

APES – Chapter 2 – Environmental Systems

Intro: A Lake of Salt Water, Dust Storms and Endangered Species

What processes have created Mono Lake's unique ecosystem?

Describe the food chain in this system.

What human interactions have played a role in creating a problem?

What human interventions are designed to bring back a functioning system?

I. Earth as a Single Interconnected System

Sidebar: Writer Lewis Thomas wrote a book called *Lives of a Cell*, comparing our planet to a single, functioning cell.

How could Earth be like a cell?

What smaller systems operate within the larger Earth system? Give examples:

II. All Environmental Systems Consist of Matter

- A. Review of basic structure of matter (p. 29-34)
- B. Review of basic chemical reactions (p. 34)
- C. Review of Biological Molecules and Cells, Cell structure (p. 35-36)

III. Energy is a Component of All Environmental Systems

- A. Review of Energy and Types of Electromagnetic Energy (p. 36-37)
- B. Review of the First and Second Laws of Thermodynamics...including:
 - 1. Efficiency
 - 2. Energy Quality
 - 3. Entropy
 - 4. Energy Conversions in Ecosystems

IV. **Environmental Systems** – 2 basic laws:

Energy flows!

Matter cycles!

A. **Open vs. Closed Systems** (see fig. 2.18, page 43)

B. **Systems Analysis** – measuring inputs and outputs

C. **Steady State** (aka Equilibrium, or Dynamic Equilibrium)

If Earth is a “cell”, what, if any systems may be in a steady state over the long (very long) term? (Biologists would call this condition “Homeostasis”.)

D. **Feedback** – the adjustments in the input or output rates caused by changes to a system...i.e. the results “feed back” into systems to change the rate of a process. (see fig. 2.21, page 45)

1. **Negative feedback loops**

2. **Positive feedback loops**

Think of Earth’s climate control system. What negative feedback loops may be operating?

What positive feedback loops may be operating?

Consider that there is **uncertainty** about the short-term and long-term effects.

V. **Natural Systems Change Across Space and Time**

A. Change across space – explain using examples:

B. Change across time – explain using examples:

Working Toward Sustainability (p. 47-48)
Managing Environmental Systems in the Florida Everglades

- a) why is this a river of grass?
- b) what human interactions have negatively impacted the system?
- c) what is the restoration plan for this system? (3 steps)

How does an “**adaptive management plan**” counter the “**law of unintended consequences**”? Give an example.

Science Applied – to solving a global problem (p. 52-54)

All of the elements that we see in the Climate Change issue were present...

- a) atmospheric changes brought about by human activities and pollutants.
- b) those changes led to problematic health issues for humans and non-human life.
- c) a fix that would be costly to existing economic interests, and developing alternatives.
- d) the need and opportunity for consensus science to spur effective action.