

GEO STAC Teaching Guide

Weed Mapping Lesson

Lesson Developer: Sean Kenna, Willamette High School

Subject Area: Botany (Ecology)

Grade Level: High School (grades 10, 11, 12)

Lesson Description: Students will locate some weed and native species found in Oregon and will understand that while databases are beneficial in studying plant populations, local on-the-ground information is commonly more up-to-date and that both are required to make large scale management decisions. Students will learn that the invasion of weeds commonly follows on the heels of a disturbance (natural or otherwise) and be introduced to some of the factors that impact the success of weeds in a particular ecosystem. Students will begin to relate the data to real-life situations and how they could be used to create management plans/strategies and/or alter existing management practices.

Learning Objectives: Students will be able to:

- Identify various regions and features within the state.
- Identify the factors that make a site susceptible to weeds.
- Use GIS technology to relate regions and features to the factors that make a site susceptible to weeds.
- Use GIS technology to describe a specific region in terms of the factors that make a site susceptible to weeds.
- Use GIS technology to identify any relationship between the presence of weeds and historical fire sites.
- Understand that GIS technology is a tool that may be used to facilitate decision making, planning and management practices.

Recommended Time to Teach: (100 minutes—additional time outside of class as needed)

Standards:

Technology:

- Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students communicate information and ideas effectively to multiple audiences using a variety of media and formats. (NETS-S Communication & Collaboration – 2B)
- Students apply digital tools to gather, evaluate, and use information. Students process data and report results. (NETS-S Research & Information Fluency – 3D)
- Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students collect and analyze data to identify solutions and/or make informed decisions. (NETS-S Critical Thinking, Problem Solving, and Decision Making – 4C)
- Social, ethical, and human issues: Students use technology tools to enhance learning, increase productivity, and promote creativity.
- Technology productivity tools: Students use technology tools to enhance learning, increase productivity, and promote creativity.
- Technology research tools: Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.

Science

- Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years. (Life Science 9-12 Standard C, The Interdependence of Organisms 3)
- Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite. This fundamental tension has profound effects on the interactions between organisms. (Life Science 9-12 Standard C, The Interdependence of Organisms 4)
- Human beings live in the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected. (Life Science 9-12 Standard C, The Interdependence of Organisms 5)
- Scientists in different disciplines ask different questions, use different methods of investigation, and accept different types of evidence to support their explanations. Many scientific investigations require the contributions of individuals from different disciplines, including engineering. New disciplines of science, such as geophysics and biochemistry often emerge at the interface of two older disciplines. (Science & Technology 9-12 Standard E Understanding About Science & Technology 1)
- Many factors influence environmental quality. Factors that students might investigate include population growth, resource use, population distribution, overconsumption, the capacity of technology to solve problems, poverty, the role of economic, political, and religious views, and different ways humans view the earth. (Science in Personal & Social Perspectives 9-12 Standard F Environmental Quality 3)
- Science and technology: Science and technology are receptive. Technology provides tool for investigation, inquiry and analysis.

Social Studies:

- To understand location, region, place, human systems, physical systems and environment as well as the interaction among human and physical systems; relationships among various regional and global patterns of geographic phenomena such as landforms, soils, climate, vegetation, natural resources and population (SS HS-People, Places, & Environments)
- Technology is as old as the first crude tool invented by prehistoric humans, but today's technology forms the basis for some of our most difficult social choices... What can we learn from the past about how new technologies result in broader social change, some of which is unanticipated?... How can we manage technology so that the greatest number of people benefit from it? How can we preserve our fundamental values and beliefs in a world that is rapidly becoming one technology-linked village? This theme appears in units or courses dealing with history, geography, economics, and civics and government. It draws upon several scholarly fields from the natural and physical sciences, social sciences, and the humanities for specific examples of issues and the knowledge base for considering responses to the societal issues related to science and technology. (SS HS-Science, Technology, & Society)
- CCG: Understand the spatial concepts of location, distance, direction, scale, movement, and region.
- SS.08.GE.01.01 Use maps, charts, and graphs to understand patterns of movement over time and space.
- CCG: Use maps and other geographic tools and technologies to acquire, process, and report information from a spatial perspective.
- SS.08.GE.02 Read, interpret, and understand how to construct geographic representations to analyze information, understand spatial relationships, and compare places.
- SS.08.GE.02.01 Use maps, charts, graphs, and photographs to analyze spatial distributions and patterns.
- CCG: Understand how people and the environment are interrelated

Geospatial Concepts:

Location: Students will identify where weeds are found and begin to look at factors suggesting why they may be found there.

Condition: Students will begin by examining the various conditions that exist on a map and later return to this as they start looking at potential factors as to why these particular areas may be more susceptible to weed invasion and potential disturbances that may have caused this condition/present distribution of weeds.

Connection: Students will examine how their weed site is connected to other places and how that relates to weed arrival, distribution, and expansion.

Diffusion: Students will observe the presence of weeds in Oregon and hypothesize on their diffusion in that area.

Pattern: Students will identify “clusters” and “other patterns” where weeds seem to be particularly problematic and identify what is located in that area and nearby.

Spatial Model: Students will begin to think about what processes allow weeds in one place to expand to other places.

Other Discipline:

Ecology: The same factors that impact weed spread are those that relate to ecology and biome traits and can be used to relate potential for desertification (related to deforestation). Extensions could be made to succession.

Meteorology - Weather processes directly influence acid precipitation, influencing the amount and patterns of precipitation.

Career Connection:

BLM, Forest Service, USGS, etc – environmental analysts look at the factors within an ecosystem and how they interact so many governmental organizations on both the state and national level use these types of information to make management decisions.

Web-based GIS Tools:

Search: This tool will be used to find cities, rivers, etc.

Identify: Students will identify ecoregions, vegetation types, weeds, etc. using this tool.

Measure: Students will use this tool to measure how close a specific weed infestation is to nearby landmarks.

Erase: This tool will be used to erase measurements made since students will need to make at least three (3) measurements.

During the GIS lesson, students will identify the factors that make a site susceptible to weed infiltration. The existence of specific weed regions will be examined to see if they are associated with historical fire sites and students may make connections to population centers, roads, etc as areas of disturbance. Students will search for patterns of weed infiltration and use this to develop a potential management practice to limit the amount of invasive species.

Materials: Weed Presentation and Background Reading, Answer Sheets, Pen/Pencil, Internet Access.

Prerequisites: Students should have an understanding of the characteristics of a weed and how they differ from native and non weed species.

Beginning the Lesson

The lesson should begin with a class discussion/ review of weeds and what traits would make for a “good” weed. Discuss how weeds get to new locations and provide background reading related to weeds and GIS use in tracking weeds. Students will view video on GIS and its uses.

Developing the Lesson:

Students will perform the following before performing the GIS activity:

1. Complete the background reading on weeds.
2. Complete the lesson on weeds and GIS.

Concluding the Lesson

Students will turn in their answer sheets and create summaries of the native and invasive species in their identified area.

Career Connections:

The video at the beginning of the lesson as well as the lesson itself provide insight into potential GIS careers.

Assessment/Evaluation:

Assessment will occur for learning will occur in a variety of ways:

- Reading questions and discussion before the GIS activity.
- Successful completion of Weed Mapping Using GIS activity.
- Unit test questions.