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Diversity beyond demographics: Environmental worldviews of forestry and natural resource undergraduate students

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Abstract

In US academic institutions, efforts often concentrate on enhancing the recruitment of students from underrepresented groups, focusing on gender and/or race. However, little attention has been paid to nondemographic forms of diversity, such as environmental worldviews (i.e., differences in the metaphysical, epistemological, and ethical beliefs that define how humans view, value, and interact with the natural world). Here, we present an exploratory measure of environmental worldview diversity among undergraduate students enrolled in natural resource-related programs. We tested our procedure at Oregon State University, a large public land-grant university in the United States. Many students reported metaphysical, epistemological, and/or ethical beliefs that deviate from what has been philosophically characterized as the dominant western worldview of natural resources (anthropocentric, dualistic, hierarchical, utilitarian, and mechanistic). Our results suggest that, although forestry students' environmental worldviews are in some ways more closely aligned with the dominant western worldview than other students in natural resources, generally student worldviews reflect a long-term generational shift away from a strict resource-commodity value orientation, as documented in the past research. Our findings highlight the importance of considering environmental worldviews as a dimension of diversity within the new generation of natural resource students. Future efforts toward understanding these levels of difference can be important assets in designing programs that appeal to a wide variety of students, ultimately helping efforts to recruit and retain a diverse pool of aspiring natural resource professionals.

KEYWORDS
diversity, environmental worldviews, ethics, humanities, natural resources education

1 | INTRODUCTION

Increasing diversity among students in natural resources (NR) is an expressed goal for many institutions of higher education in the United States (ESA, 1993, 2006; NSF, 2008; OSU CoF, 2017). Efforts focus largely on demographic forms of diversity, such as race and gender. These efforts are motivated partially by the recognition that demographically diverse people are likely to have different values,

ideas, beliefs, and perspectives (Page, 2008), and such less-visible forms of diversity are important as well. In this regard, the goal is to increase both demographic diversity and what might be called "worldview diversity."

What do we mean when we use the word "worldview?" Our conceptualization reflects a philosophical approach that breaks worldviews into three major dimensions: metaphysics (i.e., beliefs about the fundamental nature and structure of the world), epistemology (i.e., beliefs about knowledge and how it is produced), and ethics (i.e., beliefs about what is good and how humans ought to behave). Although it is useful to separate these for analytical purposes (Figure 1), the three dimensions are closely related. For instance, metaphysical beliefs about how the world is, influence ethical beliefs about how humans ought to act; and ethical beliefs about how humans ought to act are informed by epistemological beliefs about how we arrive at moral knowledge or understanding. Especially salient to NR are environmental worldviews, i.e., the metaphysical, epistemological, and ethical beliefs that influence how people view, value, and interact with the natural environment (Callicott, 1994; Mathews, 1991). Our theoretical framework, therefore, blends two longstanding intellectual traditions dating at least to the 1970s: conceptually, we draw on environmental ethics and philosophy, and empirically, we draw on environmental social science focusing on environmental value orientations.

What constitutes worldview *diversity* in NR? The dominant worldview of NR in Eurocentric Western societies has traditionally been (1) anthropocentric (i.e., only humans have direct moral standing); (2) dualistic (i.e., humans are separate from nature); (3) hierarchical (i.e., humans are above nature); (4) utilitarian (i.e., nature is valuable solely for its instrumental benefits); and (5) mechanistic (i.e., nature can be known objectively through reductive, empirical scientific inquiry) (Callicott, 1994; Crist, 2019; Mathews, 1991; Plumwood, 1993; Xu & Bengston, 1997). Worldview diversity, then, involves the representation of people whose worldviews deviate from the dominant NR

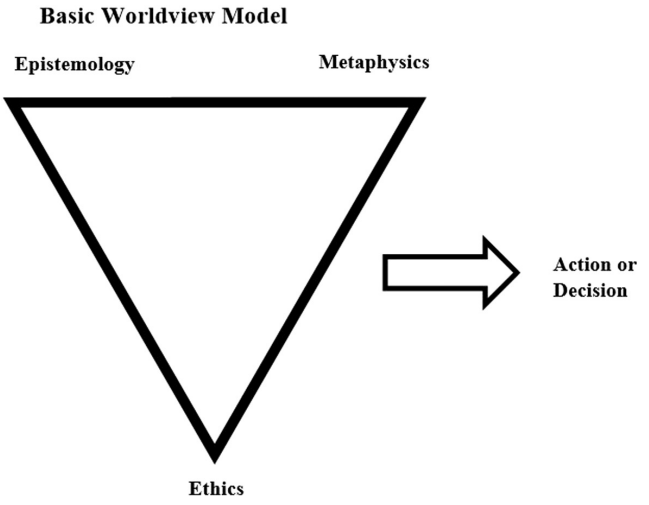

FIGURE 1 Basic worldview model—this figure contains the basic elements that make up a worldview: Epistemology, ethics, and metaphysics, which ultimately influence actions or decisions.

TABLE 1 Participant demographics[a]

Major	*n*	Gender[b]		Race[c]		Class rank[d]			
		Female	Male	People of color	White	Freshman	Sophomore	Junior	Senior
Forestry	45	7 (15%)	34 (76%)	3 (7%)	39 (87%)	0	3 (7%)	4 (9%)	37 (82%)
Natural Resources	41	24 (59%)	15 (38%)	6 (15%)	35 (85%)	0	6 (15%)	7 (17%)	27 (66%)
Fish Wildlife and Animal Science	42	27 (64%)	15 (36%)	8 (19%)	34 (81%)	1 (2%)	6 (14%)	23 (55%)	12 (29%)
Other	90	38 (42%)	49 (54%)	23 (26%)	65 (72%)	38 (42%)	15 (17%)	14 (16%)	21 (23%)

Note: $N = 218$.

[a]Cell values are counts and percentages (percentages rounded to the nearest whole number).

[b]Although not ideal, gender is reported as a binary in this table. Students were given the option to self-identify as nonbinary or to indicate a preference to self-describe. To protect anonymity, we have not reported the distribution of these students among major categories. Because these students were omitted from the table, percentages do not sum to 100%.

[c]Race is also reported as a binary. Due to low representation, we grouped students together as People of Color to protect anonymity. Percentages do not sum to 100% due to missing responses from some students.

[d]Percentages do not sum to 100% because students of unknown rank are not reported in the table.

worldview along one or more dimensions. For example, an alternative worldview might include nonutilitarian and nonanthropocentric beliefs that nature should be honored as kin, and recognized as a sacred community whose value surpasses what it provides for humans (Kimmerer, 2013). Worldview diversity would be increased if people with both utilitarian anthropocentric and "kincentric" nonanthropocentric perspectives were represented in NR (Bhattacharyya & Slocombe, 2017; Salmón, 2000).

Demographic information has been closely tracked to monitor diversity trends in NR over time (Arismendi & Penaluna, 2016; Bal & Sharik, 2019a, 2019b; Sharik et al., 2015). For example, research shows that gender and racial diversity have increased in some areas of environmental sciences and NR fields; although in some of the most traditional fields such as fisheries (Arismendi & Penaluna, 2016), aquatic sciences (Abernethy et al., 2020), and forestry (Bal & Sharik, 2019a, 2019b) the demographic composition has been slower to change. Environmental worldviews, however, are not a commonly measured metric of diversity. As such, while there is a significant amount of data on demographic diversity in undergraduate NR programs, the status of and trends in worldview diversity remain less clear.

One reason why worldview diversity has not been regularly assessed may relate to the complexity of the "worldview" concept, which necessitates measurement tools informed by interdisciplinary insights. Therefore, our objectives in the present study are to present an exploratory measure of worldview diversity in NR; and to assess, in a small-scale study, whether a reputable undergraduate forestry program differs from nonforestry NR programs in terms of worldview diversity. In line with reported lags in demographic diversity in undergraduate forestry programs (Bal & Sharik, 2019a, 2019b), we hypothesized that worldview diversity would be similarly resistant to change among forestry students, compared with students in other NR majors.

2 | METHODS

We administered an online survey to a sample of Oregon State University undergraduate students focusing on recruitment from natural resources-related courses and baccalaureate core classes during the 2017–2018 academic year.[1] A total of 260 students from a variety of majors voluntary completed the survey; 218 responses were used for analysis based on their completion of the survey (Table 1). We based our analysis on the comparison of four major categories including Forestry ($n = 45$; 21%), Fisheries Wildlife and Animal Sciences (FWAS; $n = 42$; 19%), Natural Resources (NR; $n = 41$; 19%), and Other, including majors such as Biology, Tourism, Recreation & Adventure Leadership, and Sociology ($n = 90$; 41%); (see the full list of majors in Appendix S1: Table A1). These percentages approximate percentages among natural resource-related areas of study nationally (Sharik et al., 2015). The survey consisted of 40 questions; a subset of these was used for the present analysis (Appendix S1: Tables A2–A5).

To measure the ethical/metaphysical elements of environmental worldviews, we used 11 Likert-type items drawn from three established scales, including the New Environmental Paradigm scale (Dunlap et al., 2000), the Connectedness to Nature scale (Mayer & Frantz, 2004), and the Environmental Identity scale (Olivos et al., 2011). None of the psychological constructs these scales were designed to measure fully encompasses the worldview construct, as we conceptualize it based on philosophical literature. In appropriating items from these scales, it was not our intent to measure the New Ecological paradigm, nature connectedness, or environmental identity, per se. Rather, we chose items from these scales because they were also suitable to measure certain (ethical and metaphysical) content of the philosophically-informed environmental worldview construct; and because, as tested and widely-used survey items, we were confident they were clearly worded and had a minimal likelihood of generating response error. Respondents rated items from 1 to 5 (strongly disagree to strongly agree) (See Appendix S1: Table A2).

To visualize and examine the similarity of metaphysical/ethical dimensions of environmental worldviews views among major categories of students, we performed a simple principal component analysis (PCA) on the responses to the items mentioned above. Then, to condense survey items for further analysis, we used a principal components factor analysis with a varimax rotation, retaining only variables with loadings of 0.40 or higher and eigenvalues greater than 1.0 (Kaiser, 1974). This procedure returned three factors, which we initially labeled Moral Inclusion (MI), Bond with Nature (BN), and Human's Role (HR) (See Appendix S1: Table A3).

Internal reliability for the three factors was measured using Cronbach's alpha (Vaske, 2008). Alpha was within levels considered acceptable for MI ($\alpha = 0.77$) and at the low end of the conventionally acceptable range for BN ($\alpha = 0.60$), so we averaged the scores of items loading on MI and BN to create a composite measure of each. However, for HR, alpha was not within a range generally considered to indicate acceptable internal reliability ($\alpha = 0.56$).[2] Therefore, we did not create a composite score for HR. In total, we report four scores for each student, including two composites for MI and BN and two individual scores for the remaining items. In all cases lower scores signify more anthropocentric (MI), more dualistic (BN), and more hierarchical (individual items) beliefs.[3] We calculated means for MI, BN, and the two individual scores for each of the four categories of major.

To capture ethical/epistemological aspects of environmental worldviews, we developed a measure to assess the extent to which students deviate from the dominant utilitarian mode of moral reasoning. "Moral reasoning" refers to the reasons people invoke to explain how they believe they ought to behave. We presented five statements (See Appendix S1: Table A4), asking students to indicate the extent to which they agreed (or not) that each expresses an appropriate way to approach an environmental decision. Items were inspired by five ethical theories identified in the environmental ethics literature (see Des Jardins, 2001; Nelson & Vucetich, 2012), each representing a different mode of moral reasoning. According

to natural law theory, what is natural is good, and should therefore be maintained. The rights of nature refer to the idea that nature has certain moral rights, which humans should uphold. Utilitarianism suggests humans should interact with the environment in ways that maximize benefits.[4] According to virtue theory, humans should manifest certain virtues, such as care and humility, when they interact with the environment. Finally, in divine command theory, humans should interact with the environment as commanded by a divine figure.

Although we piloted this measure informally among colleagues, we acknowledge this was a highly exploratory section (and therefore a limitation) of the survey. Based on suggestive evidence generated from this measure, reported below, we highlight the development and validation of a measure of environmental moral reasoning as a direction that merits attention in future research. For analysis, we compared responses to each moral reasoning statement among major categories by conducting Kruskal-Wallis One Way Analysis of Variance on Ranks (ANOVA on ranks) and corresponding pairwise comparisons. We also calculated the proportion of students who rated utilitarianism higher than, or equivalent to, other modes of moral reasoning and compared these proportions using a chi-square test.

A final epistemology measure assessed perceptions of nonscientific (i.e., creative, artistic, philosophical) ways of knowing. We used Likert-type items developed by Goralnik et al. (2015) and had students rate 5 statements about the value of the humanities. A standard definition of the humanities was provided for reference (Stanford Humanities Center: http://shc.stanford.edu/what-are-the-humanities). Survey items were scored from 1 to 5 (strongly disagree to strongly agree). To group the items, we used principal components factor analysis, following the specifications noted above. All five items loaded on a single factor (See Appendix S1: Table A5), which we call Attitudes toward Humanities (AH). Internal reliability was good ($\alpha = 0.88$), so we averaged the five-item scores and produced one composite measure for each student (Vaske, 2008). To compare responses among major categories we conducted a similar ANOVA on the ranks procedure as described above. Higher scores correspond to more positive attitudes toward the humanities, suggesting students acknowledge the legitimacy of forms of knowledge other than the Western scientific approach generally dominating NR fields (See Appendix S1: Table A6). Students were also asked whether they want their academic program to incorporate the humanities (yes/no/unsure). We used a chi-square test to compare "yes" versus "no/unsure" responses between major categories.

3 | RESULTS

The metaphysical/ethical dimensions of worldviews (anthropocentrism, dualism, hierarchy) differed by category of major (Table 2). While evaluating environmental worldview items as a whole, slight clustering of major categories is observed (Figure 2). Forestry students have a tendency toward the bottom left quadrant of the figure, while other major categories have a tendency toward the right side of the figure. The left half of the figure is defined by survey items 1,3,5, 8, and 10 (See Appendix S1: Table A2). Agreement with these statements suggests stronger alignment with the dominant worldview. The right portion includes 2,4,6,7,9, and 11 (See Appendix S1: Table A2). Agreement with these statements suggests stronger alignment with an alternative worldview. On average,

TABLE 2 Descriptive statistics for environmental worldview index

Worldview index	Major	*N*	Mean	SD
Moral inclusion	Forestry	45	3.97	1.00
	FWAS	42	4.56	0.83
	NR	41	4.60	0.66
	Other	90	4.13	0.99
Bond with nature	Forestry	45	3.74	1.08
	FWAS	42	4.02	0.98
	NR	41	4.16	0.89
	Other	90	3.95	1.01
Humans have the right to modify the natural environment to suit their needs[a]	Forestry	45	2.07	0.88
	FWAS	42	3.69	1.12
	NR	41	3.29	1.04
	Other	90	3.07	1.02
Humans are a top member of a hierarchy that exists in nature[a]	Forestry	45	1.80	0.83
	FWAS	42	2.95	1.21
	NR	41	3.10	1.21
	Other	90	2.60	1.27

Note: Items have been reversed coded to maintain assertion that lower scores signify stronger dominant views.

[a]Items initially included in human's role factor.

forestry students scored lower (indicating stronger dominant views) on MI (i.e., they were more anthropocentric), BN (i.e., they were more dualistic), and the scores for the two individual items, which we loosely interpret as indicating views toward hierarchy, than nonforestry students (Table 2).

For the ethics/epistemology dimension of worldviews (modes of moral reasoning), we found similarities and differences between majors (Figure 3). Virtue was rated highest by all major categories, while the divine command was rated lowest. However, whereas utilitarianism received the second-lowest ratings among nonforestry students, it received the second-highest rating among forestry students. There was a statistically significant relationship between forestry and other major categories for mean utilitarianism and rights of nature ratings (Table 3 and Figure 3). A higher percentage of forestry students also rated utilitarianism as their preferred mode of moral reasoning (Figure 4).

For our final epistemology measure of Attitudes toward Humanities, the sample overall reported favorable attitudes toward the humanities (See Appendix S1: Table A6). However, mean scores on the items included in AH were lower among forestry than nonforestry students. These differences were statistically significant between forestry and NR students (Table 4). The percentage of forestry students who would like the humanities in their program was also lower than the percentage of nonforestry students, while natural resource students expressed the most interest in the humanities. However, this difference was not statistically significant (Figure 5).

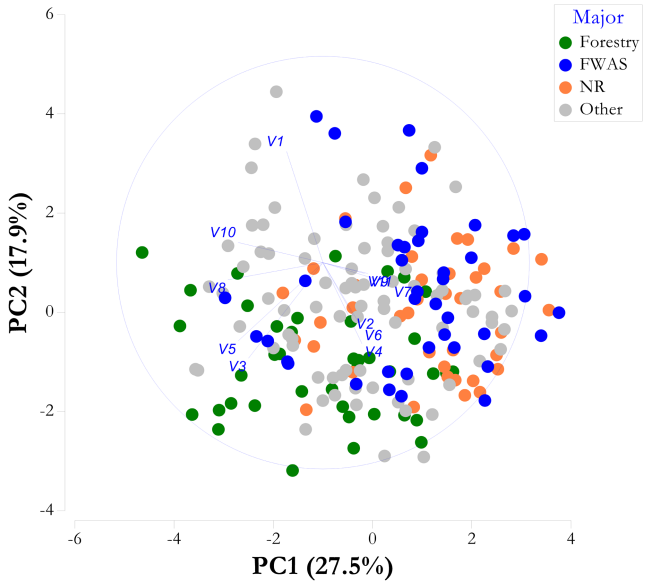

FIGURE 2 PCA of environmental worldview items by major category

4 | DISCUSSION

Overall, our sample endorsed many elements of a nondominant environmental worldview. Students generally affirmed the nonanthropocentric belief that at least some parts of nature have intrinsic value and direct moral standing, and endorsed the nondualistic belief that humans are part of the natural world. However, whereas nonforestry students generally rejected the idea that humans dominate over nature, forestry students were more accepting of this idea (Table 2). In this regard, forestry students were more aligned with the dominant Eurocentric Western view that humans are at the top of a hierarchy above nature, and nonforestry NR students did not. Forestry students also scored lowest on MI (anthropocentrism), BN (dualism), and the two items we associate with views of the hierarchy of humans over nature; providing further evidence of alignment with the dominant worldview as defined in environmental philosophy (Callicott, 1994; Crist, 2019; Mathews, 1991; Plumwood, 1993; Xu & Bengston, 1997).

Among all students, virtue was the most highly rated mode of moral reasoning, suggesting students do not see environmental

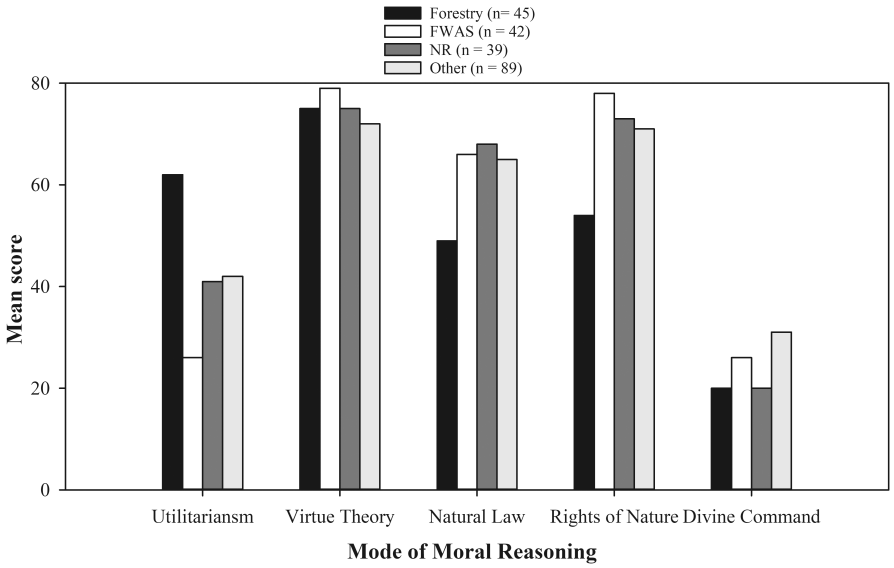

FIGURE 3 Mode of moral reasoning mean score by major category

TABLE 3 Mode of moral reasoning results for ANOVA on rank analysis ($p < .05$ in bold)

Mode of moral reasoning	Comparison	Diff. of ranks	Q	*p*-Value
Utilitarian $H = 29.174$; df = 3; **$p < .001$**	Forestry vs. FWAS	69.224	5.286	**<.001**
	Forestry vs. NR	43.819	3.324	**.005**
	Forestry vs. Other	41.137	3.68	**.001**
	FWAS vs. Other	28.088	2.453	.085
	NR vs. Other	2.683	0.232	1
	FWAS vs. NR	25.405	1.894	.35
Natural law $H = 9.621$; df = 3; **$p < .05$**	NR vs. Forestry	34.896	2.673	**.045**
	NR vs. Other	4.689	0.415	1
	NR vs. FWAS	4.020	0.304	1
	FWAS vs. Forestry	30.876	2.35	.113
	FWAS vs. Other	0.670	0.059	1
	Other vs. Forestry	30.207	2.694	**.042**
Rights of nature $H = 13.551$; df = 3; **$p < .01$**	FWAS vs. Forestry	45.442	3.458	**.003**
	FWAS vs. Other	14.582	1.276	1
	FWAS vs. NR	11.088	0.844	1
	NR vs. Forestry	34.354	2.648	**.049**
	NR vs. Other	3.494	0.311	1
	Other vs. Forestry	30.860	2.746	**.036**
Virtue $H = 0.779$; df = 3; $p = .85$				
Divine command $H = 2.518$; df = 3; $p = .47$				

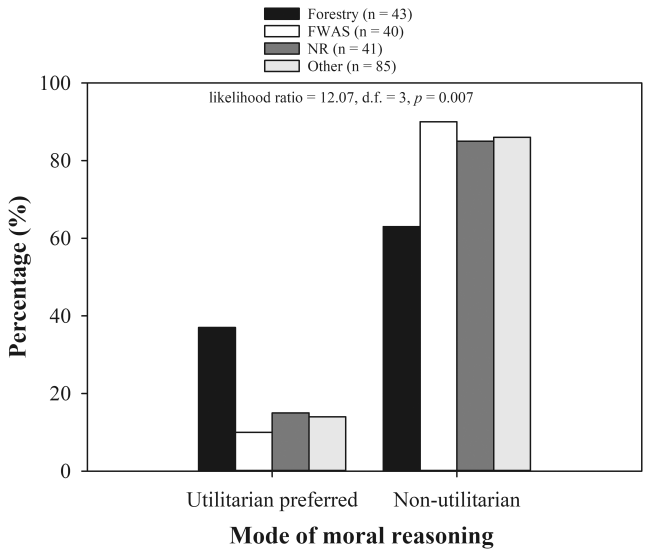

FIGURE 4 Percentage of students who prefer utilitarian mode of moral reasoning

TABLE 4 Attitudes toward humanities results for ANOVA on ranks analysis ($p < .05$ in bold)

Attitudes toward humanities	Comparison	Diff. of ranks	Q	*p*-Value
$H = 9.944$; df = 3; **$p < .019$**	NR vs. Forestry	37.033	2.814	**.029**
	NR vs. Other	19.912	1.734	.498
	NR vs. FWAS	4.941	0.367	1
	FWAS vs. Forestry	32.092	2.423	.092
	FWAS vs. Other	14.971	1.292	1
	Other vs. Forestry	17.121	1.527	.760

decision-making as only a calculation of benefits relative to costs (Figure 3). Nonetheless, forestry students did strongly endorse utilitarian reasoning, and more forestry than nonforestry students indicated utilitarianism as their preferred mode of moral reasoning (Figure 4).

On the whole, although forestry students are in some ways more strongly aligned with a dominant environmental worldview than nonforestry students, we suggest this is better understood as a difference in degree, rather than of kind. Our findings corroborate with past research demonstrating generational shifts away from a strict resource-commodity orientation, and toward a perspective valuing various elements of nature for more than just their usefulness to humans (Brown & Harris, 2000; Bruskotter & Fulton, 2008; Manfredo et al., 2020; Martin & Steelman, 2004; Xu & Bengston, 1997).

Our work here can be situated within this body of research, documenting the continuation and ongoing evolution of a trajectory of worldview diversification that initiated several decades ago. However, our study also builds on this work by articulating the characteristics of environmental worldview shift in more nuanced philosophical terms.

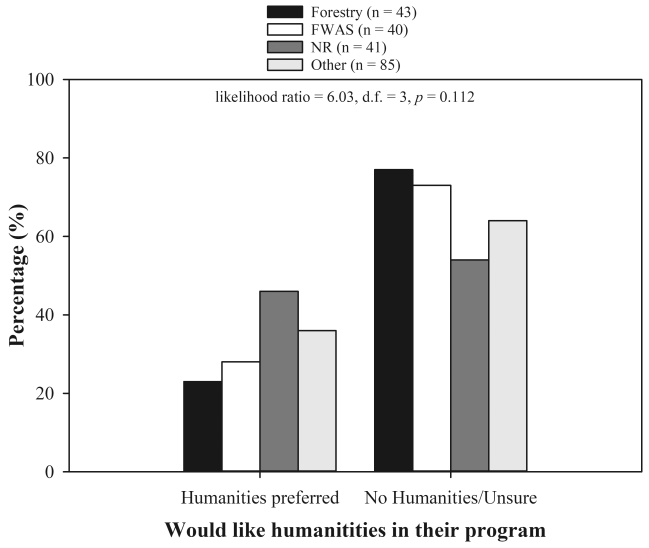

FIGURE 5 Percentage of students who would like humanities as part of their undergraduate program

In an exploratory capacity, this study suggests interesting trends meriting investigation at a broader scale. Our results suggest there is already some worldview diversity in NR at OSU, which inspires the hypothesis that similar diversity might exist in other undergraduate NR programs. Yet this hypothesis also leads us to wonder whether current NR programs are set up to support students with worldviews different from the dominant worldview. Enrollments in traditional NR programs, including forestry, have been declining (Bal & Sharik, 2019a, 2019b; Sharik et al., 2015). In part, this may be because incoming students do not find resonance in the ethical, metaphysical, and epistemological orientations of some NR programs. Institutionally, some suggest NR remains largely aligned with the dominant (anthropocentric, dualistic, hierarchical, utilitarian, mechanistic) worldview (Crist, 2019), or at least perceived to be thusly aligned by prospective students. It may be important to consider how NR programs could re-define or re-invent themselves to remain relevant and attract students.

Given student interest in the humanities, one strategy might be to increase offerings in the humanities within NR programs. However, while overall our sample reported positive attitudes toward the humanities (see Appendix S1), most respondents were unsure or did not want humanities studies as part of their degree program (Figure 5). This finding suggests that while NR students recognize the value of alternative ways of knowing, they either believe science is sufficient to understand and manage interactions between humans and the environment, or they fail to appreciate the relevance of the humanities in this regard. This view is inconsistent with scholarship suggesting a rich array of disciplinary perspectives (including the humanities) is required to address wicked environmental challenges (Allen & Gould, 1968; Balint et al., 2011; Brown et al., 2010; Hulme, 2011). There are many ways NR programs might be expanded to incorporate the humanities. For example, readings or even courses in environmental philosophy, ethics, or history could be integrated into the curricula of introductory, elective, or capstone courses. Programs might also develop short courses or one-credit seminars featuring guest lecturers from humanities programs across campus. Through these or other channels, integrating scholarship from the humanities into NR programs may equip students not only to become better environmental problem solvers but also to build vocabularies and skills allowing them to express and critically evaluate aspects of both dominant and nondominant worldviews. In this way, NR programs can create space for, and give voice to, diverse people expressing diverse perspectives.

Finally, students entering NR fields should be appreciated as complex individuals who bring different values, beliefs, and ways of knowing. Programs that do not intentionally create space for diverse perspectives may alienate students who hold alternative values and beliefs, or force them to assimilate to prevailing institutional norms; thus flattening an important yet often invisible and unacknowledged dimension of diversity (e.g., see discussions in Wolsko et al., 2006, Marvasti & McKinney, 2011, also Lee, 2019). Educators need to understand the environmental worldviews of their students in order to meet aspiring NR professionals where they are, designing programs that broaden students' horizons while also nurturing their unique beliefs and experiences. We challenge readers to reflect on current diversity efforts and ask how NR might at once remain committed to reducing social inequities while also considering invisible but nonetheless critical elements of diversity. We encourage the NR community to broaden its definition of diversity to include environmental worldviews by actively recruiting, retaining, and supporting students (and faculty, staff, and partners) who represent diverse worldviews.

AUTHOR CONTRIBUTIONS

Sativa Cruz: Conceptualization (lead); data curation (lead); formal analysis (lead); investigation (lead); methodology (lead); project administration (equal); resources (equal); supervision (equal); validation (lead); visualization (lead); writing – original draft (lead); writing – review and editing (lead). **Chelsea Batavia:** Conceptualization (equal); data curation (equal); formal analysis (equal); investigation (equal); methodology (equal); resources (equal); validation (equal); writing – original draft (equal); writing – review and editing (equal). **Ivan Arismendi:** Formal analysis (lead); investigation (equal); methodology (equal); visualization (lead); writing – review and editing (equal). **Ana Spalding:** Formal analysis (equal); investigation (equal); methodology (equal); validation (equal); writing – review and editing (equal). **Michael Paul Nelson:** Conceptualization (lead); data curation (equal); formal analysis (equal); funding acquisition (lead); investigation (lead); methodology (equal); project administration (lead); resources (equal); supervision (lead); validation (equal); visualization (equal); writing – original draft (equal); writing – review and editing (equal).

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OPEN RESEARCH BADGES

This article has earned Open Data and Open Materials badges. Data and materials are available at https://doi.org/10.5061/dryad.qrfj6q5jw; the dataset is complete and analysis should be reproducible using methodology within manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study is deposited in Dryad. https://doi.org/10.5061/dryad.qrfj6q5jw.

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ENDNOTES

[1] Total undergraduate enrollment was 23,566 in Fall 2017 and 23,849 in Spring 2018. College of Forestry undergraduate enrollment was 882 in Fall 2017 and 850 in Spring 2018.

[2] One item was removed from the HR score to improve reliability (See Appendix S1: Table A3).

[3] Certain items were reversed coded (See Appendix S1: Table A3).

[4] Although the item allowed a non-anthropocentric interpretation, we expect most students interpreted "benefit" in anthropocentric terms.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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