Axis axis **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Artiodactyla	Cervidae

Common name Indian spotted deer (English), axis deer (English), chital (English)

Synonym *Cervus axis*

Similar species

Summary *Axis axis* is an introduced species of deer from India. It has historically been introduced to various locations because of its desirable qualities as a game species. When herd populations become too large they impact local vegetation and increase erosion. They also forage on a variety of vegetation removing food sources for many native species and domestic cattle. They also carry transmissible diseases and pose an increased threat to human safety in and around highway corridors.

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Species Description
Axis axis is a moderately large deer standing 88-97cm at the shoulders. It has a rufous brown coat that is covered with white spots on the abdomen, rump, throat, insides of legs and ears and underside of tail that persist throughout the life of the animal. A dark stripe runs down the back from the nape to the tip of the tail. A gland-bearing cleft is present on the front of the pastern of the hind foot. *A. axis* dental formula is similar to elk, *Cervus elaphus*, but the upper canines (the so-called \"elk teeth\") are lacking. Males measure an average total length of 1.7m with a tail 200mm in length and their height at the shoulder can reach 90cm. Females are generally smaller. Weights can reach 66-113kg in males and 43-66kg in females (Mungall and Sheffield, 1994). Antlers are present only on bucks, and immediately upon shedding a set of antlers, growth begins on the next set. The larger the antlers, the longer the development period, from \"velvet\" through to \"hard\" antler. Antlers over 76cm take roughly five months to fully develop. Each antler has three tines; the brow tine forms at near right angle with the beam and the front (or outer) tine of the terminal fork is much longer than the hind (or inner) tine.

Notes
Axis axis was originally classified as *Cervus axis*, making it a species of elk. However, the classification was shifted in the 1950's, elevating *Axis* to its own genus. Today, there are two distinct species in the *Axis* genus: *A. axis* (chital) and *A. porcinus* (hog deer). Furthermore, *A. axis* now contains three subspecies: In India and Nepal there is *A. axis axis*, Sri Lanka hosts the closely related *A. axis cylonensis*, and at least one more subspecies exists and is recognised as *A. axis calamaniensis* (Anderson, 1999).

Lifecycle Stages
Davis and Schmidly (1997) report that *Axis axis* fawns begin eating green forage by 5½ weeks of age, but weaning is delayed until they reach 4-6 months of age. Permanent dentition is acquired when 2½-3 years of age and adult size is reached at 6 years for females and 4-5 years for males. The natural lifespan of *A. axis* is 9-13 years, although zoo animals may reach 18-22 years of age. *A. axis* are gregarious and found in herds ranging from a few animals to 100 or more. The leader is usually an old, experienced doe. Adult males are normally found living with herds of young and old animals of both sexes. Rutting males vocalise *via* a bugle-like bellow and both sexes have alarm calls or barks (Davis and Schmidly, 1997).

Uses
The meat of *Axis axis* (venison) is highly regarded as it is extremely lean. As a result, there is an economic value for the meat. Poaching and blackmarket sales are common wherever *A. axis* occur. The axis deer is a prized hunting quarry, owing to its beauty, especially bucks with antlers > 76cm. Many game ranches receive upwards of US$1000 for each trophy buck taken (Anderson, 1999).

Habitat Description
Axis axis are found almost exclusively at lower elevations (below ~ 1000m) throughout dry and mixed deciduous forest habitat and secondary forest lands broken by glades, with an understorey of grasses, forbs and tender shoots which supply adequate drinking water and shade. They are most commonly associated with a mixture of forest and more open grass-shrub, but they occupy a wide range of habitats throughout their native range, often avoiding rugged terrain. Their native range is characterised by significant seasonal changes in temperature and, more significantly, extreme swings in precipitation. The deer regularly encounter long periods of drought and poor forage availability, as well as widespread flooding and lush seasonal growth during the rainy season (Anderson, 1999; and Davis and Schmidly, 1997).

Reproduction
In the wild, *Axis axis* bucks are found throughout the year with hardened antlers and in rutting condition. The reproductive cycle of each individual is not synchronised with that of other males in the herd. Concurrently, throughout the year, some bucks are coming into rut, while others are going out of rut, or are in a non-breeding condition. Females also experience non-synchronised estrous cycles, with each cycle lasting about 3 weeks. Bucks do not retain harems of does, but instead mate with does in each herd as they become receptive. One fawn is typically produced per pregnancy and gestation lasts 210-238 days. Following parturition, females again mate during the subsequent breeding period. Adult females tend to produce one fawn each year (Davis and Schmidly, 1997).

Nutrition
Axis axis consume an extremely wide range of forage items throughout their native range and in introduced locales. They eat over 75 species of plants, as well as the full spectrum of plant parts including leaves, stems, fruits, seeds, flowers and bark. Their diet consists largely of grasses in all seasons, augmented with browse. Green grasses less than 10cm high are preferred. In Texas, they graze on grasses such as paspalum, switch grass and little bluestem. Sedges are favourite spring foods. Browse species include live oak, hackberry and sumac (Anderson, 1999; and Davis and Schmidly, 1997).

General Impacts
Axis axis often congregate in large groups and return to, and remain in, areas for long periods of time. When they occupy riparian areas, they heavily trample and browse vegetation. During the rut (reproductive season) significant impact to trees occurs when bucks rub and polish their antlers on bark, frequently leading to the death of the trees. This results in a loss of the stability that vegetation provides, with resulting destabilisation of stream banks, changes in stream flow and increased erosion and sedimentation of streams, ponds and rivers. When deer populations become too large, their trailing behaviour creates dirt pathways through even the thickest of vegetation. These trails can lead to significant erosion and, in wet forest areas, increase runoff by decreasing the mossy layer available that would normally retain water (Anderson, 1999; and the National Park Service, 2004).
\r\nAnderson (1999) reports that *A. axis* cause crop damage when natural forage is scarce. In their introduced range, they can also compete directly with cattle for forage. Although they prefer to graze grass, it is clear that the deer will respond to available forage conditions and eat what is available to them, which causes damage to local native species. *A. axis* can also graze forage grasses and other plants much closer to the ground than domesticated species. In extreme drought conditions, *A. axis* will eat bark off trees (Anderson, 1999).
\r\n*A. axis* have been found to carry and transmit bovine tuberculosis and several other diseases. They carry common parasites that can directly affect humans if and when droppings enter freshwater systems. Parasitic zoonoses harbored by *A. axis* include: leptospirosis, cryptosporidiosis, and strains of *Escherichia coli* (Anderson, 1999).

Management Info
Preventative measures: Risk Assessment models for assessing the risk that exotic vertebrates could establish in Australia have been further explored by the Western Australia Department of Agriculture & Food (DAFWA) to confirm that they reasonably predict public safety, establishment and pest risks across a full range of exotic species and risk levels.
The Risk assessment for the Axis deer (*Axis axis*), has been assigned a VPC Threat Category of **EXTREME**. Mammals and birds were assessed for the pest risk they pose if introduced to Australia, by calculating Vertebrate Pests Committee (VPC) Threat Categories. These categories incorporate risk of establishing populations in the wild, risk of causing public harm, and risk of becoming a pest (eg causing agricultural damage, competing with native fauna, etc). The 7-factor Australian Bird and Mammal Model was used for these assessments. \r\n
Physical: The most successful control strategies for *A. axis* has been a combination of fencing and hunting. Control by fencing is not 100% and deer often escape. *A. axis* are able to jump over 2m fencing and studies show that 3m or higher fencing is required to adequately keep *A. axis* out of, or inside, an area.
Once *A. axis* become established in urban and suburban areas, hunting does not remain a practical method of control, therefore it is best to gain control of *A. axis* populations before they become established in suburban areas (Anderson, 1999; and the University of Hawai'I, Undated).
Biological: Reproductive control using such techniques as contraception and sterilisation are possibilities for management but are expensive and time-consuming, requiring many man hours of labor intensive field work. New Zealand controls its exotic deer populations through recreational and commercial hunting, which have been very effective.

Pathway
Many game ranches receive upwards of $1000 for each trophy buck taken (Anderson, 1999).

Principal source: Anderson, 1999. Axis Deer Overview & Profile
Davis and Schmidly, 1997. The Mammals of Texas.

Compiler: National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG)

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Pubblication date: 2010-01-25

ALIEN RANGE

[3] ARGENTINA
[1] CROATIA
[1] AUSTRALIA
[19] UNITED STATES

Red List assessed species 9: EX = 2; CR = 4; EN = 2; VU = 1;

Ctenitis squamigera **CR**
Moho bishopi **EX**
Paroreomyza montana **EN**
Psittirostra psittacea **CR**
Tinostoma smaragditis **EN**
Drepanis funerea **EX**
Myadestes lanaiensis **CR**
Pseudonestor xanthophrys **CR**
Pterodroma sandwichensis **VU**

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Summary: Eradication case study in Turning the tide: the eradication of invasive species.

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