

High School Conceptual Progressions Model Course III

Narrative and Rationale: This model course map is the third course in a three-year course sequence. It uses a customized version of the High School Conceptual Progressions model from NGSS Appendix K as the instructional year end goals. The PEs from Course 3 were then arranged into five different bundles of PEs based on a conceptual flow throughout the year.

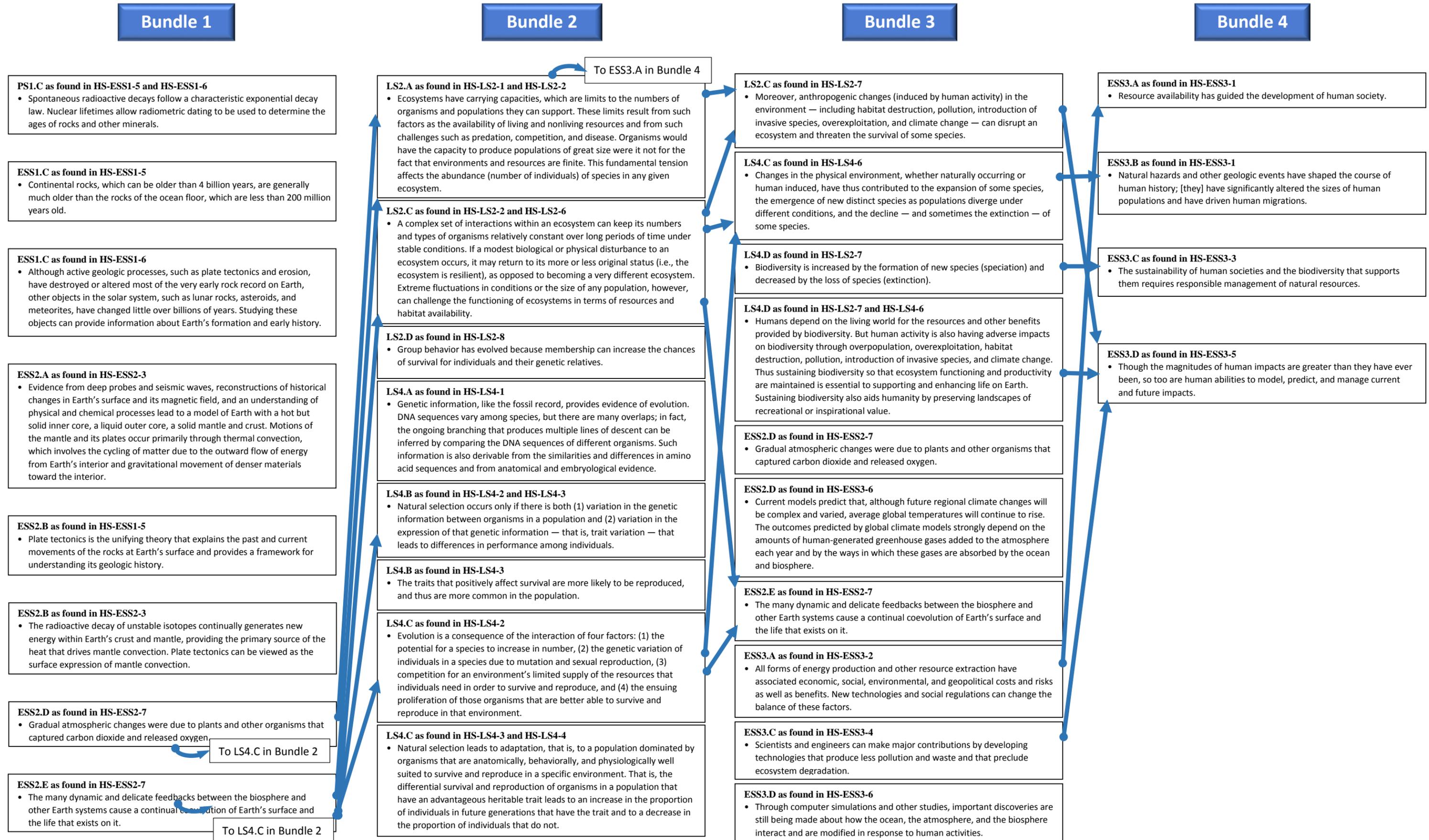
Course 3 begins by expanding upon what was learned in Course 1 about ecosystems and heredity by taking a deeper look into the evolution of Earth systems and organisms. The course then focuses on how humans influence Earth systems and vice versa. It is important to note that the practices and crosscutting concepts described are intended as end-of-instructional unit expectations and not curricular designations – additional practices and crosscutting concepts should be used throughout instruction in each bundle.

Bundle 1: Evolution of Earth ~5 weeks	Bundle 2: Evolution of Life ~7 weeks	Bundle 3: Human Influence on Earth ~8 weeks	Bundle 4: Earth’s Impact on Humans ~4 weeks
<p>HS-ESS1-5. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.</p> <p>HS-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth’s formation and early history.</p> <p>HS-ESS2-3. Develop a model based on evidence of Earth’s interior to describe the cycling of matter by thermal convection.¹</p> <p>HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth’s systems and life on Earth. ¹</p>	<p>HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.</p> <p>HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.</p> <p>HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.</p> <p>HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species’ chances to survive and reproduce.</p> <p>HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.</p> <p>HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.</p> <p>HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to</p>	<p>HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*</p> <p>HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*</p> <p>HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth’s systems and life on Earth.</p> <p>HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.*</p> <p>HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*</p> <p>HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.</p> <p>HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.</p> <p>HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.</p> <p>HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a</p>	<p>HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.</p> <p>HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.</p> <p>HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.</p>

NGSS Example Bundles

Bundle 1: Evolution of Earth <i>~5 weeks</i>	Bundle 2: Evolution of Life <i>~7 weeks</i>	Bundle 3: Human Influence on Earth <i>~8 weeks</i>	Bundle 4: Earth's Impact on Humans <i>~4 weeks</i>
	<p>increase in proportion to organisms lacking this trait.</p> <p>HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.</p> <p>HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.</p>	<p>range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p> <p>HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.</p>	

^{1.} The bundle only includes part of this PE; the PE is not fully assessable in a unit of instruction leading to this bundle.



LS4.C as found in HS-LS4-3

- Adaptation also means that the distribution of traits in a population can change when conditions change.

LS4.C as found in HS-LS4-5

- Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline — and sometimes the extinction — of some species.
- Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.

To LS2.C and LS4.C
in Bundle 3

ETS1.A as found in HS-ETS1-1

- Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.
- Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.

ETS1.B as found in HS-LS2-7, HS-LS4-6, HS-ESS3-2, HS-ESS3-4, and HS-ETS1-3

- When evaluating solutions, it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts.

ETS1.B as found in HS-LS4-6 and HS-ETS1-4

- Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs.

ETS1.C as found in HS-ETS1-2

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed.