1. Timber can be produced sustainably to maintain biodiversity in woodland.

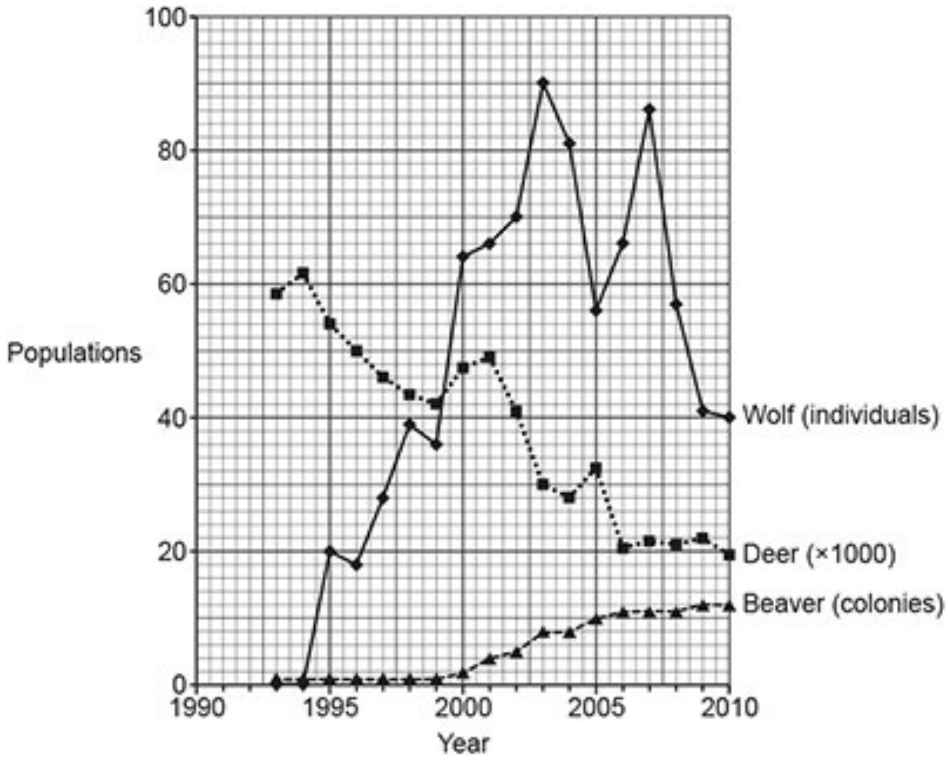
Describe **one** way in which timber can be produced sustainably.

[1]

2(a). Grey wolves became extinct in an area of North America in the 1920s. In 1993 some grey wolves were reintroduced into the same area.

Grey wolves feed mainly on large herbivores, such as deer.

The graph shows the population of grey wolves and some other species since the reintroduction.



Describe the changes in the deer population since 1993.

[3]

(b).

i. Calculate the percentage increase in the wolf population between 1995 and 2003.

Percentage increase = ... **[2]**

ii. Between 2003 and 2010 there were no significant changes in the climate of this area of North America and no disease outbreaks.

Suggest and explain **one** reason for the changes in the grey wolf population since 2003.

[2]

(c). Beavers are mammals that live in water. They form colonies nesting under big mounds of wood set as islands in areas of water.

In 1993 there was one colony of beavers living in the area to which the wolves were reintroduced.

i. Suggest why the population of beavers is measured in colonies rather than individual animals.

[1]

ii. Scientists have claimed that the reintroduction of the wolves has caused the beaver population to increase.

Evaluate the support given by the evidence in the graph for the scientists' claim.

[4]

iii. Beavers build dams in the water using trees they have cut down. Deer damage trees while they are feeding. Wolves often hunt deer that are feeding near water.

The following explanation for the increase in beaver population has been suggested by scientists:

- The presence of wolves causes deer to avoid grazing close to water.
- This means that trees near water are not damaged.
- Beavers have a plentiful supply of trees with which to build dams.

Suggest **one** other piece of useful evidence that could be measured that would support the scientists' claim.

[1]

(d). Beavers are a species that was once native to Britain. The species became extinct in Britain about 400 years ago.

In 2009, a population of beavers was brought from Norway and released into the wild in Britain.

i. Explain why the reintroduction of beavers to Britain is an example of conservation.

[2]

ii. Suggest a situation in which preservation of a habitat would be necessary.

[1]

3. The kakapo, shown in the photograph below, is an endangered species of flightless bird that lives in New Zealand. The population size of kakapos has experienced a large decrease over the past few hundred years. There are now fewer than 250 kakapos living in the wild.

i. State the term for a large decrease in population size that reduces the gene pool.

---

[1]

ii. Adaptations can be categorised into three different types:

- anatomical
- behavioural
- physiological.

The table lists four traits that kakapos have evolved.

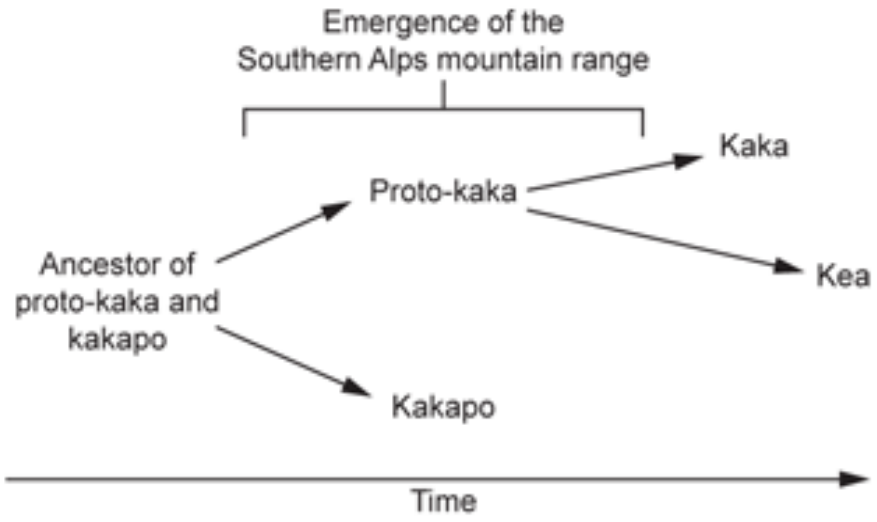
Complete the table by naming the type of adaptation represented by each of the four kakapo traits.

Kakapo trait	**Type of adaptation**
Active at night to avoid predators	
Green feathers that camouflage with its surroundings	
Slow digestion to extract nutrients from a high-fibre, low-protein diet	
Strong beak and claws to climb trees	

[2]

iii. The kakapo and two other species of bird, the kaka and the kea, evolved from a common ancestor approximately 70 million years ago.

The evolutionary timeline of the three species is shown in the figure below.



- The kakapo cannot fly. It forages for leaves and roots on the ground in forests and grasslands.
- The kaka can fly. It eats seeds, fruit, and occasionally the eggs of other birds in forest habitats.
- The kea can fly. It eats plants, larvae and other small animals. It lives in mountainous forest habitats.
- All three species live on the South Island of New Zealand and had overlapping ranges until the population size of kakapos started to decrease. Populations of kakas also live on the North Island of New Zealand.

A student studied the information and suggested that all three species evolved by sympatric speciation.

Evaluate the student's conclusion.

[4]

iv. New Zealand has a high species biodiversity compared to many countries.

Species biodiversity includes the concepts of species richness and species evenness.

Explain the difference between species richness and species evenness.

[2]

4. The Maasai Mara is a grassland ecosystem in east Africa with a large range of wildlife.

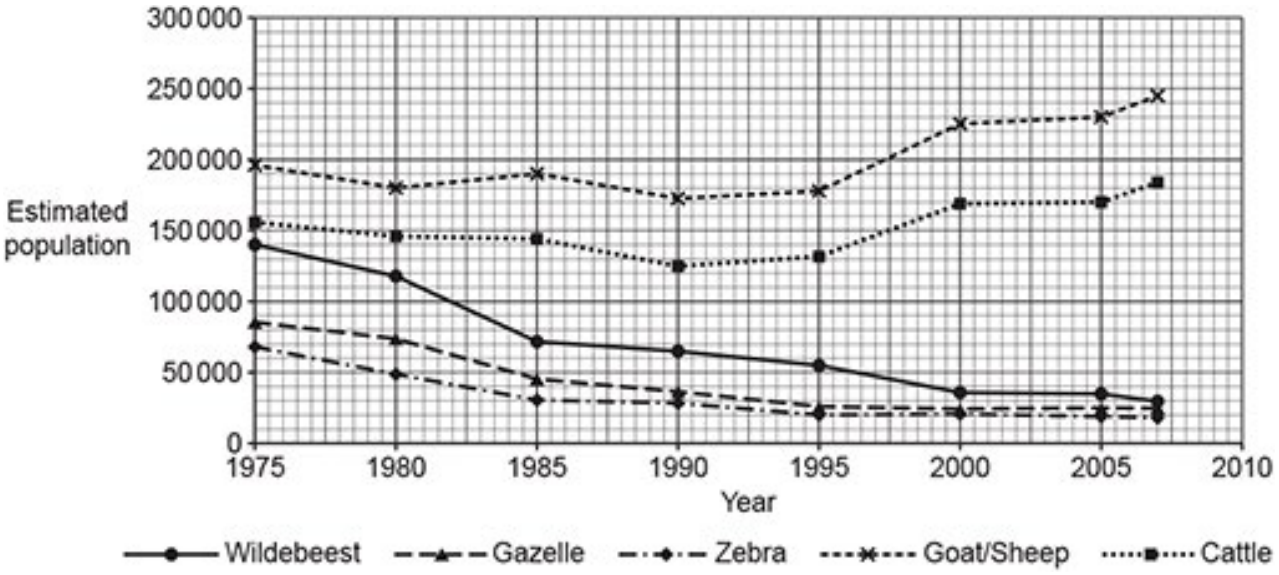
The human population in the area is increasing.

An increasing human population can affect the biodiversity of an area.

The wildlife present in the Maasai Mara includes several large mammals, such as gazelle, zebra and wildebeest.

Domestic animals, such as cattle, sheep and goats, are farmed by humans to provide food.

The graph below shows the population of some large mammals in the Maasai Mara between 1975 and 2007.



i. Calculate the rate of change in wildebeest population between 1975 and 2007.

Rate = ... animals per year **[2]**

ii. *The graph has been used to support the claim that rising human population in the Maasai Mara has a negative impact on biodiversity in the area.

Use the evidence in the graph to evaluate this claim.

[6]

Additional answer space if required.

5. It is important that commercial fishing is done in a sustainable way.

Fish farms are one potential solution to declining fish stocks.

i. List **three** other strategies that governments could use to increase the sustainability of commercial fishing.

1 _____

_____

2 _____

_____

3 _____

_____

[3]

ii. International agreements are an important approach to sustainability.

Suggest why international agreements are particularly important in the case of sustainable fishing.

_____

_____**[1]**

6. Competition is an important factor in determining population size.

Which statement about competition is **not** correct?

A Competition between two species can result in the extinction of the less well-adapted species.
B Competition occurs between individuals of the same species.
C Predators only compete within their own species.
D Species with overlapping niches will compete with one another.

Your answer ☐ **[1]**

END OF QUESTION PAPER