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Social Science in Forestry Curricula: A Case Study of Colombia Forestry Programs

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Abstract: Tropical forest management depends greatly on complex social interactions. To understand the underlying human causes of deforestation and to plan forest management, it is of great importance to incorporate social science in the study of forestry. There is insufficient information about the incorporation of social sciences in undergraduate forestry programs. Foresters are well prepared in ecology, silviculture, forest measurements, and operational topics such as logging, but their knowledge of basic elements of social sciences is limited. This study explored the extent to which tertiary forestry education programs in Colombia include social science. It also examined students' perceptions of social sciences courses in the curriculum. About 10% of course credits are in economics, administration, and foreign language, courses on social science are listed as optional. A high percentage of current sophomore (fifth semester), junior, and senior students do not have clear knowledge of basic social research methods, although a majority have used social science techniques at some point in their academic careers.

Keywords: undergraduate forestry curricula; social forestry; sustainable forest management; Colombian forest

1. Introduction

The UN Forest Principles 1992 (FP) recognized the multiple functions of the forest and their importance for the economic development and maintenance of all type of lives [1]. Thus, FP became the first international call to incorporate the ecological, economic, and social dimensions to forest management. Several efforts have been made to include these dimensions in forestry and forestry education [2].

There are a number of challenges in including the social dimension as an important component of sustainable forest management, including its complexity [3] and the existence of disciplinary boundaries [4]. Traditionally, forestry professionals have been trained to understand the biophysical aspects of forest and timber production [5,6]. Although, wood production is perceived as of diminished importance relative to other forest values and forest management objectives, due to changes in society, such as changes in markets, agricultural expansion, and ecosystem services [7]. For example, a study of forestry students in Brazil showed that students do not perceive forest production as of high importance in their professional training [8]. Since societies change and the job market demands for professional foresters with skills that are more complex than timber production [9], forestry educational institutions may consider integrating those changes in their curricula and thus, look after progress on sustainability.

According to FAO [10], the scope of Sustainable Forest Management (SFM) has recently expanded to cover stakeholders' social and cultural values. In this regard, scientists have devoted time to studying social-related issues of forestry to inform policy-makers and development agencies [11–14]. Nonetheless, the call to reform the forestry higher education curricula to address social sciences has received minimal attention [15]. As a result, forestry professionals currently face the challenge to accommodate social science in their technical practice with insufficient preparation [6]. This situation is a concern in the tropical forest of Colombia, which is inhabited by heterogeneous groups of people with diverse opinions about forest management. In addition, there are international cooperation requests to place more emphasis on social aspects of forestry, such as governance, community participation, social resilience, and equity among other social aspects.

Despite the recent changes in forestry education, foresters have not been able to establish a strong link with society [9]. The social component of forest management seems to focus only on community participation [4]. Although, involving communities in forest management is fundamental to achieve the sustainability of the forest, it is also of equal importance for forest professionals to understand the underlying implications of social sciences.

Recent studies suggest that the integration of social science in forestry would be possible through a redirection of academic programs that involve faculty and administration, include information from stakeholders, and embrace extracurricular actions [16]. Thus, forestry curricula constitute an important venue to the study of forest sustainability.

This study is exploratory; it aimed to examine the extent of the inclusion of social science in the forestry education programs of Colombia, and assessed students' perceptions of social science.

Forestry Education in Colombia

The Republic of Colombia is considered the second most biodiverse country, it hosts around 10% of the biodiversity of the world distributed in its almost 314 types of tropical ecosystems [17]. The most significant natural forest ecosystems are located in the Andean Basin, the Amazonian Basin, and the Pacific Choco-biogeography rainforest, covering approximately 53% of the territory of the country (61 million of hectares). Forest ecosystems are home to a large population of indigenous, afro-Colombian descendants, and mestizo communities [18]. Ironically, those communities are the poorest and most underdeveloped of the country. Currently, the Colombian forests and their communities are facing great risk due to high rates of deforestation and illegal timber extraction [19]. Extreme poverty, high rates of illiteracy, along with illicit crops and armed conflict jeopardize the permanence of the forest stand [20]. Accordingly, the sustainable management of Colombian forest is an unquestionably complex task that requires the concurrence of several actors, including forest professionals whom during the last three decades, have had to attend socio-economic aspects of forest without proper preparation.

Forestry education of Colombia has its roots in European forestry schools, following the example of Austria and Germany. The first forestry program in the country was established in 1951 in response to the demand for more specialize technicians to harvest vast areas of tropical forest for timber production [21]. However, forest ecosystems offer a myriad of products and services that were not considered when the first forestry schools were established. Consequently, "modern" foresters need to develop competencies and acquire new knowledge to be able to identify all those benefits and to attend new requirements of forest sustainability.

At the time of this study, there are five traditional forestry-engineering programs; (five-year degree programs). There are also four technological schools (three-year degree programs), each school specialized in one subject, plantations, timber markets, restoration, and harvesting; and one technical school (two-year degree program) that specializes in harvesting. In addition, there are three agroforestry engineering programs (one is under distance education modality) and one technological school in agroforestry. All these institutions have the responsibility to prepare foresters to undertake the challenge to attend complex issues associated with forest management and conservation.

In 1999, the Ministry of Education of Colombia decreed that all engineering programs should include classes under four major subjects: basic sciences, basic engineering science, applied engineering, and complementary education or socio-humanities. This last subject refers to economics, administration, social sciences, and humanities. The same year, the five forest engineering programs agreed to allocate 10% of the credits to the socio-humanities component [22]. However, there was no clear agreement on what kind of courses should be included to cover one of the most challenging issues of the Colombian forest management. Currently, foresters work on a wide variety of development agencies, industries, government, and mine companies that require basic knowledge of social science and methods not only to accomplish their task but also to be able to communicate with professionals from other disciplines and stakeholders.

2. Methodology

A mix-methods approach was used to explore how social aspects are incorporated in undergraduate forest engineering and forestry technology curricula of Colombia. It also assessed students' understanding of social science in forestry. First, we reviewed the curricula of 12 of the 13 existing forestry related programs to examine the number of courses with socio-humanities component. The analysis differentiated between traditional forest engineering programs (*Ingenieria Forestal*) that account for five schools, and the mixed-forestry programs, which include two agroforestry engineering programs, four technological, and one technical schools. Then, we conducted an in-depth review of the syllabus of three of the five forest engineering programs to understand the extent in which the social science concept is addressed.

In addition, we designed a cross-sectional survey of 25 questions distributed in three well-defined sessions. The first session explored respondents' current understanding of the importance to work with local communities; this section was denominated aspect understanding. The second session assessed participants' opinion about working with people who may have a different way of thinking about forest management (aspect opinion). The third session sought for respondents' knowledge of social research methods (aspect knowledge). The target population was the group of senior forest engineering students from Universidad Distrital F.J.C., Colombia. The selection of senior students obeyed to the fact that during the upper division courses, students have to go to field practice exposing them to real situations.

To check for the accuracy of the instrument, a pilot test was administered to 15 participants, (faculty members and senior students). The adjusted instrument was distributed to students during class hours. Out of the 280 senior students enrolled by the end of year 2013, 136 responded to the questionnaire. Data collection took place during the month of November 2013.

3. Results

Courses in social science represent a small proportion of the curricula compared with the biophysical and technical courses. This limitation rests on the fact that social courses are seldom required and if so, they only address topics of community participation. Forest education programs in Colombia include a wide variety of courses that comprise for the socio-humanities component. An in-depth review of the syllabi of the socio-humanities courses of three of the most prestigious forest engineering programs showed that there is a tendency to generalize the term "social science" to community participation and rural economic development. The socio-humanities component occupies a small percentage of the core curricula, and a relatively low percentage of social classes are listed as optional. Thus, the Colombian forestry curricula do not distribute courses equally to reflect the three pillars of sustainable forest management. A large percentage of the survey's participants indicated that there is a dissociation between technical and social forestry.

3.1. A Review of Colombia's Undergraduate Forestry Program Curricula

Forestry education in Colombia has steadily evolved in response to global demand for more sustainable practices. Earlier and traditional programs started six decades ago as forest engineering. Two decades ago, the first agroforestry engineering program was established to incorporate other land uses to the practice of forestry. Today, there are three agroforestry schools located in different areas of the country. More recently, some technological schools have opened to offer distance education and to be more accessible to technicians on the field. These new schools focus on the management of plantations, restoration of ecosystems, agroforestry, and marketing of forest products. The social component of Colombia forest programs is labelled as socio-humanities.

In general, the traditional forest engineering programs assign more than 13% of the total number of courses to the socio-humanities component ranging from 5 to 13 courses. Nevertheless, this number differs with the number of credits assigned to the same component. The number of credits varies from 5% to 17% out of the total number of credits required for graduation (see Table 1). The traditional forestry engineering programs include a list of electives along with an assortment of other courses from other disciplines in which two or three belong to the socio-humanities. However, there is no guarantee that students would select at least one of them. A slightly high percentage (45%) of the socio-humanities courses falls on the category of policy, economics, and administration. Meanwhile, extension and sociology represent only 14%. In other words, only one course in each program covers forestry extension. One program includes one course in sociology, anthropology, and ethics. Only two of the five engineering programs have a course that focus on community participation.

The number of courses in socio-humanities for the mixed-forestry programs ranges from 7 to 14 accounting for 6% to 8% of the total credits per program. It is worth mention that these mixed-forest programs place more emphasis (61%) on aspects of forest administration and marketing. In addition, the technological programs are shorter in time than forestry engineering programs, and one of the agroforestry engineering programs is a distance education program.

Content analysis of the syllabi of three of the most prestigious forest engineering programs showed that a course in social research methods *per se* is not included. As oppose to the general list of courses, statistics, and experimental designed are core courses taught during the first six semesters for the three programs. One of the forest extension courses in one of the programs partially mentioned the use of social research techniques; although, it does not specifically refer to the type of techniques. Similarly, a course's syllabus listed interviews as one of the strategies to transfer technology, but it is only mentioned as part of the course's units. In general, none of the syllabi reviewed addressed important concepts of social research methods such, measures, design, sampling, data analysis, and/or issues of ethics when using interviews. Each program has a course covering topics on the forest-human relationship; this course is usually labelled as forest extension, which teaches students how to transfer technology to enhance peoples' well-being. There is a generalized tendency to relate social concepts to economic well-being or rural extension, leaving other domains of social science unattended. Only one of the courses addresses the role of people's culture and their relation to forest management and conservation. That course provides the theoretical elements about cultural systems and their relation with nature. The topic of community participation or participatory silviculture is included in a course in two of the engineering programs; their syllabus indicated that students learn rural development models and rural organizations, such clusters, agro-industries, and the forest value chain.

The analysis of the surveys showed quite a fair balance of gender representation, 43.4% were women and 56.6% were men, this result shows the increasing number of woman enrolling in forest engineering programs. A large number of participants (87%) are younger than 20 years old. The distribution of participants among semesters is presented in the Table 2.

Table 1. Credits and courses required for graduation and core courses in socio-humanities.

	Forest Engineering	**Forest Engineering**	**Forest Engineering**	**Forest Engineering**	**Forest Engineering**	**Agroforestry Engineering**	**Agroforestry Engineering**	**Technology**	**Technology**	**Technology**	**Technology**	**Technology**
Total credits for graduation	172	170	177	164	157	170	170	94	88	99	95	97
Total number of courses	34	58	59	65	39	14	14	8	26	31	38	6
Total number of core courses in socio-humanities	5	8	8	13	10	18	8	7	12	2	19	10
Total credits required in socio-humanities	8		26	24	28	14	14	8	26	38	6	21

Table 2. Participants per semester.

Semester	Percentage
Fifth	10
Sixth	11
Seventh	18
Eighth	13
Ninth	18
Tenth	31
Total	100.00

3.2. Students' Understanding that Forest Management Implies to Work with Local Communities

Three items comprised the aspect understanding; for data analysis, a new variable labeled understanding was created to be able to calculate means. Results showed that a large percentage (90%) of the participants acknowledged that they would work with local communities in their professional practice. ANOVA analysis was performed to check for differences among semesters (Table 3). There were not significant differences of responses among students in different semesters for the items that comprised the aspect understanding.

Table 3. Statistical significance for understanding and opinion aspects.

Aspect	Test	Significance
Understanding	F	0.089
Understanding (fifth and seventh)	t	0.318
Understanding (fifth and tenth)	t	0.160
Opinion	F	0.903
Opinion (fifth and seventh)	t	0.030
Opinion (fifth and tenth)	t	0.048

3.3. Students' Opinion about Working with People Who have Different Perception about Forest Management

A new variable labeled (opinion) was created to calculate means. The results from ANOVA shown that there were not significant differences among students from different semesters and there was not a significant difference by gender either. However, when comparing the means (*t*-test), there are statistical differences between students from fifth (sophomore) and seventh (junior) semester, and fifth and tenth (senior) semester (see Table 3).

In addition, there was no correlation between understanding and opinion aspects (see Table 3).

3.4. Students' Knowledge of Social Research Methods

The aspect knowledge was comprised of 13 dichotomous questions. The Cronbach reliability test was of 0.894 indicating that the items selected are consistent. The phi coefficient showed positive weak association among question #7 with the other questions that comprised this aspect (Table 4). A high percentage (78%) of participants do not know the difference between social research and biophysical research methods. However, more than 60% of the participants claimed to have used surveys and questionnaires.

Table 4. Values of phi coefficient for the knowledge aspect.

Questions	Description	7	8	9	10	11	12	13	14	15	16	17	19	20
7	Do you know the difference between social research methods and biophysical research methods?	1.00												
8	Do you know the difference of quantitative and qualitative analysis in social research methods?	0.58	1.00											
9	Do you know what content analysis is?	0.45	0.73	1.00										
10	Have you designed questionnaires?	0.57	0.84	0.73	1.00									
11	Have you designed interviews?	0.58	0.83	0.72	1.02	1.00								
12	Do you know how to design questionnaires?	0.50	0.74	0.62	1.06	0.90	1.00							
13	Do you know how to designed interviews?	0.51	0.74	0.62	0.90	1.08	1.12	1.00						
14	Do you know what a descriptive survey is?	0.53	0.76	0.73	0.97	0.96	0.87	0.83	1.00					
15	Do you know what an analytical survey is?	0.54	0.78	0.74	0.95	0.94	0.83	0.80	1.17	1.00				
16	Do you know what an open question is?	0.58	0.83	0.73	1.04	1.01	0.89	0.87	0.96	0.93	1.00			
17	Do you know what a closed question is?	0.58	0.83	0.73	1.04	1.01	0.89	0.87	0.96	0.93	1.41	1.00		
19	Do you know what a reliability test is?	0.65	0.91	0.69	0.93	0.91	0.80	0.79	0.86	0.84	0.92	0.92	1.00	
20	Do you know what a validity test is?	0.53	0.76	0.55	0.76	0.77	0.66	0.66	0.71	0.71	0.76	0.76	0.89	1.00

4. Discussion

Forests provide multiple ecological, environmental, and social services important for human well-being. Their destruction is mainly caused by anthropogenic activities. To understand the underlying human causes of deforestation and to respond appropriately, it is of great importance to incorporate social science in the study of forest management. Although there are several studies that include the social dimension of forest management, there is insufficient information about the incorporation of social sciences in undergraduate forestry programs. Foresters are facing several challenges when practicing in the field, although they are well prepared in ecology, silviculture, forest measurements, and logging mechanics, their knowledge of some key elements of social sciences is limited [9]. Forestry education in Colombia has played an important role in the conservation of natural areas as well as the development of timber industry. The emergence of diverse modalities to learn about forestry sciences at the higher education level may be explained by the fact that traditional schools are located in cities far from forest areas. In addition, there is a need to integrate forestry with other land uses such agriculture to combat deforestation and to provide to forest owners sustainable alternatives [7].

Forestry education programs in Colombia include social science in their curriculums under a category named socio-humanities complying with a National law that requires all engineering programs to incorporate social science in their curricula. However, there is a lack of research to monitor the efficiency of the law and the syllabi in making effective contribution to the sustainable management of the country's forest lands.

The term 'sustainable forest management' encompasses the inclusion of social, economic, and ecological aspects of forest [10]. Forestry graduates are facing the challenge to transcend traditional boundaries of academic disciplines to respond to complex issues associate to forestry practice. In Malaysia, for example, the role of foresters have shifted from traditional commercial exploitation to environmental and social focuses [23]. Colombian foresters and forestry students have used questionnaires and interviews to address other aspects of forest management such integrated basin management. However, when it comes to understanding why they are using social research techniques, there is notorious doubt. This implies that foresters are collecting important social data [24] but do not know the underlying reasons of its collections, its implications, and its processing.

In some countires, undergraduate forestry curricula have been adjusted to address rapid changes in society [25,26]. Nevertheless, there is a persistent lack of training in the social aspects of forestry [6,16] that was also noted in previous decades by Dourojeanni [5] and Sample *et al.* [27]. Colombian foresters acknowledge the importance to understand the plurality of local values; however, their basic knowledge of social research is poor.

These results indicate that sophomore students (5th semester) do not have a strong understanding of the inclusion of the social component in forest management. This was an expected finding since so-called socio-humanities classes are taught after the sixth semester. The first five semesters of the plan of study are dedicated to the core engineering courses, such as calculus, geometry, chemistry, and physics. In addition, sophomore students have a different opinion to their senior fellows about working in communities with different perceptions of forest management.

Incorporating social aspects of forestry in the curricula is perhaps as complex as the valuation of forest services, yet it is as important as forest conservation. Society has changed and universities are still reticent to accommodate changes [28]. Endter-Wada *et al.* [24] mentioned that one of the obstacles to integrate biophysical and social science is due to differences in epistemologies and paradigms in which natural scientists and social scientists work. This could be the reason that limited the incorporation of social sciences in the forestry curricula.The proportion of social courses compared with the biophysical courses in all of the programs is small. Social courses are listed as optional. However, in practice, the social component of forest management can not be left as an option.

This study was exploratory; consequently, more research is needed to identify what are the most pertinent courses to include in the curricula, to help students acquire the social science knowledge and skills necessary for the contemporary practice of forestry.

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