

How Fast Is Our Campus Changing? A Field Survey of Rates

Investigation question: Which weathering, erosion and deposition processes are at work on our school grounds right now, how fast is each one going, and how long would it take for them to make a change everyone would notice?

Classroom field investigation

Groups of 4

1 session

Setup 8 · Activity 40 · Cleanup 4 min

MS-ESS2-2 · assesses

MS-ESS2-1 · supports

Name _____

Group _____

Date _____

Your role today

- ☐ **Navigator and safety lead:** Carries the campus map with the assigned stations, keeps the group inside the assigned areas and away from traffic, and manages the time at each station.
- ☐ **Measurer:** Takes each measurement three times with the ruler, tape or straightedge, calling out the values with units.
- ☐ **Recorder and photographer:** Writes every value in the table, photographs each feature with a ruler in the frame for scale, and sketches the station on the map.
- ☐ **Rate analyst:** Looks up the feature's age on the campus facts table, computes the average, the rate and the extrapolation back in the classroom, and checks every unit.

Safety

- Stay inside the marked areas and never enter parking lots, driveways, loading zones or streets; stations are chosen away from traffic.
- No climbing on walls, railings, slopes or roofs; measure only what you can reach standing on level ground.
- Wear gloves to handle sediment and wash hands afterward; do not touch broken glass, sharp metal, animal droppings or anything in a storm drain; report hazards to the teacher instead of removing them.
- Sun and heat: hats, water and shade breaks on hot days; on wet days surfaces are slippery, so walk and keep both hands free when moving between stations.
- Groups stay together and within sight of an adult; the navigator checks that all four members are present before leaving each station.
- Chalk marks only on pavement, never on walls, signs or plants; chalk washes off.

Procedure

1. In class, read the campus facts table and the station list. For each assigned station, predict in the first table what process and agent you expect to find and whether you think the rate will be fast or slow.

2. Station A (worn step or threshold): lay the straightedge across the step from edge to edge where the wear is deepest. Measure the gap between the straightedge and the lowest point of the dip with the ruler, three times at slightly different spots. Record all three in millimeters. Mark the deepest spot with chalk for future classes.
3. Station B (sediment deposit): find the pile of sand, soil or grit at a downspout, curb or drain edge. Measure its length and width with the tape and its thickness at three points with the ruler. Collect one spoonful in the bag and note its color and grain size. Look uphill or up-gutter and write where the material most likely came from.
4. Station C (crack with plants): measure the crack's width at its widest point three times and its total length once. Note what is growing in it and whether the edges are crumbling.
5. Station D (crumbling corner, flaking paint or rust): measure how far the damaged zone extends from the original edge or surface, three times. Note whether the damage is chemical (rust, flaking, dissolving) or physical (chips, cracks).
6. At every station, photograph the feature with the ruler in the frame, sketch its location on the map, and write the agent you think is responsible (water, ice, wind, gravity, living things, chemical reaction, people and vehicles).
7. Back in class, average the three measurements for each station. Find the feature's age or the time since the last cleaning on the campus facts table. Compute the rate: average change $\div$ time, in millimeters per year (or, for the sediment pile, liters per year from length $\times$ width $\times$ thickness $\div$ 1,000 for cm^3 to liters).
8. Extrapolate for each station: choose a change everyone would notice (the step worn through at 150 mm; the crack 100 mm wide; the gutter or a 20-liter bucket full of sediment) and compute how long it takes at your rate: target $\div$ rate.
9. Answer the analysis questions individually, then write your explanation of how the campus is changing, which processes are involved, how fast each one is, and what would have to be true for your long-term predictions to come out right.

Record your observations

Lab 3 recording sheet: How fast is our campus changing?

Fill in the predictions before you go outside. At each station record three measurements with units, the agent, and a sketch on the map. Back in class complete the rate table, the extrapolation and the questions.

Field safety — Stay in the marked areas, away from parking lots and streets. No climbing. Gloves for sediment, then wash hands. Do not touch glass, sharp metal or anything in a drain; tell the teacher. Stay with your group.

Campus facts (teacher fills in before class)

Feature	Year built or last resurfaced	Age in years (this year minus that year)	Last swept or cleaned (date)	Last heavy rain (date)
Station A: steps or threshold at				
Station B: sediment at				
Station C: crack at				
Station D: crumbling or rusting				
Station E or F (if used)				

Predictions (before going outside)

Station	Process I expect (weathering, erosion, deposition)	Agent I expect	Fast or slow rate?
A			
B			
C			
D			

Field measurements

Station	What I measured (and units)	Measurement 1	Measurement 2	Measurement 3	Average	Agent observed and the evidence for it
A						
B (length, width)						
B (thickness)						
C (width)						
D						
E or F						

Rates and extrapolations (back in class)

Station	Average change (with units)	Time it took (years, from the campus facts)	Rate (change ÷ time, with units)	Noticeable change I chose	Time to reach it (target ÷ rate)
A				Step worn through: 150 mm	
B				A 20-liter bucket full	
C				Crack 100 mm wide	
D					

-  Sketch a map of your stations on the campus. At each station draw an arrow showing where material comes from (source) and where it goes (sink), and label the process on the arrow. Mark the station where the fastest rate was found with a star.

- Which station had the largest rate and which the smallest? Did your predictions match? Give the two rates with units.

- Did you find any evidence of a sudden event (for example, a sediment layer left by one storm, or a freshly broken chunk)? What told you it was sudden rather than gradual?

Analysis questions

3. Show the rate calculation for Station A in millimeters per year. Example of the form: $18 \text{ mm of wear} \div 45 \text{ years}$. Then convert the rate to millimeters per century.

4. Using your Station A rate, calculate how many years it would take to wear the step through (150 mm). Then calculate how long it would take to wear away a cliff 300 m tall at the same rate (300 m = 300,000 mm).

5. Trace the sediment at Station B backward and forward: where did it come from (what was weathered, by what agent), what carried it (erosion by what), and where will it go next if nobody sweeps it? Use the three process words.

6. Your fastest and slowest rates on campus probably differ by a factor of 10 or more. Explain how the campus shows that one place can have changes on very different time scales at the same time, and give the space scale of each feature.

7. Every extrapolation assumes the rate stays the same. List two things that could make the real rate at Station A or C speed up and two that could slow it down. Then say whether your 'years to wear through' answer is more likely too long or too short.

8. Uniformitarianism: a geologist finds a stone threshold in a 1,000-year-old building worn 60 mm deep. Could she use your Station A rate to check that age? Show the calculation, then explain what she would need to be careful about.

9. Write your explanation: how is our campus changing, by which processes and agents, at what rates, and how long until the changes are obvious? Cite at least three stations by letter and include at least two rates with units.
