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Viewpoint

Promoting geodiversity: learning lessons from biodiversity

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ABSTRACT

Progress made in promoting geodiversity in recent times is reviewed, concluding that it is now an established component of the Earth Sciences. However, it still lacks the status and standing of biodiversity in governmental, political and public forums. The paper assesses what can be learnt from the experience of the development and promotion of biodiversity. Based on this experience, eight suggestions for increasing the understanding and ownership of geodiversity beyond the Earth science community are provided as a basis for discussion.

1. Introduction

Geodiversity has become established as a component of the Earth Sciences in recent years. However, compared with biodiversity, it still lacks the status and standing in political, diplomatic, policy and public arenas. How did biodiversity attain its current status and what can we learn to help to promote the status of geodiversity? This paper addresses this issue and identifies eight actions which could be taken to promote geodiversity to wider audiences beyond the Earth Science profession.

2. The current position

Geodiversity has been increasingly recognised as an important component of the Earth Sciences since the term was first coined by Sharples in 1993 (Sharples, 1993). There is a growing literature published in scientific journals, such as the Proceedings of the Geologists Association (for example, Gordon et al., 2012; Erikstad, 2012), and in more informal series, such as Earth Heritage Conservation. A special issue of the Proceedings of the Geological Society of London was devoted to the history of geoconservation (Burek and Prosser, 2008) and one of the Scottish Geographical Journal devoted to geodiversity (Hansom, 2012). The key text by Gray is now in its second edition (Gray, 2004, 2013). Charters for geodiversity have been adopted, for example in Scotland the Scottish Geodiversity Charter (Scottish Geodiversity Forum, 2012), and one is in an advanced state of preparation for England to be published in 2014 (English Geodiversity Forum, in press). A UK Geodiversity Action Plan has been published (UK GAP, 2012). There are many strategies and action plans being developed locally within the United Kingdom (see, for example, Burek and Potter, 2006; Lawrence et al., 2007; Gordon and Barron, 2011). The International Union for Nature Conservation has passed two Resolutions on the importance of geodiversity in nature conservation activity at its General Assemblies in 2008 and 2012 (IUCN, 2008, 2012). The Council of Europe has made a recommendation on geological conservation (Council of Europe, 2004). There is an international network of GeoParks under the aegis of UNESCO and Earth heritage is recognised as an intrinsic component in the selection of World Heritage Sites of Outstanding Universal Value (Dingwall et al., 2005). There are many geosites formally protected, especially in Britain as SSSIs (Ellis, 2011), and local sites informally protected through local government mechanisms, such as Local Geological Sites or Local Geodiversity Sites. And, significant international groups have been established, such as ProGEO (Wimbledon and Smith-Meyer, 2012).

But geodiversity does not have the same status and level of acceptance as biodiversity.

There is no formally agreed definition at governmental level. The commonly used definition is by Gray who defines geodiversity as

> "*the natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (landforms, topography, physical processes) and soil and hydrological features. It includes their assemblages, structures, systems and contributions to landscapes*" (Gray, 2013, p. 12).

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Despite some initial resistance and concerns about the validity of implied parallels with biodiversity, the term is now widely accepted (Gray, 2008, 2013). It is the abiotic equivalent of biodiversity and, therefore, is a natural complement to biodiversity rather than a separate and un-associated approach. The subject covers past and present Earth processes, embraces static features that have a range of ages and reflect the variety of processes during the Earth's history, and includes modern processes that significantly influence biodiversity.

Unlike biodiversity, there are no national statutory imperatives, no European Directives and no international agreements or conventions. There is a clear acceptance of the connection between biodiversity and geodiversity in the context of the overriding framework for natural resources assessment and management through the Ecosystem Approach and ecosystem services. For example, the International Union for the Conservation of Nature (IUCN) focuses its attention on biodiversity almost to the exclusion of geodiversity (see Crofts and Gordon, in press). And, until recently effort has been concentrated on protection of geodiversity in sites rather than in the context of natural resource management of whole landscapes. For example, most effort in Great Britain has been on the protection of geological and physiographic SSSIs, established originally under the National Parks and Access to the Countryside Act 1949, through the Geological Conservation Review (Ellis, 2011). This outstanding approach has been used as a basis for geoheritage conservation in other countries, but is only part of the geodiversity concept.

3. Learning from the success of biodiversity

Despite the unfavourable trends in species, habitats and ecosystems with losses and functional degradation (Secretariat of the Convention on Biological Diversity, 2010), biodiversity has been a success in raising the profile of these issues internationally, regionally, nationally and locally and pressuring governments to do something to reverse negative trends.

A concerted international movement, led by the large international conservation organisations, such as the Worldwide Fund for Nature, working with the UNEP and the IUCN, produced the World Conservation Strategy (IUCN/UNEP/W, 1980), the key document arguing for a new international approach to biodiversity conservation. This was followed up a decade later by Caring for the Earth (IUCN/UNEP/W, 1991), restating the case and arguing for a new international instrument. This in turn was influential in persuading member countries of the United Nations, meeting at the first Earth Summit in Rio in 1992, to agree to the codification of a Convention on Biological Diversity in 1992. One hundred and eighty countries are now signatories to the Convention. As a result, global targets were established, national action plans were stimulated, programmes of work on key aspects were agreed, and key principles, such as the Ecosystem Approach, were established (Secretariat of the Convention on Biological Diversity, 2010).

Arguably, the intellectual basis was established through the writings of biologists, foremost among them being Edward O. Wilson (Wilson, 1992).

There is an internationally agreed definition of biodiversity. Article 2 of the Convention states that '"Biological diversity' means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems' (http://www.cbd.int/convention/articles/default.shtml?a=cbd-02).

An evidence base of biodiversity trends has been established at many different scales for species and habitats. Internationally, for example, the IUCN Red Lists have proved to be a global checklist on species loss and the need for action to stem this, alongside the Convention's own periodic monitoring reports (Secretariat of the Convention on Biological Diversity, 2010). In the UK, for example, nature NGOs have established data collection and monitoring schemes with long records for assessing trends, such as the British Trust for Ornithology's Common Birds Survey began in 1994.

The force of the international agreement has led to the formulation of regional strategies and legal instruments. For example, in the European Union the Biodiversity Strategy to 2020 is now a key policy statement agreed by all Member States (European Commission, 2012), and Directives relating to the protection of species and habitats and their recovery are now legal instruments which all Member States have to comply with (Council of the European Communities, 1992). In the UK, statutory duties for biodiversity linked to the Convention on Biological Diversity (and clearly therefore a result of the UK being a signatory to the Convention) have been placed on public bodies in England and Wales through Section 40 (1) of the Natural Environment and Rural Communities Act 2006 and in Scotland through Section 1 of the Nature Conservation (Scotland) Act 2004. For England and Wales the duty is as follows: "every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity". The duties for England, Scotland and Wales are, however, relatively weak as they use the term 'have regard to' and cannot override other statutory functions of the authorities.

From this short appraisal, there are a number of key elements in the development of biodiversity which are relevant as lessons for geodiversity. International expert groups worked productively together to develop the conceptual basis and the arguments for international agreement and action. The scientific basis was elaborated at an early stage. An evidence base was built up on the trends and their causes to inform what was needed to be done and to evaluate progress. A clear and internationally agreed definition enabled the concept to be embedded in international and national legal instruments. Information on trends and the agreement on the definition provided a firm basis for articulating biodiversity to a wider public audience. And, the approval of international law provided the foundation for regional laws and national laws to be made and implemented.

4. Improving the promotion of geodiversity

Given the relative success of biodiversity conservation instruments and actions, what can the Earth Science community learn from that experience to increase the profile and acceptance of geodiversity? Eight interrelated suggestions are put forward for debate.

(1) Gray has articulated a definition and it can provide a basis for development. The international Earth Science representative bodies need to join together to agree a definition. This should be in language easily understood by the public. Too often there are sterile arguments about the definition of geodiversity, and its component parts such as geoheritage, geoconservation and even invention of new terms which add to the confusion, such as geomorphosites. There is a need to agree an accessible statement of what geodiversity means for society.
(2) The development of statements and protocols on geodiversity is needed if the lessons from biodiversity are to be learned. Within the UK, geodiversity statements should be developed for each of the constituent administrations. These could be modelled on Scotland's Geodiversity Charter for example, which was drawn up by government and non-government bodies with an interest in promotion of geodiversity and has the imprimatur of the Scottish Minister for the Environment.

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These statements could then form the basis for a duty on geodiversity in up-dated nature conservation legislation of each administration when the opportunity arises.

(3) Internationally, the development of thinking on geodiversity, akin to the work in the 1970s and 1980s by the biological conservation community suitably updated, is needed to provide the arguments for inclusion of geodiversity in the theory and practice of nature conservation. Whether it is possible to win the argument for an international convention akin to that on biodiversity is highly debatable, but it could be linked to the Earth Charter. Within the EU any powerful directive on geodiversity is unlikely, given the difficulty of gaining agreement on a Soil Directive. Nevertheless, it is incumbent on the Earth Science community to lead arguments to ensure that the abiotic component of nature is fully recognised in the working practices of the UN and its convention secretariats, especially the CBD, and within the European Commission and especially in the Directorates dealing with biodiversity and regional development programmes.

(4) Greater attention needs to focus on the fundamental importance of Earth systems and processes for human life, both directly and through its interconnection with biotic nature. With the growth in recognition of the interconnections within nature and the services provided through the functioning of ecosystems (see, for example, Millennium Ecosystem Assessment, 2005), geodiversity should play an increasingly important role. Some progress is being made (see for example, Gray et al., 2013; Santucci, 2005). To emphasise the importance of geodiversity in the assessment and evaluation of ecosystem services, quantitative estimates of the monetary values and the additional contribution made are required. Also the linkage between geodiversity and biodiversity in the development of mechanisms for improving adaptation to and mitigation of climate change should be developed further following, for example, the preliminary analysis of Brazier and colleagues (Brazier et al., 2012).

Maybe using the simple, but fundamental, concept of 'nature', as this is both biotic and abiotic, would help. The universally accepted definition in the Oxford English Dictionary is "the phenomena of the physical world collectively, including plants, animals, the landscape, and other features and products of the earth, as opposed to humans or human creations". A recent breakthrough exemplifies this point. In the new definition of the term "protected area" (which includes geosites), approved by the IUCN, the word 'nature' was deliberately included to ensure that abiotic elements of geodiversity, as well as biotic elements, was included, rather than the narrower definition of a protected area provided in the Convention of Biological Diversity (Dudley, 2008).

(5) Use of everyday language should be a top priority if engagement with wider audiences beyond the Earth Science community is to be achieved. Too often language is dense with too many polysyllabic words and long sentences that are not understandable to even the educated layman. It is ironic, perhaps, that the first TV series on geology in recent times was presented by an evolutionary biologist with excellent communication skills: Aubrey Manning in 1998 (BBC Two 8 part series *Earth Story*). Fortunately, a geologist is now taking the lead role: Iain Stewart who has also been appointed to the first chair of Geoscience Communication in the UK at Plymouth University and has presented a series of programmes including *Earth: the power of the Planet.* Training of Earth Scientists in public communication should be accepted by university geology course teachers as being essential. Hopefully, with a new generation of communicators who understand what they are talking about and can exploit social media, as well as TV and print media, will come increasing understanding of the importance of geodiversity and its accepted place alongside biodiversity in the debates about the future of our natural and human worlds.

(6) Without a ready supply of students being exposed to the thinking of the Earth Sciences at secondary school level, the supply of students to undergraduate courses and then into employment will diminish. It is unfortunate that the place and extent of geology and geomorphology is being actively diminished in the schools' curriculum. This has been of such concern in Scotland that a conference has been held and politicians lobbied; so far with little effect on the curriculum (Royal Scottish Geographical Society, 2013). Lobbying for reinstatement of geology and geomorphology into the schools' curriculum is essential, alongside the need for adequate recruitment of and training for Earth Science teachers.

(7) A great deal of effort has been made into measuring rates and causes of natural geological and geomorphological changes at short and geo timescales. But, is this sufficient to inform decisions necessary, for example, about the management of coastal and river systems in the light of irregularity in weather patterns and the extreme events being experienced? And, is attention to protecting biotic nature in protected areas, such as nature reserves, taking too narrow a focus when physical natural processes can have an overwhelming effect? Does this not point to greater scientific investment by the funding bodies in measuring the rates and causes of abiotic natural changes?

(8) And, finally, but of high importance, should be for the learned societies within the Earth Sciences community nationally, regionally and globally to use their combined convening power to lobby influencers and decision makers. In the UK, the Geologists Association, the Geological Society of London and the Royal Geographical Society could take the lead, working with the two national academies, the Royal Society London and the Royal Society of Edinburgh, to lobby government ministers, politicians, political advisers, and senior civil servants, for recognition of geodiversity, as an equal partner alongside biodiversity.

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