

Survivors and Newcomers: How Mount St. Helens Came Back

Learning target: I can use evidence from a passage to explain why recovery after a disturbance was faster in some places than others, and what survivors and pioneer species each contributed.

Reading with evidence

About 40 min

Individual

MS-LS2-4 · practice

reading

writing

Standards connections

MS-LS2-4 (practice): The passage reports what scientists measured at fixed plots over decades, and the questions ask students to use those measurements as evidence that a physical change (burial under pumice and ash) shaped which populations returned and how fast. This builds the evidence-citing habit the PE requires.

Purpose: build · **Time:** about 40 minutes · **Format:** individual

Answers with reasoning

Survivors and Newcomers

[1] On May 18, 1980, Mount St. Helens in Washington State had been swelling for about two months as magma pushed up inside it. At 8:32 a.m. a magnitude 5.1 earthquake shook the volcano, and its bulging north side gave way in the largest landslide in recorded history. Hot gas, rock and ash then blasted sideways across the valleys to the north. Forests were flattened or scorched across about 600 square kilometers, and 57 people died. Ash rose more than 20 kilometers high, and the summit ended the day about 400 meters lower.

[2] The damage was not the same everywhere, and that difference shaped the next forty years. Closest to the crater, flows of hot pumice buried the ground many meters deep, creating the Pumice Plain. Nothing there survived: no soil, no roots, no seeds. Farther out, in the blowdown zone, the blast laid whole forests flat under a blanket of ash. But beneath the ash lay the old forest soil, and in it were roots, seeds, fungi and animals that had been underground when the blast passed. Each zone was a different starting line.

[3] Scientists who hiked into the blowdown zone that first summer found more survivors than anyone expected. Northern pocket gophers, small burrowing rodents, had been safe in their tunnels, and their digging soon pushed old soil up through the ash, making patches where seeds could sprout. Many slopes were still under late-spring snow on May 18, and small plants and young trees beneath it were shielded. Frogs, toads and salamanders survived too, some underground and some in ponds still sealed with ice. Where survivors remained, recovery began right away. Ecologists call this secondary succession.

[4] The Pumice Plain had no survivors, so every living thing there had to arrive from outside. Seeds blew in on the wind, but most landed on loose pumice that held little water and almost no usable nitrogen, and the seedlings died. Within about two years of the eruption, scientists found a single prairie

lupine, a low purple-flowered plant, growing on the plain far from other plants. Bacteria in small bumps on lupine roots take nitrogen gas from the air and change it into a form plants can use. Dead lupines left nitrogen-rich litter behind, and living lupines caught windblown seeds. Seedlings of other species did especially well where a lupine had died. This is primary succession, and the lupine was one of its pioneers.

[5] Larger animals changed the land too. Elk wandered back into the blast zone to graze; their hooves broke up the crusted ash, and their droppings carried seeds and nutrients. Along streams, willows and red alders took root; alders, like lupines, host microbes that capture nitrogen from the air. Spirit Lake, north of the crater, was struck by the landslide and covered with a floating mat of blasted trees. At first its water held almost no oxygen, because bacteria were feeding on the dead material, but within a few years oxygen returned, and algae, insects and amphibians followed.

[6] In 1982 Congress set aside the area as the Mount St. Helens National Volcanic Monument. Most of the blast zone inside it was left to recover on its own instead of being replanted, which made the mountain a huge natural experiment. Scientists marked permanent study plots and returned to them summer after summer to count plants, measure how much ground they covered, and record insects, birds and small mammals. The counts told a consistent story: where survivors remained, the number of species climbed quickly; on the Pumice Plain, species arrived slowly and unevenly, clustering around lupines and streams.

[7] Today meadows, shrub thickets and young trees cover much of the blast zone, and elk, birds and amphibians are common. Yet the Pumice Plain is still open and patchy, and no part of the landscape looks exactly as it did on May 17, 1980. Succession follows patterns that scientists can recognize, but it runs on no fixed schedule and does not promise to rebuild the community that grew there before. How fast a place recovers, and what it becomes, depends on what survived, what arrived, and what the first arrivals did to the ground.

Part A: Find and explain the evidence

1. Paragraph 1 describes the eruption with several numbers. Choose two of them and explain what each one tells you about the size of the disturbance.

Answer: Any two with an accurate interpretation, for example: about 600 square kilometers of forest flattened or scorched shows the disturbance covered an enormous area, far larger than a single forest stand; the summit ending the day about 400 meters lower shows the mountain itself was physically reshaped; ash rising more than 20 kilometers shows the eruption reached high into the atmosphere, so its effects spread far beyond the blast zone; 57 deaths shows the human cost; magnitude 5.1 shows that a moderate earthquake was enough to trigger the collapse of a mountainside that magma had already pushed out of shape.

Why: The item checks that students read numbers as evidence of scale rather than skipping them.

Also acceptable: The date and time are numbers but do not describe size; redirect a student who picks them.

- Two numbers from paragraph 1
- Each is interpreted, not just copied

2. Paragraph 2 says the differences in damage 'shaped the next forty years.' Describe the two zones the passage compares and the one difference between them that mattered most.

Answer: The Pumice Plain near the crater was buried under hot pumice many meters deep with nothing alive beneath it, while the blowdown zone farther out had its trees flattened and was covered with ash but kept the old soil, roots, seeds, fungi and animals underneath. The difference that mattered most was whether anything survived under the surface.

Why: Students should identify survivors (or soil) as the key difference; depth of deposit is the cause of that difference.

Also acceptable: Accept 'the Pumice Plain had no soil and the blowdown zone did' as the key difference.

- Both zones described
- Survivors or soil beneath the surface identified as the key difference

3. Name three kinds of survivors from paragraph 3 and explain how **one** of them helped recovery begin.

Answer: Three of: northern pocket gophers in their tunnels; small plants and young trees under late-spring snow; frogs, toads and salamanders underground or in ice-covered ponds; roots, seeds and fungi in the buried forest soil. Example explanation: the gophers' digging brought old soil up through the ash and made small patches where seeds could sprout.

Why: The explanation must link the survivor to a change that helped other organisms or to a population starting again.

Also acceptable: For amphibians, accept 'they were breeding again within a few years, so their populations restarted from survivors.'

- Three survivors from paragraph 3
- One mechanism explained

4. Why did most seeds that landed on the Pumice Plain die, and how did the lupine solve that problem for the plants that came after it? Cite paragraph 4.

Answer: Most seeds died because the loose pumice held little water and almost no usable nitrogen (paragraph 4). Bacteria in lupine root bumps change nitrogen gas from the air into a usable form; dead lupines left nitrogen-rich litter, living lupines caught windblown seeds, and seedlings of other species did especially well where a lupine had died, so the lupines made spots where later plants could start.

Why: Both the problem (water and nitrogen) and the lupine's two contributions (nitrogen fixation and trapping seeds) should appear.

Also acceptable: A student who explains only the nitrogen contribution has the core idea; noticing that seedlings did best where a lupine had died (not right under a living one) is a sign of careful reading.

- Names water and/or nitrogen as the problem
- Explains that lupine root bacteria make nitrogen usable
- Mentions the litter left by dead lupines or the seeds caught by living ones

5. Paragraphs 3 and 4 use the terms secondary succession and primary succession. Using only what the passage says, explain the difference in your own words.

Answer: Secondary succession starts where survivors and soil remain, so recovery begins immediately from what was already there (the blowdown zone). Primary succession starts on ground with nothing alive and no soil, so everything must arrive from outside and the ground must be changed before most plants can live there (the Pumice Plain).

Why: The passage defines the terms through the two zones; the student's own words should carry the survivors-versus-nothing contrast.

Also acceptable: Accept 'secondary is faster because it has a head start' if the reason (survivors) is given.

- Secondary tied to survivors or soil
- Primary tied to bare ground with arrivals from outside

6. Paragraph 6 describes how scientists collected evidence. What did they do, and why does returning to the same plots every year make the evidence stronger than a single visit would?

Answer: They marked permanent plots and returned to the same squares every summer to count plants, measure ground cover and record insects, birds and small mammals. Returning to the same spots each year turns single snapshots into a trend; it shows how counts change over time and lets scientists compare zones fairly, because the place and the method stay the same while only the year changes.

Why: The answer should mention both the method (fixed plots, repeated counts) and the reason repeated measurement is stronger (trend, fair comparison, less chance a single odd year misleads).

Also acceptable: Accept 'one visit could be a lucky or unlucky year' as the reasoning.

- Describes fixed plots and yearly counts
- Explains why repetition strengthens the evidence

7. Find the sentence in paragraph 7 that corrects the idea that succession is a fixed schedule that rebuilds the original ecosystem. Copy or closely paraphrase it, and give one piece of evidence from earlier in the passage that supports it.

Answer: The sentence: succession follows patterns that scientists can recognize, but it runs on no fixed schedule and does not promise to rebuild the community that grew there before. Supporting evidence: the plot counts showed species climbing quickly where survivors remained but arriving slowly and unevenly on the Pumice Plain (paragraph 6), or the plain's recovery hinged on a single lupine turning up far from other plants, which was chance rather than a timetable (paragraph 4).

Why: This item makes the accuracy correction explicit: the textbook calls succession 'predictable', and the passage shows the pattern is real but the timing and endpoint are not fixed.

Also acceptable: Accept the sentence beginning 'no part of the landscape looks exactly as it did' as the identified correction.

- Identifies the correct sentence
- Gives supporting evidence from an earlier paragraph

Part B: Make an argument

8. Write an argument: **Recovery at Mount St. Helens was shaped more by what survived than by what arrived.** Agree or disagree. Support your position with evidence from at least two different paragraphs, and explain how the evidence supports it.

Answer: A strong answer takes a position and uses the zones. Agree: in the blowdown zone, survivors (gophers that mixed old soil into the ash, plants and young trees protected by snow, amphibians that lived through the blast, paragraph 3) started recovery right away, and the plots showed species counts climbing quickly where survivors remained (paragraph 6). Disagree: on the Pumice Plain nothing survived, so recovery depended entirely on newcomers, especially the lupine that made nitrogen usable and caught seeds (paragraph 4) and the elk that carried seeds and nutrients in (paragraph 5). The best responses say the answer depends on the zone: survivors drove the fast recovery in the blowdown zone, and newcomers drove the slow recovery on the Pumice Plain.

Why: Full credit requires a clear position, evidence from two different paragraphs, and reasoning that connects each piece of evidence to the position. Either position can earn full credit; a 'depends on the zone' position is the most accurate reading of the passage and should be rewarded.

Also acceptable: A partial-agreement answer that distinguishes the zones is the strongest response.

- Clear position
- Evidence from at least two paragraphs
- Reasoning connects the evidence to the claim

Teacher notes

The passage is 690 words in seven paragraphs. Its facts are established: the 8:32 a.m. magnitude 5.1 earthquake on May 18, 1980, after about two months of swelling; the collapse of the north flank as the largest landslide in recorded history; about 600 square kilometers (230 square miles) of forest devastated by the lateral blast; 57 deaths; an ash column above 20 kilometers (USGS gives more than 24 km within 15 minutes); a summit about 400 meters (1,314 feet) lower; the National Volcanic Monument created by Congress in 1982; pocket gophers, snow-covered plants, and amphibians underground or in ice-covered ponds among the documented survivors; Spirit Lake struck by the avalanche, covered by a log mat, nearly oxygen-free at first and recovering within a few years. The first lupine on the Pumice Plain is dated 1981 in Washington State University accounts and about 1982 in others, so the passage says 'within about two years' and no item depends on the exact year. Lupine root nodules hold nitrogen-fixing bacteria and alder roots hold nitrogen-fixing microbes (*Frankia*). Field studies on the plain (del Moral and Wood, 1993) found lupines improved soil only locally and also competed with seedlings while alive; seedlings did best in spots a lupine had occupied and then died, which is the nuance paragraph 4 keeps. The passage deliberately corrects two textbook simplifications: an eruption does not kill everything (survivors mattered), and succession is a pattern, not a schedule. If students ask whether the Pumice Plain will become forest, the honest answer is that scientists expect trees to spread slowly from the edges and stream banks, but no one can give a date.

Scaffold offered to students: Finding evidence fast

Each question names the paragraph where its evidence lives. Go to that paragraph first and underline the sentence that answers the question before you write. For q8, make a two-column list before writing: 'survivors' on the left (gophers, snow-covered plants, amphibians, old soil) and 'newcomers' on the right (lupine, elk, windblown seeds, willows and alders). Decide which column had the bigger effect in which zone; the best arguments notice that the answer depends on the zone.

Extension: Design the next study

Scientists at the monument still return to their plots every summer. Suppose you could add one new measurement to their study for the next ten years. Choose it, explain what question it would answer about succession or resilience, and describe how you would compare the Pumice Plain with the blowdown zone so the comparison is fair. Then predict what you expect the numbers to show, and say what result would surprise you.