

1 **Students of color speak on racial equity in environmental sustainability**

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13 **ABSTRACT:** Racial and ethnic diversity in environmental sustainability advances social equity
14 and innovation solving social-ecological crises. Yet, Black, Indigenous and people of color
15 (BIPOC) remain underrepresented in sustainability fields despite high environmental concern.
16 Universities provide pathways to sustainability careers and help diversify the field by making
17 programs more equitable and inclusive for racially minoritized students. Toward this end, we
18 interviewed undergraduate BIPOC students in interdisciplinary environmental and sustainability
19 degree programs about their experiences. Their observations reflect a legacy of systemic racism
20 that persists today within environmentalism. Many described motivations connecting ecological
21 and social well-being but lamented limited interdisciplinary and global perspectives in the
22 curriculum. Experiences of discrimination, lack of relatability, and limited discussions of race
23 led to feeling isolated and excluded. Support networks, extracurricular participation, and BIPOC-
24 specific opportunities improved student inclusion and belonging. BIPOC students hold
25 knowledge unapparent to non-marginalized groups that illuminates pathways to racial equity in
26 environmental sustainability.

27 Global-scale environmental changes driven by human activities are occurring at
28 unprecedented rates, disrupting the Earth's climate system,¹ exceeding planetary boundaries,²
29 threatening biodiversity,^{3,4} and degrading ecosystem services with negative impacts
30 disproportionately affecting the poor and other marginalized populations.⁴⁻⁶ Because
31 environmental changes arise from political, economic, and cultural driver⁵ transforming political
32 economic systems to advance sustainable development requires cross-sector cooperation
33 characterized by inclusive decision-making that embraces human diversity.⁶ Yet in the U.S. and
34 Europe,⁷ the environmental movement and related disciplines remain predominantly white⁸⁻¹⁰
35 despite Black, Indigenous, and people of color (BIPOC) demonstrating high environmental
36 concern¹¹⁻¹⁴ and comprising the majority of environmental justice activists.^{9,15}

37 Bridging this racial/ethnic gap matters for both instrumental and normative reasons.
38 Achieving sustainability requires multi-dimensional thinking suitable to the complexity of socio-
39 ecological systems.¹⁹ Identity diversity contributes to cognitive diversity within groups, and
40 teams with greater cognitive diversity produce more successful outcomes in the context of
41 complex problems.²⁰⁻²² Thus, racial/ethnic diversity advances sustainability. More important
42 than arguments regarding the instrumental value of BIPOC to environmental sustainability,
43 however, is the fact that the environmental field continues to lag behind other scientific fields
44 with respect to racial/ethnic diversity.¹⁶ Environmental employment opportunities are growing.¹⁷
45 In an equitable society, people of all races and ethnicities would have access to expanding career
46 opportunities. A racially/ethnically diverse environmental workforce also helps advance
47 environmental justice. Environmental injustices, such as the Flint, Michigan water crisis¹⁸ and
48 threats to the Standing Rock Sioux Tribe's water quality and cultural heritage from the Dakota
49 Access Pipeline,^{19,20} arise in part through BIPOC's exclusion from environmental decision

50 making.¹⁵ Greater racial/ethnic diversity within the environmental field enables BIPOC to
51 influence environmental conditions through management, research, policy, education, and other
52 practices in the wide range of sustainability fields.

53 Interdisciplinary environmental and sustainability (IES) degree programs offered at
54 colleges and universities are expanding.²¹ Yet, despite possessing strong interest in and
55 preparation for environmental careers,²² BIPOC students tend not to select environmental majors
56 due to programmatic attributes. These attributes include curriculum, which signals to prospective
57 students the program's values, and compositional diversity, which suggests to BIPOC students
58 the likelihood of a welcoming climate and academic success.²³ Universities can open pathways
59 to environmental careers for BIPOC by increasing IES programs' racial/ethnic diversity
60 (compositional race and ethnicity demographics of the student body), equity (ensuring BIPOC
61 access to resources, opportunity, and advancement), and inclusion (creating a culture where
62 BIPOC students feel supported, empowered, and represented).²⁴ Furthermore, diversifying IES
63 programs can improve learning outcomes for *all* students by preparing them to participate in an
64 increasingly diverse workforce and society, but only when a critical mass of BIPOC are present
65 *and* IES programs optimize conditions for cross-cultural interactions.^{25,26}

66 Towards the aim of identifying ways to make IES programs more racially/ethnically
67 inclusive, we investigated the experiences of undergraduate BIPOC students in IES programs at
68 two private universities in a major metropolitan region of the midwestern U.S. We used
69 grounded theory methodology²⁷ within an action research²⁸ approach that involved collaboration
70 among stakeholders experiencing a problematic experience (BIPOC students) and professional
71 researchers (faculty) to collect and analyze data supporting action towards a more just situation.
72 We interviewed 24 students with declared environmental majors who self-identified as BIPOC

73 about their motivations for studying the environment, positive and negative experiences within
74 their IES program, and recommendations for making it more diverse, equitable, and inclusive.
75 Interview analyses illuminated how racial/ethnic identities influence students' educational
76 experiences and offer transferable insights, while the action research approach provides a model
77 that IES programs can adapt to generate their own context-specific knowledge and strengthen
78 pathways for BIPOC students to sustainability careers.

79 **Results**

80 Interviewees described varying influences that led them to choose an environmental
81 major (Supplementary Table 1), such as encouragement from an *influential person* like a college
82 professor, high school teacher, friend, or parent; experiences during *prior education* (e.g., field
83 trip, project, or course) *or involvement* with an environmental issue in their neighborhood. Two-
84 thirds of participants further expressed that their interest in studying the environment arose from
85 recognizing the *interdependence of ecological and human well-being*. For some, this realization
86 grew from witnessing environmental injustice: "I have family who live in areas that just feel
87 completely forgotten about. Like trash everywhere, pollution everywhere . . . I could have the
88 tools to at least try to clean up some of those areas and make them nicer for everyone to live in."
89 Others emphasized an inherent connection between people, nature, and culture: "I'm a
90 backpacker, and it was more than just being fascinated by nature, I realized how . . . I care about
91 my ancestors, I care about where my food comes from, I care about understanding the
92 connection of the world."

93 Yet, within their IES degree programs, BIPOC students described observations and
94 experiences that led them to feel isolated and excluded (Figure 1, Supplementary Table 2).
95 Multiple students observed *little compositional diversity* within classes for their major consisting

96 of mainly white students and faculty. Some contrasted this with general education courses where
97 the class composition was more racially/ethnically diverse. Some interviewees also reported that
98 environmental student clubs and internships lacked diversity. For instance:

99 I'm usually the only person of color or one of very few people of color in my classes for
100 my major . . . also that's reflected in the organizations I'm a part of. I am the only person
101 of color on [the executive board of the student environmental club] and I was the only
102 person of color in [that] club, which at one point had 40 members. . . . Sometimes I feel I
103 have to be the voice of poor people of color because they're not in my classes or they're
104 not in the organizations I go to. Not saying that the people that are there are oblivious
105 [but] I feel like you don't think about race as much as someone who is actually affected
106 by their race.

107
108 Predicaments like this left several students feeling frustrated, angry, or out of place. As one said,
109 "The most I'm going to see a person of color working at [this university] is probably at [the
110 dining services], and that's really messed up, that makes me really sad."

111 Participants also observed *limited interdisciplinary and global perspectives*, which
112 conflicted with their own understanding that social and ecological issues intersect. BIPOC
113 students described the social implications of science to be understudied in their majors. Although
114 both universities' IES curricula include natural science, social science, and humanities courses,
115 students reported that content about how environmental science affects different racial/ethnic
116 groups was often limited to elective courses like environmental justice. One reflected: "I feel like
117 some [professors] wouldn't even be able to talk to a student of color about race . . . it's like,
118 'This is a science class. We're gonna talk about hard, empirical facts here' . . . So if someone
119 were to bring up racism . . . it's like 'I'm gonna hit you with the empirical facts' and deny the
120 lived experiences of these people." Some BIPOC students recounted examples where faculty and
121 peers purported a "white environmentalism" by offering solutions to environmental problems
122 that would be incompatible for many BIPOC and portending to fix environmental problems
123 experienced by BIPOC as a "white-savior" who knows best. Furthermore, some interviewees

124 expressed dismay that the curriculum emphasized a predominantly white male canon while
125 ignoring contributions by BIPOC to the environmental field. As one said:

126 I love Aldo Leopold but if I'm asked to read *A Sand County Almanac* one more time, I'll
127 be a little mad. We could read so many books about ecology that aren't written by old
128 dead white men but we almost never do. I know that obviously the field is dominated by
129 older, or dead, white men from America or Europe, but there are so many people working
130 in this field in other places with different problems and solving them in different ways.
131 And we just don't really talk about it.

132
133 Some participants described *experiencing discrimination*, more often from peers than
134 faculty or staff. They reported moments where others ignored or dismissed their experiences in
135 class discussions, thereby invalidating their racial/ethnic reality. One reflected, "I feel like the
136 small microaggressions are more of like, 'Really, you've gone through that?' . . . Kinda not
137 believing." Others described sensing an "us versus them" mentality in the tone of professors or
138 peers who used vague language to refer to groups of people: "It's like you can tell how someone
139 owns the word. People can say 'they' or 'black people' and it feels and sounds totally different."
140 One student described feeling tokenized:

141 I'm [an] intern and there was an instance where my supervisor referred to me as an
142 African-American student . . . in an email sent to multiple people. And did not recognize
143 me by name or mention that I am [an] intern, a position I worked very hard for. He just
144 said I was an African American student in [this department]. And I feel like that's a
145 disservice to the hard work that I put in. And it's very disrespectful, it's very tokenizing.

146
147 These direct observations □ little compositional diversity; limited interdisciplinary and
148 global perspectives in the curricula; and/or personally experiencing discrimination □ led BIPOC
149 students to feel excluded and isolated (Figure 2). Some participants reported that peers or faculty
150 seemed unable to empathize with their lived experiences. This *lack of relatability* left BIPOC
151 students feeling disconnected from their IES programs. As one said, "You're not gonna
152 understand my struggle because you don't live it, you don't see it." Another explained, "Some
153 people will never know what it's like to live in a food desert, what it feels like to live in a

154 neighborhood where there are more liquor stores than there are grocery stores . . . So there is this
155 disconnect when [peers] talk about some stuff.” A few encountered difficulty making friends.
156 One reflected, “I wouldn’t say I’ve ever felt like I’ve been treated differently because of my race
157 or ethnicity, but I definitely think it’s harder to create friendships.”

158 This lack of relatability left some interviewees feeling frustrated or disheartened to
159 participate in class discussions. They described feeling bewildered by white peers’
160 interpretations of events or issues; yet, many felt uncomfortable sharing their own perspectives.
161 These BIPOC students observed that white faculty and peers rarely raised questions about race as
162 it related to course content. One shared, “For a while I just didn’t ask questions . . . I was just
163 like, ‘I’m gonna just sit here and let it go.’ But definitely my junior and senior year that was
164 when I really was like, ‘I’m just sick of sitting in these classes and no one questions anything,’ or
165 they might have questions but they’re not the type of questions that I wanna ask.” A handful of
166 interviewees described themselves as outspoken; however, most discussed feeling reluctant to
167 raise questions or offer comments in class related to race, social justice, or personal experiences.
168 Several expressed worries about being judged or upsetting others. As one said, “I sometimes
169 don’t say anything on purpose because I don’t want to make some people uncomfortable.” These
170 students felt more open discussing race in some contexts than others. One reflected, “Sometimes
171 if I’m in a class . . . which is predominantly white . . . I wait like two or three classes and see,
172 ‘Am I actually going to speak in this class? Or is this a class where I’m just on my laptop, where
173 I’m quiet?’” Another said, “‘Am I gonna be judged?’ That question always arises in my head.
174 And, sometimes I’m more comfortable than others, but I feel like to be truly comfortable, that
175 shouldn’t really be a thought.” This *limited discussion of racial/ethnic identities* arose from the
176 lack of compositional diversity in the classroom as well as white students’ and professors’

177 limited ability and/or willingness to discuss race.

178 Several participants suggested that little compositional diversity, limited interdisciplinary
179 and global perspectives, and lack of discussions about race within their IES degree programs led
180 to *limited social consciousness for all* students (Figure 2). One reported, “I feel like [white peers]
181 don’t want to speak [about environmental racism] because there’s minorities in the room, so they
182 stay silent and they have no opinions.” Another reflected, “. . . it’s not so much [that white peers]
183 give ideas . . . that I feel are inherently racist but the fact that there are [not] any ideas that are
184 outside of their race . . .” A lack of racial/ethnic diversity restricts learning for all students; yet,
185 the complexity of achieving sustainability requires learning across diverse cultures. One student
186 explained, “I went to this conference and I was like one of three brown people in a room full of
187 like one hundred. So that’s constantly repeated, and . . . I don’t think you can talk about
188 sustainability if you’re not getting the issue from all perspectives.”

189 BIPOC students also reported positive experiences within their environmental majors that
190 fostered some sense of inclusion and belonging (Figure 1, Supplementary Table 3). Several
191 received *support from faculty, staff, or peers* who listened to and acknowledged their experiences
192 or assisted them towards achieving their goals. One shared, “I’ve grown as a student, in ways
193 that I’m very happy with, and a lot of that has to do with the help that [professors] offered me,
194 and just the fact that they’ve been respectful of me as a student.” While many interviewees felt
195 supported by faculty or staff, some reported that they had to seek out that support. Others noted
196 that faculty/staff support mainly focused on academics or career development. Participants often
197 felt more comfortable discussing issues related to race with friends. Roughly half described
198 deriving support from friendships with peers. A BIPOC student shared, “One of [my friends] I
199 have three classes with him and he’s one of my other supports. He’s white, but he’s a white

200 immigrant . . . And, he is a minority, too . . . because he's gay . . . And he understands . . . his
201 privilege, too, and he reflects upon them and he kinda has my back." Some interviewees simply
202 described neutral relationships: "I wouldn't say that my peers necessarily want me to fail but I
203 wouldn't say they have overtly cheered me on either."

204 *Extracurricular participation* in student organizations, internships, or faculty research
205 within their IES program or, slightly more often, the university at large helped participants to
206 connect with others and feel comfortable being themselves. One reflected:

207 I often talk about the lack of diversity and inclusion within the environmental field, and
208 I'm actually trying to start a campaign to increase the number of environmentalists [of
209 color] on [this] campus, and people in the [student] environmental organizations have
210 been very supportive with that and helping me get that started, but also just listening to
211 the issues that I see when I'm mentioning it and being receptive to it instead of reactive.

212
213 Students' involvement beyond the IES program often, but not always, occurred through cultural
214 organizations. One shared, "I'm [in] a Filipino student organization. And so, when I'm there, I
215 can speak freely about my experiences." Yet, not all interviewees felt comfortable or had the
216 opportunity to join clubs, as we describe below.

217 Several participants benefited from *targeted opportunities* for BIPOC students, such as
218 scholarships, grants, internships, research positions, or organizational membership. Some had not
219 directly benefited but nonetheless valued the existence of such opportunities. One said:

220 . . . a lot of those internships I've applied for had a lot of those disclaimers like, 'We
221 encourage minorities, and women, and people of color.' I actually really enjoy those . . .
222 it shows to me that they wanna increase diversity amongst their staff and get those
223 opportunities out there. Not necessarily like . . . you're gonna get the job, because you
224 have to be qualified of course. But, a lot of the [university] sponsored internships that
225 I've looked for have had that disclaimer and I enjoy them a lot.

226
227 Stories about feeling supported, engaging in extracurricular activities, and recognizing
228 targeted opportunities implied some degree of belonging (Figure 2). Unlike others who described
229 discomfort discussing experiences related to their racial/ethnic identities, some BIPOC students

230 felt *comfortable discussing race* in the classroom or with peers. One reflected, “The people that
231 I’ve had classes with . . . try to be as respectful as possible when bringing [race] up, and then are
232 very much willing to listen, and some teachers will actually directly acknowledge and say, ‘I’m
233 white and middle class, so I may not know the whole situation.’” Notably, students felt
234 comfortable speaking about their racial/ethnic identities most often in courses like environmental
235 sociology, environmental ethics, or environmental justice.

236 Despite these positive aspects of some participants’ experiences as environmental majors,
237 others identified *barriers to participation* (Supplementary Table 2) that prevented them from
238 realizing e support, networks, and opportunities. Being a commuter student, working to meet
239 financial needs, or fulfilling family responsibilities made it difficult for some BIPOC students to
240 participate as much as they would like: “I’m busy, I have a lot of work and I have
241 responsibilities, I take care of my sisters . . .” A few identified lacking a career-related social
242 network as an obstacle: “I didn’t know about any [opportunities] because you have to know
243 people in the environmental community to do it and if you don’t know anybody it’s hard.” The
244 discomfort of being BIPOC in a majority white setting, as reported earlier, also prevented some
245 from participating in clubs, internships, or related opportunities. Along with reducing these
246 barriers, interviewees offered several recommendations for making their IES program more
247 inclusive of BIPOC students (Table 1, Supplementary Table 4).

248 Table 1. Black, Indigenous, and people of color (BIPOC) students identify ways to make IES
 249 degree programs more inclusive of people from all races.

Recommendations	Illustrative quotes
<p><i>Integrate BIPOC voices into the curriculum</i> (For example: incorporate literature by BIPOC, include Indigenous perspectives, invite BIPOC as guest speakers, address social justice within courses, partner with local communities in course projects)</p>	<p>“one goal is to increase environmental literacy, so if [faculty] were to include minority environmental writers and put it into the lesson plan and curriculum that would be awesome”</p> <p>“with environmental science, you talk about environmental justice and you talk about the injustice being done to people of color, and when professors talk about that it seems like they’re just reading off the slides. It doesn’t seem like they’re really going into it . . . I feel like [the program] needs to go deeper into those types of issues”</p>
<p><i>Train faculty/staff in diversity, equity and inclusion</i></p>	<p>“It’d also be great if professors all had some sort of diversity training . . . I feel like a lot of people don’t recognize . . . the ways in which people of color have to navigate the world versus someone who is white.”</p>
<p><i>Hire racially/ethnically diverse faculty/staff</i></p>	<p>“I definitely wish that there were more professors of color, who understand the need to talk about these issues from a different perspective.”</p> <p>“it’s encouraging, too, to see people you can more closely identify with in leadership roles”</p>
<p><i>Recruit BIPOC students</i> (For example: invite BIPOC students currently in the major to speak at high schools or campus orientation)</p>	<p>“I feel like there’s just a need to get more students in there that are minorities.”</p>
<p><i>Create resources to support BIPOC students</i> (For example: financial scholarships, research opportunities, student groups)</p>	<p>“I would love to see a student group that are students of color interested in environmentalism . . . focused on supporting each other and career development and leadership development . . . and maybe . . . have workshops or teach-ins about environmental justice issues and have guest speakers come in . . . so it would be a way that they’re supporting each other but then they’re also teaching the [university] community about these issues as well.”</p>

251 **Implications for IES degree programs.** Our results align with prevailing research on BIPOC
252 students' sense of belonging in scientific, technology, engineering, and mathematics (STEM)
253 fields. Belonging, which refers to "the experience of mattering or feeling cared about, accepted,
254 respected, valued by, and important to the campus community,"²⁹ can affect students' academic
255 satisfaction, grades, and retention. In STEM, white men are more likely to feel that they belong,
256 while women and BIPOC students are more likely to find scientific fields unfriendly,
257 unsupportive, or hostile.^{29,30} In the present study, limited racial/ethnic compositional diversity
258 among students and faculty combined with white dominated curricula left many interviewed
259 BIPOC students feeling excluded and isolated. Their observations and experiences reflect a
260 legacy of systemic racism that persists today within environmentalism.³¹⁻³⁴

261 Participants offered recommendations to address this racism (Table 1). Among these,
262 hiring faculty of color will require IES programs at predominantly white institutions to
263 reconsider every step of the hiring process from crafting the job description through candidate
264 selection to actively reject biases towards whiteness.³⁵ Increasing compositional diversity of
265 faculty, staff, and students without changing aspects of organizational culture and structure that
266 reinforce white dominance can harm BIPOC. IES programs also must attend to historical,
267 organizational, psychological, and behavioral dimensions that influence the learning
268 environment.^{36,37} Toward this end, BIPOC students recommended providing equity and inclusion
269 training for all faculty and staff; integrating the curriculum to acknowledge BIPOC, the
270 worldviews of marginalized groups, and the social implications of science; and dedicating
271 resources to specifically support BIPOC students. Faculty, staff, and administrators
272 implementing such changes can draw upon research literature on promoting racial equity in
273 STEM education³⁸⁻⁴¹ and should be prepared to persist through resistance.⁴²

274 This study catalyzed practical steps to increase racial diversity, equity, and inclusion at
275 both study sites, including forming dedicated committees to facilitate change, faculty/staff
276 training, pedagogical revisions, review of hiring practices, and financial and other supports (e.g.,
277 peer mentoring) for BIPOC students. Participants' recommendations might apply differently in
278 other contexts; however, the action research approach transfers across settings. Standpoint theory
279 emphasizes that marginalized groups, in this case BIPOC students, hold knowledge based on
280 their social positions that is inapparent to non-marginalized groups; thus, research on
281 racial/ethnic diversity within IES degree programs should start with the perspectives of BIPOC
282 students.³³ Other IES programs can engage in action research that involves BIPOC students and
283 faculty as co-researchers to learn about the experiences of BIPOC in their own institutions and
284 then tailor programmatic changes to improve the learning environment accordingly.

285 It is important to keep in mind a limitation of our study: grouping students of distinct
286 racial/ethnic identities under the umbrella of BIPOC overlooks the unique experiences of
287 different racial/ethnic groups and nuances of students' intersectional experiences.⁴³ Pathways to
288 belonging within higher education differ among students' unique, multifaceted identities;²⁹ thus,
289 this is an important area for further research. Nonetheless, this study offers a transferable process
290 for investigating the experiences of BIPOC students in IES programs and documents their
291 insights and recommendations for shifting the environmental field from a narrow "white
292 environmentalism" to one that embraces the diverse perspectives and approaches required for
293 solving complex social-ecological crises.

294 **Methods**

295 We followed an action research approach employing grounded theory methodology.
296 Action research involves a democratic process by which stakeholders experiencing a problematic

297 situation and professional researchers collaborate to collect and analyze data that supports action
298 leading to a more just situation. Together, the professional researchers and stakeholders define
299 the research questions and cogenerate knowledge about them for the express purpose of taking
300 action to promote social change.²⁸ The study began when Espedido and Rivera, both BIPOC and
301 IES students, raised concerns with faculty (Schusler and Chaudhary) about the lack of
302 racial/ethnic diversity within their degree programs. The two initially sought to recruit more
303 BIPOC students to the programs but quickly realized through conversations with admissions
304 personnel that recruitment alone would not guarantee prospective students' ability to attend the
305 university nor their retention once enrolled. At this point, Chaudhary, Espedido, Rivera, and
306 Schusler decided that investigating the experiences of currently enrolled BIPOC students could
307 usefully inform actions towards increasing racial/ethnic diversity, equity, and inclusion within
308 IES programs. These 4 designed the research and 5 other BIPOC students (Engel, Hernández,
309 Howerton, Marcos, Sepp) subsequently joined the research team and contributed to data
310 collection, analysis, and/or reporting. Thus, the 9-member research team included 2 professional
311 researchers and 7 BIPOC students, with the latter holding dual roles as participants and
312 researchers.

313 We selected grounded theory methodology to prioritize BIPOC experiences rather than
314 preconceived conceptions about their experiences. Grounded theory involves “*developing*
315 theories from research grounded in data rather than *deducing* testable hypotheses from existing
316 theories” (italics in original).²⁷ We followed a constructivist approach to grounded theory
317 through which we aimed to elucidate the research problem of increasing racial/ethnic diversity,
318 equity, and inclusion in undergraduate IES degree programs through our interactions with
319 participants and their perspectives. Our resulting explanations offer interpretive depictions of the

320 phenomenon studied -- students' of color experiences as undergraduate environmental majors --
321 not exact representations,²⁷ although we sought to develop as robust an interpretation of the data
322 as possible. Semi-structured interviews⁴⁴ comprised the data collection method. The research
323 was approved by two university research ethics boards, one at each study site.

324 The use of action research with BIPOC students holding dual roles as researchers and
325 participants strengthened the study. Sharing racial/ethnic identities, or even sharing experiences
326 across different racial/ethnic identities, can foster coherence among participants and researchers
327 that enhances the rigor of research findings.⁴⁵ Each student on the research team who conducted
328 interviews was an experienced facilitator in conversations about race and ethnicity. That they
329 also identified as BIPOC in environmental majors positioned them with a high degree of
330 relatability to both the interviewees and the social contexts of the study sites. Sharing these
331 aspects of identity with participants improved rapport and reduced the likelihood of researcher
332 reactivity.⁴⁶ One can logically expect that BIPOC students would respond more openly and
333 frankly to questions posed by a BIPOC peer than faculty (even BIPOC faculty), given the more
334 equitable power relationship between peers.

335 It was important, however, that BIPOC students on the research team did not allow their
336 own experiences to bias their interpretations of the data.⁴⁶ Responding themselves to the
337 interview questions in an interview conducted by another member of the research team allowed
338 each student researcher to gain awareness of their own perceptual lenses and thereby minimize
339 the undue influence of these as they conducted the research. That BIPOC students led data
340 collection and analysis, along with the research team's prolonged engagement in the study
341 settings and use of peer debriefing during analysis, assured the results' credibility. An audit trail
342 documenting the research team's intentions, instrument development, raw data, reduced data,

343 data synthesis, and process notes about methodological and analytic decisions provided
344 dependability and confirmability of results.⁴⁷

345 **Study Sites.** The study took place at two private universities in a major metropolitan
346 region of the midwestern U.S., each enrolling over 10,000 undergraduates at the time of data
347 collection (2017-2018). Both were majority white institutions with 38.7% BIPOC among the
348 entire student body at site 1 and 39.0% at site 2. Site 1 enrolled 291 undergraduates in six majors
349 related to environmental sustainability; 29.4% of these majors identified as BIPOC. Site 2
350 enrolled 166 undergraduates as environmental science or studies majors, of whom 20.5% were
351 BIPOC. Both programs feature multi-disciplinary curricula that stress environmental and social
352 sciences and humanities, Earth and ecological systems sciences, and undergraduate research
353 experiences.

354 **Participants.** Using purposeful sampling,⁴⁴ we invited students with declared
355 environmental majors at each school who self-identified as BIPOC to participate in an interview.
356 On 2 to 3 occasions, the academic dean or department chair at each site e-mailed the study's
357 recruitment message to all undergraduate environmental majors. The e-mail invited those
358 identifying as a racial/ethnic minority in the U.S. to contact the researchers if they would like to
359 take part in an interview. Twenty-four students of varied racial/ethnic backgrounds participated
360 (Table 2), including the 7 BIPOC students on the research team (5 at Site 1 and 2 at Site 2). The
361 racial/ethnic composition of interviewees' home communities as well as the primary or
362 secondary education schools they attended also varied. Some grew up in predominantly
363 communities of color, others in largely white communities, and only a few in areas with a mix of
364 racial/ethnic diversity. All interviewees provided documented informed consent before
365 participating in data collection.

366 We concluded data collection upon identifying several theoretically and practically
 367 important emergent themes; however, we do not claim to have reached theoretical saturation in
 368 sampling. A study limitation relates to analyzing the experiences of BIPOC students as one
 369 group when participants possessed widely diverse racial/ethnic identities. To ensure
 370 confidentiality, we could not differentiate results by participants' specific racial/ethnic identities,
 371 as some may be the only student with that precise racial/ethnic identity in their major. Our results
 372 do not take into account differences in experiences across distinct racial/ethnic groups nor
 373 students' intersectional experiences.⁴³ Yet, what might be meaningful for a male African-
 374 American student might not apply in the same way, or at all, to a female Mexican-American
 375 student, for example. In future studies, it would be fruitful to illuminate such intersectional
 376 nuances of BIPOC students' experiences.

377

378 Table 2. Racial/ethnic identities of students interviewed. All resided in the United States.

	Site 1	Site 2	Total
African-American	3	0	3
Asian-American (including Burmese, Chinese, Filipino, Vietnamese)	5	2	7
Latinx (including Ecuadorian, Mexican)	2	4	6
Mixed races/ethnicities (including Arabic-White, Asian-White, Black-White, Chinese-Vietnamese, Japanese-Puerto Rican, Mexican-Filipina, Puerto Rican-Mexican-White)	5	3	8
Total	15	9	24

379

380 **Data collection.** We conducted in-depth, semi-structured interviews with participants
381 individually or, more often, in small groups of 2- 3 students from May, 2017 to June, 2018.
382 Taking place on participants' respective campuses, the interviews lasted from 30 to 90 minutes.
383 The interview guide (see Supplementary Information) began with questions about the student's
384 decision to attend that specific university and select an environmental major, prior educational
385 experiences, and extra-curricular involvement. We then inquired about students' perceptions of
386 how their racial/ethnic identities influenced their experiences within the environmental major.
387 We asked them to discuss their experiences in the major both in and out of the classroom,
388 including their comfort speaking with peers and professors about race, instances of overt or
389 covert racism, opportunities available to them as BIPOC students, and whether they felt
390 supported by faculty, staff, and peers. Finally, we invited interviewees to recommend actions that
391 could make their IES degree program more racially/ethnically equitable and inclusive. Because
392 the interviews had the potential to raise negative experiences, such as recalling racial
393 discrimination, we provided participants with a list of mental health providers, racial/ethnic
394 identity affinity groups, and other resources available to students on campus and in the local
395 community at the interview's conclusion. Each interview was audio recorded with participants'
396 permission. The recordings began after participants' introductions so that identifying information
397 was not recorded and confidentiality was ensured. The recordings were transcribed and the
398 transcripts imported into NVivo 12⁴⁸ to manage the data for analysis.

399 **Data analysis.** Using grounded theory, we examined inductively participants' words
400 describing their experiences as BIPOC students in environmental majors. Grounded theory
401 employs an iterative process of initial coding, constant comparison, focused coding, and memo-
402 writing to identify converging and diverging patterns in the data and arrive at emergent themes.²⁷

403 To the best of our ability, we set aside preconceptions and constructed our interpretations
404 through extensive interaction with the data to develop the most acute elucidation of its meaning.

405 Initial coding involved carefully reviewing each meaningful segment of data and creating
406 a descriptive label capturing its essence. Each code was also ascribed properties describing the
407 nature of data it encapsulated. While coding a transcript, the analyst systematically compared
408 how each new segment of data related to or deviated from prior codes. This allowed for revising,
409 adding, or creating sub-codes to more robustly depict the data. Through this iterative process and
410 in communication with one another, each analyst created new codes and applied codes developed
411 by others to produce collectively a preliminary set of analytic categories. When we began
412 analysis, we managed data from the two sites separately; however, because no conflicting codes
413 arose between the data from the two sites during initial coding, we merged the datasets to
414 proceed with focused coding.

415 Two rounds of focused coding involved continuing comparative analysis of the
416 preliminary category system with the data within and across transcripts to discern which
417 categories held the most explanatory power pertinent to the research question. During focused
418 coding, the analysts substantiated some categories and re-configured others by separating,
419 combining, or otherwise synthesizing codes to most saliently reflect the data and illuminate
420 overarching ideas about the data that became the key themes reported in the results above.
421 Writing analytic memos throughout this iterative process helped the analysts refine their
422 interpretations by elaborating on the meaning of codes, documenting recurring patterns or unique
423 perspectives, identifying budding connections between codes, and exploring potential
424 relationships within and across categories.²⁷ Ongoing conversations between the analysts and,
425 periodically, with the full research team helped to reach consensus on data interpretation. Rich

426 description provided through the inclusion of multiple, illustrative quotes for each thematic
427 category in Supplementary Information (Supplementary Tables 1-4) enable readers to discern the
428 transferability of results to their own contexts.⁴⁷ For ease of reading, we removed from excerpted
429 quotes utterances common in conversation, such as repeated words, “you know,” and “like.”

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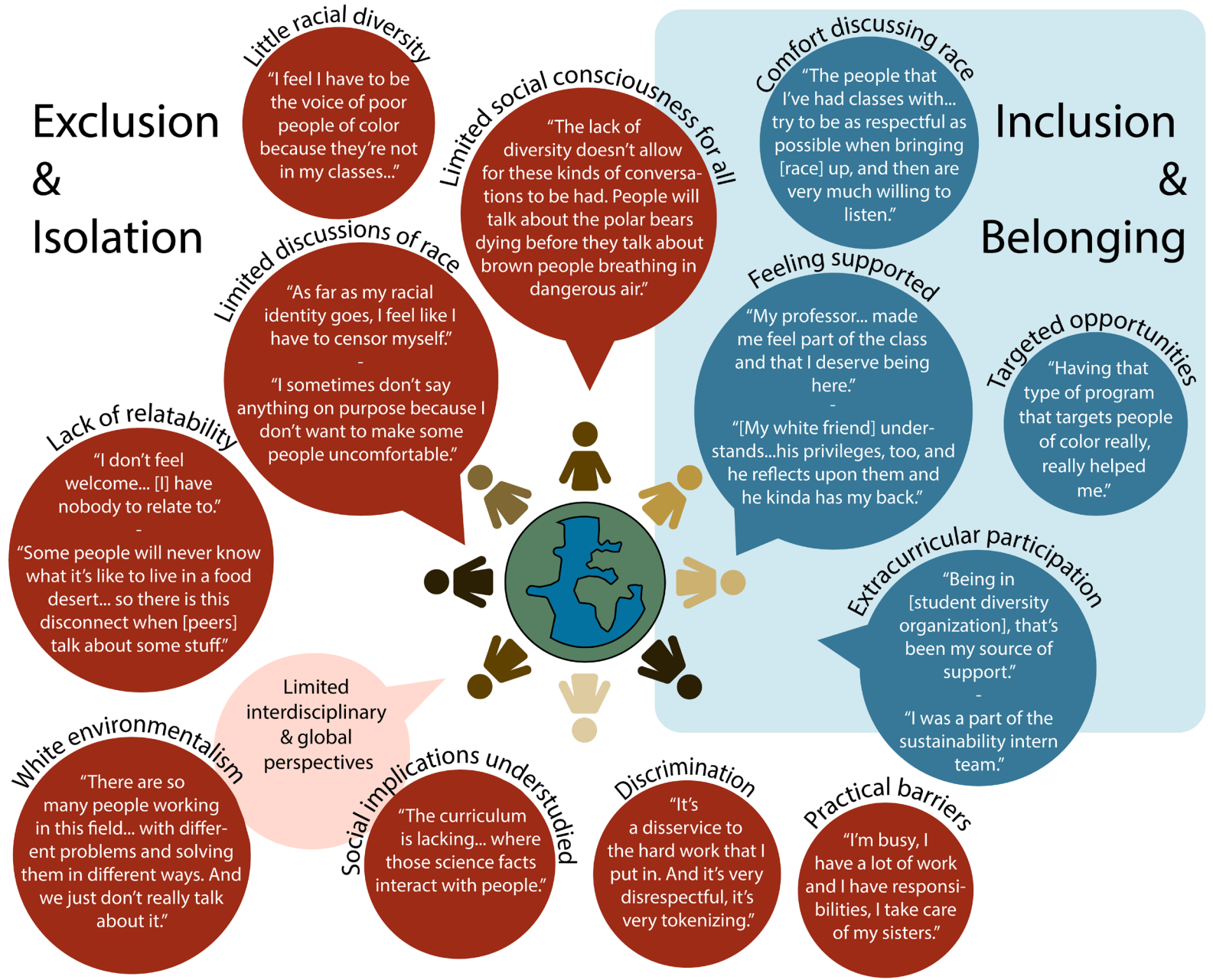


Figure 1. Key themes and illustrative quotes that emerged from interviews with BIPOC students reflecting on their experiences as undergraduates in interdisciplinary environmental and sustainability degree programs.

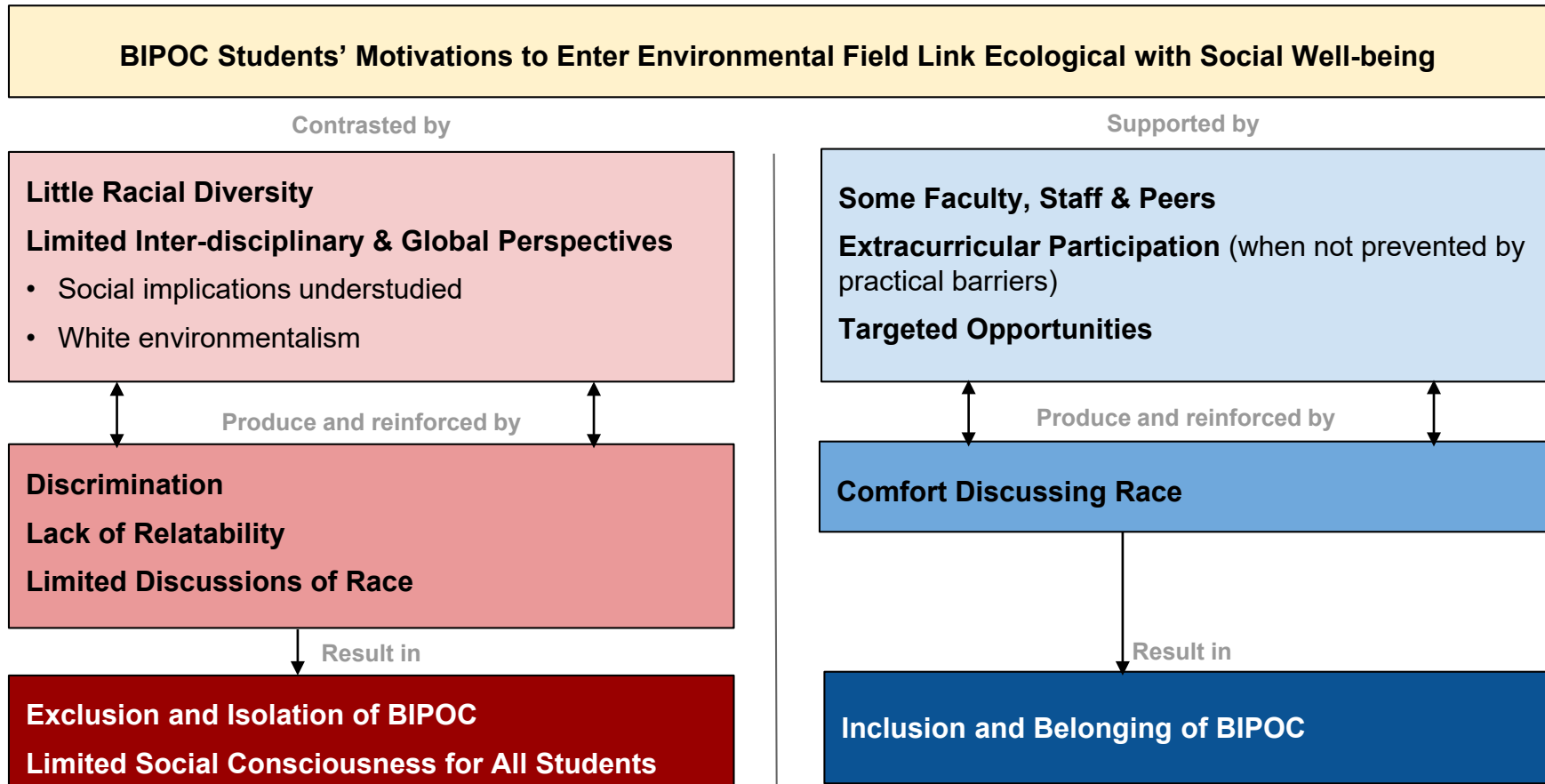


Figure 2. BIPOC students' observations and experiences in interdisciplinary environmental and sustainability degree programs often contrast their motivations for studying the environment and lead to exclusion and isolation, although some supportive experiences contribute to feeling included and a sense of belonging.

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539 C.E., B.R., T.S. and V.B.C. conceived the study. C.E., B.R., M.E. and J.M. conducted focus
540 group interviews and provided editorial comments. J.M., M.H., A.H. and K.S. conducted
541 analyses. T.S. wrote the paper. All authors provided editorial comments on the manuscript.

542 **Competing interests**

543 Authors declare no competing interests.

544 **Additional information**

545 Interview Guide

546 Supplementary Tables 1-4