WRITE BACK:
Conservation culturomics should include images and a wider range of scholars

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Ladle *et al*. (2016) recently described several creative ways to leverage "big data" for conservation (see also Di Minin *et al*. 2015), such as datasets comprising search engine queries and Twitter traffic to track cultural trends and monitor environmental conditions. In doing so, they explicitly limit such conservation 'culturomics' (counting elements of cultural output) to the use of text-based sources, echoing the term's inventors who tracked words and short word combinations (n-grams) in the Google Books database (Aiden and Michel 2013). We argue that it is critical to allow the concept of culturomics to expand beyond text, specifically to include images. We justify this broader definition of culturomics through brief reviews of work in human–environment research, and suggest that scholars from a wider range of disciplines should be recruited in the development, testing, and interpretation of conservation culturomics tools.

Our experience of landscape is primarily visual. We first *see* our environment, before we interact with it, or intellectualize it. Indeed, it is a hallmark of visual culture studies to suggest that "seeing comes before words" (Berger 1972, p. 7). While this way of encountering land is ancient, our capacity for visual communication is new. Our ability to visualize, and therefore conceptualize, the Earth as a fragile planet was a watershed moment in the environmental movement (Figure 1). Now, landscape images both profound and mundane proliferate in a way that is historically unprecedented. Today, the public easily creates and curates their own visual expressions of values, aesthetics, and ideology by capturing and distributing images and videos online. They document where they are going, what they do there, and how they feel about it. Importantly, what they capture visually online is not always consistent with what they do and say in person or even in image captions, which often use slang and intentional misspellings in challenging ways (Figure 2). Social media-based methods like conservation culturomics should therefore examine this juxtaposition. Moreover, the subsequent analysis should build on scholarly insight about the unexpected ways that identities, values, perceptions, and preferences interact with environmental behavior (eg environmental psychology, sense of place).

It is a common observation in conservation policy that the challenges facing many species and landscapes are cultural problems more than they are science problems (Fischer *et al*. 2007). This calls for engagement with the humanities and social sciences. When studying art history or material culture, scholars have traditionally relied on slow manual collection and qualitative analyses of images that have been painstakingly created (eg painted) over time (Shove *et al*. 2007; Bennett and Joyce 2010). Social sciences, including anthropology and sociology, have also leveraged images using low-*n* qualitative methods, such as generating images and meaning with small groups of participants through photo-elicitation interviews (Pink

2003; Harper 2012). In those fields, the online sharing of images has fueled new knowledge that is relevant to conservation. There is evidence, for instance, that the careful use of online images can help to mediate contentious environmental decision-making contexts (Barry 2013), rather than bypass them. We argue that such insights can be applied in more quantitative settings.

Those taking fullest advantage of the geocoded image data increasingly shared online are ecosystem services (ES) researchers, but they do not seem to connect their work to conservation culturomics. The strong quantitative skills of ecologists and economists who study ES have facilitated rapid progress in cultural ES mapping, spurred by large projects such as OpenNESS (www.openness-project.eu) and ESMERALDA (www.esmeralda-project.eu) (Martínez-Harms and Balvanera 2012). Some of these initiatives involve manual coding of images for eventual quantification. Others assume that a photo posted equals a service delivered. Given the scale of investment in this field, it is easy to anticipate that automation is on the way. Machine learning algorithms are maturing, to allow for automatic recognition of specific features and sentiments within the vast amounts of image data being generated (Fang *et al*. 2015; Karpathy and Fei-Fei 2015). Tools leveraging these algorithms will enable faster image-based cultural ES mapping and conservation culturomics. Meanwhile, image datasets are expanding beyond social media. Increasing amounts of digitization in archives and newspapers will present the possibility for longitudinal studies using images, akin to what Google *Ngram Viewer* does for text.

On the basis of these trends and what we know about people and culture based on the humanities and social sciences, we posit that conservation culturomics needs to include both images and interdisciplinary engagement to ensure the resulting insights are nuanced, thorough, and unbiased. Such acceleration of tools and data hold some risks (Boyd and Crawford 2012; Cresswell 2014): that engagement with those holding a stake in conservation will be replaced with convenient online proxies; that imbalances and biases in online access and archival coverage will be replicated; or that privacy will be violated. Engagement with the humanities and social sciences will help to alleviate these concerns, ground insights derived from such increasingly rapid and quantitatively powerful methods in social and cultural principles, and expand current understanding of human interactions with landscapes.

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Figure 1. *"The Blue Marble" – Earth as seen by the* Apollo 17 *astronauts in 1972, triggering the environmental movement.*

Credit: NASA

Figure 2. *"Wood* [sic] *you like to go for a walk?" Smartphones have driven a proliferation of user-generated image data about nature, but image captions don't always tell the whole story.*

Credit: Pixabay