



Module 3: Soil Science and Soil Health

Hands-On Activity Lesson C: Living Soils & Ecosystem Services

Module 3 Lesson C: Living Soils & Ecosystem Services – Hands-On Activity C1, C2, C3, C4 Hands-On Activities: C1. Soil Glue, C2 Infiltration, C3 Build vs. Deplete, C4 Soil Respiration

Data Collection Worksheet

Grouping: Teams of 3–4 students (working together at each station)

Time: ~50 minutes (for all activities and observations)

Materials: (for reference, per group)

- Soil Sample A (description/location: _____)
- Soil Sample B (description/location: _____)
- 2 clear jars or cups (for slake test) with water and wire mesh screens
- 2 metal cans or rings for infiltration + water (250 mL per test) + timer
- Practice cards or a list for sorting activity + worksheet/table
- 2 jars with lids, baking soda, vinegar, and small cups (for respiration test)
- Stopwatch, measuring cup, marker/labels, gloves, paper towels (as needed)

Activity C1: Soil Glue Test – Aggregate Stability Observations

Observe what happens when a dry clod of each soil is submerged in water. Note changes such as breaking apart and water cloudiness. Use the table below to record your observations.

| Soil Sample | What happened when submerged in water? (Aggregate Stability Observation) |
|-------------|---|
| A (_____) | <i>e.g., clod remained mostly intact; only slight crumbling; water stayed clear.</i> |
| B (_____) | <i>e.g., clod burst apart quickly; soil particles dispersed; water became very muddy.</i> |

Activity C2: Soil Infiltration Test – Water Absorption Rate

Measure how fast each soil sample absorbs water. We added **250 mL** of water to each sample using an infiltration ring.

- **Soil A:** Time for 250 mL to infiltrate = _____ seconds. (*Record how long until water soaked in.*)
- **Soil B:** Time for 250 mL to infiltrate = _____ seconds.

Additional notes or observations:

- Soil A: *e.g., water disappeared rapidly, no puddling.*
- Soil B: *e.g., water pooled for a while, took long to soak in; some water might have run off.*

Activity C3: Build vs. Deplete – Sorting Farming Practices

List the practices under the correct category after your group discussion. (The practices to sort were: frequent plowing/tillage, no-till farming, leaving fields bare, planting cover crops, using synthetic fertilizers, adding compost, CAFO/confined feeding, rotational grazing.)

Soil-Building Practices:

1. _____
2. _____
3. _____
4. _____

Soil-Depleting Practices:

1. _____
2. _____
3. _____
4. _____

(Choose one practice from each list to explain in the reflection questions below.)

Activity C4: Soil Respiration Test – CO₂ Fizz Observations

After sealing jars with baking soda and soil, vinegar was added. Describe the reaction (fizz/bubbling) for each soil:

| Soil Sample | CO ₂ Release (Fizz Reaction) upon adding vinegar |
|-------------|---|
| A (_____) | _____ |
| B (_____) | _____ |

| Soil Sample | CO ₂ Release (Fizz Reaction) upon adding vinegar |
|-------------|---|
| A (_____) | _____ |
| B (_____) | _____ |

e.g., “A had a lot of fizz that bubbled up for ~10 seconds” vs. “B had very little fizz, only a few bubbles.”

Reflection & Analysis – Answer the following questions based on your results. Be clear and use evidence from your observations or prior knowledge. (Each question includes a hint to guide your thinking – use these to deepen your answer.)

1. **Soil Glue Test:** Which soil sample had more stable aggregates (stayed intact better in water)? **Why** do you think that sample was more stable?
(Hint: Consider what Soil A and B contain. Did one have more organic matter or roots acting like “glue”? How does better stability help soil in nature – for example, when it rains heavily?)
 2. **Infiltration Test:** Which soil had a faster infiltration rate (absorbed water quicker)? **Why** did that soil soak up water more efficiently than the other?
(Hint: Think about soil structure and pore spaces. What factors could make Soil A vs. B absorb water differently – e.g., presence of plant roots, organic matter, or compaction? Why is good infiltration important for farmers and for preventing runoff?)
 3. **Build vs. Deplete Sorting:** Pick **one** practice you labeled as **Soil-Building** and **one** you labeled as **Soil-Depleting**. For each, explain **why** you put it in that category.
 - Soil-Building practice chosen: _____ – Why is it soil-building?
 - Soil-Depleting practice chosen: _____ – Why is it soil-depleting?
(Hint: Refer to what these practices do to the soil. For example, how does adding compost affect soil life and nutrients? How does frequent tillage affect soil structure and carbon? Use concepts from class like nutrient cycling, erosion, or soil food web to support your reasoning.)
 4. **Soil Respiration (CO₂) Test:** Which soil sample produced more CO₂ (i.e., had a stronger fizz reaction)? **What does this tell you** about the soil’s “living” component?
(Hint: More fizz means more microbial respiration. What does that say about the amount of organic matter or microbes in that soil? Why would one soil have less microbial activity – what might it be lacking?)
 5. **Ecosystem Services:** Name **one** important **benefit to the environment** or to farmers that comes from having a **healthy, living soil** (think of the properties you observed). Explain briefly.
(Hint: You might mention water, climate, or productivity. For instance, does healthy soil help with water supply or flood control? Does it store carbon to help with climate change? Does it support better crop growth? Choose one and elaborate.)
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Skills You'll Use:

- **Observing & Measuring:** You carefully observed physical changes (e.g. how soil clods broke down, how fast water infiltrated, how much fizz released) and took measurements of time/volume, practicing scientific data collection.
- **Analytical Thinking:** You interpreted what your observations meant – linking a cloudy jar to poor soil structure, or fast infiltration to good soil porosity – and answered questions using evidence.
- **Critical Categorization:** By sorting farming practices into “build” or “deplete,” you applied conceptual knowledge to a new context, strengthening your understanding of sustainable vs. unsustainable practices.
- **Collaboration:** You worked as a team to perform tests and discuss ideas, improving your communication and teamwork skills in a lab setting.
- **Systems Connection:** You connected small-scale findings (soil tests) to big-picture systems – recognizing how soil health underpins ecosystem services like water filtration and carbon storage, and seeing how human actions can impact those services.

Remember: “*Living soil*” means soil is full of life and interactions. The best soils acted differently in your tests – they stayed together, drank up water, and “breathed” out gases – all because of the organic matter and organisms within. Healthy soil leads to better food production, reduced erosion, cleaner water, and increased carbon storage in the ground. By noticing these small experiments, you’re seeing how **nurturing the life in soil can yield big benefits for our planet.** 🌱