Most threatened species of deer occur in isolated rural areas of developing countries where wildlife poaching and pressure on wildlife habitats, like grazing, cutting of grass and collection of fuel wood is frequently intense (Holloway 1975). This is unfortunate; that many of these species are on the verge of extinction and a detailed knowledge of their ecology is required for long-term conservation measures (Martin 1977). The rapid decline of swamp deer *Cervus duvauceli duvauceli* in the terai area of Uttar Pradesh (U.P) over recent years is a case in point. The barasingha or Indian swamp deer- (*Cervus duvauceli* Cuvier 1823) belongs to a species group together with the brow-antlered deer (*Cervus eldi*) and the extint Schomburgk’s deer (*Cervus schomburki*). These deer species evolved in the indo-chinese and Malayan subregions (Mani 1974). The evolutionary history of the cervids indeed goes back to the Miocene of Eurasia, about 20 million years ago and resulted in forms resembling modern musk deer (Clutton-Brock *et al.* 1982). Forest dwelling muntjak-like deer occurred widely in Eurasia by the middle of Miocene (Viret 1961). Towards the end of Miocene cervines invaded open habitat and started feeding extensively from grassy plants, and in the late Pliocene a progressive complexity of antler forms appeared (Clutton-Brock *et al.* 1982) pointing to progressive radiation of modern deer species. In the wake of this evolutionary process, the speciation of the three closely related deer, which are all adapted to swampy grassland conditions, must have taken place in the riparian flats and alluvial flood plains (Mani 1974).

Descriptions on barasingha *Cervus duvauceli* appeared sporadically in hunting literature of the last century. Blanford (1888-91) was however, the first to give an account of the
distribution of the species. Brander (1923) presented more information on the barasingha and made a distinction between the barasingha in northern India and those in central India. Ellerman & Morrison-Scott (1951) subsequently distinguished two subspecies: *Cervus duvauceli duvauceli* Cuvier 1823 and *Cervus duvauceli branderi* Pocock 1943. Later, Groves (1982) distinguished the northeast race as new sub-species and named as *C. d. ranjitsinhi*. Now three subspecies of swamp deer are known to occur in the Indian subcontinent namely *Cervus. d. duvauceli* distributed in northern India, *Cervus. d. brandreri* distributed in Kanha National Park in central India and *Cervus. d. ranjitsinhi* distributed in Assam.

(i) *Cervus duvauceli duvauceli*:
This sub-species inhabits the soft swampy grounds of Northern India. It has lighter coat and whitish horns. This terai animal has a larger hoof, which helps them to move on swampy grounds. In term of skull and antlers, they have short nasal comparing to snout length, nose not deep or swallow, antlers long, slender not compressed or palmated. The ears are large and rounded with thick white hairs internally. Tail is longer then *C.d. ranjitsinhi*.

(ii) *Cervus duvauceli branderi*:
This central Indian sub-specie prefers hard ground and has a darker coat with dark antlers having white tips. The hoof is hard and well knit with normally haired pastern. Its name is derived from A.A Dunbar Brander who had first studied and described it as a distinct from the terai variety. Skull of these animals are small and body size is also small; nasal long, snout is short but nose is not deep, maxilla is rather broad as nominate race. Antlers are
extremely long and many branched with long brow tine, branching high up the beam, and anterior branch especially long.

(iii) *Cervus duvauceli ranjitsinhi*

This race is heavily built, but linearly of the same height as *C.d. brander* i.e. smaller than the nominate race. The ears are smaller, less rounded and distinctly pointed and have very little white hair on the inside unlike the other two races. The tail is shorter. It can be distinguished by its elongated nasals and short deep snout, short thick antlers, branching low down, with especially shortened anterior branch, antlers somewhat compressed and tends to be palmated. The feet are splayed with bare heel as in *C.d duvauceli*.

Preferred habitats of the swamp deer are marshes and grassland (Sankaran 1990). The ruthless destruction of terai ecosystem for agriculture and human settlements has led to large-scale fragmentation, shrinkage and degradation of these unique vegetation types. Simultaneously, the population of mammalian and avian species such as one horned rhino *Rhinoceros unicornis*, tiger *Panthera tigris*, swamp deer *Cervus duvauceli*, hispid hare *Caprolagus hispidus* and Bengal florican *Eupodotis bengalensis* witnessed serious decline in their abundance and distribution. Due to repatriation of settlers through out the terai of UP, most of the grasslands have been converted into agriculture in the past (Sankaran 1990) Forestry policies have often considered grasslands as “wasteland”. The resulting plantation of exotics and indigenous tree species in grassland has converted several good grassland habitats into woodland (Rahmani et al. 1988).
Distribution

The barasingha is indigenous to India. It is believed that barasingha in the historic past ranged over a large tract along the foothills of the Himalayas in the alluvial and flood plains between the Indus in the west to the Brahmaputra in the east extending to the Sundarbans, and to the south as far as the Godavri. The distribution range of swamp deer was reduced considerably due to habitat destruction and over hunting and at the turn of the 20th century, the species survived in swampland areas from upper Assam extending to the Sundarbans in the east to the Indo-Gangetic plains in the west and south wards up to eastern Maharashtra (Jerdon 1874, Bhadian 1934, Prater 1980, Brander 1982). The trend in range reduction continued and Schaller (1967) reported swamp deer from 28 localities only, of which five were in southern Nepal and the rest were in the Indian states of Uttar Pradesh (U.P.), Assam, West Bengal and Madhya Pradesh. At the beginning of the 21st century barasingha could only be found in three relatively small areas: firstly the Kheri, Pilibhit and the adjacent division in southwestern Nepal including Sukla Phanta Sanctuary and a small population was recently reported in JilMil taal of Haridiwar district, Uttaranchal; Secondly the Manas and Kaziranga National Parks in Assam with a few animals have been recorded in Laokhowa Sanctuary. Thirdly, the Kanha National Park in Madhya Pradesh. Although it cannot be entirely excluded that a few straddlers may be found outside these isolated areas, they would certainly not amount to viable population.

Status

The barasingha is highly endangered species listed in schedule I of the Indian Wildlife (Protection) Act 1972 and Appendix-I of the Convention on International Trade of Endangered Species (CITES). The establishment of Dudhwa National Park in 1977, was
therefore, hailed as great event, because it meant strict legal protection to the habitat of largest surviving herd of this species. The status of subspecies of barasingha *Cervus. d. duvauceli* was first assessed by Schaller (1967), who reported the presence of this subspecies from 11 localities in northern India. Holloway later reviewed the status in 1973 that found barasingha surviving in four localities out of 11 localities surveyed by Schaller in 1967. The four localities were in Pilibhit, north Kheri, south Kheri, and Bahraich. Exact population numbers were difficult to obtain. The latest estimate of 1,270 –1,450 was reported by Qureshi (1995). Sankaran (1990) estimated the barasingha population to be 765 in whole of the Dudhwa National Park.

**Description**

The barasingha (*Cervus duvaucelli*) is a large deer about the size of a North American wapiti or Indian sambar. Morphologically it is closely related to several species (red deer, wapiti, sika, maral, sambar) in the genus *Cervus* in the New and Old Worlds and Asia. It is a large, graceful deer, standing 44 to 46 inches high at the shoulder (Blandford 1888-91). A full grown stag weighs about 138 kg (Brander 1923). Barasingha shows marked seasonal change in its coat color. Animals in their summer coat are a rich chestnut brown on the back and somewhat lighter brown on the sides and belly and creamy white on the inside of legs, rump and underside of tail. The winter coat, which is acquired by hinds in November is dull to grayish brown. Adult stags have a long, coarse, dark brown, almost black coat, considerably darker than that of hinds and young stags. The hair on the neck especially in males is up to five inches long, giving the animal a prominent ruff. The chin and throat are whitish and so are inside the ears. The fawn has brown coat without spots. The first indication of the antlers is small bumps on the frontal bones, which appear at about seven
months of the age in the fawn. Yearling stags have simple spike antlers. The first set of adult antlers usually consists of brow tine and a main beam with one or two forks. (Schaller 1967, Martin 1977). Barasingha in hindi means twelve —pointer” indicating antler pattern in adult stags with an antler crown of 5 tines about halfway up to the antler beam in addition to the brow tine, which branches off at a right angle. This result in a total number for both antlers of 12 tines. Very old stag may carry antlers with sometimes as many as 7 tines on each beam. The number of antler tines and the weight varies considerably according to age, food condition and other factors.

The barasingha cast their antler in May in Central India. The barasingha in Northern India and Nepal as well as Easteren India have generally advanced antler growth with stags cast their antlers in January in Assam and February in northern India and Nepal (Schaller 1967). However under the present study it was found that stags shed their antlers in ending March in Dudhwa Kishanpur Conservation Units (DKCU). The first stag which cast its antler was seen on 22 March. Record antler length of barasingha was reported Ward (1922) which measured 104cm round the curve. Burke (1928) collected three sample from Central India, all with 104 cm. In 1977 Martin collect a pair of antlers in Kanha National Park its length round the curve was 92 cm. In 2006 a pairs of antlers was collected in Dudhwa National Park whose length round the curve was 82 cm having 14 tines.

Literature Review

In India research on different ungulate species has not made significant progress unlike in Africa where long-term studies have been carried out on majority of ungulate species. (Schaller 1967) did pioneering studies in the Kanha National Park on species such as chital,
sambar and swamp deer; This was followed by detailed study in Gir Forest Ecosystem by Berwick in 1974, Khan 1993 also studied ecology of Gir ungulate. Green (1985) studied ecology of muck deer in Kedarnath Wildlife Sanctuary and Green (1987) analyzed the ecological separation in Himalayan ungulate. Pendharkar and Goyal (1995) carried out a study on social organization of Goral in Simbalbara Sanctuary and Darpur Reserved Forests. Mishra and Johnsingh (1996) studied habitat selection of Goral in Himachal Pradesh. Ilyas, Khan & Khan (2003) have studied status, abundance and factors governing distribution of ungulate in Kumaon Himalayas. Barasingha, the second largest deer in DKCU has been one of least studied in all respects throughout its ranges. Most of the information on the species is limited to the observation published as short notes (Bhadian 1934, Holloway 1973 Qureshi 1991, Schaaf & Singh (1977) & Qureshi et. al. 1995). However Martin (1977) studied the ecology of hard ground barasingha in Kanha National Park. Primarily the information on the DKCU comes in the form of various official documents of the Forest Department. These include Forest Working Plans (North Kheri Forest Division- Kakkar 1964, Chandra 1973, Gaur 1982, Srivastava 1993 and South Kheri Forest Division - Chandra 1972, Rizvi 1980, Pant 1990, Srivastava 2000) and Wildlife Management Plan for Dudhwa National Park and Dudhwa Tiger Reserve (De 2001). Singh (1997) has listed 821 species of angiosperms in the flora of Dudhwa National Park. It was only during 1980s that the DKCU attracted attention of researchers and since then several researches on selected featured faunal species have been undertaken. Prominent among them are: the ecology of swamp deer (Singh 1984), rhino habitat and monitoring of reintroduced rhinos (Hajra and Shukla, 1983, Sale and Singh1987, Sinha and Sawarkar 1991), ecology of Bengal florican (Rahmani et al. 1990, Sankaran and Rahmani 1991), study on bird diversity (Javed 1996), ecology of Black necked stork (Maheshwaran 1998)
and management of forest in India for biological diversity and forest productivity (Kumar et al. 2002). Singh (1985) provided area statistics under different vegetation types based on Landsat – 3 satellite data of November, 1981. Although Singh 1984 studied ecology of swamp deer, but after this no study has been done on this species. Once the Satiana area of Dudhwa National Park was famous for its swamp deer, but now population in this area is drastically declined. Present study focus on the factors responsible for decline of Satiana population.

Objectives of the study

- To estimate the population status, distribution, abundance and structure of barasingha *C. d. duvauceli*.
- To investigate the habitat utilization pattern of barasingha *C. d. duvauceli*.
- To study food habits of barasingha *C. d. duvauceli*.
- To study the basic diurnal activity pattern of barasingha *C. d. duvauceli*.
- To know the predation pressure on barasingha population *C. d. duvauceli*.
- To suggest mitigation measures for threats to its conservation.
Figure: 1.1. Past and present distribution of *Cervus duvauceli*