From:	Higginbotham, Jennifer
To:	Reed, Katie; Andridge, Rebecca; Anthony, Anika; Beavers, TJ; Bielefeld, Eric; Crowley, Nat; Evans, Kevin; Fowler, Sara; Myers, Roberto; Pascall, Melvin; Pruchnicki, Maria; Smith, Randy; Rose, Paul; Slechta, Ryan R.; Spreitzer, Peter; Szkoda, Blake; Uppalapati, Sri; Whittington, Karl
Cc:	Horn, David; Martin, Andrew; Speer, Shari
Subject:	Re: 6/1 Council on Academic Affairs meeting
Date:	Monday, June 1, 2020 9:46:06 AM
Attachments:	image001.png Advising Sheet for Hydrogeology Certificates.docx Advising Sheet for Marine Science Certificates_rev by.docx Advising Sheet for Museum Curation Certificates.docx Advising Sheet for Petroleum Geology Certificates.docx

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Dear Council,

The registrar's office flagged a couple of minor issues with the advising sheets for the four certificates that we're reviewing for Earth Sciences this afternoon. Wendy Panero very kindly went ahead and updated them so that we'd have them for the vote. They're attached.

All best,
Jennifer

From: Reed, Katie <reed.901@osu.edu>
Sent: Thursday, May 28, 2020 1:29 PM
To: Andridge, Rebecca; Anthony, Anika; Beavers, TJ; Bielefeld, Eric; Crowley, Nat; Evans, Kevin; Fowler, Sara; Higginbotham, Jennifer; Myers, Roberto; Pascall, Melvin; Pruchnicki, Maria; Smith, Randy; Reed, Katie; Rose, Paul; Slechta, Ryan R.; Spreitzer, Peter; Szkoda, Blake; Uppalapati, Sri; Whittington, Karl
Cc: Henkin, Tina; Panero, Wendy; Anderson, Cindy M.; Donaldson, Anita; Bisesi, Michael; Bricker, Adrienne; Bronson, Denise; Brown, Danielle; Clinchot, Daniel; Collier, Alexis; Curtis, Paulette G.; Daley, Linda; Roy, David; Delaney, Lisa N.; DeLong, Beth H.; Earley, Michael; Ferguson, Megan A.; Givens, Ben; Greenbaum, Robert; Guthrie, Emily J.; Hadad, Christopher; Haddad, Deborah; Hamamoto, Darryl T.; Heysel, Garett; Hood, Linda; Horn, David; Hampshire, Jill; Johnson, Jay; Jones, Norman; Jungers, Melissa; Kalish, Alan; Hallihan, Kathleen; Katunich, Linda; Kelley, Katherine; Kleffner, Mark; Larsen, Deborah; Bernhagen, Lindsay; Martin, Andrew; Martineau, Gail; Gable, Michael; Nahikian-Nelms, Marcia; Neal, Steve; Osborne, Jeanne; Pandey, Bishun; Pearce, Laura; Peter, Lisa J.; Pope-Davis, Don; Price, Jenna M.; Prud'homme, Andrea; Quinzon-Bonello, Rosario; Read, Emma K.; Reeser, Susan; Griffiths, Robert; Greenbaum, Robert; Runco, Mark; Simmons, Jennifer; Speer, Shari; Stephenoff, Gail; Strawn, John L.; Tepper, Bennett J.; Toliver, Kristina M.; Tomasko, David; Vankeerbergen, Bernadette; Wallace-Pascoe, Dawn; Weld, Tara J.
Subject: 6/1 Council on Academic Affairs meeting

Good Afternoon,

The Council on Academic Affairs will meet virtually on **Monday, June 1 from 3-5 p.m.** (note updated

time). Please use this link to participate in the meeting:

https://osu.zoom.us/j/95024889288

The Council will discuss the following proposals:

- **Workforce Development Certificate - Remote Pilot Exam Prep Training – College of Engineering**
- **Proposal to add a clinical faculty track – College of Arts and Sciences**
- **Proposal to establish certificates in Marine Science, Hydrogeology, Petroleum Geology, and Natural History Museum Curation – College of Arts and Sciences**
- **Proposal to establish a new certificate in Usability and User Experience in Healthcare – College of Medicine**
- **Proposal to revise the BSED Early Childhood Education, Early Childhood Education with Visual Impairments and Middle Childhood Education programs – College of Education and Human Ecology**
- **Proposal to move the Orientation and Mobility Licensure Program to a new department – College of Education and Human Ecology**
- **Proposal to revise the BSED Integrated Language Arts English program – College of Education and Human Ecology**

All materials can be found on the CAA website:

https://oaa.osu.edu/2019-20-caa-meetings-and-proposals

The minutes from the 4/15 and 5/11 CAA meetings will be sent in a separate email.

Thanks,
Katie

THE OHIO STATE UNIVERSITY

Katie Reed
Executive Assistant to the Vice Provost for Academic Programs
Office of Academic Affairs
203 Bricker Hall, 190 North Oval Mall, Columbus, OH 43210
614-292-5672 Direct / 614-292-5881 Main Office
reed.901@osu.edu oaa.osu.edu

COLLEGE OF ARTS AND SCIENCES
THE OHIO STATE UNIVERSITY

TYPE 1B, 2, 3A HYDROGEOLOGY CERTIFICATE (HYDRGEO-CT)

The 12-15 credit hour Hydrogeology Certificate will provide students with a competitive advantage in beginning a career in the hydrologeological fields or pursuing entrance into a graduate degree program in fields related to hydrogeology. The certificate is designed to enhance both critical thinking and the technical skills for practicing hydrogeology.

One groundwater course (4 credits):

- **EARTHSC 5651**: Hydrogeology (4)

One surface water course (3 credits):

- **EARTHSC 5665**: Land surface hydrology (3)
- **ENR 4285**: Watershed hydrology (3)
- **CIVILEN 5130**: Applied Hydrology (3)

Electives (at least 5 credit hours):

- **EARTHSC 5751**: Quantitative Reservoir Modeling (4)
- **EARTHSC 4450**: Water, Ice and Energy in the Earth System (3)
- **EARTHSC 5203**: Geo-environment and Human Health (3)
- **EARTHSC 5621**: Introduction to Geochemistry (3)
- **EARTHSC 5550**: Geomorphology (4)
- **ENR 5268**: Soils and Climate Change (2)
- **ENR 5261**: Environmental Soil Physics (3)
- **ENR 5273**: Environmental Fate and Impact of Contaminants in Soil and Water (3)
- **CIVILEN 5220**: Open Chanel Hydraulics (3)
- **AGSYSMT 4575**: Applied Agricultural Water Management (2)
- **GEOG 5210**: Fundamentals of GIS (3)

Hydrogeology Certificate program guidelines

The following guidelines govern the Hydrogeology Certificate.

Credit hours required: 12-15 credit hours.

Overlap with a major

- The certificate must be in a different subject than the major.
- Max 50% overlap with degree program (i.e. major, minor, other certificate, GE, or graduate program)

X193 credits: Not permitted.

Certificate Completion: If the certificate is not complete on the DAR, the student must consult with the Coordinating Advisor.

Consult with Coordinating Advisor

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

Undergraduate certificate program:

Coordinating Advisor: Professor Ashley Griffith, 381 Mendenhall Labs, Columbus, OH 43210; griffith.233@osu.edu

- Minimum C- for a course to be listed on the certificate.
- Minimum 2.00 cumulative point-hour ratio required for the certificate.

Graduate certificate program:

Coordinating Advisor: Professor Steve Lower, 084 Orton Hall, lower.9@osu.edu; 614-292-1571

- Course selections must be numbered 4000+ outside the student's home unit and 5000+ within the home unit.
- Minimum C- for a course to be listed on the certificate.
- Minimum 3.00 cumulative point-hour ratio required for the certificate.

COLLEGE OF ARTS AND SCIENCES
THE OHIO STATE UNIVERSITY

TYPE 1B & 3A MARINE SCIENCE CERTIFICATE (MARINE-CT)

The 12-13.5 credit hour Marine Science Certificate will provide students with a competitive advantage in pursuing careers in marine science in the private and public sectors or pursuing entrance into a graduate degree program in marine science. The certificate is designed to enhance both critical thinking and the technical skills in marine science.

Required core course (3 credits):

- **EARTHSC 5206**: Advanced Oceanography (3)

Elective courses (9 credits):

In addition, students will select from the courses listed below.

- **EARTHSC 4450:** Water, Ice and Energy in the Earth System (3)
- **EARTHSC 5622**: Stable Isotope Biogeochemistry (3)
- **EARTHSC 5602.02**: Carbonate Depositional Systems (3)
- **EARTHSC 5780**: Reflection Seismology (4)
- **GEOG 5900**: Climatology (3)
- **EEOB 5410**: Ocean Ecology (1.5)
- **EEOB 5430**: Fish Ecology (3)
- **EEOB 4230**: Focused study on ecology and evolution of invertebrates (2)
- **ENR 5614**: Marine and aquatic education ()

Of these electives, no more than one of:

- **GEOG 5210:** Fundamentals of Geographic Information Systems (3)
- **EARTHSC 5310:** Remote Sensing in the Earth Sciences (3)
- **CIVILEN 5001:** Introduction to Geographic Information Systems (4)

Marine Geology Certificate program guidelines

The following guidelines govern the Marine Geology Certificate.

Credit hours required: 12-13.5 credit hours.

Overlap with a major

- The certificate must be in a different subject than the major.
- Max 50% overlap with degree program (i.e. major, minor, other certificate, GE, or graduate program)

X193 credits: Not permitted.

Certificate Completion: If the certificate is not complete on the DAR, the student must consult with the Coordinating Advisor.

Consult with Coordinating Advisor

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

Undergraduate certificate program:

Coordinating Advisor: Professor Ashley Griffith, 381 Mendenhall Labs, Columbus, OH 43210; griffith.233@osu.edu

- Minimum C- for a course to be listed on the certificate.
- Minimum 2.00 cumulative point-hour ratio required for the certificate.

Graduate certificate program:

Coordinating Advisor: Professor Steve Lower, 084 Orton Hall, lower.9@osu.edu; 614-292-1571

- Course selections must be numbered 4000+ outside the student's home unit and 5000+ within the home unit.
- Minimum C- for a course to be listed on the certificate.
- Minimum 3.00 cumulative point-hour ratio required for the certificate.

COLLEGE OF ARTS AND SCIENCES
THE OHIO STATE UNIVERSITY

TYPE 1B, 2, 3A NATURAL HISTORY MUSEUM CURATION CERTIFICATE (MUSEUM-CT)

The 12-14 credit hour Natural History Museum Curation Certificate will prepare students for employment as a museum curator or curatorial assistant. The certificate is designed to provide both disciplinary expertise and curatorial training in museum curation.

Disciplinary courses (6-8 credits):

- **EARTHSC 4421**: Earth Materials (3)
- **EARTHSC 4423**: Introductory Petrology (3)
- **EARTHSC 4501**: Paleontology (4)
- **EARTHSC 4502**: Stratigraphy and Sedimentation (4)
- **EEOB 2210**: Biodiversity of Ohio – Plants (2)
- **EEOB 2220**: Biodiversity of Ohio – Birds (2)
- **EEOB 3310**: Evolution (4)
- **EEOB 3320**: Organismal Diversity (3)
- **EEOB 4210**: Focused Study of Ecology and Evolution – Vertebrates (2)
- **EEOB 4220**: Focused Study of Ecology and Evolution – Mammals (3)
- **EEOB 4230**: Focused Study of Ecology and Evolution – Invertebrates (2)

Students with demonstrated knowledge of the identification and classification of natural samples at the advanced undergraduate level may instead replace up to 6 credit hours with additional internship and museum curatorial practice/management hours.

A museum internship (3 credits minimum; 6 credits maximum):

- **EARTHSC 5191.01**: Museum Internship (3-6)
- **EEOB 5610**: Translating Evolution (3)

Curatorial and/or museum management experience (3 credits minimum):

- **EARTHSC 5501**: Museum Data Curation (3)
- **ARTEDUC 5671**: Organizational Leadership in the Nonprofit Arts (3)
- **ARTEDUC 5682**: Nonprofit Arts Institution Governance and Board Leadership (3)
- **ARTEDUC 5685**: Arts/Cultural Organizations: Resource Management & Revenue Streams (3)
- **ARTEDUC 5686**: Cultural Program Design, Implementation, and Evaluation (3)
- **ARTEDUC 7748**: Museum Practicum (3)

Natural History Museum Curation Certificate program guidelines

The following guidelines govern the Natural History Museum Curation Certificate.

Credit hours required: 12-14 credit hours.

Overlap with a major

- The certificate must be in a different subject than the major.
- Max 50% overlap with degree program (i.e. major, minor, other certificate, GE, or graduate program)

X193 credits: Not permitted.

Certificate Completion: If the certificate is not complete on the DAR, the student must consult with the Coordinating Advisor.

Consult with Coordinating Advisor

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

Undergraduate certificate program:

Coordinating Advisor: Professor Ashley Griffith, 381 Mendenhall Labs, Columbus, OH 43210; griffith.233@osu.edu

- Minimum C- for a course to be listed on the certificate.
- Minimum 2.00 cumulative point-hour ratio required for the certificate.

Graduate certificate program:

Coordinating Advisor: Professor Steve Lower, 084 Orton Hall, lower.9@osu.edu; 614-292-1571

- Course selections must be numbered 4000+ outside the student's home unit and 5000+ within the home unit.
- Minimum C- for a course to be listed on the certificate.
- Minimum 3.00 cumulative point-hour ratio required for the certificate.

COLLEGE OF ARTS AND SCIENCES
THE OHIO STATE UNIVERSITY

TYPE 1B, 2, 3A PETROLEUM GEOLOGY CERTIFICATE (PETRGEO-CT)

The 13-15 credit hour Petroleum Geology Certificate will provide students with a competitive advantage in beginning a career in the oil and gas industry or pursuing entrance into a graduate degree program within the field of petroleum geoscience. The certificate is designed to enhance both critical thinking and the technical skills for practicing petroleum geoscience.

Required core courses (7 credits):

- **EARTHSC 5661**: Petroleum Geology (4)
- **EARTHSC 5189.01**: Field Geology I (3) Summer term

Elective courses (6-8 credits):

In addition, students will select two more courses (6-8 credits) listed below.

- **EARTHSC 5189.02:** Field Geology II (3) Summer term
- **EARTHSC 4560**: Applied Geophysics (3)
- **EARTHSC 5687**: Borehole Geophysics (3)
- **EARTHSC 5751**: Quantitative Reservoir Modeling (4)
- **EARTHSC 5780**: Reflection Seismology (4)

Students with prior comparable field geology coursework may substitute an additional elective in place of EARTHSC 5189.01.

Petroleum Geology Certificate program guidelines

The following guidelines govern the Petroleum Geology Certificate.

Credit hours required: 13-15 credit hours.

Overlap with a major

- The certificate must be in a different subject than the major.
- Max 50% overlap with degree program (i.e. major, minor, other certificate, GE, or graduate program)

X193 credits: Not permitted.

Certificate Completion: If the certificate is not complete on the DAR, the student must consult with the Coordinating Advisor.

Consult with Coordinating Advisor

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

Undergraduate certificate program:

Coordinating Advisor: Professor Ashley Griffith, 381 Mendenhall Labs, Columbus, OH 43210; griffith.233@osu.edu

- Minimum C- for a course to be listed on the certificate.
- Minimum 2.00 cumulative point-hour ratio required for the certificate.

Graduate certificate program:

Coordinating Advisor: Professor Steve Lower, 084 Orton Hall, lower.9@osu.edu; 614-292-1571

- Course selections must be numbered 4000+ outside the student's home unit and 5000+ within the home unit.
- Minimum C- for a course to be listed on the certificate.
- Minimum 3.00 cumulative point-hour ratio required for the certificate.

TO: Randy Smith, Vice Provost for Academic Programs
Eric Bielefeld, Chair, Council on Academic Affairs
FROM: Shari Speer, Associate Dean for Academic Affairs, Graduate School
DATE: 5-8-2020
RE: Proposal for Certificates in Marine Science, Hydrogeology, Petroleum Geology, and Natural History Museum Curation

The Department of Earth Sciences in the College of Arts and Sciences is proposing new certificates in Marine Science, Hydrogeology, Petroleum Geology, and Natural History Museum Curation.

This proposal was received by the Graduate School on October 29th, 2019. It was reviewed by GS/CAA on November 7th, 2019 and some revisions were requested. Final Revisions were received on April 7th, 2020, and reviewed by GS/CAA on April 23rd 2020. No further revisions were requested, and the proposal was recommended for approval by the Graduate Council. The proposal was approved by the Graduate Council on May 4th, 2020.

THE OHIO STATE UNIVERSITY

College of Arts and Sciences

School of Earth Sciences

275 Mendenhall Laboratory
125 South Oval Mall
Columbus, OH 43210-1398

614-292-2721 Phone
614-292-7688 Fax

earthsciences@osu.edu
www.earthsciences.osu.edu

October 1, 2019

To ASCC and CAA members:

I am writing to document the School of Earth Science's strong endorsement of five new certificate programs proposed as part of their substantial revision of the Earth Sciences BS program:

- Certificate in Natural History Museum Curation (certificate types 1, 2, and 3: embedded undergraduate; post-bachelor undergraduate; and graduate certificate (both embedded and stand-alone)).
- Certificate in Petroleum Geology (certificate types 1, 2, and 3, as above).
- Certificate in Hydrogeology (certificate types 1, 2, and 3, as above).
- Certificate in Marine Science (certificate types 1 and 3, as identified above).
- Certificate in Planetary Science (certificate type 1, as identified above).

All five of these certificates have been designed for in-person delivery at this time. Each certificate proposal (as well as the redesign of the Earth Sciences BS program) is the result of thoughtful and extensive assessment of the curriculum, student interest, and market appeal. These certificates are designed to complement a number of existing natural science programs (both graduate and undergraduate—so they utilize 5000-level dual-career courses), and they should also, in distinct ways, appeal to individuals who are in the workforce and have already earned Bachelor's degrees, to advance their careers and expand career opportunities.

Please feel free to contact me if you have any additional questions.

Sincerely,

Matthew R. Saltzman
Professor and Director
School of Earth Sciences

THE OHIO STATE UNIVERSITY

College of Arts and Sciences

Offices of the Associate
and Assistant Deans

114 University Hall
230 North Oval Mall
Columbus, OH 43210

614-292-1667 Phone
asc.osu.edu

August 29, 2019

To ASCC and CAA members:

I am writing to document the College of Arts and Sciences' strong endorsement of four new certificate programs coming out of the School of Earth Sciences as part of their substantial revision of the Earth Sciences BS program:

- Certificate in Natural History Museum Curation (certificate types 1, 2, and 3: embedded undergraduate; post-bachelor undergraduate; and graduate certificate (both embedded and stand-alone)).
- Certificate in Petroleum Geology (certificate types 1, 2, and 3, as above).
- Certificate in Hydrogeology (certificate types 1, 2, and 3, as above).
- Certificate in Marine Science (certificate types 1 and 3, as identified above).

All four of these certificates have been designed for in-person delivery at this time. Each certificate proposal (as well as the redesign of the Earth Sciences BS program) is the result of thoughtful and extensive assessment of the curriculum, student interest, and market appeal. These certificates should complement a number of existing natural science programs (both graduate and undergraduate—so they utilize 5000-level dual-career courses), and they should also, in distinct ways, appeal to individuals who are in the workforce and have already earned Bachelor's degrees, to advance their careers and expand career opportunities.

The college of Arts and Sciences—as well as the Ohio Department of Higher Education and the State legislature--have been encouraging our departments to explore opportunities to develop certificate programs, and the School of Earth Sciences' proposals are exemplary. They address both our college's enrollment goals and our state's workforce enhancement goals.

Sincerely,

THE OHIO STATE UNIVERSITY

Steven Fink

Associate Executive Dean, College of Arts and Sciences
114 University Hall, 234 North Oval Mall, Columbus, OH 43210
614.292.6868 Office / 614.247.7498 Fax

Fink.5@osu.edu

Proposal Submission Guidelines for Establishing a New Certificate

1. Required Information

• Name of proposed certificate. Identify certificate type from certificate grid (*e.g.*, Type 2, standalone post-bachelor undergraduate certificate).

Hydrogeology, type 1 (undergraduate academic certificate, embedded), type 2 (Undergraduate academic certificate, post-bachelor degree) and 3 (graduate academic certificate, stand alone (3a) or embedded (3b))

• Indicate whether the certificate will be delivered wholly on-line, wholly in-person, a combination, or with all hybrid courses.

In person delivery.

• Proposed implementation date.

Spring 2020

• Academic units (e.g., department, college) responsible for administering the certificate program.

Earth Sciences, College of Arts and Sciences

2. Rationale

• Describe the rationale/purpose of the certificate.

Ohio State has a significant strength in hydrogeologic sciences, with additional strengths in environmental engineering, environmental sciences, soil science, and contaminant transport. These strengths are found across the university, including the College of Engineering and College of Food, Agriculture, and Environmental Science. This new certificate will clarify to students, graduate schools, and employers that the student engaged in a coherent set of undergraduate coursework to prepare the student to work or do research in the area of hydrogeology. The certificate also includes the course work for students to meet the educational criteria for certification by the American Institute of Hydrology.

The American Institute of Hydrology certifies individuals with appropriate educational background, work experience, and passing score on a qualifying exam under the categories of: Professional Hydrologist-Surface Water, Hydrologist-Groundwater, and Hydrologist-Water Quality. These certifications require

> *Five semester … hours in Chemistry and Physics and Calculus. An additional 25 semester … hours in Hydrology coursework of which at least 10 semester … hours come from Hydrology courses; 10 semester … hours come from Hydrology Allied courses; and 5 semester … hours come from Hydrology Supplemental courses.*

A student completing this certificate along with an undergraduate degree in either Earth Science or Civil Engineering will provide students with the necessary courses for both surface water and groundwater certification.

• Identify a likely source of student demand for the proposed certificate, and provide one or two examples.

Students majoring in or pursuing a graduate degree the Earth Sciences, Environmental Sciences, and Civil or Environmental Engineering will be able to indicate their focus on the hydrogeologic sciences with such a certificate.

For example, students majoring in Earth Sciences on the Earth System Science track (or the proposed Climate, Water, and Environment revised track) will be able to combine their major coursework with this certificate with two additional classes in SES, CFAES, or CEGE.

Complementary to this population, students in Environmental Engineering (CEGE) and Environmental Science (CFAES) in the specializations of Environmental Molecular Sciences, Soil Resources and Environmental Sustainability, or Water Sciences will be able to combine this certificate with their program of study, in which 4-7 credit hours will overlap, enabling these students to be prepared to enter the workforce in the area of hydrogeology.

• Provide the following statement: *Upon completion of the academic certificate in* <specify title>*, learners will be prepared to. . .*" <list a maximum of 3 outcomes>.

Upon completion of the academic certificate in Hydrogeology, students will be prepared to
(1) Solve natural and human-caused problems in water resources and water contamination.
(2) Enter the workforce as a practicing hydrologist or hydrogeolgogist in government agencies, geotechnical firms, and environmental consulting firms in the private section.
(3) seek certification as a hydrologist by the American Institute of Hydrology, meeting the requirements if also completing an undergraduate degree in civil engineering or earth sciences.

3. Relationship to Other Programs / Benchmarking

• Identify any overlaps with other programs or departments within the university. Append letters of concurrence or objection from related units.

The certificate can be earned primarily through courses offered in the School of Earth Sciences. Additional course options are available to students in Civil Engineering and SENR and some of the courses required for the undergraduate majors in those units are included as required or as options for this certificate.

• Indicate whether this certificate or a similar certificate was submitted for approval previously.

This is a new proposal, no such certificate proposal has been submitted for approval previously.

Explain at what stage and why that proposal was not approved or was withdrawn.

• Identify similar programs at other universities in Ohio or in the United States and their levels of

success.

We can identify no other similar programs in Ohio. Elsewhere in the US, only the University Nevada, Reno offers a MS degree in hydrogeology, while University of Colorado offers an undergraduate concentration in this field, and Western Michigan University offers a 15-credit hour certificate.

4. Student Enrollment

• Indicate the number of students you anticipate will choose to pursue this certificate.

Annual enrollment in the required SES classes are ~20 students, up to half of whom come from the College of Engineering and CFAES, taking the classes to satisfy distribution requirements in the BS major or MS degree. We expect about half of the SES students who already take ES 5651 and 5655 to complete the certificate (taking 2 additional classes), and up to 25% of the students from other colleges (taking 2-3 additional classes) to pursue the certificate, for an estimated 20-30 students pursuing such a certificate annually. Growth will be facilitated with outreach to the relevant populations. The Undergraduate Studies Committee will advertise the certificate during student visit days, communicate the opportunity to advisors and the career center. The School of Earth Sciences will work with ASC communications to ensure that those employed in the region are aware of the opportunity.

5. Curricular Requirements

• Provide ASC certificate advising sheet (see Appendix 5).

• List the courses (department, title, credit hours, description) which constitute the requirements and other components of the certificate. If any courses have prerequisites, please indicate so. Indicate which courses are currently offered and which will be new. When new course requests are submitted through curriculum.osu.edu, indicate that those course requests are being submitted as part of a new certificate proposal. As much as possible, the curriculum committees will review the course requests in conjunction with the certificate proposal.

Course Number	**Course Name**	**Credit Hours**	**Prereqs.**
Required groundwater course:			
EARTHSC 5651	*Hydrogeology:* Geologic and hydrologic factors controlling the occurrence, movement, storage, and chemical quality of surface water and ground water; exploration, evaluation, development and management of water resources.	4	EARTHSC 1100, 1105, 1108, 1121, 1151, 2203, OR 2205; and Math 1152 or above
Complete one of the following surface water courses:			
EARTHSC 5655	*Land Surface Hydrology:* Physical processes of land surface hydrology in the context of the global hydrologic cycle. Consideration of the processes and mechanisms responsible for water and energy fluxes, with examples from various river basins.	3	Math 1152 or above, and Physics 1250 or above.

ENR 4285	*Watershed Hydrology:* Covers hydrologic processes in watersheds, including precipitation, evapotranspiration, infiltration, runoff, and streamflow. We will evaluate how watershed characteristics, climate, and land use control these processes. In addition, we will discuss and practice current physical, chemical, and computational techniques for characterizing the hydrologic functioning of watersheds.	3	Chem 1210, Math 1151 or 1156
CIVILEN 5130	*Applied Hydrology:* Hydrologic cycle, meterology, streamflow, evapotranspiration, hydrographs, runoff relations, runoff hydrographs, groundwater, unit hydrographs, flood routing, frequency and duration studies, and application of hydrologic techniques.	3	CIVILEN 3160
Complete at least 5 credit hours of electives from the following:			
EARTHSC 5751	*Quantitative Reservoir Modeling:* Principles of analytical and numerical techniques in modeling single- and multiphase flow in gas, oil, and water (aquifer) reservoirs. Development of Matlab code for two- and three-dimensional flow in porous media.	4	EARTHSC 2245, Math 1152
EARTHSC 4450	*Water, Ice, and Energy in the Earth System:* Earth's energy budget and the transfer of water between reservoirs. Processes that regulate water transfer, common measurement approaches, and the importance of water in geological processes, global change, and as a resource.	3	EARTHSC 1100, 1105, 1108, 1121, 1151, 2203, 2204, 2205, GEOG 3901, OR GEOG 5900; or permission of instructor
EARTHSC 5203	*Geo-environment and Human Health:* Examine geo-environmental processes that are contributing to human health degradation and the resultant societal impacts.	3	EarthSci 2245, or GE data anly course, or equiv; and Soph standing or above; or permission of instructor
EARTHSC 5621	*Introduction to Geochemistry:* Introduction to the chemistry of the solid Earth and hydrosphere describing the processes controlling the distribution of elements.	3	Chem 1220 or above
EARTHSC 5550	*Geomorphology:* Investigation of the mechanics and chemistry of landscape development; interpretation of materials, processes, types, and evolution of landforms produced under diverse climates.	4	EARTHSC 1100, 1121, OR 1200; AND EARTHSC 1122 or 2122; or permission of instructor
ENR 5268	*Soils and Climate Change:* Soil processes, abrupt climate change, trace gases and their properties, global C cycle, gaseous emissions, C-neutral fuels, carbon sequestration, Kyoto Treaty, trading of C credits.	2	-

ENR 5261	*Environmental Soil Physics:* Principally involves the state and transport of water, heat and gas within soil, and the associated soil physical properties.	3	-
ENR 5273	*Environmental Fate and Impact of Contaminants in Soil and Water:* An overview of contaminant sources, transport through soil and water, and environmental fate and impact to human and ecosystem receptors.	3	Grad standing or two semesters of chemistry
CIVILEN 5220	*Open Channel Hydraulics*: Flow classifications, channel properties, energy and momentum principles, critical flow, uniform flow formulas, erodible and nonerodible channel design, and gradually-varied profile computations.	3	Civil Eng 3160, Math 2177 or 2415 and 2568
AgSysMt 4575	*Applied Agricultural Water Management:* Planning and managing the drainage, irrigation, erosion and sediment control, water harvesting and storage systems and agricultural constructed wetlands for the agricultural landscape.	2	AgSysMt 2370 and 2371, ENR 3000 or permission of instructor
GEOG 5210	*Fundamentals of GIS*: Basic principles of geographic and land information systems and their use in spatial analysis and information management.	3	Not open to students with credit for Geog 5220 (607), CRPlan 5001 (607), or CivilEn 5001 (607)

• State the minimum number of credits required for completion of the certificate.

Total 12-15 hours, where the range is a result of the variable credit hours fulfilling the electives.

• Indicate the number of semesters expected to complete the certificate. Confirm that courses are offered frequently enough and have the capacity to meet this expectation.

While intended to be completed in 4 semesters, due to the annual offering of the required classes and the number of options for electives, the certificate can be completed in as few as 2 semesters for those students who have already completed the necessary prerequisites.

• If applicable, describe existing facilities, equipment, and off-campus field experience and clinical sites to be used. Indicate how the use of these facilities, equipment, etc., will impact other existing programs.

None.

• For interdisciplinary certificates, describe the way in which advising and other student support will be provided.

Advising and students support services are available through the department, college, and university, as is available to any student pursuing a program.

• If applicable, describe additional university resources (including advisors and libraries) that will be required for the new certificate.

Not Applicable

• Provide ASC completion sheet for certificates.
• Provide semester-by-semester sample program.

Plan to complete in two years
Year 1:
EarthSc 5651 (Autumn, offered annually)
EarthSc 5655 (Spring, offered annually)
Year 2:
elective (Autumn)
elective (Spring)

Plan to complete in one year
Year 1:
EarthSc 5651 (Autumn, offered annually)
elective (Autumn)
EarthSc 5655 (Spring, offered annually)
elective (Spring)

Additional Graduate School Guidelines

• Students must be admitted into a graduate certificate program.
• Admitted students must meet the minimum admission requirements of the Graduate School.
• Certificates are administered by a graduate studies chair and committee that are responsible for admission decisions.
• Proposals originate in a TIU following the TIU's curricular approval process. Once submitted in curriculum.osu.edu and approval by the college, proposals will be routed automatically to the Graduate School for review. Once approved by the Graduate School, proposals are review by the Council on Academic Affairs (CAA).
• A letter of support from the college dean or associate executive dean must accompany the proposal.
• If a graduate non-degree student is admitted to a graduate certificate program, no more than four hours of semester graduate credit accumulated while in this non-degree classification may be counted toward the certificate.

Assessment Plans for the Certificate in Hydrogeology

As the proposed certificate programs are meant to be integral to the learning experience of our majors, graduate students, as well as students in associated disciplines, and therefore we will assess our certificate programs in similar ways. This will support our need to assess the individual programs while also assessing their efficacy in meeting the goals of broader and deeper education for our students. The learning goals of each certificate program include higher-level and systems-level thinking, along with preparedness for careers or further study. We further assess the program with regards to the students we attract to the program, their success in completing the requirements, and their satisfaction with the program.

Indirect measures: Each measure will be assessed for undergraduates and graduate students separately and together for each certificate. We will track data on:

Student's BS/BA or graduate program
First post-graduation employment or graduate institution placement
Average and range of time-to-certificate
Student retention rate in the certificate program
Cumulative student GPA in the certificate courses
Student evaluation of instruction of individual courses included in the certificate
Survey of program satisfaction upon completion

These indirect measures address the employment objective of each certificate. Specifically:
Hydrogeology

> *Upon completion of the academic certificate in Hydrogeology, students will be prepared to*
> *(2) Enter the workforce as a practicing hydrologist or hydrogeolgogist in government agencies, geotechnical firms, and environmental consulting firms in the private section.*
> *(3) seek certification as a hydrologist by the American Institute of Hydrology, meeting the requirements if also completing an undergraduate degree in civil engineering or earth sciences.*

Direct measures: Each measure will be assessed for undergraduate and graduate students separately and together for each certificate.

We will measure student learning of the high-level thinking goals through performance in the required courses of each certificate program.

> *Upon completion of the academic certificate in Hydrogeology, students will be prepared to*
> *(1) Solve natural and human-caused problems in water resources and water contamination.*

This will be assessed with a pre-course survey in Hydrogeology (EarthSc 5651), with growth measured by results from the end-of-course exam. Students will be asked to demonstrate their understanding of basic hydrogeology concepts at the start of the course, along with comfort levels in their ability to work individually on tasks specific to those required for work in the hydrogeology field, including lab skills plus and industry-standard software codes.

COLLEGE OF ARTS AND SCIENCES
THE OHIO STATE UNIVERSITY

TYPE 1B, 2, 3 HYDROGEOLOGY CERTIFICATE (HYDRGEO-CT)

Coordinating Advisor: Professor Ashley Griffith, 381 Mendenhall Labs, Columbus, OH 43210; griffith.233@osu.edu

The 12-15 credit hour Hydrogeology Certificate will provide students with a competitive advantage in beginning a career in the hydrologeological fields or pursuing entrance into a graduate degree program in fields related to hydrogeology. The certificate is designed to enhance both critical thinking and the technical skills for practicing hydrogeology.

One groundwater course (4 credits):

- **EARTHSC 5651**: Hydrogeology (4)

One surface water course (3 credits):

- **EARTHSC 5665**: Land surface hydrology (3)
- **ENR 4285**: Watershed hydrology (3)
- **CIVILEN 5130**: Applied Hydrology (3)

Electives (at least 5 credit hours):

- **EARTHSC 5751**: Quantitative Reservoir Modeling (4)
- **EARTHSC 4450**: Water, Ice and Energy in the Earth System (3)
- **EARTHSC 5203**: Geo-environment and Human Health (3)
- **EARTHSC 5621**: Introduction to Geochemistry (3)
- **EARTHSC 5550**: Geomorphology (4)
- **ENR 5268**: Soils and Climate Change (2)
- **ENR 5261**: Environmental Soil Physics (3)
- **ENR 5273**: Environmental Fate and Impact of Contaminants in Soil and Water (3)
- **CIVILEN 5220**: Open Chanel Hydraulics (3)
- **AGSYSMT 4575**: Applied Agricultural Water Management (2)
- **GEOG 5210**: Fundamentals of GIS (3)

Hydrogeology Certificate program guidelines

The following guidelines govern the Hydrogeology Certificate. Required for certificate:

Credit hours required: 12-15 credit hours.

Overlap with a major

- The certificate must be in a different subject than the major.
- Max 50% overlap with degree program (i.e. major, minor, other certificate, or GE)

Grades required

- Minimum C- for a course to be listed on the certificate.
- Minimum 2.00 cumulative point-hour ratio required for the certificate.

X193 credits: Not permitted.

Certificate Completion: If the certificate is not complete on the DAR, the student must consult with the College of Arts and Sciences Coordinating Advisor.

Filing the certificate program form: The certificate program form must be filed at least by the time the graduation application is submitted to a college/school counselor.

Changing the certificate: Once the certificate program is filed in the college office, any changes must be approved by the College of Arts and Sciences Coordinating Advisor.

School of Earth Sciences undergraduate advisor
Dr. Karen Royce royce.6@osu.edu 614-292-6961

School of Earth Sciences graduate advisor
Professor Steve Lower, 084 Orton Hall, lower.9@osu.edu; 614-292-1571

COLLEGE OF ARTS AND SCIENCES
THE OHIO STATE UNIVERSITY

TYPE 1B, 2, 3 HYDROGEOLOGY CERTIFICATE (HYDRGEO-CT)

Student: _____

Other degree programs (Majors, minors, certificate): _____

Course	Credit Hours	Semester Completed	Overlap with other major, minor, other certificate program or GE?
One groundwater class			
EARTHSC 5651	4		
One surface water course			
	3		
Electives (minimum 5 credit hours)			

Total Credit hours: _____ (minimum 12)

Credits double counted with major, minor, other certificate program, or GE:
_____ (maximum 50%)

Advisor's signature _____

One groundwater course (4 credits):

- **EARTHSC 5651**: Hydrogeology (4)

One surface water course (3 credits):

- **EARTHSC 5665**: Land surface hydrology (3)
- **ENR 4285**: Watershed hydrology (3)
- **CIVILEN 5130**: Applied Hydrology (3)

Electives (at least 5 credit hours):

- **EARTHSC 5751**: Quantitative Reservoir Modeling (4)
- **EARTHSC 4450**: Water, Ice and Energy in the Earth System (3)
- **EARTHSC 5203**: Geo-environment and Human Health (3)
- **EARTHSC 5621**: Introduction to Geochemistry (3)
- **EARTHSC 5550**: Geomorphology (4)
- **ENR 5268**: Soils and Climate Change (2)
- **ENR 5261**: Environmental Soil Physics (3)
- **ENR 5273**: Environmental Fate and Impact of Contaminants in Soil and Water (3)
- **CIVILEN 5220**: Open Chanel Hydraulics (3)
- **AGSYSMT 4575**: Applied Agricultural Water Management (2)
- **GEOG 5210**: Fundamentals of GIS (3)

Proposal Submission Guidelines for Establishing a New Certificate

1. Required Information

• Name of proposed certificate. Identify certificate type from certificate grid (*e.g.*, Type 2, standalone post-bachelor undergraduate certificate).

Marine Science, type 1 (undergraduate academic certificate, embedded)
Marine Science, type 3 (graduate academic certificate, embedded)

• Indicate whether the certificate will be delivered wholly on-line, wholly in-person, a combination, or with all hybrid courses.

In person delivery.

• Proposed implementation date.

Spring 2020

• Academic units (e.g., department, college) responsible for administering the certificate program.

Earth Sciences and EEOB, Arts and Sciences

2. Rationale

• Describe the rationale/purpose of the certificate.

Undergraduate demand: Many students majoring in Earth Science, EEOB, Zoology, Microbiology, Geography, Engineering, and SENR programs arrive at Ohio State with an interest in marine science. For example, Professor Grottoli in SES is a marine scientist who studies coral reefs. Since she arrived in 2005, she has mentored 69 undergraduate students in her lab as research assistants, interns and/or volunteers and been the major advisor to 22 senior theses. Her undergraduate students come from SES, EEOB, ENG, MICRO, ZOOL, GEOG, and SENR programs and she interfaces with students in the Marine Biology Club and the Under the Sea Club at OSU. Dr. Grottoli turns away about 50% of students who want to work in her lab because the demand far exceeds her capacity.

Thus, there is significant interest in marine science among undergraduate students, and significant expertise in marine science among the faculty at OSU (see list below). Since the faculty are dispersed across the university, there is no clear departmental home, but there is a clear center of gravity in ASC. This certificate will clarify to students, graduate schools, and employers that the student engaged in a coherent set of undergraduate coursework to prepare the student to pursue marine sciences as a career or in graduate school.

Graduate demand: There are 15 marine science faculty at OSU (see list below) and one research scientist, all with graduate students in their labs. The graduate students in their labs would greatly benefit from a certificate, as it would give them better training in their field, greater recognition for their expertise in marine science, and give them potential advantages when seeking employment after graduation.

The expertise: There are 15 tenure track faculty at OSU who are marine scientists or who study the oceans in some capacity. They include Andrea Grottoli, Derek Sawyer, Elizabeth Griffith, Ann Cook, CK Shum, and William B Lyons (SES, ASC), Meg Daly, Elizabeth Marshall, and James Bauer (EEOB, ASC), Matthew Sullivan (Micro, ASC), Mark Flint and Jaylene Flint (Vet Med), Rongjun Qin and Caglar Yardim (Engineering), and Tim Haab (CFAES). Research scientist Leonid Polyak (Byrd Polar) is also a marine scientist.

• Identify a likely source of student demand for the proposed certificate, and provide one or two examples.

Students majoring in Earth Sciences and Biology, SENR, CFAES, ENG, and MICRO will be able to indicate their focus on the marine sciences with such a certificate with a minimum of extra courses. The courses and prerequisites also offer synergies for majors in SENR, CFAES, ENG, and MICRO.

For example, a student majoring in Earth Sciences (Climate, Water, and Environment track) will be able to complete the certificate with 2 additional courses with strategic choices within the major.

• Provide the following statement: *Upon completion of the academic certificate in* <specify title>*, learners will be better prepared to. . .*" <list a maximum of 3 outcomes>.

Upon completion of the academic certificate in Marine Science, students will be better prepared to
(1) integrate biological, geological, chemical, and physical datasets to test scientific hypotheses across the major disciplines of marine science.
(2) apply systems-level thinking to marine science question.
(3) continue in the field of marine science, well prepared to adapt to the rapidly changing field.

3. Relationship to Other Programs / Benchmarking

• Identify any overlaps with other programs or departments within the university. Append letters of concurrence or objection from related units.

The certificate overlaps with the BS in Earth Sciences and BS in EEOB

• Indicate whether this certificate or a similar certificate was submitted for approval previously.

This is a new proposal, no such certificate proposal has been submitted for approval previously.

Explain at what stage and why that proposal was not approved or was withdrawn.

• Identify similar programs at other universities in Ohio or in the United States and their levels of success.

Bowling Green State University currently offers a Specialization in Marine and Aquatic Biology within their BS Biology degree (>100 students in the specialization of 700 Biology Majors). There is no program in Ohio for Marine Science at either the undergraduate or graduate level.

4. Student Enrollment

• Indicate the number of students you anticipate will choose to pursue this certificate.

We anticipate initial enrollment to be modest, about 10 for both undergraduate and graduate certificates. Growth will be facilitated with outreach to the relevant populations. The Undergraduate Studies Committees in Earth Sciences and EEOB, will advertise the certificate during student visit days, communicate the opportunity to advisors and the career center.

Growth among graduate students will be facilitated through direct emails to the marine science faculty on campus and to the graduate chairs in each department. It is expected the undergraduate and graduate enrollment will grow to at least 80 and 20, respectively, within 4 years.

5. Curricular Requirements

• Provide ASC certificate advising sheet (see Appendix 5).

• List the courses (department, title, credit hours, description) which constitute the requirements and other components of the certificate. If any courses have prerequisites, please indicate so. Indicate which courses are currently offered and which will be new. When new course requests are submitted through curriculum.osu.edu, indicate that those course requests are being submitted as part of a new certificate proposal. As much as possible, the curriculum committees will review the course requests in conjunction with the certificate proposal.

Course number	Course name	Credit hours	Prereqs.
Everyone takes (3 credit hours)			
EARTHSC 5206	*Advanced Oceanography:* Advanced study of geological, chemical, physical, and biological oceanography; their interactions; and their interactions with relevant current issues such as global change modeling, fisheries management, and energy exploration.	3	Junior standing or higher in any STEM major discipline; or Grad Standing; or permission of instructor
Plus at least 9 credit hours from the options below			
EARTHSC 4450	*Water, Ice and Energy in the Earth System:* Earth's energy budget and the transfer of water between reservoirs. Processes that regulate water transfer, common measurement approaches, and the importance of water in geological processes, global change, and as a resource.	3	EARTHSC 1100, 1105, 1108, 1121, 1151, 2203, 2204, 2205, GEOG 3901, OR GEOG 5900; or permission of instructor
EARTHSC 5622	*Stable Isotope Biogeochemistry:* Focus on theoretical and applied aspects of stable isotope biogeochemistry in the natural environment with emphasis on carbon, oxygen and nitrogen.	3	Major standing in any STEM major
EARTHSC 5602.02	*Carbonate Depositional Systems:* The field study of carbonates in a modern setting such as the Bahamas or southern Florida. 7-day field trip preceding or following the semester.	3	---
EARTHSC 5780	*Reflection Seismology:* Basics of reflection seismic data processing and interpretation, using petroleum	4	EARTHSC 1100, 1105, 1108, 1121, 1151, 2203, OR 2205; Math 1141 or 1151 or

	industry standard seismic processing software, hardware, and data.		above, and Physics 1250 or above
GEOG 5900	*Climatology:* An introduction to the fundamental physical and mathematical principles governing both day-to-day weather and the average of weather, or climate. Objectives are to understand the physical processes of the earth-atmosphere system, describe its weather features and climate characteristics today, and outline how they might change in the future as a result of global warming.	3	---
EEOB 5410	*Ocean Ecology*: Diversity and distribution of marine organisms; population dynamics, productivity, and structure of marine ecosystems; human impact on ocean resources.	1.5	EEOB 3410 or grad standing
EEOB 5430	*Fish Ecology*: Lecture emphasis on the behavior, migration, distribution, and evolution of fish; laboratory emphasis on ecological and systematic ichthyology. Lab fee required.	3	EEOB 3410 or grad standing
EEOB 4230	*Focused study on ecology and evolution of invertebrates*: Analysis of the anatomical, physiological, behavioral and ecological characteristics of the major invertebrate groups.	2	EEOB 3410
ENR 5614	Marine and aquatic education (Limbo)	2	15 cr hrs of social, physical, and/or biological sciences, or teacher certificate; and permission of instructor
The 9 credit-hour requirement may include at most one of the following.			
GEOG 5210	*Fundamentals of Geographic Information Systems:* Basic principles of geographic and land information systems and their use in spatial analysis and information management.	3	
EARTHSC 5310	*Remote Sensing in the Earth Sciences:* The overall learning of geodetic (active) and passive remote sensing technologies and in-depth data analytics of their processing to apply to research in Earth sciences and engineering. This course is focused on students learning the theory and data processing methods to enable the use of contemporary satellite or airborne platform-equipped observations for science and engineering applications.	3	EARTHSC 1100, 1105, 1108, 1121, 1151, 2203, OR 2205; and MATH 1141 or 1151 or above, and Physics 1250 or above; or grad standing; or permission of instructor
CIVILEN 5001	*Introduction to Geographic Information Systems*: Introduction to the basic principles of geographic	4	CivEng 2050, for CivilEn and EnvEng majors only

	information systems and their use in spatial analysis and information management		

• State the minimum number of credits required for completion of the certificate.

Total 12-13.5 hours. (Range due to varied credit hours of the disciplinary courses)

• Indicate the number of semesters expected to complete the certificate. Confirm that courses are offered frequently enough and have the capacity to meet this expectation.

While intended to be completed in two years, the certificate may be completed in as little as 2 semesters due to the frequency of course offerings.

• If applicable, describe existing facilities, equipment, and off-campus field experience and clinical sites to be used. Indicate how the use of these facilities, equipment, etc., will impact other existing programs.

None.

• For interdisciplinary certificates, describe the way in which advising and other student support will be provided.

Earth Science and Biology Advisors will advise Marine Science Certificate students, consulting with DUG's as necessary

• If applicable, describe additional university resources (including advisors and libraries) that will be required for the new certificate.

None.

• Provide ASC completion sheet for certificates.
• Provide semester-by-semester sample program.

Example program for an Earth Science student, two years:
Fall: EarthSc 5206 (offered annually)
Spring: EarthSc 4450 (offered even-year springs) or EarthSc 5622 (offered even-year springs)
Fall: Geog 5900 (offered annually)
Spring: EarthSc 5780 (offered odd-year springs) or *EarthSc 4450* (offered even-year springs)

Note that a student planning this program with their BS program (CWE track) will "double count" EarthSc 5206 (3 credit hours) and 4450 (3 credit hours).

Example program for a Biology student, two years:
Fall: EarthSc 5206 (offered annually) *and/or EEOB 4230* (offered even-year fall)
Spring: Geog 5900 (offered every semester)
Fall: EEOB 5430 (offered fall) *and/or EEOB 4230* (offered even-year fall)
Spring: EEOB 5410 (offered spring)

Note that a student planning this program with their BS program will "double count" two of EEOB 5430, 5410, and 4230 (3.5-5 credit hours).

Additional Graduate School Guidelines

- Students must be admitted into a graduate certificate program.
- Admitted students must meet the minimum admission requirements of the Graduate School.
- Certificates are administered by a graduate studies chair and committee that are responsible for admission decisions.
- Proposals originate in a TIU following the TIU's curricular approval process. Once submitted in curriculum.osu.edu and approval by the college, proposals will be routed automatically to the Graduate School for review. Once approved by the Graduate School, proposals are review by the Council on Academic Affairs (CAA).
- A letter of support from the college dean or associate executive dean must accompany the proposal.
- *If a graduate non-degree student is admitted to a graduate certificate program, no more than four hours of semester graduate credit accumulated while in this non-degree classification may be counted toward the certificate.*

Assessment Plan for the Certificate in Marine Science

As the proposed certificate programs are meant to be integral to the learning experience of our majors, graduate students, as well as students in associated disciplines, and therefore we will assess our certificate programs in similar ways. This will support our need to assess the individual programs while also assessing their efficacy in meeting the goals of broader and deeper education for our students. The learning goals of each certificate program include higher-level and systems-level thinking, along with preparedness for careers or further study. We further assess the program with regards to the students we attract to the program, their success in completing the requirements, and their satisfaction with the program.

Indirect measures: Each measure will be assessed for undergraduates and graduate students separately and together for each certificate. We will track data on:

Student's BS/BA or graduate program
First post-graduation employment or graduate institution placement
Average and range of time-to-certificate
Student retention rate in the certificate program
Cumulative student GPA in the certificate courses
Student evaluation of instruction of individual courses included in the certificate
Survey of program satisfaction upon completion

These indirect measures address the employment objective of each certificate. Specifically:
Marine Science

Upon completion of the academic certificate in Marine Science, students will be better prepared to

(3) continue in the field of marine science, well prepared to adapt to the rapidly changing field.

Direct measures: Each measure will be assessed for undergraduate and graduate students separately and together for each certificate. We will measure student learning of the high-level thinking goals through performance in the required courses of each certificate program.

Upon completion of the academic certificate in Marine Science, students will be better prepared to

(1) integrate biological, geological, chemical, and physical datasets to test scientific hypotheses across the major disciplines of marine science.

(2) apply systems-level thinking to marine science question.

Assessment of Learning Outcomes: Students in Advanced Oceanography (EarthSc 5206) will answer embedded multiple-choice, short-answer and essay questions in the exams that will asses whether the students can integrate information from biological, geological, chemical and physical data to test scientific hypotheses (expected goal of scoring 75% or higher for each individual). Students will demonstrate their mastery of applying learned concepts to answer marine science questions using systems-level thinking, i.e. how parts of a system interrelate and function over time and interact with other systems, during student-led in-class discussions of focused reading of scientific research and viewing of videos addressing key questions in marine sciences.

COLLEGE OF ARTS AND SCIENCES
THE OHIO STATE UNIVERSITY

TYPE 1B & 3 MARINE SCIENCE CERTIFICATE (MARINE-CT)

Coordinating Advisor: Professor Ashley Griffith, 381 Mendenhall Labs, Columbus, OH 43210; griffith.233@osu.edu

The 12-13.5 credit hour Marine Science Certificate will provide students with a competitive advantage in pursuing careers in marine science in the private and public sectors or pursuing entrance into a graduate degree program in marine science. The certificate is designed to enhance both critical thinking and the technical skills in marine science.

Required core course (3 credits):

- **EARTHSC 5206**: Advanced Oceanography (3)

Elective courses (9 credits):
In addition, students will select from the courses listed below.

- **EARTHSC 4450:** Water, Ice and Energy in the Earth System (3)
- **EARTHSC 5622**: Stable Isotope Biogeochemistry (3)
- **EARTHSC 5602.02**: Carbonate Depositional Systems (3)
- **EARTHSC 5780**: Reflection Seismology (4)
- **GEOG 5900**: Climatology (3)
- **EEOB 5410**: Ocean Ecology (1.5)
- **EEOB 5430**: Fish Ecology (3)
- **EEOB 4230**: Focused study on ecology and evolution of invertebrates (2)
- **ENR 5614**: Marine and aquatic education ()

Of these electives, no more than one of:

- **GEOG 5210:** Fundamentals of Geographic Information Systems (3)
- **EARTHSC 5310:** Remote Sensing in the Earth Sciences (3)
- **CIVILEN 5001:** Introduction to Geographic Information Systems (4)

Marine Geology Certificate program guidelines

The following guidelines govern the Marine Geology Certificate. Required for certificate:

Credit hours required: 12-13.5 credit hours.

Overlap with a major

- The certificate must be in a different subject than the major.
- Max 50% overlap with degree program (i.e. major, minor, other certificate, or GE)

Grades required

- Minimum C- for a course to be listed on the certificate.
- Minimum 2.00 cumulative point-hour ratio required for the certificate.

X193 credits: Not permitted.

Certificate Completion: If the certificate is not complete on the DAR, the student must consult with the College of Arts and Sciences Coordinating Advisor.

Filing the certificate program form: The certificate program form must be filed at least by the time the graduation application is submitted to a college/school counselor.

Changing the certificate: Once the certificate program is filed in the college office, any changes must be approved by the College of Arts and Sciences Coordinating Advisor.

School of Earth Sciences undergraduate advisor
Dr. Karen Royce royce.6@osu.edu 614-292-6961

School of Earth Sciences graduate advisor
Professor Steve Lower, 084 Orton Hall, lower.9@osu.edu; 614-292-1571

COLLEGE OF ARTS AND SCIENCES
THE OHIO STATE UNIVERSITY

TYPE 1B & 3 MARINE SCIENCE CERTIFICATE (MARINE-CT)

Student: _____

Other degree programs (Majors, minors, certificate): _____

Course	Credit Hours	Semester Completed	Overlap with other major, minor, other certificate program or GE?
Required			
EARTHSC 5206	3		
Electives (minimum 9 credit hours)			

Total Credit hours: _____ (minimum 12)

Credits double counted with major, minor, other certificate program, or GE:
_____ (maximum 50%)

Advisor's signature: _____

Required core course (3 credits):

- **EARTHSC 5206**: Advanced Oceanography (3)

Elective courses (9 credits):
In addition, students will select from the courses listed below.

- **EARTHSC 4450:** Water, Ice and Energy in the Earth System (3)
- **EARTHSC 5622**: Stable Isotope Biogeochemistry (3)
- **EARTHSC 5602.02**: Carbonate Depositional Systems (3)
- **EARTHSC 5780**: Reflection Seismology (4)
- **GEOG 5900**: Climatology (3)
- **EEOB 5410**: Ocean Ecology (1.5)
- **EEOB 5430**: Fish Ecology (3)
- **EEOB 4230**: Focused study on ecology and evolution of invertebrates (2)
- **ENR 5614**: Marine and aquatic education ()

Of these electives, no more than one of:

- **GEOG 5210:** Fundamentals of Geographic Information Systems (3)
- **EARTHSC 5310:** Remote Sensing in the Earth Sciences (3)
- **CIVILEN 5001:** Introduction to Geographic Information Systems (4)

Proposal Submission Guidelines for Establishing a New Certificate

1. Required Information

• Name of proposed certificate. Identify certificate type from certificate grid (*e.g.*, Type 2, standalone post-bachelor undergraduate certificate).

Petroleum Geology, type 1b (undergraduate academic certificate, embedded), type 2 (Undergraduate academic certificate, post-bachelor degree) and 3 (graduate academic certificate, stand alone (3a) or embedded (3b))

• Indicate whether the certificate will be delivered wholly on-line, wholly in-person, a combination, or with all hybrid courses.

In person delivery.

• Proposed implementation date.

Spring 2020

• Academic units (e.g., department, college) responsible for administering the certificate program.

Earth Sciences, College of Arts and Sciences

2. Rationale

• Describe the rationale/purpose of the certificate.

With a Certificate in Petroleum Geology, students will have a competitive advantage for beginning a career in the oil and gas industry or pursuing entrance into a top graduate degree program within the field of petroleum geoscience. The certificate is designed to enhance both critical thinking and the technical skills for practicing petroleum geoscience.

• Identify a likely source of student demand for the proposed certificate, and provide one or two examples.

Students majoring in these programs will be able to indicate their focus on Petroleum Geology with such a certificate with a minimum of additional courses. This certificate, together with either the revised Geological Sciences and Geophysics subprograms of the Earth Sciences BS, will replace the prior Petroleum Geology and Geophysics subprogram.

For example, an undergraduate student majoring in Earth Sciences on the Geological Sciences track will be able to combine their major coursework with this certificate after two additional classes and no additional prerequisites (e.g. EarthSci 5661 and an elective). A student on the Geophysics track will be able to complete the certificate through attendance at field camp. Both sets of students will then be well prepared to pursue a career in the oil and gas industry or a graduate program in energy-related disciplines.

A graduate student in Earth Sciences and Civil Engineering will be able to demonstrate that their graduate program had significant depth and breadth related in the discipline of petroleum geology, preparing them for careers in energy sectors.

In addition to students pursuing degrees within Earth Sciences, the certificate will support career development for students in Civil Engineering, in Environmental Engineering, and in Chemical Engineering.

• Provide the following statement: *Upon completion of the academic certificate in* <specify title>*, learners will be better prepared to. . .*" <list a maximum of 3 outcomes>.

Upon completion of the academic certificate in Petroleum Geology, students will be better prepared to
(1) Identify and evaluate the geological components of a subsurface petroleum system.
(2) Understand the state-of-the-art geological, geophysical, and geochemical methods for exploring and producing petroleum systems.
(3) Understand the importance of geology, geochemistry, geophysics, engineering, and business aspects of the petroleum industry

3. Relationship to Other Programs / Benchmarking

• Identify any overlaps with other programs or departments within the university. Append letters of concurrence or objection from related units.

The certificate complements the BS in Earth Sciences.

• Indicate whether this certificate or a similar certificate was submitted for approval previously.

This is a new proposal, no such certificate proposal has been submitted for approval previously.

Explain at what stage and why that proposal was not approved or was withdrawn.

• Identify similar programs at other universities in Ohio or in the United States and their levels of success.

There are no comparable programs in Ohio for undergraduate or graduate students.
At the graduate level, there are few certificate programs nationally, most notably UT Austin and Texas A&M University.

4. Student Enrollment

• Indicate the number of students you anticipate will choose to pursue this certificate.

The Petroleum Geology and Geophysics subprogram of the Earth Sciences BS has represented 25-35% of all undergraduate majors. Growth will be facilitated with outreach to the relevant populations including website. The Undergraduate Studies Committee, will advertise the certificate during student visit days, communicate the opportunity to advisors and the career center.

5. Curricular Requirements

• Provide ASC certificate advising sheet (see Appendix 5).

• List the courses (department, title, credit hours, description) which constitute the requirements and other components of the certificate. If any courses have prerequisites, please indicate so. Indicate which courses are currently offered and which will be new. When new course requests are submitted through curriculum.osu.edu, indicate that those course requests are being submitted as part of a new certificate proposal. As much as possible, the curriculum committees will review the course requests in conjunction with the certificate proposal.

Course Number	Course Name	Credit Hours	Prereqs.
All Students Complete:			
EARTHSCI 5661	*Petroleum Geology:* The formation, accumulation, and trapping of oil and natural gas. Geologic source beds and traps; hydrocarbon flow; hydraulic properties of reservoirs and confining units; hydrocarbon chemistry; thin-section analysis of reservoir rocks.	4	EARTHSC 4502; or written permission of instructor
EARTHSCI 5189.01	*Field Geology I:* Concentrated training in the basic essentials of field observation and mapping; the work is done in central Utah, with headquarters in Ephraim. Requires full time of student.	3	EarthSci 1100, 1121, or 1200; EarthSci 4530

Course Number	Course Name	Credit Hours	Prereqs.
Complete two additional courses from the list below:			
EARTHSCI 5189.02	*Field Geology II:* Concentrated training in the basic essentials of field observation and mapping; the work is done in central Utah, with headquarters in Ephraim. Requires full time of student.	3	EarthSci 4423 and EarthSci 5189.01
EARTHSCI 4560	*Applied Geophysics:* Methods and techniques of pure and applied geophysics; geological interpretation of geophysical data.	3	EARTHSC 1100, 1105, 1108, 1121, 1151, 2203, OR 2205; Math 1141/1151, Physics 1250

EARTHSCI 5687	*Borehole Geophysics:* Principles and applications of borehole geophysical practices in the energy industry and in scientific drilling.	3	EARTHSC 1100, 1105, 1108, 1121, 1151, 2203, OR 2205; Math 1151; Physics 1250
EARTHSCI 5751	*Quantitative Reservoir Modeling:* Principles of analytical and numerical techniques in modeling single- and multiphase flow in gas, oil, and water (aquifer) reservoirs. Development of Matlab code for two- and three-dimensional flow in porous media.	4	EarthSci 2245, Math 1152
EARTHSCI 5780	*Reflection Seismology:* Basics of reflection seismic data processing and interpretation, using petroleum industry standard seismic processing software, hardware, and data.	4	EARTHSC 1100, 1105, 1108, 1121, 1151, 2203, OR 2205; Math 1141/1151

• State the minimum number of credits required for completion of the certificate.

Total 13-15 hours, where the range is a result of the variable credit hours of the electives.

• Indicate the number of semesters expected to complete the certificate. Confirm that courses are offered frequently enough and have the capacity to meet this expectation.

The certificate can be completed in one calendar year, including summer.

• If applicable, describe existing facilities, equipment, and off-campus field experience and clinical sites to be used. Indicate how the use of these facilities, equipment, etc., will impact other existing programs.

None.

• For interdisciplinary certificates, describe the way in which advising and other student support will be provided.

• If applicable, describe additional university resources (including advisors and libraries) that will be required for the new certificate.

None.

• Provide ASC completion sheet for certificates.

• Provide semester-by-semester sample program.

The following information is included to demonstrate that the frequency of course offerings is sufficient for an undergraduate student to complete the program in a two-year period.

Sample program, ideal for undergraduate students following the Geophysics Subprogram of the Earth Science BS
Year 1:
EarthSc 4560 (Spring, offered even springs) and EarthSc 4530 (Spring, offered annually)
Year 2:
EarthSc 5189.01 (Summer, offered annually)
EarthSc 5661 (Spring, offered annually)

Sample program, ideal for undergraduate students following the Geological Science Subprogram of the Earth Science BS
Year 1:
EarthSc 4530 (Spring, offered annually)
Year 2:

EarthSc 5189.01 (Summer, offered annually)
EarthSc 5189.01 (Summer, offered annually)
EarthSc 5661 (Spring, offered annually)

Additional Graduate School Guidelines

- Students must be admitted into a graduate certificate program.
- Admitted students must meet the minimum admission requirements of the Graduate School.
- Certificates are administered by a graduate studies chair and committee that are responsible for admission decisions.
- Proposals originate in a TIU following the TIU's curricular approval process. Once submitted in curriculum.osu.edu and approval by the college, proposals will be routed automatically to the Graduate School for review. Once approved by the Graduate School, proposals are review by the Council on Academic Affairs (CAA).
- A letter of support from the college dean or associate executive dean must accompany the proposal.
- *If a graduate non-degree student is admitted to a graduate certificate program, no more than four hours of semester graduate credit accumulated while in this non-degree classification may be counted toward the certificate.*

Assessment Plan for the Certificate in Petroleum Geology

As the proposed certificate programs are meant to be integral to the learning experience of our majors, graduate students, as well as students in associated disciplines, and therefore we will assess our certificate programs in similar ways. This will support our need to assess the individual programs while also assessing their efficacy in meeting the goals of broader and deeper education for our students. The learning goals of each certificate program include higher-level and systems-level thinking, along with preparedness for careers or further study. We further assess the program with regards to the students we attract to the program, their success in completing the requirements, and their satisfaction with the program.

Indirect measures: Each measure will be assessed for undergraduates and graduate students separately and together for each certificate. We will track data on:

Student's BS/BA or graduate program
First post-graduation employment or graduate institution placement
Average and range of time-to-certificate
Student retention rate in the certificate program
Cumulative student GPA in the certificate courses
Student evaluation of instruction of individual courses included in the certificate
Survey of program satisfaction upon completion

These indirect measures address the employment objective of each certificate. Specifically:
Petroleum Geology

Upon completion of the academic certificate in Petroleum Geology, students will be better prepared to
(3) Understand the importance of geology, geochemistry, geophysics, engineering, and business aspects of the petroleum industry

Direct measures: Each measure will be assessed for undergraduate and graduate students separately and together for each certificate. We will measure student learning of the high-level thinking goals through performance in the required courses of each certificate program.

Petroleum Geology

Upon completion of the academic certificate in Petroleum Geology, students will be better prepared to
(1) Identify and evaluate the geological components of a subsurface petroleum system.
(2) Understand the state-of-the-art geological, geophysical, and geochemical methods for exploring and producing petroleum systems.
(3) Understand the importance of geology, geochemistry, geophysics, engineering, and business aspects of the petroleum industry

Learning objectives for the academic certificate in Petroleum Geology will be evaluated in two successive exercises at the end of Field Camp I (EarthSc 5189.01), a required class for all students in the program, the (i) Petroleum Geology & Covenant Core exercise, and (ii) the capstone South Cross Section exercise. In the Petroleum Geology & Covenant Core exercise,

students describe rock core recovered from the Covenant petroleum field in Utah and interpret the depositional environment and economic potential of the subsurface petroleum system based on the core in conjunction with other geological and geophysical data from the field. In the South Cross Section exercise, students synthesize the Covenant core data with field geological data collected from the southern Sanpete Valley and additional geophysical data to build a reservoir scale structural model of the deformed subsurface rock structure, identifying potential traps and related petroleum systems.

COLLEGE OF ARTS AND SCIENCES
THE OHIO STATE UNIVERSITY

TYPE 1B, 2, 3 PETROLEUM GEOLOGY CERTIFICATE (PETRGEO-CT)

Coordinating Advisor: Professor Ashley Griffith, 381 Mendenhall Labs, Columbus, OH 43210; griffith.233@osu.edu

The 13-15 credit hour Petroleum Geology Certificate will provide students with a competitive advantage in beginning a career in the oil and gas industry or pursuing entrance into a graduate degree program within the field of petroleum geoscience. The certificate is designed to enhance both critical thinking and the technical skills for practicing petroleum geoscience.

Required core courses (7 credits):

- **EARTHSC 5661**: Petroleum Geology (4)
- **EARTHSC 5189.01**: Field Geology I (3) Summer term

Elective courses (6-8 credits):

In addition, students will select two more courses (6-8 credits) listed below.

- **EARTHSC 5189.02:** Field Geology II (3) Summer term
- **EARTHSC 4560**: Applied Geophysics (3)
- **EARTHSC 5687**: Borehole Geophysics (3)
- **EARTHSC 5751**: Quantitative Reservoir Modeling (4)
- **EARTHSC 5780**: Reflection Seismology (4)

Students with prior comparable field geology coursework may substitute an additional elective in place of EARTHSC 5189.01.

Petroleum Geology Certificate program guidelines

The following guidelines govern the Petroleum Geology Certificate. Required for certificate:

Credit hours required: 13-15 credit hours.

Overlap with a major

- The certificate must be in a different subject than the major.
- Max 50% overlap with degree program (i.e. major, minor, other certificate, or GE)

Grades required

- Minimum C- for a course to be listed on the certificate.
- Minimum 2.00 cumulative point-hour ratio required for the certificate.

X193 credits: Not permitted.

Certificate Completion: If the certificate is not complete on the DAR, the student must consult with the College of Arts and Sciences Coordinating Advisor.

Filing the certificate program form: The certificate program form must be filed at least by the time the graduation application is submitted to a college/school counselor.

Changing the certificate: Once the certificate program is filed in the college office, any changes must be approved by the College of Arts and Sciences Coordinating Advisor.

School of Earth Sciences undergraduate advisor
Dr. Karen Royce royce.6@osu.edu 614-292-6961

School of Earth Sciences graduate advisor
Professor Steve Lower, 084 Orton Hall, lower.9@osu.edu; 614-292-1571

COLLEGE OF ARTS AND SCIENCES
THE OHIO STATE UNIVERSITY

TYPE 1B, 2, 3 PETROLEUM GEOLOGY CERTIFICATE (PETRGEO-CT)

Student: _____

Other degree programs (Majors, minors, certificate): _____

Course	Credit Hours	Semester Completed	Overlap with other major, minor, other certificate program or GE?
Required Courses			
EARTHSC 5661	4		
EARTHSC 5189.01	3		
Elective Courses (6-8 credit hours)			

Total Credit hours: _____ (minimum 12)

Credits double counted with major, minor, other certificate program, or GE:
_____ (maximum 50%)

Advisor's signature _____

Required core courses (7 credits):

- **EARTHSC 5661**: Petroleum Geology (4)
- **EARTHSC 5189.01**: Field Geology I (3) Summer term

Elective courses (6-8 credits):
In addition, students will select two more courses (6-8 credits) listed below.

- **EARTHSC 5189.02:** Field Geology II (3) Summer term
- **EARTHSC 4560**: Applied Geophysics (3)
- **EARTHSC 5687**: Borehole Geophysics (3)
- **EARTHSC 5751**: Quantitative Reservoir Modeling (4)
- **EARTHSC 5780**: Reflection Seismology (4)

Students with prior comparable field geology coursework may substitute an additional elective in place of EARTHSC 5189.01.

Proposal Submission Guidelines for Establishing a New Certificate

1. Required Information

• Name of proposed certificate. Identify certificate type from certificate grid (*e.g.*, Type 2, standalone post-bachelor undergraduate certificate).

Natural History Museum Curation, type 1 (undergraduate academic certificate, embedded), type 2 (Undergraduate academic certificate, post-bachelor degree) and 3 (graduate academic certificate, stand alone (3a) or embedded (3b))

• Indicate whether the certificate will be delivered wholly on-line, wholly in-person, a combination, or with all hybrid courses.

In person delivery.

• Proposed implementation date.

Spring 2020

• Academic units (e.g., department, college) responsible for administering the certificate program.

Earth Sciences, College of Arts and Sciences

2. Rationale

• Describe the rationale/purpose of the certificate.

The certificate will provide both the disciplinary background as well as experience and skills in working in a museum. The certificate is targeted to students wishing to pursue a career in natural history museums.

A survey of recent postings for positions in natural history museums shows that most desire applicants to have the disciplinary expertise ranging from a BS, MS, to a PhD, where the BS-level positions are generally described as "curatorial assistant" or "outreach specialist," whereas positions with the title "curator" require a PhD. Most of these positions, even at the assistant level, require either curatorial or museum-based outreach experience. For example, position descriptions in current job postings include the following responsibilities and requirements:

> "Responsible for providing advisement and assistance for the systematic arrangement of specimens within the collections of assignment. Responsible for working with the collections management staff to integrate and treat research collection materials. Responsible for following established best-practices in the legal acquisition, accession, and curation of newly acquired specimens within the collections of assignment." Cleveland Museum of Natural History, Assistant/Associate Curator of Vertebrate Paleontology (PhD required)

> "The curator is further expected to integrate their understanding of minerals and earth science with the three outward-facing themes of the museum: the history of life and earth systems, the interconnected of life and earth systems, and the future of life and earth systems. Living and non-living earth systems interact profoundly. The curator is expected to collaborate with education, programming and exhibit staff to engage scholars, the public, and policy-makers towards a more sustainable place for humans in the earth's systems." Carnegie Museum of Natural History, Curator of Mineral and Earth Sciences (PhD required)

> "…knowledge and experience in the identification and classification of geological specimens, in particular mineral specimens. … knowledge and experience in managing a Museum Collection, and knowledge of national and international principles, practices, standards and ethics around management of such a collection" Museums Victoria, Collections Manager, Geosciences (BS required)

• Identify a likely source of student demand for the proposed certificate, and provide one or two examples.

Students majoring in the natural sciences that seek employment in research but not academia, as well as public outreach and education without working in a traditional classroom setting. This certificate program is part of the School of Earth Sciences' efforts to provide clear pathways for career training within the natural sciences.

In a recent search of job listings on Indeed.com (July 19, 2019), we found 319 open listings for museum curatorial positions in the United States, although not all of them were specifically for natural history museums. During each of the last 20 years, we have received requests, either from enrolled students or from prospective students, for course offerings in natural history museum curation studies at Ohio State. In the last 12 months alone, we have received such requests from six students.

• Provide the following statement: *Upon completion of the academic certificate in* <specify title>*, learners will be better prepared to. . .*" <list a maximum of 3 outcomes>.

Upon completion of the academic certificate in Natural History Museum Curation,

(1) learners will be better prepared to identify natural history specimens (which may include minerals, fossils, plants, and animals), place the specimens in scientific context, and recognize the scientific, historical, or other value of specimens.

(2) learners will be better prepared to curate natural history collections through experience with one or more of (a) preparation, (b) cataloging, (c) collections management, and (d) preservation.

(3) learners will be better prepared to manage the operations of a museum including one or more of experience with (a) seeking museum funding, (b) managing a museum enterprise in a dynamic social context, and (c) engaging in public outreach by various means including exhibition development.

3. Relationship to Other Programs / Benchmarking

• Identify any overlaps with other programs or departments within the university. Append letters of concurrence or objection from related units.

The certificate overlaps with the BS in Earth Sciences. Students majoring in biology and other natural science fields will find they will be able to use their course credits to fulfill parts of the requirements.

• Indicate whether this certificate or a similar certificate was submitted for approval previously.

This is a new proposal, no such certificate proposal has been submitted for approval previously.

Explain at what stage and why that proposal was not approved or was withdrawn.

• Identify similar programs at other universities in Ohio or in the United States and their levels of success.

There are few full degree programs specifically for the curation of natural history collections in the US, or indeed the world. There are no such programs in Ohio. What we are proposing is essentially unique in the United States, but our proposed program includes some content that is similar to that in programs elsewhere.

Among universities and colleges in Ohio, Kent State University offers a concentration (pathway) leading to a degree in Information Science (digital technology). The concentration does not include disciplinary study of, or practical experience with, natural history collections.

https://www.kent.edu/sites/default/files/file/Museum%20Studies%20Pathway.pdf

Ohio University, Athens, offers a Museum Studies Certificate through the School of Art and Design. The university does not have a natural history museum, or a certificate in natural history museum curation.

https://www.ohio.edu/fine-arts/art/museum-studies-certificate

Ohio Northern University offers an undergraduate Public History minor to help prepare students for work in museums, the National Park Service, state historical societies, and other public history careers.

https://www.onu.edu/arts_sciences/history_politics_and_justice/areas_of_study/public_historymuseum_studies

Among American universities the program most similar to that which we are proposing is hosted by the University of Colorado, Boulder. Their program includes an MS degree offering in Museum and Field Studies and a Professional Certificate.

MS degree in Museum and Field Studies (University of Colorado, Boulder):

https://www.colorado.edu/cumuseum/mfs

Professional Certificate (University of Colorado, Boulder):

https://www.colorado.edu/cumuseum/graduate-program/about-program/professional-certificate

This is a 12 credit-hour certificate plus a 75-hour internship.

Some colleges or universities in the United States offer general BA or MA programs in museum studies, which may include natural history collections. Examples:

Earlham College (Indiana) offers an undergraduate minor in Museum Studies, operated cooperatively by the History, Geology, Biology, and Art departments.

https://earlham.edu/academics/programs/museum-studies/

State University of New York, Buffalo State, offers an MA degree in Museum Studies through the History and Social Sciences Education Department.

https://suny.buffalostate.edu/programs?bpid=522

George Washington University offers an MA degree in the Field of Museum Studies. Content areas are in disciplines such as American studies, anthropology, biological science, history, art history, or an appropriate interdisciplinary combination.

http://bulletin.gwu.edu/arts-sciences/museum-studies/ma/

Florida State University, Tallahassee, offers a graduate-level certificate in Museum Studies through an interdepartmental program. The program is open to graduate students enrolled in any FSU department.

https://hps.fsu.edu/students/museum-studies-certificate

https://classics.fsu.edu/programs/graduate-program/museum-studies

The Johns Hopkins University offers online degree or certificate options in museum studies. They are an MA degree in Museum Studies, an MA degree in Cultural Heritage Management, and a Graduate Certificate in Digital Curation.

https://landing.advanced.jhu.edu/museum-studies?

Most universities that offer programs in Museum Studies are focused on the arts and art history, and some such as the University of Florida, offer the flexibility for a student to concentrate studies in another disciplinary area while earning an MA degree or a Graduate Certificate in Museum Studies.

https://arts.ufl.edu/academics/art-and-art-history/programs/museum-studies/

4. Student Enrollment

• Indicate the number of students you anticipate will choose to pursue this certificate.

We anticipate initial enrollment to be modest, initially enhancing the experience and work preparation for undergraduate and graduate students in the earth sciences and EEOB, entomology, and related fields, limited by access to the availability of internships in the Orton Geological Museum and the Museum of Biological Diversity. However, a 5-year goal of the strategic plan for the Orton Geological Museum is to establish partnerships with other museums and research centers. To do this, the museum must have the collections catalogued and digitized, which will be an outgrowth of the initial efforts of the proposed 5501 course. Such partnerships will open up internship options to museums at Ohio State (e.g. Museum of Biological Diversity), in Columbus (e.g. COSI, Ohio History Connection) as well as in the region (e.g. Cincinnati Museum Center, Cleveland Museum of Natural History), allowing for the expansion of the program.

5. Curricular Requirements

• Provide ASC certificate advising sheet (see Appendix 5).

• List the courses (department, title, credit hours, description) which constitute the requirements and other components of the certificate. If any courses have prerequisites, please indicate so. Indicate which courses are currently offered and which will be new. When new course requests are submitted through curriculum.osu.edu, indicate that those course requests are being submitted as part of a new certificate proposal. As much as possible, the curriculum committees will review the course requests in conjunction with the certificate proposal.

Course Number	Course Name	Credit Hours	Prereqs.
All students take 6-8 credit hours of courses that provide in-depth knowledge of the identification and classification of natural samples in their broader scientific context. Additional courses may be			

approved from other disciplines, where approval will be contingent upon providing hands on experience in the identification and classification of natural samples. Students with demonstrated knowledge of the identification and classification of natural samples at the advanced undergraduate level may instead replace up to 6 credit hours with additional internship and museum curatorial practice/management hours.

This requirement addresses learning objective (1). Each class has been evaluated and determined to address both the identification and classification of natural specimens, placing in scientific and/or historical context.

EARTHSC 4421	*Earth Materials:* Internal and external symmetry of minerals; relationship of physical properties to crystal structure; introduction to modern and traditional identification methods; sight identification of about 30 minerals.	3	Chem 1210
EARTHSC 4423	*Introductory Petrology:* Origin, occurrence, association, and mineral composition of the common rocks; laboratory includes work by megascopic and microscopic methods.	3	EARTHSC 1100, 1121, OR 1200; AND 4421
EARTHSC 4501	*Paleontology:* Fundamentals of paleontology and processes responsible for the fossil record. Application of paleontology to geology, evolutionary studies, paleoclimatology, paleoenvironmental reconstruction.	4	EARTHSC 1122 or 2122 & 3 cr hrs in bio sciences
EARTHSC 4502	*Stratigraphy and Sedimentation:* Principles of, and procedures in, stratigraphy and sedimentation, illustrated by field and laboratory studies of sedimentary rocks.	4	EARTHSC 1100, 1121, OR 1200; AND EARTHSC 1122 or 2122
EEOB 2210	*Biodiversity of Ohio – Plants:* A lecture and field course in identifying common Ohio plants; emphasis on taxonomic principles, use of keys and manuals, and field recognition of plants; includes some Saturday field trips.	2	4 sem. credit hours in biology
EEOB 2220	*Biodiversity of Ohio – Birds:* The general biology of birds with emphasis on their natural histories and field identification of local species.	2	4 sem. credit hours in biology
EEOB 3310	*Evolution:* Basic conceptual issues and processes in evolution with an emphasis on the ecological basis of adaptation and consequences of natural selection.	4	BIO 1114(H)
EEOB 3320	*Organismal Diversity:* A survey of organismal diversity and the evolutionary relationships between and within major groups of organisms. Class is laboratory based.	3	EEOB 3310
EEOB 4210	*Focused Study of Ecology and Evolution – Vertebrates:* Analysis of the anatomical, physiological, behavioral, and ecological characteristics of the major vertebrate groups.	2	EEOB 3310
EEOB 4220	*Focused Study of Ecology and Evolution – Mammals:* Mammals of the world, their natural history, distribution, taxonomy, and major anatomical and physiological adaptations; study of local species emphasized in lab.	3	EEOB 3310
EEOB 4230	*Focused Study of Ecology and Evolution – Invertebrates:* Analysis of the anatomical, physiological, behavioral and ecological characteristics of the major invertebrate groups.	2	EEOB 3310

Course Number	Course Name	Credit Hours	Prereqs.	Learning Objective
All students complete 3-6 credit hours of the following, providing museum internship experience.				
EARTHSC 5191.01	*Museum Internship:* Formal, independent study and practical training in a natural history museum. Students become acquainted with the research, teaching, and outreach activities of a museum, and enhance their knowledge of resources, research methodologies, curatorial procedures, exhibit development, institutional culture, and work environment.	3-6	Jr standing or above; and permission of instructor.	One or more of 2a, 2c, 2d, 3b, 3c
EEOB 5610	*Translating Evolution:* Hands-on study of the theory and practice of informal science education, with an emphasis on the translation of concepts and research on evolutionary biology to non-specialist audiences.	3	EEOB 3310 or Bio 1114 + 4 additional credits in biology	3b and 3c

Course Number	Course Name	Credit Hours	Prereqs.	Learning Objective
All student complete at least 3 credit hours of the following, providing curatorial and/or museum management experience				
EARTHSC 5501	*Museum Data Curation*: An introduction to modern curatorial practice in a museum of natural samples.	3	Permission of instructor	2
ARTEDUC 5671	*Organizational Leadership in the Nonprofit Arts:* Students will be assisted in enhancing their knowledge and ability to take responsible leadership roles in non-profit arts organizations and as a major constituent of public arts agencies.	3		3a, 3b
ARTEDUC 5682	*Nonprofit Arts Institution Governance and Board Leadership:* Research-based, practical exploration of nonprofit boards critically examines governance policies and practices; specifically focusing on management, board and staff relations and issues of accountability.	3		3a, 3b
ARTEDUC 5685	*Arts/Cultural Organizations: Resource Management & Revenue Streams:* An analysis of current issues in resource management and revenue streams available to arts & cultural organizations, and its application to marketing and development practice.	3		3a
ARTEDUC 5686	*Cultural Program Design, Implementation, and Evaluation:* Research of program theory, design, and their application implementation.	3		3b, 3c

ARTEDUC 7748	*Museum Practicum:* An examination of the role of education in art museums through an in-depth experience in a museum setting.	3		3c

• State the minimum number of credits required for completion of the certificate.

12-14 credits

• Indicate the number of semesters expected to complete the certificate. Confirm that courses are offered frequently enough and have the capacity to meet this expectation.

This certificate may be completed in 3 semesters, arising from the fact that the Earth Science disciplinary courses are offered annually.
The EEOB and ArtEd courses are not necessary to complete the sequence, yet offer a broader array of choices for students
EarthSc 5191.01 will be offered both fall and spring semesters; EarthSc 5501 will be offered spring and summer semesters.

• If applicable, describe existing facilities, equipment, and off-campus field experience and clinical sites to be used. Indicate how the use of these facilities, equipment, etc., will impact other existing programs.

Initially the collections and facilities of the Orton Geological Museum will form the primary support for the hands-on aspects of the Natural History Museum Curation program. The Orton Museum houses one of the largest university collections of minerals, rocks, and fossils in the United States, and this collection will be made available for instruction in curatorial methods and procedures. Most of the collection is physically located in Orton Hall, which has adequate space and infrastructure for teaching, for specimen processing, preparation and curation, and for exhibit preparation and installation. The Orton Museum is transitioning to a digital cataloging system utilizing state-of-the art digitizing and imaging technology. The Orton Museum has long enjoyed close links to the Orton Geological Library, which is also housed in Orton Hall, and its vast hard-copy and electronic resources. These library resources are an invaluable support for the curatorial work done in the Orton Museum. In addition, the Museum of Biological Diversity, with its extensive collections of Holocene (recent) biological organisms, and the Antarctic Rock Repository, with the world's largest collection of geological specimens from Antarctica, are expected to be used in teaching students curatorial methods and procedures. Students from EEOB and Entomology can benefit from learning curatorial methods in any of these collections facilities.

• For interdisciplinary certificates, describe the way in which advising and other student support will be provided.

• If applicable, describe additional university resources (including advisors and libraries) that will be required for the new certificate.

• Provide ASC completion sheet for certificates.

See below

• Provide semester-by-semester sample program.

An example two-year plan for BS student in Earth Sciences
Year 1: EarthSc 4421 (fall; offered annually) and EarthSc 4501 (spring; offered annually)
Year 2: EarthSc 5191.01 (fall; to be offered each semester) and EarthSc 5501 (to be offered annually)

An example one-year plan for a graduate student with demonstrated prior learning for learning objective (1):
Fall: EarthSc 5191.01 (3 hours) and EarthSc 5501 (3 hours)
Spring EarthSc 5191.01 or EEOB 5610 (3 hours) and ArtEduc 5685 (3 hours)

Additional Graduate School Guidelines

• Students must be admitted into a graduate certificate program.
• Admitted students must meet the minimum admission requirements of the Graduate School.
• Certificates are administered by a graduate studies chair and committee that are responsible for admission decisions.
• Proposals originate in a TIU following the TIU's curricular approval process. Once submitted in curriculum.osu.edu and approval by the college, proposals will be routed automatically to the Graduate School for review. Once approved by the Graduate School, proposals are review by the Council on Academic Affairs (CAA).
• A letter of support from the college dean or associate executive dean must accompany the proposal.
• If a graduate non-degree student is admitted to a graduate certificate program, no more than four hours of semester graduate credit accumulated while in this non-degree classification may be counted toward the certificate.

Assessment Plans for the Certificate in Natural History Museum Curation

As the proposed certificate programs are meant to be integral to the learning experience of our majors, graduate students, as well as students in associated disciplines, and therefore we will assess our certificate programs in similar ways. This will support our need to assess the individual programs while also assessing their efficacy in meeting the goals of broader and deeper education for our students. The learning goals of each certificate program include higher-level and systems-level thinking, along with preparedness for careers or further study. We further assess the program with regards to the students we attract to the program, their success in completing the requirements, and their satisfaction with the program.

Indirect measures: Each measure will be assessed for undergraduates and graduate students separately and together for each certificate. We will track data on:

Student's BS/BA or graduate program
First post-graduation employment or graduate institution placement
Average and range of time-to-certificate
Student retention rate in the certificate program
Cumulative student GPA in the certificate courses
Student evaluation of instruction of individual courses included in the certificate
Survey of program satisfaction upon completion

These indirect measures address the employment objective of each certificate. Specifically:
Museums

Upon completion of the academic certificate in Natural History Museum Curation,
(2) learners will be better prepared to curate natural history collections through preparation, cataloging, collections management, and preservation.
(3) learners will be better prepared to seek museum funding, to manage a museum enterprise in a dynamic social context, and to engage in public outreach by various means including exhibition development.

Direct measures: Each measure will be assessed for undergraduate and graduate students separately and together for each certificate. We will measure student learning of the high-level thinking goals through performance in the required courses of each certificate program.
Natural History Museum Curation

Upon completion of the academic certificate in Natural History Museum Curation,
(1) learners will be better prepared to identify natural history specimens (including minerals, fossils, plants, and animals), place the specimens in scientific context, and recognize the scientific, historical, or other value of specimens.

Assessment of Learning Outcomes: Students in Museum Curation Internship (EarthSc 5191.01) will demonstrate prior learning in the identification of natural history specimens through assessment of their internship portfolio. The internship portfolio is graded with a standard a scoring rubric to assess demonstrating the placement of the specimens in scientific context and their value to academic research and/or as models for use in communication of science to the broader public.

COLLEGE OF ARTS AND SCIENCES
THE OHIO STATE UNIVERSITY

TYPE 1B, 2, 3 NATURAL HISTORY MUSEUM CURATION CERTIFICATE (MUSEUM-CT)

Coordinating Advisor: Professor Ashley Griffith, 381 Mendenhall Labs, Columbus, OH 43210; griffith.233@osu.edu

The 12-14 credit hour Natural History Museum Curation Certificate will prepare students for employment as a museum curator or curatorial assistant. The certificate is designed to provide both disciplinary expertise and curatorial training in museum curation.

Disciplinary courses (6-8 credits):

- **EARTHSC 4421**: Earth Materials (3)
- **EARTHSC 4423**: Introductory Petrology (3)
- **EARTHSC 4501**: Paleontology (4)
- **EARTHSC 4502**: Stratigraphy and Sedimentation (4)
- **EEOB 2210**: Biodiversity of Ohio – Plants (2)
- **EEOB 2220**: Biodiversity of Ohio – Birds (2)
- **EEOB 3310**: Evolution (4)
- **EEOB 3320**: Organismal Diversity (3)
- **EEOB 4210**: Focused Study of Ecology and Evolution – Vertebrates (2)
- **EEOB 4220**: Focused Study of Ecology and Evolution – Mammals (3)
- **EEOB 4230**: Focused Study of Ecology and Evolution – Invertebrates (2)

Students with demonstrated knowledge of the identification and classification of natural samples at the advanced undergraduate level may instead replace up to 6 credit hours with additional internship and museum curatorial practice/management hours.

A museum internship (3 credits minimum; 6 credits maximum):

- **EARTHSC 5191.01**: Museum Internship (3-6)
- **EEOB 5610**: Translating Evolution (3)

Curatorial and/or museum management experience (3 credits minimum):

- **EARTHSC 5501**: Museum Data Curation (3)
- **ARTEDUC 5671**: Organizational Leadership in the Nonprofit Arts (3)
- **ARTEDUC 5682**: Nonprofit Arts Institution Governance and Board Leadership (3)
- **ARTEDUC 5685**: Arts/Cultural Organizations: Resource Management & Revenue Streams (3)
- **ARTEDUC 5686**: Cultural Program Design, Implementation, and Evaluation (3)
- **ARTEDUC 7748**: Museum Practicum (3)

Natural History Museum Curation Certificate program guidelines

The following guidelines govern the Natural History Museum Curation Certificate. Required for certificate:

Credit hours required: 12-14 credit hours.

Overlap with a major

- The certificate must be in a different subject than the major.
- Max 50% overlap with degree program (i.e. major, minor, other certificate, or GE)

Grades required

- Minimum C- for a course to be listed on the certificate.
- Minimum 2.00 cumulative point-hour ratio required for the certificate.

X193 credits: Not permitted.

Certificate Completion: If the certificate is not complete on the DAR, the student must consult with the College of Arts and Sciences Coordinating Advisor.

Filing the certificate program form: The certificate program form must be filed at least by the time the graduation application is submitted to a college/school counselor.

Changing the certificate: Once the certificate program is filed in the college office, any changes must be approved by the College of Arts and Sciences Coordinating Advisor.

School of Earth Sciences undergraduate advisor
Dr. Karen Royce royce.6@osu.edu 614-292-6961

School of Earth Sciences graduate advisor
Professor Steve Lower, 084 Orton Hall, lower.9@osu.edu; 614-292-1571

COLLEGE OF ARTS AND SCIENCES
THE OHIO STATE UNIVERSITY

TYPE 1B, 2, 3 NATURAL HISTORY MUSEUM CURATION CERTIFICATE (MUSEUM-CT)

Student: _____

Other degree programs (Majors, minors, certificate): _____

Course	Credit Hours	Semester Completed	Overlap with other major, minor, other certificate program or GE?
Minimum 6 credit hours disciplinary courses			
Museum Internship (3-6 credit hours)			
Curatorial and/or museum management experience *(minimum 3 credit hours)*			

Total Credit hours: _____ (minimum 12)

Credits double counted with major, minor, other certificate program, or GE:
_____ (maximum 50%)

Advisor's signature _____

Disciplinary courses (6-8 credits):

- **EARTHSC 4421**: Earth Materials (3)
- **EARTHSC 4423**: Introductory Petrology (3)
- **EARTHSC 4501**: Paleontology (4)
- **EARTHSC 4502**: Stratigraphy and Sedimentation (4)
- **EEOB 2210**: Biodiversity of Ohio – Plants (2)
- **EEOB 2220**: Biodiversity of Ohio – Birds (2)
- **EEOB 3310**: Evolution (4)
- **EEOB 3320**: Organismal Diversity (3)
- **EEOB 4210**: Focused Study of Ecology and Evolution – Vertebrates (2)
- **EEOB 4220**: Focused Study of Ecology and Evolution – Mammals (3)
- **EEOB 4230**: Focused Study of Ecology and Evolution – Invertebrates (2)

Students with demonstrated knowledge of the identification and classification of natural samples at the advanced undergraduate level may instead replace up to 6 credit hours with additional internship and museum curatorial practice/management hours.

A museum internship (3 credits minimum; 6 credits maximum):

- **EARTHSC 5191.01**: Museum Internship (3-6)
- **EEOB 5610**: Translating Evolution (3)

Curatorial and/or museum management experience (3 credits minimum):

- **EARTHSC 5501**: Museum Data Curation (3)
- **ARTEDUC 5671**: Organizational Leadership in the Nonprofit Arts (3)

- **ARTEDUC 5682**: Nonprofit Arts Institution Governance and Board Leadership (3)
- **ARTEDUC 5685**: Arts/Cultural Organizations: Resource Management & Revenue Streams (3)
- **ARTEDUC 5686**: Cultural Program Design, Implementation, and Evaluation (3)
- **ARTEDUC 7748**: Museum Practicum (3)

From: **Kletchka, Dana** kletchka.1@osu.edu
Subject: Re: Museums museums museums
Date: August 28, 2019 at 11:13 AM
To: Panero, Wendy panero.1@osu.edu
Cc: Babcock, Loren babcock.5@osu.edu, Saltzman, Matthew saltzman.11@osu.edu, Acuff, Joni E. acuff.12@osu.edu, Hutzel, Karen E. hutzel.4@osu.edu

DK

Dear Wendy,

Thank you for your patience while I looked over these materials—it is exciting to see this idea come to fruition through all of your hard work. I am also cc'ing Dr. Karen Hutzel, chair; and Dr. Joni Acuff, graduate studies chair of AAEP, to make sure that everyone is in the loop.

I think the ARTEDUC courses that you mentioned, save one, are entirely appropriate for the certification and could easily see students enrolling in 5671 (organizational leadership), which is a course that I have been teaching since I arrived. There are typically 25-28 students in the class but there is room for a few graduate students each semester. I wonder if 5685 (arts/cultural resource management and revenue streams) might be more appropriate for students who aspire to be museum administrators/development staff, but since that is a long process, there may be folks who are interested for their long-term goals.

The syllabi outlines that you provided are thorough explorations of the field, with the caveat that are heavy in curatorial and registration/collection management and do not appear to discuss much in the way of education, interpretation, learning, or public engagement/scholarship. These are aspects of the field that many people learn in their internships, but I would suggest covering the fundamentals in at least an introductory way in these courses.

I wanted to call your attention to another class that I teach, which is a museum practicum (syllabus attached). Rather than discussing education or interpretation, we talk about professional practices, systems thinking, building a network, grant-writing, and mentoring. I think this could be very useful to students who are graduating and would only require slight modifications to the syllabus. Again, these are things that might be experienced in an internship, but I found a similar class to be very helpful in terms of securing a position and navigating institutional politics when I began my career in museums.

Happy to talk further individually or as a group. Good luck as you proceed!

Dana

THE OHIO STATE UNIVERSITY

Dana Carlisle Kletchka, Ph.D.
Assistant Professor of Art Museum Education
Faculty Director, Museum Education Specialization
College of Arts and Sciences
Department of Arts Administration, Education and Policy
The Ohio State University

The Ohio State University
245E Sullivant Hall | 1813 N. High Street
Columbus, OH 43210
614.688.4412 | http://u.osu.edu/kletchka.1
Pronouns: she/her/hers / Honorific: Dr.

From: "Panero, Wendy" <panero.1@osu.edu>
Date: Monday, August 19, 2019 at 7:48 AM
To: "Kletchka, Dana" <kletchka.1@osu.edu>
Cc: "Babcock, Loren" <babcock.5@osu.edu>, "Saltzman, Matthew" <saltzman.11@osu.edu>
Subject: Museums museums museums

Hi Dana!

We've been busy in Earth Sciences since you and I last talked.

Loren Babcock is our new Museum Director. He's been working hard to spin up a lot of initiatives to modernize the museum and to get students active in both curation and outreach.

As part of this, we're proposing a Natural History Museum Certificate. If you don't know about certificates, they are a 12-credit hour curriculum that will be reflected on a student's transcript. While there is a lot of flexibility in their definitions, all 12 hours much be done through Ohio State (no transfers).

We are hoping to include some Art Education courses & seminars in the list of options. As the requirements are laid out, we anticipate that many of the graduate students pursuing this certificate - but few of the undergrads - will end up taking 1-2 of these courses.

I've attached a DRAFT of the proposal, where you can see the layout. I would like a few things from you: Can you comment on the inclusion of the classes/seminars we've listed - are they appropriate and accessible to a natural science student population? Are there classes that we missed? Classes we should not include?
Second: do these classes/seminars currently have the enrollment capacity to include a small handful of additional students?

Second, do you have broader comments about the proposal? As you will see in there, we have two new courses that we are proposing as part of this certificate. I'm also including their syllabi for your perusal.

All the best,

Wendy

Wendy Panero
Professor and Associate Director
School of Earth Sciences
Ohio State University

AE7748 AU18
syllabus.docx

From: **Saltzman, Matthew** saltzman.11@osu.edu
Subject: FW: ongoing curriculum development in SES
Date: December 22, 2019 at 1:49 PM
To: Panero, Wendy panero.1@osu.edu

MS

I don't have much from EEOB…this is all.

From: Panero, Wendy <panero.1@osu.edu>
Sent: Tuesday, August 27, 2019 2:51 PM
To: Freudenstein, John <freudenstein.1@osu.edu>
Cc: Saltzman, Matthew <saltzman.11@osu.edu>; Daly, Marymegan <daly.66@osu.edu>; Hamilton, Ian <hamilton.598@osu.edu>
Subject: Re: ongoing curriculum development in SES

Hi John, Ian and I got it figured out off line. Thanks!

Wendy Panero
Professor and Associate Director
School of Earth Sciences
Ohio State University

On Aug 27, 2019, at 2:50 PM, Freudenstein, John <freudenstein.1@osu.edu> wrote:

Wendy:

There is no such course as EEOB 4310. If you are referring to EEOB 5410 (Aquatic Ecosystems - Ocean Ecology), that was taught last year.

John

From: Panero, Wendy <panero.1@osu.edu>
Sent: Tuesday, August 27, 2019 1:20 PM
To: Freudenstein, John <freudenstein.1@osu.edu>
Cc: Saltzman, Matthew <saltzman.11@osu.edu>; Daly, Marymegan <daly.66@osu.edu>; Hamilton, Ian <hamilton.598@osu.edu>
Subject: Re: ongoing curriculum development in SES

Hi folks,

As a follow up, one of the classes in the Marine Science certificate, EEOB 4310, doesn't appear to have been offered in the last few years. Is that a temporary blip, or will this class be offered only infrequently?

Wendy

Wendy Panero

Professor and Associate Director
School of Earth Sciences
Ohio State University

On Aug 27, 2019, at 1:02 PM, Freudenstein, John <freudenstein.1@osu.edu> wrote:

Matt and Wendy:

We will work on this and get back to you. I am including Ian Hamilton, our Vice Chair for Undergraduate Education, on this, since he should also weigh in.

Regards, John

From: Saltzman, Matthew <saltzman.11@osu.edu>
Sent: Tuesday, August 27, 2019 12:39 PM
To: Freudenstein, John <freudenstein.1@osu.edu>; Daly, Marymegan <daly.66@osu.edu>
Cc: Panero, Wendy <panero.1@osu.edu>
Subject: ongoing curriculum development in SES

Hi John and Meg,

Wendy Panero and I wanted to follow up with you both about ongoing curricular revisions in Earth Sciences (Box invite sent separately). Attached are three key DRAFT documents (still with 'track changes': Earth Science BS revision, Museum Curation and Marine Science Certificates) that we'd particularly like to get your input on.

In general, we really hope you can comment on both the inclusion of the EEOB classes we've listed - are they appropriate and accessible to a natural science student population? Are there EEOB classes that we missed? Lastly, do these classes currently have the enrollment capacity to include a small handful of additional students?

Summary points from these documents include:

1) we are going from 4 BS tracks in Earth Sciences to 3. The table below is pasted in from the attached 'BS Program Revision' doc, and as you can see we have the EEOB 5420 course as an elective listed under 'Water'.

Two Water Classes (6-7 hours, including at least one EARTHSC course):			
EARTHSC	Hydrogeology	4 (L)	EARTHSC 1100, 1105,

5651			1108, 1121, 1151, 2203, OR 2205; and Math 1152 or above
EARTHSC 5655	Land Surface Hydrology	3	Math 1152 or above, and Physics 1250 or above
ENR 4285	Watershed Hydrology	3 (L)	Chem 1210, and Math 1151 or 1156
EEOB 5420	Aquatic Ecosystems: Ecology of Inland Waters	1.5	EEOB 3410
ENR 3280	Water Quality Management	2	
ENR 4260	Soil Resource Management	3	ENR 3000 or permission of instructor

For this BS track revision we are aiming for Fall 2020 as the implementation semester.

2) In addition to the revision to the BS, we have 6 new Certificates proposed, two of which have electives in EEOB. For the Museum Curation Certificate, we have 8 EEOB courses listed for electives. Let us know if you think these are a good fit and have capacity? In the Marine Science, there are 3 electives from EEOB. For the Certificates, we are aiming for Spring 2020 as implementation semester.

Last point to make is that Wendy is under some time constraints to get this submitted to our ASC Curriculum Committee, so we were hoping you might be able to offer some comments or suggestions in the next 1-2 weeks?! Sorry for the short fuse but it has been difficult to herd cats over the summer!

Happy to discuss in person or by phone if you have questions or comments as well.

Best regards,
Matt and Wendy

<image001.png>
Matthew R. Saltzman
Director and Professor
School of Earth Sciences
275 Mendenhall Lab, 125 South Oval Mall, Columbus, OH 43210-1398
6142920481 Office
saltzman.11@osu.edu

From: **Saltzman, Matthew** saltzman.11@osu.edu
Subject: FW: ongoing curriculum development in SES
Date: December 22, 2019 at 1:50 PM
To: Panero, Wendy panero.1@osu.edu

MS

From Geography…

From: Munroe, Darla <munroe.9@osu.edu>
Sent: Tuesday, October 15, 2019 11:01 AM
To: Saltzman, Matthew <saltzman.11@osu.edu>
Cc: Panero, Wendy <panero.1@osu.edu>
Subject: Re: ongoing curriculum development in SES

Wendy, verbiage here may be helpful?
https://geography.osu.edu/courses/2800

Darla K. Munroe, PhD
Professor and Chair
Faculty Advisory Board, Sustainability Institute
Editor in Chief, *Journal of Land Use Science*
Scientific Steering Committee, the Global Land Programme

The Ohio State University
College of Arts and Sciences Department of Geography
1036 Derby Hall, 154 North Oval Mall, Columbus, OH 43210
614-247-8382 Office
munroe.9@osu.edu osu.edu

From: "Saltzman, Matthew" <saltzman.11@osu.edu>
Date: Monday, October 14, 2019 at 3:25 PM
To: "Munroe, Darla" <munroe.9@osu.edu>
Cc: "Panero, Wendy" <panero.1@osu.edu>
Subject: RE: ongoing curriculum development in SES

Thanks Darla. 10:00 am is perfect. If we could meet here in Mendenhall 275 D that would be helpful so that Wendy can get to her class at 11.

Happy to talk about the latest on geospace as well. Wendy and I are in a holding pattern on that certificate while we await revisions from our geodetic science faculty. Because there is supposedly a high level UARC meeting taking place at Ohio State only 10 days from now, I'm sure this topic will come up (as it did at the last meeting in July).

Matt

Matthew R. Saltzman
Director and Professor
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614292048[illegible] Office

614292048 1 Office
saltzman.11@osu.edu

From: Munroe, Darla <munroe.9@osu.edu>
Sent: Monday, October 14, 2019 3:18 PM
To: Saltzman, Matthew <saltzman.11@osu.edu>
Cc: Panero, Wendy <panero.1@osu.edu>
Subject: Re: ongoing curriculum development in SES

Matt, great, yes, how about 10 am tomorrow? I'm free until noon.

Also, would love to go back to your geospatial certificate – if we could maybe partner on that, our people would be behind it.

Thanks,
Darla

Darla K. Munroe, PhD
Professor and Chair
Faculty Advisory Board, Sustainability Institute
Editor in Chief, *Journal of Land Use Science*
Scientific Steering Committee, the Global Land Programme

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munroe.9@osu.edu osu.edu

From: "Saltzman, Matthew" <saltzman.11@osu.edu>
Date: Monday, October 14, 2019 at 2:59 PM
To: "Munroe, Darla" <munroe.9@osu.edu>
Cc: "Panero, Wendy" <panero.1@osu.edu>
Subject: RE: ongoing curriculum development in SES

Hi Darla,

Now that Gretchen has put out a call for working groups in ASC relate to each of the four themes, as well as asking us to think about new themes, I wanted to get back in touch with you about Climate Change Certificate. Would you have time in the next day or so for a short 30 minute meeting about strategizing in the area of Climate Change? If you think this is a good idea, I could make anytime tomorrow morning work or Wednesday morning as well.

I am also going to reach out to Ian Howat to see if he would be interested in representing SES on one of the theme working groups, perhaps 'Sustainability' is ultimately where climate change will find a home (if not a new theme of its own). I know in your unit Bryan Mark (or Ellen Thompson) certainly have lots to contribute in the way of courses and expertise on the topic.

Thanks, Matt

THE OHIO STATE UNIVERSITY

Matthew R. Saltzman
Director and Professor
School of Earth Sciences
275 Mendenhall Lab, 125 South Oval Mall, Columbus, OH 43210-1398
6142920481 Office
saltzman.11@osu.edu

From: Munroe, Darla <munroe.9@osu.edu>
Sent: Tuesday, September 10, 2019 8:45 AM
To: Saltzman, Matthew <saltzman.11@osu.edu>
Cc: Panero, Wendy <panero.1@osu.edu>
Subject: Re: ongoing curriculum development in SES

Matt,

OK, great, will follow up with my faculty on the UARC meeting, good idea.

No, we have not talked certificate in Climate Change, I think we would also be keen on that.

Thanks,
Darla

Darla K. Munroe, PhD
Professor and Chair
Faculty Advisory Board, Sustainability Institute
Editor in Chief, *Journal of Land Use Science*
Scientific Steering Committee, the Global Land Programme

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munroe.9@osu.edu osu.edu

From: "Saltzman, Matthew" <saltzman.11@osu.edu>
Date: Sunday, September 8, 2019 at 5:42 PM
To: "Munroe, Darla" <munroe.9@osu.edu>
Cc: "Panero, Wendy" <panero.1@osu.edu>
Subject: RE: ongoing curriculum development in SES

Hi Darla,

Thanks much for the initial feedback, which is very helpful at this stage. Although 5 of our Certificates were submitted to the ASC Curriculum Committee for review, the Geodetic and Geospatial Certificate submission was delayed due to too many issues, both internally and externally. So for that specific piece I think we can plan to set up a meeting later in Fall semester to discuss the use of the word 'Geospatial' and involve a broader group of faculty from SES, Geography, CEGE and hopefully others as well. There is a meeting being arranged for October 24-25 with the National Geospatial-Intelligence

meeting being arranged for October 24-25 with the National Geospatial-Intelligence Agency (NGA) (about the possibility of a UARC at Ohio State), which I think Harvey Miller (perhaps others in Geography?) is involved in as well as Mike Bevis and CK Shum on our side of things. Perhaps that is good timing to revisit this.

We can also talk more about how we can help rework your Geography BS with mutual benefit to both units. Another area in which it seems logical for us to team up is in Climate Change – have you discussed anything along these lines of a Certificate? We discussed it on our end as an excellent idea, but the conversation didn't progress beyond that (no champion took it on) and I think we just went for what seemed like the lower hanging fruit.

Best, Matt

THE OHIO STATE UNIVERSITY

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275 Mendenhall Lab, 125 South Oval Mall, Columbus, OH 43210-1398
6142920481 Office
saltzman.11@osu.edu

From: Munroe, Darla <munroe.9@osu.edu>
Sent: Thursday, September 5, 2019 8:36 AM
To: Saltzman, Matthew <saltzman.11@osu.edu>
Cc: Panero, Wendy <panero.1@osu.edu>
Subject: Re: ongoing curriculum development in SES

Dear Matt,

OK, thanks for all this – some quick answers because I am under a big time crunch for SBS / new Exec Dean meetings.

This is too much for us to systematically review in a 2-week window, so I'm hoping we could delay a few weeks until we have a good chance to go through all of it. I would like our curriculum committee to discuss and also the GIS faculty. Ideally, I would really to combine forces so that your students are getting our electives and vice versa in a way that builds capacity in both sides.

Answers to your questions

1. 3900, 3901, 5900 all look good. Please add 5301 Sustainable Transportation in sustainability wherever it makes sense? We also have more classes coming on line later, hope to revisit.

2.

Geodetic certificate

If we have to do this on a short time horizon, I will say, our faculty won't accept a Geodetic and Geospatial Science certificate that has only one GIS elective. Claiming the term "geospatial" will probably directly hurt our GIS BS program.

I think there are lots of win-win solutions, however – here's one option

I would suggest you add the following courses of GEOG to the second category (Remote Sensing and Mapping/Visualization):
GEOG 5225 - Geographic applications of remote sensing
GEOG 5201 - Geovisualization

In your third category (GIS, GPS, or Data Analytics), at least two of our courses should fit perfectly:
GEOG 5210 - Fundamentals of GIS (you mistyped it as 5220, need to correct)
GEOG 5103 - Intermediate spatial data analysis

Applications category (suggested additions)
5300 Geography of Transportation
5301 Sustainable Transportation

Basically, if there is a healthy peppering of Geog classes throughout, I think we can live with “geospatial” – otherwise, should be solely “geodetic”, if that makes sense.

On our side, I hope to enrich the curriculum of our Geog BS (we currently have only 4 majors!!!) so we’ll be in touch later this year on that.

Please call if you want to follow up!!

Darla

Darla K. Munroe, PhD
Professor and Chair
Faculty Advisory Board, Sustainability Institute
Editor in Chief, *Journal of Land Use Science*
Scientific Steering Committee, the Global Land Programme

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munroe.9@osu.edu osu.edu

From: "Saltzman, Matthew" <saltzman.11@osu.edu>
Date: Sunday, August 25, 2019 at 3:22 PM
To: "Munroe, Darla" <munroe.9@osu.edu>
Cc: "Panero, Wendy" <panero.1@osu.edu>
Subject: ongoing curriculum development in SES

Hi Darla,

It was good to talk with you over coffee about various ways in which SES can partner with Geography, and I wanted to follow up on the aspect of our conversation that related to curriculum. I’m sharing here in-progress documents that lay out our ongoing curricular revisions in Earth Sciences (Box invite sent separately), which represents the culmination of a year-long planning exercise. Attached are some key DRAFT documents (still with ‘track changes’: Earth Science BS revision, Geodetic and Geospatial Certificate) that I’d

track changes: Earth Science BS revision, Geodetic and Geospatial Certificate) that I'd particularly like to get your input on. For the BS track this includes sustainability/climate course electives, some of which are in Geography.

We really hope you can comment on both the inclusion of the classes we've listed - are they appropriate and accessible to a natural science student population? And equally important - are there classes that we missed? Lastly, do these classes currently have the enrollment capacity to include a small handful of additional students?

Summary points from these documents include:

1) we are going from 4 BS tracks in Earth Sciences to 3. For all of these tracks we will have a requirement to complete at least 1 course focused on the Science of Sustainability. Are there courses you might suggest in Geography that would be a good fit for this requirement? Also, one of the 3 BS tracks is our 'water, climate and environment' track (maintained in large part by that Division in SES https://earthsciences.osu.edu/research) within which we have a requirement for 2 Climate classes (also 2 Water, 2 Environment classes) and seek your input on courses from Geography you think would be a good fit and have capacity. The table below is pasted in from the attached 'BS Program Revision' doc, and as you can see we have these 3 Geography course electives listed under 'Climate'.

Two Climate Classes (5-6 hours, including at least one EARTHSC course):			
EARTHSC 5206	Advanced Oceanography	3	EARTHSC 1100 or 1105 or 1121 or graduate standing or permission of instructor
EARTHSC 5650	Glaciology	3	EARTHSC 4450 or permission of instructor
GEOG 3900	Global Climate Change: Causes and Consequences	3	---
GEOG 3901	Global Climate and Environmental Change	3	---
GEOG 5900	Climatology	3	---

For this BS track revision we are aiming for Fall 2020 as the implementation semester.

2) In addition to the revision to the BS, we have 6 new Certificates proposed, most of which have electives in Geography. For the Geodetic and Geospatial Certificate, GEOG 5220 Fundamentals of GIS is listed as a Pick 1: GIS, GPS, or Data Analytics (3 hours). Are there other GEOG courses you think would be a good fit and have capacity? For the Certificates, we are aiming for Spring 2020 as implementation semester.

I also want to make it clear that we feel that these planned Certificates and BS track revisions in SES are complementary to any longer-term, collaborative efforts with your unit such as in the area of Physical Geography you had mentioned over coffee.

Last point to make is that Wendy is under some time constraints to get this submitted to our ASC Curriculum Committee, so we were hoping you might be able to offer some

comments or suggestions in the next 1-2 weeks?! Sorry for the short fuse but it has been difficult to herd cats over the summer!

Happy to discuss in person or by phone if you have questions or comments as well.

Best regards,
Matt

THE OHIO STATE UNIVERSITY

Matthew R. Saltzman
Director and Professor
School of Earth Sciences
275 Mendenhall Lab, 125 South Oval Mall, Columbus, OH 43210-1398
6142920481 Office
saltzman.11@osu.edu

From: **Saltzman, Matthew** saltzman.11@osu.edu
Subject: FW: ongoing curriculum development in SES
Date: September 17, 2019 at 3:34 PM
To: Panero, Wendy panero.1@osu.edu

MS

FYI

From: Lenhart, John <lenhart.49@osu.edu>
Sent: Tuesday, September 17, 2019 3:06 PM
To: Saltzman, Matthew <saltzman.11@osu.edu>
Cc: MacKay, Allison A. <mackay.49@osu.edu>
Subject: RE: ongoing curriculum development in SES

Hello Matt,

I apologize for the delay in getting back to you. Allison forwarded this on a few weeks ago for a review and we ran it through our undergraduate studies committee. That took a little time. Here are the comments that we came up with.

Earth Science Program Revision
From a programmatic perspective, the proposed changes to do not impact the environmental or civil engineering undergraduate programs. Students in the existing Earth System Science subprogram already have the option to take ENVENG 2100 or ENVENG 3200 so with the modification of this subprogram there should not be much of an impact. The following are provided as suggestions.

1. As presented in this draft, the information in the tables is difficult to follow. In addition, credit hours in some of the tables do not seem to add up correctly. Check to verify they are correct. Also consider modifying the tables describing the programs and changes to more clearly note the total credit hours required to graduate. It may also be beneficial to prepare tables that provide side-by-side comparisons of the existing and proposed B.S. programs.
2. Consider whether allowing the extended list of Earth Science GE courses to count equally as pre-requisites will adequately prepare students for the major. The intent is clear, but if the content of the courses differs widely then the student preparation may suffer.
3. Consider whether changing the subprogram title from “Earth System Science” to “Climate, Water, and the Environment” provides student benefit. There are already many degree programs on campus with “environment” or “environmental” in their title and adding another may lead to further student confusion.
    a. The groups of courses within this subprogram should be evaluated. For example, EnvEng 2100 should probably go under the “water” group as its focus is water chemistry. It does provide this content as it applies to environmental systems, but it is pretty focused on water. The same may apply to some of the other courses.
4. Consider a more concise name change for EARTHSC 2122(1122) as “Climate and Life over Billions of Years on Earth” is a little cumbersome and lengthy.

Proposed Certificate in Hydrology
This proposal is well conceived and will provide a tangible benefit to Earth Science students. The following are provided as suggestions.

1. Courses in geotechnical engineering (CIVILEN 3540 and 3541) could be beneficial as they include aspects of flow through porous media from a different perspective

2. The inclusion of CIVILEN 5130 and CIVILEN 5220 could be problematic for Earth Sciences students due to there prerequisites.

Let me know if you need us to do anything else.

Regards,

John

THE OHIO STATE UNIVERSITY

John J. Lenhart, Ph.D.
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The Ohio State University
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From: Saltzman, Matthew <saltzman.11@osu.edu>
Sent: Wednesday, August 21, 2019 9:04 AM
To: MacKay, Allison A. <mackay.49@osu.edu>; Weavers, Linda <weavers.1@osu.edu>
Cc: Panero, Wendy <panero.1@osu.edu>
Subject: ongoing curriculum development in SES

Hi Allison and Linda,

Hope your semester is off to a good start. I know Allison and I have our 'Plan of Actions' to deliver to the Provost next month, so we can commiserate on that!

I'm writing to follow up on separate conversations I've had with each of you this past year in which I had mentioned the ongoing curricular revisions in Earth Sciences, which involve both substantial changes to our BS degree tracks and also the creation of new Certificates. I'm sharing with you now these in-progress documents in a Box folder that lay out the proposed changes (Box invite sent separately). I'm attaching here the key DRAFT documents (Earth Science BS revision, Hydrogeology Certificate) that I'd like to get your input on, which include water/environmental course electives, some of which are in CEGE. There is also a DRAFT Geodetic Science Certificate in the Box folder that is floating around among our geodesists but with this cast of characters we're not sure when it will actually be ready for comment from your unit (perhaps CK Shum has already shared it with some over there…).

We really hope you can comment on both the inclusion of the classes we've listed below

- are they appropriate and accessible to a natural science student population? And equally important - are there classes that we missed? Lastly, do these classes currently have the enrollment capacity to include a small handful of additional students?

The summary points from these documents are:

1) we are going from 4 BS tracks in Earth Sciences to 3. One of the 3 tracks is our 'water, climate and environment' track (maintained in large part by that Division in SES https://earthsciences.osu.edu/research) which has class electives in CEGE. Specifically, within that BS track, we have a requirement for 2 Water classes and 2 Environment classes and seek your input on courses from CEGE you think would be a good fit and have capacity. For this we are aiming for Fall 2020 as the implementation semester. The table below is pasted in from the attached 'BS Program Revision' doc, and as you can see we have two ENVENG courses listed under 'Environment' but for the 'Water' electives do you think Applied Hydrology (CIVILEN 5130 or the 5220 Open Channel Hydraulics would be good fits?

Two Water Classes (6-7 hours, including at least one EARTHSC course):			
EARTHSC 5651	Hydrogeology	4 (L)	EARTHSC 1100, 1105, 1108, 1121, 1151, 2203, OR 2205; and Math 1152 or above
EARTHSC 5655	Land Surface Hydrology	3	Math 1152 or above, and Physics 1250 or above
ENR 4285	Watershed Hydrology	3 (L)	Chem 1210, and Math 1151 or 1156
EEOB 5420	Aquatic Ecosystems: Ecology of Inland Waters	1.5	EEOB 3410
ENR 3280	Water Quality Management	2	
ENR 4260	Soil Resource Management	3	ENR 3000 or permission of instructor
Two Environment Classes (6 hours, including at least one EARTHSC course)			
EARTHSC 5621	Introduction to Geochemistry	3	Rank 4 standing in EARTHSC or related field; Chem 1220 or above or permission of instructor
EARTHSC 5626	Chemical Geology	3	
EARTHSC 5203	Geo-Environment and Human Health	3	EARTHSC 2245 or GE data analysis course or equivalent; Soph standing or above; or permission of instructor
ENVENG 3200	Fundamentals of Environmental Engineering	3	Chem 1210
ENVENG 2100	Environmental Engineering Analytical Methods	3	Chem 1210 and 1220
ENR 3000	Soil Science	3	

2) In addition to the revision to the BS, we have 6 new Certificates proposed, two of which (Hydrogeology and Geodetic Science) have electives in CEGE. For the Hydrogeology Certificate, Applied Hydrology (CIVILEN 5130) is listed as a Surface Water

Hydrogeology Certificate, Applied Hydrology (CIVILEN 5130) is listed as a Surface Water Hydrology elective and the 5220 Open Channel Hydraulics is listed as a general elective. Are there other CEGE courses you think would be a good fit and have capacity? And by the way, if you don't know about certificates, they are a 12-credit hour curriculum that will be reflected on a student's transcript. For the Certificates, we are aiming for Spring 2020 as implementation semester. Wendy is the expert (cc'd here) so she can comment if you have further questions!

I also want to make it very clear that we feel that these planned Certificates and BS track revisions in SES are complementary to longer-term, collaborative efforts with your unit and others (e.g., SENR). We all can agree that there are higher level water- and geodetic-based curricular initiatives that could best serve the needs of certain populations of students at Ohio State.

Last point to make is that Wendy is under some time constraints to get this submitted to our ASC Curriculum Committee, so we were hoping you might be able to offer some comments or suggestions in the next 1-2 weeks?! Sorry for the short fuse but it has been difficult to herd cats over the summer!

Happy to discuss in person or by phone if you have questions or comments as well.

Best regards,
Matt and Wendy

Matthew R. Saltzman
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From: Saltzman, Matthew saltzman.11@osu.edu
Subject: FW: ongoing curriculum development in SES
Date: December 22, 2019 at 1:46 PM
To: Panero, Wendy panero.1@osu.edu

MS

From: Brooks, Jeremy S. <brooks.719@osu.edu>
Sent: Monday, September 9, 2019 10:40 AM
To: Saltzman, Matthew <saltzman.11@osu.edu>; Sharp, Jeff <sharp.123@osu.edu>
Cc: Panero, Wendy <panero.1@osu.edu>; Johnston, Renee <johnston.230@osu.edu>
Subject: Re: ongoing curriculum development in SES

Hi Matt,

Apologies for the delayed reply. Our Academic Affairs Committee at the end of August and your BS program revision and 2 proposed certificate programs were on the agenda. Unfortunately, the representative for our Aquatic Sciences group had to leave the meeting early for another commitment - and it was her feedback that would have been most useful. I have emailed the Aquatic Sciences faculty to solicit their feedback and I will summarize it and send it along once I've heard from everyone.

In the meantime, there is some feedback that I can share.

- we are supportive of the BS program revision and I can provide a letter (or a separate email) of concurrence if it is needed.

- I will wait for additional feedback on the Hydrogeology certificate program. However, there is one barrier to SENR students pursuing this certificate. Since two semesters of Calculus are required (in part as pre-reqs for required courses), our students (who are only required to take one (Math 1156 or 1151) might find that challenging.

- We think the Marine Sciences certificate meets a need, but I am waiting for more direct feedback on whether there are better courses that could be used in that program. For instance, ENR 5614 hasn't been taught for a few years (it's been taught as a summer course at Stone Lab) and it is generally geared towards professional educators. I don't foresee that class being taught again any time soon, so there may be better options from SENR.

Apologies again for the delay, and I hope that have more info from our Aquatic Sciences faculty soon.

Best

Jeremy

On Aug 29, 2019, at 2:42 PM, Sharp, Jeff <sharp.123@osu.edu> wrote:

Matt, Discussion of this will be an agenda item after our Academic Affairs Committee meeting on Friday and we should have some helpful feedback for you then. Jeff

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From: Saltzman, Matthew <saltzman.11@osu.edu>
Sent: Thursday, August 15, 2019 9:02 AM
To: Sharp, Jeff <sharp.123@osu.edu>
Cc: Panero, Wendy <panero.1@osu.edu>
Subject: ongoing curriculum development in SES

Jeff,

I know you are quite busy preparing for your meeting tomorrow but I wanted to share 3 in-progress documents with you that lay out our ongoing curricular revisions in Earth Sciences. The summary points from these documents are:

1) we are going from 4 BS tracks in Earth Sciences to 3. One of the 3 tracks is our 'water, climate and environment' track (maintained in large part by that Division in SES https://earthsciences.osu.edu/research) which has class electives in SENR. Specifically, within that BS track, we have a requirement for 2 Water classes and 2 Environment classes and seek your input on courses from SENR you think would be a good fit and have capacity.

2) In addition to the revision to the BS, we have 6 new Certificates proposed, two of which include Hydrogeology and Marine Science which have electives in SENR. The same question as posed above applies to these Certificate electives and course requirements – if there are courses from SENR you think would be a good fit and have capacity we would appreciate the feedback.

Independent of the above efforts, we are also looking forward to connecting with your SENR faculty and the SI on a higher level water-based curriculum initiative. We feel that these planned certificates and curriculum revisions in SES are complementary to further collaborative efforts with your unit and others (e.g., CEGE). Happy to discuss in person or by phone if you have questions or comments as well.

Best, Matt

<image001.png>
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