

MS-ESS3-2 Earth and Human Activity

California Science Test—Item Content Specifications

# MS-ESS3-2 Earth and Human Activity

Students who demonstrate understanding can:

Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

[Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]

Continue to the next page for the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Analyzing and Interpreting Data  Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.  Analyze and interpret data to determine similarities and differences in findings. | ESS3.B: Natural Hazards   1. Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. | Patterns  Graphs, charts, and images can be used to identify patterns in data.  Connections to Engineering, Technology, and Applications of Science  Influence of Science, Engineering, and Technology on Society and the Natural World  The uses 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. |

## 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.

4.2 Ability to analyze data to identify relationships

### 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.

4.2.1 Ability to use empirical data to describe patterns and relationships

4.2.2 Ability to identify patterns (qualitative or quantitative) among variables represented in data

4.2.3 Ability to apply concepts of statistics and probability to data

4.2.4 Ability to consider limitations of data analysis (e.g., measurement error, sample selection)

### Disciplinary Core Idea Assessment Targets

#### ESS3.B.4

* Identify and describe patterns of location and timing of natural hazard events relative to geographic or geologic features of the impacted region
* Identify and describe patterns of frequency and severity of natural hazard events and their associated types of damage
* Describe the risk of a prospective natural hazard event based on geographic/geologic features
* Describe different types of impacts, including the type of damage (e.g., wind, flooding, etc.) associated with different natural hazard events
* Describe the susceptibility of a region to different types of hazard impacts
* Describe patterns in different indicators that can be used to predict the likelihood of future hazard events
* Describe steps humans can take to mitigate the impacts of natural hazard events

### Crosscutting Concept Assessment Target(s)

CCC1 Use graphs, charts, and images to identify patterns in data

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides two (or more) data sets from the same natural disaster:

* Compares the information provided in each and describes a pattern between the location and/or frequency and/or severity of a natural disaster and the geologic features of the impacted region (4.2.1, ESS3.B.4, and CCC1)

Task provides a map showing the location and severity of a class of natural disasters:

* Identifies a pattern that a geographic feature of a region makes it more susceptible to that class of disaster than regions that do not have that geographic feature (4.2.2, ESS3.B.4, and CCC1)

Task provides data on the frequency and severity of a certain class of natural disasters:

* Applies concepts in probability and averages to demonstrate that a “one-in-a-hundred year” event means that the probability that an event of that magnitude will occur in a given year is 1%, but not that the event will occur exactly once per hundred years (4.2.3, ESS3.B.4, and CCC1)
* Uses probability to determine if a proposed structure (rated to some level of severity event) is well suited to a region (4.2.3, ESS3.B.4, and CCC1)

Task provides information from many natural disasters about the severity of the event and the time difference between when an alert about an impending disaster event was made to the citizens of a region and the time when the event actually occurred (if at all):

* Identifies the limitations of using the relationship between severity and lead time to predict the event in advance (4.2.4, ESS3.B.4, and CCC1)

## California Environmental Principles and Concepts

* EP1: The continuation and health of individual human lives and of human communities and societies depend on the health of the natural systems that provide essential goods and ecosystem services.
* EP2: The long-term functioning and health of terrestrial, freshwater, coastal, and marine ecosystems are influenced by their relationships with human societies.

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Different types of volcanoes, their causes, and the types of eruptions that they can emit
* Structural features of buildings in different regions where different natural disasters are more likely
* Established safety mechanisms based on the predictability of both primary and secondary effects of natural disasters
* Patterns in natural hazard data (e.g., tornadoes and hurricanes) to make predictions or reduce impact on humans
* Patterns in seismic data to study earthquakes, volcanic eruptions, and tsunamis

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Natural disasters are chaotic events that cannot be predicted.
* Human activity does not affect the susceptibility of a region to the impacts of a natural catastrophe.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

MS-ESS3-2 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/MS-ESS3-2 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/MS-ESS3-2%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 California Environmental Principles and Concepts <https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix2.pdf>

Posted by the California Department of Education, March 2021 (updated February 2024)