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Editorial: Geoscience and geodiversity in ecosystem services

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Editorial on the Research Topic

Geoscience and geodiversity in ecosystem services

Ecosystem services are commonly known as outputs, conditions, or processes of natural systems that directly or indirectly benefit humans or enhance welfare in societies, either directly or as inputs into the production of other goods and services. Geodiversity refers to the variety of the geological and physical elements of nature, such as minerals, rocks, soils, fossils and landforms, and active geological and geomorphological processes. Geodiversity is the fundament of ecosystem variations, and together with biodiversity, provides the basis for economic, social, cultural and environmental benefits. Knowledge of geodiversity is essential for the effective management of the resources we use every day and to support future technological innovations, and therefore it is important that the direct connections between geodiversity and ecosystem become key areas of active and increased research.

The Research Topic presents contributions which provide some examples of the importance of geoscience and geodiversity in the utilization, development and preservation of ecosystem services. As pointed out by [Fox et al.](#), geodiversity and the ecosystem services it provides, are under threat from anthropogenic pressures and environmental changes. UNESCO Global Geoparks preserve geodiversity and enhance human wellbeing and cultural heritage. Therefore, understanding the role geodiversity plays in providing ecosystem services is necessary for providing holistic conservation priorities and ensure sustainable use ([Fox et al.](#)). Aesthetically values are important elements, and to investigate this aspect, [Fox et al.](#) used georeferenced images taken inside the Troodos Geopark in Cyprus. They found that aesthetically appreciated views as inferred by social media within the geopark do not only include natural features such as forest and water. They are often also related to geodiversity and anthropogenically altered landscapes in the geopark, such as mineral extraction sites and vineyards. The results can help to inform conservation practices with the goal of sustainable access and enjoyment of aesthetic services.

[Fancello et al.](#) present a proposal and quantitative assessment of new geosites in Sardinia (Italy) as contributions to the geological and archaeological heritage. The area located on the south-western coast of the island is characterized by a wide geodiversity, a complex history testified by several archaeological sites, rich ecosystems, and scenic landscapes. [Fancello et al.](#) propose to establish a geo-trail covering ecological diversity and local tourist attractions. In their paper they present a quantitative assessment of the geosite values and address the main

concerns related to the preservation and valorization of the geosites. A site-by-site description at the end of the paper can be used as a field guide.

Through the history of our Earth, geodiversity has been the fundament of evolving life and biodiversity. Our understanding and knowledge of the Earth's history, with plate tectonic movements and climatic changes through geological time, goes hand in hand with the paleontological records. Pang et al. document the first discovery of amber resin in Lichi Mélange in Eastern Taiwan. The composition of amber indicates a possible origin of dipterocarp trees that are absent in the paleobotanic record and modern flora in Taiwan. Furthermore, they find that the infrared spectra analysis shows its compositional similarity to the amber from Sumatra, Indonesia. Petrographic analysis of the surrounding sandstone suggests that the amber was deposited into the continental margin that was attached to Taiwan through the arc-continental collision in ~6–7 Ma.

Groundwater accounts for 99% of liquid freshwater on Earth and is the source of one-quarter of all the water used by humans (<https://www.unesco.org/reports/wwdr/2022/en>). Magnetic resonance sounding (MRS) is a geophysical method that can determine groundwater content directly and quantitatively. Tian et al. present a data processing scheme to extract MRS signal envelopes accurately. Their simulation results show that regarding Gaussian noise and power frequency harmonic noise, their algorithm can reliably extract the MRS signal envelopes. The algorithm is also suitable for extracting multi-exponential MRS signals. The effectiveness and practicability of the algorithm is verified by field data.

Nearly two decades ago, one of the key findings from the Millennium Ecosystem Assessment (2005) was that of a group of 24 ecosystem services, 60% were degraded. Today, cleaning up the past and restoring and repairing damaged ecosystems are on the political and public agenda around the world.

The expanding urban environments leaves us with increasing amounts of waste materials to be re-used given cost-effective technologies and willingness. In this context, development of methods and techniques for assessing materials, tools and services provided by different resources is important. As an example, recycled tires from automobiles have become a major environmental issue due to the explosive expansion of the industry

and illegal dumping and burning of tires (Amin et al.). Amin et al. have made an evaluation of shear strength parameters of sustainable utilization of scrap tires derived geo-materials for civil engineering applications. They find that the use of tire chips sand as an alternative backfill material requires less pressure and has more improved properties than traditional backfills. In both shear tests, 30% of the tire chips sand exhibit the best results.

Geological knowledge is needed to restore any damaged living ground, and basic knowledge of the bedrocks and surficial deposits, the diversity of bedrock and surficial deposits, and the processes that form and erode rocks, sediments and soils is fundamental for reaching the UN SDG no. 15 to “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainable manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss”. Articles published in this species issue provide new information that can be used to aim for sustainable living conditions for all living organisms on Earth.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

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