**General Education Course Inclusion Proposal**

**SCIENTIFIC INQUIRY**

*This proposal form is intended for departments proposing a course for inclusion in the Northern Michigan University General Education Program. Courses in a component satisfy both the Critical Thinking and the component learning outcomes. Departments should complete this form and submit it electronically through the General Education SHARE site.*

**Course Name and Number: BI 305 Ecology of the Northern Forest**

**Home Department: Biology**

**Department Chair Name and Contact Information** (phone, email): Dr. John Rebers ([jrebers@nmu.edu](mailto:jrebers@nmu.edu)) 227-2585

**Expected frequency of Offering of the course** (e.g. every semester, every fall): every fall

**Official Course Status**: Has this course been approved by CUP and Senate? YES

*Courses that have not yet been approved by CUP must be submitted to CUP prior to review by GEC. Note that GEC is able to review courses that are in the process of approval; however, inclusion in the General Education Program is dependent upon Senate and Academic Affairs approval of the course into the overall curriculum.*

**Overview of course** (please attach a current syllabus as well): *Please limit the overview to two pages (not including the syllabus)*

A. Overview of the course content:

BI 305 is the study of the interactions of physical features, vegetation, animal life and human influences in the northern forests through lectures and labs. Lectures emphasize an ecological perspective of terrestrial and aquatic ecosystem and how they relate to implications of natural change (disturbances, such as fire, and succession) and those of anthropogenic origin (climate change, logging, mining, exotic species introduction). Labs emphasize two things: identifying and becoming familiar with the biology of common local organisms (plants, fungi, lichens, insects, birds, mammals) and how they are adapted to local environments. Second, using this basic knowledge, students conduct small research projects involving use of the scientific method, including hypothesis testing, collection of original data, analyzing data and presenting results in written format similar to a short scientific paper.

B. Explain why this course satisfies the Component specified and significantly addresses both learning outcomes

This course meets the critical thinking component in several ways:

i. First, the focus of assignments on environmental issues provides an opportunity to engage in analytical reasoning and argumentation on issues that have both positive and negative perspectives.

ii. Second, students evaluate various forms of evidence and knowledge. Students must draw on various resources for evidence and compare the accuracy (fact-check) and synthesize information from sources ranging from primary scientific literature; popular press (local and regional) including newspapers, television and online news sources; editorials and blogs from individuals, web or other materials available from industry, conservation groups, and government agencies.

iii. Third, students must integrate and synthesize information across various disciplines: biology, social science, economics, and history.

Second, the lab meets the scientific inquiry requirement in lab by requiring three 5-7 page scientific papers based in hypothesis-driven field studies that involve original data collection and analysis, as well as writing a paper in a standard, journal style format, with an introduction, methods, results, and discussion/conclusions sections. Papers also require supporting a hypothesis and interpretation of results by thorough and documented literature review within the paper.

C. Describe the target audience (level, student groups, etc.)

This class is currently listed as a 300-level, and is targeted to advanced undergraduates from any discipline. (Biology majors cannot receive credit towards their major for this class.) This class should be particularly interesting to those with a keen interest in learning more about the natural environment that surrounds us at NMU. We also feel that this class could be quite useful for those interested in teaching biology and environmental science material at the K-12 level.

D. Give information on other roles this course may serve (e.g. University Requirement, required for a major(s), etc.)

This class is used as a “choose one” elective in some EEGS majors.

E. Provide any other information that may be relevant to the review of the course by GEC

**PLAN FOR LEARNING OUTCOMES  
CRITICAL THINKING**

*Attainment of the CRITICAL THINKING Learning Outcome is required for courses in this component. There are several dimensions to this learning outcome. Please complete the following Plan for Assessment with information regarding course assignments (type, frequency, importance) that will be used by the department to assess the attainment of students in each of the dimensions of the learning outcome. Type refers to the types of assignments used for assessment such as written work, presentations, etc. Frequency refers to the number of assignments included such as a single paper or multiple papers. Importance refers to the relative emphasis or weight of the assignment to the entire course. For each dimension, please specify the expected success rate for students completing the course that meet the proficiency level and explain your reasoning. Please refer to the Critical Thinking Rubric for more information on student performance/proficiency in this area. Note that courses are expected to meaningfully address all dimensions of the learning outcome.*

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| **DIMENSION** | **WHAT IS BEING ASSESSED** | **PLAN FOR ASSESSMENT** |
| **Evidence** | Assesses quality of information that may be integrated into an argument  For environmental issues in lecture, read literature from the following sources  1. Primary scientific  2. Scholarly review articles;  3. Official web sites of industry, conservation groups, government agencies.  4. journalistic media  5. popular literature  6. individuals (editorial, blog) | 50% of the lecture topics will deal with local environmental issues (logging, mining, climate change, exotic species introductions) that have both positive and negative impacts and user-group perspectives. Discussions in class will focus on examining and comparing the accuracy of various sources of information (scientific literature, popular media) used in these arguments.  1. 1 term paper in lecture (25% of lecture grade) will focus on evaluating the quality of evidence used from different sources, and where misconceptions and disinformation commonly arise.  Based on department expectations, combined categories of “proficient” and “exceeds proficiency” shall exceed 70% of students. |
| **Integrate** | Integrates insight and or reasoning with existing understanding to reach informed conclusions and/or understanding  1. ability to integrate multidisciplinary information | 50% of lecture discussion will focus on environmental issues that are multidisciplinary and will require students to read literature and synthesize arguments related to biology and other physical sciences, social and economic, and cultural and historical perspectives.  10-20% of lecture exam questions will focus on understanding the multidisciplinary nature of these problems and perspective of different user groups.  Based on department expectations, combined categories of “proficient” and “exceeds proficiency” shall exceed 70% of students. |
| **Evaluate** | Evaluates information, ideas, and activities according to established principles and guidelines  1. Evaluate a case history  2. form a persuasive, well-informed, and professionally documented argument concerning an environmental issue of local relevance | 1. Each lecture exam will include an essay question (25% of their exam grade) focused on a case history related to an environmental issues discussed in class, but with some new twist. The performance of students will be assessed based on how well they use existing knowledge on the topic to argue persuasively from a new perspective.  2. This dimension will also be met by the term paper in lecture (25% of lecture grade) on an environmental issue that must be successfully defended using authoritative, and interdisciplinary information as described above.  Based on department expectations, combined categories of “proficient” and “exceeds proficiency” shall exceed 70% of students. |
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**PLAN FOR LEARNING OUTCOMES  
SCIENTIFIC INQUIRY**

*Attainment of the SCIENTIFIC INQUIRY Learning Outcome is required for courses in this component. There are several dimensions to this learning outcome. Please complete the following Plan for Assessment with information regarding course assignments (type, frequency, importance) that will be used by the department to assess the attainment of students in each of the dimensions of the learning outcome. Type refers to the types of assignments used for assessment such as written work, presentations, etc. Frequency refers to the number of assignments included such as a single paper or multiple papers. Importance refers to the relative emphasis or weight of the assignment to the entire course. For each dimension, please specify the expected success rate for students completing the course that meet the proficiency level and explain your reasoning. Please refer to the Rubric for more information on student performance/proficiency in this learning outcome. Note that courses are expected to meaningfully address all dimensions of the learning outcome.*

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| **DIMENSION** | **WHAT IS BEING ASSESSED** | **PLAN FOR ASSESSMENT** |
| **Research Question** | Develop a manageable and appropriate research question that is tied to testable hypotheses.  1. Clearly stated hypothesis stated in the introduction  2. logic of hypothesis developed through class discussion and literature review | Three laboratory exercises in labs will involve a formal write-up in the form of a 5-7 page scientific (journal-style) paper. These papers will make up 75% of the lab grade for the course  Some of the labs are designed to introduce students to a particular topic. This preparation, along with assigned readings, will allow students to identify a scientific problem, evaluate what is known about a problem, formulate questions with regard to the problem, and develop testable hypotheses.  This section of their papers will be worth 25% of their paper grade  Based on department expectations, combined categories of “proficient” and “exceeds proficiency” shall exceed 70% of students. |
| **Methodology/Data Collection** | Select and/or develop appropriate scientific methodologies  1. Field methods for sampling different habitats and organisms (e.g. transects & plots for sampling vegetation; kick nets for aquatic organisms  2. random sampling design | Three or four labs involve practice with the methodologies of sampling and identifying different kinds of organisms, as well as sampling design and simple statistics (t-tests, correlation).  Quizzes in labs related to collection and identification of organisms make up the other 25% of their lab grade.  In the three labs involving formal hypothesis testing, this dimension will be evaluated in the Methods section of each paper, which is worth 15% of their paper grade. Students will be assessed on whether they use methods appropriate for sampling a particular organisms or habitat, whether the methods are described so they are repeatable, and whether they included some aspect of a randomized sampling design.  Based on department expectations, combined categories of “proficient” and “exceeds proficiency” shall exceed 70% of students. |
| **Analysis, Results and Presentation** | Collected data is appropriately analyzed and presented  1. ability to organize data in a spread sheet with dependent and independent variables identified  2. Compute descriptive statistics (e.g. means and standard deviations)  3. Compute statistical tests related to formal hypotheses  4. Present results in table and figure format  5. write a narrative summary of results supported by tables, figures, and statistics | In the three labs involving formal hypothesis testing, this dimension will be evaluated in the Results section of each paper, which is worth 30% of the paper grade.  Assessing this dimension will include the following elements:  (1) correctness of computations for data summaries and statistics, (2) clarity of supporting evidence and narrative, (3) format of tables, graphs, and statistical statements.  Based on department expectations, combined categories of “proficient” and “exceeds proficiency” shall exceed 70% of students. |
| **Discussion/Conclusions** | Conclusions are linked to evidence and are in the context of scientific limitations and implications.  1. The discussion will be centered on whether hypotheses were supported by evidence in the Results Section  2. interpretation of findings and comparison with the scientific literature  3. limitation of study (approach, methods, scope)  4. Ramifications of the study | In the three labs involving formal hypothesis testing, this dimension will be evaluated in the Discussion section of each paper, which is worth 30% of their paper grade.  The following elements will be assessed  1. addressing the original hypothesis (supported or not?)  2. assessing the quality of the evidence  3. using the literature and information from other labs to find a reasonable interpretation of the results  4. discussing limitations  5. addressing ramification of the study in the context of larger ecological themes  Based on department expectations, combined categories of “proficient” and “exceeds proficiency” shall exceed 70% of students. |