

Secondary Earth Science 2 Endorsement Specs

Purpose

This endorsement, when attached to a current Secondary Education License, verifies that the individual has the skills and knowledge necessary to teach students in an advanced secondary earth science classroom and is required to teach Advanced Earth/Environmental (AP, CE, and IB) and other high school earth science elective courses. Those with this endorsement can also teach all the courses a Earth Science 1 endorsed educator can teach. NOTE: Advanced Earth/Environmental Science (AP, CE, and IB) courses may also include additional requirements in order to be approved by the university or college board to teach.

Endorsement Prerequisites

To be eligible for this endorsement, candidates must meet the following prerequisites:

- Have a Secondary Education License
- Have the Secondary Science Core Endorsement
- Have the Secondary Earth Science 1 Endorsement

Endorsement Requirement Areas

The Science Core Endorsement has the following 2 requirement areas:

1. Advanced Data Analysis Content Knowledge
2. Advanced Earth Science Knowledge

Endorsement Type

A professional endorsement will be awarded when all of the requirement areas have been met. An associate endorsement will be awarded if the applicant holds a professional Earth Science 1 endorsement **OR** has completed at least 1 of the 2 requirement areas.

Requirement Area Options

The different options available to complete each of the requirement areas are described below. Quick links to the requirement area competencies are linked in parentheses.

Requirement Area 1: Advanced Data Analysis Content Knowledge ([ES2.1](#))

Complete one of the following options to show evidence of competency in this Requirement Area

University Courses

- Any 3+ credit university course (passed with a grade of C or higher) in Statistics (e.g., General Statistics, Applied Statistics, Probability and Statistics, Statistics for Scientists)

College Major (Meets Requirement Areas 1-2 for this endorsement)

- College Major in Earth Science, Earth Science Education, Physical Science Education, or an Earth Science Variation (e.g., Environmental Science, Geology, Meteorology, Astronomy)
- Other College Majors may be approved for this endorsement with approval of USBE Science Specialist based on a transcript review



Requirement Area 2: Advanced Earth Science Content Knowledge ([ES2.2](#))

Complete one of the following options to show evidence of competency in this Requirement Area

University Courses

- Complete **TWO** 3+ credit university courses (passed with a grade of C or higher) in Advanced/Applied Earth Science in addition to the courses taken to meet Earth Science 1 Endorsement requirements (if applicable). Examples of course could include: Atmospheric Science, Environmental Management, Geologic/Natural Hazards, Historical or Physical Geology, Intro to GIS, Soil Science

College Major (Meets Requirement Areas 1-2 for this endorsement)

- College Major in Earth Science, Earth Science Education, Physical Science Education, or an Earth Science Variation (e.g., Environmental Science, Geology, Meteorology, Astronomy)
- Other College Majors may be approved for this endorsement with approval of USBE Science Specialist based on a transcript review

Requirement Area Competencies

The Secondary Earth Science 2 competencies are organized into 1 section:

1. **Earth Science 2 Core Ideas** – This endorsement is required to teach Advanced Earth/Environmental Science (AP, CE, and IB) and high school Earth Science elective courses. These competencies and requirements go above that of the core ideas found in the SEEd Earth Science Standards.

ES2.1 Advanced Data Analysis

ES2.2 Advanced Earth Science Content Knowledge

Each of the requirement area competencies are described below. Quick links to each requirement area options are provided in the parentheses.

Requirement Area 1 - Advanced Data Analysis Content Knowledge ([Options](#))

Requirement Area ES2.1: Advanced Data Analysis

Area ES2.1.A: Representing and Describing Data

- ES2.1.A.a Construct a graph, plot, or chart (X,Y; Log Y; Bar; Histogram; Line, Dual Y; Box and Whisker; Pie) showing correct: a) Orientation, b) Labeling, c) Units, d) Scaling, e) Plotting, f) Type, g) Trend line
- ES2.1.A.b Describe data from a table or graph, including: a) Identifying specific data points, b) Describing trends and/or patterns in the data, c) Describing relationships between variables

Area ES2.1.B: Statistical Tests and Data Analysis

- ES2.1.B.a Perform mathematical calculations, including: a) Mathematical equations, b) Means, c) rates, d) ratios, e) percentages.
- ES2.1.B.b Use confidence intervals and/or error bars (both determined using standard errors) to determine whether sample means are statistically different.
- ES2.1.B.c Perform chi-square hypothesis testing
- ES2.1.B.d Use data to evaluate a hypothesis (or prediction), including a) Rejecting or failing to reject the null hypothesis, b) Supporting or refuting the alternative hypothesis.

Requirement Area 2 - Advanced Life Science Content Knowledge ([Options](#))

Requirement Area ES2.2: Advanced Earth Science Content Knowledge



Area ES2.2.A: The Living World and Populations

- ES2.2.A.a Describe the global distribution and principal environmental aspects of terrestrial biomes.
- ES2.2.A.b Explain how solar energy is acquired and transferred by living organisms.
- ES2.2.A.c Describe ecosystem service and human disruptions to them.
- ES2.2.A.d Describe island biogeography and its role in evolution.
- ES2.2.A.e Describe ecological tolerance.
- ES2.2.A.f Explain how natural disruptions, both short and long-term, impact an ecosystem.
- ES2.2.A.g Describe ecological succession and its effect on ecosystems.
- ES2.2.A.h Identify differences between generalist and specialist species.
- ES2.2.A.h Identify differences between K- and r-selected species.
- ES2.2.A.i Explain survivorship curves.
- ES2.2.A.j Explain age structure diagrams.
- ES2.2.A.k Explain factors that affect total fertility rate in human populations.
- ES2.2.A.l Explain how human populations experience growth and decline.

Area ES2.2.B: Earth Systems and Resources

- ES2.2.B.a Describe the characteristics and formation of soil including similarities and differences between properties of different soil types.
- ES2.2.B.b Describe the structure and composition of the Earth's atmosphere including how environmental factors can result in atmospheric circulation.
- ES2.2.B.c Describe the characteristics of a watershed.
- ES2.2.B.d Describe how the Earth's geography affects weather and climate.
- ES2.2.B.e Describe the environmental changes and effects that result from El Niño or La Niña events (El Niño–Southern Oscillation).
- ES2.2.B.f Explain the concept of the tragedy of the commons.
- ES2.2.B.g Describe the effect of clearcutting on forests.
- ES2.2.B.h Describe agricultural practices that cause environmental damage.
- ES2.2.B.i Describe different methods of irrigation including their benefits and drawbacks.
- ES2.2.B.j Describe the benefits and drawbacks of different methods of pest control.
- ES2.2.B.k Identify different methods of meat production including the benefits and drawbacks.
- ES2.2.B.l Describe causes of and problems related to overfishing.
- ES2.2.B.m Describe natural resource extraction through mining including ecological and economical impacts of natural resource extraction through mining.
- ES2.2.B.n Describe the effects of urbanization on the environment.
- ES2.2.B.o Explain the variables measured in an ecological footprint.
- ES2.2.B.p Explain the concept of sustainability.
- ES2.2.B.q Describe methods for mitigating problems related to urban runoff.
- ES2.2.B.r Describe sustainable agricultural and food production practices.
- ES2.2.B.s Describe the benefits and drawbacks of aquaculture.
- ES2.2.B.t Describe methods for mitigating human impact on forests.

Area ES2.2.C: Energy Resources and Consumption

- ES2.2.C.a Identify differences between nonrenewable and renewable energy sources.
- ES2.2.C.b Describe trends in energy consumption.
- ES2.2.C.c Identify types of fuels and their uses.
- ES2.2.C.d Identify where natural energy resources occur.
- ES2.2.C.e Describe the use and methods of fossil fuels in power generation and the effects of

fossil fuels on the environment.

- ES2.2.C.f Describe the use of nuclear energy in power generation and the effects of the use of nuclear energy on the environment.
- ES2.2.C.g Describe the effects of the use of biomass in power generation on the environment.
- ES2.2.C.h Describe the use of solar energy in power generation and the effects of solar energy power generation on the environment.
- ES2.2.C.i Describe the use of hydroelectricity in power generation and the effects of the use of hydroelectricity power generation on the environment.
- ES2.2.C.j Describe the use of geothermal energy in power generation and the effects of geothermal energy power generation on the environment.
- ES2.2.C.k Describe the use of hydrogen fuel cells in power generation and the effects of hydrogen fuel cell power generation on the environment.
- ES2.2.C.l Describe the use of wind energy in power generation and the effects of wind energy power generation on the environment.
- ES2.2.C.m Describe methods for conserving energy.

Area ES2.2.D: Atmospheric, Aquatic, and Terrestrial Pollution

- ES2.2.C.n ES2.2.D.a Identify the sources and effects of air pollutants
- ES2.2.C.o Explain the causes and effects of photochemical smog and methods to reduce it.
- ES2.2.C.p Describe thermal inversion and its relationship with pollution.
- ES2.2.C.q Describe natural sources of CO₂ and particulates.
- ES2.2.C.r Identify indoor air pollutants.
- ES2.2.C.s Explain how air pollutants can be reduced at the source.
- ES2.2.C.t Describe the effects of acid deposition on the environment.
- ES2.2.C.u Describe human activities that result in noise pollution and its effects.
- ES2.2.C.v Identify differences between point and nonpoint sources of pollution.
- ES2.2.C.w Describe the impacts of human activities on aquatic ecosystems.
- ES2.2.C.x Describe the causes and effects of endocrine disruptors on ecosystems.
- ES2.2.C.y Describe the impacts of human activity on wetlands and mangroves.
- ES2.2.C.z Explain the environmental effects of excessive use of fertilizers and detergents on aquatic ecosystems.
- ES2.2.C.aa Describe the effects of thermal pollution on aquatic ecosystems.
- ES2.2.C.bb Describe the effect of persistent organic pollutants (POPs) on ecosystems.
- ES2.2.C.cc Describe the effects of bioaccumulation and biomagnification.
- ES2.2.C.dd Describe the effects of solid waste disposal methods.
- ES2.2.C.ee Describe changes to current practices that could reduce the amount of generated waste and their associated benefits and drawbacks.
- ES2.2.C.ff Define lethal dose 50% (LD₅₀) and evaluate dose response curves.

Area ES2.2.E: Global Change

- ES2.2.E.a Explain the importance of stratospheric ozone to life on Earth and chemicals used to substitute for chlorofluorocarbons (CFCs).
- ES2.2.E.b Identify Greenhouse Gases and the sources and potency of the greenhouse gases.
- ES2.2.E.c Identify the threats to human health and the environment posed by an increase in greenhouse gases
- ES2.2.E.d Explain how changes in climate, both short- and long-term, impact ecosystems.
- ES2.2.E.e Explain the causes and effects of ocean warming and ocean acidification.
- ES2.2.E.f Explain the environmental problems associated with invasive species and strategies

to control them.

- ES2.2.E.g Explain how species become endangered and strategies to combat the problem.
- ES2.2.E.g Explain how human activities affect biodiversity and strategies to combat the problem.