relationship geodiversity – culture: a) Devil's Rock, Wyoming, USA; b) Puerta del Diablo (Devil's Gate), Tupiza, Bolivia, c) Garganta del Diablo (Devil's Throat), Cafayate, Argentina.



**Examples of communal symbols** of some Czech municipalities reflecting geodiversity and natural resources: a) Skryje (palaeontological element), b) Zlaté Hory (gold as a resource), c) Jáchymov (landforms and symbols related to mining activity), d) Havířov (hydrological elements and symbols related to mining activity).

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Anchoring the geodiversity – culture relationships within the concept of abiotic ecosystem services may provide a framework for future studies and may contribute to the better understanding of protection and sustainable use not only of geoheritage, but entire geodiversity and justify conservation and management measures applied not only on the site level (that means on particular geosites, geomorphosites or geocultural sites), but also on the geodiversity as a whole.

