

## Introduction and Information

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### Summary:

This is a one semester course designed to give you resources to teach your high school students the principles of Rangeland Ecology driving the EBIPM process, management and restoration techniques, and prepare them to assist or observe in the demonstration areas.

The curriculum will consist of five modules to introduce rangeland ecosystems, plant communities and the EBIPM step-by-step process. Each module will consist of activities and lessons designed to teach students the ecological process of rangelands as well as management. Themes consistent through each module will be the use of **GPS** and Mapping, and reading scientific research papers, field experiences, plant identification,

Components of each module:

The modules will have lessons for teachers to use in the classroom as well as in the field at the demonstration areas and will be based on the step-by-step process of EBIPM. Individual modules will contain biology and ecology lessons as well as lessons designed to teach the tools and strategies for restoration. Desirable and invasive species identification will occur through all modules. These are called Species to be Learned (STBL), and there are 3 activities given for use. Each module has scientific papers and other reading material available. These are no doubt challenging reading material for high school students, but are an important part of the EBIPM process, as they guide the decisions made for

restorative processes. For each module there is a field trip. These are very open ended activities, and really depend on you as the teacher and your interactions with the outreach coordinator. There is a case study for each module as well. In these, students will be summarizing their knowledge and making a presentation to the class. They will also include educational standards from the National Science Education Standards (NSES). Along with the goals and objectives for each lesson a pre-test and post-test are available.

#### Teacher prospective

This curriculum is teacher created. I have worked in the field as an experiential educator teaching natural history. I have also taught in the classroom. I designed this curriculum from those backgrounds and with you as a classroom teacher in mind. I know that each class is unique and you know your students and what your class's need. This curriculum is a compilation of activities and resources that I have used, seen, learned about, and thought highly of which will help you prepare your students for understanding the EBIPM process. EBIPM is a true application of what scientists do in the real world and will allow students to see the outcome of using and knowing the scientific method.

While preparing this curriculum I participated in research experiments and observed many demonstration sites. While I think that focusing for an entire semester on the EBIPM process would be a spectacular learning activity for students and truly allow them to understand the scientific method and the associated ecological principles involved in rangeland management, I am realistic about the limitations you as a classroom teacher might face. This curriculum can be used from cover to cover, as a supplement to a class, or simply as a preparation for a one day field trip to an EBIPM demonstration site. Please use some or all of the activities to suit your class. I encourage you to adapt and supplement this curriculum as you see fit. I also encourage you to contact the outreach coordinator early on in your semester and talk to them about making as many field visits as possible. You might find that the field season for EBIPM and the school year do not align perfectly, but please do not let that hold you back. In an ideal world students would be pre-learning in the classroom, observing and participating in the field, and then bringing their learning full circle in the classroom again to conclude. Again, please consider this curriculum as a resource for you to use as a teacher, not a blueprint for a class.

Each module contains some repeated activities, such as the study of the invasive and preferred plant species in the range, or the reading of scientific research papers. I included these activities as a way for teacher to have some consistency and routine in their classrooms to teach the principles. The activities are designed with the goals of EBIPM in mind. This curriculum includes challenging reading and activities that will increase scientific literacy. While only the NSES are included, the scientific literacy component obviously meets other reading standards. They are not included here because this curriculum is science based.

While I did create some of the activities independently, this curriculum gives you access to other invasive species curriculums. I have used these activities in the past, and reviewed them through this process. The EBIPM process is collaborative as is learning. I truly did not see the reason for creating new activities when so many great activities already exist. For example, I recommend activities from the Montana invasive species curriculum. The only change that needs to be made in the activities is to make them site specific. The University of Idaho has a tremendous curriculum as well, and I highly recommend you pull activities from it, especially to supplement the first two modules. It has been my

goal to cite all of the resources I have used, and any omissions of citations are unintentional. I extend a huge ‘thank you’ to the educators who created lessons to be used and to those involved in the EBIPM who created working documents that will be huge supplements to the classroom.

In staying in spirit and connection with the EBIPM process, lessons are actually designed around the exact process and documents that are used as land assessments and management tools in the field. Although complex at first, they become clear and simple with practice and application. Again, these are real tools that students may be using in the field as college interns only a couple years later. I encourage you to challenge your students and expose them to the materials scientists and landowners are really using!

As a teacher I encourage you to read 3 publications before starting to get yourself up to speed on the process and some of the ecological principles. They may be downloaded or ordered from the EBIPM website and will take only a short time to read.

[Applying Ecologically-Based Invasive Plant Management: An Introduction and Overview](#)

[Ecological Principles for Invasive Plant management](#)

And; [Adaptive Management for Invasive Annual Grasses: A step-by-Step Users Guide.](#)

These publications will give you a content overview and help you to decide if the EBIPM curriculum is right for your classes. These will also turn into classroom texts in the later modules of the curriculum. The EBIPM website has pages of literature and videos which will give you background on all of the topics within this curriculum (check out in particular the e-news page for lectures from researchers). While the curriculum is designed to be taught to students who have a basic understanding of biology and scientific method, it also would allow for younger students to be introduced to these concepts. Again, as a teacher I trust that you can supplement this curriculum in your class to ‘pre-teach’ concepts and guide younger students to conceptual understanding of rangeland ecosystems and the EBIPM process.

Module 4 begins the work of the EBIPM, however, you may want to introduce the subject early on in the semester. This unit in particular is inquiry based and involves many scientific principles. You and your students may not know the meaning of some of the information. That is OK, and is often the case in the scientific method. You might simply have to do some extra research on these projects and answer some questions with your students. Ecosystems and management are difficult and complicated scientific issues. It is nearly impossible to teach all of the information a student might need to know, but I have attempted to include many broad reaching lessons to introduce concepts to students.

Please feel free to contact me if you have any questions. I hope this curriculum will guide you and your classroom to an understanding of the EBIPM process and of rangeland ecosystems. Again, let this be your roadmap, and do not feel limited by what I have included. Make the adaptations and supplements you see fit for your students. Rangelands and the Sagebrush-Steppe are truly beautiful places, and are a natural resource to be preserved by younger generations.

## Modules Goals

Module	Goals
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1: Rangeland ecosystems	Identify a healthy rangeland ecosystem. Describe why rangelands are important socially, economically, & environmentally. Explain the difference between invasive species and native species. Increase scientific literacy through guided reading.
2: Plant Identification & systematics	Explain ways in which plants are classified into different categories. Identify plant species specific to the location. Describe the life strategies of species specific to the location. Increase scientific literacy through guided reading.
3: Scientific Principles	Explain how the scientific method could be used in invasive species management. Describe sampling methods including belt transects, line transects, and quadrants Increase scientific literacy through guided reading.
4: EBIPM steps 1, 2 & 3	Explain the rangeland health indicators Describe how site availability, species availability, and species performance allow for invasive weed growth. Increase scientific literacy through guided reading. Identify the ecological principles that are at work in an infested site.
5: EBIPM Steps 4-5	Choose tools for weed reduction based on ecological principles. Create a potential monitoring plan for the management plan. Increase scientific literacy through guided reading.

## Module Objectives

Module	Objectives
1: Rangeland ecosystems	<ol style="list-style-type: none"> <li>a. Define rangeland ecosystem.</li> <li>b. Apply the concept of niche to ecosystem processes</li> <li>c. Describe succession in the sagebrush steppe ecosystem</li> <li>d. Distinguish between native and invasive species</li> <li>e. Explain how soils effect plant communities</li> <li>f. Explain how weather and climate effect plant communities.</li> <li>g. List desired and invasive species</li> <li>h. Describe the effects invasive species have on the environment</li> <li>i. Describe the economic impacts invasive species have</li> <li>j. State how land owners are effected by invasive species</li> </ol>

<p>2: Plant Identification &amp; systematics</p>	<ul style="list-style-type: none"> <li>a. Differentiate between annual and perennial plants</li> <li>b. Define native and invasive species</li> <li>c. Distinguish between grasses, shrubs, forbs, and litter</li> <li>d. Describe the general life cycle of plant</li> <li>e. Describe the life cycle and life strategies of invasive plants</li> <li>f. Describe the life cycle and life strategies of native plants</li> <li>g. Compare the life strategies of natives and non-natives</li> <li>h. Classify plants into taxonomic categories</li> <li>i. list desired and invasive species</li> <li>j. identify plants based on characteristics of leave shape arrangement or flower structure</li> </ul>
<p>3: Scientific Principles</p>	<ul style="list-style-type: none"> <li>a. Define experiment, control, data, hypothesis, outcome, tests, sample</li> <li>b. Describe how the previous words are related to scientific testing</li> <li>c. Understand taxonomic systems of plant classification.</li> <li>d. Explain how data is collected in the field</li> <li>e. Summarize the process of us belt transects as a sampling method</li> <li>f. State why controls are needed in scientific studies</li> <li>g. Describe why continued monitoring is needed in the scientific process, particularly when studying ecosystems</li> </ul>
<p>4: EBIPM steps 1 &amp; 2</p>	<ul style="list-style-type: none"> <li>a. Identify soil degradation caused by different environmental factors</li> <li>b. Explain how plant mortality plays a role in rangeland health</li> <li>c. Identify preferred and invasive species</li> <li>d. Describe disturbance role in site availability</li> <li>e. Describe propagule dispersal's role in species availability</li> <li>f. Describe propagule pressure's role in species availability.</li> <li>g. Identify how resource acquisition effects species performance</li> <li>h. Describe how the life strategy of plans affects plant performance.</li> <li>i. Apply the principles of stress to species performance.</li> </ul>
<p>5: EBIPM Steps 3-5</p>	<ul style="list-style-type: none"> <li>a. List tools available to create sites for preferred species</li> <li>b. Describe the tools which allow higher dispersal of preferred species</li> <li>c. Describe the tools which will allow for better reproduction of preferred species</li> <li>d. Apply the strategies which will increase resource acquisition</li> <li>e. relate the strategies which will provide more positive response the environment</li> <li>f. Apply tools and strategies to increase stress on invasive species</li> <li>g. Identify the life strategies of invasive and native plants which allow for one to out compete the other.</li> </ul>

Scientific literacy objectives

Read for specific information

Summarize the results of a scientific study

Synthesize information given in charts and graphics

Gain exposure to scientific writing style and the peer review method for publication

Understand the concept of primary information and primary data

**Class/ Subject Correlations**

<b>Module</b>	<b>Subjects</b>	<b>Class correlation</b>
1 Rangeland Ecosystems	Ecosystem, communities, interactions, rangelands, natural resources	Biology, Env. Science, Agriculture Science, Ecology
2 Plant Identification and systematics	Taxonomy, Plant ID, Botany, Ecosystem, Communities	Biology, Botany, Horticulture,
3 Scientific Principles & Research	Scientific Method, Research Methods, Ecosystems	Biology, Science Inquiry/Research, Environmental Science, Agriculture Science, Botany, Horticulture, Ecology
4 EBIPM Steps 1,2, & 3	Ecology, succession, rangeland, soils,	Biology, Science Inquiry/Research, Environmental Science, Agriculture Science, Botany, Horticulture
5 EBIPM Steps 4 & 5	Ecosystem, communities, interactions, rangelands, natural resource management, Scientific Method, soils, social involvement.	Biology, Science Inquiry/Research, Environmental Science, Agriculture Science, Botany, Horticulture, Ecology

**NSES content standards**

NSES Content Standard - This module meets the following National Science Education Standards

Content Standard A: As a result of the activities in grades 9-12, all students should develop an understanding of;

Abilities necessary to do scientific inquiry

Understandings about scientific inquiry

Content Standard C: As a result of the activities in grades 9-12, all students should develop an understanding of;

Biological evolution

Interdependence of organisms

Matter, energy, and organization in living systems

Behavior of organisms

Content Standard D: As a result of the activities in grades 9-12, all students should develop an understanding of;

Energy in the earth system

Geochemical cycles

Content standard E: As a result of the activities in grades 9-12, all students should develop an understanding of;

Abilities of technological design

Understandings about science and technology

Content standard F: As a result of the activities in grades 9-12, all students should develop an understanding of;

Personal and community health

Population growth

Natural history

Environmental quality

Natural and human-induced hazards

Science and technology in local, national, and global challenges.

### **Pretest and post-test**

Each module will have a pretest and post test. These can be use as summative assessments in the classroom or for the EBIPM to track effectiveness of the curriculum. There will be question from all of the sections which are to follow.

## STBL

STBL is the Species To Be Learned for each module. Each module will have 10 species to be identified. Through identification students will learn plant physiology and adaptations. This will be the essential plant species students will need to know to successfully understand the EBIPM program. The National Resources Conservation Service (NRCS) is a resource and has a majority of the plants available. The activities available are:

[Wanted posters<sup>1</sup>](#)

[Herbarium creation](#) (template)

[ID card creation](#) (template)

## SSR

Suggested Scientific Readings are scientific papers that are associated with the topics of each module. The SSR component of the modules is multi-purposed. Ideally they will help students to understand the ecology of rangeland as well as the process of scientific research. For each assigned reading there will be a reading guide with guiding questions for reading. These questions will be on the test as well.

[SSR Reading Guide](#)

## Case Study

A case study will be included in each module as well. This is an attempt to give real-world exposure early on in the curriculum. For each case study group will prepare a presentation highlighting information about the module being studied and about EBIPM. Alternatively, the town hall meeting can be done which many stake-holders need to

Module 1 – Working Ranch EBIPM video

Module 2 – Birds of Prey Natural area

Module 3 – Reynolds Creek what can be learned

Module 4 - Nevada Land Conservancy/ NF Crooked River

Module 5 – Ditto Ranch/ Martin Basin

[Presentations](#)

[Town Hall Discussion](#)

## Field Visit

Each module has a lesson that is planned around a field visit. The best way to learn about rangeland is to see the rangeland. Schedule a tour with your local outreach coordinator or even just visit natural site and enjoy some time outside. Get creative if you think your students are up to the challenge by collecting

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<sup>1</sup> See Activity lesson plan for details on the lesson

extras for the herbarium. Bring a GPS to mark some points and load them into Google Earth. (Module 1 has an introduction lesson) Create a map of the semester with all of the sites you have been to.