





■ The delta of the Yellow River in China, taken from a US satellite.

# Unit 3 Fresh Water

## Key Words

**abyss (n)** – အသူတစ်ရာနက်သော ချောက်

**agriculture** – စိုက်ပျိုးရေး

**canyon (n)** – နက်ရှိုင်းသော ချောက်

**cold-blooded (adj)** – သွေးအေးသတ္တဝါ

**drain (v)** – ရေမြောင်း

**floodplain (n)** – စီးဆင်းလာသော ချောင်းများ၊

တောင်ကျရေများက မြစ်ကြောင်းသို့ ဆုံဆည်းသွားရာမှ ကျယ်ပြန့်သော မြစ်နေရာတစ်နေရာ

**gravity (n)** – ကမ္ဘာမြေထု၏ ဆွဲငင်အား

**hydroelectric plant (n)** – ရေအားလျှပ်စစ်ဖြင့် လျှပ်စစ်ထုတ်လွှတ်ခြင်း

**lifeless (adj)** – အသက်မပါသော

**mangrove (n)** – လမုပင်

**mate (v)** – မိတ်လိုက်ခြင်း

**mouth [of a river] (n)** – ချောင်းဝ၊ မြစ်ဝ

**nutrients (n)** – အာဟာရဓာတ်၊ ဩဇာဓာတ်

**rapids (n)** – ရေမော်

**scales (n)** – အတိုင်းအတာ၊ ပမာဏ။ စကေး၊ စံအမှတ်အသား

**sediment (n)** – အနည်အနှစ်

**source [of a river] (n)** – မြစ်ဖျားခံရာ

**stream (n)** – ချောင်း၊ စမ်းချောင်း

**tributary [of a river] (n)** – မြစ်၊ ချောင်း လက်တက်

**vertebrate (n)** – ကျောရိုးရှိသတ္တဝါ

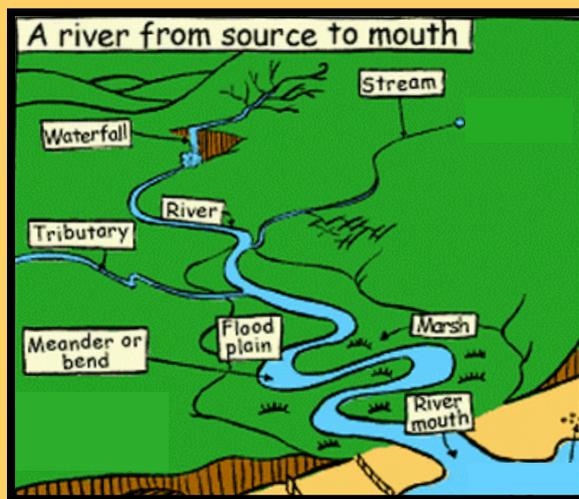
**waterfall (n)** – ရေတံခွန်

# 3.1 The River System (00:00 – 05:40)

## A Before you watch

1. **Discuss** and answer the questions.
  - a. Review 1.4. What information might be useful for this section?
  - b. Over 70% of the Earth is covered with water. How much of that do you think is fresh water rather than salt water?
2. Read the text and fill the gaps using the words in the diagram (and the box).

## River Systems



Rivers have a \_\_\_\_\_<sup>a</sup>, which is where they begin, and a \_\_\_\_\_<sup>b</sup>, which is where they end. In between there are three stages to the river: the *upper*, *middle* and *lower* reaches. The upper reaches begin in the mountains. High in the mountains, water flows into small, fast-moving \_\_\_\_\_<sup>c</sup>. In other places there are great \_\_\_\_\_<sup>d</sup>, where water pours over high cliffs into the rivers below. In the middle reaches, these and other smaller rivers – called \_\_\_\_\_<sup>e</sup> – join with a bigger river. Nearer to the sea, the land usually becomes flatter and rivers begin to bend slowly. In the lower reaches are \_\_\_\_\_<sup>f</sup> and marshes. These are areas of low, wet land. They contain **sediment** from the higher land, which is washed down during floods. Finally, at the end of its journey, the fresh water from the river meets the salt water of the sea, often in a delta.

source   floodplains   streams  
mouth   tributaries   waterfalls

## B As you watch

1. How much of the water on earth is fresh water?
2. What natural forces made the “towers” shown in the video?
3. What is the name of the highest waterfall in the world?
4. How high is it?
5. What happens to the water before it reaches the bottom?

## C After you watch

1. Order the statements from the video to explain how rain forms.



- a. \_\_\_ On reaching mountains, the moist air is forced upwards.
- b. \_\_\_ As it cools, it condenses into cloud and finally rain.
- c. \_\_\_ Moisture rising as water vapour from the surface of the sea is blown inland by wind.

2. Draw a diagram showing the water cycle. Use the statements above, the information in the video and the information you already have.
3. What does this tell you about the water you drink every day?

## 3.2 The Upper Reaches (05:40 – 14:53)

■ St. Louis River rapids in Jay Cooke State Park, Minnesota, USA

### A Before you watch

1. **Discuss:** Predict the characteristics of rivers in their upper reaches. Do they have:
  - a. fast-moving water or slow-moving water?
  - b. warm or cold water?
  - c. lots of oxygen or not much oxygen?
  - d. lots of life or not much life?

### B As you watch

1. Answer the questions about rivers from A.
2. What animal is the only large predator in the upper reaches of the Japanese river system?
3. How long can this creature live for?
4. What animal hunts the salmon in the upper reaches in Canada?

### C After you watch

1. Complete the text by filling the gaps.
2. Find the Colorado River on the map on pages 126 and 127. What does the map tell you about the elevation of the area?



### From the Source

In their \_\_\_\_\_<sup>a</sup>, mountain streams are full of power. Streams join to form rivers; they build in power and create \_\_\_\_\_<sup>b</sup>. The water here is cold; it is low in \_\_\_\_\_<sup>c</sup> but high in oxygen. Although mostly \_\_\_\_\_<sup>d</sup>, the power of upland rivers to shape the land is great. They are powered by \_\_\_\_\_<sup>e</sup>, and they're the most \_\_\_\_\_<sup>f</sup> forces on the planet.

For the past five million years, Arizona's Colorado River has eaten away at the desert's sandstone to create a gigantic \_\_\_\_\_<sup>g</sup>. It's over one mile deep and at its widest, it's 17 miles across. This river has cut the world's longest canyon system – a 1000 mile scar visible from space: The Grand Canyon (see picture, above).

**rapids** **canyon** **erosive** **gravity**  
**lifeless** **nutrients** **upper reaches**

# 3.3 The Middle Reaches (14:53 – 24:06)

## A Before you watch

1. **Discuss:** How does a river change after it leaves the mountains and hills?

## B As you watch

- Are the middle reaches the same as the upper reaches or different? Make notes. Describe:
  - appearance
  - animal life
- How old are the otter cubs when they start their fishing practice?
- How big do the mugger crocodiles grow to?
- How many animals migrate across the Serengeti each year?
- Why are the rivers both good and bad for the herds of wildebeest?
- How big do Nile crocodiles grow to?

## C After you watch

1. Complete the text by circling the correct word from each pair.

### Into the Middle Reaches

As rivers leave the valleys / mountains<sup>a</sup> behind, they gradually cool / warm<sup>b</sup> and begin to support more / less<sup>c</sup> life. As the land flattens out / rises<sup>d</sup>, rivers slow down / speed up<sup>e</sup> and lose / increase<sup>f</sup> their power. Now they are carrying heavy / light<sup>g</sup> loads of sediment that change the colour of the water to blue / brown<sup>h</sup>.

2. Complete the table below using the text above.

	Upper Reaches	Middle Reaches
a. Water temperature	<i>cold</i>	<i>warmer</i>
b. Water Speed		
c. Animal life		
d. Predators		
e. Sediment		

## ANIMAL CLASS: A GUIDE TO ANIMAL CLASSIFICATIONS

### 1. REPTILES

There are over 8,000 species of reptile in the world. Many reptiles live both on land and in the water. Reptiles live everywhere on Earth except for polar ice and tundra.

#### All reptiles:

- are **vertebrates** (have a backbone).
- are “**cold-blooded**” (cannot create their own body heat; they need the heat from the sun to stay warm).
- are covered with **scales**.
- have lungs for breathing.

#### Most reptiles:

- have four legs.
- lay eggs.



### IS IT A REPTILE?

Are the following animals reptiles? Why?

- a snake
- a penguin
- a frog
- a tortoise



# 3.4 Lakes (24:06 – 32:09)

## A Before you watch

1. **Discuss** and answer the questions.
  - a. Why are lakes important for humans?
  - b. What are some of the most important lakes in your country? Why are they important?

## B As you watch

1. Fill the gaps with numbers from the video.
  - a. Lakes hold \_\_\_\_\_ times more fresh water than rivers.
  - b. \_\_\_\_\_ of the largest lakes in the world are in the Great Rift Valley in East Africa.
  - c. There are \_\_\_\_\_ of different species of cichlids in Lake Malawi.
  - d. The floor of Lake Malawi drops \_\_\_\_\_ metres into an **abyss**.
2. What is the cause of the “smoking” lakes?
3. What do the lake fly midges do after they have mated?
4. Fill the gaps with facts about Lake Baikal
  - a. It is the \_\_\_\_\_ lake in the world.
  - b. It contains over \_\_\_\_\_ of all the freshwater in the world.
  - c. It is the \_\_\_\_\_ lake in the world.
  - d. \_\_\_\_\_ of the species at Baikal live nowhere else on Earth.

5. What are the names of these animals?



## C After you watch

1. Complete the table below with the examples of adaptation mentioned in the video. Write down the purpose/benefits of each adaptation.
2. Find the Great Rift Valley on the map on pages 130 and 131. Why do you think there are so many big lakes there?
3. Find Lake Baikal on the map on pages 136 and 137. What are its map coordinates?
4. Answer the questions from A.

Animal	Adaptation(s)	Behavioural or Physical?	Possible purpose/Benefit(s)
a. cichlids			
b. dolphin fish			
c. lake fly midges			
d. freshwater seal			

# 3.5 The Lower Reaches (32:09 – End)

## A Before you watch

1. **Discuss:** What do you remember about the river system from 3.1?
2. Read the text and fill the gaps with words from 3.1A.

### The Amazon: Super-river



"The Amazon begins in the Andes and flows eastwards across Brazil. On its way the system **drains** a third of South America. Eventually, over 4,000 miles from its \_\_\_\_\_<sup>a</sup>, it empties into the Atlantic Ocean.

"The Amazon transports a billion tons of \_\_\_\_\_<sup>b</sup> a year. This is clearly visible at the *mixing of the waters*, where a massive \_\_\_\_\_<sup>c</sup> called the Rio Negro flows into the main river."

## B As you watch

1. Listen and check your answers from A.
2. Mark the statements true or false. If false, explain why.
  - a. Rivers have a lot of sediment in the lower reaches.
  - b. There are more fish species in the Atlantic Ocean than the Amazon River.
  - c. The "great broad" waterfalls are found only in the lower reaches of rivers.
  - d. Rivers go faster again before they join the ocean.
  - e. The "river tiger" is a kind of tiger.
  - f. Piranha fish eat other fish.
  - g. Wetlands are important for birds.

## C After you watch

1. Read the text and answer the questions.
  - a. Which is nearer to the sea, a delta or a floodplain?
  - b. Why do people choose to farm on or near floodplains?
  - c. Where do deltas form?
  - d. What causes deltas to form?

### Deltas and Floodplains

Floodplains form in the lower reaches of the river system. Floodplains are a flat area around a river. This area is covered with water when the river floods. The soil around floodplains is fertile and very good for farming because there is lots of sediment in it. This is one reason why humans have always lived near in these areas.

River deltas are formed where a sediment-filled river meets the sea, ocean or a lake. Sediment is not pushed very far into the lake or river because the river is running slowly and has less power. It is easy to see which water has sediment and which does not. Often, just before the delta, the river splits into smaller rivers (like in the photo of the Amazon on the left).

2. Use the information in the map below to answer the following questions in groups.



- a. The map relates to **mangrove** forests. What do you think the map is showing?
- b. What is a suitable title for the map?
- c. From what you have learned in this unit, can you give reasons why mangrove forests may only grow in these places?

# UNIT 3: FRESH WATER -



## FOCUS ON MYANMAR

### INLE LAKE, SHAN STATE

Myanmar's most famous lake



An Intha man fishing on Inle Lake.

Inle Lake is a lake located in the Nyaungshwe Township of Taunggyi District of Shan State. It is the second largest lake in Myanmar (after Indawgyi Lake in Kachin State) with an estimated surface area of 44.9 square miles (116 km<sup>2</sup>), and one of the highest at an elevation of 2,900 feet (880 m). During the dry season, the average water depth is 7 feet (2.1 m), with the deepest point being 12 feet (3.7 m), but during the rainy season this can increase by 5 feet (1.5 m).

Although the lake is not large, it contains a number of important species. Over twenty species of snails and nine species of fish are found only at Inle. In November, December and January of each year, 20,000 brown and black head seagulls migrate to the lake.

Inle Lake is facing problems because of increased population and increases in **agriculture** and tourism. Between 1935 and 2000, the open water area of Inle Lake decreased by 32.4%. The water hyacinth also creates a major problem. It grows rapidly, filling up the smaller streams and large areas of the lake, taking nutrients and sunlight from other organisms. Over the past twenty years, pumps have been used to help control the growth of this plant. Public awareness education and small-scale control have also been successful.

There were very high temperatures in 2010, which caused the water level of the lake to drop too low, and drinking water had to be brought to the area. Additionally, the floating market was in danger of disappearing. One other serious consequence was that the **hydroelectric plant** at Lawpita, where the former capital Yangon received its power supply from, could not operate it properly.

1. Is Inle Lake bigger or smaller than Indawgyi Lake?
2. What is its height above sea level?
3. How high can the water level rise to in rainy season?
4. What is important about some of the wildlife at Inle Lake?
5. What organism is causing a problem and why?
6. What three problems do humans cause at Inle Lake?
7. What problem is talked about as a result of high temperatures, and what are the consequences?
8. What specific problems might there be at Inle Lake in the future because of the three human-related causes?

# ADDITIONAL ACTIVITIES



## FOCUS ON MYANMAR | SKILLS WORK

### THE AYEYARWADDY RIVER

Myanmar's main waterway

The Ayeyarwaddy (or Irrawaddy) River is the largest and most important river in Myanmar. It flows from north to south for 1,348 mi (2,170 km). Its source is in Kachin State, where the N'mai and Mali rivers meet. The source of those rivers is the Himalaya glaciers of Northern Myanmar (at about latitude 28°N). From here the Ayeyarwaddy flows south, through the dry zone. It meets the Chindwin River to the south of Mandalay.

The Ayeyarwaddy Delta begins about 58 miles (93 km) above Hinthada, where it flows into smaller streams. Finally, thousands of miles from its source, the Ayeyarwaddy River drains into the Andaman Sea. The brown sediment from the Ayeyarwaddy can be clearly seen from space.

The Ayeyarwaddy River is important for many reasons. Firstly because many people in Myanmar are farmers, and they need the water to grow rice and other crops, especially in the Dry Zone (see Unit 5) and the delta region. Second, it is important because there are many important species of animal which live there, such as the Ayeyarwaddy dolphin. Finally, it is important for trade and travel. Rice, teak, cotton and other goods are transported up and down the river. In some parts of Myanmar there are no railways, so river transport is the main way of traveling from place to place.



1. Answer the questions.
  - a. Is the source of the Ayeyarwaddy in the north, south, east or west of Myanmar?
  - b. Which rivers meet to form the Ayeyarwaddy?
  - c. What is the source of those rivers?
  - d. Who is the Ayeyarwaddy River important to, and why?
2. Choose one of Myanmar's major rivers – the Chindwin, Kaladan, Salween (Thanlwin), Yangon River or Patheingyi River, for example.
3. Find information about the following:
  - How long is the river?
  - Where does it flow?
  - How do people rely on this river?
4. What are some of the animals that live in this river's ecosystem?
5. How is this river connected to other rivers?
6. What environmental challenges is this river facing?
4. Make a poster presenting what you have learned about your river. Some useful websites are:
  - The Arakan Rivers Network: [www.arakanrivers.net](http://www.arakanrivers.net)
  - The Burma Rivers Network: [www.burmariversnetwork.org](http://www.burmariversnetwork.org)
  - Karen Environmental and Social Action Network (KESAN): [www.kesan.asia](http://www.kesan.asia)
  - Salween Watch: [www.salweenwatch.org](http://www.salweenwatch.org)



■ Grjotagja Cave, Iceland, was famous for bathing until tectonic activity made the water too hot for bathing.

# Unit 4 Caves

## Key Words

**acid (n)** – အက်ဆစ်

**bacteria (n)** – ဗက်တီးရီးယားများ၊ ပိုးမွှားများ

**bioluminescence (n)** – သက်ရှိသတ္တဝါများ ကိုယ်ပေါ်မှ အလင်းထုတ်ခြင်း (ဥပမာ - ပိုးစုန်းကြွေး)

**chemical reaction (n)** – ဓာတု ဓာတ်ပြုခြင်း

**common ancestor (n)** – မျိုးဆက် တူညီမှု ရှိခြင်း

**consumer (n)** – စားသုံးသူ

**cooperation (n)** – မျိုးစိတ်များ အတူတကွ ပူးပေါင်း နေထိုင်ခြင်း

**corrosive (adj)** – ပွန်းပဲ့တိုက်စား ပျက်စီး ယိုယွင်းစေသော အရာ

**crystal (n)** – သလင်းကျောက်

**droplets (n)** – (အရည်) အစက်ကလေး

**echolocation (n)** – ရေအောက်တွင် ရှိသော အရာထူ၏ အကွာအဝေးကို ၎င်း၏ ပဲ့တင်သံကြွေချိန်ဖြင့် တိုင်းတာခြင်း

**evolution (n)** – ဆင့်ကဲတိုးတက်ပြောင်းလဲခြင်းဖြစ်စဉ်

**food chain (n)** – အစာ ကွင်းဆက်

**fossil (n)** – ကျောက်ဖြစ်ရုပ်ကြွင်း

**hydrogen sulfide (n)** – ဟိုက်ဒရိုဂျင်ဓာတ်၊ ဟိုက်ဒရိုဂျင် ဆာလဖိုင်

**isolation (n)** – သီးသန့်ဖြစ်ခြင်း၊ ကိုယ်ထီးတည်း ဖြစ်ခြင်း

**limestone (n)** – ထုံးကျောက်

**lure (n)** – သားကောင်များကို သွေးဆောင်ဖြားယောင်းသောအရာ

**mucus (n)** – ချွဲ၊ သလိပ်၊ နှပ်၊ နှာရည်

**producer (n)** – အစာထုတ်လုပ်သူ

**sedimentary [rock] (adj)** – အနည်ကျသော၊ နှန်း (ကျောက်)

**sense (v)** – အာရုံခံသည်

**speciation (n)** – တိရစ္ဆာန်မျိုးစိတ်များ နေရာဒေသ ကွဲပြားမှုအရ ဆင့်ကဲ တိုးတက် ပြောင်းလဲခြင်း

**stalactite (n)** – ကျောက်စက်ပန်းဆွဲ

**stalagmite (n)** – ကျောက်စက်မိုးမျှော်

**theory of evolution, the (n)** – ဆင့်ကဲ တိုးတက် ပြောင်းလဲခြင်း သီအိုရီ

# 4.1 Caves, the Final Frontier (00:00 – 07:28)

## A Before you watch

1. **Discuss** and answer the questions.
  - a. What kinds of animals live in caves?
  - b. What do you think makes life in caves difficult for animals?
  - c. What do animals need to survive in the caves? (E.g.: the special skills, adaptations, etc)
2. Read the text. Were your answers to **A1** right?

### The Cave Environment

Living in caves means living without sunlight, so animals have adapted to this lightless environment. A glowworm is an insect. It makes **bioluminescence**, a “chemical light” to attract its prey. Bats and cave swiftlets (a type of bird) find their way by using sound not sight.

Other animals have adapted in different ways. Snakes in Borneo catch bats in the dark by **sensing** the heat from their bodies. Blind Salamanders can feel small movements in the water which helps them hunt. **Bacteria** use **hydrogen sulfide** gas, which comes from inside the Earth, for their energy.

3. Match these verbs with their synonyms.
 

a. trap	1. catch
b. produce	2. eat
c. draw	3. attract
d. consume	4. make

## B As you watch

1. How deep is the shaft of the Cave of Swallows, in Mexico?
2. What animal creates the “galaxy” of little lights in the cave in New Zealand?
3. What is the purpose of the glow worm’s thread?
4. What big challenge do cave animals face?

## C After you watch

1. Complete the text about cave glow worms' adaptations using verbs from **A3**.

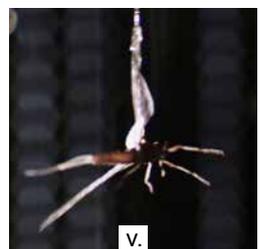
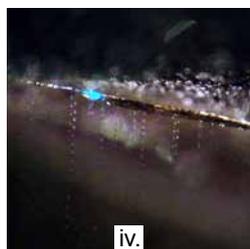
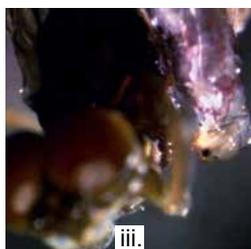
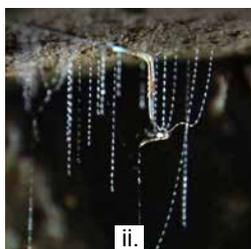
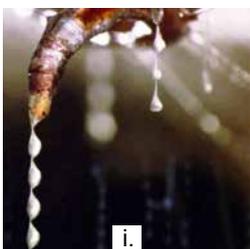
### Glow Worms: Luring Their Prey

"This is a cave glow worm. To \_\_\_\_\_<sup>a</sup> its prey, it goes fishing with a line of silk. The silk comes from glands in the glow worm’s mouth and is covered with **droplets** of **mucus**. Each glow worm \_\_\_\_\_<sup>b</sup> lots of these lines. After it sets its lines, the glow worm waits, like a fisherman.

"But the glow worm doesn’t leave everything to chance. The blue light is a **chemical reaction** happening in its tail. It is a **lure**, to attract prey. The insects are \_\_\_\_\_<sup>c</sup> to the lights and they get trapped in the sticky lines. Now, the glow worm pulls up the line and slowly \_\_\_\_\_<sup>d</sup> the insect, alive."

2. Order the pictures according to the text and the video.
 

a. i   b.   c.   d.   e.



## 4.2 Looking into Limestone (07:28- 11:20)

### A Before you watch

- 1. Discuss:** How do you think caves are made? What forces on Earth are powerful enough to make them?
- 2. Discuss** and choose the correct sentences.
  - i. Limestone is stone made from fruit.
  - ii. Limestone is made from the bodies of marine animals.
  - i. Limestone was formed underwater.
  - ii. Limestone was formed in volcanoes.
  - i. Limestone caves are created by wind.
  - ii. Limestone caves are created by water.

### B As you watch

- 1.** How much of the world's surface is covered in limestone?
- 2.** What is limestone made from?
- 3.** What does this tell you about the link between areas of limestone and the sea?
- 4.** What shaped the limestone pillars in Borneo?
- 5.** What substance in the water "eats away" at limestone to form caves?

### C After you watch

- 1.** Read the text about limestone and check your answers to **A2**.
- 2.** Match the headings to the paragraphs.
  - a. What Limestone Is Made From
  - b. What Limestone Tells Us about Our Planet
  - c. What We Can Find inside Limestone
  - d. What Kind of Rock Limestone Is
- 3.** Match the pictures to the paragraphs.

### A Lesson in Limestone

- 1. Limestone** is a **sedimentary** rock. Sedimentary rocks are formed over a long time from the sediment at the bottom of seas or rivers.
- 2.** Most limestone contains the bodies of marine animals with shells. When they die, their shells and bones break down into the sediment. Pressure from the water and layers of sediment above pushes down. This makes the layers underneath hard. Finally, after millions of years, it becomes stone.
- 3.** Limestone is important for science because it often has fossils inside it. **Fossils** are the bodies of animals from millions of years ago. When they die, they fall into the sediment. Over a long time, their bodies become hard and turn to stone. When scientists find fossils, they can learn more about Earth's ancient animals.
- 4.** Limestone is also interesting because it shows us how much the Earth changes over time. Limestone is created underwater, over millions of years. Today's highest mountains were under the sea millions of years ago. People have even found fossils of ancient sea animals at the top of high mountains in the Himalayas.



# 4.3 Food Chains (11:20 – 21:25)

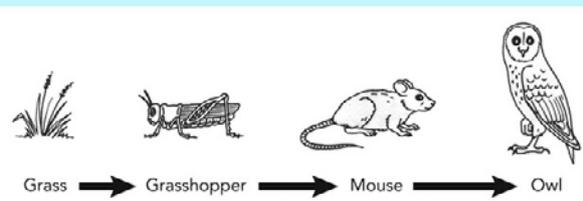
## A Before you watch

1. **Discuss:** What do you think a food chain is?
2. Read the text. Were you right?

**Food Chains**

A **food chain** is a group of organisms in an ecosystem which depend on each other for food. At the bottom of the food chain are **producers**. These are usually plants. They take energy from sunlight. Above them, the animals are called **consumers**. They all take their energy from the producers (plants) or from each other (meat).

Below is an example of a food chain: Grass grows on the ground. It takes energy from sunlight. Small grasshoppers then eat the grass. Mice will eat the grasshoppers, and owls will eat the mice.



```

    graph LR
      Grass --> Grasshopper
      Grasshopper --> Mouse
      Mouse --> Owl
  
```

## B As you watch

1. What is “guano”?
2. What is the cave’s food chain based on?
3. Complete the table.

Animal	Dependant on other animals? Which? How?
a. cockroaches	
b. centipedes	
c. crabs	
d. bats	
e. falcons/bat hawks	

3. In cave ecosystems, there are also food chains, but they are different. **Discuss:**
  - a. Why are they different?
  - b. What animals might be in a cave food chain?

## C After you watch

1. Draw a simple cave food chain using the information above and from the video.



Beginning of the food chain: wild plants and flowers growing at Portscatho, Cornwall, England

# 4.4 Growth and Evolution (21:25 – 39:03)

## A Before you watch

1. Read the text and answer the questions.
  - a. How is adaptation different to speciation?
  - b. Is the example of insect-eating bats and fruit-eating bats an example of adaptation, cooperation or speciation?
  - c. Is the example of echolocation an example of adaptation, cooperation or speciation?
  - d. Is the example of vampire bats feeding each other an example of adaptation, cooperation or speciation?

## B As you watch

1. Which picture represents a **stalactite**, which represents a **stalagmite**?



2. What are stalactites and stalagmites made of?
3. What is this and why is it important for cave diving?



4. What unusual water feature of caves does this picture represent?



5. What causes the feature above?
6. What predator's adaptation does this picture represent in the video?



## C After you watch

1. What has affected the evolution of the species of the troglobites at the end of the video?
2. The predators in the video have evolved to hunt for their prey in the darkness of caves. Match the adaptation to the animal.
 

a. the bats	1. heat
b. the snakes	2. sound
c. the salamanders	3. movement

### Evolutionary Theory

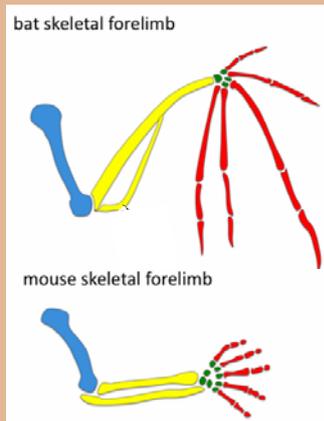
The **theory of evolution** comes from an idea by scientist Charles Darwin (1809-1882). **Evolution** is change over long periods of time. Three important types of changes are:

- **adaptation** – animals' behaviour or bodies changing over time to suit their habitat.
- **speciation** – new species of plants or animals from old ones. They keep adapting until they are no longer the same kind of animal. This often happens when groups of animals in a species breed in **isolation** from other groups.
- **cooperation** – organisms evolving together and benefiting from each other.

### Examples of Evolution in Bats

Scientists have recently been studying bat and mouse evolution. The bones of bats (below) are very similar to mouse bones. This shows that bats and mice evolved from a **common ancestor** millions of years ago. Some bats species have evolved **echolocation** – they can “see” using sound. Other bat species eat fruit and do not need echolocation to hunt insects.

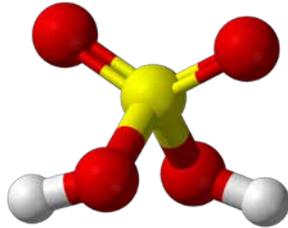
Finally, vampire bats need to feed often, and will die within two days without food. They have evolved to feed each other if one bat has not found food. These and many more examples show us how organisms evolve to survive.



# 4.5 Danger in Caves (39:03 – End)

## A Before you watch

1. **Discuss:** Look at these pictures. Can you guess what the “danger” in these caves might be?



2. **Discuss:** Read the text about this dangerous substance. Can you guess what it might be?

It is a strong, **corrosive acid**.  
It is colourless or a white-yellow colour.  
It is used in strong cleaning liquids.  
It can form naturally but humans also make it by mixing chemicals.  
It is very dangerous to humans and can burn skin and make people blind.

## B As you watch

1. What is the dangerous substance found in the water of the Villa Luz cave?
2. Where does the acid in these caves come from?
3. What kind of animals can live in the water in this cave?
4. What are the “snotites”?
5. What is the snotites’ “important role” in the cave?
6. How many miles of Lechuguilla have scientists mapped?
7. How was Lechuguilla cave formed?
8. How were the beautiful **crystals** in Lechuguilla formed?

## C After you watch

1. Label the images according to the video.
  - a. Extremophile bacteria, feeding on the rock
  - b. The only water in the cave is in still, clear pools
  - c. Walls covered with delicate, fragile crystals
  - d. Cones, frosted with crystals



# UNIT 4: CAVES -



## FOCUS ON MYANMAR

### CAVES OF MYANMAR

Myanmar's caves are open to the world once more | Adapted from <http://myanmarcaves.wikidot.com>. Images © Liz Price

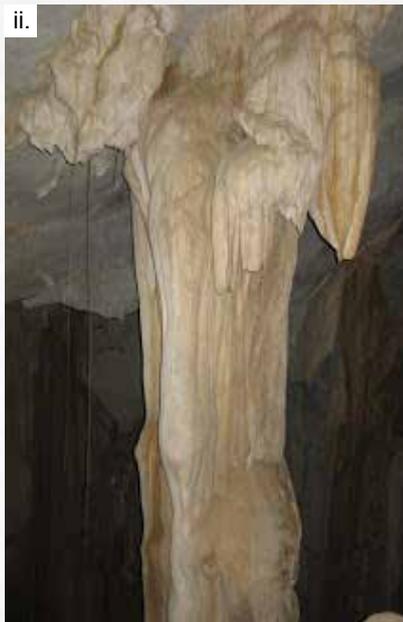
Myanmar is one of the few countries unexplored by modern cavers. In colonial times – at the end of the 19th and early 20th centuries – there were many visitors to Myanmar's caves. Some were just going on picnics and others were doing scientific studies. Some of the scientists published their findings. Since then, very little research has been done on the caves, and when General Ne Win took power in 1962, it became more difficult for foreigners to travel to the areas with caves. However it is now getting easier to travel around the country, and cavers are once again interested in exploring Myanmar's caves.

Another problem for explorers has been understanding the information from colonial times. The British used different names and different spellings for caves. Also, most places in Myanmar no longer have their old British names. For example, the town which was called Amherst (in Mon State) by the British is now called Kyaik Khami.

There are several caves in the Hpa-an area, which has limestone mountains all around it. Most of the caves around Hpa-an are temple caves, with Buddhas and other Buddhist art inside them.

Mon State also has caves in its limestone mountains and hills. The most famous are the Farm Caves, which colonial explorers wrote about in the 1920s. The nearby Saddam Cave was also interesting for colonial explorers, mostly because of its stalagmites, its fresh water pools and its bats and other animals.

Shan State has some of the longest and most famous caves in Myanmar. The longest known cave in Myanmar is in the Taunggyi area. Mondowa Guh is 5,807 feet (1,770 m) in length. It is a river cave. At the front is a temple, with Buddhist statues and images, but beyond that it is a wild cave.



Inside Saddam Cave, clockwise from top left:

i. \_\_\_\_\_; ii. \_\_\_\_\_; iii. \_\_\_\_\_

1. When was most research into Myanmar's caves done?
2. Why have there been problems exploring Myanmar caves?
3. What is the connection between Buddhism and caves in Myanmar?
4. Where is the longest cave?
5. What kind of cave is the longest cave? How do you think it was created?
6. What do you think a "wild cave" is?
7. Identify and label the photographs from Saddam Cave (left), based on what you have learned in this unit.

# ADDITIONAL ACTIVITIES

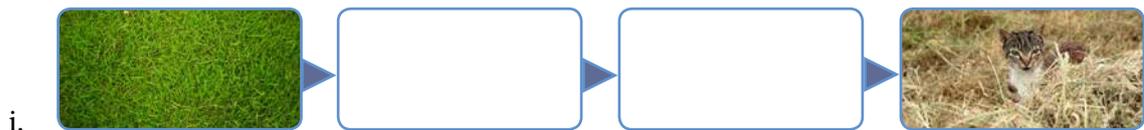


## SKILLS WORK

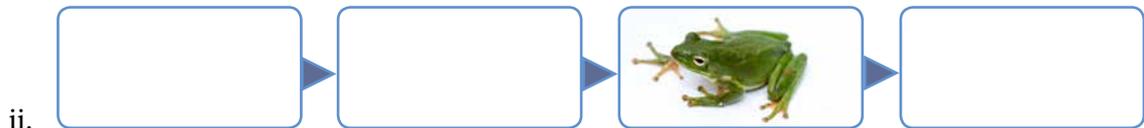
1. Using the picture below as your example, explain in your own words what a food chain is.



2. Complete the food chains below by writing and/or drawing the consumers and producers you think are missing. Then explain the environment in which you might find this food chain.



- a. What type of ecosystem could this be in? \_\_\_\_\_  
b. How do you know? \_\_\_\_\_



- a. What type of ecosystem could this be in? \_\_\_\_\_  
b. How do you know? \_\_\_\_\_



- a. What type of ecosystem could this be in? \_\_\_\_\_  
b. How do you know? \_\_\_\_\_

3. Choose one of the food chains above and write a short story explaining how each animal/plant lives, gets its energy, and then provides energy for others.

Find a way to use the following words in your story:

nutrients produce environment attract consume adapt



■ A single thorn tree, growing in the Namib Desert, Namibia.

# Unit 5 Deserts

## Key words

**antennae (n)** – အင်းဆက်ပိုးမွှားများတွင်ရှိသော အာရုံခံ အစိတ်အပိုင်း

**desert (n)** – သဲကန္တာရ

**dew (n)** – နှင်းစက် နှင်းပေါက်

**drought (n)** – မိုးခေါင်သည်

**exoskeleton (n)** – အခွံ၊ ကြေးခွံ (ကျောရိုးမဲ့ သတ္တဝါများ၏ ခန္ဓာကိုယ်ကို အကာအကွယ်ပေးသော အရာ)

**flash flood (n)** – ရုတ်တရက် ရေလွှမ်းမိုးခြင်း

**food insecurity (n)** – အာဟာရဖြစ်စေသော အစားအစာများကို လုံလောက်စွာ ရရှိနိုင်သော အခွင့်အလမ်း မရှိခြင်း

**irrigation (n)** – ဆည်မြောင်း

**invertebrate (n)** – ကြောရိုးမဲ့ သတ္တဝါ

**plague (n)** – ပုလိပ်ရောဂါ

**rain shadow / rainshadow (n)** – မိုးကွယ်ရာ ဒေသ (တောင်တန်းများ ကာရံထားမှုကြောင့် မိုးများ မရောက်နိုင်သော နေရာဒေသ)

**rainfall (n)** – မိုးရေချိန်

**rainstorm (n)** – မိုးသက်မုန်တိုင်း

**river bed (n)** – မြစ်၊ ချောင်းများအတွင်း ရေစီးဆင်းသည့် နေရာ

**root (n)** – အမြစ်

**sand dune (n)** – သဲတောင်ပူစာ၊ သဲခုံ

**swarm (n)** – ပျံသန်းနိုင်သော ပိုးကောင်များ

**territory (n)** – ပိုင်နက်၊ ကျက်စားရာ နေရာ

**warm-blooded (adj)** – သွေးနွေးသော (သွေးနွေးသတ္တဝါ)

# 5.1 Rainshadow Deserts (00:00 – 6:00)

## A Before you watch

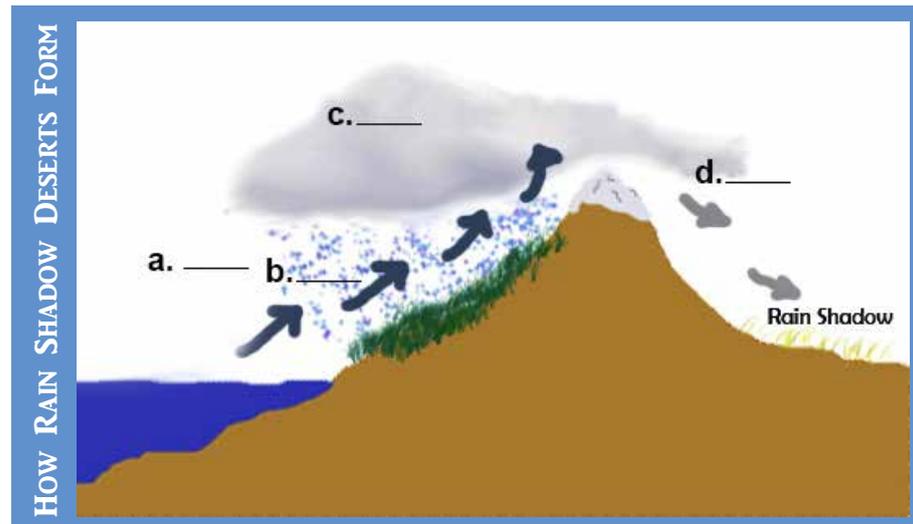
- Discuss:** What do you know about deserts?
- Find the Gobi Desert on the map on pages 136 and 137. In which countries is it?

## B As you watch

- How much of the Earth's land is desert?
- Which deserts do not have any life in them?
- What surprising weather is there in the Gobi Desert?
- What are the highest and lowest temperatures in the Gobi Desert?
- What is the Bactrian camels biggest problem?
- How do they solve that problem?
- When do Bactrian camels breed?

## C After you watch

- The Gobi Desert is a **rainshadow** desert. Label the diagram which shows how rainshadow deserts form.
  - clouds forced upwards and rain falls on the mountains
  - hardly any moisture remains when the wind gets over the mountains.
  - clouds form over the sea
  - wind blows clouds into the mountains



## ANIMAL CLASS: A GUIDE TO ANIMAL CLASSIFICATIONS

### 2. MAMMALS

There are more than 4,000 different species of mammals. The smallest is the hog-nosed bat. It weighs 0.07 ounces (2 grams) and the largest is the blue whale, which weighs 132 tons (120 tonnes). Some live on land and some live in water, but all mammals share some common characteristics.

#### All mammals:

- are vertebrates (have a backbone).
- are “**warm-blooded**” (create their own body heat).
- give birth to live babies.
- feed milk to their young.

#### Most mammals:

- have hair or fur on their bodies.

■ Camels are mammals which have adapted to living in the desert.

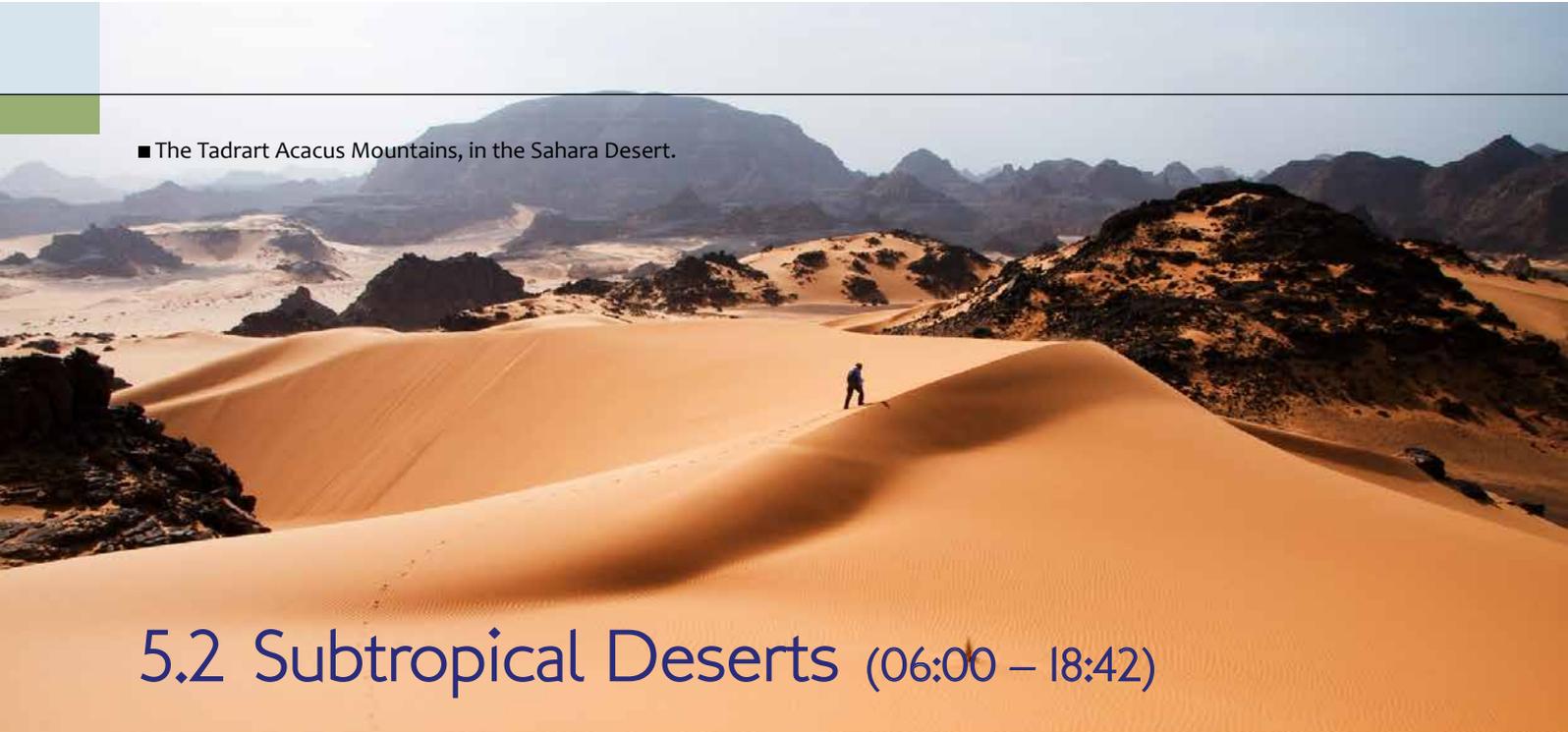


### IS IT A MAMMAL?

Are the following animals mammals? Why?

- a bumble bee
- a monkey
- a whale
- a human





## 5.2 Subtropical Deserts (06:00 – 18:42)

### A Before you watch

1. **Discuss** and answer the questions.
  - a. What does the map below show?
  - b. What does the map below show us about where deserts are?
  - c. What is a subtropical desert?

### B As you watch

1. How are the camels in the Sahara different from the Gobi camels?
2. What two things together “shape all deserts”?
3. What is special about the **sand dunes** in Namibia?
4. How much does the temperature rise every hour during the day in Australia?
5. How do kangaroos keep cool?
6. How do Fennec foxes keep cool?

### C After you watch

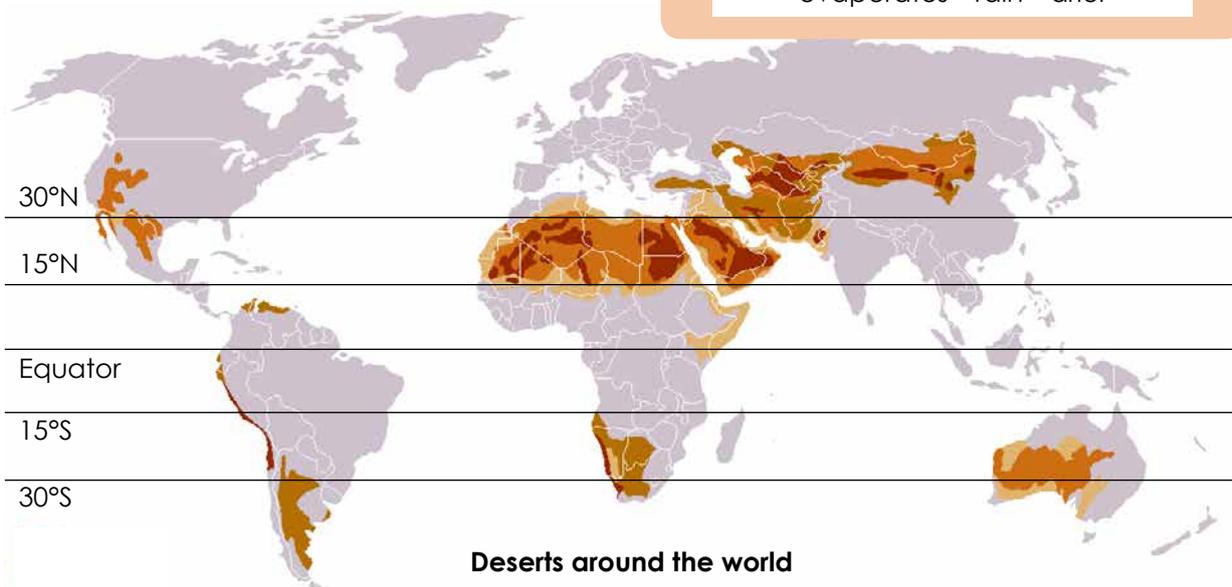
1. Complete the text using the words in the box.

#### How Subtropical Deserts Form

The formation of subtropical deserts is linked to the \_\_\_\_\_<sup>a</sup>. Because the sun's rays hit the equator \_\_\_\_\_<sup>b</sup>, it is much hotter than other places. The hot, \_\_\_\_\_<sup>c</sup> air at the equator rises and clouds form. Winds blow the clouds north and south, and rain falls between the equator and 15°N and 15°S.

Because of this, the areas between 15 – 30°N and 15 – 30°S get very little \_\_\_\_\_<sup>d</sup>, but they get lots of \_\_\_\_\_<sup>e</sup> and warm air. The warm air \_\_\_\_\_<sup>f</sup> water from the ground. This makes the dry desert even \_\_\_\_\_<sup>g</sup>.

moist directly sunlight weather  
evaporates rain drier



# 5.3 The Atacama and Sonora Deserts

(18:42 – 32:35)

## A Before you watch

1. The Atacama desert is located at 30°S in South America. Find it on the map on pages 128 and 129.
2. The Sonora is at 30°N in North America. It is east of the Gulf of California. Find the area on the map on pages 126 and 127 (It is not labeled).

## B As you watch

1. What animal does the video compare the guanacos with?
2. How do the guanacos get their water?
3. In the Sonora desert, what season is the monsoon?
4. What animal lives in the saguaro cacti?
5. Where are the bats migrating from and to?
6. Why is the saguaro cactus important to other animals in the Sonora Desert?
7. What has shaped the land in Utah? How?

## C After you watch

1. Below are explanations of how the two types of cactus in the video get their water. Label them correctly: *Atacama cactus* or *Saguaro*.

a. \_\_\_\_\_

When the summer monsoon rains come, the cacti drink as much as they can. After a **rainstorm**, their long, shallow **roots** suck up the water. When full, the cactus can store up to five tons of water, enough for it to survive many months of **drought**.

b. \_\_\_\_\_

There is a cold sea current that runs parallel to the land. The cold water cools the moist, warm air above it and that produces fog. The wind blowing onto the shore brings the fog inland. The fog condenses on the cacti and becomes **dew**. This dew provides the only source of water.

2. Read the text then answer the questions.

- a. What mammals were competing in the video?
- b. What were they competing for?
- c. How did they compete?
- d. What might happen to a loser in one of these fights?
- e. What benefits did the winner get?
- f. How might this competition be useful for the survival of the species?
- g. Can you think of other species which compete in this way or a similar way?

## Competition in Evolution (Survival of the Fittest)

In 4.4 you looked at evolutionary theory. You saw *adaptation*, *speciation* and *cooperation* in and between animal species. However, evolutionary theory also talks about competition in and between species.

Competition is when animals compete (fight) for some kind of resource. This competition is sometimes called "natural selection" or "survival of the fittest". This means that only the strongest and fittest animals or plants will live and breed; the others will die or be killed.

Most competition is for food and water, sunlight, **territory** or mates. During competition for mates, males of the same species will fight each other until one is the winner. The female will choose or be chosen by the male and they will then mate.

■ Ants will compete for the same resources and territory, even ants of the same species.



# 5.4 Surviving in the Desert (32:51 – 46:10)

## A Before you watch

1. Read the text and answer the questions.
  - a. What animal does the flat lizard prey on?
  - b. Which animal preys on the flat lizard?
  - c. Why is it safer to be a female flat lizard?
  - d. What is the reason for the males' colours?

### Augrabies Flat Lizards

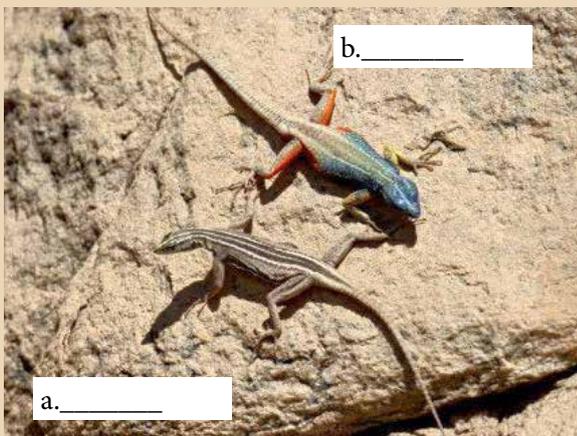
Augrabies flat lizards live in South Africa. They are called flat lizards because of their strange, flat bodies. The male and the female look a little different to each other. The males are very colourful. They have a blue head and a green back. Their front legs are yellow and their back legs are orange. Females are less colourful; they are a grey brown colour all over their bodies.

#### Predators and Prey

The flat lizard is both a predator and a prey animal. Its diet is mostly blackfly, tiny flies which live around rivers. However, because of its bright colours, the male is easy to see and they are often eaten by kestrels, which are large birds of prey. Female flat lizards, because of their darker colours, are harder to see, so are not eaten as often.

#### Why the Bright Colours?

The males probably have very bright colours to attract females. Like other species, male flat lizards compete for females. Scientists think that the males with the best and brightest colours are the most attractive to the females.



Augrabies Flat Lizards

2. Label the picture of the flat lizards correctly.

## B As you watch

1. What is the "secret" of the river?
2. How do the lizards catch their prey?
3. How far do elephants walk in a day to find food? Why?
4. How do the onyx stop the lions attacking them?
5. What do elephants prefer to eat?
6. Where did the water in the river come from?
7. How often do the elephants usually drink?
8. How did the flood help the lion family?

## C After you watch

1. Read the text and mark the statements true or false. If false, explain why.
  - a. Flash floods get their name from the flashes of lightning which happen during floods.
  - b. They happen in less than six hours.
  - c. Melting snow can cause a flash flood.
  - d. They are dangerous because they are often more powerful than people think.

### Flash Floods

A **flash flood** is called that because it can happen "in a flash" (quickly). Usually, they happen in less than six hours. They can happen for many reasons, such as heavy rain, a large storm or snow melting. All flash floods can be dangerous, but in the desert they can be even more deadly.

Flash floods deliver a very large amount of water in a very short time. Roads often cross dry **river beds** and people who are traveling – on foot or in cars – try to cross them, but do not realise the strength of the water. Another danger is that the water comes very quickly, so people can be caught in a flood before they realise.

In the USA, government figures show that more people die in floods each year (127, on average) than by lightning (73), tornadoes (65) or cyclones (16).

# 5.5 Locusts (46:10 – End)

## A Before you watch

1. **Discuss** and answer the questions.
  - a. What kind of animal is a locust?
  - b. What do they eat?
  - c. What else do you know about them?

## B As you watch

1. How long can desert locust eggs be unhatched for?
2. What is a hopper?
3. How much food does a full-grown locust eat each day?
4. Why do the locusts need to keep moving?

## C After you watch

1. Put these in order of size, according to the video: **plague, group, swarm.**
2. Complete the text with the words in C1.
3. According to the text, what problems can locusts cause for people?
4. Find Madagascar on the map on pages 130 and 131.

## Flight of the Locusts

Locusts are migratory insects. They travel in \_\_\_\_\_<sup>a</sup> -, sometimes called bands. Because the locusts eat so much, they have to keep flying to find food. When these flying bands meet up, they form larger groups, called \_\_\_\_\_<sup>b</sup>. When these join together, they form \_\_\_\_\_<sup>c</sup>. These can be more than 40 miles wide and contain over 1 billion locusts. They eat everything in front of them and can destroy whole farms.

Madagascar, an island off Southeast Africa has had big locust problems since 2012. Each year, large numbers of locusts come back and eat farmer's crops. In 2013, the country couldn't grow enough rice because of locusts.



## ANIMAL CLASS: A GUIDE TO ANIMAL CLASSIFICATIONS

### 3. INSECTS

Insects are divided into two main groups: those with wings and those without. There are nearly one million species of insects, and more are discovered each year.

#### All insects:

- are **invertebrates** (do not have a backbone).
- have a hard **exoskeleton** on the outside of the body.
- are divided into three parts: the head, the thorax (the middle section), and the abdomen (the back end).
- have two **antennae** and six legs.
- hatch from eggs.

#### Some insects:

- have wings.

■ Locusts are flying insects. They are similar to grasshoppers.



### IS IT AN INSECT?

Are the following animals insects? Why?

- a. a spider
- b. a butterfly
- c. a fish
- d. a snow leopard



# UNIT 5: DESERTS -



## FOCUS ON MYANMAR | SKILLS WORK

### MYANMAR'S DRY ZONE

So dry that it is nearly a desert | Information from: <http://www.irinnews.org/report/99919/hunger-in-myanmar-s-dry-zone>



A woman trying to collect water in the Dry Zone.

A quarter of Myanmar's population live in Myanmar's *Dry Zone*. 60% of those are farmers, who depend on the land to eat and to make money. Many face problems with access to food and water.

The area is dry because it is in the rain shadow of the Chin Hills. It has the lowest average annual **rainfall** in Myanmar. In some parts of the Dry Zone, the average rainfall is fewer than 4 inches (100 mm) of rain. The average rainfall in most other parts of Myanmar is 8 - 24 in. (200 - 600 mm).

One of the major issues facing the Dry Zone is food insecurity – people are without reliable access to a enough affordable, nutritious food. A 2014 survey showed that 18.5 percent of dry zone households face **food insecurity**. One local woman, 30-year-old Kyi Htay, from Bagan, Mandalay Region said “Getting food is a headache for us every day”.

Unfortunately, the problem will probably become worse in the future. Farmers' harvests have been poorer in recent years and water shortages are a problem. There are an increasing number of droughts because of the lack of rain and poor **irrigation**.

Improving food security in the Dry Zone area requires several solutions. These include planting new trees, more money for modern farming methods and help for farmers to improve the soil so they can grow more. Until these things happen, many people will face difficulties in Myanmar's driest place.

1. Answer the questions.
  - a. What causes Myanmar's Dry Zone area to be dry?
  - b. Why might the problem of food insecurity get worse in the future?
2. Make two lists of short and long-term solutions to improve the life of farmers there.
3. From the map, choose a region of Myanmar, e.g.: Northeastern Myanmar (Kachin and Shan States) or Myanmar's Eastern Coast (Tanintharyi Region and Mon State): Calculate its average rainfall for the following months: *May, August, November*, as in the example below:

#### Finding Averages

To find the average of several things, add them together, and divide by the number of things.

July's Rainfall in Northeastern Myanmar:

900 mm (Putao)  
+ 450 mm (Myitkyina)  
+ 200 mm (Kengtung)

---

1550 mm (Total)

1550 mm / 3 cities = about 517 mm.  
The average rainfall for Northeastern Myanmar in July is 517 mm.

4. Put your data about average regional rainfall into a bar graph below. Be sure to:
  - label your axes.
  - title your graph.
  - draw clear bars.
  - space the units of measurement evenly.
5. Present your results to the class.

# ADDITIONAL ACTIVITIES

RAINFALL • မိုးရေချိန်

Annual Average • တစ်နှစ်ပတ်လုံးလျှမ်းမျှ

