

HS-LS2-7 Ecosystems: Interactions, Energy, and Dynamics

California Science Test—Item Content Specifications

# HS-LS2-7 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

[Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Constructing Explanations and Designing Solutions  Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.  Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. | LS2.C: Ecosystem Dynamics, Functioning, and Resilience  5. Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.  LS4.D: Biodiversity and Humans  4. Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). *(secondary to HS-LS2-7)* | Stability and Change  Much of science deals with constructing explanations of how things change and how they remain stable. |
| Continuation of the previous row:  Not applicable | Continuation of the previous row:  5. Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. *(secondary to HS-LS2-7)* (Note: This Disciplinary Core Idea is also addressed by HS-LS4-6.)  **ETS1.B: Developing Possible Solutions**  10. 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. *(secondary to HS-LS2-7)* | Continuation of the previous row:  Not applicable |

## Assessment Targets

Assessment targets describe the focal knowledge, skills, and abilities for a given three-dimensional Performance Expectation. Please refer to the Introduction for a complete description of assessment targets.

### Science and Engineering Subpractice(s)

Please refer to appendix A for a complete list of Science and Engineering Practices (SEP) subpractices. Note that the list in this section is not exhaustive.

6E.1 Ability to solve design problems

6E.2 Ability to evaluate and/or refine solutions to design problems

### Science and Engineering Subpractice Assessment Targets

Please refer to appendix A for a complete list of SEP subpractice assessment targets. Note that the list in this section is not exhaustive.

6E.1.1 Ability to solve design problems by engaging in a systematic, iterative process that results in structures or processes, or the plans for structures or processes

6E.1.2 Ability to generate multiple solutions for a design problem that meet design criteria and constraints

6E.1.3 Ability to solve a design problem by constructing a device or generating a design solution

6E.1.4 Ability to apply relevant scientific knowledge and/or evidence in designing solutions

6E.2.1 Ability to compare or critique competing design solutions based on design criteria

6E.2.2 Ability to evaluate and/or refine (optimize) design solutions based on scientific knowledge or evidence

6E.2.3 Ability to optimize performance of a design by prioritizing criteria and considering trade-offs to test, revise, and retest

### Disciplinary Core Idea Assessment Targets

#### LS2.C.5

* Describe ways human activity can negatively impact the environment (overpopulation, overexploitation, habitat destruction, pollution, introduction of nonnative species, climate change) and ways that proposed solutions can reverse or decrease the negative impacts

#### LS4.D.4

* Predict factors that will cause biodiversity to increase or decrease

#### LS4.D.5

* Propose and design solutions to decrease the negative impacts that human activities can have on the environment
* Refine proposed solutions to prioritizing the criteria and considering tradeoffs necessary to further reduce the environmental impact and loss of biodiversity while addressing human needs

#### ETS1.B.10

* Evaluate and refine solutions based on achieving a balance between overall environmental stability and human needs
* Describe and quantify the criteria (human activities being mitigated) and the constraints (cost, human needs, environmental impacts) for the solution to a problem as well as tradeoffs to the solution

### Crosscutting Concept Assessment Target(s)

CCC7 Construct explanations of how things change and how they remain stable

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a scenario describing how a human activity negatively affects the environment:

* Designs or refines a design solution to mitigate the negative impacts of the activity (6E.1.1, LS2.C.5, and CCC7)
* Sketches or selects a sketch of a design solution to mitigate the negative impacts of the activity (6E.1.3, LS2.C.5, and CCC7)

Task provides a scenario describing how a human activity decreases biodiversity:

* Suggests design solutions that also meet certain criteria or constraints and are designed to mitigate the negative impacts of the activity (6E.1.2, LS.4.D.4, LS4.D.5, and CCC7)

Task provides competing design solutions to mitigate the negative impacts of a human activity on the environment and/or biodiversity:

* Selects the best design solution based on a given list of criteria and constraints (6E.2.1, LS4.D.5, ETS1.B.10, and CCC7)

Task provides a design solution to mitigate the negative impacts of a human activity on the environment and/or biodiversity:

* Evaluates the design solution and identifies tradeoffs, e.g., social vs. environmental, which would have to be made in its implementation (6E.2.1, LS.4.D.5, ETS1.B.10, and CCC7)

Task provides a design solution to mitigate the effects of a human activity that negatively impacts the environment and/or decreases biodiversity:

* Evaluates a design solution and identifies a likely unintended consequence, either social or environmental (6E.2.2, LS4.D.5, ETS1.B.10, and CCC7)

Task provides data on competing design solutions that attempt to mitigate the negative impacts of a human activity on the environment:

* Uses data to suggest improvements to one or more competing design solutions (6E.2.3, LS4.D.5, ETS1.B.10, and CCC7)

## California Environmental Principles and Concepts

* EP2: The long-term functioning and health of terrestrial, freshwater, coastal, and marine ecosystems are influenced by their relationships with human societies.
* EP4: The exchange of matter between natural systems and human societies affects the long-term functioning of both.

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Water-requiring products that use less water
* Reducing CO2 emissions from factories and automobiles
* Alternative forms of energy such as installing windmills to harvest wind energy
* Reforestation of land cleared for agriculture or other development to increase biodiversity
* Conservation efforts to stop the introduction of invasive species

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Every solution to a potential environmental problem is economically feasible.
* Every solution to a potential environmental problem is socially feasible.
* Human activities have minimal impact on the environment and biodiversity.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

HS-LS2-7 [Evidence](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/HS-LS2-7%20Evidence%20Statements%20June%202015%20asterisks.pdf) Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/HS-LS2-7 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/HS-LS2-7%20Evidence%20Statements%20June%202015%20asterisks.pdf)

California Environmental Principles and Concepts <http://californiaeei.org/abouteei/epc/>

California Education and the Environment Initiative <http://californiaeei.org/>

The *2016 Science Framework for California Public Schools Kindergarten through Grade 12*

Appendix 1: Progression of the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts in Kindergarten through Grade 12 <https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix1.pdf>

Appendix 2: Connections to Environmental Principles and Concepts <https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix2.pdf>

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