Marsh in Motion

Trace how coastal water and living plants change each other over time.

ES.4 "Engage in an evidence-based argument to explain how Earth's systems affect the biosphere and the biosphere affects Earth's systems over various amounts of time."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two ways water changes cordgrass, circle two ways cordgrass changes water or land, and label each marked example with its time scale.

A Coast Built by Grass

1 At the edge of a tidal creek, smooth cordgrass grows where many land plants cannot. Twice a day, ocean water floods its roots and leaves salt behind as it drains. The grass can survive salty, waterlogged soil because it moves oxygen from its leaves to buried roots and releases extra salt. A young upland tree on the same muddy bank would likely die. These observations support a claim about direction: ocean water helps determine which organisms live in this part of the biosphere. Tides act within hours, while the salt they bring continues to influence the marsh across growing seasons.

2 During a coastal storm, waves can tear away marsh edges and bury some plants under debris. Yet an intact stand of cordgrass also slows flowing water. Its stems reduce wave energy, and its roots help hold muddy soil in place. Sediment carried by the water can settle among the stems instead of washing out to sea. After many tides, layers of trapped sediment can raise the marsh surface. The storm shows that water can change the biosphere in a single day, while living plants can change the shape of the coast over years. Neither effect makes a marsh immune to stronger storms.

3 Over decades, rising sea level brings another test. If the marsh surface rises through sediment buildup and plant growth as fast as the water, cordgrass may remain in a suitable flood zone. If water rises faster, longer flooding can weaken or kill the grass. With fewer living stems to slow water and trap mud, the surface may gain less sediment, making flooding worse. This is a feedback: an ocean change affects organisms, and the loss of organisms changes how land responds to the ocean. The outcome depends on rates of change, not simply on whether plants are present.

2 ANSWER WITH EVIDENCE

Use the passage

1. Make a claim about how ocean water affects which plants can live by the creek. Support it with two observations from the passage.

2. How can a storm change the marsh in one day, while cordgrass changes the coast over years? Use evidence for both directions of change.

3. Explain how rising sea level could start a feedback that makes flooding worse over decades. What evidence in the passage supports each step?

4. A student claims, “Cordgrass slows waves, so a marsh will always survive rising sea level.” Challenge this claim using evidence about different rates of change.

3 YOUR TURN

Your own words

On a different hillside, heavy rain washes soil from bare ground into a creek. Shrubs grow there over several years, and the creek becomes less muddy after rain. Write a four-sentence argument explaining how rain and shrubs could affect each other’s effects on the land over different time scales. Use both observations as evidence and explain how a long drought might change your prediction.

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PART 1 · READ AND MARK

Underline two ways water changes cordgrass, circle two ways cordgrass changes water or land, and label each marked example with its time scale. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Make a claim about how ocean water affects which plants can live by the creek. Support it with two observations from the passage.	**Ocean water favors salt-tolerant cordgrass over upland plants. It floods the bank twice daily and leaves salt in the soil; cordgrass can survive those conditions, but a young upland tree would likely die.**
2	How can a storm change the marsh in one day, while cordgrass changes the coast over years? Use evidence for both directions of change.	**Storm waves can tear away marsh edges or bury plants in one day. Over years, cordgrass slows water, holds soil with its roots, and traps sediment that can raise the marsh surface.**
3	Explain how rising sea level could start a feedback that makes flooding worse over decades. What evidence in the passage supports each step?	**If water rises faster than the marsh surface, longer flooding can weaken or kill cordgrass. Fewer stems then slow less water and trap less mud, so the surface may gain less sediment and experience worse flooding.**
4	A student claims, "Cordgrass slows waves, so a marsh will always survive rising sea level." Challenge this claim using evidence about different rates of change.	**Cordgrass slows waves, but that does not guarantee survival. If sea level rises faster than sediment buildup and plant growth raise the marsh, longer flooding can weaken or kill the grass.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Rain can change a bare hillside quickly by washing soil into the creek. Over several years, shrubs may reduce that erosion because their roots help hold soil, which fits the observation that the creek becomes less muddy after rain. This suggests living plants can change how the land responds to later storms. A long drought might weaken or kill the shrubs, leaving less root cover and allowing rain to carry more soil away again.

Accept arguments that identify evidence for both directions of change and distinguish rapid rain effects from changes that occur as shrubs grow. Students should describe drought effects as a possibility, not a certain outcome.