Fiscal Unit/Academic Org	Anthropology - D0711
Administering College/Academic Group	Arts and Sciences
Co-adminstering College/Academic Group	
Semester Conversion Designation	New Program/Plan
Proposed Program/Plan Name	Sustainable and Resilient Social and Ecological Systems
Type of Program/Plan	Undergraduate certificate program
Program/Plan Code Abbreviation	
Proposed Degree Title	

Credit Hour Explanation

Program credit hour requirements		A) Number of credit hours in current program (Quarter credit hours)	B) Calculated result for 2/3rds of current (Semester credit hours)	C) Number of credit hours required for proposed program (Semester credit hours)	D) Change in credit hours
Total minimum credit hours required for completion of program				14	
Required credit hours offered by the unit	Minimum			5	
	Maximum			5	
Required credit hours offered outside of the unit	Minimum			0	
	Maximum			0	
Required prerequisite credit hours not included above	Minimum			0	
	Maximum			0	

Program Learning Goals

Note: these are required for all undergraduate degree programs and majors now, and will be required for all graduate and professional degree programs in 2012. Nonetheless, all programs are encouraged to complete these now.

Program Learning Goals

- Students will understand the dynamic couplings and interconnections between physical earth systems, ecosystems, and human systems.
- Students will be able to apply this understanding to the development of sustainable and resilient systems in their work, studies, and personal lives.

Assessment

Assessment plan includes student learning goals, how those goals are evaluated, and how the information collected is used to improve student learning. An assessment plan is required for undergraduate majors and degrees. Graduate and professional degree programs are encouraged to complete this now, but will not be required to do so until 2012.

Is this a degree program (undergraduate, graduate, or professional) or major proposal? Yes

Does the degree program or major have an assessment plan on file with the university Office of Academic Affairs? No

DIRECT MEASURES (means of assessment that measure performance directly, are authentic and minimize mitigating or intervening factors)

Classroom assignments

- Pre- and post-testing

Evaluation of a body of work produced by the student

- Capstone course reports, papers, or presentations

INDIRECT MEASURES (means of assessment that are related to direct measures but are steps removed from those measures)

Surveys and Interviews

- Student survey

USE OF DATA (how the program uses or will use the evaluation data to make evidence-based improvements to the program periodically)

- Analyze and discuss trends with the unit's faculty

Program Specializations/Sub-Plans

If you do not specify a program specialization/sub-plan it will be assumed you are submitting this program for all program specializations/sub-plans.

Pre-Major

Does this Program have a Pre-Major? No

Attachments

- SARSES Complied Concurrence Data.docx: Concurrence

  (Support/Concurrence Letters. Owner: Healy,Elizabeth Ann)

- SARSES Cover letter_Chair.pdf: Program Letter

  (Letter from Program-offering Unit. Owner: Healy,Elizabeth Ann)

- SARSESProposal_April2022.docx: Proposal

  (Program Proposal. Owner: Healy,Elizabeth Ann)

Comments

- Have you made the changes from the email? *(by Vankeerbergen,Bernadette Chantal on 03/30/2022 12:48 PM)*
- Please see Panel feedback e-mail sent 03/30/22. *(by Cody,Emily Kathryn on 03/30/2022 12:20 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Healy,Elizabeth Ann	10/14/2021 08:19 AM	Submitted for Approval
Approved	Guatelli-Steinberg,Debra	10/14/2021 08:46 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	03/13/2022 09:42 PM	College Approval
Revision Requested	Cody,Emily Kathryn	03/30/2022 12:20 PM	ASCCAO Approval
Submitted	Guatelli-Steinberg,Debra	03/30/2022 12:44 PM	Submitted for Approval
Approved	Guatelli-Steinberg,Debra	03/30/2022 12:45 PM	Unit Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	03/30/2022 12:48 PM	College Approval
Submitted	Healy,Elizabeth Ann	04/04/2022 01:35 PM	Submitted for Approval
Approved	Guatelli-Steinberg,Debra	04/04/2022 02:17 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	04/05/2022 04:35 PM	College Approval
Pending Approval	Cody,Emily Kathryn Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	04/05/2022 04:35 PM	ASCCAO Approval

THE OHIO STATE UNIVERSITY

College of Arts and Sciences

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13 October 2021

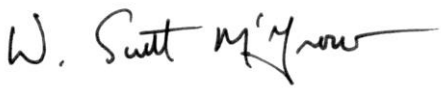
Curriculum and Assessment Committee
College of Arts and Sciences
OSU

Dear Members of the Curriculum and Assessment Committee:

I write as Chair of the Department of Anthropology to offer my full support for the proposed certificate program "Sustainable and Resilient Social and Ecological Systems (SARSES)." This program has been developed by some of the world's leading authorities on sustainability and systems research and should be a welcomed addition to the university's undergraduate curriculum. Systems approaches are increasingly used to solve some of the world's most complex problems. These problems demand integrated, interdisciplinary thinking, and the program outlined here teaches students how to apply a systems perspective in a variety of domains, especially social and ecological ones. In doing so, we believe the program aligns very well with the new GE Sustainability Theme.

I'm sure you'll agree that the development of this certificate represents the essence of interdisciplinary scholarship and teaching. We hope you find it acceptable.

Sincerely,



W. Scott McGraw
Professor and Chair

Sustainable and Resilient Social and Ecological Systems (SARSES):

An Interdisciplinary Undergraduate Certificate Program

April 4, 2022

Faculty Leads:

Lead: Anna Willow, Anthropology/Marion Campus (willow.1@osu.edu)

Co-Lead: Mark Moritz, Anthropology (moritz.42@osu.edu)

Advisory Team Members & Certificate Oversight Committee:

Leslie Beyer-Hermsen, Marion Campus (Assistant Dean)

Jeffrey M. Bielicki, Civil, Env. and Geo. Engineering

Jonathan Calede, EEOB/Marion Campus

David Cole, Earth Sciences

Sara Crosby, English/Marion Campus

Kip Cutis, History/Mansfield Campus

Sean Downey, Anthropology

Bryan Mark, Geography

Wendy Panero, Earth Sciences

Richard W. Yerkes, Anthropology

1. Required Information

We are requesting the following categories for the proposed Sustainable and Resilient Social and Ecological Systems (SARSES) Certificate:

- Category **1a**, meaning that it is a stand-alone post-secondary undergraduate academic certificate. For example, students currently enrolled at another university would be able to take this certificate.
- Though we understand that there are currently systemic hurdles at the Registrar's Office, we are also hoping to offer the new program as a **1b** certificate. Indeed, the majority of students who complete the certificate are expected to do so during their OSU baccalaureate experience.
- We are also requesting that this be a category **2** certificate since we expect that some individuals who already hold a baccalaureate degree may want to enroll in order to enhance their professional development and credentials.

The proposed implementation date for this certificate is Autumn of 2022. The certificate will be administered by faculty and staff in the Department of Anthropology. Advising and student support will be provided by a designated certificate coordinator, with curriculum updates and contact information posted online. A Certificate Oversight Committee, comprised of the individuals listed on the first page of this document, will meet biannually to examine assessment results and enrollment trends and consider the inclusion of additional courses.

2. Rationale

The Sustainable and Resilient Social and Ecological Systems (SARSES) program is an interdisciplinary certificate designed to give students a broad understanding of the relationships between multiple systems and inform their participation in a wide variety of sustainability-related fields. Upon completion of the certificate in Sustainable and Resilient Social and Ecological Systems, learners will have a comprehensive and cross-disciplinary understanding of the systemic interconnections between physical earth systems, ecosystems, and human systems and be able to apply this understanding to the development of sustainable systems in their future work, studies, and personal lives. Learners in the SARSES program will be encouraged via the lead-in and capstone courses to formulate their own understandings of these relationships, which will necessarily be informed by their expertise and experience in their major and minor fields of study. Throughout their involvement in the program, students will develop a portfolio through which they reflect on the connections between the courses they take. The portfolio creation process will be introduced in the SARSES certificate's lead-in course (Anthropology 3050) and presented/assessed in its capstone course (Anthropology 3051). This follows the "bookends" model being implemented along with OSU's new General Education requirements. While exposure to systems thinking is a central aspect of the program, the courses that students take in

the designated areas of ecosystems, earth systems, environmental social sciences, and environmental humanities need not be infused with an explicit systems thinking approach. Rather, the material students encounter in these courses will be put into context by the lead-in and capstone course experiences. With multiple courses to choose from in each category, students are able to tailor the SARSES certificate to their own needs and interests; they will benefit from making connections between courses and learning how to frame the core dimensions of their studies in an exciting and important new way.

Informed by these broad goals, students who complete the SARSES certificate will demonstrate their proficiency by achieving several specific learning outcomes:

Goal	Expected Learning Outcomes
Students will understand the dynamic couplings and interconnections between physical earth systems, ecosystems, and human systems.	Successful students are able to … • Demonstrate cross-disciplinary ecological literacy. • Draw on diverse perspectives to aid the analysis and resolution of complex environmental problems. • Describe dynamic couplings between social systems, earth systems, and ecosystems.
Students will be able to apply this understanding to the development of sustainable and resilient systems in their work, studies, and personal lives.	Successful students are able to … • Explain why a systemic understanding is important to solving sustainability problems. • Think systemically about local, regional, national, and global problems and possible solutions. • Make choices that promote sustainability and resilience.

The Sustainable and Resilient Social and Ecological Systems (SARSES) certificate program increases the interdisciplinary breadth of undergraduate education at OSU by bringing together courses and ideas that are drawn from a wide variety of disciplines and departments. It shows students that there are many different ways to approach the complex problems we face and gives them the tools they need to integrate and apply these approaches in effective and innovative ways.

When we train students in their majors, they are expected to understand how people in that discipline look at the world. While General Education courses introduce students to other perspectives, systemic thinking about problems that draws on diverse theoretical perspectives is a valuable—yet only rarely taught—skill. Seen in this light, systemic

thinking can be considered a valuable skill that is both highly in demand in the contemporary workplace and essential if we are to tackle the complex socio-ecological problems world citizens now face. This certificate not only exposes students to multiple perspectives, it also teaches them to forge conceptual connections among these perspectives and to value disciplinary perspectives that differ from their own.

The SARSES certificate program will help to train tomorrow's leaders in the field of sustainability and resilience, whether they enter that field through a liberal arts, business, or engineering education. Many prospective students will have majors in social sciences or humanities and wish to expand their education into the realm of sustainability and resilience. Others will have majors in a science or sustainability field and desire to complement their degree with a more holistic approach that accounts for human behavior and social systems. Students of environmental management and policy will be interested in the certificate's in-depth treatment of the complex socioecological systems they may soon find themselves managing. Still other students may be enrolled in business, public affairs, law, health/medicine, or engineering programs and wish to extend their training in the areas of systems thinking, sustainability, and resilience—all which are in demand by today's employers. We know that employers seek to hire individuals who can think critically and have strong analytical skills. And, as the OSU ASC Career Success webpage states, "employers want to know that you can help them solve problems and reach their goals" (https://artsandsciences.osu.edu/career-success/students). Demonstrating their ability to think systemically about difficult problems will provide a competitive edge for certificate alumni as they seek employment or graduate school admission. This certificate is a degree-enhancement and is not intended to take the place of training or accreditation related to a major or minor. Students who complete the SARSES certificate can advertise that they have had courses that introduce socio-ecological systems thinking and have had the opportunity to extend their understanding of these relationships through coursework emphasizing ecosystems, earth systems, and human systems.

3. Relationship to Other Programs/Benchmarking

Interdisciplinary learning is about making connections. Such learning enables students to leverage their knowledge and ability to engage with multiple ways of knowing in order to arrive at more comprehensive understandings that can be directed toward the resolution of complex problems with complex solutions. It empowers students to forge their own conceptual links and apply their knowledge to make a positive and lasting impact on the world.

The Sustainable and Resilient Social and Ecological Systems (SARSES) certificate will feature a curriculum that is distributed across multiple disciplines and departments yet also unified by its emphasis on systemic thinking, sustainability, and resilience. Course level data and academic

unit level data compiled by the Sustainability Education and Learning Committee (SELC) of OSU's Sustainability Institute were analyzed closely as part of this certificate program's development. Based on our review of the SELC data, we are confident that this certificate will be an important and sought-after contribution to OSU's sustainability curriculum.

While several overlapping programs are in existence or have been proposed), no existing OSU program has such a strong systemic approach, most require a full major or minor rather than a certificate that can enhance any major, and few of the programs take an explicit cross-disciplinary approach. Existing programs with some similarity to the SARSES certificate include a major in Environment and Society (Geography), a minor in Society and Environmental Issues (School of Environment and Natural Resources), and a minor in Environment, Economy, Development, & Sustainability (School of Environment and Natural Resources). Like most OSU majors, Geography's Environment and Society major is contained within a single department, limiting students' exposure to diverse perspectives. Systems thinking is not an explicit focus of the major. Similarly, the minor in Society and Environmental Issues is completed almost entirely within the School of Environmental and Natural Resources and does not incorporate the environmental humanities. While this program is similar to the SARSES certificate in its integration of human and natural systems, its focus on conservation and policy differs from the proposed program's broader interdisciplinary emphasis. The Environment, Economy, Development, & Sustainability minor also begins with similar assumptions regarding the value of understanding and addressing relationships between human and natural systems but is much more specific in its emphasis on the economic, business & social change aspects of sustainability. Finally, the structure of the SARSES certificate—especially its lead-in and capstone courses—is unique.

Currently, there are no sustainability certificate programs offered by anthropology or sociology. We will ensure that complementarity rather than duplication is established by keeping open and transparent channels of communication with faculty in all of these programs.

In the United States, Sustainability Certificates are becoming an increasingly common undergraduate offering, with such programs offered at many Big 10 and other peer institutions. For example:

- University of Illinois, Environmental Sustainability Certificate: https://earth.illinois.edu/academics/online-bachelor-degree/ensu-certificate
- University of Iowa, Sustainability Certificate: https://admissions.uiowa.edu/academics/sustainability-certificate
- Duke University, Sustainability Engagement Certificate: https://sustainability.duke.edu/academics/certificate
- University of Wisconsin-Madison, Sustainability Certificate: https://nelson.wisc.edu/undergraduate/sustainability-certificate/index.php
- Penn State, Earth Sustainability Certificate:

https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-earth-sustainability-certificate/overview

- Northwestern University, Institute for Sustainability and Energy Certificate: https://isen.northwestern.edu/isen-certificate

These programs have been successful at attracting students and sustaining their operations over long periods of time. The Ohio State University does not have a comparable general certificate program in sustainability.

Programs focusing specifically on socioecological systems are less common, although a few examples do exist in the western US:

- University of Idaho, Social Ecological Systems Training and Education Program: https://webpages.uidaho.edu/mtnseon/SESTEP.html
- Arizona State University offers an undergraduate certificate in Food Systems as well as a graduate certificate in Complex Adaptive Systems: https://schoolofsustainability.asu.edu/degrees-and-programs/certificates/

Because these programs are new and cutting edge, little information exists on their level of success. Given the current popularity of both sustainability and socioecological systems in academic and workforce discourses, we have every reason to believe that this certificate will be highly successful.

Letters of concurrence were provided by numerous programs, including Earth Sciences, Law, EEOB, The Center for Life Science Education, Chemistry and Biochemistry, Psychology, Engineering, Business, and the School of Environment and Natural Resources. This certificate program has not been previously submitted for approval.

4. Student Enrollment

We anticipate that this program will attract between 20 and 30 students in its initial year. Students will be recruited through communication with relevant departments, flyers, social media advertisements, and word of mouth. After two or three years of offering the program, we anticipate the number of enrolled students stabilizing around approximately 75. Enrollment trends will be examined biannually by the Certificate Oversight Committee.

5. Curricular Requirements

Recognizing that undergraduate students from diverse fields of study must be trained to think deeply and systemically as they confront the immense challenges of the 21st century, the Sustainable and Resilient Social and Ecological Systems certificate explicitly integrates learning in the areas of human-natural systems, environmental and earth systems, society and culture, and health and well-being. Although less central to the certificate's requirements, the coursework also promotes engagement (and co-curricular explorations) in the areas of economy, governance,

engineering, technology, and design. In addition, the integrative, systemic focus of the SARSES certificate will lead students to consider the intersection of all of the high-demand sustainability areas noted in the recent report of the Sustainability Education and Learning Committee (energy, food, water, climate, mobility, air, land, communities, justice, and health and well-being).

The SARSES certificate requires a minimum of 14 credits drawn from diverse departments and distributed as listed below. Courses marked with an asterisk (*****) are offered on regional campuses. Courses with a prerequisite are marked with a hashtag (#) and specific prerequisites are listed in Appendices A and B. Number of credits is listed in parentheses after each course.

One required course: ANTHROP 3050: Social and Ecological Systems: From Problems to Prospects (4 credits).* This course is the lead-in course for the certificate as well as a new research-oriented GE Sustainability Theme course (2000 level). 4 credits. Note: This course will introduce the portfolio creation process and help to guide students through course selection for the SARSES certificate.

Students will select three additional courses from three of the following four areas:

- A 2000+ level **ecosystems course** that integrates basic ecological knowledge with human impacts on the environment. 3 or 4 credits. Select **one** of the following courses:

    - EEOB 4240: Focused Study of Ecology and Evolution - Plants and People # (3)
    - EEOB 4410: Conservation Biology # (3)
    - ENR 2100: Introduction to Environmental Science * (3)
    - ENR 3322: Forest Ecosystems # (3)
    - GEOG 3980: Biogeography: An Introduction to Life on Earth (3)
    - HCS 2201: Ecology of Managed Plant Systems (4)

- A 2000+ level **earth systems course** that combines basic earth systems knowledge with human impacts on the environment. 3 or 4 credits. Select **one** of the following courses:

    - EARTHSCI 2203: Environmental Geoscience * (3)
    - GEOG 2800: Our Global Environment * (3)
    - GEOG 2960: Introduction to Physical Geography * (4 credits)
    - GEOG 3900: Global Climate Change: Causes and Consequences (3)

- A 2000+ level **environmental social science** that considers complex relationships between human beliefs and behaviors, human health and well-being, and human effects on the environment. 3 credits. Select **one** of the following courses:

    - AEDECON 2500: Introduction to Environment, Economy, Development, and

Sustainability # (3)
    - AEDECON 4330: The Sustainable Economy: Concepts and Methods # (3)
    - ANTHROP 3623: Environmental Anthropology *# (3)
    - ANTHROP 4597.03H: The Prehistory of Environment and Climate (3)
    - ARCH 2220: Sustainability and the Built Environment (3)
    - CRPLAN 3000: Planning Resilient Environments # (3)
    - ENR 2300: Society and Natural Resources *# (3)
    - ENR 3200 Environmental and Natural Resource Policy *# (3)
    - ENR 3400: Psychology of Environmental Problems # (3)
    - ENR 3530: Women, Environment and Development (3)
    - PUBHEHS 5320: Climate Change and Human Health (3)
    - SOCIOL 3460: Environmental Justice* (3)

- A 2000+ level **environmental humanities course** that explores human-environment relationships, how they have varied over time and space, and the ethical dimensions of our impact on the earth. 3 credits. Select **one** of the following courses:

    - ENGLISH 3597.03: Environmental Citizenship * (3)
    - ENGLISH 4321: Environmental Literatures, Cultures, and Media *# (3)
    - HISTORY 2700: Global Environmental History *# (3)
    - HISTORY 2704: Water: A Human History *# (3)
    - HISTORY 3700: American Environmental History *# (3)
    - PHILOS 2342: Environmental Ethics (3)

- **One capstone reflection portfolio: ANTHROP 3051: Sustainable and Resilient Social and Ecological Systems Capstone Portfolio (1 credit).*#** Students in this course will identify connections among the courses taken for the certificate and explain how they will apply their knowledge and engage constructively with sustainability in their post-graduation lives and careers. Although not required for the certificate program, students will be encouraged to participate in experiential learning (including internships, undergraduate research, volunteer service, and other opportunities) outside of the certificate program proper and to include those experiences in their capstone reflection. 1 credit.

There is no prerequisite for participation in the SARSES certificate. The certificate program is designed to be as accessible and adaptable as possible. While some of the courses listed above do have prerequisites, pre-requisite-free options can be found in every course category. (Courses with pre-requisites are retained on the list in case a student's situation makes that course a suitable choice.) Ultimately, our goal is that the SARSES certificate can be offered not only on the Columbus campus, but on OSU's regional campuses as well. Each course category includes options that are listed as offered on OSU's regional campuses. Initially, regional offerings may

not be frequent enough for the certificate to be completed on all campuses, but the certificate's coordinator will work diligently to expand the certificate's availability. In addition to the courses listed here, certificate administrators are eager to incorporate additional options from across the university. As such, faculty members can suggest courses to be considered for inclusion in the certificate program. These courses will be reviewed by the Certificate Oversight Committee.

Ideally, students will take Anthropology 3050 first and subsequently take other courses required for the certificate program, but in some cases students will have already taken required courses and wish to count them retroactively. Up to one-third of the course requirements for the SARSES certificate may be applied in this manner, provided the student includes descriptions of the courses and their relevance in their Capstone Portfolio.

6. Sample Program

Most students will complete the SARSES certificate within two years (or four semesters). The following sample program demonstrates a common pathway to certificate completion and includes courses offered on OSU's regional campuses:

	Year 1	Year 2
Semester 1	ANTHROP 3050: Social and Ecological Systems: From Problems to Prospects	GEOG 2800: Our Global Environment ENR 2100: Introduction to Environmental Science
Semester 2	HISTORY 2700: Global Environmental History	ANTHROP 3051: SARSES Capstone Reflection Portfolio

7. Assessment

Assessment results will be examined biannually by the Certificate Oversight Committee. Success in the learning outcomes identified earlier in Section 2 of this proposal will be measured with pre-test and post-test surveys:

- **Pre-test:** Although, as noted above, some order-of-enrollment exceptions may occur—and some students who do not go on to complete the certificate will take the course—the majority of students who complete the SARSES certificate will begin their journey in Anthropology 3050. At the beginning of the course, students will take a non-graded assessment that includes both quantitative and qualitative responses. For this reason, it is a logical place to obtain a baseline of student knowledge. The lead-in course will also provide students with the framework and training necessary to develop their capstone reflection portfolio. Students

will be strongly encouraged to update this portfolio after each certificate course in order to emphasize the coordination among courses and concepts.

Post-test: Capstone portfolios will be used to assess learner outcomes. Portfolium or a similar program will be used to facilitate the portfolio creation process. In addition, students will complete a post-test as part of their capstone completion requirement for the certificate. The same assessment will be given to students in the pre- and post- test periods. While not used as a basis for grading, assessments will be tracked for individual attainment of certificate objectives as well as aggregated to measure how well the certificate is meeting its objectives. OSU's Drake Institute for Teaching and Learning may be asked to help design appropriate assessment tools.

Please see Appendix D to view the assessment rubric that will be used for pre- and post- tests.

8. Alignment with GE Requirements

One of the key requirements for this certificate is a GE Sustainability Theme course entitled "Social and Ecological Systems: From Problems to Prospects." This high-impact research practice course surveys the diverse past, present, and future of human-environment relationships. Students will investigate key contemporary issues, discover their ecological, cultural, and historical causes, and explore how constructive solutions can be achieved. This course is an ideal fit with the Sustainability Theme Expected Learning Outcomes and will be an exciting addition to OSU's campuses.

The SARSES certificate program is consistent with the broad goals of OSU's new General Education requirements in that it is an integrative program woven into a student's undergraduate career. Like the new GE, this certificate emphasizes critical thinking, holistic understanding, and skills that transcend disciplinary boundaries and prepare students to live as informed global citizens.

9. Appendices

Appendix A: ASC Advising Sheet

The Ohio State University
College of Arts and Sciences

Sustainable and Resilient Social and Ecological Systems (SARSES) Certificate (1A, B)

Advising Staff Contact:
Karen Royce, Undergraduate Advisor for Anthropology
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royce.6@osu.edu, (614)292-6961

Faculty Contact:
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350B Morrill Hall
Marion, OH 43302
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The Sustainable and Resilient Social and Ecological Systems (SARSES) program is an interdisciplinary certificate designed to give students a deep appreciation of the relationship between multiple systems and inform their participation in a wide variety of sustainability-related fields. Upon completion of the academic certificate in Sustainable and Resilient Social and Ecological Systems, learners will be better prepared to understand the systemic interconnections between physical earth systems, ecosystems, and human systems and apply this understanding to the development of sustainable systems in their future work and/or studies.

Important Notes:

Students are encouraged to work with the advisors early in the process of pursuing this certificate in order to plan the most efficacious path to completion.

Anthropology 3050 functions as the foundation course for the certificate and students are thus encouraged to take this course before moving on to other requirements. Anthropology 3051 is the capstone and should be taken at the end of the certificate program.

The SARSES certificate requires a minimum of 14 credits drawn from diverse departments and distributed as follows (*indicates that a course is listed as offered on regional campuses):

Required foundation course:

*ANTHROP 3050: Social and Ecological Systems: From Problems to Prospects (4)

Choose one course from three of the following four categories:

A 2000+ level **ecosystems course**:

EEOB 4240: Focused Study of Ecology and Evolution - Plants and People (3)
Prereq: 1 course in Biological Sciences
EEOB 4410: Conservation Biology (3)
Prereq: EEOB 3310 and 3410, or permission of instructor.

*ENR 2100: Introduction to Environmental Science (3)
ENR 3322: Forest Ecosystems (3)
Prereq or concur: 2100, 2300, and 3321, or permission of instructor.
GEOG 3980: Biogeography: An Introduction to Life on Earth (3)
HCS 2201: Ecology of Managed Plant Systems (4)

A 2000+ level **earth systems course**:

*EARTHSCI 2203: Environmental Geoscience (3)
*GEOG 2800: Our Global Environment (3)
*GEOG 2960: Introduction to Physical Geography (4)
GEOG 3900: Global Climate Change: Causes and Consequences (3)

A 2000+ level **environmental social science** course:

AEDECON 2500: Introduction to Environment, Economy, Development, and Sustainability (3)
Prereq: soph standing or permission of instructor.
AEDECON 4330: The Sustainable Economy: Concepts and Methods (3)

Prereq: AEDECON 4310.

*ANTHROP 3623: Environmental Anthropology (3)

Prereq: ANTRHOP 2202 or equiv, or permission of instructor.

ANTHROP 4597.03H: The Prehistory of Environment and Climate (3)

ARCH 2220: Sustainability and the Built Environment (3)

CRPLAN 3000: Planning Resilient Environments (3)

Prereq: Math 1148 or permission of instructor.

*ENR 2300: Society and Natural Resources (3)

Prereq: Not open to students with credit for ENR 203.

*ENR 3200 Environmental and Natural Resource Policy (3)

Prereq: ENR 2100 and 2300. Not open to students with credit for 4000.

ENR 3400: Psychology of Environmental Problems (3)

Prereq: ENR 2300 or Psych 1100.

ENR 3530: Women, Environment and Development (3)

PUBHEHS 5320: Climate Change and Human Health (3)

*SOCIOL 3460: Environmental Justice (3)

A 2000+ level **environmental humanities course**:

*ENGLISH 3597.03: Environmental Citizenship (3)

*ENGLISH 4321: Environmental Literatures, Cultures, and Media (3)

Prereq: English 2367, or permission of instructor.

*HISTORY 2700: Global Environmental History (3)

Prereq or concur: English 1110.xx.

*HISTORY 2704: Water: A Human History (3)

Prereq or concur: English 1110.xx, or permission of instructor.

Prereq: ANTHROP 3050, SARSES certificate student

*HISTORY 3700: American Environmental History (3)

Prereq or concur: English 1110.xx, or permission of instructor.

PHILOS 2342: Environmental Ethics (3)

Required **capstone reflection portfolio:**

*ANTHROP 3051: SARSES Capstone Portfolio (1)

SARSES Certificate Program Guidelines

Credit hours required:

- Minimum of 14

Overlap with courses in degree:

- The certificate must be in a different subject than the major
- Maximum 50% overlap with courses in a major, minor, other certificate, or GE

Grades required:

- Minimum C- for a course to be listed on the certificate
- Minimum of 2.00 cumulative GPA for all certificate course work

X193 credits:

- Not permitted

Approval required:

- The certificate course work must be approved by a college/school advisor

Consult with Advisor:

- For filing deadlines
- For changes or exceptions to a certificate plan

Appendix B: Course List

This alphabetized list indicates the many options students have for completing the SARSES certificate. Listings for each course include (1) department, (2) course title, (3) credit hours, (4) brief description, (5) prerequisites, (6) whether the course is new, (7) which part of the certificate requirements the course satisfies, and (8) whether the course is offered on regional campuses.

~

AEDECON 2500: Introduction to Environment, Economy, Development, and Sustainability (3 credits). Introduces students to principles from various disciplines related to social, economic and environmental sustainability. Students will evaluate key concepts and examine tradeoffs that are a part of sustainability action using case studies representing diverse perspectives. Prereq: soph standing or permission of instructor. New: no. Satisfies: environmental social science. RC: no.

AEDECON 4330: The Sustainable Economy: Concepts and Methods (3 credits). Introduces students to core concepts of sustainability in economics and the quantitative methods necessary to understand and evaluate sustainable development. Prereq: AEDECON 4310. New: no. Satisfies: environmental social science. RC: no.

ANTHROP 3050: Social and Ecological Systems: From Problems to Prospects (4 credits). This high-impact research course surveys the diverse past, present, and future of human-environment relationships. Students will investigate key contemporary issues, discover their cultural and historical causes, and explore how constructive solutions can be achieved. Prereq: none. New: **yes**. Satisfies: required introduction to SARSES certificate. RC: anticipated.

ANTHROP 3051: SARSES Capstone Portfolio (1 credit). This course asks students to identify connections among the courses taken for the certificate and explain how they will apply their knowledge and engage constructively with sustainability in their post-graduation lives and careers. Prereq: ANTHROP 3050, SARSES certificate student. New: **yes**. Satisfies: required for completion of SARSES certificate. RC: anticipated.

ANTHROP 3623: Environmental Anthropology (3 credits). Theory and ethnographic examples of human-environment interactions, focusing on the role of culture and behavior in environmental adaptation. Prereq: ANTRHOP 2202 or equiv, or permission of instructor. New: no. Satisfies: environmental social science. RC: yes.

ANTHROP 4597.03H: The Prehistory of Environment and Climate: Models of Sustainability and Resilience from the Past (3 credits). Relationships between prehistoric environments and climates and sustainable and resilient agricultural and engineering systems are studied to understand the causes and consequences of recent and ancient environmental disasters and illustrate how lessons

from the past can be used in modern responses modern events. Prereq: none. New: no. Satisfies: environmental social science. RC: no.

ARCH 2220: Sustainability and the Built Environment (3 credits). Introduction to sustainability and the built environment, emphasis on cultural context, including contributing geographic, political, social, and economic factors which influence the form of the constructed world. Prereq: none. New: no. Satisfies: environmental social science. RC: no.

CRPLAN 3000: Planning Resilient Environments (3 credits). Environmental resilience requires a comprehensive planning approach. Through planning techniques and practices, identify practical applications for creating resilient environments. Prereq: Math 1148 or permission of instructor. New: no. Satisfies: environmental social science. RC: no.

EARTHSCI 2203: Environmental Geoscience (3 credits). Concepts and challenges of geological hazards and resources, environmental pollution, and health; regional and long-range planning; and global change and sustainability. Prereq: none. New: no. Satisfies: earth systems. RC: yes.

EEOB 4240: Focused Study of Ecology and Evolution - Plants and People (3 credits). Overview of the importance of plants to humans. Students will gain an understanding of the interrelations between humans and plants, including plant domestication, history and uses of spices and flavorings derived from plants, as well as non-food uses of plants. Recommended prereq: previous or concurrent enrollment in EEOB 2210. Prereq: 1 course in Biological Sciences (Plant Biology Preferred). Satisfies: ecosystems. RC: no.

EEOB 4410: Conservation Biology (3 credits). Application of ecology, population genetics, and biogeography to the study and conservation of biodiversity, threatened communities, and endangered species. Prereq: EEOB 3310 and 3410, or permission of instructor. New: no. Satisfies: ecosystems. RC: no.

ENGLISH 3597.03: Environmental Citizenship (3 credits). Provides tools for environmental citizenship by teaching interdisciplinary perspectives on biophysical/sociocultural forces that shape environments. Addresses general processes through local case studies.
Prereq: none. New: no. Satisfies: environmental humanities. RC: yes.

ENGLISH 4321: Environmental Literatures, Cultures, and Media (3 credits). Examines past and present environmental issues from the perspective of English studies, including literary, rhetorical, and cultural analysis of texts and media. Prereq: English 2367, or permission of instructor. New: no. Satisfies: environmental humanities. RC: yes.

ENR 2100: Introduction to Environmental Science (3 credits). Introduction to environmental science, the ecological foundation of environmental systems, the ecological impacts of

environmental degradation by humans, and strategies for sustainable management of environment and natural resources. Prereq: none. New: no. Satisfies: ecosystems. RC: yes.

ENR 2300: Society and Natural Resources (3 credits). Introduction to interactions between humans, natural resources, and ecosystems from a social science perspective. Prereq: Not open to students with credit for ENR 203. New: no. Satisfies: environmental social sciences. RC: yes.

ENR 3200 Environmental and Natural Resource Policy (3 credits). This course covers topics such as the constitutional foundations of environmental policy, the role of congress and the executive branch in designing policy and bureaucratic agencies in implementing them, and the courts system as the final arbiter for environmental disputes. It also covers some of the foundational legislation in the U.S. to protect the environment and natural resources. Prereq: ENR 2100 and 2300. Not open to students with credit for 4000. New: no. Satisfies: environmental social sciences. RC: yes.

ENR 3322: Forest Ecosystems (3 credits). Structure and function of temperate forest ecosystems; field-oriented study of the relationships among ecosystem components, and of the composition and successional dynamics of forest communities. One or more all-day field trips. Au Sem. Prereq or concur: 2100, 2300, and 3321, or permission of instructor. New: no. Satisfies: ecosystems. RC: no.

ENR 3400: Psychology of Environmental Problems (3 credits). The theory and psychology behind individual and group behavior as it relates to environmental problems. Prereq: 2300 or Psych 1100. New: no. Satisfies: environmental social science. RC: no.

ENR 3530: Women, Environment and Development (3 credits). Interdisciplinary study of women's roles as environmental stewards and in resource-based development in global context. Attention given to gender differences in environmental and rural development practices. Prereq: none. New: no. Satisfies: environmental social science. RC: no.

GEOG 2800: Our Global Environment (3 credits). Introduction to global environmental issues, including the interaction of physical and social factors in the causes of and strategies for ameliorating environmental problems. Prereq: none. New: no. Satisfies: earth systems. RC: yes.

GEOG 2960: Introduction to Physical Geography (4 credits). The elements and processes of the natural environment, their characteristics, distribution, and implications in the human habitat. Prereq: none. New: no. Satisfies: earth systems. RC: yes.

GEOG 3900: Global Climate Change: Causes and Consequences (3 credits). Examines the natural and human factors that force changes in our climate and environment and explores

strategies for a sustainable environment in the future. Prereq: none. New: no. Satisfies: earth systems. RC: no.

GEOG 3980: Biogeography: An Introduction to Life on Earth (3 credits). The patterns and processes responsible for the global distribution of Earth's flora and fauna; the inter-relationship between biota and soils; climate and topography will be emphasized. Prereq: none. New: no. Satisfies: ecosystems. RC: no.

HCS 2201: Ecology of Managed Plant Systems (4 credits). Origin, diversification, and biogeography of plants inhabiting managed landscapes. Prereq: none. New: no. Satisfies: ecosystems. RC: Columbus and Wooster.

HISTORY 2700: Global Environmental History (3 credits). Global overview of the ecology of the human condition in past time, stressing climate change, earth systems, technology, energy, demography, and human cultural-economic revolutions. Prereq or concur: English 1110.xx. New: no. Satisfies: environmental humanities. RC: yes.

HISTORY 2704: Water: A Human History (3 credits). History of human use and understandings of water from ancient to modern times, with case studies taken from different geographic locations. Sometimes this course is offered in a distance-only format. Prereq or concur: English 1110.xx, or permission of instructor. New: no. Satisfies: environmental humanities. RC: yes.

HISTORY 3700: American Environmental History (3 credits). The history of American ecosystems from the last Ice Age to the present; focuses on historical debates over the causes and consequences of environmental change. Prereq or concur: English 1110.xx, or permission of instructor. New: no. Satisfies: environmental humanities. RC: yes.

PHILOS 2342: Environmental Ethics (3 credits). Examination of the moral issues generated by the impact of human beings on the natural environment. Prereq: none. New: no. Satisfies: environmental humanities. RC: no.

PUBHEHS 5320: Climate Change and Human Health (3 credits). Recognize current controversies about climate change, summarize the evidence about climate change on human health, and identify major human diseases associated with climate change. Prereq: none. New: no. Satisfies: environmental social science. RC: no.

SOCIOL 3460: Environmental Justice (3 credits). Examines environmental issues from a sociological perspective, especially human causes of environmental change such as technology, population, and consumption, and social reactions. Prereq: none. New: no. Satisfies: environmental social science. RC: yes.

Appendix C: Certificate Completion Sheet

College of Arts and Sciences

Sustainable and Resilient Social and Ecological Systems (SARSES) Certificate Program

Student Name: _____

Student OSU Email: _____

Certificate Advisor Name: _____

Required Core Courses (5 credits):

Course (Hours)	Course Grade	Term Completed
Anthropology 3050:Social and Ecological Systems: From Problems to Prospects (4 credits)		
Anthropology 3051: SARSES Capstone Portfolio (1 credit)		

One course from 3 of the following categories, selected from the Sustainable and Resilient Social and Ecological Systems (SARSES) Certificate Advising Sheet (9-11 credits):

Course (Hours)	Course Grade	Term Completed
A 2000+ ecosystems course (3 or 4 credits)		
A 2000+ level earth systems course (3 or 4 credits)		
A 2000+ level environmental social science course (3 credits)		
A 2000+ level environmental humanities course (3 credits)		

Total credits (14-16): _____

Certificate Advisor Signature: _____

Date: _____

Appendix D: Pre- and Post- Test Assessment Rubric

The following assessment will be given to students at the beginning of Anthropology 3050 (Social and Ecological Systems: From Problems to Prospects) and the end of Anthropology 3051 (SARSES Capstone Portfolio). The same test will be given on both occasions. Students are expected to complete the assessment without the aid of written or online resources.

1. Briefly describe the meaning and implications of the phrase *social and ecological systems.*

2. Briefly describe the meaning and importance of *sustainability* and *resilience*.

3. Briefly summarize how physical earth systems, ecosystems, and human systems are related.

4. Give one example that illustrates the interrelationship of physical earth systems, ecosystems, and human systems.

5. Briefly describe how information and ideas from multiple fields of study can be integrated to resolve complex environmental problems.

6. Briefly describe why a systemic perspective is important to solving contemporary sustainability problems.

7. Give one example of how a systemic perspective has been or could be used to resolve a local, regional, national, or global socio-ecological challenge.

8. Briefly describe how your understanding of sustainable and resilient systems is likely to influence decisions you make in your work, studies, and/or personal life.

Complied Concurrence Data for SARSES Certificate Program and Related Courses

Note: The numbers of the relevant courses have now changed. Anthropology 2350 is now Anthropology 3050. Anthropology 2351 is now Anthropology 3051.

College of Public Health

On behalf of the College of Public Health, we support your proposed interdisciplinary undergraduate certificate in *Stable and Resilient Social and Ecological Systems* (SARSES) plus the proposed capstone course. (4/27/2021)

Earth Sciences

Earth Sciences concurs on your course and certificate "Stable and Resilient Social and Ecological Systems" and associated capstone course.

We also concur on your course Anthropology 2350: "Social and Ecological Systems: From Problems to Prospects."

These look like great opportunities for our students, and wish you success with them. (4/28/2021)

Fisher College of Business

This looks fine to me. (4/27/2021)

Engineering

I've had positive feedback on the proposal from our faculty, so I'm inclined to grant concurrence as well. FYI, FABE received a request for concurrence through CFAES as well...and the same answer has been provided through that channel. (5/11/2021)

Do we know how much overlap of courses can occur between a certificate program like this and another degree program? I think this is a nice program and it will likely attract students from arts and science, but I don't see it being particularly attractive for engineering students unless they can double count. I do not see any concurrence issues. (5/11/2021)

EEOB

EEOB concurs with the offering of the undergraduate certificate, "Stable and Resilient Social and Ecological Systems" and the capstone course, ANTH 2351: Sustainable and resilient social and ecological systems capstone por□olio. Please let me know if you have any questions. (5/11/2021)

Law

Kris, thanks for your email. The College of Law has no objections to this concurrence request. Please let me know if I can help in any other way. (4/28/2021)

Communication

Interesting effort, good luck. We concur. (4/28/2021)

School of Environment and Natural Resources

Note: Some of the departments within SENR initial has concerns about the certificate program. Their original communications are provided in Appendix A. After working with the Sustainability Institute and several individuals within SENR, we were able to resolve these concerns and obtain concurrence. The following email confirming concurrence was sent by Jeremy Brooks on 9/13/2021:

I provided and overview and summary of the discussions around SARSES with our Academic Affairs Committee this past Friday. I relayed to the committee that you had modified the set of course options and were pursuing staffing options to improve the mentoring and guidance of students as they develop their portfolios throughout the program and enter into the capstone course.

With these changes in mind, SENR can provide concurrence for the program. I was unable to find the concurrence form for the program as a whole (I have it for the intro and capstone course) – but hopefully this email will suffice. If not, can you please re-send the concurrence form and I'll be happy to fill it out. Please let me know if you have any questions or concerns.

Compiled Concurrence Data for Anthropology 2350

Fisher College of Business

This looks fine to me – we don't really have anything like this in FCOB. (4/15/2021)

College of Engineering

Both Department of Civil Engineering and Department of Food, Agricultural and Ecological Engineering have reviewed the syllabus for ANTHROP 2350 *Social and Ecological Systems: From Problems to Prospects* and are supportive of and concur with the Department of Anthropology's proposed offering. (4/19/2021)

Department of Psychology

Kris: This email is to confirm that we support your department's new course in social and ecological systems (Anthro 2350). (4/19/2021)

EEOB

The Department of Evolution, Ecology and Organismal Biology supports this offering. (4/27/2021)

Center for Life Science Education

I concur with this course offering. (4/29/2021)

Chemistry and Biochemistry

There is no overlap with any courses taught in Chemistry and Biochemistry. (4/17/2021)

SENR

This is interesting course that will serve the new certificate program well. There is some overlap with ENR/AEDE 2500 - Introduction to Sustainability. That class touches on topics like resilience, social-ecological systems (and systems thinking in general), climate change, ecosystem dynamics, planetary boundaries in the Anthropocene, ecosystem services, consumption (overconsumption and sustainable consumption), biodiversity loss, and social/political/technological innovations that are intended to address pressing problems. I think the distinguishing components are that 2500 brings in business and economics more explicitly and has slightly less of an emphasis on physical and natural systems. The proposed course also has much more emphasis on student research. I have included additional thoughts in the email accompanying this form. (4/29/2021)

Communication

The School of Communication grants concurrence.(4/15/2021)

Law

The College of Law supports this proposal. (4/17/2021)

Earth Sciences

Earth Sciences concurs on your course and certificate “Stable and Resilient Social and Ecological Systems” and associated capstone course.

We also concur on your course Anthropology 2350: “Social and Ecological Systems: From Problems to Prospects.”

These look like great opportunities for our students, and wish you success with them. (4/28/2021)

Appendix A: Initial Concerns Expressed by SENR, which have now been resolved

CFAES

The College of Food, Agricultural, and Environmental Sciences sought feedback from academic units within the college that have discipline overlap with the proposed interdisciplinary undergraduate certificate, ‘Stable and Resilient Social and Ecological Systems [SARSES]’ regarding the requested concurrence for this proposal. The following is a summary of the feedback obtained from those units. I will be sending separately feedback from the Department of Agricultural, Environmental and Development Economics, which is consistent with the following feedback, but also includes specific suggestions that the Department of Anthropology may want to follow-up with the department to consider.

Overall, CFAES appreciates the general goals of the proposed program and the inclusion of the introductory course and the capstone reflection course. The CFAES feels that there are ways that this program could be improved so that it would have the full support of the College. **As it stands, the CFAES does not support the proposed program.** We think the following ideas could potentially strengthen the program:

1. Narrowing the selection of courses so that there is a more defined set of learning outcomes and/or specific domains. As it stands, there are so many courses and so many options that it lacks a coherent identity.
2. Including courses that provide a specific skill or skillset that could be of value to students entering the job market and clearly identifies/signals to students and employers what they can expect this certificate to provide
3. Creating specific clusters of courses that indicate a clear subject domain or set of skills that will be of value to students.

There are three overarching concerns.

The **first** is that, as currently designed, the program does not seem to provide students with a clearly demonstrable skill set that will distinguish them on the job market (or for a graduate program). We appreciate the emphasis on systems thinking, but the stated objective of giving students a deeper understanding of the relationship between multiple systems is not an easily measurable objective; and it is also one that is shared by existing programs on campus. In general, certificate programs should provide a defined skillset or set of tools that allow students to demonstrate a clear competency. Otherwise, it will be hard for students to indicate the value of the program and it might lead to

dissatisfaction among employers who have expectations based on existing professional certification and accreditation programs.

The developers of the program took a great first step in identifying other, similar programs as models. However, many if not all of those programs differ in that they (i) are narrower and more focused, (ii) have some kind of practical skills development (communications skills, policy skills, organizational management, analytical skills, etc.), and/or (iii) they are linked to a specific domain (e.g. energy, environmental justice, food systems). The proposed program does not have any of these features. For example:

- the SESTEP program through Idaho has a number of very specific skills-based outcomes including stakeholder analysis and management, tools and methods for monitoring and collecting data, GIS tools, data synthesis techniques, etc.
- Illinois' program is much narrower, has a smaller number of courses to choose from, and includes course like Environmental Consulting and Sustainable Organizations that may provide more practical knowledge
- Iowa's program has a section on communication, ethics and interpretation
- Duke's program has more narrowly defined pathways that signal an emphasis in a particular domain

Second - and related - as currently designed, it is unclear what the certificate program adds that is not already covered by existing minors on campus. Students have ample opportunity to be exposed to systems thinking and become better critical thinkers, which are two the key goals of the program. The proposal notes that there are several existing programs; but suggest that these programs are deficient because they require a full minor and/or fail to incorporate social science. But it's unclear what advantage this certificate has over a minor (it's approximately the same number of credits), and there are several existing minors that do incorporate social science – including the EEDS minor (not listed in the proposal), and the minor in Society and Environmental Issues. We're not suggesting that these minors are the same as the proposed certificate; but that there is clearly overlap and that these minors do not suffer from the challenges identified with this proposal.

Third – and related to the first two points, this certificate program has the potential to "muddy the water" when it comes to sustainability programs at OSU. We believe it is important that students and employers have a clear sense of the distinction between the various sustainability-related programs at OSU so that both sides of the equation know what they are getting. The designers of the certificate noted the catalog of courses that was developed by SELC with support from SI, so they are aware of the large number of classes that already fall under the "sustainability" umbrella. In addition, there is already an existing major (EEDS) and associated minor (EEDS) that incorporate the learning goals and expected learning outcomes outlined in the proposal. If it would be helpful, the SENR in CFAES would be willing to share the updated learning objectives for the EEDS major with the developers of this certificate.

A concern is that this additional program might make it difficult for students and employers to know how the multiple "sustainability" options at OSU differ and what the advantages are of choosing one over another. If there is interest in developing a strong, well-recognized sustainability "brand" at OSU, the CFAES believes that there are ways units can work together to identify mechanisms that will allow such a brand to gain recognition to benefit our students and OSU as a whole. We're concerned that, as designed, this certificate program doesn't provide a novel and specific way of contributing to that goal.

There are other concerns that have been raised by faculty in the college. These include:

- Can students be provided with a holistic understanding of SARSES without taking a course on the economy and/or on governance and politics? This content is embedded in some of the courses that are listed, but students may need a foundation in some of that material first. Some of the courses listed may require prerequisites that would limit a student's ability to take that course – and students could easily move through this curriculum without taking a course that touches on economic factors or governance issues.
- Related, the faculty in HCS raised concerns about the prerequisites for one of the courses, HCS 5602, and several alternative course were offered as suggestions if this becomes an issue for their students
- Some of the courses listed in the ecosystems set do not integrate ecological knowledge with human impacts on the environment – at least not in any meaningful depth. For instance instructors in SENR suggested that ENR 2360 is not suited for that section because it includes very little mention of anthropogenic impacts. There were also concerns about HC 2201 and EEOB 2410 which do not appear to directly address human impacts other than in a superficial way. This raises some questions about the depth of integration that exists in other courses.

As mentioned above, I will forward the direct input from AEDE to you, following this message. Please let me know if you have any questions or need additional information. (5/10/2021)

Agricultural, Environmental and Development Economics (AEDE)

AEDE does not support the proposed program. While AEDE finds the overall goals of the program to be laudable, we offer some input below to reflect what we see as issues with the program and recommendations for consideration.

1) This certificate program has a lot of overlap with the EEDS major and minor, which is housed in the School of Environmental and Natural Resources.

2) The learning outcomes may perhaps be hard to achieve in four courses, especially with the broad array of choices the students have. Such a broad array can lead to a lack of focus or gaps in content. For instance, how could a student "Describe dynamic couplings between social systems, earth systems, and ecosystems" with a certificate, and possibly a major, that hasn't required that student to take a course in economics? The economic system, i.e. markets, is one critically important system that drives the sustainability of the local to global environment. If a business or economics student took this course, they potentially could derive value as they would get ecology, earth systems, and humanities, and the capstone to help embed systems thinking. But given the link between EEDS and business, as well as the EEDS minor, it's not likely that business students would take this certificate.

3) More specifically, the introductory course for the certificate, " **Social and Ecological Systems: From Problems to Prospects**," has significant gaps that make it less than ideal as the introductory course in a sustainability certificate. The course does not reflect the inclusion of any content in economics, which is one of the critical elements of sustainability. To understand potential solutions to sustainability problems, students will need to understand how markets and incentives influence current outcomes in order to develop workable ideas about how to effect change. Additionally, the idea of tradeoffs seems completely missing from the proposed course. Consider for instance the "Industrial Agriculture" topic,

which focuses on Industrial Agriculture, using the "Food, Inc." movie. It's hard to tell, but the approach has the potential to offer a one-sided interpretation of the agricultural sector, which ignores any of the nuances of food production across an incredibly diverse sector, both domestically and internationally.

We recommend considering the ENR/AEDE 2500 "Introduction to Sustainability" class as a more robust introductory course for this certificate, that would give students a balanced view of sustainability.

4) Several programs at other universities, by virtue of their design, are substantially more focused, and provide students with more value because of their focus. Those programs seem to provide students with sets of skills that will enhance their degree.

5)The skills gained in this certificate program are those associated with systems thinking, which is a good set of skills to have, but it's not obvious how students develop and enhance those systems thinking skills with the very broad set of courses included under each category, especially as a capstone where that could possibly be done isn't required. If systems thinking is the key outcome, converting the proposed introductory course into a capstone focused on showing students how to integrate across systems to develop meaningful solutions to the sustainability problems would be very useful, especially if ENR/AEDE2500 were used as the introductory course.

6) There are several other economics classes that might be considered for inclusion:

- AEDE 2580: Feast or Famine: The Global Business of Food
- AEDE 3680: Regional Economics and Sustainable Growth
- AEDE 4310: Environmental and Natural Resource Economics
- AEDE 4330: The Sustainable Economy: Concepts and Methods
- AEDE/IS 4597: Food, Population, and the Environment

(5/10/201)