SUSTAINABILITY SCIENCE AND PRACTICE

Courses offered by the Sustainability Science and Practice program are listed under the subject code SUST on the Stanford Bulletin's ExploreCourses (https://explorecourses.stanford.edu) website.

Mission of the Cterminal Program in Sustainability Science and Practice

The Sustainability Science and Practice program (SUST for short) is an interdisciplinary cterminal master's program hosted by the School of Earth, Energy and Environmental Sciences (http://exploredegrees.stanford.edu/schoolofearthsciences). The goal of the program is to prepare leaders to radically accelerate the transition to a more sustainable society. As the global human population climbs toward 11 billion this century and consumption demands increase, society must find ways to meet the needs of people in ways that do not forgo possibilities for future generations. These sustainability challenges are marked by extreme complexity, urgency, conflicting demands, and often a paucity of resources or political will to address them. Transforming these challenges into powerful opportunities requires a new kind of leader — one who can both envision a prosperous future for all and who can design practices and cultivate partnerships essential to building that future. The SUST program equips students with the theoretical and conceptual knowledge and the mindsets and practical skills needed to advance sustainability, securing human well-being around the world and across generations.

The curriculum covers three main elements:

Element 1: Understanding complex social-environmental systems

Students develop a "systems perspective", deepening their awareness of the dynamic and interrelated nature of social-environmental systems. They explore tools to measure, map, and model five capital assets — social, natural, human, manufactured, and knowledge capital — and their complex interactions in order to recognize potential feedbacks, thresholds, and unintended consequences, as well as to identify leverage points and opportunities for interventions that can have transformative impact.

Element 2: Understanding decision making and developing strategies for change

Students examine the roles of diverse actors who influence change in social-environmental systems and explore strategies to align decision making and behavior with sustainability. They explore mindsets and attributes of transformative leaders and the strategies and approaches of organizations advancing sustainability across sectors. Students develop skills in decision making in complex and uncertain contexts, use metrics and evaluation approaches aligned with sustainability goals, cultivate leadership orientations, and practice effective communications and storytelling approaches.

Element 3: Designing innovations with impact at scale

Students develop understanding of how to intervene in complex systems for transformative impact by exploring frameworks and tools from systems thinking, design thinking, social cognitive theory, behavioral economics, and partnership strategies. They develop practical skills in mapping complex systems and designing creative, high-leverage interventions that realign systems with the goal of intergenerational well-being.

Sustainability Leadership Practicum

To integrate and internalize core lessons from the SUST curriculum, each student completes a 120-hour practicum project of their own design, collaborating on a complex sustainability challenge with an outside partner and working through the types of constraints often faced by decision makers and leaders. Students apply the leadership mindsets, knowledge, and skills from the curriculum to this practical experience and present their final analysis and reflections to faculty and peers.

Learning Outcomes

The Sustainability Science and Practice program integrates theoretical and conceptual knowledge, mindsets, and practical skills to enable students to understand and manage complex systems, understand decision making and develop strategies for change, and develop partnerships and design innovations with potential for impact at scale.

The program prepares students to become effective participants and agents of change as individuals and within organizations across all sectors of society, contributing to the advancement of the goal of sustainability, i.e., the well-being of people around the world and across generations. Using a conceptual framework that connects human well-being with key underlying assets, students learn how social-environmental systems work, how decisions can be made to influence system dynamics in a way that supports sustainability goals, and how to engage with others to design new ways of managing these systems.

Master of Arts in Sustainability Science and Practice

University requirements for master's degrees are described in the "Graduate Degrees (http://exploredegrees.stanford.edu/graduatedegrees/#masterstext)" section of this bulletin.

The Sustainability Science and Practice program offers current Stanford undergraduates the opportunity to apply to a one-year cterminal master's program. Students can pursue either a cterminal Master of Arts (M.A.) degree or a cterminal Master of Science (M.S.) degree.

Application and Admission

The Sustainability Science and Practice program has quarterly cterminal degree application deadlines: November 5, 2019; February 18, 2020, and May 12, 2020. To apply, students should submit an online application. The application includes the following:

- The online Stanford cterminal application (https://www.applyweb.com/stanterm).
- A statement of purpose, about one page in length, that describes why this program is meaningful to the applicant, what experiences and education have prepared the applicant for the program, and provides a clear picture of who the applicant is and what matters to him or her.
- A resume.
- A current Stanford unofficial transcript.
- Two letters of recommendation, including one from the applicant's master's adviser (who must be an Academic Council member) and one from another Stanford faculty member who knows the student well and can speak to the student's qualifications and fit for the program. An optional third letter of recommendation may also be submitted for consideration.
- Master's Program Proposal (https://stanford.box.com/progpropma) completed to include a list of courses that the student proposes to take to fulfill degree requirements.

Applications must be submitted no later than the quarter prior to the expected completion of the bachelor's degree and within quarterly application deadlines. An application fee is assessed by the Registrar's
Office for coterminal applications once a student matriculates into the program.

Students applying to the coterminal master’s program must have completed a minimum of 120 units towards graduation with a minimum overall Stanford GPA of 3.4.

All applicants must devise a program of study that includes a set of courses appropriate to the master’s level, and determined in consultation with the master’s advisor.

The student has the option of receiving the bachelor’s degree after completing the degree’s requirements, or receiving the bachelor’s and master’s degrees concurrently upon the completion of the master’s program.

If accepted, the student must submit a Graduate Authorization Petition through Axess; a $125 fee applies to a successful Graduate Authorization Petition.

University Coterminal Requirements
Coterminal master’s degree candidates are expected to complete all master’s degree requirements as described in this bulletin. University requirements for the coterminal master’s degree are described in the “Coterminal Master’s Program” section. University requirements for the master’s degree are described in the “Graduate Degrees” section of this bulletin.

After accepting admission to this coterminal master’s degree program, students may request transfer of courses from the undergraduate to the graduate career to satisfy requirements for the master’s degree. Transfer of courses to the graduate career requires review and approval of both the undergraduate and graduate programs on a case by case basis.

In this master’s program, courses taken during or after the first quarter of the sophomore year are eligible for consideration for transfer to the master’s program, the ethics course can be treated as a master’s program elective and counted toward the 45 units required for degree completion.

Degree Requirements
The following are required of all M.A. students:

- A minimum of 45 units of course work.
- At least 34 units of the student’s course work for the master’s program must be at the 200 level or above.
- All remaining course work must be at the 100 level or above.
- All courses for the master’s program must be taken for a letter grade; courses not taken for a letter grade must be approved by the program director.
- A minimum overall GPA of 3.4 must be maintained.
- The majority of the student’s 45 units must be designated as “arts” units. Arts and science designations for courses can be viewed on the program’s Master Course List (https://stanford.app.box.com/file/124238118535).

• A list of elective courses approved for the master’s program can be found on the Master Course List.

If courses required for the master’s degree have been taken in the undergraduate career, students may pursue additional electives to fulfill the 45 units required for degree completion.

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sustainability</strong></td>
<td></td>
</tr>
<tr>
<td>Courses required for all SUST coterms:</td>
<td></td>
</tr>
<tr>
<td>SUST 210  Pursuing Sustainability: Managing Complex Social Environmental Systems</td>
<td>3</td>
</tr>
<tr>
<td>SUST 220  Case Studies in Leading Change for Sustainability</td>
<td>3</td>
</tr>
<tr>
<td>SUST 230  Innovating Large Scale Sustainable Transformations/Collaborating for the Future</td>
<td>3-4</td>
</tr>
<tr>
<td>SUST 240  Sustainability Leadership Practicum</td>
<td>1-4</td>
</tr>
<tr>
<td>EARTHSYS 111  Biology and Global Change</td>
<td>4</td>
</tr>
<tr>
<td>EARTHSYS 212  Human Society and Environmental Change</td>
<td>4</td>
</tr>
<tr>
<td><strong>Psychology / Understanding Behavior</strong></td>
<td></td>
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<tr>
<td>Minimum 1, maximum 2 of the following, or approved alternative</td>
<td></td>
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<tr>
<td>PSYCH 215  Mind, Culture, and Society</td>
<td>3</td>
</tr>
<tr>
<td>PSYCH 216  Public Policy and Social Psychology: Implications and Applications</td>
<td>4</td>
</tr>
<tr>
<td>PSYCH 265  Social Psychology and Social Change (Must be taken for 3 units)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Decision Making</strong></td>
<td></td>
</tr>
<tr>
<td>One of the following, or approved alternative:</td>
<td></td>
</tr>
<tr>
<td>LAW 7508  Problem Solving and Decision Making for Public Policy and Social Change</td>
<td>4</td>
</tr>
<tr>
<td>GSBGEN 367  Problem Solving for Social Change (Limited Enrollment-Check course description for details)</td>
<td>3</td>
</tr>
<tr>
<td>SUST 261  Art and Science of Decision Making</td>
<td>3-4</td>
</tr>
<tr>
<td>ENVRES 240  Environmental Decision-Making and Risk Perception (Must be taken for 3 units)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Design Thinking</strong></td>
<td></td>
</tr>
<tr>
<td>Minimum 1, maximum 2 of the following, or an approved alternative</td>
<td></td>
</tr>
<tr>
<td>ME 206A &amp; ME 206B  Design for Extreme Affordability and Design for Extreme Affordability</td>
<td>8</td>
</tr>
<tr>
<td>SUST 231  FEED Lab: Food System Design &amp; Innovation</td>
<td>3-4</td>
</tr>
<tr>
<td>ME 377  Design Thinking Studio</td>
<td>4</td>
</tr>
<tr>
<td>MS&amp;E 177  Inventing the Future</td>
<td>4</td>
</tr>
</tbody>
</table>

For the Master of Arts in Sustainability Science and Practice, an approved ethics course must be taken if the student has not completed an ethics course in their undergraduate career. If taken during the master’s program, the ethics course can be treated as a master’s program elective and counted toward the 45 units required for degree completion.

<table>
<thead>
<tr>
<th>Ethics</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of the following, or approved alternative:</td>
<td></td>
</tr>
<tr>
<td>ETHICSCOC 234R  The Ethics of Stewardship</td>
<td>3</td>
</tr>
<tr>
<td>EARTHSYS 136/236  The Ethics of Stewardship</td>
<td>2-3</td>
</tr>
</tbody>
</table>
Master of Science in Sustainability Science and Practice

University requirements for master’s degrees are described in the "Graduate Degrees (http://exploredegrees.stanford.edu/graduatedegrees/#masterstext)" section of this bulletin.

The Sustainability Science and Practice program offers current Stanford undergraduates the opportunity to apply to a one-year coterminal master’s program. Students can pursue either a coterminal Master of Arts (M.A.) degree or a coterminal Master of Science (M.S.) degree.

Application and Admission

The Sustainability Science and Practice program has quarterly coterminal degree application deadlines: November 5, 2019; February 18, 2020; and May 12, 2020. To apply, students should submit an online application. The application includes the following:

- The online Stanford coterminal application (https://www.applyweb.com/stanterm).
- A statement of purpose, about one page in length, that describes why this program is meaningful to the applicant, what experiences and education have prepared the applicant for the program, and provides a clear picture of who the applicant is and what matters to him or her.
- A resume.
- A current Stanford unofficial transcript.
- Two letters of recommendation, including one from the applicant’s master’s adviser (who must be an Academic Council member) and one from another Stanford faculty member who knows the student well and can speak to the student’s qualifications and fit for the program. An optional third letter of recommendation may also be submitted for consideration.
- Master’s Program Proposal (https://stanford.box.com/progpropma) completed to include a list of courses that the student proposes to take to fulfill degree requirements.

Applications must be submitted no later than the quarter prior to the expected completion of the bachelor’s degree and within quarterly application deadlines. An application fee is assessed by the Registrar’s Office for coterminal applications once a student matriculates into the program.

Students applying to the coterminal master’s program must have completed a minimum of 120 units towards graduation with a minimum overall Stanford GPA of 3.4.

All applicants must devise a program of study that includes a set of courses appropriate to the master’s level, and determined in consultation with the master’s advisor.

The student has the option of receiving the bachelor’s degree after completing the degree’s requirements, or receiving the bachelor’s and master’s degrees concurrently upon the completion of the master’s program.

If accepted, the student must submit a Graduate Authorization Petition through Axess; a $125 fee applies to a successful Graduate Authorization Petition.

University Coterminal Requirements

Coterminal master’s degree candidates are expected to complete all master’s degree requirements as described in this bulletin. University requirements for the coterminal master’s degree are described in the “Coterminal Master’s Program (http://exploredegrees.stanford.edu/cotermdegrees)” section. University requirements for the master’s degree are described in the "Graduate Degrees (http://exploredegrees.stanford.edu/graduatedegrees/#masterstext)" section of this bulletin.

After accepting admission to this coterminal master’s degree program, students may request transfer of courses from the undergraduate to the graduate career to satisfy requirements for the master’s degree. Transfer of courses to the graduate career requires review and approval of both the undergraduate and graduate programs on a case by case basis.

In this master’s program, courses taken during or after the first quarter of the sophomore year are eligible for consideration for transfer to the graduate career; the timing of the first graduate quarter is not a factor. No courses taken prior to the first quarter of the sophomore year may be used to meet master’s degree requirements.

Course transfers are not possible after the bachelor’s degree has been conferred.

The University requires that the graduate adviser be assigned in the student’s first quarter, even though the undergraduate career may still be open. The University also requires that the Master’s Degree Program Proposal be completed by the student and approved by the department by the end of the student’s first graduate quarter.

Degree Requirements

The following are required of all M.S. students:

- A minimum of 45 units of course work.
- At least 34 units of the student’s course work for the masters program must be at the 200 level or above.
- All remaining coursework must be at the 100 level or above.
- All courses for the master’s program must be taken for a letter grade; courses not taken for a letter grade must be approved by the program director.
- A minimum overall GPA of 3.4 must be maintained.
- The majority of the student’s 45 units must be designated as “science” units. Arts and science designations for courses can be viewed on the program’s Master Course List (https://stanford.app.box.com/v/sust-courses).
- A list of elective courses approved for the master’s program can be found on the Master Course List. (https://stanford.app.box.com/file/124238118535)
- If courses required for the master’s degree have been taken in the undergraduate career, students may pursue additional electives to fulfill the 45 units required for degree completion.

Mathematics and Statistics Prerequisites

For the Master of Science in Sustainability Science and Practice, the following mathematics and statistics requirements must be fulfilled prior to or during the master’s program. The mathematics and statistics course work may not be counted toward the 45 units required for master’s degree completion.

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 51 Linear Algebra, Multivariable Calculus, and Modern Applications</td>
<td>5</td>
</tr>
<tr>
<td>CME 100 Vector Calculus for Engineers</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 102A Introduction to Statistical Methods (Postcalculus) for Social Scientists</td>
<td>5</td>
</tr>
</tbody>
</table>
### Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATS 110</td>
<td>Statistical Methods in Engineering and the Physical Sciences</td>
<td>5</td>
</tr>
<tr>
<td>STATS 116</td>
<td>Theory of Probability</td>
<td>4</td>
</tr>
<tr>
<td>CS 109</td>
<td>Introduction to Probability for Computer Scientists</td>
<td>3-5</td>
</tr>
<tr>
<td>EE 178</td>
<td>Probabilistic Systems Analysis</td>
<td>4</td>
</tr>
</tbody>
</table>

### Sustainability

Courses required for all SUST coterm:

- **SUST 210**: Pursuing Sustainability: Managing Complex Social Environmental Systems
- **SUST 220**: Case Studies in Leading Change for Sustainability
- **SUST 230**: Innovating Large Scale Sustainable Transformations/Collaborating for the Future
- **SUST 240**: Sustainability Leadership Practicum
- **EARTHSYS 111**: Biology and Global Change
- **EARTHSYS 212**: Human Society and Environmental Change

### Psychology / Understanding Behavior

Minimum 1, maximum 2 of the following, or approved alternative:

- **PSYCH 215**: Mind, Culture, and Society
- **PSYCH 216**: Public Policy and Social Psychology: Implications and Applications
- **PSYCH 265**: Social Psychology and Social Change (Must be taken for 3 units)

### Decision Making

One of the following, or approved alternative:

- **LAW 7508**: Problem Solving and Decision Making for Public Policy and Social Change
- **GSBGEN 367**: Problem Solving for Social Change (Limited Enrollment-Check course description for details)
- **SUST 261**: Art and Science of Decision Making
- **ENVRES 240**: Environmental Decision-Making and Risk Perception (Must be taken for 3 units)

### Design Thinking

Minimum 1, maximum 2 of the following, or an approved alternative:

- **ME 206A & ME 206B**: Design for Extreme Affordability and Design for Extreme Affordability
- **SUST 231**: FEED Lab: Food System Design & Innovation
- **ME 377**: Design Thinking Studio
- **MS&E 177**: Inventing the Future

For the Master of Science in Sustainability Science and Practice, an approved ethics course must be taken if the student has not completed an ethics course in their undergraduate career. If taken during the master's program, the ethics course can be treated as a master's program elective and counted toward the 45 units required for degree completion.

### Ethics

One of the following, or approved alternative:

- **ETHICSOC 234R**: The Ethics of Stewardship
- **EARTHSYS 136/236**: The Ethics of Stewardship

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For a statement of University policy on graduate advising, see the "Graduate Advising" section of this bulletin.

### Graduate Advising Expectations

The Sustainability Science and Practice (SUST) program believes that a clear and productive relationship between the graduate adviser and graduate student is necessary for academic and professional success. Because the program sees itself as building leaders for the future of sustainability, it is committed to providing students with graduate advisers who embody such leadership and employ the knowledge, mindsets, and skills of the program in their role.

### Acquiring an Adviser

- The SUST program provides prospective students with a list of faculty members who have expressed willingness to act as advisers for students in the program. Students research potential advisers with similar interests and shared academic focus areas that they would like to emphasize in their own studies.
- Students contact the faculty member to ask for a meeting to explore whether the advising relationship is going to be a good fit for both parties.
- While the official adviser-of-record must be on the Academic Council (i.e., professor, associate professor, or assistant professor), students may ask a non-Academic Council member to serve as a co-adviser. Students should consult with the Change Leadership for Sustainability executive director or program director about co-advising relationships.

### Advising Expectations

Faculty advisers are expected to serve as intellectual advisers and professional mentors, preparing students to be ready for, and successful in, their future careers.

A prospective faculty adviser meets with a student prior to application submission to:

- Discuss the student's motivation for applying to the program;
- Plan and review course lists and selection; and
- Discuss what the adviser/advisee relationship will look like.

Once admitted, the student and adviser should meet quarterly to:

- Review courses for that quarter and sign off on the study list;
- Discuss career goals and practicum ideas;
- Help connect the student with larger networks outside of Stanford for sustainability work;
- Engage the student in relevant research opportunities and projects;
- Review the student's practicum proposal and attend (if possible) the student's final practicum presentation. The program director is an additional resource for students, specifically for practicum planning, mentoring, and completion. Students are expected to talk with their adviser and the program director about this aspect of the program.

### Meetings and Scheduling

The student is responsible for scheduling the quarterly advising meeting. In-person meetings are encouraged; however, meetings by phone or video conference are acceptable, if mutually agreed. If a student is on leave of absence, the program encourages him/her to check in with his/her adviser each quarter via email. If an adviser is on sabbatical, it is expected that planning for this would have been covered in an earlier meeting. Most faculty members on sabbatical continue the advising relationship with existing advisees, and meetings shift from in-person to phone or video conference.
Addressing Mental Health
Pursuing a master’s degree at Stanford University is one of the many exciting but challenging tasks students may be taking on. The pressures of academic work, external projects, and family affairs can at times cause students mental, physical, and emotional stress. The program encourages academic advisers to provide resources to students who may show signs of struggling with mental health, including extreme levels of anxiety and depression, or battling issues such as grief.

Resources
• Counseling and Psychological Services (CAPS) offers crisis counseling. Walk-in appointments are available, and clinicians are always on call at (650) 723-3785.
• The Graduate Life Office is available during office hours at (650) 736-7078, or 24/7 at (650) 723-8222, pager ID number 25085.
• The Bridge Peer Counseling Center offers counseling by trained students 24/7 at (650) 723-3392.
• The Office for Religious Life offers spiritual guidance for students. Call (650) 723-1762 or visit the Round Room at Memorial Church.
• The Faculty and Staff Help Center, located in Kingscote Gardens, offers confidential help for Stanford faculty and staff.
• If you are aware of someone in distress, contact CAPS, the Department of Public Safety or the Office of the Dean of Students.

Program Staff:
Director of Graduate Studies: Pamela Matson
Executive Director: Julia Novy-Hildesley
Program Director: Shelley Ratay
Program Coordinator: Lauren Neville

Affiliated Faculty and Lecturers:
• Kevin Arrigo (Earth System Science)
• Nicole M. Ardoin (Education)
• Shilajeet Banerjee (Sustainability Science and Practice)
• William Barnett (Business)
• Sally Benson (Energy Resources Engineering)
• Paul Brest (Law)
• Marshall Burke (Earth System Science)
• Gretchen C. Daily (Environmental Science)
• Jenna Davis (Civil and Environmental Engineering)
• Rob Dunbar (Earth System Science)
• Zephyr Frank (History)
• Pamela Hinds (Management Science and Engineering)
• Rob Jackson (Earth System Science)
• James Holland Jones (Earth System Science)
• Jeffrey R. Koseff (Civil and Environmental Engineering)
• Eric Lambin (Earth System Science)
• Susan Liautaud (Law, Public Policy)
• Hazel Markus (Psychology)
• Pamela Matson (Earth System Science)
• Rosamond Naylor (Earth System Science)
• Julia Novy-Hildesley (Professor of the Practice, Sustainability Science and Practice)
• Burke Robinson (Management Science and Engineering)
• Matt Rothe (Sustainability Science and Practice and Earth Systems)
• Jenny Suckale (Geophysics)
• Barton Thompson (Law)
• Peter Vitousek (Biology)