

Short Communication

Conservation science training: the need for an extra dimension

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Abstract Because of the complex interactions between socio-economic systems and remaining natural systems, conservation biology will need to be better integrated within a wider discipline of conservation science that is inherently integrated with the social sciences. Key to this progress will be the graduate training given to conservation scientists. We surveyed graduate students at the annual Student Conference on Conservation Science at Cambridge University in March 2007 to look at how current conservation science students view this need for integration. Our survey indicates that students want social science training alongside that in biology or ecology and that their current training in social science is inadequate for their future work in conservation.

Keywords Conservation education, conservation science, graduate education, interdisciplinarity, social science training.

Allegedly it was Konrad Lorenz who said ‘The specialist knows more and more about less and less and finally knows everything about nothing.’ If this dictum applies to the scientists charged with finding solutions to pressing environmental problems, such as loss of biodiversity and rapid ecosystem conversion, then there will be serious implications. Here we report that future conservation scientists would like to heed Lorenz’s warning.

In the conservation community there is increasing awareness that (1) conservation is about people and their decisions (an underlying theme of the Millennium Ecosystem Assessment, 2005), (2) understanding social context is critical for conservation successes (Adams et al., 2003; Mascia et al., 2003) and (3) scientists need to learn how to contribute more explicitly to the policy processes that govern ecosystems (Turner, 2000; Clark, 2001). Continued

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progress will require conservation biology to be better integrated within a wider discipline of conservation science (Balmford & Cowling, 2006). However, as pointed out by Adams (2007), ‘most people active in conservation are trained as biologists...’

Key to overcoming this problem will be the graduate training given to future conservation scientists. In regards to this problem and current graduate training, we wanted to find out from a student’s perspective the importance of integrating knowledge across disciplines, students’ general level of knowledge outside their discipline, and the extent to which their training adequately provided them with broad knowledge across disciplines. To investigate this we surveyed the graduate students at the annual Student Conference on Conservation Science at Cambridge University, UK, in March 2007.

The 170 graduate student delegates at the conference were all invited to complete a questionnaire. We received 72 responses from students from 41 countries. Fifty-seven respondents indicated ecology or biology as their field of study, with the rest indicating conservation, environmental management or similar fields. The majority of the respondents were seeking MSc or PhD degrees (44 and 36%, respectively). The remaining respondents included MPhil graduates (3), BSc graduates (3), those between training (7) and an MA student. Our sample size is unavoidably small, and our results should therefore be considered indicative rather than conclusive, but nevertheless we believe they offer some useful insights about training needs.

Firstly, we asked students about the importance of conservation scientists actively engaging in the policy process, poverty issues and economics. Most respondents felt that engagement in these matters was desirable. For example:

- Engaging in policy decisions is an important activity for conservation scientists (> 90% agreed or strongly agreed).
- Poverty eradication and ecological conservation are separate policy issues (> 70% disagreed or strongly disagreed).
- Economics should not influence conservation decisions (> 55% disagreed or strongly disagreed).
- Knowledge of economics, political science and development studies was directly applicable to their own research (> 90% agreed or strongly agreed).

We then asked the students a series of knowledge questions from a range of disciplines to see if their interest was backed by awareness. Correct response rates were high. For example, 68% correctly responded to a multiple-choice question about the economic concept of opportunity cost (compared with 25% for random guess), 44% correctly identified amphibians as the world's most threatened vertebrate class (compared with 20% for random guess), 48% correctly responded to a multiple-choice question about the political science concept of governance (compared with 25% for random guess) and 40% correctly identified 1 billion people as the World Bank's estimate of the number of people currently living below the USD 1 per day poverty line (compared with 25% for random guess).

These students felt that a broad knowledge base was important, and they showed that they already had such a base. However, when asked about their future work in conservation, a large percentage of students found their training either not sufficient or wholly inadequate in political science (71%), economics (73%), development studies (57%) and management studies (53%). The case was different for biology and ecology, in which 78% of students felt that their training was sufficient or nearly sufficient.

Paired with this question we asked the students about the amount of time spent during their graduate studies on the same five topics. We plotted the students' perception of the adequacy of training on each topic against the time spent on it. For all topics there appeared to be an approximately linear positive relationship and these correlations were statistically significant (Table 1). Students spent on average 69% of their time focusing on biology or ecology, whereas on average they spent < 5% of their time on political science. The results show that although students felt inadequately trained in social sciences, their perceived adequacy of training increased with increasing amount of time spent on it.

Comparing students' answers to the knowledge questions with their perception of the adequacy of their training, we find that there was no difference in the correct

response rate between students who thought their training was either sufficient or nearly sufficient and those who thought their training was insufficient. This was true for all four knowledge questions (ecology/biology $\chi^2 = 1.05$, $df = 1$, $P = 0.307$; economics $\chi^2 = 0.089$, $df = 1$, $P = 0.765$; political science $\chi^2 = 0.767$, $df = 1$, $P = 0.381$; development studies $\chi^2 = 0.051$, $df = 1$, $P = 0.821$). This suggests either that the relationship between students' perception of their training and their knowledge is more nuanced or perhaps that our questions were not indicative.

Finally, we examined how the MSc respondents compared to the PhD respondents. There was no difference in the perceived adequacy of training between MSc and PhD students ($\chi^2 = 0.007$, $df = 1$, $P = 0.979$). However, there was a weak trend in the correct response rates to our knowledge questions with MSc students outperforming PhD students (Mann-Whitney $U = 312.5$, $P = 0.091$). The mean score of the MSc students ($n = 32$) was 59%, whereas that of the PhD students ($n = 26$) was 45%. Perhaps this result is a function of a typically broader MSc training compared to a more focused PhD training.

With our small sample size and bias towards students interested in the broad scope of the Student Conference on Conservation Science, some of our individual results may seem to be simple talking points on graduate education. However, taken as a whole, our survey indicates that (1) demand for social science training amongst young conservation scientists is high, (2) this demand comes from some students already able to answer fairly difficult questions in social science fields, and (3) there is likely to be a positive response in the perceived adequacy of training based on the time spent on that training. The challenge stemming from these results is how can we improve social science training in our 1- to 5-year graduate programmes when demand on student's time is already at a premium?

Approaches already in practice include problem-based courses where students take on all aspects of a looming conservation issue and often work with stakeholder and government groups outside academia (Inouye & Dietz, 2000). Certificate programmes also exist where students complete a programme in, for example, economics, alongside their primary degree (e.g. University of Vermont, University of Maryland). Other opportunities include the Society for Conservation Biology's new social science tools website (SCB, 2009) and the workshops it runs on social science techniques. Additionally, at the Student Conference on Conservation Science students can hear keynote addresses or attend workshops specifically on the role of social science in conservation. Our experience suggests that for many of the attendees this is often the first time they are confronted with social science techniques and approaches.

As a conservation community we need to find out whether any of these approaches yield both strong social science training and confidence in students who see this

TABLE 1 Average percentage of time spent training and percentage of respondents ($n = 72$) who thought their training was adequate for five topics relevant to conservation science, and the Spearman rank correlation of the perceived adequacy of training with the percentage time spent on each topic. P values are two-tailed.

Topic	% time spent	% training is adequate	R_s (P)
Biology/ecology	68.9	47.8	0.249 (0.04)
Management studies	8.5	8.8	0.322 (< 0.01)
Development studies	6.8	3.0	0.399 (< 0.01)
Economics	5.5	4.4	0.442 (< 0.01)
Political science	4.7	2.9	0.240 (0.05)

integration as important for their future work. We need to gauge the success of these approaches and be transparent about the results. This is likely to be a challenge that educators, practitioners, conservation societies and others need to think about strategically and collaboratively, not in the search for single solutions to graduate training but to explore complementary approaches and share successes. At the same time, we need to avoid the corollary of Lorenz's dictum: that generalists created by such training know nothing about everything.

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Biographical sketches

BRENDAN FISHER'S work is centered around identifying trade-offs across development and conservation objectives, with a specific focus on ecosystem service assessments and valuation. ANDREW BALMFORD'S research focuses on the costs and benefits of conservation; quantifying the changing state of nature, enhancing conservation effectiveness and public support, and exploring how best to reconcile conservation and development. RHYS GREEN carries out research on the effects of human land use, climate change and conservation management on bird populations. ROSIE TREVELYAN is the Director of the Tropical Biology Association, through which she is developing a community of well-trained, motivated conservation scientists and practitioners through capacity-building activities in Africa and South-East Asia.