**Ecological Pyramids**

1. **Ecological Pyramids**

Ecological pyramids include pyramids of

They are quantitative models that are usually measured for a given area and time.

*They give an idea of what feeds on what and which organisms exist at different trophic levels*

Ecological pyramids allow easy examination of energy \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

They also help to demonstrate that ecosystems are systems that are in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

1. **Trophic Levels**

Let’s take your Florida Everglades food web and put it into an ecological pyramid shape that shows feeding relationships via trophic levels.

*Pyarmids give an idea of what feeds on what and which organisms exist at different trophic levels*

Ecological Pyramid

Now label each trophic level with its name.

Eg. Producer, consumer, etc.

1. **Energy Transfers and the Law of Thermodynamics**



*Ecological pyramids allow easy examination of energy transfers and losses*.

Study the fate of solar radiation

Of all the solar energy that is reaches the planet only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is absorbed by the surface.

And producers only capture \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of it.

All of life on the planet, therefore, is based off of\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of sun’s energy!!!

1. **Energy Transfers and the Law of Thermodynamics**

Say there is an input of 1000 units of solar radiation to the earth. How many units would be used for photosynthesis? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

This is the base for the ecological pyramid. All other organisms rely on this input of just \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Using a pencil,

* Draw arrows to show how **photosynthesis** is occurring in the kelp forest diagram to the left.
* Label the arrows with the molecules that you think are being transferred and transformed during photosynthesis
* Now show **cellular respiration.**
* Label the arrows with the molecules that you think are being transferred and transformed during cellular respiration
1. **Photosynthesis and Cellular Respiration**



In the space below write the photosynthesis chemical equation

Put a circle around the matter in the equation above. Draw ray lines where solar energy comes in.

Each time sugar is made during photosynthesis (in the chloroplast of the autotroph)it is broken down by the organism (mitochondria of both autotrophs and heterotrophs) and energy is lost. This process is called cellular respiration

In the space below write the cellular respiration chemical equation. Circle the matter in the equation and put ray lines around the heat energy.

So even though plants use 0.06% of all the solar energy, this does not mean that animals get 0.06% of that energy due to cellular respiration.

In fact each time one organism eats another organism in a food web, energy is lost as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Therefore the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ shape is an appropriate shape to represent the loss of each at each feeding level.

The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the principle of conservation of energy, which states that energy, in an isolated system, can be transformed but cannot be created or destroyed.

Think about photosynthesis and respiration

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is converted into \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy and then \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy.

*Ecological pyramids allow easy examination of energy transfers and losses.*

The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ explains the inefficiency and decrease in available energy along a food chain and energy generation systems—due to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

*Ecological pyramids allow easy examination of energy transfers and losses*.

The second law of thermodynamics states that the **entropy** of a system \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ over time.

**Entropy** is a measure of the amount of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a system. An increase in entropy arising from energy transformations reduces the energy available to do work.

*Ecological pyramids allow easy examination of energy transfers and losses.*

Ecological Pyramids demonstrate entropy and the 2 nd Law of Thermodynamics in that at each trophic level, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and therefore, energy decreases at each level.

*Ecological pyramids allow easy examination of energy transfers and losses.*

1. **10% Rule and The Second Law of Thermodynamics**

Each trophic level loses 90% of energy due to heat loss (2nd law), therefore only 10% gets passed on.

Let’s say the system starts out with 900 kilojoules per meter 2 per year (kj∙m -2∙ yr -1 ) of autotrophs.

How much is passed on to the turtles, mice, insects, etc.?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How much is passed on to the alligator? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Draw a PYRAMID OF ENERGY (PRODUCTIVITY ) in the space below and show how it losses energy as you go up the trophic levels. Use the #s in the previous example. Remember that the productivity pyramid express a flow of energy.

Not only does each trophic level loss 90% of its energy, it also losses 90% of its biomass. When energy is converted to biomass, this is also considered “productivity” . You can tell whether we are talking about biomass productivity or energy productivity by the units used--j∙m -2 ∙ yr -1 or g∙m-2 ∙yr-1

If we start with 56,000 kg of plant matter, how much biomass will be left at each trophic level?

A pyramid of biomass represents the standing stock or storage of each trophic level, measure in grams of biomass per square meter per year(g∙m-2)

Draw a PYRAMID OF BIOMASS in the space below. Include quantities and units.

Since there is so little energy and matter left by the time we get to the alligator, there are few alligators in the food web as compared to plants.

If there are 15,000,000 individual plants, how many alligators will there be?

Draw a PYRAMID OF NUMBERS in the space below. Include quantities and units.

Draw an INVERTED PYRAMID OF BIOMASS in the space below. Include quantities and units.

1. **10% Rule and Population Stability**

Based off of the 10% rule, why don’t alligator populations, who have no natural predators, grow exponentially?

1. **Bioaccumulation and Biomagnification**



Explain, in your own words, the difference between bioaccumulation and biomagnification.