

Keweenaw Bay Ojibwa Community College

2018-2020 Environmental Science Assessment Reporting

Environmental Science Mission

To provide students with the skills necessary to assess and manage natural resources by delivering an academic program that integrates Anishinaabe worldviews with biological, physical, and social sciences.

2018-2020 Goals

Goals for this reporting period reflect outcomes of the department's 2018 program review summary report and program revisions that were approved in conjunction with the review:

1. Infuse Anishinaabe cultural content into every departmental course.
2. Increase writing content across all levels of the departmental curricula.
3. Develop and expand social science curricula within the department.
4. Develop and expand curricula pertinent to the Great Lakes regional environment.

2018-2020 Program Learning Outcomes

1. Explain the importance of the natural world in Anishinaabe culture.
2. Explain scientific principles pertinent to environmental science.
3. Explain social science concepts pertinent to environmental science.
4. Apply the scientific method to answer research questions.
5. Employ standard methods to conduct environmental research.
6. Accurately interpret scientific data.
7. Conduct a professional poster presentation developed from original research.

Keys to this report

- **CLO = course learning outcome.** The majority of data in the following spreadsheets were collected by directly assessing designated course learning outcomes through exams, writing assignments, lab reports, or other graded activities.
- **PLO = program learning outcome.** These outcomes are typically assessed at the program-end level through the KBOCC Assessment Committee's evaluations of students' Capstone (ES297) poster projects.
- **CCA = co-curricular activities.** The KBOCC Assessment Committee defines co-curricular activities as "structured learning activities outside of coursework that address college-wide or program learning outcomes. Examples typically include special departmental events that are directly linked to learning outcomes. Where these outcomes are assessed, findings are included in this report.

Outcomes from the following additional departmental activities are typically included in the departmental *evaluation report*:

- **Extra-curricular activities** that promote student engagement and success, including student support and student life activities
- **Community outreach** activities that support the College's engagement with the local and tribal communities. These activities may provide volunteer service, information about the College, learning experiences for community members, or opportunities for collaboration between the College and community groups.

Period included in this report: Fall 2018 through Summer 2020

PLO 1: Explain the importance of the natural world in Anishinaabe culture.

Objective	Measurement Tool (Who, what, how, when?)	Measurement Goal (Expected Results)	Findings (Actual Results)	Action or Recommendation
Discuss Anishinaabe worldviews	ES110 CLO (2018): Describe aspects of the natural world in Anishinaabe culture. Assessed through essay exam following extensive field studies.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 94%. Outcome met.	This was the first year I used this format and series of essay questions. I'll repeat it for at least one more cycle before considering revision.
	ES216 CLO (2019): Discuss Anishinaabe perspectives related to sustainability. Assessed through essay assignment.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 96%. Outcome met.	
Describe the cultural importance of the abiotic environment	GS105 CLO (2019): Discuss Anishinaabe values related to the physical earth. Assessed through essay on exam 3.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 91%. Outcome met.	This essay focused on the cultural importance of water. Next time consider essay on geology.
	ES125 CLO (2019): Describe the importance of water in Anishinaabe culture. Assessed through essay format take-home final exam.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 95%. Outcome met.	Consider multiple, focused writing assignments (fish, treaty rights, wild rice, etc.) instead of offering open-ended format.
	ES158 CLO (2020): Describe the sacredness of the Great Lakes environment in Anishinaabe culture. Assessed through essay-format final exam.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 89%. Outcome met.	Next time involve guest speaker and talking-circle format.

Describe the importance of the biotic environment	ES107 CLO (2018): Discuss inter-relationships between humans and the biological and physical environment. Assessed through essay writing assignment.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	Consider expanding the assessment of this outcome if this special-topics course is repeated.
	BI200 CLO (2018): Explain fundamental concepts and theories in conservation biology. Assessed through short answer exam questions.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 92%. Outcome met.	This was a new course so the assessment of this key learning outcome will probably be repeated once more before revising materials.
	ES121 CLO (2019): Describe values and uses of trees in Anishinaabe culture. Assessed through two short essays on final exam.	80% or more of students will meet or exceed expectations.	90% of students met or exceeded expectations. Average score: 95%. Outcome met.	All students excelled except one who had not yet begun our Composition course sequence. This was his first semester.

PLO 2: Explain scientific principles pertinent to environmental science.

Objective	Measurement Tool (Who, what, how, when?)	Measurement Goal (Expected Results)	Findings (Actual Results)	Action or Recommendation
Explain principles relevant to the abiotic environment	GS105 CLO (2019): Describe basic concepts of earth systems. Assessed through Earth systems model on exam 1.	80% or more of students will meet or exceed expectations.	8 of 9 students met or exceeded expectations. Outcome met.	Continue developing new formats to assess.
	GS105 CLO (2019): Describe basic concepts of earth systems. Assessed through two essay questions on exam 2.	80% or more of students will meet or exceed expectations.	8 of 9 students met or exceeded expectations. Outcome met.	
	GS105 CLO (2019): Describe basic concepts of earth systems. Assessed through several questions on exam 3.	80% or more of students will meet or exceed expectations.	8 of 9 students met or exceeded expectations. Outcome met.	
	GS105 CLO (2020): Explain the concept of plate tectonics. Assessed through short answer questions on exam 1.	80% or more of students will meet or exceed expectations.	18 of 20 students met or exceeded expectations. Average score: 88%. Outcome met.	
	GS105 CLO (2020): Describe human influences on the physical landscape of the earth. Assessed through short essay questions on exam 2.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 90%. Outcome met.	Link to outdoor activities.
	ES125 CLO (2018): Describe human impacts on water quality and quantity. Assessed through midterm essay.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 86%. Outcome met.	Consider building this to a final project and having students deliver PowerPoint presentations on case studies.
	ES110 CLO (2019): Conduct basic research using the scientific method. Assessed through two field activities involving streams.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 92%. Outcome met.	

Explain principles relevant to the biotic environment	BI200 CLO (2018): Explain fundamental concepts and theories in conservation biology. Assessed through short answer exam questions.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 92%. Outcome met.	This was a new course so the assessment of this key learning outcome will probably be repeated once more before revising materials.
	ES204 CLO (2019): Compare and contrast local forest communities using an established classification system. Assessed through four 1-page essays on exam 1.	80% or more of students will meet or exceed expectations.	7 of 8 students met or exceeded expectations. Average score: 80%. Outcome met.	
Apply ecological concepts to the Great Lakes environment	ES121 CLO (2019): Describe primary morphological characteristics of regional trees. Assessed through short-answer questions on two exams.	80% or more of students will meet or exceed expectations.	90% of students met or exceeded expectations. Average score: 89%. Outcome met.	Consider activity requiring students to make illustrations.
	ES121 CLO (2019): Memorize scientific names of regional tree species. Assessed through matching and fill-in-the-blank questions on two exams.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 97%. Outcome met.	
	ES204 CLO (2019): Describe ecological impacts of the logging industry on Michigan forests. Assessed through 2-page essay on exam 2.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 91%. Outcome met.	Consider creating field-based activity to assess, perhaps with students taking photographs of logging sites we'd visit and explaining their observations in essays/presentations. Link to outdoor activities.
	GS105 CLO (2020): Describe human influences on the physical landscape of the earth. Assessed through short essay questions on exam 2.	80% or more of students will meet or exceed expectations.	100% students met or exceeded expectations. Average score: 90%. Outcome met.	

PLO 3: Explain social science concepts pertinent to environmental science.

Objective	Measurement Tool (Who, what, how, when?)	Measurement Goal (Expected Results)	Findings (Actual Results)	Action or Recommendation
Describe human relationships with the environment	ES125 CLO (2019): Describe human impacts on water quality and quantity. Assessed through midterm essay exam.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score = 86%. Outcome met.	Lots of other ways to examine this topic further.
	ES158 CLO (2020): Describe the sacredness of the Great Lakes region in Anishinaabe culture. Assessed through final essay.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 89%. Outcome met.	Link to outdoor activity with guest speaker.
	ES107 CLO (2018): Discuss inter-relationships between humans and the biological and physical environment. Assessed through final essay.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score: 88%. Outcome met.	Lots of other ways to examine this topic further.
Discuss issues related to sustainability	BI200 CLO (2018): Describe benefits of habitat restoration and protection. Assessed through essay exam questions.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score = 96%. Outcome met.	Re-assess this outcome with a more robust sample size. Due to time limitations in the semester, only three essay questions were used.
	ES216 CLO (2019): Critically analyze current sustainability issues. Assessed through student PowerPoint projects & presentations.	80% or more of students will meet or exceed expectations.	10 of 13 students (77%) met or exceeded expectations. Average score = 86%. Outcome met.	The “sustainability in the news” activities were a minor component in this course but were very popular and effective with students. Next time increase the emphasis on these activities and assess.
	ES216 CLO (2019): Critically analyze current sustainability issues. Assessed through 3-to-5 paragraph essay.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score = 90%. Outcome met.	

	ES216 CLO (2019): Explain links between environmental, economic, and social factors related to sustainability. Assessed through 3-to-5 paragraph essay.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score = 93%. Outcome met.	
	ES125 CLO (2019): Explain key policies related to water resource management. Assessed through essay homework assignments for chapters 9 and 10.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score = 100%. Outcome met.	Repeat with different case studies.
Explain the roles of various entities involved in environmental management	ES125 CLO (2019): Explain key policies related to water resource management. Assessed through essay-format chapter homework assignments.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score = 100%. Outcome met.	Find assignment that focuses on the role(s) of a specific Federal agency, such as the USGS or USEPA.
	ES217 CLO (2020): Describe the role of various parties involved in environmental policy-making. Assessed through homework essay for chapter 3.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score = 100%. Outcome met.	Repeat with different chapter.
	ES217 CLO (2020): Discuss environmental issues in the U.S. from case studies. Assessed through final paper.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Average score = 89%. Outcome met.	Have students deliver PowerPoint presentations, as originally planned (when campus is not shut down!)

PLO 4: Apply the scientific method to answer research questions.

Objective	Measurement Tool (Who, what, how, when?)	Measurement Goal (Expected Results)	Findings (Actual Results)	Action or Recommendation
Formulate a testable hypothesis	<p>ES110 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through stream discharge lab activity.</p> <p>BI200 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through forest diversity lab activity.</p> <p>GS105 CLO (2019): Conduct basic environmental research using the scientific method. Assessed through soil permeability lab.</p>	<p>80% or more of students will meet or exceed expectations.</p> <p>80% or more of students will meet or exceed expectations.</p> <p>80% or more of students will meet or exceed expectations.</p>	<p>100% of students met or exceeded expectations. Outcome met.</p> <p>100% of students met or exceeded expectations. Outcome met.</p> <p>100% of students met or exceeded expectations. Outcome met.</p>	<p>Repeat in 2020 with different streams.</p> <p>Repeat in 2020 with different forests.</p> <p>Repeat in 2021. Campus closure in 2020 prevented this activity from happening.</p>
Conduct an experiment to test a hypothesis	<p>ES110 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through stream discharge lab activity.</p> <p>BI200 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through forest diversity lab activity.</p> <p>GS105 CLO (2019): Conduct basic environmental research using the scientific method. Assessed through soil permeability lab.</p>	<p>80% or more of students will meet or exceed expectations.</p> <p>80% or more of students will meet or exceed expectations.</p> <p>80% or more of students will meet or exceed expectations.</p>	<p>100% of students met or exceeded expectations. Outcome met.</p> <p>100% of students met or exceeded expectations. Outcome met.</p> <p>100% of students met or exceeded expectations. Outcome met.</p>	<p>Same comments as above.</p>

Draw conclusions from an experiment	ES110 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through stream discharge lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	Same comments as above.
	BI200 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through forest diversity lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	
	GS105 CLO (2019): Conduct basic environmental research using the scientific method. Assessed through soil permeability lab	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	

PLO 5: Employ standard methods to conduct environmental research.

Objective	Measurement Tool (Who, what, how, when?)	Measurement Goal (Expected Results)	Findings (Actual Results)	Action or Recommendation
Demonstrate appropriate techniques of data collection	ES110 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through stream discharge lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	No need to revise.
	BI200 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through forest diversity lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	
	GS105 CLO (2019): Conduct basic environmental research using the scientific method. Assessed through stream discharge lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	
Demonstrate proper use of equipment	ES110 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through stream discharge lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	No need to revise.
	BI200 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through forest diversity lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	
	GS105 CLO (2019): Conduct basic environmental research using the scientific method. Assessed through stream discharge lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	

PLO 6: Accurately interpret scientific data.

Objective	Measurement Tool (Who, what, how, when?)	Measurement Goal (Expected Results)	Findings (Actual Results)	Action or Recommendation
Construct appropriate graphical representation of data	ES110 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through stream discharge lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	No need to revise.
	BI200 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through forest diversity lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	
	GS105 CLO (2019): Conduct basic environmental research using the scientific method. Assessed through stream discharge lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	
	GS105 CLO (2019): Conduct basic environmental research using the scientific method. Assessed through soil permeability lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	
Conduct appropriate statistical tests	ES110 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through stream discharge lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	No need to revise.
	BI200 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through forest diversity lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	

Make appropriate inferences from data analysis	ES110 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through stream discharge lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	No need to revise.
	BI200 CLO (2018): Conduct basic environmental research using the scientific method. Assessed through forest diversity lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	
	GS105 CLO (2019): Conduct basic environmental research using the scientific method. Assessed through stream discharge lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	
	GS105 CLO (2019): Conduct basic environmental research using the scientific method. Assessed through soil permeability lab activity.	80% or more of students will meet or exceed expectations.	100% of students met or exceeded expectations. Outcome met.	

PLO 7: Conduct a professional poster presentation developed from original research.

Objective	Measurement Tool (Who, what, how, when?)	Measurement Goal (Expected Results)	Findings (Actual Results)	Action or Recommendation
Employ standard scientific poster formatting	ES297 (Capstone): One student in Fall 2019 and four in Spring 2020.	100% of students will score 14 or higher on Environmental Science Capstone poster rubric.	100% of students scored 14 or higher on Environmental Science Capstone poster rubric. Outcome met.	Continue using rubric that was revised for 2020.
Employ writing standards appropriate for scientific poster	ES297 (Capstone): One student in Fall 2019 and four in Spring 2020.	100% of students will score 14 or higher on Environmental Science Capstone poster rubric.	100% of students scored 14 or higher on Environmental Science Capstone poster rubric. Outcome met.	Continue using rubric that was revised for 2020.
Use appropriate graphics to augment visual appeal of poster	ES297 (Capstone): One student in Fall 2019 and four in Spring 2020.	100% of students will score 14 or higher on Environmental Science Capstone poster rubric.	100% of students scored 14 or higher on Environmental Science Capstone poster rubric. Outcome met.	Continue using rubric that was revised for 2020.

Environmental Science PLO/CLO curriculum map

PLO 1: Explain the importance of the natural world in Anishinaabe culture

a. Discuss Anishinaabe worldviews

- BI206: Discuss Anishinaabe worldviews on plants and animals.
- BI211: Describe traditional values and uses of plants in Anishinaabe culture.
- ES110: Describe aspects of the natural world in Anishinaabe culture.
- ES121: Describe values and uses of trees in Anishinaabe culture.
- ES125: Describe the importance of water in Anishinaabe culture.
- ES158: Describe the sacredness of the Great Lakes region in Anishinaabe culture.
- ES204: Discuss the importance of forest ecosystems in Anishinaabe culture
- ES216: Discuss Anishinaabe perspectives related to sustainability.
- ES217: Discuss Anishinaabe perspectives on natural resource stewardship.
- ES218: Apply understandings of environmental justice and ethics to a contemporary Indigenous issue in North America through a class presentation.
- ES219: Using examples, discuss the significance of the Great Lakes region in Anishinaabe culture.
- ES219: Discuss contemporary environmental issues facing Anishinaabe tribes.
- ES219: Discuss the role of traditional stories as a medium for sharing ecological knowledge.
- ES219: Describe natural resource stewardship objectives of Anishinaabe tribes.
- ES219: Explain how traditional Anishinaabe worldviews are reflected in contemporary natural resource management objectives.
- ES219: Explain the importance of treaty rights to Anishinaabe tribes.
- ES219: Explain how sovereignty relates to tribal natural resource stewardship.
- ES242: Describe the importance of wetlands in Anishinaabe culture.
- GS105: Discuss Anishinaabe values related to the physical earth.

b. Describe the cultural importance of the abiotic environment

- ES107: Discuss inter-relationships between humans and the biological and physical environment.
- ES110: Describe aspects of the natural world in Anishinaabe culture.
- ES125: Describe the importance of water in Anishinaabe culture.
- ES242: Describe the importance of wetlands in Anishinaabe culture.
- GS105: Discuss Anishinaabe values related to the physical earth.

c. Describe the cultural importance of the biotic environment

- BI101: Discuss Anishinaabe values related to organisms of the Great Lakes region.
- BI200: Discuss the importance of biological diversity in Anishinaabe culture.
- BI203: Describe the importance of wildlife in Anishinaabe culture.
- BI205: Discuss the significance of fish in Anishinaabe culture.
- BI206: Discuss Anishinaabe worldviews on plants and animals.
- BI211: Describe traditional values and uses of plants in Anishinaabe culture.
- ES107: Discuss inter-relationships between humans and the biological and physical environment.
- ES110: Describe aspects of the natural world in Anishinaabe culture.
- ES121: Describe values and uses of trees in Anishinaabe culture.
- ES125: Describe the importance of water in Anishinaabe culture.
- ES204: Discuss the importance of forest ecosystems in Anishinaabe culture.
- ES242: Describe the importance of wetlands in Anishinaabe culture.

PLO 2: Explain scientific principles pertinent to environmental science

a. Explain principles relevant to the abiotic environment

- BI205: Explain ecologic concepts as they pertain to fish and their habitats.
- BI206: Explain interactions between populations and habitats.
- BI206: Compare and contrast different biomes.
- ES107: Discuss inter-relationships between humans and the biological and physical environment.
- ES110: Describe environmental processes in scientific terms.
- ES110: Identify major environmental problems including their causes and consequences.
- ES121: Describe relationships between tree species and their habitat.
- ES125: Discuss the location, availability, and abundance of the world's water resources.
- ES125: Describe human impacts on water quality and quantity.
- ES125: Explain the water cycle and how the various components interact.
- ES158: Discuss foundational concepts in geography.
- ES158: Describe the spatial organization of people, places, and environments on Earth's surface.
- ES158: Describe consequences of human modifications of the environment.
- ES158: Explain relationships between the physical earth and human civilizations in terms of culture and ethnicity.
- ES204: Describe the impacts of the logging industry on Michigan forests.
- ES204: Describe forest management and conservation efforts in Michigan.
- ES204: Compare and contrast local forest communities using an established classification system.
- ES204: Explain relationships between forest communities and their physical habitats.

ES217: Discuss environmental issues in the United States from case studies.
ES242: Describe functions and values of wetlands.
ES242: Describe characteristics and locations of earth's major wetland types.
ES242: Explain how vegetation, hydrology, and soils are used to identify and delineate wetlands.
GS105: Describe basic concepts of earth systems.
GS105: Explain the concept of plate tectonics.
GS105: Explain how various water cycle components interact.

b. Explain principles relevant to the biotic environment

BI101: Describe structures and functions of cells.
BI101: Describe the developmental stages of mitosis and meiosis.
BI101: Define basic biological concepts and terms.
BI101: Explain how genetic information is passed to offspring.
BI101: Explain mechanisms of natural selection.
BI101: Classify organisms in the five major kingdoms according to defining characteristics.
BI200: Describe ecological and evolutionary principles related to biological diversity.
BI200: Explain fundamental concepts and theories in conservation biology.
BI200: Explain human impacts on biological diversity.
BI203: Explain ecological principles as they affect wildlife populations.
BI205: Explain ecologic concepts as they pertain to fish and their habitats.
BI206: Describe principles of population ecology.
BI206: Explain interactions between populations and habitats.
BI211: Describe plant morphology.
BI211: Characterize major families of plants.
BI211: Identify plant structures.
BI211: Identify plants using taxonomic keys.
BI211: Identify local species in the field using scientific names.
BI211: Create a plant collection using IBC standards.
ES107: Discuss inter-relationships between humans and the biological and physical environment.
ES110: Describe environmental processes in scientific terms.
ES110: Identify major environmental problems including their causes and consequences.
ES121: Describe primary morphological characteristics of trees.
ES121: Describe mechanisms of tree survival, reproduction, and dispersal.
ES121: Describe relationships between tree species and their habitat.
ES121: Describe local forest communities.

ES121: Memorize scientific names of regional tree species.
ES121: Identify regional tree species on sight.
ES158: Describe consequences of human modifications of the environment.
ES204: Describe the impacts of the logging industry on Michigan forests.
ES204: Describe forest management and conservation efforts in Michigan.
ES204: Compare and contrast local forest communities using an established classification system.
ES204: Explain relationships between forest communities and their physical habitats.
ES217: Discuss environmental issues in the United States from case studies.
ES242: Describe functions and values of wetlands.
ES242: Describe characteristics and locations of earth's major wetland types.
ES242: Explain how vegetation, hydrology, and soils are used to identify and delineate wetlands.
GS105: Describe basic concepts of earth systems.

c. Apply ecological concepts to the Great Lakes environment

BI205: Discuss human impacts to fish populations in the Great Lakes, with focus on Lake Superior.
BI205: Define basic biological concepts related to fisheries, focusing on those of the Great Lakes region.
BI206: Describe characteristics of local plant and wildlife species.
BI206: Conduct basic research in local ecosystems.
BI211: Identify local species in the field using scientific names.
ES121: Describe local forest communities.
ES121: Memorize scientific names of regional tree species.
ES121: Identify regional tree species on sight.
ES121: Conduct basic research in local forest ecosystems.
ES125: Describe human impacts on water quality and quantity.
ES204: Describe the impacts of the logging industry on Michigan forests.
ES204: Describe forest management and conservation efforts in Michigan.
ES204: Compare and contrast local forest communities using an established classification system.
ES204: Conduct basic research in local forest ecosystems.
ES242: Compare and contrast local wetland communities using an established classification system.

PLO 3: Explain social science concepts pertinent to environmental science

a. Describe human relationships with the environment

BI200: Explain human impacts on biological diversity.

BI205: Discuss human impacts to fish populations in the Great Lakes, with focus on Lake Superior.

ES107: Discuss inter-relationships between humans and the biological and physical environment.

ES110: Identify major environmental problems including their causes and consequences.

ES110: Explain how human populations impact the environment.

ES125: Describe human impacts on water quality and quantity.

ES158: Describe consequences of human modifications of the environment.

ES204: Describe the impacts of the logging industry on Michigan forests.

ES216: Explain how actions of past generations impacted the status of today's natural resources.

ES217: Discuss environmental issues in the United States from case studies.

ES217: Explain how economics, risk, and human values relate to environmental decision-making.

ES218: Describe how different cultures develop ethical relationships with the non-human world.

ES218: Describe common ethical views and arguments in contemporary environmental issues.

ES218: Using examples, explain environmental justice inequalities as notions of distribution, participation, and recognition.

ES218: Explain place-based practices that contribute to environmental inequities for different social and species groups.

ES218: Explain transboundary practices that contribute to environmental inequities for different social and species groups.

ES218: Compare and contrast "meanings" of environmental justice for different places and people groups.

ES219: Discuss contemporary environmental issues facing Anishinaabe tribes.

ES242: Describe historical and contemporary human impacts to wetlands.

GS105: Describe influences of humans on the physical landscape of earth.

b. Discuss issues related to sustainability

BI200: Describe benefits of habitat restoration and protection.

BI200: Compare and contrast various conservation strategies.

BI205: Discuss objectives of fisheries management.

ES110: Explain how human populations impact the environment.

ES110: Compare and contrast possible solutions to sample environmental problems.

ES125: Discuss the location, availability, and abundance of the world's water resources.

ES125: Explain socioeconomic issues related to contemporary water resource issues.

ES125: Explain key policies related to water resource management.

ES158: Compare and contrast the socioeconomic development of various global regions.

ES204: Describe forest management and conservation efforts in Michigan.

ES216: Discuss theoretical approaches to sustainability.

ES216: Explain links between environmental, economic, and social factors related to sustainability.
ES216: Explain how actions of past generations impacted the status of today's natural resources.
ES216: Critically analyze current sustainability issues.
ES216: Create and deliver a PowerPoint presentation on a current issue related to sustainability.
ES218: Describe how different cultures develop ethical relationships with the non-human world.
ES218: Describe common ethical views and arguments in contemporary environmental issues.
ES219: Discuss contemporary environmental issues facing Anishinaabe tribes.
ES242: Explain wetland management and conservation strategies, including relevant policies and laws.

c. Explain the roles of various entities involved in environmental management

BI200: Summarize key developments in the history of biological conservation.
BI203: Apply general management principles to wildlife problems in various ecosystems.
BI205: Discuss objectives of fisheries management.
BI205: Explain various fisheries research methodologies.
ES110: Compare and contrast possible solutions to sample environmental problems.
ES125: Explain key policies related to water resource management.
ES204: Describe forest management and conservation efforts in Michigan.
ES217: Discuss environmental issues in the United States from case studies.
ES217: Discuss the evolution of major environmental laws in the United States.
ES217: Describe government structures involved in environmental policy.
ES217: Describe the roles of various parties involved in environmental policy-making.
ES217: Explain a theoretical environmental policy-making process.
ES217: Explain how economics, risk, and human values relate to environmental decision-making.
ES217: Create and deliver a PowerPoint presentation on a current issue related to environmental policy.
ES218: Describe common ethical views and arguments in contemporary environmental issues.
ES219: Describe natural resource stewardship objectives of Anishinaabe tribes.
ES219: Explain how traditional Anishinaabe worldviews are reflected in contemporary natural resource management objectives.
ES219: Explain the importance of treaty rights to Anishinaabe tribes.
ES219: Explain how sovereignty relates to tribal natural resource stewardship.
ES235: Apply GIS to natural resource management issues.
ES242: Explain wetland management and conservation strategies, including relevant policies and laws.

PLO 4: Apply the scientific method to answer research questions

a. Formulate a testable hypothesis

BI200: Conduct basic environmental research using the scientific method.

BI205: Conduct basic environmental research using the scientific method.

BI206: Conduct basic research in local ecosystems.

ES110: Conduct basic environmental research using the scientific method.

ES121: Conduct basic research in local forest ecosystems.

ES204: Compare and contrast local forest communities using an established classification system.

ES204: Conduct basic research in local forest ecosystems.

ES242: Compare and contrast local wetland communities using an established classification system.

ES242: Conduct basic ecological research in local wetland ecosystems.

GS105: Conduct basic environmental research using the scientific method.

b. Conduct an experiment to test a hypothesis

BI200: Conduct basic environmental research using the scientific method.

BI205: Conduct basic environmental research using the scientific method.

BI206: Conduct basic research in local ecosystems.

ES110: Conduct basic environmental research using the scientific method.

ES121: Conduct basic research in local forest ecosystems.

ES204: Compare and contrast local forest communities using an established classification system.

ES242: Compare and contrast local wetland communities using an established classification system.

ES204: Conduct basic research in local forest ecosystems.

GS105: Conduct basic environmental research using the scientific method.

c. Draw conclusions from an experiment

BI200: Conduct basic environmental research using the scientific method.

BI205: Communicate technical information about fisheries.

BI205: Conduct basic environmental research using the scientific method.

BI206: Conduct basic research in local ecosystems.

ES110: Conduct basic environmental research using the scientific method.

ES121: Conduct basic research in local forest ecosystems.

ES204: Compare and contrast local forest communities using an established classification system.

ES242: Compare and contrast local wetland communities using an established classification system.

ES204: Conduct basic research in local forest ecosystems.

GS105: Conduct basic environmental research using the scientific method.

PLO 5: Employ standard methods to conduct environmental research

a. Demonstrate appropriate techniques of data collection

BI200: Conduct basic environmental research using the scientific method

BI203: Use quantitative methods to describe wildlife populations.

BI203: Develop a species management plan.

BI203: Conduct habitat analyses.

BI205: Conduct basic environmental research using the scientific method.

BI206: Conduct basic research in local ecosystems.

BI211: Create a plant collection using IBC standards.

ES110: Conduct basic environmental research using the scientific method.

ES121: Conduct basic research in local forest ecosystems.

ES204: Compare and contrast local forest communities using an established classification system.

ES204: Conduct basic research in local forest ecosystems.

ES235: Identify data formats required for spatial data analysis.

ES235: Explain the basic theory and framework of geographic information systems.

ES235: Use data resources to conduct spatial analyses.

ES235: Collect and format different types of spatial data.

ES235: Apply GIS to natural resource management issues.

ES242: Compare and contrast local wetland communities using an established classification system.

GS105: Conduct basic environmental research using the scientific method.

b. Demonstrate proper use of equipment

BI200: Conduct basic environmental research using the scientific method.

BI205: Conduct basic environmental research using the scientific method.

BI206: Conduct basic research in local ecosystems.

BI211: Create a plant collection using IBC standards.

ES110: Conduct basic environmental research using the scientific method.

ES204: Conduct basic research in local forest ecosystems.

ES235: Use data resources to conduct spatial analyses.

ES235: Collect and format different types of spatial data.

ES235: Apply GIS to natural resource management issues.

ES242: Compare and contrast local wetland communities using an established classification system.

GS105: Conduct basic environmental research using the scientific method.

PLO 6: Accurately interpret scientific data

a. Construct appropriate graphical representation of data

BI200: Conduct basic environmental research using the scientific method.

BI206: Conduct basic research in local ecosystems.

ES110: Conduct basic environmental research using the scientific method.

ES121: Conduct basic research in local forest ecosystems.

ES204: Conduct basic research in local forest ecosystems.

ES235: Use data resources to conduct spatial analyses.

ES235: Apply GIS to natural resource management issues.

ES235: Present spatial data in a visually appealing and scientifically correct manner.

ES242: Compare and contrast local wetland communities using an established classification system.

GS105: Conduct basic environmental research using the scientific method.

b. Conduct appropriate statistical tests

BI200: Conduct basic environmental research using the scientific method.

BI203: Use quantitative methods to describe wildlife populations.

ES110: Conduct basic environmental research using the scientific method.

GS105: Conduct basic environmental research using the scientific method.

c. Make appropriate inferences from data analysis

BI200: Conduct basic environmental research using the scientific method.

BI203: Use quantitative methods to describe wildlife populations.

BI203: Develop a species management plan.

BI205: Communicate technical information about fisheries.

BI206: Conduct basic research in local ecosystems.

ES110: Conduct basic environmental research using the scientific method.

ES121: Conduct basic research in local forest ecosystems.

ES204: Compare and contrast local forest communities using an established classification system.

ES204: Conduct basic research in local forest ecosystems.

ES235: Explain the basic theory and framework of geographic information systems.

ES235: Use data resources to conduct spatial analyses.

ES235: Apply GIS to natural resource management issues.

ES242: Compare and contrast local wetland communities using an established classification system.

GS105: Conduct basic environmental research using the scientific method.

PLO 7: Conduct a professional poster presentation developed from original research

a. Employ standard scientific poster formatting

ES204: Conduct a scientific poster presentation developed from group research project.

ES242: Conduct a scientific poster presentation developed from group research project.

b. Employ writing standards appropriate for scientific poster

ES204: Conduct a scientific poster presentation developed from group research project.

ES242: Conduct a scientific poster presentation developed from group research project.

c. Use appropriate graphics to augment visual appeal of poster

ES204: Conduct a scientific poster presentation developed from group research project.

ES242: Conduct a scientific poster presentation developed from group research project.