Michigan Tech

Office Memo

Office of the Provost and
Senior Vice President for Academic Affairs

Phone: (906) 487-2440
Fax: (906) 487-2935

TO: Richard Koubek, President

FROM: Jacqueline E. Huntoon, Provost & Senior Vice President for Academic Affairs

Jacqueline E Huntoon

DATE: April 22, 2021

SUBJECT: Senate Proposal 58-21

Attached is Senate proposal 58-21, “Establishment of a New Graduate Certificate in Natural Resource and Environmental Economics,” and a memo stating the Senate passed this proposal at their April 21, 2021 meeting. I have reviewed this memo and recommend approving this proposal.

I concur X do not concur _____ with this recommendation.

Richard Koubek, President

4/26/21

Date

Michigan Tech

University Senate

DATE:	April 22, 2021
TO:	Richard Koubek, President
FROM:	Samuel Sweitz University Senate President
SUBJECT:	Proposal 58-21
COPIES:	Jacqueline E. Huntoon, Provost & Senior VP for Academic Affairs

At its meeting on April 21, 2021, the University Senate approved Proposal 58-21, "Establishment of a New Graduate Certificate in Natural Resource and Environmental Economics". Feel free to contact me if you have any questions.

The University Senate of Michigan Technological University

Proposal 58-21

Establishment of a New Graduate Certificate in Natural Resource and Environmental Economics

Submitted by
Master of Science in Applied Natural Resource Economics (BNRE)
College of Business

1. Proposal Date: revised as of February 15, 2021
2. Proposing Contacts and Departments: Gary Campbell, BNRE Program Director (gacampbe@mtu.edu)
3. Sponsor Department Approvals: Approved by the faculty of the College of Business, November 13, 2020

4. General Description and Characteristics of Certificate
   4.1. The College of Business at Michigan Tech proposes a nine credit Certificate in Natural Resource and Environmental Economics. Natural Resource and Environmental Economics is used to analyze the issues involved with the exploitation and consumption of our natural resources and environment and the impact of those decisions on society. Graduate students will study how to use economics to analyze decisions and policies about the production and use of natural resources and the environment to complement their main field of study.
   4.2. Coursework in the Natural Resources and Environmental Economics Certificate is designed to guide graduate students in the development of the ability to use economics to analyze the issues and concerns about the production and use of natural resources and the impact on the environment for society's needs.
5. Rationale for the Certificate

   The production and use of natural resources and the impact on the environment involves more than just technical considerations. It also involves understanding the social impact of those technical decisions and what can be done to achieve more desired social outcomes. By earning this Certificate, graduate students from other academic backgrounds can learn how to use the tools of economics to expand their ability to analyze more aspects of the issues in their own field of study involving natural resources and the environment. This is an important skill as the concern about sustainability of activities is growing. This means companies across all industries have increased demand for workers with the necessary skills to evaluate the sustainability and environmental impacts of business processes and the use of natural resources, and to recommend changes where appropriate (demand above national average for 2019-20 according to the Bureau of Labor Statistics – see the table below). This

certificate will give students the knowledge and skills necessary to fill this growing need in the labor market for economists.

The Certificate should be of particular interest for students in areas like Civil and Environmental Engineering, Forestry, Mechanical Engineering, Environmental Policy, and Mining Engineering. All of these fields are expected to see significant employment growth over the next 10 years. For example, employment projections according to the Bureau of Labor Statistics for relevant occupations from 2019 to 2029 are included in the table below.

Occupation Classification	Projected Employment Growth (2019 – 2029)
Environmental Engineers	3.1%
Foresters	3.8%
Mechanical Engineering	3.9%
Environmental Scientists	7.8%
Mining/Geological Engineers	4.2%
Conservation Scientists	5.1%
Civil Engineers	1.7%

Projected employment growth in key fields of interest combined with an increased emphasis on environmental concerns and sustainable use of natural resources in both the public and private sectors indicates that the skills students learn through the Certificate will be in high demand by employers.

6. Related Programs

A comprehensive search of comparable or similar certificate programs at different times by different faculty turned up nothing comparable to this certificate program in the Great Lakes Environment and especially in Michigan. The three states focused on were Michigan, Wisconsin and Minnesota.

Two certificate programs in Michigan were found to be only obliquely related to our certificate: 1) the University of Michigan's School for Environment and Sustainability has a graduate certificate in "industrial ecology" that has some aspects related to economics, but it is not an economics certificate; and 2) Central Michigan University offers a graduate certificate in "recreation and park administration," where natural resource management plays an important role, but economics is even less relevant here.

Oregon State University offers a graduate certificate in "sustainable natural resources," but this certificate is only indirectly and minimally linked to economics. The University of

Florida's School of Forest Resources and Conservation offers several forestry-related graduate certificates that allow students to complete the requirements using some economics electives, but in no case are these economics courses required.

Looking closely at Michigan State University, several degree programs (undergraduate and graduate) as well as certificates have elements related to natural resource and environmental economics. However, in all cases there is one major difference. Given that MSU is Michigan's land grant institution, agriculture plays a large role in all cases. This area of emphasis is not relevant to Michigan Tech.

We did uncover a number of graduate certificate programs that are similar to what we wish to accomplish with our certificate. However, they are all at a great distance from the Great Lakes Environment, and thus do not specifically focus on Great Lakes resources:

Graduate Certificate in Environmental and Resource Economics, Portland State University

Environmental and Resource Economics Graduate Certificate Programs | Environmental and Resource Economics (pdx.edu)

This Certificate is similar to ours in terms of structure and curriculum content. There is a heavy emphasis on sustainability, which is also very important for our proposed certificate, but our program is more well-rounded, exploring other issues such as market failure, non-market valuation, natural resource markets, and competing sources of energy. The Portland State Certificate must be completed in one year.

Certificate in Natural Resource Management, University of Denver

Natural Resource Management | Graduate Certificate | University of Denver, University College

There are two offerings: a 4-course Certificate and a 6-course Certificate. Because DU is on the quarter system, the time to completion is not directly comparable, but it appears both Certificates must be completed in 12 months, just like Portland State. Given the strength of DU's law program, it is not surprising that several of the courses that can be taken for the Certificate focus on regulations and litigation with respect to natural resources. Our program has that element as well, but almost entirely in just one required course, EC4650 Environmental Economics. This program also places much more emphasis on health economics than our Certificate. In total, DU's program offers 22 required or elective courses for completion of the certificate, which means the course curriculum is broader than ours. A similarity, however, is that both our certificate and DU's allow (and require) coursework outside of economics. That said, our proposed Certificate focuses much more on economics than DU's.

Natural Resource Certificate in Conservation, Colorado State University (online)

Conservation Actions – Natural Resources Certificate | CSU Online (colostate.edu)

Again, this Certificate focuses on natural resource management, and economics is one component. So, the course offerings are broader, but our Certificate would appeal to students

specifically interested in the economics of the natural environment. It is not particularly strong in many areas of strength in our Certificate, including market failures (e.g., third-party exploitation, free riding, and overexploitation of common-property resources), health economics, energy management, and a unique element in our program, a mineral economics course.

Natural Resource Management and Sustainable Ecosystems Certificate, Harvard Extension School

Natural Resources & Eco-System Sustainability Certificate | Harvard Extension

Given that this is part of an extension school, there is a large agricultural component associated with this Certificate, which is probably the largest difference between this program and our proposal. Michigan Tech does not have a strong focus on agriculture, and it was never the intent to include agriculture as part of any of our economics programs including our Certificate. Another major difference is the same as those above: our Certificate focuses more closely on economics whereas the Harvard Extension certificate is more broadly interested in policy, where economics is only one component. There are similarities however: 1) this Certificate requires four courses; and 2) the curriculum is similar except for the agricultural component. Projected Enrollments

7. Projected Enrollments: Currently non-major graduate student enrollment in the classes indicate 10-15 students would be involved over the initial years. The number may increase as students become aware that a certificate is available. We anticipate individuals and firms in environmental- related industries (e.g., mining) will be interested in this degree, especially as Michigan Tech offers additional graduate certificates leading to Master's degrees.

8. Scheduling Plans: No scheduling changes are needed.

9. Curriculum Design: The Certificate will require that students take two courses in the area offered by the College of Business plus a third course that can be chosen from the approved course list. With approval of the Director of the COB Graduate Program or the COB Associate Dean, the third course can be a dual-listed 4xxx course for students in an accelerated master's program (e.g., EC4620 or EC4630). Students joining the program in either spring or fall are able to complete the certificate in three semesters, assuming prerequisites have already been met. The program will not be offered online at the present time, but might transition to online instruction in the future based on demand.

   College of Business courses – two required courses (6 credits)
   EC 5640 – Natural Resource Economics (3 credits)
   EC 5650 – Market Failure & Environment (3 credits)

   Third Course – Choose one from this approved course list – minimum of 3 credits
   EC 5620 – Energy Industry Economics (3 credits); dual-listed as EC 4620 Energy Economics
   EC 5630 – Mineral Industry Economics (3 credits); dual-listed as EC 4630 Mineral Industry Economics

ENG 5510 – Introduction to Sustainability & Resilience (3 credits); dual-listed as ENG 4510 Introduction to Sustainability & Resilience
FW 5088 – Economic Analysis of Forestry & FW 5180 – Ethics of Conservation and Sustainability; the latter is dual-listed as FW 4180 Ethics of Conservation and Sustainability (4 credits total)
SS 5300 – Environmental and Natural Resources Policy (3 credits)
SS 5325 – Water Policy, History, and Governance (3 credits); dual-listed as SS 4325 Water Policy, History, and Governance

10. Course Descriptions

EC 5640 - Natural Resource Economics
Analyzes the economic aspects of producing/using natural resources. Nonrenewable resources and renewable resources are discussed. The economics of land use, macroeconomic topics such as economic growth, sustainability and green accounting are considered. Credits: 3.0Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Level(s): Graduate Pre-Requisite(s): EC 2001 or EC 3002

EC5650 – Market Failure & Environment
Considers the efficient and equitable use of environmental resources. Measures the benefits and costs of decreasing pollution and protecting scarce ecological resources; addresses market failures and the economic valuation of environmental amenities. Requires students to learn quantitative and technical techniques to determine the efficient use of resources. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Level(s): Graduate Pre-Requisite(s): EC2001 or EC3002

EC 5620 - Energy Economics
Introduction to the institutional, technical, and economic issues of the production and use of energy resources, including petroleum, natural gas, coal, nuclear, electric utilities, and alternative energy. Research project applies economic analysis to supply, distribution, and use of energy resources, including environmental and social consequences. Credits: 3.0Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Restrictions: Permission of instructor required; Must be enrolled in one of the following Level(s): Graduate

EC 5630 - Mineral Industry Economics
Analyzes the economic aspects of the production/use of minerals in society. Uses economic analysis to explain behavior and policy implications for issues of supply, demand, markets, and foreign trade for important minerals. Analyzes the impact of government policies on the minerals industries. Credits: 3.0Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall, Spring Restrictions: Must be enrolled in one of the following Level(s): Graduate

ENG 5510 - Introduction to Sustainability and Resilience
Introduction to sustainable development, resilience, and global grand challenges with

emphasis on socio-technical systems. Key topics include earth systems literacy, policy development, corporate social responsibility, ecological economics, sustainability indicators, and industrial / societal applications (e.g. agricultural, mining sustainability, etc.). Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

FW 5088 - Economic Analysis of Forestry
Financial analysis and economic theory applied to forestry project analysis and selection, focusing on prices. Covers risk, capital markets, taxation, auctions, land valuation, harvesting decisions, and non-market valuation. Credits: 2.0 Lec-Rec-Lab: (2-0-0). Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Level(s): Graduate

FW 5180 - Ethics of Conservation and Sustainability
Discusses relationship between ecological science and environmental ethics as it relates to natural resource management, conservation and sustainability. Credits: 2.0 Lec-Rec-Lab: (0-2-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Level(s): Graduate

SS 5300 - Environmental and Natural Resources Policy
An overview of environmental and natural resource policies in the U.S. and internationally. Emphasizes policies regarding forests, wildlife, public lands, pollution, and climate change. Discussion of policy administration by the USDA Forest Service and National Park Service. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall - Offered alternate years beginning with the 2019-2020 academic year Restrictions: Must be enrolled in one of the following Level(s): Graduate

SS 5325 - Water Policy, History, and Governance
This seminar will explore the global history, politics, and governance of freshwater resources. Topics will include the effects of forestry, mining, watershed management, sanitation systems, privatization, climate change, fisheries, emerging contaminants, and agriculture on water systems and policies. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring - Offered alternate years beginning with the 2016- 2017 academic year

11. Model Schedule Demonstrating Completion Time

    Courses are offered each Fall and Spring semester so the certificate can be done in two or three semesters.

12. Library and other Learning Resources

    No new library or learning resources are needed

13. Faculty Resumes

    The faculty who teach Natural Resource Economics are:

    Gary Campbell, Professor
    William Breffle, Associate Professor
    Jenny Apriesnig, Assistant Professor

    CVs can be found at: https://www.mtu.edu/business/people-groups/faculty-staff/

14. Equipment: No additional equipment is required
15. Program Costs: No additional costs are anticipated as teaching and marketing activities will be concurrent with current MS efforts.
16. Space: No additional space is needed
17. Policies, Regulations, and Rules: Not applicable
18. Accreditation Requirements. No applicable professional accreditation
19. Planned Implementation Date: Fall 2021
20. Assessment

    Upon completion of the certificate, students will be able to:

    1. Design and implement economic analyses of issues involving natural resources and the environment.
    2. Communicate the results of economic analysis effectively.

    Assessment of the Certificate will be done by evaluating paper and oral presentation assignments in the required courses.