

ESI Detailed Course Outline

Unit 1 Issue Analysis

Lesson 1.1 Defining an Issue

1. Solving environmental problems requires research, planning, and communication skills.
 - Investigate an environmental problem that may occur locally.
2. Organization and record-keeping are essential to success in environmental science.
 - Set up the *ESI Notebook and Laboratory Notebook*.
3. Environmental problems occur locally, nationally, and globally.
 - Compare climate changes and problems that occur locally, nationally, and globally.
4. Issues, problems, and facts have different characteristics.
 - Categorize environmental issues, problems, and facts related to an environmental topic.
5. Solving environmental problems includes economic, political, and ethical considerations related to the issue, which require in-depth analysis.
 - Analyze issues by identifying key terms, historical viewpoints, and facts.
 - Use multiple sources to identify the economic, political, and ethical aspects of an issue.

Lesson 1.2 Bias and Belief

1. Ethical questions surrounding environmental issues generate discussions and opinions based on personal beliefs.
 - Explore personal beliefs and knowledge to gain a perspective on environmental issues.
2. Peoples' backgrounds and knowledge influence public perception of environmental issues.
 - Conduct a public perception survey of an environmental issue.
3. Effective communication and conflict resolution foster a working relationship when differing viewpoints exist.
 - Analyze effective communication behaviors.
 - Identify effective conflict resolution behaviors and develop classroom conflict guidelines.
4. Media bias affects how humans perceive and respond to environmental issues.
 - Identify forms of bias in media sources.

Unit 2 Biodiversity

Lesson 2.1 Environmental Observations

1. Researchers observe environmental systems by collecting quantitative and qualitative data.
 - Observe an environment and collect quantitative and qualitative data using transects.
2. The biodiversity of an environment is measured by analyzing species evenness and species richness.
 - Use transect data to calculate the biodiversity of ecosystems.
3. Environmental managers make decisions using data that is precise and accurate.
 - Determine the precision and accuracy of data collected using sensors.
4. Researchers use GIS and GPS to collect, analyze, and present environmental data.

- Collect data using sensors and a Global Positioning System.
- Analyze and display environmental data using a Geographic Information System.

Lesson 2.2 Ecosystem Balance

1. Healthy ecosystems have a diverse number of species dependent upon each other.
 - Explain the interdependent relationship of organisms in a pond.
2. Complex relationships in an ecosystem are analyzed using models.
 - Model population growth of deer in an ecosystem.
3. The functionality of an ecosystem is dependent on limiting factors.
 - Use species population, predation, and area to predict ecosystem productivity.

Lesson 2.3 Ecosystem Problems

1. Natural and anthropogenic events cause changes at all trophic levels in an ecosystem.
 - Explain the natural and anthropogenic causes of population growth and decline of a species.
 - Model a lakeshore housing development and explain how it will affect an ecosystem.
2. New organisms affect biodiversity when introduced to an ecosystem.
 - Develop a public service announcement informing the public about an invasive species.
3. Ecosystem management practices maintain biodiversity and ecosystem function.
 - Manage a deer and wolf population using a statistical model.
 - Design an ecosystem management plan to help a threatened species recover.
4. Migrating species affect ecosystem diversity.
 - Explain the relationships between marine, estuarine, and freshwater stream food webs supporting a salmon population.

Unit 3 Energy, Technology, and Society

Lesson 3.1 Producing Energy

1. Resource availability, environmental risks, and technology drive the development of new energy sources.
 - Explain the natural and anthropogenic causes of population growth and decline of a species.
 - Model a lakeshore housing development and explain how it will affect an ecosystem.
2. Cost affects energy resource development.
 - Develop a public service announcement informing the public about an invasive species.
3. Emissions influence energy source development, production, and use.
 - Manage a deer and wolf population using a statistical model.
 - Design an ecosystem management plan to help a threatened species recover.
4. Energy sources are compared using full cost accounting.
 - Explain the relationships between marine, estuarine, and freshwater stream food webs supporting a salmon population.

Lesson 3.2 Energy Choices

1. Energy usage is dependent upon consumer choices.

- Evaluate technologies used to produce cellulosic ethanol.
 - Collect data to evaluate the potential for solar power in their community.
 - Complete an environmental impact statement for a new electrical generation installation.
2. Government policies and subsidies affect energy development and impact the environment.
 - Compare solar cost to average monthly electrical bill.
 - Compare regional energy source costs.
 3. Environmental regulations consider the implications of economic, environmental, individual, and societal needs.
 - Compare the life cycle emissions of various renewable and nonrenewable energy sources.
 4. Individual consumers can reduce energy consumption by changing personal habits, auditing energy usage, and using government programs.
 - Research and calculate the social, economic, and environmental costs of an energy source.
 - Select energy sources for a community using the principles of full cost accounting.

Unit 4 Feeding the World

Lesson 4.1 Agriculture and the Environment

1. A growing population demands increased agricultural production.
 - Calculate the land and food energy requirements of a growing population.
 - Describe potential solutions for increasing the future food supply.
2. Agricultural practices influence biodiversity.
 - Measure the biodiversity in soil from different agricultural environments.
3. Problem-solvers conduct background research to connect available information to a research objective.
 - Research the effects of genetic modification on agriculture and the environment. (Project 4.1.3)
 - Write a scientific research paper using good resources and parenthetical citations.

Lesson 4.2 Ag Management Practices

1. Sustainable agricultural practices can protect the environment while meeting global food needs.
 - Explain and recommend sustainable practices for conserving natural resources in agricultural production.
2. Agriculturalists have responded to their effect on the environment by predicting and managing current and future impacts.
 - Collect environmental data from an agricultural field.
 - Address an environmental issue and develop a sustainable production plan for an agricultural field.
3. Land managers use precision technologies to manage and monitor the environment.
 - Use GPS and GIS technologies to map environmental data.
 - Use GIS maps to identify and solve a potential environmental issue.

Unit 5 Pollution

Lesson 5.1 Pollution Sources

1. Agricultural pollutants interact with each other in complex ways.
 - Test the effects of nitrogen and phosphorus on eutrophication.
2. Many sources create pollution within ecosystems.

- Identify types and sources of pollutants in a river watershed.
3. Pollutants affect the physical and chemical makeup of an ecosystem in different ways.
 - Plot correlations between pollutants and physical and chemical stream characteristics.
 - Compare fertilizer runoff in soils with different textures.

Lesson 5.2 Polluted Environments

1. Pollutants affect the health of living organisms in an ecosystem.
 - Observe and explain how water pollution affects the mortality of an indicator species.
2. Human population growth affects environmental pollution.
 - Analyze the relationship between population growth and air quality using a computer simulation.
3. Populations contribute to and are affected by pollution in different ways.
 - Investigate and research pollution in local areas.

Lesson 5.3 Pollution Solutions

1. Governments enact policies and regulations to manage resources.
 - Explain how federal regulations affect local communities, agriculture, and the environment.
 - Identify local facilities out of compliance with environmental laws.
2. Polluted resources cause social, economic, and scientific issues.
 - Test a method for purifying polluted drinking water.
 - Complete an engineering design project to solve water pollution issues in a specific area of the world.
 - Design and test a water purification system.

Unit 6 ESI Research

Lesson 6.1 Environmental Research Project

1. Research is driven by questions and supported by literature reviews, experimentation, and communication of results.
 - Brainstorm ideas for research projects and define a question and hypothesis to study to frame research.
2. Scientists conduct background research to summarize what is already known about a research question.
 - Collect and summarize similar research conclusions.
3. Environmental questions are studied using research, the scientific method, critical thinking, and problem-solving techniques.
 - Write a research proposal outlining the background and need for their research and a plan for conducting the research.
 - Conduct a self-designed research project and collect data for results and analysis.
4. Research experiments include the interpretation of data in the form of posters, papers, or oral presentations.
 - Write a research paper summarizing the findings of their research.
 - Prepare a research poster to present to the class and at local science fairs.
5. Scientists must inform the public about environmental issues before policymakers can decide how to work toward a solution.

- Identify an environmental issue with the public interest.
- Develop and present an issue to a public group or organization.