BIOZONE

BIOLOGY

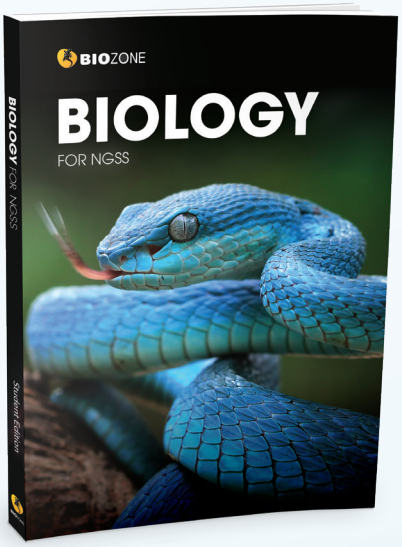
FOR NGSS

FREE SAMPLE

for classroom trial

This sample packet may be photocopied and trialled in the classroom.

BIOLOGY for NGSS



BIOZONE's third edition of Biology for NGSS is now in full color. This title has been specifically written to meet the requirements of the Next Generation Science Standards (NGSS) for high school Life Sciences (HS-LS).

Structured on the Disciplinary Core Ideas of the NGSS framework, this title provides a flexible approach to delivering NGSS. BIOZONE's high-quality infographics and inquiry-driven pedagogical approach inspires students to be curious about the living world. Our unique, interactive worktext approach encourages direct interaction with the content, allowing students to record their answers within the context of the stimulus material and form a record of work for quick and easy revision. NGSS assessment tools allow teachers to assess student understanding of the content.

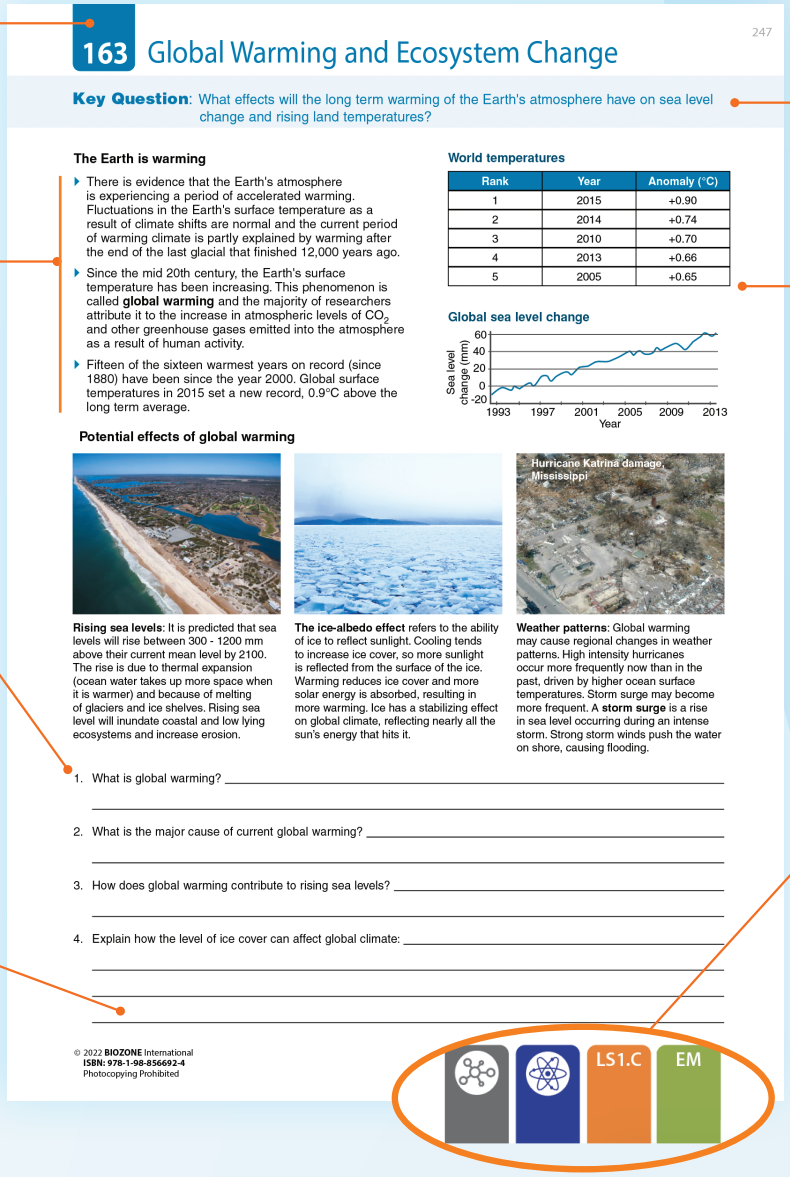
Activity Page

Activity number
Activities are numbered to make navigation through the book easier.

Content organization
Logically organized content makes it easier for students to access and engage with the information.

Direct questioning
A direct questioning style helps students to easily identify what is being asked. A wide range of tasks, including free response, data analysis and presentation, and interpretation and evaluation of evidence, scaffold student learning to build confidence and competence.

Write-on answers
Students write their answers directly onto the page. This becomes their record of work and helps them when it is time to review for tests and exams.



247

163 Global Warming and Ecosystem Change

Key Question: What effects will the long term warming of the Earth's atmosphere have on sea level change and rising land temperatures?

The Earth is warming

- There is evidence that the Earth's atmosphere is experiencing a period of accelerated warming. Fluctuations in the Earth's surface temperature as a result of climate shifts are normal and the current period of warming climate is partly explained by warming after the end of the last glacial that finished 12,000 years ago.
- Since the mid 20th century, the Earth's surface temperature has been increasing. This phenomenon is called **global warming** and the majority of researchers attribute it to the increase in atmospheric levels of CO_2 and other greenhouse gases emitted into the atmosphere as a result of human activity.
- Fifteen of the sixteen warmest years on record (since 1880) have been since the year 2000. Global surface temperatures in 2015 set a new record, 0.9°C above the long term average.

World temperatures

Rank	Year	Anomaly (°C)
1	2015	+0.90
2	2014	+0.74
3	2010	+0.70
4	2013	+0.66
5	2005	+0.65

Global sea level change

Potential effects of global warming

Rising sea levels: It is predicted that sea levels will rise between 300 - 1200 mm above their current mean level by 2100. The rise is due to thermal expansion (ocean water takes up more space when it is warmer) and because of melting of glaciers and ice shelves. Rising sea level will inundate coastal and low lying ecosystems and increase erosion.

The ice-albedo effect refers to the ability of ice to reflect sunlight. Cooling tends to increase ice cover, so more sunlight is reflected from the surface of the ice. Warming reduces ice cover and more solar energy is absorbed, resulting in more warming. Ice has a stabilizing effect on global climate, reflecting nearly all the sun's energy that hits it.

Weather patterns: Global warming may cause regional changes in weather patterns. High intensity hurricanes occur more frequently now than in the past, driven by higher ocean surface temperatures. Storm surge may become more frequent. A **storm surge** is a rise in sea level occurring during an intense storm. Strong storm winds push the water on shore, causing flooding.

1. What is global warming? _____
2. What is the major cause of current global warming? _____
3. How does global warming contribute to rising sea levels? _____
4. Explain how the level of ice cover can affect global climate: _____

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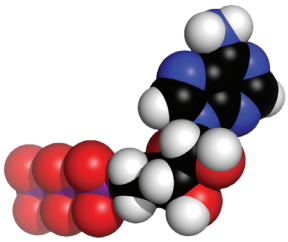
Key question
Each activity has a key question summarizing its primary focus. It helps students to understand where the activity's emphasis lies.

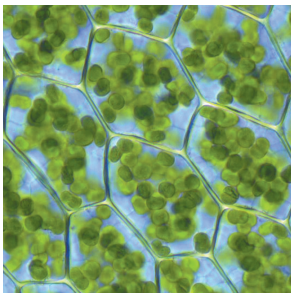
Data driven activities
Answering questions based on the analysis and interpretation of real world data develops core skills in evidence-based reasoning and logical thinking. Communicating these analyses effectively builds skills in literacy.

Activity coding system
Tab codes indicate online support via BIOZONE's Resource Hub and identify the three dimensions (DCIs, SEPs, and CCCs) covered in the activity.

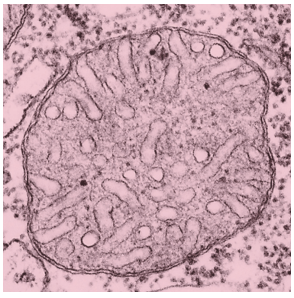
LS1.C

5: Energy in Living Systems





Kristian Peters



Activity number

Anchoring Phenomenon

Man in a box: What happens to oxygen and carbon dioxide levels in a closed system? 99 111

What is ATP and why is it important?

☐ 1 Living organisms use cellular respiration as the process by which organic molecules are broken down to release energy and form molecules of ATP. ATP is an energy transfer molecule and its hydrolysis provides the energy to do cellular work *[CCC-5]*. Use a model *[SEP-2]* to show how ATP provides energy to carry out life's functions *[CCC-6]* *[LS1.C]*. 100 101

How does photosynthesis convert light energy into stored energy?

☐ 2 Photosynthesis is the process that captures light energy and converts it into stored chemical energy *[CCC-5]* *[LS1.C]*. In plants, photosynthesis occurs in organelles called chloroplasts, and consists of two stages; the independent phase and light dependent phase *[CCC-5]*. Use a model *[SEP-2]* to show how photosynthesis transforms light energy into stored chemical energy *[HS-LS1-5]*. 102 103 104 112

☐ 3 In photosynthesis, carbon dioxide and water are converted into glucose and oxygen *[SEP-2]* *[CCC-5]* *[LS1.C]*. Conduct an investigation *[SEP-3]* to demonstrate that light drives photosynthesis. 102 104 105

How is glucose used to make other macromolecules?

☐ 4 Glucose consists of carbon, oxygen, and hydrogen atoms. Construct and revise an explanation based on evidence for how organisms build a wide range of organic molecules (e.g. amino acids, nucleic acids, fats) from the atoms in glucose *[LS1.C]* *[CCC-5]* *[SEP-6]* *[HS-LS1-6]*. 106

How are photosynthesis and cellular respiration connected?

☐ 5 Use a diagrammatic model *[SEP-2]* to show how the glucose produced during photosynthesis is used in cellular respiration *[LS1.C]* *[CCC-5]* *[HS-LS1-6]*. 107

How is energy produced during cellular respiration?

☐ 6 Use a model *[SEP-2]* to compare the ATP production from aerobic and anaerobic pathways in different organisms *[CCC-5]*. Construct an explanation *[SEP-6]* for the different ATP yields in different pathways *[CCC-5]* *[LS1.C]* *[HS-LS1-7]*. 108

☐ 7 Cellular respiration takes place in the cell cytoplasm and in the mitochondrion *[CCC-6]*. In cellular respiration, glucose and oxygen are used to produce ATP *[CCC-5]*, which provides the energy needed to perform cellular work, such as muscle contraction *[LS1.C]* *[HS-LS1-7]*. Use a model *[SEP-2]* based on evidence to demonstrate an understanding of cellular respiration 109

☐ 8 Use a respirometer to investigate *[SEP-3]* cellular respiration in living organisms (e.g. seeds) *[CCC-5]* *[LS1.C]*. 110

☐ 9 Use a model to illustrate the chemical process of cellular respiration. What are the inputs and outputs? Use the model to show that bonds in oxygen and food molecules are broken and bonds in new compounds are formed, resulting in a net transfer of energy *[SEP-2]* *[CCC-5]* *[LS1.C]* *[HS-LS1-7]*. 112

44 Specialization in Animal Cells

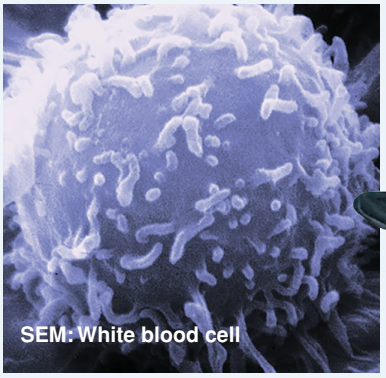
Key Question: How does cell modification allow animal cells to carry out specialist functions?

Specialization in animal cells

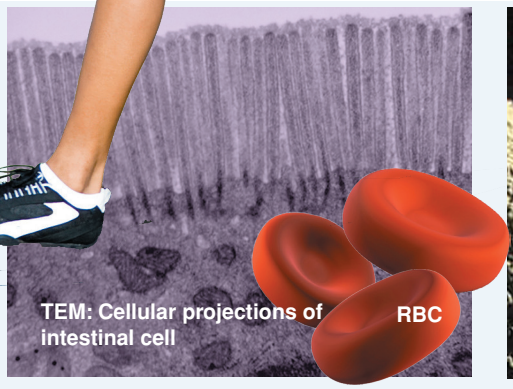
- There are over 200 different types of cells in the human body.
- Animal cells lack a cell wall, so they can take on many different shapes. Therefore, there are many more types of animal cells than there are plant cells.
- Specialized cells often have modifications or exaggerations to a normal cell feature to help them do their job. For example, nerve cells have long, thin extensions to carry nerve impulses over long distances in the body.
- Specialization improves efficiency because each cell type is highly specialized to perform a particular task.

Thin, flat epithelial cells line the walls of blood vessels (arrow). Large fat cells store lipid.

Some nerve cells are over 1 m long.

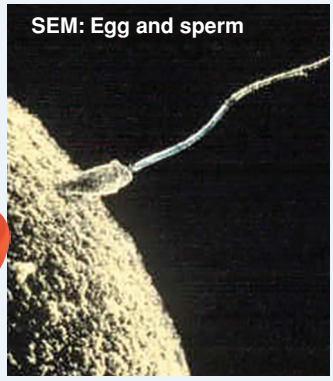


Some animal cells can move or change shape. A sperm cell must be able to swim so that it can fertilize an egg. A white blood cell changes its shape to engulf and destroy foreign materials, e.g. bacteria.



Louisa Howard, Katherine Connolly Dartmouth College

Cells that line the intestine have extended cell membranes. This increases their surface area so that more food (nutrients) can be absorbed. Red blood cells (RBCs) have no nucleus so they have more room inside to carry oxygen around the body.



The egg (ovum) is the largest human cell. It is about 0.1 mm in diameter and can be seen with the naked eye. The smallest human cells are sperm cells and red blood cells.

1. What is the advantage of cell specialization in a multicellular organism? _____

_____

_____

_____

2. For each of the following specialized animal cells, name a feature that helps it carry out its function:

   (a) White blood cell: _____

   (b) Sperm cell: _____

   (c) Nerve cell: _____

   (d) Red blood cell: _____

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91 Circulation and Gas Exchange Interactions

Key Question: How do the circulatory and respiratory systems interact?

Circulatory system

Function

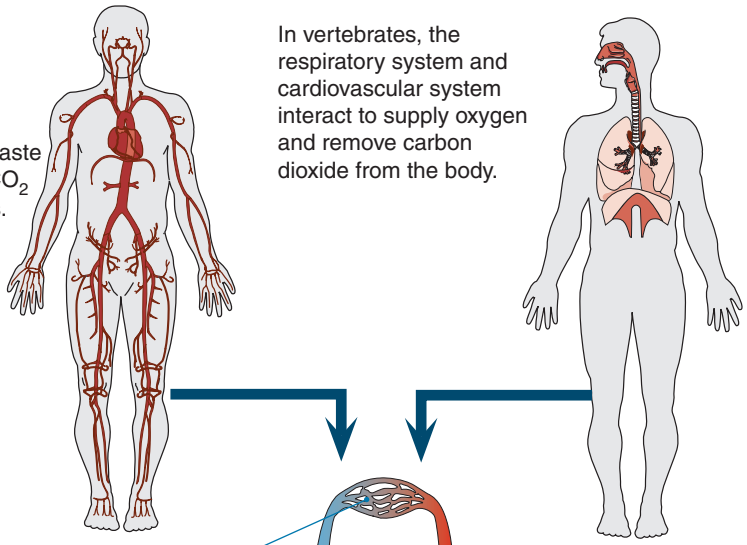
Delivers oxygen (O_2) and nutrients to all cells and tissues. Removes carbon dioxide (CO_2) and other waste products of metabolism. CO_2 is transported to the lungs.

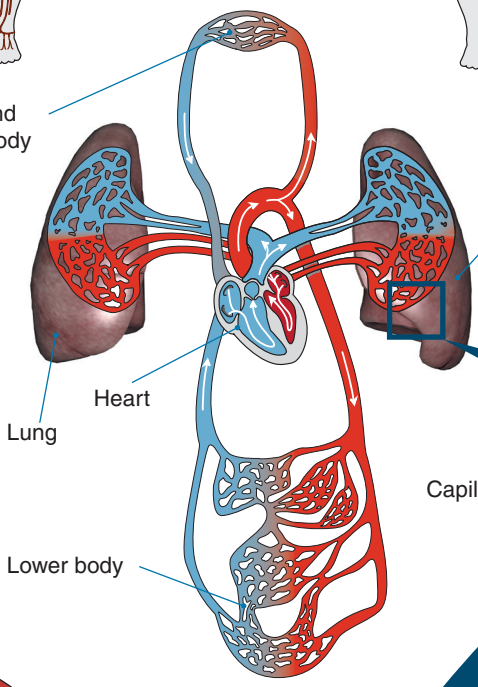
Components

- Heart
- Blood vessels:
  - Arteries
  - Veins
  - Capillaries
- Blood

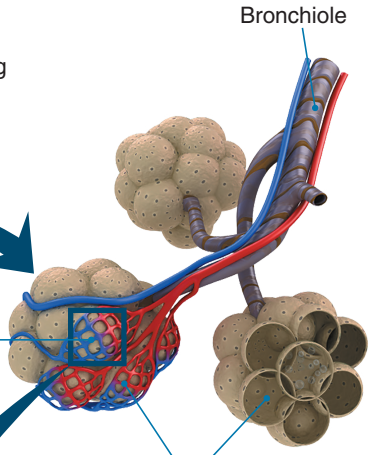
Interaction between systems

In vertebrates, the respiratory system and cardiovascular system interact to supply oxygen and remove carbon dioxide from the body.

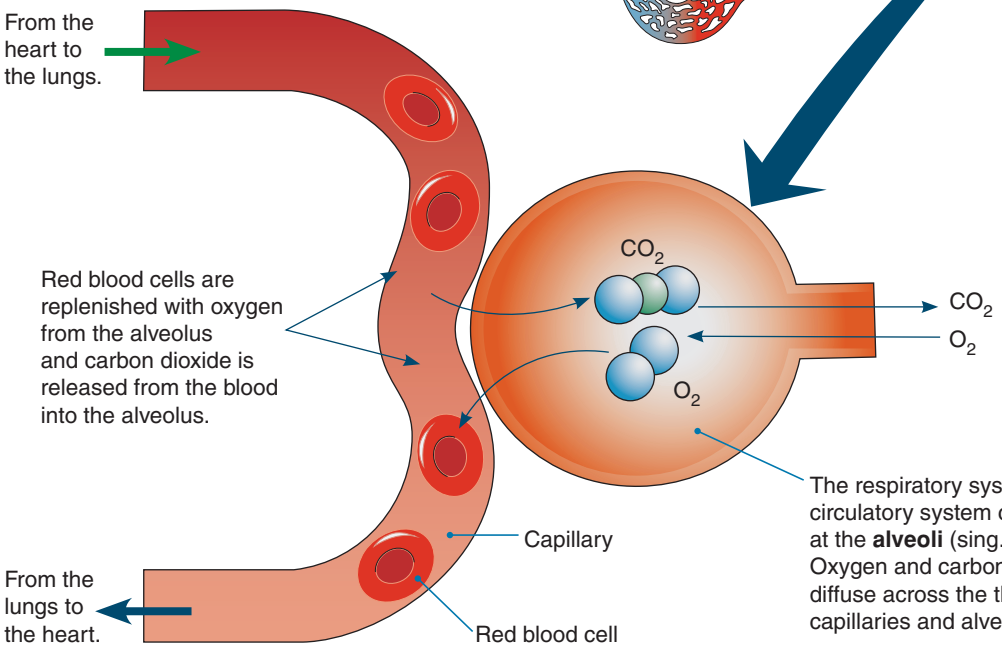




Oxygen (O_2) from inhaled air moves from the lungs into the circulatory system and is transported within red blood cells to the heart. The heart pumps the blood to the body where O_2 is released and carbon dioxide (CO_2) is picked up. The blood returns to the heart and is pumped to the lungs where CO_2 is released into the lungs to be breathed out.



The airways of the lungs end at the **alveoli**, which are microscopic air sacs that enable gas exchange.



Red blood cells are replenished with oxygen from the alveolus and carbon dioxide is released from the blood into the alveolus.

The carbon dioxide released from the blood exits the body during exhalation. Inhalation brings in fresh air, containing oxygen.

The respiratory system and the circulatory system come together at the **alveoli** (sing. alveolus). Oxygen and carbon dioxide diffuse across the thin walls of capillaries and alveoli.

Respiratory system

Function

Provides surface for gas exchange. Moves fresh air into and stale air out of the body.

Components

- Airways:
  - Pharynx
  - Larynx
  - Trachea
- Lungs:
  - Bronchi
  - Bronchioles
  - Alveoli
- Diaphragm

LS1.A SSM

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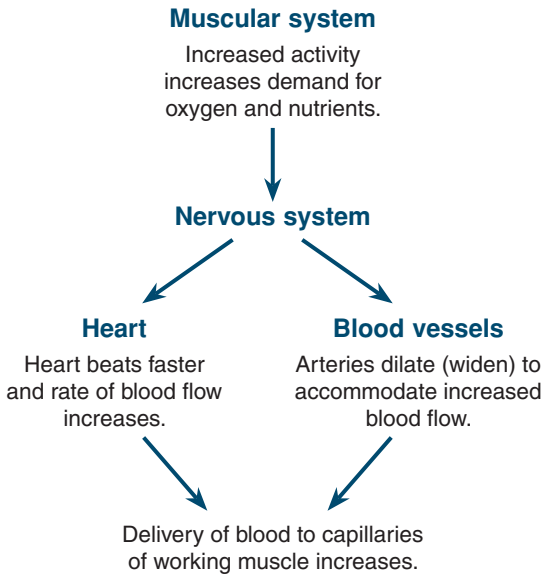
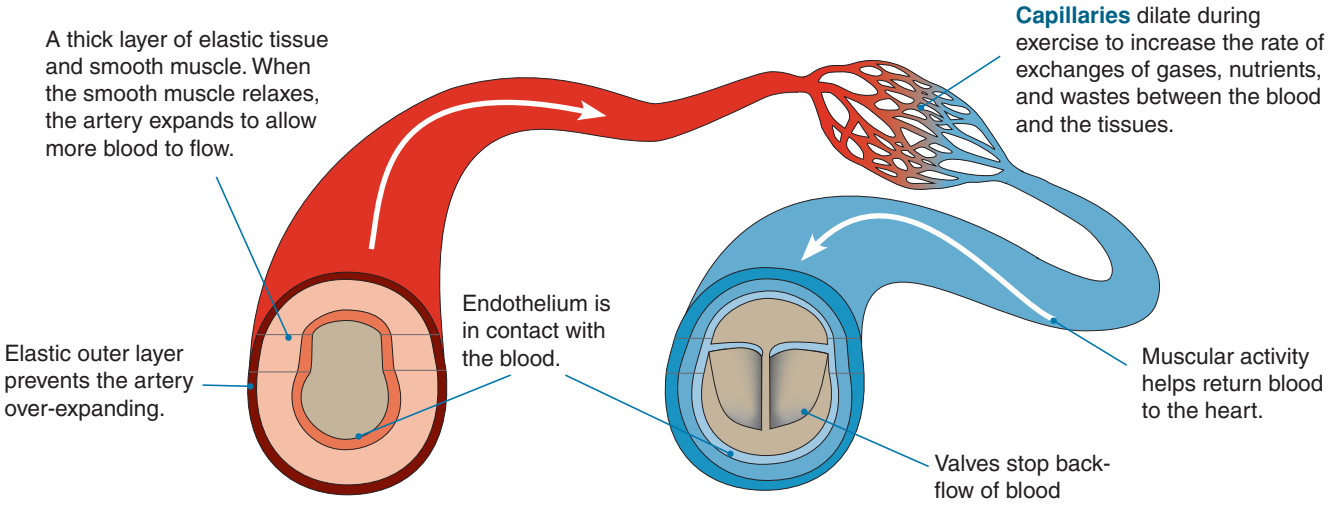
Responses to exercise

- During exercise, your body needs more oxygen to meet the extra demands placed on the muscles, heart, and lungs. At the same time, more carbon dioxide must be expelled. To meet these increased demands, blood flow must increase. This is achieved by increasing the rate of heart beat. As the heart beats faster, blood is circulated around the body more quickly, and exchanges between the blood and tissues increase.
- The arteries and veins must be able to resist the extra pressure of higher blood flow and must expand (dilate) to accommodate the higher blood volume. If they didn't, they could rupture (break). During exercise, the muscular, cardiovascular, and nervous systems interact to maintain the body's systems in spite of increased demands (right).





Artery

The strong, stretchy structure of arteries enables them to respond to increases in blood flow and pressure as more blood is pumped from the heart.

Vein

Veins return blood to the heart. They are less muscular than arteries, but valves and the activity of skeletal muscles, especially during exercise, help venous return.

1. In your own words, describe how the circulatory system and respiratory system work together to provide the body with oxygen and remove carbon dioxide:

2. (a) What happens to blood flow during exercise? _____

   (b) How do body systems interact to accommodate the extra blood flow needed when a person exercises?

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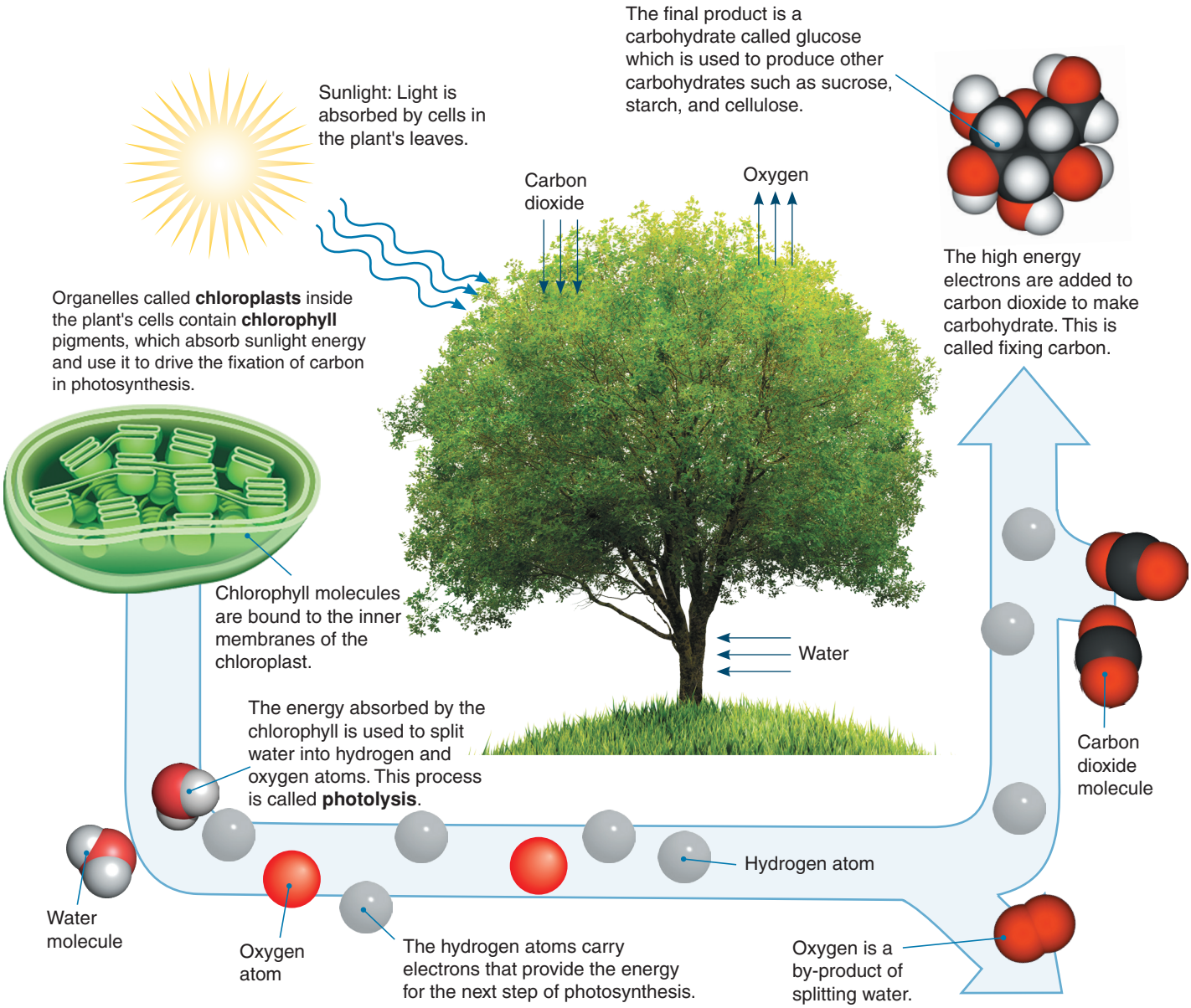
102 Introduction to Photosynthesis

Key Question: How does photosynthesis convert sunlight, carbon dioxide, and water into glucose and oxygen?

- Plants, algae, and some bacteria are photoautotrophs. They use pigments called chlorophylls to absorb light of specific wavelengths and capture light energy. The light energy is used in a process called photosynthesis.
- During photosynthesis, carbon dioxide and water are converted into glucose and oxygen. The reaction requires sunlight energy, which is transformed into chemical energy within the bonds of the glucose molecule. This chemical energy fuels life's essential processes.



Photosynthesis is commonly displayed as either of the two equations on the right. Both are correct, but the bottom equation cancels the extra water molecules.

$$6CO_2 + 12H_2O \xrightarrow{Light} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

$$6CO_2 + 6H_2O \xrightarrow{Light} C_6H_{12}O_6 + 6O_2$$

1. Write the word equation for photosynthesis: _____

_____

2. Where does the oxygen released during photosynthesis come from? _____

LS1.C EM

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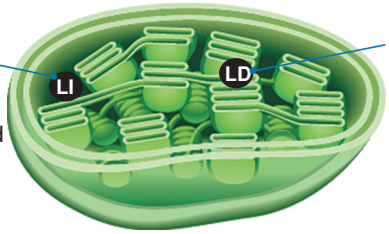
Requirements for photosynthesis

Plants need only a few raw materials to make their own food:

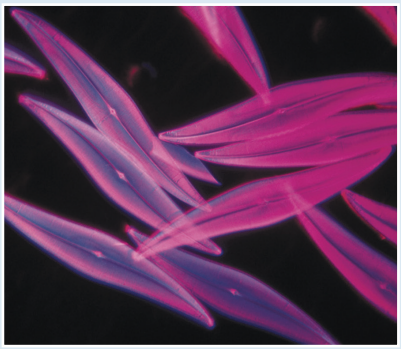
- Light energy from the sun
- Chlorophyll absorbs light energy
- CO_2 gas is reduced to carbohydrate
- Water is split to provide the electrons for the fixation of carbon as carbohydrate

Photosynthesis is not a single process but two complex processes (the light dependent and light independent reactions), each with multiple steps.

Production of carbohydrate (**light independent reactions** of Calvin cycle) occur in the fluid stroma of chloroplast. This is commonly called carbon 'fixation'.



Energy capture (**light dependent reactions**) occurs in the inner membranes (thylakoids) of the chloroplast.



The photosynthesis of marine algae, such as these diatoms, supplies a substantial portion of the world's oxygen. The oceans also act as sinks for absorbing large amounts of CO_2.

Macroalgae, like this giant kelp, are important marine producers. Algae living near the ocean surface get access to light used in photosynthesis (the red wavelength).

On land, vascular plants, such as trees with transport vessels, are the main producers of food. Plants at different levels in a forest receive different intensity and quality of light.

3. (a) What form of energy is used to drive photosynthesis? _____

   (b) What is the name of the molecule that captures this energy? _____

   (c) Where in the plant cell does photosynthesis take place? _____

   (d) What form of energy is your answer to (a) converted into? _____

   (e) What happens in each of the two phases of photosynthesis? _____

   _____

4. (a) Primary production is the production of carbon compounds from carbon dioxide, generally by photosynthesis. Study the graph (below right) showing primary production in the oceans. Describe what the graph is showing:

   _____

   _____

   _____

   (b) Explain the shape of the curves described in (a): _____

   _____

   _____

   _____

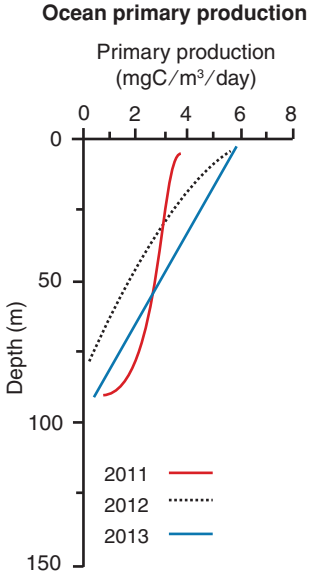
   (c) About 90% of all marine life lives in the photic zone (the depth to which light penetrates). Suggest why this is so:

   _____

   _____

   _____

   _____



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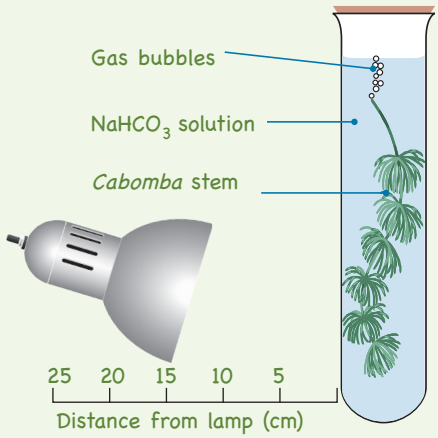
105 Investigating Photosynthesis Rate

Key Question: How does light intensity affect photosynthesis rate?

Investigation 5.1 Measuring bubble production in *Cabomba*

See appendix for equipment list.

1. Fill a boiling tube 2/3 full with a 20°C solution of 1% sodium hydrogen carbonate ($NaHCO_3$).
2. Cut a ~7 cm long piece of *Cabomba* stem (cut underwater). Place the *Cabomba* into the boiling tube (cut end up). Carefully push the *Cabomba* down.
3. Place the boiling tube in a rack and position a lamp so that it will shine on the tube when switched on.
4. To test the set up, switch on the lamp for one minute to check that bubbles emerge freely from the stem. If they don't, you may have to recut the stem to open it.
5. When you have checked your set-up, switch off the lamp and, **after 5 minutes**, use a stop watch to record the number of bubbles emerging from the stem over a minute. Repeat.
6. Use a ruler to mark out distances 0, 5, 10, 15, 20, and 25 cm from the boiling tube.
7. Starting at 25 cm, move the lamp to each of the distances in turn and use a stopwatch to record the number of bubbles emerging from the stem over a minute. Run two tests at each distance and allow 5 minutes after moving to a new distance before recording (this allows for acclimation).
8. Record your results in the table right. Calculate the mean rate of gas production for each distance (and lamp OFF).
9. After you have finished recording, unstopper the tube and test the gas with a glowing splint. What happens?



Distance (cm)	Bubbles per minute		
	Test 1	Test 2	Mean
OFF			
25			
20			
15			
10			
5			
0			

1. Use your calculated means to draw a graph on the grid of the rate of gas production vs light intensity (distance).
2. What did your splint test tell you about the gas produced by the *Cabomba* plant?

3. From this experiment what can you say about photosynthesis, light, and the gas produced?

4. How do you think you could refine the design of this investigation to improve it?

LS1.C EM

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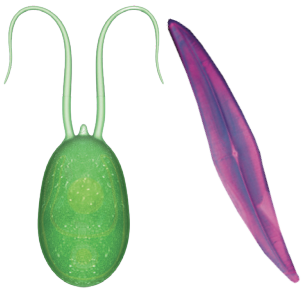
143 Constructing Food Webs

Key Question: How can we use the organisms in an ecosystem to construct food chains and food webs?

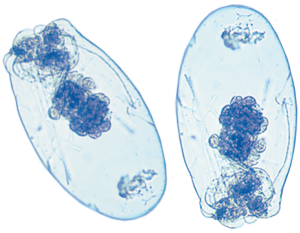
The organisms below are typical of those found in many lakes. For simplicity, only a few organisms are represented here. Real lake communities have hundreds of different species interacting together. Your task is to assemble the organisms below into a food web in a way that shows how they are interconnected by their feeding relationships.



Autotrophic protists (algae)
Chlamydomonas (above left), and some diatoms (above right) photosynthesize.

Macrophytes
Aquatic green plants photosynthesize.

Detritus
Decaying organic matter.



***Asplanchna* (planktonic rotifer)**
A large, carnivorous rotifer.
Diet: Protozoa and young zooplankton (e.g. *Daphnia*).

***Daphnia* (zooplankton)**
Small freshwater crustacean.
Diet: Planktonic algae.

Leech
Fluid feeding predators.
Diet: Small invertebrates, including rotifers, small pond snails, and worms.

Three-spined stickleback
Common in freshwater ponds and lakes. **Diet**: Small invertebrates such as *Daphnia* and insect larvae.

Diving beetle (adults and larvae)
Diet: Aquatic insect larvae and adult insects. They will also scavenge from detritus. Adults will also take fish fry. Adults and larvae are voracious and may be top predators in small ponds.

Common carp
Diet: Mainly feeds on bottom living insect larvae and snails, but will also eat some plant material (not algae).

Dragonfly larva
Large aquatic insect larvae.
Diet: Small invertebrates including *Hydra*, *Daphnia*, insect larvae, and leeches.

Great pond snail
Diet: Omnivorous. Main diet is macrophytes but will eat decaying plant and animal material also.

Herbivorous water beetle
Diet: Adults feed on macrophytes. Young beetle larvae are carnivorous, feeding primarily on pond snails.

Protozan (e.g. *Paramecium*)
Diet: Mainly bacteria and microscopic green algae such as *Chlamydomonas*.

Pike
Diet: Smaller fish and amphibians. They are also opportunistic predators of rodents and small birds.

Mosquito larva
Diet: Planktonic algae.

Hydra
A small, carnivorous cnidarian.
Diet: small *Daphnia* and insect larvae.

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1. From the information provided for the lake food web components on the previous page, construct twelve different **food chains** to show the feeding relationships between the organisms. Some food chains may be shorter than others and most species will appear in more than one food chain. An example has been completed for you.

Example 1: Macrophyte → Herbivorous water beetle → Carp → Pike

(a) _____

(b) _____

(c) _____

(d) _____

(e) _____

(f) _____

(g) _____

(h) _____

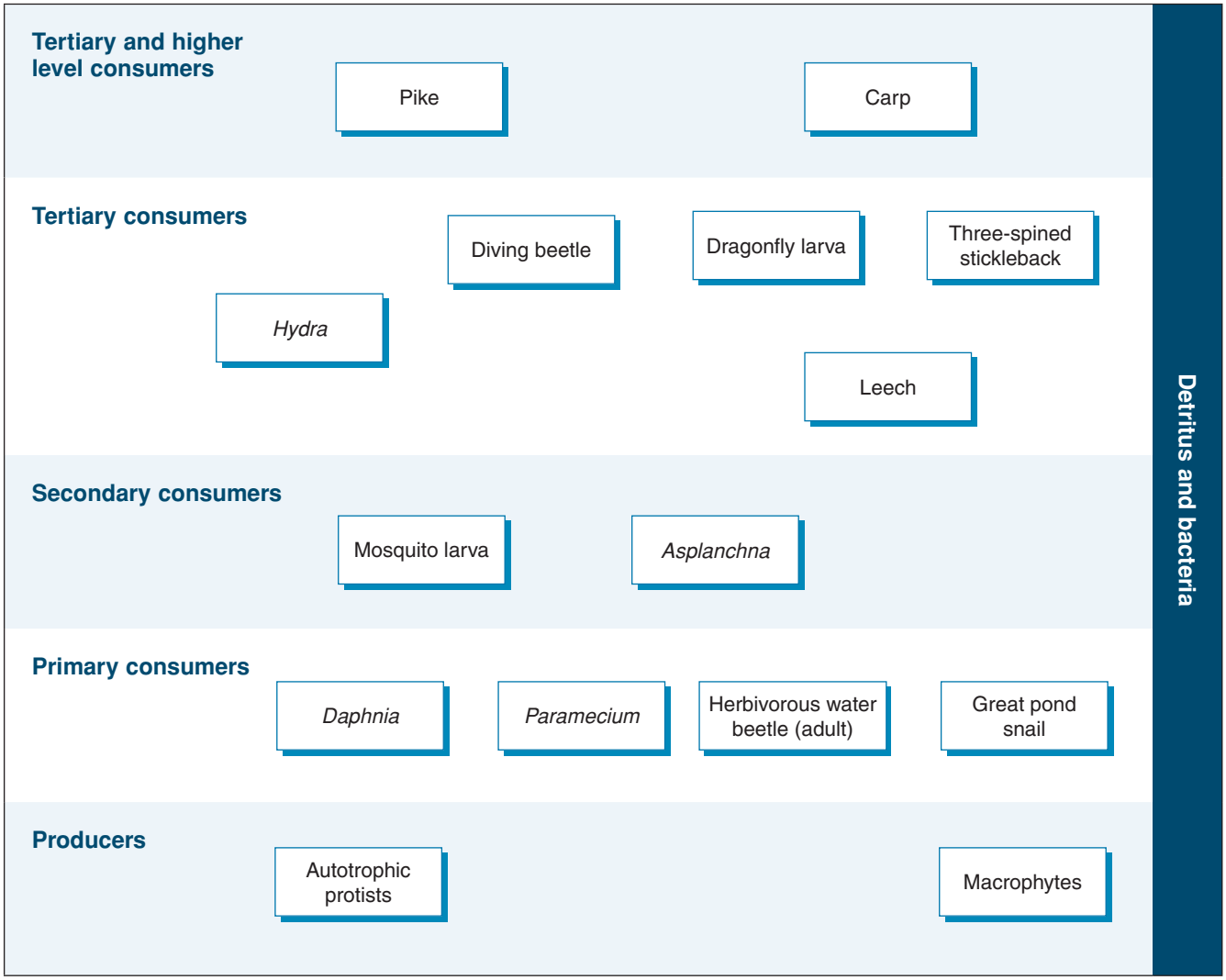
(i) _____

(j) _____

(k) _____

(l) _____

2. Use the food chains you created above to help you to draw up a food web for this community in the box below. Use the information supplied on the previous page to draw arrows showing the flow of energy between species (only energy **from** (not to) the detritus is required).



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163 Global Warming and Ecosystem Change

Key Question: What effects will the long term warming of the Earth's atmosphere have on sea level change and rising land temperatures?

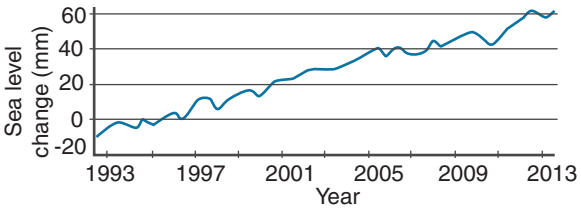
The Earth is warming

- There is evidence that the Earth's atmosphere is experiencing a period of accelerated warming. Fluctuations in the Earth's surface temperature as a result of climate shifts are normal and the current period of warming climate is partly explained by warming after the end of the last glacial that finished 12,000 years ago.
- Since the mid 20th century, the Earth's surface temperature has been increasing. This phenomenon is called **global warming** and the majority of researchers attribute it to the increase in atmospheric levels of CO_2 and other greenhouse gases emitted into the atmosphere as a result of human activity.
- Fifteen of the sixteen warmest years on record (since 1880) have been since the year 2000. Global surface temperatures in 2015 set a new record, 0.9°C above the long term average.

World temperatures

Rank	Year	Anomaly (°C)
1	2015	+0.90
2	2014	+0.74
3	2010	+0.70
4	2013	+0.66
5	2005	+0.65

Global sea level change



Potential effects of global warming

Rising sea levels: It is predicted that sea levels will rise between 300 - 1200 mm above their current mean level by 2100. The rise is due to thermal expansion (ocean water takes up more space when it is warmer) and because of melting of glaciers and ice shelves. Rising sea level will inundate coastal and low lying ecosystems and increase erosion.

The ice-albedo effect refers to the ability of ice to reflect sunlight. Cooling tends to increase ice cover, so more sunlight is reflected from the surface of the ice. Warming reduces ice cover and more solar energy is absorbed, resulting in more warming. Ice has a stabilizing effect on global climate, reflecting nearly all the sun's energy that hits it.

Weather patterns: Global warming may cause regional changes in weather patterns. High intensity hurricanes occur more frequently now than in the past, driven by higher ocean surface temperatures. Storm surge may become more frequent. A **storm surge** is a rise in sea level occurring during an intense storm. Strong storm winds push the water on shore, causing flooding.

1. What is global warming? _____

2. What is the major cause of current global warming? _____

3. How does global warming contribute to rising sea levels? _____

4. Explain how the level of ice cover can affect global climate: _____

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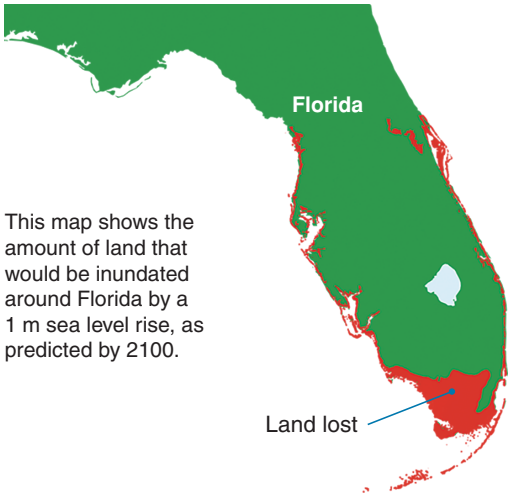
Case study: Global warming and sea level rise

Low lying wetlands such as the Everglades risk being inundated by seawater. The Everglades (above) contains a variety of ecosystems including mangrove forests, sawgrass marshes, cypress swamps, and pine lands.

Studies have found that the small fish that make up the foraging base of many coastal species do better under less saline conditions. As the saltwater-freshwater interface moves inland, the production of the Everglades will decline.

Peat collapse is another effect of saltwater intrusion. The intrusion of saltwater removes the peat soil. Peat bogs support a variety of freshwater species and the plants and ecosystem they support helps filter the fresh water humans depend on.



This map shows the amount of land that would be inundated around Florida by a 1 m sea level rise, as predicted by 2100.

The Everglades that make up a large part of southern Florida are extremely flat. In fact, moving inland they increase just 5 cm in altitude per kilometer. This means that even minor increases in sea level will have major effects on the wetland ecosystems found there.

- The rise in the mean sea level and inundation of the land is only part of the effect of sea level rise. As the sea level rises, ground water is intruded by saltwater, destroying freshwater habitat from underneath. In addition, storm surge becomes more important. As outlying islands, reefs, and other barriers to storm surges become closer to sea level, they are less effective at preventing flooding during storms. Storm surges during severe hurricanes can be up to 15 m above the high tide level. The storm surge can therefore cause severe erosion and damage to the land far beyond the mean high tide mark.
- Examples of ecosystem change in the Everglades due to sea level change include the movement of mangrove forests approximately 3 km inland since the 1940s and therefore the equivalent reduction in freshwater ecosystems behind the mangroves.

5. (a) What feature of the Florida Everglades make it susceptible to flooding? _____

_____

(b) Describe the effects of sea level rise on the ecosystems of the Everglades: _____

_____

_____

_____

_____

6. In the US, the American crocodile is only found in southern Florida (right). They can tolerate high temperatures and brackish water (water that is a mix of sea water and fresh water). The American crocodile is less tolerant of cold than the American alligator. The alligator is more widespread and is found throughout the southeastern US and coexists with the American crocodile in southern Florida.

(a) What could happen to the American crocodile range in Florida if sea levels rise?

_____

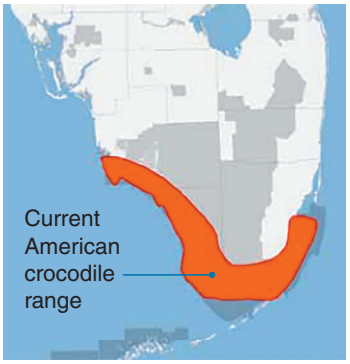
_____

(b) How might global warming affect its range overlap with the American alligator?

_____

_____

_____



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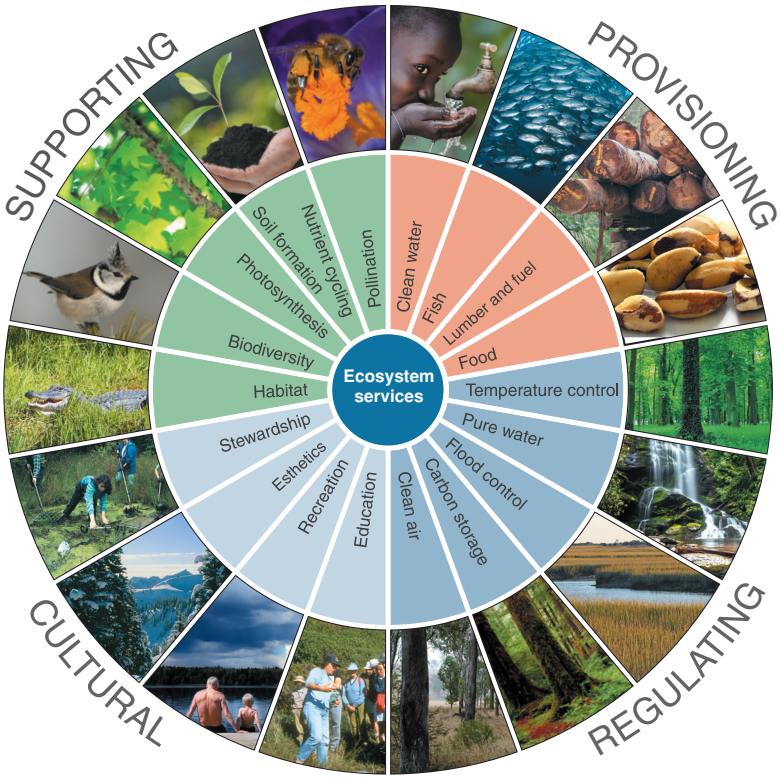
254 Humans Depend on Biodiversity

Key Question: How does the biodiversity of an ecosystem affect its ability to provide ecosystem services?

Ecosystems provide services

- Humans depend on Earth's ecosystems for the services they provide. These ecosystem services include resources such as food and fuel, as well as processes such as purification of the air and water. These directly affect human health.
- Biologically diverse and resilient ecosystems that are managed in a sustainable way are better able to provide the ecosystem services on which we depend.
- The UN has identified four categories of ecosystem services: supporting, provisioning, regulating, and cultural.
- Regulating and provisioning services are important for human health and security (security of resources and security against natural disasters).
- Cultural services are particularly important to the social fabric of human societies and contribute to wellbeing. These are often things we cannot value in monetary terms.




Disease resistance in sorghum

Biodiversity is important in crop development, e.g. promoting disease resistance. Many medical breakthroughs have come from understanding the biology of wild plants and animals.


Lyme disease is spread by the deer tick

CDC

High biodiversity creates buffers between humans and infectious diseases, e.g. Lyme disease, and increases the efficiency of processes such as water purification.


Landslide

NOAA

Biodiversity and ecosystem health are essential for reducing the effects of human activities, e.g. pollution, and the effects of environmental disasters such as eruptions and landslides.

1. What are ecosystem services and why are they important to humans? _____

_____

_____

_____

2. What is the relationship between biodiversity and the ability of an ecosystem to provide essential ecosystem services?

_____

_____

_____

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