Marwell Wildlife

Biodiversity trail

What is biodiversity?

The term Biodiversity refers to the variety of all living organisms, from microscopic bacteria to giant redwood trees. It includes the variety of genetic information available within a species. The interrelationships between organisms are also an integral part of biodiversity. Organisms have evolved over time to develop different adaptations to survive in their habitats and niches. These adaptations contribute to the diversity of life on earth.

There are many biodiversity hotspots across the globe which includes ecosystems such as rainforests, coral reefs and seamounts. These ecosystems contain the greatest proportion of the Earth's species although we only know about a few of them.

Biodiversity trail

This trail will take you on a tour of the diversity of life here at Marwell and allow you to discover more about biodiversity and its importance to us.

Use the map provided to help you follow this trail.

You will need to look for signs near the enclosures to help find the information you need. You may also need to use your own knowledge or observational skills to work out some answers.

1. Humboldt penguin

Humboldt penguins are named after the Humboldt Current which runs past the coasts of Chile and Peru where these birds live.

Whilst the most familiar penguin species are found in colder climates, the Humboldt penguin originates from a more temperate climate.

1. a) Look at the different penguin species pictured around penguin cove. How many different species of penguins are there?

17 species

1. b) What adaptations do Humboldt penguins have which allow them to be successful in the ocean environments they spend most of their time in? (Choose two).

- Wings shaped like flippers – for swimming
- Streamlined body – to glide quickly through the water
- Specialised feathers – downy part close to the skin to trap air (for insulation); small stiff overlapping outer-part (penguin spreads oil (produced by preening gland) on to feathers to make them windproof and waterproof)
- Black back with white underneath – for camouflage (counter-shading)
- Mouth spines – instead of teeth. Found on the inside of the mouth and on tongue to grip and hold on to wriggly fish!
- Very good long-distance vision – for seeing both underwater and in air
- Webbed feet and tail – help penguins to steer underwater
- Denser bones than birds that fly – helps penguins to dive deep underwater

2. *Greater flamingo*

Greater flamingos live in highly saline water (high concentrations of salt) and alkaline habitats such as estuarine lagoons and mangrove swamps.

2. a) What level of biodiversity would you expect to find in such harsh conditions? Why?

Low levels of biodiversity – only animals that are adapted to such extreme environments will be able to survive.

2. Greater flamingo continued

2. b) What adaptations can you see that might help greater flamingos to survive in these environments?

- Long legs – for wading through deep water, body kept out of caustic water conditions which could otherwise be harmful.
- Bill – designed for removing food from the silt (food items are filtered out through comb-like plates in specialised beak).
- Webbed feet – for walking through mud
- Additional adaptations:-
- Rest by standing with one leg folded into the body – a method for conserving body heat.

2. c) Why do you think we sometimes play the sound of flamingo flocks into the flamingo enclosure?

Although flamingos have bred in small groups in captivity, it is believed that they generally prefer larger groups. Sounds of greater flamingos are sometimes played into the enclosure to provide the illusion that the flock is much larger than it is. We hope this will encourage successful breeding for our flamingos.

3. Cheetah

About 10,000 years ago, all but one species of cheetah (*Acinonyx jubatus*) died out. Only a few individuals survived, from which all of today's cheetah are descended.

The breeding of close relatives in this **founder population** has resulted in today's cheetah sharing approximately 99% of their genetic information, compared to about 80% for most species.
   This means that there are very few alleles (different forms of the same gene) within the remaining global cheetah population.

3. a) What problems can this lack of genetic diversity within the cheetah population cause?

This means they are very vulnerable to disease and sudden environmental change.

Growth and development issues (for example, some cheetah may be born with asymmetrical skulls, poor quality sperm in males, etc).

Problems with reproduction (this has been apparent in captivity, however cheetah seem to be doing OK in the wild).

4. Heart of Africa

As you enter Heart of Africa, on the right hand side you will notice a board showing the huge diversity of antelopes that there are.

4. a) What factors have determined the huge variety of shapes and sizes of antelope that have evolved?

> Diet and environment – these determine the adaptations the animal need to maximise its chance of survival.

If you walk over to the other side of Heart of Africa you can see a range of antelope horns, which further illustrate the diversity of antelope.

Now look at the cichlid fish from Lake Malawi (back wall of Heart of Africa).

4. b) How are so many different species of cichlid fish able to survive in the same lake?

> Many different species have evolved to exploit distinct niches, this means that they can coexist within an ecosystem without direct competition with each other. For example: algae eaters, scale eaters, egg eaters, snail eaters, etc.

5. Lemur loop

Marwell Zoo is home to five species of lemur. In our Lemur Loop area, you can find three of these species. Lemurs are endemic to the island of Madagscar. All lemurs evolved from a common ancestor and adapted to the variety of habitats found on Madagascar. Over time they have evolved into over 100 different lemur species which can be found on Madagascar today!

5. a) Look at the ID signs and list the three species of lemur housed in this enclosure.

1. **Crowned lemur**   3. **Ring-tailed lemur**

2. **Black-and-white ruffed lemur**

5. Lemur loop continued

*If a species is **endemic** it means that it is only found in a particular habitat or location and it is not found anywhere else in the world.*

5. b) Why is it important to conserve the habitats where these endemic animals are found?
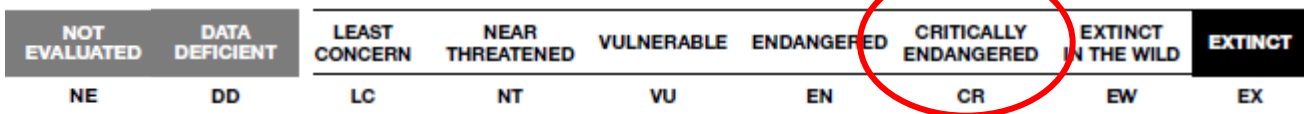
It is important to conserve the habitats like those in Madagascar because they are the only place where animals like lemurs exist; if they were to disappear so too would the animals as they are adapted to that particular area and nowhere else.

6. Amur leopard

Many species are threatened by human activities – the Amur leopard is one of these threatened species.

6. a) Circle the correct IUCN conservation status of the Amur leopard on the scale below.

NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENDANGERED	EXTINCT IN THE WILD	EXTINCT
NE	DD	LC	NT	VU	EN	CR	EW	EX

6. b) Identify two threats to the Amur leopard in the wild.

Unsustainable hunting, habitat fragmentation, human-animal conflict and loss of prey species are all threats to the Amur leopard.

Conservation efforts to try to protect Amur leopards from extinction include anti-poaching patrols, education schemes , and captive breeding programmes.

7. Okapi

The okapi is a large mammal (almost 2 meters tall!) and lives in the Ituri Forest of the Democratic Republic of Congo, in Central Africa.
The okapi was not known to European scientists until 1901 because it is such a shy and elusive animal.

7. a) What does this tell you about our current knowledge of the biodiversity of life on earth?

If an animal as large as the okapi managed to go undiscovered for so long, it is likely that there are many other species of which we have no knowledge.

7. b) What activity is currently threatening the forest habitat in which the okapi live? What is the product of this activity used for?

Mining for minerals such as coltan; used in the manufacture of microchips for mobile phones. Also, logging and agriculture threaten the forests where the okapi live.

8. Energy for Life: Tropical House

Despite covering less than 10% of the earth's land area, rainforests contain over half of the world's plants and animal species making them incredibly bio-diverse.

The level of bio-diversity in an area is an indicator of how healthy the habitat is; the more bio-diverse an area the healthier it is considered to be. Scientists conduct many biodiversity surveys in the same area, throughout different seasons and over years to monitor the health of the ecosystem.

Energy for Life: Tropical House continued

8.a) As you enter the Tropical House, estimate how many different species there are in the main room.

Estimated number of animal species: ☐

Estimated number of plant species: ☐

8.b) Use the tablets on the pathways to find out how many animal species are actually housed in the Tropical House (you will have to count).

Number of animal species: 27

Number of plant species: 650

(Please inform your group of the number of plant species housed within the Tropical House).

It is likely that your estimate and the actual number of species is different. This is why it is important to complete rigorous ecological surveys to achieve more reliable results about the biodiversity of habitats. It is not only the number of species that should be considered, but also their abundance. The Simpson's biodiversity index covers both of these things and results in a value between 0 and 1 to show if an area is actually bio-diverse or if it just seemed that way in the raw data. The equation is shown below.

Simpson's biodiversity index:

$$D = 1 - \frac{\Sigma n (n-1)}{N (N-1)}$$

Where **D** is the value of the index (a number between 0 and 1 with 1 meaning the area surveyed is infinitely diverse)
Σ is the 'sum of'
n is the number of individuals of the same species
N is the total number of all individuals

Species	n *Number of individuals of the same species (correct Sept-18)*	n-1 *The number of individuals from the same species minus one*	n(n-1) *The number of individuals of the same species multiplied by the number of individuals of the same species minus one*
Asian brown tortoise	6	5	30
Assassin snail	40	39	1,560
Lesser goliath beetle	33	32	1,056
Postman butterflies	325	324	105,300
Yellow-throated frog	40	39	1,560
False penguin tetra	326	325	105,950
Pearl gourami	77	76	5,852
Striped panchax	39	38	1,482
Silver shark	14	13	182
Tambraparini barb	900	899	809,100
Scissortail rasbora	399	398	158,802
Pygmy marmoset	6	5	30
Javan chevrotain	3	2	6
Linné's two-toed sloth	1	0	0
Crested wood partridge	8	7	56
Nicobar pigeon	4	3	12
Fisher's turaco	1	0	0
Java sparrow	6	5	30
Sclater's crowned pigeon	1	0	0
Eastern superb fruit dove	2	1	2
Brazilian tanager	1	0	0
White-naped pheasant-pigeon	1	0	0
Asian glossy starling	17	16	272
Purple honey tree creeper	1	0	0
N *(Total number of all individuals)*	2,251		
	∑ *The sum of the n(n-1) column*		1,191,282

Energy for Life: Tropical House continued

8.d) Use the raw data that you collected in 8b to work out the Simpson's biodiversity index for the Tropical House.

$$D = 1 - \frac{1{,}191{,}282}{2{,}251 \times 2{,}250}$$

$$D = 1 - \frac{1{,}191{,}282}{5{,}064{,}750}$$

$$D = 1 - 0.24$$

$$D = 0.76$$

$$D = 1 - \frac{\Sigma\, n\,(n-1)}{N\,(N-1)}$$

The higher the value of D the higher the level of biodiversity

8.e) How could you make your results reliable when calculating simpson's biodiversity index in the field?

Repeat the observations at different times of year and day to ensure you spot as many species as possible. Stay quiet and hidden when observing species. Use a systematic sampling method to estimate the number of each species. E.g. quadrats, mark-recapture

9. Binturong

The binturong, also known as the bearcat, is a member of the viverridae family, which includes civets. Despite its appearance, the binturong is very agile and easily moves through the trees, high up in the canopy of its forest home. The binturong inhabits primary (forests untouched by human activity) across South East Asia.

9.a) One of the major threats to the binturong is deforestation and logging. Why do you think this type of human activity affects the binturong population more than some other species in the same habitat?

As binturong mostly live in primary forests, it means they are more vulnerable to any sort of human activity in their habitat. Also, as more forests around the world are being explored by humans and used for their resources, there will be fewer habitats left for the binturong and other animals which live in primary forests

9.b) One of the reasons the binturong's habitat is being destroyed is to clear areas for palm oil plantations. Palm oil is an ingredient used in many processed foods. What changes in your own life can you make to help reduce this impact on the binturong habitat?

Check foods we buy for the presence of palm oil. Choose only sustainable palm oil or products with no palm oil in it.

10. Capybara

Capybara are the world's largest rodents, they inhabit areas close to water including marshes, and forest or grassland areas along rivers or streams.

10. a) How are capybara adapted for this lifestyle?

The capybara's ears, eyes and nose are all positioned on top of head, this is so they are still able to breathe and use their senses while the rest of their body is submerged in water.
They also have partially webbed feet to help them to swim.

10. b) i) How is the growing of single crops on large grassland areas in South America affecting capybara?

Clearing land for single crops (monoculture) reduces the usable habitat of the capybara. This monoculture practice also reduces the overall biodiversity of the area as only single plants species are grown rather than the wide variety of plants normally found in grassland areas.

10. b) ii) What could you do to and how it would help?

Buy locally produced items – helps by reducing the demand for overseas products (such as items grown on South American grasslands). If there is less demand then it is less likely more grassland will be planted with more crops. However, we may also need to consider alternative livelihoods for farmers who rely on income for their crops if demand for their products is reduced. You could do some more research into this area and hold a debate back at school/college on this issue.

11. Summary

On your journey around Marwell you have looked at just a small sample of the millions of plant and animal species that exist on earth.

11. a) Why do you think it is so important for humans to take steps to preserve the biodiversity of our planet?

Could come up with ideas such as:-
- Unknown organisms may still to be discovered with possible uses in medicine, etc.
- Many plants and animals that we rely on already could be at risk if we don't make an effort to preserve biodiversity.
- Whole food webs could be affected by loss of biodiversity; this is a problem because we really don't know the full effects of losing biodiversity. Many food web relationships can be quiet complex meaning species can rely on others in ways we don't yet understand.

11. b) What steps could we take to help preserve biodiversity?

Could come up with suggestions such as:-
- Sustainable living (living in a way that does not impact upon future generations).
- (e.g. eat less meat, choose bus/bicycle/trains rather than cars, reduce/reuse/recycle etc)
- Donate to or get involved with, conservation efforts to conserve species and their habitats.
- Encourage more wildlife in your school or garden by creating safe spaces for sheltering insects or nesting birds.
- Share your ideas and knowledge with others and encourage them to join you in helping wildlife.

Well done! You have completed the Biodiversity Trail; now see what other animals you can see around the zoo.

Marwell Wildlife

Biodiversity Trail

1. Humboldt penguins
2. Greater flamingo
3. Cheetah
4. Heart of Africa
5. Lemur Loop
6. Amur leopard
7. Okapi
8. Tropical House
9. Binturong
10. Capybara

Map labels:

Fur, Feathers & Scales

Cold Blooded Corner

TROPICAL house

Tropical House ENTRANCE

Coming soon!

Fur, Feathers & Scales

Life Among the Trees

Formal Gardens

Marwell Hall

Tigers

Café Graze

PICNIC LODGE

Wild Explorers

Snow Leopards

Reception

Science & Learning Centre

Giraffe House

PICNIC HUT

coming next! Water & Wetlands

Penguin Station

Gift Shop & Art Gallery

Gift Shop

Membership

KEY

- (i) Information
- Toilets / disabled & baby change
- Changing Places facility (Radar key required)
- Café Graze & Coffee Corner - Open all year
- Outdoor picnic tables
- Seasonal refreshments Ice creams / coffee
- Penguin Station rail train
- Road train stops
- Adventure playgrounds
- Under cover area
- First Aid Emergency? Call: 01962 777983
- **Science & Learning Centre** Pre-booked education groups or special events
- **Marwell Hall** Special events & private bookings