Advancing tropical forestry curricula through Non-Timber Forest Products

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SUMMARY

There is growing consensus that the expanding scope of tropical forestry is not properly reflected in the way students are being trained. Forestry graduates across the tropics remain poorly equipped on how to engage with local stakeholders, on the technical and economic aspects of multiple-use management, on participatory approaches to forest resource use, and on how to respond effectively to global forestry paradigms. By their very nature, non-timber forest products (NTFPs) are located at the heart of a pluralistic view of tropical forest use and management and their inclusion in forestry curricula could promote interdisciplinary training. In this paper we provide some insights on the status and trends of NTFP education in Latin America through a synthesis of interviews with experts and the results of an electronic survey in order to outline some of the obstacles that need to be overcome in order to advance forestry curricula by using NTFPs. We argue that NTFPs are suitable to introduce topics that traditionally have not been taught to university level forestry students yet not necessarily through formal courses on NTFP management or textbooks on the topic. Instead, a modular approach may be a potentially effective way to promote interdisciplinary thinking and enhance adoption by university professors.

Keywords: forest management, forestry education, Latin America, multiuse forestry

Progression du curriculum de la forêt tropicale par les produits forestiers autres que le bois

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Il existe un consensus grandissant que l'envergure croissante de la foresterie tropicale n'est pas refletée dans la manière dont les étudiants sont formés. Au travers des tropiques, les licenciés en foresterie demeurent pauvrement équipés dans l'engagement avec les parties prenantes locales, dans les aspects techniques et économiques de la gestion à usage multiple, dans les approches participationelles d'usage de la ressource forestière, et pour savoir comment répondre efficacement aux paradigmes forestiers globaux. De par leur nature même, les produits forestiers autres que le bois (NTFPs) se retrouvent au coeur d'une vue pluralistique de l'utilisation et de la gestion de la forêt tropicale, et leur inclusion dans le curriculum forestier pourrait promouvoir une formation pluridisciplinaire. Nous offrons dans cet article des réflexions sur le status et les courants de l'éducation en NTPFs en Amérique Latine à travers une synthèse d'interviews avec des experts et les résultats d'une enquète éléctronique, pour souligner certains des obstacles devant être surmontés afin de pouvoir faire progresser le curriculum forestier avec l'aide des NTPFs. Nous démontrons que les NTPFs peuvent servir à introduire des sujets n'ayant pas été traditionnellement enseignés aux étudiants universitaires en foresterie, et cela, sans avoir nécessairement recours à des cours formels sur le sujet des NTPFs, ou à des livres techniques sur la matière. Une approche en modules pourrait par contre être un moyen potentiellement efficace de promouvoir une pensée pluridisciplinaire, et encourager son adoption par les ensignants universitaires.

La promoción de los planes de estudio de silvicultura tropical mediante los productos forestales no madereros

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Existe un consenso creciente de que la diversificación cada vez mayor del campo de la silvicultura tropical no se ve reflejada de modo apropiado en la forma de preparar a los estudiantes de silvicultura. Los licenciados en silvicultura en todos los países tropicales siguen teniendo mala preparación en cuanto a cómo relacionarse con grupos interesados locales, en los aspectos técnicos y económicos de la gestión forestal multiuso, en el empleo de técnicas participativas en el uso de recursos forestales, y en cómo responder de forma efectiva a los paradigmas de la silvicultura global. Por su misma naturaleza, los productos forestales no madereros (PFNM) se encuentran en el centro de una visión pluralista del uso y de la gestión del bosque tropical, y su inclusión en los planes de estudio podría promover la preparación interdisciplinaria. En este estudio se proporciona un panorama global del estado y de las tendencias de la educación de PFNM en América Latina a través de una síntesis de entrevistas con expertos y los resultados de una encuesta electrónica, para así resumir algunos de los

obstáculos que deben ser vencidos si se quiere mejorar los planes de estudio en el campo silvicultural mediante el uso de los PFNM. Opinamos que los PFNM permiten introducir temas que tradicionalmente no han sido enseñados a los estudiantes de silvicultura a nivel universitario, aunque no necesariamente a través de cursos formales sobre la gestión de PFNM ni de libros de texto relacionados. En lugar de eso, se propone un enfoque modular, el cual puede resultar efectivo para promover el pensamiento interdisciplinario y la adopción por parte de los profesores universitarios.

INTRODUCTION

Tropical forest management has evolved dramatically over the last few decades as we have come to understand the many ways that forests are perceived, used, and conserved along with the varying practices and approaches needed to sustain them (Sayer and Maginnis 2005). Regulatory frameworks have changed from highly centralized control by national forest agencies into more pluralistic and decentralized frameworks that respond to the diverse voices of society (Sayer and Elliot 2005, Nasi and Frost 2009). Forests are no longer the exclusive domain of the state nor are solely destined to industrial timber production. Timber-dominated models, long at the heart of tropical forestry, are being challenged to explicitly include goods such as non-timber forest products (Tieguhong and Ndoye 2007, Menton *et al*. 2009) and the provision of environmental services of global significance such as carbon sequestration (Putz *et al*. 2008). Millions of hectares of tropical forest are currently owned by local and indigenous communities (Sunderlin *et al*. 2008). Their conservation may depend among other factors on a closer dialogue between tropical forest science and traditional knowledge (Michon *et al*. 2007), where locally adapted silviculture and harvest systems are developed together within organizational and institutional culture through participatory approaches (Lawrence 2007).

Tropical forestry curricula has not kept up with most of these changes. Forestry graduates across the tropics remain poorly equipped on how to engage with local stakeholders, on the technical and economic aspects of multiple-use management, on participatory approaches to forest resource use, and on how to respond effectively to global forestry paradigms. Curricular inflexibility, scarce funding for curricular advancement, and institutional inertia are consistently mentioned across Latin America, Africa and Asia as the main factors behind this pantropical ossification (Caballero 2002, Sikor *et al*. 2005, Temu *et al*. 2006, FAO 2007, Kammesheidt *et al*. 2007). At a recent international workshop on forestry education held in 2007, participants from 29 countries identified the need to move towards holism and away from industrial-based forestry models and recommended both to "retrain foresters in new approaches to forest management" and "review the objectives of forestry education in the light of current and future developments" (Temu and Kiwia 2008). Promoting interdisciplinary thinking and ways of working by integrating knowledge and tools from the biophysical, economic, and social sciences in addressing management issues is considered as one way forward (Zarin *et al*. 2003, Innes 2005, Kainer *et al*. 2006).

Non-timber forest products (NTFPs) are at the heart of a pluralistic view of tropical forest use and management (Lawrence 2003). Thus NTFPs can help promote interdisciplinary training by exposing forestry students to a range of intersecting topics including timber management (Guariguata *et al*. 2010). By nature, NTFPs are multidimensional and multiuse, as they include seeds, fruits, bark, fungus, latex, resins, foliage, wood and animal protein (Alexiades and Shanley 2004, Kusters and Belcher 2004, Sunderland and Ndoye 2004). Moreover, they are of significant importance in household economies (Belcher and Schreckenberg 2007). Local knowledge and harvest strategies vary for a given NTFP across different socioeconomic and tenure contexts (Varghese and Ticktin 2008) and social groups (Lawrence *et al*. 2005). NTFPs are extracted throughout tall, closed-canopy forests (Peres *et al*. 2003), secondary forests (Pulido *et al*. 2007), agroforests (Belcher *et al*. 2005a) and at the interface between forest and urban centers (Stoian 2005, Lewis 2008). NTFP use is also influenced by specific market, developmental and institutional settings (Ruiz-Pérez *et al*. 2004, Belcher *et al*. 2005b). Modernizing forestry training and education through NTFPs may also have implications for forest conservation. Although harvesting of NTFPs alone has proven disappointing from the viewpoint of a forest development-conservation strategy (Kusters *et al*. 2006), they nevertheless can contribute as effectively as nearby protected areas in maintaining forest cover when fit into multiple use forestry systems (Bray *et al*. 2008, Ellis and Porter-Bolland 2008).

Despite the many books and guidelines on NTFP management that have been produced over the years (Table 1), the extent to which NTFP topics are being incorporated into tropical forestry curricula is not well known. In this paper we gather insights on status and trends in NTFP education by using Latin America as a regional example and where both the resource base and diversity of NTFPs is significant (Alexiades and Shanley 2004, Shanley and Medina 2005). We conducted an electronic survey complemented with the views of experts and our own about what we believe are critical aspects on using NTFPs as a means to propel tropical forestry curricula forward. We reflect also on what we think are main obstacles that need to be overcome for this to happen.

METHODS

From August through October 2009 we launched an electronic survey in Spanish (www.surveymonkey.com). Our primary source of dissemination was the Latin-american network of

TABLE 1 *Published guidance on non-timber forest product (NTFP) management in the tropics highlighting those with application on Latin America (Spanish and Portuguese). Arranged in chronological order.*

Title	Scope	Emphasis	Languages	Reference
Sustainable harvest of non-timber plant resources in tropical moist forest: an ecological primer	Tree ecology and silviculture	Closed canopy, natural forests	English Spanish	Peters (1994) Peters (1996a)
The Ecology and Management of Non-Timber Forest Resources	*Idem*	*Idem*	English	Peters (1996b)
Participatory inventory: a field manual written with special reference to Indonesia	Step-by-step plant inventorying involving local participation	South East Asian forests	English	Stockdale and Corbett (1999)
Resource assessment of non-wood forest products.	Inventorying from a biometric standpoint	Tropical and temperate forests, plants and animals	English, Spanish, French	Wong *et al*. (2001)
Applied Ethnobotany	Tools and methods on the biophysical, social, and economic aspects of sustainable plant harvest	African forests, woodlands and savannas	English Spanish	Cunningham (2001) Cunningham (2002)
Practical Tools for Researching Successful NTFP Commercialization: a Methods Manual	Interventions to support local communities in decision-making on NTFP commercialization	Primary and secondary forests, and plantations in Mexico and Bolivia	Spanish English	Marshall *et al*. (2006b) Marshall *et al*. (2006c)
Steps to sustainable and community-based NTFP management	Step-by step process for sustainable harvest plans with local communities	South East Asian forests	English	Stockdale (2005)
Manejo de produtos florestais não madeireiros: Um manual com sugestões para o manejo Participativo em comunidades da amazônia	Technical background for extensionists in community-based management	Brazilian Amazonia	Portuguese	Machado (2008)
Frutiferas e Plantas Uteis na Vida Amazonica	Ecology and use of NTFPs for local communities	*Idem*	Portuguese	Shanley and Medina (2005)

forestry education (RELAFOR; www.relafor.net), which includes forestry students, researchers and professors throughout the region. We also targeted individual forestry schools, professional list-serves and institutions that offer higher education programs in natural resources management. We collected a total of 208 responses out of a total of 444 electronic mails soliciting participation in the survey. The survey identified respondents' background, their previous degree of exposure to various NTFP management topics during university education (made explicit in Table 2) and their opinions on the current needs for NTFP education. The survey also asked whether or not issues related to NTFPs were being formally taught at their universities; in case of a negative response the reasons were requested in open-ended format. At the same time we undertook 13 interviews out of a pool of 28 international experts selected for their expertise in various aspects of tropical forest management and research, including NTFPs. The interviews covered the topics of tropical forestry education as a whole and how it relates to NTFPs. All experts have long-term work experience in tropical forests (mean = 23 yr; range = 10-40) and currently invest a substantial percent of their professional time on NTFP-related work (mean = 73 %; range = 5%-100%). With the exception of two individuals (primarily with tropical African and Asian experience), all experts have worked extensively across Amazonian (Bolivia, Brazil, Colombia, Perú, Venezuela) and Mesoamerican countries (Costa Rica, Guatemala, Honduras, México, Nicaragua, Panamá). At the time of the interviews, the experts were currently engaged in teaching, training, and outreach activities on average 83 % of their time (range = 40%-100%).

RESULTS AND DISCUSSION

Respondents to the electronic survey represented the following countries: Argentina, Brazil, Bolivia, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Mexico, Nicaragua, Peru and Venezuela. Ninety-six percent of the respondents are Latin American and 99.5% live and work in

TABLE 2 *Topics related to NTFP management that were presented to survey participants across Latin America for answering the question "have you been exposed to any of the following topics either as a student or a teacher?". N= 208.*

Theme	Percent responses
Peri-urban systems	3
Assessing harvesting impacts	10
Monitoring management outcomes	13
International markets and certification	17
Defining sustainable harvest	16
Integration with other uses (timber extraction)	18
Ecology	25
Inventorying	31
Commercialization	31

Latin America. Seventy percent of all respondents received their primary training in forestry while the rest were spread across biology/ecology and agronomy. The large majority (77%) works in tropical forests while the remaining 23% in subtropical forests. When asked if there should be more NTFP education at the university level, 70% of the respondents were "very much in agreement" and 21% were in "agreement". The remaining 9% were split between "not agree" and "neither agree nor disagree". When asked the extent to which they have encountered specific themes with direct relation to NTFPs in university curricula, either as students or professors, an overall low degree of exposure was noted. In particular, issues directly related to sustainable management in the context of NTFPs (e.g., sustainable harvest, monitoring management outcomes or including NTFPs in a broad management context) received very low response rates (Table 2). When asked whether a formal course on NTFP management was offered as part of the forestry curriculum either as students or professors, 66% of the respondents said "no", 28% responded "yes" while 6% "did not know". Follow up research identified courses in seven universities across Chile, Bolivia, Brazil, Mexico and Perú. Respondents from Argentina, Costa Rica, Colombia and Venezuela uniformly stated the absence of courses at the university level on NTFPs.

As a whole, this suggests that training and education on NTFPs across Latin America may be underdeveloped. For those who answered "no" above, we categorized their open-ended responses as follows (we acknowledge that some are interrelated): (i) lack of trained professors on the topic of NTFPs; (ii) lack of available teaching material and/or a synthetic treatment of NTFPs for university audiences; (iii) rigidity at the institutional level in promoting new courses; (iv) scarce human and financial resources for designing an entire course on NTFPs due to their multifaceted nature; (v) lack of interest from the central government in promoting multiple use of forests; and (vi) low contribution of NTFPs to the national economy. When we asked experts about the obstacles and/or challenges to improving NTFP education in Latin America, their opinions added further insight: (i) discomfort by faculty when introducing new topics; (ii) little preparation by forestry graduates to work with rural people and to deal with uncertainty; and (iii) insufficient exposure to interdisciplinary approaches for solving management problems including critical thinking and experimentation. We discuss these issues in detail below.

Lack of trained teachers may be a direct consequence of lack of published material; in fact, many respondents to our survey believed that relevant instructional material on NTFP management was largely unavailable across the Latin American region. Of the respondents who self-identified as university professors (N = 87), 93% replied that if there were an NTFP textbook available, they would use it. However, we challenge this perception because Spanish translations of basic information on NTFP management do exist (Table 1). It therefore appears that instructors across the Latin-american region are not currently adopting available materials. One important obstacle to the lack of formal coursework on NTFPs, as mentioned repeatedly by survey respondents, was apparently little interest by the government in promoting multiple use of forests due to the low contribution that NTFPs make to the national economy. To the extent that national priorities influence the development of forestry curricula, forestry schools may be reluctant to invest in teaching methods and approaches for managing other forest products with lesser commercial value. We believe this is the product of a vicious circle. On the one hand, local market chains for NTFPs across the tropics are generally under-represented in national statistics making their relevance in national research and development concomitantly low (Vantomme 2003, Shackleton *et al*. 2007). On the other hand, national governments are still the major employers of forestry graduates across the tropics (Temu *et al*. 2005;2006, FAO 2007). Integrating NTFPs into national forest surveys to more accurately represent their contribution to national trade is a necessary first step into making NTFPs more visible from a local perspective (Shackleton *et al*. 2007).

Another explanation for the relative paucity of university courses dedicated to NTFPs often mentioned by survey respondents is related the multifaceted nature of these products, which makes it difficult for one teacher to cover

all aspects involved. Although team teaching can help to overcome this limitation by providing students with cross-disciplinary information and perspectives on NTFP management, our own experience across Latin America, complemented with the views from the experts we interviewed, is that team teaching rarely happens in practice. The above challenges and constraints when teaching NTFPs at the university level can be seen as impeding progress of curricular advancement, yet they also highlight windows of opportunity. In the sections to follow, we further discuss some issues that in our view are central to understanding how the introduction of NTFPs could help revitalize tropical forestry curricula. We believe that our discussion is also applicable beyond the Neotropical realm.

Moving forward

We argue that NTFPs serve as a wedge for introducing concepts, tools and approaches to forestry graduates in Latin America and elsewhere. Despite the wealth of material listed in Table 1, what we believe is missing is an integrated teaching approach that helps promote interdisciplinary thinking and problem solving along with a strong foundation on tools and methods. A promising avenue to this end is to develop educational material in the form of modules that include, among others topics, commercialization, household economics, multiple forest management, traditional knowledge (harvest systems), participatory approaches (mapping, monitoring), functional ecology, population biology and property rights as they apply to NTFPs. These modules could be crafted through case studies on specific products (see e.g., Shanley and Medina [2005] for a compilation of local uses and practices of NTFPs from the Brazilian Amazon) and inserted as appropriate in e.g., silviculture, inventorying, forest products, or land use planning coursework. For example, Brazil nut trees (*Bertholletia excelsa*) have been used to teach participatory mapping and inventorying and to show how local communities can strengthen tenure rights and legitimize resource claims to external stakeholders (Cronkleton *et al*. 2010). Specific modules can be further used in departments other than forestry (e.g., anthropology, agronomy, natural resource economics) or else taught by faculty from these departments in forestry schools hence fostering cross-fertilization of knowledge and collaboration across disciplines. A modular approach (as opposed to being exposed to the "new book" on NTFP management), could further help to minimize discomfort from faculty when introducing new topics particularly when team teaching is not possible.

Listening to local perspectives and facilitating dialogue

Given the importance of NTFPs to local communities, tropical foresters need to be equipped with the minimum tools to design, experiment, adapt and measure the outcomes of any management intervention to meet social needs (Ticktin and Johns 2002). Both local knowledge and perceptions are necessary when developing interventions aimed at commercialization (Marshall *et al*. 2006a), resource inventorying (Stockdale and Corbet 1999, Sheil *et al*. 2006), and decision making (Lynam *et al*. 2007). Further, basic knowledge of negotiation skills is useful. For example, in order to jump start sustainable NTFP enterprises and activities, substantial dialogue on various fronts is sometimes needed (e.g., Chibnik and Purata 2007). In addition, many tropical timber species of primary interest to the industry have non-timber values that accrue to local people (Herrero-Jáuregui *et al*. 2008). If foresters are able to liaise between the timber industry and local communities to help minimize conflict of either use, the potential for effective partnerships may be enhanced (e.g., Ros-Tonen *et al*. 2008). It is also important to empower students with tools for NTFP resource monitoring in ways that meet the needs of both scientific rigor and local forest users in a collaborative process (Danielsen *et al*. 2005, Setty *et al*. 2008). Notably, survey respondents seemed poorly exposed to the topic of monitoring management outcomes (Table 2).

Focusing on sustainability through experimentation and problem solving

Because of the relative lack of silvicultural knowledge for determining general harvest principles for many NTFPs in the tropics (Pierce *et al*. 2008, Shanley and Stockdale 2008; an issue also mentioned by both survey respondents and experts), collaboration between foresters and local communities to determine sustainable harvest regimes needs to be treated as an ongoing experiment. Rotation cycles of NTFPs are orders of magnitude shorter when compared to timber, thus allowing greater freedom of experimentation and faster rates of knowledge development. Adoption of new materials on NTFP management (e.g., toolkits, booklets) could be enhanced if they stimulate the processes of exploration and fieldwork. To this end, concepts and principles about uncertainty and adaptive management as they apply to local forest communities (Colfer 2005) may need to be taught. The handbook to develop local management guidelines for wild plant harvesting (derived from the results of participatory research on NTFP management in Nepal and India) recently produced by Lawrence *et al*. (2008) is rooted in this philosophy. We think this approach is worth following elsewhere across the tropics.

CONCLUSIONS

As tropical foresters move from timber dominated models to more holistic management approaches (Sayer and Maginnis 2005, Sist et al. 2008), management for multiple species, for multiple uses and for multiple actors may become more common under enabling legal and socioeconomic factors (García-Fernández et al. 2008). Many experts, educators and practitioners are calling for changes in curricula along with shifts in institutional culture to keep up with the ever-growing ways of how tropical forests are both valued and

used across the world (Temu et al. 2005, FAO 2007, Temu et al. 2008). In particular, we believe that teaching and training on NTFPs needs more attention to this end. Although we acknowledge that the development of teaching modules as proposed above requires time as well as financial and human resources, which are often limited in tropical countries (e.g., Vu Anh et al. 2008), we think this approach is worth exploring. It would provide a flexible framework to introduce a systems thinking approach, to promote interdisciplinarity and critical thinking skills, and to better prepare tropical foresters to design and manage multiple use forest systems. Timber-oriented thinking is still pervasive when national norms for NTFP extraction and management are crafted, and, conversely, silvicultural norms for timber, most often than not, end up disregarding local NTFP values within the same forest (Guariguata et al. 2010). Pioneering steps have been taken, e.g. in Brazil, to integrate management of timber and NTFP through training and education (Pinto et al. 2008). Furthermore, at the University of Veracruz in Mexico, a research and education institute (CITRO: http://www.uv.mx/citro/intro.html) was recently created with the central philosophy of cross-disciplinary research and education in multiple use forest management. Despite these promising examples, a thorough re-packaging of the information on the many dimensions of NTFP management and ecology is warranted so that training and education in tropical forestry can move firmly into the future.

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