Chapter-I:
CONTEXT AND RESEARCH OBJECTIVES

1.1 INTRODUCTION

The Great Indian One-horned Rhino (*Rhinoceros unicornis* Linn.1758) or Indian Rhino was widely distributed throughout the Indo-Gangetic and Brahmaputra flood plains (i.e. from Pakistan all the way through India, Nepal, Bangladesh, Bhutan and Myanmar (Laurie, 1978; Dinerstein, 2003). The Indian Rhino was a survivor, the product of at least 35 million years of evolution, but this species had undergone least morphological changes through the process of evolutionary changes (Dinerstein, 2003). This aspect itself makes the animal quite unique and an object of prime interest of science.

Though in the wild, this species has hardly any natural predator or enemy yet the species got dislodged and ultimately disappeared from most of the former distribution range, mainly being anthropogenic causes (Laurie, 1978; Choudhury, 1996; Dinerstein, 2003). There seems to be two basic reasons—firstly, the natural habitat of the species is most suitable for agriculture and human settlement, which leads to the encroachment of the Rhino habitat in the form of agricultural practices and push them out. Secondly, the superstitious belief on the magical power of Rhino horn and other body parts for human well being (and its high value in international market), is eliminating this species from most of the former ranges through poaching (Lauri, 1978; Dinerstein and Price, 1991; Bhattacharya, 1994).
By the turn of this century, this species had disappeared from the majority of its former ranges. By 1968, only two populations had more than 80 individuals, i.e. Kaziranga National Park and Royal Chitwan National Park (Dinerstein and Mecracken 1990; Dinerstein and Price, 1991). Today only about 2800 individuals survive in India and Nepal (Talukdar et al. 2010).

In this chapter of the study it has tried to review that- what is generally known about the- evolution and surviving species of Rhinos in the world? What do we know about the Ecology and Conservation of Indian Rhino? and then describe the context and objectives of the study.

1.2 BACKGROUND

1.2.1 EVOLUTION OF RHINOS

The earliest known Rhino like mammals belong to the genus *Hyrachys*, known from the late Eocene deposits in Asia, North America and Europe reassembles early horses with no horn (Prothero et al. 1993). The first true Rhino belonging to the family *Rhinoceratidae* also appeared in the late Eocene, but less dominant than *Hyracodontidae* (Running Rhinos) and *Amynodontidae* (Aquatic Rhinos). The *Hyracodontidae* divided in to two groups ie. *Hyracodontidae* (dog sized cursorial) and *Indricotherinae* (immense lineage). The later group included some truly spectacular Rhinos like Giraffe-Rhinos (*Paraceratherium granger*) of Mongolia and disappeared from Asia by middle Miocene (Osborn, 1923). The aquatic Rhinos had reached their maximum diversity in late Eocene and early Oligocene, especially in Asia and surviving until middle Miocene (Wall, 1989). The third family of Rhinos *Rhinocerotidae*...
first appeared in the late Eocene and flourished in Oligocene in Eurasia. Due to climatic change at the end of Miocene, almost entire Rhino fauna was eliminated except two families in Eurasia (Martin and Wright, 1967). One of those, the *dicerorhinines* was the ancestors (wooly rhino) of today’s Sumatran Rhino. Africa’s Black Rhinos first emerged in the Pliocene and the other living species, the White Rhinoceros appeared more recently, in the middle Pleistocene resembles *Ceratotharium* that derives from *Diceros* lineage (Laurie, 1978). The Great Indian One-horned Rhinos and Javan Rhinoceros also appear in middle Pleistocene.

![Figure-1.1: Various forms of Prehistoric ancestors of Rhinos (After Dinerstein, 1993)](image)

1.2.2 LIVING RHINOS IN THE WORLD

Today only five species of Rhino grouped under four genera survive in the world that restricted in few protected areas of Africa and Asia (Table-1.1).

The White or Square-lipped Rhino (*Ceratotherium simum*) is the largest of all living Rhinos with two sub-species. The Northern White Rhinoceros (*Ceratotherium simum cottonii*) are found in Northern Uganda, Sudan, Central
African Republic & Republic of Congo. The other is Southern White Rhinoceros (*Ceratotherium simum simum*), found in Zambezi, Namibia and Angola. Unlike black rhino the back of this species is straighter and larger head with broad square lip. Skin is smooth with short hair and little developed skin folds. Two horns found in both male and female. Cheek teeth are high crowned and no incisors and canines (Dinerstain, 2003; Foose et al. 1993).

Black Rhinos or Prehensile-lipped Rhinos (*Diceros bicornis*) is almost hairless, smooth skin and skin not folded. Lips are triangular, prehensile and very mobile. Two horns with variable proportions and shape found in both male and female. Short crowned cheek teeth and no incisors and canines. Altogether four sub-species are found in different areas of Africa- *Diceros bicornis bicornis* (Namibia & south Africa), *Diceros bicornis longipes* (Cameroon), *Diceros bicornis michaeli* (Ethiopia, Kenya, South Africa and Tanzania) and *Diceros bicornis minor* (Malawi, South Africa, Swaziland, Tanzania and Zimbabwe) (Goddard, 1967, 68; Foose, 1993)

The Asiatic or Sumatran Two-horned Rhino (*Dicerorhinus sumatransis*) is the smallest of all surviving Rhinos and bear hair on the body. The species earlier distributed from Assam, India and southern Bhutan, south and east to the Indonesian island of Sumatra and Borneo. The last strongholds of the population all appeared to be in Borneo (*Diceros sumatrensis harrissoni*), Sumatra and Malaysia (*Diceros sumatransis sumatransis*). There are two distinct skin folds, one encircling the trunk just behind the foreleg and the other just anterior to the hind-leg which doesn’t go over the back. There is one pair of incisor in each jaw and lower incisor modified as sharp forward pointing tusk.
Premolars are molariforms (Dinerstein, 2003; Foose et al., 1993; Talukdar et al., 2010)

Javan or Lesser One-horned Rhino (*Rhinoceros sondaicus*) is formerly widely distributed from North Eastern India across Indochina to the island of Java in Indonesia. Today only known population is in the rain forest Western Java (*Rhinoceros sondaicus sondaicus*) and in Vietnam (*Rhinoceros sondaicus annamiticus*). This animal is with thick hairless skin, with three folds across the back and other around the neck and legs. The upper lip is pointed and single horned. Tusks are present in both sexes in the lower jaw. Single horn found in male only (Foose et al., 1993; Shebeare, 1953).

The Great Indian One-Horned Rhino (*Rhinoceros unicornis* Lin.) is the second largest living Rhino and the largest among all three Asian Rhinos. The animal is massive, large headed, well developed single horn and more developed skin folds around neck. The species was historically limited to floodplains and forest tract in the Brahmaputra, Ganges and Indus river valleys. Today the species is restricted in some pockets of India and Nepal (Laurie, 1978; Foose et al., 1993).
Table-1.1: Present status of Living Rhinos in world.

<table>
<thead>
<tr>
<th>Species→attribute↓</th>
<th>Ceratotherium simum</th>
<th>Diceros bicornis</th>
<th>Diceros sumatransis</th>
<th>Rhinoceros sondaicus</th>
<th>Rhinoceros unicornis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-species</td>
<td>C.s. cottoni, C.s. simum</td>
<td>D. b.bicornis, D.b. longipes, D. b. michaeli &amp; D. b. minor</td>
<td>D.s.harrissoni, D. s. sumatransis</td>
<td>R. s. Sondaicus</td>
<td>R. s. annamiticus</td>
</tr>
<tr>
<td>Present</td>
<td>Northern Uganda, Sudan, Central African Republic, Republic of Congo, Zambezi, Namibia and Angola.</td>
<td>Namibia &amp; south Africa; Cameroon; Ethiopia, Kenya, South Africa and Tanzania; Malawi, South Africa, Swaziland, Tanzania and Zimbabwe.</td>
<td>Borneo, Sumatra and Malaysia</td>
<td>Java &amp; Vietnam</td>
<td>India &amp; Nepal</td>
</tr>
<tr>
<td>Nos. Surviving in wild</td>
<td>DD</td>
<td>DD</td>
<td>130-180</td>
<td>30-40</td>
<td>~2800</td>
</tr>
<tr>
<td>Body Characters</td>
<td>1. Height (m)</td>
<td>1.7-1.8</td>
<td>1.6</td>
<td>1.2-1.4</td>
<td>1.4-1.7</td>
</tr>
<tr>
<td></td>
<td>2. Weight(kg)</td>
<td>2300</td>
<td>720-1300</td>
<td>800-900</td>
<td>1500-2300</td>
</tr>
<tr>
<td></td>
<td>3. Head size</td>
<td>Broad</td>
<td>Broad</td>
<td>Broad</td>
<td>Tapering</td>
</tr>
<tr>
<td></td>
<td>4. Horn</td>
<td>Two(M,F both)</td>
<td>Two(M,F both)</td>
<td>Two (M,F both)</td>
<td>Single(M only)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>5. Skin type</td>
<td>Smooth and hairless</td>
<td>Smooth and hairless</td>
<td>Smooth and hairy</td>
<td>With Small tubercles &amp; hairless</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With Tubercles &amp; hairless</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Skin folds</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td>Small folds behind shoulders &amp; thighs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prominent skin folds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Teeth</td>
<td>Incisors absent</td>
<td>Incisors absent</td>
<td>Incisors present</td>
<td>Incisors present</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incisors present</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Lips</td>
<td>Upper lip (UL) square</td>
<td>UL pointed</td>
<td>UL pointed</td>
<td>UL pointed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Humps</td>
<td>Present</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td></td>
</tr>
</tbody>
</table>

(Source- Bhattarharya, 1993; Foose et al., 1993 & 1997; Van et al., 1999; Talukdar et al., 2010)
1.2.3 ECOLOGY, BIOLOGY AND CONSERVATION OF INDIAN RHINO

Indian rhino was recorded from a number of habitats, including marshy lowland and reed beds, tall grass or bush with patches of savanna, thick tree and scrub riverine forest and dry, mixed forest. It was recorded throughout its range in alluvial plain habitats, riverine and marshy areas bordered by riverine woodlands, dry sal forest, or tropical almond forest also often uses cultivated areas, pastures, and modified woodlands (Laurie et al., 1983; Dinerstein and Price, 1991; Nowak, 1999).

An Indian rhino weights about 1600 -2200 kg. and average height is 1.6 - 1.8 meter (Laurie et al., 1983). A free ranging female Indian rhino is fully grown about 6-8 years whether males are fully grown and sexually matured at about 8-10 years of age. The age of first calving in Chitwan National Park, Nepal was recorded at 6 - 8 years and average gestation period was 16 months (462 - 491 days), females choose secluded areas to give birth. Mating takes place throughout the year (Laurie, 1978). One calf usually born at a time and the birth interval is commonly 3 - 5 years (Nowak, 1999). Calves are suckled frequently up to the age of 1-1.5years. Male calves leave their mothers at an average age of 3 year 3 months compared with 2 years 10 months for female calves (Laurie, 1978). The maximum age in captivity is recorded 47 years (Laurie et al., 1983).

Indian rhinos have observed to feed on 183 species of plants, with grasses making up between 70 - 89% of the diet depending on the season. Other foods included fruits, leaves and branches of shrubs and trees, sedges and ferns, submerged and floating aquatic plants, and cultivated crops (Laurie et al., 1983; Hazarika, 2007). The Indian rhino drinks from streams, rivers,
lakes, puddles, or wallows. Rhinos often drink very dirty water heavily contaminated with rhino urine (Laurie, 1978).

Smell is the strongest sense of Indian Rhino and has a good hearing, however rhinos have poor vision. The Indian rhino is active mainly at night, in early morning and in the late afternoon. The middle of the day is mainly spent resting, either in the shade or in wallows. There is often a rest period during the night, between midnight and 3:00 am. (Laurie et al., 1983)

Apart from cow-calf pairs, Indian rhinos rarely form groups. Adult males are usually solitary, but they sometimes occur in temporary associations of up to nine rhinos of various sex and age classes. These groups form at wallows and grazing grounds where the rhinos often feed or rest together but move independently of each other (Laurie, 1978, Hazarika, 2007). There is some degree of range exclusivity but no true territoriality in Indian Rhino. The home ranges of dominant bulls overlap with one another. When two dominant Indian rhino males meet, they may fight using their tusk-like lower incisor and horn, fight can even end in the death of one of the combatants (Lauri, 1978; Nowak, 1999). Female Indian rhinos have home ranges covering 9 - 15 km². in Chitwan and for breeding males, it varied from at least 2 - more than 8 km² (Laurie, 1978; Hazarika, 2007).

By the first decade of the 20th century, the Indian rhino was close to extinction. In India there were only a few survivors, the main group comprised of a dozen individuals along the Brahmaputra River and another around 50 in Nepal. At that point there was a change in human perception in Indian towards conservation of Indian Rhino; the sport hunting was halted, general legal
protection was established, and Kaziranga was made a reserve. In later years, protection had been upgraded and extended to all other areas having rhino population. Government of India had declared special project “Project Rhino” for conservation of the species in India (Dinerstein, 2003).

International Union for Conservation of Nature and natural resources (IUCN) included the species as “Vulnerable” in red data list in 1960. In 1970’s IUCN categorized it as “Endangered” and continued the same status up to 2009. During this period due to the continuous efforts from local government, NGO and other concern the status of the animals have been improved and listed as “Vulnerable” again in Red data Book during evaluation of IUCN/SSC in 2009.

Government of India and Nepal had increased security against rhino poaching, 24 hour protection in Sanctuaries and National Parks by armed guards and national army is really appreciated. Both the country also started intelligence network against Poachers activity and an international consensus to stop the trade of Rhino horn and other body parts, which substantially decrease the poaching incidences (Martin et al., 1987; Vigne and Martin 1984; Martin, 1996).

Government of Nepal and India with the help of conservation organization translocated rhinos from Chitwan National Park to Bardia Conservation Reserve and Suklaphanta Conservation Reserve in Nepal and from Pobitora Wildlife Sanctuary and Kaziranga National Park to Dudhwa National Park in India. Recently (in 2005) Government of Assam has took an ambitious programme with conservation organization as “Indian Rhino Vision
2020" (IRV2020), where the goal was to attain a population 3000 wild Rhinos distributed over seven protected areas of Assam by year 2020. Under this programme 6 rhinos (from Pobitora Wildlife Sanctuary and Kaziranga National Park) have been translocated to Manas National Park and monitoring continuously.

1.3 PRESENT CONTEXT OF STUDY

The Great Indian One-horned Rhino or Indian Rhino (Rhinoceros unicornis) survive with only about 2800 individuals in India and Nepal (Talukdar et al., 2010). Out of which more than 80% of global population lives within the Indian subcontinent, specifically inside the protected areas of Assam like Kaziranga National Park, Pobitora Wildlife Sanctuary, Orang National Park and Manas National Park.

Pabitora Wildlife Sanctuary holds 84 rhinos in its 38.81 km² area. Rhino population in Pobitora Wildlife Sanctuary seems to be going beyond the ideal density as everyday animals move out of the park into agricultural areas extensively. The habitat of the sanctuary badly degraded as a result of extensive cattle grazing, and human disturbance from nearby villages. Around 40% of the total population of Rhino moves out of the sanctuary at dusk and return back to the sanctuary in the dawn (Talukdar et al., 2007) may be in search of food and space, which leads conflict with the people. The protection of Rhino from poachers outside the sanctuary is a challenging task for the wildlife authority. It is also impractical to guard the rhinoceros round the clock to
prevent their stray activity. Considering all these it is a matter of concern for the survival of Pabitoran Rhino population.

This scientific study on the Ecology and Conservation of Great Indian One-horned Rhino (*Rhinoceros unicornis*) at Pobitora Wildlife Sanctuary was carried out to know the habitat quality and to quantify the extent of different conservation threats to Rhino in the habitat, that using these findings wildlife authority of Pobitora Wildlife Sanctuary can adopt conservation and management strategy to conserve viable population of Rhino in the area.

1.4 OBJECTIVES

- To study the population status and demography of Indian Rhino in Pobitora Wildlife Sanctuary.
- To study the habitat suitability of Indian Rhino in Pobitora wildlife sanctuary.
- To investigate the ranging and habitat utilization pattern of Indian Rhino in Pobitora Wildlife Sanctuary.
- To investigate the movement of Rhino outside the Pobitora Wildlife Sanctuary.
- To investigate and quantify the conservation threats and review the management strategies of Rhino in Pobitora Wildlife Sanctuary, Assam.