# Flagship species in conservation:
The Giant panda

This Factsheet summarises the problems facing the Giant Panda and describes the strategies that are being used to try to save it from extinction.

Giant pandas are known as Flagship species – a popular species that has been chosen as a symbol to stimulate conservation awareness and action.

The fossil record indicates that giant pandas first appeared in the early Pleistocene, some 3 million years ago. In the middle Pleistocene (about 600 000 years ago), they were distributed widely in southern, central and southwestern China. During the last ice age their numbers fell dramatically and have continued to do so since humans arrived. By the beginning of the 20th century, their populations had been reduced to a few small, isolated regions and that is still the case today.

Fig 1. The habitat of giant panda in China
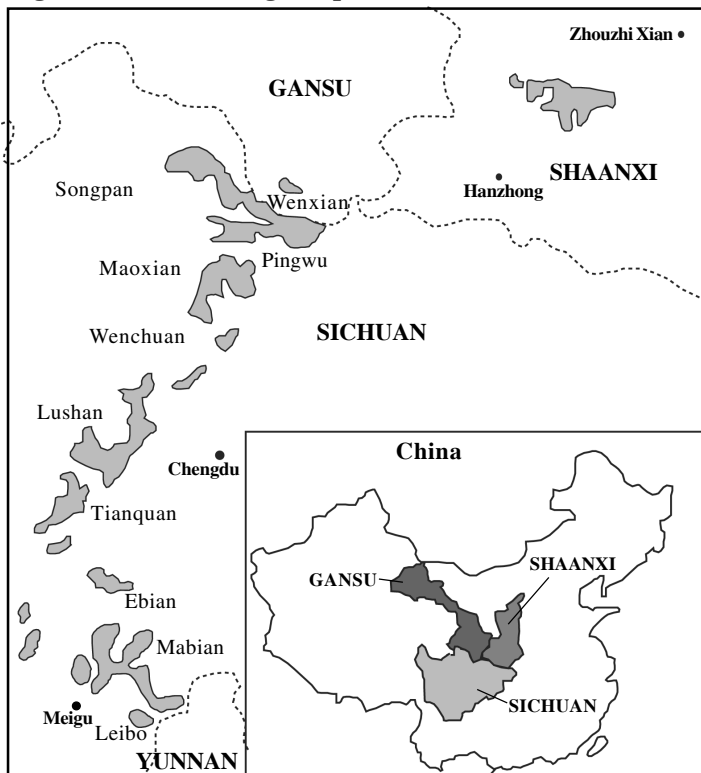
Since 1963 the Chinese government has established 58 giant panda nature reserves (Table 1).

Table 1. Giant Panda Reserves

Location	No. of reserves	Area / km^2
Sichuan	37	22,761
Gansu	7	7,100
Shaanxi	14	4,290
Total	58	34,151

This might sound very encouraging but it hides serious problems:

- The different populations are widely separated from and unable to get to each other
- Recent studies of the panda's preferred habitats indicate that the reserves do not provide ideal habitat (see Box page 2)
- The pandas migrate long distances between the warm and cold seasons and their migration routes are increasingly bringing them into conflict with urban and industrial development
- Some habitats are likely to face much greater economic exploitation e.g. deforestation for tourist developments, iron and coal mining and granite quarrying, human exploitation of bamboo
- They only eat bamboo, but are poorly adapted herbivores and need vast quantities of bamboo to survive

The giant pandas are distributed in six mountain ranges: the Qinling, Min, Qionglai, Daxiangling, Xiaoxiangling and Liang mountains. Since the 1950s, the area of suitable habitat for giant pandas has decreased rapidly.

The has resulted in the fragmentation of panda populations, so that 30 habitat patches now exist. This increases **edge effects**, which greatly increase exposure to human interference and often lead to local extinction.

In small, scattered populations there is also an increased risk of inbreeding, resulting in a loss of genetic diversity. Scientists estimate that an isolated population needs a minimum of 50 fertile individuals to maintain genetic variability. Among the 30 giant panda habitat patches, 20 contain less than 10 effective mature adults.

Besides threats from human activity, giant pandas also face problems as a result of natural phenomena such as the 60 – 70 year cycle of bamboo-blooming.

Large-scale, synchronous blooming is a long-term survival strategy of all temperate bamboo species. Bamboo forests are eaten by a wide range of species and excess populations of herbivores can threaten the survival of the bamboo in an area. The large-scale blooming and death of bamboo dramatically decreases the number of local bamboo-feeders as they starve or migrate in search of food elsewhere. In turn, this allows the bamboo to recover.

This cycle of blooming and dying is localized, and occurs in different areas at different times. Weak or diseased pandas that are unable to migrate will die. Successful migrants mix and breed with different populations of pandas, thus preventing inbreeding and increasing the genetic diversity of the wild populations. This evolutionary relationship has developed over tens of thousands of years.

But habitat fragmentation has disrupted this relationship - there are no places for giant pandas to move to during large-scale bamboo blooming periods and the result can be the death of an entire isolated population.
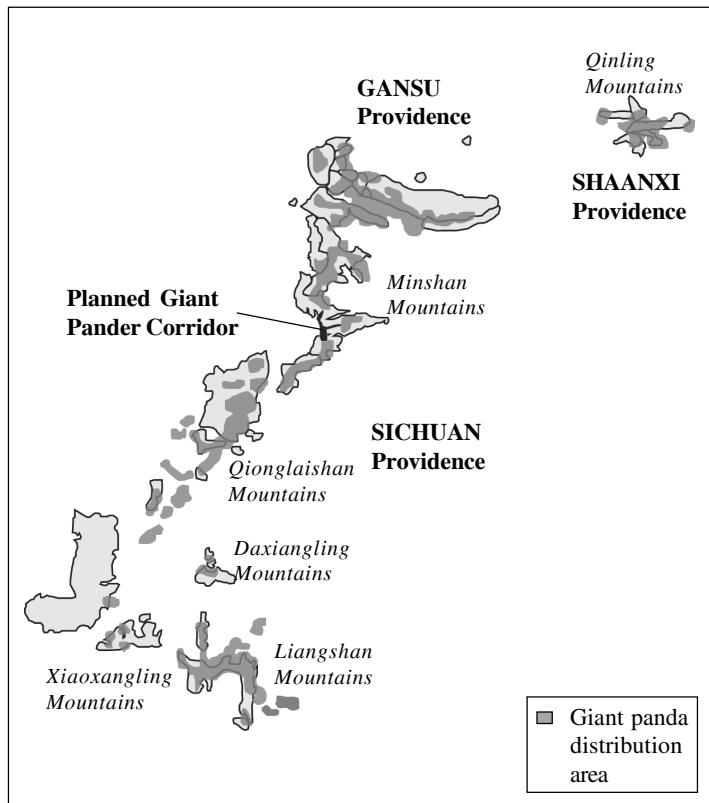
Question: So if a major problem is habitat fragmentation, what is the solution?

Answer Linking these habitats with protected corridors.

Habitat corridors in the Min mountains of Sichuan

The Min Mountains of Sichuan have the largest giant panda population in the world – 581 of the estimated total of 1114 individuals (52%).

Fig 2. Giant panda distribution

These individuals are divided into two populations: population A (539 individuals) in the northern region and population B (42 individuals) in the southern region. Population B is under severe threat of inbreeding and, unfortunately, is also close to three large cities, the forests surrounding which are being altered to accommodate tourists.

The proposed corridor could become an important passage to reconnect population A with population B. In the past these populations were able to interbreed but the development of a large highway and the development of farming land on either side of the highway prevented them coming into contact.

The primary purpose of re-establishing the corridor is to allow pandas to migrate to other areas when they need to escape a starvation incident (bamboo flowering) and to encourage outbreeding with other populations. The corridor does not therefore have to be very wide – it is only meant to allow migration rather than establishment of a resident population.

In 1998, the Chinese government began to restore destroyed habitats in the region. This involved removing pine trees and thorny shrubs that prevent establishment of bamboo seedlings.

Scientists monitoring the effects of these efforts set up hundreds of transect lines across the corridor to detect traces of giant panda activity. They found that several pandas from population A have been found ranging further south, and those of population B (in the south-eastern corner) have been found moving west, closer to the corridor.

Question: Suggest how scientists detected "traces of giant panda activity"

Answer: Nibbled bamboo shoots and faeces

The next stage will be to re-route the highway through a tunnel in the mountains, after which the surface highway will be closed. Farmland on either side of the highway will be returned to bamboo forest.

Giant panda genome

Conservation biologists and geneticists from five countries are planning to sequence the genome of the giant panda.

The genome contains some 3 billion base pairs, and scientists suspect that it holds about the same number of genes as the human genome

Giant panda's ideal habitat

The conclusions of many recent scientific studies in China have revealed that the giant panda's ideal habitat is as follows:

- Bamboo forest - bamboo comprises about 99% of a panda's diet, and pandas spent up to 14 hours per day foraging, depending on the bamboo's nutrient and energy content
- Understorey vegetation
- 1400 – 3600 m in elevation
- Ridges in gently sloping regions < than 15° slope. As slope increases, pandas become less and less active
- Relatively high humidity

Captive breeding

Giant pandas have been kept and bred in zoos with the hope that they could be released into the wild. However, fertilisation of the females is guaranteed only by insemination with semen from several males.

Conservation Strategy: Summary

- Reduce fragmentation and link up scattered populations by high elevation corridors between reserves

- Restore and protect bamboo forests

- Restrict harvesting of bamboo by humans

- Develop small scattered energy plants e.g. HEP rather than huge ones which then stimulate nearby urban development

- Assess the genetic diversity within each population and identify matings that would increase diversity

- Increase captive breeding of genetically diverse individuals for later release into the wild

Practice Questions

1. Outline why fragmentation of panda populations is a threat to their survival (3)

2. **Pandas: poor herbivores?**
    Read the account and answer the questions that follow.
    Pandas feed almost exclusively on bamboo but their digestive system is unable to break down cellulose!
    Bamboo biomass contains about 7500 kJ kg^{-1}, but pandas can only obtain about 15% of this energy. The table compares a giant panda with a giraffe - a typical herbivore.

	Panda	Giraffe
Mass / kg	75	800
Basal metabolic rate (the amount of energy needed to maintain vital body functions e.g. temperature regulation, heart beat, breathing etc.)/ kj day^{-1}	16000	44000
Other energy needs/kj day^{-1}	2,700	40,000
Feeding rate/kg hour^{-1}	0.8	1.4
Time spent feeding/hours day^{-1}	18	12
Length of intestine as multiple of body length	X6	X25

(a) For a 70 kg giant panda, calculate the daily:
   (i) mass of bamboo eaten (1)
   (ii) energy intake in the form of bamboo (1)
   (iii) energy transferred to the panda from its food (1)

(b) Suggest **one** reason why such a small proportion of the energy in the bamboo is obtained by panda's digestive systems (1).

(c) Compare the mass of food eaten per day with the basal metabolic rate for both a panda and a giraffe (2).

(d) Comment on the chance of survival of an individual, 75 kg panda in view of its typical, daily energy budget (2).

Answers

1. Means that individuals from different populations cannot mate;
    Leads to inbreeding;
    Loss of genetic diversity;
    Therefore unable to adapt to environmental change/susceptible to disease/defects;
    Unable to find bamboo during synchronous blooms;

2. (a) (i) 0.8 kg/hour x 18 hours = 14.4 kg;
    (ii) 14.4 kg x 7500 kJ kg = 108 000 kJ;
    (iii) 108 000 kJ x 15% = 16 200 kJ;

(b) Unable to digest cellulose/ short digestive system means that food passes through too quickly;

(c) A giraffe eats only a little more (16.8 kg) in a day than a panda;
    However, this supplies over four times as much energy;

(d) There is almost no energy available for other processes e.g. growth and repair;
    the panda will be unable to fight diseases etc/ is likely to be unhealthy / die;
    Bamboo feeding grounds are being lost and pandas do not have the energy needed to move to new areas;