

# Environmental Science 20: Unit 3 Final Exam Review Package - Terrestrial Ecosystems

## 1. Introduction: How to Use This Review Package

Welcome to the Unit 3 Final Exam Review Package for Terrestrial Ecosystems. This document is designed to help you consolidate your understanding of the core concepts covered in this unit. It summarizes the key information from Chapters 5, 6, and 7 and provides a series of practice questions to test your knowledge and ability to apply what you have learned. For the most effective review, we advise you to first read through the summary and familiarize yourself with the glossary of key terms before attempting the practice questions.

## 2. Glossary of Key Terms

Mastering the vocabulary of a subject is a critical step toward success on any exam. A strong command of these terms is essential for correctly interpreting multiple-choice questions and for formulating clear, precise short-answer responses. The definitions below are the foundation for the concepts you will be tested on.

Term	Definition
<b>Terrestrial Ecosystems</b>	Ecosystems on land where the vast majority of human resource management occurs.
<b>Biome</b>	A massive geographical area characterized by similar climate, geology, and typical plant and animal life.
<b>Boreal Forest</b>	A biome in northern Saskatchewan characterized by coniferous forests, vast bogs, fens, and acidic Podzol soils.
<b>Aspen Parkland</b>	A transitional biome in central Saskatchewan with a mix of fescue grasslands and Aspen groves on extremely fertile Black Chernozemic soils.
<b>Grasslands</b>	A biome in southern Saskatchewan dominated by drought-tolerant grasses, with hot, dry summers and Brown/Dark Brown Chernozemic soils.
<b>Palliser's Triangle</b>	A semi-arid region in the southwest corner of the Canadian prairies that receives less than 350mm of annual rainfall.
<b>O-Horizon</b>	The uppermost layer of soil, consisting of decomposing plant material and humus.
<b>A-Horizon</b>	Known as topsoil; a mix of mineral matter and decayed organic matter that is the primary zone for agriculture.
<b>E-Horizon</b>	A light-colored layer of soil where minerals have been leached downward.
<b>B-Horizon</b>	Known as subsoil; the zone of accumulation, rich in clay, iron, and other minerals leached from upper layers.

<b>C-Horizon</b>	The layer of unconsolidated material (e.g., glacial till) from which the soil formed.
<b>R-Horizon</b>	The solid, unweathered rock layer at the bottom of the soil profile.
<b>Humus</b>	The dark, stable organic matter in soil created by the decomposition of plants and animals, crucial for fertility and moisture retention.
<b>Erosion</b>	The removal of topsoil by the forces of wind and water.
<b>Salinization</b>	The buildup of salts on the soil surface, typically caused by a rising water table and subsequent evaporation.
<b>Desertification</b>	The expansion of arid conditions into semi-arid areas.
<b>Photosynthesis</b>	The process used by plants to convert carbon dioxide and water into glucose and oxygen using light energy.
<b>Ecosystem Services</b>	Benefits that ecosystems provide, such as soil stabilization, water regulation, and nutrient cycling.
<b>Biopores</b>	Drainage pathways in the soil created by plant roots and decomposers that allow rainwater to penetrate the soil.
<b>Sustainable Intensification</b>	An agricultural approach to maximize production while maintaining ecological health.
<b>Pulse Crops</b>	Crops such as lentils and peas that are used in rotation to fix nitrogen naturally in the soil.
<b>Shelterbelts</b>	Rows of trees planted to reduce wind speed and prevent soil erosion.
<b>Traditional Ecological Knowledge (TEK)</b>	A system of Indigenous stewardship based on generations of direct observation and relationship with the environment.
<b>Reciprocity</b>	A core principle of TEK emphasizing a mutual, give-and-take relationship where humans must give back to the land.
<b>Biodiversity</b>	The variety of life at the genetic, species, and ecosystem levels.
<b>Habitat Fragmentation</b>	The process where large, continuous habitats are broken into smaller, isolated patches by human activity like roads or development.
<b>Edge Effects</b>	The different environmental conditions (e.g., more wind, sun, predation) that occur at the boundaries of fragmented habitats compared to the interior.
<b>In-situ Conservation</b>	The strategy of protecting species within their natural environment.
<b>Ex-situ Conservation</b>	The strategy of protecting species outside of their natural environment.

These terms are the building blocks for the core concepts summarized in the next section.

### 3. Core Concepts Summary Outline

This section serves as the conceptual backbone of the unit. The outline distills the most critical information from each chapter into a digestible format, which is perfect for efficient review and for identifying any areas that may require more of your attention.

#### 3.1. Chapter 5: Biomes and Soil

- **What is a Biome?**
  - A biome is a massive geographical area defined by its climate, geology, and typical life forms. The two primary abiotic factors that determine a biome's characteristics are **temperature** and **precipitation**.
- **Saskatchewan's Major Biomes:**
  - **Boreal Forest:** Located in the northern third of the province, it features coniferous trees, bogs, and acidic Podzol soils.
  - **Athabasca Plain:** A far northern region with sparse forest, exposed lichen, and thin, nutrient-poor soils.
  - **Mid-Boreal Upland:** An interior boreal region with mixed forests of Aspen, Pine, and Fir on deeper Podzol soils.
  - **Aspen Parkland:** A central transitional zone with aspen groves and grasslands on highly fertile Black Chernozemic soils.
  - **Grasslands:** Southern plains dominated by drought-tolerant grasses on Brown and Dark Brown Chernozemic soils.
- **Soil Composition:**
  - Soil consists of four primary components in the following approximate percentages:
    - **Mineral Matter (~45%):** Sand, silt, and clay from weathered bedrock.
    - **Organic Matter (~5%):** Decomposed material (humus) that provides fertility.
    - **Soil Water (~25%):** Dissolves nutrients for plants.
    - **Soil Air (~25%):** Provides oxygen for roots and microbes.
- **The Soil Profile:**
  - **O-Horizon (Organic):** The uppermost layer of decomposing plant material.
  - **A-Horizon (Topsoil):** A mix of mineral matter and humus; the primary zone for agriculture.
  - **E-Horizon (Eluviated):** A light-colored layer where minerals have been leached downward.
  - **B-Horizon (Subsoil):** The zone of accumulation, rich in clay and minerals that have moved down from above.
  - **C-Horizon (Parent Material):** Unconsolidated material from which the soil formed.
  - **R-Horizon (Bedrock):** The solid, unweathered rock layer.
- **Major Threats to Soil:**

- The four major threats to soil integrity are **Erosion**, **Salinization**, **Organic Matter Depletion**, and **Desertification**.

### **3.2. Chapter 6: The Producers**

- **Photosynthesis:**
  - This is the fundamental process where plants use light energy to convert carbon dioxide and water into glucose (energy) and oxygen, forming the base of terrestrial food webs.
  - Chemical Equation:  $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Light} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
- **Key Ecosystem Services of Plants:**
  - **Soil Stabilization:** Plant roots mechanically reinforce the soil, holding it in place against erosion.
  - **Water Regulation:** Roots create **biopores** that help rainwater infiltrate the soil, recharging groundwater.
  - **Nutrient Cycling:** Plants play a key role in the Carbon, Nitrogen, and Phosphorus cycles.
- **Human Reliance and Stewardship:**
  - **Agriculture:** Stewardship involves practices like **Sustainable Intensification**. Examples include using **Pulse Crops** (lentils, peas) to fix nitrogen and planting **Shelterbelts** to prevent wind erosion.
  - **Forestry:** In forestry stewardship, **selective cutting is preferred over clear-cutting** to maintain forest structure and ecological health.
  - **Traditional Ecological Knowledge (TEK):** This involves Indigenous stewardship practices guided by the principle of **Reciprocity**, which emphasizes giving back to the land.

### **3.3. Chapter 7: Biodiversity and Conservation**

- **Biodiversity:**
  - Defined as the variety of life at three levels: genetic, species, and ecosystem. It is essential for ecosystem resilience.
- **Habitat Fragmentation:**
  - This is the process where large habitats are broken into smaller, isolated patches.
  - Its two primary negative consequences are:
    - **Edge Effects:** Altered environmental conditions at the boundaries that reduce habitat quality.
    - **Reduced Gene Flow:** Isolation of populations, which can lead to inbreeding.
- **Saskatchewan Species at Risk:**
  - Three key examples mentioned are the **Burrowing Owl**, **Swift Fox**, and **Greater Sage Grouse**.
- **Conservation Strategies:**
  - **In-situ Conservation:** Protecting a species in its natural environment. An example is the creation of **Grasslands National Park**.

- **Ex-situ Conservation:** Protecting a species outside of its natural habitat. An example is the use of **captive breeding programs for Swift Foxes**.

Now that you have reviewed the core concepts, it is time to apply your knowledge with the following practice questions.

## 4. Practice Questions

This section is designed to test both your recall of key facts and your comprehension of the major concepts. Part A focuses on definitions and key facts, while Part B requires you to formulate deeper, more explanatory answers.

### Part A: Fill-in-the-Blanks

1. The two primary abiotic factors that determine a biome are temperature and \_\_\_\_\_.
2. The semi-arid region in the southwest corner of the Canadian prairies, known for receiving less than 350mm of annual rainfall, is called \_\_\_\_\_.
3. The dark, stable organic matter in soil created by the decomposition of plants and animals is known as \_\_\_\_\_.
4. The A-Horizon in a soil profile is more commonly known as \_\_\_\_\_.
5. The process where excess salts build up on the soil surface, often due to a rising water table, is called \_\_\_\_\_.
6. Plants convert carbon dioxide and water into glucose and oxygen through the process of \_\_\_\_\_.
7. Rows of trees planted to reduce wind speed and prevent soil erosion are called \_\_\_\_\_.
8. The process where large, continuous habitats are broken into smaller, isolated patches is called \_\_\_\_\_.
9. Protecting a species in its natural environment, such as in a National Park, is an example of \_\_\_\_\_ conservation.
10. The core principle of Traditional Ecological Knowledge that emphasizes a mutual, give-and-take relationship with the land is \_\_\_\_\_.

### Part B: Short Answer Questions

1. Describe the four main components of healthy soil and their approximate percentages.
2. Explain the difference between the O-Horizon and the A-Horizon in a soil profile. What is the primary role of each?
3. Identify two ecosystem services provided by plants and explain how each one benefits the terrestrial ecosystem.
4. Compare and contrast *in-situ* and *ex-situ* conservation strategies. Provide one example of each from the Saskatchewan context.
5. What are “edge effects” and why are they a concern for species that require large, undisturbed habitats?

## 5. Answer Key

This section contains the answers to the practice questions above. Use it to check your work and identify areas for further review.

### Part A: Fill-in-the-Blanks - Answers

1. precipitation
2. Palliser's Triangle
3. humus
4. topsoil
5. salinization
6. photosynthesis
7. shelterbelts
8. habitat fragmentation
9. *in-situ*
10. reciprocity

### Part B: Short Answer Questions - Model Answers

1. **Answer:** Healthy soil is composed of four main components. Approximately 45% is **Mineral Matter**, which includes sand, silt, and clay from weathered bedrock. About 5% is **Organic Matter**, or humus, which is crucial for fertility and moisture retention. The remaining 50% is pore space, ideally filled with about 25% **Soil Water** (which dissolves nutrients for plants) and 25% **Soil Air** (which provides oxygen for roots and microbes).
2. **Answer:** The O-Horizon is the uppermost layer, consisting almost entirely of **organic material** like decomposing leaves and plant litter. The A-Horizon, or topsoil, lies beneath it and is a mix of **mineral matter and highly decayed organic matter (humus)**. The primary role of the O-Horizon is to provide a source of new organic material, while the A-Horizon is the primary zone for agriculture and plant growth due to its fertility.
3. **Answer:** One key ecosystem service from plants is **Soil Stabilization**. Plant roots act like reinforcing bars, mechanically holding the soil together and preventing erosion from wind and water. Another service is **Water Regulation**. Roots create channels called biopores that allow rainwater to infiltrate the soil instead of running off the surface, which helps recharge groundwater reserves.
4. **Answer:** *In-situ* conservation involves protecting species within their natural habitat. An example from the text is the establishment of **Grasslands National Park** to protect prairie ecosystems. In contrast, *ex-situ* conservation involves protecting species outside their natural environment. An example is using **captive breeding programs for Swift Foxes** in facilities like zoos to build up their population before reintroduction.
5. **Answer:** “Edge effects” are the different environmental conditions that occur at the boundaries or “edges” of a fragmented habitat compared to its interior. These conditions can include more wind, more direct sunlight, and increased access for predators. They are a concern because they reduce the quality and amount of usable “core” habitat for interior species, like the Greater Sage Grouse, that are sensitive to human infrastructure and require large, undisturbed areas to thrive.