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## DIGITAL ENVIRONMENTALISM

### *Tools and Strategies for the Evolving Online Ecosystem*

ANDREW DAVID THALER

*Duke University*

KEVIN A. ZELNIO

*Independent Scholar*

AMY FREITAG

*Duke University*

RICK MACPHERSON

*Coral Reef Alliance*

DAVID SHIFFMAN

*University of Miami*

HOLLY BIK

*University of New Hampshire*

MIRIAM C. GOLDSTEIN

*University of California, San Diego*

CRAIG MCCLAIN

*National Evolutionary Synthesis Center*

The heart of conservation, environmentalism, and environmental science is the communication of knowledge. The importance of communicating directly to the public is exemplified in the origins of environmentalism, when the work of scientist-writers such as Rachel Carson and Aldo Leopold inspired social and

legislative change. By continuing this legacy, experts and the public can more effectively deal with ongoing social, technological, and conservation issues. In establishing a dialogue, communicators can begin to demolish the public perception of the ivory tower by portraying scientists as enthusiastic and accessible. “When scientists are seen to be

interested in a world outside science, the public are more likely to trust them” (Callaghan, 2007, para. 4).

Digital tools such as blogs and social media allow scientists and environmentalists to utilize an online ecosystem that provides unprecedented access to the general public. These tools make it possible to rapidly disseminate information, bypassing gatekeepers common in traditional media, and communicate directly to the public, often with no filter between author and audience and without the time delay of traditional print publications. Information holders can discuss underreported subjects, offer critical evaluation, and provide explanations of multifaceted and often confusing topics. Environmental leaders can use online tools to quickly confront disinformation campaigns and address false or misleading initiatives. But the online ecosystem and the tools to access it are not without challenges.

Here, we examine the history, challenges, and opportunities of the online ecosystem as it applies to digital environmentalism. After a general overview of online tools and audiences, we explore three case studies and create a road map for successful online initiatives.

## The Online Ecosystem

The emergence of new media platforms for communication over the last two decades has fundamentally altered not only the methods by which people interact with each other but also the underlying structure of those interactions. Traditional forms of communication were limited by distribution or participation in the conversation. Media that allowed an author to reach a wide audience (e.g., books, newspapers, radio, television) precluded conversation, while media that allowed conversation (e.g., letters, telephone, public forums) precluded distribution to a wide audience (Shirky, 2009). The World Wide Web, particularly content hosting platforms such as blogs and online forums, not only allows authors to broadcast their content to a wide audience but also allows direct conversation between the author and the audience. Individuals cease to be passive participants in media and become active coauthors in a larger conversation (Shirky, 2009).

This new “social” communication landscape bypasses the gatekeepers of traditional media. Anyone can launch a web page or write a blog, often free of charge. This freedom allows authors to report and discuss events that may not necessarily be considered newsworthy by traditional news agencies, free of the constraints of column space and advertising (Brumfiel, 2009). Ideas can be presented half formed, to be refined by an interested and often anonymous audience. Refined ideas develop in the light of public scrutiny and become stronger as an actively engaged audience grows. Although online communities appear similar to other communities built around shared ideals, they differ in how they are organized and the types of issues they are ideally suited to address. Activism in online

communities focuses on information, and the goals of a digital environmentalist are rooted in education, through the curation and distribution of knowledge.

Communities built around online platforms behave like natural ecosystems. The software that underlies these systems is the hard structure, providing a foundation for communities to develop. The growing community alters this underlying structure, allowing novel niches to emerge. Growing communities interact with each other to various degrees. Some are completely exclusive, locked behind pay walls and password protection, while others are completely open, free to access for anyone who wishes. Online ecosystems are even susceptible to a kind of “virtual” natural selection, with the users acting as selective agents, causing the software, ideas, and the community itself to evolve.

Environmental organizations thrive in this new ecosystem. They were early adopters of new communication platforms by launching their own websites and developing a presence on emergent social media networks, such as Facebook and Twitter, rapidly populating the online ecosystem. Native online environmental groups, and the digital environmentalists who formed their core constituency, developed to respond to specific needs in the larger environmental movement that are particularly well suited to online engagement: reporting news to a global audience; providing expert analysis of scientific findings; repackaging scientific messages; and confronting pseudoscientific, pseudoenvironmental, and false, misleading, or intentionally deceptive claims.

The online ecosystem removes a barrier between environmentalists and their audience, allowing conversations between segments of the population that do not frequently interact. Engagement is important for a successful environmental campaign. For scientists in particular, removing barriers to communication exposes the public to the scientist as a person and allows them to build trust through the individual, not just the ideas being discussed. The online ecosystem also allows for increased access to scientific ideas. This broadens the conversation so that anyone who is interested can provide scientific and environmental content and engage new audiences that might not otherwise be exposed to these ideas (Groffman et al., 2010). As a result, there is no longer a singular scientific expertise but many different types of expertise that are complementary. This shift relies on a broader social shift to a philosophy that all knowledge is partial; collaboration and interaction are necessary to fully understand a topic (Collins & Evans, 2002). Recognition of local knowledge, experiential knowledge, and other historically disempowered knowledge types changes the power dynamic in the scientific community and contributes to a broader social movement “democratizing science” (McCormick, 2007).

Experts with associated authority are no longer granted status simply through education or institutional affiliation. “There seems to be a demand—not for a single authoritative source—but for a greater plurality of advice so that

residents are not left with what they perceive as a *monopoly of self-interested information* [emphasis added]" (Irwin & Wynne, 1996, p. 57). Technology has helped meet this demand by providing a forum for determining this new expertise in a more democratic fashion (Fischer, 2002). In the *blogosphere* (the realm of the Internet pertaining to blogs), "elections" of experts occur through readership, comments on blogs, and acceptance into a network of established experts, among other means. Expertise relies heavily on content rather than on an individual's reputation, though reputation may still play a role in recruitment of readers. This type of open or democratic science increases success in science-informed management because of greater transparency and process legitimization (Jasanoff, 2004) by recognizing a greater pool of stakeholders.

### Accessing the Online Ecosystem

In the online ecosystem, the fundamental platforms that support broad communication are blogs and social networking services. The online ecosystem is a varied landscape with multiple audiences, and as such, several tools have emerged to access these different arenas. These tools have developed their own audiences, conversations, and methods of communication and have altered the overall online ecosystem.

#### Blogs

Blogs have existed in some form since the creation of the World Wide Web, although the basic tenets of blogging have historical roots (Rosenberg, 2009). The term *weblog* was coined by Jorn Barger to describe a list of interesting links (Wortham, 2007) or other curated Internet content and refers to both the website and individual entries, but the latter are more accurately known as posts. The neologism *blog* has become shorthand to describe a website where updates are posted in reverse chronological order so that the most recent content is presented first, keeping a fresh face on the homepage. This latter point is important because the mission of a blog is to keep readers constantly updated on the topics or focus of the blog and its authors. While details of individual blogs vary widely, most blogs allow readers to comment on posts, enabling interaction with the author and among readers. Comments may be threaded to make it easier to follow a conversation and keep track of tangential discussions.

According to Blogpulse.com, a blog tracking system set up by the market research company Nielsen, there are over 160 million blogs. Over 60,000 blogs and one million posts are added to the Internet each day. Despite this enormous rate of expansion, only a small portion of the blogosphere is dedicated exclusively to science content—a smaller portion still is written by active scientists. Science journalists, popular science writers, and other enthusiasts author the

remainder of the science blogs. Within this network of science blogs, a minority is dedicated to environmental issues. These few form a community of shared concerns that can foster activism.

There are no defining characteristics of an environmental blogger. Many are from nonprofit conservation organizations, some are independent activists or concerned citizens, and many are in academia as students, researchers, or faculty; very few are policymakers. Authors tend to be male, but the number of female environmental bloggers is growing. What they all share is a passion to educate the public about environmental issues, bring to light pressing environmental concerns or actions, and discuss solutions to environmental challenges.

Blogs connect ideas with a person. Like any popular writing, a blogger's voice is not only important for establishing the conversation's tone but also for attracting readers. Bloggers often use their real names to gain credit for their work and nurture their online reputations. Some bloggers prefer to use a pseudonym to maintain continuity among the variety of interactions they have in the blogosphere. Anonymous blogging does not often occur on environmental or science blogs because of the importance of reputation in gaining authority and building a readership (Wilkins, 2008). Bloggers, whether using their real names or a pseudonym, need to differentiate their signal from the noise of the Internet.

Blogging removes a barrier between authors and their audience, allowing conversations between segments of the population that do not frequently interact. Engagement is important for a successful environmental campaign. For scientists in particular, removing barriers to communication exposes the public to the scientists as persons and allows them to build trust through the individual, not just the ideas being discussed (Wilkins, 2008). Marie-Claire Shanahan (2011) described this situation as a *boundary layer*, stating,

[Bloggers] are not translating but in their explanatory writing are creating a site for interaction between themselves and their readers, among their readers, and between their readers and a variety of information sources. This characterization of the writer as a participant in the mixing is both consistent with and highlighted by the boundary layer analogy, illustrating the potential for science blogs to contribute to changing the ways in which science journalism and science communication are conceived. (p. 917)

#### Social Media

Platforms for social media typically encourage short-form media generation (i.e., Tumblr, Posterous) and real-time status updates (i.e., Twitter, Facebook, Foursquare, Google+). These applications encourage link sharing and crowdsourcing the evaluation of links (i.e., StumbleUpon, Reddit, Digg). The effect of link sharing can have tremendous results for authors, who can receive orders of

magnitude more page views when links are featured on any of these aggregation websites.

Finding out who participates in social media is challenging because different applications appeal to different audiences. In general, social networking appeals to men and women ages 35 to 44, with a wide variation in ages of users who adopted certain services. Social networking services vary spatially as people tend to adopt specific services by nationality, en masse (Chappell, 2011). Such spatial and demographic variation presents problems for using a one-size-fits-all approach to social media and highlights the necessity of taking on a pluralist approach to science and environmental communication to cast a wide net when attracting an audience (Zelnio, 2010).

Integration of oneself or organization into the fabric of the social network is essential. One cannot merely be a content provider. To be an effective member of an online community one must actively reach out to others who share similar interests and contribute consistently to the conversation. In the new social model of activism, this involves interacting with a wide variety of people who may share your content with their networks. For digital environmentalists, social media is imperative because of its innate components of drawing in audiences and sharing content across multiple platforms. Increasingly, the line between “traditional” and “new” media is blurred (Zivkovic, 2010) as more independent scientists, activists, and environmental enthusiasts take to the Internet and shape their messages using these communication and campaign tools (Bonetta, 2009). The low cost makes expanding one’s reach affordable, and most social media platforms are constructed with ease of use at the forefront of their design. Social media are among the most versatile tools in an environmentalist’s arsenal—when used correctly and in conjunction with a well-nurtured network they offer an enormous return for low overhead.

## Strategies and Challenges for Environmental Bloggers

Among the many strategies available to environmental scientists and activists, many are ideally suited to blogging and social media platforms. Along with these strategies, new challenges have also emerged.

### Real-Time Reporting of Events

Posting short updates from the field, summarizing events on blogs, and reporting news from conferences can connect readers to the most up-to-date information available. Because blogging and social media are not limited to “sexy” or trendy news, topics that usually would not receive much attention can be highlighted through online media and follow a story through its resolution.

## Playing an Offensive Strategy

Social media offers a quick and responsive way to combat pseudoscience, denialism, conspiracy theories, greenwashing, and outright deception. Scientific and environmental misconceptions are common in the mainstream media; blogging and social networks can be used to respond quickly and thoroughly (Kouper, 2010).

## Translating Scientific Jargon

People are genuinely interested in science and the environment, but the terminology is often impenetrable or confusing. Scientists and environmental activists are rapidly becoming go-to sources for breaking news (Groffman et al., 2010; Wilkins, 2008). As a result, the line between nonjournalistically trained bloggers and their traditional counterparts is often blurred (Zivkovic, 2010). Scientists and environmentalists have an opportunity to break the jargon barrier to recruit a diverse audience (Yong, 2010).

## Fostering Connections

Creating connections is the heart of social media. Disparate parties such as scientists, activists, and stakeholders can use social media to connect with each other, share information, and curate useful resources.

## Continuing Conversations

An issue or a conversation does not end with a blog post, status update, or a comment. Communication directly with the public creates a continuous conversation after the mainstream media determines coverage of the issue is no longer newsworthy. Bloggers have played key roles in a wide variety of situations, relentlessly maintaining the conversation and staying on top of new developments, which is imperative with chronic environmental problems (Kouper, 2010).

## Activism Versus Slacktivism

The accessibility of blog and social media platforms makes it easy to become superficially involved in the environmental movement (Shulman, 2009). For instance, Facebook allows people to “like” a topic without requiring any additional commitment. While those people may feel they are lending support to the topic, this can artificially increase the number of people who appear to be involved in an issue (Furlong, 2004; Golden, 1998). This armchair activism, known informally as “slacktivism,” can be defined as “people who support a cause by performing simple measures [and] are not truly engaged or devoted to making a change” (Joint United Nations Programme, 2010).

Slacktivism is a double-edged sword. On one hand, it is difficult to assess how important environmental issues



really are to individuals who join online communities. On the other hand, ease of integration is important for environmental movements. When entrance into an online community has fewer barriers, individual participation tends to be much stronger (Thackeray & Hunter, 2010). This means that the mechanisms that make it easy for individuals to join groups without any additional personal involvement are the same mechanisms that are necessary to recruit the most active members. An environmental movement can use metadata from slacktivists to evaluate general interest in their organization or issue, improve their online image, and refine targets for marketing their messages.

### Science Communication Versus Activism

On the surface, it seems like the goals of science communication and activism are opposed. Activists by default have agendas, while a science communicator's duty is to be an unbiased source of information. This apparent dichotomy means that it is essential for online environmental activists to be aware of their inherent biases and address them, even as they educate their audience. By acknowledging inherent biases while attempting to provide unbiased analyses and in-depth background information, the author builds the readers' trust and allows the audience to make an informed decision about the merits of an environmental campaign.

### Understanding the Audience

Perhaps one of the greatest challenges for digital environmentalists is understanding their audience. Simple metrics such as page views, unique visitors, number of followers, number of comments, and number of backlinks give authors an impression of how many people read and are interested in their content but rarely provide insight into who is reading and why. Most of the target audience is composed of passive members of the community, consuming content without engaging with the authors or the rest of the community. Understanding this invisible audience is essential for a successful outreach initiative.

As a case study in understanding passive audiences, we conducted reader surveys in early 2011 for the popular marine science and conservation blogs Southern Fried Science (SFS) (<http://southernfriedscience.com>) and Deep Sea News (DSN) (<http://deepseanews.com>). Both surveys were advertised on the blog homepage, related Facebook pages, and announced through Twitter. Prizes were offered to encourage readers to participate. Because SFS and DSN are members of a broader science blogging community with overlapping readers, statistics are reported separately for each blog though survey questions were intentionally paired for comparison. There were 80 respondents for SFS and 210 respondents for DSN surveys. Based on average number of daily readers, the response rate was 10% to 15%.

Given such a low response rate, the surveys may be biased in favor of frequent readers and those who generally participate more in the blog community. Still, survey responses indicated that a large portion (>50%) of respondents were readers who did not otherwise engage with the community.

The average reader is a well-educated American young adult (25–34 years old; 49.4% for SFS and 41.5% for DSN), though middle-aged individuals were distinct among the audience (35–54 years old; 26% for SFS, 34.5% for DSN). Readership was slightly more female on SFS (55.1%) and slightly more male on DSN (51.5%) and was largely from the United States and Canada, followed by the United Kingdom (79.5%, 9.0%, and 5.1%, respectively, for SFS and 70.3%, 9.0%, and 4.0%, respectively, for DSN). Both blogs have a well-educated readership with a high percentage of readers having or pursuing a graduate or professional degree (34.6% for SFS, 17% for DSN).

The paths by which readers discovered these blogs reflected both the benefits of social media and a strong tie to traditional communication routes. Readers generally found SFS through links from other blogs (26.7%) or through Twitter (21.3%), while readers found DSN through slightly different channels: still largely from links from other blogs (28.6%) but also through Google searches (19.1%) and word of mouth (15.1%). The ways in which repeat readers discovered the blogs reflected their method of access. The majority visit by accessing the blog (57.3% for SFS, 54.7% for DSN) but also through following the authors on Twitter (37.3% for SFS, 10.0% for DSN) and subscribing to the blog through syndicated feeds (34.7% for SFS, 30.9% for DSN).

Most readers visited the blogs “a few times a week” (41.9% for SFS, 41.8% for DSN) or “a few times a month” (33.8% for SFS, 22.4% for DSN). While this is below the number of posts these blogs publish each month, it is enough to keep up with information before it leaves the home page (both blogs are set to display the most recent 10 posts on the homepage).

Interactive engagement is surprisingly limited. A majority of readers never comment (57.3% for SFS, 54.2% for DSN), and those that do have left only one or two comments (25.3% for SFS, 23.4% for DSN). DSN asked readers why they don't comment, and most responses fell into one of three categories: (1) The reader did not feel qualified (28.6%), (2) the reader had nothing to add (25.7%), or (3) the reader did not generally comment on blogs (17.1%). Of the 30 respondents who claimed that they did not feel qualified, 16 held a graduate degree of unknown discipline.

The types of posts that readers valued varied widely, reflecting an audience with diverse interests and expectations of the blogs. When asked if there was a favorite post, no more than two respondents singled out the same post. Favored posts tended to be content rich (defined as structured posts written to convey ideas, discuss new research, or opine on current events). The audience's diversity of interests was also evident when asked what other blogs

they read. While their response included many blogs focused on ocean science and conservation, a wide variety of topical and general science blogs were listed.

## Case Studies in Digital Environmentalism

The following are three examples of successful online environmental campaigns that exemplify the value and breadth of digital environmentalism but by no means represent limits to its potential.

### Addressing Pseudoscience

In 2007, a California-based, for-profit, publicly traded company (henceforth, *the company*), proposed a plan for marine ecosystem restoration, climate change mitigation, and the creation of high-volume, low-cost carbon offsets for individuals and businesses. The company proposed mimicking the addition of nutrients that naturally occur along coastlines through the artificial fertilization of iron filings into seawater. This model offered a method to fix and sink oceanic and atmospheric carbon dioxide and a lucrative carbon offset scheme primed for capitalization.

Unfortunately, key aspects of the company's plan and rationale were not scientifically supported. In late 2007, the science blog *Malaria, Bedbugs, Sea Lice, and Sunsets* published a short critique of the company's proposed iron fertilization off the Galapagos Islands (MacPherson, 2007). In that post, the author, a research director for a conservation organization, posed several questions, principally the following:

What might a rain of iron filings mean for benthic ocean communities? Where does the iron filing supply come from and what contaminants might it have? And since not all phytoplankton are alike, what happens if you spur on harmful algal blooms. Finally, couldn't the lure of massive profit potentially taint your research into the efficacy (or threats) from your iron dumping scheme? (para. 2)

Within 1 week of that post, a follow-up post on *Deep Sea News* pressed the company for a response to questions regarding their methodology (McClain, 2007). The author, a deep sea biologist, leveled his skepticism at the out-of-sight yet problematic seafloor impacts following the dumping of iron filings into the ocean, including the lack of ability to quantify any long-term and downstream effects, potential oxygen depleted conditions of the seafloor below fertilization, enhanced release of nitrous oxide with 200 times the greenhouse gas potential of carbon dioxide during the decomposition of organisms, and lack of predictability of the amount of carbon dioxide that will actually sink to the seafloor and how long it will be sequestered.

A final critique of the company's methodology appeared on the science blog *Oyster's Garter* by a doctoral candidate in oceanography, detailing a point-by-point dismantling of

the science behind the company's responses to criticism from scientists (Goldstein, 2007). Iron fertilization studies conducted in Norwegian fjords had detected no change in available biomass or any indication of carbon sequestration, though they did detect disturbance to local faunal assemblages (Öztürk, Steinness, & Sakshaug, 2002). More recently, similar studies in the equatorial Pacific revealed major ecologic shifts in the benthic ecosystem surrounding regions that had received iron inputs (Wolff et al., 2011).

The company's proposal was geoengineering on a massive scale with little to no understanding of the effect of iron fertilization on ocean ecosystems. The net effect of online science blog criticism of the company's science led to national media attention as well as concern from numerous international conservation nongovernmental organizations (NGOs), and several Galapagos-based conservation groups worried over plans to dump massive amounts of iron filings into Galapagos's waters.

By early February of 2008, the company announced their plans to "indefinitely postpone activities." Shortly afterward, their website was shuttered and the founder issued the following statement (no longer available but archived by MacPherson, 2008):

A highly effective disinformation campaign waged by anti-offset crusaders has provoked widespread opposition to plankton restoration in the environmental world, and has caused the company to encounter serious difficulty in raising the capital needed to fund its planned series of ocean research trials.

### Citizen Science and Empowerment

Blogging and social media platforms are useful for citizen science projects (Silvertown, 2009). Using his blog and associated Twitter account, David Shiffman, then a master's student in marine biology, recruited more than 50 individuals to join him as volunteer shark researchers. Recruits learned about shark science and conservation issues and participated in a long-term shark research project. Though no formal participant surveys were distributed, similar citizen science projects have resulted in increased knowledge of the animals or ecosystem that volunteers worked with (Brossard, Lewenstein, & Bonney, 2005), increased participant awareness of the environment (Evans et al., 2005), and increased feelings of environmental stewardship among volunteers (Cooper, Dickinson, Phillips, & Bonney, 2007). In addition, the use of volunteers is a cost-effective method to gather data (Lepczyk, 2005). Some citizen science programs also empower their volunteers to become more politically active in conservation (Jasanoff, 2004).

Social media platforms are effective at organizing supporters of conservation policies and directing their passions to where they can be helpful. Many on-the-ground NGO representatives are working hard to get conservation laws passed around the world. They often encounter resistance from powerful interest groups that benefit from the status

quo (Ghimire, Ghimire, & Pimbert, 1997). These groups often claim that only a few people support conservation, while many support jobs (Brockington, Igoe, & Schmidt-Soltau, 2006). On-the-ground NGO representatives sometimes need conservation-minded citizens to express their support for a new environmental policy, either by signing a petition or directly contacting government officials. Consequently, NGO representatives have consistently reported that the assistance of the online community was essential in passing the many federal and state shark conservation legislations (e.g., U.S. Shark Conservation Act, Florida lemon shark protection, and statewide bans on selling shark fins in Hawaii and Guam) (David Shiffman, personal communication, February 19, 2010).

### **Oil Spill Coverage and Rapid Response to News Events**

Scientific blogs are beginning to play pivotal roles during large environmental news stories, where the public is desperate for accurate, in-depth information amid scarce facts and wild speculation. The Deepwater Horizon oil spill was one such scenario where the rapid turn of events required an equally rapid response. Throughout 2010, DSN was an authoritative source of information on the oil spill, providing interpretation of mainstream media coverage and expert scientific analysis, filtering multiple information streams, and highlighting important issues long after mainstream media interest had waned.

At the beginning of the spill, the DSN bloggers were able to use their scientific training and expertise to filter and interpret the flood of conflicting reports coming out of the Gulf. Popular posts included a timeline of events leading up to the oil spill, an explanation of the oceanographic circulation of the Gulf, the science and toxicology of dispersants, and an overview of oil-related impacts on wildlife from the scholarly literature. DSN also collected links to mainstream media reports, government websites, and other reliable blogs. As the oil spill continued, DSN provided frequent updates and continued to contribute original reporting and interpretation. In response to dwindling mainstream media coverage after the well was capped, DSN initiated a series of topical posts containing in-depth reviews of scientific literature, presented in an easily digestible format. A series focusing on oil-dispersing chemicals and Gulf seafood safety proved very popular and was heavily referenced across both the online community and the mainstream media.

Scientific blogging following the Deepwater Horizon spill had tangible repercussions for all parties involved. Readers directly benefited from the DSN team's dissemination of accurate information from peer-reviewed scientific studies. Scientists posting at DSN also reaped scientific rewards: Online communication opened a dialogue between scientists at DSN and SFS, resulting in the sharing of invaluable pre-spill deep-sea sediment cores. DSN reporting has led to collaboration between

scientists and advocacy groups monitoring the oil spill's fallout as well as between an interviewee and a nonprofit environmental group.

The DSN case study also exposed some unsettling truths regarding credibility in the online era. The contributing scientists at DSN possess expert knowledge in specialized subdisciplines yet were instantly branded as "oil spill experts" as the Deepwater Horizon coverage rose to prominence. Journalists on tight deadlines searched the Internet to find readily available experts but did not take a scientist's level of knowledge (based on their publication record and number of years' experience) into account. Because of the speed and topical variety of DSN blogging during the height of oil spill coverage, their material was frequently mined by mainstream media for quotations, often without proper attribution, resulting in misleading or inaccurate statements attributed to bloggers who were acting more as journalists than as oil spill experts.

DSN's role in the Deepwater Horizon oil spill demonstrated that practicing scientists could play a critical role in rapidly disseminating accurate information through blogs and social media. By engaging with a general audience through these interactive online applications, DSN scientists learned about the public's common concerns (e.g., the potential health effects of dispersants), searched through the scientific literature for the best available information, and wrote accessible, jargon-free posts interpreting the science. Unlike traditional media, DSN was able to convey scientific information without needing external "expert commentary," allowing rapid response to changing events. By bringing scientific knowledge and training to bear on issues of critical public interest, scientists can become a source of objective information in an era of heated public discourse.

### **The Message and the Medium**

Blogging and social media platforms have matured over the last decade, reaching a point where their use is nearly ubiquitous. Their strength is in the ability to maintain large, active, well-connected networks that permit the unimpeded flow of information. Environmental movements have taken advantage of these platforms to spread their messages, organize their base, and reach potential members. The speed and flexibility of blogging and social media allow digital environmentalists to draw attention to and discuss a plethora of environmental concerns—drawing from the expertise of scientists, policymakers, and on-the-ground activists within their networks. While the ease of use may lead to what many refer to as slacktivism, the overall increase in network size makes up for a less-engaged membership. Even an apathetic nod to an environmental movement lends momentum that resonates throughout one's personal network, supporting the cause and helping to find additional leaders. These factors make blogging and social media effective tools for any movement.

The ubiquity and ease of access inherent in blogging and social media platforms means that the same tools that allow the effective dissemination of an environmental message can be used by groups with opposing viewpoints. Environmental groups' response to these opposing viewpoints determines how the public perceives that group, and it is critical to the success of any movement. Actions online can serve to enhance a group's reputation or further marginalize it, alienating a more moderate audience. Online environmental groups can highlight the individuals involved as opposed to the organization. Individuals can develop their own conversational style when interacting with an audience—authoritative expertise, casual conversation, humor, and even occasionally sarcasm. The challenge is to maintain a conversation that includes supporters, legitimate opposition, curious members of the public, and people actively trying to derail it while avoiding being scornful, combative, or disrespectful of the opposing view.

Engaging with legitimate dissent is the strongest way to build a readership and provides active and visible refutations of common or uncommon misconceptions. It facilitates a dialog driven by a mutual desire to educate. Occasionally (or frequently), activists may be forced to confront the uncomfortable truth that they are wrong. In which case, a gracious concession can build further credibility. Distinguishing between a legitimate dissenting viewpoint voiced by an interested member of the public and the actions of someone intentionally trying to derail the conversation can be challenging. Many environmental initiatives compete for audience attention with well-organized, well-funded, vocal, antienvironmental interests. In general, these efforts are more interested in overwhelming the conversation rather than engaging in an honest dialog. It should go without saying that many environmental movements are guilty of using these same tactics, and while they may feel personally satisfying, they do little to further the goals of the movement. Separating honest dissent from derailment is a skill that can be built only from experience. To build a strong online reputation, new entrants into the online ecosystem should always err on the side of caution and assume good faith when a dissenting voice enters the conversation.

Climate change denial is among the most aggressive and prevalent online antienvironmental movements. The origin,

methods, and fallacies of the climate change denial movement are summarized in Orrin H. Pilkey, Keith C. Pilkey, and Mary Edna Fraser's (2011) *Global Climate Change: A Primer*. In it, the authors produce a prescient argument for a systematic disinformation campaign to manufacture doubt about anthropogenic climate change. Appropriate responses to such tactics have benefited from observations made from reader statistics and page view patterns that suggest, at least for blogs, that the vast majority of readers don't read the comments—similar results to our survey described above. Even a comment thread that devolves into a series of out-of-context, off-topic, and deliberately incendiary statements rarely detracts from the original post. However, one or two prominently placed, thoughtful, well-worded comments with links following the original post to additional resources will serve the reader better than a prolonged debate with individuals intentionally trying to disrupt the conversation.

It is important to remember that the medium isn't the message. Although these discussions occur on defined platforms, the overall message is independent of these platforms. Attempts to overwhelm or drown out any message online are ultimately futile so long as the original post remains. The message can move across media, adapting to the changing online ecosystem and selecting the most appropriate platform. A discussion that becomes unwieldy on Twitter may be more suited to social network sites that allow longer, better structured conversations. A blog with few page views might benefit from a more-engaged Twitter presence or by encouraging participants to share content over social networking sites such as StumbleUpon or Reddit. In an ecosystem as dynamic as the Internet, becoming entrenched in one or two platforms is a guaranteed way to be left behind.

The communication opportunities offered by the still relatively young blog and social networking platforms have created new strategies for environmental activism and will likely create more in the future. These opportunities are rooted in a restructuring of society's networks, stretching farther and becoming more inclusive. These broadened networks blur once rigid lines in society (e.g., Shanahan, 2011), help define the individual, and empower person-to-person discussions rather than propaganda wars. Increasing the number of people exposed to and involved in curating online environmental information can only benefit the future of environmentalism.

## References and Further Readings

- Bonetta, L. (2009). Should you be tweeting? *Cell*, 139(3), 452–453. doi:10.1016/j.cell.2009.10.017
- Brockington, D., Igoe, J., & Schmidt-Soltan, K. (2006). Conservation, human rights, and poverty reduction. *Conservation Biology*, 20(1), 250–252.
- Brossard, D., Lewenstein, B., & Bonney, R. (2005). Scientific knowledge and attitude change: The impact of a citizen science project. *International Journal of Science Education*, 27(9), 1099–1121.
- Brumfiel, G. (2009). Science journalism: Supplanting the old media? *Nature*, 458, 274–275. doi:10.1038/458274a
- Callaghan, P. (2007, September 5). *Why communicate science?* Retrieved from <http://www.sciencealert.com.au/opinions/20070609-16305.html>
- Chappell, B. (2011). *Social network analysis report: Geographic: Demographic and traffic data revealed.*



- Retrieved from <http://www.ignitesocialmedia.com/social-media-stats/2011-social-network-analysis-report>
- Collins, H. M., & Evans, R. (2002). The third wave of science studies: Studies of expertise and experience. *Social Studies of Science*, 32(2), 235–296.
- Cooper, C., Dickinson, J., Phillips, T., & Bonney, R. (2007). Citizen science as a tool for conservation in residential ecosystems. *Ecology and Society*, 12(2), 11.
- Evans, C., Abrams, E., Reitsma, R., Roux, K., Salmonsén, L., & Marra, P. (2005). The Neighborhood Nestwatch program: Participant outcomes of a citizen-science ecological research project. *Conservation Biology*, 19(3), 589–594.
- Fischer, F. (2002). Citizens, experts, and the environment: The politics of local knowledge. *Planning Theory & Practice*, 3, 249–255.
- Furlong, S. R. (2004). Interest group participation in rule making: A decade of change. *Journal of Public Administration Research and Theory*, 15(3), 353–370.
- Ghimire, K. B., Ghimire, K., & Pimbert, M. P. (1997). *Social change and conservation: Environmental politics and impacts of national parks and protected areas*. London, UK: Earthscan.
- Golden, M. M. (1998). Interest groups in the rule-making process: Who participates? Whose voices get heard? *Journal of Public Administration, Research & Theory*, 8(2), 245–270.
- Goldstein, M. (2007). Carbon export is dead stuff and poop, and so are Planktos' arguments [Web log post]. Retrieved from <http://theoystersgarter.com/2007/10/20/carbon-export-is-dead-stuff-and-poop-and-so-are-planktos-arguments>
- Groffman, P. M., Stylinski, C., Nisbet, M. C., Duarte, C. M., Jordan, R., Burgin, A., . . . Coloso, J. (2010). Restarting the conversation: Challenges at the interface between ecology and society. *Frontiers in Ecology and the Environment*, 8, 284–291.
- Irwin, A., & Wynne, B. (1996). *Misunderstanding science?* Cambridge, UK: Cambridge University Press.
- Jasanoff, S. (2004). *States of knowledge: The co-production of science and social order*. Abingdon, UK: Routledge.
- Joint United Nations Programme on HIV/AIDS. (2010). @ AIDS: Unlocking the potential of social media. *Outlook* (pp.140–143). Retrieved from [http://data.unaids.org/pub/Outlook/2010/20100713\\_outlook\\_report\\_web\\_en.pdf](http://data.unaids.org/pub/Outlook/2010/20100713_outlook_report_web_en.pdf)
- Kouper, I. (2010). Science blogs and public engagement with science: Practices, challenges and opportunities. *Journal of Science Communication*, 9(1), 1–10.
- Lepczyk, C. A. (2005). Integrating published data and citizen science to describe bird diversity across a landscape. *Journal of Applied Ecology*, 42(4), 672–677.
- MacPherson, R. (2007). To the dump, to the dump, to the dump, dump [Web log post]. Retrieved from <http://coralnotesfromthefield.blogspot.com/2007/10/to-dump-to-dump-to-dump-dump-dump.html>
- MacPherson, R. (2008). If you can't stand the heat, stay out of the carbon sequestration biz [Web log post]. Retrieved from <http://coralnotesfromthefield.blogspot.com/2008/02/if-you-cant-stand-heat-stay-out-of.html>
- McClain, C. (2007). Will iron fertilization work? [Web log post]. Retrieved from <http://deepseanews.com/2007/10/will-iron-fertilization-work>
- McCormick, S. (2007). Democratizing science movements: A new framework for mobilization and contestation. *Social Studies of Science*, 37(4), 609–623.
- Öztürk, M., Steinness, E., & Sakshaug, E. (2002). Iron speciation in the Trondheim Fjord from the perspective of iron limitation for phytoplankton. *Estuarine, Coastal and Shelf Science*, 55(2), 197–212.
- Pilkey, O. H., Pilkey, K. C., & Fraser, M. E. (2011). *Global climate change: A primer*. Durham, NC: Duke University Press.
- Rosenberg, S. (2009). *Say everything: How blogging began, what it's becoming, and why it matters*. New York, NY: Crown.
- Royal Pingdom. (2010). Study: Ages of social network users [Web log post]. Retrieved from <http://royal.pingdom.com/2010/02/16/study-ages-of-social-network-users>
- Shanahan, M. C. (2011). Science blogs as boundary layers: Creating and understanding new writer and reader interactions through science blogging. *Journalism*, 12(7), 903–919.
- Shirky, C. (2009). *Here comes everybody: The power of organizing without organizations*. New York, NY: Penguin Books.
- Shulman, S. W. (2009). The case against mass e-mails: Perverse incentives and low quality public participation in U.S. federal rulemaking. *Policy & Internet*, 1(1), 23.
- Silvertown, J. (2009). A new dawn for citizen science. *Trends in Ecology & Evolution*, 24(2), 467–471.
- Thackeray, R., & Hunter, M. (2010). Empowering youth: Use of technology in advocacy to affect social change. *Journal of Computer-Mediated Communication*, 15(4), 575–591.
- Wilkins, J. S. (2008). The roles, reasons and restrictions of science blogs. *Trends in Ecology & Evolution*, 23(8), 411–413. doi:10.1016/j.tree.2008.05.004
- Wolff, G. A., Billett, D. S. M., Bett, B. J., Holtvoeth, J., FitzGeorge-Balfour, T., Fisher, E. H., . . . Chaillan, F. (2011). The effects of natural iron fertilisation on deep-sea ecology: The Crozet Plateau, southern Indian Ocean. *PLoS ONE*, 6(6), e20697. doi:10.1371/journal.pone.0020697
- Wortham, J. (2007). After 10 years of blogs, the future's brighter than ever. *Wired Magazine*. Retrieved from <http://www.wired.com/entertainment/theweb/news/2007/12/blog-anniversary>
- Yong, E. (2010). Not exactly rocket science: On jargon, and why it matters in science writing. *Discover Magazine*. Retrieved from <http://blogs.discovermagazine.com/notrocketscience/2010/11/24/on-jargon-and-why-it-matters-in-science-writing>
- Zelnio, K. A. (2010). From the editor's desk: Quantifying outreach to the cult of science [Web log post]. Retrieved from <http://deepseanews.com/2010/11/from-the-editor%E2%80%99s-desk-quantifying-outreach-to-the-cult-of-science>
- Zivkovic, B. (2010). The line between science and journalism is getting blurry. . . again. *Scientific American*. Retrieved from <http://blogs.scientificamerican.com/observations/2010/12/20/the-line-between-science-and-journalism-is-getting-blurry-again>