



Recommendations for Undergraduate Sustainability Education at Ohio State

Sustainability Education and Learning Committee

The Ohio State University

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Executive Summary

The sustainability challenges facing communities locally and around the world today underscore the need for interdisciplinary sustainability education that enables students to become informed citizens, engaged professionals, and effective problem solvers. Sustainability education is an integral pillar of 21st century public, land grant, research and community-engaged institutions. **Ohio State recognizes the importance of sustainability, including sustainability education,** in its university-wide strategic sustainability goals and through other investments, including the energy partnership with ENGIE-Axiom and creation of the Sustainability Institute (SI).

The purpose of this report is to establish a framework for sustainability education at Ohio State that provides a coordinated approach and supports cross-unit collaboration to strengthen existing programs and pioneer new programs. The Sustainability Education and Learning Committee (SELC), facilitated by SI, has collected and evaluated data from Ohio State curricular resources, student surveys, peer benchmarking, and career development staff to assess the current landscape of sustainability education at Ohio State. The results of this assessment, including key findings and recommendations, are presented in this report.

Key Findings

Ohio State has a strong basis on which to deliver a comprehensive sustainability education, but lags behind its peers in sustainability education

Based on a 2016 assessment completed for the Association for the Advancement of Sustainability in Higher Education (AASHE), Ohio State has established an impressive record of sustainability efforts on campus that earned the highest sustainability rating of any Big Ten university. However, despite being in the top 15% in research, campus engagement, public engagement, and innovation, Ohio State's curriculum rating was substantially lower, most notably in the number and type of academic courses and learning outcomes.

Ohio State can distinguish itself with a comprehensive approach to sustainability education that encompasses the multiple definitions and disciplinary lenses of sustainability

Despite a common focus on improving the well-being of people and protecting the earth's life support systems, different disciplines emphasize different aspects of sustainability. A comprehensive approach includes contributions from the physical and natural sciences; the social sciences, business, law, and policy; engineering and planning; and humanities and the arts.

Most of the 44 sustainability-related majors at Ohio State are associated with physical and natural sciences or engineering and a smaller number associated with social sciences, business, law, or policy. By contrast, the humanities lacks any sustainability program, revealing a significant gap.

These findings motivate some of the key gaps and opportunities articulated in the report for

enhancing Ohio State's sustainability curriculum.

SELC embraces the diversity of thought that underpins sustainability, and the recommendations in this report rest upon the SELC's intention to enhance sustainability education across multiple dimensions. These are synthesized in a Six-Dimension Framework for sustainability education that SELC developed: (1) human-natural systems, (2) environmental and earth systems, (3) economy and governance, (4) society and culture, (5) engineering, technology, and design, and (6) health and well-being. This framework can be used as a tool to synthesize information about the extent to which the educational content of curriculum, ranging from an individual course or module to a program of study, addresses each of these six thematic areas. Inventorying the characteristics of existing efforts in sustainability education using this framework, and advertising that inventory to potential students, existing students, faculty and staff, and potential employers, figure prominently in the SELC recommendations listed below.

Sustainability content and goals are substantially underrepresented in many of the learning outcomes of core sustainability programs at Ohio State

A review of expected learning outcomes and program learning goals for programs presently considered "core" to OSU's sustainability education efforts reveals a high degree of variability in the specificity and depth to which sustainability content is included. The absence of explicit sustainability-linked goals in many programs penalizes OSU in national rankings, and complicates searches for sustainability education content by students, prospective students, advisors, and potential employers.

Student interest in sustainability is strong and there are areas of unmet demand for additional sustainability education

In general, student interest in courses and programs with a focus on – or a component of -- sustainability education is robust, with evidence for enrollment growth in most existing programs. Student survey responses also indicate an unmet desire for additional sustainability education, ranging from a course within the General Education (GE) to a major or minor program.

Institutional coordination and support of sustainability education is critical for communicating and growing programs

Information collected from peer and aspirational-peer institutions with established sustainability curricula shows that these institutions generally offer specific sustainability-focused undergraduate majors, minors, and/or certificate programs, many of which are interdisciplinary, and have web-based search tools to assist students in identifying sustainability-focused courses and programs. Some institutions also have student sustainability advisors or sustainability teaching fellows, in order to recruit students and improve teaching and learning in the diverse subject area of sustainability. Ohio State has a number of sustainability programs, but lacks a coordinated approach. In addition, Ohio State offerings in sustainability education are not searchable online nor is there a centralized staff of advisors, making it difficult for a student or potential student to find programs suited to their interests.

Summary of Recommendations

1. Clarify and classify content of existing sustainability programs

- A. Collect and share information on the sustainability content of specific courses and programs.
- B. Improve Expected Learning Outcomes (ELOs) of existing sustainability programs.

2. Improve communications of sustainability programs and learning opportunities

- A. Build a central web portal for sustainability education at Ohio State with search tools.

3. Increase coordination among units and people working in sustainability education

- A. Develop networks of faculty teaching in sustainability and academic programs and student services staff working in sustainability.
- B. Host an annual Ohio State workshop for student services professionals interested in supporting sustainability teaching, learning, and advising goals.

4. Pursue new cross-unit education programs and initiatives

- A. Develop a range of interdisciplinary academic degree enhancements in high-interest sustainability areas, including, minors, certificates, team-taught individual courses, and online modules.
- B. Create new interdisciplinary majors that fill key gaps in Ohio State's sustainability education programs, including: (a) Environmental humanities, (b) Sustainable agriculture & food systems, (c) Sustainable energy systems, (d) Water sustainability and security, (e) Community resilience and planning.
- C. Support expansion of interdisciplinary project-based learning opportunities, including capstone courses across academic units and classroom linkages to campus as a living lab and to city and community sustainability efforts.
- D. Support development and implementation of the proposed GE theme in sustainability.
- E. Prepare content on foundational sustainability topics to be incorporated into existing courses or used for public outreach.

5. Develop inclusive and equitable processes to encourage collaboration among academic units

- A. Provide incentives to faculty and academic units for collaboration, including an equitable budget model that rewards cooperation among academic units, faculty incentives to develop content, and support for faculty fellows in sustainability education.
- B. Support an inclusive, ongoing process that engages faculty and academic units across the university and that is responsive to student and employer interests in identifying specific opportunities for sustainability education.

Introduction

The societal challenges of climate change, water scarcity, and other environmental problems underscore the need for interdisciplinary sustainability education that enables students to become informed citizens, engaged professionals, and effective problem solvers. Confronting, understanding and addressing sustainability challenges requires integrating and applying knowledge of human and environmental systems from multiple disciplines, including natural and physical sciences, social and behavioral sciences, engineering, public health, business, law, planning, policy, arts and humanities. Given the challenges faced by communities locally and around the world, sustainability education is an integral pillar of 21st century public, land grant, research and community-engaged institutions.

Ohio State has a strong basis on which to deliver comprehensive sustainability curricula, including existing undergraduate and graduate programs that focus on human-environment systems and environmental and earth science programs across multiple disciplines and colleges. Over 500 faculty are engaged in sustainability research and teaching at Ohio State and 44 undergraduate majors have at least some aspect of sustainability as part of their core curriculum. In spite of these strengths, Ohio State lags behind its peers in terms of visibility and recognized programs in sustainability education.

This report focuses on **undergraduate sustainability education at Ohio State**. Its purpose is to:

- (i) Establish an overall framework for interdisciplinary, cross-unit sustainability education
- (ii) Summarize current programs and assess potential demand for existing and new offerings
- (iii) Articulate a set of specific recommendations for improving education programs at Ohio State

We make use of a variety of data, including information from student surveys, peer benchmarking, and career development staff at Ohio State, to assess the strengths and weaknesses of current conditions and to identify promising opportunities. We also discuss key barriers to achieving these outcomes. It is our hope that, by illuminating these opportunities and barriers and articulating a set of recommended next steps, we can build the foundation for a truly integrative and collaborative approach that minimizes competition among academic units, is inclusive of the depth and breadth of sustainability knowledge and interests at Ohio State, and elevates Ohio State as a leader among its peers in sustainability education.

While this report articulates specific initiatives to improve coordination and communication of existing programs and identifies specific areas that are in high demand or are critical gaps, **we do not provide a comprehensive roadmap for developing all aspects of sustainability education programs**. Curriculum development must be done by faculty and with the support and engagement of academic units, and there is more work to be done in this regard. In addition, more data on existing programs and their potential for addressing student and employer interests is needed. Our recommendations include next steps for addressing these needs. Also missing is an assessment of, and recommendations for, co-curricular and experiential learning programs, as well as for graduate programs. We have not attempted to address these here, and plan to do so as part of our future work.

As the group that developed these recommendations, the **Sustainability Education and Learning Committee (SELC)** is committed to continuing its work in engaging with faculty and academic units to identify and pursue opportunities for sustainability education, and to support cross-unit cooperation and collaboration. SELC is facilitated by the Sustainability Institute at Ohio State, which supports sustainability teaching and learning across the university with dedicated staff and resources.

Background

In 2015, Ohio State adopted strategic sustainability goals that encompassed and aligned with Ohio State's core goals of teaching, research, outreach and engagement, and resource stewardship. The sustainability goals for teaching and learning are to (1) deliver sustainability education that provides Ohio State students at all stages of instruction — from General Education to professional and technical programs — with opportunities to understand sustainability holistically, framed by the environment, science, technology, society, the economy, history, culture, and politics; and, (2) address the complexities of sustainability through a variety of learning formats, strategies, and occasions.

In December 2017, the Sustainable and Resilient Economy (SRE) Discovery Themes program and the Office of Energy and Environment (OEE) led the development of a framing document for furthering sustainability education at Ohio State co-authored by faculty from six different colleges at Ohio State (**Appendix A**). This document identifies high-level goals for sustainability education at Ohio State and proposed the formation of a faculty working group to further develop these ideas. This document was shared with the curricular associate deans (APAC) at Ohio State and other key leaders and has received broad support.

In March 2018, SRE/OEE worked with the Office of Academic Affairs (OAA) to convene a sustainability faculty working group to provide recommendations regarding the specific strategies and structures that Ohio State should implement for delivering innovative, transdisciplinary sustainability education with the outcomes described in the framing document. An offer to join was extended to all curricular deans and their corresponding academic units, and interested curricular deans suggested names for committee membership. The Sustainability Education and Learning Committee (SELC) was founded with faculty from seven different colleges at Ohio State, all giving their own time to meet together to identify strategies for curriculum development and improved collaboration. In January 2019, the SRE Discovery Themes program merged with OEE to create the Sustainability Institute (SI) at Ohio State, which supports and facilitates the work of SELC.

Mission. The mission of SELC at Ohio State is to link and enhance communications across the university to identify existing academic courses and programs that are directly aligned with sustainability and to facilitate the development, delivery, and awareness of competency-based modules, courses, and programs applicable to sustainability science, policy, and practice regionally, nationally, and internationally.

Goals. The goal of SELC is to provide a **platform for faculty and academic units to develop a comprehensive and coordinated sustainability education programs for undergraduate and graduate students** that will result in:

- Better coordination and communication of existing educational content and programs related to sustainability, including those that focus on human-environment systems and the foundational academic programs in environmental areas of study
- Exploration of potential for new sustainability learning modules, courses and programs designed to augment existing sustainability programs
- Identification of curricular gaps in key sustainability areas
- Improved coordination and expansion of co-curricular offerings related to sustainability¹

¹ SELC does not focus on these recommendations in this specific report, but will follow up with further co-curricular and learning recommendations based on the outcomes of the curricular recommendations included here.

Alignment with University Teaching and Learning Mission

Ohio State seeks to be an exemplar of the best teaching and learning to improve student outcomes. In terms of sustainability goals, the university seeks to (1) deliver sustainability education that provides Ohio State students at all stages of instruction with opportunities to understand sustainability holistically, framed by the environment, science, technology, society, the economy, history, culture, and politics; and (2) address the complexities of sustainability through a variety of learning formats, strategies and occasions. SELC provides ongoing leadership and support across campus to units working to identify, develop and implement curricular content in sustainability. SELC supports interdisciplinary teaching and learning programs and activities that are inclusive of a diversity of disciplines, including natural, physical and social sciences, engineering, public health, business, law, planning, policy, humanities and the arts.

Coordination, communication, and strengthening of existing sustainability programs, as well as development of new courses and complementary programs, will support the University's commitment to excellence in teaching and learning. Through the Discovery Themes Initiative, Ohio State has hired more than 50 new faculty in sustainability. Many of these faculty have already developed new coursework, and greater coordination among their efforts is needed. As new courses or programs are developed, or new interdisciplinary teaching opportunities arise, faculty will need support in incorporating sustainability content. SELC seeks to provide this by providing information about the sustainability topics and content of existing programs and courses, so that overlaps are reduced and greater synergies and opportunities for collaboration across units are realized.

In addition, SELC will seek in the future to improve experiential learning and co-curricular opportunities, including greater coordination and expanded opportunities for using campus as a living lab. This report focuses on curricular recommendations and does not detail further co-curricular or experiential learning opportunities. SELC plans to make further recommendations in those areas based on the outcomes associated with the recommendations in this report.

Sustainability Education Framework

"Sustainability" has emerged as a goal and principle that is defined in multiple ways across different disciplines, and has become the focus of a wide range of academic programs that articulate a range of essential learning components (see **Appendix B** for a summary of these multiple definitions and learning components). SELC collected and synthesized these various definitions of sustainability. Rather than attempting to distill a single definition of sustainability, we acknowledged the importance of embracing these multiple definitions as they represent different, but essential, dimensions of sustainability.

Figure 1 presents a conceptual framework for a comprehensive approach to sustainability education at Ohio State that informed SELC discussions. Referred to as "The Four Leaf Clover" of sustainability education, this figure illustrates four broad areas of inquiry: physical and natural sciences; social sciences, business, law and policy; engineering and planning; and humanities and arts. These knowledge domains provide the foundation for sustainability education and their overlaps are the basis for interdisciplinary education and training. While curricular programs commonly have a core focus in one of four knowledge domains, sustainability requires some level of integration of this core. SELC spent considerable time early on discussing where existing undergraduate academic programs should be placed within this framework and in what ways this framework provides insights into potential opportunities for new curricula. This

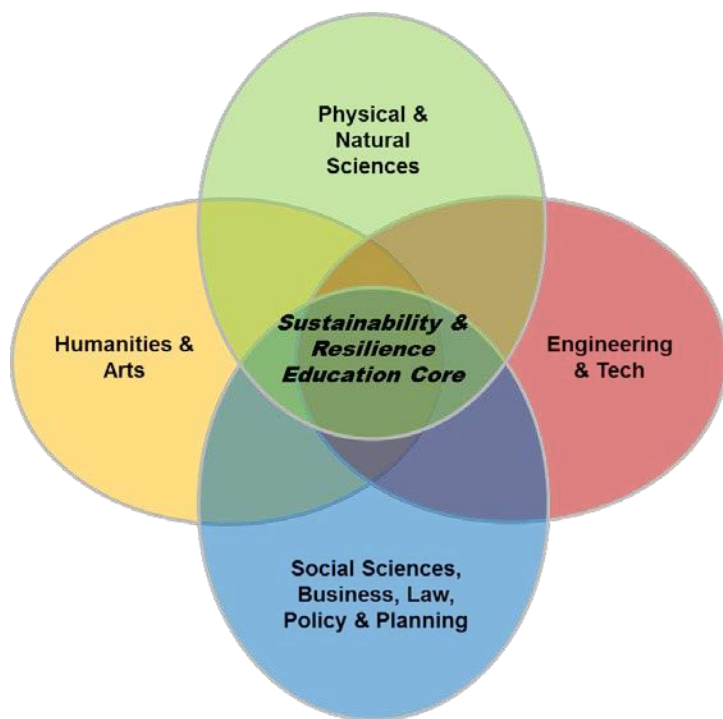


Figure 1: The Four-Leaf Clover: A Conceptual Framework for Sustainability Education at Ohio State

1. **Human-natural systems:** coupled human-natural systems, integrating environmental, economic & social factors, systems thinking, resilience
2. **Environmental & earth systems:** environmental & earth systems; knowledge of planetary/natural systems; understanding of how these systems are impacted by human activities
3. **Economy & governance:** economic and political factors, including consumption, production, tradeoffs, policy, governance/institutions, business strategy
4. **Society & culture:** social/cultural factors, including justice, equity, values, ethics, history, religion, the arts, citizenship, power, behaviors, cultural critique
5. **Engineering, technology & design:** engineering; technological innovation; systems design; human-machine interface; manufacturing processes; life cycle; product design
6. **Health & well-being:** human health, safety, risk, sustainable livelihoods, social welfare and well-being

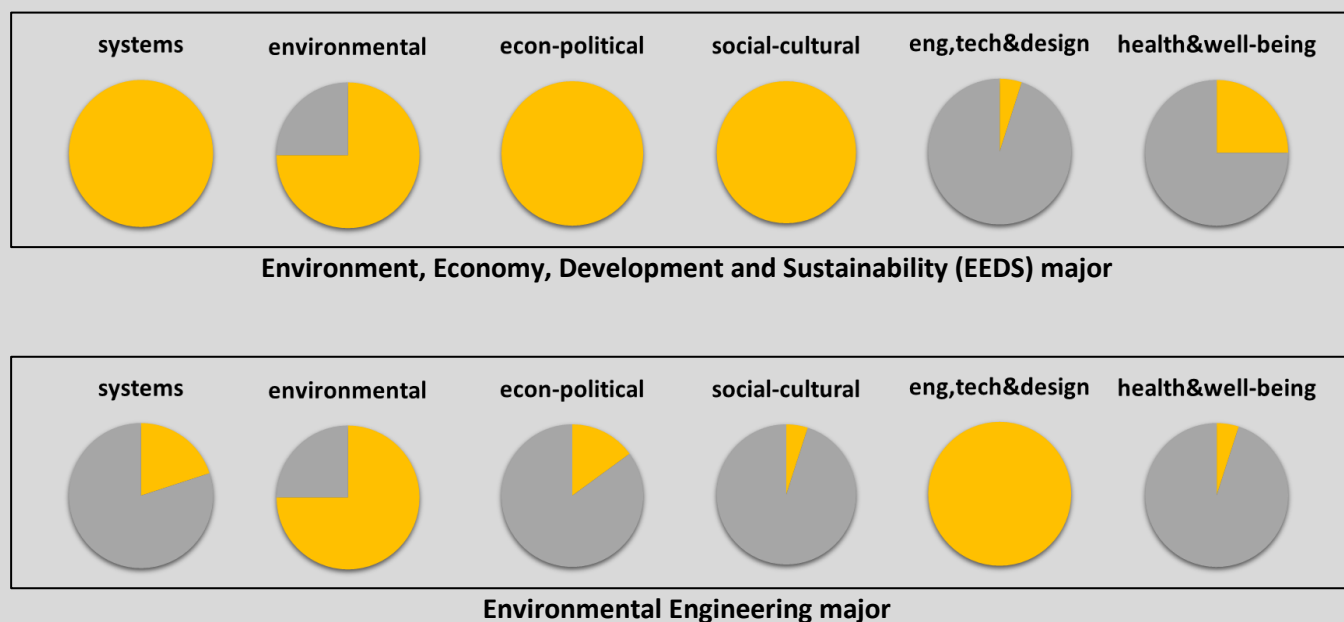
This classification provides the basis for SELC’s Six-Dimension Framework that provides a multidimensional categorization of the content of sustainability programs and courses and a richer summary of sustainability content relative to other schemes. To operationalize this framework, SELC developed a classification scheme for both individual courses and academic programs that categorizes the relative amount of course or program content for each of these six thematic areas (see **Appendix D** for a full description). Displayed as proportions of six thematic circles, this framework provides a simple dashboard approach to communicating the sustainability content of a course or program (see **Text Box 1**). This provides a means to communicate the breadth of Ohio State’s sustainability programs and provides an

exercise provided initial guidance in terms of existing programs and gaps (**Appendix C**). For example, a clear gap that emerged is the lack of integration of humanities and the arts with other areas.

The Six Dimensions of Sustainability. The Four Leaf Clover diagram provides a holistic representation of sustainability education based on the underlying disciplinary areas, but does not articulate the central topics or thematic areas of sustainability. To more explicitly represent the subject matter of sustainability education, SELC distilled the various facets of sustainability from the core concepts of the scholarly definitions list above into a set of keywords that were further grouped into the six thematic areas. The six thematic areas identified are as follows:

information tool for students as they seek certain types of training or study. **SEL** sees considerable potential in this framework to provide a basis for inventorying and communicating Ohio State’s sustainability education programs, including in student advising and exploration of sustainability-related majors and identification of curricular gaps.

Any program can construct a 6-dimension representation of their program by following the criteria in the program template shown in **Appendix D**. For each of the six areas, the relative number of program learning outcomes and courses offered by that unit within that topical area determines the percent of the circle that is filled in. The Environment, Economy, Development and Sustainability (EEDS) major and the Environmental Engineering major are illustrated below. Both of these majors focus on multiple dimensions of sustainability, and therefore all of the circles are either fully or partially filled in. However, the programs also clearly differ in their content, as illustrated by the six dimensions.



Text Box 1: The Six-Dimension Sustainability Framework for the EEDS and Environmental Engineering majors

Sustainability Education at Ohio State

Ohio State has a strong basis on which to further undergraduate sustainability teaching and learning. Several academic units administer degree programs with a strong focus on humans and the environment, including the School of Environment and Natural Resources (SENR) and Agricultural, Environmental and Development Economics (AEDE) in the College of Food, Agricultural and Environmental Sciences; Earth Sciences, History, Anthropology and Geography in the College of Arts and Sciences College; City and Regional Planning and Civil, Environmental and Geodetic Engineering in the College of Engineering; and the College of Public Health. Many of these programs include interdisciplinary coursework as part of their core curriculum and several academic programs are structured as cross-unit programs.

Existing Undergraduate Programs. **Appendix E** provides a list of the 59 core sustainability programs that currently exist at Ohio State, defined as those that address both human and environmental systems and their interactions.² These programs include 44 majors and 19 minors distributed across five colleges (**Figure 2**). A total of 3,339 degrees were granted to students who completed sustainability-related major programs and 359 sustainability-related minor programs were completed in AY 2017-2018.³

Key enrollment trends based on enrollment data over the last five years⁴ reveal growth in many, but not all, programs (see **Appendix F** for detailed information). Highlights include:

Figure 2: Core Sustainability Majors

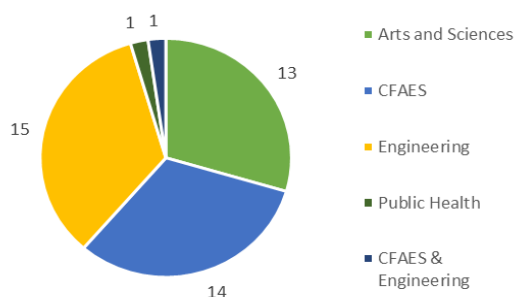
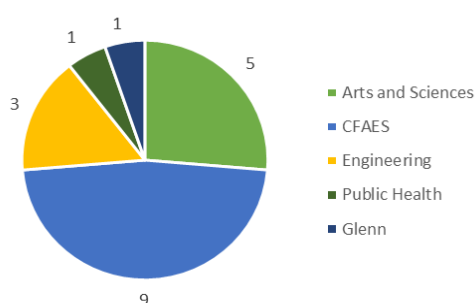


Figure 2: Core Sustainability Minors



- Overall enrollment in sustainability and resilience major academic plans has increased 18% over the last 5 years (AY 2013-2014 to AY 2017-2018) which compares to an 11% enrollment increase for the university as a whole.
- 32 of 44 majors experienced steady enrollment or increased; of these 8 major programs have at least doubled their enrollment over the past 5 years.
- On the other hand, 12 majors witnessed declining enrollments over the past 5 years. It is likely that, in some cases, this is due to new programs starting during this time period and attracting students away from these existing programs.
- Overall completion of minor program academic plans in sustainability or resilience related areas has increased. Nine minor programs have increased and 6 minor programs have more than doubled.
- The gender and ethnic mix of students has changed over time and varies widely across academic plans:
- The proportion of female students enrolled in these programs grew from 42.7% to 45.7% over these five years.
- The proportion of non-white students grew from 20.4% to 26.5%. However, the two largest non-white populations were Asian and Black/African American, which had divergent trends: the Asian student population grew by 24% whereas the Black/African American

population declined by 8% over this time period.

- The trends in these enrollments vary widely across academic plans. The proportion of non-white students (female students) grew by more than 10% in five (four) programs and declined in four (four) programs.

A review of new or revised academic plans and new or revised courses from 2012-2018 by college or school also reveals an increase in creation of new sustainability-related courses since the Q2S conversion. This trend has accelerated in the past few years following the creation of the Discovery Themes (see **Appendix G**).

Expected Learning Outcomes. There is a high degree of variability in specificity and depth of the current ELOs across Ohio State's core sustainability programs. The program-level ELOs of some units include only very general sustainability language, and the ELOs of some units that clearly address sustainability include almost no language reflecting sustainability content. Some of the lack of specificity likely comes from the fact that many units have not revised their ELOs since OSU converted to semesters in 2012, at which time units were advised to keep ELOs general (measurable outcomes in assessment plans were more specific) and to avoid creating more than 5-10 ELOs per program. In the meantime, some units have revised, expanded, and made their ELOs much more specific in response to accreditation pressures. In these programs, ELOs may now number as many as 30 per program, and their language and conceptual depth is highly specific to particular sustainability concepts.

² Feedback from the curricular deans on the programs listed in both Appendix A was provided in December 2017. Appendix E is updated to include majors or minors classified as sustainability-related for the 2016 AASHE STARS submission.

³ The Office of Enrollment Services – Analysis and Reporting (OESAR) provided SELC with the number of graduates per academic plan and number of students enrolled in academic plan by academic year for the last five years for each of the plans listed in Appendix E.

⁴ Based on 44 of the 46 majors (two were omitted because EARTHSC started and PUBAFF ended during the time period).

Searching OSU sustainability ELOs therefore yields an unreliable measure of sustainability programming, because many sustainability programs lack explicit or well-developed sustainability language and keywords in their ELOs.

While developing 6-dimension characterizations of OSU programs can help highlight sustainability content that is currently not reflected in ELOs, the task remains to improve and deepen sustainability ELOs especially for units where ELOs may be overly general. Academic units may want to consider more directly communicating their sustainability content, which could be done by revising ELOs to more accurately reflect the content of their programs. In reviewing ELOs, SELC found multiple instances of ELOs that could be broadened or restated to more explicitly communicate their sustainability content. This would also allow for more focused assessment of the achievement of those learning outcomes. Overall these efforts are needed to reduce the wide variability in clarity and specificity of sustainability ELOs.

Sustainability Education Trends

To assess the potential opportunities for undergraduate sustainability education at Ohio State, SELC analyzed potential undergraduate student interest in sustainability courses and programs using survey data collected via two university-wide surveys to undergraduate students of all majors of study. We also gathered information regarding employer needs for specific training, skills, and knowledge, and benchmarked with peer universities across the country. The results of these analyses provide insights into the current and potential demand for expanding sustainability education at Ohio State.

Student Interest and Awareness. Student demand for undergraduate sustainability education was assessed using university-wide data from two undergraduate student surveys. The Environmental Social Sustainability Lab (ESS Lab) at Ohio State administrated created a survey in collaboration with faculty and staff in Facilities, Operations, Development (FOD), Student Life, the Sustainability Institute, and other units. The ESS Lab survey, which included questions on student interests in academic programs and opportunities for professional skills development, was distributed to undergraduates in October 2018 (no. respondents \cong 2,100 which is about 4.5% of undergraduate students enrolled in 2017-2018)¹. The other survey was developed by students working closely with members of SELC as a part of an Environment, Economy, Development, Sustainability (EEDS) capstone course during spring semester 2018. This EEDS capstone survey was a short survey sent to all undergraduate students at Ohio State (no. respondents \cong 3,900). **Appendix H and I** provide the selected survey questions and more detailed analysis from the ESS Lab and EEDS capstone surveys respectively, including the percentage of respondents by college and aggregate discipline.

The ESS Lab survey (**Appendix H**) reveals a strong demand among students for both academic learning and professional development. Overall:

- 54% of students who responded agreed, somewhat agreed, agreed, or strongly agreed that they would like to become more involved with the academic side of sustainability (including sustainability courses or research) versus 20% felt that they are currently involved in this way.
- 35% of respondents said they are very interested or extremely interested in having sustainability courses as part of their major; 27% as part of a minor; and 32% as part of a General Education curriculum; 64% of respondents have at least a moderate interest in taking sustainability courses as part of the General Education curriculum.
- 86% of respondents expressed an interest in taking at least one sustainability course as part of their undergraduate studies; 58% (31%) of students who responded expressed an interest in taking 2-3 (3-4) courses in sustainability.

¹ The ESSL survey was sent to a random sample of 20,500 non-transfer undergraduate students at the Columbus campus and the sample was further stratified by student ranks 1-4. Approximately 2,100 students responded to the survey request.

- 55% of respondents agreed somewhat agreed, agreed, or strongly agreed that they would like to become more involved with the professional side of sustainability (including internships, volunteer opportunities, or student organizations) versus 17% who felt that they are currently involved in these activities.
- Student interests varies across the academic plan in which they are enrolled. For example:
 - The strongest interest in sustainability courses as part of the major comes from students enrolled in the School of Environment and Natural Resources (SENR), Knowlton School of Architecture, and the College of Public Health (88%, 61%, 55% of respondents, respectively, are very or extremely interested).
 - Interest in sustainability courses as part of the General Education curriculum is widespread, ranging from 48% of respondents from Pharmacy to 81% of those from SENR expressing at least a moderate interest.

The EEDS capstone survey provides insights into the potential demand for sustainability topics and courses. The capstone students generated a list of topics and potential course offerings based on benchmarking with other schools as well as their own areas of interest. The results are by no means exhaustive of all potential topics, but nonetheless reveal some strong trends. **Figures 3 and 4** provide the relative popularity of the topics and course titles that were listed on the survey.⁵

To examine how student interest varies by disciplinary focus, respondents were grouped into one of 14 aggregate disciplines based on the discipline with which their major is most closely associated.⁶ **Appendix J** provides the distribution of topics by discipline and vice versa, the distribution of disciplines by topic. The top five topics for each of the 14 aggregate disciplines (N=total number of respondents in discipline) are as follows (percent of respondents within the discipline choosing a given topic):

- **Agricultural & Environmental Sciences** (N=90): sustainable food systems (55%), agriculture (45%), clean energy (45%), sustainable land use (44%), climate change (43%)
- **Arts** (N=43): sustainable food systems (70%), climate change (59%), clean energy (57%), sustainability in business (43%), waste (43%)
- **Architecture, Planning, & Design** (N=48): clean energy (65%), climate change (65%), sustainable land use (56%), sustainable technology and innovation (52%), transportation (48%)
- **Behavioral Sciences** (N=192): clean energy (56%), climate change (55%), sustainable food systems (54%), sustainable technology and innovation (46%), sustainability in business (39%)
- **Business** (N=314): sustainability in business (73%), clean energy (54%), climate change (46%), sustainable technology & innovation (44%), sustainable food systems (43%)
- **Education** (N=83): climate change (54%), sustainable food systems (52%), clean energy (48%), clean water security (42%), water quality (35%)

⁵ EEDS capstone survey: Respondents were asked to choose up to 5 of 14 possible sustainability topics about which they would like to learn the most and 5 of 15 possible titles of courses they would be interested in taking.

⁶ **Appendix J** provides the correspondence of academic plans to aggregate disciplines. In some cases, this closely follows the aggregation of plans to colleges (e.g., Engineering). In other cases, in which colleges contain a diversity of disciplines, it does not.

- **Engineering (N=438):** clean energy(68%), sustainable technology & innovations (56%), climate change (44%), sustainable food systems (42%), transportation (42%)

- **Health Sciences (N=274):** climate change (53%), sustainable food systems(52%), water quality (43%), clean energy (42%), clean water security (36%)

- **Humanities (N=111):** sustainable food systems (63%), clean energy (58%), climate change (44%), sustainability in business (37%), waste (36%)

- **Life Sciences (N=242):** clean energy (57%), sustainable food systems (52%), climate change (48%), biodiversity (42%), water quality (37%)

- **Mathematical Sciences (N=73):** sustainable technology & innovations (55%), clean energy (52%), sustainability in business (45%), sustainable food systems(39%), climate change (39%)

- **Physical sciences (N=74):** clean energy(64%), climate change (50%), sustainable food systems (49%), sustainable technology & innovations (45%), waste (37%)

- **Public Affairs & Social Issues (N=96):** sustainable food systems (54%), climate change (50%), clean energy (41%), clean water security (39%), environmental policy (37%)

- **Social sciences (N=114):** clean energy (53%), sustainable food systems (48%), climate change (47%), sustainability in business (40%), environmental policy (38%)

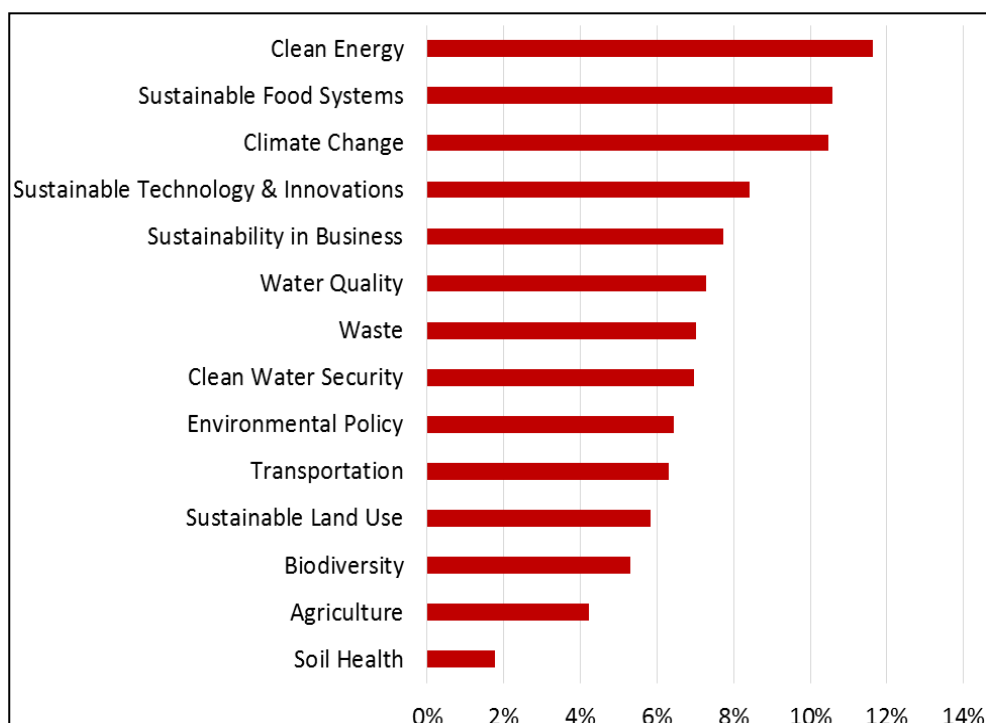


Figure 3: Student interest in sustainability topics (source: EEDS capstone survey, Spring 2018. Each respondent chose up to 5 responses. Total no. responses = 16,524)

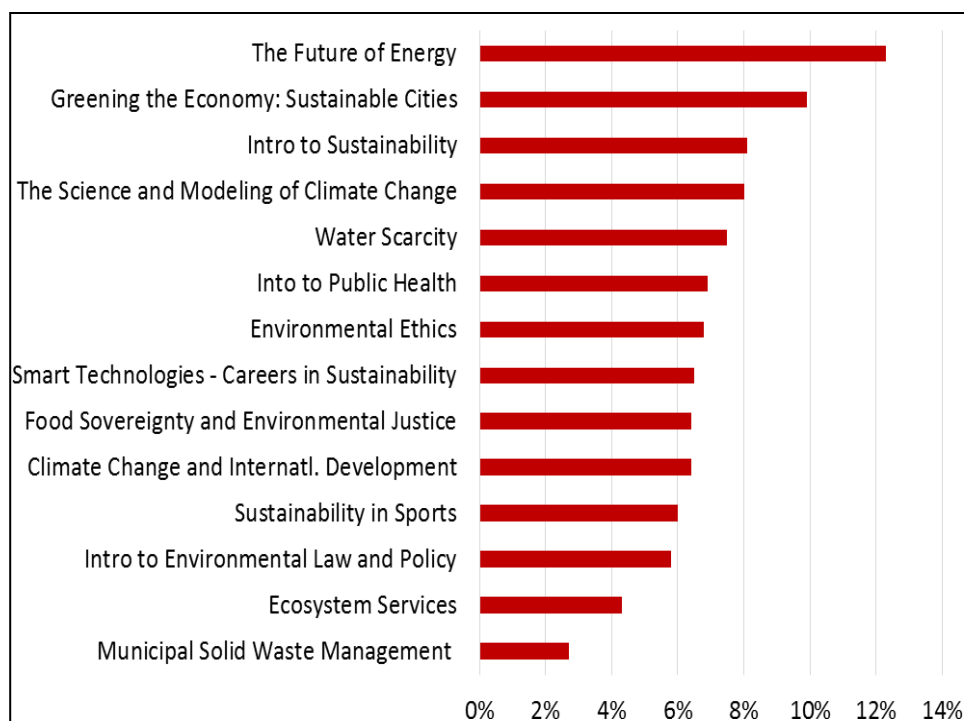


Figure 4: Student interest in sustainability course titles (source: EEDS capstone survey, Spring 2018. Each respondent chose up to 5 responses. Total no. responses = 13,623)

Employer Needs. Employer demand for sustainability-related training, knowledge, and skills was assessed by gathering internal information from career development offices in academic units across campus and via targeted phone calls to employers hiring Ohio State students into sustainability-related work post- graduation. **Appendix K** includes the questions that were administered via Qualtrics survey and phone to internal career development contacts and via phone to external employment contacts. This survey of career development contacts was qualitative in nature. SELC is conducting additional work to gather feedback from employers and external stakeholders to augment the information collected from our internal contacts. The most common responses from our internal Ohio State respondents included:

- Employers are seeking students with critical thinking skills and students with the ability to collaborate in diverse teams.
- Universities should aim to provide opportunities to students to better develop communication, leadership, management, and professionalism skills. Many employers cite that these “soft” skills are more critical than specific disciplinary training.
- Some Ohio State career development staff also cited that interdisciplinary training is valuable in developing the intangible skills students need to excel in the workforce, and that this paired with their major program of study provides a well-rounded applicant in the eyes of our key partners and employers.

Peer Benchmarking. Benchmarking with peer and “aspirational” universities was conducted by the undergraduate EEDS capstone student group working with SELC, in addition to further collection of information by SELC faculty and staff. The primary list of comparable institutions included Arizona State University, University of Illinois at Urbana-Champaign, University of Maryland College Park, University of Michigan, Michigan State University, Penn State University, University of Colorado at Boulder, University of Iowa, University of Minnesota, and University of Wisconsin-Madison. Most of these institutions offer interdisciplinary undergraduate programs, all offer a centralized sustainability office or institute to leverage campus connections, and some included standout initiatives (**Table 1**). Additional information collected was coordinated via a request through the Office of Distance Education (ODEE) and Eduventures (market analysis firm) and through web review and phone calls. For this exercise, peer institutions were primarily defined as Big 10 institutions, and “aspirational” peer institutions were identified as institutions with established sustainability curricula or other specific standout expertise.

Taken together, these benchmarking activities yielded several interesting insights:

- Areas in which peer institutions are offering specific **undergraduate degree programs** that Ohio State does not currently offer include: sustainable supply chain management major (Arizona State University), interdisciplinary sustainability studies minor (University of Maryland), energy economics concentration and energy business and finance major (Penn State University).
- Penn State University (World Campus), University of Wisconsin-Madison, University of Illinois at Urbana-Champaign, and the University of Colorado at Boulder offer a number of sustainability and energy related **certificate programs** in the following areas: certificate in environmental writing, certificate in sustainability studies, international agriculture and natural resources, and earth sustainability. Penn State World Campus also offers a number of degrees online (e.g. Bachelor of Arts in Energy and Sustainability Policy).
- The University of Maryland-College Park has programs to build capacity for sustainability education and augment new curricular offerings that are offered by the Global Sustainability Institute and Office of Sustainability. These include:
 - **Student sustainability advisors:** Student advisors in specific sustainability areas present to first year courses at the request of a faculty member.
 - **Sustainability teaching fellows program:** Faculty attend to learn how to integrate sustainability topics into their courses.
- Many of the peer institutions offer **web search tools** by sustainability theme area to assist students in selecting majors, minors, and other coursework by interest area.
- Arizona State University has been successful in linking **local community and city sustainability efforts** and management with university sustainability work. The Director of Sustainability for the City of Tempe fosters city sustainability goals and will link with university research and design goals and strengths, guest lecture on campus, and work toward improving city-university partnerships.
- Arizona State has hired **Transacademic Interface Managers (TIMs) to broker projects** between the city, external contacts, or university operations with the academic community. They also use sustainabilityconnect.asu.edu/ as a central database and web portal for presenting opportunities regarding these classroom-campus as living lab partnership opportunities.

- **Microcredentials are growing in popularity.** Modular and online learning allows institutions to break out a number of specific sustainability competencies as individual milestones, or to package them together into a course, certificate, or degree program. There are a number of institutions and external agencies working on these types of curricular opportunities or professional development for students.

University	Category	Total Population	Interdisc Graduate Programs	Interdisc Undergrad Majors	Interdisc Undergrad Minors	Interdisc Certs	Search by Interest Tool	Institute or Office of S&R	Co-Curricular Initiatives of Interest
Arizona State	Aspirational	71,900		X	X		X	X	
Illinois	Big 10	33,900		X	X			X	X
Maryland	Big 10	38,100			X			X	X
Michigan	Big 10	46,000		X	X			X	X
Michigan State	Big 10	39,000		X				X	
Penn State	Big 10	46,600	X	X	X	X	X	X	
UC Boulder	Aspirational	33,200	X	X	X	X	X	X	X
Wisconsin	Big 10	43,300		X			X	X	

Table 1: Benchmarking Summary Table for Key Comparable Institutions

SWOB: Strengths, Weaknesses, Opportunities, Barriers

An examination of academic programs and course offerings, enrollment trends, student survey data, employer interests, peer, benchmarking and additional knowledge and insights that emerged from discussions within the SELC committee and with others supports the following assessment of the sustainability and resilience education at Ohio State.

Strengths

Ohio State currently offers strong academic programs in foundational areas of sustainability.

- Enrollment trends from academic years 2013-2018 show that enrollment in 44 sustainability-related majors has increased by 18% in the last 5 years, with 32 of the 44 majors remaining steady or increasing and at least 8 of these majors having doubled enrollment numbers. We also note the steady interest from academic programs to offer new and revised sustainability-related courses.

There is strong student demand for sustainability courses and learning programs, including specific application areas and the general education curriculum.

- Based on the EEDS capstone and ESS Lab surveys of undergraduate students, 54% of student respondents to these surveys indicated they would like to become more involved with the academic side of sustainability and 55% of respondents noted an interest in becoming more involved with the professional side of sustainability via internships, student learning programs and organizations, and other opportunities.
- The EEDS capstone survey demonstrates strong student interest from many different disciplines of study in multiple areas, especially: clean energy, climate change, and sustainable food systems.
- Results from the ESS Lab survey indicate that 32% of undergraduate students are very interested or extremely interested in General Education sustainability courses and that 86% (58%) of respondents expressed an interest in taking at least one (2-3) sustainability course as part of their undergraduate studies.
- Benchmarking reveals that many institutions now require sustainability coursework for all students via GE requirements.

There are successful cross-unit collaborations at Ohio State that administer interdisciplinary sustainability programs.

- For example: The Environment, Economy, Development, Sustainability (EEDS) major is a collaboration between SENR and AEDE. The growth of the EEDS major, from just 25 students in academic year 2012-2013 to over 200 enrolled students at present, demonstrates student interest in these types of collaborative academic plans.

The Office of Academic Affairs (OAA) supports improved coordination and development of cross-disciplinary, cross-college sustainability education.

- OAA endorsed the Sustainability Education and Learning Committee (SELC) in December of 2017. SELC provides an experienced, core group of faculty across units and disciplines that is dedicated to supporting curriculum development and exploring new opportunities for interdisciplinary collaboration. This committee developed the four-leaf clover vision for cross-disciplinary sustainability education, which garnered broad support from APAC and academic units across

campus. APAC has also endorsed the concept of inventorying existing programs (and potentially courses too) using the 6-dimension sustainability framework.

Ohio State has built a core network of faculty that align with sustainability and resilience related research and teaching that has grown since the inception of the Discovery Themes in 2014.

- Ohio State has over 500 faculty working in core areas of sustainability.
- Over 60 faculty in sustainability have been hired through the DT investment. These faculty span many units and disciplines and the Discovery Themes promoted the hiring of many faculty in these areas who are interested in cross-disciplinary research and teaching.

Well-established capstone courses in several colleges support project-based learning through strong partnerships with FOD and other units on campus, as well as with community partners including the City of Columbus and other municipalities.

- There are hundreds of students from Engineering and from EEDS that are engaged each year in working closely with campus and community partners through capstone projects.

Regional campuses offer unique opportunities for fostering hands-on sustainability education through their own campus-based programs.

- The OSU Mansfield campus Ecolab utilizes a multi-disciplinary approach to assemble a local food production system, via the campus Microfarm, to create economic opportunity, improve educational outcomes, and establish a foundation of food security. The Ecolab also seeks to manage the natural resources available in the campus area (600 acres of forests, wetlands, and pine plantations) while simultaneously creating opportunities for research and learning.

Ohio State recently formalized a process for approving new certificate programs, which provide a means for offering sustainability-related degree enhancements in targeted sustainability and resilience areas.

- Benchmarking work revealed that there are a number of peer institutions offering sustainability-related certificates.
- Additionally, Eduventures (a market analysis firm working with ODEE) and other benchmarking noted the growing trend for microcredentials which allow students flexibility in adding on content in a specific theme area without the commitment of a full major or minor academic plan.
- Certificates open up new market opportunities by providing options for professionals and other non-traditional students to enroll in education programs.

The Sustainability Institute (SI) at Ohio State provides new opportunities to support greater cross-disciplinary collaboration of faculty and academic units engaged in sustainability education.

- SI has one staff member dedicated to supporting these efforts and plans to support two faculty teaching leads to provide overall leadership and facilitation of these efforts.
- SI staff members also work collaboratively with other sustainability offices on campus to submit information to the AASHE STARS process. Ohio State currently is listed as an AASHE STARS “Gold” campus, in recognition of our campus sustainability goals, resource stewardship, research, and teaching efforts to date.

The energy partnership between ENGIE-Axium and Ohio State provides multiple funding opportunities in

the area of academic collaboration for sustainability-related work.

- Engie-Axiom has provided a \$25 million to support two endowments for undergraduate and graduate/professional education respectively, in addition to a \$2 million endowment to support teaching and learning programs in sustainability and a \$15 million endowment to support campus sustainability projects, including campus as a living lab projects. In addition, Engie-Axiom is investing \$50 million in a new innovation center to support convergence research on new energy technologies, models, and systems (see **Appendix L**).

Smart Campus provides a platform for engaging with campus as a living lab.

- A comprehensive effort to define Smart@OhioState defines Ohio State's ambition as "transforming campus into a living laboratory for connected technologies that create more livable, sustainable and socially just communities across Ohio." A strategic plan identifies four key sectors: mobility, health and wellness, teaching and learning, and energy and sustainability. The plan articulates multiple proposed initiatives in these areas.

Weaknesses

Despite Ohio State's AASHE STARS gold rating for the campus overall, our academic credit scores as an institution are low. In particular, we are losing potential STARS rating points in the following AASHE-specified areas:

- Specification of sustainability learning outcomes at the institution-level (covering all students)
- Sustainability learning outcomes at the division level (covering particular schools or colleges)
- Institution designates sustainability courses in its course catalog of offerings
- Institution designates sustainability courses on student transcripts

Ohio State does not offer any academic plan that integrates the environment or sustainability concepts with humanities or the arts or with other disciplines related to sustainability, including environmental sciences, law, or social sciences.

- Many other institutions offer programs in environmental humanities.
- There is strong interest from multiple units within ASC to establish an environmental humanities program at Ohio State and many faculty at Ohio State are engaged in environmental humanities scholarship, but to-date efforts to establish a program have stalled due to a lack of incentives for units to cooperate.

Despite over 59 programs and 1,000+ courses in topics related to sustainability, students lack awareness of the academic programs, courses, and learning program opportunities in sustainability that are available to them.

- ESS Lab survey (**Appendix H**): 42% of students answered that they somewhat or strongly disagree that they are well-informed about their options to enroll or participate in sustainability courses, minors, majors, and other educational offerings at OSU.

Ohio State lacks a coordinated and consistent approach to developing and communicating sustainability learning programs.

- SELC completed a review of all ELOs for sustainability focused or sustainability related majors and found that learning outcomes vary greatly in number, depth, and focus between programs and

academic units. For example, the five majors in SENR have 25-30 ELOs each that contain a total of 44 mentions of general concepts of sustainability. Earth Sciences has two majors with a total of six ELOs that make no mention of general sustainability concepts.

- SELC attempted to apply a keyword search to existing courses to identify sustainability-related courses. This approach did not yield reliable or complete results since course titles and descriptions are not updated frequently. We lack a clear method for which we can assess the current offerings of sustainability courses at this granular level.

Ohio State's current GE requirements do not explicitly include sustainability topics, and GE-approved courses that do contain sustainability content cannot be located easily by interested students.

Opportunities

Employers are seeking students who can think holistically about the challenges in their field and are seeking students with some exposure to interdisciplinary learning.

- An internal survey of career development staff on campus yielded information indicating that many employers cite that “soft” skills, such as communication, leadership, professionalism, and the ability to work in multidisciplinary, diverse teams, are sometimes more critical than specific disciplinary training. Sustainability teaches students to think holistically by requiring systems thinking and integrating knowledge from multiple disciplines, as well as providing real world applications that inspire students to learn and apply their knowledge.

Better communications and coordination of current academic programs, courses, and other learning opportunities in sustainability would improve the student experience and serve to better connect faculty and staff working in this area.

- Benchmarking results indicate that a number of peer institutions provide web tools and other resources for students, staff, and faculty to search academic offerings and programs university-wide within specific theme areas.
- Other institutions provide outreach to faculty and/or staff to help educate them about ways to incorporate sustainability into classes and programmatic initiatives.
- Better coordinate advising, career development, recruitment, and other student services functions university-wide.
- Revisiting and reworking ELOs can help to better communicate sustainability content that is being taught and will help to fill perceived gaps.
- Ohio State's AASHE STARS academic credits score was especially low in the category of “learning outcomes” primarily because most units that address sustainability have not updated their learning outcomes to include more specific language detailing the different dimensions described in the six dimension framework. As a result, students and accrediting bodies who examine ELOs for evidence of how OSU units are covering sustainability concepts will miss much of what our units offer related to sustainability. SELC can provide guidance to units that wish to improve their sustainability related ELOs.

Students have strong interest in sustainability topics for which there are currently no academic plans. The opportunity exists to improve and expand academic offerings in these areas to meet the needs and interests of students.

- The EEDS capstone survey reveals strong student interest for a range of sustainability topics. The strongest areas of interest across the most students and disciplines are sustainable energy, food systems, and climate change. Other topics, including water, sustainable technologies, sustainable cities, and sustainability in business, also had strong interest.
- The ESS Lab survey revealed that students have a strong interest in sustainability courses as part of a General Education (GE) curriculum. Ohio State is in the midst of a review of the GE requirements that includes a proposed revision with thematic areas, including one in sustainability.
- Benchmarking of peer institutions reveals that there are number of areas where peer institutions are offering sustainability academic programs in areas that Ohio State does not. A few of those examples include the area of certificate programs, undergraduate majors in sustainable supply chain management and energy finance, and an interdisciplinary minor in sustainability studies.

Ohio State is well-positioned to formalize and expand project-based learning opportunities on campus, including at regional campuses, and in communities in collaboration with external partners.

- Innovative, new course offerings or redesigned course offerings not only align with the university's focus on excellent in teaching, but provide students with tangible opportunities to learn about real-world sustainability challenges.
- The Ohio State energy partnership with ENGIE-Axiom provides funding support to curriculum development, student scholarships, and project-based learning. This additional support provides additional opportunities and bandwidth for learning experiences, particularly those which utilize campus as a living lab.
- Ohio State can leverage our many existing relationships with industry partners interested in sustainability (e.g. Honda, Nike, etc.) and with public organizations (e.g. City of Columbus (Smart Columbus), COTA, MORPC, etc.) to help improve the training of students in preparation for the labor market.

By improving our academic credit and resource stewardship scores, we have an opportunity to earn an AASHE STARS institutional sustainability rating of "platinum" (the highest ranking).

- The AASHE STARS sustainability campus rating system is one method by which Ohio State communicates our work in sustainability. Currently, we are at an overall rating of "gold." Gathering information on courses and programs using the six dimension framework could assist the university with the academic credit reporting section, which is an area where the university currently seeks improvement.

Barriers

Strong academic silos remain within and across colleges that prevent communication and collaboration.

- Students and faculty are deeply engaged within their own disciplines and programs and do not have clear incentives or opportunities to explore other disciplines or courses offered in other units.
- The EEDS capstone survey results indicate that many undergraduate students are unaware of existing academic and learning opportunities that Ohio State offers in the areas of sustainability, resilience, and environmental studies.
- Expectations for teaching, research, and ELOs vary significantly between colleges, schools, academic units, and programs.

The current budget model rewards academic units for numbers of students enrolled in their academic plans and in their courses. This acts as a disincentive to team-teaching or partnering across academic units.

- The current budget model encourages a unit to hold as many credit hours as possible within its own courses and programs.
- Dividing the enrollment credits produced by a team-taught course is not straightforward within a single college, and is even more challenging between colleges.
- For faculty, team-teaching across units or colleges presently is also discouraged by the fact that contributions to a team-taught course do not count equally toward expected teaching loads across units.
- The existing budget model presents a consistent obstacle to the development of interdisciplinary programs, which often are seen as “giving away” enrollments to other units.

A lack of alignment between university-level and academic-unit level goals and support may derail attempts to improve and expand sustainability programs.

- Faculty lack the proper incentives for engaging in interdisciplinary courses, programs; research goals and pressures may prevent faculty from engaging in this work.
- Currently university sustainability teaching and learning goals do not fully align with department goals and tenure requirements, making it difficult to engage junior faculty in developing new content or courses related to sustainability.

Efforts to create new academic programs or courses may compete with improving coordination and communication of current programs.

- New efforts may gain quick attention, but could draw students away from existing programs currently offered in the sustainability education space.

Recommendations

1. Clarify and classify content of existing sustainability programs

A. Collect and share information on sustainability content of specific courses and programs using the six-dimension framework.

Proposed implementation: SELC facilitates process to collect information from all relevant academic units and classifies it according to the six-dimension framework.

B. Improve Expected Learning Outcomes (ELOs) of existing sustainability programs to make sustainability content more explicit and specific.

Proposed implementation: Academic units that are interested revise their ELOs; SELC develops “best practices” guidance to assist with process.

2. Improve internal and external communications of sustainability programs and learning opportunities

A. Build a central web portal with search tools that enable prospective and current students to search by topic, discipline and other keywords and to link to relevant academic programs across the university, including:

- i. Tools for students in the University Exploration program to learn about options in sustainability education.
- ii. Content featuring sustainability education opportunities in first-year and transfer student orientation.
- iii. Modules communicating the six dimensions of sustainability and using the six-dimension framework to communicate sustainability courses and programs.

Proposed implementation: SI facilitates process and works with academic units and other relevant offices and programs to develop and execute.

3. Increase coordination among units and people working in sustainability education

A. Develop a network of all academic programs and student services staff working in sustainability for communicating and engaging them in program coordination and development. Likewise, develop a **faculty affiliate network** to improve communication of existing courses, programs, and opportunities for new course or program development.

B. Host an annual Ohio State workshop for student services professionals (recruiters, advisors, career development) for all colleges interested in supporting sustainability teaching, learning, and advising goals.

Proposed implementation: SI works with OAA to develop and maintain networks and to host annual workshop.

4. Pursue new cross-unit education program opportunities

A. Develop a range of interdisciplinary academic degree enhancements in high-interest sustainability areas that provide holistic learning reflecting the multiple dimensions of sustainability, including, but not limited to:

- Minors
- Academic certificates
- Technical/professional certificate
- Certificate of completion
- Team-taught individual courses
- Online modules for distance education, existing courses, or public education

Thematic areas for which there is strong interest include, but are not limited to:

- Energy
- Health and Well-Being

- Food
- Climate
- Water
- Justice
- Air
- Land
- Mobility
- Communities

Proposed implementation: Academic units that span multiple disciplines work together to propose specific degree enhancement program; a subgroup of SELC works with units to facilitate the process, including providing an initial assessment of the overall need for the program and of potential synergies and overlaps with existing programs; SI provides limited matching support to academic units for lead faculty.

B. Create new interdisciplinary majors that fill key gaps in Ohio State’s sustainability education programs. Based on gaps and opportunities identified in this report, the following have strong potential for development:

- i. Environmental humanities
- ii. Sustainable agriculture & food systems (in development)
- iii. Sustainable energy systems
- iv. Water sustainability and security
- v. Community resilience and planning

Proposed implementation: Academic units that span the relevant disciplines work together to develop proposal; a subgroup of SELC works with units to facilitate the process, including providing an initial assessment of the overall need for the program and potential synergies and overlaps with other programs, and working with units to identify and minimize overlaps with existing programs.

C. Support expansion of interdisciplinary project-based learning opportunities, including

- i. Integrating and coordinating capstone courses across academic units and disciplines.
- ii. Strengthening classroom linkages to campus as a living lab and to city and community sustainability efforts in Ohio.

Proposed implementation: SI works collaboratively with key internal and external partners to develop a database of projects and works with course instructors to assist with identifying projects and integrating into the classroom.

D. Support development and implementation of the proposed GE theme in sustainability.

Proposed implementation: A subgroup of SELC develops guidance for OAA for implementing and managing the sustainability theme, including the process by which units propose new or existing courses for inclusion in the theme.

E. Prepare content on foundational sustainability topics that can be incorporated into existing courses or used for public education or outreach (e.g. through Extension). Topics include, but are not limited to:

- Defining sustainability
- Measuring and assessing sustainability
- The nature of human-natural-engineered systems
- The role of technological change and innovation
- Planning and managing for resilience
- Ecosystem services and management
- Human behavior and decision making
- Equity and environmental justice

Proposed implementation: A subgroup of SELC works with faculty and students to develop content and feature sustainability experts at Ohio State. SELC shares with academic units and faculty engaged in sustainability education. SI communicates and markets to external audiences in multiple formats and via multiple channels.

5. Develop inclusive processes to enable and encourage collaboration among academic units

A. Provide incentives to faculty and academic units for collaboration, including

- i. An **equitable budget model** that rewards cooperation among academic units to improve coordination of existing programs and to develop cross-unit, interdisciplinary programs.
- ii. **Faculty incentives** to develop sustainability interdisciplinary programs, team-taught courses, and integrate project-based learning opportunities into courses.
- iii. **Faculty fellows** in sustainability education to represent the major disciplinary areas to support cross-college coordination, integration and development.

Proposed implementation: A subgroup of SELC works with OAA and involved colleges to develop a set of guiding principles for an equitable budget model that rewards collaboration among academic units, including cross-unit interdisciplinary programs and team-taught courses, and identifies recommendations for incentivizing faculty for engaging in course or program development.

B. Support an inclusive, ongoing process that engages faculty, students and academic units across the university and that is responsive to employer interests and societal needs in identifying specific opportunities for sustainability education, including

- i. Improving the content and impact of existing sustainability programs.
- ii. Developing new programs in high-demand areas in ways that complement existing offerings and minimize competition among units.

Proposed implementation: Faculty and academic units that span relevant disciplines work together to identify potential opportunity. SELC establishes a process by which interested groups can vet ideas and receive feedback or support from SELC (e.g., in terms of facilitation) or from SI (e.g., in terms of matching funds to support lead faculty) for developing their proposal. This process includes opportunities for student participation and feedback.

Next Steps

These recommendations vary in their priority, resource needs and required effort. SI will contribute resources in support of these recommendations, but additional resources will be needed for many of these. Recognizing that availability of resources and degree of support will determine the timeline for these recommendations, we propose the following:

Summer 2019

- Develop survey instrument for gathering information to classify sustainability programs and courses according to the six-dimension framework (Rec 1A) and for identifying staff engaged in sustainability academic programs (Rec 3A)
- Identify faculty engaged in teaching sustainability courses (Rec 3A) as part of SI's faculty affiliate recruitment process
- Establish subgroup of SELC to work with academic units that are already in process of developing degree enhancements or majors in core sustainability areas (Recs 4A, 4B)
- Identify several SELC members to engage with the university's process to develop the GE sustainability theme (Rec 4D)

Fall 2019

- Socialize the framework, key findings and recommendations from this report with key academic units and leaders
- Implement survey to gather data on programs and courses (Rec 1A) and names and contact information of student services professionals engaged with sustainability (Rec 3A)
- Develop guidance for ELO revisions to articulate sustainability content (Rec 1B)
- Begin developing database of projects, partners, instructors and courses to support expanded campus and community project-based learning opportunities (Rec 4C)
- Develop recommendations for equitable budget model and faculty incentives (Rec 5A)

Academic Year 2019-20

- Complete classification of sustainability programs and courses using six dimension framework (Rec 1A) and develop dashboard as part of web portal (Rec 2A)
- Develop modules to explain six dimensions of sustainability and classification framework (Recs 1A, 4E)
- Begin design of web portal (Rec 2A)
- Host first annual workshop for student services professionals engaged in sustainability academic programs (Rec 3B)
- Finalize recommendations for GE sustainability theme (Rec 9) (*Anticipated*); budget model and faculty incentives (Recs 4D, 5A)

Summer 2020

- Refine analysis of existing education gaps on basis of program and course survey data and employer needs and identify priority degree enhancements or majors (Rec 4A, 4B, 5B)
- Expand database of projects and partners for project-based learning (Rec 4C)

Academic Year 2020-21

- Finish web portal and launch as part of Time for Change Week in April 2021 (Rec 2A)
- Develop tools for students in University Exploration and content featuring sustainability education opportunities in first-year and transfer student orientation (Rec 2A)
- Work with academic units to develop priority degree enhancement programs (Rec 4A) and majors (Rec 4B)
- Support implementation of GE track on sustainability (Rec 4D) (*Anticipated*)
- Develop and share modules that provide content on foundational sustainability topics for integration into courses or for public outreach and education (Rec 4E)
- Establish ongoing, inclusive process for vetting and supporting sustainability education proposals (Rec 5B)

APPENDICES

Appendix A: SELC Framing Document

A Framing Document for Furthering Environmental and Sustainability Education at Ohio State University

Background. Sustainability science is a transdisciplinary science that focuses on understanding the complex dynamics that arise from interactions between human and environmental systems. It draws from multiple disciplines of the natural, social, medical and engineering sciences, and humanities, as well as from the professions and the knowledge of practice. It's grounded in environmental areas of study, including environmental and earth sciences, environmental engineering and planning, environmental public health, environmental social sciences, environmental humanities, and environmental policy and decision making. Central questions include: How are long-term trends in environment and development reshaping our society? How can science and technology be more effectively harnessed to address sustainability goals? What factors determine the limits of resilience and sources of vulnerability in human-environment systems? What incentive structures can most effectively lead to more sustainable communities at local, regional, national and global scales?¹ Key competencies essential for academic programs to build the knowledge and capacity of students to address sustainability challenges include:²

- **Systems thinking:** comprehending how systems are connected, and internal system dynamics
- **Futures thinking:** envisioning how the past and present inform and influence the future
- **Values thinking:** understanding the effects our values have on our decisions
- **Strategic thinking:** developing strategies to achieve a vision
- **Interpersonal competence:** communicating, negotiating, collaborating, leading, fostering empathy

Rationale. Solutions to the challenges of climate change, increasing land and ecosystem degradation, resource exploitation and development, and other environmental problems rely on science and technology innovations as well as human culture, decision making, institutions, policies and practices. Transdisciplinary approaches that combine scientific and experimental forms of knowledge of human and environmental systems are needed to advance sustainability science, solution-focused applications, and new policies and practices beyond the academy. This shift relies on citizen engagement and workforce training that provides a range of educational opportunities, from technical training in science and technology fields to new skills grounded in systems approaches to a holistic understanding of sustainability and human-environment interactions and systems.

Ohio State is a 21st century land grant institution with a mission to educate students through a comprehensive array of programs, prepare students to be leaders in business and public life, and foster a culture of citizenship and service. Interdisciplinary learning programs that support a range of learning—from educating the next generation of citizens broadly in environmental and sustainability issues to providing in-depth training to address local, state, regional and global sustainability challenges—are essential for Ohio State to fulfill this mission. This requires a different approach to

¹ This description draws heavily from Clark, William C. 2007. Sustainability science: A room of its own. *Proceedings of the National Academy of Sciences* 104 (6): 1737-1738

² Wiek, A, Withycombe, L, Redman, CL. 2011. Key competencies in sustainability: a reference framework for academic program development. *Sustainability Science*, 6(2), 203-218; Barth, M, Godemann, J, Rieckman, M, Stoltenberg, U. 2007. Developing key competencies for sustainable development in higher education. *Internatl J. of Sustainability in Higher Education*, 8(4), 416-430.

curriculum development—one that is not limited to a single discipline, single degree paradigm, department or college.

Goals and Strategy. Ohio State’s sustainability goals for teaching and learning are to (1) deliver a curriculum that provides Ohio State students at all stages of instruction — from General Education to professional and technical programs — with opportunities to understand sustainability holistically, framed by the environment, science, technology, society, the economy, history, culture, and politics; and, (2) address the complexities of sustainability through a variety of learning formats, strategies, and occasions. Ohio State has a strong basis on which to bring together a comprehensive sustainability curriculum, including existing undergraduate and graduate programs that focus on human-environment systems and environmental programs across multiple disciplines and colleges that provide a strong foundation (see Appendix A and Table 1).

A critical next step in advancing environmental and sustainability education at Ohio State is a **comprehensive framework that defines a university-wide structure for delivering sustainability education** that will result in:

- Better coordination and communication of existing educational content and programs related to sustainability, including those that focus on human-environment systems and foundational academic programs in environmental areas of study, and articulation of how they contribute to overall sustainability teaching and learning goals.
- Exploration of potential for new sustainability science learning modules, courses and programs designed to augment existing programs by integrating knowledge from multiple disciplines on human-environment systems. For example, a set of sustainability science courses that can be customized to fit a student’s major or minor and provide a focus on a core application area, e.g., food, water, air, land, climate, energy and communities.
- Identification of curricular gaps in key sustainability areas. For example, Ohio State offers many courses in core sustainability areas, e.g., energy science and technology, resiliency planning, and environmental humanities, but does not have academic programs in these areas.
- Improved coordination and expansion of co-curricular offerings related to sustainability. For example, coordinating information about existing student learning programs and expanding experiential learning focused on campus ecosystem services, project-based courses, campus food systems, and partnerships with Smart Columbus.

Towards this end, we propose an inclusive, campus-wide process to further develop this framework guided by leaders and faculty from the Office of Academic Affairs (OAA), colleges and academic units, and interdisciplinary, cross-college programs, including the Sustainable and Resilient Economy (SRE) and Initiative for Food and AgriCultural Transformation (InFACT) Discovery Theme programs, and centers or institutes with an interest in sustainability. This process will be facilitated by SRE and the Office of Energy and Environment (OEE).

Figure 1 presents a conceptual framework for organizing sustainability education at Ohio State. The foundation is comprised of four broad areas of inquiry: physical and natural sciences; social sciences, business, law and policy; engineering and planning; and humanities and arts. These knowledge domains provide the foundation for sustainability education and their overlaps provide the basis for interdisciplinary education and training. While curricular programs commonly have a core focus in one of the four knowledge domains, sustainability science requires some level of integration of this core

knowledge with knowledge from other domains. While variants of this approach shape some existing curricula at Ohio State, this framework also can be used to guide other existing curricula and the development of new content areas and co-curricular programs.

Implementation. We propose a campus-wide engagement of faculty from multiple colleges and academic units via an interdisciplinary faculty working group to develop a comprehensive framework that defines a structure for delivering sustainability education with the outcomes described above. We believe there are substantial gains to be had from better coordination and communication of existing programs to deliver a comprehensive set of environmental and sustainability programs. In addition, there is a need to assess the potential for strategic opportunities to build new programs in key interdisciplinary areas that can complement these programs. Towards this end, we propose the following work plan:

- Engage employers from the private and public sectors to provide feedback regarding workforce development and training needs in the areas of environmental, sustainability, and resilience management, strategy, planning, policy, etc. including applications to energy, water, food, air and other natural resources and ecosystem services.
- Review existing program and professional development offerings in the areas of environment, sustainability and resilience campus-wide (at Ohio State) and at other Universities (external to Ohio State).
- Benchmark Ohio State relative to peer institutions to identify exemplar programs and strategic opportunities.
- Develop structure and a set of recommendations for implementing a comprehensive framework for delivering sustainability education to undergraduate students, including:
 - Expand on this document to articulate a conceptual framework for sustainability education at Ohio State that identifies foundational disciplines, existing and potential interdisciplinary areas of study, and core application areas (e.g., energy, food, water, air, land, climate, communities).
 - Operationalize the framework by identifying the academic programs that exist at Ohio State, their relationship to each other, their contributions to an overall sustainability education program, and key curricular gaps.
 - Articulate specific strategies for better coordination and communication of existing programs, including description of a central portal for students to learn about the multiple possible programs of study and to be tracked into a specific program of study and support services that need to be coordinated and made available to students to meet their educational and professional development goals.
 - Describe the structure of a cross-college sustainability science curriculum that would augment and enhance existing programs of study and that is focused on human-environment interactions, including human dependence and impacts on earth and environmental systems; the role of technology, policy, economy, society, culture, and institutions; implications for the sustainability, resilience, and well-being of local communities, nations, and global society. Suggest topics for courses to be included, the ways in which knowledge will be integrated from across multiple disciplines, mechanisms and incentives for faculty to develop interdisciplinary or team-taught courses, the ways in which students may customize the program to fit their major or minor, and the options for focusing on core application areas.

- Develop ideas for how a sustainability theme would be structured as part of the GE curriculum revision (conditional on approval of sustainability as a GE theme).
- Identify whether there are strategic opportunities for developing new degree programs in key interdisciplinary areas of study, e.g., energy science, resiliency planning, environmental humanities. Provide an initial assessment of the feasibility of developing these programs, including potential academic units that would participate and their interest in collaboration.
- Provide guidance regarding co-curricular sustainability learning programs, including student engagement in sustainability initiatives on campus, campus as a living lab, community service projects, internships, education abroad programs, and other experiential learning opportunities. Describe mechanisms and incentives for project-based learning, including capstone courses, and other impactful learning activities related to sustainability.
- Work with OEE, Facilities, Operations and Development (FOD), and the President & Provost's Council on Sustainability to expand engagement of students and faculty in campus initiatives and using campus as a test bed.
- Work with student services from multiple colleges to expand professional development opportunities for students in environment, sustainability and resilience related fields, including internships, networking events, campus visits by industry professionals, etc.
- Develop a set of recommendations for expanding interdisciplinary graduate education programs, including Environmental Sciences Graduate Program (ESGP) specializations, developing new interdisciplinary graduate specializations, and exploring opportunities for new interdisciplinary certificate and masters programs focused on specific dimensions of sustainability science or resilience.
- Develop possible certificate programs or educational opportunities for non-degree seeking professionals.
- Identify sources of external support for specific learning programs and initiatives.

List of Contributing Faculty

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Appendix A: Current Situation

Ohio State has a strong basis on which to further sustainability teaching and learning. Specifically:

- At an undergraduate level, several academic units administer degree programs with a strong focus on humans and the environment, including the School of Environment and Natural Resources (SENR) and Agricultural, Environmental and Development Economics (AEDE) in the College of Food, Agricultural and Environmental Sciences; Earth Sciences, History, Anthropology and Geography in the Arts and Sciences College; City and Regional Planning and Civil, Environmental and Geodetic Engineering in the College of Engineering; and the College of Public Health (see Table 1). Many of these programs include interdisciplinary coursework as part of their core curriculum.
- Several academic programs are structured as cross-unit programs, for example:
 - Environment, Economy, Development and Sustainability (EEDS) undergraduate major is jointly offered by SENR and AEDE and includes core courses from the Fisher College of Business
 - The Humanitarian Engineering undergraduate minor in Engineering includes coursework on human dimensions from other colleges
 - A sustainable agriculture major that spans CFAES, several allied colleges, and other Ohio colleges and universities including Central State, is under development with support of a USDA Higher Education Challenge Grant led by the Agroecosystems Management Program
 - At a graduate level, the Environmental Sciences Graduate Program (ESGP) is a multi-college program that provides an interdisciplinary curriculum across physical sciences and engineering, biological sciences, and social sciences with disciplinary depth in established specializations
- A variety of co-curricular programs exist to support student interest in environment and sustainability, including Green Engineering, Humanitarian Engineering, Scholars programs in Environment and Natural Resources, and residential programs. These include the SUSTAINS Learning Community that provide opportunities to be engaged with faculty on research projects, project-based learning experiences, and community engagement and the STEP program which provides support to second year students to engage in in-depth interactive learning with faculty and peers.
- University-wide support and leadership in key areas of sustainability science, including food and food security (InFACT); materials and manufacturing (M&MS, IMR); energy (OEE); climate (Byrd Polar); water (GWI, Water Resources Center, Ohio Sea Grant); mobility (CAR, CURA); human-natural systems, sustainability assessment, resilience (SRE); and pilot areas as part of the Humanities and the Arts Discovery Theme: Environmental Humanities, Humane Technologies, and Science and Technology Studies.

These and other initiatives, such as those outlined by the Environmental Sciences Advisory Committee (Appendix B), have demonstrated the existing strengths and strong potential for furthering interdisciplinary learning and cross-unit collaboration at OSU. Nonetheless, substantial barriers to integrating knowledge across different domains and units remain. Students and faculty are often deeply engaged within their own disciplines and programs, and do not have clear incentives or opportunities to explore other disciplines or courses offered in other units. In fact, students, faculty, and staff are often unaware of the existing courses and learning opportunities that Ohio State offers in environment, sustainability, and resilience studies. In addition, a financial incentive that rewards academic units based on the number of students enrolled in their own courses acts as a direct disincentive to team teaching or partnering across academic units. Finally, the variety of opportunities that students have for engagement in environment and sustainability are largely uncoordinated, often under-supported, and

sometimes duplicative. For example, there are over a hundred student organizations that focus on some aspect of environment or sustainability.

Table 1: A Preliminary List of Existing Ohio State Majors and Minors Related to Environment and Sustainability

Name	Major/ Minor	College	School/ Department	Curriculum Sheet
Anthropology	Major	Arts and Sciences	Anthropology	https://anthropology.osu.edu/undergrad/major-bs
Earth Sciences	Major	Arts and Sciences	Earth Sciences	https://earthsciences.osu.edu/majors#Geological Sciences Subprogram
Earth Sciences	Minor	Arts and Sciences	Earth Sciences	https://artsandsciences.osu.edu/sites/artsandsciences.osu.edu/files/minorsheet-earth-sciences-7.2015_0.pdf
Evolution, Ecology, and Organismal Biology	Major	Arts and Sciences	EEOB	https://eeob.osu.edu/undergrad/ee/ee-major-bs
Evolution, Ecology, and Organismal Biology	Minor	Arts and Sciences	EEOB	https://eeob.osu.edu/undergrad/ee/ee-minor
Atmospheric Sciences	Major	Arts and Sciences	Geography	https://asp.osu.edu/sites/asp.osu.edu/files/BS%20Atmospheric%20Sciences_0_0.pdf
Environment and Society	Major	Arts and Sciences	Geography	https://geography.osu.edu/undergrad/majors/environment
Geography – multiple tracks	Major	Arts and Sciences	Geography	https://geography.osu.edu/sites/geography.osu.edu/files/BS%20Geographic%20Information%20Science%20%28NEW%20GIS%29_4.pdf
Atmospheric Sciences	Minor	Arts and Sciences	Geography	https://artsandsciences.osu.edu/sites/artsandsciences.osu.edu/files/atmospheric-sciences-minor.pdf
Geographic Information Science	Minor	Arts and Sciences	Geography	https://artsandsciences.osu.edu/sites/artsandsciences.osu.edu/files/gis-minor.pdf
Environment, Health, Technology, and Science	Major	Arts and Sciences	History	https://history.osu.edu/undergrad/major
Environment, Health, Technology, and Science	Minor	Arts and Sciences	History	https://history.osu.edu/undergrad/minor/ehts
Agribusiness and Applied Economics	Major	CFAES	AEDE	https://aede.osu.edu/sites/aede/files/imce/files/Undergrad/Agribusiness%20and%20Applied%20Economics%20major.pdf
Agribusiness and Applied Economics	Minor	CFAES	AEDE	https://aede.osu.edu/sites/aede/files/imce/files/Undergrad/Agribusiness%20minor.pdf
Environmental Economics	Minor	CFAES	AEDE	https://students.cfaes.ohio-state.edu/sites/ap/files/site-library/site-documents/minors/Environmental%20Economics%20minor%20AU%2014%20rev.Oct2015%282%29.pdf
Food Business Management	Major	CFAES	FST	https://fst.osu.edu/sites/fst/files/imce/images/Food%20Business%20Management%20New%20Logo%20October%202014%20%281%29.pdf
Food Science and Technology	Major	CFAES	FST	https://fst.osu.edu/sites/fst/files/imce/images/Food%20Science%20Au%2017.pdf

Sustainable Plant Systems	Major	CFAES	HCS	https://hcs.osu.edu/sites/hcs/files/imce/images/SPS-Plant%20Biosciences%20Autumn%202017.pdf
Plant Pathology	Major	CFAES	Plant Pathology	https://students.cfaes.ohio-state.edu/sites/ap/files/site-library/site-documents/Major_Sheets/Plant%20Path%20New%20Logo%20Summer%202015%20October%202014%20%284%29.pdf
Plant Pathology	Minor	CFAES	Plant Pathology	https://students.cfaes.ohio-state.edu/sites/ap/files/site-library/site-documents/minors/Plant%20Pathology%20Minor%20AU%2014%20%283%29.pdf
Plant Health Management	Major	CFAES	Plant Pathology/ Entomology	https://students.cfaes.ohio-state.edu/sites/ap/files/site-library/site-documents/Major_Sheets/Plant%20Health%20Management%20Summer%202015%20final%20October%202014%20%283%29.pdf
Environmental Policy and Decision Making	Major	CFAES	SENR	https://senr.osu.edu/sites/senr/files/imce/images/New%20EPDM_4.pdf
Environmental Science	Major	CFAES	SENR	https://senr.osu.edu/sites/senr/files/imce/images/ES2_1.pdf
Forestry, Fisheries, Wildlife	Major	CFAES	SENR	https://senr.osu.edu/sites/senr/files/imce/images/FFW_au16_1.pdf
Natural Resource Management	Major	CFAES	SENR	https://senr.osu.edu/sites/senr/files/imce/images/Curric%20Road%20Map%20NRM%20-%20NRRM_4.pdf
Environmental Science	Minor	CFAES	SENR	https://senr.osu.edu/sites/senr/files/imce/images/ENVSCI_minor_1.pdf
Forestry, Fisheries, Wildlife	Minor	CFAES	SENR	https://senr.osu.edu/sites/senr/files/imce/images/FFW%20minor_0.pdf
Rural Sociology	Minor	CFAES	SENR	https://senr.osu.edu/sites/senr/files/imce/images/RURAL%20SOC%20minor_0.pdf
Society and Environmental Issues	Minor	CFAES	SENR	https://senr.osu.edu/sites/senr/files/imce/images/SOCENV_minor.pdf
Soil Science	Minor	CFAES	SENR	https://senr.osu.edu/sites/senr/files/imce/images/Soil_Sci_minor_1.pdf
Sustainable Agriculture	Minor	CFAES	SENR	https://senr.osu.edu/sites/senr/files/imce/images/SUSTAGR_minor_0.pdf
Environment, Economy, Development, Sustainability	Major	CFAES	SENR/AEDE	Major: https://senr.osu.edu/sites/senr/files/imce/images/EEDS_13.pdf
Environment, Economy, Development, Sustainability	Minor	CFAES	SENR/AEDE	Minor: https://senr.osu.edu/sites/senr/files/imce/images/eeds_minor_3.pdf
Agricultural Systems Management	Major	CFAES/ Engineering	FABE	https://students.cfaes.ohio-state.edu/sites/ap/files/site-library/site-documents/Major_Sheets/Agricultural%20Systems%20Management%20%28eff%20SU%2013%29%20Feb%202017.pdf

Food, Agricultural and Biological Engineering (Ag. Eng. Spec.)	Major	CFAES/ Engineering	FABE	https://fabe.osu.edu/sites/fabe/files/imce/files/CurrSheets/FABE%20AG%20Curriculum%20Sheet%202017-2018.pdf
Humanitarian Engineering	Minor	Engineering	-	https://engineering.osu.edu/sites/engineering.osu.edu/files/uploads/he_minor.pdf
Civil Engineering	Major	Engineering	CEGE	https://ceg.osu.edu/sites/ceg.osu.edu/files/uploads/2015-16_civ_eng_curriculum_flowchart_guide_update_6.pdf
Surveying and Mapping	Minor	Engineering	CEGE	https://ceg.osu.edu/sites/ceg.osu.edu/files/uploads/surveying_and_mapping_minor_program_2015_0.pdf
Environmental Engineering	Minor	Engineering	CEGE	https://ceg.osu.edu/sites/ceg.osu.edu/files/uploads/environmental_engineering_minor_program_2015_0.pdf
Environmental Engineering	Major	Engineering	CEGE	https://ceg.osu.edu/sites/ceg.osu.edu/files/uploads/2015-16_env_eng_curriculum_flowchart_guide_update_4.pdf
City and Regional Planning	Major	Engineering	Knowlton School	http://knowlton.osu.edu/sites/default/files/pdf/AU17_BSCR.pdf
Landscape Architecture	Major	Engineering	Knowlton School	http://knowlton.osu.edu/landscape-architecture
City and Regional Planning	Minor	Engineering	Knowlton School	http://knowlton.osu.edu/sites/default/files/pdf/City%20and%20Regional%20Planning%20Minor_approved%20ASC%202015.pdf
Science, Engineering, and Policy	Minor	John Glenn College of Public Affairs	Glenn College	http://glenn.osu.edu/undergraduate/sepp/
Public Health	Major	Public Health	-	https://cph.osu.edu/sites/default/files/students/docs/17-18%20BSPH%20EPH%20curriculum%20%26%20four%20year%20plan%20guide.pdf
Global Public Health	Minor	Public Health	-	https://cph.osu.edu/sites/default/files/students/docs/Undergraduate%20Minor%20in%20Global%20Public%20Health.pdf

Appendix B: Excerpt from the 2009 Ohio State Environmental Sciences (ES) Advisory Committee Recommendations

In consultation with the Report of the Task Force on Environmental Sciences from September 2009, the ES Advisory Committee has developed recommendations to greatly improve the integration and growth of ES activities across campus. These recommendations will be beneficial to both ES faculty and their TIU departments. Target timeline to accomplish items are listed in parentheses.

Statement of Purpose. To engage in high-quality interdisciplinary educational and research efforts in environmental sciences by:

- Creating a clearly defined structure for education and research that has ES as its primary mission.
- Raising the profile of research and graduate programs in ES at OSU.
- Connecting faculty, students, and researchers engaged in research, teaching, and /or outreach related to ES.
- Reducing barriers to performing interdisciplinary ES research, teaching and/or outreach.
- Recruiting and retaining talented graduate students in ES.

Recommended changes to administrative structure

1. Establish Environmental Sciences Network (Years 1-3)

- a. Become the central portal and “storefront” for ES research and education.
- b. Develop research clusters focused on high priority and emerging issues in environmental science.
- c. Facilitate the pursuit of collaborative, interdisciplinary research and training grants.
- d. Develop interdisciplinary, team-taught courses.
- e. Offer cross-college seminars.
- f. Coordinate outreach and service-learning activities.
- g. Create central website portal for environmental sciences.
 - i. Provide information for future students (e.g., links to graduate programs that offer training in environmental sciences, links to faculty webpages, information on application process).
 - ii. Highlight important news, activities, and opportunities.
 - iii. Advertise courses and seminars.
 - iv. House discussion groups/forums/blogs where research clusters can explore potential collaborative activities.
 - v. Distribute periodic electronic newsletters highlighting ES news, activities, and opportunities.

2. Reduce barriers to participation in interdisciplinary ES activities (Year 3)

- a. Restructure the faculty and chair evaluation/reward system to encourage participation in interdisciplinary ES activities.
- b. Create MOU of “ground rules” for interdisciplinary environmental science participation in departments and colleges. MOU should contain information on advising, co-advising, teaching outside the department, co-teaching inside or outside the department, large collaborative grants, multi-author publications, and participation in centers and/or the ES Network.
 - i. Large collaborative grants and multi-author publications: Reduce penalties by giving greater value to co-PI status and co-author status on grants and publications.
 - ii. Co-advising: Allow both faculty advisors to count these students as advisees for P&T and salary increases.
 - iii. Co-teaching: Return revenue to TIUs proportional to number of faculty involved in each course, incentivize faculty to co-teach by recognizing the increased effort of co-teaching (i.e., it is not automatically 50% effort for each instructor).
 - iv. Service in interdisciplinary committee work: Place increased value on service in IGPs or other interdisciplinary committees.
- c. Change POA and APT documents of units to describe expectations for interdisciplinary research, instruction, and service and rewards for these efforts (i.e., P&T and salary increases).

3. Modify the structure of the Environmental Science Graduate Program ESGP (Year 1)

- a. Collaboratively develop dual major PhD with TIUs that participate in ESGP.
- b. Promote cross-cutting specialization tracks within ESGP that are consistent with priority research clusters. The ESGP GSC approved this concept last academic year.

Revise the graduate student accounting mechanism to allow participating TIUs to receive full credit for ESGP graduates advised by their faculty. In many cases, fully counting of students in both IGP and a faculty member’s TIU will reduce barriers and possibly

Appendix B: Overview of Sustainability Education and Definitions

Sustainability Definitions. Key elements of **recognized scholarly definitions** of sustainability include the following concepts:

- Sustainability is a condition that allows humans and other species to flourish and thrive in perpetuity within Earth's carrying capacity, and not unjustly burdened by the actions of others²
- Sustainability involves a triple bottom line that balances environmental impacts, economic gains, and social well-being³
- Sustainability means staying within critical ecosystem and environmental boundaries, including planetary boundaries that define a "safe operating space" for humanity⁴
- Sustainability also depends on the resilience of natural and human systems, such as those providing energy and food, and the ability of communities to recover, adapt and flourish in the face of changing environmental, economic and social conditions.
- Sustainability suggests non-declining human welfare or well-being; using resources in a way that maintains or improves the well-being of communities and global society
- Sustainability is inherently complex and political, often contested, shaped by real-world processes influenced by relations of power, and is normative because it is value-laden⁵
- Sustainability implies meeting the needs of the present without compromising the ability of future generations to meet their own needs⁶

Considering these complex and multi-faceted elements involved in sustainability, there are also a wide range of **essential components recognized by multiple disciplines engaged in sustainability education**:

- Holistic, interdisciplinary educational approaches that foster synthesis and systems-thinking skills
- Focus on the interfaces between human and natural systems (coupled human-natural systems)
- Curricula include key concepts from natural sciences, social sciences, applied sciences and humanities
- Promote understanding of both sociopolitical and natural aspects of environmental problems, the limits of technology and science, and the importance of acknowledging and reporting uncertainty
- Include attention to the role of values and policy within cultures, and the importance of philosophical perspectives on 'progress' and 'well-being'
- Critical appraisal of "problem-solving" approaches, in order to think differently about problems and solutions, and educating to avoid problems in the first place
- Critical perspectives on culture that question dualistic, hyper-rationalist or other constructs that shape science, technology and culture as though human and natural systems are separate, and nature and culture opposed

² Bullock, C. and Hitzhusen, GE. (2015). Participatory Development of Key Sustainability Concepts for Dialogue and Curricula at The Ohio State University. *Sustainability* 7(10), 14063-14091; doi:[10.3390/su71014063](https://doi.org/10.3390/su71014063)

³ Elkington, J. (2004). Enter the triple bottom line. In A. Henriques & J. Richardson (Eds.), *The triple bottom line: Does it all add up?* (pp. 1-16). London, England: Earthscan

⁴ Rockström, J., et al. 2009. Planetary boundaries: exploring the safe operating space for humanity. *Ecology and Society* 14(2): 32. [online] URL: <http://www.ecologyandsociety.org/vol14/iss2/art32/>

⁵ Mansfield, B (2009). Sustainability. In N Castree, D Demeritt, B Rhoads, and D Liverman (Eds), *The Companion to Environmental Geography* (pp. 37-49). London: Blackwell.

⁶ Our Common Future (Brundtland Report) by the World Commission on Environment and Development (1987)

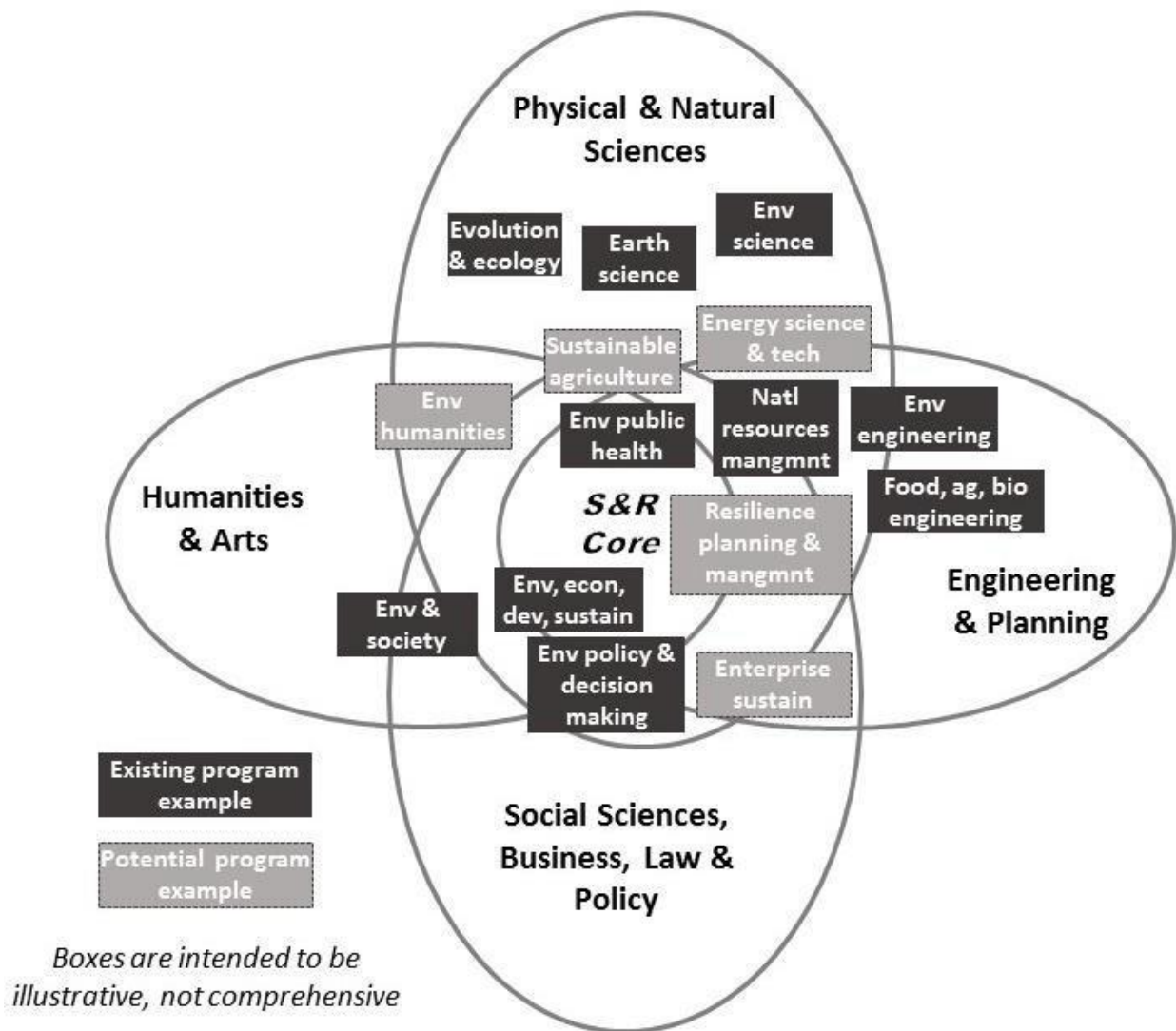
An earlier report on environmental programs in higher education (2011)⁷ suggests **four core competency intensions** of effective interdisciplinary environmental programs, which we adapt here as guidance for sustainability programs:

- Develop sustainability-minded citizens
- Prepare sustainability professionals to be problem solvers
- Train sustainability scientists
- Educate sustainability integrators

At Ohio State, we support a comprehensive array of programs that address sustainability, connecting across broad domains of natural sciences, social sciences, engineering, and humanities, to empower a diverse selection of multi-disciplinary and disciplinarily-focused sustainability programs.

⁷ Vincent, Shirley. 2011. Interdisciplinary Environmental Education: Elements of Field Identity, Core Competencies, and Curriculum Design for Higher Education.

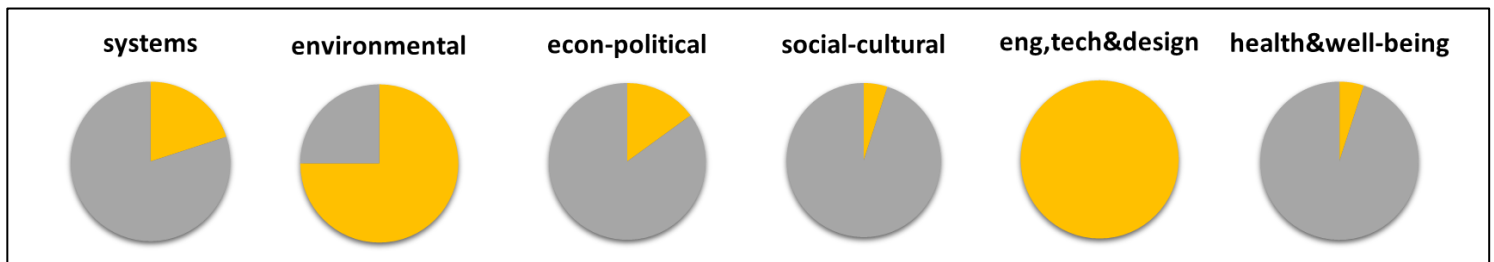
Appendix C: Existing Programs and Potential Program Gaps in Sustainability Education at Ohio State



Appendix D: Six Dimension Framework for Sustainability Program and Course Evaluation

The Six Dimension Framework Tool

for sustainability program and course evaluation



Data Collection

- Using an Excel tool, academic units will be asked to report the relative amount of content for each of the six categories above in their sustainability-related academic programs. For each of the six dimensions, they will assign a value between 0-100. The sample percentages above from the Environmental Engineering major represent the overall sustainability content in the program and an illustration of the approximate amount of content in each of the six dimensions.
- For courses, academic units will be asked to simply classify their courses by checking a box (yes/no response) indicating which of the six dimensions are addressed via the content of each specific sustainability-related course.

The Six Dimensions Defined

- **1 - systems:** coupled human-natural systems, integrating environmental, economic & social factors, systems thinking, resilience
- **2 - environment:** environmental, earth, and natural resource systems; knowledge of planetary/natural systems, e.g., climate, aquatics, soils, forests, wildlife, geology, ecology, agriculture; understanding of how these systems impact human well-being (e.g., health, economy, social justice, future generations)
- **3- economic-political:** economic and political factors of sustainability (economy/consumption/production; laws/policy/governance/institutions; business/strategy/management; costs/benefits/tradeoffs)
- **4 - social-cultural:** social/cultural factors of sustainability (justice, equity, values, ethics, history, religion, the arts, citizenship, power, behavior and decision making, cultural critique...)

- **5 – technology & design:** engineering; technological innovation; systems design; human-machine interface; manufacturing processes; life cycle; product design (design of technology and infrastructure to promote sustainability and human well-being)
- **6 - well-being:** human health, safety, risk, sustainable livelihoods, social welfare and well-being

*Note: We can also pull out **sustainability challenge/theme areas** for separate/additional emphasis according to university DTs, UN SDG challenge areas, etc: climate, energy, food, water, air, soil...*

Guidance for assessing the sustainability content of PROGRAMS for each of the six categories

- 100% = This is a primary focus of the program, e.g., two of more of the ELOs and a required course are focused on this area of sustainability.
- 75% = This is a clear focus of the program, e.g., at least one ELO or required course is focused on this area of sustainability.
- 50% = There are no ELOs or required courses in this area, but the program offers multiple courses (5 or more for a larger program, 3 or more for a smaller program) or other learning opportunities, e.g., internships, education abroad, minors, certificates, in this area of sustainability.
- 25% = There are no ELOs or required courses in this area, but the program offers 2-4 courses in this area.

Note: If there are other learning opportunities that you offer that cause you to adjust these percentages (internships, education abroad, certificates, etc.), please describe these additional offerings.

Appendix E: List of Sustainability-Related Majors and Minors

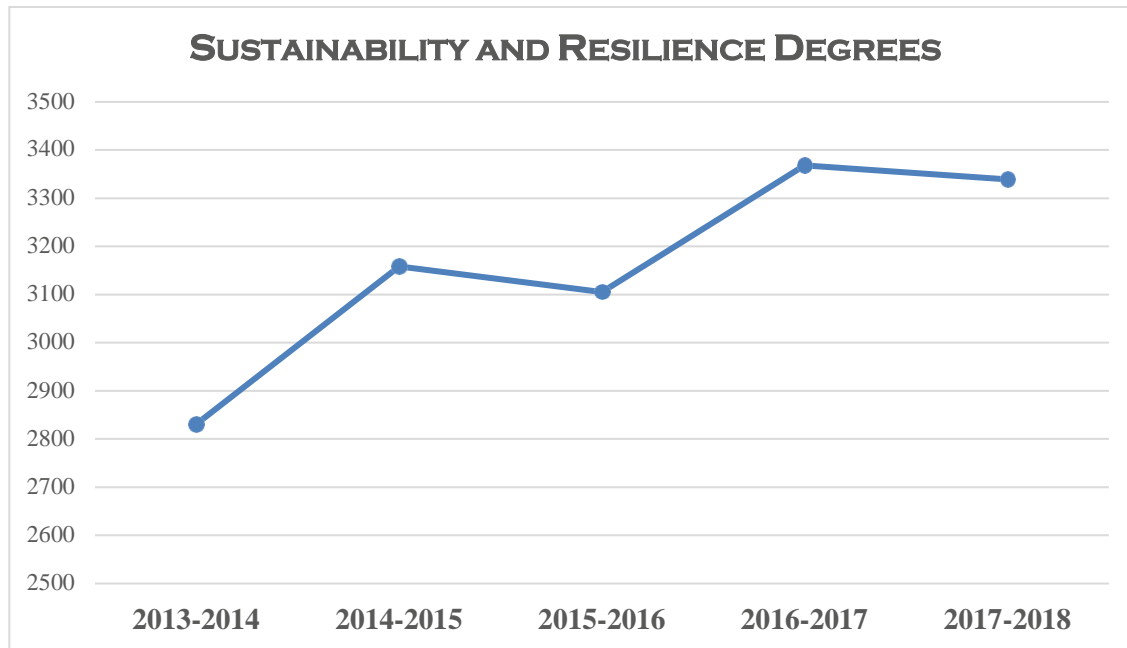
<u>Academic Program</u>	<u>Major or Minor</u>	<u>College/School</u>
Environment, Economy, Development, Sustainability	Major	School of Environment and Natural Resources
Plant Pathology	Major	College of Food, Agricultural, and Environmental Sciences
Environmental Engineering	Major	College of Engineering
Earth Sciences	Major	College of Arts and Sciences
Public Health	Major	College of Public Health
Food, Agricultural, Biological Engineering	Major	College of Engineering and College of Food, Agricultural and Environmental Sciences
Biology	Major	College of Arts and Sciences
Evolution and Ecology	Major	College of Arts and Sciences
Civil Engineering	Major	College of Engineering
Natural Resource Management	Major	School of Environment and Natural Resources
Social Work	Major	College of Social Work
Computer Science and Engineering	Major	College of Engineering
Zoology	Major	College of Arts and Sciences
Environmental Science	Major	School of Environment and Natural Resources
Materials Science and Engineering	Major	College of Engineering
Animal Science	Major	College of Food, Agricultural, and Environmental Sciences
Agribusiness and Applied Economics	Major	College of Food, Agricultural, and Environmental Sciences
Aerospace and Astronautical Engineering	Major	College of Engineering
Sustainable Plant Systems	Major	College of Food, Agricultural, and Environmental Sciences
Forestry, Fisheries, Wildlife	Major	School of Environment and Natural Resources
Interior Design	Major	College of Arts and Sciences
Biomedical Engineering	Major	College of Engineering
Environmental Policy and Decision Making	Major	School of Environment and Natural Resources
Landscape Architecture	Major	Knowlton School of Architecture
Chemical Engineering	Major	College of Engineering
Electrical and Computer Engineering	Major	College of Engineering

Visual Communication Design	Major	College of Arts and Sciences
Entomology	Major	College of Food, Agricultural, and Environmental Sciences
Geography	Major	College of Arts and Sciences
Plant Health Management	Major	College of Food, Agricultural, and Environmental Sciences
Engineering Physics	Major	College of Engineering
Industrial and Systems Engineering	Major	College of Engineering
Industrial Design	Major	College of Arts and Sciences
History	Major	College of Arts and Sciences
Mechanical Engineering	Major	College of Engineering
Hospitality Management	Major	College of Arts and Sciences
City and Regional Planning	Major	Knowlton School of Architecture
Food Science and Technology	Major	College of Food, Agricultural, and Environmental Sciences
Anthropology	Major	College of Arts and Sciences
Food Business Management	Major	College of Food, Agricultural, and Environmental Sciences
Forestry, Fisheries, Wildlife	Minor	School of Environment and Natural Resources
Society and Environmental Issues	Minor	School of Environment and Natural Resources
City and Regional Planning	Minor	Knowlton School of Architecture
Environmental Science	Minor	School of Environment and Natural Resources
Global Public Health	Minor	College of Public Health
Earth Sciences	Minor	College of Arts and Sciences
Geographic Information Systems	Minor	College of Arts and Sciences
Agribusiness	Minor	College of Food, Agricultural, and Environmental Sciences
Plant Pathology	Minor	College of Food, Agricultural, and Environmental Sciences
Surveying and Mapping	Minor	College of Engineering
Rural Sociology	Minor	School of Environment and Natural Resources
Environmental Economics	Minor	College of Food, Agricultural, and Environmental Sciences
Environmental Engineering	Minor	College of Engineering
Atmospheric Science	Minor	College of Arts and Sciences
Environment, Economy, Development, Sustainability	Minor	School of Environment and Natural Resources
Evolution and Ecology	Minor	College of Arts and Sciences
Humanitarian Engineering	Minor	College of Engineering

Science, Engineering, Public Policy	Minor	Glenn College of Public Affairs
Sustainable Agriculture	Minor	School of Environment and Natural Resources

Sources: OSU AASHE STARS Submission 2016 and Initial SELC Framing Document

Appendix F: Enrollment Trends and Degrees Awarded for Sustainability-Related Undergraduate Academic Plans



Sustainability-Related Major Program Degrees Awarded by Year

ACAD_PLAN	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	% Change from 13-14 to 17-18
EEDSUS-BSE	5	29	53	63	52	940%
PLNTPTH-BS	2	4	2	5	7	250%
ENVENG-BS	12	34	34	40	37	208%
EARTHSC-BS	11	21	33	27	33	200%
PUBHLTH-BS	32	82	74	95	94	194%
FABENG-BS	34	35	44	45	95	179%

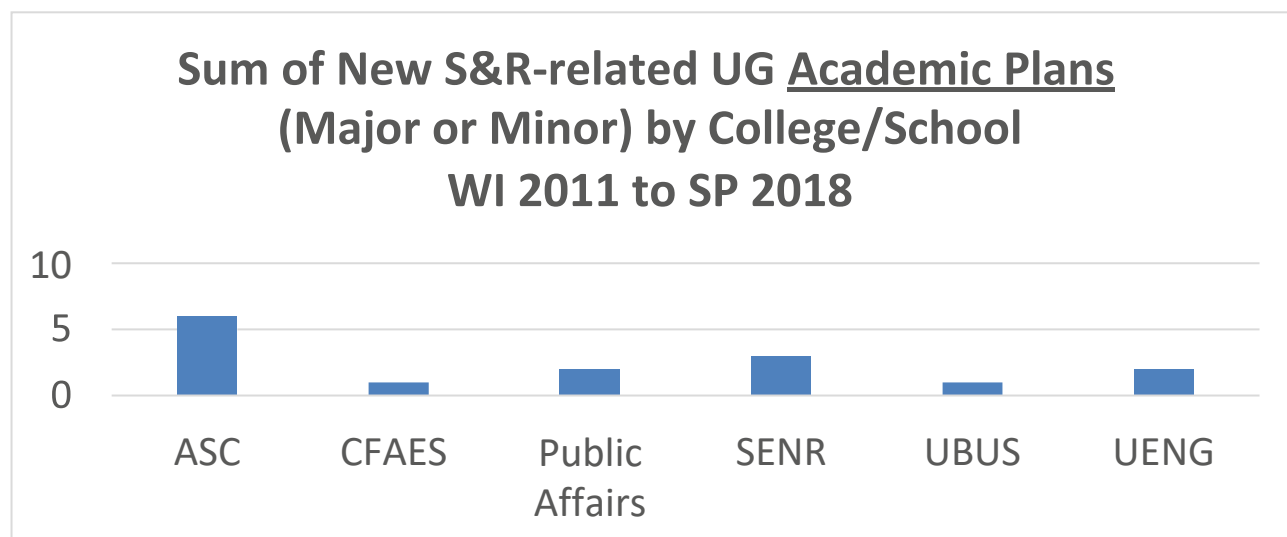
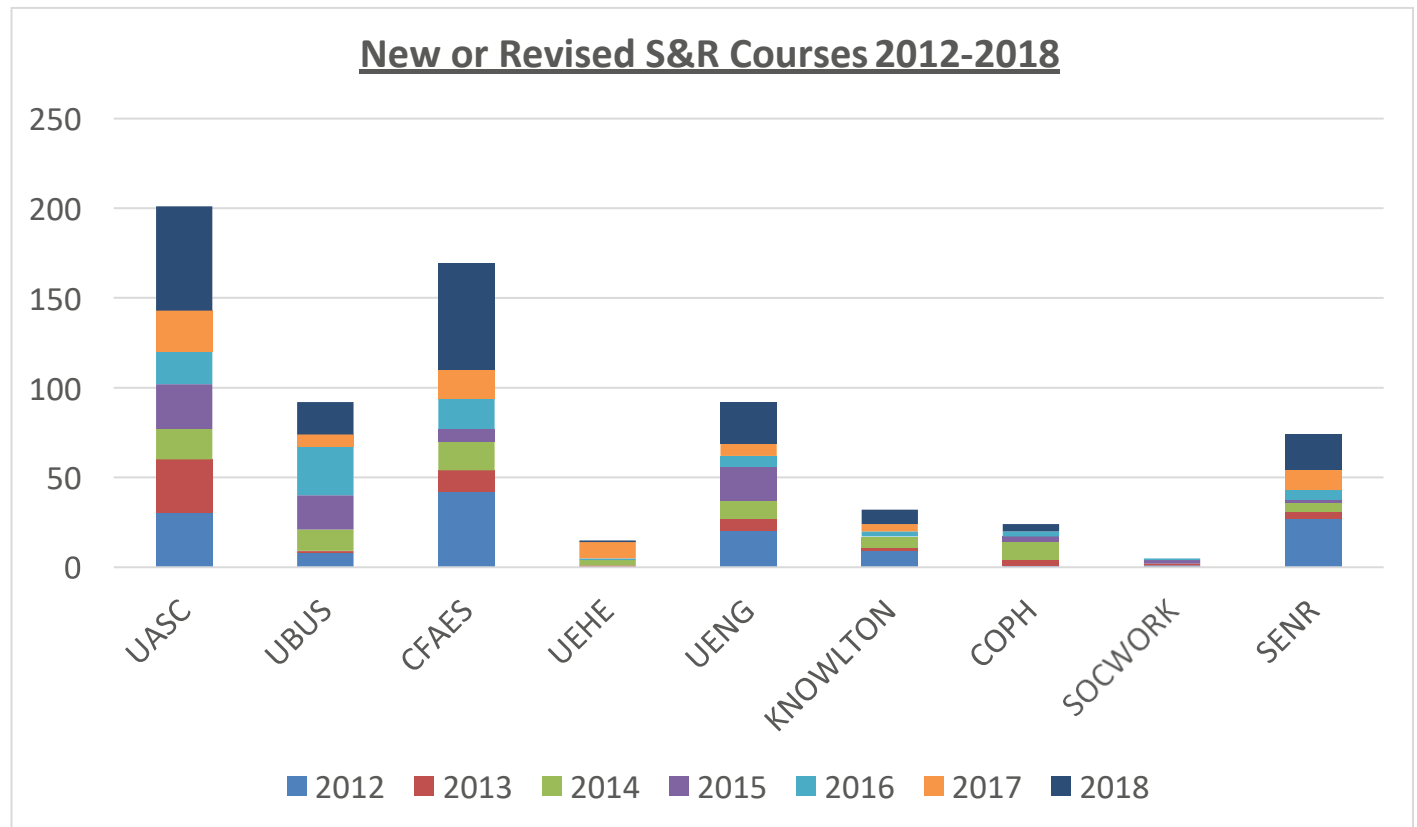
BIOLOGY-BA	22	30	41	39	53	141%
EVOLECO-BS	13	17	23	30	28	115%
CIVENG-BS	113	158	166	188	179	58%
NATRESM-BS	19	33	31	25	30	58%
SOCWORK-BS	160	196	192	232	246	54%
CSENG-BS	164	190	232	275	249	52%
ZOOLOGY-BA	7	6	13	8	10	43%
ENVSCI-BS	29	39	38	46	40	38%
MATSENG-BS	48	68	44	64	66	38%
ANIMSC-BS	125	160	149	157	171	37%
AGBUSAE-BS	70	100	98	94	94	34%
AEROENG-BS	60	59	65	72	78	30%
SUSTPLT-BS	37	58	43	51	45	22%
FFW-BS	22	23	44	29	26	18%
INTDSN-BSD	14	16	13	15	16	14%
BIOMEDE-BS	62	68	72	82	70	13%
ENVPDM-BS	24	26	25	13	27	13%
LARCH-BS	18	28	21	18	20	11%
CHEMENG-BS	181	166	179	235	201	11%
ECENG-BS	198	213	206	235	216	9%
VSLDSN-BSD	15	16	16	19	16	7%
BIOLOGY-BS	354	344	356	336	376	6%
ZOOLOGY-BS	64	66	75	64	67	5%
ENTMLGY-BS	3	1	5	4	3	0%

GEOG-BS	9	2	4	1	9	0%
PLHLTHM-BS	1	2	3	2	1	0%
ENGPYS-BS	24	22	14	20	23	-4%
GEOG-BA	23	28	15	19	19	-17%
INDENG-BS	130	148	137	145	106	-18%
INDDSN-BSD	21	13	21	14	17	-19%
HISTORY-BA	162	153	108	122	127	-22%
MECHENG-BS	264	261	196	224	206	-22%
HSPMGT-BS	104	104	93	83	80	-23%
CRPLAN-BS	51	35	29	36	39	-24%
FDSCTE-BSF	40	35	32	30	26	-35%
ANTHROP-BA	60	47	43	41	31	-48%
FDBUSMG-BS	14	14	18	21	6	-57%
ANIMSC-BSN	10	8	5	4	4	-60%
TOTALS	2831	3158	3105	3368	3339	18%

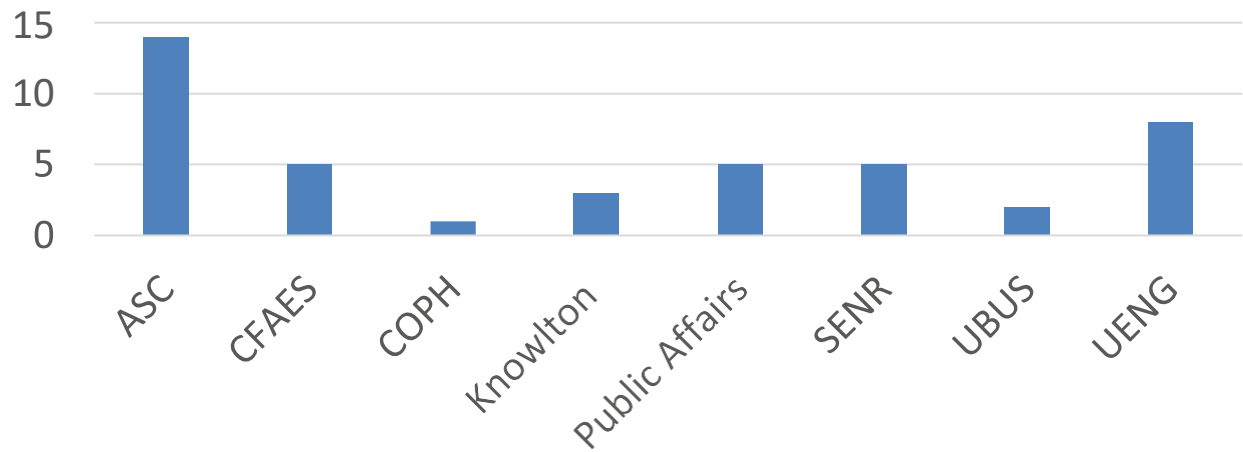
Sustainability-Related Minor Programs Completed by Year

ACAD_PLAN	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	% Change from 13-14 to 17-18
FFW-MN	5	8	16	15	22	340%
SOCENV-MN	3	5	12	11	12	300%
CRPLAN-MN	13	30	24	38	46	254%
ENVSCI-MN	6	13	23	12	18	200%
GPBHLTH-MN	41	82	77	113	98	139%
EARTHSC-MN	2	5	4	10	4	100%
GEOGINF-MN	7	12	5	15	13	86%
AGBUSAE-MN	66	71	71	81	83	26%
PLNTPTH-MN	6	9	7	7	6	0%
SURVMAP-MN	7	9	3	6	6	-14%
RURLSOC-MN	2	1	4	2	1	-50%
ENVECON-MN	4	4	2		1	-75%
ENVENG-MN	8	8	3	3	1	-88%
ATMOSSC-MN		1	2	3		#DIV/0!
EEDSUS-MN		7	11	19	26	#DIV/0!
EVOLECO-MN		1		5	2	#DIV/0!
HUMENG-MN			5	7	13	#DIV/0!
SCIENPP-MN				2	6	#DIV/0!
SUSTAGR-MN		2	3	1	1	#DIV/0!
TOTALS	170	268	272	350	359	211%

Appendix G: New or Revised Sustainability-Related Academic Plans or Courses (2012-2018)



**Sum of Revised S&R-related UG Academic Plans
(Major or Minor) by College/School
AU 2013 to SP 2018**



Appendix H: Selected Results from the ESS Lab Student Sustainability Survey

The Environmental Social Sustainability Lab (ESS Lab) at Ohio State created and administered this survey in collaboration with faculty and staff in facilities, Student Life, the Sustainability Institute, and other units. The survey included questions on student interests in academic programs and opportunities for professional skills development. It was distributed to undergraduates in October 2018 ($N \cong 2,100$ which is about 4.5% of undergraduate students enrolled in 2017-2018). *Source: ESS lab fall 2018 campus sustainability survey.*

Please rate your interest in sustainability courses for your MAJOR							
	Not interested at all	Slightly interested	Moderately interested	Very interested	Extremely interested	Total # Responses	%Total Undergrad Enrollment
Agriculture	11%	24%	34%	21%	10%	71	3.4%
Architecture	4%	18%	18%	21%	39%	28	5.4%
Arts and Sciences	20%	23%	25%	19%	12%	818	4.8%
Business	22%	23%	26%	18%	10%	277	3.7%
Education and Human Ecology	21%	20%	25%	21%	14%	110	3.4%
Engineering	17%	17%	27%	24%	14%	423	5.2%
Environ. & Natural Resources	1%	1%	10%	22%	66%	83	31.4%
Exploration Program	22%	26%	26%	17%	10%	101	3.9%
Health & Rehabilitation Sci	18%	27%	27%	21%	8%	97	5.2%
John Glenn Public Affairs	8%	28%	36%	20%	8%	25	7.9%
Nursing Dental and Medical	23%	20%	22%	25%	11%	65	5.4%
Pharmacy	39%	29%	16%	13%	3%	31	6.0%
Public Health	6%	12%	27%	39%	15%	33	10.3%
Social Work	38%	25%	13%	25%	0%	16	3.7%
Total	19%	21%	25%	21%	14%	2,178	4.7%
40% none or slight			60% moderate+				
				35% very+			

Please rate your interest in sustainability courses for your MINOR							
	Not interested at all	Slightly interested	Moderately interested	Very interested	Extremely interested	Total # Responses	%Total Undergrad Enrollment
Agriculture	26%	22%	28%	20%	4%	46	2.2%
Architecture	11%	21%	5%	37%	26%	19	3.7%
Arts and Sciences	27%	23%	21%	16%	11%	546	3.2%
Business	29%	23%	23%	17%	9%	197	2.6%
Education and Human Ecology	30%	15%	30%	17%	8%	60	1.9%
Engineering	31%	19%	25%	17%	8%	212	2.6%
Environ. & Natural Resources	5%	9%	20%	34%	32%	44	16.7%
Exploration Program	29%	27%	24%	17%	3%	59	2.3%
Health & Rehabilitation Sci	34%	28%	20%	14%	3%	64	3.4%
John Glenn Public Affairs	18%	35%	29%	18%	0%	17	5.4%
Nursing Dental and Medical	42%	19%	16%	16%	6%	31	2.6%
Pharmacy	57%	14%	14%	14%	0%	21	4.1%
Public Health	29%	12%	47%	6%	6%	17	5.3%
Social Work	27%	45%	18%	9%	0%	11	2.6%
Total	28%	22%	23%	17%	10%	1,344	2.9%
50% none or slight			50% moderate+				
				27% very+			

Please rate your interest in GENERAL EDUCATION sustainability courses							
	Not interested at all	Slightly interested	Moderately interested	Very interested	Extremely interested	Total # Responses	%Total Undergrad Enrollment
Agriculture	16%	30%	33%	17%	4%	70	3.3%
Architecture	11%	11%	18%	39%	21%	28	5.4%
Arts and Sciences	10%	25%	32%	22%	11%	811	4.7%
Business	13%	20%	34%	23%	10%	272	3.6%
Education and Human Ecology	12%	34%	24%	22%	9%	110	3.4%
Engineering	11%	27%	32%	19%	11%	420	5.2%
Environ. & Natural Resources	2%	17%	20%	28%	33%	83	31.4%
Exploration Program	17%	30%	29%	16%	9%	101	3.9%
Health & Rehabilitation Sci	19%	25%	34%	15%	7%	97	5.2%
John Glenn Public Affairs	8%	16%	36%	28%	12%	25	7.9%
Nursing Dental and Medical	22%	26%	28%	20%	5%	65	5.4%
Pharmacy	26%	26%	32%	16%	0%	31	6.0%
Public Health	6%	16%	41%	25%	13%	32	10.0%
Social Work	13%	25%	13%	38%	13%	16	3.7%
Total	12%	25%	31%	21%	11%	2,161	4.7%
36% none or slight		64% moderate+					
				32% very+			

I am well informed about my options to enroll or participate in sustainability courses, minors, majors, and other educational offerings at OSU

	Frequency	Percent	
Strongly disagree	294	13.4	somewhat disagree+ 42.5
Somewhat disagree	639	29.1	
Neither agree nor disagree	448	20.4	
Somewhat agree	588	26.8	somewhat agree+ 37.1
Strongly agree	228	10.4	
Total Responses	2197		

I am involved in the academic side of sustainability (for example through taking sustainability courses and pursuing sustainability-related research opportunities.)

	Frequency	Percent		
Strongly disagree	441	20.5	disagree+ 50.6	
Disagree	646	30.1		
Somewhat disagree	295	13.7		
Neither agree nor disagree	326	15.2		
Somewhat agree	244	11.4	somewhat agree+ 20.4	
Agree	112	5.2		agree+ 9
Strongly agree	82	3.8		
Total Responses	2146			

I would like to be more involved in the academic side of sustainability

	Frequency	Percent		
Strongly disagree	115	5.4	disagree+ 14	
Disagree	185	8.6		
Somewhat disagree	178	8.3		
Neither agree nor disagree	490	22.8		
Somewhat agree	677	31.5	somewhat agree+ 54.9	
Agree	357	16.6		agree+ 23.4
Strongly agree	147	6.8		
Total Responses	2149			

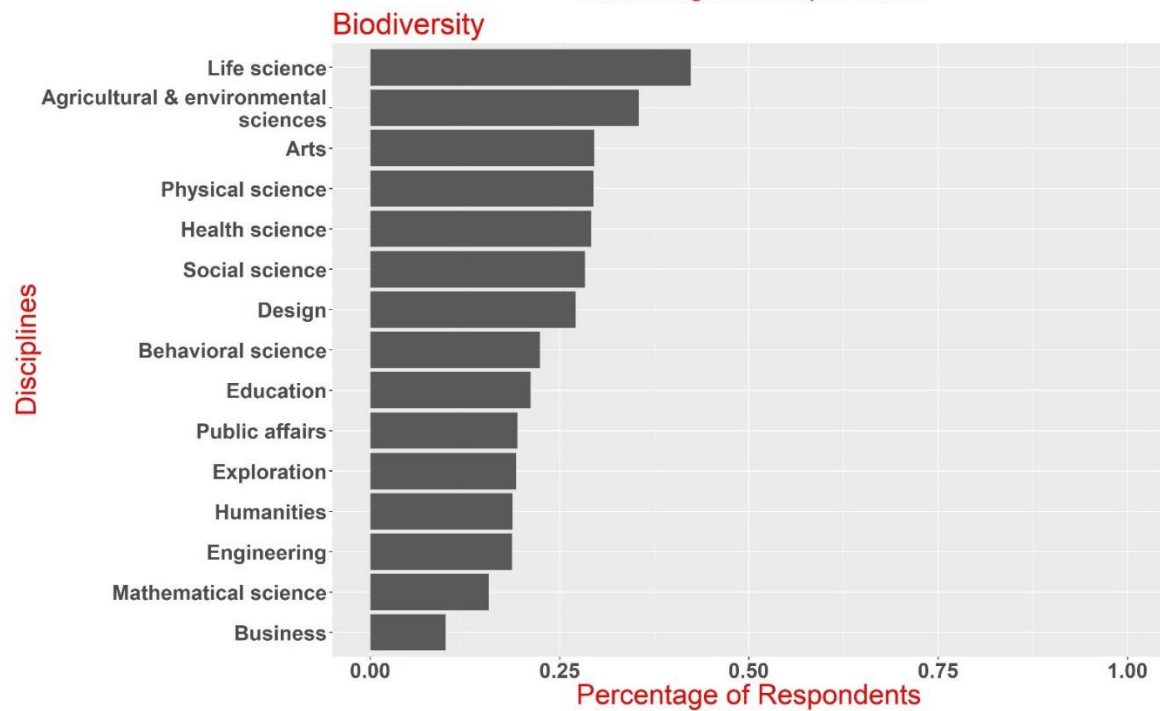
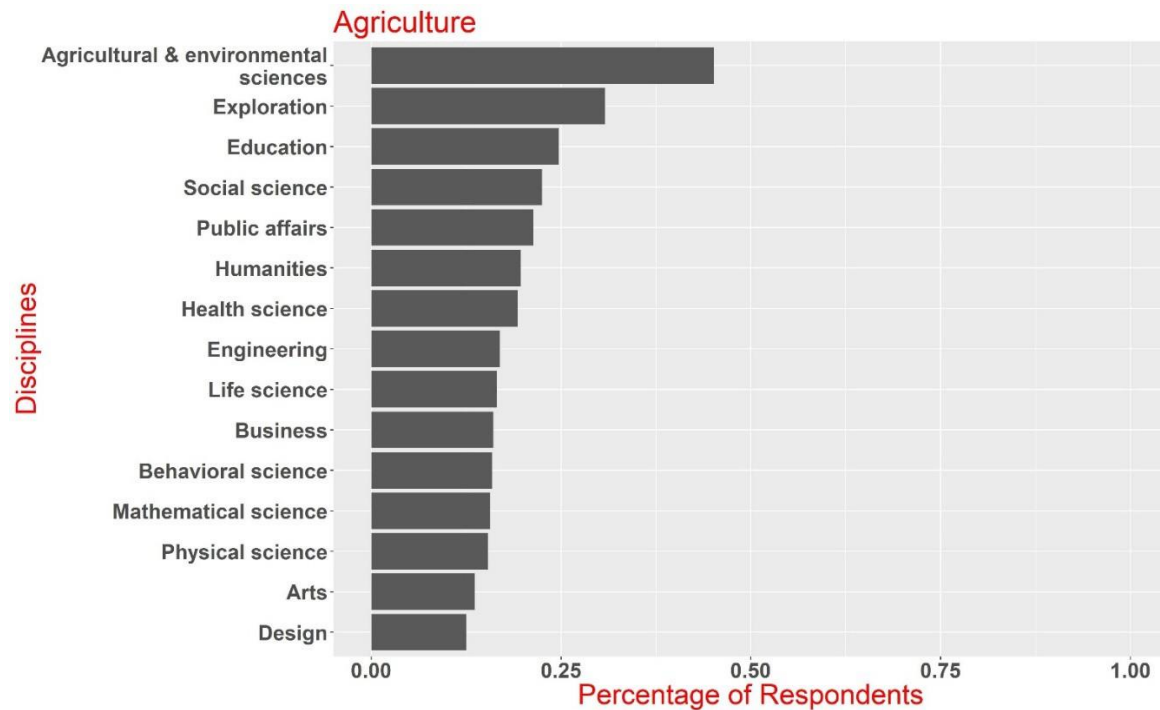
I am involved in the professional side of sustainability (for example pursuing sustainability-related internships, volunteer opportunities, and student organization involvement or leadership)

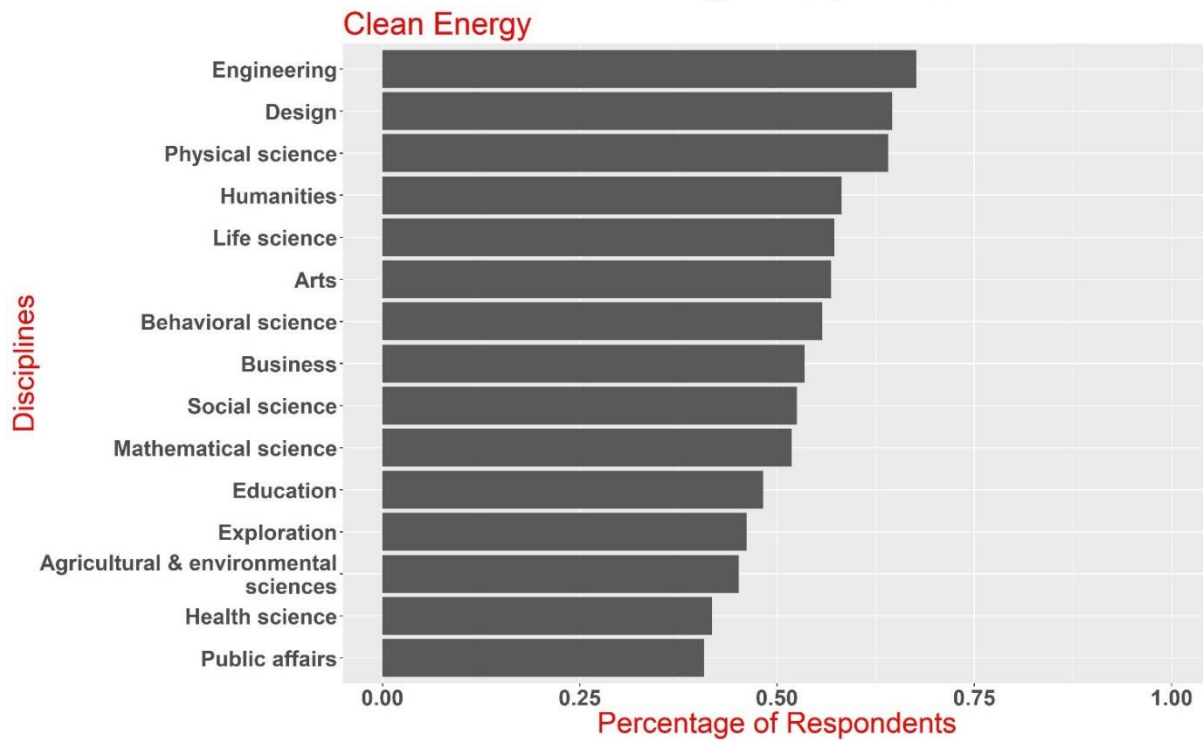
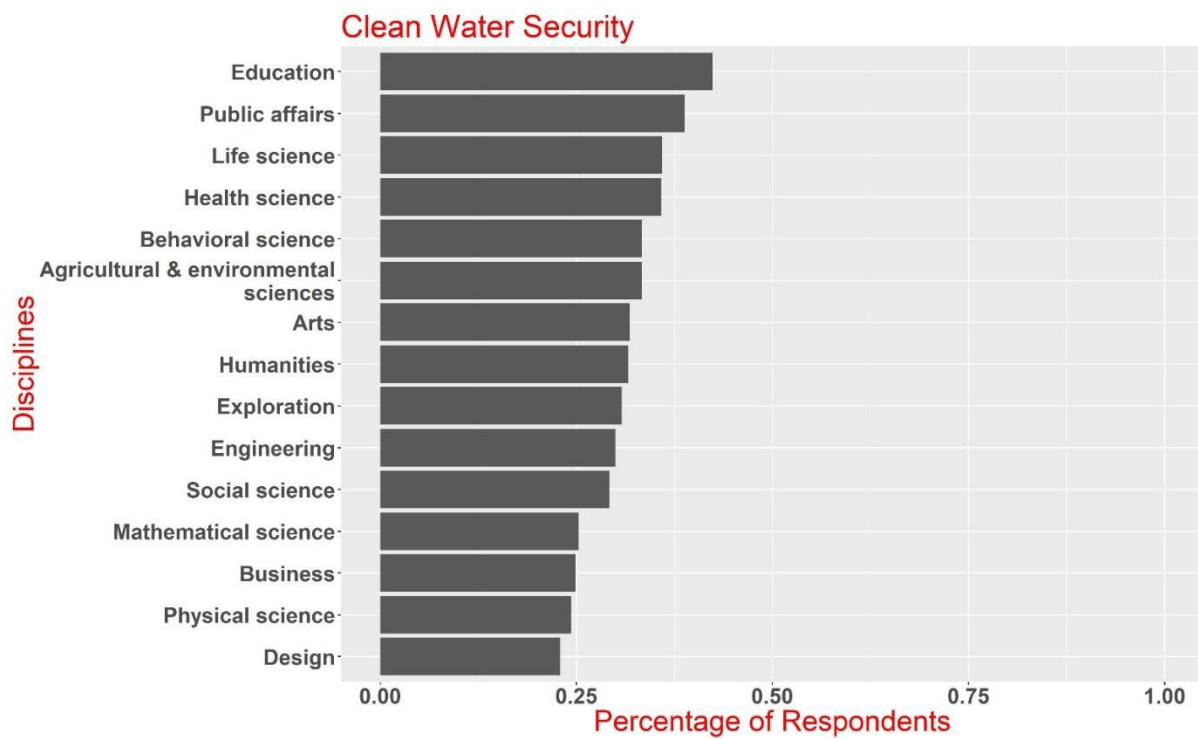
	Frequency	Percent		
Strongly disagree	554	25.7	disagree+ 55.9	
Disagree	651	30.2		
Somewhat disagree	283	13.1		
Neither agree nor disagree	295	13.7		
Somewhat agree	206	9.6	somewhat agree+ 17.3	
Agree	93	4.3		
Strongly agree	73	3.4		agree+ 7.7
Total Responses	2155			

I would like to be more involved in the professional side of sustainability

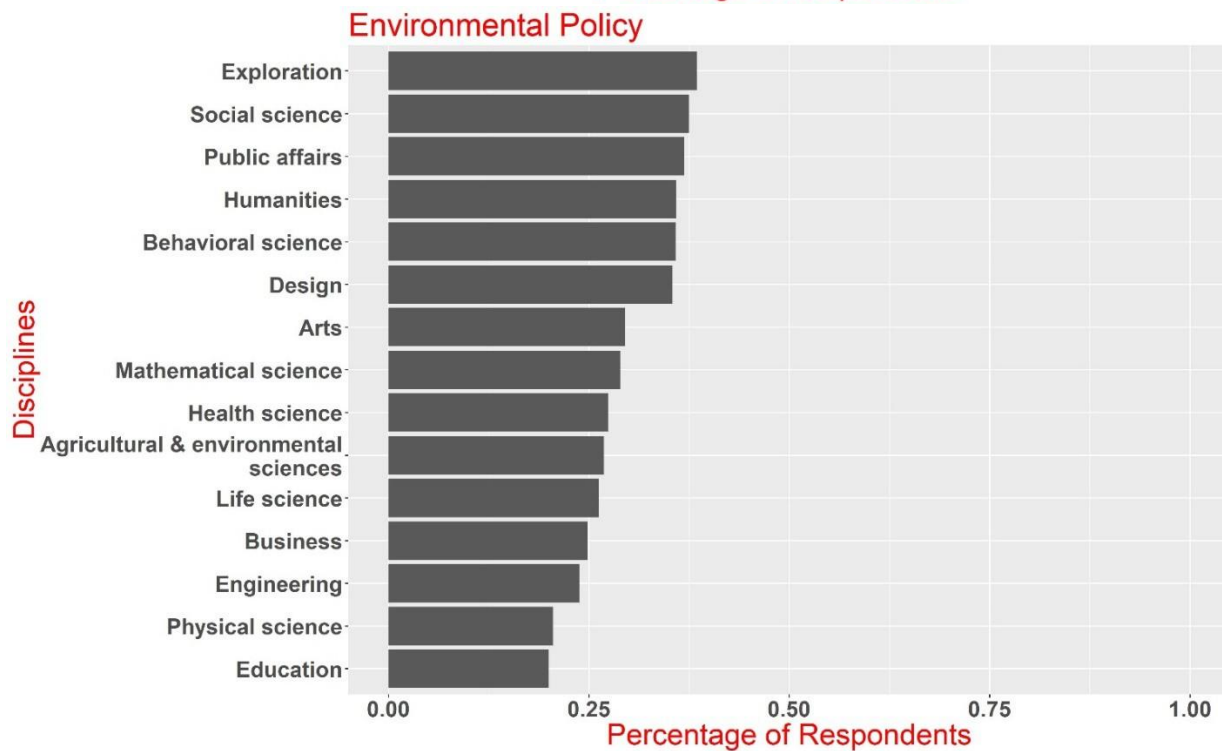
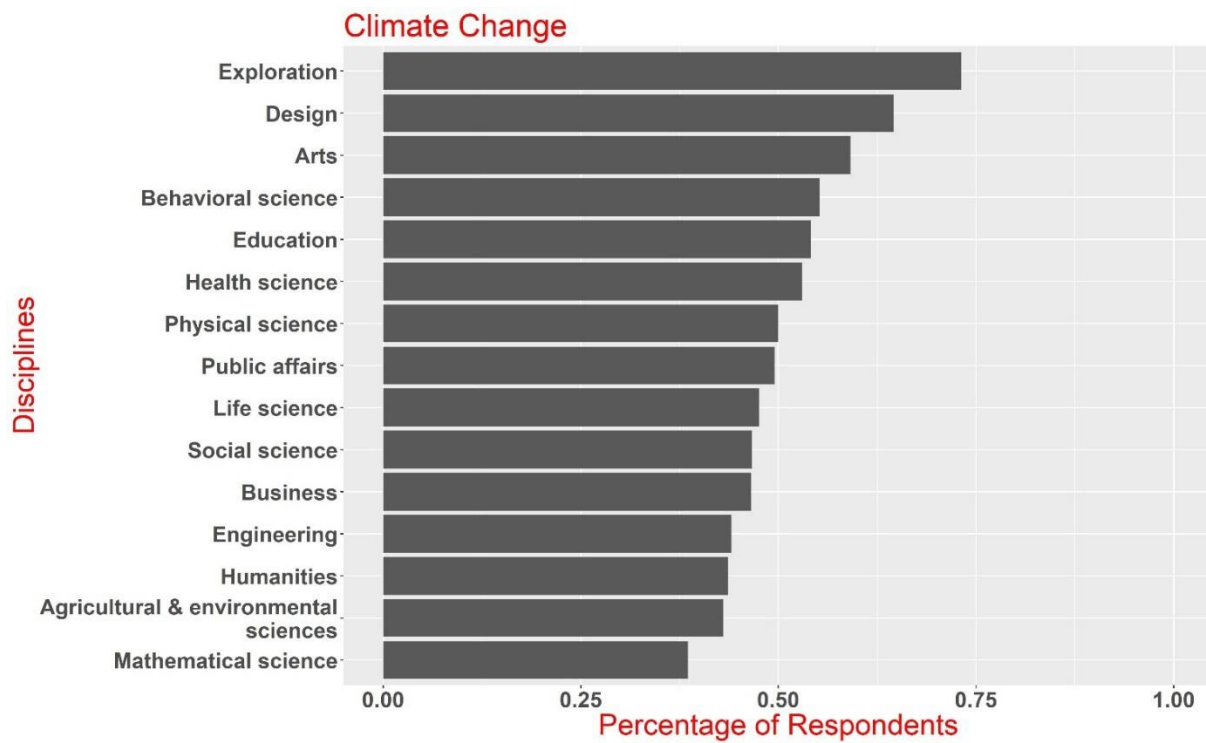
	Frequency	Percent		
Strongly disagree	143	6.6	disagree+ 15.9	
Disagree	200	9.3		
Somewhat disagree	172	8		
Neither agree nor disagree	450	20.9		
Somewhat agree	670	31.1	somewhat agree+ 55.1	
Agree	320	14.9		
Strongly agree	196	9.1		agree+ 24
Total Responses	2151			

Appendix I: Selected Results from EEDS Capstone Survey by Disciplines and Topic Areas

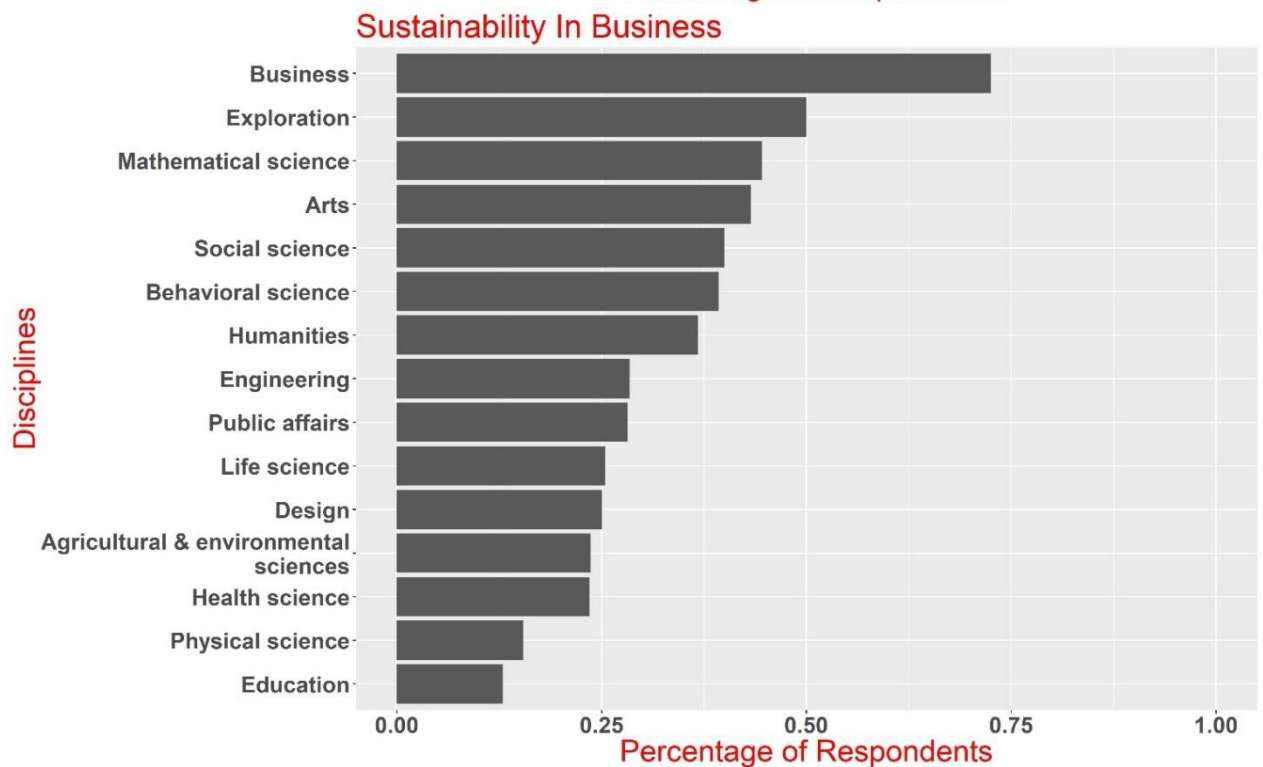
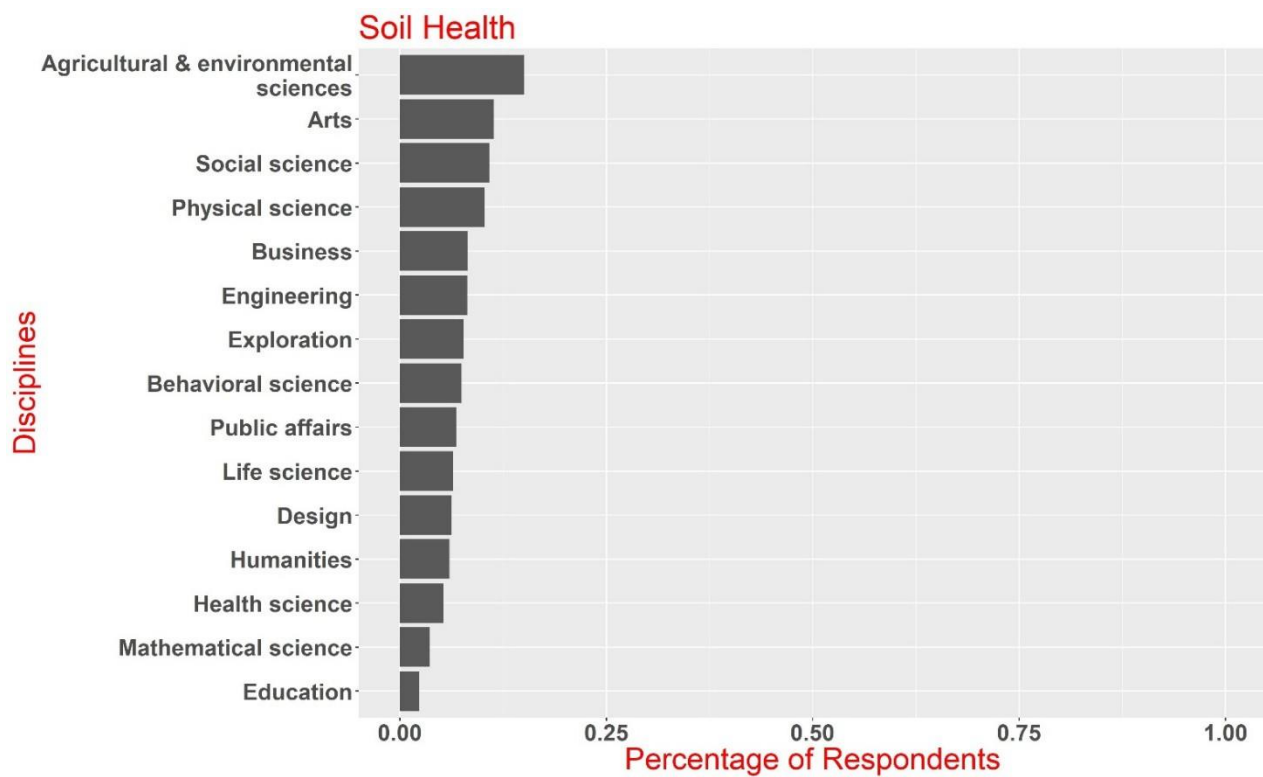




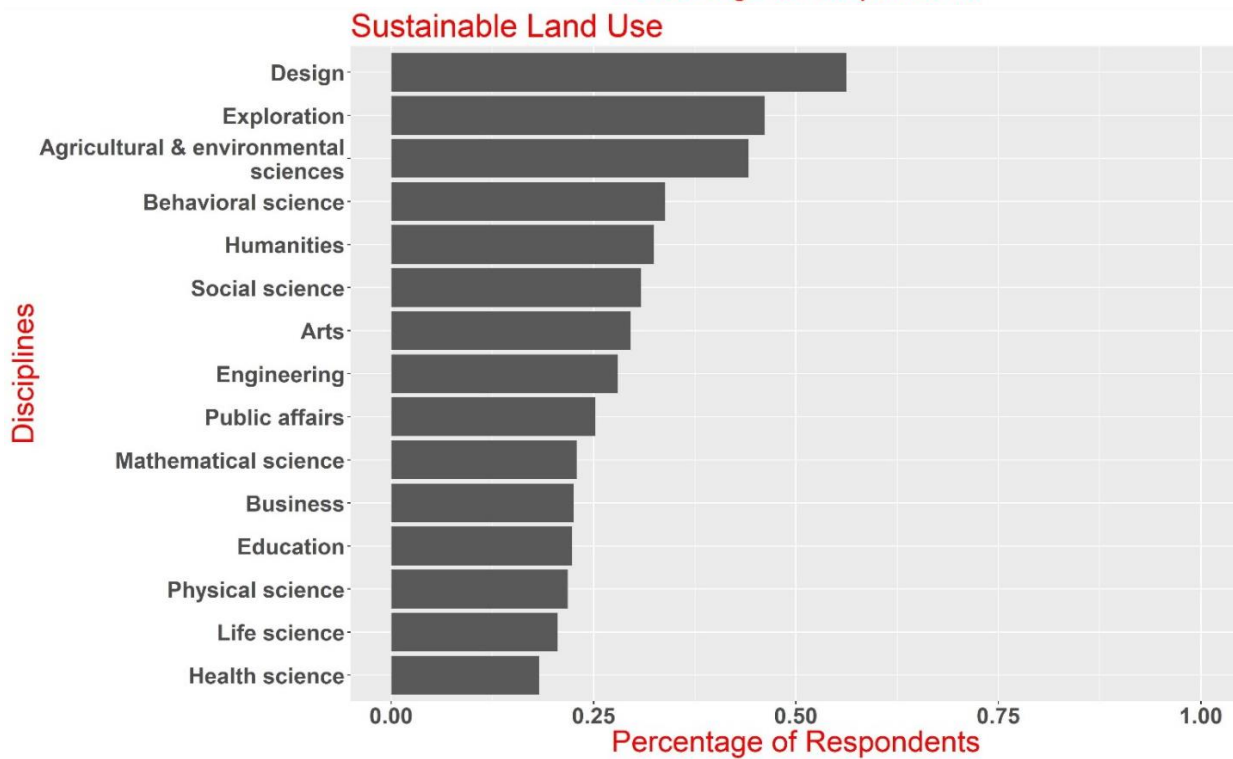
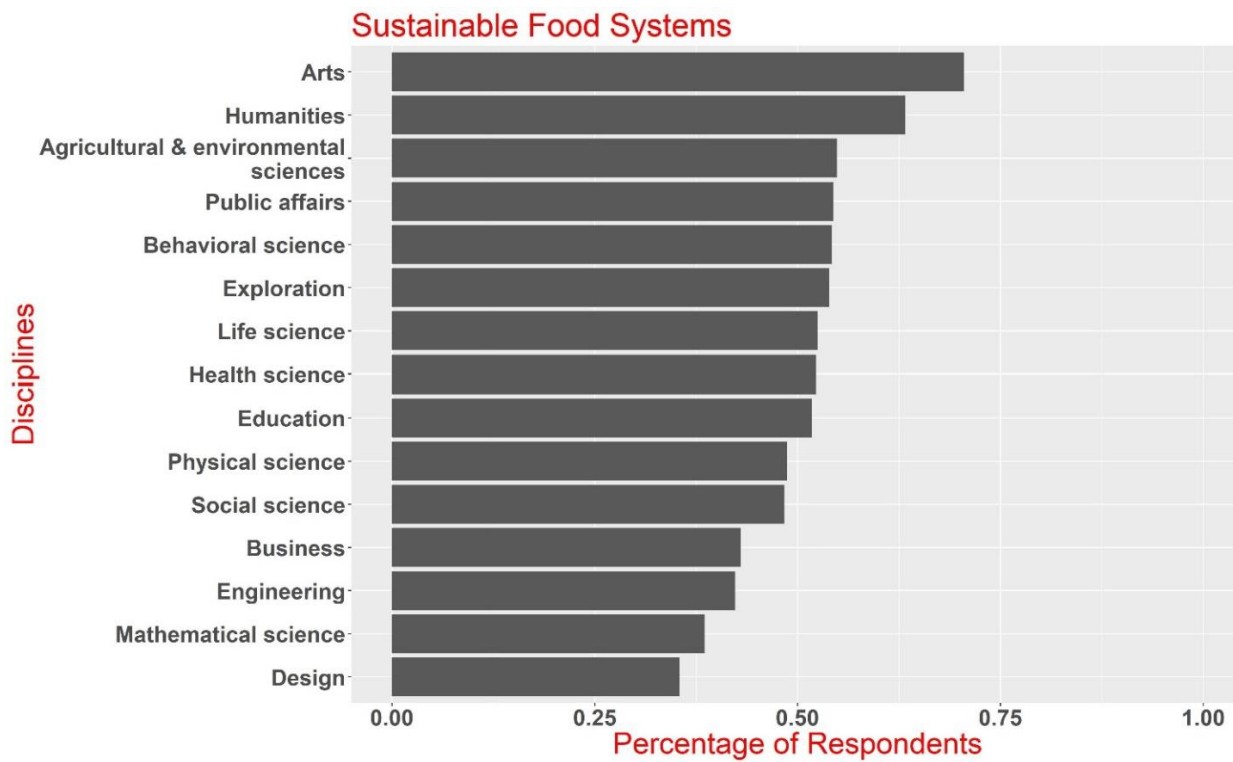
Q6: Percent of undergraduate students by discipline expressing interest in **learning more about a topic** (respondents were allowed to choose up to 5 topics from list of 14 total, #Responses=9,200, N=2,218 EEDS capstone course project, Spring 2018)



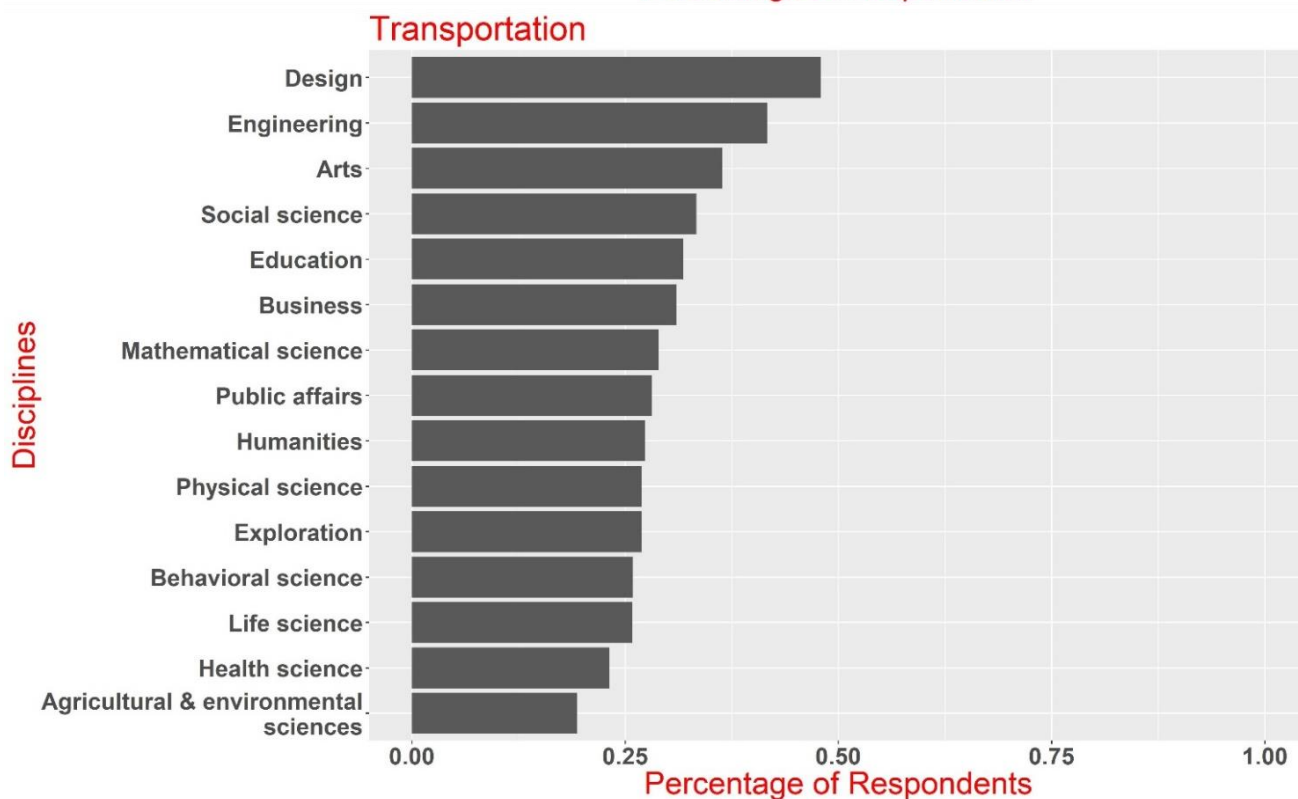
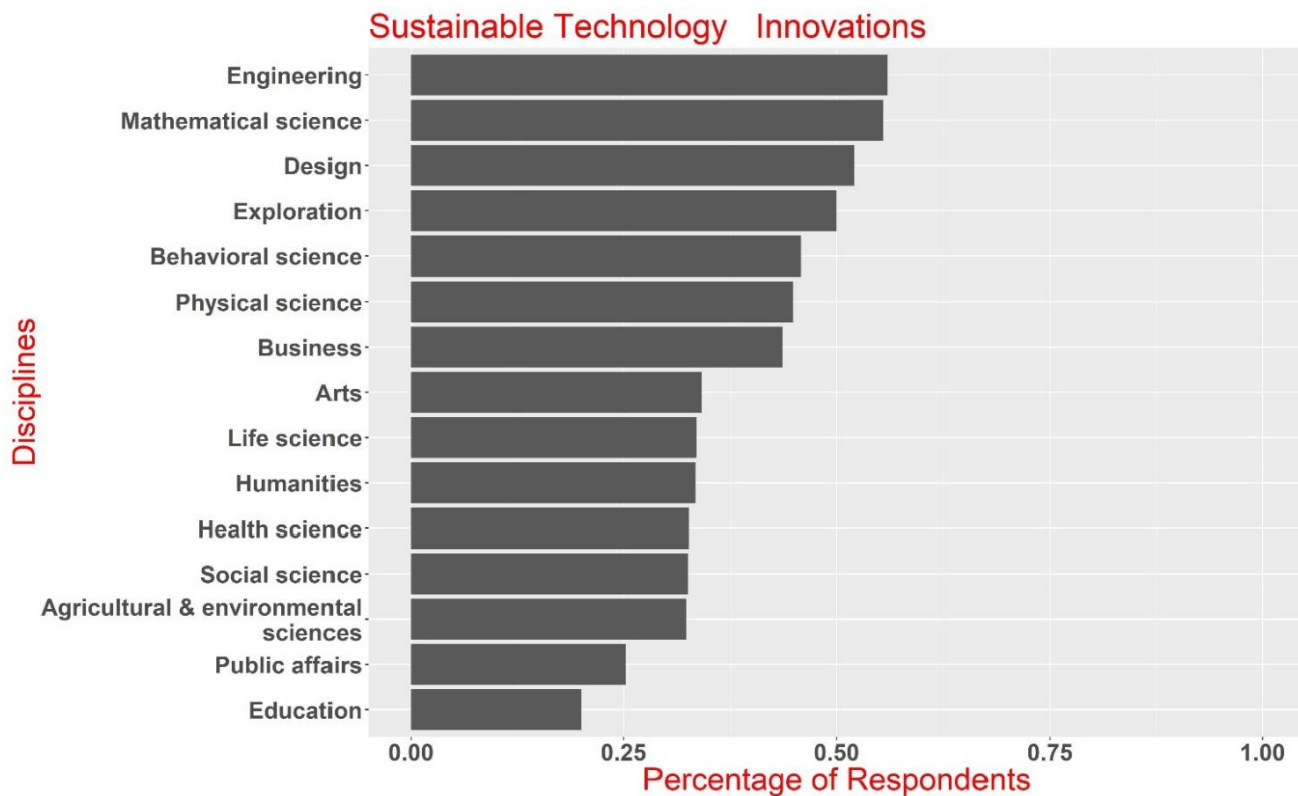
Q6: Percent of undergraduate students by discipline expressing interest in **learning more about a topic** (respondents were allowed to choose up to 5 topics from list of 14 total, #Responses=9,200, N=2,218 EEDS capstone course project, Spring 2018)



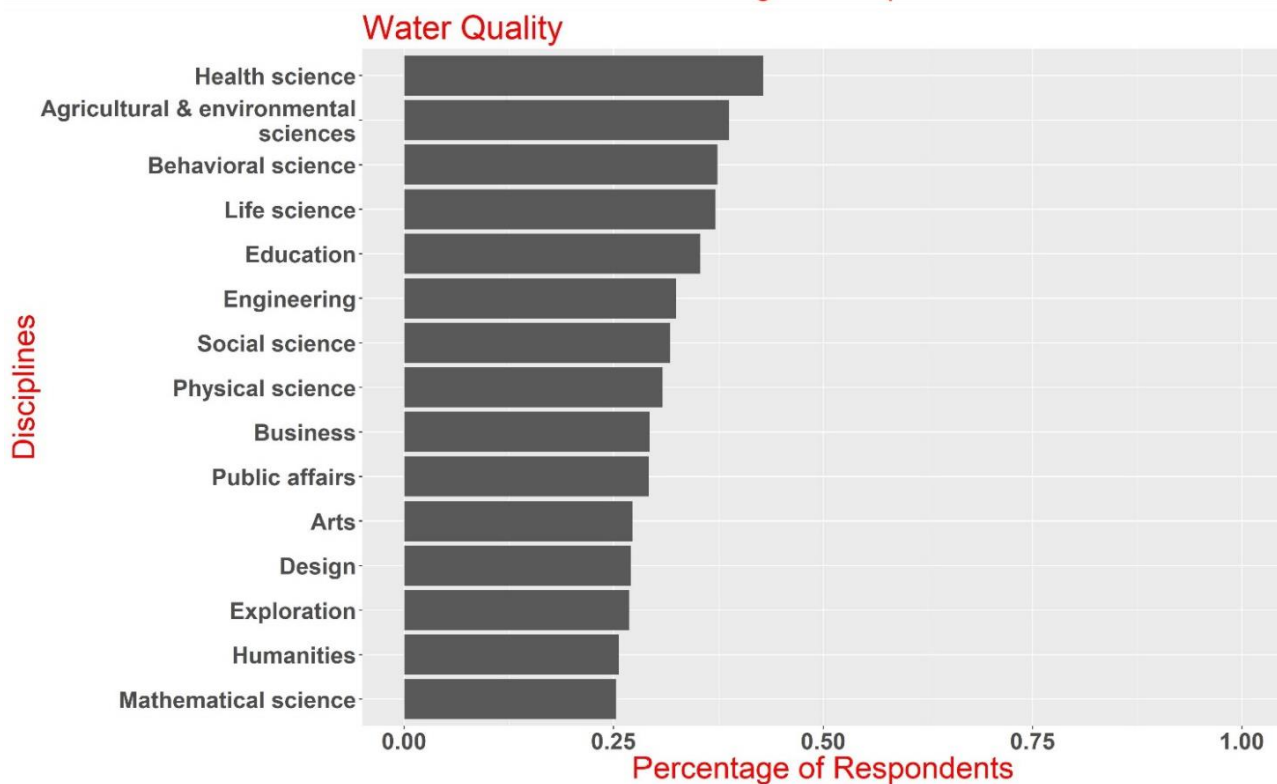
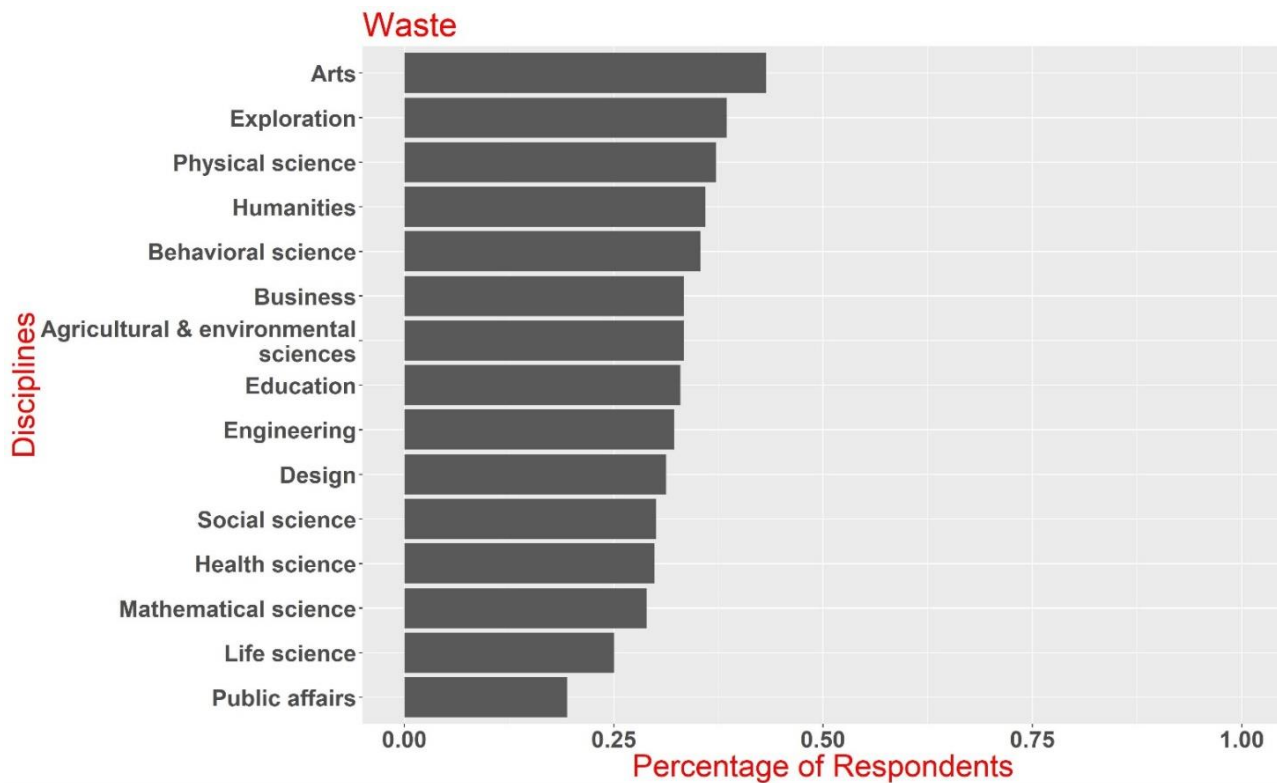
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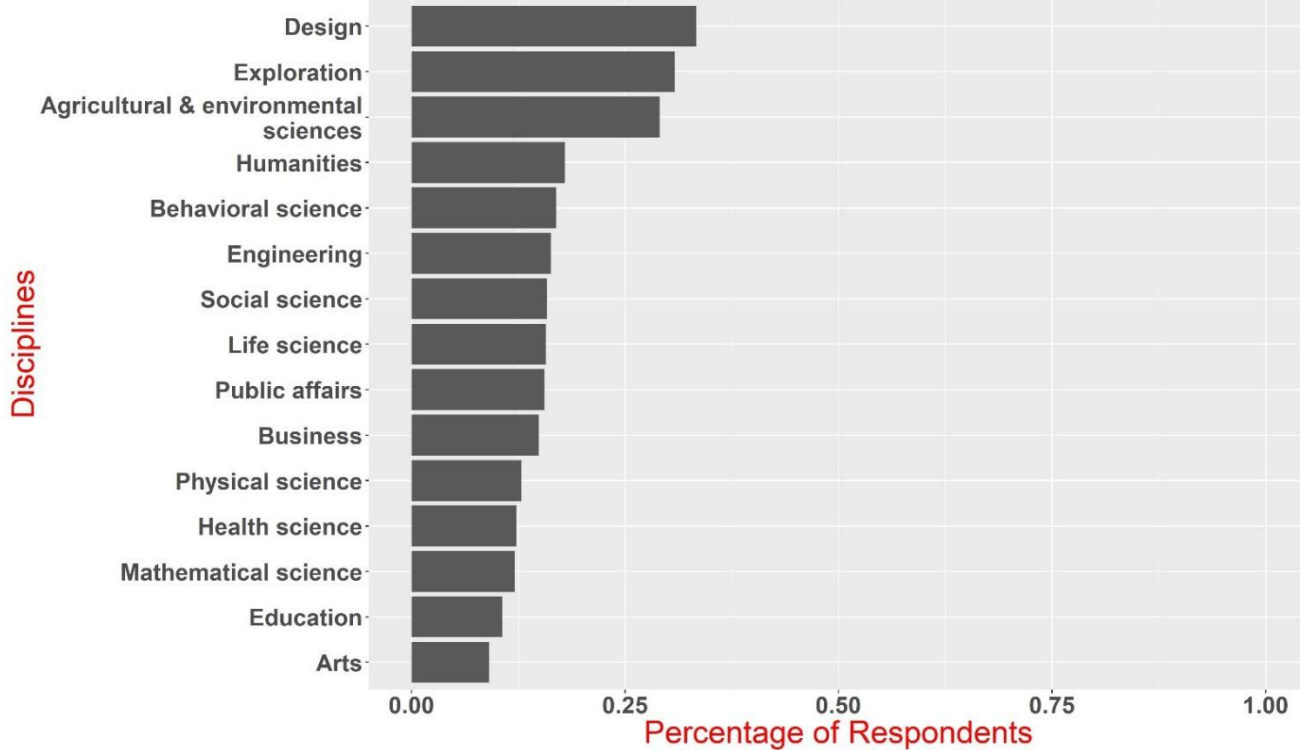


Q6: Percent of undergraduate students by discipline expressing interest in **learning more about a topic** (respondents were allowed to choose up to 5 topics from list of 14 total, #Responses=9,200, N=2,218 EEDS capstone course project, Spring 2018)

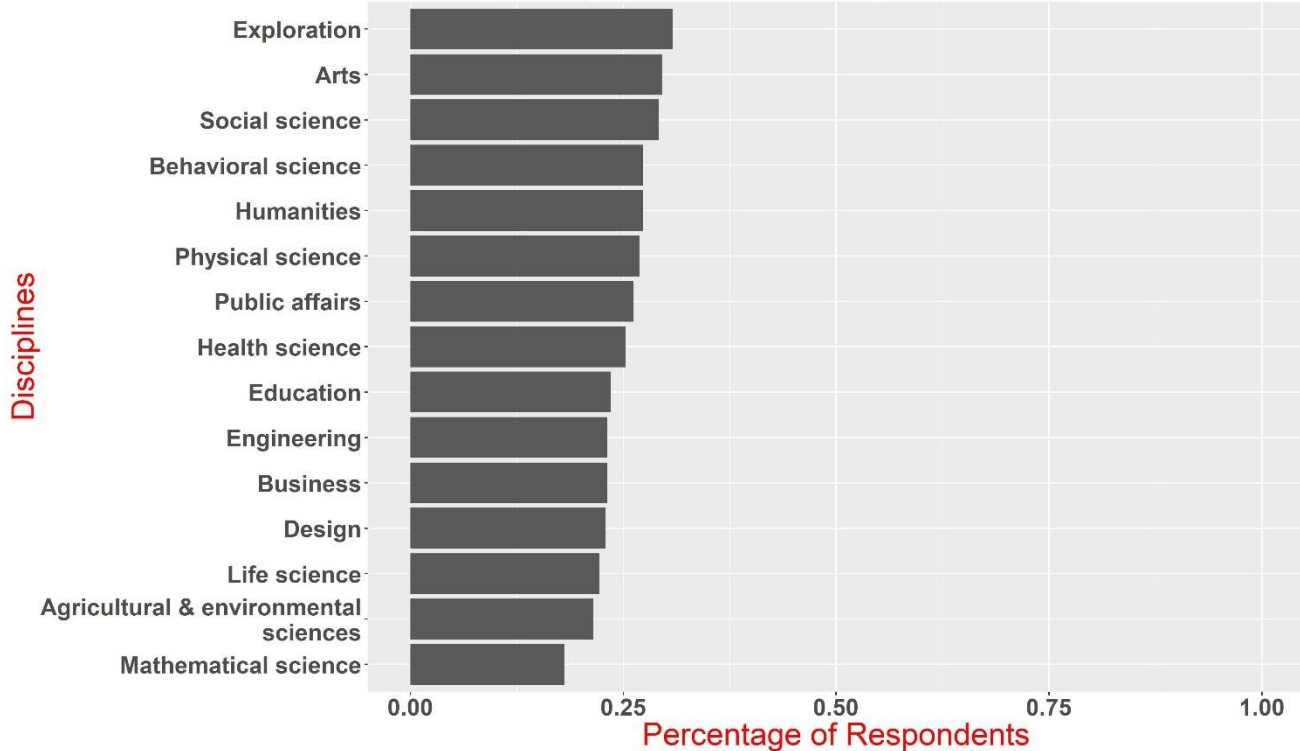


Q6: Percent of undergraduate students by discipline expressing interest in **learning more about a topic** (respondents were allowed to choose up to 5 topics from list of 14 total, #Responses=9,200, N=2,218 EEDS capstone course project, Spring 2018)

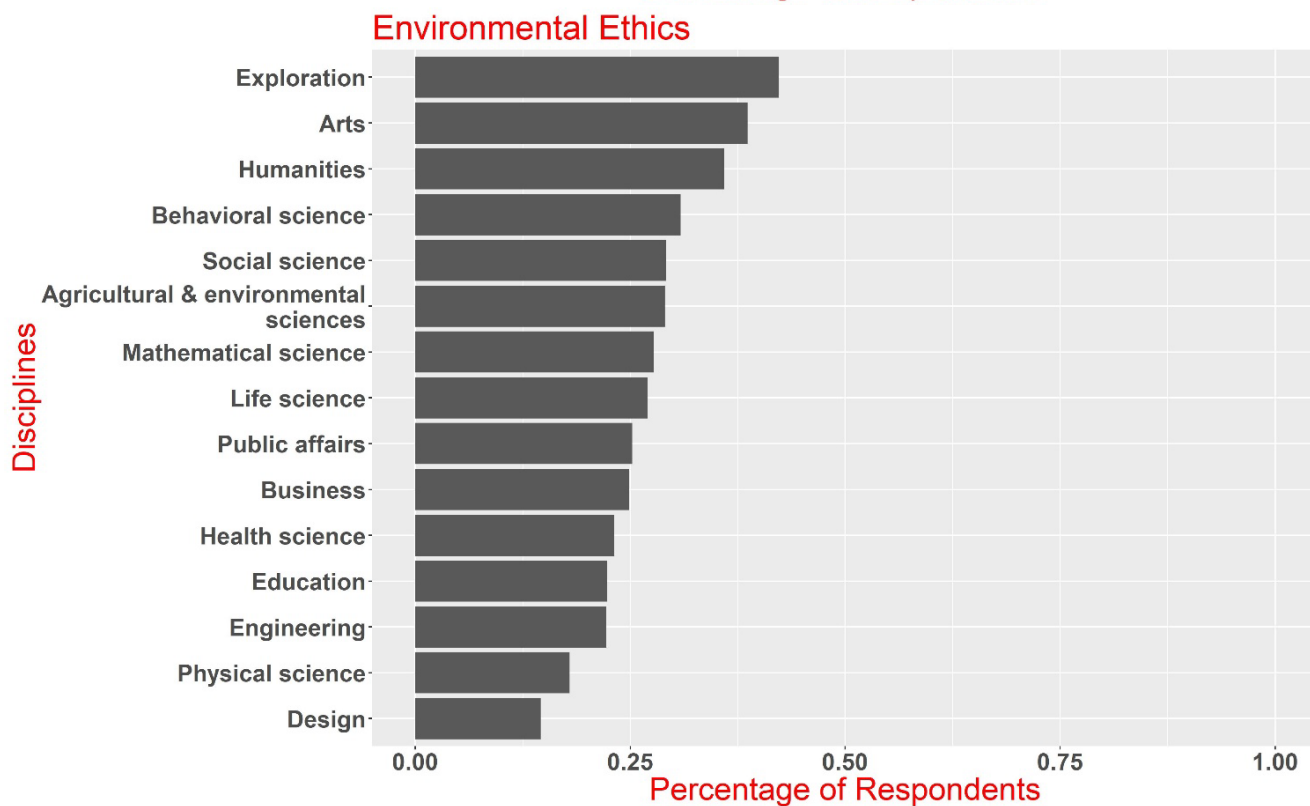
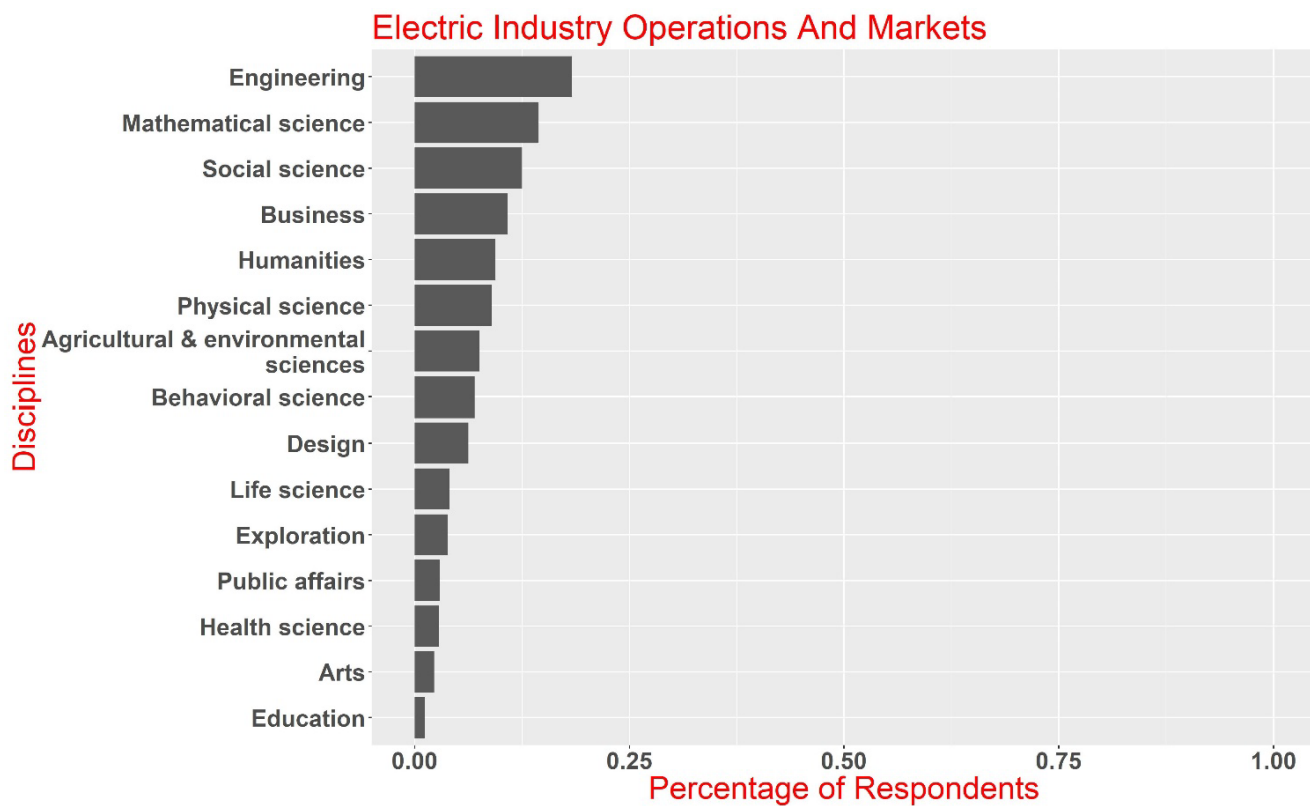
Ecosystem Services A Method For Sustainable Development



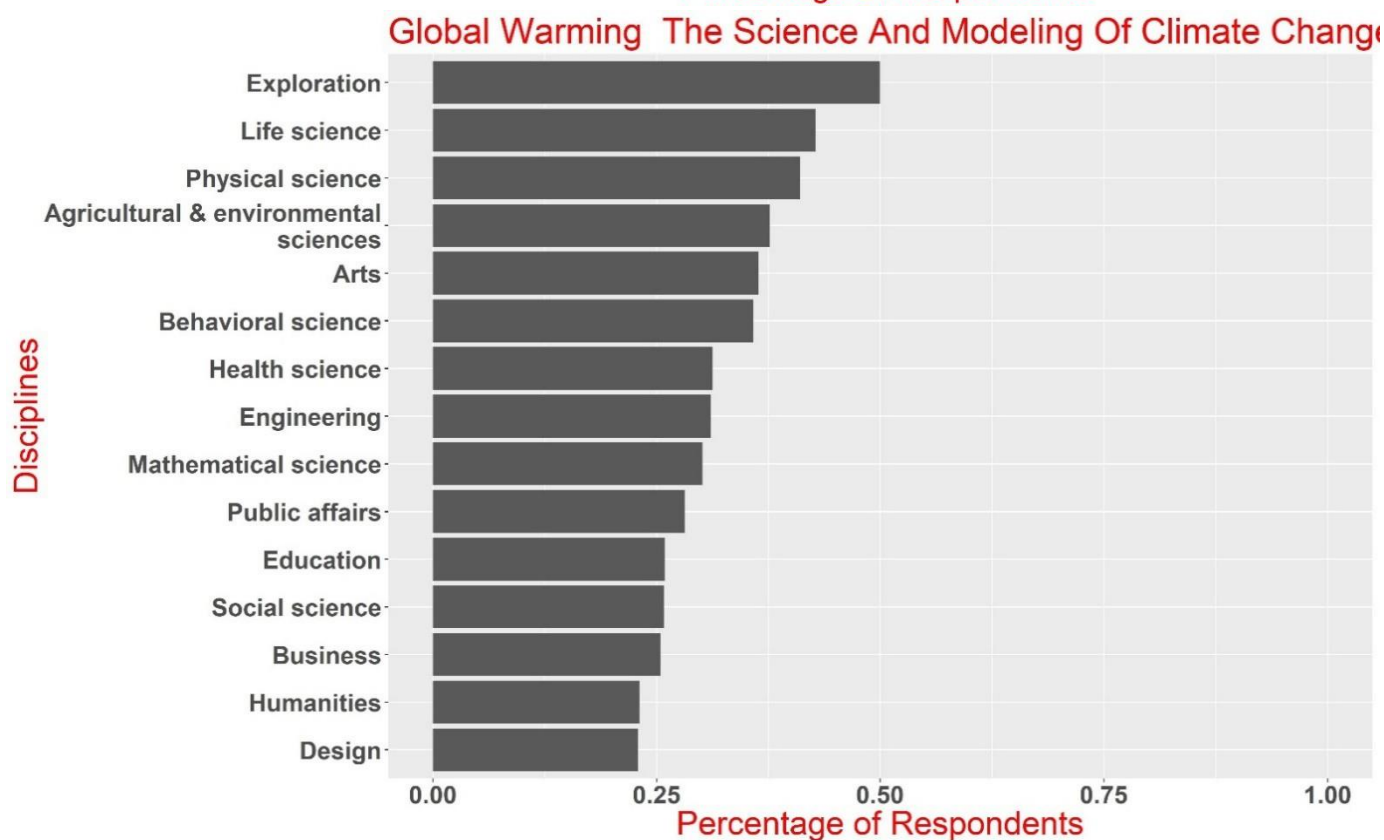
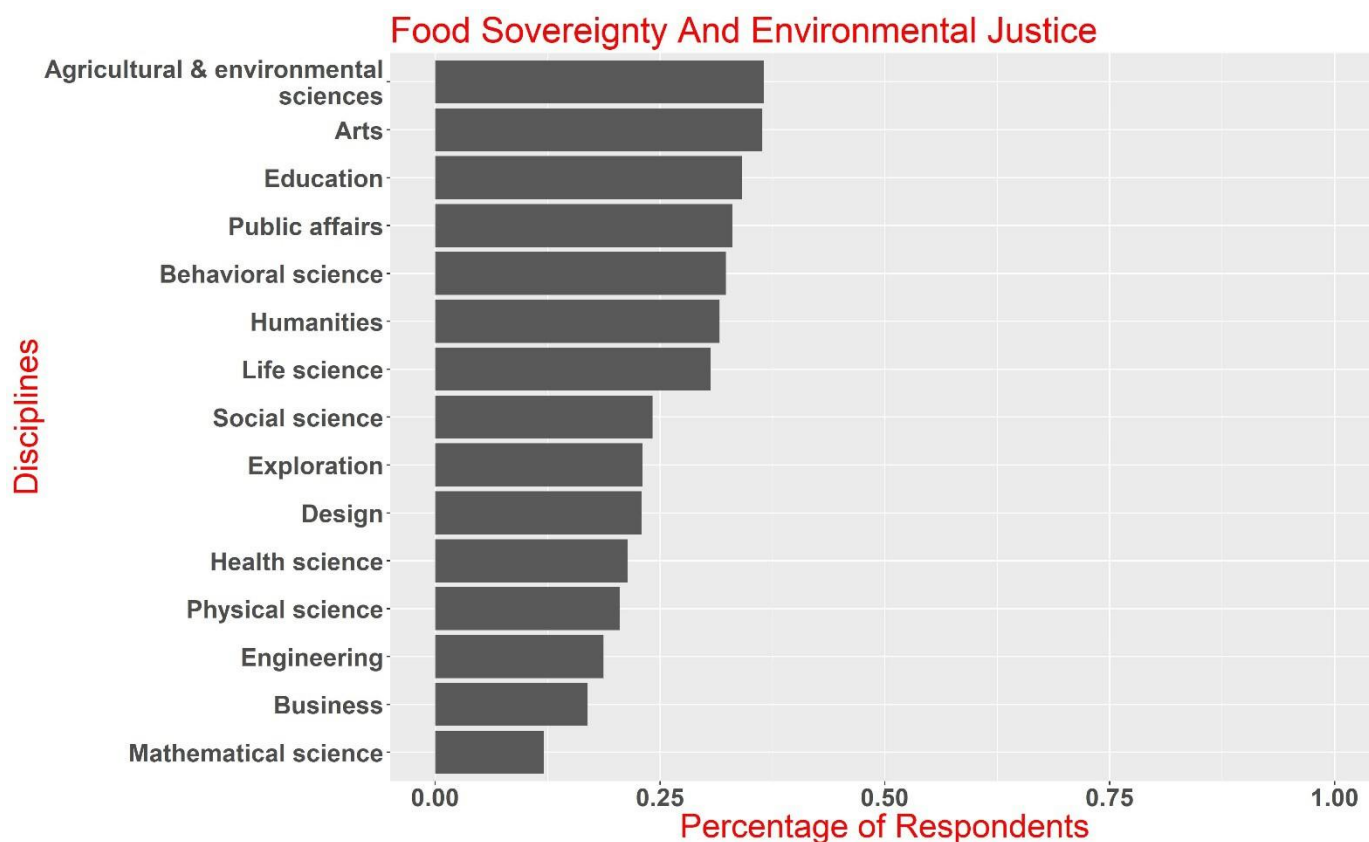
Climate Change And International Development



Q7: Percent of undergraduate students by discipline expressing interest in **taking a class on this topic** (respondents were allowed to choose up to 5 topics from list of 14 total, #Responses=7,924, N=2,211 EEDS capstone course project, Spring 2018)

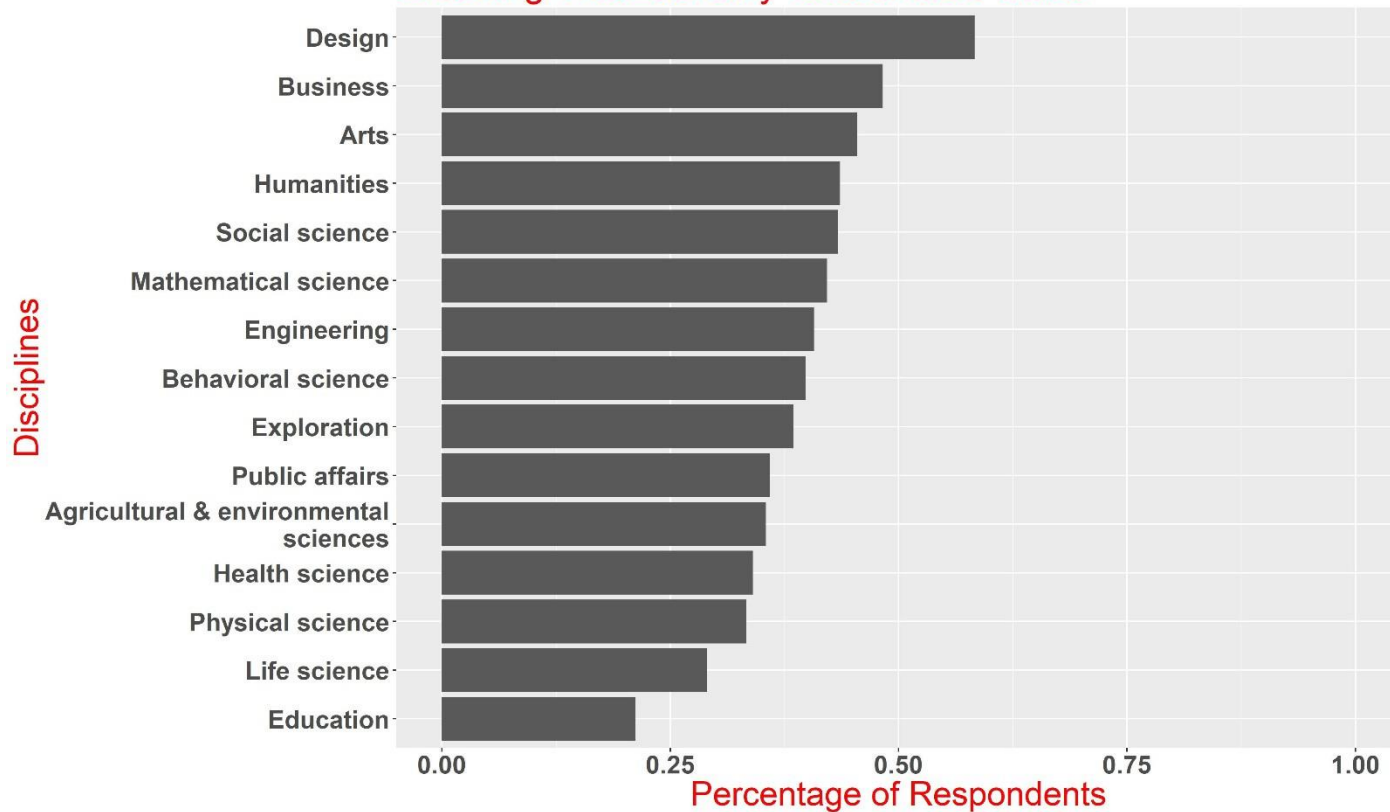


Q7: Percent of undergraduate students by discipline expressing interest in **taking a class on this topic** (respondents were allowed to choose up to 5 topics from list of 14 total, #Responses=7,924, N=2,211 EEDS capstone course project, Spring 2018)

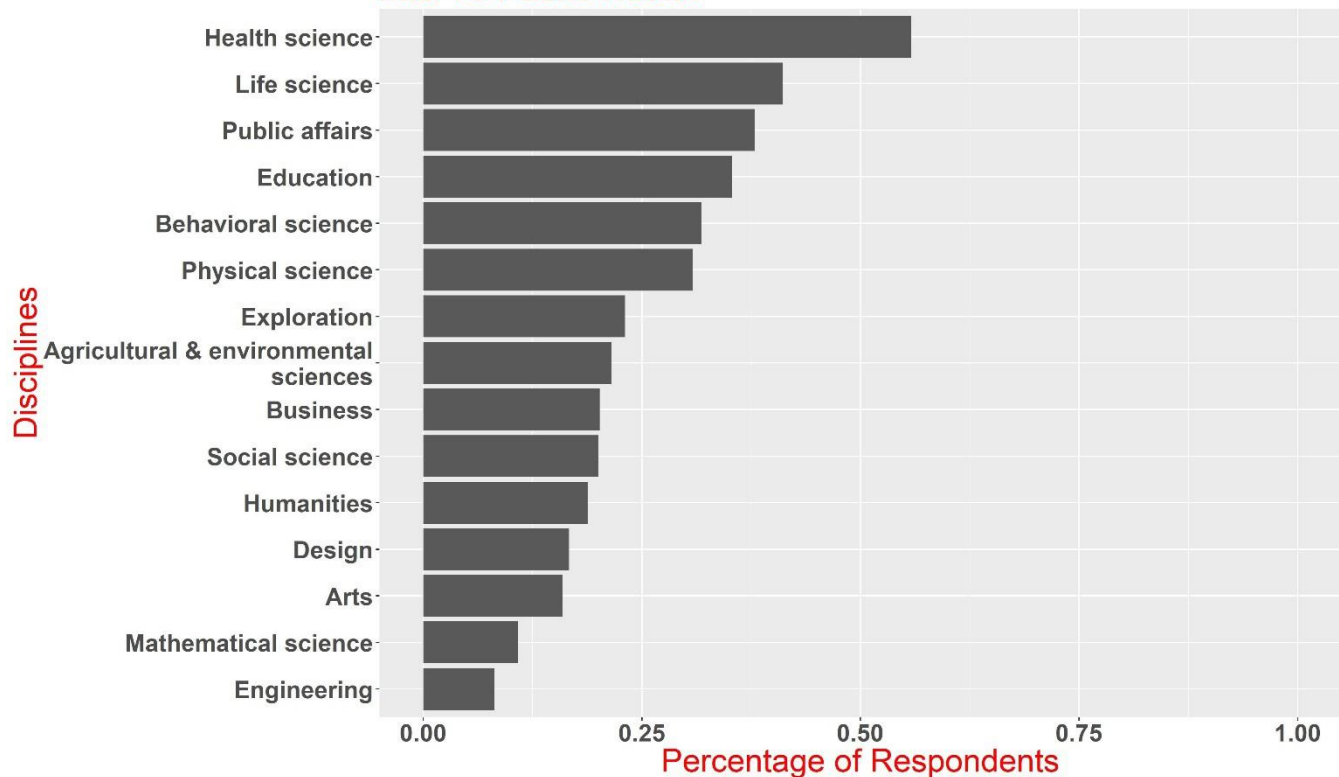


Q7: Percent of undergraduate students by discipline expressing interest in taking a class on this topic
 (respondents were allowed to choose up to 5 topics from list of 14 total, #Responses=7,924, N=2,211
 EEDS capstone course project, Spring 2018)

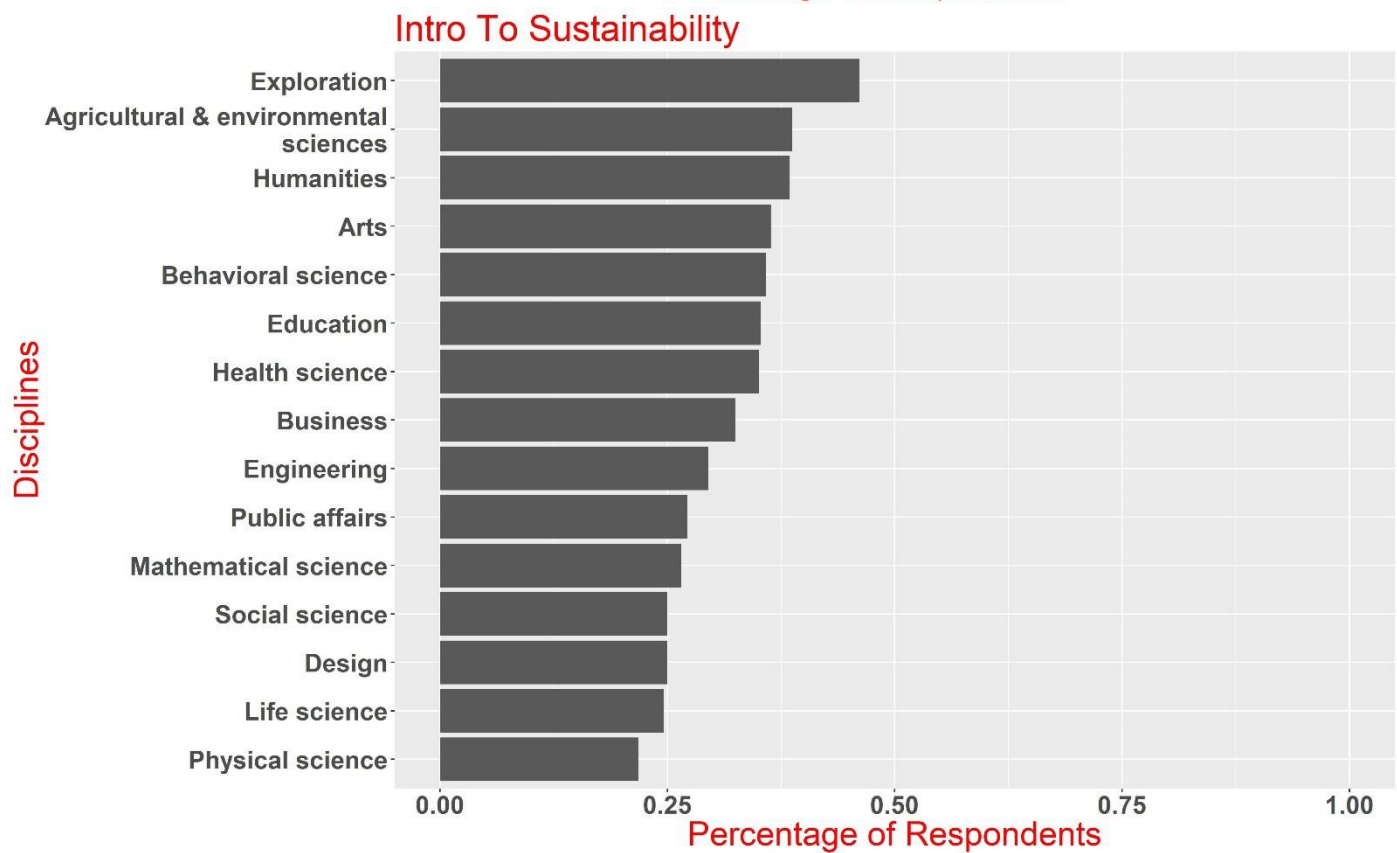
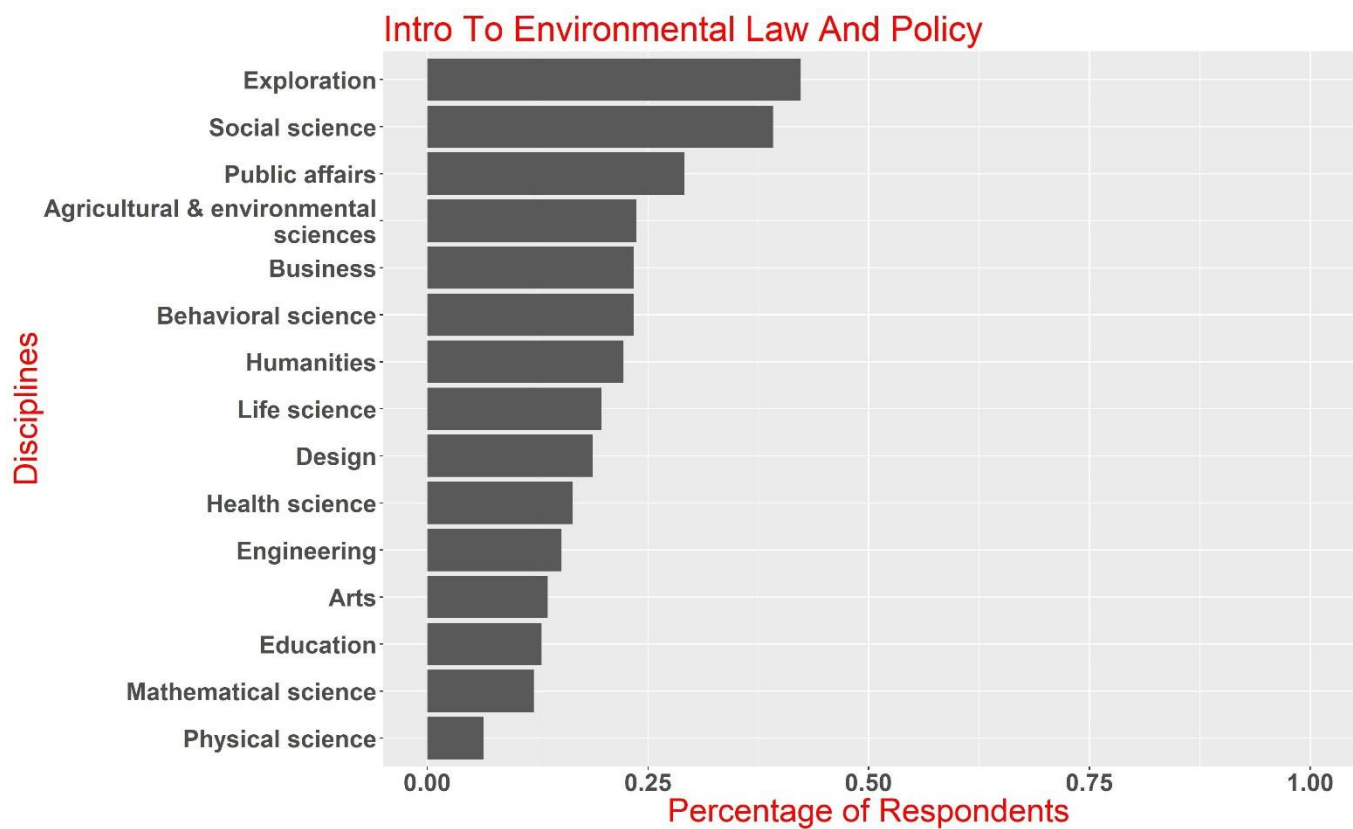
Greening The Economy Sustainable Cities



Into To Public Health

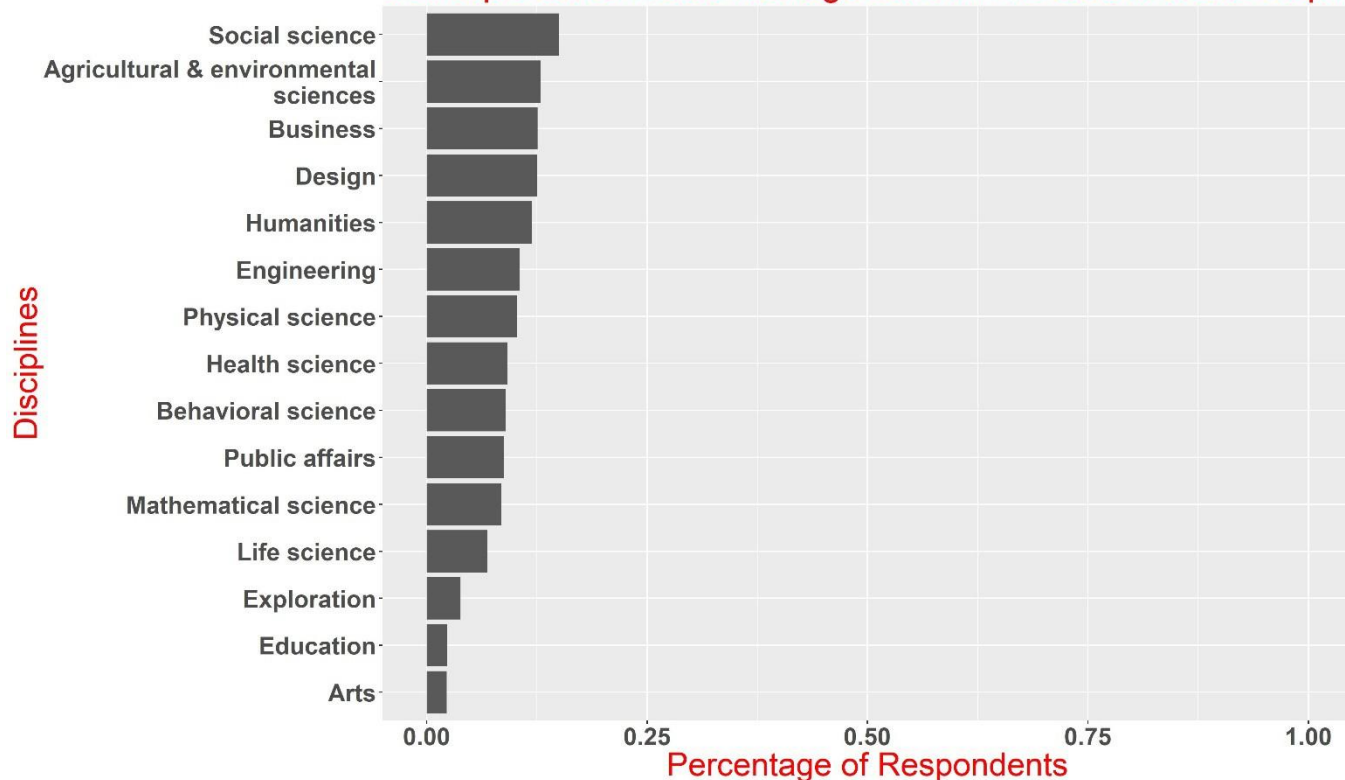


Q7: Percent of undergraduate students by discipline expressing interest in **taking a class on this topic** (respondents were allowed to choose up to 5 topics from list of 14 total, #Responses=7,924, N=2,211 EEDS capstone course project, Spring 2018)

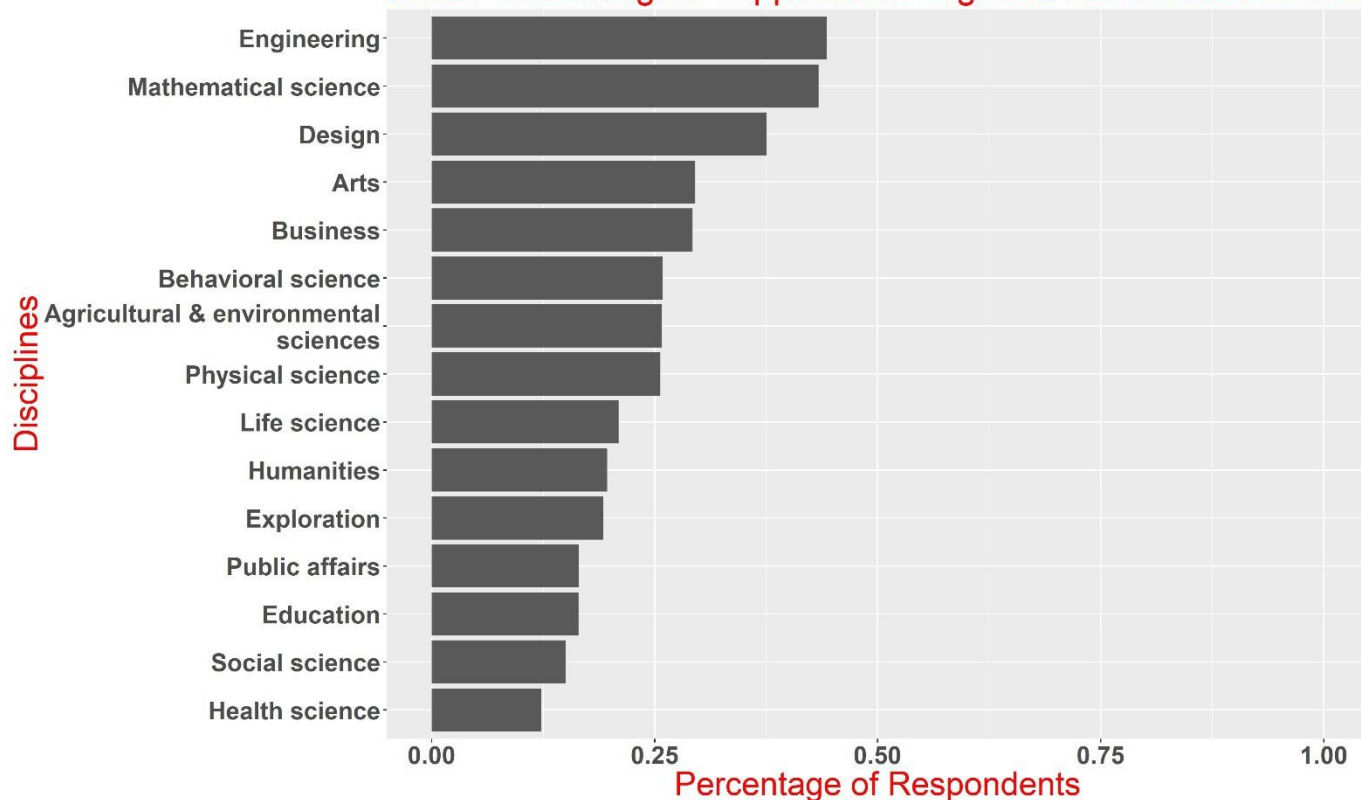


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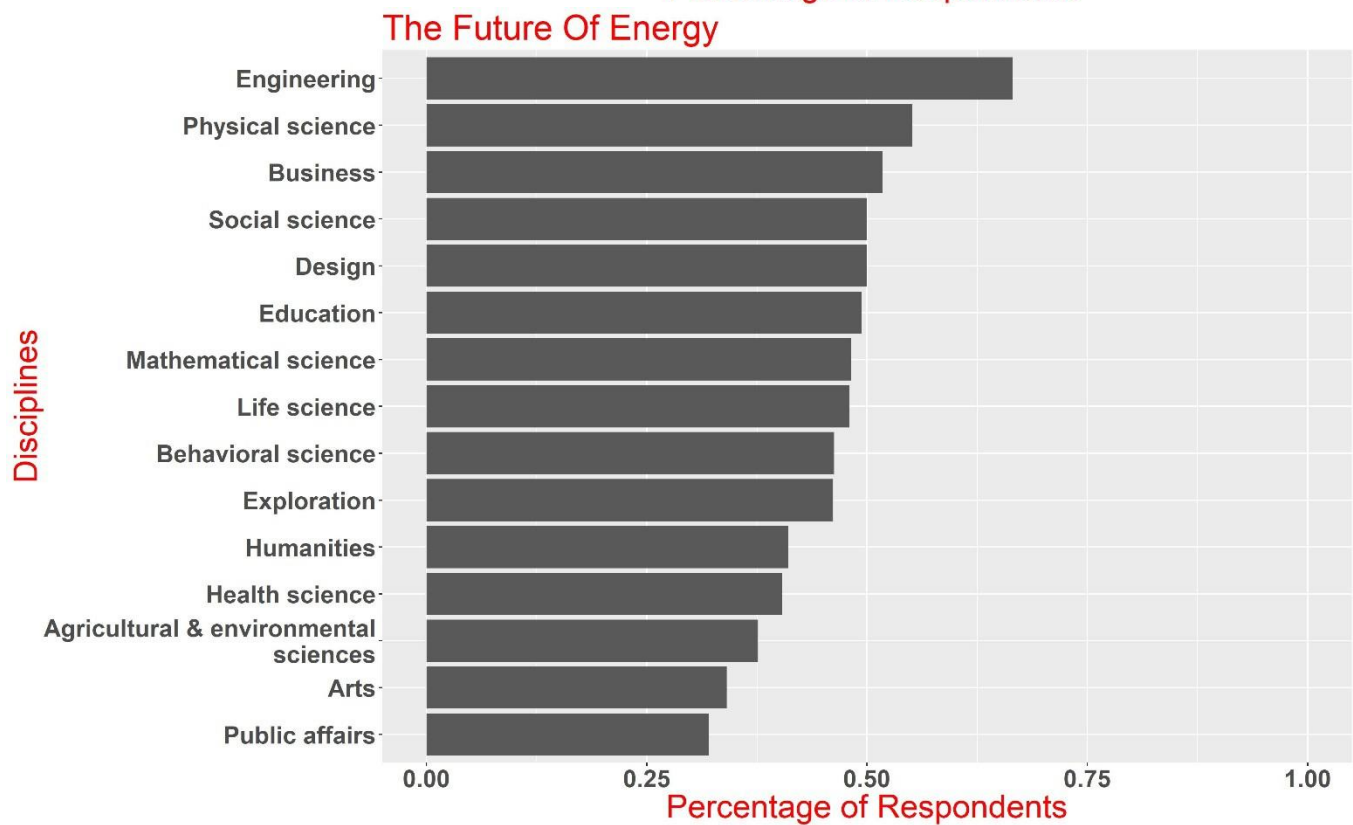
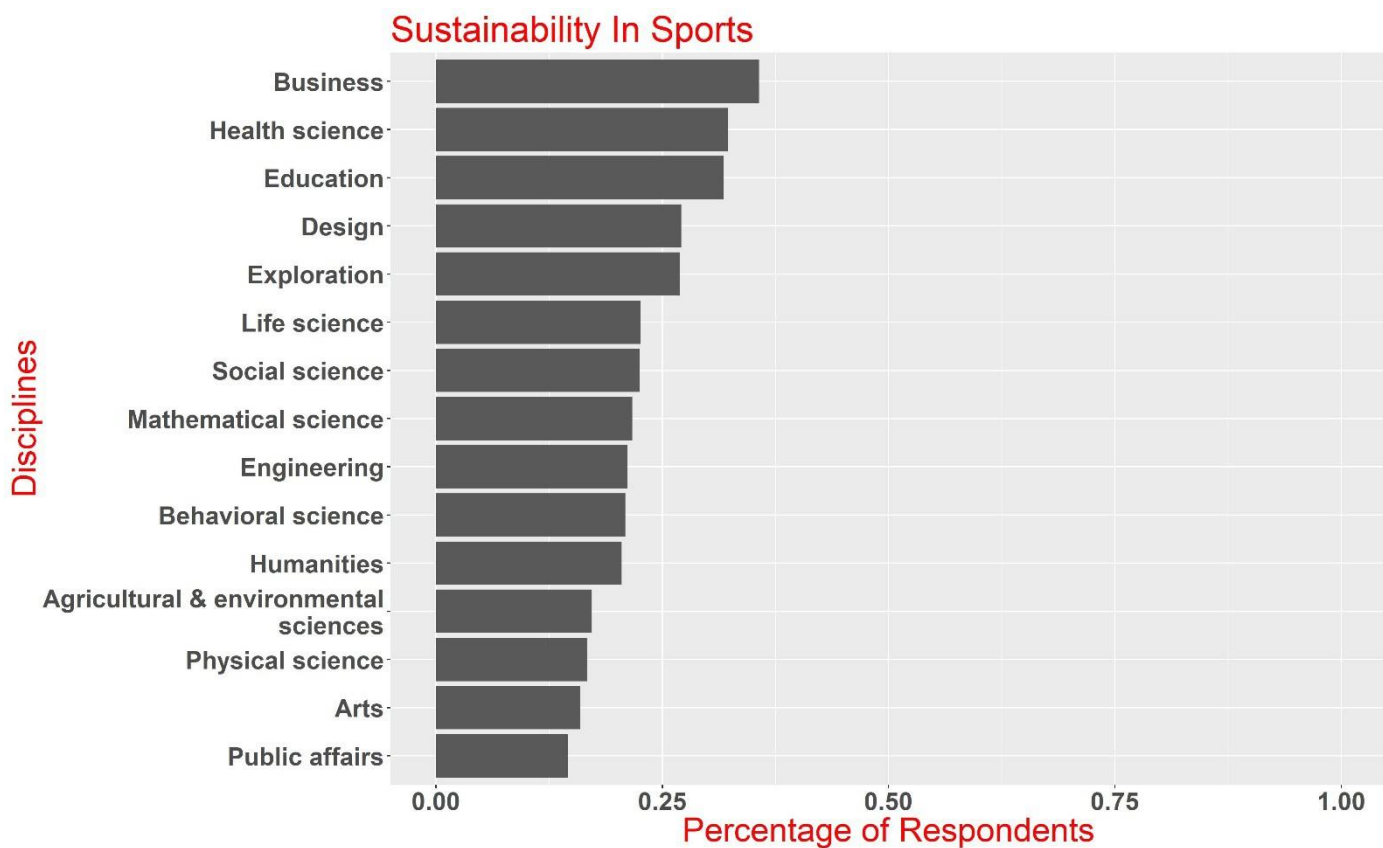
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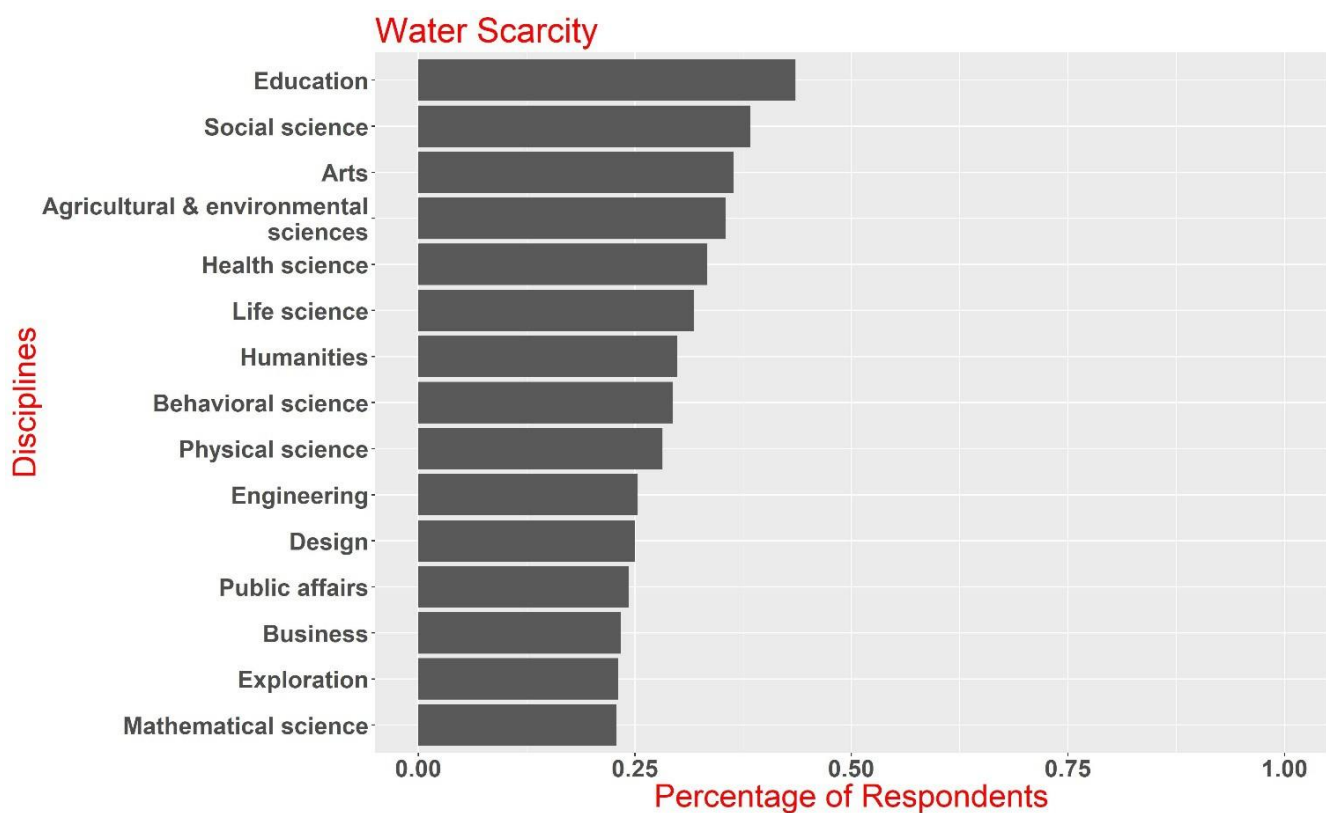
Smart Technologies Applicable Programs For Careers In Sust



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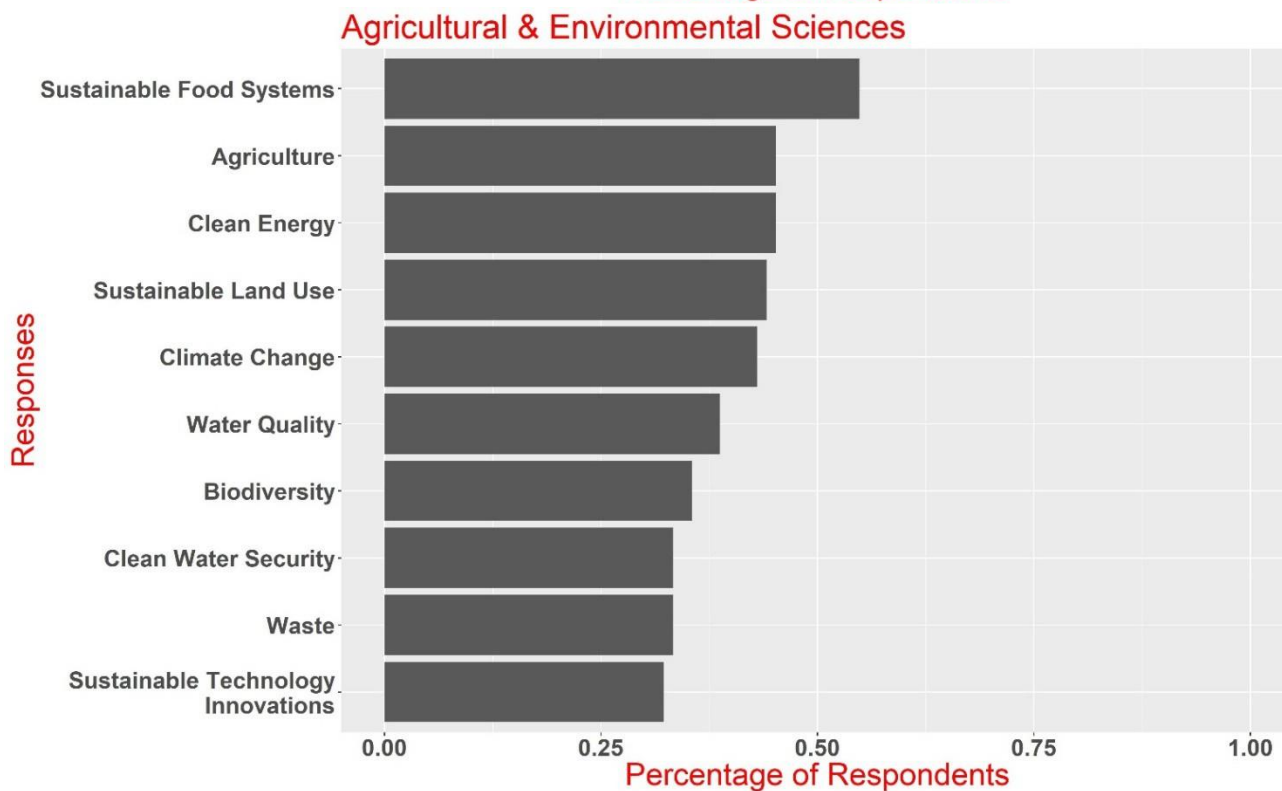
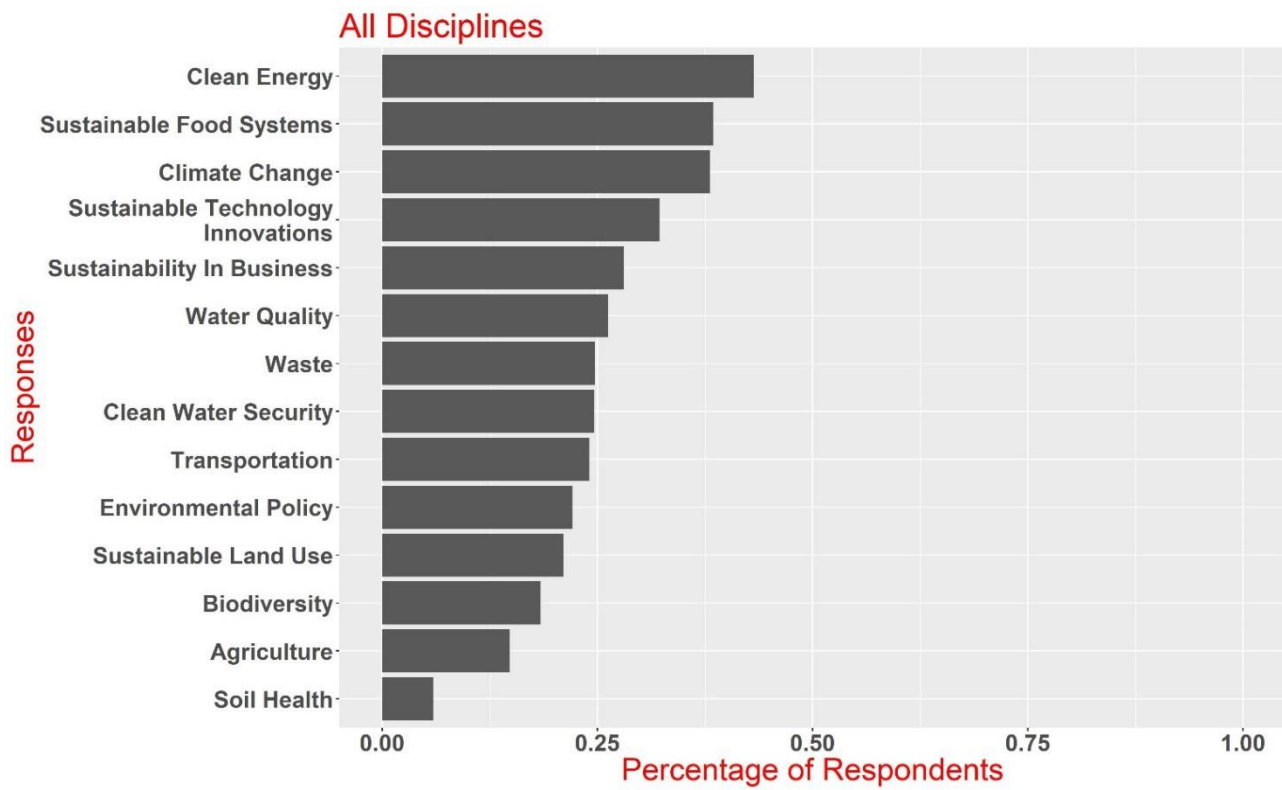


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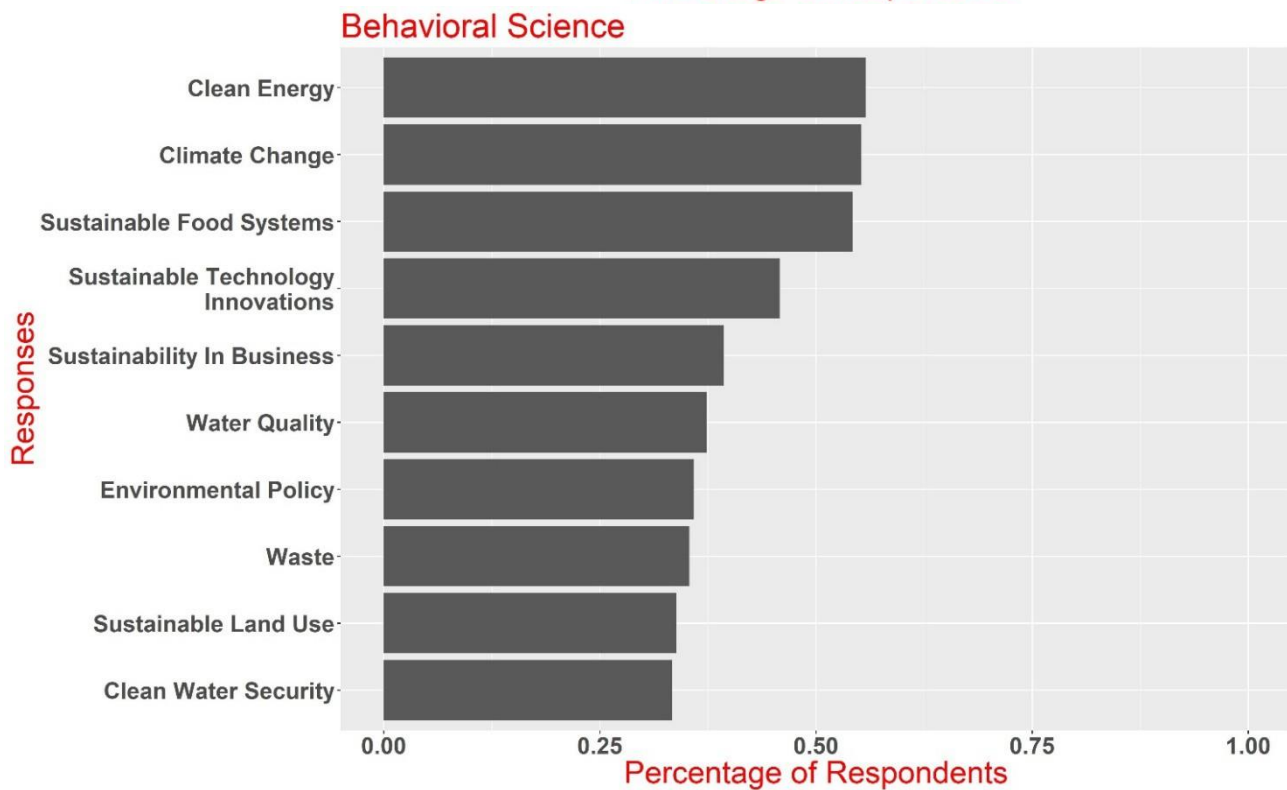
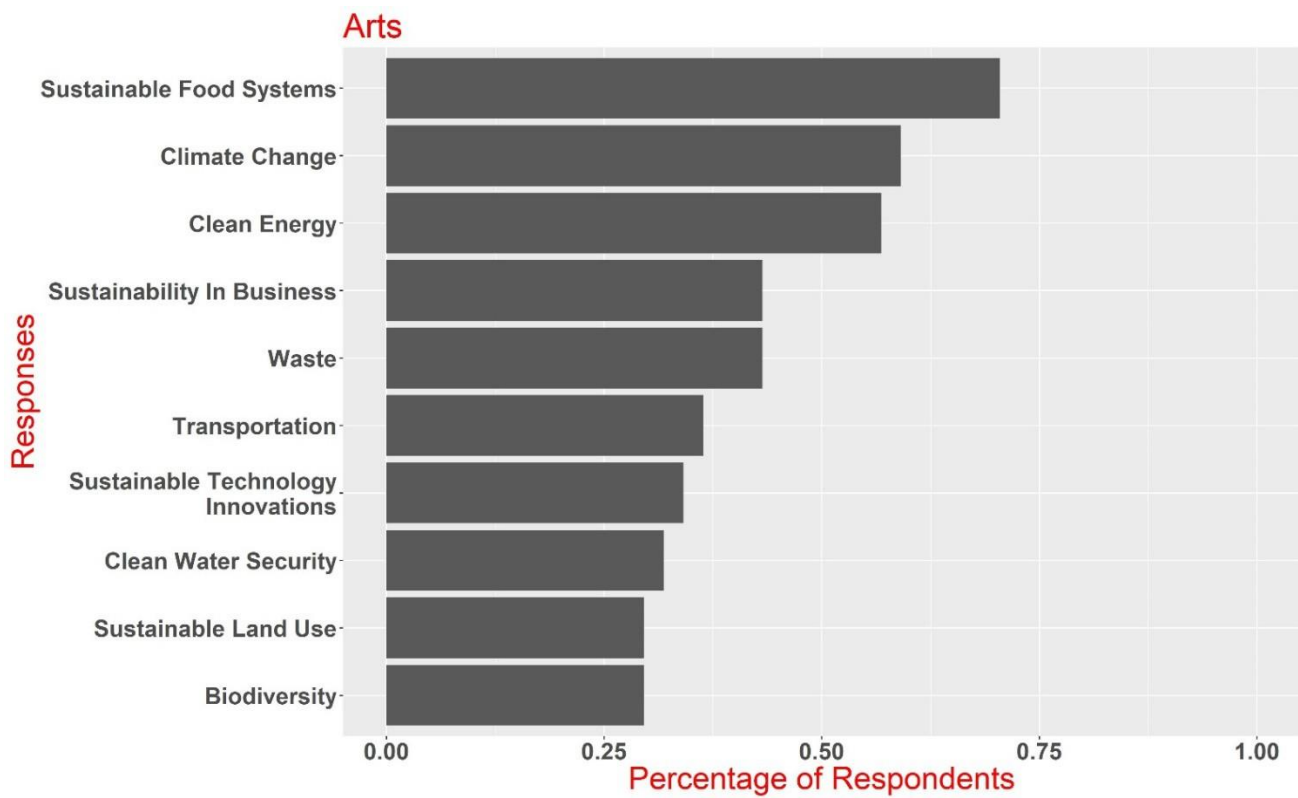
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Grand Total	2218	2211



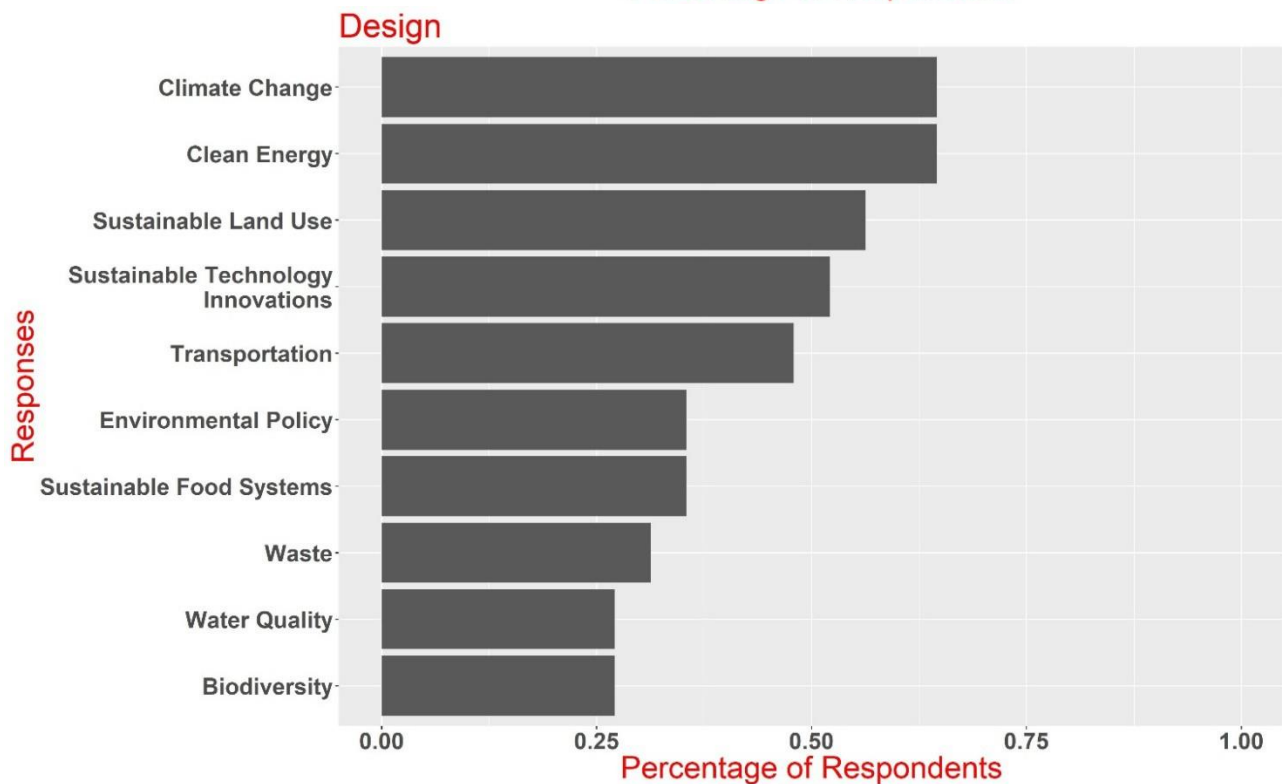
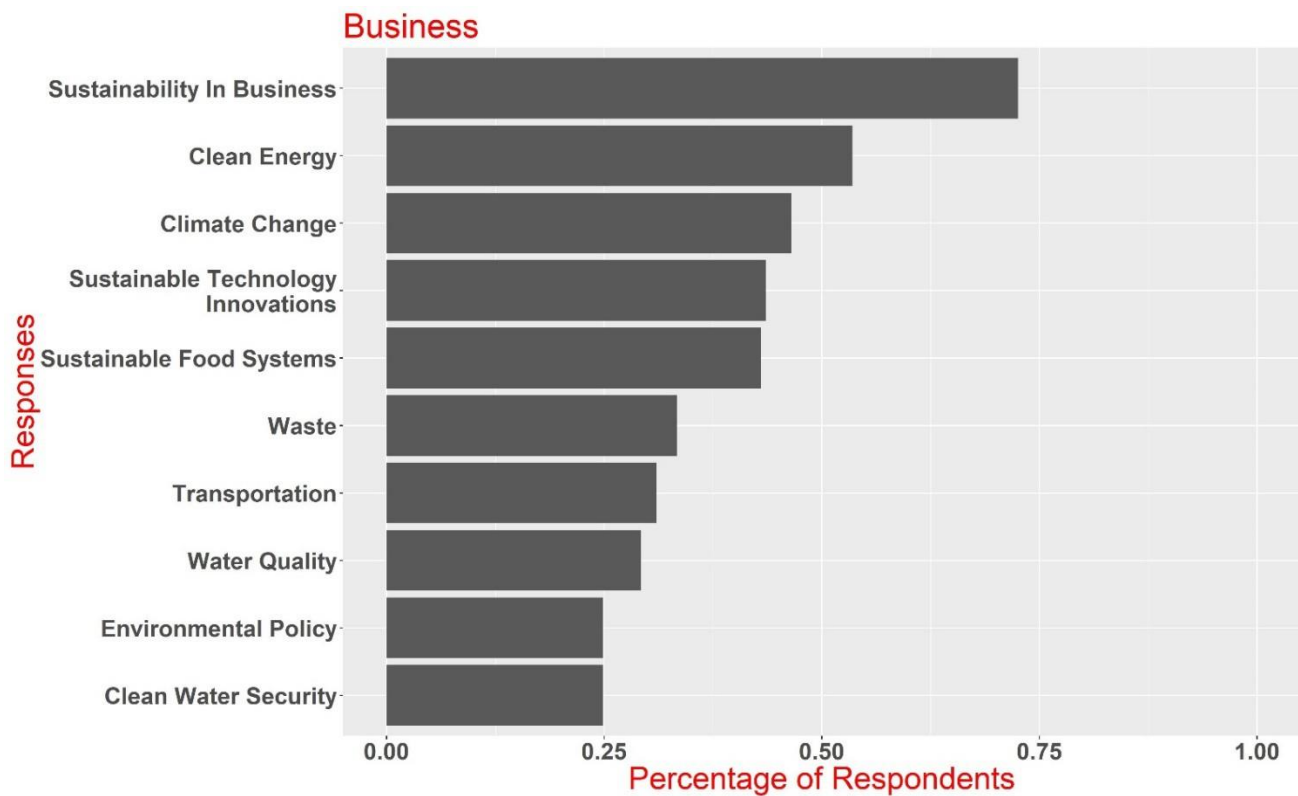
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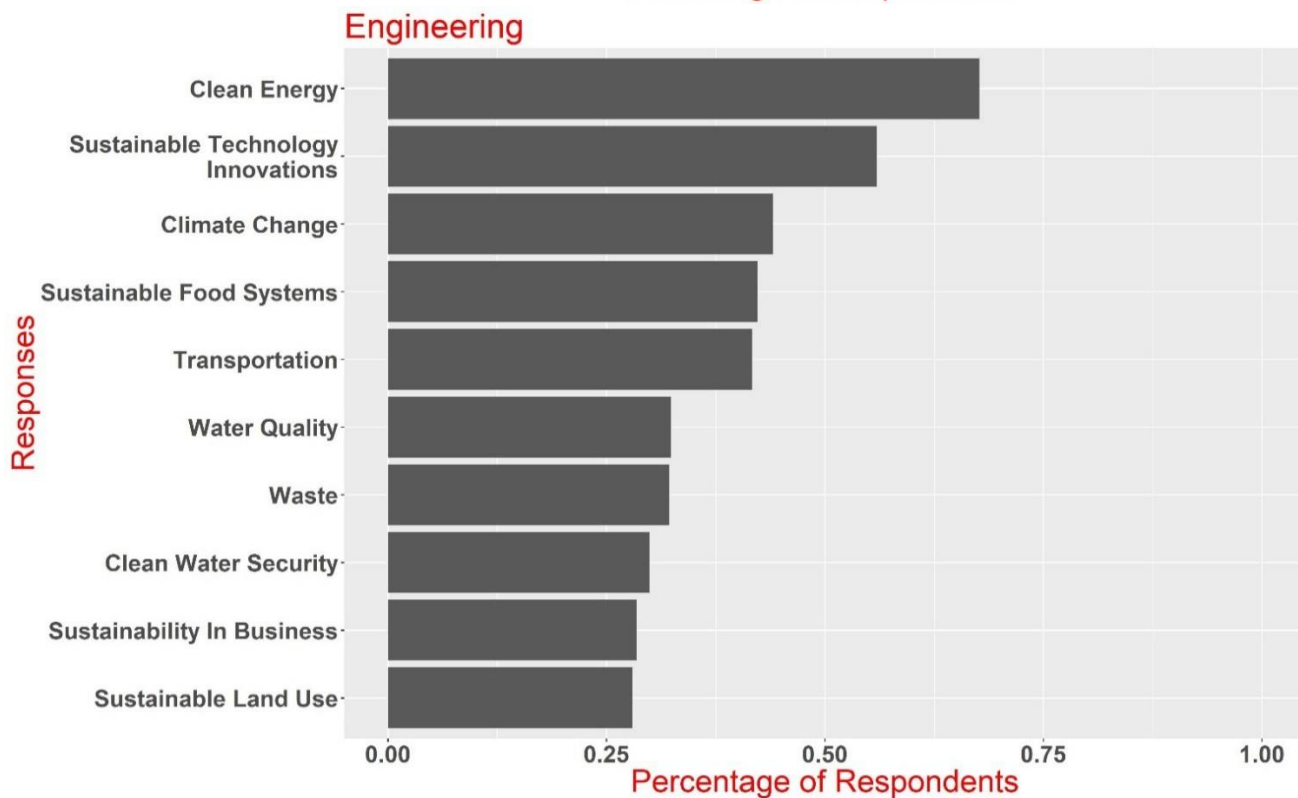
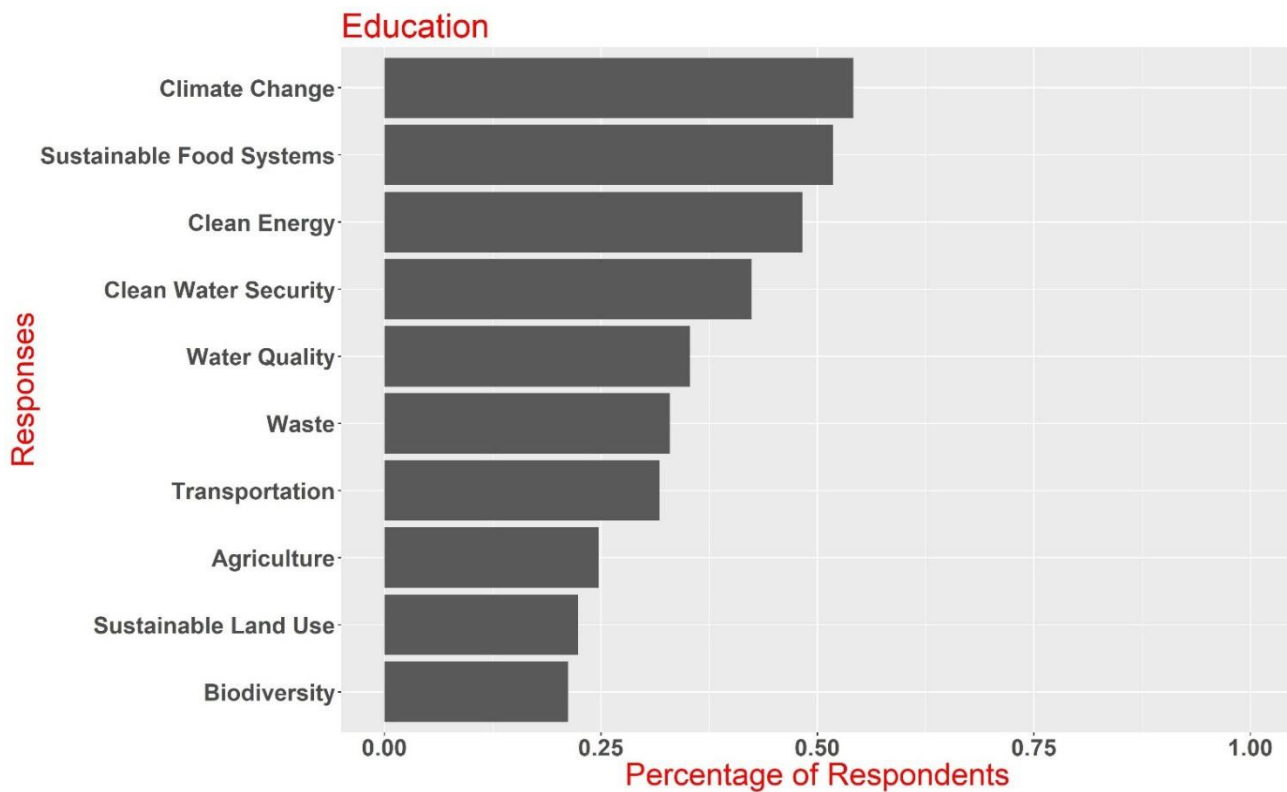
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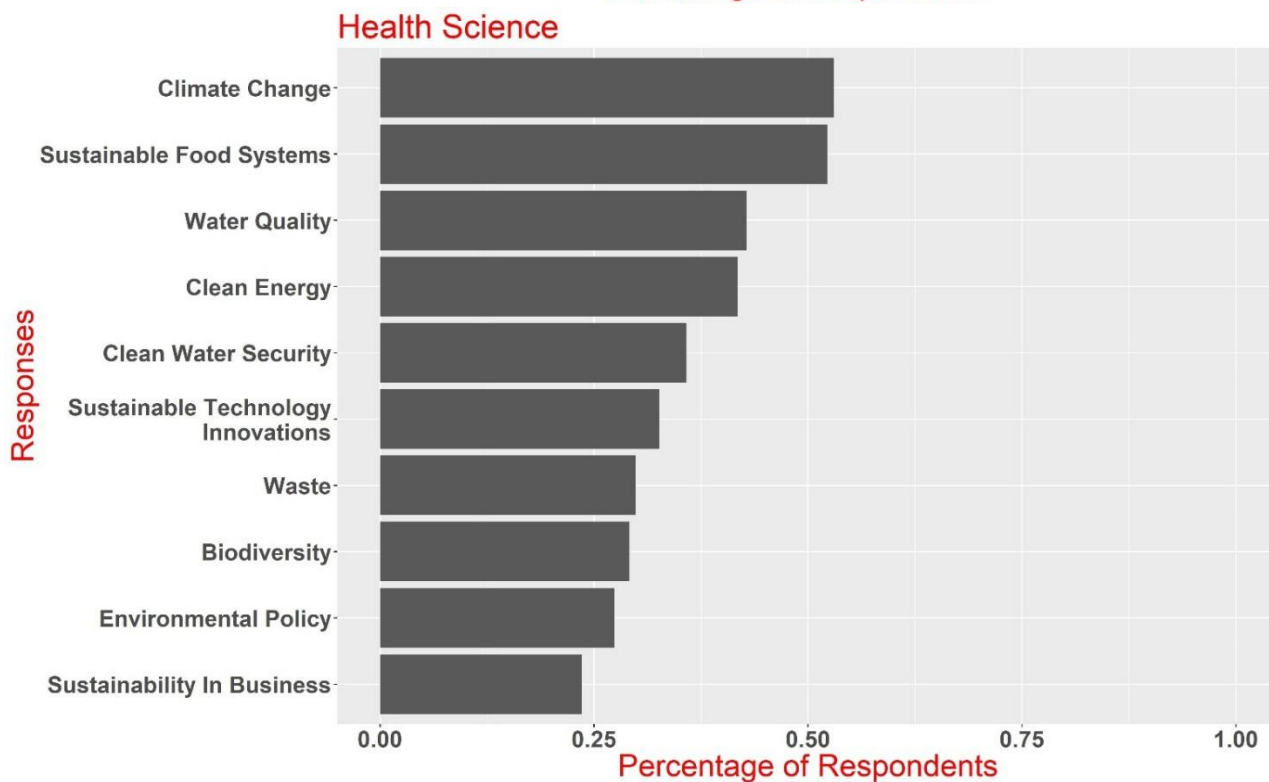
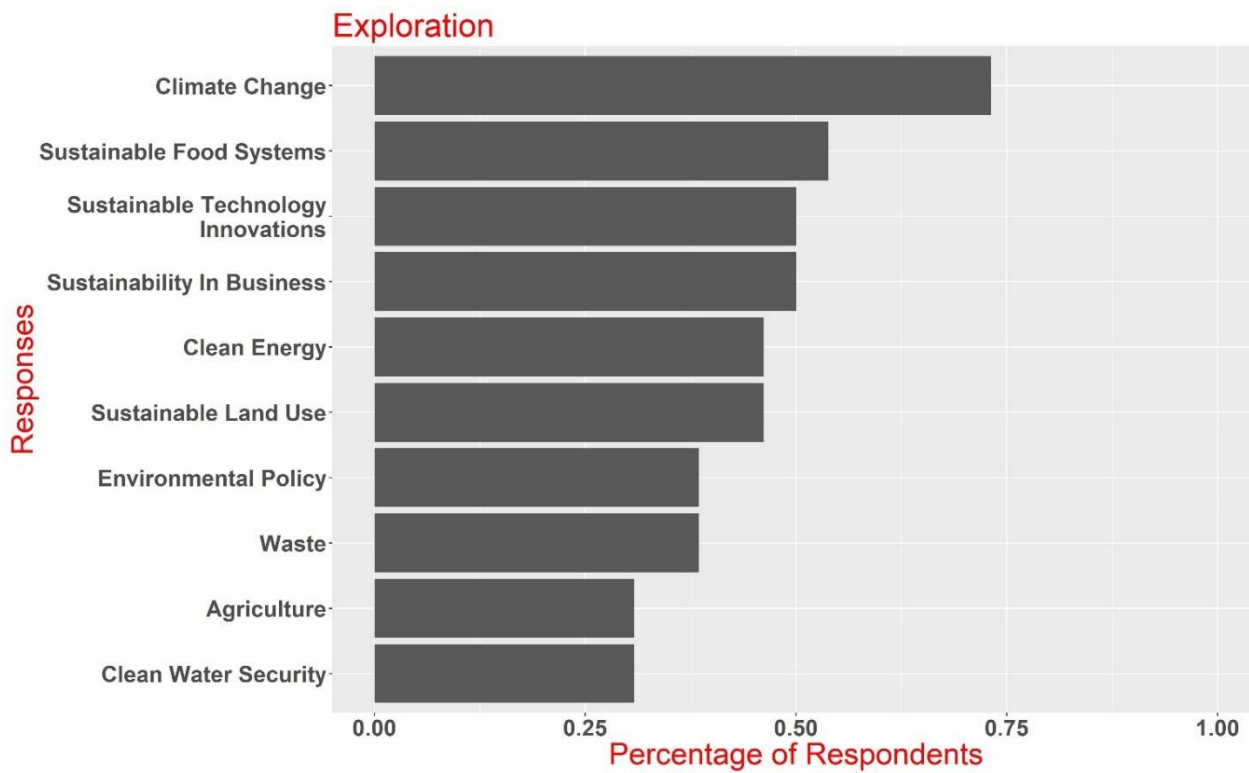
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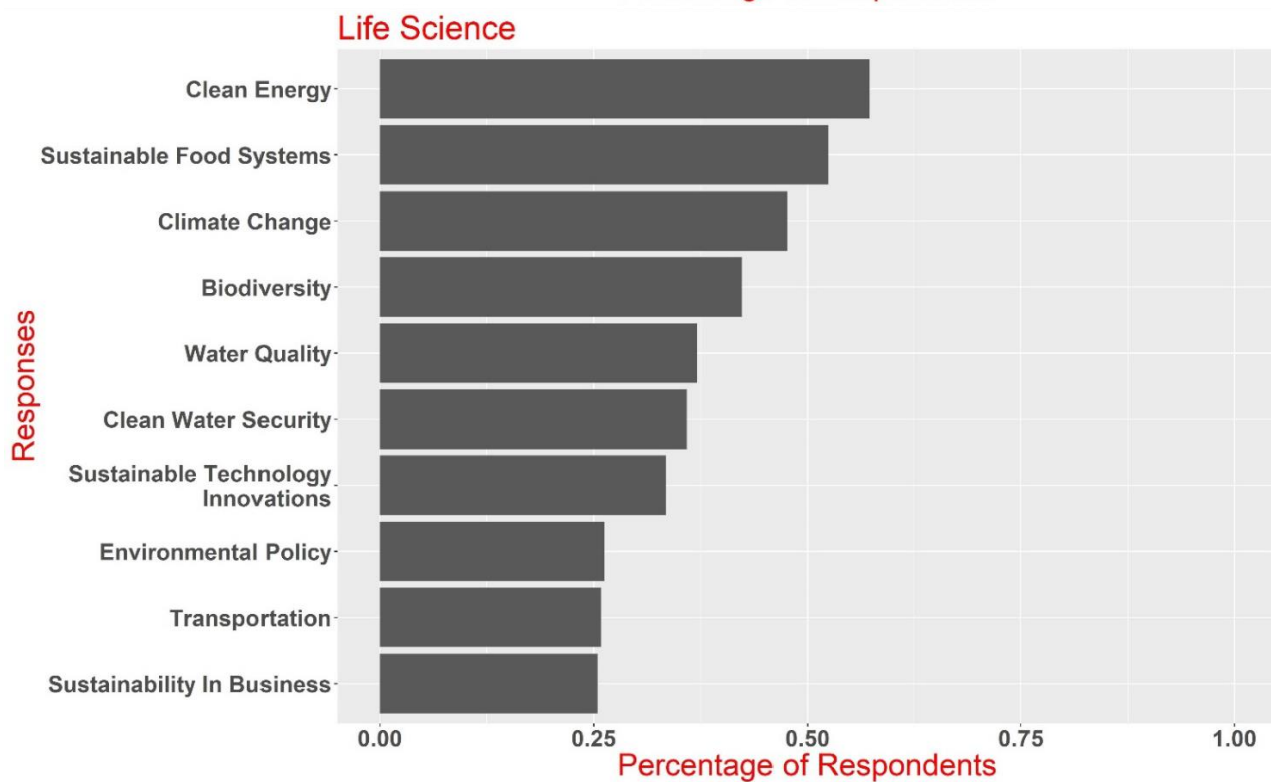
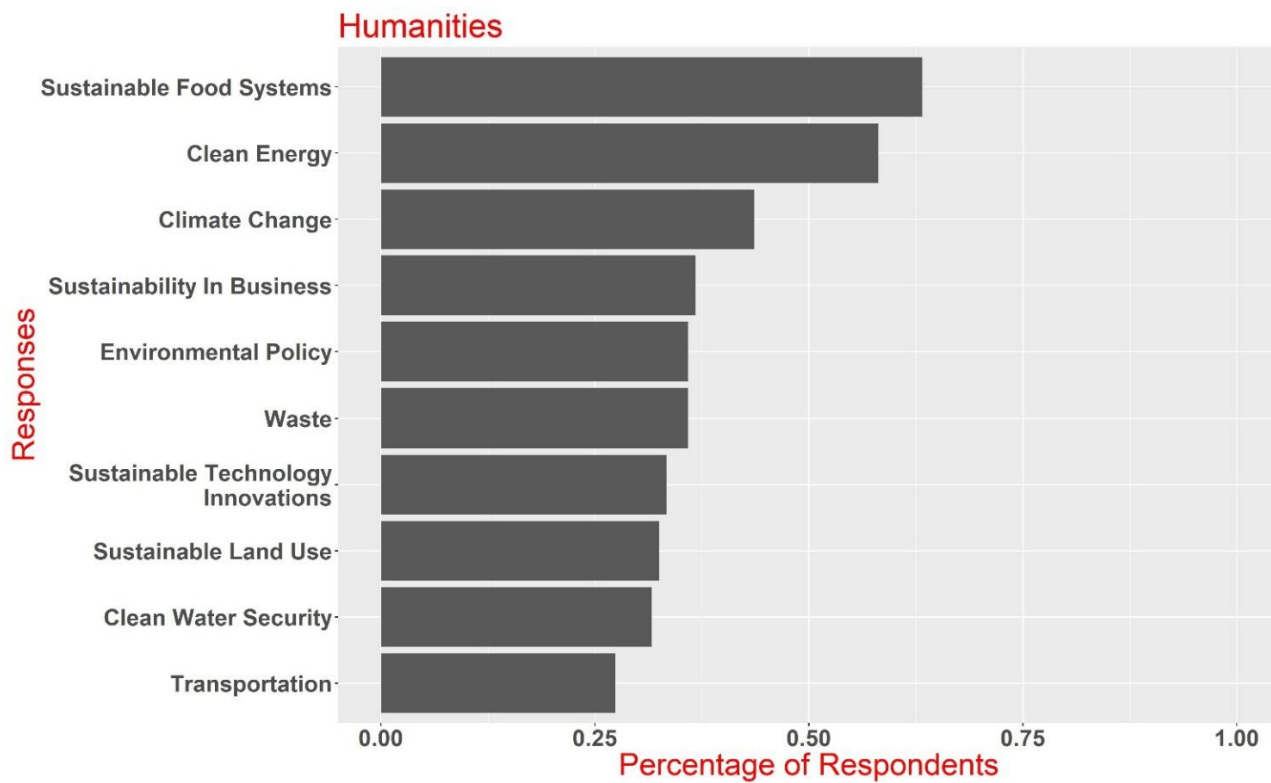
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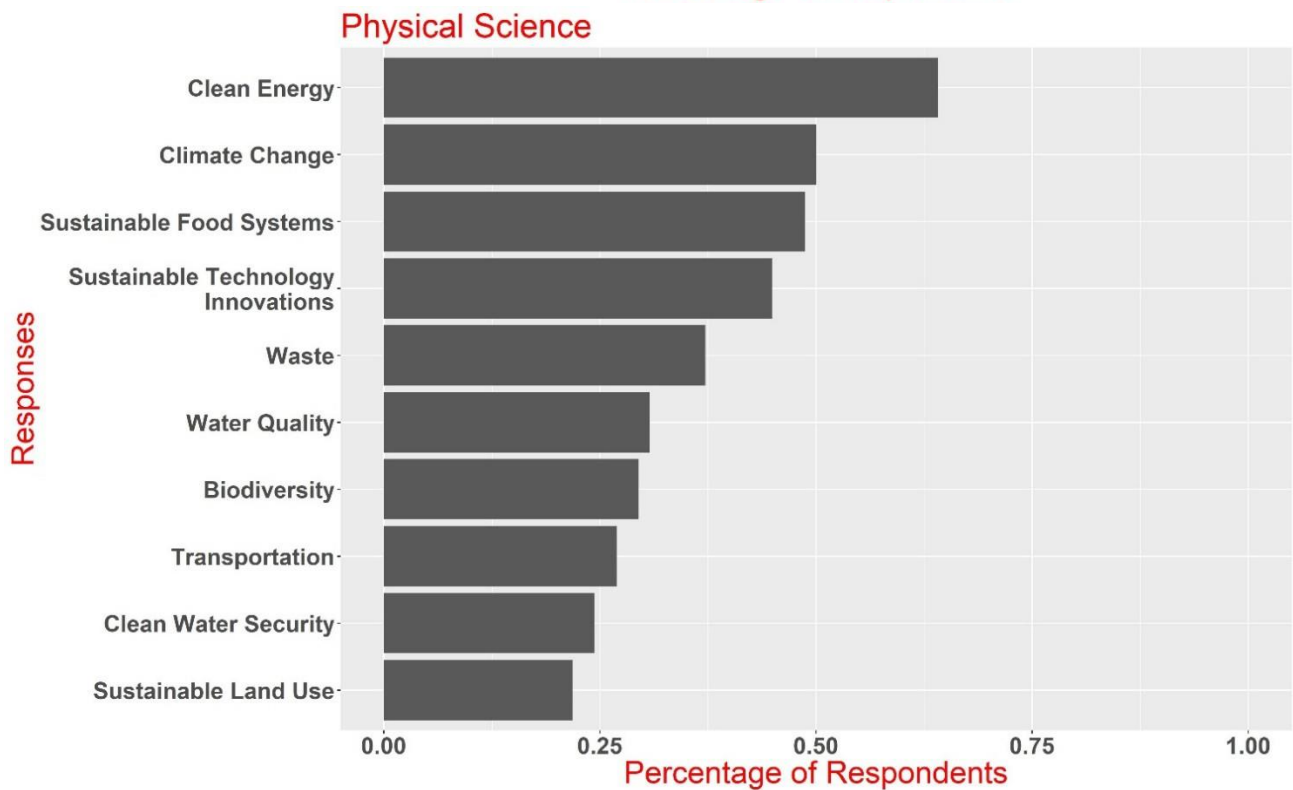
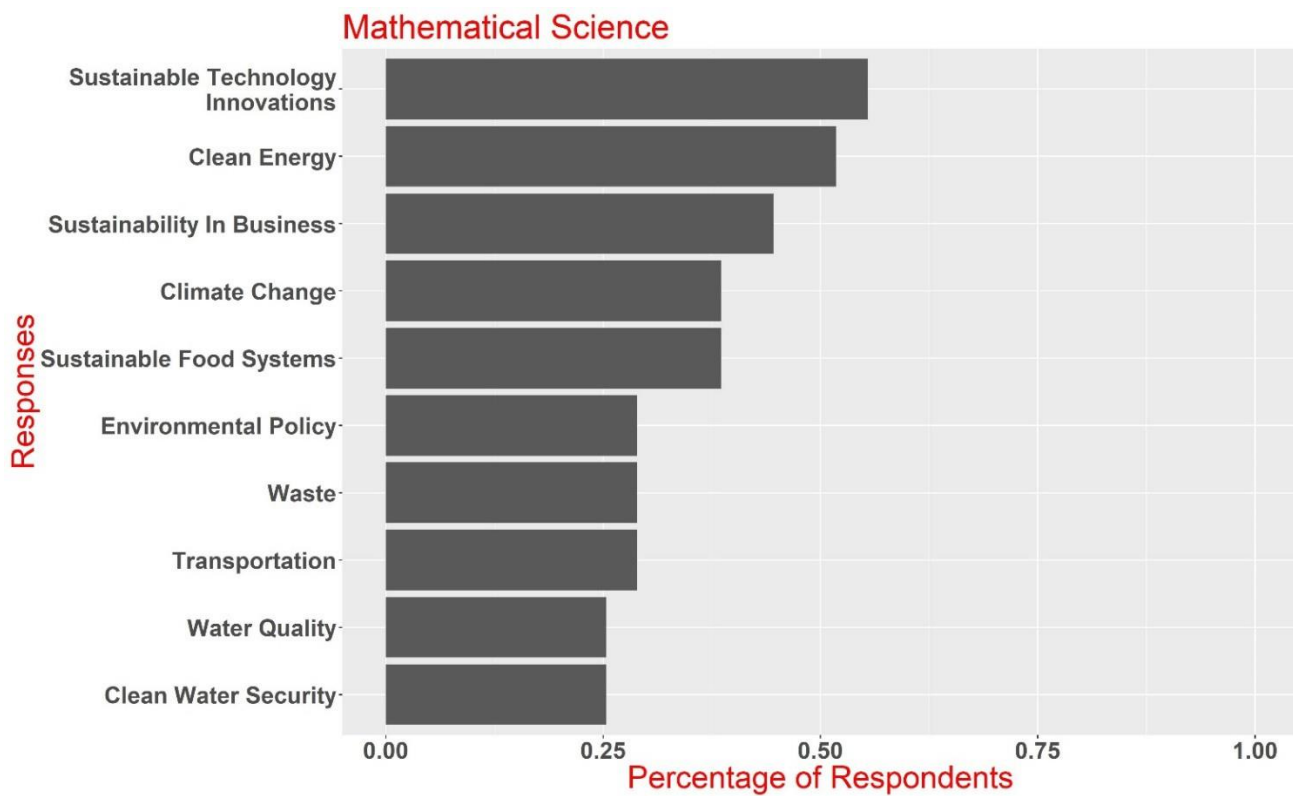
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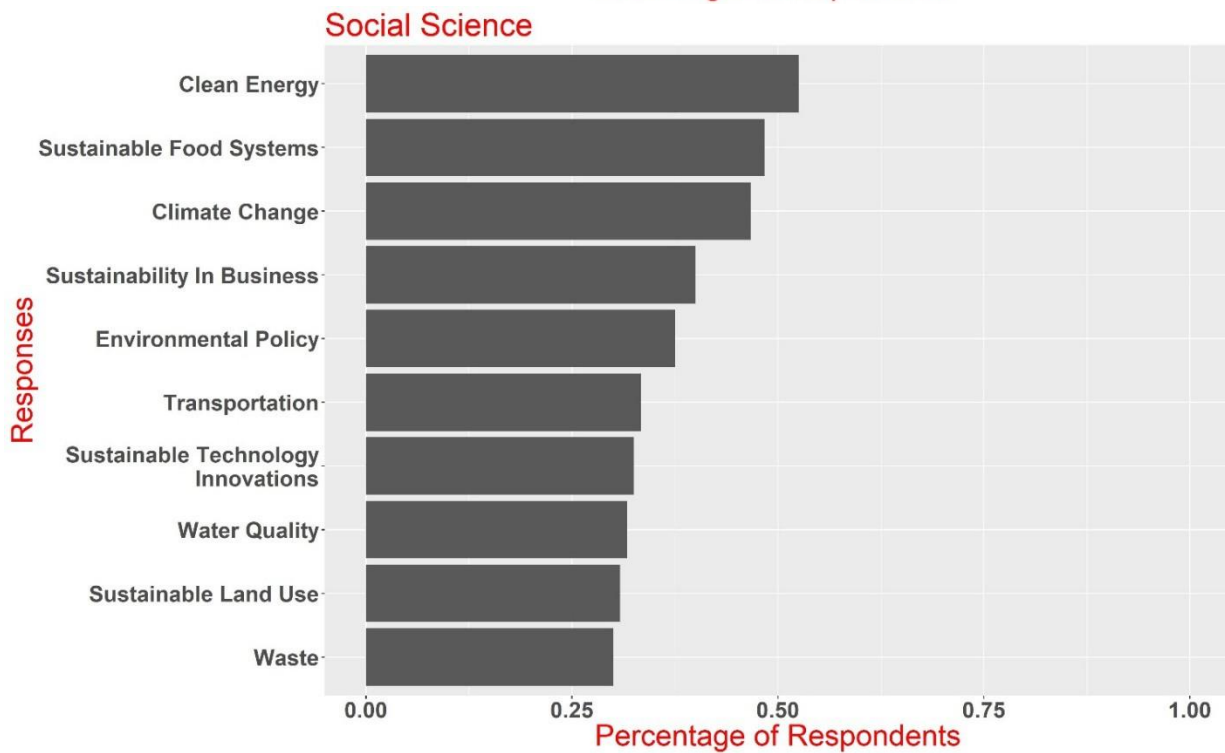
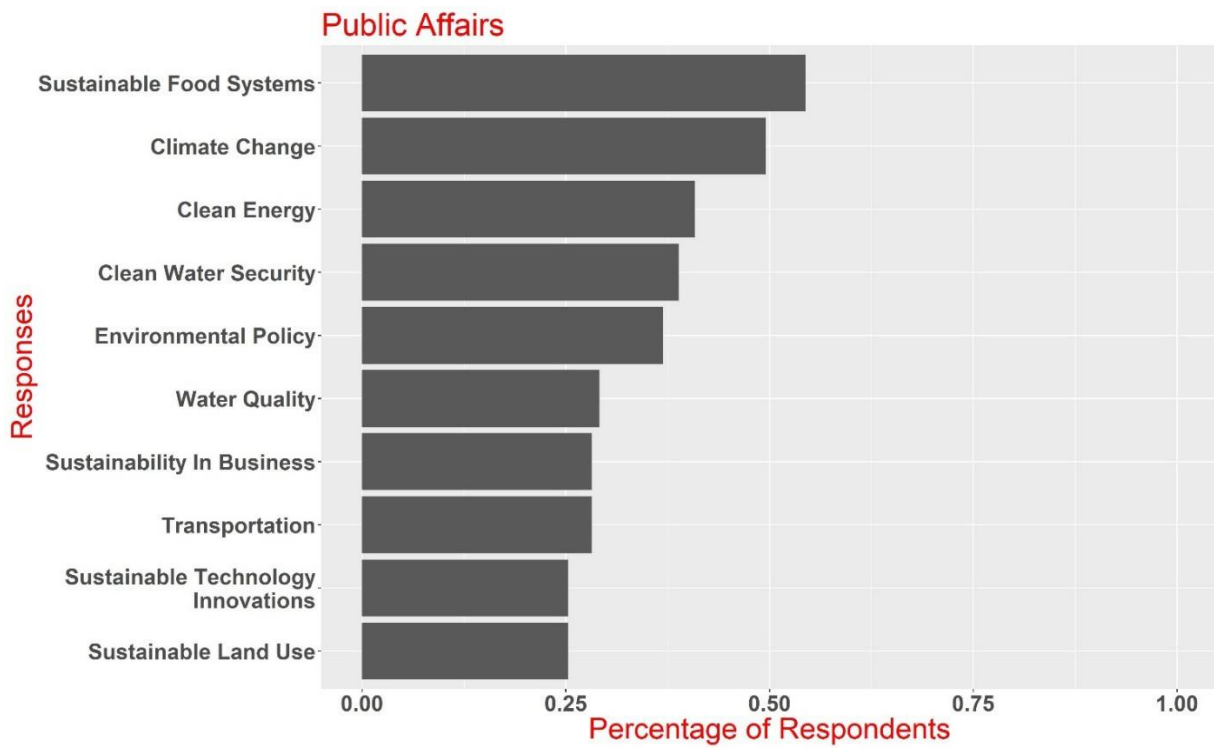
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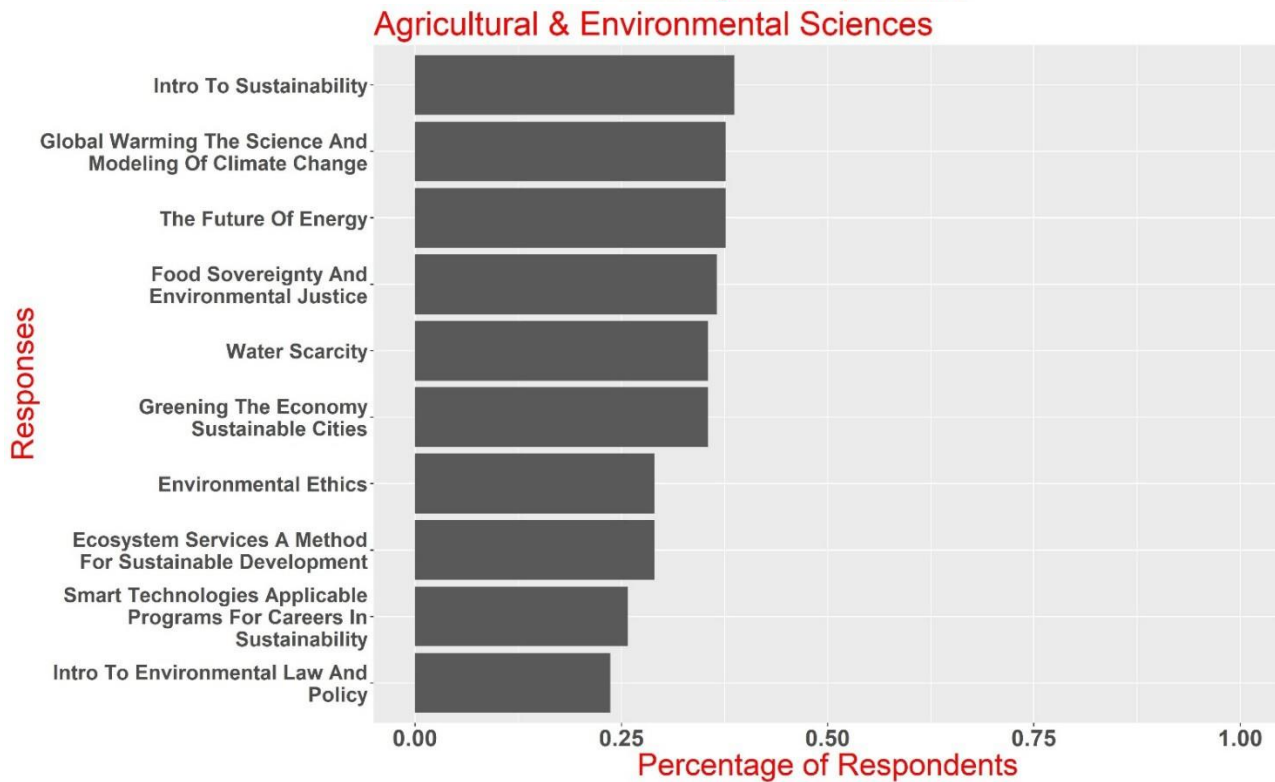
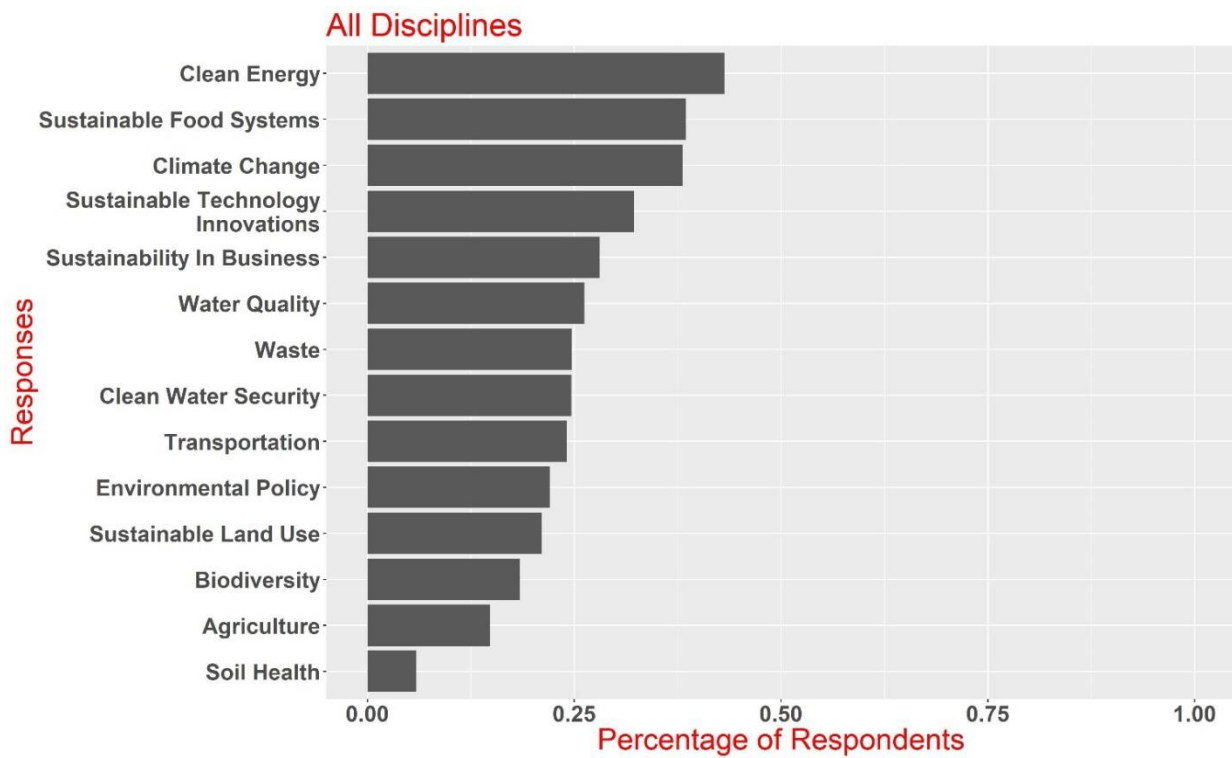
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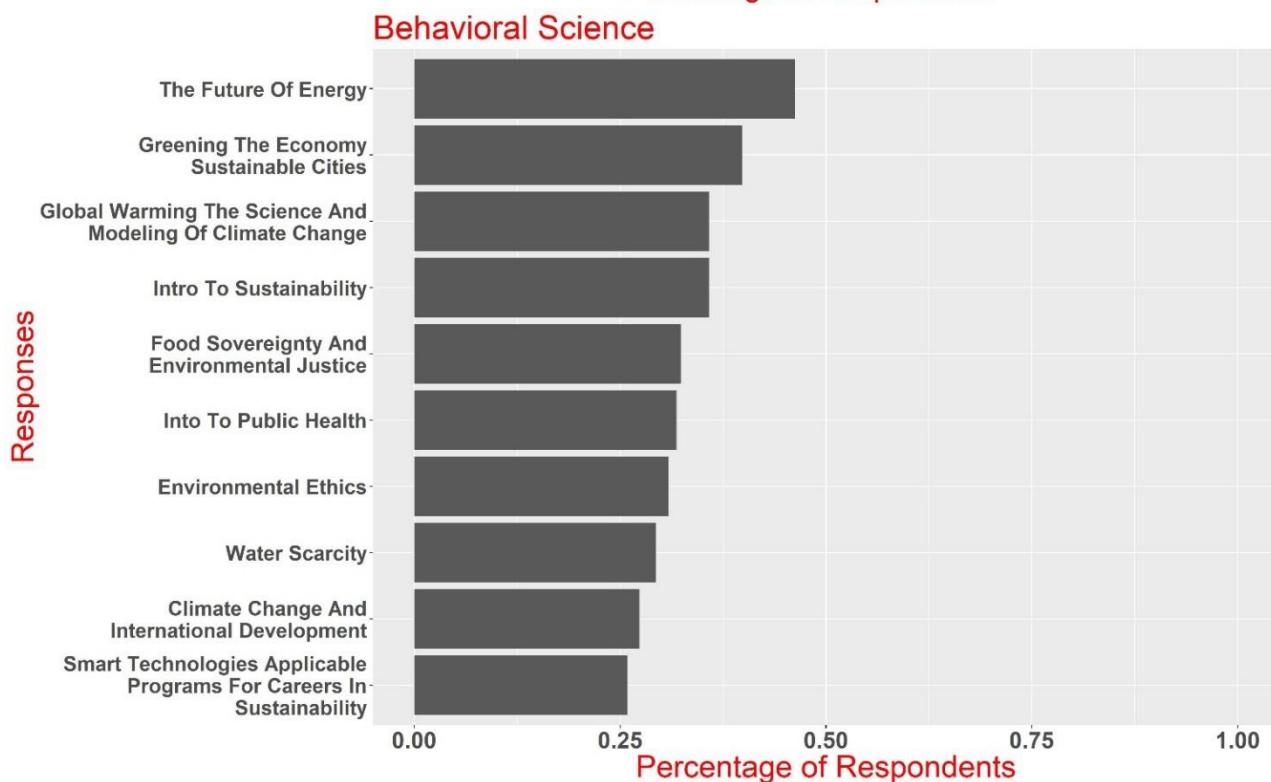
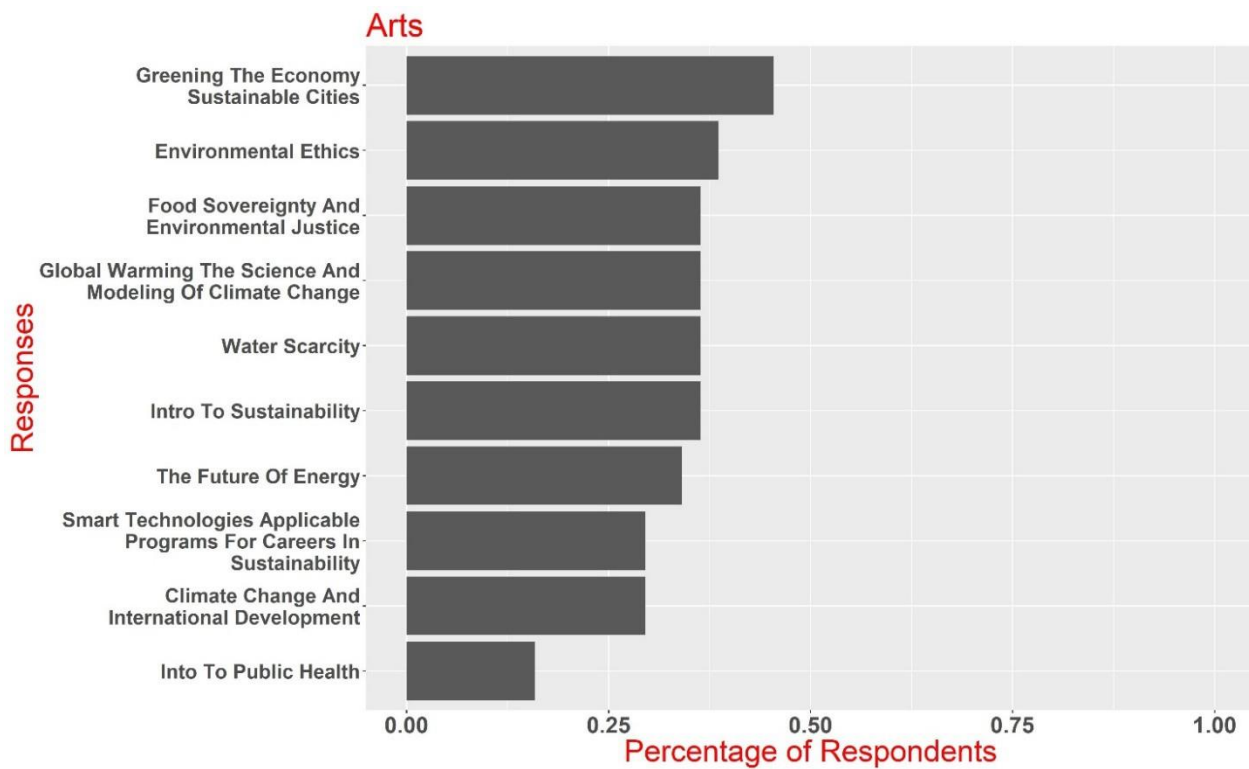
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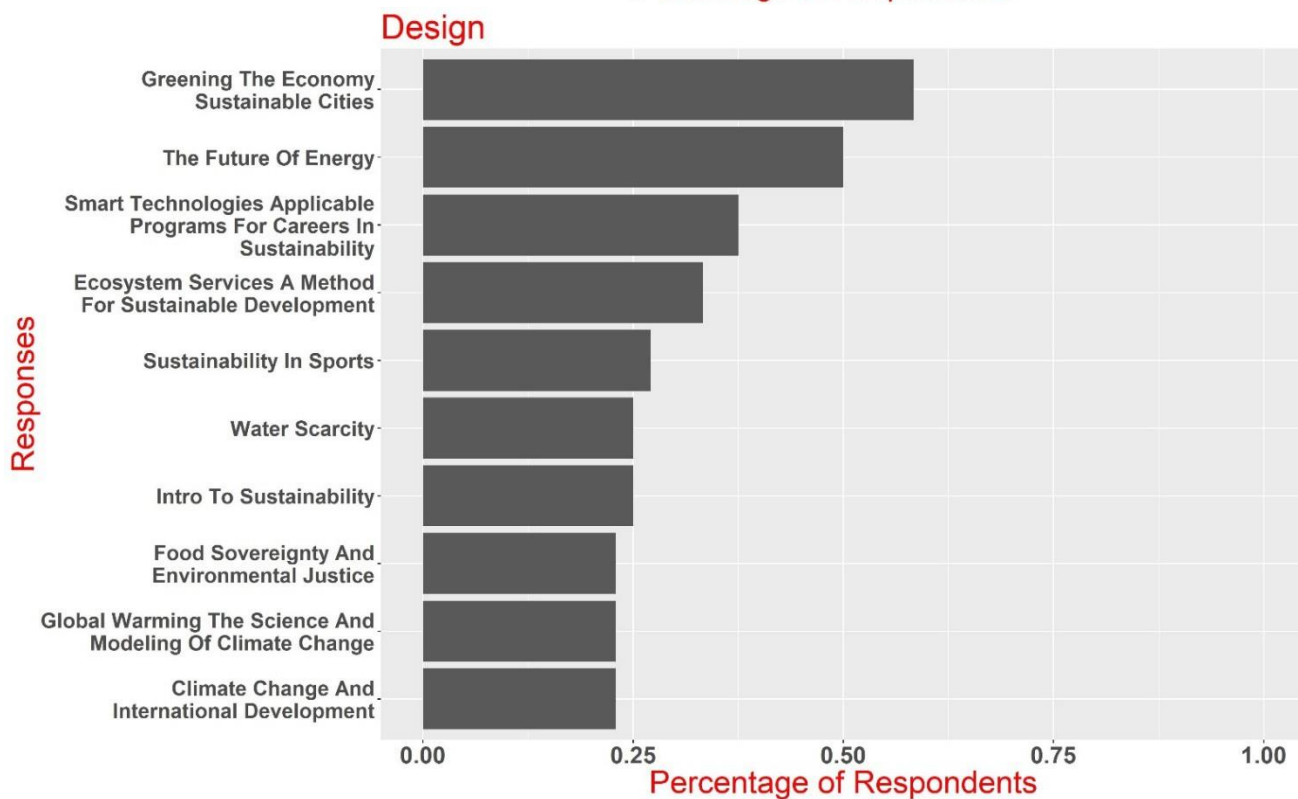
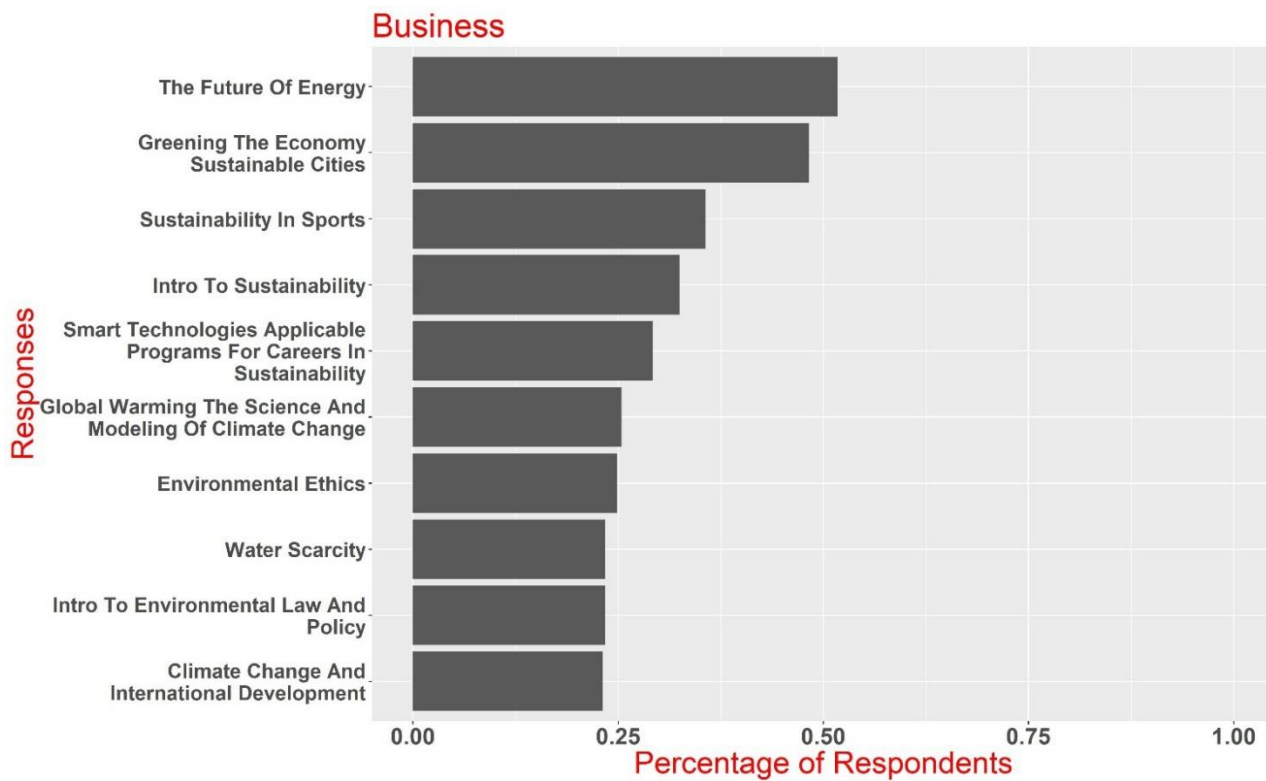
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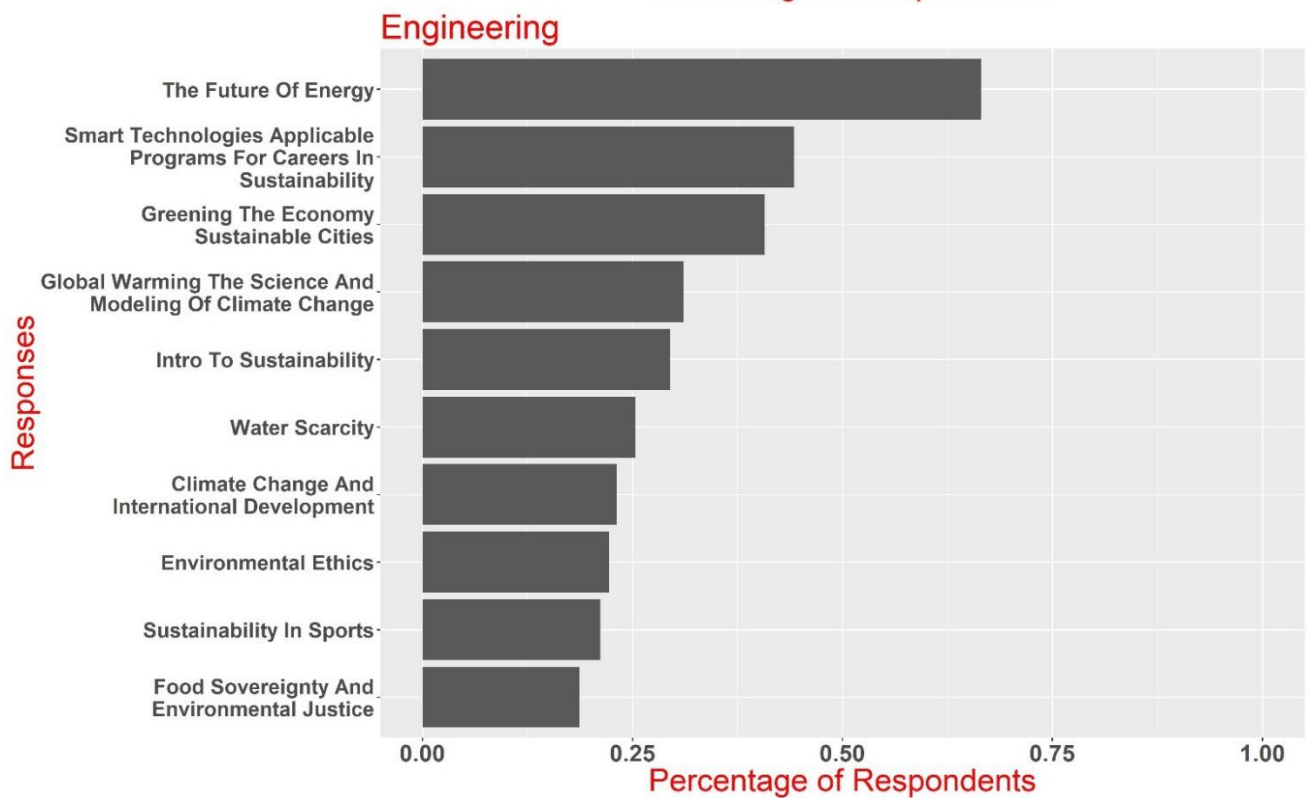
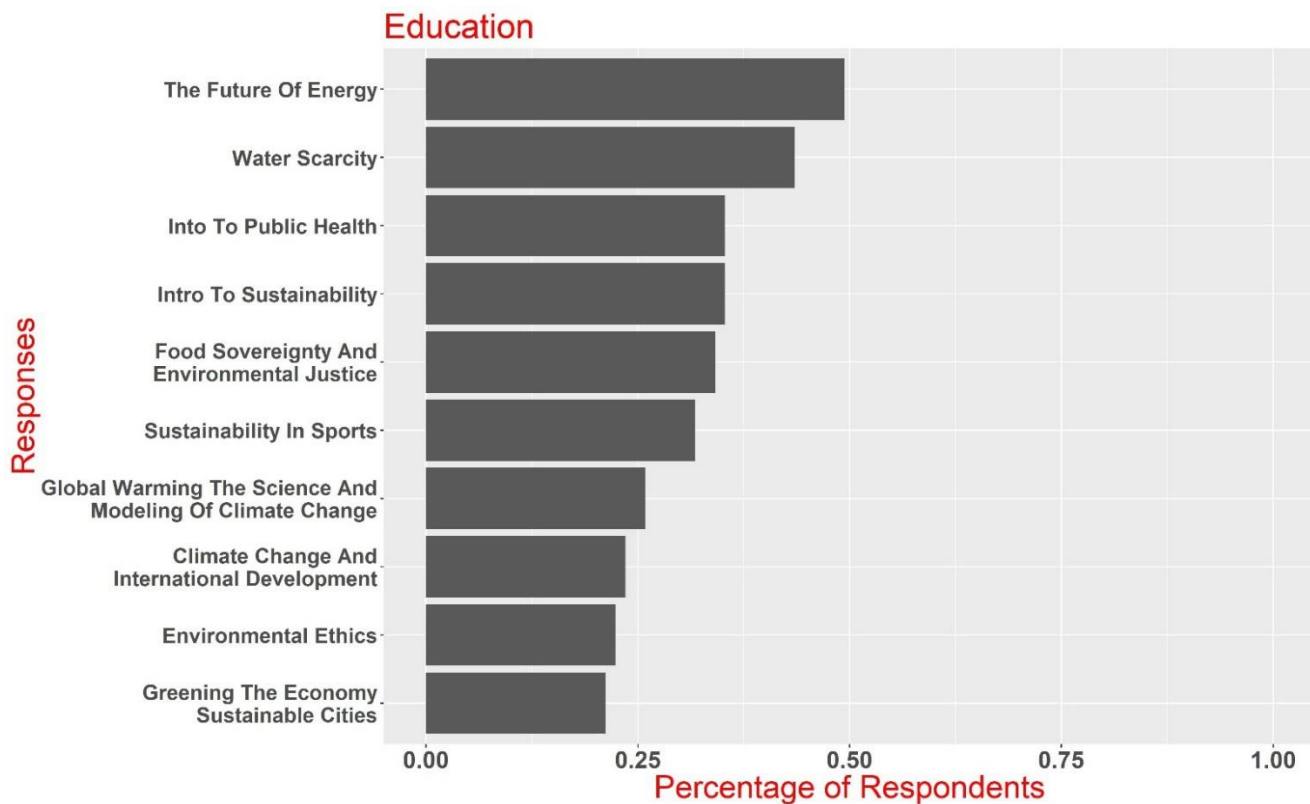
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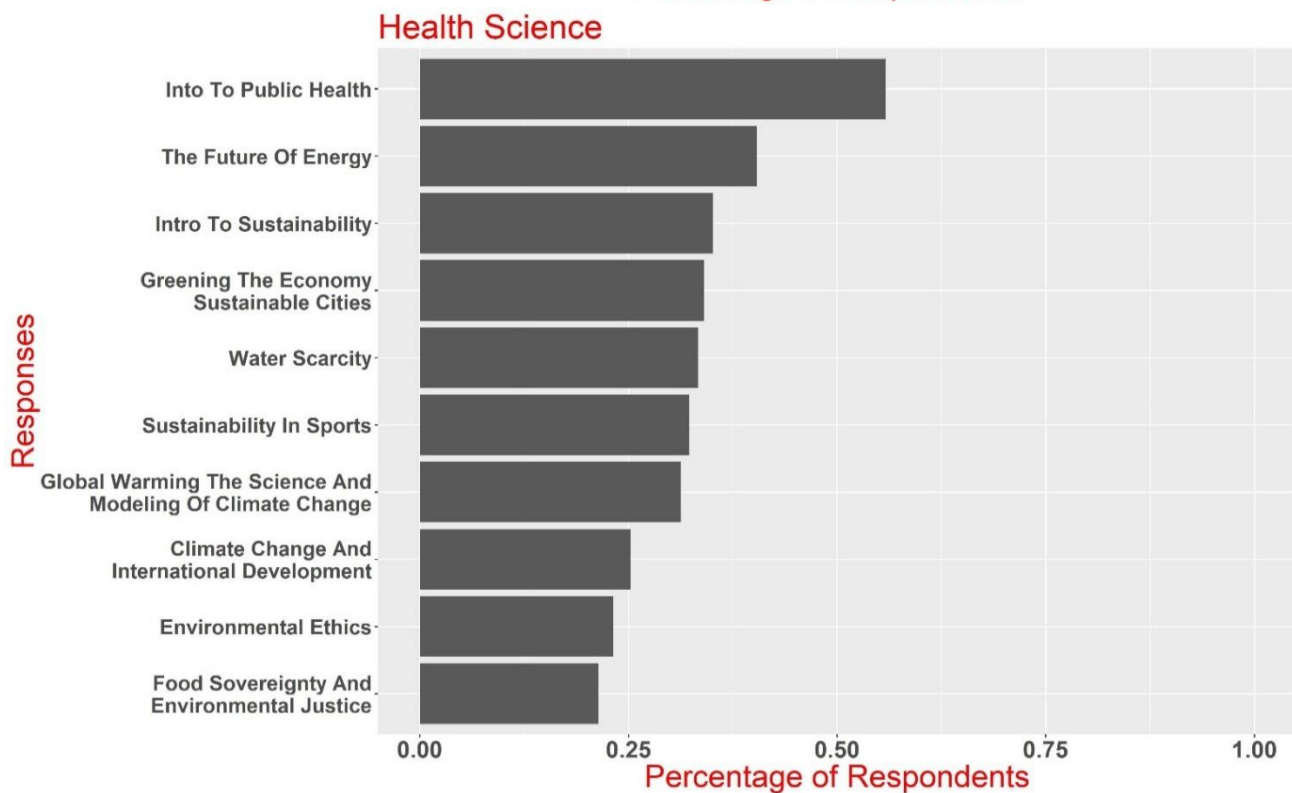
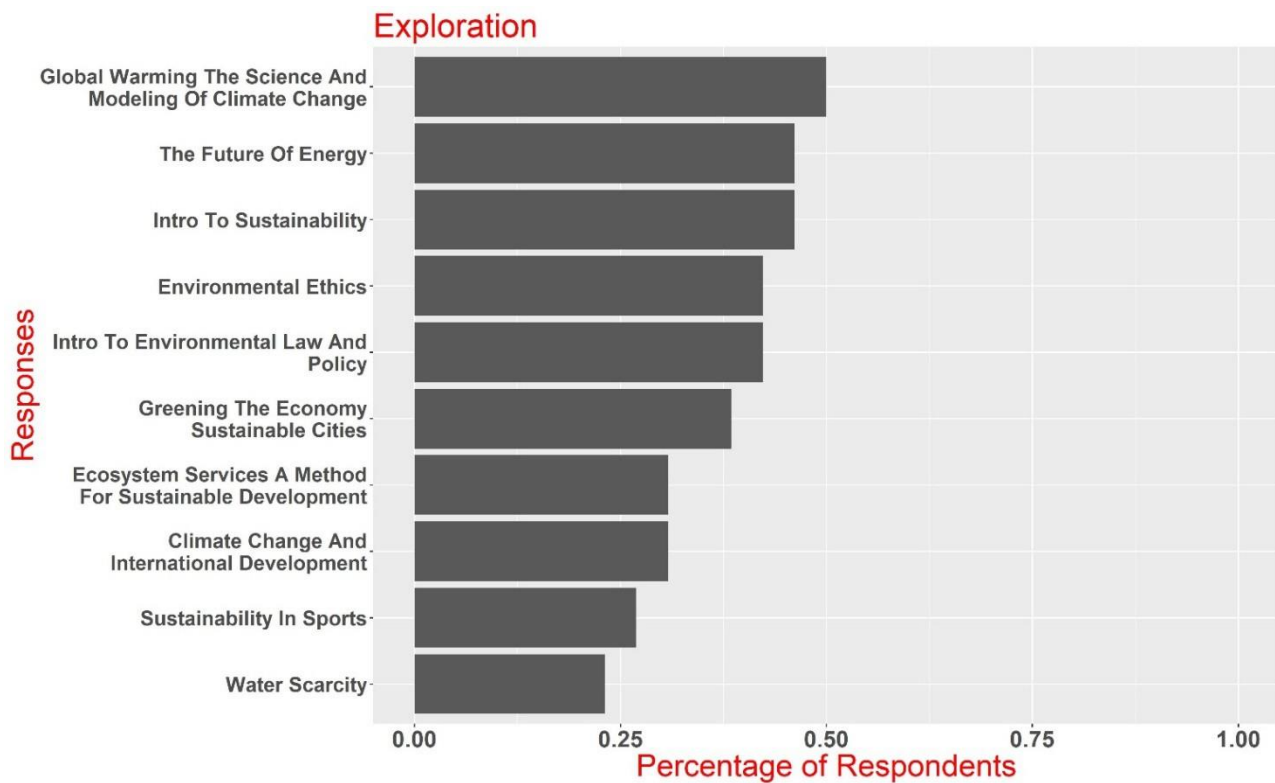
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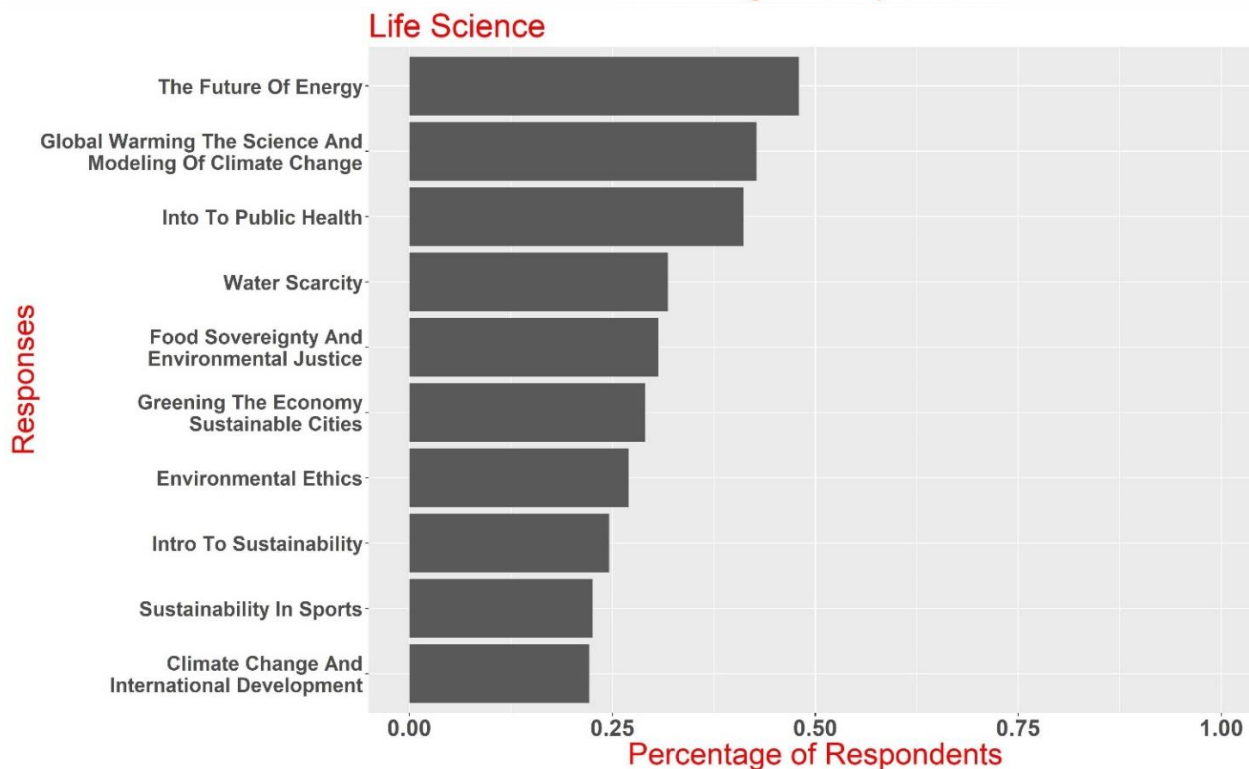
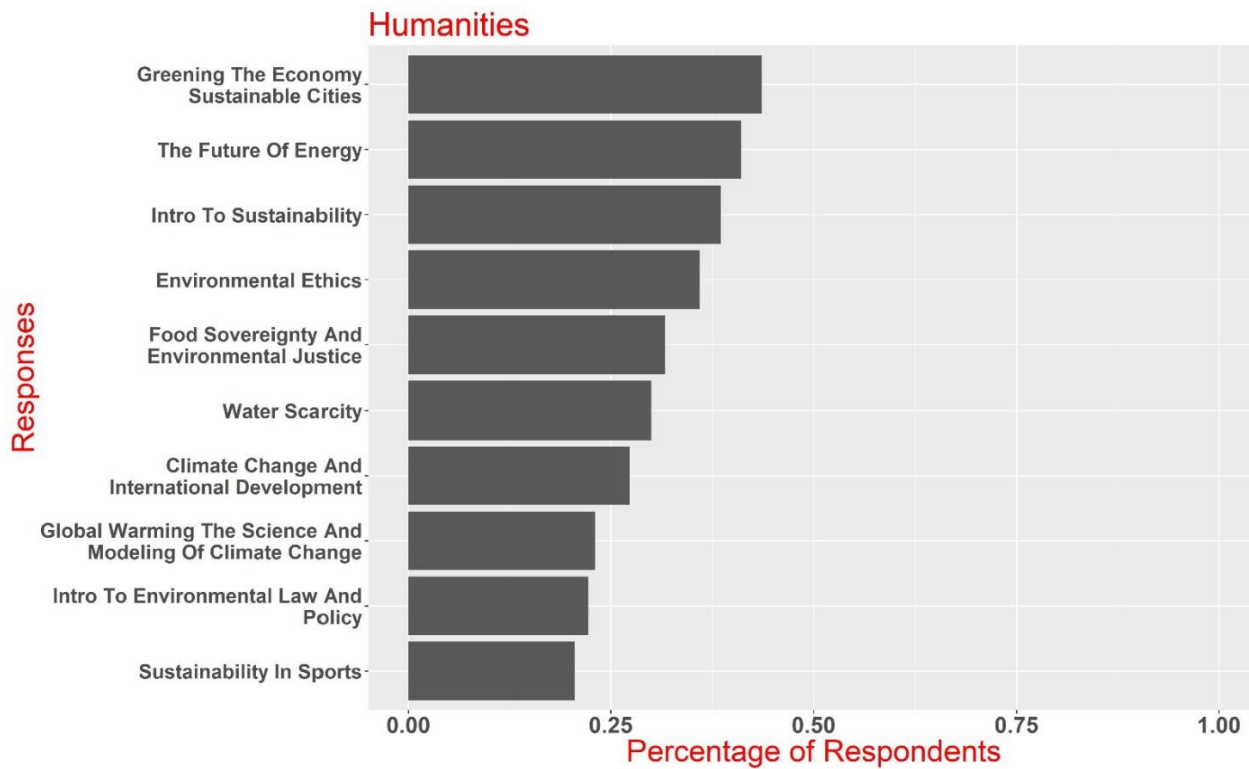
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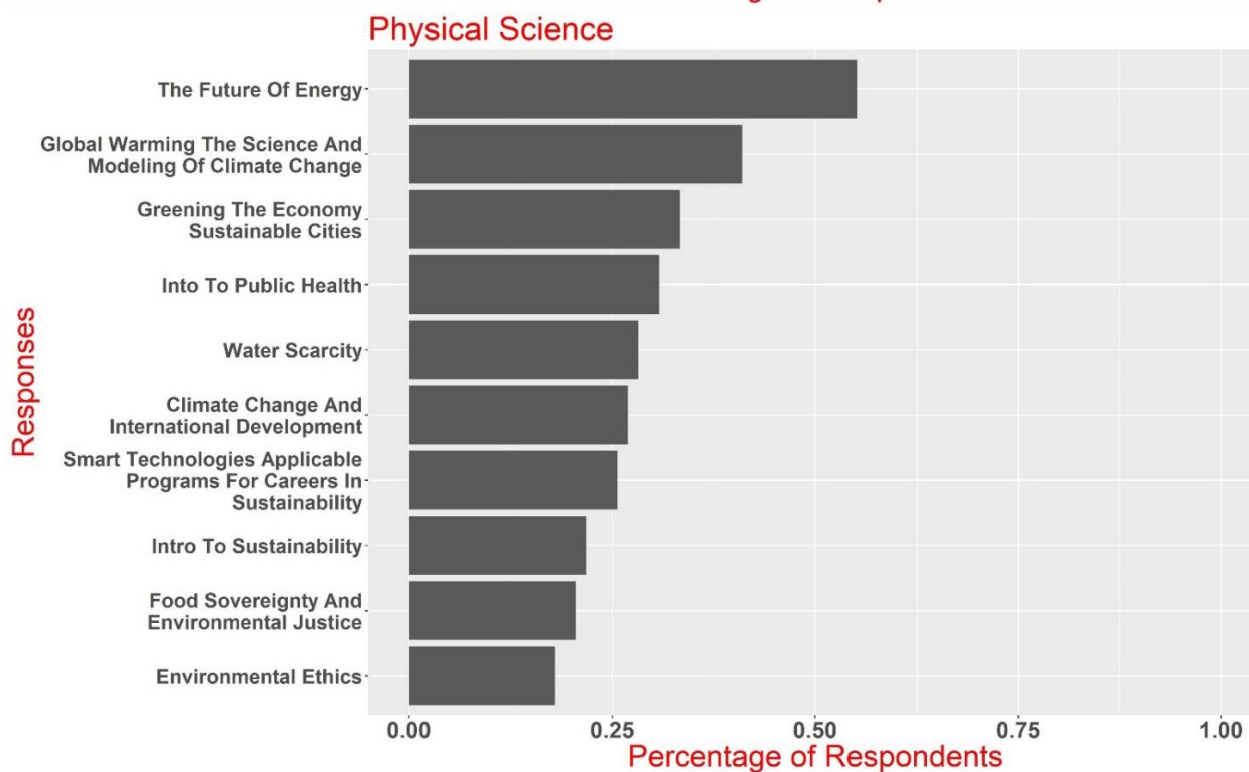
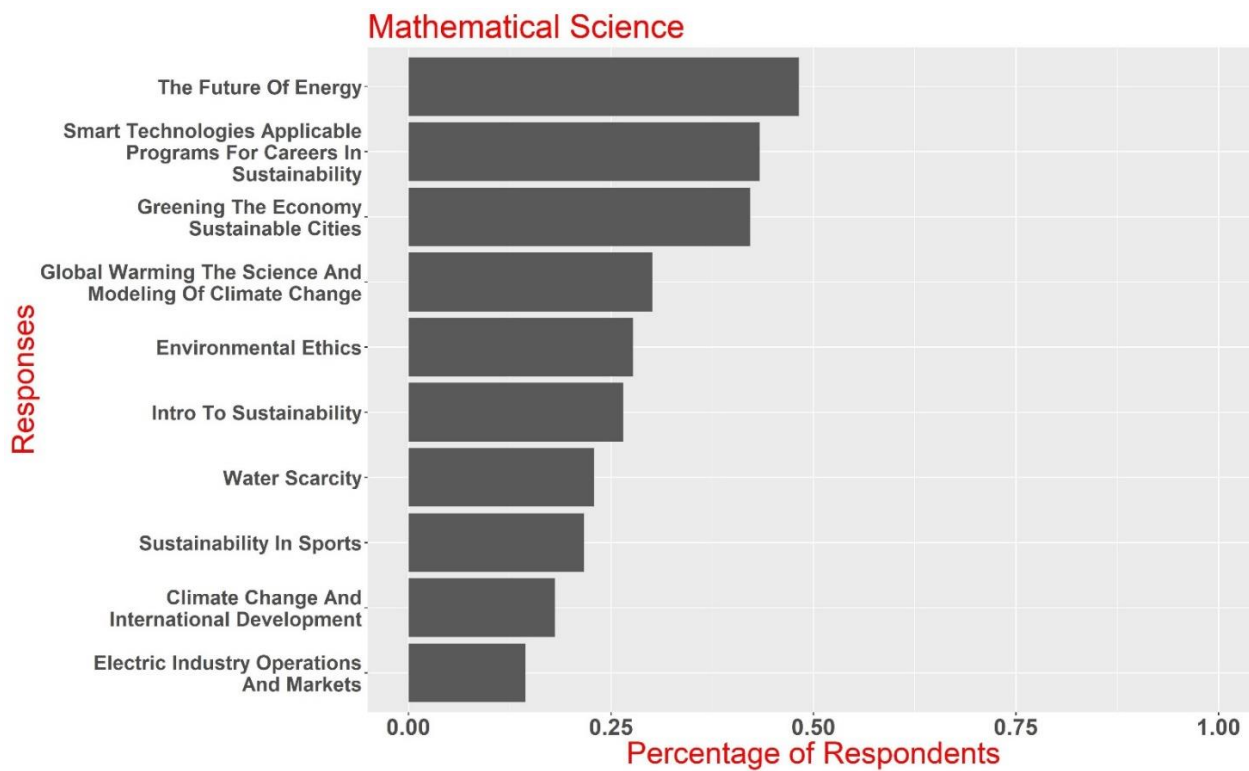
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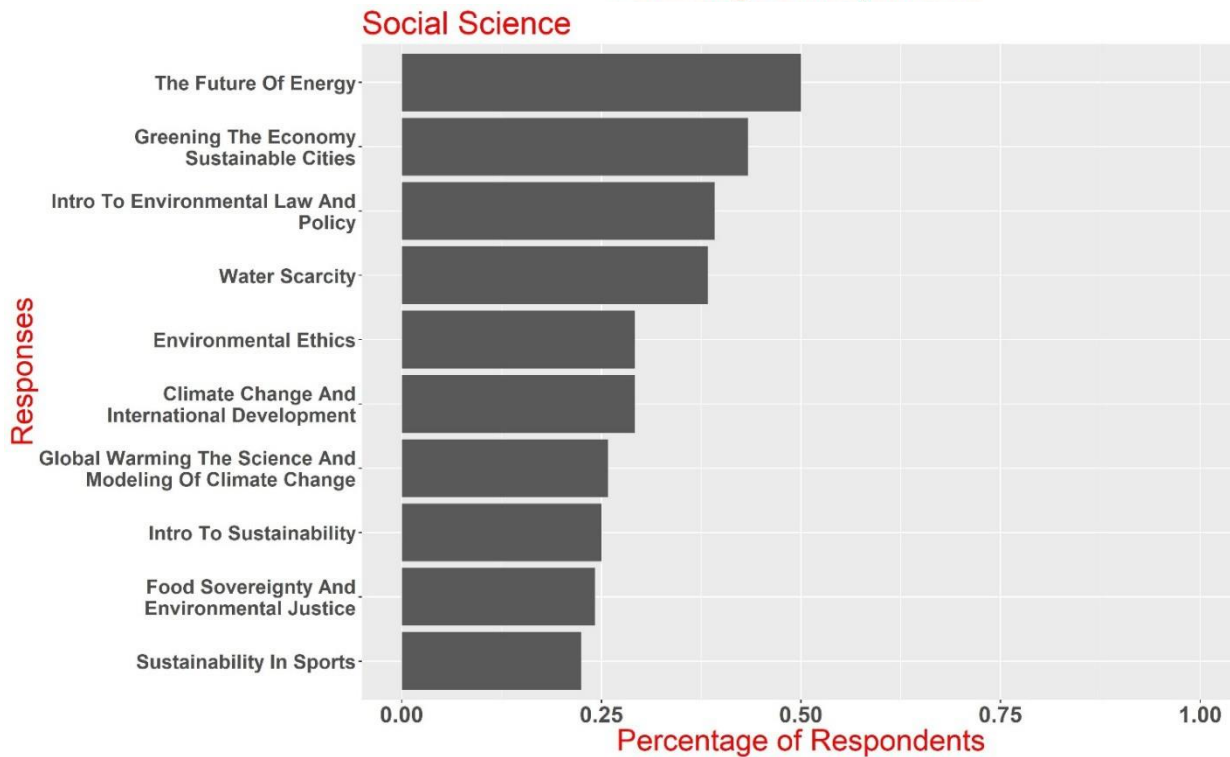
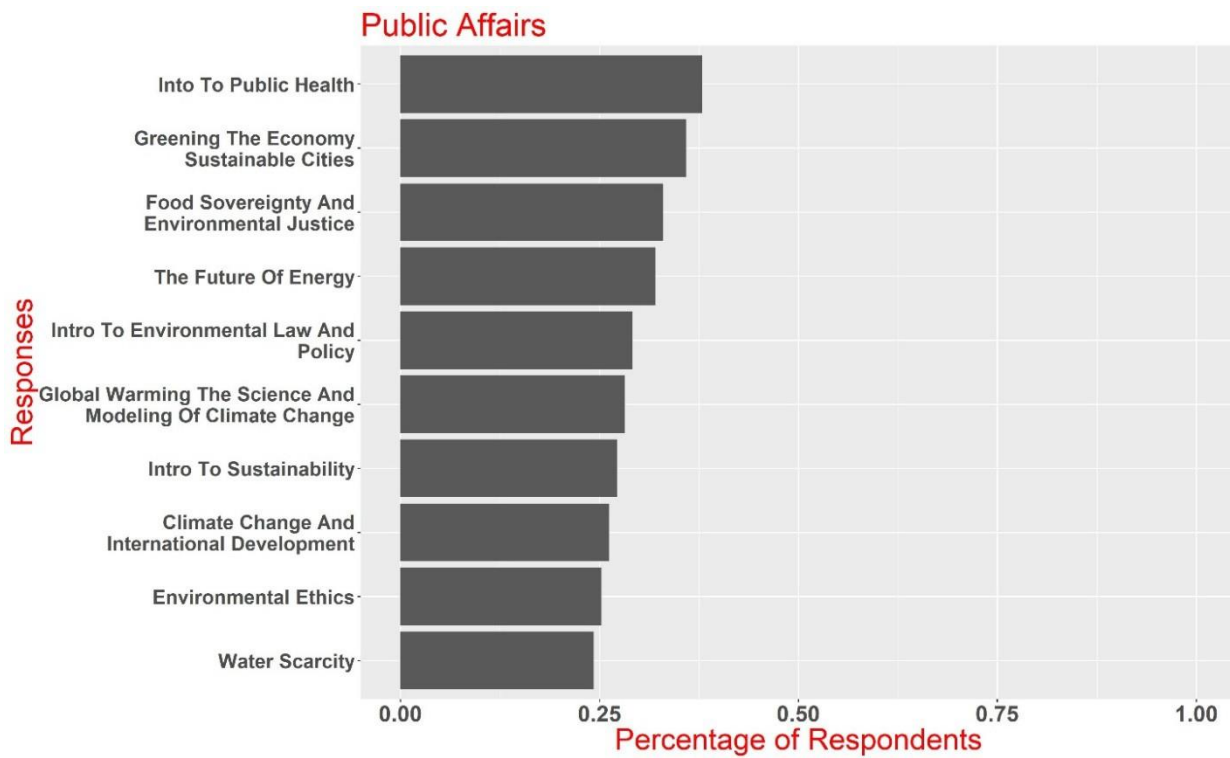
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Social sciences	114	115
Grand Total	2218	2211

Appendix J: Correspondence Between Academic Plans and Aggregate Disciplines

Discipline	Major
Agricultural & environmental sciences	Agricultural Systems Management
	Animal Sciences
	Entomology
	Environmental Science
	Evolution and Ecology
	Food Science and Technology
	Forestry Fisheries & Wildlife
	Horticulture and Crop Science
	Plant Pathology
	Sustainable Plant Systems
Arts	Arts Management
	Dance
	Film Studies
	History of Art
	Jazz Studies
	Moving Image Production
	Music
	Performance
	Studio Art
	Theatre
Behavioral science	Agricultural Communication
	Behavior, Culture&Context Exp
	Communication
	Environmental Policy&Decsn Mkng
	Psychology
Business	Accounting
	Business
	Economics - Business
	Fashion and Retail Studies
	Finance
	Food Business Management
	Health Information Management

	Hospitality Management
	Human Resources
	International Business
	Logistics Management
	Management&Industry Exploring
	Marketing
	Master of Accounting
	Operations Management
	Real Estate and Urban Analysis
	Sport Industry
Design	Architecture
	City and Regional Planning
	Industrial Design
	Interior Design
	Landscape Architecture
	Visual Communication Design
Education	Agriscience Education
	Art Education
	Early & Middle Childhood Stds
	Early Childhood Educ
	Early Childhood Education
	Education & Public Service Exp
	Education-Lng Arts/English Edu
	Education-Special Education
	Foreign Language Education
	Middle Childhood Education
	Music Education
	Music Education Pre-Prof
	Science&Mathematics Education
	Special Education
	Teachng Engl Spkrs Other Langs
Engineering	Aero and Astronautical Eng
	Air Transportation
	Aviation
	Aviation Management
	Biomedical Engineering

	Chemical Engineering
	Civil Engineering
	Computer Science & Engin (pre)
	Computer Science & Engineering
	Construction Systems Mgmt
	Electrical & Computr Eng (pre)
	Electrical and Computer Eng
	Engineering
	Engineering Physics
	Environmental Engineering
	Food, Agri & Biological Eng
	Industrial & Systems Eng (pre)
	Industrial and Systems Eng
	Materials Sci and Engineering
	Mechanical Engineering
	Welding Engineering
Exploration	Arts & Sciences-Undecided
	Exploration
	Exploration in Agriculture
	Re-Exploration
	Science&Technology Exploration
Health science	Athletic Training
	Dental Hygiene
	Exercise Science Education
	Health & Rehabilitation Sci
	Health Professions Exploration
	Health Sciences
	Health Sciences Program
	Hlth Prmtn, Ntrtn & Exrcs Sci
	Human Dvlpmt & Family Science
	Human Nutrition
	Kinesiology
	Medical Dietetics
	Medical Laboratory Science
	Nursing
	Pharmaceutical Sciences

	Public Health
	Radiologic Sciences & Therapy
	Respiratory Therapy
	Speech and Hearing Science
	Speech Language Pathology
Humanities	Chinese
	Classics
	Comparative Studies
	English
	French
	German
	History
	Japanese
	Korean
	Linguistics
	Philosophy
	Romance Studies
	Spanish
	Women's, Gender&Sexuality Sts
Life sciences	Biology
	Biomedical Science
	Microbiology
	Molecular Genetics
	Neuroscience
	Zoology
Mathematical science	Actuarial Science
	Computer & Info Science (pre)
	Computer & Information Science
	Data Analytics
	Data Analytics (pre)
	Information Systems
	Mathematics
Physical science	Astronomy and Astrophysics
	Atmospheric Sciences
	Biochemistry
	Chemistry

	Earth Sciences
	Physics
Public affairs	Community Leadership
	Criminology & Criminal Justice
	International Studies
	Journalism
	Public Mangmnt, Ldrshp, & Plcy
	Public Policy Analysis
	Social Work
	World Politics
Social science	Agribusiness and Applied Econ
	Anthropological Sciences
	Anthropology
	Consumer and Family Fincl Serv
	Economics
	Envrnmnt,Ecnmy,Dvlpmnt&Stnblty
	Geographic Informatn Sciences
	Geography
	Political Science
	Sociology
	Natural Resource Management

Appendix K: Career Development Feedback on Sustainability-Related Undergraduate Academic Programs and Training

Introduction: Curriculum development at Ohio State

- Education & Learning Committee focused on sustainability is currently working on cross-discipline and interdisciplinary curriculum development. Seeking to expand our current offerings, better coordinate/collaborate campus-wide, and support efforts of sustainability as a new theme in OSU's upcoming revision to the General Education requirements

Objectives: what we want to learn from the employer/career development

- Employer needs in the context of capabilities of new entry-level employees interested in working in sustainability within the employer's field
- Information sharing – informing the contact that OSU students seeking sustainability work receive training in many different disciplines (e.g. engineering, natural sciences, social science, integrated sustainability science, humanities, etc.) and learning if some of these areas are more/less valuable for that employer's specific workforce needs
- Identify the benefits of specific suggested additions to our existing curriculum at the undergraduate level (e.g. is there a program we may not offer that would be valuable to employers?)

Benefits that employers may receive by providing us with their feedback

- A collaborative relationship with a broad network of sustainability-related contacts at Ohio State to continue an ongoing discussion of education as compared to workforce needs. Potential collaboration with classes or campus operations to help solve employer issues via project-learning experiences.

For reference (if needed):

SELC's six dimensions of sustainability (demonstrates the breadth of how we define it)

- **1 - systems:** coupled human-natural systems, integrating environmental, economic & social factors, systems thinking, resilience
- **2 - environment:** environmental, earth, and natural resource systems; knowledge of planetary/natural systems, e.g., climate, aquatics, soils, forests, wildlife, geology, ecology, agriculture; understanding of how these systems impact human well-being (e.g., health, economy, social justice, future generations)
- **3- economic-political:** economic and political factors of sustainability (economy/consumption/ production; laws/policy/governance/institutions; business/strategy/management; costs/benefits/tradeoffs)
- **4 - social-cultural:** social/cultural factors of sustainability (justice, equity, values, ethics, history, religion, the arts, citizenship, power, behavior and decision making, cultural critique...)
- **5 – technology & design:** engineering; technological innovation; systems design; human-machine interface; manufacturing processes; life cycle; product design (design of technology and infrastructure to promote sustainability and human well-being)
- **6 - well-being:** human health, safety, risk, sustainable livelihoods, social welfare and well-being

QUESTIONS

Name: _____ Affiliation: _____

Title: _____

Responsibility: _____

1. [General skills]

- We (Ohio State) want to prepare the best employees you can get—so regardless of what role they take in your organization, **what are five key skill sets that you need your employees to have?** Are these skills specific to your company or would you say they are representative for other employers?

2. [Education]

☐ Do you hire from specific disciplines? What value (if any) do you place on interdisciplinary training?

☐ What does a well prepared employee look like?

- i. What can they do
- ii. What do they know
- iii. What are they aware of
- iv. What experience do they have
- v. What ability do they promise—what is their potential?

3. [Value/potential of better prepared employees]

☐ If your new employees came in with the proper preparation, what would that enable you to do differently? For example, would this provide savings in terms of time, money, and effort?

4. [Working with OSU]

☐ How would see your company engaging with undergraduate students studying in sustainability-related majors?

Some options:

- Be an internship/co-op site
- Sponsor capstone/practicum projects at Ohio State
- Collaborate on research with Ohio State faculty and undergraduate students
- Participate on an advisory board
- Mentor students
- Send speakers/judges to workshops, classes, hackathons, etc.

Appendix L: Comprehensive Energy Management Academic Collaboration Overview

Endowments – 9 approved by Board of Trustees

- **Scholarships: \$25 million**
 - \$12.5M - undergraduates; \$12.5M - graduate/professional students
- **Faculty Endowments: \$9.5 million**
 - Five endowed positions
- **Sustainability Projects: \$15 million**
- **Sustainability Curriculum: \$5 million**

ADDITIONAL SUPPORT

- **Philanthropic Support: \$810,000 annually for 50 years**
- **Internships: \$100,000 per year paid directly to interns (10 per year)**
- **Visionary Project: \$50 million**
 - Energy Advancement and Innovation Center