35. Ecosystems *(Chapter 54)*

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I. Productivity of Ecosystems *(1283-1289)*

A. Energy Input

B. Primary Productivity

1. Definition

C. Gross *versus* Net Primary Productivity

1. Respiration and net primary productivity

2. Units of measure

3. Example from nature

D. Limits to Productivity on Land

1. Water as a limiting resource

2. Examples from natural systems

3. Goals of agriculture

E. Limits to Productivity in the Sea

1. Vertical zonation

2. Light and nutrients as limiting resources

3. Upwelling and the mixing of seawater

II. Energy Flow and Ecological Efficiency *(1289-1295)*

A. Limits to Net Productivity

B. Consumers and the Multiplicative Loss of Energy

1. Limits to herbivore productivity

2. Maintenance costs of animals: respiration

3. Paths of energy loss

4. Ecological efficiency and the multiplicative loss of energy

C. Ecological Pyramids: Productivity, Biomass, and Numbers

III. Nutrient Cycling *(1295-1300)*

A. Review of Energy Flow

B. General Patterns of Nutrient Cycling

1. Sources of nutrients

2. The biosphere

3. Atmospheric and sedimentary cycles

C. A General Compartment Model of Nutrient Cycles

1. Available compartments and unavailable compartments

2. Movement among the available compartments

3. Movement between available and unavailable compartments

D. Principles of Nutrient Cycling

1. Nutrients vary in form

2. Cycling follows paths of energy flow

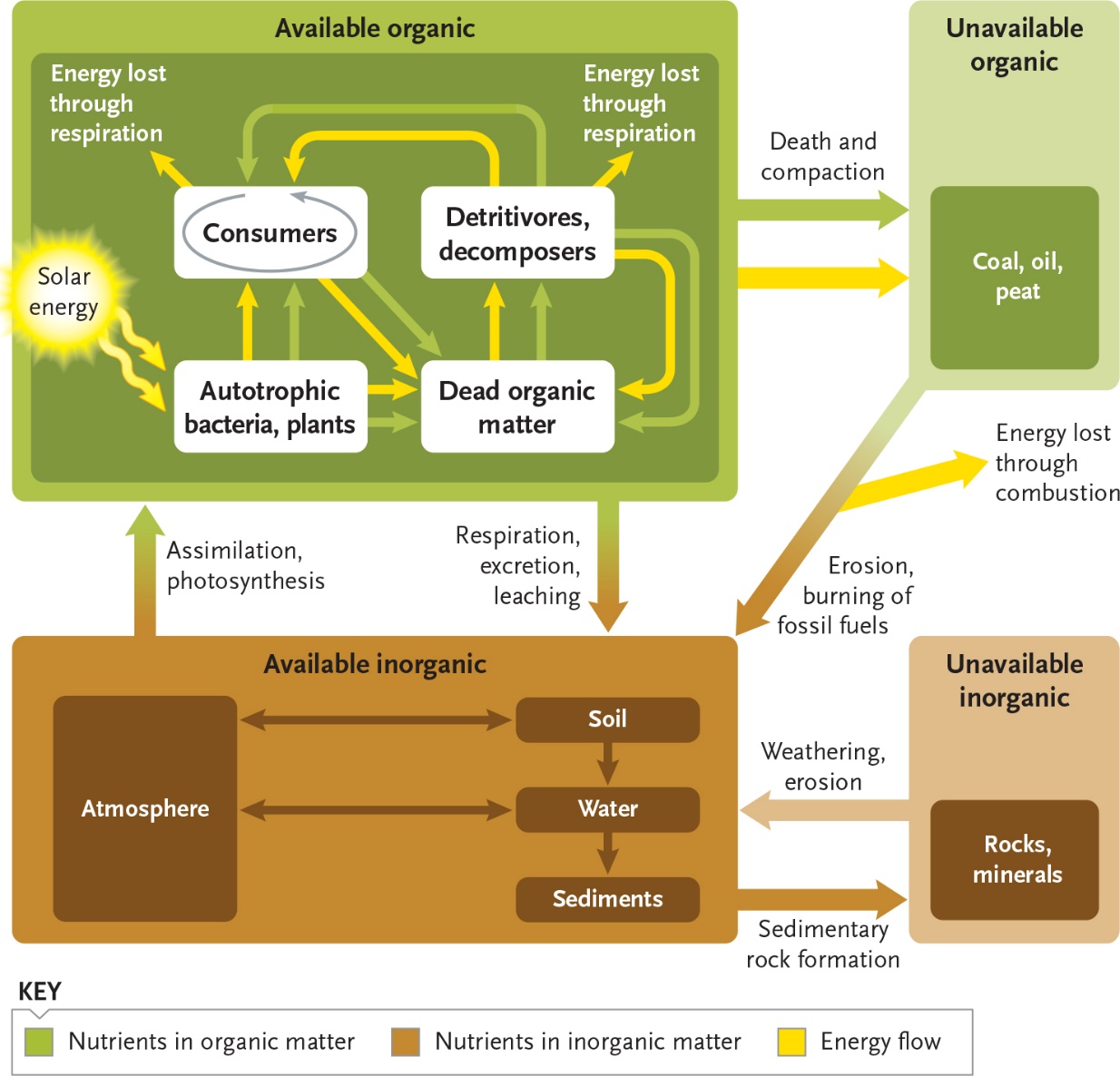
3. Higher trophic levels depend on lower trophic levels

4. Complexity and integration of biogeochemical cycles

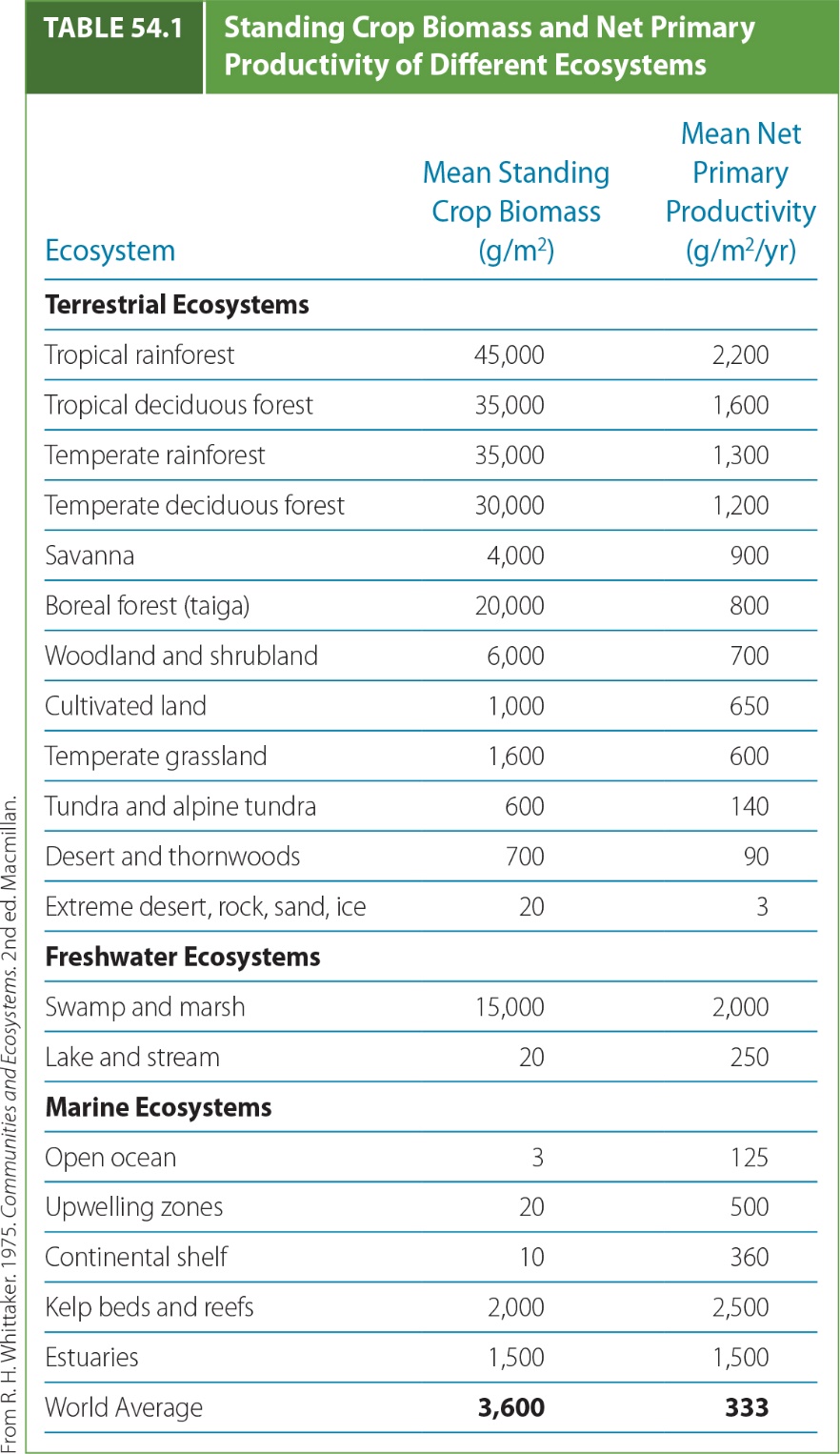
5. Steady states in undisturbed systems

6. Worldwide nutrient cycles as a closed system

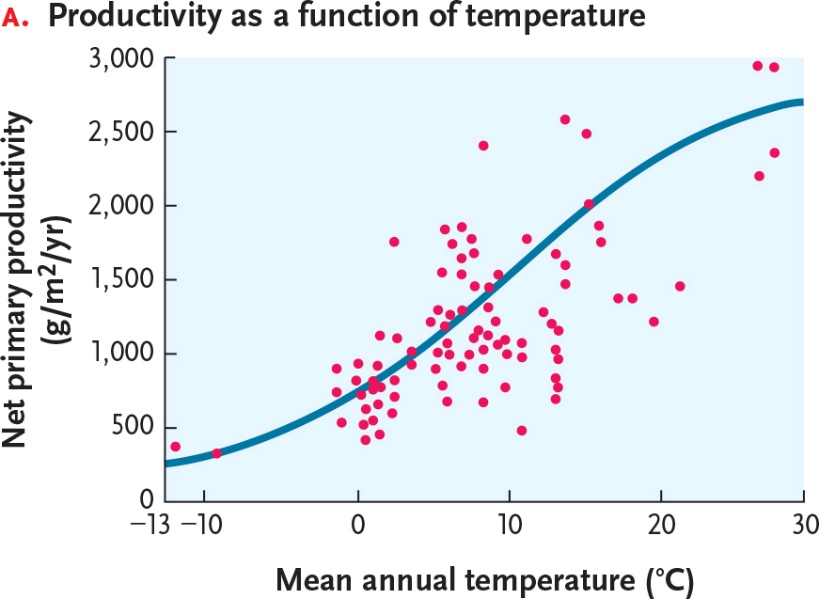
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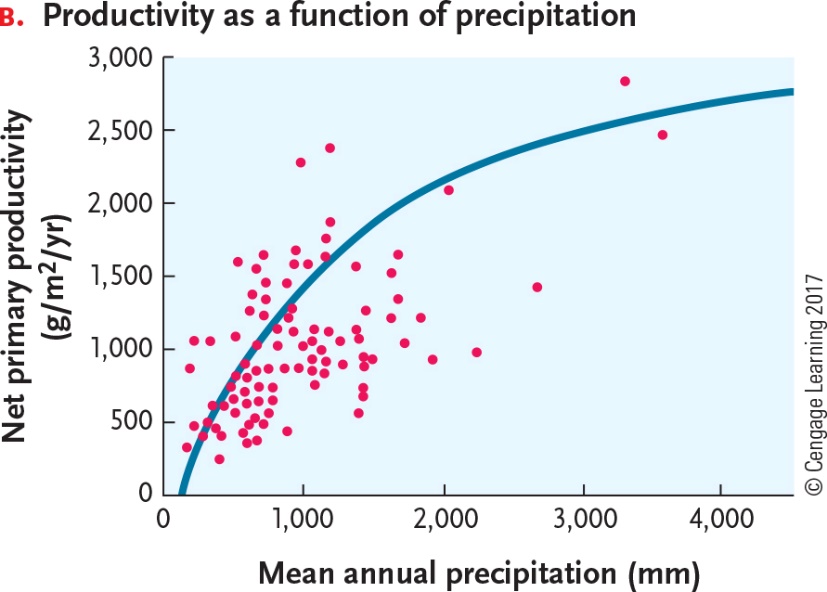


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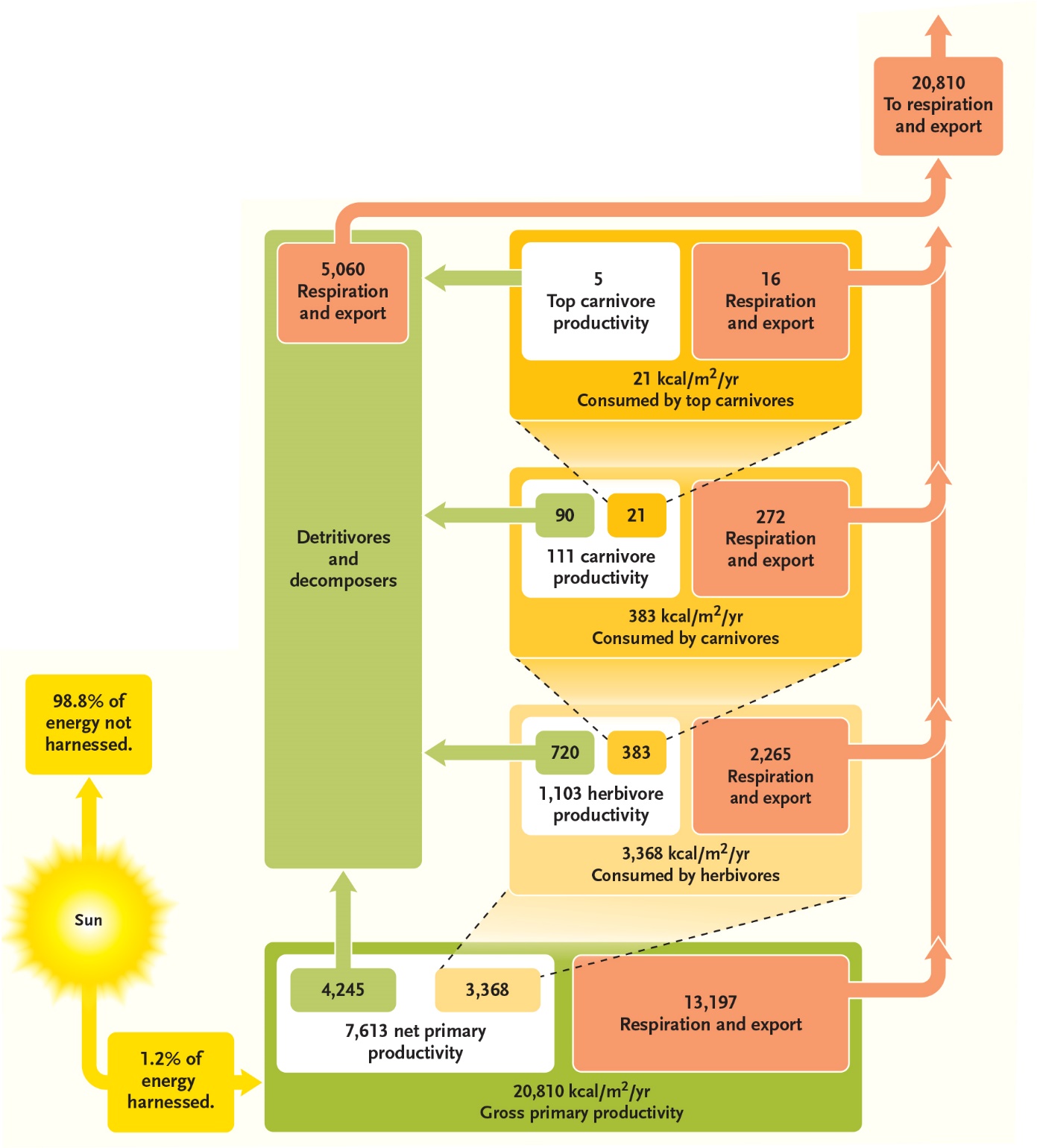


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