



# 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
- Special 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. 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
- Rest by standing with one leg folded into the body – a method for conserving body heat.

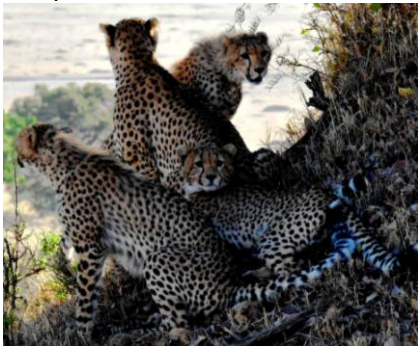


### 2. c) Why do you think we sometimes play the sound of flamingo flocks into the flamingo enclosure?

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 Madagascar. 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.

## 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 which is used to manufacture microchips for mobile phones. Logging and agriculture also 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.

### 8. a) As you enter the Tropical House, estimate the number of different species housed in the exhibit.



Estimated number of  
plant species:

Estimated number of  
animal species:



## Energy for Life: Tropical House continued

8. b) Use the table below to make a tally of every new species you see as you walk through the tropical house.

Tally of plant species seen	Tally of animal species seen
Total:	Total:

8.c) The tablets and signs show the species you can find in the tropical house. Count up the **actual** number of species and record in the box.

Number of invertebrate species:	4	Number of reptile species:	2
Number of bird species:	10	Number of amphibian species:	2
Number of fish species:	6	Number of Mammal species:	3
Total number of animal species:			27

Your teacher will inform you of the number of plant species housed within the Tropical House, record the number in the box.

Number of plant species:

650

8.d) Compare your answers for parts a-c. Were they very different? How could you improve your survey technique to make it more reliable?

1. Survey for a longer period of time and at different times throughout the day as some animals may only come out when it is quieter or they may be nocturnal e.g. plants can grow seasonally.
2. Use equipment such as binoculars to identify animals from afar to minimise observer presence and aid identification of species.
3. Consider alternative methodology for the counting of individuals of the same species e.g. tag and release or breaking up into 'countable units' e.g. of 10 or 100 to estimate large groups of individuals (e.g. for the fish in the tropical house or flocks of birds).



## 8. Energy for Life: Tropical House continued

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.

### 8.e) What might reduce the biodiversity of a habitat and therefore reduce the health of the ecosystem?

Change in land use, for example urbanisation or farming. This may fragment animal populations/reduce the food available to animals/prevent effective hunting by predators/reduce cover for prey/alter light levels and therefore affect plant growth. Change in habitat structure for example due to climate change. This can have the same affects listed above.

Over-hunting can have a large impact on food webs and ecosystem relationships due to the interdependence between species.

## 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. As more forests around the world are being explored by humans and used for their resources, the binturong's habitat becomes fragmented leaving fewer areas for the binturong and other animals living in primary forests.

## 9. Binturong continued

**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 all products and food we buy to see if it contains palm oil. To help reduce the impact of palm oil on the animals in these areas, choose palm oil free products or those made with sustainable palm oil. Look out for the sustainable palm oil symbol!

## 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 do you think the growing of single crops on large grassland areas in South America affects 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.

## 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 quite complex meaning species can rely on others in ways we don't yet understand.

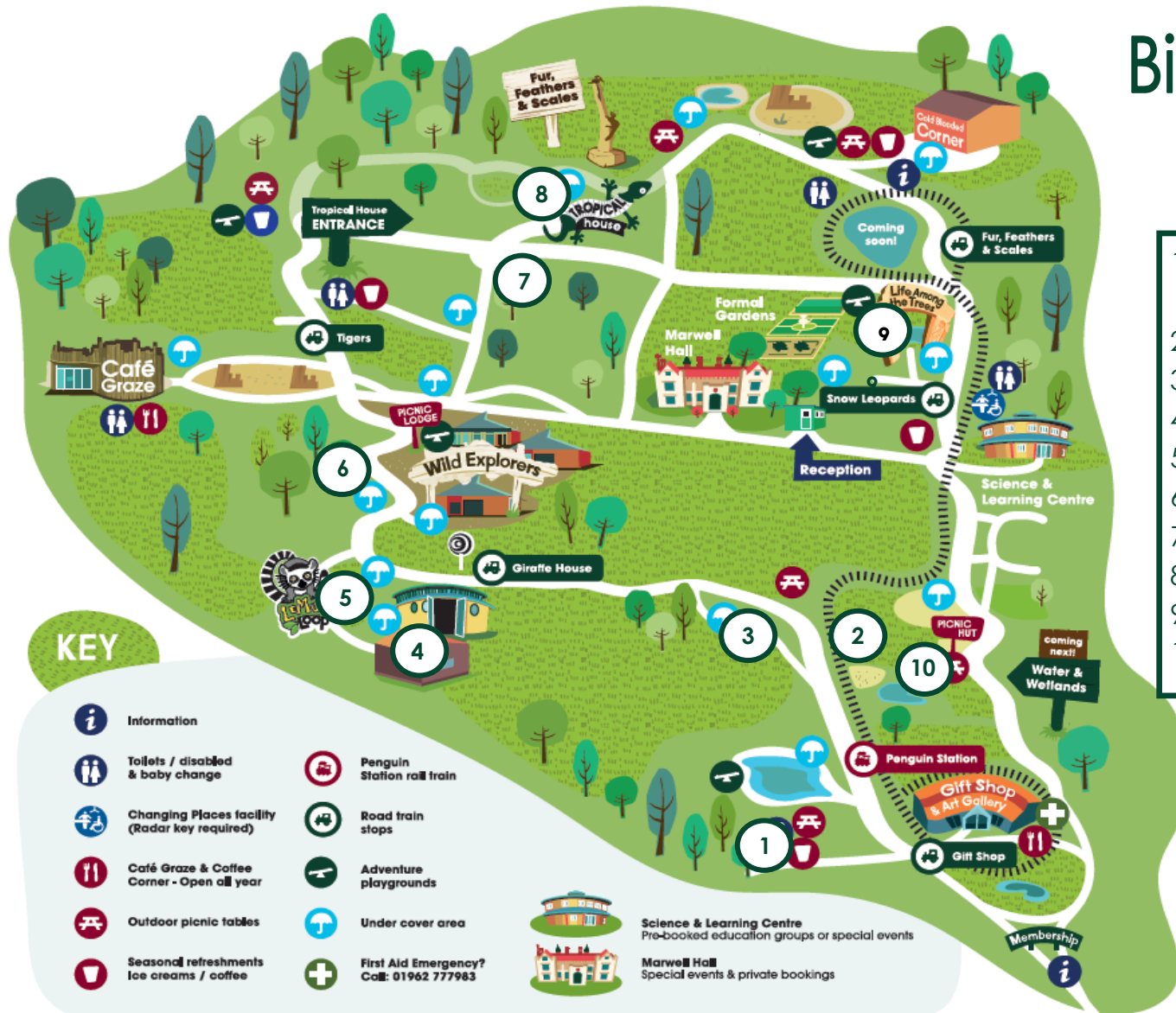
### **11. b) What steps could we take to help preserve biodiversity?**

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 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.**

# 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



