Inflow
births
immigration

A
B
C

D

Overflow
lower recruitment
higher mortality
poor condition
increased emigration
habitat degradation

Outflow
culling
predation
natural deaths
accidents
emigration

Introduction

The aim of this guide is to illustrate how deer population numbers and structure can vary over time. This guide is linked to the Management Plans, Cull Planning and Population Modelling guides which should be considered essential companion reading.

Terms

habitat = the land to which a population of deer has access this might comprise a mixture of woodland/ forest, farmland, moorland, and so on.
impact = the effect, through browsing/grazing, and other behaviour, that deer have on their habitat, including effects on other species reliant on the habitat, and on human interests such as deer vehicle collisions and crop damage. Note that impacts can be both positive and negative and in some cases neutral depending on human objectives.

Population dynamics

The way that the numbers and structure of an animal population vary over time, and the factors which cause variations, are described by population dynamics.
In the case of deer the size of the population changes in response to a number of factors as illustrated in Fig. 1.

Fig 1. The reservoir and dam represent the habitat in which the deer live.

The water level "C" represents the current deer population level. While the inflow and outflow are equal the population will be stable, if the inflow exceeds the outflow, the population will rise, if the outflow exceeds the inflow the population will fall. Culling can be regarded as a sluice gate by which the amount of outflow can be varied.

At level "D" numbers are low and habitat resources are abundant, consequently deer mortality is low and recruitment is high. Habitat and deer condition are both good.

As the population rises towards level "B" competition between individuals and habitat impact increases, but at level "B", the "sustainable carrying capacity" (SCC), the habitat can sustain the deer in good condition throughout the year without further degradation.

If the population reaches "A" ,the "absolute carrying capacity" (ACC), there will be lower recruitment, higher mortality and generally poorer body condition. Emigration/range expansion may increase if the surrounding area is not already saturated. There will be significant impact to the habitat and the original carrying capacity may be reduced (equivalent to the top of the dam wall being eroded).

Most deer populations, in the absence of significant predators (as in the UK), and if not culled adequately, have a tendency to grow over time towards level "A". The rate of growth of an unmanaged population in favourable conditions and with an even sex ratio, can be between 15 and 30 percent per annum. If there are more females than males (as is often the case) the rate of growth can be considerably greater.

Managing a population

Usually deer populations should not be allowed to reach the absolute carrying capacity, it is not likely to be good for the deer or their habitat. This implies that most deer populations require some management to hold them at least at the SCC. Human interests (e.g. preventing damage to crops or sensitive habitats) may dictate a further reduction to a "managed carrying capacity" (MCC), the range of which is indicate by levels D and B in fig. 2. The actual level will be determined by management objectives, see also the Cull Planning guide.

Currently the only practical method of manipulating population numbers is to cull (increase the "outflow") and in particular to ensure a sufficient cull of female deer, since they are responsible for the majority of the "inflow". See the Cull Planning guide.

If there are multiple objectives in one area then priorities will have to be set and compromises made.

If more than one deer species are present management objectives for each species may vary. Where neighbours have widely different objectives in managing deer, attempts should be made at resolving differences (see the Cross Boundary Liaison guide).

Fig. 2 Changes in a deer population where "inflow" exceeds "outflow" e.g. an unmanaged population or where numbers culled are less than recruitment. The solid black line shows how deer numbers increase if management is insufficient to prevent a rise in population. The shape of the curve depends on the deer species, the factors affecting recruitment and natural mortality and the degree of culling. Culling can hold the population at points along the curve as illustrated by the examples in Table 1 below. See also the Cull Planning guide.
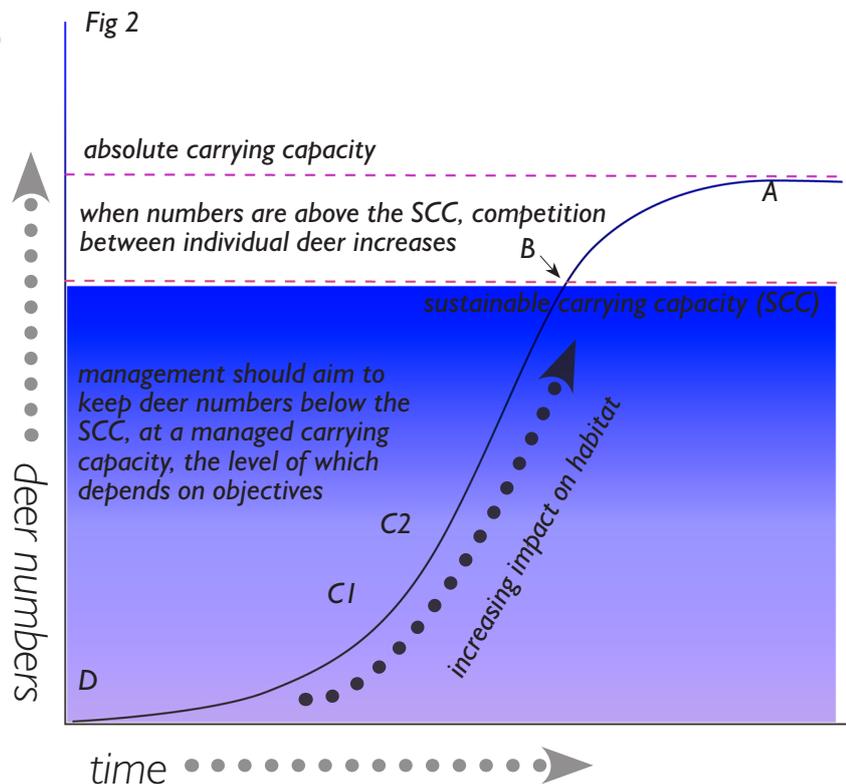
Fig 2

absolute carrying capacity

when numbers are above the SCC, competition between individual deer increases

A

B

sustainable carrying capacity (SCC)

management should aim to keep deer numbers below the SCC, at a managed carrying capacity, the level of which depends on objectives

C2

C1

increasing impact on habitat

D

deer numbers

time

Table 1

Population level on graph	Management objectives	Actions
D	Minimum numbers. Numbers held as close to zero as possible (e.g. to protect a salad crop) Or Deer numbers are currently low	As many deer are culled as possible. It may be more appropriate or cost effective to fence a whole site, or accept very limited impact. Or No management may be considered necessary but provision should be in place should the situation change.
D - C2	Example of a range of population where limited impact is accepted e.g. to forestry crop or habitat. C2 represents the maximum numbers tolerable and will be higher/lower according to the situation.	A 'maintenance' cull programme keeps numbers at a tolerable level between D and C2. Impact is monitored and if it is becoming intolerable a 'reduction' cull is begun, focussing on female deer. On small, sensitive areas fencing could be combined with culling in the wider area.
C1 - B	Typical range of population in a herd managed for multiple objectives. Max antler quality is more likely nearer to C1, max venison production nearer to B. Habitat and crop impact will increase as deer numbers increase and could become intolerable before other objectives, which might require higher numbers, are achieved.	A 'maintenance' cull programme keeps numbers at a level that satisfies as many objectives as possible. Progress against objectives is monitored and if not satisfactory due to high deer numbers a 'reduction' cull is begun. Evidently, the higher the population has become, the longer it may take to reduce it. On small, sensitive areas, fencing could be combined with culling in the wider area. Individual objectives may change over time and the population level can be raised or lowered to accommodate them.
A	Population at or near carrying capacity. Individual animals probably in poorer condition and more prone to mortality especially in prolonged period of harsh weather. High probability of damage to habitats and crops and increased risk of deer vehicle collisions. Increased likelihood of deer range expansion.	Deer numbers on the property or surrounding areas may well not be tolerable. A 'reduction' cull will bring numbers down but because of the size of the cull required, and because the general condition of the animals may improve as a result of lowering numbers (thus increasing recruitment and survival rates), it may take a sustained effort over a number years to bring numbers to the desired level. The focus should be on culling a large number/proportion of female deer during the reduction phase.