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**Master Syllabus**

**Course: BIO 143, Ecology and Environmental Issues**

**Cluster Requirement: 2B, Science in the Engaged Community**

This University Studies Master Syllabus serves as a guide and standard for all instructors teaching an approved in the University Studies program. Individual instructors have full academic freedom in teaching their courses, but as a condition of course approval, agree to focus on the outcomes listed below, to cover the identified material, to use these or comparable assignments as part of the course work, and to make available the agreed-upon artifacts for assessment of learning outcomes.

**Course Overview:**

BIO 143 is designed for non-science majors . The course introduces the science of ecology, and applies the concepts to relevant environmental issues. Material is presented through lectures and readings. Student learning is assessed through many short assignments (completed in class or as homework), four writing assignments, and four multiple-choice exams.

**Learning Outcomes:**

Course-Specific Learning Outcomes:

After completing the course, students will be able to:

1. Use scientific vocabulary relevant to ecology.

2. Explain basic ecological concepts that govern

1. responses of individual organisms to their environment
2. patterns of population structure and population growth
3. interactions between species
4. the structure of communities
5. movement of energy and nutrients through ecosystems.

3. Apply ecological concepts to understand and propose solutions to environmental problems.

4. Apply the scientific method to answer ecological questions.

5. Interpret scientific information presented as graphs.

6. Evaluate the validity of web sites presenting scientific information.

7. Describe the scientific peer-review and publication processes.

University Studies Learning Outcomes: Cluster 2B, Science in the Engaged Community.

After completing the course, students will be able to:

1. Analyze and evaluate the use of scientific information in the context of social, economic, environmental or political issues.

2. Apply scientific theories and knowledge to real‐world problems.

3. Effectively communicate scientific information in writing.

**Examples of Texts and/or Assigned Readings:**

*Essentials of Ecology* (6th edition) by G. Tyler Miller and Scott E. Spoolman

Smith, D.W., Peterson, R.O., Houston, D.B. 2003. Yellowstone after wolves. *BioScience* 53:4, 330-340.

**Example Assignments:**

The Cluster 2B learning outcomes are assessed throughout the course. Two writing assignments are described here: Frogs and Atrazine addresses Outcome 1, Yellowstone after Wolves addresses Outcome 2, and both address Outcome 3.

**Frogs and Atrazine**

A university scientist (Tyrone Hayes) was hired by Syngenta (the producer of atrazine, one of the most widely-used herbicides in the US) to test the effects of the chemical on development of frogs, to support Syngenta’s application to the EPA to renew its license to produce atrazine. Hayes found that atrazine caused male frogs to become hermaphrodites (they had lowered testosterone and produced eggs in their testes). Syngenta then hired another lab, which was unable to reproduce Hayes’ results – but they used different controls as a basis for comparison.

Part 1. Students watch a portion of a documentary describing Tyrone Hayes’ research.

Part 2. The class works through understanding graphs of experimental results from the two labs. The instructor presents each graph, students work in pairs to interpret the graph, then the class as a whole discusses what they see.

Part 3. As homework, students review several web sites on how to evaluate the reliability of web sites.

Part 4. Students are assigned a short (2-3 page) paper.

Paper prompt:

If you wanted to follow up on our class about how atrazine affects frogs, you might go to the internet and read sites that argue for or against continued use of atrazine in the US. Your assignment is to locate two such sites (one for atrazine use, one against), summarize their arguments, and evaluate whether the site is a trustworthy source of information.

Your paper should have one page (or slightly more) addressing each web site. That page should contain the following sections:

* URL: Complete web address of the site.
* Summary: In one paragraph, summarize the argument the site is presenting for or against atrazine.
* Evaluation: Report who is the author of the information, what organization (if any) sponsors the site (name and their mission/purpose), and what the author’s credentials are. Discuss whether the author/organization is likely to have a bias (probably, given the what you were asked to search for!) or whether they are just presenting information. Discuss where the author got their information: whether and how their sources are noted, and whether they appear to be reliable sources. Tell how up-to-date the website is. This should all take 2-3 paragraphs.
* In a final, short paragraph, state whether you would consider this site a good information source and, briefly, why.

What sorts of websites to choose: Look for sites that are actually advocating for or against using atrazine, not just reporting that there is a controversy or reporting particular effects of atrazine. Do not use Wikipedia, or news sites that are repeating a story written by someone else. News-style stories are fine, as long as you’re looking at the web site that wrote the original story. Sites that argue both sides of the issue equally are appropriate, as are sites that present only (or primarily) one side.

Grading rubric: attached

**Yellowstone after Wolves**

Part 1. Lecture on food webs and indirect interactions.

Part 2. Students read “Yellowstone after Wolves” article as homework and make note of all the species that were affected by the reintroduction of wolves, how those species interact with wolves, and whether their populations have increased or decreased.

Part 3. Students work in groups in class to draw a food web for the Yellowstone ecosystem, including important indirect interactions.

Part 4. Students are assigned a short (2-3 page) paper.

Paper prompt:

A wealthy landowner owns 1 million undeveloped acres in the western US. The ecosystem supported here is very similar to that of Yellowstone National Park. There have been no wolves on this land in 70 years, and the landowner is considering reintroducing them. He is interested in restoring the ecosystem to its “natural” state and in increasing the diversity of plant and animal species present. However, other concerns will also affect his decision: he enjoys hunting elk, he considers coyotes a nuisance because they eat his pet cats, he doesn’t like beavers because he doesn’t want his land flooded, and he doesn’t want to anger his neighbors, who raise cattle.

Write a report for the landowner describing the likely effects of reintroducing wolves to his land. Address at least three of the landowner’s goals. For each, you should explain what effects wolves will have and why (explain the direct or indirect effects of wolf predation on the species you’re considering). Back up each of your conclusions with data from studies in Yellowstone or elsewhere. In a final paragraph, you may make a recommendation of whether wolves should be reintroduced, or you can leave that decision to the landowner.

Grading rubric: attached.

**Sample Course Outline:**

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| --- | --- | --- |
|  | **Date** | **Topic** |
| Unit 1: How to be a scientist | 2-Sep | Course intro |
|  | 4-Sep | Intro to ecology |
|  | 9-Sep | Island biogeography |
|  | 11-Sep | On-campus field work (groups 1-5) |
|  | 14-Sep | On-campus field work (groups 6-10) |
|  | 16-Sep | Scientific method 1 |
|  | 18-Sep | Scientific method 2 |
|  | 21-Sep | Data analysis |
|  | 23-Sep | Publishing & peer review |
|  | 25-Sep | Exam prep/review |
|  | 28-Sep | Exam 1 (covering Unit 1) |
| Unit 2: Climate change |  |  |
|  | 30-Sep | Intro to climate change |
|  | 2-Oct | Carbon cycle |
|  | 5-Oct | Nutrient cycles |
|  | 7-Oct | Energy |
|  | 9-Oct | catch-up |
|  | 13-Oct | Contamination |
|  | 14-Oct | Species distributions |
|  | 16-Oct | Phenology |
|  | 19-Oct | Exam prep/review |
|  | 21-Oct | Exam 2 (covering Unit 2) |
| Unit 3: Invasive species & commercial species | | |
|  | 23-Oct | Intro to invasion |
|  | 26-Oct | Life history |
|  | 28-Oct | Population growth |
|  | 30-Oct | Population dynamics |
|  | 2-Nov | Population structure |
|  | 4-Nov | catch-up |
|  | 6-Nov | Impacts of invasives |
|  | 9-Nov | Harvesting: fisheries |
|  | 13-Nov | Exam prep/review |
|  | 16-Nov | Exam 3 (covering Unit 3) |
| Unit 4: Biodiversity and endangered species | | |
|  | 18-Nov | Intro to diversity |
|  | 20-Nov | Competition |
|  | 23-Nov | Mutualism |
|  | 30-Nov | Food webs & indirect effects |
|  | 2-Dec | Ticks & Lyme disease |
|  | 4-Dec | Patterns in biodiversity |
|  | 7-Dec | Landscape ecology |
|  | 9-Dec | Endangered species |
|  | 11-Dec | Ecosystem services |
|  | 14-Dec | Exam prep/review |

The final exam will cover Unit 4.

**Yellowstone after Wolves rubric (25 points possible)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Missing major elements** | **Below expectations** | **Meets expectations** | **Superior** |
| Explaining interactions | Fewer than three points presented; Conclusions about the effects of wolves unexplained, or incorrectly explained (4) | Fewer than three distinct points presented;  Conclusions about the effects of wolves only partially explained (6) | Three or more main points presented;  Conclusions about effects of wolves explained fairly well (8) | Three or more main points presented;  Each conclusion about effects of wolves thoroughly explained (10) |
| Use of data | Data not used, or does not support the conclusions (1) | Data used to support conclusions not relevant (3) | Data is used, but its linkage to the conclusions not explained well (5) | Strong, relevant data used to support each conclusion (7) |
| Citations | Proper citations not used for data (0) | Proper citations used for most data (1) | Proper citations used for all data  (2) | Proper citations used for all data  (3) |
| Recommend-ation | Final recommendation not supported by the three points (0) | Final recommendation only weakly supported by the three points (.5) | Final recommendation partially supported by the three points (.7) | Final recommendation strongly supported by the three points (1) |
| Organization | No clear focus;  No continuity between ideas or paragraphs;  Paragraphs don’t have topic sentences, or supporting information not supplied. (.5) | Parts may be coherent, but overall coherence lacking;  Information in each paragraph partially supports the topic sentence;  First and final paragraphs unrelated to main points of paper. (1) | Paragraphs fairly well organized with topic sentences and supporting information;  First and final paragraphs partially introduce/summarize the main ideas;  Generally reads well, but continuity lost in a few places. (1.5) | Each paragraph has a clear topic sentence and supporting information;  First paragraph effectively introduces the paper topic;  Final paragraph summarizes the ideas of the paper;  Continuity uniformly good;  Clear interesting story. (2) |
| Style & Mechanics | Ineffective transitions impede flow;  Lack of creativity in use of language;  Discussion diffuse and insubstantial;  Many mechanical problems, some of which obscure meaning. (.5) | Some interruptions in flow of sentences or paragraphs;  Some awkward and wordy sentences;  Some inappropriate word selection;  Discussion tentative and unfocused;  Some mechanical problems, but usually not so serious as to obscure meaning. (1) | Effective transitions generally make paper easy to read;  Word choice generally good;  Some creative use of language;  Discussion authoritative in places;  Mechanical problems minor and few in number. (1.5) | Use of transitions and emphasis makes paper easy to read;  Natural sounding sentences that flow easily;  Discussion uniformly authoritative;  Mechanical problems minor, if present at all. (2) |

**Frogs and Atrazine rubric (25 points possible)**

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| --- | --- | --- | --- | --- |
|  | **Missing major elements** | **Below expectations** | **Meets expectations** | **Superior** |
| Sites chosen  (points for each site) | Site cannot be tracked down or is not advocating for/against atrazine (0) | Site fully identified, can be found, but is not clearly advocating for/against atrazine (.5) | Site is not clearly identified and is hard to find, but is appropriate (.5) | Site fully identified, can be found, is appropriate (1) |
| Summary  (points for each site) | No summary provided (0) | Position presented in the site is summarized inaccurately, or important points missing (1) | Position presented in the site is summarized accurately, but with an important point missing (2) | Position presented in the site is clearly and accurately summarized (3) |
| Evaluation  (points for each site) | Evaluation is missing several required elements, or is only weakly supported by evidence (2) | Evaluation is missing a required element, or is not always supported with evidence or examples (3) | Evaluation includes all required points and is supported with sufficient evidence and examples (4) | Evaluation includes all required points and is strongly supported with evidence and examples (5) |
| Conclusion  (points for each site) | No conclusion stated (.5) | Conclusion stated is not consistent with the evaluation (1) | Conclusion stated without support, but consistent with the evaluation (1.5) | Conclusion stated and supported with points from the evaluation (2) |
| Organization | No clear focus;  No continuity between ideas or paragraphs (.5) | Parts may be coherent, but overall coherence lacking (1) | Generally reads well, but continuity lost in a few places (1.5) | Continuity uniformly good (2) |
| Style & Mechanics | Ineffective transitions impede flow;  Lack of creativity in use of language;  Discussion diffuse and insubstantial;  Many mechanical problems, some of which obscure meaning. (.5) | Some interruptions in flow of sentences or paragraphs;  Some awkward and wordy sentences;  Some inappropriate word selection;  Discussion tentative and unfocused;  Some mechanical problems, but usually not so serious as to obscure meaning. (1) | Effective transitions generally make paper easy to read;  Word choice generally good;  Some creative use of language;  Discussion authoritative in places;  Mechanical problems minor and few in number. (1.5) | Use of transitions and emphasis makes paper easy to read;  Natural sounding sentences that flow easily;  Discussion uniformly authoritative;  Mechanical problems minor, if present at all. (2) |