



Food webs and energy chains

Time needed for activity 30 mins for each activity

Location Indoors or outdoors. The activities are split into those which could be completed at your setting or on a sand dune system

Context

These activities and games are aimed at increasing learners' knowledge and understanding of sand dune food chains, energy transfer and relationships within the sand dune ecosystem.

Natural Resources Wales' purpose is to pursue sustainable management of natural resources in all of its work. This means looking after air, land, water, wildlife, plants, and soil to improve Wales' well-being, and provide a better future for everyone.

Curriculum for Wales

Science and Technology

- **What matters** - Being curious and searching for answers is essential to understanding phenomena.

- **What matters** - The world around us is full of living things which depend on each other for survival.

Maths and Numeracy

- **What matters** - The number system is used to represent and compare relationships between numbers and quantities.

Expressive Arts

- **What matters** - Creating combines skills and knowledge, drawing on the senses, inspiration, and imagination.

Objectives

- Learners will be able to understand the relationships between living things.
- Learners will be able to explain a simple sand dune food chain or food web.
- Learners will be able to write a scientific observation.
- Learners will gain a basic understanding of how energy is transferred along food chains from one stage to the next.

Please note: Ideally, these games and activities work best to consolidate learning following on from our **Activity plan - Characteristics of life and classification**.

What to do

Activity 1 - Introducing sand dune food chains

This activity sets the scene for the other activities and games and gives learners the opportunity to discuss and get to grips with the new technical vocabulary.

What to do

1. Explain to your learners that they are going to find out about how living organisms obtain nutrients and obtain energy to live.
2. Ask your learners to describe what a food chain is? A **food chain** is a sequence which describes who eats whom in the wild and shows the order in which living things depend on each other for energy. Discuss their answers in more detail.



3. Can your learners explain where all food chains begin? Explain that all food chains begin with the sun which passes energy onto plants. Can they identify or describe any other components of a food chain?
- Start by asking learners to write down or call out as many plants as they can, try to encourage a range from the largest tree to the smallest but equally important algae, lichen, moss, or liverwort.
 - Plants take up water and minerals from the ground, convert light energy from the sun into chemical energy and their leaves absorb a gas called carbon dioxide (CO₂) from the air. Plants convert these ingredients into food through the process of photosynthesis. Because plants produce or make their own food with some help from the sun, plants are known as primary producers and can also be described in this context as 'sun munchers'.
 - Animals, which eat only plants are called herbivores, 'plant munchers' or primary consumers. Examples include cow, sheep, pony, rabbit, mouse, beetle, and caterpillar.
 - These animals in turn will be eaten by animals which eat other animals - these are known as carnivores, secondary consumers or 'animal munchers'. Examples include lion, polar bear, eagle, spider, shark, Venus fly trap and owl.
 - In some chains there is even a tertiary consumer or top consumer which eats primary and secondary consumers as their main source of food. Tertiary consumers can be carnivores or omnivores. Their diet can comprise only meat or include plants as well. Examples include lion, seals, and shark.
 - Some animals eat both meat and plants. They are called omnivores or 'plant and animal munchers'. Examples include pigs, dogs, hedgehogs, squirrel, crabs, robin, and duck.
 - Decomposers such as bacteria and fungi are organisms that break down dead plants or animals into substances that provide nutrients for primary producers.

Some species are classified as primary, secondary, or tertiary consumers depending on the environmental conditions they are living in. Examples include lion and shark. You may want to not raise this with younger learners at this point as it may confuse them.

To help learners understand the concept of food chains, it might be useful to show your learners this BBC Bitesize **animation** and this 7minute BBC Teaching **film** discusses animal food chains and food webs. For a GCSE level understanding of trophic levels then **read all about levels of organisation**.

Activity 2 - Who goes where game?

This activity can be completed:

- against the clock - how many cards can each group correctly sort in two minutes?
- as a speed challenge - which group will correctly complete the challenge in the quickest time

Equipment and resources

- **Resource cards (set A) - Sand dune super species** (40 cards in total)
- Food chain labels (decomposer, primary producers, primary consumers, secondary consumers, tertiary/top consumers)
- Chalk or 5 hula hoops per group

What to do

1. Split your learners into small groups (3-4) and give each group a set of the photo component **Resource cards (set A) - Sand dune super species**.
2. Give each group 5 hula hoops or ask your learners to chalk 5 large circles on the ground.
3. Ask them to place a food chain label card in each hoop or circle.
4. Ask your learners to decide if each species is a primary producer, primary consumer, secondary consumer, tertiary consumer, or decomposer and place their resource cards into the appropriate hoop or circle.



- Match up the two halves of the cards (photo and text) **Resource cards (set A) - Sand dune super species**. There will be some that learners find relatively easy, others which they may need some guidance on. It is a useful exercise in using powers of deduction and doing the ones they can first.
- Run through the cards, did they allocate them successfully?

Super species

Decomposer	Primary producers	Primary consumers Herbivores	Secondary consumers Carnivore Omnivore	Tertiary/Top consumers Carnivore Omnivore
Least puffball	Birds foot trefoil	Small blue butterfly	Dune robber fly	Kestrel
Willow poisonpie	Creeping willow	Grey bush cricket	Dilwyn's dung beetle	Peregrine falcon
Dune inkcap	Early marsh orchid	Vernal mining bee	Chough	Fox
Winter stalkball	Early gentian	Vineyard or striped snail	Dune tiger beetle	
Parasol	Marram grass	Rabbit	Great crested newt	
	Petalwort	Horse	Natterjack toad	
	Prickly saltwort		Slow worm	
	Pyramidal orchid		Sand lizard	
	Sea holly		Ringed plover	
	Sea sandwort		Little tern	
	Shore dock		Meadow pipit	
	Fen orchid		Redshank	
	Sand couch grass			
	Sea stock			



Activity 3 – Food chain components quiz

This quiz activity can be run in the form of ‘it’s a knockout’.

Equipment and resources

Resource cards (set A) - Sand dune super species

What to do

- Place the 5 food chain label cards in different areas of your outdoor setting or sand dune system – not too far apart!
- Ask your learners to stand in the middle.
- Explain that the aim of the game is to guess whether each species is a primary producer, primary consumer, secondary consumer, omnivore, or decomposer. Explain to your learners that each time a species card is shown they should go and stand in the area which best describes the species’ place in a sand dune food chain. For example, if they think the fox is a secondary consumer they should go and stand in the secondary consumer area.
- Those who have guessed right remain in the game, those who haven’t are out and should stand to the side and give encouragement to those left playing.
- Work through the **Resource cards (set A) - Sand dune super species** photo component until you run out of cards, your learners have had enough, or you have a winner!

Activity 4 - Link it Up

Challenge your learners to arrange and sort themselves into a sand dune food chain.

Equipment and resources

- Resource cards (set A) - Sand dune super species
- Clothes pegs

What to do

1. Split your learners into small groups according to what species are in their food chain.
2. Give each learner one or more cards from **Resource cards (set A) - Sand dune super species**. You can differentiate and decide whether they have just the photo or text as well.
3. Ask each group to arrange itself into a food chain, from the main source of energy to the end consumer.
4. Can they arrange themselves into the correct sequence without talking?

Here’s some suggested food chains that could be made from the **Resource cards (set A) - Sand dune super species**.

Sun	Sun	Sun	Sun
Sand couch grass	Birds foot trefoil	Early marsh orchid	Organic matter
Grey bush Cricket	Rabbit	Small blue butterfly	Vineyard or striped snail
Sand lizard	Fox	Ringed plover	Great crested newt
Kestrel		Peregrine falcon	Kestrel
Willow poisonpie	Winter stalkball	Parasol	Least puffball

It is important to point out that not all of the species mentioned here will eat all of the species in the previous level. We have only provided you with 40 cards so you could add other species that live in all habitats not just the sand dune such as a worm. Also introduce organic matter and discuss the role of decomposers. Where would they fit into this chain?



Activity 5 - Drama in the dunes - To eat or not to eat? That is the question.

This activity introduces the story of a sand dune food chain through drama.

Equipment and resources

- Resource cards (set A) - Sand dune super species
- Script - see below
- Pegs
- Mats or something to sit on if the ground is wet

What to do

1. Give every learner a card from **Resources cards (set A) - Sand dune super species** just the photo component, not the written description - and ask them to peg it to the front of their top.
2. Ask them to read what species they are and decide whether they are a producer, primary consumer, secondary consumer, tertiary consumer, or decomposer. If they have any doubt, they can ask a friend or member of staff.
3. Explain that you are going to tell them a story and depending on where they consider themselves to be within the food chain, they need to follow the actions.
4. Follow the script and lead your learners through the activity.
5. Once the "human model" is complete, the group leader can read out the parts of the sand dune food chain with the participants acting out the functions through motion and sound.

Script - Drama in the dunes - To eat or not to eat? That is the question

Role	Script	Action
Narrator	"The sun gives light and warmth and is the source of all energy for life on this planet! Whoever has the 'sun' please come and stand in the middle and take a bow."	
The sun	"I am the sun; I give light and warmth."	Stands in the middle and takes a bow.
Narrator	"Plants take up water and minerals from the ground, convert light energy from the sun into chemical energy and their leaves absorb a gas called carbon dioxide (CO ₂) from the air. Inside the leaves an incredible thing is happening! Plants convert these ingredients into food through the process of photosynthesis. Because plants produce or make their own food with some help from the sun, plants can be called sun munchers or primary producers."	



Role	Script	Action
Producers	Chant “yum yum thank you sun”.	Producers kneel around the sun, facing outwards. They should stretch their arms out and twiddle their fingers towards the sun, enjoying the sun’s rays.
Narrator	“Many animals enjoy eating our delicious green plant producers. They are called primary consumers, the first to consume or eat a living thing. Herbivores, the vegetarian primary consumers of the animal kingdom make yourselves known! As consumers of producers, please come and sit forming a circle around the producers facing outwards.”	
Primary Consumers	Make chewing noises.	Sit forming a circle around the producers facing outwards. Pretending to graze greedily.
Narrator	“There are some that eat their greens but also like some meat in their diet. Step forward the Omnivores!”	
Omnivores	Make sounds as if they are nibbling and shredding their food.	Omnivores form a circle around the primary consumers. Facing inwards, they sit down and pretend to nibble and shred their food.
Narrator	“Next we have the carnivorous secondary consumers who do not like their greens but love meat.”	
Secondary consumers	Growling noises.	Secondary consumers spread themselves around the outside of the food chain and face inwards. Crouching down low, ready to pounce on their prey, they act as a vicious predator and look scary.
Narrator	“We have some living things left, we can’t forget them, they are, the ‘fun guys’. Yes, ladies and gentlemen, put your hands together for fungi and decomposing insects, our exceptionally important decomposers. These ‘fun guys’ consume all of you when you die and with the help of other tiny living things, turn you all into soil”.	



Role	Script	Action
Decomposers	“Chip, chop, break it down, giving nutrients back to the soil”.	Decomposers stand facing inwards in a circle, around the outside of the sand dune food chain. They should take a step to their left, stop and, pretend to break their food down with an imaginary knife and fork and then repeat.
Narrator	“Ladies and gentlemen, has the story ended? What grows in soil I hear you cry? What draws nutrients up through their roots? We are back to our green plants, our producers. So, our story never ends. Ladies and gentlemen this is... (pause for effect) the Cycle of Life!”	

Activity 6 - Sand dunes web of life

This activity explores food chains, interdependence, and energy exchange.

Equipment and resources

- Resource cards (set A) - Sand dune super species
- Ball of string or wool
- Pegs

What to do

1. Give each learner in your group a card from **Resource cards (set A) - Sand dune super species**. Make sure one learner is the sun. Once they have had a look at their card ask them to peg the card to the front of their top so others can see it.
2. Ask your learners to form a circle facing inwards.
3. Give a ball of string to the learner holding the sun card and ask them to wrap the string loosely around their hand before the next step.
4. Ask those with a primary producer (sun muncher) card (picture of a plant) to put their hands up and invite the string holder to choose one of them to throw the ball of string to. Can the ‘sun’ explain its relationship to this primary producer? For example, “I am the sun and I give energy to the...”.
5. Ask the learner now holding the ball of string to wrap it loosely around their hand before throwing it on.
6. Ask those with a primary consumer/herbivore (plant muncher) card to hold up their hands and repeat steps 3 to 4.
7. The next learner can choose to pass the string onto either a secondary consumer/carnivore (an animal muncher) or back to a producer.
8. This continues until ideally everyone is connected, and the string is tangled into a complex web.
9. Discuss a reason why one element in the web may be removed. For example, a storm causes an area of embryo dunes which had some Marram grass growing on it to be washed away. The learner holding this card sits down and gives a little tug to the string. Ask whoever feels the tug to sit down as well.
10. Discuss how damage to one element of the web can affect the whole web of life e.g. the rabbit population dies from an outbreak of Myxomatosis, a highly contagious viral disease in rabbits that can be fatal. This could result in a reduction in available food for carnivores such as foxes.
11. How does the removal of one element of the web effect the whole ecosystem? For example, what affect would levelling half of the dune system to make way for a new visitor centre and carpark have?



Activity 7 - Sand dune energy flow

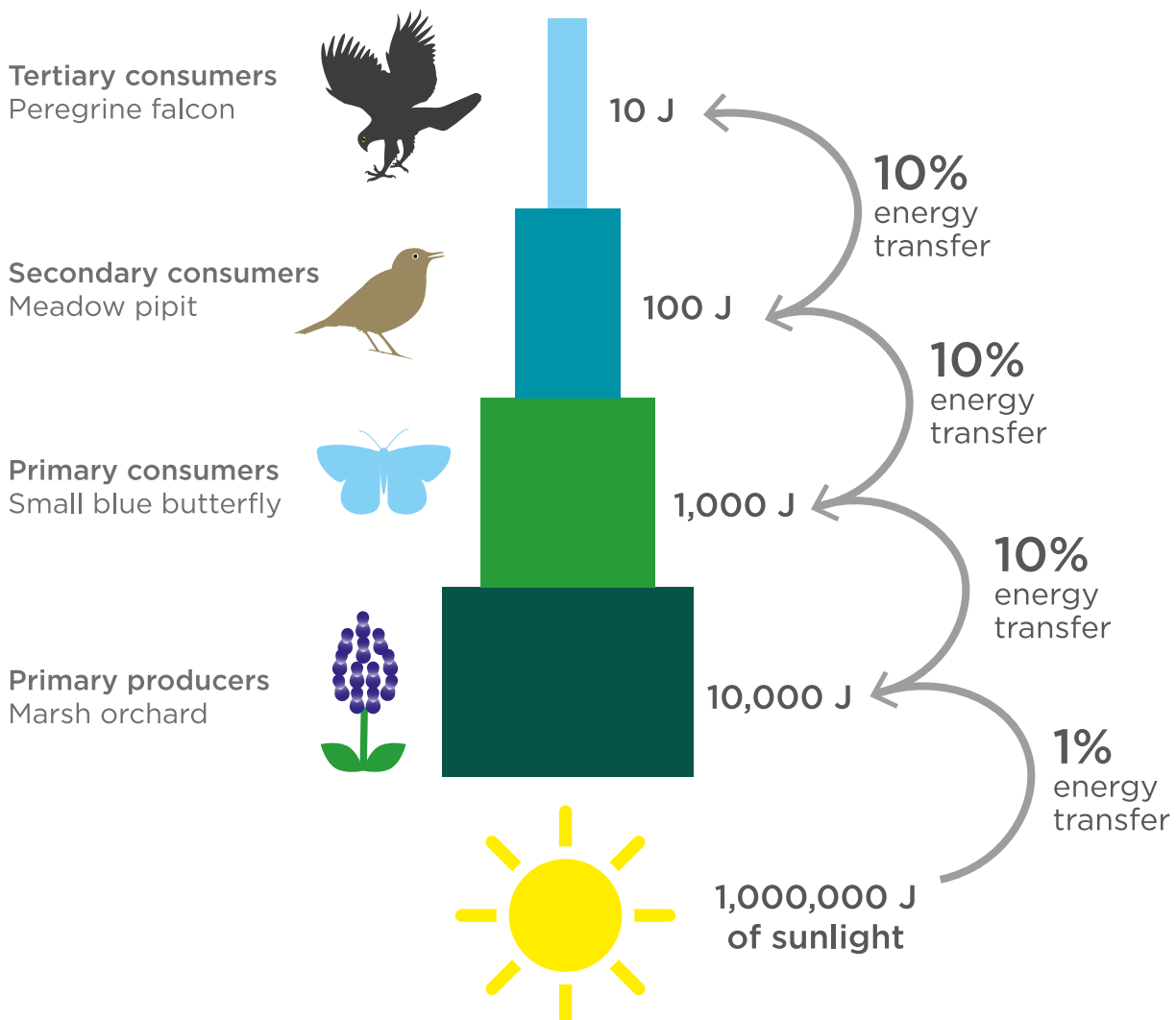
Our **Energy Flow** activity, **Number 17** in our booklet **Animals and Habitats** booklet builds on our Food Chain activities and can be played on a sand dune system or in your setting's outdoor learning area.

Watch this video clip to understand more about Trophic levels **What Are Trophic Levels? | Ecology & Environment | Biology | FuseSchool - YouTube**

Energy is transferred along food chains from one stage to the next but not all the energy available to organisms at one stage can be absorbed by organisms at the next one. The amount of available energy decreases from one stage to the next. Some of the available energy goes into growth and the production of offspring.

This energy becomes available to the next stage, but most of the available energy is used up in other ways including:

- energy is released when creatures move and sweat.
- energy is lost in waste materials such as faeces. For example, primary producers have a lot of energy as they are at the start of the food chain. Energy flow decreases with each trophic level, as does the number of organisms at that level. There are far fewer tertiary consumers than primary producers. The diagram below gives an example of this energy flow through the trophic levels.





The numbers below are arbitrary, this is an example to show your learners how the numbers will fall as you move up the levels.

- Energy from the sun will be used to help the Southern marsh-orchid to grow.
- This one orchid may be providing food (energy) for 20 Small blue butterflies.
- The 20 small blue butterflies may provide food for 10 Meadow pipits.
- The 10 meadow pipits may be potential prey for one Peregrine falcon.

Pyramids of biomass or pyramids of numbers are explained at GCSE level here: [Pyramids of numbers - Food chains - GCSE Biology \(Single Science\) Revision - BBC Bitesize](#)

Activity 8 - Sand dune food chain detectives

NB: This activity needs to be completed on a sand dune system

This activity develops knowledge of insect/animal features, behaviours, and habitats.

Equipment and resources

- Clipboards and pencils
- Sand dune plant, insect ID sheets/apps or the **Resource cards (set A) - Sand dune super species**
- Magnifying glasses
- Minibeast collecting pots

Background information – Please note, to successfully complete this activity, your learners will need to ideally have some prior knowledge of the different habitats within a sand dune system. Our **Information note - Coastal sand dunes in Wales** and can be used to support this.

What to do

1. Explain to your group that they are going to be energy investigators searching for specimens/evidence of decomposers, primary producers, primary consumers, secondary consumers, and tertiary consumers.
2. You can either divide into separate groups to investigate different areas within the sand dune system or working as one overall group, split your learners into smaller groups and move into different habitats within the sand dune system.
3. Ask your learners to predict where in the sand dune habitat they will find the greatest evidence of life. Amongst the embryo dunes, foredunes, secondary dunes, dune grasslands or dune slacks? Pick a few of the **Resource cards (set A) - Sand dune super species** photo component and ask your learners which habitat within the sand dune system they think they will be found? This could be done as part of a discussion or completed by laying the cards into their suggested habitat. Draw circles in the sand for each habitat and ask your learners to place the cards in the circle/habitat they think that species might be found. Note their ideas.
4. In their groups, provide learners with equipment for their investigation and to collate their findings.
5. In each habitat within the dune system give your learners time to explore and discover. Can they use the equipment provided to find and identify any of the primary producers listed on the **Resource cards (set A) - Sand dune super species**? Can they find evidence of species from all of the other levels? Discuss what evidence the learners could look out for to confirm signs of life, for example, feathers, bones, burrows, faeces, grass and plants that have been eaten, bore holes in the bark and footprints.
6. On their worksheet, working as a group, ask learners to tally up what they saw for each component of the sand dune food chain.
7. Discuss with your learners whether their predictions about which sand dune habitat would contain the most evidence of life was correct. What have they learnt from this activity?
8. Ask your learners to total the number of specimens or pieces of evidence found in each habitat. What do their results show about energy transfer?

Play the **Energy flow game - Activity 17** in our booklet **Animals and Habitats** to demonstrate how the amount of available energy in a food chain decreases from one stage to the next.



Suggested key questions

- What is a food chain? What is a food web? What is the difference/similarity?
- How are animals and plants dependent on one another?
- How is energy transformed and transferred as it flows through the food chain?
- What does a food chain start with?
- What does a food chain end with?
- What can disrupt a food chain or web and why?

Adapting for different needs/abilities

More support

- Use less of the **Resource cards (set A) - Sand dune super species**.
- Keep your food chains simple, only 3-4 steps and use animals your learners will know and recognise.
- Don't introduce the concept of energy transfer.

More Challenge

- Ask your learners to use the **Resource cards (set A) - Sand dune super species** and pencils as arrows, to create their own sand dune food web. Ask learners to use the sand dune food web to write two food chains. Can they label the producer, primary consumer, secondary consumer, and decomposer (if there is one) in their chain? Activity 5 and 6 will help with this.
- Use all of the **Resource cards (set A) - Sand dune super species**
- Ask your learners to create a visual pyramid of the energy transfer within a food chain.

Follow up activity/extension

- Animals adapt to suit what they eat. Ask your learners to take a close look at three species and record two ways that their bodies or behaviours have adapted to suit their feeding style or type of food available.
- Can your learners write their own definitions for each of the food chain layers?

Looking for more learning resources, information and data?

Please contact: education@naturalresourceswales.gov.uk or go to <https://naturalresources.wales/learning>

Alternative format; large print or another language, please contact: enquiries@naturalresourceswales.gov.uk
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