Annual Departmental Report

Amended for 2020-2021 Academic Year to Accommodate and Reflect Adjustments due to Pandemic

There are amended instructions throughout this document to reflect the special circumstances of this academic year (AY20-21) that you will find red. As an institution and as departments we have learned that we can use our creativity to deliver learning even in the most difficult of circumstances.

Program Information

Program/Department: Environmental and Earth Science/Earth and Geographic Sciences
Department Chair: Elizabeth Gordon
Department Assessment Committee Contact: Elizabeth Gordon

This document is to be kept in the department and an electronic file is due to the AVP of Institutional Research & Planning by June 1, 2021.

A. Departmental Special Section for AY2021

Department Lessons Learned and Accomplishments
In thinking through the academic year, report on how the department adapted to changes brought on by the pandemic. Reflect on actions that surprised you, on lessons learned that will help in the future, and major accomplishments.

Earth and Geographic Sciences offered courses of various modalities through the pandemic. Our introductory course, GEOG1000, was offered in both hybrid and fully asynchronous formats to accommodate student needs. Our 1000 and 2000 level lab courses, some of which are required for the major and all of which are available for general education students, were offered in both onsync and hybrid formats. Students in Oceanography and Meteorology attended several labs in person during the semester, while students in Geology were equipped with personal 'rock boxes' so that they could complete required lab work remotely. Upper level students were able to gain some field experience during fall semester, despite the limitations put in place due to covid. Faculty members adjusted to remote learning by recording lectures and labs, holding online office hours, and providing extra supports for students when needed.

It became evident during the past year that it is difficult for many of our students to fully engage with courses, particularly lab work, when attending remotely. Students seemed more reluctant to ask for assistance, and it's more difficult for the instructor to gauge student

understanding through a screen. More students dropped or withdrew from courses compared to semesters past. For those who remained enrolled for the entire semester, more students performed poorly compared to 'normal' semesters, oftentimes simply because they did not complete required coursework. Many of our students were not as successful with remote learning compared to fully in person instruction.

That said, there were some aspects of remote teaching that faculty members may retain for future semesters. Most of our faculty members recorded their lectures, either as the replacement for in person lecture (asynchronous sessions) or recorded the in person session for students who wanted to review information again later. In both circumstances, students provided feedback that they benefited from being able to review lectures at their own pace or to double check their notes at a later date. Faculty may therefore elect to continue to record their lectures in future semesters. Some may do so in a flipped classroom model, in which they assign lectures to be viewed outside of class time and then devote the class session to detailed discussion.

Faculty members reported that some of the collaborative tools, such as the jamboard, helped to engage students in coursework. Such tools are likely to be used in future semesters, even when students are attending in person.

A couple of faculty members replaced final exams with final projects due to the remote format. The success of the final project as opposed to an exam to evaluate student learning this year has prompted the faculty members to retain this model going forward.

While most of our courses will return to fully in person learning come fall semester, faculty members will consider some asynchronous offerings in future semesters to reach students who may not be able to take the courses otherwise. In the asynchronous version of GEOG1000 during Spring 2021, for example, students achieved a high level of success. We may therefore offer at least one section of GEOG1000 in this modality in future academic years.

B. Program Learning Outcomes (PLOs) (Educational Objectives)

I. List of PLOs and the timeline for assessment.

PLO #	PLO – Stated in assessable terms	Where are the learning outcomes for this level/program published?	Timing of assessment (annual,	When was the last assessment of the PLO completed?

		(please specify) Include URLs where appropriate	**semester, bi-annual, etc.)**	
1.	Students will communicate scientific information through written, oral, and graphical expression with clarity, logical organization, and use of scientific evidence to support their ideas.	https://www.fitchburgstate.edu/academics/programs/environmental-and-earth-science-babs	Annual	AY19
2.	Students will use the scientific process, including experimental design, analysis and critical evaluation of information, and integration of evidence from relevant sources, in the context of environmental investigations.		Bi-annual	
3.	Students will apply an interdisciplinary approach to analyze and propose solutions to environmental science problems.		Bi-annual	
4.	Students will describe the complex interactions between humans and their environment, including geological hazards, air and water pollution, global environmental issues, and use and conservation of Earth's resources.		Annual	AY19
5.				

II. **PLO Assessment** (Please report on the PLOs assessed and/or reviewed this year. Programs should be assessing at least one each year.)

Using the table below, list and briefly describe the **direct method(s)** used to collect information assessing whether students are learning the core sets of knowledge (K), skills (S) and attitudes (A) identified as essential.

PLO # (from above)	**Assessment description (exam, observation, national standardized exam, oral presentation with rubric, etc.)**	**When assessment was administered in student program (internship, 4th year, 1st year, etc.)**	**To which students were assessments administered (all, only a sample, etc.)**	**What is the target set for the PLO? (criteria for success)**	**Reflection on the results: How was the "loop closed"?**
1	final paper for Climatology	3rd/4th year	all majors in course (both AY20 and 21)	all students at least proficient (3 on 4pt scale)	address gaps in key skills
3	final project for Water Resources and Society (create a water plan for a water-stressed city 50 years in the future)	variable (2nd - 4th year)	all majors in course	all students at least proficient (grade of 80% or higher)	implement more assignments earlier in the semester to help students begin to evaluate complex, interdisciplinary issues

If applicable, use the space below to report on PLO assessment impacted by the move to remote learning.

For PLO1 - the student artifacts for spring 2021 were fewer than anticipated - a couple of students withdrew from the course, one student stopped attending, and another did not complete the final project in time for assessment. This resulted in only seven artifacts. To address the low number, student artifacts from the same course offered in spring 2020 were combined with these data - this brought the number to 18.

Summary of Findings: Briefly summarize the results of the PLO assessments reported in Section II above combined with other relevant evidence gathered and show how these are being reviewed/discussed. How are you "closing the loop"? Please reflect on changes that the department has had to engage in given changes to teaching modality and especially capstone experiences.

Reflection Prompt	**Narrative Response**
Other than GPA, what data/ evidence is used to determine that graduates have achieved the stated outcomes for the degree? (e.g., capstone course, portfolio review, licensure examination)	**PLO1**: Final paper for Climatology, a course required for Environmental and Earth Science students. This course is typically taken in the 3rd or 4th year. -78% of students wrote an effective abstract -78% of students demonstrated proper writing mechanics for scientific communication -72% properly cited sources and used appropriate sources of information -83% used figures and tables effectively There was a notable difference in student success regarding these criteria between spring 2020 vs spring 2021 - students in 2020 demonstrated much higher levels of success (avg 90%) vs

	those in 2021 (<60% on most skills). It is not clear if this was due to covid burnout or some other factor. **PLO3:** Final project for Water Resources and Society. This is an elective course for our majors typically taken by 2nd-, 3rd-, or 4th-year students. 90% properly cited and formatted their sources 50% demonstrated a satisfactory understanding of the complexity of the issues of water supply (economical, societal, environmental factors) 70% evaluated and synthesized interdisciplinary data (economical, societal, environmental) in order to propose a solution to an environmental problem (loss of freshwater supply)
Who interprets the evidence? **What is the process? (e.g. annually by the curriculum committee)**	**PLO1:** evaluated by faculty member using rubric **PLO3:** evaluated by faculty member with grading rubric
What changes have been made as a result of using the data/evidence? (close the loop)	**PLO1:** A librarian session was scheduled during spring 2021, and while feedback from students was positive, many students were not proficient at properly citing sources. The instructor will include additional information literacy exercises during the next course offering to improve student success with identifying and citing sources. **PLO3:** When this course is next offered, the instructor will have more assignments and in-class discussions leading up to the final project that help students synthesize interdisciplinary data, better understand complex issues, and apply that knowledge to a new scenario.

C. Assessment Plan for Program/Department

I. Insert the program or department Assessment Plan

II. Explain any changes in the assessment plan including new or revised PLOs, new assessments that the program/department plans to implement and new targets or goals set for student success.

There have been no changes this year.

III. If you do not have a plan, would you like help in developing one?

n/a ☐

D. Program Review ActionPlan or External Accreditation Action Letter/Report

Annual Reflection/Follow-up on Action Plan from last Program Review or external accreditation (only complete the table that is appropriate for your program)

I. Programs that fall under Program Review:

i. Date of most recent Review: **Oct 2020**

ii. Insert the Action Plan table from your last Program Review and give any progress towards completing the tasks or achieving targets set forth in the plan.

Specific area where improvement is needed	Evidence to support the recommended change	Person(s) responsible for implementing the change	Timeline for implementation	Resources needed	Assessment Plan	Progress Made this Year
See attached table						To begin AY22

iii. If you do not review and ☐ have an action plan, would you like help in developing one based on your last program needs of the program? **n/a**

II. Programs with external Accreditation: n/a

i. Professional, specialized, State, or programmatic accreditations currently held by the program/department.
ii. Date of most recent accreditation action by each listed agency.
iii. Date and nature of next review and type of review.

List key issues for continuing accreditation identified in accreditation action letter or report.	**Key performance indicators as required by agency or selected by program (licensure, board or bar pass rates; employment rates, etc.)(If required.)**	**Update on fulfilling the action letter/report or on meeting the key performance indicators.**

E. Departmental Strategic Initiatives

Accomplished Initiatives AY 20-21 Add more rows as needed	**Corresponding Strategic Plan Goal & Strategy** Goal # followed by Strategy # ex: 1.3	**Indicate if a Diversity, Equity and Inclusiveness (DEI) Goal**
completed self study review and developed action plan, so no initiatives to report on for this year		☐

		☐
		☐
		☐

Planned Initiatives for AY 2021-22 Add more rows as needed	Associated Strategic Plan Goal & Strategy Goal # followed by Strategy # ex: 1.3	Indicate if a Diversity, Equity and Inclusiveness (DEI) Goal
Community building and revival of student club	**1.2** *Establish a learning environment in which academic and co-curricular programs work in synergy to offer applied learning experiences that prepare students for purposeful personal and professional lives.*	☐
Career mapping, through DEF work	**2.5** *Integrate career services into departments and curriculum, and build more consistent career advising across campus, especially for first-year students and sophomores.*	☐
Professional development and curriculum integration of newly acquired drone	**4.4** *Provide faculty and staff professional development opportunities and appropriate tools, including technology, to ensure they can be effective in their roles.*	☐
Expand use of OER and further develop social justice components of departmental courses	**2.1** *Achieve a cultural shift around how we advise, mentor, and teach all students, especially traditionally underrepresented and underserved students, so that we meet them where they are.*	■

Develop pathways/Early college offerings	**2.1** *Achieve a cultural shift around how we advise, mentor, and teach all students, especially traditionally underrepresented and underserved students, so that we meet them where they are.*	[redacted]

F. Departmental Reflection:

Take this section to reflect on--

1) *Initiatives that you may be considering for 22-23 academic year that you did not already capture above.*

-Expansion of articulation agreements with nearby community colleges
-Collaboration with other departments to expand interdisciplinary course offerings and, possibly, minors

2) *Reflect on how the department adapted to the pandemic. Reflect on actions that surprised you and on lessons learned that will help in the future.*

Environmental and Earth Science Curriculum and Assessment

I. Catalog description of major requirements

A BS or BA in Environmental and Earth Science require at least 36 credit hours. Required courses include:

Core requirements (27 credits):

GEOG 1000 - Earth Systems Science 3 cr. Or ENSC 1000 - Introduction to Environmental Science 3 cr.
GEOG 2100 - Geology 3 cr.
GEOG 2400 - Introduction to Geospatial Technologies 3 cr. Or GEOG 3120 - Computer Cartography 3 cr.
GEOG 2500 - Oceanography 3 cr.
GEOG 3110 - Climatology 3 cr.
GEOG 4000 - Geographic Information System 3 cr. Or GEOG4002 GIS II or GEOG 4001 WebGIS
GEOG 4200 - Geomorphology 3 cr.
GEOG 4500 - Remote Sensing of the Environment 3 cr.
GEOG 4600 - Environmental Hydrogeology 3 cr.

An additional three courses chosen from (9 credits):
BIOL 1900 - General Biology II 4 cr. Or BIOL 2100 - Flora of New England 3 cr. Or BIOL 3100 - Conservation Biology 3 cr. or BIOL 3102 - Marine Biology 3 cr.
ENSC 2000 - Field Techniques in Environmental Science I 3 cr.
GEOG 2056 - Climate Change and Human History 3 cr.
GEOG 2200 - Meteorology 3 cr.
GEOG 2800 - Map Use 3 cr.
GEOG 3270 - Common Rocks and Minerals 3 cr.
GEOG 4220 - Structural Geology 3 cr.
GEOG 4700 - Geographic Perspectives on Conservation 3 cr.
GEOG 4900 - Independent Study in Geography 1, 2, 3 cr.
GEOG 4940 - Internship in Geography 3 cr. * or GEOG 4950 - Internship in Geography 6 cr. * or GEOG 4960 - Internship in Geography 12 cr. *
*(max 9 cr of internship to apply toward major)

Required cognate courses (27 cr): (to be taken as part of Liberal Arts and Sciences distribution and free electives):
BIOL 2300 - Ecology 4 cr.
CHEM 1300 - General Chemistry I 4 cr.
CHEM 1400 - General Chemistry II 4 cr.
MATH 1700 - Applied Statistics 3 cr.
MATH 1300 - Precalculus 4 cr. or MATH 2300 - Calculus I 4 cr.
PHYS 2300 - General Physics I 4 cr. or PHYS 2600 - Calculus-Based Physics I 4 cr.
PHYS 2400 - General Physics II 4 cr. or PHYS 2700 - Calculus-Based Physics II 4 cr.

II. Assessment Plan

Students who complete a major in Environmental and Earth Science will demonstrate a scientific understanding of how the Earth operates as a system and how humans interact with their environment. They will be able to distinguish between science and non-science, back up arguments with quantitative evidence, communicate their ideas effectively, and explain the necessity and characteristics of an interdisciplinary approach to solving environmental problems.

Environmental and earth science students will:

- communicate scientific information through written, oral, and graphical expression with clarity, logical organization, and use of scientific evidence to support their ideas.
- use the scientific process, including experimental design, analysis and critical evaluation of information, and integration of evidence from relevant sources, in the context of environmental investigations.
- discuss the structure and composition of Earth's interior, surface, and atmosphere, and explain what it means to consider Earth as a system.
- apply an interdisciplinary approach to analyze and propose solutions to environmental science problems.
- describe the complex interactions between humans and their environment, including geological hazards, air and water pollution, global environmental issues, and use and conservation of Earth's resources.

1. Students will communicate scientific information through written, oral, and graphical expression with clarity, logical organization, and use of scientific evidence to support their ideas.

1.1. Information literacy: locate, evaluate, and use relevant information effectively.
1.2. Written communication
1.3. Oral communication
1.4. Graphical/visual

2. Students will use the scientific process, including experimental design, analysis and critical evaluation of information, and integration of evidence from relevant sources, in the context of environmental investigations.

2.1. Gather, organize, interpret, and report scientific data in the context of environmental and earth science investigations.
2.2. Critically and logically analyze competing ideas, and distinguish between scientific and non-scientific approaches to solving problems.
2.3. Use common software (e.g., Excel) to organize and graphically present data.
2.4. Conduct spatial analysis in a GIS environment
2.5. Analyze an environmental issue using and processing remotely acquired imagery
2.6. Describe ethical principles related to scientific inquiry and use of Earth's resources.

3. Students will discuss the structure and composition of Earth's interior, surface, and atmosphere, and explain what it means to consider Earth as a system.

3.1. Describe the structure and composition of Earth's interior, surface (lithosphere, hydrosphere), and atmosphere
3.2. Identify interactions among lithosphere, atmosphere, hydrosphere, and biosphere
3.3. Illustrate and describe energy transfer and element cycling in the Earth system, such as Earth's energy budget, atmospheric circulation, ocean circulation, and the carbon cycle.
3.4. Discuss constructional forces that have shaped Earth's surface (e.g., plate tectonics), theories and evidence of crustal movements, and the effects of crustal movements on Earth's landscape; erosional-depositional processes that change the earth's surface (e.g., weathering, erosion); and describe processes by which water moves on, above, and beneath Earth's surface
3.5 describe Earth's physical evolution through geologic time

4. Students will apply an interdisciplinary approach to analyze and propose solutions to environmental science problems.

4.1. Integrate principles of earth science, physics, chemistry, and biology to answer geoscience questions.
4.2. Apply mathematical principles to quantitatively interpret geoscience data.

5. Describe the complex interactions between humans and their environment, including geological hazards, air and water pollution, global environmental issues, and use and conservation of Earth's resources.

5.1. Discuss society's dependence on Earth resources, such as mineral, rock resources, soil, and water resources; fossil fuels.

5.2. Explain natural hazards related to earth system processes.

5.3. Evaluate the effect of human activity on Earth's natural processes (e.g., global warming, ozone depletion, air pollution, water pollution).

The curriculum to achieve these objectives is as follows:

To gain content knowledge in the **physical environment**, students will take six courses (18 credits):
GEOG1000 *Earth Systems Science,* **OR** ENVS1000 *Introduction to Environmental Science* (3) OR GEOG2003 *Environmental Geology*
GEOG2100 *Geology* (3)
GEOG2500 *Oceanography* (3)
GEOG3110 *Climatology* (3)
GEOG4200 *Geomorphology* (3)
GEOG4600 *Environmental Hydrogeology*

To develop skills in **environmental spatial analysis**, students will take three courses (9 credits)
GEOG2400 *Introduction to Geospatial Technologies* OR GEOG3120 *Computer Cartography* (3)
GEOG4000 *GIS* (3)
GEOG4500 *Remote Sensing of the Environment* (3)

To understand **environmental interactions and applications** – students choose three courses (9 credits) from the following:
GEOG2200 *Meteorology*
GEOG2056 *Climate Change and Human History*
GEOG4220 *Structural Geology*
GEOG4700 *Geographic Perspectives on Conservation*
GEOG4900 Independent Study in Geo
GEOG4940/50/60 Internship in Geo
BIOL2100 *Flora of New England* OR BIOL3100 *Conservation Biology* OR BIOL3102 *Marine Biology*
ENSC2000 *Field Techniques in Environmental Science*
ENSC4050 *Internship in Environmental Science*

Required cognate courses allow students to integrate knowledge from various fields to address environmental problems:
Physics I and II
General Chemistry I and II
MATH1700
MATH1300 or 2300
BIOL2300 *Ecology*

Assessment plan, continued: Curriculum map, aligning outcomes with required and elective courses**.**

Courses-->	1000 *OR*	2003	2100	2400	2500	3110	400X	4200	4500	4600		2056	2200	4220	4700	4900
SLO	EES	Evn Geo	Geol	Geospatial	Ocean	Climo	GIS	Geomorph	Rem Sens	Hydro		CCHH	Meteorolog	structural	Log Pers Co	Internship
1. Students will communicate scientific information through written, oral, and graphical expression with clarity, logical organization, and use of scientific evidence to support their ideas.																
1.1. Information literacy						x						x				
1.2. written communication			x		x	x		x		x		x				x
1.3. oral communication						x	x	x	x	x					x	x
1.4. graph/visual				x	x	x	x	x	x	x			x			
2. Students will use the scientific process, including experimental design, analysis and critical evaluation of information, and integration of evidence from relevant sources, in the context of environmental investigations.																
2.1. Gather, organize, interpret, and report scientific data in the context of environmental and earth science investigations				x	x		x	x	x	x			x			x
2.2. Critically and logically analyze competing ideas, and distinguish between scientific and non-scientific approaches to solving problems																
2.3. Use common software (e.g., Excel) to organize and graphically present data					x	x							x			
2.4. Conduct spatial analysis in a GIS environment							x									
2.5. Analyze an environmental issue using and processing remotely acquired imagery									x							
2.6. Describe ethical principles related to scientific inquiry and use of Earth's resources.															x	
3. Students will discuss the structure and composition of Earth's interior, surface, and atmosphere, and explain what it means to consider Earth as a system.																
3.1. Describe the structure and composition of Earth's interior, surface (lithosphere, hydrosphere), and atmosphere.	x	x	x		x	x		x		x			x			varies
3.2. Identify interactions among lithosphere, atmosphere, hydrosphere, and biosphere	x	x			x	x							x		x	
3.3. Illustrate and describe energy transfer and element cycling in the Earth system, such as Earth's energy budget, atmospheric circulation, ocean circulation, and the carbon cycle.	x	x			x	x							x			
3.4. Discuss constructional forces that have shaped Earth's surface (e.g., plate tectonics), theories and evidence of crustal movements, and the effects of crustal movements on Earth's landscape; erosional-depositional processes that change the earth's surface (e.g., weathering, erosion); and describe processes by which water moves on, above, and beneath Earth's surface.	x	x	x		x			x		x						
3.5. describe Earth's physical evolution through geologic time						x										
4. Students will apply an interdisciplinary approach to analyze and propose solutions to environmental science problems.																
4.1. Integrate principles of earth science, physics, chemistry, and biology to answer geoscience questions.		x				x		x	x	x					x	
4.2. Apply mathematical principles to quantitatively interpret geoscience data.	x	x	x	x	x	x	x	x	x	x			x		x	
5. Describe the complex interactions between humans and their environment, including geological hazards, air and water pollution, global environmental issues, and use and conservation of Earth's resources.																
5.1. Discuss society's dependence on Earth resources, such as mineral, rock resources, soil, and water resources; fossil fuels.		x								x					x	
5.2. Explain natural hazards related to earth system processes		x	x							x			x			
5.3. Evaluate the effect of human activity on Earth's natural processes (e.g., global warming, ozone depletion, air pollution, water pollution)	x	x			x	x						x	x		x	

Assessment plan, continued: Assessment process

PLO #	PLO	Frequency of assessment	Assessment tool	Process (who performs assessment, analyzes data)
1.	Students will communicate scientific information through written, oral, and graphical expression with clarity, logical organization, and use of scientific evidence to support their ideas.	Annual	Manuscripts Presentations Student-created graphs Student-created maps	Instructor uses rubric to assess
2.	Students will use the scientific process, including experimental design, analysis and critical evaluation of information, and integration of evidence from relevant sources, in the context of environmental investigations.	Every 2-3y	Lab reports	Instructor
3.	Students will discuss the structure and composition of Earth's interior, surface, and atmosphere, and explain what it means to consider Earth as a system.	Annual	Exam question in relevant course	Instructor grades question
4.	Students will apply an interdisciplinary approach to analyze and propose solutions to environmental science problems.	Every 2-3y	Exam question in relevant course; Paper	Instructor grades question/essay
5.	Students will describe the complex interactions between humans and their environment, including geological hazards, air and water pollution, global environmental issues, and use and conservation of Earth's resources.	Every 2-3y	Exam question in relevant course; Position paper	Instructor grades question/essay

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Department Chair: Elizabeth Gordon
Department Assessment Committee Contact: Elizabeth Gordon

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understanding through a screen. More students dropped or withdrew from courses compared to semesters past. For those who remained enrolled for the entire semester, more students performed poorly compared to 'normal' semesters, oftentimes simply because they did not complete required coursework. Many of our students were not as successful with remote learning compared to fully in person instruction.

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		(please specify) Include URLs where appropriate	**semester, bi-annual, etc.)**	
1.	Students will describe and analyze physical and human conditions on Earth's surface using geographic terms and concepts.	https://www.fitchburgstate.edu/academics/programs/geographic-science-and-technology-babs	Annual	
2.	Students will communicate via written and oral expression with clarity, logical organization, and with effective argument using geographic data and analysis.		Bi-annual	AY19
3.	Students will identify a research problem and use relevant data and other sources of information to conduct geographic research.		Bi-annual	
4.	Students will acquire, interpret, and present spatial information by graphic means including maps, graphs, images, and other means such as databases.		Bi-Annual	
5.	Students will use geospatial technologies including GIS, Remote Sensing, and other relevant technology (e.g., GPS) for analyzing geographic phenomena, performing spatial analysis, and solving geographic problems.		Annual	AY19

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1	final paper for Climatology	3rd/4th year	all majors in course (both AY20 and 21)* **only three students*	all students at least proficient (3 on 4pt scale)	address gaps in key skills

If applicable, use the space below to report on PLO assessment impacted by the move to remote learning.

Assessment data was mostly affected by low enrollments – only three student artifacts (two from Sp20 and one from Sp21) were available for students from this major

Also note that Dr. Huang, who teaches most of our core GST courses, was on leave for AY21, so assessment of the program was limited this year.

Summary of Findings: Briefly summarize the results of the PLO assessments reported in Section II above combined with other relevant evidence gathered and show how these are being reviewed/discussed. How are you "closing the loop"? Please reflect on changes that the department has had to engage in given changes to teaching modality and especially capstone experiences.

Reflection Prompt	Narrative Response
Other than GPA, what data/ evidence is used to determine that graduates have achieved the stated outcomes for the degree? (e.g., capstone course, portfolio review, licensure examination)	**PLO1**: Final paper for Climatology, a course required for Environmental and Earth Science students. This course is typically taken in the 3rd or 4th year. -100% of students wrote an effective abstract -67% of students demonstrated proper writing mechanics for scientific communication -67% properly cited sources and used appropriate sources of information -67% used figures and tables effectively
Who interprets the evidence? What is the process? (e.g. annually by the curriculum committee)	evaluated by faculty member using rubric
What changes have been made as a result of using the data/evidence? (close the loop)	With only three students, it's difficult to draw broad conclusions and make changes, but as noted for Environmental and Earth Science students, additional information literacy exercises will be incorporated into this particular course

C. Assessment Plan for Program/Department

I. Insert the program or department Assessment Plan

II. Explain any changes in the assessment plan including new or revised PLOs, new assessments that the program/department plans to implement and new targets or goals set for student success.

There have been no changes this year.

III. If you do not have a plan, would you like help in developing one?

n/a ☐

D. Program Review ActionPlan or External Accreditation Action Letter/Report

Annual Reflection/Follow-up on Action Plan from last Program Review or external accreditation (only complete the table that is appropriate for your program)

I. Programs that fall under Program Review:

i. Date of most recent Review: **Oct 2020**

ii. Insert the Action Plan table from your last Program Review and give any progress towards completing the tasks or achieving targets set forth in the plan.

Specific area where improvement is needed	Evidence to support the recommended change	Person(s) responsible for implementing the change	Timeline for implementation	Resources needed	Assessment Plan	Progress Made this Year
See attached table						To begin AY22

iii. If you do not review and ☐ have an action plan, would you like help in developing one based on your last program needs of the program? **n/a**

II. Programs with external Accreditation: n/a

i. Professional, specialized, State, or programmatic accreditations currently held by the program/department.
ii. Date of most recent accreditation action by each listed agency.
iii. Date and nature of next review and type of review.

List key issues for continuing accreditation identified in accreditation action letter or report.	Key performance indicators as required by agency or selected by program (licensure, board or bar pass rates; employment rates, etc.)(If required.)	Update on fulfilling the action letter/report or on meeting the key performance indicators.

E. Departmental Strategic Initiatives

Accomplished Initiatives AY 20-21 Add more rows as needed	Corresponding Strategic Plan Goal & Strategy Goal # followed by Strategy # ex: 1.3	Indicate if a Diversity, Equity and Inclusiveness (DEI) Goal
completed self study review and developed action plan, so no initiatives to report on for this year		☐

		☐
		☐
		☐

Planned Initiatives for AY 2021-22 Add more rows as needed	Associated Strategic Plan Goal & Strategy Goal # followed by Strategy # ex: 1.3	Indicate if a Diversity, Equity and Inclusiveness (DEI) Goal
Community building and revival of student club	**1.2** *Establish a learning environment in which academic and co-curricular programs work in synergy to offer applied learning experiences that prepare students for purposeful personal and professional lives.*	☐
Career mapping, through DEF work	**2.5** *Integrate career services into departments and curriculum, and build more consistent career advising across campus, especially for first-year students and sophomores.*	☐
Professional development and curriculum integration of newly acquired drone	**4.4** *Provide faculty and staff professional development opportunities and appropriate tools, including technology, to ensure they can be effective in their roles.*	☐
Expand use of OER and further develop social justice components of departmental courses	**2.1** *Achieve a cultural shift around how we advise, mentor, and teach all students, especially traditionally underrepresented and underserved students, so that we meet them where they are.*	■

Develop pathways/Early college offerings	**2.1** *Achieve a cultural shift around how we advise, mentor, and teach all students, especially traditionally underrepresented and underserved students, so that we meet them where they are.*	[redacted]

F. Departmental Reflection:

Take this section to reflect on--

1) *Initiatives that you may be considering for 22-23 academic year that you did not already capture above.*

-Expansion of articulation agreements with nearby community colleges
-Collaboration with other departments to expand interdisciplinary course offerings and, possibly, minors

2) *Reflect on how the department adapted to the pandemic. Reflect on actions that surprised you and on lessons learned that will help in the future.*

Geographic Science and Technology Curriculum and Assessment

I. Catalog description of major requirements

Required Courses

GEOG 1000 - Earth Systems Science 3 cr.
GEOG 1100 - Principles of Human Geography 3 cr. ***
GEOG 2400 - Introduction to Geospatial Technologies 3 cr.
GEOG 3120 - Computer Cartography 3 cr.
GEOG 4000 - Geographic Information System 3 cr. or
GEOG 4003 - Geographic Information Systems II 3 cr.
(one of the two could count as a major elective if both are taken)
GEOG 4500 - Remote Sensing of the Environment 3 cr.

Additional 6 Elective Courses

GEOG 2056 - Climate Change and Human History 3 cr.
GEOG 3000 - Geographic Economic System 3 cr.
GEOG 3004 - GIS for Criminal Justice 3 cr.
GEOG 3100 - Political Geography 3 cr.
GEOG 3110 - Climatology 3 cr.
GEOG 3200 - U.S. and Canada 3 cr.
GEOG 3300 - Urban Geography 3 cr.
GEOG 3400 - Population Geography 3 cr. ***
GEOG 4001 - Web GIS 3 cr.
GEOG 4000 - Geographic Information System 3 cr. or
GEOG 4003 - Geographic Information Systems II 3 cr. (unless used as a major requirement)
GEOG 4200 - Geomorphology 3 cr.
GEOG 4700 - Geographic Perspectives on Conservation 3 cr. ***
GEOG 4940 - Internship in Geography 3 cr.
GEOG 4950 - Internship in Geography 6 cr. or
GEOG 4960 - Internship in Geography 12 cr. (maximum 12 credits counting toward major)
ECON 1200 - Principles of Economics: Microeconomics 3 cr. *
ECON 2550 - Urban Economics 3 cr. *
POLS 1500 - State and Urban Government 3 cr. *
POLS 1300 - Introduction to International Relations 3 cr. *
*Maximum two courses among the four counting toward the major.

Required Cognate Courses:

CSC 1500 - Computer Science I 3 cr.
MATH 1300 - Precalculus 4 cr. (or above)

II. Assessment Plan

The Earth and Geographic Sciences Department expects that each Geographic Science and Technology graduate should have a well-rounded understanding of geographic knowledge and skills. With this intent, the program requires the students to take a series of courses which include the following essential elements of geography.

1. The use of maps to present and interpret patterns of physical and human characteristics on the Earth's surface;
2. The distinctiveness of places and regions with respect to the integration of physical and human characteristics;
3. Description and explanation of human characteristics and their spatial distribution on the Earth's surface, including composition of population, cultural complexes, economic interdependence, settlement and political patterns;
4. Human-environment interactions, including the perception, distribution and use of natural resources.

The program provides students with opportunities to develop the following skills and understandings with respect to the elements of Geography:

1. Analytical thinking

Students should be able apply geographic terms and concepts in both description and analysis of physical and human conditions on Earth's surface. Pertinent courses: Geog1000 EES, 1100 Human Geo.

2. Written and oral expression

Students should be able to communicate via written and oral expression with clarity, logical organization, and with effective argument using geographic data and analysis. Pertinent courses: Geog2056 Climate Change, Geog3000 Econ Geo, Geog3100 Political Geo, Geog3110 Climatology, Geog3200 Regional Geo, Geog3300 Urban Geo, Geog3400 Pop Geo, Geog4200 Geomorph, Geog4700 Conservation

3. Research

Students should be able to identify a research problem and use relevant data and other sources of information to conduct geographic research. Pertinent courses: Geog2400 Intro, Geog2056 Climate Change, Geog3000 Econ Geo, Geog3100 Political Geo, Geog3110 Climatology, Geog3200 Regional Geo, Geog3300 Urban Geo, Geog3400 Pop Geo, Geog4200 Geomorph, Geog4700 Conservation

4. Graphic expression

Students should be able to acquire, interpret, and present spatial information by graphic means including maps, graphs, images, and other means such as databases. Pertinent courses: Geog3120 Cart, Geog3300 Urban Geo, Geog4000 GIS, Geog4001 Web GIS, Geog 4002, GIS II.

5. Geospatial technical skills

Students should be able to use geospatial technologies including GIS, Remote Sensing, and other relevant technology (e.g., GPS) for analyzing geographic phenomena, performing spatial analysis, and solving geographic problems. Pertinent courses: Geog2400 Intro, Geog3120 Cart, Geog3300 Urban Geo, Geog4000 GIS, Geog4001 Web GIS, Geog4002 GIS II, Geog4500 RS.

Public Health Sciences Assessment Plan (2021)

Program learning outcome Students will:	**Core Courses**	**Concentration specific**
- discuss the history and philosophy of public health.	Public Health in the US	
-use appropriate methods and tools to analyze public health data and discuss the importance of evidence based approaches.	MATH 1700 applied stats EPH2010 Epidemiology GEOG 2400 Intro to Geospatial Tech. EPH3050 Evaluation methods	GIS (EPH)
-explain the science of human health and disease, and discuss opportunities for promoting health.	BIOL 1200 BIOL 1300 EXSS 1000 Health and Fitness EXSS2400 Health Promotion or NURS2300 Health Assessment	
-describe the socioeconomic, behavioral, biological, and environmental factors that affect human health.	PSY 1100 SOC 1100 SOC 2750 Medical Sociology BIOL 2700 Medical Microbiology EPH3000 Environmental Health	CHEM1200 Chem for health sciences (EPH) ECON electives (PHP) SOC electives (PHP) PSY electives (PHP) GEOG (both)
-discuss the fundamental concepts and features of project planning, assessment, and evaluation	EPH3050 Evaluation Methods in Public health	Public Health Strategies (new, PHP)
-describe the characteristics of health systems in the US as well as other countries	EPH2000 Public Health in the United States	Public Health Strategies (new, PHP)
-explain the basic concepts of, and responsibilities of government in, the legal, ethical, economic, and regulatory dimensions of public health policy	POLS 1000 US Government PHIL 2001 Medical Ethics *or* PHIL 2500 Contemporary Ethical Problems ECON1100 Principles of Macroecon	POLS electives (PHP) GEOG3006 Environmental Policy (EPH)
-describe fundamental scientific principles related to environmental health	GEOG 1000 Earth Systems Science or GEOG2003 Environmental Geology EPH3000 Environmental Health	GEOG2XXX Water Resources and Society (EPH)
-explain how the built environment influences human health and contributes to health disparities	GEOG3300 Urban Geography SOC 2440 Urban Sociology	
-synthesize evidence from various sources to address environmental and public health issues	EPH3000 Environmental Health EPH3050 Evaluation Methods Internship	

Earth and Geographic Sciences departmental action plan
Response to recommendations by external evaluators
Programs reviewed: Environmental and Earth Science (EES); Geographic Science and Technology (GST)

We appreciate the feedback of the reviewers – Brad Hubeny of Salem State (denoted BH below) for EES and Will Hansen of Worcester State (denoted WH below) for GST. We have broken recommendations into the broad categories of: marketing and outreach; curriculum; and personnel and resources. We have further indicated our short term (0-2 years), medium range (3-5 years) and long-term (5-7) timelines for these actions, as well as a couple of recommendations that we do not intend to act upon.

<u>Marketing and outreach</u>

Short term (0-2 years)

- Use mission, vision, objectives to develop a coherent 'self identity', and then work with marketing department to promote (BH)
    - We agree that marketing the department will help with recruitments, and that having coherent messaging is an important first step. All faculty will begin discussion on our self-identity in May, and begin working with Marketing in the upcoming academic year.
- Explore participation in the Early College program with the Introduction to Geospatial Technologies and look for funding opportunities to allow additional outreach (WH).
    - Faculty in the department are interested in learning more about the Early College program. The Department Chair will arrange for Drew Goodwin to attend department meeting in Spring or Fall of 2021, and continue to work to identify applicable courses for Early College.

Medium range (3-5y)

- Pursue additional opportunities for outreach to local high schools and community groups (both)
    - Already part of the department's action plan, we will begin discussing opportunities for our students to return to their high schools and other youth groups once it is safe (post-pandemic) to do so. We will also continue/pursue department activities such as river clean-ups, geocaching activities, and outdoor expeditions such as hiking and canoeing/kayaking to build community within our department.
- Distribute department newsletter (BH)
    - Faculty in the department expressed skepticism that a print newsletter would be feasible, but we began to discuss other ways to increase our social media presence. We plan to continue to discuss avenues for publicizing faculty and student work, including the department's webpage. The department will pursue broader marketing efforts through collaboration with the marketing department, with the ultimate goal of developing a communications and marketing plan for the department.
- Raise awareness of the program within Fitchburg State though the development of activities highlighting the technologies and applications used in the curriculum (WH).
    - The department felt that this would best be accomplished through our student groups, which have become dormant during COVID. We anticipate reviving the groups (ELF/GeoClub and GIS club) within the next couple of years as we build community more broadly within the department.
- Expand community outreach by cooperative projects with local groups through the Geospatial expertise of the faculty and students, and continue to work with the Crocker Center to develop community service opportunities for faculty and students (WH).
    - As noted in the personnel section, expanding opportunity that involves geospatial expertise relies heavily on Dr. Huang. The department will continue to request a new hire with complementary experience so that this goal may be achieved.

Long-term (5-7y)

- Consider establishing an advisory board (WH)
    - The department agrees that an advisory board could serve an important role in developing opportunities for our students as well as shaping the future of the department. Faculty will continue to

build on existing partnerships and collaborations in the near-term, with the goal of identifying potential board members for an advisory board in the long-term. We would connect with local entities such as the Fitchburg Department of Public Works, Nashua River Watershed Association, and the Fitchburg Greenway Committee

Curriculum

Short term (0-2 years)

- Add a technology objective to the Major Program Objective to align with the defined Student Learning Outcome and the University Mission Statement (WH).
    - Recognizing that the geospatial component of our programs is a key strength, the department agrees that adding a technology program objective would help to highlight such work. GEOG faculty will draft an objective to add to the SLOs within the next two years.
- A two-year plan for transfer students, both internal and external (BH); develop articulation agreements (both)
    - Given that most of our students transfer from other programs, either internally or externally, we agree that creating a two-year plan would assist with advising and ensure students are able to finish their degree in four years. We will revisit our current two-year rotation of courses and translate that into a two year plan for transfer students.
    - The Department Chair will work with Heather Thomas (MassTransfer Coordinator) to identify and expand existing articulation agreements
- Collaborations/interdisciplinary programs with other programs (BH)
    - The department looks forward to increasing collaboration with other departments. In particular, we are aware of two potential collaborations with Engineering Technology: a sustainability program and Civil Engineering concentration.
    - Physics faculty members will begin discussion about an interdisciplinary minor that includes Physics
- GEOG 2400 added to GST and GIS minors (WH)
    - We agree that this is worthy of discussion, and will necessitate agreement with Computer Science as the latter is an interdisciplinary minor. We plan to initiate those discussions in AY22.
- Consider making GEOG 2400 and other geospatial courses into lab courses to increase field opportunities and recruit gen ed students (WH)
    - The Intro to Geospatial Technologies course (GEOG2400) does contain some field experiences, including GPS activities and geocaching. We will discuss expanding on those experiences in this class, as well as incorporating GPS activities into some of our other lab courses.
- Consider renumbering courses and updating course descriptions to convey a logical sequence of increasing complexity and expected proficiency (WH).
    - We will discuss the numbering of courses to ensure they reflect complexity. It is worth noting that, while GEOG2400 is a logical gateway for the advanced level GIS courses, the intermediate courses (e.g., GEOG3120) emphasize different skills. For example, GEOG3120 has a focus on map-making and presentation of data, while GIS courses place a heavy emphasis on data analysis. Within our GST program, we accomplish proper sequencing of courses through advising. We think it's important to have more than one course as a pathway into our programs – GEOG2400 and GEOG3120 – and because other majors such as Engineering Technology require GEOG3120, it would create barriers to add GEOG2400 as a prerequisite for that course. We will discuss this particular case in the upcoming year to balance access with proper sequencing
- Examine the Geospatial curriculum to map out competencies and address the information literacy issue through collaboration with the library (WH).
    - We plan to map competencies in all programs in the next academic year. Because our geospatial courses focus on digital literacy, we would look to other courses within the major to focus on information literacy. We will also note the addition of a FYE into the new gen ed program; one of the outcomes of the FYE is information literacy. We do emphasize major-specific information literacy in EES courses such as Climatology, which is an elective for GST students. We will discuss how to ensure that GST students achieve the information literacy outcome through our other GEOG courses.

Medium range (3-5y)

- Continue to explore other educational opportunities such as study abroad (WH)
    - Faculty in the department are interested in expanding our study abroad opportunities, as well as to develop similar experiences for experiential learning domestically. Once faculty are able to travel (post-pandemic), we will continue to expand opportunities.
- Develop a field methods course; consider offering as a capstone (BH)
    - Faculty in Environmental and Earth Science had previously discussed a field methods course with several of the Biology faculty members. We plan to renew this discussion with them (e.g., Drs. Picone and Ludlam) within the next year to decide if developing such a course would be feasible. There are two field method courses listed in the catalog in Biology/Chemistry (ENSC2000 and 2100) that are not typically offered, so a longer discussion about feasibility is warranted before creating a new course in our department.
- Collaborations/interdisciplinary programs with other programs – Business, CS, Environmental Chem (BH)
    - As noted previously for collaboration with ETech, we look forward to discussing other opportunities with colleagues. Given that both Drs. Clark and Gordon have geochemistry backgrounds, and with Dr. Downs and O'Connor having interest in environmental chemistry, we would focus our efforts on discussions about an environmental chemistry program.
- Certificates, especially GIS and Environmental sampling
    - The department had several years ago discussed a GIS certificate, but it was decided at that time that it would be difficult to support with only one geography faculty member. Since those prior discussions, Dr. Parsons has revived our Remote Sensing course, and we have hired a couple of strong adjuncts with experience in geospatial technologies. We will begin discussion on whether a GIS certificate is now feasible, and if so, develop a proposal within 1-2 years.
    - We appreciate the suggestion for an environmental sampling certificate. We do not think we have enough resources in our department alone to support this, but we will initiate discussion with faculty in Biology/Chemistry for such a certificate.
- Explore the Capstone course idea though faculty discussion and the addition of portfolio and synthesis building activities in upper level classes (WH)
    - We agree that discussion surrounding a capstone course is worthwhile, and had included this action item in our self-study. As outlined there, we will expand course-based research opportunities over the next two years, and then consider if our existing courses warrant a capstone designation, or if we need to develop a new course to achieve the goals of a capstone.
- Consider the development of OER materials for the Geospatial courses (WH)
    - Dr. Huang has previously explored OER materials for geospatial courses, but has so far not identified any that match the content of those courses at the appropriate level. For GIS courses, students are trained using materials published by the company that develops the GIS software – some of those materials are available online, but the lab activities are contained within a textbook that requires purchase. The company that develops the Remote Sensing for which we have a license shares much of the data and lab activities for free. We will continue to explore OER materials as more materials are offered online.

No action planned

- Longer lab periods for EES courses (BH)
    - We agree that longer lab periods are the norm for upper division field-based courses. While our block schedule and 3 credit/4 hour structure for EES labs has historically been accomplished through three-75 minute sessions per week, Dr. Clark and Parsons have begun experimenting with combining two of those sessions into a longer, 150 minute lab period once per week, with the other weekly 75 minute period reserved for lecture. This creative solution allows for longer lab periods without necessitating a 4 credit hour course.
- Modify GST course sequencing: GEOG 2400, GEOG 4000 and GEOG 4003 (GEOG4000 as prereq) in that order (WH)
    - We appreciate the suggestion for sequencing these courses. GEOG2400 is already a prerequisite (one of three options) for GEOG4000 and 4003. GEOG4000 GIS and 4003 GISII, despite the names, are parallel courses – one can be taken without the other so sequencing the courses in this way is not in line with

the course content. The current structure allows for EES and EPH majors to choose which GIS course to take, rather than restrict them to the first in a series. We feel that this flexibility is important for our students. (we may be able to add an advanced course when enrollments warrant) sufficient for college level entry level industry

Personnel and resources

Short term (0-2 years)

- New faculty line in geography/GIS, either with a health geography background (BH) or human geography and GIS (WH)
    - We have requested a new faculty line every year since our previous self-study (2014) and outlined our plans to do so in our 2019 self-study. We will continue to request such a position.
- Alternatively/meantime, technician who can assist with upkeep of geospatial lab (WH), as well as the field equipment (BH).
    - We appreciate the suggestion for a staff member who dedicates time to technology issues that arise in our computer lab (SCI127), as this would alleviate some of the burden on faculty teaching geospatial courses. Our current lab technician has already volunteered to obtain a license to operate a departmental drone (see below), and currently assists with the upkeep of equipment for teaching. Because our lab technician also has responsibilities in other departments, the department chair will initiate discussion with the Dean of Health and Natural Sciences on how to approach such a position – either by expanding our current technician's responsibilities or requesting a new staff position.
- Expand modern lab equipment, especially water chemistry/environmental equipment (BH)
    - We agree that expanding our environmental sampling capabilities would benefit our students as well as the research opportunities for Dr. Clark and colleagues from Biology/Chemistry. We will request new equipment as part of the University's strategic funding process as well as through special project funding.
- Purchase drone (both)
    - The department began discussion about the acquisition of a drone last year, and began research into models and attachments. The department's lab technician and administrative assistant began research into developing a Drone policy, which would be required before purchase of a drone. We will submit a strategic funding request for the purchase of a drone as well as funds for our technician to become licensed to operate the drone.
- Support for research, including funding and APRs (BH)
    - Our faculty members continue to apply for funding opportunities, both internal and external. We appreciate the support of the University in funding the department's efforts to date, and we will continue to collaborate with relevant University offices (e.g., Grant Center) on identifying funding opportunities to support student and faculty research.

Earth and Geographic Sciences Action Plan in Table Format

Specific area where improvement is needed	Evidence to support the recommended change	Person(s) responsible for implementing the change	Timeline for implementation	Resources needed	Assessment Plan
Enrollments	Enrollments, while improving, remain below target	All faculty	Begin AY21	May require small but undetermined amount of funding	Increased enrollments
Curriculum and assessment	New LA&S and associated assessment; Gaps in major courses; skill development; internship assessment	Geo faculty	AY21 – Overall discussion; LAS proposals and assessment plan AY22 – add/modify major courses as needed AY22-23 – discuss internship assessment AY24 - evaluate	None	Addition of key courses to curriculum; LAS designations for intro courses; continued assessment of skills; assessment plan for LA&S outcomes and internships
Capstone experience	No required capstone	Geo faculty	AY21 – planning AY22 – pilot of course-based capstone; identify earth science internships AY23 - evaluate	Course release to build internships	Addition of capstone experience to curriculum
Strengthen community	Limited sustained opportunities for student extracurricular engagement	All faculty	AY21 – planning AY22 – at least three events AY23 – monthly events	Not yet identified	Number of planned departmental events; attendance at said events
Marketing	Enrollments	All faculty	1-2y: develop coherence across programs 3-5y: Departmental newsletter		
Outreach -on campus -to local high schools -to broader community	Enrollments/department recognition	All faculty	1-2y: planning 3-5y: implementation 5-7y: develop advisory board	Small amount of funding may be requested to support outreach efforts	Increased outreach activities, ideally translating into increased enrollments

Participation in early college program	Increase enrollment in courses, possible recruitment	All faculty	1-2y		More early college students in courses
Transfer friendly curriculum/Articulation agreements	Increase enrollments	Faculty develop 2yr plans; Chair to work with Heather Thomas	1-2y		Establishment of 2 yr plan; increase articulation agreements
Curriculum alignment -Add technology objective -GST sequencing and mapping competencies	Align curriculum with learning outcomes	Geo faculty	1-2y		Technology objective added; GST curriculum map
Experiential learning -study abroad -capstone -field course -certificates	Expand student opportunities	Geo faculty	1-2y: planning 3-5y: implementation	Funding for 'scouting trips' to expand study abroad (or domestically); acquire relevant equipment	Increase offerings of experiential learning
Departmental Collaborations	Increase course enrollments	All faculty	1-2y: ETech 3-5y: Bio/Chem		Expansion of programs, increased enrollments of courses
Personnel	Additional faculty line in geography needed; technician support	Chair to request; all faculty assist in hiring process	Annual request	Costs associated with faculty hire	New geographer joins the department
Equipment acquisition	Student access to equipment that better prepares them for graduate school and employment; expand opportunities for research	Chair to request; faculty identify equipment needs	1-2y, pending budgetary resources	Costs of equipment acquisition and upkeep	Acquisition of relevant equipment