Information about geodiversity — i.e. the variety of the material, non-biological parts of the natural world — could be better used and more integrated in environmental management in the UK, finds new research. The authors examined the inclusion of geodiversity information in UK assessments and identified a number of areas where geoscience knowledge is vital for informing ecosystem management.

Ecosystem-level assessments, such as the Millennium Ecosystem Assessment and the UK National Ecosystem Assessment (UKNEA), review the ecosystem services — such as food, fuel or recreation — that society gains from the natural environment. Valuing ecosystem services is an important part of an ‘ecosystem approach’ to environmental management, which aims to promote the conservation of nature and the sustainable use of resources.

Many ecosystem services are either underpinned or delivered by ‘geodiversity’, the variety of rocks, minerals, fossils, soils, waters, natural landforms and processes which shape them over time.

However, despite geodiversity’s importance to ecosystem services and functioning, its recognition at a policy level, according to the authors, remains low and is poorly integrated in the development of ecosystem approaches.

Geodiversity information can provide a view of how environments and life (by the study of fossils, for example) have adapted to a changing climate or environmental conditions over a geological timescale. This can be used to help understand possible future environmental changes, their effects on life and how we might prepare for or adapt to them.

This research first examined how geodiversity information fits into the ecosystem approach and ecosystem assessment at a conceptual level, and used this to examine the degree to which this is recognised within the UKNEA. They then reviewed published scientific literature to select examples of how geoscience can help inform the management and delivery of ecosystem services, with a focus on climate change adaptation.

The researchers found that the UKNEA did contain many elements of geodiversity, both alone and integrated within parts of environmental systems, such as soil formation nutrient cycles and natural coastal protection. However, the authors found that these were rarely presented in a systematic fashion nor generally acknowledged as an essential part of sustainable land management.

Four main geodiversity-related gaps in the UKNEA process were identified. These were the omission of non-renewable resources, a lack of long-term perspectives both in the past and the future, an uneven treatment of geomorphological processes (physical processes, such as erosion, at or near the Earth's surface) and a general lack of integration of the dynamic links between geodiversity and biodiversity.

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The authors also highlight areas where they feel other geodiversity-related evidence could be better integrated into the UKNEA, focusing on areas where geoscience knowledge can be used to inform adaptive ecosystem management.

For example, they highlight that understanding of past ranges of natural variability, rates and types of geomorphological processes (i.e. earth surface processes, such as air, water and ice, which can mould the landscape) is important for anticipating and planning for change, as well as for validating conservation management decisions and allowing prioritisation of limited resources.

A real-world example is the use of records of sea-level change, over the last 10,000 years, to inform future sea-level rise scenarios and their impacts on coastal biodiversity. In Scotland, sea-level rise is overtaking the final phase of land uplift, following melting of the last Scottish ice-sheet, with the result that coastal retreat and squeeze will have a widespread impact on ecosystem services (e.g. loss of habitats, loss of beaches for recreation). The record of past processes, landforms and sediments helps us understand how the coastal system works. This can then be used to inform adaptive coastal management and bring multiple benefits for people and nature conservation.

Finally, the authors identified a number of future challenges and opportunities for the further integration of geodiversity into ecosystem approaches. These include encouraging the greater participation of geoscientists in interdisciplinary networks and delivering new geoscience research to help support the ecosystem approach and climate change adaptation.

The authors conclude that geodiversity is relevant across a broad range of policy agendas including nature conservation, planning, landscape, environment, education, sustainable rural development, health and quality of life; and that geodiversity information was underrepresented in the ecosystem assessments examined. For ecosystem assessments to be fully successful they must also integrate the best geodiversity information available.