

Reading a Succession Model, Then Building Your Own

Learning target: I can interpret a timeline model of secondary succession, compare it with primary succession, and draw a labeled model showing how each stage changes the ground for the next.

Diagrams and models

About 40 min

Individual

MS-LS2-4 · practice

MS-LS2-1 · supports

visual modeling

writing

Name _____

Date _____

Period _____

Directions

Study Figure 1 and Figure 2 before answering anything. Figure 1 is a model, not a photograph, and the years are typical ranges for a forest in the western United States, not a schedule every forest follows. Answer the questions in Part A using the figures. In Part B, draw your own model of primary succession on a lava flow. Your drawing must have four stages, labels, and an arrow note between each pair of stages saying what the earlier stage changed.

You will need: This worksheet, Pencil, Colored pencils (optional)

After the fire: one common pattern of secondary succession

Year 0: just after the fire

Blackened ground, standing dead trunks, stumps on the surface. Underneath: live roots, buried seeds, fungi, burrowing animals. Full sun on the ground.

Years 1 to 3: herbs

Fireweed, grasses and other fast-growing plants sprout from

Years 5 to 15: shrubs and seedlings

Shrubs shade the ground. Tree seedlings (pines, aspens) start under them. Deer browse the shrubs; hawks hunt the open meadow.

Years 20 to 60: young forest

Fast-growing sun-loving trees form a canopy. Shade kills most of the

Years 100 and beyond: older forest

Shade-tolerant trees (firs, spruces) replace sun-loving ones as they die. Thick leaf litter and fallen logs. A different mix of birds and mammals than the meadow had.

Figure 1. A model of secondary succession after a severe forest fire in a mountain forest of the western United States. Years are typical ranges, not fixed dates.

Primary versus secondary succession

Primary succession	Secondary succession
Starts on bare rock, lava, pumice or glacier gravel	Starts after fire, flood, storm, logging or farming
No soil and no survivors	Soil remains, often with roots, seeds and animals in it
Pioneers are lichens, mosses or nitrogen-fixing plants	Pioneers are fast-growing herbs from the seed bank and roots
Soil must be built from broken rock and dead pioneers	Soil is already present; it may be improved by added litter
Often takes centuries before trees can grow	Shrubs in years, trees in decades
Both	
Each stage changes light, soil or shelter for the next	
Populations shift as resources shift	
The end result may differ from what was there before	

Figure 2. Primary and secondary succession side by side. Items in the middle are true of both.

Part A: Interpret the models

- In Figure 1, which stage has the most sunlight reaching the ground, and which has the least? Use the stage labels.

- Explain why the herbs and grasses that filled the meadow in years 1 to 3 mostly disappear by years 20 to 60. Name the physical component that changed and the stage that changed it.

- The animals change from stage to stage: mice and seed-eating birds, then deer and hawks, then squirrels and woodpeckers. For one of these changes, explain which resource appeared or disappeared to cause it.

4. Figure 1 shows sun-loving trees forming the first canopy and shade-tolerant trees replacing them later. Why can the shade-tolerant trees win in the long run even though the sun-loving trees got there first?

5. Using Figure 2, give the main reason primary succession usually takes much longer than secondary succession, and name one organism that does the slow early work in primary succession.

6. The caption of Figure 1 says the years are 'typical ranges, not fixed dates.' Give one reason a real burned forest might move through these stages faster, and one reason it might move more slowly.

Part B: Build your own model

-  Draw a four-stage timeline model of **primary succession on a cooled lava flow**. Stage 1 must show bare lava with cracks. Stages 2, 3 and 4 are yours to choose, but they must end with shrubs or small trees. Label at least one organism in each stage after the first. Between each pair of stages, draw an arrow and write on it what the earlier stage changed about the ground (for example, 'adds thin soil', 'adds usable nitrogen', 'adds shade'). Give your model a title and include a note that says roughly how long the whole sequence might take.

7. Look at your drawing. Which arrow note describes the single most important change, the one without which the later stages could not happen? Explain your choice.

8. Suppose a second lava flow covers your stage 3 landscape. Does succession start again from stage 1, or from somewhere else? Explain using the idea of survivors.

Four stages you can borrow

If you are stuck on Part B, use this sequence and add your own labels and arrow notes: (1) bare lava with cracks; (2) lichens and mosses on the rock, with a few ferns in cracks where water collects; (3) a thin soil layer with grasses, nitrogen-fixing plants and insects; (4) shrubs and small trees with birds. For each arrow, ask: what did the plants in the earlier stage leave behind when they died, and what did they block or trap while alive?

Model a succession that does not reach forest

Not every succession heads toward the community that was there before. In much of the Great Basin, sagebrush shrublands that burn are often taken over by cheatgrass, an invasive annual grass from Eurasia that dries out early in summer and burns easily. The extra fuel brings more frequent fires, and sagebrush, which does not resprout after burning, cannot grow back between them. Draw a second timeline model for this 'fire trap' and compare it with Figure 1. Which physical component is being changed repeatedly, and why does the cycle keep the ecosystem from moving to later stages?