2 TECHNIQUES & PROCEDURE
For the purpose of this research work an area of 1000 ha. of the Panna Forest Reserve was selected for intensive study. The area exhibited practically the whole range of habitat types found in the reserve including surface water during the hot season. Field studies were conducted on a full time basis from December 1998 to February 1999 and August 1999 to October 1999. Monthly data were also collected during periods of 2-4 days duration in August September and January, February, March 2000. Observations were facilitated by use of binoculars and cameras. Most efficient method of observing animals directly was from free platforms or Machans.

Study of Ecological Parameters

Soil Characteristics:

For this superficial examination of soil was done and described. The physical characteristics of the surface layer were taken into consideration.

Following four terrain types have been worked out as described by Kotwal (1987).
1. Valley plains:
Areas around major drainage system and wide flat lands.

2. Moderate slopes:
Areas with contour frequency of less than five centimetres on the
topographic map of 1:50000 scale.

3. Steep slopes:
With contour frequency of more than five centimetres.

4. Plateau or 'dadar':
Areas on the flat hill tops.

Study of signs and symptoms and Basic field observations

Recording basic field observation is of prime importance for wild
dlife studies. But unfortunately this is neglected by many because of the
immense field work involved. Study of sign and symptoms in the field
calls for repeated collection of field data and their unbiased analysis and
interpretation. It is an art of interpreting the field events through
identification and analysis of the various sign that are left in the field by
wild animals. Signs and symptoms constitute mute evidence and they
have to be interpreted cautiously.

Basic field observations were based on:

1. Direct Observations
2. Identification and interpretation of field symptoms

Animal signs are normally concentrated along the routes
frequented by animals such as 'game paths' or 'trials'. Thus it becomes
necessary for a field investigator to possess a sound knowledge of the
habitat as well as the habits of the wild animal. A good reconnaissance of the habitat for an appraisal of topography, vegetation, water source and game tracks is of utmost importance before embarking on a field investigation. Game tracks or paths can be regular foot paths within the forest area, stream banks, dry stream beds and even regular roads. Topographic feature or vegetative components are usually used for concealment. These 'travel lanes' are so formed so as to afford convenience to animals in reaching places for various functions like breeding, feeding, loafing and resting. It must be appreciated that the movements of an animal are seldom random but are always 'activity oriented'.

The most common evidences encountered in the field are-

I. Impression of the foot on the soil.
II. Feeding signs.
III. Animal dropping.
IV. Homes/ Den and shelter.
V. Other evidences (fraying, wallowing, scent marking, calls).

Foot prints:

Seasonal fluctuations affect the frequency of foot prints. An area suitable for a particular species in summer may not be so for the same species in winter or in rains.

Feeding Sign:

They constitute the obvious signs left on the vegetation by herbivores.
Signs found on Vegetation:

Feeding signs in a wild life habitat are very common in leaves and twigs and at times on the bark of large trees.

Deer leave a sharp cut on the vegetation due to the combined action of incisors on both the jaws. During antler shedding the deer rub their antlers on tree trunks which leave vertical furrows. Height of furrow depend on the height of the deer.

Animals dropping

The faecal dropping of animals provide important clues in the field from which certain basic inferences can be drawn regarding relative abundance of certain animals, spatio-temporal utilisation of habitat and food habits of various animals. These evidences help us in the "diachronic analysis" of the habitat. i.e. analysis of the variation in utilisation pattern of a habitat by animals due to seasonal changes; these variation may pertain to procurement of food, shelter, territory and migration. Such an analysis helps to establish the movement pattern of an animal species which will have a significant bearing on management.

The dropping of herbivores are 'known as pellets', 'dungs' or 'bolus' depending upon the form. The form and place of dropping vary considerably and at times they are 'species-specific'.

Homes, Den and Shelter

Every animal has a resting place where it retires after performing the day to day activity. These places are not of permanent nature, since most of the animals abandon their resting place from time to time as per
the 'spatio-temporal utilisation of the habitat. Animals have a tendency to abandon their resting place once the element of seclusion is lost.

Other evidences

Fraying:

It is the mark left on tree boles by deer especially when the animals is in 'velvet'. The antlers are rubbed against the tree trunk during shedding which leave a belt like mark on side of the tree.

Scent marking:

Many animals have scent glands; these scent markings serve as means of chemical communication to attract the opposite sex and also to indicate the occupation of a territory to the conspecific. These glands facilitate the animal in marking the area during its activity.

Calls:

Vocalisation is a species specific trial and many animals have characteristic calls. Calls gives due to animal presence and obviates the necessity of sighting. It has temporal significance also because calls indicate the time of utilisation of the habitat.

Recording Field Observation

The recording of a field data is important which provide some preliminary information. The basic methods and time for recording field observations was as given by Gopal (1992).

1. Time: Time will be noted as follows-

Dn - Dawn (One hour before sunrise)
Em - Early morning (Up to one hour after sunrise)
Fn - Forenoon (From one hour after sunrise till noon)
An - Afternoon (Three hours before sunset up to sunset)
Ln - Late afternoon (Two hours before sunset up to sunset)
Dk - Dusk (Period after sunset till dark)
En - Evening (Two hours period after dusk)
Nt - Night (Period from evening till dawn)

2. Description of Place:
   This should include compartment or beat number and salient identification marks of the place where observation is made, viz.

I. Local Name of the place
II. Road /Path
III. Nala bed
IV. Water hole
V. Salt lick
VI. Den /Carve
VII. Cattle Camp
VII. Any other important feature with which the location can be marked.

3. Description of habitat - This includes -
   a. Description of terrain.
   b. Description of ground and soil like rocky, stony, sandy or clay soil.
   c. Vegetation
      I. Woodland level (five meter in height). Mention of forest type, density and composition.
      II. Scrub level (1.8 meter to 5 meter in height)
      III. Field level (0.5 meter to 1.8 meter in height)
      IV. Ground level (0.5 meter)
In the present study description of the forest reserve (habitat) has been featured into six types -

I. Pure teak forest.
II. Pure bamboo forest
III. Bamboo teak mixed forest.
IV. Early reverine forest.
V. Moist mixed forest.
VI. Mixed deciduous forest.

Habitat analysis, based on objective measurement is an essential pre-requisite for sound management. A survey has been done with the help of a hand compass and the existing stock maps which facilitated delineation of the area into various terrain types. All the four types of cover viz. Woodland level, scrub, field and ground level are present in forest. Different types of vertical combination of cover are uniformly interspread throughout the cover.

**Phenological Study**

Phenological changes observed in the study area were recorded till January 1998 that is new leaves emerging mature leaves, falling, flowering and fruiting of trees and shrubs.

All plants have a definite flowering and fruiting period and those are important for the wild herbivores, which depend on the plant material for their food. The phenology of herbaceous plants and grasses was described by three different conditions: emerging (time the plant remained green) flowering and dormancy. Important plant species occurring in on area should be recognized, and their flowering fruiting and other phenological attributes should be properly recorded. The phenological observation were made on some species in the different forest cover types and grassland of the study area from (January 1998 to March 2000).
Determination of Habitat Preferences and Density of the Animals

Animals are the main components of any wild life habitat, and the idea of evaluating a habitat is to find its suitability as a place for the wild animals to live. If animals display no preference for any particular habitat than their distribution over a selected area containing these habits should be approximately even. During the present study Chinkara, Neelgai and Black buck tended to Congregate in large herds especially in dry season.

All evaluation procedures rank certain biological and physical properties for a particular area; the procedure vary as per the characteristic which are taken into consideration, and also the importance value attached to each; Shaw (1985) has indicated an evaluation method developed in Britain (Gold smith, 1975), which uses following Index of ecological value.

I. Extent (E) = Area or length.

II. Rarity (R) = Recorded foe every habitat type and calculate from:

R = 100 minus percentage area.

III. Plant species richness (S) = Number of flowering plant species in a sample p 10+ of 20X20m size.

IV. Animal species richness (V) = This is related to vertical stralification on a one to four scale.

For each habitat type, an "Index of ecological value" (IEV) is determined using the following relationship:

\[ IEV = \sum (E \times R \times S \times V) \]
Techniques For Behavioural Studies

I. Technical Aids:

The Technical aids used for observing animals under field conditions were binoculars for close observation, telescope for distant observation, and night vision scope for observation under low light conditions. Behaviour was recorded by written notes on a note book. Written records were supplemented by still photography. A small cassette tape recorder was used for vocal recordings.

II. Observations and Description:

Although quantitative methods of data collection and analysis are ultimately indispensable for a valid behavioural study, the identification of the behavioural pattern that are to be quantified generally is based on and proceeded by qualitative observation. Observations on the feeding, social and territorial behaviours of the Chinkara, Neelgai and Black buck have been described.

Ethogram

Study of Ethology begins with the description and categorization of the events. The basis of each behavioural investigation is the ethogram, a precise inventory of all the behaviour patterns. Ethograms with respect to Chinkara, Neelgai and Black buck were prepared. Data for climatic conditions of the study area were obtained from the Meteorological Department in Khajuraho.