



PART 1

Read the text below and answer questions 1–13.

THE HIDDEN LIFE OF SOIL

A

Soil is often dismissed as inert dirt—an anonymous substrate that merely holds plants upright. Yet in ecological terms it is better understood as a living system, in which minerals, water and air are interwoven with an astonishing density of organisms. A teaspoon of healthy topsoil can contain vast populations of bacteria, filamentous fungi, protozoa, nematodes and arthropods, all interacting within the pore spaces between particles. These microscopic communities are especially active in the rhizosphere, the narrow zone surrounding roots where plants release sugars and signalling compounds that shape microbial behaviour. Through this underground economy, soil life governs nutrient availability, influences how water infiltrates, and determines whether an ecosystem can recover from stress. The productivity of a field or forest, therefore, depends not only on what is added above ground, but on the biological processes unfolding beneath the surface.

B

One of the most consequential processes in this subterranean world is decomposition. When leaves, roots and dead organisms enter the soil, they do not simply “rot” in a single step; they undergo a sequence of transformations driven by diverse decomposers and moderated by temperature, moisture and oxygen. Different microbes specialise in different compounds: some attack simple sugars, others dismantle cellulose, and still others break down more resistant molecules such as lignin. As organic material is processed, nutrients are converted into forms that plants can absorb or store—an example of nutrient sequestration occurring at the micro-scale. During this process, microbes mineralise organic nitrogen, releasing nitrogen and other elements into the soil solution, where roots can take them up. Because the pathway involves many organisms and chemical stages, its speed and outcomes vary greatly across environments; the same plant litter may be transformed rapidly in warm, moist conditions but persist much longer where soils are cold, dry or oxygen-poor.

C

Fungi contribute to soil fertility in distinctive ways that differ from bacterial activity. Many fungi grow as networks of hyphae—fine filaments that extend through soil like threads—binding particles into stable aggregates and improving structure. When aggregates form, they create a patchwork of pores that allows water to infiltrate rather than sheet across the



surface, while also protecting organic matter from rapid breakdown. Fungi are also central to symbiotic partnerships with plants. In the most widespread form, mycorrhizae, fungal hyphae attach to roots and extend the plant's effective foraging area far beyond what the roots alone could reach. In exchange for sugars supplied by the plant, mycorrhizal fungi help the host acquire scarce nutrients, particularly phosphorus, which often moves slowly through soil. This relationship is not a minor accessory to plant growth; in many ecosystems it is a foundational mechanism by which plants negotiate nutrient limitation and stabilise productivity under stress.

D

Bacteria are equally essential, but they tend to operate through rapid population changes and biochemical versatility rather than long-lived filament networks. In nutrient-rich microhabitats—especially around decomposing residues or in the rhizosphere—bacterial cells can multiply quickly, accelerating key steps in nutrient cycling. Their role in the nitrogen cycle is particularly important. Certain bacteria convert ammonia into nitrites and then nitrates, forms that many plants absorb efficiently. Other bacterial groups, under low-oxygen conditions, perform denitrification: they use nitrate as an alternative “electron acceptor” and convert it into gaseous forms that return nitrogen to the atmosphere. This dual capacity means bacteria can both increase nitrogen availability for crops and also remove nitrogen from soil systems, influencing not only yields but also emissions of nitrogen-based greenhouse gases. The balance between these processes depends on soil moisture, aeration and organic inputs, illustrating how biology and physical structure jointly shape fertility.

E

Because soil organisms require both food and shelter, organic matter is a critical determinant of soil health. Organic matter functions as a habitat matrix that supports microbial diversity, but it also changes soil physics in ways that matter for plants and landscapes. When organic residues accumulate and are incorporated into aggregates, the soil behaves more like a sponge: it holds moisture within pore spaces and releases it gradually, helping plants endure dry periods. This buffering effect reduces drought stress, while the improved structure also reduces surface sealing, so intense rain is more likely to infiltrate than to flow away. As a result, soils rich in organic matter can reduce runoff during heavy storms and lower the loss of nutrients and sediments into waterways. By contrast, when organic matter is depleted through erosion, bare fallow periods or repeated disturbance, the soil often becomes compacted and less absorbent, increasing both drought vulnerability and the likelihood of damaging floods downstream.



F

Modern agriculture has frequently disrupted these biological and structural processes, sometimes unintentionally. Heavy mechanised tillage fractures aggregates and severs fungal hyphae, breaking the networks that stabilise soil architecture. It also exposes previously protected organic matter to oxygen, accelerating oxidation and reducing long-term carbon storage. At the same time, the widespread use of synthetic fertilisers can supply plants with readily available nutrients while altering incentives within the soil ecosystem. When nitrogen and phosphorus are delivered in soluble form, plants may invest less in maintaining symbiotic relationships that help them forage for scarce resources, weakening mutualisms that would otherwise support resilience. Some pesticides further complicate the system by affecting non-target organisms that contribute to decomposition, aggregation and biological pest control. The combined effect can be a simplified soil community that depends increasingly on external inputs, while becoming more fragile when those inputs are interrupted or when climatic stress intensifies.

G

In response to declining soil function, many researchers and farmers have promoted regenerative approaches that aim to rebuild biological activity and structure rather than merely replace nutrients. Strategies include reducing disturbance, keeping the ground covered with crops or residues, diversifying rotations, and adding organic amendments such as compost to restore carbon and microbial habitat. These practices seek to re-establish stable aggregates, support diverse communities in the rhizosphere, and improve the efficiency with which nutrients and water are retained and cycled. However, outcomes are context-dependent: soils differ in texture, climate, history and baseline biology, and improvements may take years to become evident rather than appearing immediately. Importantly, while long-term gains are possible, the passage of time needed is not fixed in a simple schedule for each environment. Understanding soil as a living system therefore shifts evaluation away from single-season yield alone and toward the maintenance of structure, biodiversity and nutrient cycling as indicators of durable productivity.

Questions 1–6

Choose the correct letter, **A, B, C or D**.

1 What point does the writer make about decomposition?

- A** It is carried out mainly by plant roots.
- B** It removes nitrogen from the soil permanently.
- C** It converts organic material into nutrients plants can use.
- D** It occurs only when oxygen is absent.



2 According to the passage, fungi contribute to soil structure by

- A** binding particles together into aggregates.
- B** preventing all water from entering the soil.
- C** converting phosphorus into nitrogen.
- D** replacing bacteria in the rhizosphere.

3 What is one effect of organic matter mentioned in the passage?

- A** It prevents soil organisms from consuming carbon.
- B** It eliminates the risk of downstream flooding.
- C** It causes soil pores to collapse during storms.
- D** It helps soil retain water and release it gradually.

4 Why can heavy tillage damage soil biology?

- A** It causes plants to release too many sugars.
- B** It breaks fungal networks and accelerates organic-matter loss.
- C** It prevents nitrogen from entering the atmosphere.
- D** It makes phosphorus move too quickly through soil.

5 What does the writer say about regenerative farming practices?

- A** Their benefits appear within the same period everywhere.
- B** They are effective only when synthetic fertilisers are increased.
- C** Their results depend on local conditions and may take years.
- D** They focus primarily on removing crop residues.

6 What is the main purpose of the passage?

- A** To argue that soil fertility depends mainly on synthetic fertilisers
- B** To explain how soil organisms support key functions and how farming can affect them
- C** To compare the economic value of different agricultural crops
- D** To show that fungi are the only organisms important to healthy soil

Questions 7–10

Complete the notes below. Choose **ONE WORD ONLY** from the text for each answer.

Soil biology and regenerative practices

- During decomposition, microbes **7** organic nitrogen, releasing nutrients into the soil solution.



- Mycorrhizal fungi receive sugars from plants and help them obtain **8**, which moves slowly through soil.
- Soils rich in organic matter can reduce runoff and limit the movement of nutrients and sediments into **9**
- Regenerative farming may add organic amendments such as **10** to restore carbon and microbial habitat.

Questions 11–13

Choose **TRUE** if the statement agrees with the information given in the text, choose **FALSE** if the statement contradicts the information, or choose **NOT GIVEN** if there is no information on this.

11 The passage indicates that bacteria can both make nitrogen available to plants and return nitrogen to the atmosphere.

12 The passage states that synthetic fertilisers encourage plants to maintain symbiotic relationships with soil organisms.

13 The passage gives precise timelines for when regenerative practices will produce benefits in different climates and soil types.

Answer Key

1. C
2. A
3. D
4. B
5. C
6. B
7. mineralise
8. phosphorus
9. waterways
10. compost
11. TRUE



12. FALSE

13. FALSE