Meridian Distance Learning Institute

Foundations of Environmental Science

Self-Paced Study Guide

Course Code ENV 101 | Modules 1–2 of 8

Course At a Glance

Instructor:	Dr. Elena Whitfield, Ph.D. Environmental Systems
Credit Load:	3 semester credits
Format:	Fully asynchronous; readings, recorded lectures, quizzes
Estimated Pace:	3–4 hours per module, 8 modules total
Support:	Weekly virtual office hours, discussion board within 24h

How to Use This Guide

This guide mirrors the online course shell module by module. Every chapter opens with **objectives**, lists an **estimated time** and reading, closes practice with a **hands-on activity**, and checks understanding with a **self-check quiz** – answers are in the Answer Key at the very end. Do the activity before the quiz; skipping it is the single biggest predictor of a failed self-check.

This guide accompanies the ENV 101 course shell and the required text *Systems of the Living Earth*, 4th ed. (Nimbus Academic Press).

Revision 3 – Spring Term

1 Earth as an Interconnected System

Learning Objectives

By the end of this chapter, you will be able to:

1. Identify the four major spheres of the Earth system and describe how they interact.
2. Explain the difference between an open system and a closed system using a real example.
3. Trace a single carbon atom through at least three reservoirs of the carbon cycle.
4. Evaluate a short case study for evidence of feedback loops.

Estimated Time

Reading: 40 min
Activity: 20 min
Quiz: 10 min
Total: about 70 minutes

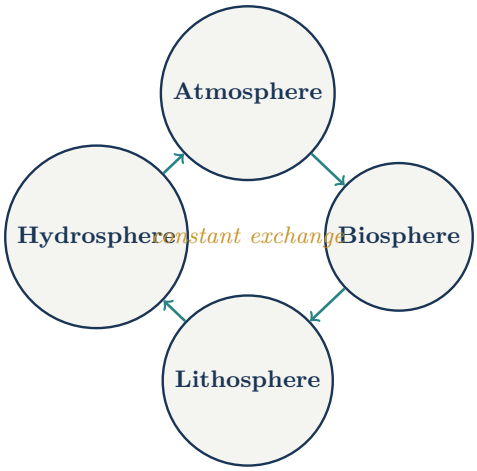
Reading Assignment

Systems of the Living Earth, Chapter 1, pp. 3–21, plus the recorded lecture "Spheres in Motion" (18 min) in the course shell.

1.1 The Four Spheres

Environmental science begins with a simple but powerful idea: the planet behaves as one interconnected system rather than a collection of separate parts. Scientists divide this system into four overlapping spheres. The **atmosphere** is the thin envelope of gases surrounding the planet, extending roughly 100 km upward before thinning into space. The **hydrosphere** includes every reservoir of water – oceans, rivers, groundwater, ice, and atmospheric vapor. The **lithosphere** is the solid outer shell of rock and soil, and the **biosphere** is the sum of every living thing and the environments they inhabit.

No sphere operates in isolation. When a wildfire burns through a forest (biosphere), it releases carbon into the atmosphere, alters the soil chemistry of the lithosphere, and can change local rainfall patterns in the hydrosphere for years afterward. Recognizing these cross-sphere interactions is the foundational skill this course builds toward across all eight modules.



1.2 Open Systems, Closed Systems, and Feedback

A **closed system** exchanges energy with its surroundings but not matter; Earth as a whole is very nearly closed in this sense – sunlight enters, heat radiates out, but almost no material leaves or arrives. An **open system**, such as a single watershed, exchanges both energy and matter freely with

what surrounds it: rain enters, rivers carry sediment out, and organisms move across its boundary daily.

Feedback loops determine whether a system resists or amplifies change. A **negative feedback loop** dampens change and pushes a system back toward equilibrium – for instance, increased cloud cover reflecting sunlight and cooling a warming surface. A **positive feedback loop** amplifies an initial change, such as melting sea ice exposing darker ocean water that absorbs more heat and melts still more ice.

Key Terms

Biosphere All living organisms and the environments that sustain them.

Closed system A system exchanging energy, but not matter, with its surroundings.

Feedback loop A process where a system's output influences its own future behavior.

Reservoir A location where a substance such as carbon is stored for a period of time.

Residence time The average duration a unit of matter remains in a given reservoir.

1.3 Case Study: The Carbon Cycle

Carbon moves continuously among the atmosphere, oceans, soil, and living tissue. A carbon atom released by a factory smokestack may be absorbed by ocean surface water within a decade, taken up by phytoplankton, sink to the deep ocean as organic debris, and remain there as sediment for thousands of years before geological uplift and erosion return it to the surface. Each reservoir has a different *residence time* – the atmosphere holds carbon for roughly 5 years on average, while deep ocean sediments can hold it for millennia.

Applied Activity

Choose one everyday object within arm's reach that contains carbon (a wooden pencil, a cotton shirt, a plastic pen). In 3–4 sentences, trace the likely path that carbon took through at least two spheres before becoming part of that object, and identify one reservoir where it may have had a long residence time. Post your answer to the Module 1 discussion board before attempting the quiz below.

Self-Check Quiz

1. Which sphere would sea ice, groundwater, and atmospheric humidity all belong to?
   (a) Lithosphere (b) Hydrosphere (c) Biosphere (d) Atmosphere
2. A single isolated lake that receives rainfall and loses water only to evaporation, with no matter otherwise entering or leaving, is best described as:
   (a) An open system (b) A closed system (c) A feedback loop (d) A reservoir
3. Melting Arctic ice exposing darker water that absorbs more solar energy, causing further melting, is an example of:
   (a) Negative feedback (b) A closed system (c) Positive feedback (d) Residence time
4. List two spheres a carbon atom might pass through between being emitted by a wildfire and being stored in deep ocean sediment.

2 Populations, Resources, and Human Impact

Learning Objectives

By the end of this chapter, you will be able to:

1. Distinguish between renewable and non-renewable resources with an example of each.
2. Explain carrying capacity and predict what happens when a population exceeds it.
3. Compare two competing strategies for managing a shared resource.

Estimated Time

Reading: 45 min
Activity: 25 min
Quiz: 10 min
Total: about 80 minutes

Reading Assignment

Systems of the Living Earth, Chapter 2, pp. 23–44, plus the case brief "The Apex Fishery Collapse" posted in the course shell.

2.1 Resources and Carrying Capacity

Resources are commonly classified as **renewable** – those that regenerate on human timescales, such as timber or fresh groundwater recharge – or **non-renewable**, those that form over geological timescales far slower than we consume them, such as coal or phosphate rock. A resource can behave as renewable in principle yet be depleted in practice if extraction outpaces regeneration, as happened to the once-abundant Apex Bank fishery in the case brief for this module. Every population, human or otherwise, exists within a **carrying capacity**: the maximum size an environment can sustain indefinitely given available food, water, and space. Populations that briefly exceed it typically experience a sharp correction – famine, disease, or emigration – before stabilizing near the original limit, unless resource availability itself changes.

Key Terms

Carrying capacity The maximum population an environment can sustain long-term.

Ecological footprint The land and resource area required to sustain a given lifestyle.

Non-renewable resource A resource that regenerates far slower than it is consumed.

Tragedy of the commons Overuse of a shared resource when no single party bears the full cost.

Applied Activity

Compare two solutions to a shared-resource problem of your choosing (a community well, a public fishery, shared grazing land). Note whether each relies on regulation, pricing, or community norms, and predict which better prevents a tragedy of the commons in that case.

Self-Check Quiz

1. A fishery harvested faster than fish populations can reproduce is best classified as:
   (a) A non-renewable resource in practice (b) Always non-renewable (c) A closed system
2. When a population briefly exceeds carrying capacity, the most likely outcome is:
   (a) Permanent stabilization above the limit (b) A correction back toward the limit
3. Name one factor that increases an individual's ecological footprint.

Answer Key

✔ Chapter 1 – Self-Check Answers

1. (b) Hydrosphere
2. (b) A closed system
3. (c) Positive feedback
4. Sample answer: biosphere to atmosphere (combustion releases carbon dioxide), then atmosphere to hydrosphere (dissolves into ocean surface water) before settling into lithosphere sediment.

✔ Chapter 2 – Self-Check Answers

1. (a) A non-renewable resource in practice
2. (b) A correction back toward the limit
3. Sample answers: higher meat consumption, larger dwelling size, more frequent air travel, or greater per-capita energy use.

✉ Questions about scoring or content should go to your instructor via the course messaging tool, not personal email, so responses count toward your participation record. ☎ Technical support: Meridian IT Helpdesk, available Monday–Friday during posted office hours.