

NEW PERSPECTIVES ON GEOCONSERVATION
IN PROTECTED AND CONSERVED AREAS

ROGER CROFTS, GUEST EDITOR



Progress and future challenges for geoconservation in protected and conserved areas

Roger Crofts

ABSTRACT

This paper introduces the set of essays in this issue of *Parks Stewardship Forum* charting the development of thinking and action on geodiversity and geoheritage conservation. It spells out progress to date on a number of fronts, including defining terms and advancing the geoconservation agenda in IUCN, leading to the conclusion that geoconservation is now well established in geoscience dialogue and practice. Future challenges are set out in some detail in the hope that geoconservation will become an increasingly relevant and integral component of nature conservation and human society agendas. Three areas of challenges are highlighted: making sure that geoconservation specialists have clear and consistent approaches to the classification and assessment of geoheritage assets and their

conservation; mainstreaming geoconservation in biodiversity and nature conservation dialogues; and relating geoconservation to all aspects of human society and the emerging people-based agendas.

INTRODUCTION

It is some 15 years since geoconservation formed the focus of an issue of *The George Wright Forum* (Santucci et al. 2005), the predecessor to *Parks Stewardship Forum*. Much has happened since then to develop the thinking, promote it, and put it into practice around the world. However, geoconservation is still not in the mainstream of protected area management, nor in the forefront of international thinking and action for nature conservation, despite

Flintholmen, Nordre Isfjorden National Park, Svalbard, Norway © ROGER CROFTS

its fundamental relevance to the nature conservation agenda (Gordon et al. 2018). Following on from the publication of the first Best Practice Guidelines on geoconservation in the IUCN World Commission on Protected Series (Crofts et al. 2020), this article sets the scene for those that follow in this special volume of *Parks Stewardship Forum*. In particular, it examines progress and sets out the further action needed to place geoconservation at the center of protected and conserved area establishment, management and communication.

PROGRESS TO DATE

What have been the main advances in the last 15 years? José Brilha's paper gives a detailed account over the last half-century. This article highlights some of the key developments.

A turning point in geoconservation was the agreement within the International Union for Con-

servation of Nature (IUCN) to a revised definition of protected areas in 2008. Instead of focusing on biodiversity, the broader term “nature” was adopted in recognition of the role of rocks, landforms, and soils, and of Earth's abiotic processes and their effect on and relationship with biodiversity (Dudley 2008). This process was consolidated by successive resolutions approved by the IUCN General Assembly (IUCN 2008, 2012, 2016, 2021) which place a duty on IUCN to include geoheritage and its conservation and protection, both *in situ* and *ex situ*, within its work. A Geoheritage Specialist Group (GSG) has been established within the World Commission on Protected Areas (WCPA) (<https://www.iucn.org/commissions/world-commission-protected-areas/our-work/geoheritage>). It has an active membership delivering a number of key outputs.

International action has been generated in a number of ways. A starting point was the first geoconservation

Earth's natural dynamism is illustrated at the margins of its tectonic plates. The Fagradalsfjall fissure eruption (2021) in Reykjanes Geopark of southwest Iceland not only challenges Earth scientists' predictive abilities; as a magnet for local people and visitors, it also challenges the civil authorities' capacity for managing risk to the public. © ROGER CROFTS



meeting held in The Netherlands in 1988, which led to the formation of ProGEO (The European Association for the Conservation of the Geological Heritage). It has developed formally into an international body. Its most recent conference in 2021 attests to the strength of and interest in the subject, with 400 participants from 58 countries giving over 150 papers. ProGEO's journal *Geoheritage* was launched in 2008. The first three issues of 2021 (four in total per year) contained 83 items, largely original papers from around the world. The geological community has also taken steps to address geoconservation with the establishment of the Commission on Geoheritage of the International Union of Geological Sciences (IUGS).

Under the ambit of UNESCO (the United Nations Educational, Scientific, and Cultural Organization) progress has been made on three fronts. The World Heritage Committee has inscribed 93 geoheritage sites on the World Heritage List, aided by experts' reviews led by IUCN (Dingwall et al. 2005; Williams 2008; Goudie and Seely 2011; Casadevall et al. 2019; McKeever and Narbonne 2021). More recently, the International Geoscience and Geoparks Program has been approved as a formal element of UNESCO. As a new protected areas category, geoparks link geoconservation to local sustainable development initiatives, especially to stimulate geotourism activities. By April 2021, 169 geoparks had been established in 44 countries. Most recently, UNESCO has approved the establishment of an International Geodiversity Day to be held on 6 October each year.

The publication of the first book on geodiversity, entitled *Geodiversity: Valuing and Conserving Abiotic Nature* (Gray 2004; 2nd. ed. 2013), was a milestone. More recently a compilation of articles was published as *Geoheritage: Assessment, Protection and Management* (Reynard and Brilha 2018). IUCN literature now recognizes geoconservation by including it, for example, in a protected area management handbook (Crofts and Gordon 2015) and a Best Practice Guideline on Geoconservation (Crofts et al. 2020).

An important element in progress was ensuring a definition of terms that was agreeable within the geoconservation community. There is some remaining debate; for example, whether *geology* is the all-encompassing word, or for geographers the importance of recognizing geomorphological landforms and processes. Hence *geoheritage con-*

servation, or *geoconservation* for short, is preferred. Values and principles have been agreed to and published. The methodology for making inventories and assessments for determining geoconservation sites has been developed and applied in many countries. Approaches for inclusion within the concepts of ecosystem services and natural capital now exist (see the papers in this issue by Gray and by Gordon, Bailey, and Larwood). Links have been made to cultural heritage conservation. The methodology for assessing threats has been developed and new approaches to education and communication applied (see Crofts et al. 2020).

Geoconservation is now firmly established in geoscience dialogue and practice.

FUTURE CHALLENGES

Despite these advances, geoconservation is still a poor second to biodiversity conservation in the priorities of protected area decisionmakers. It is not firmly established as an intrinsic part of nature for protected or conserved areas, nor is it embedded in the public mind. To remedy this, I propose action by the geoconservation community on three fronts.

1. Getting our house in order

The concepts of geodiversity and geoconservation are still relatively young and there remain a number of issues requiring further development to enhance the credibility of the sector within the geoscience community and with wider communities of interest.

Foremost is the global agreement of a systematic, scientifically credible, and comprehensive framework for the identification of geosites. Despite a number of efforts led by IUGS over the past three decades (such as a Global Indicative List of Geological Sites), until the recent establishment of a new program to develop a global standard for the recognition of the geological heritage little progress had been made. This essential work is needed to aid the development of a global network of sites that has credibility within the wider nature conservation community.

Ensuring consistency in inventory and assessment work and its application to all countries would be helpful. Currently, too many inventories are developed for individual countries rather than building on the most credible and systematic methodology available. Also, many classifications of

geoheritage interest have been developed as a basis for determining conservation values and the threats to them. More consistency is needed so that cross-border comparisons can be made and a coherent global approach adopted.

The need for more areas to be protected and conserved for their geodiversity interest and for their geoheritage significance is clear from recent assessments (see for example Casadevall, Tormey, and Richards 2019 on volcanic sites) and from the papers in this issue by Goudie on desert environments, Gunn on karst environments, Migoñ on rock landforms, and Larwood, Santucci and Fiorillo on paleontological sites. A systematic basis for selection is essential, and will hopefully result from the aforementioned work under the auspices of IUGS and the designation of key geoheritage areas by IUCN, as well as through the two schemes under the UNESCO umbrella: global geoparks and World Heritage sites.

Identifying global type sites is a critical task currently underway. The Global Stratotype Section and Point at Luoyixi Town, Guzhang County, Hunan Province, China, is an internationally recognized type site in the Xiangxi UNESCO Global Geopark. © JOHN GUNN



There has been debate about the need for an international convention on geodiversity akin to the one on biodiversity. No successful case has so far been made and the fallback has been to use the Digne Declaration, the International Declaration of the Rights of the Memory of the Earth issued by the participants in the first international symposium for the conservation of geological sites (Digne 1991). It is not clear whether UN Member States would agree, but the recent agreement by UNESCO on the international Geodiversity Day perhaps gives some grounds for optimism.

Ensuring up-to-date material is available for informing decisions on World Heritage site proposals is necessary, both for the whole suite of site criteria and for those abiotic systems that are currently underrepresented, such as deserts and periglacial areas.

To stimulate more action nationally and locally, geodiversity action plans for each nation, and site management plans to include diversity elements, should be encouraged.

To place geoconservation firmly on the nature conservation agenda, a new program of work to develop a network of Key Geoheritage Areas is underway by GSG and some IUCN members.

2. Mainstreaming geoconservation in the nature conservation/biodiversity dialogues

Unless geodiversity, and specifically geoconservation, can be mainstreamed into the broader nature conservation agenda and action, the potential gains for the wider conservation community will not be achieved. This issue is arguably the most important one for the next few years for the geodiversity and geoconservation community. There are a number of initiatives that need to be considered and acted upon.

Action is needed to determine how geoconservation can contribute to the achievement of the revised biodiversity targets to be agreed to at the next Conference of Parties of the Convention on Biological Diversity (CBD 2021), which aim to reduce the loss of biodiversity by 2030. The four goals and 20 targets contain aspects where geoconservation can contribute. For example, Goal A.1 states, “The area, connectivity and integrity of natural systems [is]

increased by at least [5%],” and Goal A.2 states, “The number of species that are threatened is reduced by [X%] and the abundance of species has increased on average by [X%].” The relevant targets for these goals are as follows. “Target 1. By 2030, [50%] of land and sea areas globally are under spatial planning addressing land/sea use change, retaining most of the existing intact and wilderness areas, and allow to restore [X%] of degraded freshwater, marine and terrestrial natural ecosystems and connectivity among them.” “Target 2. By 2030, protect and conserve through a well connected and effective system of protected areas and other effective area-based conservation measures at least 30 per cent of the planet with the focus on areas particularly important for biodiversity.” For both of these goals and associated targets, abiotic processes are a critical component and work is needed urgently to make these linkages. Specifically, it will be essential to determine how geoconservation can help to achieve the 30% target. Adopting the “nature’s stage” approach, as described by Gordon, Bailey, and Larwood in this issue, is a step forward.

A more systematic approach is required in all nations to ensure that geoconservation sites and areas are formally linked to those protected areas that are designated primarily for biodiversity conservation. Some geoheritage features and processes that are vital to the ecological functionality and health of sites may well have been missed in the designation process.

More broadly, it is important that geoconservation becomes a central component in wider nature conservation approaches, such as the ecosystem approach (see Gray’s paper), natural capital accounting, and the application of nature-based solutions (see paper by Gordon, Bailey, and Larwood). Not only do guidelines need to be produced to make the links, but also specialists need to work with colleagues in devising new strategies and approaches and be influential in how these are applied in practice.

Unless the geoconservation and wider geoscience community improves its ability to communicate, limited progress will be made. Promoting speaking “a common language” with the biodiversity conservation community, popularizing our language of communication, removing obscure polysyllabic



Geodiversity underpins biodiversity in many locations and recognizing that link is important in achieving effective management of nature. Keen of Hamar National Nature Reserve, Yell, Shetland, Scotland, UK, is formed of serpentine rich metallic soils which provide the basis for rare endemic plants and species-rich grassland. © ROGER CROFTS

terminology, and using language that the public understands and can relate to are the ways forward. Tormey discusses modern methods of education and communication in his paper.

3. Geoconservation and the people agenda

There are many ways to develop greater understanding of and interest in geodiversity and geoconservation for the public. After all “biodiversity” once was an unknown word, and beyond the “fluffy and furry” animals its concepts were little known to the public until the 1990s. The third element of the future agenda is therefore simply to use all means possible to help people participate in, enjoy (at source or at distance), and be stimulated by Earth history—what is happening now and what might happen in the future. There are a number of ingredients in pursuit these objectives.

First, learning lessons from the past Earth history is likely to be helpful (this is developed by Tormey in his paper). How is it that plate tectonics has become a well-known and generally understood theory of Earth evolution? Simply by experts telling the story in a simple and easily understandable fashion. The public does not need to understand the intricacies of the different types of collisions between the plates, but can understand their consequences for the world today. Beyond this, it is important to place Earth processes in a longer time frame and to seek to extrapolate those trends and their underlying causes that are relevant today and may be relevant in the foreseeable future. Of course, there are real uncertainties about the future of “life on Earth,” especially the variability and rates of change of Earth processes. What is now known from geological studies is that steady state and gradual change have not always been the norms over the duration of Earth’s history. As a result, rather than expecting slow changes and smooth transitions, extremes are more likely, including rapid changes and threshold crossing with unpredictable consequences.

Second, and more pragmatically, it is important that the geodiversity and geoconservation community form a clear view of how geoconservation can aid the delivery of international agendas, especially the realization of the UN Sustainable Development Goals. Of the 17 goals, six are particularly connected to the proper functioning of Earth’s natural systems and their protection, conservation, and sustainable use: *ending poverty; ending hunger and achieving food security; ensuring healthy lives; promoting education and lifelong learning opportunities; combating climate change; conserving the oceans; and protecting, restoring, and promoting sustainable use of terrestrial ecosystems, including halting and reversing land degradation and halting biodiversity loss*. The linkages are obvious: water, soils, and minerals, as well as the natural processes that sustain life. Geoconservation has a major role to play in safeguarding the natural goods and services produced from geodiversity and is, therefore, a vitally important component of sustainable development in the meaning of the term as originally stated in the report of the Brundtland Commission. The geoconservation community must make these points abundantly clear by providing objective evidence to support the arguments and by offering forms of words to be used in the emerging protocols and indicators. Progress has already been

made and reported by Gill and Smith (2021) and can be built upon, as summarized by Gray and Crofts in this issue.

Third, and of equal importance, is addressing the question of how can geoconservation help with the amelioration and mitigation of the climate change crisis. The paper in this issue by Gordon, Tormey, and colleagues sets out the possibilities for protected and conserved areas. Suffice to say, adaptive management of geosites is possible, with new techniques being put into practice, based on “working with nature” approaches.

Fourth, support in responding to the COVID-19 pandemic and other global pandemics that will follow is important. An excellent overview for protected and conserved areas has been prepared by WCPA (IUCN WCPA 2021). The main messages relevant to geodiversity and geoconservation are that there is potential for protected and conserved areas to aid a green recovery, which will provide a cost-effective, nature-based solution at a small cost compared with money spent already on economic recovery. This should result in improved ecosystem management and more ecological restoration. One of the key lessons already learned is that giving people opportunities to be closer to nature has beneficial effects on their health and well-being. The clamor to go to natural places has increased substantially. However, there are concerns about the ability of sites and site management to cope with the pressures and the need to minimize damage without undermining the users’ experience. The geodiversity and geoconservation community should be making an input on all of these issues. In this context, the need for more sites and areas to be protected is argued by Goudie for desert environments and by Migoń for rock landforms and landscapes, while Tormey and Casadevall provide lessons on managing hazards in volcanic areas.

Fifth, and more generally but linked to the lessons from COVID-19, experts should be addressing the contribution of geoconservation to improving the connections between people and nature. There is now a well-proven case of improving human health and well-being through contact with nature. Moving away from dense scientific material using too many words in crammed visitor centers to more innovative approaches is an important way forward



Connecting people and nature is now a fundamental part of protected and conserved areas management, as seen here at Magdalena Fjord in the Nordvest-Spitsbergen National Park, Norway. © ROGER CROFTS

in geoconservation education and communication. By far the best way to do this is by enthusing and stimulating more people about geoconservation. Traditional techniques, such as interpretation signs, guided or self-guided trails, and leaflets, are still valid and relevant—provided they are created with the targeted audience in mind rather than for the expert. There are many new techniques exploiting modern media and new thinking about outreach to target audiences, which are explored in the paper by Tormey.

Finally, geoconservation has a significant role to play in reducing conflict. Addressing the questions of how geoconservation can help to heal human divides resulting from water wars or mineral extraction, for example, are significant challenges but with potentially rewarding outcomes for nature and people. Specifically, there remain many conflicts about the exploitation of natural resources by one nation without thinking about the consequences for adjacent nations. What are termed ‘water wars’ is a classic case in point where experts in the geodiversity

of river systems can bring vital information to bear on tense negotiations, and all too often dialogues of the deaf, between nations. Treating whole rivers as a single unit rather than as a series of separate units, and recognizing the special places of geoheritage significance requiring protection are matters that the geoconservation community should be addressing. Goudie, Gunn, Migoń, and Larwood, Santucci and Fiorillo all address these issues in their papers on specific settings and environments.

CONCLUSION

Significant progress has been made over the 15 years since the previous George Wright Society publication on geodiversity and geoconservation. That progress is summarized in this short introductory paper. More important are the advances that are currently underway to address the outstanding issues within geodiversity and geoconservation and to ensure that the latter gains greater recognition for its contribution to improve nature conservation and human well-being.

ORIGINS AND OVERVIEW OF THE PAPERS IN THIS SPECIAL ISSUE

The papers in this volume describe progress and opportunities on many aspects of geodiversity and geoconservation focusing on protected and conserved areas. Most of the authors of the papers that follow began their collaboration with the preparation of the IUCN WCPA Best Practice Guidelines on *Geoconservation in Protected and Conserved Areas* (Crofts et al. 2020) as members of the Geoheritage Specialist Group. We benefited from the copy editing by Dave Harmon, executive director of the George Wright Society. As a result, he suggested that we write a series of articles for Parks Stewardship Forum providing a broader and more forward looking perspective than we were able to produce in the formal guidelines and enlist other collaborators in the process. The result is the 12 papers in this set.

The set is in four sections. The first, “Overview,” provides both a history of geoconservation since its origins half a century ago, by José Brilha, and a progress report and discussion of future issues to be addressed, by Roger Crofts. The second section,

“Changing the setting,” focuses on the link between geoconservation and the major international frameworks and issues. Murray Gray and Roger Crofts consider the contribution of geoscience to the achievement of the UN Sustainable Development Goals. Murray Gray also describes the role of geodiversity as part of the concept and practice of the ecosystem approach. John E. Gordon, Joseph J. Bailey and Jonathan G. Larwood spell out the implications of adopting the “nature’s stage” approach to linking geoconservation with biodiversity conservation. John E. Gordon, Daniel Tormey, Rachel Wignall, Vanessa Brazier, and Roger Crofts explore the implications of climate change on the management of protected and conserved areas. The third section, “Getting the message over,” has a single paper by Daniel Tormey dealing with the all-important subject of education and communication. The papers in the final section, “Geoconservation in different settings and environments,” give advice on the new approaches being adopted and new sites/areas needing to be protected. Andrew S. Goudie updates an earlier co-authored study on desert areas and

Taking water from rivers and underground springs to supply human populations can have a deleterious effect on conserving nature. For instance, at the Shaumari Reserve, Jordan, the supply of water essential for the successful re-introduction of the Arabian oryx has been reduced due to the demands from the city of Amman. © ROGER CROFTS



landforms needing protection. John Gunn focuses on geoconservation in karst and cave environments. Daniel Tormey and Thomas Casadevall identify best practice in hazard management in volcanic areas. Jonathan G. Larwood, Vincent L. Santucci and Anthony R. Fiorillo report on the results of an international survey of conservation of fossil resources. Finally, Piotr Migoń argues the case for recognition and protection of varieties of rock landforms.

It is hoped that the reader will find these contributions challenging and stimulating, and that they will result in greater recognition of the importance of geoconservation in the stewardship of protected and conserved areas.

I thank my colleagues for their contributions and their commentary on other papers which has improved the set presented here.

Roger Crofts

Geoheritage Specialist Group, IUCN World Commission on Protected Areas
6 Eskside West
Musselburgh, Midlothian, Scotland EH21 6HZ United Kingdom
roger.dodin@btinternet.com

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On the cover of this issue

The precipitous rock spires of Meteora World Heritage Site in Greece have a complex geological history. Over the centuries a number of Eastern Orthodox monasteries were built atop them, and today's World Heritage Site recognizes this cultural history as part of the overall geoheritage. | [STATHIS FLOROS](#)