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Enrollment Decision-Making by Students in Forestry and Related Natural Resource Degree Programmes Globally

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Enrollment decision-making by students in forestry and related natural resource degree programmes globally

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HIGHLIGHTS

- Forestry and Related Natural Resources (FRNR) students from 51 countries report that enjoyment of nature was the most important factor driving their decision to enroll.
- Decision factors that caused hesitation included earning potential, availability of funding, and political issues.
- Importance factors differed significantly between genders, race/ethnicity, academic standing, world region, and social background (i.e. urban vs rural).
- Women and people of color from multiple world regions had a greater hesitancy to enroll in an FRNR programme than their white male counterparts.
- Implications for recruitment and retention include the need for continual diversity and inclusion efforts and a balance between personal preferences and employability.

SUMMARY

A survey of 396 undergraduate and graduate students from 51 countries on 5 continents currently enrolled in Forestry or Related Natural Resource (FRNR) degree programmes was conducted of attendees to the International Union of Forest Research Organizations' (IUFRO) conference in Salt Lake City, Utah, 2014. These perspectives come from some of the most active students in their respective fields. We explored the motivating reasons for enrolling in their current FRNR programme, and conversely why they may have been hesitant to do so. Results indicate that enjoyment of nature was the most important factor on average driving the decision to enroll, closely followed by job satisfaction, concern for the environment, enjoyment of outdoor recreation, being outdoors, and an interest in subject material. Hesitancy factors included earning potential, availability of funding/scholarships, and politically contentious issues. A number of significant differences were found across demographic categories. Of particular note was the greater hesitancy on the part of women and people of color to enroll in FRNR degree programmes compared to their white male counterparts. We discuss the limitations of our study arising from its international scope and imbalance of responses among countries and regions.

Keywords: decision making, forest education, hesitation, international survey, motivation, student enrollment

Comment les étudiants prennent-ils globalement la décision de s'inscrire en diplômes de foresterie et de programmes en ressources naturelles connexes?

T.L. BAL, M.D. ROULEAU, T.L. SHARIK et A.M. WELLSTEAD

Une étude de 396 étudiants de premier cycle et diplômés de 51 pays sur 5 continents actuellement étudiants en programmes d'études en Foresterie ou ressources naturelles connexes (FRNR) a été menée auprès de participants à la conférence de l'Union internationale des organisations de recherche forestière (IUFRO) à Salt Lake City dans L'Utah en 2014. Ces perspectives proviennent de certains des étudiants les plus actifs dans leurs domaines respectifs. Nous avons exploré les raisons les ayant motivés à s'inscrire dans leurs programmes FRNR en cours, et, complémentairement, les facteurs qui les avaient peut-être fait hésiter. Les résultats indiquent que la jouissance de la nature était le facteur moyen le plus important ayant précipité leur décision de s'inscrire, suivie de près par la satisfaction professionnelle, les préoccupations environnementales, l'amour de la récréation en plein air, le grand air et un intérêt dans le matériel académique. Les facteurs d'hésitation comprenaient le potentiel de gains, la disponibilité de bourses d'études et de soutien financier et les questions contentieuses politiquement. Un nombre de différences importantes a été identifié dans cinq catégories démographiques. On remarque en particulier que les femmes et les personnes de couleur hésitent davantage à s'inscrire aux programmes de FRNR, comparés à leurs pairs masculins et blancs. Nous analysons les limites de notre étude, provenant de son échelle internationale et du déséquilibre des réponses au travers des pays et des régions.

La toma de decisiones sobre la matriculación de los estudiantes en programas de licenciatura relacionados con la silvicultura y los recursos naturales a nivel mundial

T.L. BAL, M.D. ROULEAU, T.L. SHARIK y A.M. WELLSTEAD

Se llevó a cabo una encuesta entre 396 estudiantes de licenciatura y de posgrado de 51 países de cinco continentes, matriculados actualmente en programas de licenciatura sobre silvicultura o recursos naturales relacionados (SRNR), aprovechando su asistencia a la conferencia de la Unión Internacional de Organizaciones de Investigación Forestal (IUFRO, por sus siglas en inglés), celebrada en Salt Lake City (Utah) en 2014. Estas perspectivas provienen de algunos de los estudiantes más activos en sus respectivos campos. Se exploraron los motivos por los que se matricularon en su programa actual de SRNR y, a la inversa, por qué pudieron haber dudado en hacerlo. Los resultados indican que disfrutar de la naturaleza fue el factor más importante en promedio que motivó la decisión de matricularse, seguido de cerca por la satisfacción en el trabajo, la preocupación por el medio ambiente, el disfrute de la actividades recreativas al aire libre, el estar al aire libre y el interés en el tema. Los factores que les hicieron dudar fueron el potencial de ganar ingresos, la disponibilidad de fondos/becas y cuestiones políticas controvertidas. Se encontraron varias diferencias significativas entre las distintas categorías demográficas. En particular destacó la mayor vacilación por parte de las mujeres y las personas de color para matricularse en programas de grado de SRNR en comparación con sus homólogos masculinos blancos. Se discuten las limitaciones de este estudio derivadas de su alcance internacional y del desequilibrio de las respuestas entre países y regiones.

INTRODUCTION

Choosing a college major sometimes requires important trade-offs by striking a balance between doing what one enjoys versus making a stable living. A natural resource (NR)-related degree is one way many students choose to pursue their personal interests professionally (Arevalo *et al.* 2012, McGown 2015). However, this sort of attractiveness to NR programmes can ebb and flow over time, space, and demographics. This can be seen in the strongly fluctuating enrollment statistics of forestry and related NR (FRNR) programmes in the United States over the past number of decades (e.g. Barnes 2010, Christensen 1983, Markworth 1968, Nyland 2008, Sharik *et al.* 2015, Vasey and Theoe 1977, Xu and Bengston 1997). From 2005–2012, nearly every natural resource academic area experienced an increase in enrollment with the exception of wood science/products, which remained relatively constant (Sharik *et al.* 2015). The demographic makeup of these programmes is also changing rapidly with a 71% increase in female enrollment and a 130% increase in racial/ethnic minority enrollment in US FRNR programmes between 2005 and 2012 alone (Sharik *et al.* 2015). However, while these increases are dramatic, they still represent only a small fraction of current FRNR total enrollments. In some FRNR fields, including forestry, declining enrollments and a lack of diversity continue to be recognized as a significant challenge (Sample *et al.* 2015).

Prior research has shown that critical differences also exist in enrollment decision-making between majority and minority students considering an FRNR major in US higher education institutions (e.g. Armstrong *et al.* 2007, Rouleau *et al.* 2017). Little effort has been made to determine the degree to which these differences exist outside the US context, although organizations like the International Forest Students' Association (IFSA) have supported surveys of students in some countries (e.g. Arevalo *et al.* 2011, 2012). This paper, to our knowledge, is the broadest geographically to date, to investigate FRNR enrollment decision-making and

motivating factors to see how the US experience compares to FRNR programmes throughout the world. Many programmes are interested in recruiting a diversity of international students; moreover, FRNR is comprised of global topics and is global in scale.

Specific enrollment data and comparable quantitative studies of FRNR students to those in Sharik *et al.* (2015) are hard to find outside the US. Many enrollment data sets likely exist within country governments or are published in local languages, thus not easily accessible or available for more global analytical endeavors (Rekola *et al.* 2017). In recent decades, reports of a general decline in forestry enrollments have come from the United Kingdom (Burley 2001, Leslie *et al.* 2006), Australia (Vanclay 2005), Canada (Innes 2005), and African countries (Längin and Ackerman 2008, Temu *et al.* 2006). Some smaller nations have had their forestry and natural resources institutions close (Kanowski 2001) or have been amalgamated or transferred into larger programmes such as biology or agriculture (e.g. Chen 2002, Innes and Ward 2010, Leslie *et al.* 2006). Ferguson (2012) discusses some of the institutional frameworks proposed to have led to the declining forestry enrollments in Australia, but does not include quantitative data supporting the assessment. In an opposite trend, many Asian countries report increasing enrollments in forestry, particularly Southeast Asian countries such as Malaysia, Laos, Thailand, and Vietnam (Faridah-Hanum and Ghani 2015, Temu *et al.* 2005,). Ratnasingam *et al.* (2013) report specific numbers of students graduating in forestry and wood science from Malaysia from 1977–2012 with a generally increasing trend, but do not show quantitative data on demographics such as gender or student perceptions about trends. Generally, other natural resources-related degrees have not had as strong a decline as traditional forestry; however, the trend can vary by country or the specific name of the degree major (Innes and Ward 2010, Sharik *et al.* 2015, Thomas 2014).

Potential reasons for the low diversity representation (at least in US context) in FRNR programmes include a

complexity of factors such as job security, low salaries, historical (and in some cases, ongoing) discrimination against minorities with respect to access to land and resources, and a tendency of minorities to be more attracted to programmes that are perceived as having a more direct impact in their communities (Armstrong *et al.* 2007, Balcarczyk *et al.* 2015, Bengston 2004, Gervais *et al.* 2017, Gharis *et al.* 2017, Leatherberry and Wellman 1988, Outley 2008, Schelhas 2002, Sharik 2015, Thomas 2017). At a country- and region-scale, there are likely other reasons for demographic patterns or increasing/decreasing enrollment trends in FRNR. A general concern is the disconnect between natural resources and the public, specifically young people, which may negatively impact students' views on studying natural resources or related programmes in college (Sharik and Frisk 2011).

To better understand FRNR enrollment trends in a global context, a survey was administered to students attending an International Union of Forest Research Organizations' (IUFRO) conference in 2014. The survey contained questions highlighting key factors in order to determine the degree to which each influenced or motivated students' decisions to enroll or hesitations before enrolling in a FRNR programme. The results from this survey have been analyzed and reported here, with the intent of identifying specific factors and how they influence students' decisions based on various population demographics from a global perspective.

DATA AND METHODS

In 2014, an online survey was administered to every registered student participant attending the IUFRO World Congress held in Salt Lake City, Utah, October 5–11, 2014. All 672 student attendees received an e-mail request to participate in this study and 396 participants completed the survey for a response rate of 58.9%, which is considered an acceptable return rate (Mayer and Wellstead 2018). These conference attendees were chosen to participate in this study because the IUFRO World Congress is held every five years, attracting a large pool of international FRNR students, making it possible to conduct a multinational investigation of FRNR enrollment decision-making while maximizing limited resources and minimizing logistical constraints. Although IUFRO conference attendees do not represent all students enrolled in FRNR programmes around the world, their views can at least provide important insights into enrollment decision-making among some of the most active and dedicated students in their respective FRNR fields. Furthermore, due to limitations beyond our control, it was impossible for privacy reasons, to assess non-response bias. In large-scale surveys where the population is known, testing for this bias is critical. Given the specialized nature of the respondents, such a test would be of limited utility. However, we took measures to minimize non-response bias including a thorough pre-testing of the survey instrument, frequent reminder emails to complete the survey, keeping the survey open for a reasonable period of time (Dillman 2011), and participating in the organization and oversight of the conference. Knowing what drove these

individuals to enroll in their FRNR programme and conversely, may have made them hesitant in doing so, is a useful starting point for programme administrators seeking to boost enrollment numbers or to simply attract more highly motivated students.

The structure of the on-line survey was modeled after Sharik and Frisk (2011) and Rouleau *et al.* (2017). The first section focused on demographic information such as the location of the student's current degree programme, their academic status, gender, race, and country of residence. The second part used a series of Likert-scale questions to determine which factors were most important to the student's decision to enroll in a FRNR programme, and conversely those that may have made them hesitant to enroll.

The survey was divided into two components: demographics of respondents and factors that impacted their decision to enroll in forestry or a related programme. Student respondents were given a list of potential influencing factors and were directed to choose how important that particular factor was to them. To gain a better understanding of the involvement of students outside of their degree programmes, the survey contained a question asking whether or not students were members of one or more university student natural-resources organizations. Finally, students were also asked what other majors they considered before deciding on a degree in FRNR. This provides information as to the personal interests of typical forestry or natural resources students.

Responses were analyzed using the SPSS 20 Statistics software. Data underwent reliability analysis using Cronbach's alpha to determine the strength of association of factors within meta-categories. For the Importance factors, a neutral response would yield a value of $\mu=2.00$ while lower values indicate less importance and higher values, greater importance. ANOVAs were computed to determine if there was a difference between types of students based on their demographics and how they answered particular questions. Output that yielded results below a significance value of 0.05 were deemed statistically significant. These results were then analyzed using the Tukey Post Hoc test. Tukey Post Hoc results below 0.05 indicate which groups in the grouping variable differ.

The statistically significant values found using a t-Test from the important factors were used for additional analysis. ANOVAs were computed using the significant t-Test results to determine which grouping variables have statistically different components (Sig. < 0.05). The significance value for each factor as well as the mean for each possible response are reported for each corresponding demographic group. Tukey test results indicate which variables differ from each other and are bolded in the ANOVA results tables.

RESULTS

About the Respondents

IUFRO conference participants who identified their gender and race included a fairly even distribution of males and females with 174 being female (just over 51%) and 162 (nearly

48%) being male (4 chose not to answer). The majority (54%) of the respondents identified as White, while 17.4% of respondents identified as being of Hispanic or Latino origin or descent. Asians (16.1%) were the largest racial group after Whites, followed by black or African American (7.0%), Native American/Hawaiian or other Pacific Islander (1.8%), and Multiracial (5%). Not surprisingly, the largest group (44%) of respondents resided in North America, the conference location (Table S1). Clearly, it would have been advantageous to have better balance among countries and regions in the survey population. Moreover, we did not differentiate between students studying at home and those studying abroad. The next most represented groups came from Europe, Asia, and Latin America at 25%, 11%, and 11%, respectively. Other parts of the world represented at the conference included Oceania, Africa, and the Middle East (Table S1). In terms of their day-to-day living environments, nearly half of the respondents (46.9%) spent the majority of their lives in urban settings compared to those doing so in suburban (30.3%) and rural environments (22.8%). There was an interaction between race and residential setting, in that the majority of non-whites (55.3%) spent most of their lives in urban environments, reporting much less time lived in rural areas (14.9%), while whites were fairly evenly distributed among urban, suburban, and rural environments (37.4%, 32.5%, 30.1% respectively) in terms of majority residency.

Most respondents (58.8%) were doctoral or post-doctoral students while 26.5% and 16.7% were masters and undergraduate students, respectively. Just over a quarter (27.7%) had completed at least three years of their current degree programme. The majority of students (51%) self-identified their current programme as forestry. Other programmes included environmental or natural resource studies (17.7%), wood science and products (3.6%), watershed science and management (1.0%), and fisheries and wildlife (0.3%). The "Mixed" category refers to students who enrolled in a combination of the previous degree programmes and comprises 7.7% of the survey population. The "Other" category refers to the remaining 18.7% of current students in degree programmes they self-identified outside of traditional FRNR categories, with most students indicating they were in other degrees related to human dimensions, natural science, and social sciences. Most students (92.5%) selecting "other" degree programmes did indicate an area related to FRNR, such as forest economics, public international law, geographical sciences, plant pathology, or environmental engineering, which makes sense given that these students were attending an international forest research conference. More students (39.3%) indicated they were enrolled in a combination of specialties within degree programmes than those enrolled in one particular specialty. At least 45.4% considered enrolling in a combination of the previous majors, but ultimately enrolled in only one field, while 12.9% and 32.2% selected only human dimensions or natural science, respectively. Finally, most students (66.2%) said they did not belong to a university student FRNR organization.

Importance Factors Influencing Choice of a FRNR Education

A reliability analysis of these items resulted in the following broader categories for these factors: "Career", "Personal", and "Academic" (Table 1). An additional category called "Affective" was created to distinguish emotional from cognitive responses and thus was expressed as "enjoyment of" rather than "interest in" in the survey questions (Rouleau *et al.* 2017, Sharik and Frisk 2011). Respondents were asked a number of questions about how important various factors were regarding their choice of pursuing a FRNR education. With the exception of the "Academic" category ($\alpha=0.229$), strong Alpha scores were reported. Given that the highest possible response is $\mu=4$, results show just how strongly respondents felt about their education and future work environments, and how much influence it has on their choice in degree programmes. The highest overall category mean was for the Affective category ($\mu=3.20$), which also had the highest internal consistency among factors ($\alpha= .816$). The highest mean values in the Career, Academic, Personal, and Affective categories were "Job Satisfaction" ($\mu=3.41$), "Subject Matter" ($\mu=3.10$), "Concern for the Environment" ($\mu=3.36$), and "Enjoy Nature in General" ($\mu=3.47$), respectively (Table 1). The frequency scores for items across the four categories are reported in Table S2.

Multiple statistically significant Importance factors, those that are different on the more important side of "neutral" ($\mu=2$), were identified, with Enjoying Nature and Job Satisfaction being the most important (Table 1). The only importance factors that were not statistically significant are Earning Potential, Tuition and Fees, and Exposure to Forestry in High School (Table 1). Factors in the same category that have the largest differences include Earning Potential ($\mu=1.97$) and Job Satisfaction ($\mu=3.41$) in the Career category and Family Member or Friend ($\mu=1.29$) and Concern for Environmental Problems ($\mu=3.36$) in the Personal category. These results indicate that respondents felt their satisfaction in a career was more important than earning potential or the influence from family or friends. In addition, respondents' concern for the environment was more important to them when choosing a major than input from family or friends.

Academic Standing contains four groups including Undergraduates, Masters, Doctoral, and Post-doctoral. Three Importance factors were statistically significant for these groups, i.e., Employment Opportunities, Being Outdoors, and Scholarships (Table 2). Tukey results indicate that undergraduate are statistically different from masters and doctoral students for Employment Opportunities and Being Outdoors. For Scholarships, only undergraduates and doctoral students are statistically different (Table 2). Undergraduate students find their future Employment Opportunities ($\mu=3.41$) to be more important than the other groups of students. Undergraduates also find Being Outdoors to be more important ($\mu=3.41$). Doctoral students reported the availability of Scholarships ($\mu=2.81$) more important than undergraduate students ($\mu=2.27$) (Table 2).

TABLE 1 Responses to “How important were the following factors when you made your decision to major in forestry or a related natural resource degree programme?” (FRNR = forestry or related natural resources)

	Mean (Not Important $\mu=0$, Very Important $\mu=4$)	Std. Deviation	n
Career $\alpha=0.554$			
<i>Employment Opportunities</i>	2.67	1.144	349
<i>High Earning Potential</i>	1.97	1.097	349
<i>Enjoy Working in Outdoors</i>	3.19	0.999	350
<i>Sense of Job Satisfaction</i>	3.41	0.805	350
Career Total	2.81	—	—
Academic $\alpha=0.229$			
<i>Subject Matter of my Programme</i>	3.10	0.926	344
<i>Available Scholarships/Funding</i>	2.76	2.576	348
<i>Reputation of School or Faculty</i>	2.57	1.102	350
<i>Tuition and Fees</i>	2.41	5.354	347
Academic Total	2.71	—	—
Personal $\alpha=0.580$			
<i>Enjoy Being Outdoors</i>	3.17	0.989	349
<i>Family or Friends</i>	1.29	1.312	348
<i>Exposure to FRNR as a Child</i>	2.55	1.298	345
<i>Exposure to FRNR courses in High School</i>	1.90	1.327	346
<i>Concern for Environmental Problems</i>	3.36	0.883	348
Personal Total	2.45	—	—
Affective $\alpha=0.816$			
<i>Enjoy Wildlife</i>	3.04	1.049	347
<i>Enjoy Nature in General</i>	3.47	0.792	346
<i>Enjoy Forestry</i>	3.10	1.170	344
<i>Enjoy Outdoor Recreation</i>	3.20	1.000	348
Affective Total	3.20	—	—

Bold numbers indicate statistically significantly different from neutral (2) at the 95% confidence level.

TABLE 2 Factors considered important and hesitant with statistically significant ANOVA mean differences (Not Important or Hesitant $\mu=0$, Very Important or Hesitant $\mu=4$) for Academic Standing

Category [†]	Under-graduate ^a	Masters ^b	Doctoral ^c	Post-Doctoral ^d	Significance
Important					
<i>Employment Opportunities</i>	3.12 ^{b,c}	2.55 ^a	2.57 ^a	2.18	0.004
<i>Enjoy Being Outdoors</i>	3.41 ^{b,c}	3.15 ^a	3.13 ^a	3.27	0.026
<i>Available Scholarships/Funding</i>	2.27 ^c	2.50	2.81 ^a	3.00	0.023
Hesitant					
<i>Job Satisfaction</i>	0.79 ^c	1.20	1.47 ^a	1.40	0.007
<i>Contentious Political Issues</i>	1.45 ^d	1.35 ^{c,d}	1.79 ^b	2.60 ^{a,b}	0.003

Letters indicate which group significantly differed from which other group.

World Regions differ significantly with respect to eight importance factors, i.e., Earning Potential, Being Outdoors, Enjoy Working Outdoors, Reputation of School/Faculty, Scholarships, Family/Friends, Enjoy Forestry, and Enjoy Outdoor Recreation (Table 3). According to the Tukey results, North America and Europe are statistically significantly different for more factors than any other two regions, i.e., for all but Family and Friends. For Reputation and Enjoy Forestry, North America, Latin America and Europe are statistically different while for Family/Friends, Europe and Asia are statistically different. Employment Opportunities are more important to North Americans than to Europeans. Being Outdoors is also more important to North Americans than Europeans, and by a larger margin. Similarly, Enjoy Working Outdoors is more important to North Americans ($\mu=3.39$) than Europeans ($\mu=2.85$). Reputation of the School or Faculty is most important to Latin Americans followed by North Americans and then Europeans. Scholarships are also more important to North Americans than to Europeans. Family and Friends are more important to Asians than to Europeans. Forestry is most important to Latin Americans followed by North Americans and then Europeans. Finally, Outdoor Recreation

is more important to North Americans than it is to Europeans (Table 3).

Gender differed significantly with respect to two importance factors, i.e., Job Satisfaction and Enjoy Nature (Table 4). Females had higher means for both factors indicating that job satisfaction and nature are more important to them than it is to males.

With respect to Race (reduced to two groups, i.e., Non-Whites and Whites), Employment Opportunities are more important to Non-Whites than to Whites, while Being Outdoors is more important to Whites than Non-Whites (Table 5). Earning Potential, Reputation, Scholarships and Family/Friends are all more important to Non-Whites. Exposure to Forestry as a Child and Enjoying Outdoor Recreation were reported as more important to Whites than to Non-Whites (Table 5).

Social Background describes the living environment in which participants spent most of their life, i.e., urban, suburban, or rural. Social Background includes two statistically significant factors, Being Outdoors and Job Satisfaction (Table 6). Tukey results indicate that urban respondents are statistically significantly different from rural respondents for

TABLE 3 Importance Factors ANOVA Means (Not Important or Hesitant $\mu=0$, Very Important or Hesitant $\mu=4$) for World Region (FRNR = forestry and related natural resources)

Category	North America ^a	Latin America ^b	Europe ^c	Oceania ^d	Asia ^e	Africa ^f	Middle East ^g	Significance
Important								
<i>Employment Opportunities</i>	2.80 ^c	2.66	2.25 ^a	3.00	2.67	2.89	3.17	0.012
<i>Enjoy Being Outdoors</i>	3.40 ^c	2.90	2.90 ^a	3.25	2.97	3.22	2.83	0.002
<i>Working in Outdoors</i>	3.39 ^c	3.15	2.85 ^{a,f}	3.25	2.88	3.61 ^f	3.17	0.001
<i>Reputation of School or Faculty</i>	2.61 ^c	2.84 ^c	2.14 ^{a,b}	2.88	2.72	2.83	3.00	0.005
<i>Scholarships/Funding</i>	2.82 ^c	2.63	2.13 ^a	3.38	2.87	2.67	2.83	0.003
<i>Family or Friends</i>	1.23	1.20	1.07 ^e	0.88	1.94 ^c	1.56	2.17	0.021
<i>Enjoy Forestry</i>	3.20 ^c	3.46 ^c	2.80 ^{a,b}	3.00	3.13	3.28	3.40	0.016
<i>Enjoy Outdoor Recreation</i>	3.39 ^c	3.13	2.93 ^a	2.88	3.19	2.94	3.50	0.020
Hesitant								
<i>Work Conditions</i>	1.26 ^{b,c,f}	1.97 ^a	1.57	1.00	2.13 ^a	2.39 ^a	2.33	0.000
<i>Remote Work Locations</i>	1.25 ^e	1.86	1.55	1.38	2.03 ^a	2.06	2.17	0.001
<i>Job Satisfaction</i>	1.10 ^{b,c,f}	1.67 ^{a,c}	1.25 ^{b,g}	0.52 ^{e,g}	1.04 ^{c,d}	1.55 ^a	1.17 ^{a,c,d}	0.000
<i>Contentious Political Issues</i>	1.43 ^e	2.08	1.52 ^e	1.75	2.33 ^{a,c}	1.61	2.50	0.002
<i>Difficult Subject Matter</i>	0.86 ^{b,c}	1.70 ^a	1.13 ^e	0.63 ^g	1.90 ^{a,c}	1.33	2.80 ^{a,c,d}	0.000
<i>Reputation of School or Faculty</i>	1.05 ^{b,e}	1.78 ^{a,c}	1.04 ^{b,e,g}	0.88	1.86 ^{a,c}	1.83	2.50 ^{a,c}	0.000
<i>Scholarships/Funding</i>	1.60 ^g	2.08	1.39 ^g	1.13	2.17	2.22	2.33 ^{a,c}	0.007
<i>Exposure in High School</i>	1.18	1.53	1.05	1.25	1.45	1.94	2.50	0.008
<i>Negative Image of FRNR sector</i>	1.13 ^g	1.61	0.98 ^g	1.25	1.52	1.78	2.83 ^{a,c}	0.001
<i>Own Gender</i>	1.01 ^{f,g}	1.19	0.68 ^{f,g}	1.25	1.30	1.89 ^{a,c}	2.83 ^{a,c}	0.000
<i>Own Race</i>	0.82 ^{f,g}	1.14	0.55 ^{f,g}	0.75	1.10	1.28 ^{a,c}	2.20 ^{a,c}	0.003

Letters indicate which group significantly differed from which other group.

TABLE 4 Factors considered important and hesitant with statistically significant mean differences (Not Important or Hesitant $\mu=0$, Very Important or Hesitant $\mu=4$) for Gender (FRNR = forestry and related natural resources)

Category	Female	Male	Significance
Important			
<i>Sense of Job Satisfaction</i>	3.47	3.35	0.033
<i>Enjoy Nature in General</i>	3.57	3.37	0.031
Hesitant			
<i>Min. Exposure to FRNR in High School</i>	1.37	1.20	0.049
<i>Negative Image of FRNR sector</i>	1.37	1.15	0.035
<i>Own Gender</i>	1.30	0.80	0.001

TABLE 5 Factors considered important and hesitant with statistically significant mean differences (Not Important or Hesitant $\mu=0$, Very Important or Hesitant $\mu=4$) for Race (FRNR = forestry and related natural resources)

Category	Non-White	White	Significance
Important			
<i>Employment Opportunities</i>	2.80	2.55	0.042
<i>Enjoy Being Outdoors</i>	2.95	3.31	0.001
<i>High Earning Potential</i>	2.21	1.81	0.001
<i>Reputation of School or Faculty</i>	2.71	2.46	0.032
<i>Scholarships/Funding</i>	2.91	2.47	0.002
<i>Family or Friends</i>	1.51	1.12	0.005
<i>Exposure to FRNR as a Child</i>	2.29	2.69	0.005
<i>Enjoy Outdoor Recreation</i>	3.00	3.33	0.002
Hesitant			
<i>Family or Friends</i>	1.36	0.99	0.000
<i>Working Conditions</i>	1.99	1.28	0.000
<i>Remote Work Locations</i>	1.90	1.27	0.000
<i>Job Satisfaction</i>	1.88	0.89	0.000
<i>Contentious Political Issues</i>	1.99	1.41	0.000
<i>Difficult Subject Matter</i>	1.46	0.96	0.000
<i>Reputation of School or Faculty</i>	1.62	1.02	0.000
<i>Scholarships/Funding</i>	2.05	1.44	0.000
<i>Min. Exposure to FRNR as Child</i>	1.57	1.03	0.000
<i>Min. Exposure to FRNR in High School</i>	1.64	1.03	0.000
<i>Negative Image of FRNR sector</i>	1.59	1.02	0.000
<i>Own Gender</i>	1.36	0.86	0.000
<i>Own Race</i>	1.27	0.58	0.000

Being Outdoors, while all three living environments differ from each other for Job Satisfaction. Respondents who spent most of their lives in rural environments feel that being outdoors is more important to them than do respondents from urban environments. Respondents from rural environments also feel that Job Satisfaction is the most important followed by those from suburban and then urban environments.

Hesitance Factors Influencing Choice of a FRNR Education

Students were also asked about factors that made them hesitate before enrolling. Each of the detracting hesitant factors was statistically significantly different (more “not hesitant”) from neutral (Table 7). Factors that caused respondents to be

TABLE 6 Factors considered important and hesitant with statistically significant mean differences (Not Important or Hesitant $\mu=0$, Very Important or Hesitant $\mu=4$) for Social Background (FRNR = forestry and related natural resources)

Category	Urban ^a	Suburban ^b	Rural ^c	Significance
Important				
<i>Enjoy Being Outdoors</i>	3.01 ^c	3.24	3.36 ^a	0.026
<i>Sense of Job Satisfaction</i>	3.27 ^c	3.36 ^c	3.66 ^{a,b}	0.002
Hesitant				
<i>Job Satisfaction</i>	1.50 ^c	1.13	1.01 ^a	0.012
<i>Difficult Subject Matter</i>	1.34 ^b	0.96 ^a	1.00	0.015
<i>Reputation of School or Faculty</i>	1.48 ^{b,c}	1.07 ^a	1.08 ^a	0.009
<i>Scholarships/Funding</i>	1.89 ^b	1.49 ^a	1.54	0.036
<i>Min. Exposure to FRNR as a Child</i>	1.48 ^{b,c}	1.06 ^a	0.98 ^a	0.003
<i>Min. Exposure to FRNR in High School</i>	1.51 ^b	0.99 ^a	1.11	0.002
<i>Own Race</i>	1.02 ^b	0.66 ^a	0.74	0.027

Letters indicate which group significantly differed from which other group.

TABLE 7 Responses to "How important were the following factors that caused you to hesitate when deciding to enroll in an NR programme?" (FRNR = forestry or related natural resources)

	Mean (Not Hesitant $\mu=0$, Very Hesitant $\mu=4$)	Std. Deviation	n
Career $\alpha=0.799$			
<i>Salary Levels and Earning Potential</i>	1.84	1.148	344
<i>Working Conditions</i>	1.57	1.246	345
<i>Remote Work Locations</i>	1.52	1.227	345
<i>Job Satisfaction</i>	0.29	1.337	345
<i>Contentious Political Issues</i>	1.63	1.429	344
Career Total	1.57	—	—
Academic $\alpha=0.751$			
<i>Difficult Subject Matter</i>	1.18	1.185	342
<i>Available Scholarships/Funding</i>	1.27	1.21	340
<i>Reputation of School or Faculty</i>	1.69	1.332	341
Academic Total	1.38	—	—
Personal $\alpha=0.808$			
<i>Family or Friends</i>	1.14	1.232	346
<i>Minimal Exposure to FRNR as a Child</i>	1.25	1.241	341
<i>Minimal Exposure to FRNR in High School</i>	1.32	1.287	343
<i>Negative Image of FRNR Sector</i>	1.27	1.283	343
<i>Own Gender</i>	1.07	1.251	342
<i>Own Race</i>	0.88	1.174	342
Personal Total	1.15	—	—

Bold numbers indicate statistically significantly different from neutral ($\mu=2$) at the 95% confidence level.

the most hesitant on average included Earning Potential, Reputation, and Political Issues, while respondents Own Race elicited the least hesitancy. The frequency scores for items across the three categories are reported in Table S3.

All Hesitant factors were statistically significant from neutral (Table 7), but of far less magnitude than the values for Importance factors (Table 1). Salary Levels and Earning Potential had the highest hesitancy score of all factors, followed by Reputation of School or Faculty. Minimal Exposure in High School had the highest value among personal factors.

Two of the thirteen factors showed a significant difference among academic ranks, with doctoral students expressing a significantly higher level of concern over Job Satisfaction than undergraduate students, and post-doctoral students having a significantly higher level of hesitancy than undergraduates and masters with respect to Contentious Political Issues (Table 2). Eleven of the thirteen factors exhibited significant differences among world regions (Table 3). North Americans showed the greatest number of factor differences with respondents from other regions, and in nearly all cases the level of hesitancy was higher for participants in other regions than in North America. Two notable exceptions were respondents' Gender and Race, where North Americans were more hesitant than Europeans. Middle Eastern respondents exhibited the highest level of hesitancy for the largest number of factors, including Subject Matter, Reputation of the Programme, Scholarship Availability, Negative Image of FRNR Sector, and their own Gender and Race.

Three factors were significantly different between genders, including Minimum Exposure in High School, Negative Image of FRNR Sector, and Own Gender, and in all cases hesitancy values were higher for females than males (Table 4). All thirteen factors showed significant differences among racial/ethnic groups, with non-whites being more hesitant than whites in all cases (Table 5). Likewise, among the seven factors exhibiting significant differences among social backgrounds, urban respondents showed higher levels of hesitancy than suburban and/or rural respondents (Table 6). Moreover, as reported earlier, there was an interaction between race and social background in that a higher proportion of non-whites spent most of their lives in urban areas than did whites.

DISCUSSION

Many of our results support work by others done in interviews or smaller surveys, but these vary depending on the demographics, locations, or specific wording in the survey. A study of culturally diverse NR students from West Virginia University (a large university with an agriculture focus) and Alabama Agricultural and Mechanical University (a Historically Black College founded before the US Civil Rights Act of 1964 intended to serve the African-American community) found that lack of scholarships, lack of family understanding and/or institutional support, and gender discrimination were barriers for students pursuing NR degrees (Balcarzyk *et al.* 2016),

while having scholarships, general family support, access to social NR clubs or groups, and friends that enjoy outdoor activities were strong factors related to a feeling of support in pursuing a NR-related degree (Balcarzyk *et al.* 2016). In another survey of primarily white, female Agriculture and NR students from Michigan State University (another large land-grant), the academic programme (subject matter), reputation of the programme, internships, advisors and recommendations of family members were the most important factors in students' decisions to attend (Shrestha *et al.* 2011). Highlighting the university or programmatic culture of supporting students socially, with student access to role models, advisers, mentors, and financial resources was an important recruiting practice. These studies have similar overlapping motivational values, but it is important to keep in mind the tailored wording and options in the survey tool choices, and the demographics of the specific locations versus a broadly national or international scope.

Major differences in Importance and Hesitancy Factors

Given that our survey population consisted of students who were currently enrolled in a FRNR degree or post-doctoral programme, we would expect them to place a high degree of importance on most of the 17 factors in the survey regarding their decision to major in forestry or a related natural resources (FRNR) degree programme, and indeed they did. Conversely, we would have expected their hesitancy to major in FRNR to be relatively low. While this was the case, they did show a degree of hesitancy that differed significantly from neutral in all 13 factors considered. These hesitancies offer suggestions as to why non-FRNR students, especially those who enjoy being in nature/the outdoors, choose not to pursue FRNR degrees and by extension careers in these fields.

Affective

Of the four categories, "Career", "Academic", "Personal", and "Affective", the latter had the highest overall mean importance score ($\mu=3.20$ compared to 2.81, 2.71, and 2.45 for the first three respectively; Table 1). Enjoying Nature had the highest score of any of the importance factors, and when coupled to the high values for Working Outdoors, Being Outdoors, Job Satisfaction, and Concern for The Environment, supports our results from earlier surveys of US students (Rouleau *et al.* 2017, Sharik and Frisk 2011) where this combination of factors seems to be extremely important in their decision to matriculate in a FRNR degree programme. Surveys of FRNR students often cite affective development such as a love of the outdoors or feeling passionate about nature in their attraction to FRNR fields (e.g. Emmons 1997, Markworth and Buttrick 1939, Wolter *et al.* 2011a, Wolter *et al.* 2011b). Arevalo *et al.* (2012) found a strong similarity in the importance of environmental protection to forestry student views from Brazil, China, and Finland. Likewise, the International Forestry Student Association (IFSA 2010) found that dealing with environmental issues was the main reason 75% of responding forestry students choose that field. In addition, a study of over 100 environmental scientists in

Canada found that concern for the environment and pre-career experiences in the natural world were ubiquitous motivations among the professionals (Wright and Wyatt 2008). Numerous authors have also shown outdoor, field-based learning experiences are important to FRNR students (e.g. Bullard *et al.* 2014, Hix 2015, Nagel 2004).

Career

Students indicated that Job Satisfaction and Working Outdoors were the most important aspects of the “Career” category, but these are also highly related to “Affective” choices. Earning Potential overall had the most “not important to neutral” rankings (Table S2), confirming earlier studies (Sharik and Frisk 2011), which may reflect a very altruistic perspective for students with significant concerns for the environment (Gifford and Nilsson 2014). There are significant differences in earning potential rankings seen between world regions (Table 3), likely reflecting a cultural emphasis on financial values (e.g. Auyeung and Sands 2010, Komppula *et al.* 2018).

Academic

The “academic” category overall ranked higher than “Personal” category, but not the “Career” or “Affective” categories. Scholarships or funding availability may negate some of the concerns over tuition or fees, while a high scoring for Subject Matter is likely tied to the importance of the “Affective” category, and the tendency for natural resource students to have a strong affinity for hands-on or experiential learning in outdoor settings (e.g. Bragg and Tappe 2015, Bullard *et al.* 2014, Fedynich *et al.* 2012, Hirsch and Lloyd 2006, Hix, 2015, Nagel 2004). A survey of Australian university students reported that academic factors (course suitability, reputation, and teaching quality) and career factors (job prospects) ranked highly among student enrollment decisions, but factors related to the affective category were not included (Soutar and Turner 2002).

Personal

The influence of family or friends ($\mu=1.29$) overall was low, while exposure to forestry as a child ($\mu=2.55$) was much more important (Table 1). Parental influence is often reported to be stronger in surveys for all college students, not just those in FRNR (e.g. Workman 2015), but there are often reported differences between demographic groups (e.g. Ceja 2006, Perna and Titus 2005). This overall trend is similar to an enrollment perspective survey in the US of students in colleges of agriculture at 1862 land grant institutions, where current students in the programme indicated that family or friends have a low influence on their choice, but having a family member involved in an agriculture-related career (meaning the students would likely have known more about such a career from an early age) was the most likely influencer in their decision to enroll (Smith-Hollins *et al.* 2015). Outley (2008) reported that minority students in the US identified individuals who most influenced their career choice as their own mother and people already employed in the field. Looking more closely at the importance of family and friends and childhood exposure to FRNR, there are significant

differences depending on the world region (Table 3) and race (Table 5). Collectivist societies (for example, many Asian cultures) highly value the opinions of their families and social responsibility and may be more willing to self-report or identify it in a survey more so than people from individualist societies such as many US, German, or Australian cultures (Giacomino *et al.* 2013, Soutar and Turner 2002, Wang and Juslin 2012). Lesson content related to or leading to exposure to FRNR in primary and secondary school can also vary by world region and cultures. It may be a topic rarely incorporated, if at all, or it may be compulsory and regularly incorporated into the curriculum, as it is for example in India (Dhaka and Choudhari 2018), thereby more regularly exposing students to FRNR topics. Formative experiences as a child help develop an affinity for the natural world and lead to more exposure to career options or environmental considerations (Sharik and Frisk 2011, Tanner 1980, Wells and Lekies 2006), whereas a commonly cited barrier to pursuing careers in FRNR is simply a lack of knowledge of FRNR careers (e.g. Adams and Moreno 1998, Outley 2008).

Major differences in demographics

Varying from Rouleau *et al.* (2017) and other recent research on FRNR student motivations, this survey includes a majority of graduate students, nearly as many non-forestry majors as forestry majors, and global representation. We also asked students to provide information on their primary social background as another demographic category in addition to race and gender.

Academic Standing

Graduate students reported Availability of Scholarships and Funding to be more important than undergraduate students (Table 2). This may be because scholarships are typically more abundant and accessible to undergraduate students than they are to graduate students, and therefore more of a concern for upper-level students. Other reasons may be that students have already accumulated debt from a baccalaureate and have reservations about continuing to do so, or undergraduates may be receiving more financial assistance from their parents (Malcolm and Dowd 2012). Although not statistically significant, Post-Docs reported that scholarships/funding were also more important than for Doctoral students, who in turn also reported that it was more important than for Masters students. Scholarships was still significantly more important than neutral for undergraduates. It is interesting that Employment Opportunities are the inverse, being ranked less important to graduate students and post-docs, but this may be because they already have an undergraduate degree and feel more qualified for employment in their field. Being Outdoors is also rated less important to graduate students than to undergraduates, which may mean they are focusing on less “outdoor field” experience in school and enrolling for more analytical or research-based programmes. Further differentiating students into years of study may shed more light on perceptions and motivations, as even first-year vs. third- or fourth-year FRNR undergraduates have discernable differences in their motivations and concerns (Arevolo *et al.* 2010). However, 76.9% of

undergraduates responding to our survey had completed 3 or more years in their programme, the result of our survey pool being conference attendees and more likely to be in leadership positions or involved with activities that provide conference travel support.

World Regions

Most of the significant differences in importance factors among regions were between North American and European respondents (Table 3), and in all cases North Americans placed a higher importance on these factors than did Europeans—for reasons that are not clear. One area that may be less speculative is that it is likely Europeans are less concerned with Scholarships than others, as higher education in Europe is largely subsidized or reduced in cost, though this varies between individual nations (Brooks 2017). About one-third of the respondents reported the US as their country of residence (Table S1), and their stronger responses could be related to feeling more comfortable in their “home country” during the survey, rather than if the conference were in another country. The survey was also conducted in English, so some may have been less comfortable in their answers if it were a second language. However, this does not explain why Europeans placed less importance on these factors than respondents from other regions.

Gender

Females responded with higher means for all of the statistically significant importance and hesitancy factors (Table 4). Other surveys have also found that females tend to place a higher value on nature or the environment or have stronger environmental concerns (Mueller and Mullenbach 2018). Arevalo *et al.* (2011) reported women in Brazil and Finland placed a higher value on environmental protection than their male colleagues. Storch (2011) also reported that female foresters in Germany had different perceptions of nature than male foresters, but that these differences were not as significant as either female or male foresters and the general public. A higher rating in Job Satisfaction may mean that female students see their FRNR field as aligned with nature or the environment, but also that future job satisfaction will be an important consideration given the challenges FRNR has faced regarding gender diversity. In the US and internationally, women may feel more hesitant about enrolling in a FRNR programme and seeking a job in the field because these programmes are typically known to be comprised of mostly males, especially in forestry (e.g. Balcarczyk *et al.* 2016, FAO 2006, FAO 2007, Kuhns *et al.* 2002, Sharik and Frisk 2011, Sharik *et al.* 2015, Rouleau *et al.* 2017, this study). Similar to North America, Nordic countries have commonly reported lower proportions of female forestry students (Lidestava and Sjölander 2007), but these countries and others such as China and Brazil, have indicated increasing trends of enrolled female forestry students (Arevalo *et al.* 2012, Sharik *et al.* 2015). Authors have described ‘forestry’ as having an image or reputation problem that can be related to diversity and inclusiveness, or that it can appear less modern or overly technical (perhaps due to accreditation standards), compared

to other NR programmes (e.g. Andersson and Lidestav 2016, Hoffmann 1988, Luckert 2006, McGown 2015, Redelsheimer *et al.* 2015, Wellman 1987, Yanciw 2004). Increasing the number of women in FRNR fields is important to change the image of forestry and related fields, yet socially constructed, male-dominated culture (e.g. Markworth and Buttrick) in academia and in the work force is still a hesitation factor for many women as shown in this study and others (Coutinho-Sledge 2015, Kern *et al.* 2019, Larasatie *et al.* 2019, Rouleau *et al.* 2017, Sharik and Frisk 2011).

Race

The significant differences for race (Table 5) are telling, even in a cross-national survey. The most important factors for non-white students in making a decision to matriculate in an FRNR degree programme included largely financial/economic factors, while those for whites were related to being outdoors, including as a child. This may be a reflection of racial stratification, with white students generally having more socio-economic opportunities, more access to outdoor recreational opportunities, and potentially more access to scholarships/funding, leading to it being less of a concern or motivating factor (Carnevale and Strohl 2013, Finney 2014). However, being outdoors and outdoor recreation were ranked as the most important to both groups. The finding in this study that non-whites showed a significantly greater hesitancy to matriculate in an FRNR degree programme than whites in all thirteen hesitancy factors, including one’s own race, is especially noteworthy. It should also be stated that enrollment of a racially and ethnically diverse student body may not be considered a problem in some countries, whereas approximately one-third of students in this survey were from the US (Table S1), where student enrollments in FRNR have not been reflective of the racial/ethnic diversity in the college-aged population for decades (Didriksen 1975, Sharik *et al.* 2015). Diverse and reflective representation is made even further complex in countries with a history of colonialism.

A survey of minority student perceptions in agriculture and natural resource fields in the US noted that the student’s own mother or knowing a person in the field had the most influence on their career choice, followed by concern for environment (Outley 2008). Other factors such as career opportunities, positive educational experiences, and job experiences with agencies or organizations were also important thematic considerations for career choice, while barriers identified included lack of information, internal agency/organization diversity, perceptions of careers, and historical cultural perceptions (Outley 2008). Comparisons were only made here between white and non-white students in order to have a large enough sample size, but future research should consider this further.

Social Background

It is noteworthy in this study that of the seven hesitancy factors where there were significant differences among respondents who spent most of their lives in urban vs. suburban or rural areas, those from urban areas showed a higher hesitancy to major in an FRNR degree programme. In the US,

traditionally, many FRNR professionals came from rural areas, regardless of ethnicity (Balcarzyk *et al.* 2016). An assumption is that people who have spent most of their life (and especially their youth, ala Louv 2005) in rural environments may have a greater appreciation for the outdoors than people from other living environments and may thus derive a greater sense of satisfaction from a career in FRNR (Collins and Anantharaman 2015, Eliason 2006, Sharik and Frisk 2011, Wolter *et al.* 2011a). Students from urban and suburban areas in the US may have spent less time in the outdoors in their youth than did their rural counterparts and thus perceive more barriers to overcome in pursuing a career in FRNR (Balcarzyk *et al.* 2016). However, in our survey, only 22% of student respondents reported as being from a rural background, suggesting that more and more students are motivated to enroll in FRNR from urban and suburban backgrounds. Moreover, the “traditionally” rural-raised FRNR student stereotype may not hold true internationally, at least among higher-academic-standing, conference-going students. Of the graduate students and post-doctoral students here, on average they reported 79.7% of their life having lived in an urban/suburban environment, while undergraduates averaged 65.4%.

Limitations of the Study

A mistake in one word of the survey answer options, (‘Forestry’ rather than ‘Forests’) likely influenced results for the affective categories. Respondents indicated enjoyment of Wildlife, Nature, Forestry, and Outdoor Recreation as positive factors in their decision to enroll in an FRNR programme. Given that 51% of students reported majoring in forestry (with the others in related fields), and that the IUFRO conference was taking place jointly with a Society of American Foresters National Convention, there was probably not a strong negative feeling of the word ‘Forestry’. However, the survey should have had ‘Forests’ along with Nature and Wildlife as an “Affective” category to choose from, relating to a feeling or attitude about forests in general, rather than the field of forestry. In addition, this change may have resulted in non-forestry majors (nearly half the study population), placing higher importance on this factor had it been “enjoying forests”, given the negative image of forestry in some segments of society (Sharik and Frisk 2011, Sharik *et al.* 2015).

The survey here was conducted with current students in FRNR, and thus one might expect their motivations for enrolling to outweigh any hesitations to enrolling. However, the hesitations do tell us what factors may have caused them not to have matriculated in an FRNR programme. It would be difficult to globally survey university students who considered FRNR specifically, but decided not to pursue it. Some small surveys of student reasons for starting outside of FRNR and transferring in (Wolter *et al.* 2011a) and leaving programmes (Wolter *et al.* 2011b) have been published. Though we asked how many years of their current programme they completed and what level of academic standing they had, students were not specifically asked if they had transferred or previously studied non-FRNR programmes. We did ask if they had *considered* other majors before deciding on a degree in

FRNR, which may be an important window into this area, with students indicating biology (43.9%), engineering (21.3%), or social sciences (20.4%) as the three highest response answers. Wolter *et al.* (2011b) interviewed US undergrads as they decided to leave a fisheries and wildlife programme, and most of them reported concerns over job prospects and earning potential, reluctance to pursue a further graduate programme, lack of outdoor experiences offered in the curriculum, and a desire for more active participation in the undergrad programme. However, these students were motivated to enroll in the programme to begin with. Thus, we are very much in need of a nation-wide or global study that surveys students in a wide array of degree programmes, especially those that lead to professional careers where knowledge, skills and abilities, and behaviors are important. These new surveys would ascertain which factors prevent potential FRNR students from enrolling, particularly non-FRNR students who enjoy being and working in nature/the outdoors since these factors are strongly associated with those who decided to major in FRNR.

Though almost 19% of respondents self-identified as majoring in “Other” categories outside of FRNR, they indicated interdisciplinary fields such as social sciences or natural sciences. As these students were attending an international conference focusing on forestry, we have assumed a likelihood that their study programme strongly correlates with FRNR topics.

The fact that well over half of the study population consisted of graduate and post-doctoral students is not a limitation per se, but rather makes it difficult to compare with earlier studies, most of which were confined to undergraduate students. However, the fact that only three of the 17 importance factors and two of the 13 hesitancy factors differed significantly among one or more of the four classes of academic standing suggests that students in these classes have a lot in common regarding their decisions to major in an FRNR degree programme. Another interpretation is that the relatively small differences in results could be a product of homogeneity of the sample. In some ways this should not be surprising in that most graduate students and post-doctoral fellows likely had degrees in the same or similar disciplines as the undergraduates in our current study, but we did not specifically ask what areas previous degrees were in, or if students were in coursework- or research-based programmes. Furthermore, one must keep in mind that these were actively engaged students who had the means to attend a large, international forest research conference in the US, which may in part explain the larger proportion of graduate and post-doctoral students.

There are limitations to cross-national studies in that it is difficult to know if they are truly representative of a global scale and global cultures, especially when such studies have an imbalance in respondents among countries and regions, such as was the case in our study (Arevelo *et al.* 2012). For example, the term ‘race’ was used in the survey, rather than ethnicity or race/ethnicity, and all of the results were collapsed into white and non-white (i.e. people of color). This obviously is complicated when surveying an international population. Additionally, the survey tool asked for country of

residence and the origin of the institution, thus students studying abroad would be another population to consider in the future. An objective in this study was to have comparable results to Sharik and Frisk (2011) and Rouleau *et al.* (2017), both of which were confined to US students. However, this meant that the survey instrument was developed and interpreted from a US perspective, potentially missing culturally relevant factors specific to other regions in the world. Institutions where students have made the decision to enroll vary in their demographic characteristics and employment markets they target. Despite this, there are common motivational factors perceived by FRNR students that encouraged them to pursue university enrollment in these fields.

CONCLUSION

From their study of factors that attracted undergraduate forestry students in the US to matriculate in a forestry degree programme, Sharik and Frisk (2011, pg 165) developed the following student profile: “someone who loves working outdoors and has a deep affection for and interest in nature, in part resulting from having experienced nature in childhood and adolescence; has a strong interest in natural science and forestry academic subjects; has a strong conservation ethic; and is committed to making a difference through sustainable management of our nation’s forests.” The main hesitations of these students were “a perceived lack of jobs and low wages compared to other professions.” A follow-up study of a closely related population by Rouleau *et al.* (2017) revealed a similar profile. A profile developed from the current study is not unlike that developed from previous studies despite the fact that it includes a much better balance between FRNR majors, includes undergraduates and graduate students, and is more global in extent, keeping in mind the context that our respondents were actively engaged, attending an international forest research conference. Universities have to balance curriculum and recruitment strategies that are important to students making decisions to enroll in programmes and consider future employer preferences for knowledge, abilities and skills, and behaviors. Future research could further examine how to further incorporate programmes geared towards potential students’ affective preferences with knowledge and skills desired by future employers (i.e. Sample *et al.* 2015), thereby impacting recruitment and retention efforts. A lingering problem for the natural resource professions is that of low gender and racial/ethnic diversity, at least in the US (Sharik *et al.* 2015, Sharik and Bal 2017). Low numbers of women and especially people of color have made it difficult to obtain survey sample sizes adequate to draw any meaningful insights into why this diversity continues to remain low. The current study, with its larger sample size, allowed for a more robust analysis of this issue and perhaps one of the most telling results is that women and people of color, surveyed from multiple world regions, continue to feel that their own gender and race make them more hesitant to pursue a degree (and by extension, a career) in FRNR than their white male peers. Future surveys of a similar nature should provide a good index of whether or not this barrier remains.

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TABLE S1 Country of residence reported and number (n) of survey respondents per academic standing level of students attending the 2014 International Union of Forestry Research Organizations (IUFRO) conference in Salt Lake City, Utah

Country	Undergrad	Masters	Doctoral	Post-Doctoral	Total %
United States	27	43	57		32.6%
Canada	17	12	16	1	11.8%
Brazil	3	4	15	2	6.2%
Germany	3	4	13	1	5.4%
Austria	5	4	4		3.3%
China	2	3	7	1	3.3%
Finland		1	11		3.1%
Sweden		1	11		3.1%
Mexico	1	4	6		2.8%
Japan		1	8		2.3%
Italy		1	5	2	2.1%
United Kingdom		1	7		2.1%
Australia		1	4	1	1.5%
India		1	3	1	1.3%
Nigeria		2	3		1.3%
Benin		1	3		1.0%
France			3	1	1.0%
Indonesia	3	1			1.0%
South Africa		1	2	1	1.0%
Taiwan		1	3		1.0%
Denmark			3		0.8%
Ghana		3			0.8%
Iran			3		0.8%
New Zealand	1	2			0.8%
South Korea		2	1		0.8%
Switzerland		2	1		0.8%
Tunisia	1		2		0.8%
Colombia		2			0.5%
Czech Republic			2		0.5%
Lithuania			2		0.5%
Norway			2		0.5%
Peru	2				0.5%
Philippines		1	1		0.5%
Belgium			1		0.3%
Bolivia		1			0.3%
Cameroon			1		0.3%
Costa Rica			1		0.3%
Cote d'Ivoire			1		0.3%
Estonia		1			0.3%
Ireland			1		0.3%
Kenya		1			0.3%
Luxembourg			1		0.3%

TABLE S1 (Continued)

Country	Undergrad	Masters	Doctoral	Post-Doctoral	Total %
Mongolia			1		0.3%
Nepal			1		0.3%
Netherlands		1			0.3%
Senegal			1		0.3%
Spain			1		0.3%
Thailand			1		0.3%
Trinidad and Tobago		1			0.3%
Turkey			1		0.3%
Total	65	104	210	11	100.0%

*4 respondents did not identify either a country or academic level

TABLE S2 Frequency counts for responses to important factors, n (%) (FRNR = Forestry and Related Natural Resources)

Category and Positive Factors	Not Important	Somewhat Unimportant	Neutral	Somewhat Important	Very Important
Career					
<i>Employment Opportunities</i>	28 (8.1%)	22 (6.3%)	69 (19.9%)	151 (43.5%)*	77 (22.2%)
<i>High Earning Potential</i>	46 (13.2%)	54 (15.5%)	134 (38.4%)*	93 (26.6%)	22 (6.3%)
<i>Enjoy Working in Outdoors</i>	9 (2.3%)	18 (4.6%)	38 (9.6%)	118 (29.9%)	166 (42.0%)*
<i>Sense of Job Satisfaction</i>	6 (1.7%)	3 (.9%)	26 (7.4%)	123 (31.1%)	192 (54.9%)*
Academic					
<i>Subject Matter of my Program</i>	6 (1.8%)	8 (2.3%)	69 (20.2%)	124 (36.3%)	135 (39.5%)*
<i>Available Scholarships/Funding</i>	37 (10.6%)	28 (8.0%)	77 (22.1%)	86 (21.8%)	120 (34.5%)*
<i>Reputation of School or Faculty</i>	24 (6.9%)	27 (7.8%)	91 (26.1%)	142 (35.9%)*	64 (18.4%)
<i>Tuition and Fees</i>	53 (15.5%)	37 (10.8%)	127 (37.1%)*	72 (21.1%)	53 (15.5%)
Personal					
<i>Enjoy Being Outdoors</i>	10 (2.9%)	17 (4.9%)	35 (10.0%)	130 (37.2%)	157 (45.0%)*
<i>Family or Friends</i>	146 (42.1%)*	46 (13.3%)	90 (25.9%)	42 (12.1%)	23 (6.6%)
<i>Exposure to FRNR as a Child</i>	40 (11.7%)	30 (8.8%)	70 (20.5%)	114 (33.3%)*	88 (25.7%)
<i>Exposure to FRNR in High School</i>	77 (22.3%)	49 (14.2%)	92 (26.6%)*	86 (24.9%)	42 (12.1%)
<i>Concern for Environmental Problems</i>	10 (2.9%)	4 (1.2%)	20 (5.8%)	132 (38.3%)	179 (51.9%)*
Affective					
<i>Enjoy Wildlife</i>	16 (4.6%)	14 (4.0%)	45 (13.0%)	139 (40.2%)*	132 (38.2%)
<i>Enjoy Nature in General</i>	6 (1.7%)	2 (.6%)	23 (6.6%)	108 (31.2%)	207 (59.8%)*
<i>Enjoy Forestry</i>	9 (2.6%)	12 (3.5%)	52 (15.2%)	122 (35.6%)	148 (43.1%)*
<i>Enjoy Outdoor Recreation</i>	13 (3.7%)	9 (2.6%)	41 (11.8%)	118 (33.9%)	167 (48.0%)*

*Highest frequency count in category.

TABLE S3 Frequency counts for responses to hesitant factors, n (%) (FRNR = Forestry and Related Natural Resources)

Category and Negative Factors	Not Hesitant	Somewhat Unhesitant	Neutral	Somewhat Hesitant	Very Hesitant
Career					
<i>Salary Levels and Earning Potential</i>	64 (18.6%)*	55 (16.0%)	108 (31.4%)*	106 (30.8%)	11 (3.2%)
<i>Working Conditions</i>	95 (27.6%)*	67 (19.5%)	92 (26.7%)	73 (21.2%)	17 (4.9%)
<i>Remote Work Locations</i>	100 (29.0%)*	64 (18.6%)	99 (25.1%)	65 (18.8%)	17 (4.9%)
<i>Job Satisfaction</i>	141 (40.9%)*	65 (18.8%)	66 (19.1%)	44 (12.8%)	29 (8.4%)
<i>Contentious Political Issues</i>	94 (27.6%)*	60 (17.6%)	86 (25.2%)	77 (22.6%)	24 (7.0%)
Academic					
<i>Difficult Subject Matter</i>	137 (40.3%)*	69 (20.3%)	85 (25.0%)	41 (12.1%)	8 (2.4%)
<i>Reputation of School or Faculty</i>	131 (38.6%)*	69 (20.3%)	85 (25.0%)	41 (12.1%)	8 (2.4%)
<i>Available Scholarships/ Funding</i>	95 (27.9%)*	53 (15.5%)	91 (26.7%)	68 (19.9%)	34 (10.0%)
Personal					
<i>Family or Friends</i>	166 (48.0%)*	32 (9.2%)	91(26.3%)	48 (13.9%)	9 (2.6%)
<i>Minimal Exposure to FRNR as a Child</i>	144 (42.2%)*	41 (12.0%)	98 (28.7%)	44 (12.9%)	14 (4.1%)
<i>Minimal Exposure to FRNR in High School</i>	136 (40.1%)*	47 (13.9%)	96 (28.3%)	47 (13.9%)	13 (3.8%)
<i>Negative Image of FRNR Sector</i>	143 (41.9%)*	51 (15.0%)	80 (23.5%)	54 (15.8%)	13 (3.8%)
<i>Own Gender</i>	177 (51.9%)*	29 (8.5%)	86 (25.2%)	37 (10.9%)	12 (3.5%)
<i>Own Race</i>	203 (59.7%)*	17 (5.0%)	95 (27.9%)	16 (4.7%)	9 (2.6%)

*Highest frequency count in category.