



Special Issue Article: Advancing Environmental Conservation: Essays In Honor Of Navjot Sodhi

Science communication for biodiversity conservation

David Bickford^{a,*}, Mary Rose C. Posa^a, Lan Qie^b, Ahimsa Campos-Arceiz^c, Enoke P. Kudavidanage^a

^a Department of Biological Sciences, National University of Singapore, 14 Science Drive 4, Singapore 117543, Singapore

^b Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, Menglun, Mengla, Yunnan 666303, China

^c School of Geography, University of Nottingham Malaysia Campus, Jalan Broga, Semenyih, 43500 Selangor, Malaysia

ARTICLE INFO

Article history:

Available online 21 January 2012

Keywords:

Science communication
Education
Conservation

ABSTRACT

The unsustainable exploitation of nature by humanity has pushed many of the earth's ecological systems to the brink of collapse. To help bring about the societal changes needed to reverse this trend, conservation biologists need to be more proactive, provocative, and purposeful in increasing environmental literacy. In this essay, we highlight different ways that scientists can engage various sectors of society and argue that passion, enthusiasm, and an understanding of the culture of human belief systems can help us to communicate effectively with a wider audience.

© 2012 Elsevier Ltd. All rights reserved.

Contents

1. Introduction	74
2. Basic environmental illiteracy	74
3. Effectively communicating science	75
4. Reaching out: beyond the ivory tower	75
4.1. General public	75
4.2. Media	76
4.3. Policy-makers and industry	76
4.4. Schools and the academe	76
5. Conclusion	76
References	76

1. Introduction

As conservation biologists, we are aware that these are troubling times. We have long called for changes in the 'business-as-usual' scenario of unsustainable development and consumption that are causing widespread ecological degradation and species extinctions. To us, it is impossible to remain blind to evidence that anthropogenic actions are negatively impacting planetary systems (Rockström et al., 2009). Human livelihood is dependent on the natural world but modern living, with its emphasis on comfort and consumption, severs our connections to the environment (Miller, 2005). However, there is inertia in human institutions and society against the changes needed to reverse the current environmental crisis.

In this essay, we reflect on how conservation biologists can be more proactive in increasing environmental literacy through effective communication and outreach. The onus is on us to work to-

wards filling the gap between knowledge and action (e.g., Bawa et al., 2004; Daily and Matson, 2008). We discuss how science communication can be made more effective and highlight some innovative approaches that have been suggested to educate and involve policy makers, key stakeholders, and the public in environmental issues and research. Our aim is to galvanize fellow scientists to take responsibility in engaging a wider sector of society in ways that are relevant and easily understood and thereby make an impact on real-world problems.

2. Basic environmental illiteracy

While the public has become more aware of environmental issues in recent decades, most do not actively engage in behaviors that support a more sustainable future. One of the fundamental barriers to affecting change is the lack of environmental literacy, which is necessary to make informed decisions and address the problems currently facing the planet (Jordan et al., 2009). Compounding this,

* Corresponding author. Tel.: +65 65162858.

E-mail addresses: rokrok@nus.edu.sg, dbsbdp@nus.edu.sg (D. Bickford).

there is a widening gap between people and the natural world, especially in urban areas (Miller, 2005). Both of these factors can exacerbate the lack of public support for biodiversity conservation.

True environmental literacy goes beyond awareness and rote learning but involves critical thinking, integrating principles, and using acquired skills to turn knowledge into action (St. Clair, 2003; Coyle, 2005). Some studies have shown that a higher level of environmental knowledge correlates with a higher degree of pro-environment behaviors (Rickinson, 2001). While formal environmental education has been increasing in some developed countries, it is still not well-integrated into curricula (Coyle, 2005; Cutter-MacKenzie and Smith, 2003). Experience of natural areas is also another factor that significantly affects people's views on the environment (Schultz, 2000). Participation in outdoor activities with an ecological focus, such as well-established field courses, can lead to the development of an empathic relationship with nature (Palmberg and Kuru, 2000; Rickinson, 2001). Knowledge and experience by themselves do not necessarily lead to desirable behavior (Salmon, 2000). However, they are still essential tools for laying the foundation for learners to appreciate and understand ecological concepts and our connection to nature. Creating a truly environmentally literate society takes time, and conservation biologists can play a larger role outside the academic sphere to help bring it about. It is therefore critical that engaging with both traditional and non-traditional audiences becomes a priority for conservation biologists and other scientists.

3. Effectively communicating science

Many people obtain limited or oversimplified information about environmental issues from sources that may be biased, particularly the media, leading to misconceptions (Coyle, 2005; Laidle et al., 2005). Thus, conservation biologists need to be much more strongly proactive in our approach to communicating, in formal educational settings as well as in other venues and via alternative methods to a diversity of audiences. Explaining and communicating our science to non-scientists should be one of our most important jobs (Sunderland et al., 2009) and the manner by which we go about this communication is vitally important.

Science, our best method for understanding the world, is often assumed to be dispassionate and without bias. However, a passion for nature is often the reason why many of us enter the field of conservation biology (Orr, 1999). We need to be more open to being passionate about what we do and actively demonstrate that passion when we interact with people outside our field. The same passion, if linked with effective communication and solid information, can be positively perceived and thus used to reach out to people across multiple audiences. If we can capture the imaginations of non-scientists with our passion and enthusiasm for nature, we can bridge the gap to understanding scientific facts. In addition, we should put a high premium on the ability to explain our research in terms and ideas that our family or next-door neighbors can readily grasp. Developing passion in how we communicate ideas can augment the capacity for people to not only grasp the main ideas, but also understand the philosophy and ethics of conservation in a fundamentally more profound manner. This is an ability we should not shy away from, but actively cultivate in our communication.

To become better communicators, scientists should also start to take into account the complexity of cultural values, belief systems, and social networks that affect people's perception of scientific information. Psychological research suggests that failures in science communication can stem from societal norms and cohesion to small groups that give rise to a tendency to agree with peers despite evidence in support of a contrary conclusion or idea (Kahan, 2010). This is one of the reasons why public debate about science –

the issue of climate change for instance (Schmidt, 2010) – is so strikingly polarized; people choose to believe what reinforces their own values over empirical data. One of the ways we can get beyond this when engaging various sectors of society is to localize issues and build upon people's personal experience to show why they should care about the environment (St. Clair, 2003). We strongly encourage conservation biologists to take local cultural context into account and not think that people will automatically be persuaded by our data to change their mindsets and behavior. Adapting our scientific communication methods to other peoples' mindsets, world views, and belief systems is no easy task. This is certainly one of the more challenging aspects of creating environmental literacy that we need to address, yet it remains largely unnoticed and misunderstood. To become better science communicators, admitting that usual approaches that 'preach to the choir' will not be as effective as more specific, targeted, and well-adapted (to the local cultural context of the audience) strategies and methods.

4. Reaching out: beyond the ivory tower

Achieving the goals of conservation will require truly multidisciplinary ways of thinking. Situated at the intersection of humanity and its relationship to the environment, conservation encompasses both natural and social sciences. One benefit is that it is possible to identify and effectively use other venues (e.g., music, art, faith systems, politics, health, etc.) where we can relate and communicate activities, values, and interests of conservation biology (Nadkarni, 2004). Collaborations with non-scientist groups as well as experts from other disciplines can create unique and important opportunities to advance environmental literacy. We highlight some examples of ways by which conservation biologists can engage different sectors of society below:

4.1. General public

There are many avenues by which conservation biologists can engage their local communities where they live and work, and frame conservation in accessible and socially relevant terms. For instance, appealing to religious communities to recognize the environmental stewardship in scripture can help to build public support for conservation initiatives (Woodhams, 2009; Clements et al., 2009). In developed countries and urban centers, citizen science programs can enable the public to participate in collecting data for ecological studies. It has been used to monitor bird populations in North America, allowing researchers to increase the spatial and temporal scales of their sampling (Bonney et al., 2009). Establishing more of these projects will help elucidate species occurrence and distribution while at the same time involve the public in the scientific process. In developing countries, especially in the tropics, it is key to engage communities that live adjacent to habitats of endangered species or protected areas. These are often the places where research stations are established, and it is important to involve local people as much as possible. Scientists can collaborate with grassroots organizations to design programs that will impart knowledge of the local ecosystems, increase understanding of conservation issues and empower stakeholders with the ability to make decisions. The exchange of knowledge can be two-way, as these communities are bonded with the wilderness through their traditional knowledge, lifelong experiences, livelihoods and even human-animal conflicts. At the same time, programs should endeavor to address the needs of the community in a way that links with biodiversity conservation. A prime example of this is the Health in Harmony program that helps to subsidize rural health care through conservation activities (Shetty, 2009).

4.2. Media

Traditionally, media rather than scientists have acted as the bridge between science and the public. However, this often leads to unsatisfactory and/or inaccurate reporting, with a tendency to sensationalize results (e.g., Ladle et al., 2005). Scientists should publish outside scientific journals (which are not accessible to most of the public) more often and be more vocal in public domain media (Pace et al., 2010). Newspapers and magazines (e.g. Sodhi, 2007), as well as social media, blogs and other resources on the internet (Clements et al., 2007) are venues where we can directly reach audiences outside academia. Because not all scientists are naturally gifted communicators, we should not be shy to seek partnerships with more skillful communicators.

4.3. Policy-makers and industry

Perhaps nowhere is open dialogue more needed than among legislators and scientists working on conservation and sustainability issues and the corporate sector because changes in policy and business models can have far-reaching and significant impacts on many environmental issues. However, we can endeavor to bridge the social and value gap in different ways. For example, we can conduct research that is relevant to policy, develop decision-support tools (Koh, 2011), or work with planners and land managers to maximize the green spaces and natural areas for biodiversity in metropolitan areas (Miller, 2005). With some creative thinking, we can determine research goals that maximize the commercial desires of industry AND promote good conservation science at the same time. By actively engaging government and industry, we can become both more effective at communicating complexities of conservation and development trade-offs, as well as helping to change mindsets (including, in some cases, our own).

4.4. Schools and the academe

Last but not least, conservation biologists can advocate for more environmental literacy at all levels in educational systems. They can help to 'educate the educators' where their environmental knowledge is found lacking (Cutter-MacKenzie and Smith, 2003) or develop syllabi and field activities targeted to different grade levels. In the academe, changes are needed in order to enable scientists to take more proactive roles in science communication and outreach. Courses can be incorporated into existing curricula for graduate students to help them develop skills in teaching and translating scientific information across disciplines and knowledge levels. Conservation biologists should seek out multidisciplinary collaborations to study and find solutions to the social dimensions of conservation (e.g. Sodhi et al., 2008). In addition, institutional constraints and reward systems within academia must begin to value public and policy participation on par with publishing of peer-reviewed high impact journal articles, and not see it as a distraction from "real" academic work. (Shanley and Lopez, 2009; Pace et al., 2010; Whitmer et al., 2009).

5. Conclusion

The time has come for conservation biologists to embrace our roles working for society, and there are numerous avenues that are available. Embracing passion for protecting our natural resources and ecosystems, and dedicating more time and effort into reaching across cultural, social, and economic barriers to communicate our environmental messages are key strategies for success.

To help humanity deal with a changing globe, we as scientists need to be more provocative, proactive, and purposeful in how we communicate to create an environmentally literate society that enacts decisions based on both sound science and the needs of humanity.

References

- Bawa, K.S., Kress, W.J., Nadkarni, N.M., Lele, S., 2004. Beyond paradise—meeting the challenges in tropical biology in the 21st Century. *Biotropica* 36, 437–446.
- Bonney, R., Cooper, C.B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K.V., Shirk, J., 2009. Citizen science. a developing tool for expanding scientific knowledge and scientific literacy. *BioScience* 59, 977–984.
- Clements, R., Bickford, D., Lohman, D., 2007. Can YouTube save the planet? *The Scientist* 21, 26.
- Clements, R., Foo, R., Othman, S., Rahman, U., Mustafa, S.R.S., Zulkifli, R., 2009. Islam, turtle conservation and coastal communities. *Conservation Biology* 23, 516–517.
- Coyle, K., 2005. Environmental Literacy in America. The National Environmental & Training Foundation, Washington, DC.
- Cutter-MacKenzie, A., Smith, R., 2003. Ecological literacy: the 'missing paradigm' in environmental education (part one). *Environmental Education Research* 9, 497–524.
- Daily, G.C., Matson, P.A., 2008. Ecosystem services: from theory to implementation. *Proceedings of the National Academy of Sciences* 105, 9455–9456.
- Jordan, R., Singer, F., Vaughan, J., Berkowitz, A., 2009. What should every citizen know about ecology? *Frontiers in Ecology and Environment* 7, 495–500.
- Kahan, D., 2010. Fixing the communications failure. *Nature* 463, 296–297.
- Koh, L.P., 2011. Balancing societies' priorities: an ecologist's perspective on sustainable development. *Basic and Applied Ecology* 12, 389–393.
- Ladle, R.J., Jepson, P., Whittaker, R.J., 2005. Scientists and the media: the struggle for legitimacy in climate change and conservation science. *Interdisciplinary Science Reviews* 30, 231–240.
- Miller, J.R., 2005. Biodiversity conservation and the extinction of experience. *Trends in Ecology and Evolution* 20, 430–434.
- Nadkarni, N., 2004. Not preaching to the choir: communicating the importance of forest conservation to nontraditional audiences. *Conservation Biology* 18, 602–606.
- Orr, D.W., 1999. Education, careers and callings: the practice of conservation biology. *Conservation Biology* 13, 1242–1245.
- Pace, M.L., Hampton, S.E., Limburg, K.E., Bennett, E.M., Cook, E.M., Davis, A.E., Grove, J.M., Kaneshiro, K.Y., LaDeau, S.L., Likens, G.E., McKnight, D.M., Richardson, D.C., Strayer, D.L., 2010. Communicating with the public: opportunities and rewards for individual ecologists. *Frontiers in Ecology and the Environment* 8, 292–298.
- Palmberg, I.E., Kuru, J., 2000. Outdoor activities as a basis for environmental responsibility. *The Journal of Environmental Education* 31, 32–36.
- Rickinson, M., 2001. Learners and learning in environmental education: a critical review of the evidence. *Environmental Education Research* 7, 207–320.
- Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F.S., Lambin, E.F., Lenton, T.M., Scheffer, M., Folke, C., Schelinhuber, H.J., Nykvist, B., de Wit, C.A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P.K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R.W., Fabry, V.J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P., Foley, J.A., 2009. A safe operating space for humanity. *Nature* 461, 472–475.
- Salmon, J., 2000. Are we building environmental literacy? *The Journal of Environmental Education* 31, 4–10.
- Schmidt, C.W., 2010. A closer look at climate change skepticism. *Environmental Health Perspectives* 118, A536–A540.
- Schultz, P.W., 2000. Empathizing with nature: the effects of perspective taking on concern for environmental issues. *Journal of Social Issues* 56, 391–406.
- Shanley, P., Lopez, C., 2009. Out of the loop: why research rarely reaches policy makers and the public and what can be done. *Biotropica* 41, 535–544.
- Shetty, P., 2009. Kinary Webb: saving lives and saving rainforests. *Lancet* 374, 1882.
- Sodhi, N.S., 2007. A clear and present danger to the planet. *The Straits Times*, 8 December 2007.
- Sodhi, N.S., Acciaoli, G., Erb, M., Tan, A.K.-J., 2008. Biodiversity and Human Livelihoods in Protected Areas: Case Studies from the Malay Archipelago. Cambridge University Press, Cambridge, UK, pp. 478.
- St. Clair, R., 2003. Words for the world: creating critical environmental literacy for adults. *New Directions for Adult and Continuing Education* 99, 69–78.
- Sunderland, T., Sunderland-Groves, J., Shanley, P., Campbell, B., 2009. Bridging the gap: how can information access and exchange between conservation biologists and field practitioners be improved for better conservation outcomes? *Biotropica* 41, 549–554.
- Whitmer, A., Ogden, L., Lawton, J., Sturmer, P., Groffman, P.M., Schneider, L., Hart, D., Halpern, B., Schlesinger, W., Raciti, S., Bettez, N., Ortega, S., Rustad, L., Pickett, S.T.A., Killilea, M., 2009. The engaged university: providing a platform for research that transforms society. *Frontiers in Ecology and Environment* 8, 314–321.
- Woodhams, D.C., 2009. Converting the religious: putting amphibian conservation in context. *BioScience* 59, 463–464.