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*Research Article*

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# Ecology and Feeding Habitat of the Gaur (Bos gaurus, Smith, 1827) in Similipal Tiger Reserve, Odisha, India

**Sandeep Ranjan Mishra*** **and Mohan M**

*Regional Chief conservator of forest and field director, Similipal Tiger Reserve, Baripada, Odisha, India*

***Corresponding author**
Sandeep Ranjan Mishra, Regional Chief conservator of forest and field director, Similipal Tiger Reserve, Baripada, Odisha, India.

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**ABSTRACT**

The gaur Bos gaurus distribution ranges from India to south Asian countries. The red list of threatened species categorizes gaur as vulnerable species and today they are found in 11 range countries. The estimated population is to be 13,000 to 30,000 with approximately 85 per cent of population being Present in India. The distribution includes thorn forest to evergreen forests. Gaur is both grazer and browser. The food plants are from the families of Poaceae, Fabaceae, Asteraceae and Malvaceae which collectively formed the major food species. The Gaur in Similipal Tiger Reserve was observed to feed on diverse species of food plants comprising of 47 species of plants of Gaur were represented by 18 species of grasses, 6 species of herbs, 8 species of shrubs and 15 species of trees. The food plants from the families of Poaceae and fabaceae constituted nearly 50% forming the major food plants species in Similipal.

**Keywords:** Bos gaurus, Ecology, Food, Feeding Habitat, Similipal Tiger Reserve

**Abbreviations:** L-Leaf, F-Flower, Fr-Fruit, S-Shoot

## Introduction

Gaur Bos gaurus is the largest bovid confined to the oriental Biogeographic region of the world. Approximately 85 per cent of its current global Population occurs in India [1]. From its reported distribution in the past the species has experienced dramatic range reductions with present population surviving in isolated forested patches. Information on its current distribution status in India has been gained through a questionary survey and literature reports [2,3]. Little is known about its ecology other than natural history accounts [4,5]. The biology and ecology gaur in different specific locations were investigated by Moorthy, Prabakar, kannan, pasha et.al. Chetri and Gad and Shyama [6-11]. In addition, two ecological studies were carried out in other countries i.e. Conry investigated home range and habitat utilization in Malaysia [12]. Prayurasiddhi attempted a comparative study on gaur and banteng (Bos javanicus) in Thailand in which the population, feeding ecology of these species were investigated [13]. Gaur is vulnerable to epidemic diseases of foot and mouth disease, Anthrax and Rinderpest [12,14]. Furthermore, poaching of animals and habitat degradation are responsible for the decline of population. The IUCN red list recommends the need for detailed scientific investigation to fill current gaps in understanding species distribution, ecology and biology [2]. As first step we aim to review the gaur literature and discuss the ecological, feeding habitat of the species and also highlight of future research.

## Study Area

Similipal is a densely forested hill in the heart of Mayurbhanj District lying close to the eastern most end of the Eastern Ghats in the Mahanadian Province and within the Chotanagpur plateau. Similipal is the richest water shed in Odisha giving rise to many per¬ennial rivers. Four types of forest habitat such as semi-evergreen, tropical moist deciduous, dry deciduous hill forests and high level sal are found in Similipal Tiger Reserve which is spread over 2,750 km² and contains 1,708 species of plants, including 94 species of orchids. It also hosts 55 species of mammals, 304 species of birds, 60 species of reptiles, 21 species of frogs, 60 species of fishes and 164 species of butterflies. The core area has a size of 1,194.75 km 2 [15,16].

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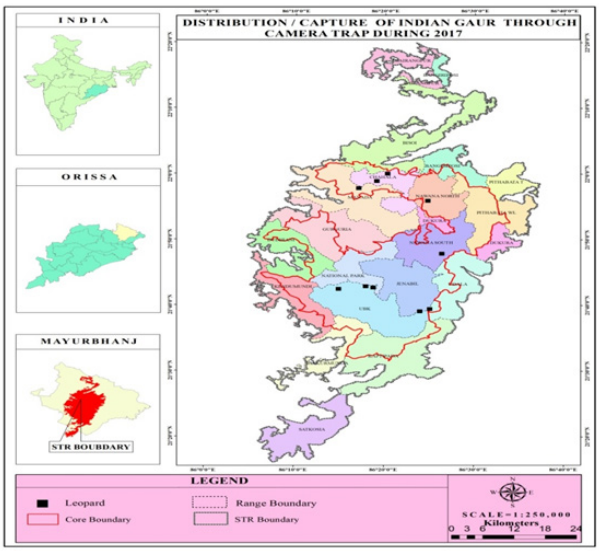


**Figure 1:** Study area and distribution of gaur during 2018.

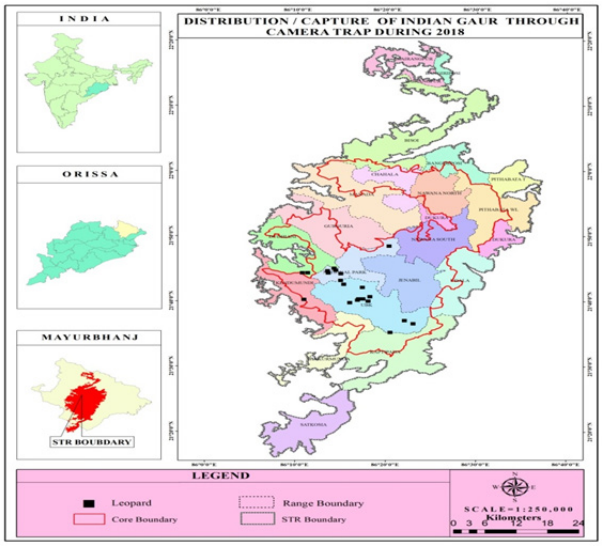


**Figure 2:** Study are and distribution of gaur during 2017.

**Description**

Gaur is the tallest living oxen and the second heaviest. Gaur bulls weigh 600-1000 kg and stand 1.6 to 1.9m of shoulder, whereas cows are about 10cm shorter and weigh about 450 to 800 kg. Gaurs are sexually dimorphic. Both sexes have horns. In males the horns are larger especially at base with more outward swath and the curving is less at the tips. Adult males have pronounced muscular crest between shoulders and a large dewlap hanging between the forelegs and smaller one under the chin [5]. Adult bulls have a shiny black, short-haired pelage except for white stockings, a gray boss between the horns, and rusty-colored hairs on the insides of the thighs and forelegs. Young bulls are dark brown like the cows' horns of young bulls are smooth, yellow-orange in colour and tipped with black, whereas the old bulls are corrugated a dull olive in colour and sometimes frayed at the tips.

Cows are considerably smaller than the bulls and their dorsal ridges and dewlaps are not prominently developed. The pelage of cow is dark brown in color and the horns are slenderer, more upright and with a more inward curved than those of bulls. Juveniles are brownish with spike horn. Young calves weigh about 43 kg have a light brown coat and lack the conspicuous white stockings which do not appear until they change into a dark brown pelage at the age of about three months.

**Reproduction**

In southern India the majority of mating reportedly takes place between Novembers and March [17]. The association of adult males and rutting behaviour is observed during this period in Mudumalai Tiger reserve [18]. The gestation period of gaur is reported to be nine months and give birth to a single calf. The cows move away from the herd before giving birth and remains with the calf for few days before rejoining the herd. The newly born calf becomes active after few minutes of birth [19]. In central India, most Gaur mates in December and January, and calves are born in August and September [20]. In Kanha National Park (central India), most 5to 8 months the young suckle milk and then switches over the green feed. Schaller recorded rutting bulls from December to June, with an apparent peak of sexual behaviour in March and April [6]. However, the occurrence of a few new-born animals throughout the year indicated that some mating must occur in every month.

**Mortality**

Information on mortality rates is not available, but large carnivore diet profile studies suggest that gaur in the diet composition of tiger ranges from 1.87 to 30.4 per cent. Schaller reported that 50 per cent of calf mortalities are due to predation [6]. Gaur constitutes less than 10 per cent in tiger's diet in Mudumalai and Kanha of India [6,21]. It constitutes higher percent in Nagarahole, Bandipur, and Indira Gandhi Wildlife Sanctuary of India with 17.4 per cent, 23.9 per cent and 30.4 per cent respectively [22-24]. In leopard's diet gaur constitutes less than 10 per cent. Whereas in wild dog's diet, it constitutes less than 1 per cent in Mudumalai and Bandipur and 12 per cent in Indira Gandhi Wildlife Sanctuary [22-24]. Poaching for meat and horns remains a serious threat for this species in Kerala-Karnataka, Kerala- Tamil Nadu boundary and North-eastern India [4].

**Threats**

Most gaur range countries are developing countries with limited financial resources to commit to conservation, so funds remain major constraints in gaur Conservation. One of the major limitations is lack of information regarding the population dynamics and habitat requirements of gaur in most protected areas. Furthermore, the estimates varied due to differences in methods of data collection, predator density of the respective area, spatio-temporal variations of gaur and influence of another mega herbivore in the ecosystem. Thus, long term monitoring of population is required other than density estimates to understand the dynamics of the system. Habitat loss has been largely responsible for the large-scale decline of gaur range and it remains a major threat to gaur conservation in Asia [2,3]. The habitat degradation and fragmentation affect gaur population in two ways. They are i). The physical disturbance caused by people such as wood cutting and forest fire and ii). Loss of food availability due to extensive cattle grazing. Poaching of gaur for meat and horns is one of the serious threats for conservation of gaur even in protected areas.

Epidemic diseases such as rinderpest causes a widespread of death of gaur and this disease has been reported in Southern and Central India [25].

**Distribution in India**

Surprisingly the majestic animal has not been well studied. In India, Gaur is Isolated into three disjunct regions they are South Western India (SWI), Central India (CI) and North Eastern India (NEI). Information on NEI is found in Choudhury and Gupta and Mukherjee [26,27]. While, CI and SWI are discussed in Davidar, Krishnan, Saharia, Shukla and Khare [5,28-30].

**Central India**

In central India, the gaur extends from central parts of the Satpura Range to the Chotanagpur Plateau and then to the northern ranges of the Eastern Ghats. Parts of the Deccan Plateau between the Gawilgarh Hills and northern Eastern Ghats also forms some of its range. It is distributed in the states of Maharashtra (northern and eastern areas), Andhra Pradesh (northern areas), Madhya Pradesh (mainly eastern and southern areas), Chhattisgarh, Jharkhand, Bihar (South-Western corner), Uttar Pradesh (only in extreme South-eastern areas) and Orissa. Central India has the highest gaur habitat of the three regions, with some 83,000 km2. The approximate gaur population is 9000 to 14000. Some important gaur areas are Melghat in Maharashtra, Kanha and Pench in Madhya Pradesh, Indrāvati in Chhattisgarh, Palamau in Jharkhand and Simlipal in Orissa. In Similipal gaur distributed throughout the tiger reserve [31-35].

**Material and Methods**

The study on the activities of food and feeding of Gaur was conducted through direct sighting in different field trips during April 2016 to dec 2019. Field Survey were conducted for gaurs form early morning to till evening. During the field survey if direct encounter GAUR. After gaurs left the place observe the plants on which they had fed. Trails, foot path, forest road, Salt licks, water bodies were followed and plants on which the gaurs had fed were also collected. Collected plant species were identified by use of field guides. Management plan, forest survey of India reports and Botanical Survey of India and consultation with local staff and forest official. Data on activity pattern, food plant species and feeding of gaur were recorded by direct sighting with the help of a pair of Bushnell 10x50 binocular. After direct observation of feeding of animals on site inspections of food plants species were identified as per Saxena and Brahmam [36-40].

**Results and Discussion**

**Time Activity**

Daily activity pattern of gaur shows a bimodal diurnal activity pattern in feeding with peaks in the morning and evening hours. Fedding activity was low during noon hours when there was gradual increase in resting and reached a peak noon and then gradually decreased. The animals were observed to recline in the cover during hottest period of the day and rumination mostly occoured during this resting period. Moving was more or less uniform throughout the day and it was more during morning and evening along with feeding than noon hours. But during dry season moving was observed to be more in noon hours as the gaur moved from one place to another as shade moved. Social behavior includes suckling, fighting and playing. Vigilance was observed more while feeding and evening hours. A vigilant gaur stands in a typical posture with its head raised, ears erected and directing its head towards source of danger [41-46].

**Food and Feeding Habitat of Gaur**

The Gaur in Similipal Tiger Reserve was observed to feed on diverse species of food plants comprising of 47 species of plants of Gaur were represented by 18 species of grasses, 6 species of herbs, 8 species of shrubs and 15 species of trees. The food plants from the families of Poaceae and fabaceae constituted nearly 50% forming the major food plants species in Similipal. A sum total of 32 species of plants belonging to 17 families were identified as food plants of gaur in two protected areas Goa. Gaur were observed to feed on 155 species of plants belonging to 38 families in tropical dry deciduous forest of Mudumalai. Arrendran has recorded that the diet composition consists of 78 species of plants belonging to 28 families and the major part of the diet consists of Leguminaceae (18 percent) and poaceae (15 percent) in Teak dominant forests in Pench.Studies carried out by M.Chetri in Nepal shows that Gaur is observed to feed on 49 species of plants in Sal forest. The gaur was a generalist feeder and was resorted to both grazing and browsing. In Similipal Browsing is high in summer while grazing dominates in monsoon. Gaur has been basically described as a grazer. Ashok Kumar has reported that grasses are major component of Gaur diet in Mudumalai Tiger Reserve. Their diet chiefly includes shoots and foliage of tree, shrubs, herbs and grass. The Gaur in Similipal consumed different parts like leaves, young shoots, flowers and fruits with leaves, young shoots, flowers and fruits with leaves as most favourite food item.

These observations are agreement with the reports of Shukla and Khare who reported that Gaur grazed and browsed on a much wider variety of plants than any other ungulates species of india, showing preference for the upper portions of plants, such as leaf blades, stems, seeds and flowers of grass species. In contrast, some earlier study by Sathyanarayan and Murthy shows those gaurs feed selectively on grass-dominated areas and are primarily grass eaters. The gaur in Similipal were observed feeding on fruits of Dillenia Pentagyna and Diospyros melanoxylon in Similipal. The Gaur were found to feed on the bark of tree species like Adina cordifolia, Anacardium occidentale. The highest feeding activity was observed in the early morning (0600 to 0800hr)and in the evening (1600 to 1800hr). During the hot hours of the i.e. 1300 to 1500hr gaur were found resting beneath the trees. Being an obligatory drinker gaur in similipal needs water every day and visited water bodies at least once a day. Drinking time varied from morning 0600hr to 1900hr evening.

**Table 1: List of food plant species consumed by gaur in Similipal Tiger Reserve**

| Family | Species | Local Name | Plants Parts are Eaten |
|---|---|---|---|
| Poaceae | Apluda mutica | Mugar | S |
| Poaceae | Aristida setacea | khadikaghasa | S |
| Poaceae | Bambusa arundinacea | Baunsa | L,S |
| Poaceae | Chloris dolichastachya | Banoghasa | S |
| Poaceae | Chrysopogon aciculatus | Guguchia | S |
| Poaceae | Cynodon dactylon | Duba | S |
| Poaceae | Cyperus rotondus | Muthaghasa | S |
| Poaceae | Dendrocalamus strictus | Baunsa | L,S |
| Poaceae | Fimbristylis miliacea | Suanali | S |
| Poaceae | Heteropogon contortus | Dauria | S |
| Poaceae | Imperata cylindrica | Chhana | S |
| Poaceae | Oplimenus compositus | Mohora | S |
| Poaceae | Panicum maximus | Ginighasa | S |
| Poaceae | Paspalidian flabidion | Bileilanji | S |
| Poaceae | Paspalum scrobiculatum | Kodoghasa | S |
| Poaceae | Saccharum spontaneum | Kasatandighasa | S |
| Poaceae | Thysanolaena maxima | Phulajhadughasa | S |
| Poaceae | Vetivera zizanioides | Benaghasa | S |
| Fabaceae | Cassia tora | Chakunda | L |
| Boraginaceae | Cordia obliqua | Bhuanla | L |
| Fabaceae | Desmodium heterocarpus | Dangarbuta | L |
| Euphorbiaceae | Euphorbia hirta | Chitakutei | L |
| Lamiaceae | Leucas aspera | Gayas | L |
| Malvaceae | Urena lobata | Bilakapasia | L |
| Fabaceae | Bauhinea vahlii | Sialilata | L |
| Rubiaceae | Gardenia latifolia | Dambaru | L |
| Verbinaceae | Lantana camara | Jajokoli | L |
| Fabaceae | Mimosapudica | Lajokuli | L |
| Arecaceae | Phoenix acaulis | Banokhajure | L |
| Rubaceae | Randia dumetorum | Mohana | L |
| Acanthaceae | Strobilanthes auriculatus | Pania | L |
| Verbinaceae | Vitex negundo | Begunia | L |
| Rutaceae | Aegle marmelos | Bela | L |
| Fabaceae | Bauhinia purpurea | Amber | L |
| Euphorbiaceae | Bridelia retusa | Pani kasi | L |
| Fabaceae | Butea superb | latapalsa | L |
| Fabacecae | Cassia fistula | Sunmari | L |
| Dilleniaceae | Dillenia pentagyna | Rai | Fr |
| Ebenaceae | Diospyros melanaxylon | Kendu | Fr |
| Tiliaceae | Grewia tilifolia | Asana | L |
| Rubiacecae | Mitragyna parviflora | Kelikadambh | Fr |
| Euphorbiacecae | Phyllanthus emblica | Anla | L |
| Dipterocarpaceae | Shorea robusta | Sal | L |
| Myrtaceae | Syzygium cumini | Jamukoli | L |
| Combretaceae | Terminalia arjuna | Arjuna | L |
| Combretaceae | Terminalia chebula | Horida | L |
| Rhamanaceae | Zizyphus mauritiana | Borokoli | L |


**Figure 3:** Gaur In a vigilant stance


**Figure 4:** Gaur in Standing Posture


**Figure 5:** Gaur calf in foot path

## Conclusion

The red list of threatened species categorizes gaur as a vulnerable species and today it is found in 11 countries. The estimated population is around 13,000 to 30,000 with approximately 85 per cent of population being present in India. Thus, India is having the best chance for long-term conservation of this species. The populations in other countries are declining alarmingly. Gaur is listed in CITES Appendix-I, which bans all international trade of gaur products. It is protected under Schedule I of Wildlife (Protection) Act 1972 of India. Most gaur range countries are developing countries with limited financial resources to commit to conservation, so funds remain major constraints in gaur conservation. Along with respective Government, the Non-Governmental Organizations, International organizations and agencies should support research and conservation-oriented activities. Gaur habitats have become fragmented throughout its ranges. Even within in this fragmented gaur range only a small portion is actually protected. Therefore, efforts should be taken to include the actual range of gaur as protected areas. For this, it is important to identify gaur utilizing unprotected areas adjacent to protected areas for better management. Forest departments established anti-poaching camps in protected areas for effective patrolling to control poaching. This considerably reduced poaching in the protected areas at least. But these strategic management measures are lacking in reserve forest areas and it should be implemented in adjoining reserve forest areas also. Epidemic outbreaks are being controlled by regulating transport of domestic cattle, vaccination programs and control of cattle grazing in sanctuary areas. Gaur is one of the important prey species for flagship species (Tiger) and thus considerable population monitoring research has been carried out along with carnivore population monitoring activities in many protected areas but species-specific research activities, community level research and habitat requirements are lacking. Hence, more focus needs to be given on these aspects.

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