

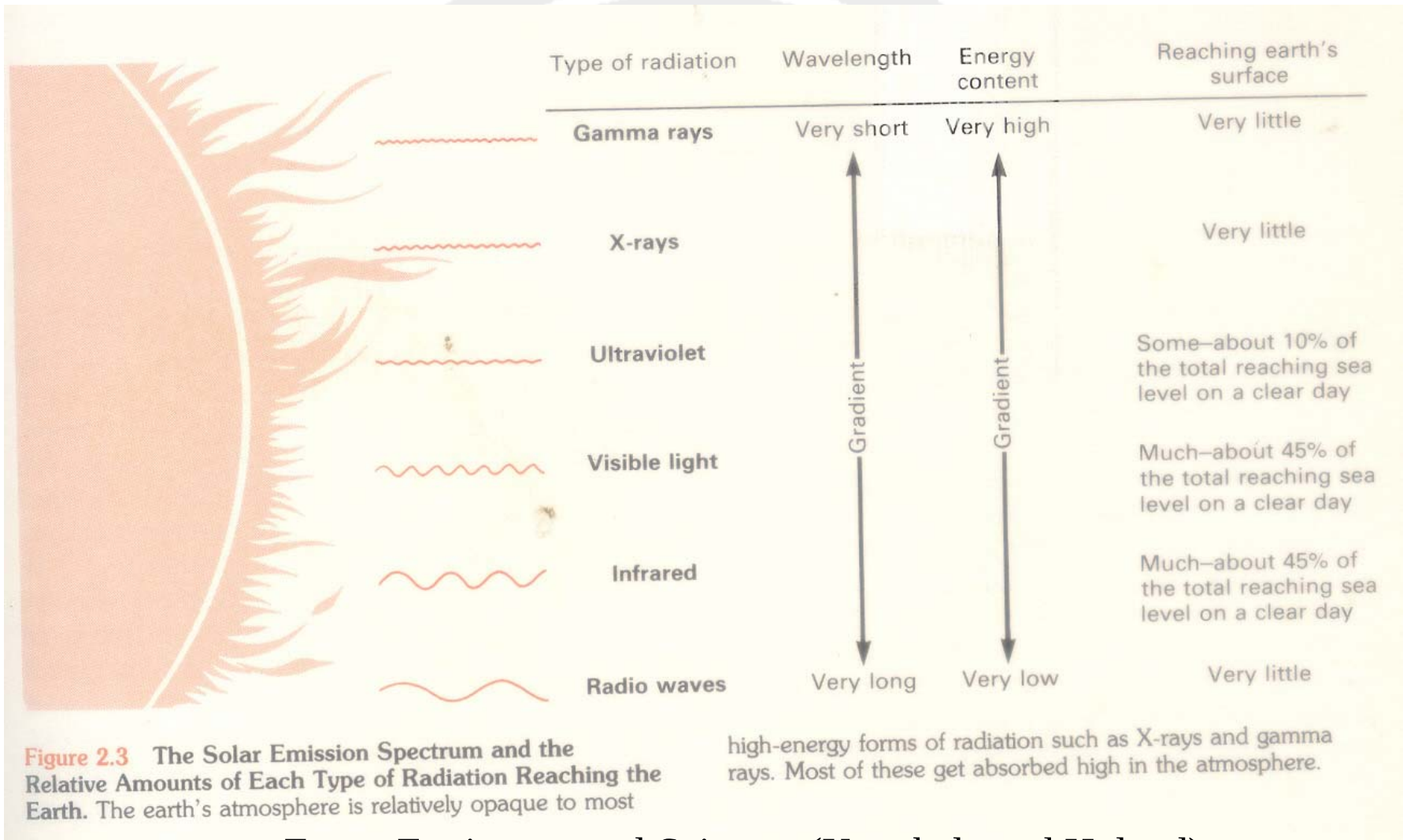
Unit 3 Lecture 4

Energy flow in an ecosystem

Energy flow is the movement of energy through an ecosystem: from the external environment through a series of organisms and back to the external environment. It is one of the fundamental processes common to all ecosystems.

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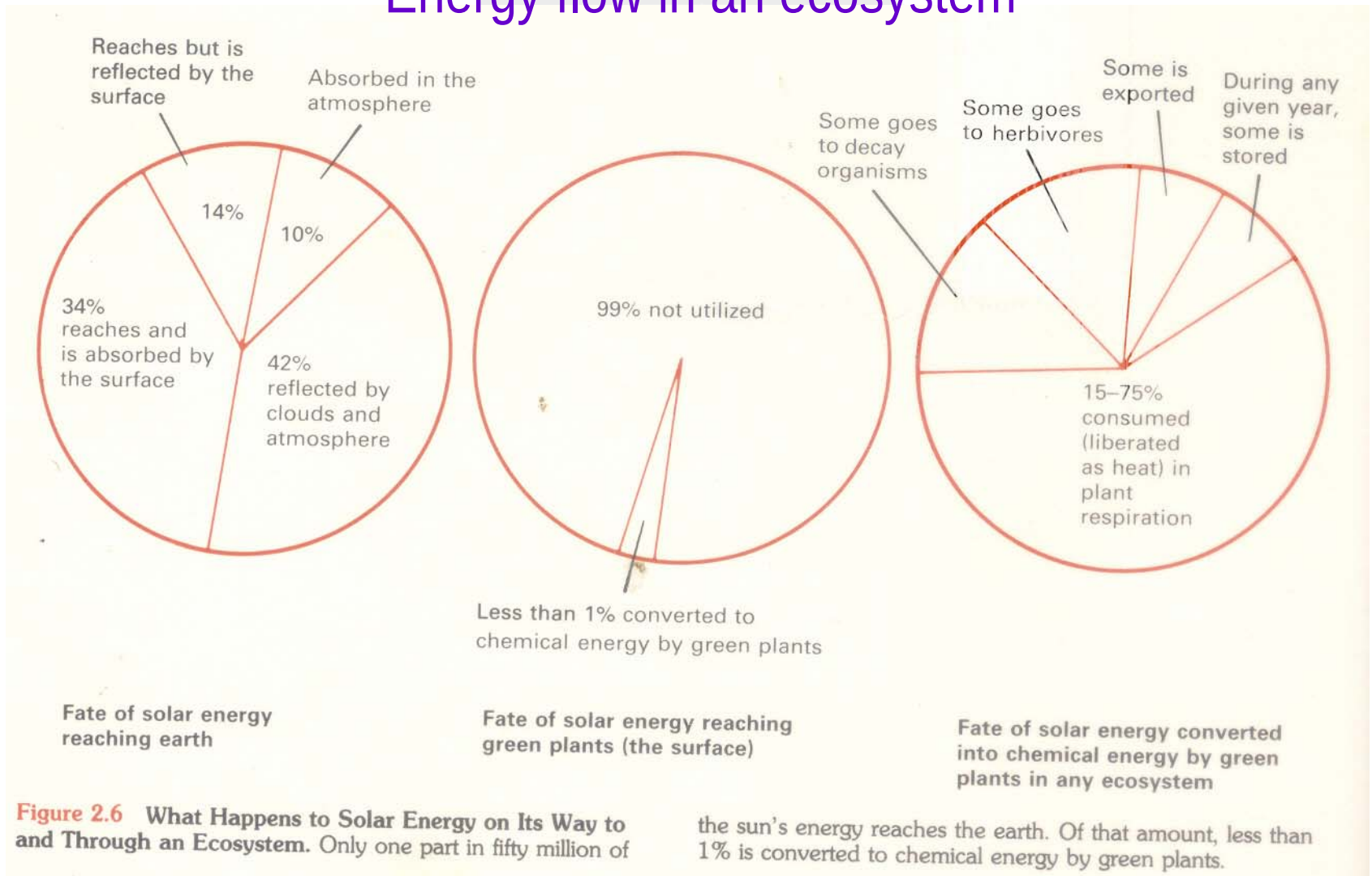
Energy flow in an ecosystem



From: Environmental Science, (Kupchela and Hyland)

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Energy flow in an ecosystem

❑ Relationship between energy flow and laws of thermodynamics

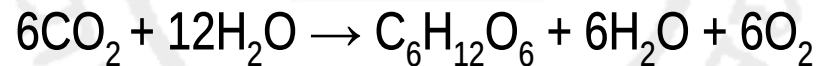
Energy can be defined as the capacity to do work. According to the **first law of thermodynamics**, light energy of the ecosystem is converted into potential energy of the food by producers and according to the **second law**, the energy accumulated by the producer pass on to the consumers in the form of eating and being eaten with a gradual loss of energy from the base to the apex of the food pyramid of an ecosystem. The measure of this gradual loss of energy is called **entropy**.

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❑ Energy flow through living system

About 1/10th of one per cent of the energy that the earth gets from the sun is fixed or converted into chemical energy by plants in photosynthesis. The conversion of solar energy into chemical energy constitutes primary production. Primary production or productivity is the rate at which the photosynthetic equation moves from left to right.



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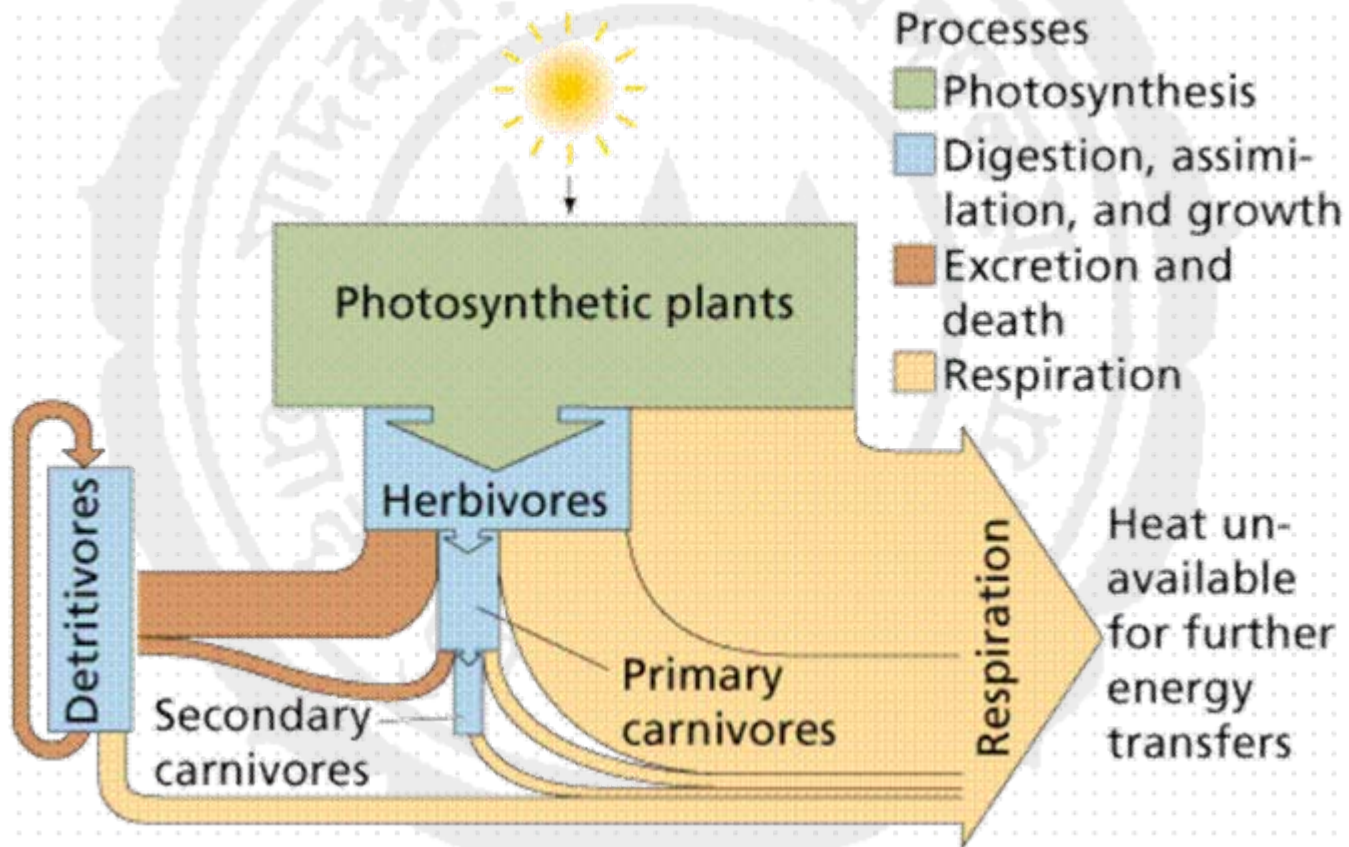
Energy flow in an ecosystem

The amount of organic matter is presented to the earth by plants each year constitutes **net primary production**. The chemical energy, which the plants use for their own metabolic needs plus net production equals **gross production**.

The expression **net community productivity** is sometimes used to describe the rate at which organic matter is accumulated in an ecosystem. Net community production is equivalent to net primary production minus the organic matter respired or used by consumers and decomposers.

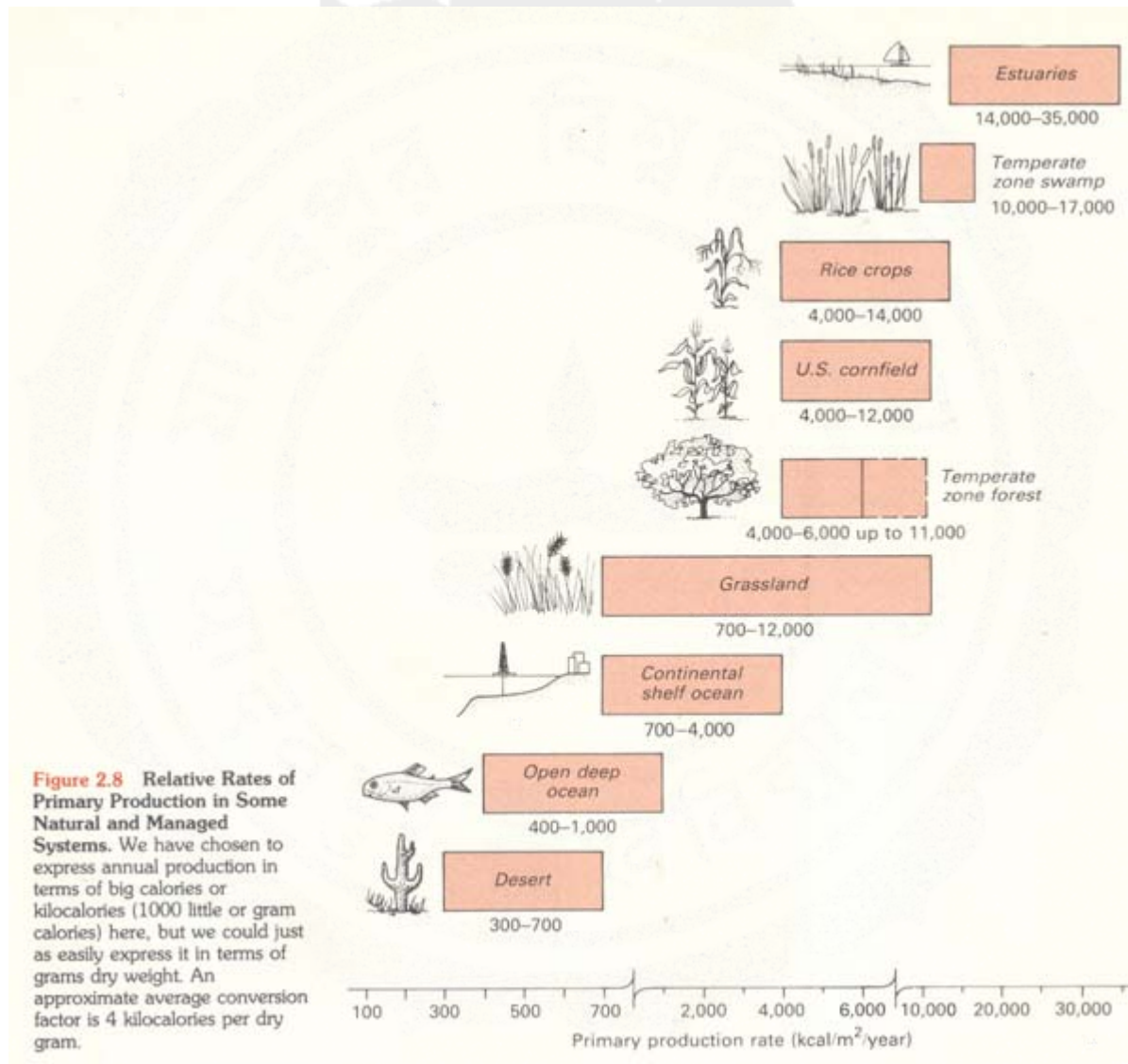
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□ Efficiency of energy transfer within ecosystem

A common ecological measure of energy efficiency is called food chain efficiency, or **trophic level efficiency**, which is the ratio of production of one trophic level to the production of the next lower trophic level.

Many other kinds of energetic efficiencies are widely used in ecological studies like **growth efficiency**, or gross production efficiency, which is the ratio of the material produced by an organism or population to the material ingested or consumed.

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□ Characteristics of energy flow

- (1) Energy flow is unidirectional
- (2) Progressive decrease in energy utilization at each trophic level

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Energy flow in an ecosystem

- ❑ Energy flow models are basically of three types:

Single Channel Energy Flow Model

Y – shaped Energy Flow Model

Universal Energy Flow Model

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❑ Single Channel Energy Flow Model:

Such model is characterized by unidirectional flow of energy through different trophic levels, involving a single food-chain and indicating dissipation of energy at each transfer

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❑ Y – shaped Energy Flow Model

- They conform to the basic stratified structure of ecosystems.
- They separately indicate the direct consumption of living plants and utilization of dead organic matter both in space and time.

❑ The detritivores differ greatly in size-metabolism relations and in study techniques

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Energy flow in an ecosystem

❑ Universal Energy Flow Model

It is applicable to any living component of any ecosystem. For any given trophic level, such figure consist of a 'box' representing the 'biomass' at any given time and pathways through it representing the flow of energy.