

MS-LS2-5 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

- 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.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.

Disciplinary Core Ideas

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.

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. *(secondary)*

ETS1.B: Developing Possible Solutions

- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. *(secondary)*

Crosscutting Concepts

Stability and Change

- Small changes in one part of a system might cause large changes in another part.

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

- Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.

Observable features of the student performance by the end of the course:

1	Identifying the given design solution and supporting evidence
a	Students identify and describe*: <ol style="list-style-type: none"> The given competing design solutions for maintaining biodiversity and ecosystem services. The given problem involving biodiversity and/or ecosystem services that is being solved by the given design solutions, including information about why biodiversity and/or ecosystem services are necessary to maintaining a healthy ecosystem. The given evidence about performance of the given design solutions.
2	Identifying any potential additional evidence that is relevant to the evaluation
a	Students identify and describe* the additional evidence (in the form of data, information, or other appropriate forms) that is relevant to the problem, design solutions, and evaluation of the solutions, including: <ol style="list-style-type: none"> The variety of species (biodiversity) found in the given ecosystem. Factors that affect the stability of the biodiversity of the given ecosystem.

	iii.	Ecosystem services (e.g., water purification, nutrient recycling, prevention of soil erosion) that affect the stability of the system.
	b	Students collaboratively define and describe* criteria and constraints for the evaluation of the design solution.
3	Evaluating and critiquing the design solution	
	a	In their evaluations, students use scientific evidence to:
	i.	Compare the ability of each of the competing design solutions to maintain ecosystem stability and biodiversity.
	ii.	Clarify the strengths and weaknesses of the competing designs with respect to each criterion and constraint (e.g., scientific, social, and economic considerations).
	iii.	Assess possible side effects of the given design solutions on other aspects of the ecosystem, including the possibility that a small change in one component of an ecosystem can produce a large change in another component of the ecosystem.