

Connecting to the *Next Generation Science Standards* (NGSS Lead States 2013)

Standard

MS-ESS3: Earth and Human Activity

<https://www.nextgenscience.org/pe/ms-ess3-3-earth-and-human-activity>

The chart below makes one set of connections between the instructions outlined in this article and the *NGSS*. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities.

Dimensions	Classroom Connections
Science and Engineering Practices Developing and using models - Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena. Designing solutions - Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. Engaging in argument from evidence - Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.	Students develop and use causal loop models to understand the impacts of engineering decision making on communities and ecosystems. Students design conservation corridors to support pollinator and human health in their own communities. Students participate in a design charrette to share conservation corridor design ideas, critique proposed solutions and discuss just and equitable designs for their own communities.

Disciplinary Core Ideas LS2.A: Interdependent Relationships in Ecosystem - Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. LS2.C: Ecosystem Dynamics, Functioning, and Resilience - Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. LS4.D: Biodiversity and Humans - Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. ESS3.C: Human Impacts on Earth System - Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. ETS1.A: Defining and Delimiting Engineering Problems - The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other	Students use systems models and simulations to make connections between human and ecological health in the context of engineering and urban planning. Students explore how conservation corridors can support pollinator species migrations and range shifts in response to climate change. Students investigate how pollinator health and healthy pollinator habitats support human health, and how access to healthy foods is unequally distributed across communities. Students use models and visualizations to understand the impact that habitat fragmentation has had on human and ecosystem health, especially in the face of a changing climate. Students investigate how engineering endeavors and urban planning have impacted ecosystem and wildlife health by disrupting
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relevant knowledge that are likely to limit possible solutions. ETS1.B: Developing Possible Solution • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	natural ecosystem functioning and connectivity. Students explore conservation corridors as a solution for connecting fragmented habitats and design local corridor patches to support pollinators and human health in their own communities.
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Crosscutting Concepts Systems and systems models - Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. Structure and Function - Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.	Students develop and use complex-causal loop models to create just and equitable solutions for supporting pollinator and human health in their own communities. Students develop and use causal loop models in coordination for self-documentation evidence to understand how the structure of urban spaces supports health ecosystem and community functioning.
<i>Building Towards</i> Performance Expectation (PE listing with Clarification Statement and Assessment Boundary) MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.] MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]	

Connections to the *Common Core State Standards* (NGAC and CCSSO 2010)

ELA

CCSS.ELA-LITERACY.RST.6-8.7

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

CCSS.ELA-LITERACY.WHST.6-8.1.B

Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

CCSS.ELA-LITERACY.WHST.6-8.1.E

Provide a concluding statement or section that follows from and supports the argument presented.

Mathematics

CCSS.MATH.CONTENT.7.SP.C.8

Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.