Availability of Formal Academic Programs in Conservation Biology in Latin America

Introduction

Latin America (in our analysis, Brazil and the Spanish-speaking countries in Central and South America and the Caribbean, including Puerto Rico) holds a disproportionate fraction of the world's biodiversity (Myers et al. 2000; Olson & Dinerstein 2002; Lamoreux et al. 2006). The region depends heavily on natural resource exploitation and has high rates of environmental degradation and biodiversity loss (WRI 2003; Hassan et al. 2005). Environmental challenges in Latin America are further complicated by a lack of conservation capacity-building opportunities that encompass many levels, audiences, and contexts (Bonine et al. 2003; Rodríguez et al. 2005, 2006; Chek et al. 2007).

Despite long-standing educational initiatives in several Latin American countries, significant effort would be required to match the supply of formal conservation education in a country like the United States (Rodríguez et al. 2005). Here we present an assessment of formal programs in conservation biology, including graduate and undergraduate degree programs focused primarily on conservation and conservation-related classes in broader biology or environmental sciences curricula.

Our goals were twofold. First, we sought to provide a current database for those interested in training opportunities in the region. Second, we identified countries that are leaders and those that have lagged behind, with the aim of informing the future development of programs in the region. We then used this database to analyze current opportunities and challenges in formal conservation education in Latin America.

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Identifying Conservation Programs and Courses

To build a database of programs and courses, we surveyed 758 undergraduate and graduate programs listed in two online directories of accredited colleges and universities in Latin America (http://www.rau.edu.uy/universidad/univ.htm and http://www.4icu.org/Latin-America/ [accessed November 2006]). In addition, we surveyed the graduate program database in the Austral and Neotropical America section of the Society for Conservation Biology Web site (http://www.conbio.org/Sections/ANA/ANACourses.cfm, accessed November 2006). The Web pages of all the universities in these databases were inspected to the greatest detail possible, including an examination of each program's curriculum. We excluded programs that lacked adequately detailed information about their course offerings. To avoid a bias toward online information sources, nine conservation practitioners with extensive experience in the region reviewed our database and, where applicable, added missing programs or program elements.

For all the relevant conservation biology programs at both the undergraduate and graduate levels, we examined the conferred degree, course requirements, and curriculum. We also recorded other attributes of interest (such as program duration, program level, and Web address) and ordered all selected programs by country. To further characterize these programs, we defined three levels of relevance to conservation biology. At one end of the spectrum were the conservation-focused programs (focused programs), defined as those with a clear conservation mission and a range of courses and requirements strongly oriented to conservation biology. These programs typically combined a strong foundation of general biology, ecology, and evolution with more than one course exclusively dedicated to conservation biology.

The next category, conservation-related programs, contained some conservation biology courses but did not have a clear academic conservation focus or mission statement. The third category, general programs, lacked a conservation focus and offered only one or two courses in conservation biology. We acknowledge that despite having clearly defined criteria, these categories are subjective. Nevertheless, this classification scheme was useful for determining qualitatively the degree of conservation focus for the

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Table 1. Undergraduate and graduate programs in conservation biology in Latin America.

		Academic programs in conservation biology					
Country	*Population (in millions)**	*general*	*conservation related*	*focused*	*total*	*Total per capita*	*Weighted index*
Argentina	39.54	6	0	3	9	0.23	0.38
Bolivia	8.86	3	1	1	5	0.56	0.90
Brazil	186.11	2	2	11	15	0.08	0.21
Chile	15.98	2	2	2	6	0.38	0.75
Colombia	42.95	5	1	3	9	0.21	0.37
Costa Rica	4.02	1	0	4	5	1.25	3.24
Cuba	11.35	0	0	0	0	0.00	0.00
Ecuador	13.36	1	1	1	3	0.22	0.45
El Salvador	6.71	0	0	1	1	0.15	0.45
Guatemala	12.18	1	0	0	1	0.08	0.08
Honduras	7.17	0	0	0	0	0.00	0.00
Mexico	106.20	12	7	6	25	0.24	0.41
Nicaragua	5.47	0	0	0	0	0.00	0.00
Panama	3.14	0	0	1	1	0.32	0.96
Paraguay	6.35	0	0	0	0	0.00	0.00
Peru	27.93	1	4	1	6	0.21	0.43
Puerto Rico	3.91	0	1	0	1	0.26	0.51
Dominican Republic	9.09	0	1	1	2	0.22	0.55
Uruguay	3.42	3	0	0	3	0.88	0.88
Venezuela	25.38	0	0	0	0	0.00	0.00

**Data from the U.S. Census Bureau (www.census.gov; accessed November 2006).*

academic programs we reviewed. This data set and a table listing all Latin American programs examined are available online at the Society for Conservation Biology Web site (http://www.conbio.org/Sections/ANA/ANACourses.cfm).

We analyzed the number of programs per capita in each country on the basis of the country population and the relative proportion of general conservation-related and focused programs. We devised a simple weighted index that gives the highest relative importance to focused programs, followed by conservation-related and general programs (Table 1; Fig. 1). The weighted index (wI) is the sum of the weighted contributions of the number of general (wG), conservation-related (wCR), and conservation-focused (wF) programs to which we assigned an increasing importance factor of 1, 2, and 3, respectively (wI = [wG+2*wCR+3*wF]/population). This index allowed us to identify countries where focused programs are a greater proportion of the total conservation educational opportunities.

Conservation Biology Education Opportunities in Latin America

We identified 92 formal programs with conservation biology courses offered through 81 colleges and universities in Latin America. These included 68 graduate programs (16 doctorate and 52 master's degrees) and 24 undergraduate programs. Of the total, 35 were focused programs and 57 were conservation-related or general programs. The distribution by country was strongly skewed, with just five countries (Mexico, Brazil, Argentina, Colombia, and Chile) offering 65% of the programs. No formal conservation biology courses at any level were offered in five countries (Cuba, Honduras, Nicaragua, Paraguay, and Venezuela). The previous five, plus Guatemala and Puerto Rico, did not offer any programs with an exclusive conservation focus (Table 1; Fig. 2). Costa Rica, Bolivia, Chile, and Panama had the highest number of programs per capita.

A caveat in our analysis was that we made no assumptions about the quality of the individual programs and treated all programs in each category in our survey as equal in that respect. Nevertheless, all programs are almost certainly not equal, and we suspect that the disparities extend beyond the geographical distribution of the programs available. Although a detailed assessment of issues of quality and impact is beyond the scope of this paper, several universities in our database are included in at least one list of the top universities of the world (http://ed.sjtu.edu.cn/rank/2006/ARWU2006TOP500list.htm).

Our results expand on those of Rodríguez et al. (2005) and more than double their estimate of the number of programs available: we estimated 0.16 programs/million people in Latin America and an average supply of 0.26 programs/million people/country. Nevertheless, our results agree with Rodríguez et al. (2005) in that the per capita supply of conservation education opportunities in the region is much lower than in the United States, for example. More generally, both studies agree in the identification of countries with

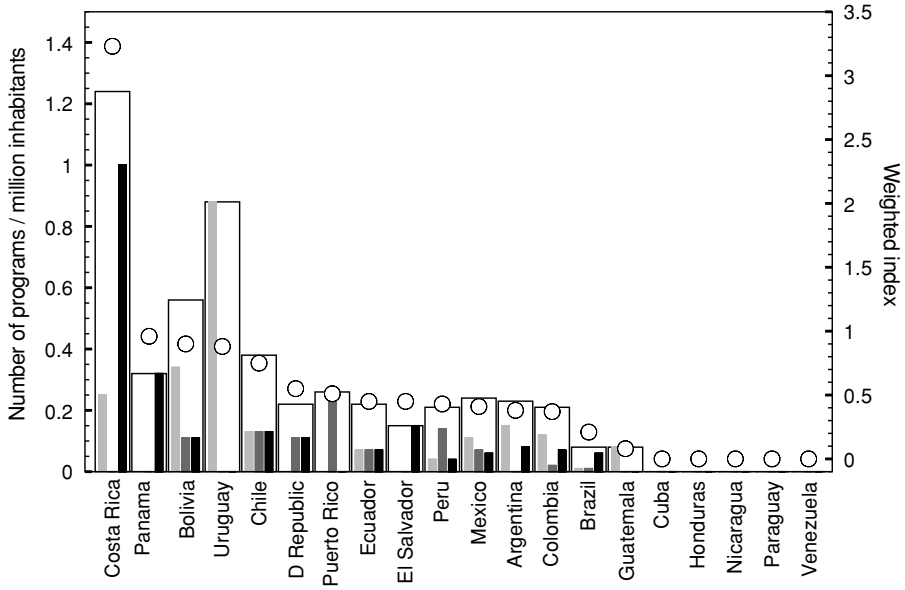

Figure 1. Per capita availability of academic programs in conservation biology by country (light gray, general programs; medium gray, conservation-related programs; black, conservation-focused programs; open bars, total number of academic programs; open circles, weighted index, which allows visualization of countries where programs with a strong conservation focus form a higher fraction of the total conservation educational opportunities).

the highest and lowest number of conservation programs; the number of programs per country in both studies was significantly correlated ($p = 0.002$).

Weighting the per capita supply of conservation education programs by the proportion of general, conservation-related, and focused programs allowed further comparison between countries. Our weighted index favored countries with the highest overall per capita number of programs and a higher representation of focused programs. We assumed that a country with eight focused programs and two broad programs would have a greater capacity to educate conservation practitioners than a country with eight broad and two focused programs. For example, Mexico had the greatest conservation education supply as indicated by the total number of academic programs of all types, but Costa Rica had a much higher supply per capita and a higher proportion of focused conservation programs (Figs. 1 & 2).

A careful comparison of the raw and weighted number of programs is needed to put these figures into context. Our analysis showed that countries with the highest overall number of programs tended to have lower per capita supply of focused programs and, therefore, a relatively low score according to our weighted index. Costa Rica had both the highest

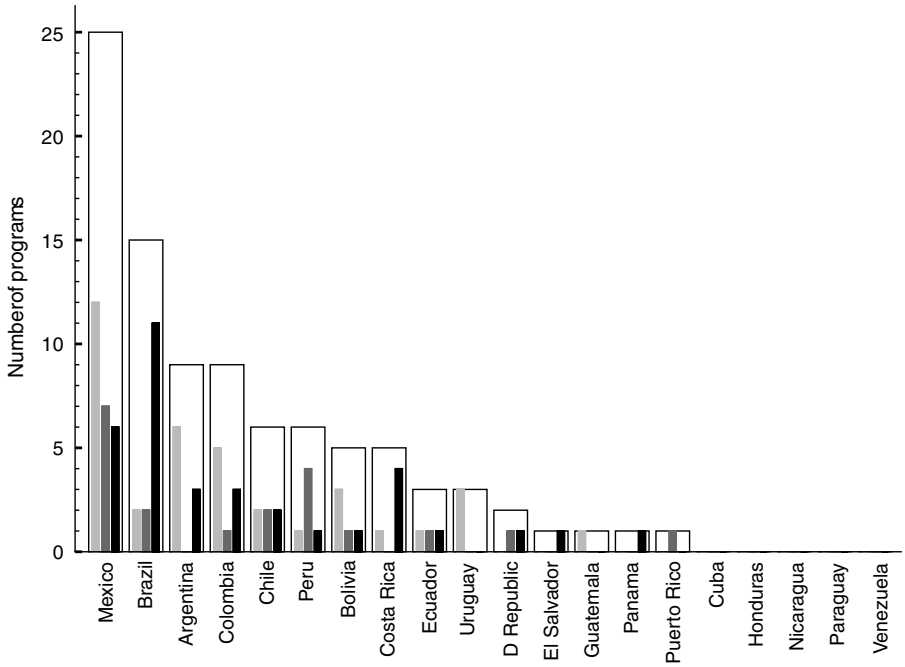

Figure 2. Total number of academic programs in conservation biology by country in Latin America (light gray, general programs; medium gray, conservation-related programs; black, conservation-focused programs; open bars, total number of academic programs).

per capita supply of conservation programs in Latin America (more than twice as many as the second-ranked country, Bolivia) and the highest score in our weighted index (more than three times that of the second-ranked country, Panama). Although the weighted score for Costa Rica was clearly heavily influenced by its relatively small population size, other countries with similar and even smaller populations did not rank as high because they had few academic programs in or related to conservation.

Several countries in Latin America had more than one or two institutions engaged in conservation education; consequently, there may be untapped opportunities for developing strong regional programs. For example, we identified 21 focused graduate programs in conservation biology in Brazil, Costa Rica, and Mexico (11 PhD programs with conservation biology courses in Mexico alone).

Implications for Conservation Biology Training in Latin America

In a world of limited resources but ever-increasing impacts on biodiversity, prioritization of conservation actions is a necessity. The better-known prioritization schemes focus on biological value, threats, and/or the degree of human influence (Brooks et al. 2006), whereas others stress socioeconomic and political factors (O'Connor et al. 2003). As advocated by Rodríguez et al. (2006), we believe our analyses inform priority setting by identifying gaps in the supply in capacity-building opportunities in the region. For example, most countries in Central America lag behind other countries in Latin America in terms of the number of undergraduate and graduate programs in or related to conservation, and half of all Latin American countries lack undergraduate science programs with conservation biology courses. The presence of a cadre of trained local conservation professionals (including among others biologists, wildlife managers, veterinarians, social scientists, education professionals, and technicians) may serve as an indicator of the potential capacity for effective conservation in the region.

In this respect, several countries (Mexico, Costa Rica, Bolivia, Argentina, Chile, and Colombia) have the greatest total supply of conservation capacity-building opportunities in Latin America and should, therefore, have a broad base of locally trained conservation biologists. Recognizing that conservation outcomes are influenced by a variety of economic, social, and political factors that may be independent of the current availability of conservation training opportunities, we contend that countries rich in training opportunities in conservation biology should have the potential for a significant impact on the development of the field and on conservation on the ground in the coming decades.

A coherent response to the biodiversity crisis in Latin America will require additional conservation professionals from a variety of backgrounds and training—from park guards to field and laboratory technicians to upper-level managers and directors. Looking to the future, each country in the Latin American region will need to assess its particular needs and context in terms of setting priorities for expansion of formal training opportunities in conservation. In some countries, particularly where conservation biology is a relatively poorly known discipline, it may make sense to focus on establishing graduate programs in conservation first. In our experience, it is sometimes easier to propose a completely new graduate program than it is to modify or add undergraduate programs, which may contain government-mandated or difficult-to-change curriculum elements. In addition, establishing graduate programs as opposed to undergraduate programs will reduce time in the pipeline for trained professionals to join the work force. On the other hand, in almost all countries in the region, an expansion of undergraduate programs will also be necessary to build a strong foundation for those planning to continue with graduate work and because an undergraduate degree will be the terminal degree for many conservation professionals.

In all discussions of expansion, one should not ignore the potential contribution of distance learning and virtual programs to conservation capacity training in Latin America (e.g., the newly established master's program in conservation biology at the Universidad Peruana Cayetano Heredia, http://www.conservaciononline.org). Finally, expanded offerings might take the form of added courses and broader inclusion of conservation content in relevant courses in existing programs rather than the establishment of new programs at either the graduate or undergraduate level.

To our knowledge this analysis is the most complete compilation of conservation education offerings in Latin America to date. We envision our study as a starting point of an ongoing dialogue with regional conservation practitioners, and we hope this database can be refined and updated with information about new programs. Clearly, there are many excellent programs in conservation biology in Latin America. Nevertheless, in our opinion, the need for professionals to address the current biodiversity crisis far exceeds the current supply of available programs and warrants an important and widespread response to build capacity in this critical region of the world.

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