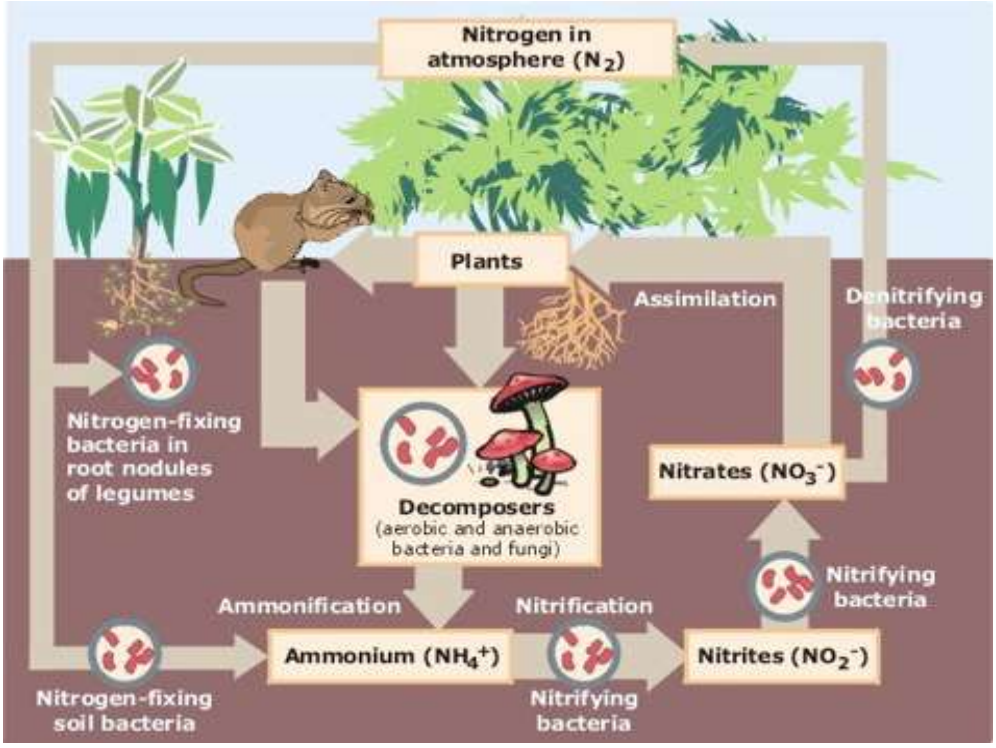
GCSE 9-1 Biology Revision Topic 9: Ecosystems and Material Cycles

Nitrogen Cycle – Nitrogen can not be lost, it moves between different molecules in the cycle



Good youtube video on the N cycle, Google 'amoeba sisters carbon& nitrogen cycle'

Highlight the different bacteria in the N cycle, then match to their description (*must know*):

Rhizobium bacteria	Decay dead plants and animals into ammonium ions
Denitrifying bacteria	Convert nitrogen gas into ammonium ions
Nitrifying bacteria	Nitrogen fixing bacteria in root nodules of leguminous plants eg peas, beans
Nitrogen fixing bacteria in soil	Convert nitrates in the soil into nitrogen gas
Decomposers (bacteria and fungi)	Convert ammonium ions into nitrites and then into nitrates

<u>Nitrogen cycling</u>

Nitrogen gas (N_2) is converted into ammonium ions by _____ _____ bacteria in the soil. The ammonium ions can then be converted by _____ bacteria into nitrites and then into nitrates. The nitrates can then be taken up by the root hair cells of plants by _____ _____. The nitrates are used by plants to synthesise _____ acids, protein and DNA which allow _____ of the plant. Plants may be eaten by animals, the plant protein is digested into amino acids which is then used by cells of the animals to make animal protein. All plants and animals that die along with animal urine and faces will be decomposed by bacteria and fungi in the soil by _____ digestion. They convert the protein into ammonia. This can then be acted on by _____ bacteria.

Alternatively nitrates may not be taken up by plants, but converted into nitrogen gas by _____ bacteria in the soil.

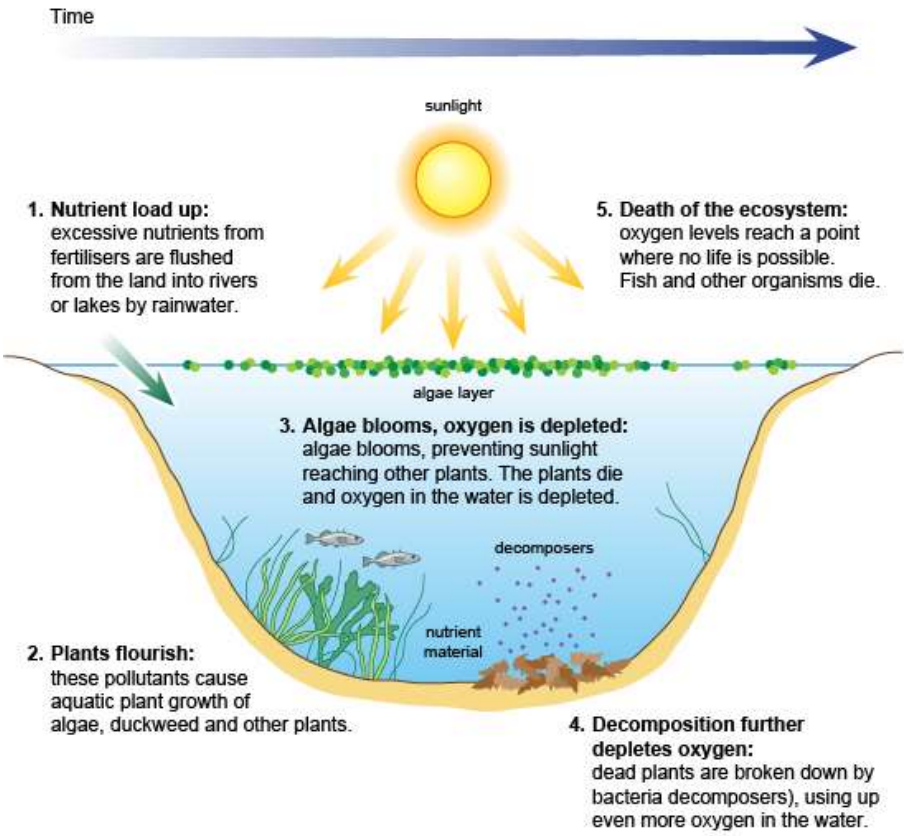
Lightning is a natural process by which nitrogen gas is fixed in to nitrates – the lightning provides the _____ for the nitrogen and oxygen to react to form nitrates which then falls in rain onto the soil. In tropical countries, with high amounts of lightning famers may not need to use as much fertiliser (which contains nitrates, phosphates and potassium).

Legumes (eg clover, peas, beans) are plants that contain nitrogen fixing bacteria called _____ in their root nodules (swellings on their roots). The bacteria fix the nitrogen gas into nitrates for the plant, reducing their need to uptake nitrates from the soil.

Q to try later: Plants grow better in fertile soil, explain how bacteria help to keep soil fertile [4]

Eutrophication –due to excess nitrates from fertiliser or sewage entering a pond/lake/river

Good youtube video 'science sauce eutrophication'



What is the technical word for nitrates dissolving in water?

If aquatic plants receive no light, what process can they not do?

Why do the plants then die?

What process is the decomposers doing that use the oxygen in the water?

What do the plants synthesise from the excess nitrates?

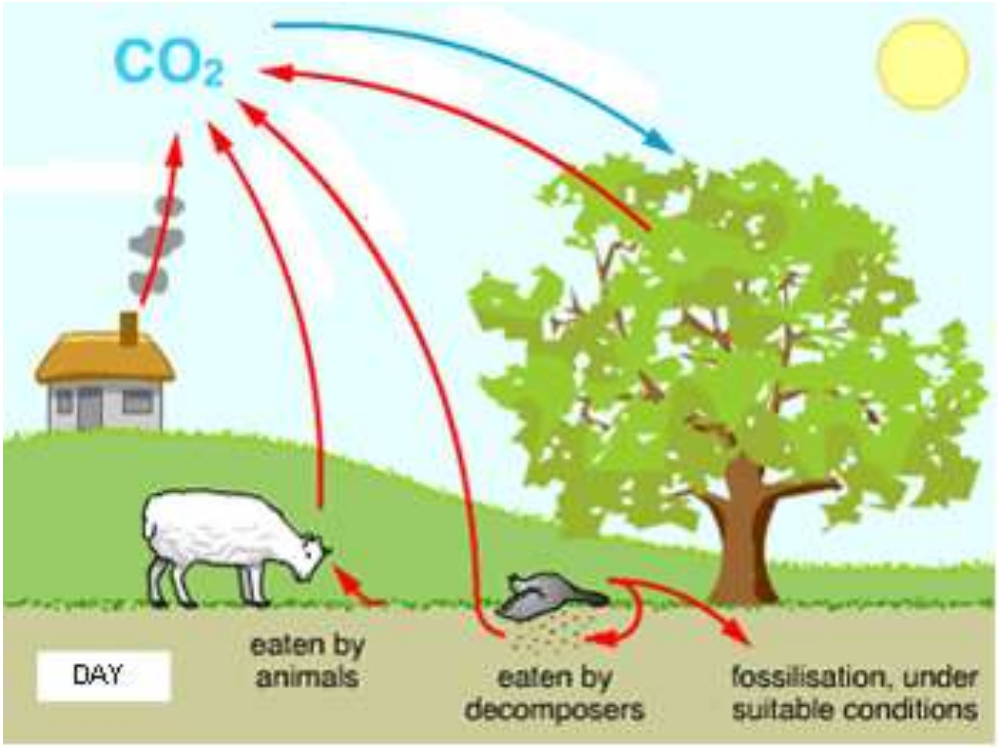
What is the technical word for lack of oxygen in water?

The Carbon Cycle – carbon can not be lost, it moves between different stages in different molecules

1. What is the equation for photosynthesis?

2. What is the equation for respiration?

Identify the processes of the arrows on the diagram of the Carbon cycle



You need to be able to state how humans are influencing the carbon cycle over time and on a yearly basis

What processes are reducing photosynthesis?

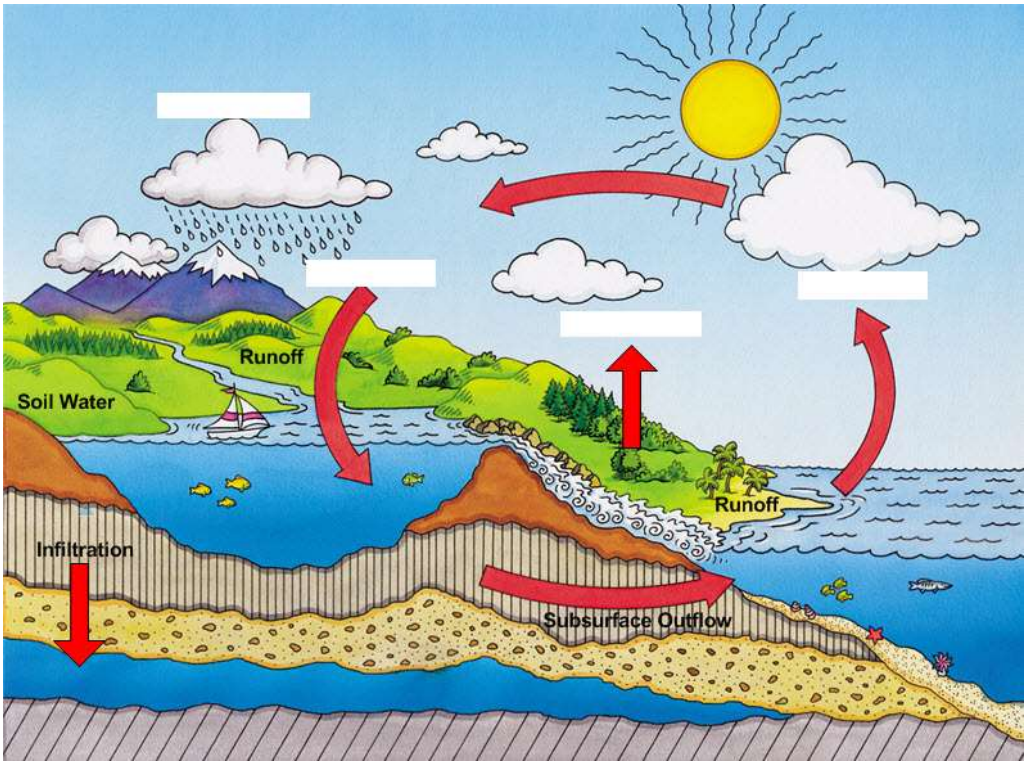
What processes are increasing the respiration?

What process increases in winter?

What process increases in summer?

Amoeba sisters carbon cycle video great to watch

The water cycle – water is not lost, it moves between different parts of the planet in different states



Youtube video on water cycle 'national science foundation water cycle'

Fill in the labels in the boxes of the key processes

You need to be able to describe each stage of the cycle- practice this **Q: describe the processes that take place in the water cycle**

Q what impact does planting a large number of trees have on the water cycle?

Production of drinking (potable) water

Desalination through distillation, what must be done in distillation to produce potable water?

Indicator species – organisms that are absent or present give an indication as to whether water or air is polluted or clean – must know the names

Water (oxygen levels)		**Air (sulphur dioxide)**	
_____ water	_____ water	_____ air	_____ air
Stonefly larvae Mayfly larvae caddisfly	Blood worms	Lichen (greater numbers and type varies)	Less lichen and different types
Freshwater shrimps	Sludge worms	Blackspot fungi	

So freshwater shrimps are only adapted to live in water with high oxygen levels and will not survive if the level decreases, while sludge worms are adapted to live in low levels of oxygen.

Direct measurement: You can also measure the concentration of oxygen in water with an oxygen probe/meter and the concentration of sulphur dioxide in air with a specific test/meter

Ecology Match the key term to definition

Population	Living factor eg disease, competition, predation
Parasitism	All the living organisms and non living components in an area
Community	2 organisms live closely together in a way that both benefit
Biotic	Feeds on or in a living organism, harming the host and benefiting the feeder
Abiotic	The survival of one species is dependent on another
Ecosystem	Non living factor eg rainfall, pollution
Mutualism	All the populations in an area
Interdependence	All the organisms of 1 species in an area

Organisms compete with each other which affect their distribution in an ecosystem
What do plants compete for?

What do animals compete for?

Decide if the following are examples of mutualism or parasitism (both show interdependence)

Example	P or M	Benefit
Mistletoe plant on an oak tree		
Cleaner fish eating shark skin		
Rhizobium bacteria in clover plant root nodules		
Tapeworm in a cat		
Oxpecker bird eating from skin on deer		
Fleas on a dog		

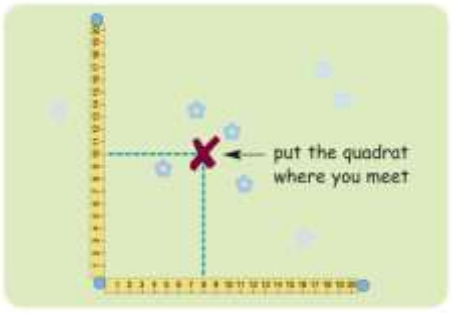
Core practical sampling plants by random sampling and transects (you did this at Fingringhoe) – very likely to get a question on this

Sampling plants: use a square frame called a _____, use this to estimate population of plants in an area as would take too long to count them all!

What method to use?

1. If the area is even eg meadow, playing field = **random sampling**

Use random number generator to determine where to place quadrat in measured out area (at least 10)
Count number species present/calculate % cover in each quadrat
Calculate population using this formula

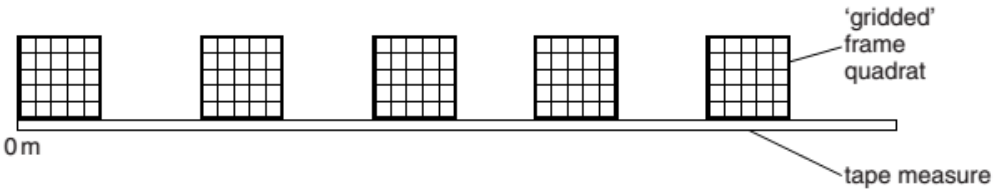


Number of species in whole area = mean number of organisms in 1 quadrat x total area

Area of 1 quadrat

Q: An area of meadow measures 15m x 25m. In 10 quadrats (0.5m x 0.5m) there was a mean of 17 daisies per quadrat, what is the estimated population of buttercups?

1. If the area is uneven eg moving from woodland to meadow, up a beach, varying soil, varying light intensity, varied trampling = **transect sampling**



Quadrats are placed at regular intervals, number of plants/% cover calculated and the varying abiotic factor is also measured in the quadrat eg light intensity (light meter), pH (pH probe), temperature (temp probe/thermometer), water availability (water probe), soil mineral ion concentration (specific tests on soil) and relate these to the change in distribution of organisms.

Food chains and pyramids

Pondweed eaten by tadpoles ==> eaten by water beetle ==> eaten by perch ==> eaten by otter

Only about 10% of energy is transferred between trophic levels. Energy is lost (and is hence not available to the next trophic level) by all of the organisms by_____ , _____ , _____. Also not all of the organisms is eaten, eg

Why don't food chains typically extend beyond 5 trophic levels?

Pyramid of biomass
Based on the dry mass of the organisms in the food chain (heated to remove all water)
Draw for the above food chain

Human Effects on Ecosystems

You need to know the plus and minus points of: fish farming (including how it is done), invasive species (_____ native species, spread _____, food for native species, _____ rapidly as no natural predators) and fertiliser use (minus point = _____) – ensure you revise this.

Decide if the following are plus or minus point of fish farming:

Less wild stocks fished	Good source of protein	Jobs created
Faeces, urine, uneaten food pollute water, can cause eutrophication and kill wild stocks	Large scale production possible	Diseases and parasites spread rapidly among stocks and may get into wild stocks
Fish may escape and breed with wild stocks	Production available throughout the year	Can selectively breed fast growing species for quicker production

Useful video 'youtube 'biology fish farming video assignment cody park')

Maintaining biodiversity – globally and locally

In an answer on why biodiversity needs maintaining think:

MORAL AESTHETIC ECOLOGICAL USEFULNESS TO HUMANS

Need to specifically know advantages of **reforestation**:

Forests represent a _____ for organisms, could prevent their _____
Trees do _____ and _____ CO_2 from the atmosphere
Tree roots _____ soil preventing its _____ and loss on mineral ions

Food security = having enough safe and healthy food at all times for the population
Wealthier populations eat more _____ and _____, so more land is used for _____ farming, so less land is available for growing _____. Farmed animals can also impact on wild populations eg fish farming fish escape and breed with wild fish

Moving people and goods can introduce invasive species and pests to an area, this can cause adverse effects on native species and crops
To increase crop production and yield more _____ is used on land, increasing risk of _____. Fertiliser production uses a lot of _____ and produces the gas ____, which is linked to _____ warming. The increase in global temperatures (climate change) is linked to:

Edexcel Exam questions, previous GCSE specification but still useful for practice – all answers are on moodle

Sample paper B1 Q6

*(d) Rather than use fertilisers, farmers could encourage bacteria to grow in the soil to provide their crops with the minerals they require.

Explain how bacteria in the soil can cycle essential plant nutrients.

(6)

B1 nov 11

*(b) Carbon is present in a wide variety of compounds in the carbon cycle.

Describe how carbon is cycled in the environment.

(6)

B1 paper May 14 Q5

*(b) Scientists observe living organisms in an environment to assess the level of pollution.

Describe how the level of water pollution and air pollution can be assessed using living organisms.

(6)

B1 May 2015 Q5

*(b) The survival of some organisms may depend on mutualism.

Explain, using **three** examples, how some organisms benefit from mutualism.

(6)

B1 May 2016 Q5

(b) describe the roles of bacteria in the nitrogen cycle (6)