

Farming and Biotechnology

Answer the following questions:

1. Where is the producer found in a pyramid of biomass?

At the bottom (the first trophic level)

2. What is the approximate biomass efficiency transfer between each trophic level?

Approximately 10 %

3. Why is not all biomass transferred to the next trophic level?

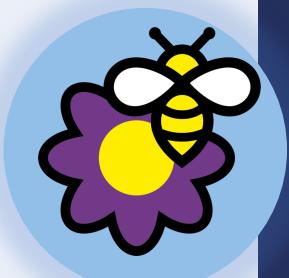
Not all material is ingested or absorbed, some biomass is lost as waste (faeces, urine, sweat etc), some is used for life processes (respiration to allow movement, growth and thermoregulation)

4. State the definition of an organism.

Any living thing e.g. plant, animal, unicellular organism

5. Calculate the volume of a space with the dimensions 50m, 40m and 12m.

$$50\text{m} \times 40\text{m} \times 12\text{m} = 24\ 000\text{m}^2$$



Taking It Further: Farming and Biotechnology

B3.2.8

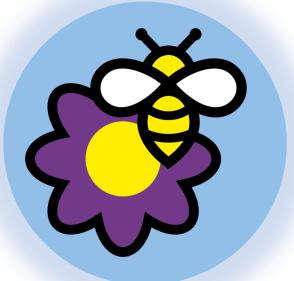
Science
Mastery

- B3.2.1 Prior Knowledge Review
- B3.2.2 Biodiversity
- B3.2.3 How Humans Affect Biodiversity
- B3.2.4 How Humans can Preserve Biodiversity
- B3.2.5 The Effect of Pollution on Biodiversity
- B3.2.6 Global Warming
- B3.2.7 Taking It Further: Pyramids of Biomass



➤ B3.2.8 Taking It Further: Farming and Biotechnology

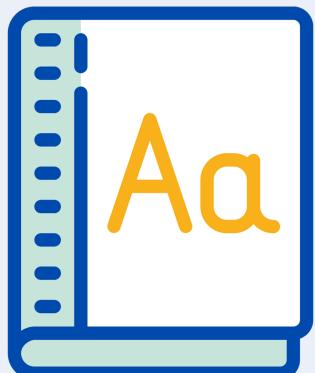
B3.2.9 Taking It Further: Food Security



Following this lesson, students will be able to:

- Describe methods used to maintain fish stocks
- Explain how intensive farming methods increase biomass efficiency transfer
- Describe an application of biotechnology in food production

Key Words:



efficiency

intensive farming

biotechnology

quota

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

- The teacher should customise this slide as needed, to facilitate
 - **reteach, explanation, demonstration or modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
 - **practise** answering specific questions or of key skills.
 - **redrafting** or **improving** previous work.

Answer the questions below.

1. Which is the best description of a pyramid of biomass?
 A. A representation of the number of organisms in each trophic level
 B. A diagram to show how big each organism is compared to others
 C. A representation of the amount of biomass in each trophic level
2. Which best explains why only approximately 10 % of biomass is passed on to the next trophic level?
 A. The rest of the biomass is released as waste urine and faeces
 B. Biomass is lost at each trophic level through waste and life processes
 C. Each trophic level needs to keep the rest of the biomass for themselves
3. Which best explains why food chains rarely have more than 5 levels?
 A. The apex predators cannot get any bigger
 B. Only approximately 10 % of biomass is passed on to the next trophic level
 C. Only half the biomass is passed on so it will eventually run out

Intensive farming

Efficiency of biomass transfers can be improved by **restricting energy transfer** from food animals by using **intensive farming** methods.



This includes:

- Limiting animals **movement**
- Controlling the **temperature** of the surroundings
- Feeding animals **high protein** diets

Issues with intensive farming:

- Ethical objections
- Overuse of antibiotics



Fishing

Fish stocks in the ocean are **declining**

Fish populations must be sustainable otherwise species may disappear

Actions to help conserve ocean fish stocks include:

- Control of **net size**
- Fishing **quotas**



Quick Quiz

Answer the following questions:

- a. State two methods used to restrict energy transfer from food animals

Limiting movement, controlling the temperature of surroundings

- b. State an advantage and a disadvantage of intensive farming methods

Advantage – less energy wasted in life processes, more efficient & cost effective

Disadvantage – inhumane conditions, force feeding animals

- c. State two methods used to conserve fish stocks

Controlling net size and sing fishing quotas

What do you think?

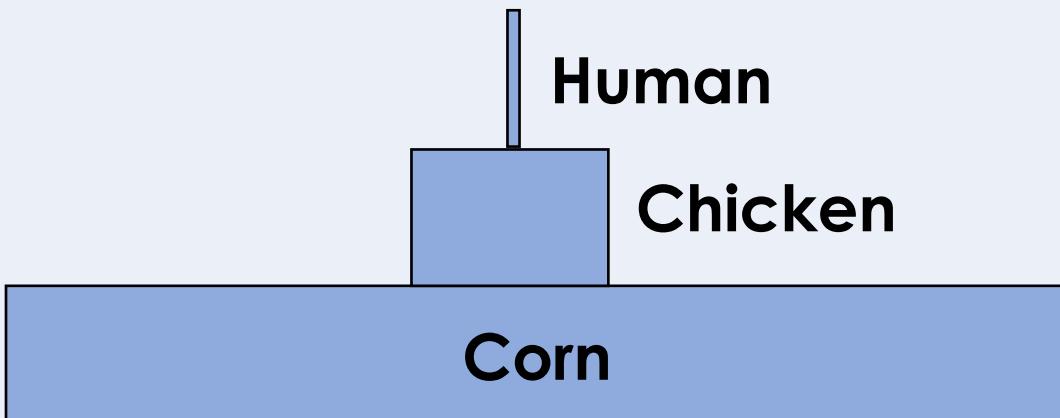
Everyone should become a vegetarian

How much energy is passed on at each trophic level?

How would the transfer compare if chicken was cut out of this food chain?

Are intensive farming methods ethical?

What compromises could be made?



Biotechnology

Modern biotechnology allows large quantities of microorganisms to be **cultured** for food

The fungus *Fusarium* is used to produce **mycoprotein** (Quorn)

The fungus is grown in aerobic conditions before the biomass is **harvested** and **purified**



Biotechnology

Genetically modified crops can be produced that have greater nutritional value

Golden rice is a GM crop that contains beta-carotene, which is converted into Vitamin A

A genetically modified bacterium can produce human **insulin**, which can be used to treat people with diabetes



Quick Quiz

Answer the following questions:

- a. Where does mycoprotein come from?

Fusarium fungus, grown on glucose syrup in aerobic conditions.

- b. Why could insulin-producing bacteria be useful?

To provide insulin to treat people with diabetes.

- c. Why could Golden Rice be useful?

To supplement Vitamin A in areas with low dietary vitamin A consumption.

Drill

1. What is the efficiency of biomass transfer from one trophic level to another?
2. State two ways farmers can improve this efficiency of transfer
3. State two issues with intensive farming.
4. State two actions that have been put in place to increase the fish population
5. State one advantage of genetically modified crops

Drill answers

1. 10%
2. Limiting animals' movement, controlling the temperature of the surroundings, feeding animals high protein diets
3. Ethical objections, overuse of antibiotics
4. Control of net size, fishing quotas
5. Crops with a greater nutritional value, can produce bacteria-producing insulin to treat diabetes

Check for understanding

I: Explain using scientific understanding to make something clear or state the reason for something happening

Example question:

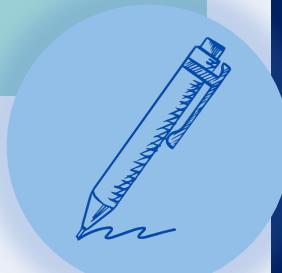
Explain why farmers make more money rearing cows for meat indoors than rearing cows outdoors.

Model answer:

- Less energy wasted in movement/thermoregulation
- More energy for growth
- Cows grow bigger

To 'explain' your answer should:

- Begin with a **scientific statement**.
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.



We: Explain using scientific understanding to make something clear or state the reason for something happening

Example question:

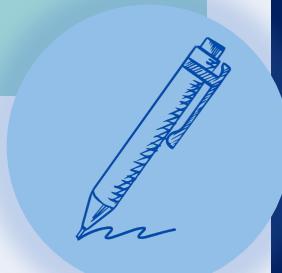
Explain why some farmers choose to rear cows outdoors even though the cows grow bigger rearing cows indoors.

Model answer:

- Increased spread of disease
- Increased use antibiotics
- Cost of heating / lighting
- Emotional stress reduces productivity
- Welfare/ethical issues

To 'explain' your answer should:

- Begin with a **scientific statement**.
- Use 'this means that', 'because' or 'so' **to link your statement to the question**.



You: Evaluate to make a conclusion based on evidence

Example question:

One farmer decided to rear cows indoors to grow bigger cows instead of rearing cows outdoors.

Evaluate this decision by the farmer.

Model answer:

Pros

- Less energy wasted in movement/thermoregulation
- More energy for growth
- Cows grow bigger

Cons

- Increased spread of disease
- Increased use antibiotics
- Cost of heating / lighting
- Emotional stress reduces productivity
- Welfare/ethical issues

- Justified conclusion given based on given points.

To 'evaluate' your answer should:

- Use the information supplied and our own knowledge to consider the **evidence for and against a point**.
- We may also be required to **include a justified conclusion**. This may sometimes be our opinion.



Answer the questions below.

1. Which is an advantage of using intensive farming methods?
 A. Less energy is lost through movement and thermoregulation
 B. Populations of animals must be kept very low
 C. Animals can be treated with antibiotics

2. Which best explains why fishing quotas are used?
 A. So that each country gets the same amount of fish
 B. To make sure that not all fish are caught in each trawl
 C. To maintain fish populations at a stable breeding level

3. Which is the correct description of mycoprotein?
 A. Genetically modified crops with added nutritional value
 B. A protein-rich food made from the fungus *fusarium*
 C. Bacteria that are used to produce insulin

Lesson B3.2.8

What was good about this lesson?

What can we do to improve this lesson?

[Send us your feedback by clicking this link](#)
or by emailing sciencemastery@arkonline.org
Thank you!