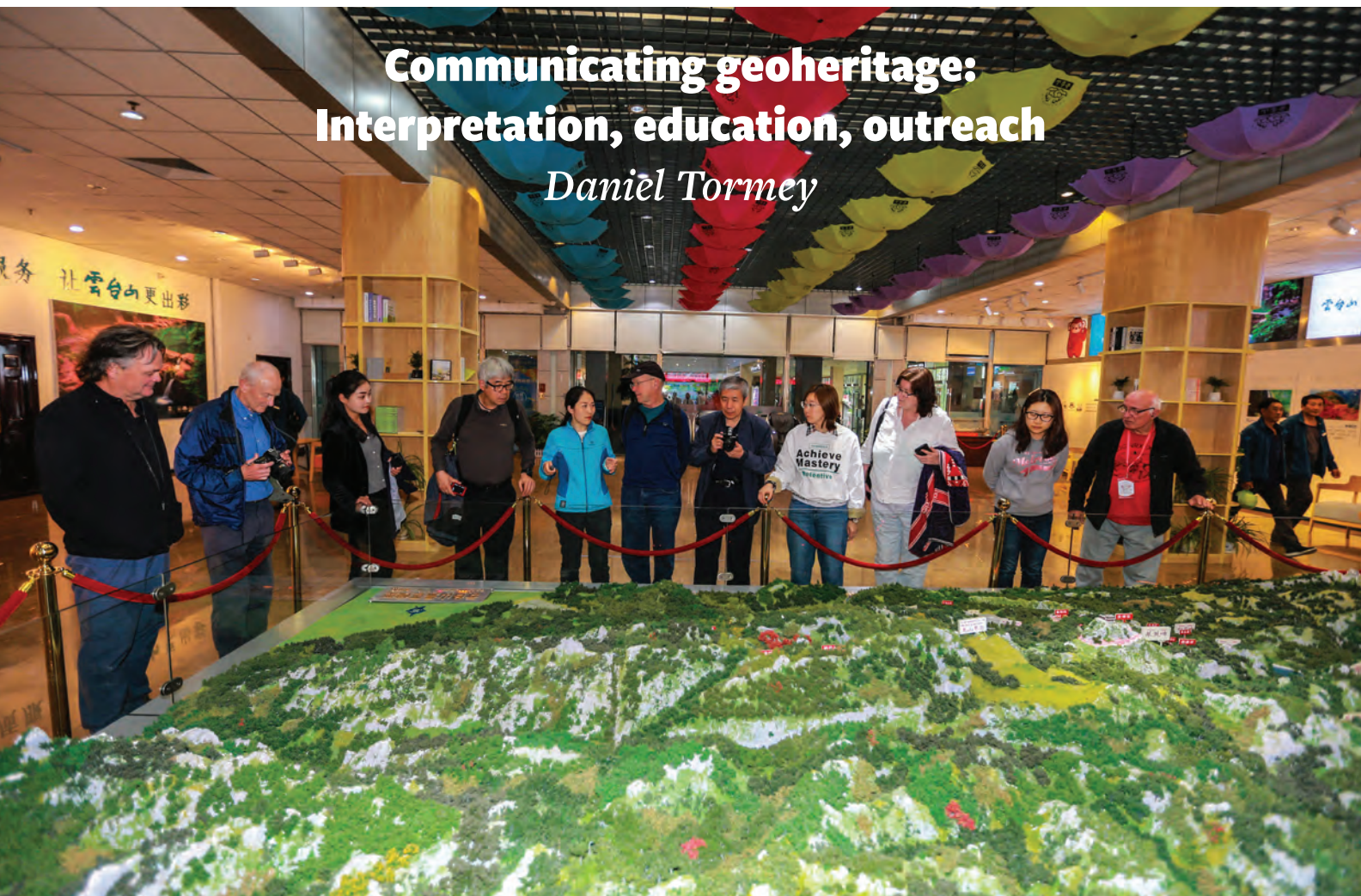


NEW PERSPECTIVES ON GEOCONSERVATION IN PROTECTED AND CONSERVED AREAS

ROGER CROFTS, GUEST EDITOR

Communicating geoheritage: Interpretation, education, outreach

Daniel Tormey



ABSTRACT

Communicating geoheritage is one of the most active areas for new ideas to support a long-term relationship with visitors and a broader digital community of supporters. Communicating geoheritage starts with interpretation to build understanding; progresses through education to build a deeper appreciation; and uses public outreach during decision-making to foster stewardship, protection, and a conservation ethic.

Keywords: Geoheritage; communication; interpretation; education

INTRODUCTION

Exploring and communicating geoheritage is true time travel and is freely available around the world. Tales of the earth capture our imagination and cause us to wonder how things have changed since the time

preserved in the rocks. For example, the great super-eruption of the volcanic center beneath Yellowstone National Park blanketed America out to the Atlantic Ocean in glassy ash 1 million years ago. Another example is the perfect fossil preservation of colored feathered dinosaurs in Liaoning Province in China, which show the evolutionary process from dinosaurs to birds 150 million years ago. A third example is the crash-landing of an extraterrestrial object 50,000 years ago at Arizona's Meteor Crater. The wonder about past events preserved in the rocks around us also suggests future conditions: the processes are ongoing and the past is the key to envisioning the future.

A display at a visitor center in Yuntaishan UNESCO Global Geopark, China, helps visitors understand the park's globally significant geoheritage.

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Time travel back to the last Ice Age at the La Brea Tar Pits in Los Angeles, California, USA. © DANIEL TORMEY

Geoheritage supports a broader understanding of the environment and the stage upon which biodiversity, cultural practices, and climate change adaptation operate. Realizing these multiple benefits depends on building a conservation ethic through effectively communicating geoheritage: helping to interpret geoheritage to interested visitors; providing educational opportunities for those who want to go deeper in their understanding and appreciation; and moving to becoming apostles of a true environmental conservation ethic that includes participating in public outreach and engagement in protected area management. As Jacques Cousteau said: “In the final analysis, people protect only what they love.”

Digital tools and new design ideas are revolutionizing how and where communication and education happen. This is one of the most rapidly evolving fields of geoheritage management and includes mobile apps that guide visitors during either a physical or

virtual visit, recording key geoheritage areas for 3-D visualization using virtual reality tools, and recorded ranger-led tours available online (see Crofts et al. 2020).

The resonance of many geological features to cultural and heritage values can make geoheritage a centerpiece for communication with visitors. Mount Fuji in Japan is a globally iconic volcanic landscape that is protected primarily for its cultural values. The educational value of sites is evident at many locations. For example, Yellowstone and Yosemite in the USA have geoheritage as their core value and demonstrate our early attempts at geoconservation and development of national parks. The Burgess Shale formation in Yoho and Kootenay National Parks, British Columbia, Canada, provides exceptional insights into the evolution of complex life forms on Earth over 500 million years ago during the Cambrian period.

Related to the current resonance of some of these key geoh heritage areas is the fact that there will be some aspects of Earth systems and features that our current knowledge does not recognize nor understand. We should be aware of leaving an inheritance for future generations to research and explore as part of their educational and cultural resources. We are just learning the vast scientific and educational value of submarine geological features; at present there are few opportunities to offer protected area status to them. All of these sites are ideal for innovative communication and education strategies.

People are finding that quality *experiences* bring more happiness than acquiring *things*. Protected areas with geological features are particularly suited to providing memorable and educational outdoor experiences. Even with the resulting influx of visitors to geoh heritage and other protected areas and museums, however, many organizations are equally focused on reaching beyond and multiplying the opportunities for geoh heritage communication and education. Communicating geoh heritage can therefore combine outreach to both actual and digital visitors, and enhance the overall awareness of the public and other stakeholders that preservation of geoh heritage values is occurring, whether or not they ever visit physically or digitally. Protected areas have an opportunity to go beyond a single visit to form a longer relationship, both before and after the visit. The physical visit is the peak experience of the longer relationship. In many ways, the site visitor center is the hub from which the many communication spokes emanate: through the site, through the near group of prospective and former visitors, to the larger group of interested people who may never physically visit but who desire to be part of the experience offered by the site's values.

INTERPRETATION

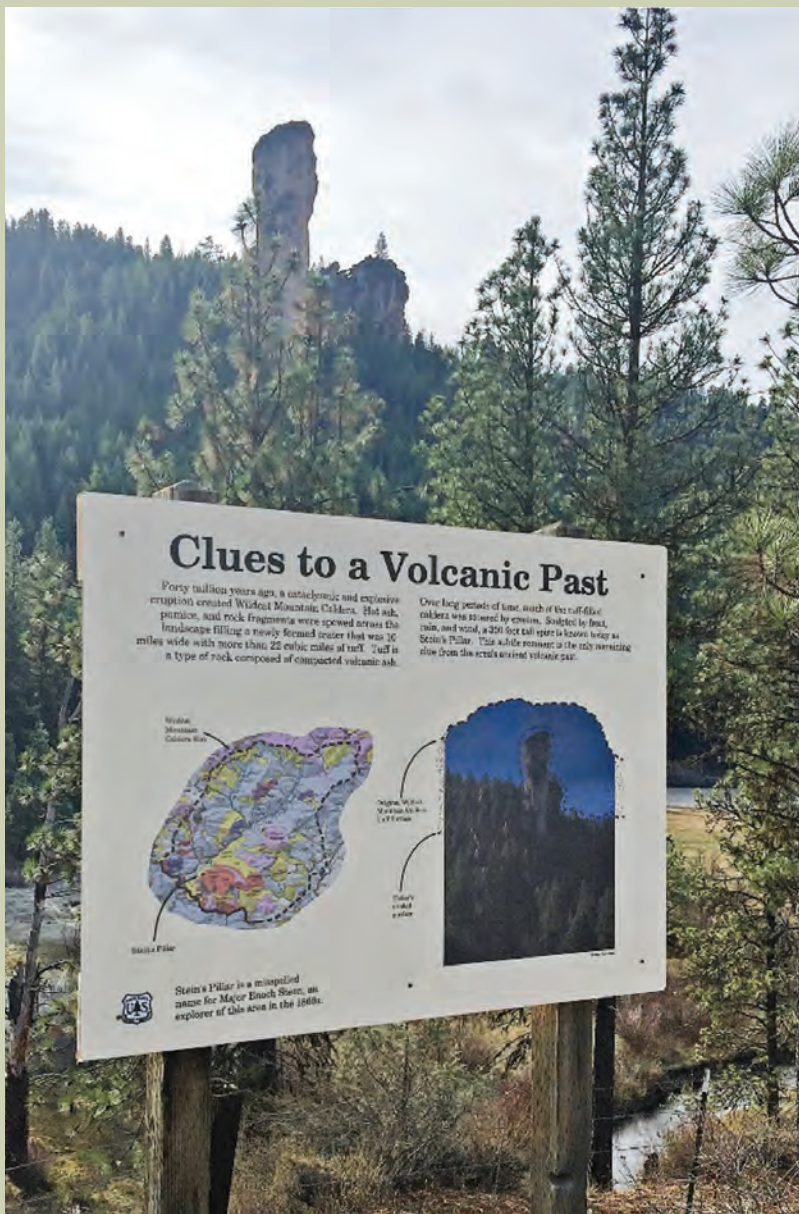
Interpretation is the first line of communication between geoconservation managers and the public. Interpretive tools and, most importantly, trained, talented interpreters/storytellers form the core of communication methods, and these can be generalized as needed for each aspect of the experience. Increasingly, interpretation moves beyond a visitor center or museum to establishing a digital relationship that extends interaction beyond the actual visit. Communicating the geoh heritage of protected areas to the world community encom-

passes all stages of the visitor's engagement: wishing, planning, traveling, arriving, visiting, leaving, remembering, and, above all, sharing the experience.

Interpretation is a method of communication that aims to reveal the significance of the property's resources rather than just convey factual information. The guiding principle of effective interpretation is "through interpretation, understanding; through understanding, appreciation; through appreciation, protection" (Tilden 1957). Interpretive programs and trained interpreters historically have targeted visitors to parks, but interpretation can now occur anywhere, including as part of environmental education outreach programs and through web-based or mobile app-assisted interpretation. On-site interpretation, however, remains particularly powerful as it can complement the public's direct experiences with geoh heritage values, and how they support biodiversity and cultural values.

Interpretation can enhance appreciation of geoh heritage resources in many ways, particularly by highlighting the connections between the scenery and underlying geology, and by delineating the relationships between geology and a protected area's flora, fauna, and human history. Additionally, viewing rocks and landscapes from different perspectives and scales further enables the understanding of the value of geologic resources as integral parts of park environments. In many ways, effective communication, including effective interpretive programs, allows the public to connect to the importance of geoh heritage values within societies and communities at large and can foster a greater appreciation of its significance. The National Association for Interpretation (<https://www.interpnet.com/>) curates an abundance of online information and tools with excellent examples of successful interpretive materials. For a broader context, both ProGEO (an international association for the conservation of geological heritage) and the International Union for Conservation of Nature (IUCN) have compiled innovative interpretive techniques (Diaz-Martinez et al. 2014). Ham (2013) has published an excellent and widely used practical implementation guide for interpretation programs.

Turning to the agency level, the approach of Parks Canada to planning interpretation is described



The core of interpretation puts visitors in the scene and engages them directly; this panel is at the perfect spot for this interaction. US FOREST SERVICE

in Jager and Sanche (2010). To achieve the goal of remaining relevant, Parks Canada first focuses on understanding what social science indicates regarding the relevance of geoheritage factors to potential visitors, stakeholders, and the country at large. This analysis has led to the recognition that it is not just the visit to the park that must be addressed, but rather the entire visitor experience cycle (which may not even include a physical visit). Parks Canada’s effort to shape the experience cycle is also focused towards providing opportunities for sharing (photos or video clips) interpretive experiences through various social media. Parks Canada is framing the overall experience as a series of shared outcomes, involving the visitor, the

heritage place being visited, Parks Canada, and its partners.

The United States National Park Service (USNPS) considers effective use of an interpretive moment or opportunity to require an interpreter who knows the resource, knows the audience, and has a range of interpretive techniques. An inspiring interpreter with excellent communication skills acts as a vital springboard to inspire visitors to learn more and follow up through the many excellent online resources. Knowing the resource means knowing the parks and its history: its compelling stories, the issues and values associated with it, and the needs of its resources. Knowing the audience means knowing why a visitor is there. It might, for example, be to get a recreational trophy such as a shareable photo or sighting, seek refuge and peace, gain knowledge, or act as a steward of nature. Some of the key techniques of the interpreter are working from the tangible to the intangible; connecting the geoheritage to big ideas such as climate change or time travel; rooting abstract ideas in the concrete scene in front of the visitor; and telling memorable stories. Bringing all of these ideas together in an interpretive moment is most effectively achieved with planning, including an overall subject, what you want to say about it, and a desired result with the visitor.

DIGITAL TOOLS

The visitor center—both the physical building and the web-based digital center—are central to effectively communicating with the large group of people interested in the park, guiding them to realize the peak visitor experience and then share it with others. A good example of working beyond the physical visitor center to the digital visitor center is summarized in the USNPS publication “Transforming the national parks digital experience” (USNPS 2019). Several types and levels of communicating geoheritage are described, with the vision that the physical and digital visitor centers be the hub for this communication.

Sometimes digital experiences or key photos go viral, which has the benefit of significantly expanding awareness of the protected area. However, when this involves a particular spot in a protected area going viral, it can lead to a rapid increase in visitor numbers, and degradation of the experience. For example, until recently Horseshoe Bend on the Colorado River, within Glen Canyon National Recreation Area upstream from Grand Canyon National Park, had been remote and wild. The 180° bend in the river formed its own canyon 1,000 ft deep. The view fits perfectly in frame of a smartphone camera, leading to large crowds of photographers. Horseshoe Bend saw a thousand visitors a year in 2014, but over 4,000 people a day came in 2019. Upgrades to parking and other amenities are planned to address the increase in visitor numbers, but those upgrades will change the formerly remote and wild feel of the place. While this aspect of the shared experience cannot be easily controlled, protected area managers must be aware of the potential for too much success in communicating geoheritage, with the inadvertent result of greater threat to potentially vulnerable geoheritage values.

Many areas are growing their reach to a global audience by the use of mobile apps. For example, many parks in the US national park system have developed mobile apps to assist and educate visitors while they are at the park through the USNPS Center for Interpretive Media (USNPS 2019). Mobile apps are also now playing a role in extending the parks' reach to connect visitors to additional learning material through live links. The American Museum of Natural History in New York is a good example of what can be done with this tool (<https://www.amnh.org/apps/>). The museum's exhibition staff have created mobile apps to accompany certain exhibits, which can include games and other innovative communication and education approaches. The museum has also created a comprehensive mobile app called Explorer; it allows the museum experience to be expanded to include pre- and post-visit activities. To share more popular objects, the museum is turning to the more intensive process of 3-D scanning.

There is room for new ideas and growth in the utility of mobile apps applied to particular protected areas. For example, an app can link to ranger-developed content such as narrative driving instructions that lead visitors to areas of interest and then provide

additional content. The goal is to have a virtual ranger guide speaking to app users and linking them to further content as interest dictates.

Google's Street View is a rich resource for exploring geoheritage since it visually transports us to many impressive sites across the country and around the world. Street View allows you to investigate a site, even one you do not know well, which can lead to important insights. Of course, the real power and fun of Street View is that it allows you to explore by moving your visual perspective around the image; very useful instructions for the application of this tool to geoheritage can be found at: (<http://www.earthsciweek.org/classroom-activities/geoheritage-google-street-view>).

EDUCATION

Once someone is hooked by effective interpretative programs, they next look for a deeper appreciation through education. Geoheritage in protected areas is a highly effective tool for science and nature education. There are many best practice examples, ranging from education of the very young through junior ranger programs, school field trips, research-oriented education in geoheritage, and education of managers and workers in the field of protected area management. Traditional geoscience education comes late in many school programs; protected areas offer the advantage of engaging visitors when they are younger and providing space for continued exploration and education in the field.

Current movement in communication and education is toward education systems that foster analytical, creative, and critical thinking skills in a real-world context; that is, teaching students how to think, as opposed to memorizing material. The best treatment of developing the educational value of geoheritage can be found in Reynard and Brilha (2019). Through exchange of conservation information and plans, Beijing Normal University and IUCN's Geoheritage Specialist Group have been working towards this goal through expanding a high school environmental education program in the United States, the National Conservation Foundation Envirothon, by applying it to China (NCF Envirothon 2019). China's education reform program since 2000 has included elements of both project-based and place-based learning. Project-based learning is a teaching method in which students gain knowledge and skills by working for an extended period of time, typically as a group, to

investigate and respond to an authentic, engaging, and complex question, problem, or challenge. It requires critical thinking, problem solving, collaboration, and various forms of communication (<http://www.pblworks.org>). Place-based education immerses students in local heritage, cultures, landscapes, opportunities, and experiences, using them as a foundation for study. It can build a sense of personal stewardship in students toward their local environment, and can also re-energize teachers (<http://www.promiseofplace.org>). Numerous studies have shown the benefits and importance of engaging students in STEM (Science, Technology, Engineering, and Mathematics) education. Just as important are programs that incorporate the environment into the curriculum.

The Envirothon supports these goals directly. It is an environmental education program that culminates in the annual NCF-Envirothon Competition in

which winning teams from participating US states and Canadian provinces compete for recognition and scholarships by demonstrating their knowledge of environmental science and natural resource management. The program has a strong outdoor component, and is sponsored by the US Forest Service, the US Natural Resources Conservation Service, and others. Much of the field education and field competitions are held in areas protected for their geoheritage and biodiversity values, and this use of geoheritage as a gateway to the broader educational goals is central to the program. The Envirothon's emphasis on both project-based and place-based learning make it a perfect fit for enhancing natural science education in China. By broadening the influence of the Envirothon program and its underlying conservation goals in China, this work provides a platform for project-based learning opportunities and field-based experiences as well as to foster international collaboration.

An Envirothon student team ready to engage in place-based learning. © NCF ENVIROTHON



Many national parks, World Heritage sites, and United Nations Educational, Scientific, and Cultural Organization (UNESCO) Global Geoparks have associated education institutes that conduct field education inspired by the geoheritage of the protected area, including elements of both project and place-based learning. At Joggins Fossil Cliffs, a World Heritage site located on the Bay of Fundy in eastern Canada, the local economic development association and three levels of government have collaborated to establish the Joggins Fossil Institute to present, promote, and manage the Fossil Cliffs through a state-of-the-art research and interpretive center. The Joggins Fossil Institute has addressed challenges in communicating volumes of often complex scientific knowledge to varied audiences in a short period of time. The institute has developed educational materials that permit the teaching of science in a way that prepares lay people not only to understand geology but to approach it critically. Ongoing research at the new Joggins Fossil Centre further supports visitors in appreciating the degree of uncertainty in paleontology and engages them in the scientific method. Scientists, educators, designers and lay people provided validation of the messaging and approach in communicating the significance of the Joggins Fossil Cliffs in innovative, engaging, and even fun ways. More detail can be found in Boon and Calder (2008).

Another place-based education program is the USNPS Junior Ranger Program, which has been very successful in reaching a youthful audience. The Junior Ranger program is an activity- and place-based program conducted in almost all US national parks. Interested youth complete a series of activities guided by a workbook during a park visit. Once complete, the results are reviewed by a park ranger, and if successful the youth receives an official Junior Ranger patch and Junior Ranger certificate. They also take the Junior Ranger Oath, which includes the motto “Explore, Learn, and Protect!” Junior Rangers frequently continue their interest in conservation and learning well after the visit. Many Junior Ranger guidebooks are available online.

PUBLIC OUTREACH

Communication is at the core of the work of protected area management. Here too there have been great advances on earlier decision-making models. Tools of multi-criteria decision-making,

supported by transparent and innovative outreach, help produce a sense of ownership in the outcomes by interested parties and makes them co-stewards of the landscape with the managers. Public outreach of this type helps create a conservation ethic that is broad and deep and builds on the initial steps of interpretation and education.

The role of protected areas in responding to the need to build resilient natural systems demands that decision-making goes beyond the park boundary. This is particularly true for geoheritage conservation, which provides the physical part of the human and ecological systems. This need is leading to the creation of collaborative partnerships that include interested parties and agencies from multiple sectors focused on a specific landscape or type of geoheritage. Landscape-scale partnerships address a range of related issues, such as climate resilience, fire resilience, community well-being, and economic growth. For example, the California Department of Conservation created a Regional Forest and Fire Capacity Program to improve forest health and fire resilience in response to the increasing intensity and frequency of the state’s wildfires. This program gave rise to the Watershed Research and Training Center’s technical fire and forest capacity building and peer networking programs to improve coordination and the dissemination of best practices (Mickel and Farrell 2021). Such collaborative leadership is a natural fit for geoheritage partnerships because it is a process involving shared or joint power where no one person or group is in charge.

Success can be measured when community members from many backgrounds come together to shape a common sense of place and develop a future vision grounded in respect for diversity of perspective (Mickel and Farrell 2021). Taking care of long-term geoheritage health and resilience is a highly complex enterprise. It cannot be separated from issues of social health and justice, economic well-being, cultural heritage, or ecological condition and change. Another example of collaborative leadership is described in another paper in this volume with respect to the volcanic area of Mount St. Helens Volcano; in their work on Mount St. Helens, the National Academies of Science, Engineering, and Medicine framed the need for effective public outreach thus:

Given the uncertainties associated with potential moderate intensity and catastrophic events, as well as the analytic uncertainty associated with incomplete or outdated information, an analytic decision process that establishes risk management as an organizing principle is needed. But, given the competing values of interested and affected parties in the region; the lack of agreement on planning time frames; the overlapping but sometimes competing management responsibilities and authorities in the region; and the limited budgets of those authorities, that process needs to promote communication and trust among agencies and the public so that technical decisions effectively and satisfactorily incorporate the priorities of those interested and affected parties.

The process recommended for this case is designed to better access, engage, understand, and act on public engagement.

CONCLUSIONS

Communicating geoheritage provides a wide range of opportunities to the protected area manager, from a traditional, location-specific approach to a more global view aimed at a broader range of visitors and supporters. Applying new tools of communication and interpretation make this an active area of geoconservation work. In many ways, effective communication, including effective interpretive programs, allows the public to connect to the importance of geoheritage values within societies and communities at large and can foster a greater appreciation of its significance. This in turn can promote a geoheritage conservation ethic.

There are many ways of communicating with people who are visiting protected areas or are looking at a distance, from traditional techniques to the most innovative social media platforms. And there are many different objectives of communication, such as education and knowledge transfer and provision

Public outreach in the Navajo Nation. © DANIEL TORMEY



of visitor information. The choice depends on the characteristics of the target audience.

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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](#)