Passion for nature: global student motivations for forest-related education and career aspirations

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Passion for nature: global student motivations for forest-related education and career aspirations

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HIGHLIGHTS

- Students' choice of forest-related programmes is inspired mostly by intrinsic factors compared to extrinsic ones.
- Careers in forest-related nature and biodiversity conservation are more appealing to students out of the 11 fields provided.
- There was least interest among the students towards work in forest-related industry and non-forest-related fields.
- Students' interests in forest-related programmes and career aspirations differed across continents.
- The motivation to pursue forest-related programmes and career aspirations did not vary much across study levels and gender.

SUMMARY

Despite the relevance of forests to biodiversity and climate change, education and careers related to them are still unattractive to young people. This paper presents findings from a study whose goal is to investigate the motivation and career aspirations of students in forest-related programmes at the university/tertiary level around the globe. The analysis is based on data gathered through a survey of 787 bachelor's, master's, and PhD students from 82 countries. The findings reveal that the choice of forest-related programmes by students is guided by (i) the desire to do beneficial work, specifically to make a positive difference for the environment/communities, (ii) job satisfaction, e.g., enjoyable work, and (iii) working outdoors. With regard to career pathways, students were most interested in working in forest-related nature and biodiversity conservation and least interested in forest-related industry and non-forest-related fields. The study found significant differences across continents regarding student preferences but only a few across study levels and gender. This paper provides useful insights that can help in tailoring forest-related programmes to meet the expectations of the students and universities.

Keywords: motivation, students, forest-related education, careers, university

Passion pour la nature: une analyse globale des motivations des étudiants pour poursuivre une éduction liée à la forêt, ainsi de leurs aspirations de carrière

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En dépit de la pertinence des forêts dans les domaines de la biodiversité et du changement climatique, l'éducation et les carrières leur étant liées manquent encore d'attraction pour les jeunes. Ce papier présente les résultats d'une étude dont le but était d'investiguer la motivation et les aspirations de carrière des étudiants dans les programmes liés à la forêt au niveau universitaire/tertiaire autour du globe. Cette analyse est basée sur des données recueillies dans une enquête auprès de 787 étudiants en licence, maîtrise et doctorat dans 82 pays. Les résultats révèlent que le choix par les étudiants de programmes liés à la forêt est guidé par (i) le désir de réaliser un travail bénéfique, en particulier de faire une différence positive dans l'environnement et les communautés, (ii) la satisfaction au travail, par exemple un travail agréable, et (iii) le travail en plein air. Pour ce qui est des cheminements de carrière, les étudiants étaient principalement intéressés par le travail dans la conservation de la biodiversité et de la nature liées à la forêt, et bien moins attirés par les champs de l'industrie liée à la forêt ainsi que ceux sans rapport à la forêt. Cette étude remarque des différences notables dans les préférences des étudiants à travers le monde, mais très peu, par contre, entre les niveaux d'étude et les sexes. Ce papier jette des lumières utiles pouvant aider à échafauder des programmes liés à la forêt à même de mieux satisfaire les aspirations des étudiants et des universités.

Pasión por la naturaleza: un análisis global de las motivaciones de los estudiantes para cursar estudios relacionados con los bosques y sus aspiraciones profesionales

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A pesar de la importancia de los bosques para la biodiversidad y el cambio climático, la educación y las carreras relacionadas con ellos siguen siendo poco atractivas para los jóvenes. Este artículo presenta los resultados de un estudio cuyo objetivo es investigar la motivación y las aspiraciones profesionales de los estudiantes de programas relacionados con los bosques a nivel universitario/terciario en todo el mundo. El análisis se basa en datos recogidos mediante una encuesta a 787 estudiantes de licenciatura, maestría y doctorado de 82 países. Los resultados revelan que la elección de programas relacionados con los bosques por parte de los estudiantes está guiada por: (i) el deseo de realizar un trabajo beneficioso, concretamente marcar una diferencia positiva para el medio ambiente y las comunidades; (ii) la satisfacción laboral, p. ej. un trabajo disfrutable; y (iii) trabajar al aire libre. En cuanto a las salidas profesionales, los estudiantes se mostraron más interesados en trabajar en la conservación de la naturaleza y la biodiversidad relacionadas con los bosques y menos en la industria forestal y los temas no relacionados con los bosques. El estudio halló diferencias significativas entre continentes en cuanto a las preferencias de los estudiantes, pero sólo algunas entre niveles de estudios y por género. Este artículo aporta ideas útiles que pueden ayudar a adaptar los programas relacionados con los bosques para satisfacer las expectativas de los estudiantes y las universidades.

INTRODUCTION

Forestry disciplines and professions face various challenges (Schmidt and Lewark 2016). In several world regions, the interest of young people in pursuing forest-related programmes has been declining which poses a significant threat to the future of the workforce (Innes and Ward 2007, Kanowski 2008). Declining enrolments have been reported in Africa (Temu *et al*. 2005, Temu and Kiyiapi 2008, Alao 2010), Australia (Vanclay 2007, Searle and Bryant 2009), Canada (Innes 2005), Europe (Van-Lierop 2003), the United Kingdom (Leslie *et al*. 2006) and the United States of America (Sharik *et al*. 2015) while an increase in enrolments has been reported in Southeast Asian countries (Temu *et al*. 2005, Ratnasingam *et al*. 2013). Continuing increases are anticipated in China due to the creation of new green jobs in the forest sector (FAO 2020a). Such trends should be assessed with caution, as some forest-related programmes were combined, or replaced, by broader environmental and natural resource-based programmes that have been very attractive to students, thus mirroring the trend towards a broader perspective on forests and forestry.

Motivation to pursue a study programme or career can be intrinsic, where the drive comes from for an individual who derives pleasure from performing a task they find satisfying, or extrinsic, because of wanting to attain an external goal or meet imposed targets or expected reward associated with certain occupations (Deci and Ryan 1985, Hennessey *et al*. 2015). Understanding what attracts students to forestry programmes is important because it can boost recruitment in these programmes, indicate the level of commitment by students to completing their studies, and reduce dropout rates (Ajekigbe 2019, Bal *et al*. 2020). It can also determine skills acquisition (Ibitoye 2011), the kind of employee they will become, and support decision making (Erol 2022). In their study on students enrolled in undergraduate forestry study programmes in Romania, Cocoradă *et al*. (2021) reported that perceived barriers to the completion of studies are based on student emotions, attitudes, and external factors. Poor programme choice not based on talent or preferences resulted in university students in forest-related programmes in Turkey being dissatisfied with their career opportunities and being unable to secure desired jobs (Yavuzaslan *et al*. 2016).

There is broad agreement on what motivates young people to pursue forest-related programmes. The Asia Pacific Forestry Education Coordination Mechanism (2018) stated that students are attracted to forestry programmes because of the desire to work outdoors, interest in managing the natural environment, and potential to interact and work with forest-based communities. Bal *et al*. (2020) reported that job satisfaction, concern for environmental factors and enjoying being outdoors were important factors for undergraduate to post-doctoral level students from six continents when deciding to major in forestry or a related natural resource degree programme. The International Forestry Students Association (IFSA) reported that 75% of the survey respondents chose forest-related programmes to engage in solving environmental problems (Dupire 2010). Searle and Bryant (2009) found that 25% of students specifically studying for Forestry degrees chose such programmes because they would have better job prospects than those studying for a degree in Resource and Environmental Management.

Career aspirations is another important factor related to the choice and success of a study programme. Studies on career aspirations of students have been conducted in fields such as nursing (Miller and Cummings 2009), business (Mayrhofer *et al*. 2005), psychology (Cassin *et al*. 2007) and geography (Unwin 1991). However, only a few attempts have been made to investigate those aspirations among students in forest-related programmes, especially at a global scale and from the bachelor's through the PhD level. In a study on undergraduate forestry students from Brazil, China, and Finland, Arevalo *et al*. (2012) reported that students were interested in working in public natural resource management, forest industry and consultancy, and research or environmental advocacy.

Differences between career aspirations of male and female students have been reported (Liff and Ward 2001). Studies in fields such as engineering have shown that female students

aspire to have careers that offer opportunities to improve the quality of life or serve the public (Seron *et al*. 2016) and to collaborate and help others in meaningful ways (Dare and Roehrig 2016) more than male students. FAO's Forest Resources Assessment shows that 42% of the graduated students in forestry in 2015 are females (FAO 2020b). With the positive advancement towards gender parity in forest-related education and employment since 2008, it is important to investigate whether the perceptions of female students differ from those of male students because the information is largely lacking to date for forest-related programmes.

The job market for graduates has become diverse and complex over the years, creating the need for comprehensive education that equips students with sufficient skills and experiences to enable them to serve society adequately and to measure up to future challenges (Sanchez and Poschen 2009, Arevalo *et al*. 2010, Bernasconi and Schroff 2011, Ratnasingam *et al*. 2013, Sample *et al*. 2015, Rekola *et al*. 2017, Gabay and Rekola 2019, UNECE *et al*. 2020). Demand for forest ecosystem services is expanding, particularly regulating services (carbon sequestration) and cultural services (recreation, tourism, education, health), while traditionally economically important ecosystem services such as biomass for bioenergy and modern wood-based mass construction remain important (Lawrence *et al*. 2017, UNECE and FAO 2018, FAO and UNEP 2020, Katila *et al*. 2020, Owuor *et al*. 2021). The traditional job portfolio in forestry connected to biomass production and the processing industry has diversified, and new green jobs in different fields of forestry are critical for achieving a "sustainability transformation" connected to forests (Evans-Klock *et al*. 2009, Hetemäki *et al*. 2017, Winkel 2017).

The global assessment of forest education (Rekola and Sharik 2022) and the regional assessments by FAO/ITTO/IUFRO (Hamid and Ibrahim 2021, Kung'u *et al*. 2021, Rekola *et al*. 2021, Rodríguez-Piñeros 2021, Shanahan *et al*. 2021, UBC Faculty of Forestry *et al*. 2021) recommend increasing the level of interdisciplinarity in forest-related programmes through the inclusion of emerging topics (such as forest landscape restoration, agroforestry, entrepreneurship) to enhance the robustness of the curriculum. The same study found an increased preference for outdoor learning and fieldwork among students, but further investigation is needed to determine if these results coincide with student expectations.

To supplement the limited research on the topic, this study's goal was to investigate the factors that motivate students to pursue forest-related programmes and their career aspirations. We provide a global perspective by comparing the views of students from five continents and from the bachelor's through to PhD level. We also explore whether perceptions differ between genders.

In doing so, we asked the following questions:

i. What drives students to pursue forest-related programmes?
ii. Which forest-related fields of employment do these students target after graduation?
iii. Which forest-related employers do they want to work for after graduation?

RESEARCH DESIGN

Materials and methods

This study was part of the "Global student networking and green jobs in the forest sector project" (2018-2022) by the European Forest Institute (EFI), the International Forestry Students Association (IFSA) and the International Union of Forest Research Organizations (IUFRO). The overall goal of the project was to investigate the employment trends in the forest sector.

The study commenced with an exploratory literature review encompassing both scientific papers and grey literature on forest-related employment and education to determine the state of knowledge and identify existing knowledge gaps. These were captured in the design of the questionnaire for a global survey. The questionnaire used in this study was drafted in English and shared with colleagues from the three project partner organizations for comments and pre-tested. The revised questionnaire was then translated by the partner organizations into Brazilian Portuguese, simplified Chinese, French and Spanish. It was divided into three parts: (i) demographic information of the survey respondents (ii) motivations and factors explaining students decision to choose forest-related programmes and careers and (iii) career aspirations which included questions about the fields in which to work, preferred employers, and forest-related employment and green jobs. See Appendix A for the full survey.

Data collection

The survey was conducted through the online survey and feedback platform Alchemer, (formerly SurveyGizmo). Data collection was conducted between June and December 2020. The survey was targeted at students and recent graduates in forest-related programmes (up to one year after graduation). The programmes targeted were those offering forestry as part of their curriculum such as forest sciences, forest engineering and forest management, natural resources management, environmental sciences, agroforestry, conservation, ecology, fisheries and wildlife, landscape management, geography (physical and human), natural resource policy/governance, recreation and eco-tourism, and wood science /products. The definitions of forest-related sector and programmes are provided below[1] from universities, technical universities,

[1] *The term 'forest-related sector' as applied in this study refers to forestry, including logging, the broader forest sector (including wood, paper, and furniture manufacturing), and emerging jobs based on the green jobs concept developed by* (UNECE and FAO, 2018) *and applied in* Owuor *et al*. (2021). *'Forest-related programme' is a modification of the definition by* Rekola *et al*. (2016) *and includes Geography, Environmental Science and Management, etc., in addition to the more traditional programmes such as forest sciences, forest engineering, and forest management (Table 1).*

universities of applied sciences, and colleges and their equivalent around the globe. However, this paper focuses only on the results from students from bachelor's, master's, and PhD levels unless otherwise specified. The survey link was distributed via newsletters, blogs, and social media channels through the strong global networks of the three globally active international organisations/networks who collaborated in this study. In addition, personal emails were sent to universities and other higher education institutions using the authors' networks.

Data analysis

The analysis was carried out using IBM SPSS v.27 software. Variables with Likert Scale response categories in a logical order (i.e. 1-not important to 5-important; 1-not helpful to 5-helpful; 1-not at all to 5-very much; 1-disagree to 5-agree) were treated as continuous, thus allowing the application of parametric statistical tests. Likert-type responses were statistically examined for differences across continents (Africa, Asia, Europe, Latin America, and North America), study levels (bachelor's, master's and PhD) and gender (female and male) using One-Way ANOVA ($p < 0.05$). ANOVA results below a significant value of 0.05 were deemed statistically significant and therefore subjected to a Tukey Post Hoc Multiple Comparisons test to determine which means differ from each other within the groups. Significant values were interpreted as an indication that a relationship between variables is not random (Maier and Winkel 2017, Rouleau *et al*. 2017). Only statistically significant results are presented in the results section, hence this section focuses on continents. Results on study level and gender are presented as supplementary information because only a few significant differences were present. Results are presented in the following sequence: continents, study levels and gender. The highest mean for each category is presented in bold while the total mean is at the second last column on Table 2 to distinguish it from the former.

RESULTS

Overview of the survey respondents

The number of students who responded to the survey was 787, representing 82 nationalities. The majority of the respondents were female (52.9%). The proportion of students who were pursuing forest-related programmes as their first choice was 67.8% while 32.2% of the respondents stated that forest-related programmes were not their first choice. Table 1 provides more information about the survey respondents.

Factors influencing student motivation to pursue forest-related programmes

The importance of factors that influenced the students' first decision to pursue a forest-related programme (Table 2), as identified from literature, was reported on a Likert Scale of 1 (not important) to 5 (important). Beneficial work (M=4.73) and job satisfaction (M=4.71) were ranked highly by students from North America. Working outdoors was ranked first by students from Latin America (M=4.33). Students from Europe ranked job satisfaction the highest out of the six factors (M=4.64). Employment opportunities played a more significant role for students from Africa (M=4.30) compared to working outdoors (M=4.10), similar to those from Asia who considered employment opportunities (M=4.14) more important than working outdoors (M=4.10) when choosing a forestry related programme. Earning potential was the lowest ranked factor by students from all five continents.

The importance of the factors decreased across the study levels. Bachelor's students showed the highest scores for five factors with the means ranging from (M=3.51) to (M=4.65), except academic ambition, which PhD students ranked higher (M=3.97). Master's students rated all six factors intermediate between bachelor's and PhD students, with the means ranging from (M=3.32 to M=4.60). Job satisfaction differed significantly between bachelor's and master's students (p=0.036), bachelor's and PhD students (p=0.000) and master's and PhD students (p=0.028). Working outdoors differed significantly between bachelor's and master's students (p=0.001) and bachelor's and PhD students (p=0.000). Beneficial work was significantly more important for female (M=4.67) than for male students (M=4.54) but was the highest ranked factor by both genders. Employment opportunities and earning potential were significantly more important to male (M=3.79 and M=3.75) than to female students (M=3.50 and M=3.41).

Plans after graduation from the current study programme

Finding employment ranked first among four options regarding plans after graduating from their current study on all the continents except Africa (Table 3). Most of the students from North America (73%) intended to find a job after their studies. For students from Africa, continuing with education was the first option (45.7%) while last for students from North America (3.2%). Out of the five continents, a higher number of students from Europe (17.1%) did not yet have a clear idea about their post-graduation plans.

At all three study levels finding employment was ranked first, with the proportion increasing with increasing level of study. Under a third of bachelor's students (29.6%) and master's students (29.8%) would like to continue with their education. A higher percentage of male students (30.1%) would like to continue with education than female students (25.2%).

Fields and types of employers to work for

Table 4 shows the fields in which the students would like to work. Overall, forest-related nature and biodiversity conservation was the highest ranked field (M=4.40). Forest-related research, the second most preferred field, was ranked first by students from Africa (M=4.53) and last by students from North America (M=3.65) followed by Europe (M=3.81). Forest management was popular among the students from Africa (M=4.48) but the least popular for students from Europe (M=3.84). The non-forest related field was the least preferred by students from all continents: Africa (M=3.28), Asia

TABLE 1 *Demographic characteristics of the survey respondents*

Respondents		**Students**
Total number of students		787
Continents (%)	Africa	10.2
	Asia	21
	Europe	32.6
	Latin America	28.2
	North America	8
Nationalities		82
Gender (%)	Female	52.9
	Male	45.1
	Other	2
Education level (%)	Bachelor	62.9
	Master	27.7
	PhD	9.4
Average age (years)	26	
Forestry programme as first choice	**Frequency**	**%**
Yes	534	67.8
No	253	32.2
Study background	**Frequency**	**%**
Forest Sciences	274	35.2
Forest Engineering & Forest Management	251	32.2
Natural Resources Management	70	9.0
Environmental Sciences	33	4.2
Wood Science/products	22	2.8
Ecology	21	2.7
Conservation	21	2.7
Natural Resource Policy/Governance	16	2.1
Agriculture	11	1.4
Landscape Management	6	0.8
Other*	62	6.9

**"Other" includes Agroforestry; Fisheries and Wildlife; Geography (physical & human) and Recreation & Eco-tourism. These programmes offer forest-related courses as part of their curriculum.*

(M=3.00), Europe (M=2.49), Latin America (M=2.82) and North America (M=2.57). Forest industries, wood processing and energy production was ranked higher (M=4.0) by students from Africa than the other four continents. Of the five continents, students from North America gave the lowest ranking to most of the fields followed by Europe, while Africa had the highest rankings for eight of the eleven fields. Significant differences were found for all the fields between the five continents (Table 4).

Comparison across study levels (Appendix Table C-1) showed that forest-related research and forest-related education were the most popular fields for PhD students (M=4.61 and M=4.17 respectively). Forest-related research was significantly different (p=0.000) and was ranked highest by PhD students (M=4.61), followed by master's (M=4.13), then bachelor's students (M=4.03). Significant differences were observed between female and male students regarding three fields: forest management (p=0.000); forest industries, wood processing and energy production (p=0.000); and forest monitoring and inventory (p=0.000) (Appendix Table C-1). Male students gave a slightly higher score to the three fields (M=4.22, M=3.44 and M=3.98 respectively) than female students (M=3.92, M=3.08 and M=3.64).

When asked about their most preferred employers, significant differences were observed among the five continents for all types of employers except for public forest services. International organizations were ranked first by students from all the continents, except North America, out of the eight categories of employers to choose from (Table 5). Students from North America ranked non-governmental organizations

TABLE 2 *How important were the following factors for your first decision to study a forest-related programme?*

S/N	Factors	Continents						Study level				Gender			Total N=787	
		Africa (a)	Asia (b)	Europe (c)	Latin America (d)	North America (e)	Significance	Bachelor (x)	Master (y)	PhD (z)	Significance	Female	Male	Significance	Mean	Std. dev
		Mean	Mean	Mean	Mean	Mean	P value	Mean	Mean	Mean	P value	Mean	Mean	P value		
1.	Beneficial work (make a positive difference for the environment/ communities	4.61	4.67	4.55*	4.63	**4.73**	0.322	**4.65***^{z}	4.60	4.42^{x}	0.036	**4.67**	4.54	0.040	4.62	0.745
2.	Job satisfaction (e.g enjoyable work, high quality of life)	4.30^{c,e}	4.43^{c}	4.64^{a,b}	4.48	**4.71**^{a}	0.000	**4.60**^{y,z}	4.45^{x,z}	4.20^{x,y}	0.000	**4.52**	**4.52**	0.698	4.52	0.750
3.	Working outdoors	4.10	4.10	4.17*	**4.33**	4.30	0.109	**4.33***^{y,z}	4.05^{x}	3.86^{x}	0.000	**4.21**	4.20	0.473	4.21	0.971
4.	Academic ambition	**4.43**^{c,d,e}	4.32^{c,d,e}	3.15^{a,b,d}	3.97^{a,b,c,e}	3.40^{a,b,c,d}	0.000	3.75	3.75	**3.97**	0.312	**3.80**	3.79	0.101	3.78	1.193
5.	Employment opportunities (e.g. positive career outlook, high job security)	**4.30**^{c,d}	4.14^{c,d}	3.34^{d,e}	3.64^{a,b,c}	3.94^{c}	0.000	**3.78**	3.71	3.53	0.156	3.75	**3.79**	0.001	3.74	1.122
6.	Earning potential (e.g. good pay, government benefits)	**4.06**	3.91	2.82	3.51	3.51	0.000	**3.51***	3.32	3.20	0.035	3.41	**3.50**	0.004	3.42	1.188

a,b,c,d,e show which continents differ significantly from each other (a=Africa; b=Asia; c=Europe; d=Latin America and e=North America).
*x,y,z, show which study levels differ significantly from each other (x=bachelor's; y=master's and z=PhD). * Frequency less by 1. Bold: highest ranking factor based on mean. (Mean 1=Not important and 5= Important)*
* Frequency less by 1.

TABLE 3 *What would you preferably do after your graduation from current course (%)? (n=787)*

	Continent					Study level			Gender	
	Africa (%)	**Asia (%)**	**Europe (%)**	**Latin America (%)**	**North America (%)**	**Bachelor (%)**	**Master (%)**	**PhD (%)**	**Female (%)**	**Male (%)**
Continue Education (incl. PhD/doctorate)	47.5	37.6	25.7	23.4	3.2	29.6	29.8	11.8	25.2	30.1
Find employment	40	46.1	48.2	58.6	73.0	51	53	53.9	54.2	50.5
I don't know yet	1.25	10.3	17.1	8.1	15.9	12.5	9.3	10.5	12.7	9.7
Other	11.25	6.1	8.9	9.9	7.9	6.9	7.9	23.7	7.9	9.7
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

TABLE 4 *How much would you like to work in each of the following thematic areas? (Continent comparison)*

S/N	**Employers**	**Continent**						**Std. deviation**	**Significance (p value)**
		Africa (n = 80) (a)	**Asia (n = 165) (b)**	**Europe (n = 257) (c)**	**Latin America (n = 222) (d)**	**North America (n = 63) (e)**	**Total (n = 787)**		
1.	Forest-related Nature and Biodiversity Conservation	4.50	**4.61**^{c}	4.23^{b}	4.42	4.34*	**4.40**	**0.843**	**0.000**
2.	Forest-related Research	**4.53**^{c,e}	4.42 ^{c,e}	3.81^{a,b,d}	4.21*^{c,e}	3.65^{a,b,d}	**4.11**	**1.064**	**0.000**
3.	Forest-related Regional and Land Use Development (Agroforestry and Mountain Forestry etc.)	**4.43**^{c,e}	4.24^{c,e}	3.89^{a,b}	4.13	3.81 ^{a,b}	**4.08**	**0.963**	**0.000**
4.	Forest Management	**4.48***^{c,d}	4.14^{c}	3.84^{a,b,d}	4.09^{a,c}	4.10	**4.06**	**0.965**	**0.000**
5.	Forest-related Social and Urban Development/ Urban Forestry	4.24^{c,e}	**4.38***^{c,d,e}	3.46^{a,b,d}	3.94^{a,c,e}	3.33^{a,b,d}	**3.86**	**1.093**	**0.000**
6.	Forest-related Education	**4.38**^{c,d}	4.25^{c}	3.60^{a,b,d}	3.83^{a,c}	3.37	**3.86**	**1.097**	**0.000**
7.	Forest Monitoring and Inventory	**4.16**^{c,e}	3.97^{c,e}	3.56^{a,b,d}	3.84^{c}	3.51^{a,b}	**3.78**	**1.086**	**0.000**
8.	Forest-based Recreation, Eco-tourism	4.11^{c,d,e}	**4.18**^{c,d,e}	3.32^{a,b,d}	3.68^{a,b,c}	3.29^{a,b}	**3.68**	**1.137**	**0.000**
9.	Forest-related human health	**4.20**^{c,d,e}	4.09^{c,d,e}	3.32^{a,b}	3.58^{a,b,e}	3.10^{a,b,d}	**3.63**	**1.58**	**0.000**
10.	Forest industries, Wood Processing and Energy Production	**4.00**^{c,d,e}	3.59^{c}	2.76^{a,b,d}	3.38^{a,c,e}	2.57 ^{a,b,d}	**3.22**	**0.047**	**0.000**
11.	Non-forest related field	**3.28**^{c,d,e}	3.00^{c}	2.49^{a,b,d}	2.82^{a,c}	2.57^{a}	**2.78**	**1.138**	**0.000**

a,b,c,d,e show which continents differ significantly from each other (a=Africa; b=Asia; c=Europe; d=Latin America and e=North America). Bold: highest ranking factor per continent and total based on the mean. (Mean 1 = not at all and 5 = very much)
* Frequency less by 1.

(NGOs) first (M=3.94). Across the continents, research organizations (e.g., universities or research centres) were second, with students from Africa giving it high preference (M=4.47), followed by Asia (M=4.43). Self-employment/entrepreneurship was the least preferred type of employment across all continents (M=3.40), followed by private forest companies (M=3.45) and private forest services (M=3.73).

Regarding study level (Appendix Table C-2), PhD students ranked research organizations (e.g., universities or research centres) the highest (M=4.68), while master's students did the same for NGOs (M=4.11). Significant differences were found for international organizations (p=0.001) across the three study levels with the highest ranking by PhD students (M=4.59) followed by master's students (M=4.55) and bachelor's students (M=4.34). The means for research organizations were also statistically significant p=0.000, they were ranked the highest by PhD students (M=4.68) compared to bachelor's (M=3.96) and master's students (M=4.14).

Significant differences were observed between male and female students regarding NGOs (p=0.031), with female students showing a slightly higher preference (M=4.10) compared to male students (M=3.94).

Students were then asked to indicate their level of agreement on a scale of 1 (disagree) and 5 (agree) for a list of statements

TABLE 5 *How much would you like to work for each of the following types of employers? (Continent comparisons)*

S/N	Employers	Continent						Std. deviation	Significance (p value)
		Africa (n = 80) (a)	Asia (n = 165) (b)	Europe (n = 257) (c)	Latin America (n = 222) (d)	North America (n = 63) (e)	Total (n = 787)		
1.	International organizations	**4.76**^{c,e}	4.70^{c,e}	4.20^{a,b,d,e}	4.53^{c,e}	*3.81^{a,b,c,d}	**4.42***	**0.819**	**0.000**
2.	Research organizations (e.g. Universities or Research Centers)	**4.47**^{c,e}	4.43^{e}	3.80^{a,b,c,d}	4.18^{c,e}	3.49^{a,b,d}	**4.08**	**1.048**	**0.000**
3.	Non-governmental organizations (NGO)	**4.60**^{b,c,d}	4.19^{a,c}	3.84^{a,b}	3.98^{a}	3.94^{a}	**4.04**	**0.912**	**0.000**
4.	Public forest service	4.11	**4.12**	3.88	4.08	3.89	**4.01**	**0.944**	**0.330**
5.	Government/Ministry	**4.29**^{c,d,e,}	4.23^{c,d,e}	3.70^{a,b}	3.94^{b}	3.81^{a,b}	**3.95**	**1.003**	**0.000**
6.	Private forest service	**4.15**^{b,c,e}	3.65^{a,d}	3.53^{a,d}	3.95^{b,c,e}	3.49^{a,d}	**3.73**	**1.000**	**0.000**
7.	Private companies (other than forest service)	**3.84**^{c,d}	3.52	3.39^{a}	3.29^{a}	3.56	**3.45**	**1.075**	**0.002**
8.	Self-employed, Entrepreneur	**4.08**^{b,c,e}	3.30^{a,d}	3.10^{a,d}	3.79^{b,c,e}	2.68^{a,b,d}	**3.40**	**1.236**	**0.000**

a,b,c,d,e show which continents differ significantly from each other (a=Africa; b=Asia; c=Europe; d=Latin America and e=North America). Bold: highest ranking factor per continent and total based on mean. Mean (1=not at all and 5 =very much)
* less frequency by 1.

concerning their preparedness and motivations for a future job, and their preferred working environment (Table 6). A job's impact on the environment was the highest ranked statement by students from all the continents (M=4.53). Students from Africa highly ranked a statement expressing that their studies prepared them well for their future careers (M=4.20), followed by Asia (M=4.01), while students from Europe ranked the same statement the lowest (M=3.75); hence the significant differences (p=0.002) between the three continents. Students from Latin America were the least confident about finding a job after graduation (M=3.43) compared to those from Africa who were most optimistic (M=4.04) making the results from these two continents significantly different (p=0.001).

When asked about their preferred working environment, students from North America ranked working outdoors the highest (M=4.51) compared to students from other continents, while students from Africa ranked working abroad first (M=4.43) out of the five continents followed by those from Latin America (M=4.18) (Table 6). Bachelor's students gave the lowest score to working in an office (M=2.83), compared to master's students (M=3.21) and PhD students (M=3.53). There were significant differences among study levels for several work-related environments (working outdoors (p=0.000), working in the country of studies and country of nationality (p=0.034) and working in an office environment (p=0.000) (Appendix Table C-3). There were no significant differences in the responses from male and female students to these questions. Significant differences were, however, observed for the importance of a job's impact on the environment (p=0.000) between the two genders: female students ranked this significantly higher (M=4.62) compared to male students (M=4.41) (Appendix Table C-3).

DISCUSSION

Motivation for pursuing forest-related programmes

Intrinsic factors such as beneficial work, job satisfaction and working outdoors were reported among the top factors that attracted students to forest-related programmes, confirming earlier studies where similar factors were reported to be important for forest and natural resources-related study programmes (Sharik and Frisk 2011, Rouleau *et al*. 2017, Bal *et al*. 2020). Interestingly, other studies have found that low earning potential and lacking employment opportunities deterred prospective students from pursuing forest education and careers in Canada (Luckert 2004), Turkey (Gümüş 2016) and the U.S. (Sharik and Frisk 2011, Sharik *et al*. 2015, Rouleau *et al*. 2017). As our sample covers only students that have decided to take up a forest-related education, these findings may be complimentary to our findings which show that extrinsic factors play a minor role when students made the decisions to pursue a forest-related programme meaning that students who enrol in forest education may be largely intrinsically motivated. Another possible reason could be that student values and motivations have changed since these earlier studies were conducted as shown by studies from the United States of America (Pryor *et al*. 2007, Millenbah and Wolter 2009, Sharik *et al*. 2015). Studies comparing economics and social sciences programmes, for instance, have shown that students enrolled in those programmes have shown stronger extrinsic and weaker intrinsic aspirations compared to students enrolled in social sciences (Janke and Dickhäuser 2019). On the other hand, the desire to do 'meaningful work' attracted students to pursuing graduate-entry medicine degree programmes (Kumar *et al*. 2020)

TABLE 6 How much do you agree with each of the following individual statements?

	Continent						Std. dev	Significance (P value)
	Africa	Asia	Europe	Latin America	North America	Total mean (n=787)		
Career preparation								
When deciding on a job, its impact on the environment is important to me	**4.68**[c]	4.48	4.40[a,d]	4.66[c]	4.52	**4.53**	**0.706**	**0.000**
My studies prepare me well for my future career	**4.20**[c]	4.01[c]	3.75	3.89	3.81	**3.89**	**0.953**	**0.002**
I feel confident about finding a forest-related job after graduation	**4.04**[d]	3.69	3.71	3.43[a]	3.59	**3.65**	**1.146**	**0.001**
I'm knowledgeable about forest-related career options	**3.98**[b,c]	3.54[a]	3.34[a,d]	3.68	3.54	**3.56**	**1.053**	**0.000**
Where would you like to work?								
I would like to work outdoors	4.50[b]	4.16[a,c]	4.34	4.41[b]	**4.51**	**4.35**	**0.860**	**0.009**
I would like to work abroad	**4.43**[b,c,e]	3.95[a,c,e]	3.54[a,b,d]	4.18[c,e]	3.33[a,b,d]	**3.88**	**1.055**	**0.000**
I would like to work in my country of studies	3.43[e]	3.72	3.52[e]	3.63	**3.98**[a,c]	**3.62**	**1.067**	**0.007**
I would like to work in my country of nationality	3.44	3.72	3.49	3.60	**3.84**	**3.59**	**1.113**	**0.054**
I would like to work in an office environment	**3.89**[b,c,d,e]	3.43[a,c,d,e]	2.77[a,b,e]	2.83[a,b,e]	2.25[a,b,c,d,e]	**3.00**	**1.213**	**0.000**
I would like to work from home	**2.85**	2.70	2.51	2.55	2.32	**2.58**	**1.176**	**0.036**

a,b,c,d,e show which continents differ significantly from each other (a=Africa; b=Asia; c=Europe; d=Latin America and e=North America). Bold: highest ranking factor per continent and total based on mean. Mean (1=disagree and 5 =agree)

Preferred fields of employment and employers

The increasing significance of forests for the provision of ecosystem services other than wood production was strongly reflected in the students' responses to fields in which they would like to work. Forest-related nature and biodiversity conservation was the most attractive field to work in for students at all levels in Asia, Latin America, North America, and Europe, and was a close runner-up in Africa. Forest management was also highly ranked in our study (M=4.06). Since we had not provided a narrower definition of forest management, students may have interpreted this in different ways, including the possibility that several students assumed that this included management of forests for other benefits aside from wood. This finding corresponds with Arevalo *et al*. (2012) who reported that management of public natural resources was preferred by undergraduate forestry students from Brazil, China, and Finland, compared to fields like environmental advocacy or education, because of the increased role the field plays in mitigating climate change. Similarly, nearly 75% of undergraduate forestry students from Australian National University reported that their career choice was a result of the desire to engage in environmental or forest management (Searle and Bryant 2009).

Previous studies carried out on students, recent graduates, teachers and other professionals have recommended the diversification of forest-related education and integrating emerging topics such as climate change and biodiversity as a way of offering holistic education to students that prepares them to work in a changing socio-economic environment for forestry (Hamid and Ibrahim 2021, Kung'u *et al*. 2021, Rekola *et al*. 2021, Rodríguez-Piñeros 2021, Shanahan *et al*. 2021, UBC Faculty of Forestry *et al*. 2021, Rekola and Sharik 2022). Our findings on students' preferences strongly support these recommendations.

Forestry has somewhat of a negative image among the public because it is believed to be unsustainable in some countries (Sharik *et al*. 2020). Since in our study students reported that a job's impact on the environment was a factor, they consider important when making a degree choice, it is not surprising that forest industries, wood processing and energy production was the least attractive field of work for them (M=3.22). However, students from Africa ranked this field higher compared to the other continents. This finding may indicate a different value orientation amongst African students who are relatively more interested in sustainable production when compared to their peers from Europe for instance. This may be related to many African countries being still in an earlier stage of the forest transition (characterized

by forest loss due to conversions into agriculture, (see FAO and UNEP 2020), and a rather resource-use-oriented attitude in an environment characterized by prevailing poverty and rapidly growing population compared to Europe or the United States of America (Roux *et al*. 2022). Forest-based recreation, eco-tourism and forest-related human health were among the lowest ranked fields by students from all continents. It remains unclear as to whether this indicates little affinity of students in forest-related programmes with these fields of employment, or that these are rather new fields for students associated with fewer employment opportunities.

As was to be expected, finding employment after graduation was a priority for students from all the continents except Africa, where it was ranked second, but only because respondents wanted to further their education. Somewhat surprisingly, students gave the top priority for work in international organisations, except those from North America who mostly preferred to work for NGOs (Table 4). Possibly, the ongoing international discussions about different forest-related issues and the familiarity of IFSA affiliates with such careers could have played a role for such preferences. The lower preference by North American students to work for international organizations may be reflected in a more limited global perspective, which in turn may be reflected in less interest in working abroad (Table 6) and less involvement in IFSA compared to students from other regions. Alternatively, North American students may have more employment opportunities at home.

Students in Africa selected forest-related research as the top field in which they would like to work, and research organizations as their second-best employer, despite the challenges faced by these institutions in Africa such as unavailability of funding, slow growth and lack of facilities (Dyer and Wingfield 2005, Erakhrumen 2007, Temu and Kiyiapi 2008). In contrast, students in Europe and North America, where there is a rather high availability of funding for research, were the least interested in working in this field.

Self-employment or entrepreneurship was the least attractive form of employment for students from all the five continents, at all study levels and both genders (Table 4). While our data does not allow any conclusions on why this is the case, one possible reason could be a general lack of entrepreneurship as a topic in forest-related curricula (Hamid and Ibrahim 2021, Kung'u *et al*. 2021, Rekola *et al*. 2021, Rodríguez-Piñeros 2021, Shanahan *et al*. 2021, UBC Faculty of Forestry *et al*. 2021, Rekola and Sharik 2022), often still oriented towards educating staff for public forest service.

Finally, and less surprising, our results show that students had very little interest in working outside the forest-related sector, even though studies for Africa and Asia thave indicated that students turn to work in other sectors after graduating from forest-related programmes due to limited employment opportunities in the forest-related sector (Temu and Kiwia 2008). It is remarkable that students in Africa were most interested in working abroad, followed by students from Latin America. This may be related to meagre opportunities in their respective home countries. In a study by Arevalo *et al*. (2012), a high interest in working in the forest sector abroad was also reported among Brazilian and Chinese students.

Continent and study level comparisons

For several questions we found significant differences between students from different world regions. A trend was that students from Africa and Asia ranked most of the choices high while those from Europe and North America ranked them relatively low although these students may have a different perception of the rating system that is culturally informed.

Furthermore, this study found few significant differences between bachelor's; master's and PhD students confirming an earlier study by Bal *et al*. (2020) conducted among bachelor's, master's, PhD and post-doctoral students in forestry and related natural resource degree programmes. This was an interesting finding because we expected bachelor's, master's, and PhD students to have different perceptions about factors they consider important when making career decisions, fields in which to work, and employers for which to work. This may indicate that preferences of students in forest related programmes remain relatively stable throughout their education path and are hence only to a limited degree affected by their level of education.

Gender differences

According to the FRA 2020 of the FAO (2020) there has been a general increase in the number of female forestry graduates. All continents (except Africa) had slightly more female than male survey respondents, a finding that was also true for the three study levels. Looking at differences relating to gender, male students ranked most of the statistically significant responses higher compared to female students. Furthermore, there were some differences regarding the parameters assessed. Beneficial work was ranked higher by female students as was a job's impact on the environment when making career decisions. Other surveys involving students in forest-related programmes also found higher preference for nature and environment by female students, for instance in the U.S. (Bal *et al*. 2020, Mueller and Mullenbach 2018), Turkey (Erol 2022), and Brazil and Finland (Arevalo *et al*. 2012). However, these preferences by female students were not mirrored in the forest-related fields in which the students wanted to work. There were no significant differences between the two genders for fields that are closely aligned to nature such as forest-related nature and biodiversity conservation, forest-based recreation and ecotourism, forest-related education, and human health. This indicates that while there are differences related to gender amongst the student motivations to study and pursue forest-related careers, these are rather subtle and may not impact career choices. This may indicate that gender equality and greater diversity in both forest-related education and employment to increase the competitiveness of the sector in general is still needed, and to navigate the transition from an ageing workforce to a new generation of professionals but may not be inhibited by diverging preferences related to gender (FAO 2006, Crandall *et al*. 2020, Larasatie *et al*. 2020).

STUDY LIMITATIONS

Global studies are promising due to their broad perspective including the possibility to explore regional differences, yet, in our case, they are also connected to some specific limitations.

First, in our study, some continents were represented only by students from very few countries: for instance, only students from 26% of the 54 countries in Africa and 31.3% of the 48 countries in Asia responded to the survey. This means that the interpretation of the results at the continental scale should be done cautiously. Second, there are no global statistics on the number of students in forest-related degree programmes available. Hence, it is difficult to determine the extent to which our respondents are representative of the larger collective of forest students. Third, and related to this, the dissemination of the survey through the IFSA network could have resulted in a bias. IFSA offers exposure to various international forest-related aspects as part of its mission to enrich its members' education through international events, networking, and intercultural exchange. Therefore, the perceptions of those students that are reached through the IFSA channels may differ from those who are not reached.

Fourth, the respondents were not asked for the rationale behind their responses owing to the standardized nature of the global survey; therefore, interpretations of our results need to be done with caution. Follow up focus group discussions would have helped in providing more information behind the responses received. In turn, the limited number of global studies touching on the topics on which we focussed constrained possibilities for comparisons, thereby exacerbating the interpretation problem. Whenever suitable, we supplemented the interpretation of our findings with single-country focussed studies to enrich interpretations.

CONCLUSION

The question of how to attract students into forest-related study programmes and by extension professionals into the traditional forestry careers has been a serious and growing concern for some time, which is also the case for the forest-related sector as a whole. For universities to attract students and to keep up with changing nature of employment, it is imperative to understand student views regarding their motivations to pursue forest-related programmes, and their aspirations for future careers and employment.

Our study shows that most of the students currently pursuing forest-related programmes were inspired by the desire to make a meaningful contribution to the environment and society. Students also consider it a profession that offers job satisfaction. Forest-related education programmes should be tailored in a way that gives students a chance to do beneficial work and to work outdoors to attract more students.

The interest to work in forest and wood processing industries was low, which needs further investigation. Diversifying the fields of employment where students can work could be attained if the curriculum covers topics on urban forestry, forest-based recreation, forest-related human health, and entrepreneurship. Future research could further examine the topics that are interesting for students and whether the diversification causes a change in their attitudes over time.

Students have relatively low confidence regarding finding a forest-related job after graduation and have some doubts regarding forest-related career options. Universities and future employers should strive to expose students to diverse sources of information about the possible career options in the forest-related sector as early as possible during their studies to enable them to make informed choices since most of them would like to work in the sector. They should also be given support to prepare them for future jobs.

Only a few significant differences were observed between the motivation to pursue forest-related programmes and career aspirations of female and male students. Communication should target how to promote altruistic motivation which is becoming stronger among both genders. Future studies could shed light on the question of recruitment and retention among the two genders as well as the major gap between them in the professional workforce.

Our study provides some insights on forest education globally. However, several research gaps remain. It is important to investigate in greater detail how well the current programmes prepare students and match with their career aspirations as well as those of potential employers and whether curriculum revisions are needed. Further surveys of a similar nature should be able to confirm differences among continents. It is imperative to investigate how education programmes and future employers recruit more students. Capturing the perceptions of other stakeholders such as employers about forest education, as done by Rekola and Sharik (2022), should continue in order to shed light on the graduates' preparedness for the job market.

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