

# HABITAT ECOLOGY

- Animal habitat is the arrangement of food, cover and water required to meet the biological needs of species
- Space and environment suited to a particular species component

# COMPONENTS OF A HABITAT

- **Cover/shelter**
- **Space (physiography, extent, alt; Lat.; Long.)**
- **Energy (food & water)**
  - **Time (succession, history, evolution)**
  - **Diversity**
  - **Associations**
  - **Interspersion**

# COMPONENTS OF A HABITAT

## 1. Cover

- usually implies hiding place: shelter and protection from the weather and other mortality factors
- it is any physical and/or biological arrangement of features that provide shelter from weather & predators

# COVER AS A WILDLIFE CONCEPT

- **Absence, sparseness and poor distribution of cover affects wild animal populations**
- **For cover management - habitat manipulation is done (burning, clearing planting)**
- **Cover requirement of animals involves several different arrangement of vegetation or other geomorphic features**

# TYPES OF COVER

- **Protective cover**
  - **Breeding cover, Escape cover**
- **Hunting related cover**
  - **Ambush cover**

## Types of Cover (by constitution)

- **Vegetal covers**
  - **thick vegetation, large trees, grasslands**
- **Non-vegetal covers**
  - **Caves, rocks, burrows, cliffs**

# ESCAPE COVER

- **Escape from predator and hunters - open ground, forest edges, rocks, cliff, dense vegetation**
- **Distance of prey-predator provides flight response time**
  - **Ibex: never > 100 meters from cliffs**
  - **Gorals: 80% pellets on slopes > 60%**

## BREEDING COVER /FAWNING COVER

- **Carnivores - dens**
- **Herbivore - thick vegetation, nests,**  
**Hard ground Barasingha: In 1960s &**  
**70s population crashed because of lack**  
**of fawning cover (tall grass)**

**Fussorial:** live & feed in the burrows eyes & ears become vestigial sensory organs on the chin. e.g. Naked mole rat

**Burrowing:** live in burrows but come out to feed e.g. Pythons, Porcupines, Hyena

**Thermal cover:** to escape high temperature; Goral rests under *Bauhinia vahlii* thickets.

Chinkara under *P. cineraria*

**Ambush (Hunting) cover**

Carnivores - Tiger, Lion , Leopard ; primarily required by stalking predators



# TREE CAVITIES:

## **Bird nesting covers**

### **- Primary users**

**: Woodpeckers, Barbets**

### **- Secondary users**

**: Parakeets, Mynas, Hornbills**

# ROOSTING COVER

- **Day-time (for nocturnal animals)**
  - **Owls, Civets, Flying squirrels**
- **Night-time (for diurnal animals)**
  - **Trees, dens, cavities, open ground**

# WATER:

## Uses

- 1. Base for metabolic activities**
- 2. Cooling the body**

# AVAILABLE TO ANIMAL IN 3 WAYS

- 1. Free water (drinking)**
- 2. Metabolic water (oxidation)**
- 3. Preformed water (food)**

# LOSS OF WATER OCCURS

- 1. Maintenance of body temperature (sweat)**
- 2. Removal of metabolic waste (urine)**
- 3. Through faeces**
- 4. Excreted air**

# WATER STRESS

**Animal vulnerable - Sambar, Chital, Nilgai**

**Animals with adaptation**

**- Black Buck, Chinkara,**

**Water unevenly distributed in wildlife habitat:**

**Seasonal migration - Wilde Beast, Zebra,  
Elephant, Gaur, Black Buck**

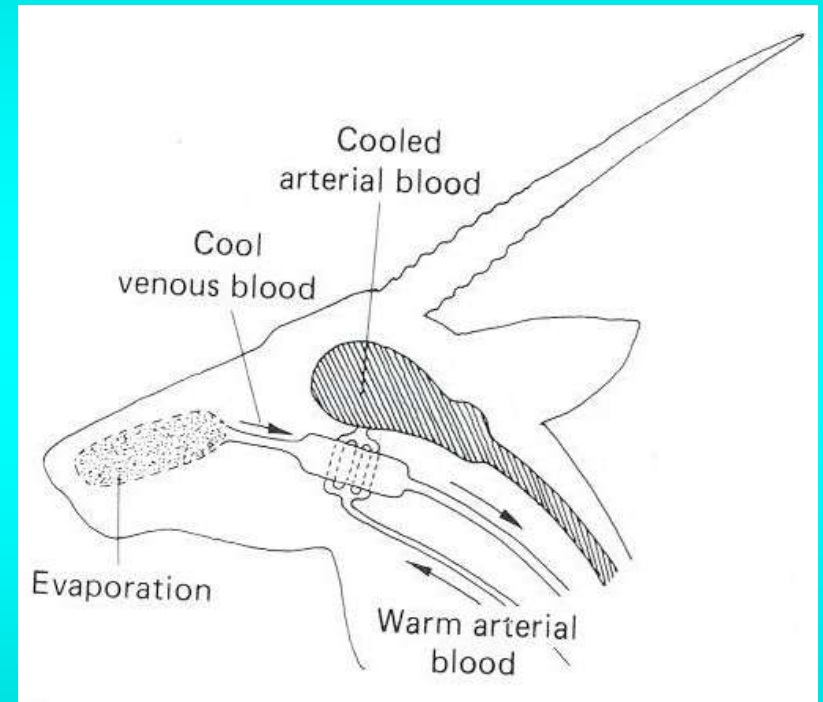
**Successful breeding depends on water**

# ADAPTATION FOR WATER CONSERVATION

- **Nocturnal or Fossorial habits**
  - Activities at lower temp. & High hum.
- **Concentrating excreta**
  - Dry faeces and concentrated urine
- **Morphology (thermal inertia)**
  - Large body size and abundant insulation
  - Greater insulation on the back
  - Scantily haired body
  - Large pinnae

# ADAPTATION FOR WATER CONSERVATION *contd.*

- **Labile body temp.**
- **Use of metabolic water**
- **Water storage**
  - **Rumen storage & quick rehydration**
- **Mobility**
- **Patterns of reproduction**





# SPACE

## Carrying capacity:

- **Maximum capacity of habitat to support animals, without damaging future capacities**
- **Carrying capacity is the user specified quality biomass of a particular species or a group of species, under the influence of social and behavioural constraints, for which a particular area having user specified objectives, will supply all energetic and physiological requirement over a long but specified period**

# TWO TYPES

- : Species specific**
- : Composite species**

**Actual C.C. - Current based on local or temporal factors**

**Potential C.C. - Theoretical maximum under a given set of natural conditions**



## Economic carrying capacity:

• **Maximum harvest density:** max. No. Of animals a habitat will support while producing a max. Sustained harvestable surplus; good pop. Quality

**Minimum Impact Density:** minimising the impact on other wildlife or vegetation without eliminating the population; for predators; good pop. Quality

## Ecological carrying capacity- unharvested

**Limiting habitat resources**

**3 types: subsistence, tolerance, security**

## **Subsistence density**

- **Usually applied to ungulates**
- **Pop. Limited primarily by forage**
- **Natural ecosystem**

## **Tolerance density**

- **Intrinsic behaviour**
- **Territorial species**

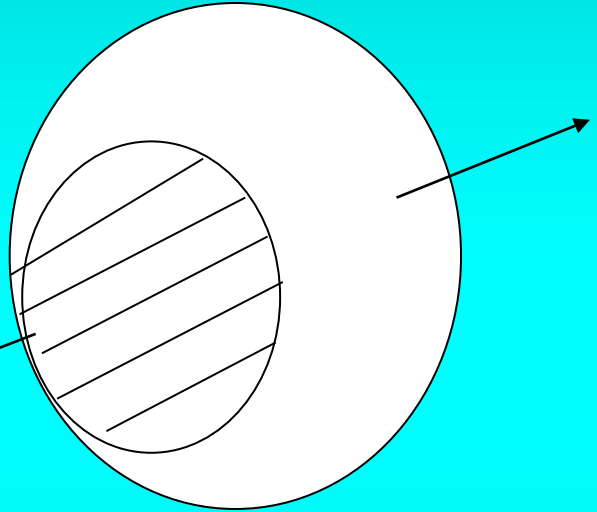
## **Security density**

- **Predation is the limiting factor**

# TERRITORY AND HOME RANGE

- **Territory relates to a space, which is vigorously defended by an animal**
- **Home range is the area where animal spends most of his time to secure its requirement for energy (food), shelter, water and breeding space**

**TERRITORY**



**HOME RANGE**

- **Territorial markings: to avoid intraspecific encounters as high intolerance and antagonism exists**
- **Territoriality is an innate species characteristic: mostly seen in mammals, birds and fishes**
- **Territories are flexible**
- **Territorial advertisement : visual, vocalizations, olfactory, defecation**



# TIGER HOME RANGE (km<sup>2</sup>)

<b>MALE</b>	<b>FEMALE</b>	<b>LOCATION</b>
<b>60-72</b>	<b>16-20</b>	<b>Chitwan</b>
<b>90-105</b>	<b>26-39</b>	<b>Chitwan</b>
<b>30-35</b>	<b>10-20</b>	<b>Kanha</b>
<b>38-50</b>	<b>12-42</b>	<b>Palamau</b>
<b>800-1000</b>	<b>100-400</b>	<b>USSR</b>

# MONITORING OF HOME RANGE IS DONE BY

- 1. Radio tele metry**
- 2. Capture - mark recapture**
- 3. Tracking and mapping routes followed by animal**

# RADIO - TELEMETRY

- **Metering without wire connection**
- **Primarily the location of animals**

# BIO - TELEMETRY

- **Biological Parameters are measured**
- **Temperature, heart beat, pulse rate, pH of rumen**

# COMPONENTS

- **Transmitter**
  - **Weight (mainly due to battery weight)**
  - **Life (with respect to size of battery )**
  - **Smallest transmitter 100 mg, life 2 weeks**
  - **Transmitter weight (+ accessories ) should not be more than 4% of body weight**

- **Frequency range allotted 142 - 168 M Hz. In India 150 - 152 M Hz. in use**
- **0.050 M Hz. separation between two transmitters**
- **Activity sensor: produces different signals in different activities e.g. resting, moving**
- **Recapture transmitters : collar with darts, triggered by receiver**

# • Receiver

## - Range of reception

### Tracking the Radio - Collared Tiger in different Habitats

(Chitwan N.P.); *Distances in km*

Method	Grassland	Riverine	Sal forest
Elephant	3.2	2.4	0.8
Vehicle	3.2	2.4	0.8
Air	16.0	16.0	13.0
Foot	1.6	1.0	0.4

## • **Antennae**

- **Directional : H type, Yagi array**
- **Omni directional : e.g. wireless antennae, use for activity pattern**



## •Collars

- **It should be long and smooth so that can be adjusted**
- **Expandable collars for sub adult animals**
- **Some degrade after fixed time**
- **Can be colour coded for easy recognition of animal**

- **Global positioning systems**
- **Satellite tracking- for animals (mainly Birds) showing large scale migration**
  - **Currently used for Olive Ridley Turtles**
  - **Siberian Cranes**

# Habitat Use by Hog Deer in Chitwan NP

*Dhungel and O'Gara*

## **Comparison between Grassland, Riverine forest and Sal Forest; 20 Hog Deer's, 3186 transmitter locations**

Sex	Grassland Locations	Riverine forest
Male (N=8)	99.4	0.6
Female (N=12)	99.7	0.3

Hog Deer used tall grasslands along rivers where food, water and dense cover are plentiful

# INTERSPERSION :

**The inter mixing of units of diff' veg'  
type/habitat types**

# JUXTAPOSITION:

- **Contrast in habitat merging**
- **It is a measure of proximity of diff' habitats**
- **Dissimilar habitat units if juxtaposed properly produce increased animal richness**

- Example**
- **food adjacent to cover**
  - **nesting cover adjacent to feeding areas**

# EDGES

**Edge is the place of contact between plant communities or successional stages or habitats**

**Ecotone: Where two or more communities not only meet but also intergrade**

**Junction zone; tension belt**

## **ANIMALS SEEK EDGE:**

- A) To have simultaneous access to more than one habitat type**
- B) Greater access to desirable veg. Choice, cover etc.**

# 'EDGE EFFECT': IS THE SUM OF INFLUENCES OF ALL CHARACTERISTICS OF EDGE

- **Composition and diversity of species**
- **Length and width**



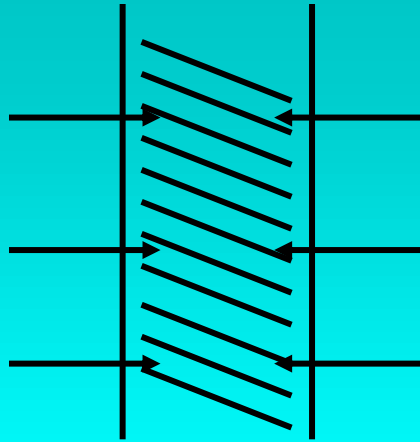
**Abrupt edge - Lake and forest or sea shore**

**Inherent edge - Long term relatively stable features produced by natural factors - topography, aspects, type of soil**

**Induced edge - Management induced edge in forest**

**Mosaic edge -**

**VEG' A**



**VEG' B**

**SAMBAR**



**A**

**SPS' A USING OUTER AREAS  
BUT EDGE LIVING**

**CHITAL**



**B**

**SPS' B - ONLY EDGE**

**GAUR.  
TIGER**



**C**

**SPS' C LIVING OUT BUT  
USING EDGE**

# MANAGEMENT IMPLICATIONS OF CREATING EDGES

- **Smallest edges are created by circular shape,**
- **Irregular forest edges look more natural**

## **Special habitats**

**Snags:** standing dead trees

**Down logs:**

**Slash:** veg' material on forest floor

**Cliffs:** over hanging rock faces

**Talus:** accumulation of broken  
rocks at the base of cliff

**Caves:**

**Point habitats/coverts:** appear as points on maps

# ECOLOGICAL ISOLATION

- i) Diff. Habitat types**
- ii) Diff. Types of food**
- iii) Diff. Area in the same season or vice versa**
- iv) Diff. Levels in the veg**
- v) Diff. Dry season refuge**

# GIR CONSERVATION. AREA (BERWICK )

	<b>FOR- EST</b>	<b>THORN SCRUB</b>	<b>SAV- ANNA</b>	<b>RIP.</b>	<b>RIV- ER</b>	<b>HILL SIDE</b>	<b>FL- AT</b>
<b>CHITAL</b>	<b>80</b>	<b>12</b>	<b>3</b>	<b>5</b>	<b>6</b>	<b>12</b>	<b>82</b>
<b>SAMBAR</b>	<b>69</b>	<b>5</b>	<b>10</b>	<b>16</b>	<b>14</b>	<b>51</b>	<b>35</b>
<b>NILGAI</b>	<b>41</b>	<b>29</b>	<b>27</b>	<b>3</b>	<b>5</b>	<b>35</b>	<b>60</b>
<b>HORNED</b>	<b>44</b>	<b>22</b>	<b>33</b>	<b>-</b>	<b>6</b>	<b>61</b>	<b>33</b>
<b>CHINKA RA</b>	<b>-</b>	<b>12</b>	<b>88</b>	<b>-</b>	<b>-</b>	<b>71</b>	<b>29</b>

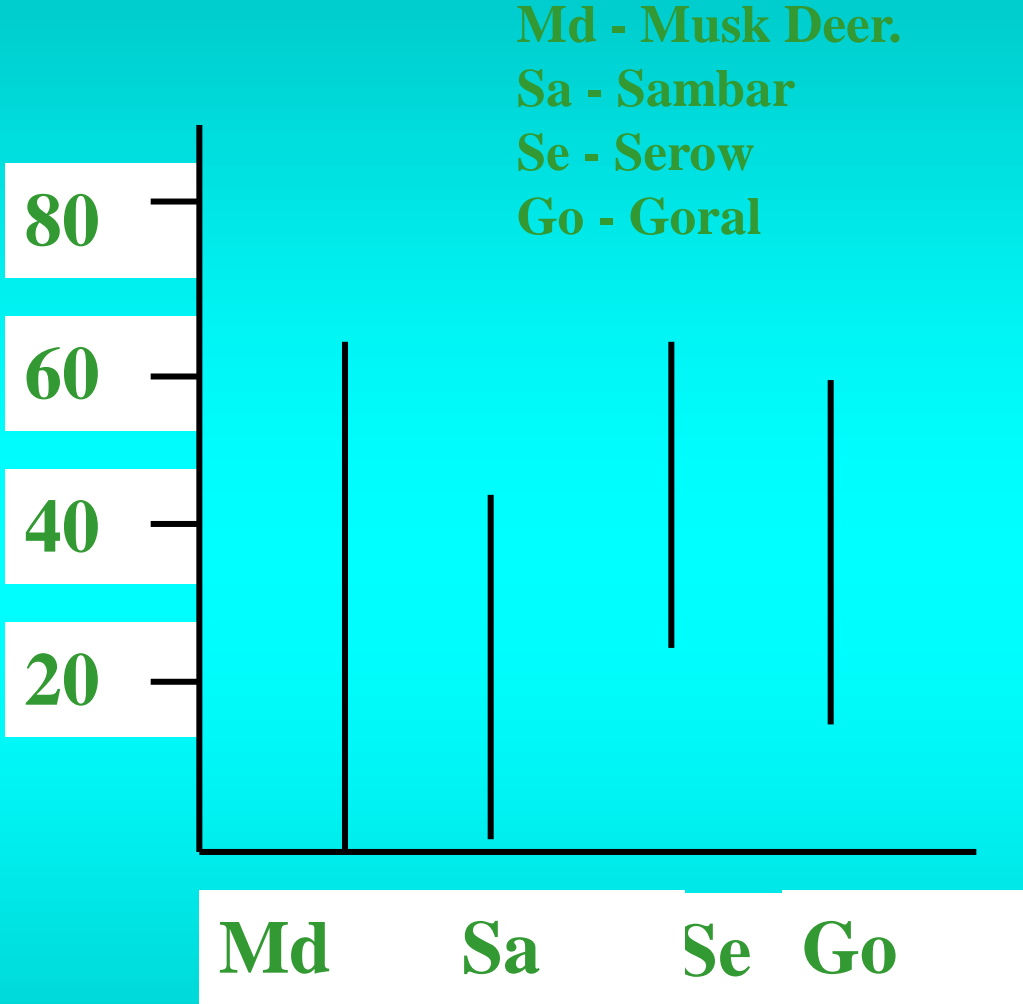
**BASED ON SIGHTINGS.**

**HIMALAYAS - ALTITUDE HAS A LARGE INFLUENCE**

# Ecological separation of Ungulates in Kedarnath Sanctuary (MJB Green, 1985)



**Angle of slope**



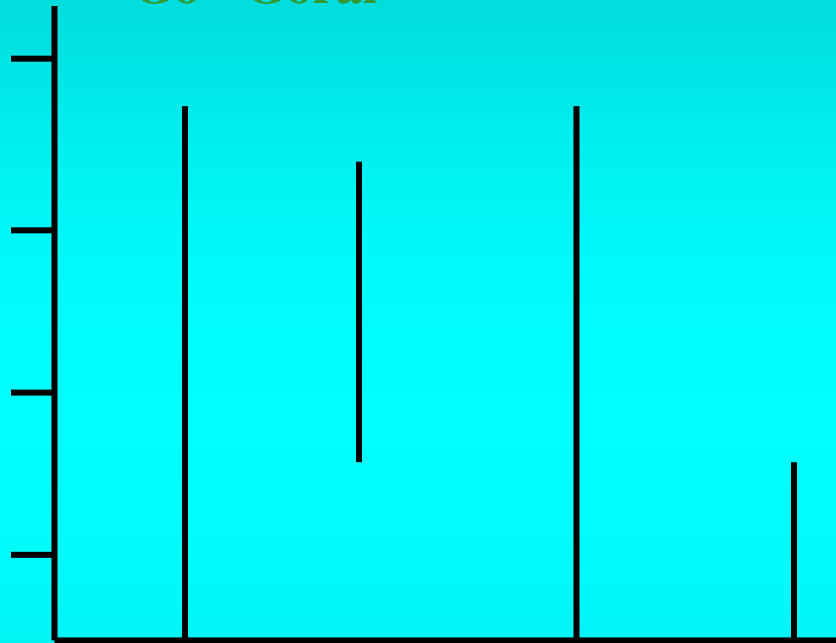
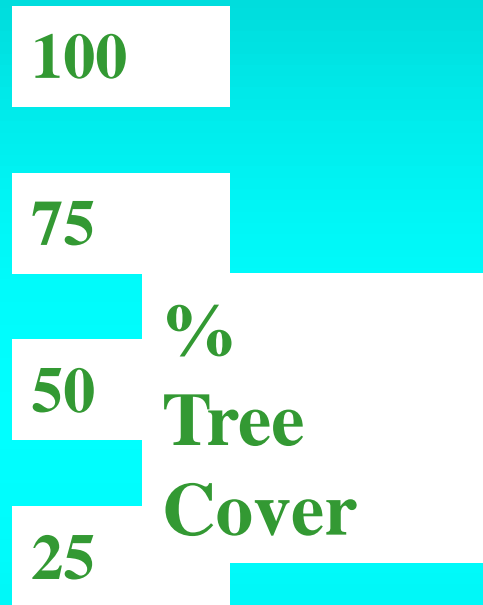


**Md - Musk Deer.**

**Sa - Sambar**

**Se - Serow**

**Go - Goral**



**Ma Sa Se Go**

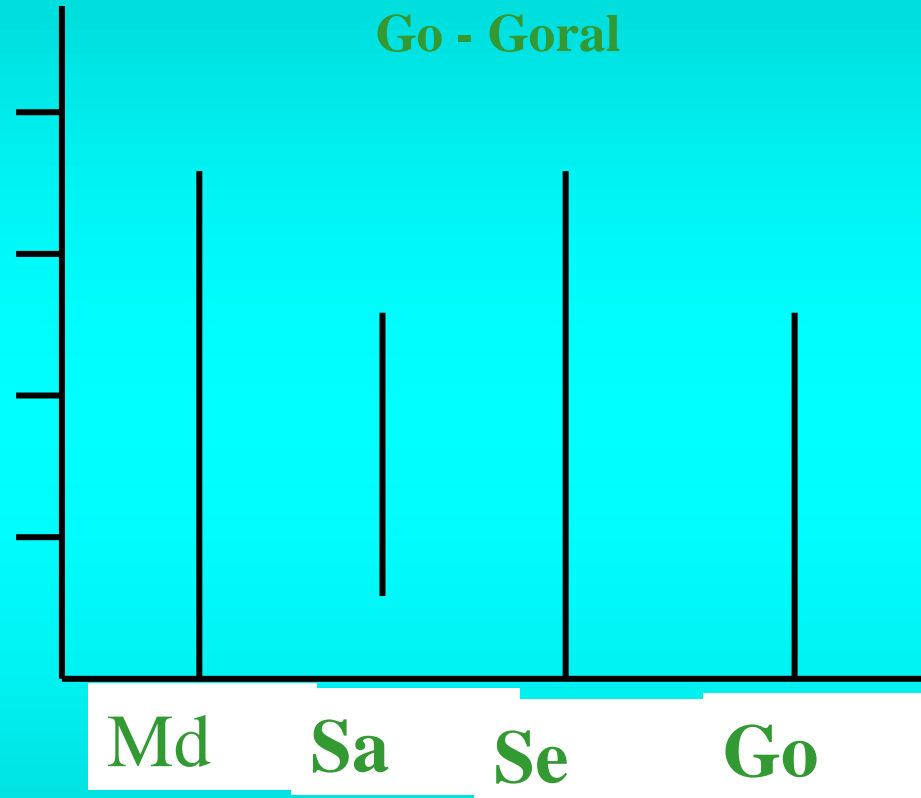
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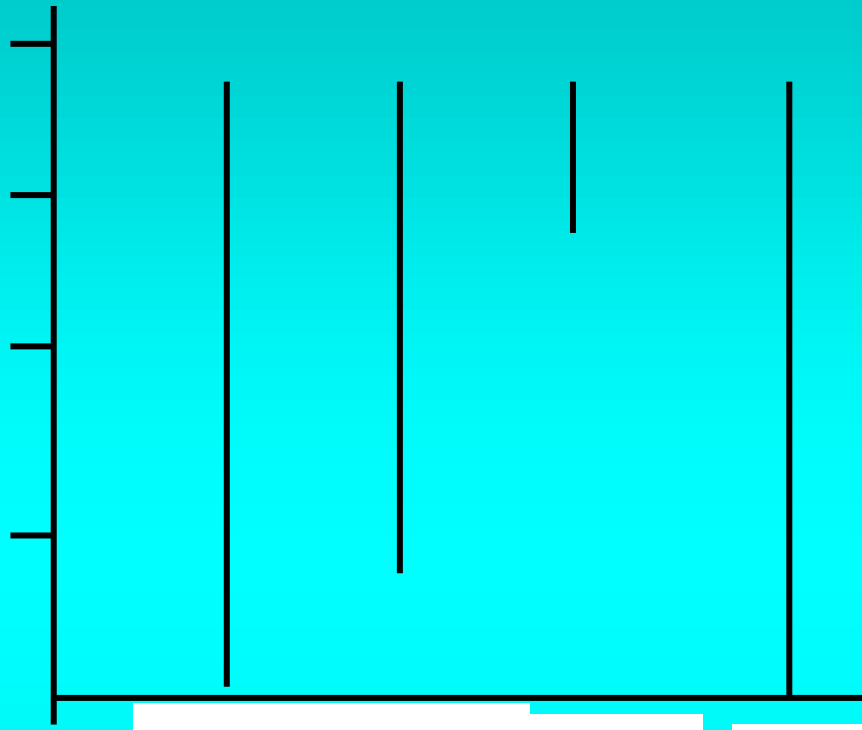
**Se - Serow**

**Go - Goral**

**%  
Shrub  
Cover**



**% Herb  
Cover**



**Md**

**Sa**

**Se**

**Go**

**Md - Musk Deer.**

**Sa - Sambar**

**Se - Serow**

**Go - Goral**

# CARNIVORES:

- 1. Habitat**
- 2. Activity pattern**
- 3. Prey size - species, age**

# ECOLOGICAL SEPARATION OF PREDATORS

- **Differential use of habitat**
- **Prey density & utilization by predation**
- **Predation and set of prey**
- **Predation and age of prey**

# Ecological Separation of Carnivores in Bandipur Tiger Reserve (AJT Johnsingh, 1980)

<b>Ecological &amp; behavioural parameters</b>	<b>Tiger</b>	<b>Leopard</b>	<b>Dhole</b>
<b>Nocturnal</b>	+	+	-
<b>Diurnal</b>	-	-	+
<b>Need for cover</b>	+	+	-
<b>Tolerance for sun</b>	-	+	-

<b>Need for water</b>	<b>+</b>	<b>-</b>	<b>+</b>
<b>Tolerance for human disturbance</b>	<b>0</b>	<b>+</b>	<b>-</b>
<b>Arboreal</b>	<b>-</b>	<b>+</b>	<b>0</b>
<b>Scavenging</b>	<b>-</b>	<b>-</b>	<b>+</b>
<b>Sociability</b>	<b>0</b>	<b>0</b>	<b>+</b>
<b>Inter pack tolerance</b>	<b>-</b>	<b>-</b>	<b>+</b>

**+ High**

**- Low**

**0 Absent**

# PREY- PREDATOR RELATIONSHIPS.

**Prey predator ratio (biomass/number)**

**1: 124**

**Bandipur**

**1: 100**

**Ngorongoro crater**

**1: 250-300**

**Serengeti**



## Table. Prey biomass and Tiger densities.

Study site	Area km <sup>2</sup>	Prey biomass kg/km <sup>2</sup>	Tiger density No./100	% consumption of prey biomass
Kanha	318	4066	6.92	5.446%
Chitwan	1024	1946	8.78	8-10%
Ranthambore	400	2765	10.0	11.5%
Nagarahole	103	7658	11.65	4.868%

**In Serengeti- Lions remove = 4.6 - 5.5 %**

**All predators = 9-10 %**

# NICHE

**Functional address of the organism in a system w.r.t. to specific parameters.**

**Or the profession of an organism in the system (activity or parameter)**

# NICHE WIDTH

**High N.W : species is generalist, can survive overlapping of species - with limited resources, the competition will set.**

- Broad Niches - less species but more numbers**
- Narrow Niches - more species & less abundance if resources are constant**