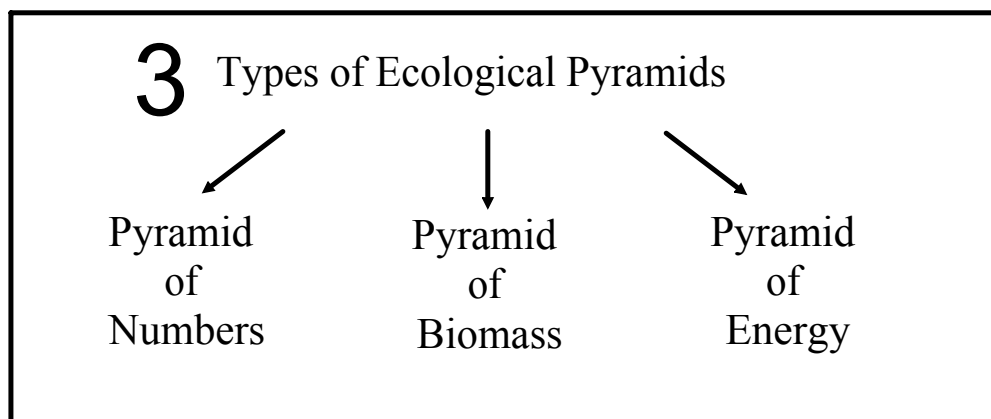


## Ecological Pyramids

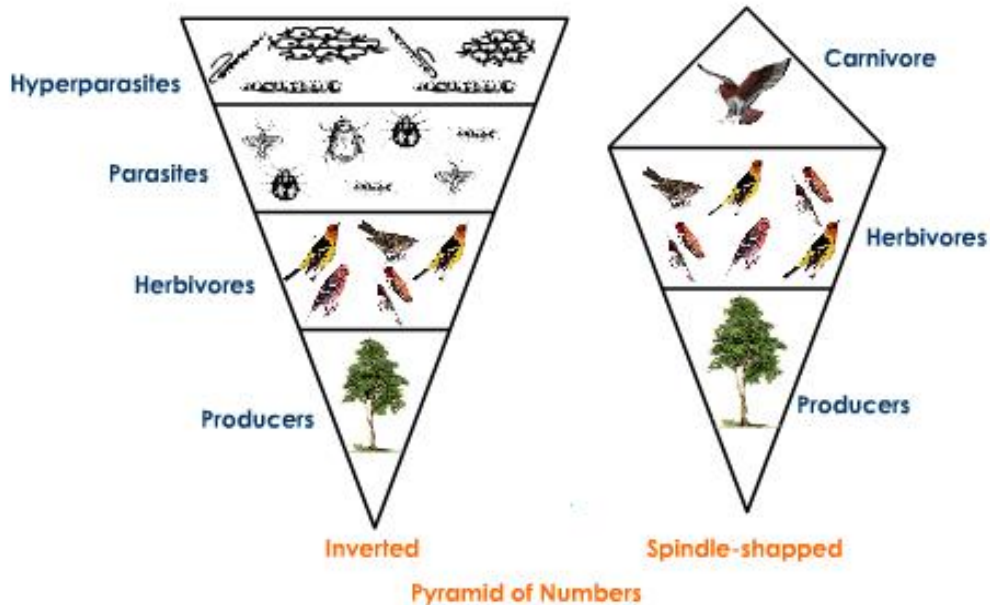
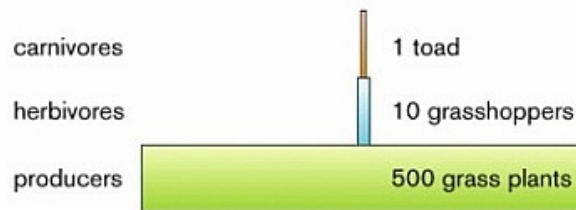
Ecological pyramids are graphical representations of the trophic structure of ecosystems.



# Pyramid of Numbers

- the graphic representation of the number of individuals at various trophic levels
- usually shows a large number of producers with diminishing numbers of consumers

For a food chain  
(grass → grasshopper → toad)

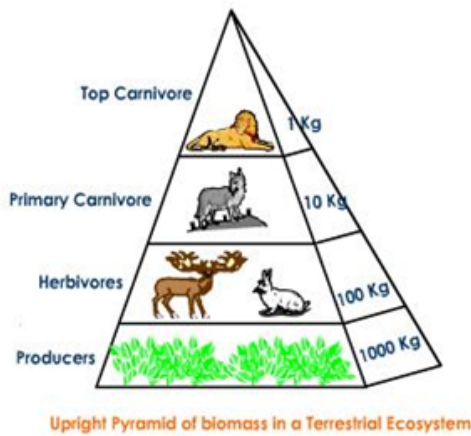


**hyperparasite** - an organism that is parasitic on or in another parasite

# Pyramid of Biomass

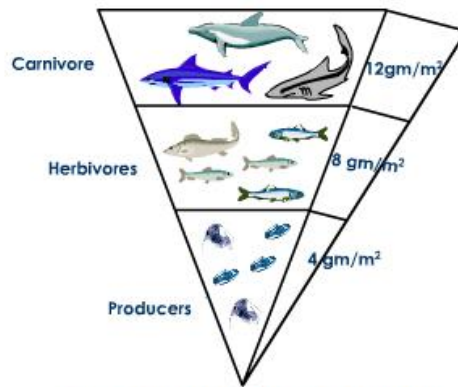
- the graphic representation of the relationship between the amounts of biomass\* at different trophic levels

\*biomass - the total mass of all the living organisms in a given area



Upright Pyramid of biomass in a Terrestrial Ecosystem

Maximum mass occurs in producers.

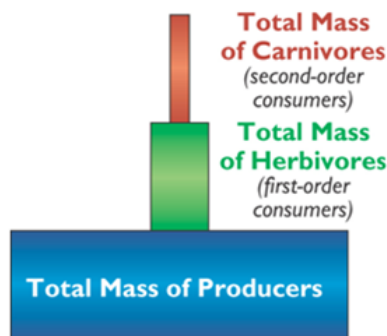


Inverted Pyramid in an Aquatic Ecosystem

Biomass of trophic levels depend upon the reproductive potential and longevity of the members.

## Pyramid of Biomass

The biomass of the producers is always greater than the biomass of the herbivores, and the biomass of the herbivores is always greater than the biomass of the carnivores. The biomass decreases with each additional step in a food chain. A diagram that shows this decrease in biomass is a pyramid of biomass.



## Pyramid of Energy

- a graphic representation that shows the amount of energy that is available at each trophic level

Can an energy pyramid be inverted?

Never

[Notes - Pyramids of Energy.pdf](#)



 [Activity - Energy Pyramids.pdf](#)

 [Square Based Pyramid Net.pdf](#)

## Pyramid Directions

1. Shade the first (bottom) level of each pyramid green.
2. Shade the second level of each pyramid yellow.
3. Shade the third level of each pyramid blue.
4. Shade the fourth (top) level of each pyramid red.
5. Label each level of the first pyramid side with the following terms as you move up the pyramid: producer, primary consumer, secondary consumer, tertiary consumer.
6. Label each level of the second pyramid side with the following terms as you move up the pyramid: plants, herbivores, carnivores, top carnivores.
7. Label each level of the third pyramid side with the following terms as you move up the pyramid: autotroph, 1<sup>st</sup> order heterotroph, 2<sup>nd</sup> order heterotroph, 3<sup>rd</sup> order heterotroph.
8. Draw a picture of what might belong in each level:
  - 1<sup>st</sup>: flowers, trees, grass, algae
  - 2<sup>nd</sup>: caterpillars, cows, grasshoppers, beetles
  - 3<sup>rd</sup>: humans, birds, frogs
  - 4<sup>th</sup>: lions, dogs, snakes
9. Fold your pyramid on the lines radiating from the center and tape it together.
10. Answer the following questions using your pyramid:
  - a. What are three terms used to describe organisms such as trees?
  - b. What are three terms used to describe organisms such as cows?
  - c. What are three terms used to describe organisms such as humans?
  - d. What are three terms used to describe organisms such as lions?
  - e. What do the organisms in each trophic level eat?
  - f. Do organisms always stay in the same level? Explain your answer.

## Notes - Pyramids of Energy.pdf



## What Is the Pyramid of Energy? Student Information Pages



Imagine you're driving down the road in a car. As you look out the window you notice a stretch of land with plants as far as the eye can see. Grass, flowers, trees, and other plants are visible in every direction. You probably wouldn't be too shocked or surprised. But imagine looking out the window to find animals as far as the eye can see. Snakes, hawks, rabbits, and other animals so thick you'd have to step over them to take a walk!

### Why does our world have so much more plant life than animal life?

One explanation is called the Pyramid of Energy. You may know that all living things need energy, from the smallest bacteria to the largest plants or mammals. You may also know that people use food chains and food webs to show how this energy is passed from the sun to *producers* (plants) and then to *consumers* (animals, fungi, bacteria, etc.). What you may not know is that **every time energy is passed from one living thing to the next, only a small portion of the energy makes it to that next living thing.** By the time you get to the end of any food chain, most of the energy that was available at the beginning is no longer available. Scientists came up with the Pyramid of Energy to explain this.

### The Pyramid of Energy

The Pyramid of Energy is a model that uses a pyramid shape to show that the energy available for consumers decreases as it travels through a typical food chain or web.

*Producers* are at the bottom of the pyramid because they are able to transform the sun's energy into a large amount of plant energy through the process of photosynthesis. Producers are the base of energy for most food chains and food webs.

Animals that eat plants make up the next level. These animals are called *primary consumers* because they are the first level of consumers. Primary consumers rely on plants for their energy. This level of the pyramid is smaller than the producer level because most of the energy used at the producer level is used by producers for their life processes (respiration, photosynthesis, reproduction, etc.) and transformed to heat before they are consumed.

Animals that eat primary consumers make up the next level. These animals are called *secondary consumers* because they are the second level of consumers. Secondary consumers rely on primary consumers for most of their energy. This level of the pyramid is smaller than the primary consumer level because most of the energy used at the primary consumer level is used for their life processes (respiration, digestion, reproduction, etc.) and transformed to heat before these animals are consumed.

Animals that eat secondary consumers make up the next level. These animals are called *tertiary consumers* because they are the third level of consumers. Tertiary consumers rely on secondary consumers for most of their energy. This level of the pyramid is smaller than the secondary consumer level because most of the energy used at the secondary consumer level is used for their life processes and transformed to heat before these animals are consumed.

It's possible to have additional levels of consumers, but in most food chains energy runs out by the second or third level.

Use this page with the *Science for Ohio* What is the Pyramid of Energy? 3D Model.

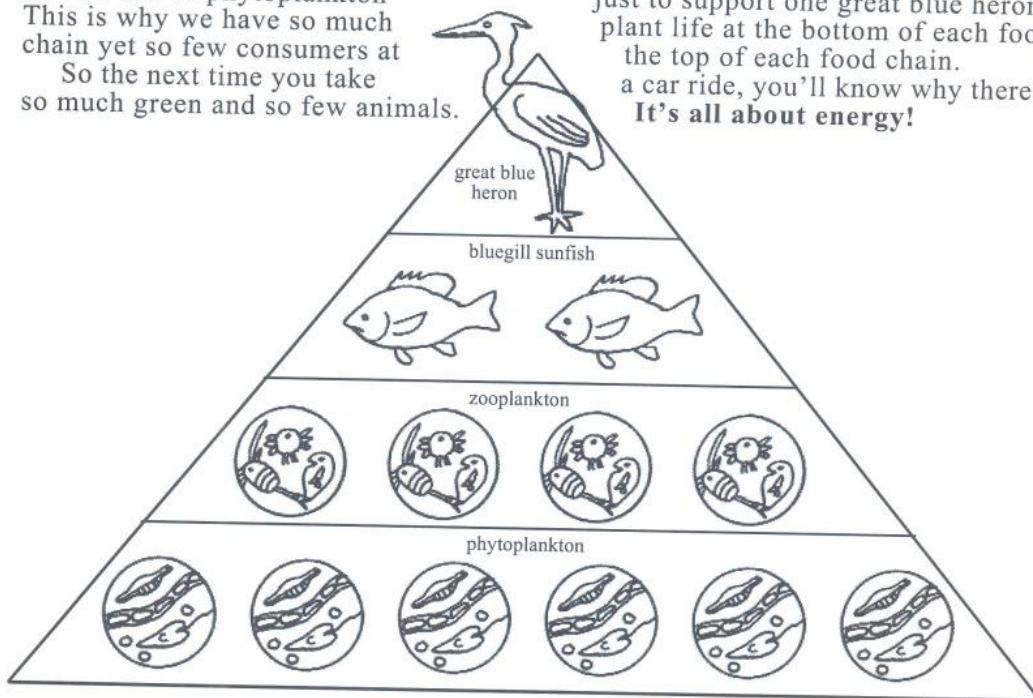


**What Is the Pyramid of Energy?**  
**Student Information Pages**  
 (continued)



**The Ten Percent Rule**

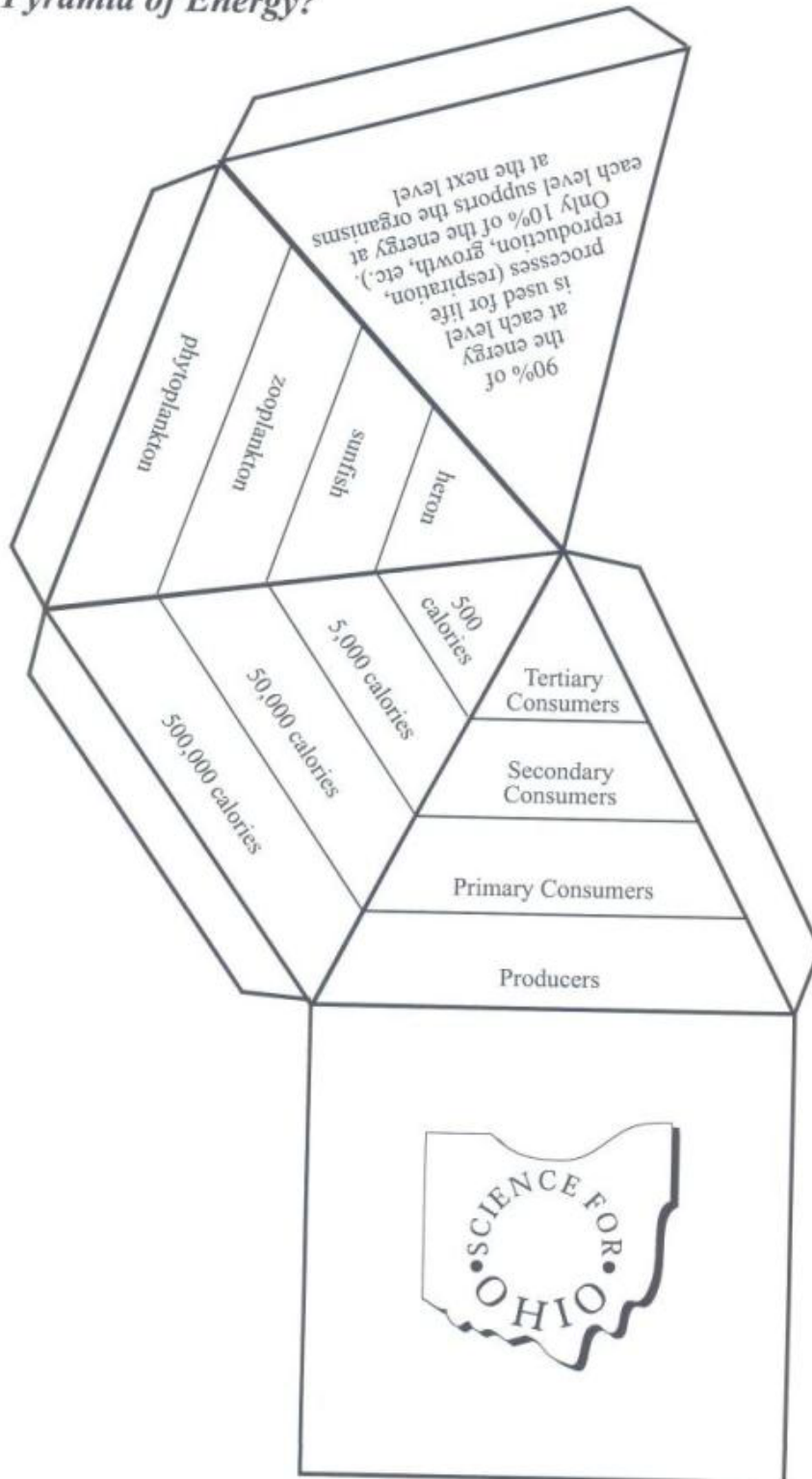
How much energy is lost from one level to the next? Scientists say that on average 90% of the available energy is used for life processes such as respiration, photosynthesis, and reproduction and transformed to heat energy before an organism is consumed. This means **only about 10% of the original energy is left to feed the next level.** This 10% is stored in the tissues (leaves, stem, muscles, organs, fat, etc.) of the organism. To understand this more clearly, let's look at the wetland example on the Pyramid of Energy 3D Model. Here producers such as phytoplankton are producing 500,000 calories of energy from sunlight each day. If you gathered all of this phytoplankton into one spot, they might fill a space the size of a room. Since only about 10% of this energy reaches the zooplankton, this leaves about 50,000 calories of energy to support the zooplankton each day. If you gathered all of these zooplankton into one spot, they might fill a space the size of a school dumpster. Since only about 10% of this energy reaches the sunfish, this leaves about 5,000 calories of energy to support the sunfish each day. If you gathered all of these sunfish into one spot, they might fill a space the size of a trash can. Since only about 10% of this energy reaches the great blue herons, this leaves about 500 calories of energy to support herons each day. If you gathered all of the herons into one spot, **you would have only one!** Fortunately, animals don't just depend on one type of consumer to meet their energy needs. But in essence it takes the energy of a room full of phytoplankton just to support one great blue heron. This is why we have so much plant life at the bottom of each food chain yet so few consumers at the top of each food chain. So the next time you take a car ride, you'll know why there's so much green and so few animals. **It's all about energy!**



Use this page with the *Science for Ohio* What is the Pyramid of Energy? 3D Model.

# BUILD YOUR OWN...

*What is the Pyramid of Energy?  
3D Model*



Use this page with the *Science for Ohio* What is the Pyramid of Energy? Student Information Pages.



## Virtual Lab - Ecosystems Pyramids of Numbers and Energy

Virtual Lab
Model Ecosystems
✕

**Question**

**How does energy flow through an ecosystem?**

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An ecosystem consists of a community of living organisms interacting with each other and the environment. The source of energy that fuels most ecosystems is the Sun. Plants use the Sun's energy to produce food in a process called photosynthesis. Organisms that use energy from the Sun or energy stored in chemical compounds to produce their own nutrients are called autotrophs. They are also called producers because most other organisms depend on autotrophs for nutrients and energy. Heterotrophic organisms that cannot make their own food may obtain nutrients by eating other organisms. A heterotroph that feeds only on plants is called an herbivore. Herbivores are also called first order heterotrophs. Carnivores that feed on herbivores are called second order heterotrophs. Carnivores that feed on other carnivores are called

Deciduous Forest Ecosystem

**Field Notes**

**Deciduous Forest Ecosystem**

**Plants:**

- Deciduous Trees
- Ferns
- Berry Bushes
- Wild Flowers
- Grasses

**Mammals:**

- Chipmunks
- Deer
- Foxes
- Opossums
- Rabbits
- Wolves

**Birds:**

- Hawks
- Woodpeckers
- Owls
- Chickadees

**Reptiles:**

- Snakes

**Amphibians:**

- Frogs
- Toads

# SOLUTIONS...

**Deciduous Forest Ecosystem**

**Third Order Heterotrophs**  
 30 (Birds) + 20 (Wolves) = 50 organisms  
 Energy Loss to Decomposers

**Second Order Heterotrophs**  
 111 (Snakes) + 210 (Deer) + 190 (Foxes) = 511 organisms

**First Order Heterotrophs**  
 30 (Rabbits) + 1320 (Chipmunks) + 386 (Opossums) + 2180 (Rabbits) + 643 (Wolves) = 4,559 organisms

**Producers**  
 2670 (Plants) + 3456 (Ferns) + 720 (Wild Flowers) + 609 (Grasses) + 541 (Grasses) = 7,996 organisms

Buttons: Check, Pyramid of numbers, Pyramid of energy, Field Guide

**Field Notes**

**Deciduous Forest Ecosystem**

**Plants:**  
 Deciduous Trees  
 Ferns  
 Berry Bushes  
 Wild Flowers  
 Grasses

**Mammals:**  
 Chipmunks  
 Deer  
 Foxes  
 Opossums  
 Rabbits  
 Wolves

**Birds:**  
 Hawks  
 Woodpeckers  
 Owls  
 Chickadees

**Reptiles:**  
 Snakes

**Amphibians:**  
 Frogs  
 Toads

**Arthropods:**  
 Insects

Reset

**Deciduous Forest Ecosystem**

**Third Order Heterotrophs**  
 30 (Birds) + 20 (Wolves) = 6 energy  
 Energy Loss to Decomposers

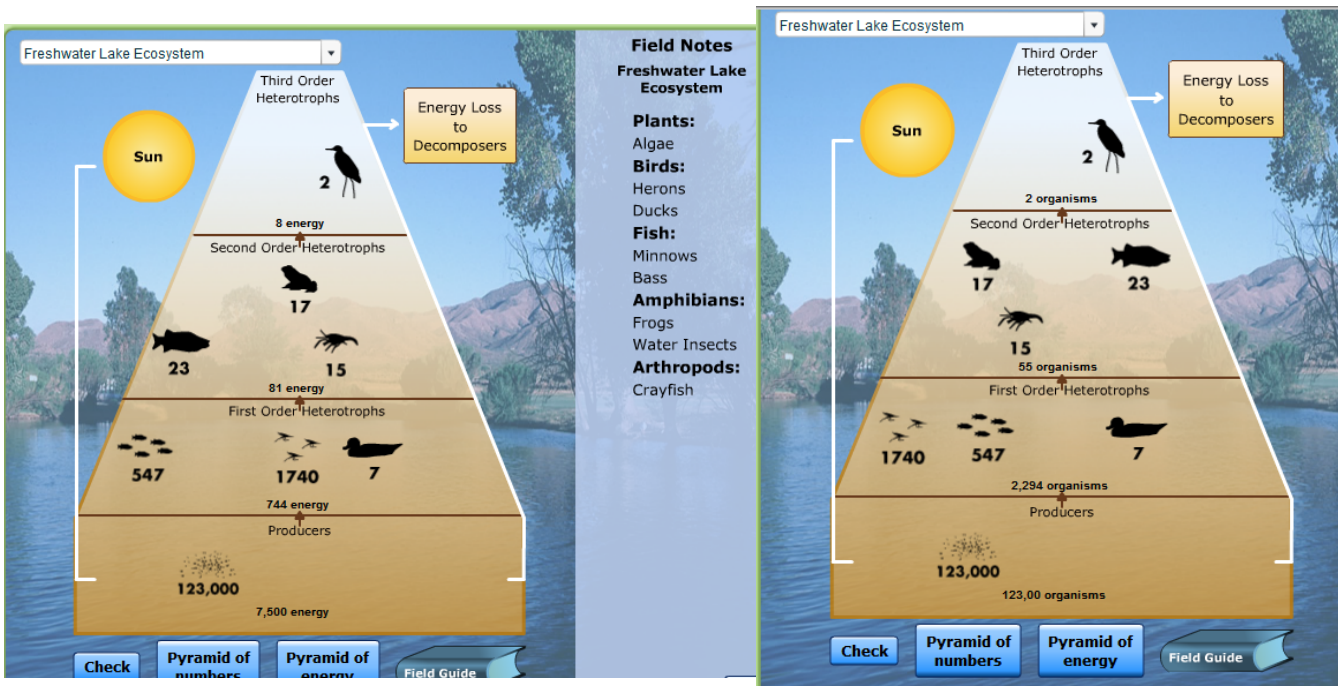
**Second Order Heterotrophs**  
 111 (Snakes) + 210 (Deer) + 190 (Foxes) = 61 energy

**First Order Heterotrophs**  
 30 (Rabbits) + 1320 (Chipmunks) + 386 (Opossums) + 2180 (Rabbits) + 643 (Wolves) = 623 energy

**Producers**  
 2670 (Plants) + 3456 (Ferns) + 720 (Wild Flowers) + 609 (Grasses) + 541 (Grasses) = 6,011 energy

Buttons: Check, Pyramid of numbers, Pyramid of energy, Field Guide

# SOLUTIONS...



## Attachments

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Notes - Pyramids of Energy.pdf

Activity - Energy Pyramids.pdf

Square Based Pyramid Net.pdf