

**The University Senate of Michigan Technological University
Proposal 4-25**

**Establishment of a New Graduate Certificate in Advanced Geographic Information Science
for Natural Resources**

**Submitted by:
College of Forest Resources and Environmental Science**

Basic Program Information

Primary Contact: Parth Bhatt, Assistant Teaching Professor; David Flaspohler, Dean and Professor, College of Forest Resources and Environmental Science

Program/Degree Type: Certificate

Program Title: Advanced Geographic Information Science for Natural Resources

Planned Implementation Date: Fall 2025

Program location/modality: Online Asynchronous

Target student population: Graduates and Working Professionals

1. General description and Characteristics of the program

1.1. General Description: The courses included in this new online certificate currently exist and have been taught for a decade as in-person classes. This proposal describes the second of three planned certificates that together can be stacked to comprise an online MGIS degree. Alternatively, individuals can take one certificate alone to boost their knowledge and skills.

The objectives of the nine-credit Graduate Certificate in Advanced Geographic Information Science for Natural Resources are:

- a) Design and offer a sequence of courses that will enable natural resource professionals and students to develop and expand their expertise in advanced geographic information science.
- b) Facilitate hands-on experience in geographic information science applications that will empower natural resource professionals and students to successfully carry out and complete advanced GIS projects and/or pursue a Master's in GIS or another graduate degree.
- c) Equip students with industry-standard skill sets and prepare them for real-world geospatial applications.

1.1. Catalogue Description : The Certificate in Advanced Geographic Information Science for Natural Resources enables students to refine and modernize their skills in the analysis and management of complex geospatial datasets. The certificate includes lectures, computer laboratories, and field experiences. The Graduate Certificate Foundations in Geographic Information Science for Natural Resources is recommended as a prerequisite to this certificate.

2. Rationale for the Certificate

Over the last decade, CFRES has experienced sustained growth, resulting in an increasingly large and diverse graduate student community. In the era of big data, the need for mapping data and spatial analysis is escalating. This proposed certificate program in Geographic Information Systems (GIS) is designed to equip students and professionals with advanced GIS skills. It will open new doors for CFRES and MTU, attracting a diverse global community to take advantage of and advance their careers in a wide variety of areas.

For current students, this second certificate will enhance their graduate degree program by integrating a technological dimension. It will provide them with a competitive edge in the job market by broadening their skill set.

For professionals, this certificate serves as a platform for skill enhancement and career enrichment in GIS. It can be utilized as a stepping stone for career advancement, enabling them to secure new positions or pivot their career trajectory. For example, one of the classes in this certificate (Python Programming for ArcGIS Pro) was offered as a short 7-week non-credit online course during Fall 2023 and Spring 2024 to test the market and had total of 30 working professionals enrolled from various parts of US, which shows the high demand of online higher education.

Moreover, this certificate holds additional value as it can be incorporated into a Masters of Geographic Information Science degree program (as well as accelerated master's program), providing a seamless transition for those interested in further academic pursuits in this field. This proposal aims to cater to the growing demand in the GIS sector and provide comprehensive training for the next generation of GIS professionals. (See Fig. 1)

3. Related Online Programs: within MTU and at other Institutions

3.1 The College of Forest Resources and Environmental Science (CFRES) at Michigan Tech currently offers these Certificates:

- Graduate Certificate - Foundations in Geographic Information Science for Natural Resources
- Python for Modern GIS and Remote Sensing (non-credit)

3.2 Other Institutions:

- Geographic Information Science and Technology-University of Southern California
- Post Baccalaureate Certificate in Geographic Information Systems-Penn State
- GIS Fundamentals Certificate-University of Wisconsin-Madison
- Geographic Information Systems Online Certificate-Lawrence Technological University

The certificate and the proposed MGIS Online degree at CFRES are distinguished primarily by their exclusive focus on forestry, natural resource management, conservation, and environmental science, unlike the broader programs from others. It closely aligns in structure with some of the existing programs. The certificates in CFRES have been developed closely with GIS industry-led experts as well as improved based on the inputs from previous alumni working as GIS analysts. Additionally, CFRES will foster distinct collaborations and funding opportunities, leveraging partnerships with entities like Michigan DNR, other state agencies, and private industries.

4. Projected Enrollments

Enrollment in the in-person MGIS program has increased from 9 to 15 students. We anticipate that with the online program introduction, this number will grow significantly over time and enhance the institution's role as a leader in the online GIS education sector in the upper Midwest and in the US.

The proposed certificate aims to attract a growing segment of graduate students and working professionals interested in GIS, Remote Sensing, and Natural Resources. With an increasing societal emphasis on environmental sustainability, forest management, conservation, climate change, precision agriculture, and wildlife conservation, there is a heightened interest among students in these fields. This program is strategically designed to cater to this burgeoning interest, offering specialized curriculum and project opportunities that align with the challenges of our time.

Table 1 shows estimated minimum targets assuming a more aggressive marketing approach is deployed. The enrollment cap depends on the number of sections that can be allocated to each course.

Table 1. Estimated minimum enrollment targets by year.

Academic Year	Estimated Minimum Enrollment Targets	
	On-Campus	On-Line
2024-2025	1	1
2025-2026	3	2
2026-2027	5	4
2027-2028	5	6
2028-2029	5	10

5. Specialized Accreditation Requirements

None.

6. Professional Licensure Requirements

This is not a licensed profession.

7. Scheduling Plans

Online sections will be implemented asynchronously through a separate section of the course on Banweb.

8. Curriculum Details

The required and elective course list is shown below with the descriptions given below. All courses below have been offered face-to-face for several years and will be revised to be offered asynchronously online starting Summer 2025.

Required Courses - 9 credits

FW5553 – 3 cr (Fall/Summer)

FW5555 - 3 cr (Spring)

FW5556 - 3 cr (Spring)

9. Model Schedule Demonstrating Completion Time

The minimum completion time for online asynchronous students is two semesters with the current scheduling and the maximum time is three semesters. A typical schedule is shown below.

Semester	Course	Credits	Pre-reqs	Co-req
1 - Fall, Summer	FW5553 - Python Programming for ArcGIS	3	FW5550	NA
2 - Spring	FW5555 Advanced GIS Concepts and Analysis;	3	FW5550	NA
	FW5556 - GIS Project Management	3	FW5550	NA

10. Library and Other Learning Resources

Students will have access to the MTU Software Center to download the required class software, as well as MTU Library's online resources.

Faculty Information

11. Faculty Qualifications

The associated faculty, and the certificate courses they have taught, are given below. All of these faculty meet the standards of Senate Procedure 116.1.1, or will have completed the required training by Summer 2025.

Name	Role	Role Detail
Parth Bhatt, Graduate Faculty	MGIS Online Program Director, Assistant Teaching Professor/Researcher (FW5556, FW5555, FW5557, FW5553, FW5540, FW5541, FW5560)	https://www.mtu.edu/forest/about/faculty-staff/faculty/bhatt/
Mike Hyslop, Graduate Faculty	MGIS In-person Program Director, Teaching Professor (FW5556) Teaches in-person modality	https://www.mtu.edu/forest/about/faculty-staff/faculty/hyslop/
Mickey Jarvi, Graduate Faculty	Associate Teaching Professor (FW5555, FW5557) Teaches in-person modality	https://www.mtu.edu/forest/about/faculty-staff/faculty/jarvi/
Tao Liu, Graduate Faculty	Assistant Professor (FW5553, FW5540, FW5541, FW5560) Teaches in-person modality	https://www.mtu.edu/forest/about/faculty-staff/faculty/liu-t/

12. Equipment

No additional equipment will be needed. MTU, CFRES, has the required licenses for all of the software used in the three classes. Access to additional computing power and storage (SSD) may be needed for students depending on enrollment, however, lab fees should cover any other additional costs.

13. Program Costs

The most significant new cost to developing and administering this certificate is the salary for a teaching professor and this has been committed by the CFRES Dean. Costs will be incurred for developing the online content, but this should be covered by CFRES and eventually by the tuition return to the College. Some additional funds will be spent

on creating a space for the instructor to have video/audio conversations with students in a sound-dampened environment with a higher-quality camera and microphone. The Dean had committed funds to support this new space.

Besides the above-mentioned funds, some funds will be required to market this program, at the moment the instructor is utilizing free, open-source platforms (i.e., LinkedIn, Listservs) to market the first approved MGIS Certificate along with the help of MTU Global Campus.

14. Space

No additional space is required at the University or College level to support this program.

15. Policies, Regulations, and Rules

The responsibility for administration of the program will reside with the Graduate Program Director, and Graduate Program Assistant (CFRES) who report to the CFRES Dean.

16. Learning Goals and Assessment Plans

The certificate's Graduate Learning Objectives (GLO) are listed below, and the mapping to assessment points is shown in Table 2.

GLO1: Upon completion of this certificate, students will achieve advanced proficiency in generating, visualizing, processing, analyzing, and managing geospatial data through the application of industry-standard GIS software, including ArcGIS Pro, ArcGIS Online, and others, alongside advanced programming techniques like Python. They will master sophisticated GIS concepts and methodologies, enabling the analysis of large and complex datasets, the automation of routine geospatial workflows, and the effective management of geodatabases. Furthermore, students will cultivate expertise in designing, executing, and communicating comprehensive geospatial projects. These skills will empower them to address real-world challenges, deliver innovative solutions, and excel in professional and industry-level geospatial roles.

GLO2: Students will be able to apply and implement practical skills relevant to the field to real-world projects and research.

Table 2. Mapping of GLO to assessment points.

Assessment Points	Graduate Learning Objectives (GLO)
These will include embedded exam questions, a culminating final project, and final grades for FW5553, FW5555, FW5556.	GLO1
Lab Assessments and practical exams for FW5553, FW5555, FW5556	GLO2

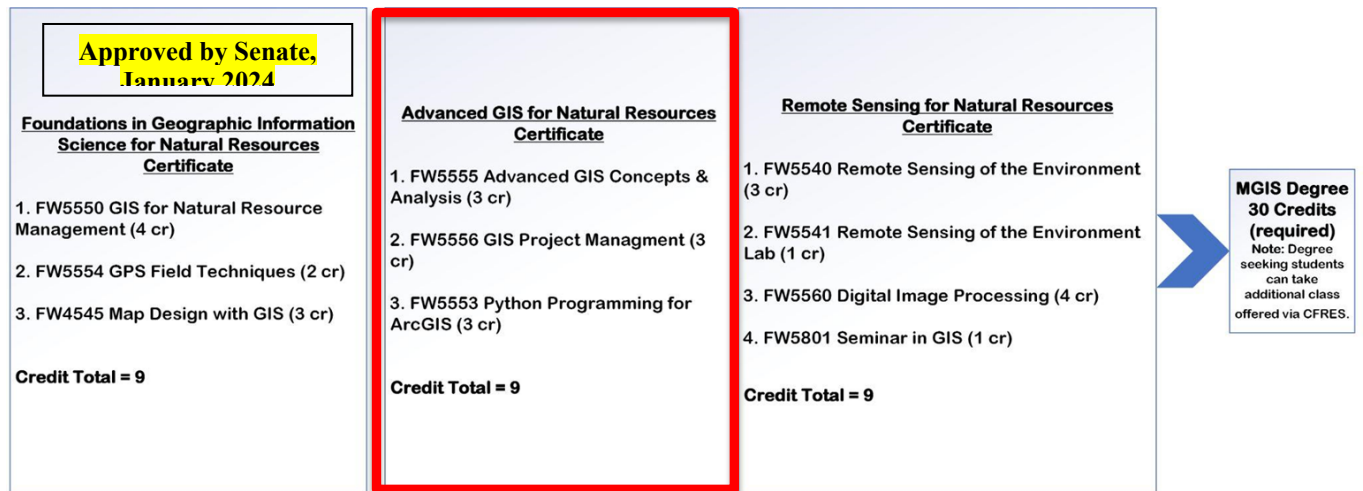


Fig. 1. How the Advanced GIS for Natural Resources Certificate Fits into Masters of GIS Program. This proposal is shown in the red box, and is the first of three certificates that, if taken in sequence, comprise a Masters of GIS.