

The Mixed-Up Field Notebooks: Two Zones, One Eruption

Investigation question: Using only the clues in twelve undated field notes, can you put the return of life in two places hit by the 1980 Mount St. Helens eruption in order, and explain why one place recovered so much faster than the other?

Evidence-based mystery

Groups of 4

1 session

Setup 5 · Activity 35 · Cleanup 5 min

MS-LS2-4 · practice

MS-LS2-1 · supports

Name _____

Group _____

Date _____

Your role today

- ☐ **Card reader:** Reads each card aloud and points out every clue in it: what is present, what is missing, and how big things are.
- ☐ **Sorter:** Places cards into the two group piles and onto the timeline strips, moving a card only when the group agrees.
- ☐ **Skeptic:** For every placement asks 'what had to happen before this?', checks that a printed clue supports the position, and flags cards that could go two ways.
- ☐ **Recorder:** Fills in Tables 1 to 3 with the clue for each placement, keeps the list of disputed cards, and counts the correct placements after the reveal.

Safety

- Scissors: cut away from fingers and pass them handle first.
- If the timeline is laid out on the floor, keep it along a wall and out of walkways so no one trips or slips on the paper strips.
- No other hazards beyond ordinary classroom materials.

Procedure

1. Read the case at the top of the recording sheet together. An ecologist visited two study zones north of Mount St. Helens again and again after the May 18, 1980 eruption. The pages fell out of the notebook and the dates were lost. Every card belongs to one of the two zones, except possibly one.
2. The Card reader reads all twelve cards aloud. On this first pass the Recorder notes any clue that might tell which zone a card came from.
3. Sort the cards into two piles, Group 1 and Group 2, using a clue that matters to living things, not just how the place looks. Set aside any card that fits neither group. Record the sort and the clue in Table 1.
4. Lay each pile on its timeline strip from earlier to later. For every card the Skeptic asks: what had to happen before this could happen? Write that clue in Table 2 or Table 3. Mark any card that could go in two positions with a '?' sticky note and record both options.

5. Answer q1 and q2 before the reveal.
6. Reveal: your teacher posts the reveal strip with zone names and approximate dates. Without moving any cards, count how many you placed in the correct position in each zone, then answer q3.
7. Decide which zone shows primary succession and which shows secondary succession, and find the cards that prove it (analysis question q4).
8. Graph both columns of the plant-cover dataset on the same grid, using one color per zone and a key, and do the calculations in q5.
9. Answer the remaining analysis questions; finish any at home. Return the cards to the envelope in letter order.

Record your observations

Lab 1 recording sheet: The mixed-up field notebooks

The case — After Mount St. Helens erupted on May 18, 1980, an ecologist visited two study zones north of the volcano again and again for forty years, writing a short field note on each visit. Twelve pages survived, but the dates did not. Your job: sort the pages by zone, put each zone's pages in order, and back every decision with a clue printed on the page. Some notes include background facts the ecologist added. One page may not belong to either study zone. (The ecologist is imaginary; the observations are based on what real scientists reported.)

Field-note cards (cut apart)

1 Card A

Rain has cut small gullies through the gray ash layer, and the old brown forest soil shows in their walls. Huckleberry and other shrubs have grown back from roots that survived underground and now form clumps about waist high. Small fir trees that lived through the blast under a snowbank are putting out new upward shoots above the ash.

2 Card B

Many lupine patches have grown and run together into wide mats. In other patches most of the plants are brown and dead: I found moth caterpillars tunneling inside the roots and feeding on the plants. Grasses and other wildflowers are scattered among the lupines, and elk hoofprints and droppings cross the plain.

3 Card C

Trucks are hauling fallen logs out of this valley, and crews are planting young Douglas-fir and noble fir seedlings in rows, digging each hole down through the ash to the old soil. Note to self: this land is outside the protected area, so its owners can log and replant it.

4 Card D

Gray pumice and ash stretch in every direction. I dug a pit 50 cm deep and found only more pumice: no old soil, no roots, no buried seeds. After rain, steam hisses from a few pits, so the deposit is still hot underneath. My insect traps caught many beetles, flies and spiders that had blown in on the wind; most were dead or dying.

5 Card E

A dense young forest of fir and hemlock now shades many slopes, and the ground under it is cool and dim. The giant trees that fell long ago have gone soft and crumbly, and mosses, ferns and mushrooms grow on them. Woodpeckers drum on dead trees that are still standing.

6 Card F

One lupine plant is blooming on the open pumice, with a ring of tiny lupine seedlings around it. I cannot see another plant for kilometers. Background: lupines are legumes. Bacteria living in small bumps on their roots turn nitrogen gas from the air into nutrients the plant can use, so a lupine can grow where the ground has almost no nitrogen.

7 Card G

Huge trees lie flat in rows, most pointing away from the volcano, under a gray layer of ash and broken rock. When I dig through it, I reach the old brown forest soil, still full of roots. On a steep slope that was still under snow on the day of the eruption, small fir trees are bent over, but their needles are green.

8 Card H

Thickets of willow and alder along the streams are now well over my head. A few young conifers grow in sheltered spots, far apart from one another. Under the meadow plants there is a thin layer of dark, crumbly soil on top of the pumice. From a ridge, the plain is a patchwork of green and gray; there is still no forest.

9 Card I

Fireweed and bracken fern shoots are pushing up through cracks in the ash. When I dig beside them, I find their roots and underground stems running down into the old soil. Dark mounds of soil mixed with ash dot the gray surface where pocket gophers have tunneled up from below, and tiny seedlings are sprouting on some of the mounds.

10 Card J

Lupines now grow in scattered patches a few meters wide. Inside a patch, the pumice is darker and holds dead lupine leaves and bits of litter blown in by the wind. Soil tests show more nitrogen inside the patches than in the bare pumice between them. Seedlings of other plants, such as fireweed, pearly everlasting and grasses, sprout far more often inside the patches, especially where old lupines have died, than outside them.

11 Card K

Young conifers taller than I am grow in patches between the fallen logs, and shrubs shade much of the ground. The fallen logs are starting to rot; moss and small mushrooms grow on their bark. Songbirds sing from the young trees.

12 Card L

Small streams fed by springs cross the plain, and their banks are lined with willow and alder shrubs, a few already taller than I am. I counted tadpoles in a shallow pond. Between the streams, meadows of lupine, grasses and wildflowers alternate with wide gray patches of bare pumice.

Table 1. Sorting the cards

	Card letters	The clue that sorts them, and why it matters to living things
Group 1		
Group 2		
Fits neither group		

Table 2. Group 1, earlier to later (you may not need every row)

Position	Card	Clue: what had to happen before this?
1		
2		
3		
4		
5		
6		
7		

Table 3. Group 2, earlier to later (you may not need every row)

Position	Card	Clue: what had to happen before this?
1		
2		
3		
4		
5		
6		
7		

1. Which clue did your group use to sort the cards into two groups? Explain why that clue matters to plants and animals, not just to the way the place looks.

2. Which card was hardest to place in order? Write the two positions you considered and the clue that settled it, or the clue you wish the card had.

After the reveal

3. How many cards did your group place in the correct position in each zone? Choose one card your group (or another group) misplaced and explain which clue was misread.

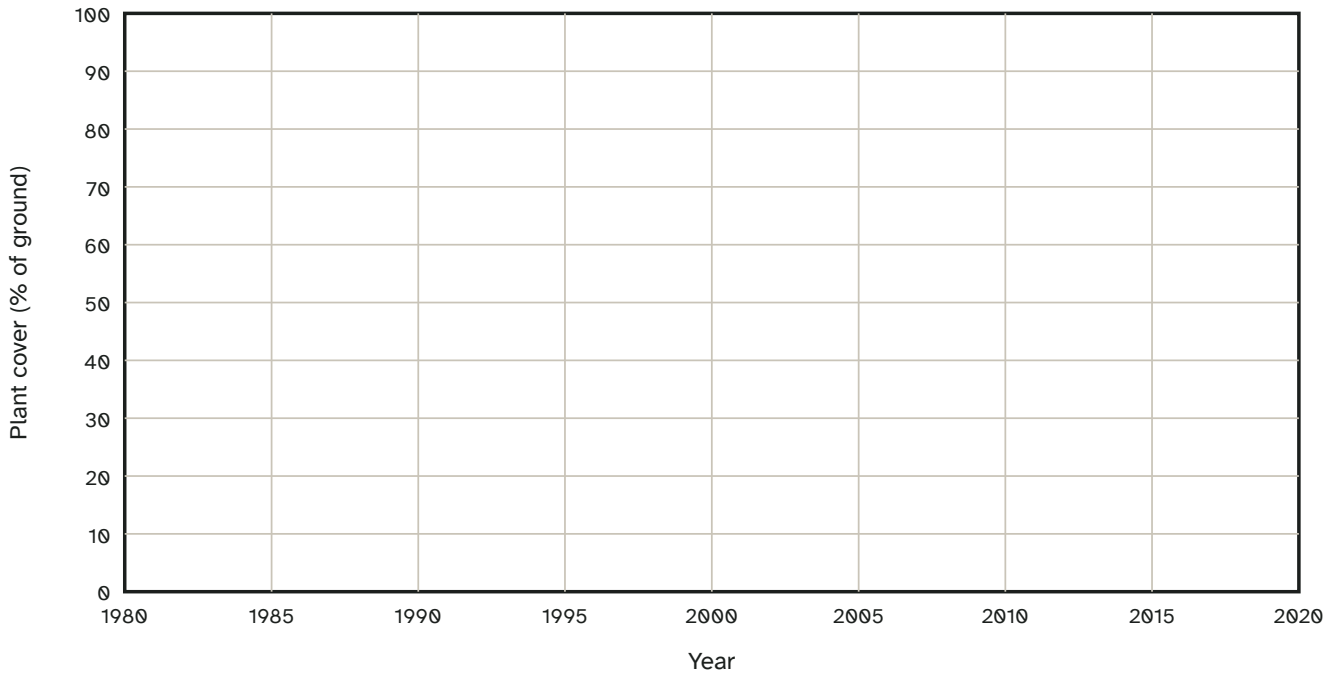
Plant cover in the two zones after the eruption

Simulated teaching dataset: the numbers are invented to be realistic, not measured.

Year	Pumice plain: plant cover (% of ground)	Blowdown zone: plant cover (% of ground)
1981	0	2
1985	1	15
1990	3	38
2000	15	70
2010	30	85
2020	45	90

Simulated teaching dataset. The numbers are invented; the pattern, with cover returning far faster in the blowdown zone, matches what ecologists described.

Plant cover over time in two zones



Analysis questions

4. Which zone shows **primary succession** and which shows **secondary succession**? Support each answer with two cards (give their letters) and the clue on each card that decided it.

5. Use the dataset. (a) Calculate the average gain in plant cover per year in each zone from 1981 to 1990, and how many times faster the blowdown zone gained cover. (b) Repeat for 2000 to 2020. What changed, and why might the blowdown zone's gain have slowed?

6. (a) Name two biological legacies in the blowdown cards. (b) Name the first arrivals recorded on the pumice plain and say where they came from. (c) Explain why legacies let the blowdown zone recover faster.

7. Card J says other seedlings sprouted far more often inside lupine patches. Explain how the lupine, a living thing, changed a nonliving part of its surroundings, and how that change affected other plant populations. Then use card B to explain why the lupine did not simply take over the whole plain.

8. Card C is the wild card. Why does it not belong in either study zone? Why would ecologists studying natural recovery keep their study plots out of logged and replanted land?

9. Claim: *the kind of ground a disturbance leaves behind affects how fast populations return*. Support or refute this claim with at least two cards and one number from the dataset, explain the reasoning that connects them, and name one weakness in this evidence.
