सत्यमेव जयते

WILDLIFE MANAGEMENT

বন বিভাগ
পশ্চিমবঙ্গ সরকার

DIRECTORATE OF FORESTS
GOVERNMENT OF WEST BENGAL

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PREFACE

A forester is required to manage the entire forest ecosystem which includes wildlife (forest flora and fauna) and its habitat. In wildlife protected areas, the objective of management is not to maximize forest harvest but to conserve wild animal populations in the given environment. Under the JICA project on 'Capacity Development for Forest Management and Training of Personnel' being implemented by the Forest Department, Govt of West Bengal, this course material on Wildlife Management has been prepared for induction training of the Foresters and Forest Guards. The object of this training manual is to help the frontline forest personnel have a better perception about basic principles and procedures involved in Wildlife Management.

The subjects covered in these materials broadly conform to the syllabus laid down in the guidelines issued by the Ministry of Environment of Forests, Govt of India, vide the Ministry's No 3 -17/1999-RT dated 05.03.13. In dealing with some of the parts of the course though, the syllabus has been under minor revision to facilitate better understanding of the subjects and to provide their appropriate coverage. The revised syllabus, with such modifications, is appended.

The contents of the course material have been compiled and edited by A Basu Ray Chaudhuri, IFS (Retd). Books and literature that have been made use of in preparing this course material have been cited in the respective lessons. Shri A Basu Ray Chaudhuri is indebted to many forest officers who have helped in the preparation of this material.

The efforts that have gone into making this course material will be best rewarded if the frontline staff of the forest department finds it useful in their day-to-day work.

Kolkata, September 2015

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Govt of West Bengal

SYLLABUS

Wildlife Management 15 hours, excursion 1 day, tour 7 days		
1.Introduction importance of wildlife	-aesthetic and recreational -economic -biological -ecological	2 hours
2.Terminologies	-carnivore, herbivore, omnivore -nocturnal and diurnal animals -carrying capacity -home range and territory -mammals -vertebrates, invertebrates -reptiles -amphibians	1 hour
3. Wildlife of the State	Some wild animals of West Bengal*	2 hours*
4.Protection of Wildlife	-wildlife diversity of India* -Threats to wildlife -preventive and combative measures -reference to Wildlife (protection) Act, 1972 -anti-poaching camps – informer network	2 hours
5.Wildlife Conservation	-sanctuaries and national parks	2 hours
6.Habitat management	-general principles - management practices* - food, water, cover, space -miscellaneous aspects - weeds and alien species - saltlicks	1 hour
7. Wild animals in captivity	- zoological park - definition, approval - National Zoo Policy 1998 - CZA guidelines for zoo management - CZA guidelines for establishing safari parks	1 hour
8.Tourism management	- ecotourism - tourism management in wildlife areas - tourism zone	1hour

	- tourism activities - facilities and amenities - carrying capacity -tourist guides and brochures -website and online booking	
9.Man animal conflict	- man animal conflict - definition - Causes - conflict Scenario in the State - steps to reduce conflict and check animal depredation - eco-development activities around the Protected Areas - award of compensation	1 hour
10. Census of wild animals	- definitions and concept - methods of Estimating Animal Numbers - census of deer -census of tigers - tiger status 2014* - population status of some wild animals*	2 hours
Field study	Visit to national parks / sanctuaries of the state.	4 days

* These are modifications with reference to the syllabus prescribed by MoEF, indicating revision/addition of topics and lesson hours.

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Wildlife Management

Lesson 1

Time 1 hour

Lesson Plan

To study

- **Wildlife Management**
  - **Introduction**
  - **Importance of wildlife**
    - aesthetic and recreational
    - economic

- **Backward Linkage** – Lessons on the Wildlife Protection Act in Forest Law.
- **Forward Linkage** – Subsequent Lessons
- **Training material required** – copy of Lesson 1 to be circulated beforehand
- **Allocation of time**

Wildlife Management

➢ **Introduction**	10 mts
➢ **Importance of wildlife**	
- aesthetic and recreational	20 mts
- economic	20 mts
➢ **Discussion/Miscellaneous**	10 mts

Wildlife Management

1. Introduction

Wildlife resources constitute a vital link in the survival of the human species. Today, when wildlife habitats are under severe pressure and a large number of species of wild fauna have become endangered, the effective conservation of wild animals is of great significance.
(Swarndeep s. Hundal 2004
http://www.arlis.org/docs/vol1/69415913/hundal_edited_final_march_10.pdf).

1.1 According to the Wildlife Protection Act (1972), wildlife includes "any animal, aquatic or land vegetation which forms part of any habitat". The 'habitat' referred to here is the natural home of any wild animal. Thus management of wildlife should deal with management of wild animals as well as their home.

1.1 Being living units of the ecosystem, plants and animals contribute to human welfare by providing

- material benefit to human life;
- knowledge about genetic resources and their preservation; and
- significant contributions to the enjoyment of life (e.g., recreation).

Human society depends on genetic resources for virtually all of its food; nearly half of its medicines; much of its clothing; in some regions, all of its fuel and building materials. Because every one of us depends on plants and animals for all vital components of our welfare, it is more than a matter of convenience that they continue to exist; it is a matter of life and death.
(Swarndeep s. Hundal 2004)

1.3 Genetic resources are often treated as inexhaustible natural resources, and this is how we take it granted that such resources, crucial for existence of humans, will continue to remain as they are. It is here that the concept of management and conservation of wildlife comes into play.

1.4 Wildlife management has been **defined** as a science and art of maintaining/changing the characteristics and interactions of habitats, wild animal populations and activities of people in order to achieve specific goals of conservation. (V.B Sawarkar 2005). It may be noted that wild animals and plants are living indicators of the characteristics of their environment or habitat; and thus wildlife management is all about how to deal with these environment characteristics to the best interest of wildlife.

2. Importance of wildlife

2.1 Aesthetic and recreational

Aesthetic value means what is pleasing to the eye, such as watching a deer graze or enjoying the sun set. There is no doubt that wild plants and animals have this aesthetic value. Recreation is a pastime or diversion that affords relaxation and enjoyment. The wildlife is a source of awe, joy, wonder, and pleasure for all of us. It has therefore immense recreational value. Wildlife recreation is more than activities designed to collect specimens of wildlife species. People enjoy seeing plants and animals in their natural habitats. This is why travellers stop along the roadside whenever a wild animal moves into an opening or when they see a brightly coloured plant.

2.1.1 Aesthetic and recreation value of wildlife overlap. Often the aesthetic value is the motivation for the recreational activities. A person sees an aesthetically pleasing landscape or experiences the joy of seeing wild animals in their natural habitat. There is a desire to capture the moment on film. Photography becomes a recreational activity that results from the aesthetic value of the landscape. The aesthetic and recreational values are interlinked. Even as aesthetic qualities of wilderness induce one to recreational activities like trekking through or camping in forests, such recreation also unveils new sights and experiences and thus enrich the aesthetic value that wildlife has to offer.

2.1.2 As the word spreads of the beauty of an area, people have the desire to travel there and experience it for themselves. When travelling, many people enjoy discovering plant species not indigenous to their home. The instinct of humans to quest for something new and unseen is best fulfilled when they have the opportunity to unravel the mysteries of nature and get the experience of seeing wild animals in their natural habitat. Wildlife tourism, also called ecotourism, continues to grow as an industry worldwide. Bird-watching and wildlife photography is a growing part of wildlife tourism. Many people now prefer to see wild animal species in their natural habitat.

2.1.3 As a wildlife area becomes popular and well known for its aesthetic and recreational value, it invites more tourists. Heavy traffic of people in a resource area will diminish the aesthetic value. There has to be a control over human traffic in the area, keeping in view its potential capacity to provide enjoyment. An important part of wildlife area management is enforcement of regulations on (i) season of the year when the protected area shall remain open to tourists, (ii) number of tourists to be allowed

entry at a time, (iii) time of the day the tourists will be allowed to move in, (iv) means of transport to be allowed, (v) core areas where tourists shall not have access, and (vi) any other matter beneficial for aesthetic and recreational value of the resource area. It is such management regulations and their observance that will have considerable impact on the aesthetic and recreational potential of a wildlife habitat. (Source:http://schools.birdville.k12.tx.us/cms/lib2/TX01000797/Centricity/Domain/1126/Benefits%20of%20Wildlife.pdf)

2.2 Economic Importance

Wild animals and their habitat form the biotic component of the ecosystem they belong to. They perform and provide various ecosystem services which have economic values. Earlier, economic importance focussed on plants and animals as a source of food and clothing. The evaluation of economic benefits was based on quantifying the provisional services that a wildlife resource area could generate. However, the priority of management of a wildlife area now-a-days is not to extract provisional services. Consequently, economic value of harvestable products has become little or negligible. Economic value, major and substantial, now lies in the cultural, regulatory and support services that a natural ecosystem comprising wildlife does generate. It is noteworthy, however, that these services or a major part of them cannot be quantified or measured in money value.

2.2.1 Recreational services

Of the cultural services the most important and visible is the recreational service. Wildlife and its supporting habitat have economic value as a recreational resource. Many recreational activities like bird watching, nature photography, hiking, camping, boating, and rock hounding have become very popular, but assigning money values to this aspect of wildlife worth is difficult. Mere addition of entry and other fees that the government or other agencies conducting such activities earn from the tourists gives only a small part of the real worth. The major part of economic value of wildlife out of recreational activities often remains unevaluated. Arguably, one way of assessing the economic value of the recreational service is to measure the amounts of money that people are willing to spend to pursue their particular interest. Expenses made by all the recreation groups visiting a particular bit of wildlife habitat in a year, when added, can give an estimate of the annual recreational value of such habitat.

2.2.2 Regulating services

The ecosystem comprising wildlife naturally provides the regulating services which help maintain a livable world. The forested wildlife habitats have key role in the hydrological

cycle, regulating stream flow, prevention of soil erosion, diminishing impact from floods. They also have important function in carbon cycle, and mitigating climate change. These are some of the regulating services that many wildlife ecosystems provide. These services have substantial economic value, which is however difficult to assess.

2.2.3 Supporting services

The wildlife resources also provide many supporting services which help to sustain the habitat and production of all services. These services may not be conspicuous but have considerable economic importance. Plants undertake photosynthesis and function as primary producers in the ecosystem; they take part in nutrient cycling. Soil biota, including flora (plants), fauna (animals) and microorganisms, perform functions that contribute to the soil's development, structure and productivity. Dispersal of seeds by birds and other animals, and pollination by butterflies help in the regeneration of vegetation. All these processes done in nature by wildlife as part of their supporting services have a cost that any alternate artificial means would have to pay dearly. We discuss below some other supporting services of wildlife.

2.2.3.1 Environmental monitoring value

The three basic elements of our environment - air, water and the soil – are constantly threatened by contamination of various sorts. More often our sensitive wildlife populations warn us of these dangers. The dangerous effects of DDT and similar chemicals were manifested in the declining populations of birds of prey. Death of fish in waterways has on many occasions alarmed us of the toxic effects of chemicals and untreated municipal waste that had been allowed to be discharged into water. The diversity of fauna over the earth ensures that one or the other species is more sensitive than humans about environmental pollution and concentrates many kinds of chemicals in their bodies. This environmental monitoring service is of so immense value that we cannot affix a price tag.

2.2.3.2 Waste processing value

A wildlife habitat, be it forest or a wetland, with the varied forms of life it supports performs a waste processing service that benefits the humans. The crows and vultures perform a great service in removing carrion (dead and decaying animals) from our highways and fields. In a less conspicuous manner, the wildlife habitats themselves play an important role in waste management and pollution reduction. Forest vegetation moderate water runoff and prevent physical pollutants from running into streams. Wetlands (swamps, bogs and marshes) act as filters and settling basins. The organisms they support break down organic materials and bind other pollutants. Needless to say that the economic worth of this waste processing service by wildlife is huge and too much to be undertaken by any man made plants and tools.

Reference Material makes

1. SWARNDEEP S. HUNDAL 2004 Wildlife Conservation Strategies and Management in India: An Overview
2. V.B Sawarkar 2005 A Guide to Planning Wildlife Management in Protected Areas and Managed Landscapes
3. http://www.clemson.edu/psapublishing/pages/4h/sw448.pdf Economic importance of wildlife.

Wildlife Management

Lesson 2

Time 1 hour

Lesson Plan

To study

- **Wildlife Management**
  - **Importance of wildlife (continued)**
    - ecological
    - biological

- **Backward Linkage** – Lessons 1
- **Forward Linkage** – Subsequent Lessons
- **Training material required** – copy of Lesson 2 to be circulated beforehand
- **Allocation of time**

Wildlife Management

➢ **Importance of wildlife (continued)**	
- ecological	35 mts
- biological	15 mts
➢ **Discussion/Miscellaneous**	10 mts

Wildlife Management

1. Importance of wildlife (continued)

1.1 Ecoogical

Broadly speaking, the variety of life in the wildlife has an enormous ecological value. As is the case for every form of life, wildlife is closely connected to the environment. It continuously interacts with all the components of ecosystem, influencing them and being dependent on them as well. Ecology deals with the relationship of all living things with their environment. All organisms that live in the same area make up a biotic community, which is a collection of plants and animals that live in the same environment. Each organism in a community is dependent on the other organisms. Therefore the role and function of one type of wildlife will have impact on the others.

1.1.1 *A farm pond is one example of a biotic community. Phytoplankton in a pond provides food for the zooplankton. The zooplankton provides food for tadpoles and aquatic insects. Small fish, frogs, and birds eat the insects. Large fish then eat the frogs and small fish. Plants such as cattails and water lilies provide food, shelter, and nesting sites for various animals and insects. Each type of wildlife is ecologically important. Many of the insects and animals will disappear if there were no cattails or water lilies. If the insects disappear, there is a severe drop in the food supply for the frogs and fish*.
(http://schools.birdville.k12.tx.us/cms/lib2/TX01000797/Centricity/Domain/1126/Benefits%20of%20Wildlife.pdf)

1.1.2 *The use of one resource in an ecosystem affects all the other resources in that area. The removal of trees from a forest will affect the lives of the forest animals. With fewer trees, the animals would have less shelter and food and could easily cause the animal population to decrease. It is also necessary to examine the importance of an insect population. The destruction of insect populations with insecticides can decrease or prevent the pollination of plants. Without pollination, plants are unable to reproduce. The result would be a shortage of food for the animals in the community. Failure to properly manage a deer population could result in overgrazing. This problem would affect the regeneration of shrubs and trees and reduce the growth rate of the forest.*
(http://schools.birdville.k12.tx.us/cms/lib2/TX01000797/Centricity/Domain/1126/Benefits%20of%20Wildlife.pdf)

1.1.3. Ecological balance is a state of **dynamic equilibrium** within a community of organisms in which genetic, species and ecosystem diversity remain relatively **stable**. The most important

point being that the **natural balance** in an ecosystem is **maintained**. The examples cited above explain how the wildlife being the biotic component of a natural ecosystem performs key ecological functions which in turn influence the biodiversity, productivity and sustainability of the ecosystem.

1.1.4 Ecological functions of some wildlife species in natural habitats are mentioned below. (Source:http://nwhi.org/inc/data/GISdata/docs/WHROW/chapter6.pdf; http://www.uesc.br/cursos/pos_graduacao/mestrado/animal/artigo_chandonet.pdf)

- Browsing or grazing by ungulates can change plant communities;
- Animals can act as "environmental engineers" and influence geomorphology and ecosystem processes;
- Frugivores (fruit eating organisms e.g. bats) can support viable fruit-bearing plants;
- Pollinators can support plant diversity;
- Seed dispersers and frugivores can influence forest succession and regeneration;
- carrion feeding can support the trophic structure of a community; all the scavenger species, regardless of their position in the animal realm (insects, such as beetles; birds, such as vultures or crows; or mammals, such as hyaenas or jackals) play a very important ecological role by limiting or avoiding the propagation of diseases and recycling nutrients which cannot be used by other species;
- carnivore predation can influence populations of ungulate prey species;
- In their preference of prey for weak, old and diseased animals, the predators limit development of potential disease, and improve genetic diversity among herbivore communities;
- In some cases, rodents can serve to disseminate beneficial mycorrhizal fungi in forests;
- reptilian primary burrow excavators can provide for avian secondary burrow users.

1.1.5 Ecological functions and the Trophic Structure

Biodiversity in an ecosystem can be organized into **trophic pyramids**.(Please refer to **Lesson 13 of Forest Botany**). A trophic pyramid consists of different trophic levels in which the vertical dimension indicates the feeding relations. The pyramid starts with a large number of producers (plant community) at the base and ends up at the top with fewer numbers of predators. Gradual reduction in the horizontal dimension, as one goes from base to top of the pyramid, represents decline in population of the organisms as trophic level goes higher. The thematic picture of the pyramid shows the various communities in dynamic equilibrium.

1.1.5.1 The wildlife in a natural ecosystem, consisting of producers (plants), primary consumers (herbivores) and predators (carnivores), occupies the various trophic levels in the trophic pyramid. Their ecological functions are central to the trophic structure of the wildlife communities. Ecological functions of organisms support the trophic structure, that is, energy

flows, food webs, and nutrient cycling in the ecosystems. It is done primarily by the predators occupying higher trophic level, that is, higher positions in the food chain, as they regulate, directly or indirectly, the species in the lower levels of food chain by controlling the latter's distribution, abundance and diversity.

1.1.6 Wildlife can be also used to assess the quality of the environment. Some species sometimes act as 'indicator species' for the health status of the ecosystem. This is, for instance, the case for all predators situated at the top of the trophic pyramid, which can highlight environmental problems that occur at the lower levels, such as poisoning, pollution and disease. (Ph. Chardonnet et.al 2002)

1.2 Biological

Biological value of the wildlife lies in its role to provide the rich biodiversity of nature. (Please see Lesson 4 of General Silviculture.) Wildlife constitutes the major part of varieties of life on earth. Biodiversity includes diversity in abundance (such as the number of genes, individuals, populations or habitats in a particular location), distribution (across locations and through time) and in behaviour, including interactions among the components of biodiversity, such as between pollinator species and plants, or between predators and prey. The biological importance of wildlife can be gauged from the fact that its biodiversity forms the basis of all the ecosystem services that a natural ecosystem can provide. It contains much of the renewable natural capital on which human livelihoods and development are grounded.

1.2.1 Even as the biological worth of a wildlife area is dependent on the kinds and distribution of the life forms it contains, the concern of a wildlife manager is focused on whether any species has become or is likely to become threatened. According to recent IUCN reports (2012 IUCN Red List),

- 20219 species have been identified as threatened out of 65518 species so far evaluated.
- Of the major vertebrate groups that have been comprehensively assessed, over 20% of mammals and 13% of birds are threatened.
- Of mammals, birds and plants, assessment over a period from 1996 to 2012 showed a rise in the number of Critically Endangered and Endangered species. The number of Vulnerable species also showed rise for Birds and plants, but showed a decline for mammals
- India is reported to have 935 no of threatened spp. (mammals 94, Birds 80 and Plants 321)

1.2.2 Importance attached to the biological value of wildlife is reflected in the fact that preserving the vast gene pool reserve of a wildlife habitat forms the first and foremost

objective of wildlife management. Major wildlife areas are identified and brought under Wildlife Protected Area Network. These protected Areas are accorded high level priority with regard to conservation of their biological resources. It may be mentioned in this connection that India has seven Natural World Heritage Sites for conservation. These are–

(1) Kaziranga National Park
(2) Keoladeo National Park
(3) Manas Wildlife Sanctuary
(4) Sundarbans National Park
(5) Nandadevi and Valley of Flowers National Park
(6) Western Ghats (39 selected sites comprising forests, national parks and sanctuaries)
(7) Great Himalayan National Park Conservation Area
(Source: The Times of India 03 September 2015)

Reference Material

(1) Ph. Chardonnet, B. des Clers, J. Fischer, R. Gerhold, F. Jori & F. Lamarque 2002 The value of wildlife; at http://www.uesc.br/cursos/pos_graduacao/mestrado/animal/artigo_chandonet.pdf
(2) Key Ecological Functions of Wildlife Species Bruce G. Marcot & Madeleine Vander Heyden at http://nwhi.org/inc/data/GISdata/docs/WHROW/chapter6.pdf
(3) http://www.nrdc.org/wildlife/files/predatorimportance.pdf
(4) Instructional Materials Service- Analyze the importance of Wildlife Management at http://schools.birdville.k12.tx.us/cms/lib2/TX01000797/Centricity/Domain/1126/Benefits%20of%20Wildlife.pdf
(5) The Times of India 03 September 2015

Wildlife Management

Lesson 3

Time 1 hour

Lesson Plan

To study

Wildlife Management

- **Terminologies**
  - -Carnivore, herbivore, omnivore
  - -Nocturnal and diurnal animals
  - -Carrying capacity
  - -Home range and territory
  - -Mammals
  - -Vertebrates, Invertebrates
  - -Reptiles
  - -Amphibians
- **Wildlife management in West Bengal**

- **Backward Linkage** – Lessons 1 and 2
- **Forward Linkage** – Subsequent Lessons
- **Training material required** – copy of Lesson 3 to be circulated beforehand
- **Allocation of time**

Wildlife Management

- **Terminologies** 35 mts
  - Carnivore, herbivore, omnivore
  - -Nocturnal and diurnal animals
  - -Carrying capacity
  - -Home range and territory
  - -Mammals
  - -Vertebrates, Invertebrates
  - -Reptiles
  - -Amphibians
- **Wildlife management in West Bengal** 15 mts
- **Discussion/Miscellaneous** 10 mts

Wildlife Management

1. Terminologies

- **Carnivore** - A carnivore is an animal that gets food from killing and eating other animals. Carnivores generally eat herbivores, but can eat omnivores, and occasionally other carnivores. Animals that eat other animals, like carnivores and omnivores are important to any ecosystem, because they keep other species from getting overpopulated.

  Since carnivores have to hunt down and kill other animals they require a large amount of calories. This means that they have to eat many other animals over the course of the year. The bigger the carnivore, the more it has to eat. A stable ecosystem has to ensure that it has many more herbivores and omnivores than carnivores.

  Examples of carnivores:

  Large carnivores: Bengal Tiger, Lion, Leopard etc.

  Medium carnivores: Rat snake, Hawks

  Small carnivores: Spider, Frogs.

  (Source:http://www.qrg.northwestern.edu/projects/marssim/simhtml/info/whats-a-carnivore.html)

- **Herbivore** - A herbivore is an animal that gets its energy from eating plants, and only plants. Many herbivores have special digestive systems that let them digest all kinds of plants, including grasses.

  Herbivores need a lot of energy to stay alive. There should be a lot of plants in the ecosystem to support the herbivores.

  Examples of herbivores:

  Large herbivores: Indian elephant, Indian rhinoceros, gaur (Indian bison)

  Medium herbivores: Spotted deer, Black buck, Indian hare

  Small herbivores – Mouse, Squirrel

- **Omnivore** - An omnivore is a kind of animal that eats either other animals or plants. Some omnivores will hunt and eat their food, like carnivores, eating herbivores and other omnivores. Some others are scavengers and will eat dead matter. Many will eat eggs of other animals.

  Omnivores eat plants, but not all kinds of plants. Unlike herbivores, omnivores cannot digest some of the substances in grains or other plants that do not produce fruit. They can eat fruits and vegetables, though.

Examples of omnivores:
Large Omnivore: Black Bear, Wild Pigs
Medium omnivore: Jungle fowl, Rats, many bird species
Small omnivore: Wasp, Fly.

- **Nocturnal animals** - Nocturnal animals are animals that prefer to come out during the night time. Some nocturnal animals can be seen during the day, others spend the whole day resting or sleeping. (https://www.edmodo.com/folder/195849).
  Examples: Bat, Owl, Red Panda, Foxes, Cricket etc.

- **Diurnal animals** – Diurnal animals are those who are active during daytime.
  Examples: Most birds, Most mammals, Butterflies.

- **Carrying capacity** – The term 'carrying capacity' has been defined in many ways. Some of the definitions are given below.
  - The carrying capacity of a biological species in an environment is the maximum population size of the species that the environment can sustain indefinitely, given the food, habitat, water, and other necessities available in the environment. (https://en.wikipedia.org/wiki/Carrying_capacity)
  - Carrying capacity is the maximum or upper limit, beyond which a particular population cannot increase in a given habitat. (Rajesh Gopal Fundamentals of Wildlife Management)
  - Carrying Capacity is the number of animals that a given area will support (or "carry") without damage to the habitat or to the animals. (http://homestudy.ihea.com/wildlife/08capacity.htm)

  It is very important to understand that, no matter how good a habitat is, and no matter how much protection is given to the animals in it, a given area will only support number of animals equal to carrying capacity. Animal populations respond to a change in the carrying capacity with a corresponding change in numbers: if conditions improve, the population will increase; if conditions get worse or habitat is lost, the population will decrease. Again, wildlife managers cannot work on carrying capacity of a single species alone. Carrying capacity of a habitat should include and accommodate the entire spectrum of herbivores and carnivores in an area.

- **Home Range and Territory** -
  An animal interacts with the biotic components – vegetal and faunal – of the environment. Competition for food and other resources influences how animals are

distributed in space. Certain parameters are used to interpret the behaviour of animals with regard to space. **Home Range** and **Territory** are two such parameters. They are indicators of animals' social interactions in monopolizing resources and mates.

The home range of an animal is the area where it spends its time; it is the region that encompasses all the resources the animal requires to survive and reproduce.

Territory is any area defended by an organism or a group of similar organisms for such purposes as mating, nesting, roosting, or feeding. Most vertebrates and some invertebrates, such as arthropods, including insects, exhibit territorial behaviour. Possession of a territory involves aggressive behaviour and thus contrasts with the home range, which is the area in which the animal normally lives. Home range is not associated with aggressive behaviour, although parts of the home range may be defended: in this case the defended part is the territory. The type of territory varies with the social behaviour and environmental and resource requirements of the particular species and often serves more than one function, but whatever the type, the territory acts as a spacing mechanism and a means of allocating resources among a segment of the population and denying it to others. (Source: http://www.britannica.com/science/territory-ecology#ref33182)

- **Mammal** – Any animal of the Mammalia, a large class of warm-blooded vertebrates having mammary glands in the female, a thoracic diaphragm, and a four-chambered heart. The class includes the whales, carnivores, rodents, bats, primates, etc (http://www.thefreedictionary.com/mammal)

- **Vertebrates** - They are the most advanced group of animals. The characteristics that make vertebrates special are the presence of the spinal cords, vertebrae and notochords. They include Fish, Birds, Mammals, Reptile and Amphibians. (Source: http://biology.tutorvista.com/organism/vertebrates.html)

- **Invertebrates** - Invertebrates are the animals that do not have a backbone or the vertebral column. Invertebrates are the most diverse group having about 12 million live species. Most of the animals on earth are invertebrates. They are cold-blooded animals; their body temperature depends on the temperature of the atmosphere. They include Crustaceans, Centipedes, Ants, Wasps, Spiders, Locusts, Honey bees, Termites, Cockroach, Grasshoppers, Crickets, Stick insect, Mantis, Crabs, Songes, Star fish, Unio, Leeches, Earthworms, etc.. (Source: http://biology.tutorvista.com/organism/vertebrates.html)

- **Reptile** - Any of the cold- blooded vertebrates constituting the class Reptilia, characterized by lungs, an outer covering of horny scales or plates, and young produced in amniotic eggs. The class includes tortoises, turtles, snakes, lizards and crocodiles.
  (Source: http://www.thefreedictionary.com/reptile)

- **Amphibian** - A cold-blooded vertebrate animal having moist skin without scales. Most amphibians lay eggs in water, and their young breathe with gills but develop lungs and breathe air as adults. Amphibians include frogs, toads, and salamanders.
  (Source: http://www.thefreedictionary.com/amphibian)

2. Wildlife Management in West Bengal

West Bengal has 4692 sq.km of forests under the Wildlife Protected Area Network. The PA constitutes 39.50% of the total forest area of the state and 5.29% of state's geographical area. Area under sanctuary and National park is as follows.

PA	Number	Area in sq.km.
Wildlife Sanctuary	15	1488.7246
National Parks	6	1981.4817

The state has two Tiger Reserves, namely **Buxa Tiger Reserve (BTR)** (760.8699 sq.km) and **Sundarban Tiger Reserve (STR)** (2584.89 sq.km). Parts of the Tiger reserve areas have again constituted national Parks and wildlife sanctuaries. The State has also two Elephant Reserves, namely, **Mayurjharna Elephant Reserve** (414 sq.km) and **Eastern Dooars Elephant Reserve** (977.51 sq.km). In addition, there is a biosphere reserve, namely **Sundarban Biosphere Reserve** (9630 sq.km).
(Source: Annual Report 2013-14 of Directorate of Forests, Govt of WB)

Reference Material

(1) Glossary of Important terms in Wildlife Ecology
http://www.afrc.uamont.edu/whited/Glossary%20of%20Terms.pdf
(2) http://www.nrdc.org/wildlife/files/predatorimportance.pdf
(3) Instructional Materials Service- Analyze the importance of Wildlife Management at
http://schools.birdville.k12.tx.us/cms/lib2/TX01000797/Centricity/Domain/1126/Benefits%20of%20Wildlife.pdf
(4) Annual Report 2013-14 of Directorate of Forests, Govt of WB
(5) Websites cited in the Lesson

Wildlife Management

Lesson 4

Time 1 hour

Lesson Plan

To study

- **Wildlife Management**
  - **Some wild animals of West Bengal**

- **Backward Linkage** – Lesson 3

- **Forward Linkage** – To try and identify some of the animals during tour.

- **Training material required** – copy of Lesson 4 to be circulated beforehand; magnified images of the animals may be shown.

- **Allocation of time**
  Wildlife Management

  - **Some wild animals of West Bengal** **50** mts

  - **Discussion/Miscellaneous** 10 mts

1. Some wild animals of the state

Bengal Tiger (*Panthera tigris***)** (Schedule I)

Bengal tiger is found in Neora Valley, Buxa, Mahananda, Sajnekhali, Jaldapara and in the Sunderbans. Male Bengal tigers average 2.9 meters (9 1/2 feet) from head to tail and weigh about 220 kilograms (480 pounds). Females are smaller, measuring about 2.5 meters (8 feet) in length and weighing approximately 140 kilograms (300 pounds). Bengal tigers prey primarily on wild deer and wild cattle.

(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

Clouded Leopard (*Neofelis nebulosa***)** (Schedule I)

This beautiful Asian cat, named for its spotted coat, is seldom seen in the wild, and its habits remain a bit mysterious. Clouded leopards roam the hunting grounds of Asia from the rain forests of Indonesia to the foothills of the Himalayas. Though little information is known about their population sizes, they are considered a vulnerable species. Clouded leopards have short, powerful legs equipped with rotating rear ankles that allow them to safely downclimb in a headfirst posture—much like a common squirrel. Sharp eyesight helps them judge distances well, and the cats use their long tails to maintain balance.

(Source: http://animals.nationalgeographic.com/animals/mammals/clouded-leopard/)

Red Panda *(Ailurus fulgens*) (Schedule I)

Red panda is found in the forests of Singalila and Neora valley. The red panda is a smaller relative of the well known giant panda. Like its larger relative, the red panda is a member of the order Carnivora, even though the vast majority of its diet is vegetable in nature. The red panda is slightly larger than a large housecat, has rusty red fur, a long light and dark striped tail, a short white nose, and dark tear tracks. It is crepuscular (active around dawn and dusk) and scansorial (well adapted for climbing), spending much of its time in trees. In the wild, red pandas eat mostly bamboo leaves. They supplement this diet with berries, mushrooms, grasses and bark. Red pandas do eat

some meat. They eat insects, bird eggs, bird nestlings, and may even catch an occasional mouse or bamboo rat.
(Souce: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal_3.htm)

Batagur Terrapin (*Batagur baska*) (Schedule I Part II)

The giant Asian river terrapin, or batagur, and the closely related painted batagur (*Callagur borneoensis*) inhabit estuaries and tidal reaches of medium to large rivers throughout Southeast Asia. Both belong to monotypic genera and represent the largest emydid turtles, reaching a carapace length that may exceed 60 cm.

(Photo: http://www.wildbengal.com/urls/endangered-reptiles.html)

The river terrapin *Batagur baska* is restricted to the estuaries of the Ganga and Brahmaputra, the Sundarbans and Bhitarkanika. Overexploitation of eggs and destruction of its mangrove habitat poses a threat to this species.
(Souce: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal_3.htm)

Goliath Heron *(Ardea goliath*) (Schedule IV)

The Goliath Heron - with an overall length of between 4 to 5 feet this is world's largest heron. In flight it has a slow and rather ponderous look and, unlike some other herons, its legs are not held horizontally. The only similar species is the purple heron, which is much smaller. It prefers to feed in or near water taking fish, frogs, lizards and insects. They use a variety of hunting techniques ranging from standing still at the edge of, or in some water waiting to spear a

(Photo: http://www.wildbengal.com/urls/endangered-aves.html)

fish, through acts like stirring the water or grass with a foot or flicking the wings, to disturbing or startling prey, to walking rapidly through the environment
(Souce: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal_3.htm)

Leopard (*Panthera pardus*) (Schedule I)

The leopard, with more than 20 subspecies described, is included in the genus Panthera on the basis of several features. It is one of the roaring cats, capable of producing a deep sawing roar similar to that of the jaguar. The leopard is also like the jaguar in coat pattern, with dark spots or rosettes. Although the size of the rosettes varies over geographical region, leopard rosettes remain empty of markings while jaguars generally have one to four dark spots inside the open spots. The background color of the leopard's coat varies from shades of yellow through a reddish brown, with some albino, although quite rare, specimens reported.

The size of the leopard varies greatly in different geographical regions. The leopard averages between five and eight feet in length and weighs from 60 to 210 pounds in the wild.

The leopard's remarkable adaptability to different environments is an indicationthat it is basically an unspecialized animal, favoring forest and forest boundary habitats where it can utilize trees for protection and observation platforms. The leopard is found in forests of Singalila, Neora Valley, Buxa, Gorumara, Senchal, Mahananda, Chapramari, and Jaldapara.

(Souce: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal_3.htm)

Jungle Cat *(Felis chaus*) (Schedule II)

In India and South East Asia, the species inhabits a greater range of habitats which, as well as marsh and swampland on forest margins, also includes tropical deciduous and evergreen forest. The jungle cat is not a particularly shy creature and can be often found close to human habitation, hunting in crop fields and plantations for small rodents. In India, it has been reported to inhabit disused buildings on the edge of human settlements. (Photo:https://en.wikipedia.org/wiki/Jungle_cat)

The jungle cat can be distinguished from other wild cat species within its range by its long legs and uniform coat colour, which ranges from sandy yellow to reddish brown. On closer examination, the adult jungle cat can be seen to have faint stripes on the legs and tail, which is tipped with black. On the head the nose and chin areas are often white, the rather large ears tipped with darker fur and in certain sub-species faint 'tear stripes' are noticeable beneath the eyes. The jungle cat is found in Senchal, Lothian island etc.

(Souce: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal_3.htm)

Golden Cat (*Catopuma temminckii)* (Schedule I)

The Asian golden cat is remarkably polymorphic in its pelage. The most common coloration is fox-red to gold-brown, but it can also be black, brown, or grey.

Very little is known of the golden cat's behavior and ecology. However it is believed to be predominantly nocturnal and prey mainly on large rodents, but its diet also includes amphibians and insects, and probably also birds, small reptiles etc. It was reported earlier to have been sighted in the Buxa tiger reserve but in recent years has not been sighted.
(Souce: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal_3.htm)

Olive Ridley (*Lepidochelys olivacea)* (Schedule I Part III)

The Olive Ridley is a small, hard-shelled marine turtle which may be identified by the uniquely high and variable numbers of vertebral and costal scutes. Although the Olive Ridley remains widespread and relatively numerous in tropical waters, most nesting sites support only small or moderate scale nesting (up to around 1,000 females per year), and most populations are known or thought to be depleted, often severely so, and some are virtually extinct.
(Photo: http://animals.nationalgeographic.com/animals/reptiles/olive-ridley-sea-turtle/)

The main food items recorded are crabs and shrimps, but sessile and pelagic tunicates, jellyfish and other small invertebrates appear in the diet, also fish eggs.

Three major threats to Olive Ridley populations have been identified: commercial harvest of adults, incidental catch in shrimp trawls, and harvest of eggs from nest beaches. The Olive Ridley has been considered by some authorities to be the most abundant marine turtle in the world, but it may also be the most exploited one. It is found mainly in the Sunderban area most notably in the Lothian islands.
(Souce: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal_3.htm)

Marbled Cat (*Felis marmorata*) (Schedule I)

A rare cat, the marbled cat resembles a long-tailed cat in size and build. Its beautiful, striking coat is pale brown, with irregular slightly darker brown blotches sharply outlined in dark brown or black. Its long cylindrical tail is full from rump to tip and carries its body pattern.
The marbled cat hunts by day, from trees, and seeks birds and eggs. This rare cat was reported earlier to have been sighted in the Buxa tiger reserve but in recent years has not been sighted.

(Souce: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal_3.htm)

Bengal Florican (*Houbaropsis bengalensis bengalensis*) (Schedule I Part III)

Bengal Florican also called as 'Bengal Bustard' is a very rare species of bird found in Indian sub-continent and Southeast Asia. Due to very small declining population, the Bengal florican is listed as 'Critically Endangered' in the Red List of Threatened Species by International Union for Conservation of Nature and Natural Resources (IUCN) since 2008. The decline of the species has accelerated dramatically between 2000 and 2010. Conservationists anticipate total extinction of this bird species within one to two decades unless drastic measures are taken to protect its habitat.

Bengal Florican is a medium sized ground bird ranging from 66-68 cm in length and stands around 60 cm tall. It has mostly black plumage. Bengal Florican shows distinct sexual dimorphism. The adult males have black head, neck and body with white wings which is distinctly visible while flying. However, when standing the white wings are seen as a thin patch on either side of the body. The back is mottled with buff-brown. On the other hand, the female and immature male is dull brown and molted on the back. The females are slightly larger in size than males.

Bengal floricans are extremely habitat specialized birds and are restricted to alluvial grasslands. They inhabit lowland dry or seasonally inundated natural or semi-natural grasslands.
(Source: Text and photo :http://www.sciencelog.net/2014/12/bengal-florican-endangered.html)

The Bengal Florican was considered extinct from North Bengal. In the late part of the 19th century, it was recorded from Malda and Nadia districts. Stuart Baker collected the last specimen from Nadia district in 1884. A single male bird was sighted along Raidak river of Buxa in 1955. In 1986, it was sighted at Pahabad Tea Garden near

Bagdogra and again at Kunjanagar and Harindanga of Jaldapara in 1988 and 1991 respectively.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal_3.htm)

Fishing Cat (*Prionailurus viverrinus*) (Schedule I)

Native to riverbanks from India through Southeast Asia, these cats love to fish. They have partially webbed paws, and a double layer of fur so when they go in the water they don't get wet down to the skin. They do not have full claw sheaths (similar to the cheetah) so their claws are partially visible even when retracted. Although they have a substantial range in tropical Asia (over 1 million square kilometers), its actual area of occupancy is much smaller as it is strongly associated with wetlands. Water pollution and forest clearance for settlement threaten the species through much of its range. Deforestation rates in tropical Asia's wetlands are quite high, resulting in similar decline among the fishing cat populations.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal_3.htm)
In 2008, the IUCN classified the fishing cat as Endangered.
(https://en.wikipedia.org/wiki/Fishing_cat)

Indian Elephant (*Elephas maximus indicus)* (Schedule I)

The Indian elephant is one of three recognized subspecies of the Asian elephant (*Elephas maximus)* . Since 1986, *Elephas maximus* has been listed as Endangered by IUCN. Indian elephants are native to mainland Asia: India, Nepal, Bangladesh, Bhutan, Myanmar, Thailand, Malay Peninsular, Laos, China, Cambodia, and Vietnam.
(Source: Text and photo: https://en.wikipedia.org/wiki/Indian_elephant).

This mammal has very strong social bonds and lives in family groups headed by a female (called a cow). Males (called bulls) occasionally join the group. Elephants are excellent swimmers.

Asian Elephants average about 8 feet (2.5 m) tall at the shoulder (smaller than African Elephants). Males weigh up to 6 tons (5,400 kg); females average about 4 tons (3,600 kg). Only males have tusks (large, pointed ivory teeth). They have very thick, wrinkled, gray-brown skin that is almost hairless. The ears not only hear well, but also help the elephant lose excess heat, as hot blood flows near the surface. Elephants breathe

through two nostrils at the end of their trunk, which is an extension of the nose. The trunk is also used to get water and food. To get water, the elephant sucks water into the trunk, then curls the trunk towards the mouth and squirts the water into it. The trunk has a prehensile (grasping) extension at the tip, which it uses like a finger.

Elephants eat roots, grasses, leaves, bark, bananas and sugar cane. Working bulls can eat up to 300-600 pounds (130-260 kg) of food each day. Elephants are found in Buxa, Gorumara, Mahananda, Chapramari, Jaldapara etc.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal_3.htm)

Man – elephant conflict in South West Bengal viz., Purulia, Bankura and West Midnapore, has been a major administrative issue for the West Bengal Forest Dept. The problem started in 1987 when elephant herds from Dalma Wildlife Sanctuary, situated in the State of Jharkhand started migrating to Jhargram Division in the state of West Bengal. (Source: http://www.teriuniversity.ac.in/mct/pdf/assignment/SUBHAMAY-CHANDA.pdf)

Pygmy Hog (*Sus salvanius)* (Schedule I)

The pygmy hog is a small wild pig weighing about 8.5 kg . It lives in dense, tall grassland, where it feeds on roots, tubers and other vegetable matter, as well as insects and other invertebrates. Nests are built and used by both sexes at all times of the year. The pygmy hog is apparently non-territorial. It lives in small family groups of about 4 - 5 individuals, comprised of one or more adult females and accompanying juveniles, and occasionally an adult male.

The continuing decline of the pygmy hog is due to the modification and elimination of its limited habitat by human settlement, agricultural encroachment, overgrazing by domestic livestock, commercial forestry, flood control projects etc. Pygmy hog was considered to be extinct from Jalpaiguri district but signs of its existence have been observed recently in Jaldapara and Gorumara.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal_3.htm)

Reference Material

(1) Websites cited in the Lesson

Wildlife Management

Lesson 5

Time 1 hour

To study

- **Wildlife Management**
  - **Some wild animals of West Bengal**

- **Backward Linkage** – Lesson 4

- **Forward Linkage** – To try and identify some of the animals during tour.

- **Training material required** – copy of Lesson 5 to be circulated beforehand; magnified images of the animals may be shown.

- **Allocation of time**
  Wildlife Management

  - **Some wild animals of West Bengal** **50** mts

  - **Discussion/Miscellaneous** 10 mts

1. Some wild animals of the state (continued)

Estuarine Crocodile *(Crocodylus porosus)* (Schedule I Part II)

As the name suggests these crocodiles are mainly found in Estuaries where tidal rivers meet the sea. This watery habitat is often mangrove lined. Also known as salt water crocodile, they can also be found sometimes in the open sea or inland in freshwater swamps. The world's largest reptile the "Salty" has a broad "stubby" snout with cone shaped teeth.

(Photo: https://en.wikipedia.org/wiki/Saltwater_crocodile)

Its average length is 4 meters but males 6 to 7 meters have been reported. Saltwater Crocs have rows of bony scales on their neck and back. There colouring is mainly greyish brown with brown and yellow sides. Their rear feet are webbed to aid with swimming. It is thought that they live up to 70 to 100 years. Their clear eyelids enable them to see underwater.

The feeding strategy of a salt water croc is to wait close to the water's edge and pounce upon its victim in the blink of an eye. The usual prey of younger crocs is smaller animals such as fish and crustacean crabs, insects etc. Adults can attack and eat larger animals by overpowering and then drowning them, (the teeth are designed more for holding) e.g. fish, turtles, birds, reptiles, mammals and even domestic cattle and people. After the prey is dead the croc will break the prey up into smaller pieces by violent flicking of the head to snap or break bones or twisting and rolling the body. Larger crocs will also take carrion (dead animals) if hungry.

The croc is available in the Lothian islands, Sajnekhali and the Sunderban.

(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

Gaur *(Bos gaurus)* (Schedule I)

Also known as the Indian bison and the wild ox, the gaur is a massive creature. The guar has an enormous head and thick, muscular body, with males sometimes standing over six feet tall at the shoulders. At birth, the guar has a golden yellow coat, which deepens to a brown or copper colour during adulthood. The skin of old guar turns completely black. Both male and female guar has horns, though the horns of the bulls are significantly larger than those of the cows.

A herbivore, the guar prefers grass. At times, guar will also munch on the bark of select trees. For most of the year, guar bulls stay in herds together without conflict. But around

mating season, males exhibit competitive behaviour. The gaur is seen in Neora valley, Jaldapara, Mahananda,Chapramari, Buxa, Garumara etc.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

Leopard Cat (*Prionailurus bengalensis*; syn, *Felis bengalensis*) (Schedule I)

The leopard cat is about the size of a domestic cat but more slender, with longer legs and well-defined webs between its toes. Its small head is marked with two prominent dark stripes and a short and narrow white muzzle. There are two dark stripes running from the eyes to the ears, and smaller white streaks running from the eyes to the nose. The backs of its moderately long and rounded ears are black with central white spots. Body and limbs are marked with black spots of varying size and color, and along its back are two to four rows of elongated spots. The tail is about half the size of its head-body length and is spotted with a few indistinct rings near the black tip. The background color of the spotted fur is tawny, with a white chest and belly. However, in their huge range, they vary a lot in coloration and size of spots as well as in body size and weight.

Leopard cats are the most widely distributed Asian small cats. Their range extends from the Amur region in the Russian Far East over the Korean Peninsula, China, Indochina, the Indian Subcontinent, to the West in northern Pakistan, and to the south in the Philippines and the Sunda islands of Indonesia.
Leopard cats are carnivorous, feeding on a variety of small prey including mammals, lizards, amphibians, birds and insects. In most parts of their range, small rodents such as rats and mice form the major part of their diet.
(Source: https://en.wikipedia.org/wiki/Leopard_cat)
The leopard cat is found in Neora valley and few other places. (Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

Spotted Deer (*Axis axis*) (Schedule III)

The Spotted Deer is the most commonly found member of the deer family in India. It is found across the entire country except in the extreme northern regions. They are mostly seen in large herds of 30 - 50 females with a few stags. They grow to a height of approximately 90 cm at the shoulders and can weigh up to 85 kgs. Their life expectancy ranges from 20 - 30 years. Despite being one of the favourite prey species of predators such as tigers

(Photo: https://www.flickr.com/photos/56819064@N05/9540195698)

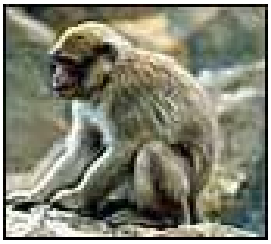
and leopards and only giving birth to a single fawn at a time, their population is quite abundant.

Their diet consists of all kinds of vegetation but grass is the favourite. They also eat the antlers that they shed for their rich nutrients.

Spotted deer are extremely nervous animals and are always on the alert for a stalking predator. They are often seen under trees housing Langurs for two reasons. Firstly, due to their higher perch, the langurs forewarn them about approaching danger and secondly, the titbits dropped by the Langurs make easy pickings for a meal.

The breeding season is not during one part of the year only. It can be in both summer and winter. However, it is mostly seen during the summers, when males can be seeing throwing their heads back and letting out loud mating calls. Although it comes nowhere close to the volume of the mating calls of the Swamp deer. Loud clashing of antlers can also be heard at night during this period.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

Assamese Macaque *(Macaca assamensis)* (Schedule II)



Assamese Macaque is one of the three non-human primate species recorded from West Bengal. The hilly tracts and foothills of North Bengal are the only resorts for this species.

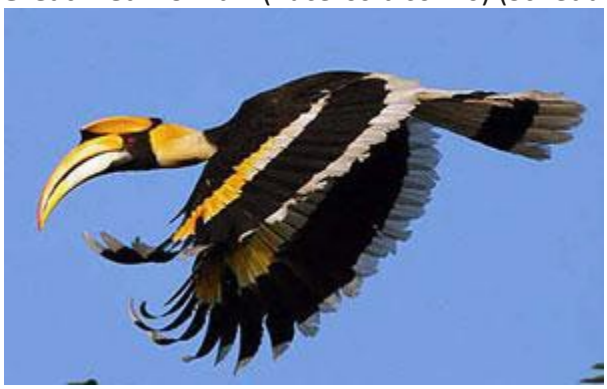
The species are dorsally yellow to dark brown in color. Their hair is brushed back with a median parting behind the eyebrows.

They are generally confined to broad leafed evergreen forests of approximately 200-2500m of elevation. Frequent raiding of crop fields and orchards have been reported in groups living near the human habitation. Major primary activities involve grooming, resting, feeding and moving from one place to another.

Survival of this species is threatened due to loss of habitat and a growing trend of man animal conflict for its proximity to human habitation.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

Since 2008, the species has been listed as Near Threatened by IUCN.
(https://en.wikipedia.org/wiki/Assam_macaque).

Great Pied Hornbill (*Buceros bicornis*) (Schedule I Part III**)**



The largest of the nine hornbill species found on the Indian subcontinent, the Great Pied hornbill has one of the widest ranges, living everywhere from sea level to heights of nearly 5,000 feet. Doing justice to its name, the Great Pied hornbill can have wingspans of nearly five feet, with tails that can measure three feet.

(Photo: http://www.wildbengal.com/urls/endangered-aves.html)

It is an incredibly beautiful bird as well, covered in black plumage, with a yellow bill that curves downward. Most distinctively, the hornbill's head is topped with an ivory formation, also known as a casque.

The Great Pied hornbill's diet consists mostly of fruit, which it collects inside its beak during feedings. Incredibly, the hornbill has reportedly been able to consume as many as 150 figs within one meal. This is invaluable for Great Pied hornbill pairs, which mate for life. A male hornbill will collect as much food as it can, swallow it, and then return to its mate, and regurgitate the meal into her mouth. It is not pretty, but it is very effective for a hornbill mother, who is unable to leave her young.

The female Great Pied hornbill's inability to leave her young is a story unto itself. She seals herself inside the hollow of a tree using her own feces (males help with the process from the outside), and stays there until her young are born.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

Python (Genus *Python*) (Schedule I part II)

The Indian python is a highly arboreal snake, once fairly common throughout the jungles of India, Sri Lanka, and the South east Asia. It can grow to a length of about 20 feet (6 m). Like the boas and anacondas of the Americas, the python is a constrictor, a snake that kills its prey by squeezing. Mammals are preferred prey, but pythons will also eat birds, other animals, even fish (pythons often live near water and are good swimmers).

(Photo:http://www.wildbengal.com/urls/endangered-reptiles.html)

Pythons drape across tree branches, camouflaged by their light and dark patterned skin, waiting to ambush their next meal. They grab their prey with a quick lashing out of the head, and then wrap themselves around the prey so it cannot breathe. A large python could squeeze the life out of a deer, and amazingly enough, the python could then swallow it whole. After such a big meal, the snake may not have to eat again for as long as a year! There are very few authenticated accounts of humans being attacked by pythons, though it certainly is possible since the largest python recorded was over 32 feet (9.8 m) long.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

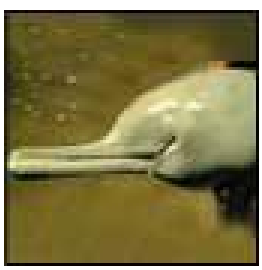
Black-necked Crane *(Grus nigricollis)* (Schedule I part III)

Black-necked cranes are the fifth rarest and the least known of all the cranes. They were the last species of crane discovered and described by ornithologists, due to the remoteness of their range.

While on their wintering areas, black-necked cranes seem quite tolerant of humans, perhaps because of local religious beliefs that protect them across much of their range.

The sighting of this rare bird in Buxa in North Bengal recently has brought a new enthusiasm in the bird lovers and the wild life department.
(Source: http://www.wildbengal.com/urls/endangered-aves.html)

Ganges River Dolphin *(Platanista gangetica)* (Schedule I)



The Ganges River dolphin has a long beak, a stocky body with a rounded belly, and large flippers. Its eye lacks a lens, and the dolphin is sometimes referred to as being blind, although its eyes do seem to function as a direction-finding device. The Ganges River dolphin weighs up to 90 kg (200 lb). It occurs only in fresh water, including slowly flowing rivers as well as relatively clear water and rapids. It eats a variety of fish and invertebrates. Reports from the 19th century speak of 'large schools' of Ganges River dolphins. However, in recent times it has not been reported to be seen.

The Ganges River dolphin is found in the Ganges, Brahmaputra, Karnaphuli and Meghna river systems, from the foot of the Himalayas downstream to the upper limits of the tidal zone, in Bangladesh, Bhutan, India and Nepal. Formerly, it was apparently quite abundant, but there is evidence that populations have severely declined more or less

throughout its range. Its habitat is severely fragmented.

The Ganges River dolphin is threatened by: accidental killing through entanglement in fishing gear; directed harvest, generally dolphin oil used as a fish attractant and for medicinal purposes; water development projects (especially water extraction and the construction of barrages, high dams, and embankments); increasing levels of chemical pollution; increasing levels of other forms of pollution, such as municipal sewage discharge and noise from vessel traffic; and overexploitation of its prey.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

Himalayan Black Bear (*Ursus thibetanus*) (Schedule II)

The Asiatic black bear's scientific name, *Ursus thibetanus*, literally means "moon bear of Tibet". This bear is also commonly called the Tibetan black bear, the Himalayan black bear, Formosan black bear, collared bear or the white-breasted bear due to its crescent-moon-shaped patch of white hair on its chest.

The Asiatic black bear favours thickly forested areas in the hill and mountains and moist tropical forests below alpine levels. During the summer period, the Asiatic black bear can be found at altitudes of 1,000 feet. Their typical territory ranges from four to eight square miles, but depends drastically upon available food sources. In other words, the less concentrated the food supply, the larger the area that the Asiatic black bear must travel to obtain the necessary food to survive.

The weight is highly variable depending on the climate conditions and food availability. Asiatic black bear are typically four to six feet tall. This wonderful animal can be seen in the Neora valley, Buxa etc.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

Woodpeckers (*Picidae)* (Schedule IV)

Woodpeckers are well-adapted for a life on tree trunks and limbs. Woodpeckers have stiff tail feathers which act as a brace for moving along vertical tree trunks. Their feet are also adapted for climbing and hanging. All woodpeckers have two toes pointing forward and either one or two toes pointing to the side or slightly backward.

(Photo: http://www.wildbengal.com/urls/endangered-aves.html)

Thus, woodpeckers are able to grip a tree trunk surface with opposable toes. Woodpeckers have evolved chisel-like bills coupled with strong neck and head muscles. These adaptations give them the ability to chip away bark and wood to uncover insects for food, as well as to create nesting cavities. The extremely long, barbed tongue (some species are able to extend their tongue two inches beyond the bill tip) enables the bird to spear insects hidden deep in small holes.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

Indian Rhinoceros (*Rhinoceros unicornis)* (Schedule I)

The biblical unicorn may have been a wild ox, but the great Indian rhinoceros is similar to a unicorn: it has a single horn, usually about 53 cm long, and it is very hard to find, being among the rarest mammals in the world today.

The Rhino's horn is not a true horn, but consists of compressed hair, and the animal prefers to defend itself with its canine teeth with which it can make horrible gashes.

They are the largest land mammals after the elephant and weigh from 1,800 to 3,600 kg. The Indian rhino has well-developed incisor teeth and two long canine teeth in its lower jaw. It is studded with knob-like tubercles and is unique in having huge folds of skin at its joints and great rolls at the neck. Together with the large, horny plates covering its body, the beast appears to be armour plated. Threatened by continued loss of habitat and poaching, conservation efforts are essential to ensure this creature's survival. The rhino is found in the beautiful forests of Jaldapara and Gorumara.
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

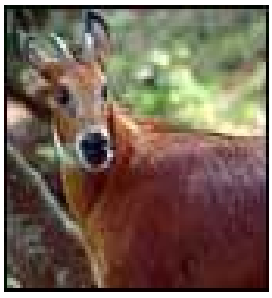
Barking deer (*Muntiacus muntjak)* (Schedule III)

This shy and elusive member of the deer family is spread across all the dense jungles of India. It has been named after its call, which bears a striking resemblance to the bark of dog. These animals grow to a height of 50 - 75 cms and weigh 20 -30 kgs. They have a life expectancy of between 20 - 30 years. They mostly live in solitude and are only very rarely seen in numbers exceeding two. Due to their low height and small stature, their main diet consists of grass and fallen fruits. They rarely venture out into open grasslands and are mostly seen feeding near the edge of dense forests. They can also be frequently seen at salt licks. They are mostly diurnal in habit.
(Picture: http://walkthewilderness.net/animals-of-india-37-barking-deer-the-deer-with-tusks/)

Their alarm call, unless endlessly repeated, is not taken seriously as an indication of the presence of a predator. They are easily startled by any movement.

A unique trait of the Barking deer is that, unlike other members of the deer family, they possess a pair of antlers as well as overgrown canines known as tushes. Both these are used as weapons in combat but the tushes are used more effectively and frequently. (Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

Serow (*Capricornis*)(Schedule I)



Goat-like, the serow stands about 3.5 feet at the shoulder with a stocky body, thick neck, large head and ears, and short limbs. Its horns are stout and conical, pointed backwards, and present in both sexes. Serow are generally colored black or reddish chestnut with white on their limbs, and they inhabit forests and wooded gorges. Usually, serows are solitary, and can be found from 6,000 feet to 10,000 feet in the mountains. The serow can be seen in the Neora valley.

The first photographic evidence of the animal in Buxa has been recently reported (Times of India 28 Feb, 2015).
(Source: http://www.westbengalforest.gov.in/urls_all/forest_wild_life_animal.htm)

King Cobra (*Ophiophagus hannah*) (Schedule II Part II)

Its size, deadliness, intelligence and ability to rear up and look a human straight in the eye have earned it a name that is more like a title: the King Cobra. The world's longest venomous snake, with a bite potent enough to kill an elephant.

It averages 3.7 m (12 ft) in length but is known to grow to 5.5 m (18 ft). It is a thin snake, olive or brown in color, with bronze eyes. It is considered to be the most intelligent of all snakes. King cobras are generally found in dense or open rainforests, as well as swamps, bamboo thickets, and even around human settlements. They are excellent swimmers, often being found near streams, and are avid tree climbers.

Their head is small and rounded, with large scales edged in black. The body is slender, and the tail is long and tapering. Coloration ranges from yellow-olive to brownish black. The snake can raise its head to a third of its length and may even move forward while upright. It has a loud, intimidating hiss resembling a dog's growl. It sometimes assumes an upright posture to see farther. The king cobra is an active hunter.

The king cobra can live up to 20 years. It lives longer in captivity than in the wild. It can deliver up to 12 oz of venom in one bite. King cobras shed their skin 4-6 times per year for adults and every month for juveniles.
(Source: http://www.wildbengal.com/urls/endangered-reptiles.html)

Reference Material:

(1) Websites and sources cited in the lesson.

Wildlife Management

Lesson 6

Time 1 hour

Lesson Plan
To study
Protection of Wildlife

- **The Wildlife Diversity of India**
  - Definition of terms
- **Threats to Wildlife**
  - Loss of Habitat
  - Disease
  - Global warming
  - Poaching
  - Inconsistent/inefficient management

- **Backward Linkage** – Lessons in Forest Protection
- **Forward Linkage** – Lesson 7

- **Training material required** – copy of Lesson 6 to be circulated beforehand;

- **Allocation of time**
  - **The Wildlife Diversity of India** 10 mts
    - Definition of terms
  - **Threats to Wildlife** 40 mts
    - Loss of Habitat
    - Disease
    - Global warming
    - Poaching
    - Inconsistent/inefficient management

  - **Discussion/Miscellaneous** 10 mts

Protection of Wildlife

1. **The wildlife diversity of india**

- India has about 8 percent of the world's biodiversity on 2 percent of the earth's surface, making it one of the 12 mega-diversity countries in the world.
- Of about 1.75 million species globally identified, around 1,26,188 species have been reported so far from India. The species recorded include flowering plants (angiosperms), mammals, fish, birds, reptiles and amphibians, constituting about 17.3 percent of the total, whereas fungi and insects make up nearly 60 percent of India's bio-wealth. This diversity can be attributed to the great variety of natural ecosystems due to the varied physical and climatic features found in India.
- India ranks tenth in the world both in respect of richness of flowering plants (17,500 spp.) and mammals (350 spp.) and fourth in Asia in plant diversity.
- The country has 10 different bio geographic zones gifted with unique and rare species of flora and fauna.
  (Source: http://www.cpreec.org/pubbook-threat.htm)

2. Definitions

(Source: http://www.cpreec.org/pubbook-threat.htm)

There are certain terms that help us understand the status of and problems faced by wildlife.

- Endemic: When a species is found only in a particular geographical region because of its isolation, soil and climatic conditions, it is said to be endemic.
- Extinct: Permanent disappearance of a species in the wild after repeated searches of known or likely areas where they may occur.
- Endangered: A species in danger of becoming extinct.
- Threatened: A species that will become endangered if its present condition in the wild deteriorates.
- Rare: A species that is not yet threatened with extinction, but is in need of close monitoring.
- Vulnerable: A species experiencing a decline in the number of its population.
- Schedule I animal: An animal specified in Schedule I of the Wildlife (Protection) Act, 1972 which is endangered or threatened or rare.
- Hotspots: Hotspots generally refer to the areas rich in general diversity, high degree of endemism and higher incidence of endangered and threatened species of flora and fauna. The Eastern Himalayas and the Western Ghats are 2 of the 18 recognized hotspots of the world.

3. **Threats to wildlife**

Today, India's biodiversity is faced with serious threats which are attributable to the following factors.

3.1 Loss of Habitat

(Source: https://www.nwf.org/Wildlife/Threats-to-Wildlife/Habitat-Loss.aspx; *http://www.cpreec.org/pubbook-threat.htm*)

Habitat loss—due to destruction and diversion, fragmentation or degradation of habitat—is the primary threat to the survival of wildlife on earth. *According to IUCN, habitat loss and degradation have affected about 89 percent of all threatened birds, 83 percent of mammals and 91 percent of all threatened plants globally. (Source: http://www.cpreec.org/pubbook-threat.htm)*

When an ecosystem undergoes dramatic changes by human activities—such as agriculture, oil and gas exploration, commercial development or water diversion—it may no longer be able to provide the food, water, cover, and places the wildlife needs to survive. Every day there are fewer places left that wildlife can call home. **There are three major kinds of habitat loss:**

3.1.1. Habitat destruction and diversion: Wildlife habitat is destroyed sometimes through natural causes like floods, heavy landslides, and advancement of deserts. But more often the causes are man-made. Illicit forest felling and encroachment of forest land take away large chunks of wildlife habitat every year. Forest fires have also occasionally destroyed wildlife habitats. Another major cause for loss of habitat is the diversion of forest land for non-forestry purpose like extended cultivation, construction of dams, mining operations, laying of roads and railways. While all these non-forestry activities are drivers of development and may be priority tasks under certain situations, when undertaken on forest lands, they cause shrinkage and destruction of natural habitats. When the natural habitat of animals is destroyed, it leads to a decline in their primary food supply and breeding and nesting grounds. Hence their numbers get drastically reduced. In the case of plants, if their natural habitat is destroyed and the species that controls the pests that attack them are lost, then their survival is at risk.

3.1.1.1 With increasing human population across the globe and the accompanying increase in demand for food, agriculture has been the main driver for loss of forests and the resulting loss in biodiversity. The increasing demand of land for agriculture has been met by clearing away the existing natural ecosystem. Further, the agricultural practices that have been followed have also accentuated the loss. With the advent of agriculture man began to grow larger quantities of selected crops. Out of thousands of edible plants on earth, we have come to depend on only a few. More than half of the plant food that we eat comes from just three grains, viz., rice, wheat and corn. Selective cultivation has paved the way for the disappearance of wild and rare species. As a result we have lost much of the faunal diversity that depended on those species.

3.1.1.2 Other ways that people are directly destroying habitat, include filling in wetlands, dredging rivers, mowing fields, and cutting down trees.

3.1.2 Habitat fragmentation: Many of the remaining terrestrial wildlife habitat in the country has been cut up into fragments by human settlements, roads, development projects and other purposes. Aquatic species' habitat has been fragmented by dams and water diversions. These fragments of habitat may not be large or connected enough to support species that need a large territory in which to find mates and food. The loss and fragmentation of habitat make it difficult for migratory species to find places to rest and feed along their migration routes. Forests in south-west Bengal represent typical examples of fragmented wildlife habitat and thus do not provide environment conducive to wildlife diversity.

3.1.3 Habitat degradation: Pollution, invasive species and disruption of ecosystem processes (such as change in the intensity of fires in an ecosystem) are some of the ways habitats can become so degraded that they no longer support native wildlife.

3.1.3.1 Large scale use of pesticides and fertilizers has polluted the land and river ecosystems. Pollution by heavy metals, persistent biocides, organic wastes, removal of sand from riverbeds and agricultural run off has spoilt many river ecosystem. The marine ecosystem is affected by hot water from nuclear and thermal power plants, toxic effluents from coastal areas, oil spills, blasting and dredging, collection of undersized fishes and other organisms, exploitation of ornamental seashells and pearl oysters by domestic shell craft industry, export of sea fans and seaweeds, etc. (Source: http://www.cpreec.org/pubbook-threat.htm)

3.1.3.2 Invasive species may turn out to be major threats to native wildlife**.**

(https://www.nwf.org/Wildlife/Threats-to-Wildlife/Invasive-Species.aspx*).*

An invasive species can be any kind of living organism—an amphibian, plant, insect, fish, fungus, bacteria, or even an organism's seeds or eggs—that is not native to an ecosystem and which causes harm. They can harm the environment, the economy or even, human health. Species that grow and reproduce quickly, and spread aggressively, with potential to cause harm, are given the label of "invasive".

The direct threats of invasive species:

- preying on native species
- out-competing native species for food or other resources
- causing or carrying disease
- preventing native species from reproducing or killing their young

3.1.3.3 **Introduction of exotic species** may be a significant threat affecting many floral and faunal species. Sometimes exotic plants are introduced and cultivated on a large scale without adequate trial and scientific assessment, in pre-introduction stage, of the consequences such exotics may have on the habitat in the long run. The scale on which *Cryptomeria japonica*

(Dhupi) and Eucaluptus had been introduced in West Bengal for economic and easy-greening reasons has now become a subject of dispute and criticism. The regeneration trend is now trying reversal of the process and going back to establishment of diverse indigenous species.

3.2 Disease

(Source: https://www.nwf.org/Wildlife/Threats-to-Wildlife/Habitat-Loss.aspx)

Disease is a normal phenomenon of the natural world. Most ecosystems include organisms such as viruses, bacteria, fungi and parasites that cause disease. Healthy wildlife and ecosystems have evolved defences to fend off most diseases before they have devastating impacts. An ecosystem with lots of variation (genetic diversity and diversity of species) is more resilient to the impacts of disease because there are greater possibilities that some species have evolved resistance, or if a species is lost, there will likely be another species to fill the niche of an extinct species.

3.2.1 Where ecosystems are not healthy, due to a loss in biodiversity and threats such as habitat loss, global warming, pollutants or invasive species, wildlife and ecosystems are more vulnerable to emerging diseases. Diseases caused by or carried by invasive species are particularly threatening, as native wildlife may have no natural immunity to them.

3.3 Global Warming

(Source: https://www.nwf.org/Wildlife/Threats-to-Wildlife/Global-Warming.aspx)

Global warming and the resulting climate change is quickly becoming the biggest threat to the long-term survival of wildlife. *The global average (land and ocean) surface temperature shows a warming of 0.85 [0.65 to 1.06] °C in the period 1880 to 2012, based on multiple independently produced datasets. Earth's average surface temperature rose by 0.74±0.18°C over the period 1906–2005*. *(Source: https://en.wikipedia.org/wiki/Global_warming)*

3.3.1 Observed Changes in Wildlife and Ecosystems

Some of the changes due to global warming that have been observed in certain parts of the world are described below.

Changes in range: Wildlife and plants that are able to adjust are shifting their ranges to higher altitudes to adjust to warming temperatures. Wildlife that already live at high altitudes or latitudes, such as the polar bears in the Arctic, may find themselves with nowhere to go.

Changes in timing of natural events: Many species take their cues about when to migrate, flower, nest or mate from seasonal changes in temperature, precipitation and daylight (phenology). Global warming is confusing those signals. The changes in the climate force wildlife to alter life cycle and seasonal events. Sometimes they might get out of synchronization with other species in their ecosystem or with other natural events. For example, some animals are laying eggs, migrating, or emerging from hibernation much earlier than they used to, only to find that the plants or the insects they need for food have not yet emerged.

Widespread forest loss: Warming and drought stress have causeed death of many trees and made them more vulnerable to pest infestations. Higher temperatures and increased fuel from dead trees are likely to lead to more wildfires.

Coral bleaching: *Coral bleaching is a stress condition in reef corals that involves a breakdown of the symbiotic relationship between corals and algae. The algae provide food for the coral and also hold the colony together. The bleaching of the coral indicates the absence of the algae and signals trouble for the reef. Without the algae, the coral will not reproduce and will eventually die. Indian Ocean corals were particularly severely impacted, with greater than 70 percent mortality reported in the Maldives, Andamans, Lakshadweep Islands, and in Seychelles Marine Park System.* (http://www.global-greenhouse-warming.com/coral-bleaching.html). Scientists believe that the biggest cause of coral bleaching is warm sea surface temperatures caused by global warming. If coral reef bleaching continues, many other marine organisms that depend on coral reefs will also be in jeopardy.

Melting of Arctic sea ice: Arctic ice is melting at a faster pace than was predicted even a few years ago. Many Arctic mammals, such as polar bears, walrus, and seals depend on sea ice for their survival.

3.3.2 Additional threats of global warning

- **Loss of wetlands**: Higher temperatures will lead to drier conditions and loss of wetlands in some regions of the planet.

- **Sea-level rise**: Sea-level rise will inundate beaches and marshes and cause erosion on both coasts, diminishing habitat for birds, invertebrates, fish, and other coastal wildlife.

- **Invasive species and disease**: Higher average temperatures and changes in rain and snow patterns will enable some invasive plant species to move into new areas. Insect pest infestations will be more severe as pests such as mountain pine beetle are able to take advantage of drought-weakened plants. Pathogens and their hosts that thrive in higher temperatures will spread to new areas.

3.4 **Poaching of animals**

Poaching of animals for their skin, fur, tusk, horns and meat for medicinal purposes is a major threat to birds, mammals, plants and reptiles. More often, superstitious beliefs are the cause for the slaughter of certain species. The meat or body parts of these animals are believed to cure particular ailments.

3.5 Inconsistent and Inefficient Management

Lack of consistency in the management policy and objective, and ineffective implementation of laws have also adverse impact on wildlife.

Reference Material:

(1) Websites and sources cited in the lesson.

Wildlife Management

Lesson 7

Time 1 hour

Lesson Plan

To study

- **Protection of Wildlife**
  - Preventive and combative measures
    - Measures against habitat destruction
    - Measures against habitat diversion
    - Measures against habitat fragmentation
    - Measures against habitat degradation
    - Measures against disease
    - Measures against global warming
    - Measures against poaching and other wildlife crimes
      - Some important Points of The Wildlife (Protection) Act
      - anti-poaching camps – informer network

- **Backward Linkage** – Lesson 6
- **Forward Linkage** – Subsequent Lessons
- **Training material required** – copy of Lesson 7 to be circulated beforehand;
- **Allocation of time**
  - Preventive and combative measures
    - Measures against habitat destruction 5 mts
    - Measures against habitat diversion 5 mts
    - Measures against habitat fragmentation 5 mts
    - Measures against habitat degradation 7 mts
    - Measures against disease 3 mts
    - Measures against global warming 5 mts
    - Measures against poaching and other wildlife crimes 20 mts

  - **Discussion/Miscellaneous** 10 mts

Protection of Wildlife

1. Protection Measures - Introduction

Wildlife protection measures essentially mean taking steps in eliminating or trying to contain the threats to wildlife. The nature and impact of various threats to wildlife have been discussed in the previous lesson. In terms of extent, some of the threats are active in global level, some are operative in regions and some could be of significance in a local habitat. Likewise, protection measures that may become necessary are likely to have relevance at various spatial levels. The various protection measures normally should flow from an understanding of the threats operative in a given wildlife habitat. It is customary to classify the threats into two broad classes, namely, preventive and combative. Protection measures following such classification are described below. However, it is worth understanding that many of the protection measures often cannot be categorised into such separate classes as preventive and combative. Some of the measures may have both the characteristics.

2. Measures against habitat destruction

2.1 **Measures against forest fire** – Forests are large repositories of wildlife diversity and should be protected against events like forest fire that often cause serious destruction of wildlife habitat.

2.1.1 Preventive measures in this regard should include

- **Regulatory provisions** in the Acts, Rules, executive orders or resolutions relating to JFMC, prescribing disincentive or enhanced punishment to those who willfully cause a fire, or do not assist in preventing or extinguishing fire.
- Provisions of **forecast of fire** to alert the forest personnel.
- **Controlled burning** and making **fire breaks** like fire lines as management practices

2.1.2 **Combative measures** may include

- Detection of forest fire
- Launching fire combat operations.

2.2 Measures against natural phenomena like floods, landslides.

Measures against such causal factors are limited to taking some **preventive measures** that may reduce the possibilities of occurrence of such phenomena and alleviate the severity of their consequences. The measures broadly consist of

- Doing land based activities like agriculture, forestry, horticulture etc. following sound principles of watershed management.
- In particular, making proper land use and undertaking appropriate soil conservation measures in the upper catchment areas of rivers.

3. Measures against habitat diversion

Preventive measures should include

- Ensuring that all proposals for diversion of forest lands for non-forestry development projects pass through stringent scrutiny under the Forest Conservation Act and rules made thereunder.
- Ensuring that areas proposed to be diverted are minimum and unavoidable
- Ensuring that areas proposed to be diverted should not, as far as possible, include any wildlife protected area

Combative measures should apply to removal of **encroachment** and restoration of habitat while observing the relevant Acts and Rules**.**

4. Measures against habitat fragmentation

Terrestrial wildlife habitats get fragmented due to human settlements and development projects. Aquatic habitats are fragmented due to dams and water diversions. Mostly, such projects are undertaken by the governments and for greater interests of human welfare. The measures in these cases are limited to

- Finding alternatives to proposed fragmentation or trying to find one where fragmentation becomes minimal.
- Ensuring that all the projects, before implementation, undergo Environmental Impact Analysis (EIA) and have, wherever possible, in-built provisions of eco-restoration to the extent possible.

5. Measures against habitat degradation

5.1 Measures against invasive species

Measures in this regard are essentially **combative and may include**

- To identify the invasive species before it has done any major damage to the native wildlife.
- To try to eliminate or contain the population
- To stop deforestation and plant up the blanks and degraded areas with desirable species.

5.2 Measures in relation to exotics

Preventive measures should include

- Not to introduce any exotic species unless it is passed and approved by thorough research and trial.
- Introduction in phases on limited scale and assessing its impact on the habitat over a long period.

When any exotic species is found harmful in a terrestrial ecosystem, the **combative measures** should include

- Trying to replace the species with indigenous ones.

5.3 Measures against pollutants

Measures against pollutants are basically **preventive**. These are

- Trying to minimize the use of chemical fertilizers and pesticides;
- Preventing, as far as possible, agricultural runoff, industrial effluents, organic waste from running into river ecosystems.
- Preventing toxic effluents from coastal areas from going into sea; regulating blasting, dredging and collection of fish and other organisms in the marine ecosystem;
- Putting in force provisions of relevant laws and rules.

6. Measures against disease

6.1 Preventive measures include

- Trying to maintain a healthy ecosystem with ample biodiversity;
- While introducing species artificially in an ecosystem like plantations in forests, ensuring that the stock of specimens being introduced are healthy and disease free. For example, in plantations, the planting material should be certified stock coming from known source.

6.2 Combative measures often are not very specific, and are difficult to implement. They consist of

- Identifying the disease from known symptoms;
- Taking remedial measures to cure the disease; applying suitable management practices to contain the spread of disease.

7. Measures against global warming

Global Warming is the increase of Earth's average surface temperature due to effect of greenhouse gases, such as carbon dioxide emissions from burning fossil fuels or from deforestation, which trap heat that would otherwise escape from Earth. (http://www.nmsea.org/Curriculum/Primer/Global_Warming/fossil_fuels_and_global_warming .htm)

Global warming and the resulting climate change will have large scale and abrupt impacts as well as long term effects on the natural ecosystems. **Mitigation of climate change** is actions to **reduce greenhouse gas (GHG) emissions**, or **enhance the capacity of carbon sinks** to absorb GHGs from the atmosphere. There is a large potential for future reductions in emissions by a combination of activities, including: energy conservation and increased energy efficiency; the use of low-carbon energy technologies, such as renewable energy, nuclear energy, and carbon capture and storage; and enhancing carbon sinks through, for example, **reforestation** and **preventing deforestation**.(https://en.wikipedia.org/wiki/Global_warming)

It is, however, obvious that any effective measure against global warming would require multi-disciplinary approach and concerted efforts on an international level.

8. Measures against poaching and other wildlife crimes

Last but not the least, this is the sphere that calls for most active efforts by the wildlife managers. The most important legislation that empowers the forest officers and the wildlife wardens to take preventive as well as combative measures in tackling wildlife crimes is the Wildlife (Protection) Act 1972. This central act has been described in lessons of "Forest Law". However, some of the salient points of the Act are highlighted below.

8.1 Some important Points of The Wildlife (Protection) Act 1972

(a) **Wildlife** includes any animal and aquatic or land vegetation which forms part of any habitat.

(b) **Wild animal** would mean any animal specified in Schedule I to IV and found wild in nature.

(c) "**Habitat**" includes land, water, or vegetation which is the natural home of any wild animal;

(d) **Hunting** would include the capturing, killing, poisoning, snaring and trapping any wild animal and includes an attempt to do so or even driving an animal for the purpose. Injuring or destroying or taking any part of the body of such animal or bird or reptiles or even damaging their eggs or disturbing their nests would also mean hunting..

(e) **Trophy** would include the whole or part of any captive animal or wild animal, other than vermin, preserved by natural or artificial means, and includes (i) rugs, skins and specimens of

such animals mounted in whole or part by taxidermy, and (ii) antler, bone, carapace, shell, horn, rhinoceros horn, hair, feather, nail, tooth, musk, eggs, nests and honeycomb.

(f) **Specified plant** refers to the plants specified under Schedule VI.

Hunting:

The Act **prohibits** the hunting of any wild animal under Schedule I, II, III,and IV. There are, however, certain **exceptions** specified in the Act (Please see Lesson 5 of Forest Law) where the **Chief Wildlife Warden may permit** the hunting of such animals. On payment of prescribed fees Chief Wildlife Warden may grant a permit to hunt any wild animal for the purpose of education, scientific research, management, collection of specimens etc. subject to conditions specified in the Act.

Sanctuary

The Act empowers the State Government to declare as **Sanctuary** (i) any area comprised **within any reserve forest or any part of the territorial waters or (ii) area other than area comprised with any reserve forest or the territorial waters,** if the Government considers such area as worthy of constituting sanctuary. (Please see Lesson 5 of Forest Law).

- Entry in sanctuary is **restricted.**
- Teasing of wild animal and littering the grounds of sanctuary are **prohibited**.
- Except under and in accordance with a permit granted by the Chief Wild Life warden, following are **prohibited**.
    - destruction, exploitation, removal of any Wildlife including forest produce;
    - destruction, damaging or diverting the habitat of any wild animal;
    - diverting, stopping or enhancing the flow of water into or outside the sanctuary
- Causing fire in sanctuary is **prohibited.**
- Entry in sanctuary with weapon is prohibited except with prior permission of the Chief Wildlife Warden.
- Use of injurious substance like chemicals, explosives etc. in a sanctuary is **banned.**
- Any officer **not below the rank of an Assistant Conservator of Forests** is empowered to remove **encroachment.**

National Park

The Act **empowers the State Government** to decalre an area, whether within a sanctuary or not, as a National Park.

Broadly speaking, all restrictions and regulations that are applicable to a sanctuary apply, as far as may be, to a National Park.

In addition, following are **prohibited**

(a) destruction, exploitation, or removal of any wildlife from a National Park;

(b) destruction or damaging the habitat of any wild animal or depriving any wild animal of its habitat within such National Park;

except under and in accordance with a permit granted by the Chief Wild Life Warden.

(c) grazing of livestock

Trade or Commerce in Wild Animals, Animal Articles and Trophies

(Please see Lesson 7 of Forest Law)

- The Act provides that wild animal, animal article, trophy, meat of wild animal, ivory (imported) and all tools, vehicles etc used in committing offence and seized are **government property**.
- The Act puts a ban on **possession, transfer and destruction** of such government property.
- The Act puts **a ban** on **dealings** in trophies, animal articles etc. derived from **scheduled animals.**

Powers of Forest Officer

(Please see Lesson 8 of Forest Law)

- Officers of the rank of Deputy Ranger/ Forester, Forest Guard and Wildlife Guard are also authorized to exercise power with regard to **entry, search, arrest and detention.**
- **Officers** exercising powers under this Act are **Public Servants**.
- No suit, prosecution, or other legal proceeding shall lie against any officer for anything, which is done in good faith.

8.1 Miscellaneous measures

Depending on requirements in actual circumstances the local wildlife managers may take a number of miscellaneous measures. The measures may be preventive as well as combative in nature. A couple of common measures are mentioned below.

- **Anti-poaching camps** – Such camps may be set up in Protected Areas. The purpose will be to strengthen protection force in monitoring and combating poaching activities. Forest personnel manning the camps will undertake intensive patrol in the areas. As and when they come across any unusual or disruptive signs , they will report to the higher authorities, investigate the matter, and as necessary, take actions as authorized under the law. They will also remain in close touch with the people residing in the villages close by, and the members of the Eco-development Committees. Depending on the strength of the forest personnel available, a number of such camps in each Protected Area. If necessary, and considered preferable , the camps may be mobile and move from place to place as per plan approved by a senior officer.

- **Informer –network** – It is an important tool in tackling any crime. Because, intelligence or prior information of an impending crime or of miscreants gives the advantage to the wildlife managers to plan and executive actions more efficiently, and at lesser cost and time. However, the operation of informer-network should be run observing some basic norms.

    - Anonymity – the identity of the informer or 'source' should remain undisclosed.

    - One-to-one relation – there should be one-to-one relation between the 'officer' and the 'sources' run by him. The 'officer' only should know the identity of the 'sources', but should not disclose the identity of one 'source' to another. The 'sources' should pass on intelligence only to the 'officer' and none else. While each 'source' should know the 'officer' he should inform, he should not know if any other 'source' is also passing on intelligence to the 'officer'.

    - Incentive- There should be preferably a system of incentive to be paid to the informers.

    - Secrecy - The network should be run in strict secrecy so as to remain effective.

Reference Material:

(1) Websites and sources cited in the lesson.
(2) http://www.environmentalpollution.in/essay/essay-on-wildlife-conservation-671-words/158
(3) (http://www.preservearticles.com/201101213602/2080-words-essay-on-wildlife-protection-in-india.html)
(4) Lessons on Forest Law

Wildlife Management

Lesson 8

Time 1 hour

Lesson Plan

To study

- **Wildlife Conservation**
  - Protected Areas (PA) of the State
    - National Parks

- **Backward Linkage** – Lesson 7
- **Forward Linkage** – Lesson 9
- **Training material required** – copy of Lesson 8 to be circulated beforehand;
- **Allocation of time**
  - National Parks 50 mts

  - **Discussion/Miscellaneous** 10 mts

Wildlife Conservation

1. National Parks

The state of West Bengal has **6 National Parks**. Brief information about the Parks is given below.

1.1 Singalila NP

(Source: http://www.wildbengal.com/urls/protected-areas-np-singalila.html)

Location: Singalila National Park is located on the Singalila Ridge at an altitude of more than 7000 feet above mean sea level, in the Darjeeling district of West Bengal. It is well known for the **trekking route to Sandakphu** that runs through it.

History: The park was declared a Wildlife Sanctuary in 1986, and was made an Indian National Park in 1992.

Geography: Situated in the district of Darjeeling, it is bordered on the north by the state of Sikkim and on the west by the country of Nepal. The park is part of the Eastern Himalayas. The two highest peaks of West Bengal, Sandakphu (3630 m) and Phalut (3600 m) are located on the ridge and inside the park. River Rammam and River Sirikhola flow through the park.

Flora

Thick forest of bamboo, oak, magnolia and rhododendron (between 2000 and 3600 m) cover the Singalila Ridge. There are two seasons of wildflower bloom - one in spring (March - April) when the Rhododendrons bloom, and another in the post monsoon season (around October), when the lower forests bloom (Primula, Geranium, Saxifraga , Bistort, Senecio, Cotoneaster and numerous orchids).

Fauna

Mammals: The park has a number of small mammals including the **Red Panda**, **Leopard Cat**, **Barking Deer**, **Yellow-throated Marten**, **Wild Boar**, **Pangolin** and the **Pika.** Larger mammals include the **Himalayan Black Bear**, **Leopard**, **Clouded Leopard**, **Serow** and the **Takin**. Tigers occasionally wander into the area, but do not have a large enough prey base to make residence in these forests.

Birds: The park is a birder's delight with over **120 species** recorded including **many rare and exotic species** like the Scarlet Minivet, Kalij Pheasant, Blood Pheasant, Satyr Tragopan, Brown and Fulvous Parrotbills, Rufous-vented Tit, and Old World babblers like the Fire-tailed Myzornis and the Golden-breasted Fulvetta.

Reptiles and Amphibians: The endangered **Himalayan Newt** frequents the region, and congregates around the lakes of Jore Pokhri, Sukhia Pokhri and nearby lakes to reproduce.

1.2 Neora Valley NP

(Source: http://www.wildbengal.com/urls/protected-areas-np-neora-vally.html)

Location: Neora Valley National Park is situated in the Kalimpong subdivision under Darjeeling District, West Bengal. Established in 1986 over an area of 88 km², the present area of the Park is 159.8917 km². The park reaches up to an elevation of 10600 ft at Rechela Danda , the highest point of Neora Valley National park,

Flora

Neora Valley sustains a unique eco-system where tropical, sub-tropical, sub-temperate, and temperate vegetative types harbour a wealth of flora and fauna. The forests consist of mixed species like rhododendron , bamboo, oak, ferns, sal etc. The Valley also has numerous species of orchids.

Fauna

Mammals

The fauna consist of such **endangered species** as the clouded leopard , red panda , and musk deer . Other species are leopard , five species of civet , black bear , sloth bear , golden cat , wild boar , leopard cat , goral , serow , barking deer , sambar , Himalayan flying squirrel and thar.

Birds

The semi-evergreen forests between 1600mts and 2700mts is the home of several rarities like Rufous-throated Partridge, Satyr Tragopan, Crimson-breasted Woodpecker, Darjeeling Woodpecker, Bay Woodpecker, Golden-throated Barbet, Hodgson's Hawk Cuckoo, Lesser Cuckoo, Brown Wood Owl, Ashy Wood Pigeon, Mountain Imperial Pigeon, Jerdon's Baza, Black Eagle, Mountain Hawk Eagle, Dark-throated Thrush, Rufous-gorgeted Flycatcher, White-gorgeted Flycatcher, White-browed Bush Robin, White-tailed Robin, Yellow-browed Tit, Striated Bulbul, Chestnut-headed Tesia, Chestnut-crowned Warbler, Black-faced Warbler, Black-faced Laughingthrush, Chestnut-crowned Laughingthrush, Streak-breasted Scimitar Babbler, Scaly-breasted Wren Babbler, Pygmy Wren Babbler, Rufous-fronted Babbler, Black-headed Shrike Babbler, White-browed Shrike Babbler, Rusty-fronted Barwing, Rufous-winged Fulvetta, Brown Parrotbill, Fire-breasted Flowerpecker, Fire-tailed Sunbird, Maroon-backed Accentor, Dark-breasted Rosefinch, Red-headed Bullfinch, Gold-naped Finch and many others.

1.3 Gorumara NP

(Source: http://www.wildbengal.com/urls/protected-areas-np-gorumara.html)

Located in the Terai region of the Himalayan foothills in the district of Jalpaiguri, it is a medium-sized park with grasslands and forests. The Park is primarily known for its population of Indian Rhinoceros. A reserve forest since 1895, the park was declared a Wildlife Sanctuary in 1949 on

account of its breeding population of Indian Rhinoceros. It was declared a National Park on January 31, 1994 . Its original area was only 7 km²; Gorumara has grown to about 80 km² by incorporating neighbouring lands.

Geography:

Gorumara is located in the Eastern Himalayas' submontane Terai belt. This region has rolling forests and riverine grasslands, and is known as the Dooars in West Bengal . The park is located on the flood plains of the Murti River and Raidak River . The major river of the park is the Jaldhaka river of the Brahmaputra river system. In this regard, Gorumara is a significant watershed area between the Ganges and Brahmaputra river systems.

Flora:

Typical flora include:

Sal forests with Teak , Shirish or *Albizia lebbeck*, and Silk Cotton (Shimul or *Bombax ceiba*) trees, Bamboo groves, Terai grassland vegetation and tropical riverine reeds. Gorumara is home to numerous tropical orchids.

Fauna:

The park has recorded fifty species of mammals , 193 species of birds , 22 species of reptiles , 7 species of turtles , 27 species of fishes and other macro and micro fauna.

Mammals: The Park is rich in large herbivores including Indian Rhinoceros, Gaur, Asian Elephant, Sloth bear, Chital, and Sambar Deer. Small herbivores include Barking deer, Hog deer and Wild boar . There is a comparative lack of large carnivores, with the only big cat being the Leopard. Tigers are, however, occasionally spotted here. It does have numerous small carnivores including various civets, mongooses and small cats. The park has a large resident population of Wild boar, and the critically endangered Pygmy Hog has been reported from the park. It also has numerous rodents, including Giant Squirrels. The **rare Hispid Hare** has also been reported from the park.

Birds: Gorumara National Park is famous for its bird population - which includes brilliant submontane forest birds like the Scarlet Minivet, Sunbird, Asian Paradise Flycatcher, Spangled Drongo and Great Indian Hornbill. Numerous woodpeckers and pheasants inhabit the park. Peafowls are very common.

Reptiles and amphibians: The park is home to a large number of snakes, venomous and non-venomous, including the Indian Python and the King Cobra.

1.4 Buxa NP

Location: Buxa Tiger Reserve (BTR) lies in Alipurduar sub-division of Jalpaiguri district of West Bengal. Its northern boundary runs along the international border with Bhutan. The Sinchula hill range lies all along the northern side of BTR and the Eastern boundary touches that of the Assam State. National Highway No.31 C roughly runs along its southern boundary. The reserve

encompasses as many as eight forest types.

History: Buxa Tiger Reserve created in 1983 comprises entire forest area of erstwhile Buxa Division and some territory of neighboring Cooch Behar Forest Division. In 1986, **Buxa Wildlife Sanctuary** was constituted over 314.52 km² of the Reserve forests. In the year 1991, 54.47 km² area was added to Buxa Wildlife Sanctuary. A year later, in 1992, Government of West Bengal declared its intentions to constitute a National Park over 117.10 km² of the Buxa Wildlife Sanctuary. State Government finally declared it a National Park in 1997.

Flora:

More than 300 species of trees, 250 species of shrubs, 400 species of herbs, 9 species of cane, 10 species of bamboo, 150 species of orchids, 100 species of grass and 130 species of aquatic flora including more than 70 sedges (Cyperaceae) have been identified so far. There are more than 160 species of other monocotyledons and ferns. Main tree species are Sal, Champ, Gamar, Simul, Chikrasi etc.

Fauna:

In the Reserve 390 species of birds, 73 species of mammals, 76 species of snakes, 5 species of amphibians have been identified so far. In a recent survey (2006) it has been found that Buxa Tiger Reserve has the highest number of fish species in the North Bengal region. Apart from tigers, animals like Elephants, dhole (wild dog), bears, civets, giant squirrel, Gaur, Chital, clouded leopard, wild Buffaloes, antelope and snakes including the regal Python are found here. About 230 species of birds and innumerable butterflies add colour to the forest. The rivers of Raidak and Jayanti which flow through the forest and the Narathali lake are home to migratory birds as well as endemic ones which abound the place. The Hornbills including Greater Pied Hornbill, Ibis Bill, Trans Himalayan Migratory Goosanders, Red-stars, Wag-tails, the rare black necked crane, migratory common teal, black stork, Large Whistling Teal, Minivets, White Eyed Poachard are some of the bird species sighted here.

1.5 Sundarban NP

(Source: http://www.wildbengal.com/urls/protected-areas-np-sundarban.html; Annual Report 2013-14, Directorate of Forests, WB)

Sunderban Tiger Reserve is one amongst the initial nine Tiger Reserves constituted at the time of inception of the Project Tiger scheme in the year 1973. Apart from a small area in 24 Parganas (North) it is largely situated within 24 Parganas (South) district of W. Bengal lying at the southern end of the State. It is a part of the famous "Sunderbans" - the largest delta in the world formed by the convergence of two mighty Himalayan rivers the Ganga and the Brahmaputra both of which flow into the Bay of Bengal. This delta consists of 10,200 sq km of mangrove forests spread over India (4,200 sq km) and Bangladesh (6,000sq km).

The Sundarban Tiger Reserve (STR) is spread over 2584.89 sq. km. The entire area is a conglomeration of river channels, creeks and islands which total about 102 in number. Of these 54 islands are inhabited and the rest 48 islands are forested. The STR is divided into the Core and the Buffer zone. The Core zone (1699.62 sq.km) includes the **Sundarban National Park** having an area of 1330.10 sq km. Considering the ecological importance of this area it has been designated by the UNESCO as a **natural World Heritage Site** in 1987. Area outside the core zone is designated as the buffer zone (885.27 sq.km) and includes the Sajnekhali Wildlife Sanctuary with an area of 362.40 sq. km. Recently the core areas have been notified as the **Critical Tiger Habitat** having an inviolate area of 1699.62 sq. km. It is also among the three Global Biosphere Reserves in the country.

Fauna:

This unique mangrove ecosystem with its numerous ecological niches is home to over 1586 faunal species of which 15 mammalian species, 8 sp. of birds, 17 species of reptiles, are included in Schedule I and II (rare & endangered) of the Wildlife (Protection) Act,1972. Fourteen (14) sp. have been listed in Appendix I of CITES.

Major faunal species :

Mammals :

Tiger:(*Panthera tigris*) - It is the topmost land based predator in the mangrove ecosystem. Tigers in Sunderbans have adapted to the saline water and like most other animals are excellent swimmers. They have a variable diet ranging from fish, crabs and smaller animals to wild boar and cheetal. Sunderbans is the only mangrove ecosystem in the entire world (apart from Bangladesh) to harbour tigers. Tigers here live in extremely stressed conditions and consider anything moving within the jungle including man as prey. Because of this habit they have been termed as man eaters.

Other mammals of interest found here are **dolphins** [both the Gangetic (*Platanista gangetica*) and Irrawady (*Oracella brevirostris*)], **cheetal**, **rhesus macaque**, **wild boar, fishing cats, leopard cats, small Indian civet, common otter**, **black finless porpoise**, etc.

Reptiles :

Estuarine crocodile (*Crocodylus porosus*): This endangered species is present in good numbers in the numerous rivers and waterways. They are often seen basking on the mudflats especially during the winter season.

Other reptiles present:

- **Snakes** are in abundance. Out of the 97 spp. available in W. Bengal 53 spp. have been reported from here. Important ones are King cobra, common cobra, Russel's viper, Common Krait, Indian Python, rat snake, chequered keelback, green whip snake etc.

- **Fresh water turtles** like Indian soft-shelled turtle, spotted pond turtle, flapshell turtle etc.
- **The sea turtles** including olive ridley, green sea and hawksbill turtle.
- **River terrapin** (*Batugar baska*) is another endangered spp. found in the area which is endemic to this region.
- **Water monitor lizard** is also found in good numbers here.

Avifauna:

Sunderbans is extremely rich in avifauna. Recent surveys have revealed the presence of over 210 sp. of birds. These include a large number of migrants from higher latitudes which visit the area especially in the winter months. A large number of **waders** are found in the numerous mud flats and sand banks in and around the area. **Main species** seen are sandpipers, spoonbills, whimberels, stilts, thick knees, curlew, green shanks, etc. The **raptors** (birds of prey) include White bellied sea eagle, Osprey, Brahminy kite, Shikra, Crested serpent eagle, and occasionally oriental honey buzzard, short toed eagle etc. The **Goliath heron** is extremely rare and is seen occasionally. **Other herons** found here are the pond herons, grey heron, purple heron and night heron. Other species of birds found here are cormorants, green pigeon, seagulls, egrets, sunbirds, cuckoos, and a variety of ducks, geese and storks especially the Lesser Adjutant stork. The area is also called as a "Kingfishers' Paradise" due to presence of 10 sp out of the total 12 sp. of kingfishers found in the country.

Fishes and crustaceans:

The creeks and rivers of Sunderbans are extremely rich in fish, crabs and molluscs. The amphibious mud skipper fish such as Peripthalmus, and Boleopthalmus are frequently seen moving around near jetties and mud banks. **Endangered species** of **Shark and Rays** like Ganges shark (*Glyphis gangeticus*) , white spotted shovel nosed guitar fish (*Rhynchobatus djiddensis*), Pondicherry shark etc are found here. Other species found are Indian dog shark, Bull shark, hammer headed shark , black tip shark , pale edged sting ray, black edged sting ray etc. **Other fishes** include hilsa, bhetki, pomphret, parshey, gurjali, topshey. Among the **crustaceans** seen are many species of **prawns** including the tiger prawns which are an important source of revenue as they have a good export market. Fiddler crabs (*Uca* sp.), ghost crabs and two extremely primitive species of trilobites commonly known as Horse shoe crabs ie (*Tachepleursgygus* and *Carcinoscropius rotundicauda*) which are highly endangered species and regarded as living fossils are also found here.

Flora:

The estuarine ecosystem of Sunderbans is dominated by the mangrove vegetation. These plants growing in loose muddy alluvial soils which are inundated twice daily have developed

specialized adaptations to cope with such conditions. They have developed specialized roots like stilt roots for support, breathing roots called as pneumatophores bearing lenticels for gaseous exchange, and also exhibit phenomenon of in situ germination within the fruits known as vivipary. Succulent leaves are seen due to high salt content in the soil. These highly productive mangrove ecosystems act as breeding grounds and nursery for a large number of fin and shell fishes. Eighty four (84) species of mangroves and their associates have been recorded. Among the **major species** found here are *Rhizophora* sp, *Bruguiera* sp, *Ceriops* sp, *Avicennia* sp., *Xylocarpus* sp, *Nypa sp*, *Phoenix* sp, *Excoecaria* sp, *Aegiceras* sp, *Acanthus* sp, and *Porterasia* sp. **Sundari** (*Heritiera fomes*) has over a period of time declined in the Indian Sunderbans probably due to the reduced supply of sweet water. It has now become restricted to the eastern part of Indian Sunderbans. Another **endangered species** is Golpata or *Nypa fruticans* which now has very limited distribution. The mangrove forests act as fish nurseries and also act as a natural barrier against tidal surges, gales and cyclones originating in the Bay of Bengal.

1.6 **Jaldapara NP**

Located in the district of Jalpaiguri the Park is spread over an area of 216 km². The altitude is 61 meters.

Flora and Fauna:

The forest is mainly **savannah** covered with tall **elephant grasses**. The main attraction of the National Park is Asiatic one-horned rhinoceros. The national park holds the maximum number of rhino population in India after Kajiranga National Park in Assam. The other animals consist of Bengal Tiger, elephant, deer, sambhar, barking deer, spotted deer and hog deer, wild pig and gaur. Jaldapara is a paradise for bird watchers. It is one of the very few places in India, where the **Bengal Florican** is sighted. The **other birds** to be found here are the Crested Eagle, Pallas's Fishing Eagle and Shikra, Jungle fowl, peafowl, patridges, and lesser Pied Hornbill. Besides, Python, monitor lizards, krates, cobras, geckos and about 8 species of fresh water turtles have also been found here.

Reference Material:

(1) http://www.wildbengal.com/urls/protected-areas-np-sundarban.html

(2) Annual Report 2013-14, Directorate of Forests, Govt of West Bengal

Wildlife Management

Lesson 9

Time 1 hour

Lesson Plan

To study

- **Wildlife Conservation**
  - Protected Areas (PA) of the State
    - Sanctuaries

- **Backward Linkage** – Lesson 8
- **Forward Linkage** – Subsequent Lessons
- **Training material required** – copy of Lesson 9 to be circulated beforehand;
- **Allocation of time**
  - Sanctuaries 50 mts

  - **Discussion/Miscellaneous** 10 mts

Wildlife Conservation

1. Sanctuaries

The state of West Bengal has 15 S**anctuaries**. Brief information about some of the S**anctuaries** is given below.

1.1 Senchal WLS

(Source: http://www.wildbengal.com/urls/protected-areas-wls-senchal.html)

Nestled in the Darjeeling hills, Senchal Game Sanctuary, established in 1915, is the oldest of such sanctuaries in the country. The area was declared a Wildlife Sanctuary in 1976. At present the total area of the sanctuary is 38.88 sq.km. It is situated at 1,500 m to 2,600m elevation. This sanctuary forms the main water supply source for Darjeelingtown.

Forests:
The sanctuary is a compact block of both natural and man-made forests, the latter comprising more than 60% of the total area. Between 2,000m to 2,400m, **oaks** occupy the top canopy. Other important species are Kapasi, Katus, Kawla, Champ, etc. Above 2,400m, Ghoge Champ and Rhododendrons are found. Sub-tropical flora is found 'between 1,500m to 2,000m with *Castanopsis indica*, *Meliosma wallichii*, *Machilus edulis*, Pipli, *Alnus nepalensis*, *Prunus nepalensis* predominating. Malling bamboo and numerous varieties of ferns etc. comprise the undergrowth.

Fauna:
Barking deer and wild pigs are distributed all over the sanctuary. Goral and serow occupy the undisturbed valleys and steep ridges, while the Himalayan Black Bear comes down from higher elevations elsewhere and stay during the period from autumn to winter. Leopard, jungle cat and leopard cat are found in lower elevations. Common Rhesus, Assamese Macaque, Indian civet, Himalayan Flying Squirrel, Scaly Ant-eater, Himalayan Jackal and Wild Dog are also found here. The area is rich in bird life. Large yellow naped wood-pecker, Tickel's Golden back Wood pecker, Emerald Cuckoos, Black-backed Kalij Pheasant, Red Jungle Fowl, Hornbills, Imperial Pigeons, Green, Pigeons, Thrushes, Babblers, Sunbirds etc. are found.

1.2 Mahananda WLS

(Source: http://www.wildbengal.com/urls/protected-areas-wls-mahananda.html)

Situated in the Darjeeling district the sanctuary sprawls over 158.04 km² of reserve forest. It was started as a game sanctuary in 1955.

Forest and Animal Species:
The forest type in Mahananda WLS varies from riverine forests of Khayer-Sisoo to dense mixed-wet forest in the higher elevation in 'Latpanchar' area of Kurseong hills. The variation in altitude

and forest types helps the existence of a large number of species of mammals, birds and reptiles. The important **mammalian species** include Bengal Tiger, Indian elephants, Indian bison, spotted deer, barking deer, many species of lesser cat, Himalayan black bear, leopard including clouded leopard and many other smaller animals like rare mountain goat (Serow), porcupines, snakes, etc. The Sanctuary also holds hundreds of **feathered species**. The exciting list includes some very **endangered species** like fairy blue bird, Himalayan pied hornbill,etc. Among the others, swallow, swift, thrush, babbler, warbler, roller, minivet, sunbird can be found in abundance.

1.3 Chapramari WLS

(Source: http://www.wildbengal.com/urls/protected-areas-wls-chapramari.html)

The Wildlife Sanctuary is located in the Nagrakata Block of Jalpaiguri District, just at the foothills of Kalimpong Sub-division and on the banks of Murti River. This area was first notified as a game sanctuary in the year 1940-41 and re-notified in 1976. It covers a small area of 9.60 sq.km.

Fauna:

A huge variety of flora and fauna covers the forests. Chapramari is famous for its **elephant** population. **Gaur** (commonly known as Indian Bison) is quite common around this region. Different other varieties of deer, reptiles and other animals can be easily seen around here. The place is a heaven for bird watchers.

1.4 Sajnekhali WLS

(Source: http://www.wildbengal.com/urls/protected-areas-wls-sajnekhali.html)

Sajnekhali Wildlife Sanctuary, situated at the confluence of Matla and Gumdi rivers, covers an area of 362.40 sq.km. Notified in 1976 the sanctuary is a part of the buffer area of Sunderban Tiger Reserve.

Fauna:

The sanctuary has a rich and varied avian population. The most noteworthy among the feathered flock are spotted billed pelican, cotton teal, herring gull, Caspian tern, grey heron, large egret, night heron, open-billed stork, white ibis, common kingfisher, brahminy kite and paradise flycatcher. The area is also important for **waders**, including the Asian dowitcher, a rare winter migrant.

The trained eye will be able to spot several **birds of prey** like the osprey, Pallas's fish eagle white-bellied sea eagle, grey-headed fishing eagle, peregrine falcon, Oriental hobby, northern

eagle owl and brown fish owl. Spectacular sight of colorful Kingfisher, Plovers, White Bellied Sea Eagle, Sandpipers, Whimbrels, Lapwings and Curfews can be seen here.

1.5 Haliday WLS

(Source: http://www.wildbengal.com/urls/protected-areas-wls-haliday.html)

Haliday Island Wildlife Sanctuary, covering an area of 5.95 sq.km is located within the famous Sunderbans in South 24 Parganas District in West Bengal. It was notified as WLS in the year 1976.

Forest and animals:
Usuallly mangrove species flourish with some sweet water species like Casuarina, Karanja, etc. which are planted on high lands. Principal animals are chital, wild pigs, Rhesus monkey and barking deer. Matla river surrounding the Sanctuary has plenty of fishes.

1.6 Lothian WLS

(Source: http://www.wildbengal.com/urls/protected-areas-wls-lothian.html)

Lothian island having an area of 38 sq.km was notified as Sanctuary in 1976. It is a part of deltaic Sunderbans which harbour a tropical estuarine swamp forest.
Forest:

The tropical estuarine swamp forest consists of mangrove vegetation. Principal tree species are Keora, Baen, Goran etc. The vegetation provides a dense cover throughout the habitat. Along the edge of the rivers there are grassy patches.
Fauna:
The animals found are Chital, Wild Pigs and Rhesus monkey. Jungle Cats are sighted occasionally. Birds are numerous including the migrants that visit the Sanctuary in winter. The marshes of the island harbour estuarine Crocodile.

1.7 Raigunj WLS

(Source: http://www.wildbengal.com/urls/protected-areas-wls-raigunj.html)

Raiganj Wildlife Sanctuary Also known as Kulik Bird Sanctuary, is situated near Raiganj in Uttar Dinajpur district of West Bengal. The area of the sanctuary is around 1.30 km². The core area is about 0.14 km² and the rest is buffer area. The Kulik river flows around part of the sanctuary and acts as the boundary in its eastern and southern parts. The shape of the sanctuary is that of the English alphabet "U". The sanctuary has a network of artificial canals connected with the river Kulik.

Fauna:

During monsoon the river water enters the sanctuary, which supports a wide variety of food for the birds, particularly for the Asian openbill, whose main diet is apple snail. The bird sanctuary is home to 164 species of birds, and some 70,000 to 80,000 migratory birds visit the sanctuary every year. They start arriving from June. The migratory species includes open-bill storks, egrets, night herons and cormorants. The resident birds are kites, flycatchers, owls, kingfishers, woodpeckers, drongoes, etc.

Global population of the Asian openbill is estimated to be 130,000 by Wetland International, and around half of them live in Asia. The species is known to breed in a colony, called heronry, but there are very few heronries in India, particularly those that are well protected. Ornithologically, Raiganj Wildlife Sanctuary is a **very important heronry**. As per the breeding population data of Asian openbills, the sanctuary regularly supports 32 - 40 percent of the existing population of Asian openbills of South Asia.

1.8 Chintamoni Kar WLS

(Source: http://www.wildbengal.com/urls/protected-areas-wls-chintamoni-kar.html)

The Chintamain Kar Bird Sanctuary lies in South 24-Parganas district of West Bengal, just a little away from the bustling Kolkata metropolis. The area was notified as Narendrapur Wildlife Sanctuary in 2004 and later renamed as Chintamani Kar Bird Sanctuary in 2005. The area of the sanctuary is 0.07 sq.km.

Flora and Fauna:

Chintamoni Kar Bird Sanctuary is an orchard covered with local fruit trees - many over a hundred years old. Main trees are mango, Jackfruit, Coconut, Tamarind, Guava, Dumur, Safeda, Chatim etc.

The Sanctuary is a home to a great variety of birds, butterflies, epiphytes, ferns and orchids. Reptiles and mammals also seek security provided by the Sanctuary in the midst of urban chaos. In addition, sanctuary is also the home of some small wildlife namely jungle cat, Civet, Water monitor Lizard, Jackal and the mongoose.

Over 150 species of birds have been recorded at the Sanctuary. The commonly seen species are as under:

Common name	Scientific name	Common name	Scientific name
Fulvous-breasted Woodpecker	Dendrocopos macei	House Crow	Corvus splendens
Rufous Woodpecker	Celeus brachyurus	Large-billed Crow	Corvus macrorhynchos

Streak-throated Woodpecker	Picus xanthopygaeus	Ashy Woodswallow	Artamus fuscus
Black-rumped Flameback	Dinopium benghalense	Eurasian Golden Oriole	Oriolus oriolus
Greater Flameback	Chrysocolaptes lucidus	White-hooded Oriole	Oriolus xanthornus
Lineated Barbet	Megalaima lineata	White-throated Fantail	Rhipidura albicollis
Blue-throated barbet	Megalaima asiatica	Black Drongo	Dicrurus macrocercus
Coppersmith Barbet	Megalaima haemacephala	Ashy Drongo	Dicrurus leucophaeus
Common Hoopoe	Upupa epops	Bronzed Drongo	Dicrurus aeneus
Common Kingfisher	Alcedo atthis	Black-naped Monarch	Hypothymis azurea
Stork-billed Kingfisher	Halcyon capensis	Asian Paradise-flycatcher	Terpsiphone paradisi
White-throated Kingfisher	Halcyon smyrnensis	Common Iora	Aegithina tiphia
Green Bee-eater	Merops orientalis	Orange-headed Thrush	Zoothera citrina
Common Hawk Cuckoo	Hierococcyx varius	Red-throated Flycatcher	Ficedula parva
Asian Koel	Eudynamys scolopaceo	Oriental Magpie Robin	Copsychus saularis
Greater Coucal	Centropus sinensis	Chestnut-tailed Starling	Sturnus malabaricus
Rose-ringed Parakeet	Psittacula krameri	Asian Pied Starling	Sturnus contra
Asian palm Swift	Cypsiurus balasiensis	Common Myna	Acridotheres tristis
Brown Fish Owl	Ketupa zeylonensis	Jungle Myna	Acridotheres fuscus
Spotted Owlet	Athene brama	Great Tit	Parus major
Large-tailed Nightjar	Caprimulgus macrurus	Red-whiskered Bulbul	Pycnonotus jocosus
Rock Pigeon	Columba livia	Red-vented Bulbul	Pycnonotuscafer
Spotted Dove	Streptopelia chinesis	Plain Prinia	Prinia inornata
Emerald Dove	Chalcophaps indica	Oriental White-eye	Zosterops palpebrosus
White-breasted Whitehen	Amaurornis phoenicurus	Blyth 's Reed Warbler	Acrocephalus dumetorum
Black Kite	Milvus migrans	Common Tailorbird	Orthotomus sutorius
Crested Serpent Eagle	Spilornis cheela	Jungle Babbler	Turdoides striatus

Shikra	Accipiter badius	Pale-billed Flowerpecker	Dicaeum erythrorynchos
Little Cormorant	Phalacocorax niger	Purple-rumped Sunbird	Nectarinia zeylonica
Little Egret	Egretta garzetta	Purple Sunbird	Nectarinia asiatieca
Cattle Egret	Bubulcus ibis	House Sparrow	Passer domesticus
Indian Pond Heron	Ardeola grayii	Forest Wagtail	Dendronanthus indicus
Asian Openbill	Anastomus oscitans	White Wagtail	Motacilla alba personanta
Brown Shrike	Lanius cristatus	Baya Weaver	Ploceus philippinus
Rufous Treepie	Dendrocitta vagabunda	Scaly-breasted Munia	Lonchura punchtulata

1.9 Jorepokhri WLS

(Source: http://www.wildbengal.com/urls/protected-areas-wls-jorepokhri.html)

Jorepokhri Wildlife Sanctuary is situated in Darjeeling District of West Bengal. An area of 4 ha. was declared a sanctuary in 1985.

Fauna:

A small lake at Jorepokhri, 28km. from Darjeeling, harbours the high altitude animals like Himalayan Newt or Salamander. A highly endangered species Himalayan Salamander is one of the rarest and oldest amphibian creature. Once regarded as totally extinct from this planet earth, it was found living in the hills of Darjeeling in 1964 at Jorepokhari. This extremely rare amphibian, which is found, in the hills of Darjeeling, is called "Goro" by the local people.

1.10 Ballavpur WLS

(Source: http://www.wildbengal.com/urls/protected-areas-wls-ballavpur.html)

Ballabhpur Wildlife Sanctuary (popular for Deer Park) was established in 1977. Spread over an area of 2.021 sq.km it is located near Santiniketan in Bolpur subdivision of Birbhum District. It has an average elevation of 56 metres.

Fauna:

It is home to a number of deer including the Blackbuck and Spotted deer. Other animals include jackals, foxes and a variety of water birds.

1.11 Bethuadahari WLS

(Source: http://www.wildbengal.com/urls/protected-areas-wls-bethuadahari.html)

The WLS is situated in the Nadia District. Spread over an area of 0.6686 sq.km (about 67 hectares) the sanctuary was established in 1980.

Fauna:

The sanctuary has a large population of Spotted deer. It has about fifty species of wildlife including python, jungle cat, porcupine, monitor lizard, Bengal fox, Common Langur and a variety of snakes, and birds including Parakeets, Indian Cuckoo, Barbets etc.

1.12 Ramnabagan WLS

(Source: http://www.wildbengal.com/urls/protected-areas-wls-ramnabagan.html)

Ramnabagan Mini Zoo within the Ramnabagan WLS spread over an area of 0.145 sq.km. is located within the municipal limits of Burdwan town. Originally, the area had been declared as Reserve Forest in 1960. In the year 1978, it had been converted to a Deer Park with the introduction of 6 nos. of spotted deer. Subsequently, the whole area was declared as Wildlife Sanctuary in 1981.

Forest:
Ramna garden is an old plantation of tall and stately Teak and Sal with associates like Kadbels, Dumur, Jam etc. Clans of bamboos have also remarkably thrived.

Wildlife:
Chital and Barking deer were introduced here in 1978. Present population of Chital (Spotted Deer) is quite high. Besides these, the present wild **animals in captivity** in the zoo are Leopard, Sloth Bear, Crocodile, Peafowl, Adjutant Stork, Rosy Pelican and Black Buck. Common Langurs are abundant in the zoo area. Parakits, Cuckoos, Storks, Snakes, Mongooses, Owls, Spotted Dove and birds like Martins thrive in a remarkable habitat in this sanctuary cum mini zoo area.

1.13 West Sundarban

(Source: http://www.wildbengal.com/urls/protected-areas-wls-west-sundarban.html)

West Sundarban Wildlife Sanctuary is the latest addition to the list of sanctuaries in the State, making the total number fifteen. It was declared a Wildlife Sanctuary in 2013. Situated in South 24-Parganas, the sanctuary covers a forest area of 556.45 sq. km. distributed in the blocks of Dulibhasani (307.49 sq.km) and Chulkati (248.96 sq.km).

Forest and animals:

A vast track of rich mangrove forests lies in this Sanctuary, which harbours Tiger, Spotted Deer, Wild Boar, Estuarine Crocodile, Water Monitor Lizard, King Cobra etc.

[**Please note**: the source of information of this lesson is the website "Wild Bengal" of the Directorate of Forests, Government of West Bengal (cited in serial no 1 of the Reference Material). However, in certain cases, the areas of the respective sanctuaries as given in the said website do not agree with what has been mentioned in the Annual Report 2013-14 of the Directorate cited in serial 2 of Reference Material. In such cases of disagreement, the areas as mentioned in the Annual Report 2013-14 have been adopted in the Lesson]

Reference Material:

(1) http://www.wildbengal.com/urls/protected-areas-np-sundarban.html

(2) Annual Report 2013-14, Directorate of Forests, Govt of West Bengal

Wildlife Management

Lesson 10

Time 1 hour

Lesson Plan

To study

- Habitat management
  - ➢ general principles
  - ➢ Management practices
    - Food, water, cover, space
  - ➢ Miscellaneous aspects
    - weeds and alien species
    - saltlicks

- **Backward Linkage** – Lesson 7
- **Forward Linkage** – To find application of management principles in the PAs during tour.
- **Training material required** – copy of Lesson 10 to be circulated beforehand;
- **Allocation of time**
  - Habitat management
    - ➢ general principles 5 mts
    - ➢ Management practices 35 mts
      - Food, water, cover, space
    - ➢ Miscellaneous aspects 10 mts
      - weeds and alien species
      - saltlicks

  - **Discussion/Miscellaneous** 10 mts

Habitat management

1. General Principles

Wildlife management is essentially management of wildlife habitat. Wildlife habitat is the physical environment where an animal lives and that provides the necessities of life. Within its habitat, an animal should find the food, water, shelter and space that it needs to survive. Protected Areas (PAs) are the protected habitats that are set apart exclusively for management of wildlife. There are again some forested ecosystems where priority of management is timber production, and sufficient wildlife exists in such ecosystems as well. Thus habitat management for wildlife should cover natural ecosystems of all kinds, and should be compatible with land use pattern and other management objectives of such ecosystems.

1.1 *A wildlife habitat has **four basic components**, viz. food, cover, water and space, which are known as the 'welfare factor'. The presence and distribution of welfare factors govern the abundance of wild animals in an area*. (*Rajesh Gopal Fundamentals of Wildlife Management*)

2. Management Practices

Habitat management involves manipulating the types, amount, or arrangement of food, water, cover and space within a habitat for the purpose of making the habitat more suitable for a specific species or group or species.

2.1 Food

Food is one of the prime requisites for the survival of any organism. Based on the food they consume, animals are categorized broadly as herbivores, carnivores and omnivores. While **herbivores depend on plant materials** for sustenance, **carnivores survive on the availability of prey animals**. So far as food is concerned, management practice is **primarily to improve the food availability for herbivores** viz. deers, antelopes, goats, sheep, monkeys, squirrels, bats, rodents etc, and thus enhance the transfer of energy up along the food chains.

2.1.1 Food for herbivores may be increased in the following manner.

- **Fruits –** Availability of fruits may be enhanced through **propagation** of edible fruit plants by sowing and planting. Growth of edible fruit yielding species may be facilitated by suitable **manipulation of canopy**.
- **Fodder –** Fodder includes leaves, shoots and twigs of shrubs and trees and blades of grasses. Availability of fodder may be increased by
    - **planting** of fodder species;
    - **sowing** of seeds of fodder species;

- **eliminating or reducing undesirable plants** (weeds and alien species) by ploughing or spraying harmless herbicides;
- **controlled burning** that removes plants competing for food and space, and reduces chances of forest fire;
- **taking pasture improvement measures** like closing the area for a couple of years;
- **cereal planting** to provide winter food for birds;

2.2 Water

Water is the most important pre-requisite for survival of all wild animals. A habitat having abundant food for wildlife will be of no use if water is not available close by. A good wildlife habitat should have well distributed water points. Animals' dependence on water and the way they replenish their water varies with the nature of habitat and the species. *Many major animals replenish their water by drinking from the available source. Animals inhabiting the desert depend on succulent vegetation or metabolic water. Water is the living medium of a habitat in wetland. (Rajesh Gopal Fundamentals of Wildlife Management)*

2.2.1 Objective of management

Water development and manipulation is an essential component of habitat management. Objectives of management may be –

- *Improving the amount, availability and quality of water in an area;*
- *Ensuring the availability of water throughout the year;*
- *Increasing or decreasing the wildlife numbers in an area by improving/removing source of water;*
- *Fully utilizing the carrying capacity of an area*.

(S.S Negi A Text Book of Forestry and Wildlife Management)

2.2.2 Water holes

Water holes are natural or artificial open basins for the storage of water (S.S Negi A Text Book of Forestry and Wildlife Management). As water is the basic necessity for survival of all animals, waterholes in an area will be frequented by wildlife of all species. The frequency of visit to the waterholes will depend on water requirement of the animal concerned.

2.2.1 Besides water, waterholes may serve to provide other requirement of wildlife. Many birds and mammals will use the water hole as a place to find water as well as food. If the waterhole is shallow, birds will use it as a bath. Amphibians such as frogs, toads and salamanders may be drawn to the water and may use it for reproductive purposes, whereas, some frogs may stay year round. In addition to all of these large inhabitants, many aquatic

insects and invertebrates will use the waterhole, providing the base of the food chain for many wildlife species.

2.2.2 ***Natural waterholes*** *are natural accumulations of water in alluvial or rocky areas. The source of water in natural waterholes may be :*

- *Runoff from adjoining areas*
- *Rain water or snow melt water in the higher hills*
- *Seepage from ground water*.

(*S.S Negi A Text Book of Forestry and Wildlife Management)*

Storage of water in the natural waterholes may be augmented by increasing the water holding capacity of the waterhole and by diverting more runoff into the basin.

2.2.3 Artificial waterholes are man made and constructed for the purpose of storage of water for wild animals. Wildlife waterholes (man made) should be small and can be located in various locations. Flat ridgetops or bottomlands are the preferred location. The bottom of the waterholes can be cemented or can be provided with polythene sheet lining so as to reduce seepage loss.

2.2.3 Other sources

(Source: *S.S Negi A Text Book of Forestry and Wildlife Management)*

Besides water holes, there may be other sources of water in a wildlife habitat.

- **Springs** – They are usually formed in the hills wherever the topographic slope cuts the natural water table. Utility of a spring may be enhanced by (1) making the spring more easily accessible for the animals, and (2) by making shallow depression so that animals find it easy to drink water from the spring.
- **Rivers and streams** – Improvement measures could be (1) making approach to the river or stream bed easier, and (2) creating depression for accumulation of water in case of seasonal rivers or streams.
- **Reservoirs and small ponds** – Reservoir means the water that is impounded behind a dam. A pond may be formed by excavating a depression or enclosing a depression on one side of a stream and leading water into it by means of a diversion ditch or drain.

2.2.4 Other Measures

(Source: *S.S Negi A Text Book of Forestry and Wildlife Management)*

Other measures to increase water availability in the habitat are:

- Plantation in the upper catchment to reduce soil erosion and prevent rapid silting up of reservoirs, ponds and waterholes.
- Fire protection measures
- Wide distribution of water holes in the catchment area.

- Formation of silting or settling ponds above waterholes.

2.3 Cover

Cover is any part of an animal's environment that provides protection and enhances the survival or reproduction of the animal. Often we think of cover as something animals hide under. Actually wildlife cover has 2 components:

- *it provides shelter from adverse weather conditions (winter or thermal cover), and*
- *it provides protection from predators (screening or escape cover).*

(http://www.clemson.edu/extension/natural_resources/wildlife/publications/fs14_habitat_requirements.html)

2.3.1 Covers may be **natural** or **artificial**, and they may be **'vegetal'** or **'non-vegetal'.** Artificial covers are those which are planted or introduced by management intervention or which arise in a habitat as artifacts following biotic intrusion.

2.3.2 Cover types and role

Wildlife also needs cover for refuge, ambush, nesting, escaping predators, breeding, rearing young, and loafing. These cover types can be broadly classified as:

- ***Refuge cover*** *– This means a vegetation from which the wild animals cannot be driven out during hunting; this is a sporting terminology used by shikaris. For example, a junglr fowl can be hunted only in open space.*
- ***Ambush cover*** *– This means any cover used by a predatory animal to ambush its prey. It can be vegetal or non-vegetal.*
  (Rajesh Gopal Fundamentals of Wildlife management)
- **Nesting cover –** This is a place of refuge and home for the wildlife. Birds use nest to hold its eggs during incubation and house its young until fledged. Other animals such as reptiles, fish, or insects deposit their eggs in their nests, or tend their young**.**
- **Roosting cover** – Birds require roosting cover as a safe place for resting;
- **Loafing cover** - *Some animals at certain points of time may prefer to spend their time aimlessly at some secluded place in a habitat. This is called 'loafing'. Any place offering shade in summer and providing adequate protection from wind in winter can serve as loafing cover. (Rajesh Gopal Fundamentals of Wildlife management)*
- **Breeding cover** – This cover is important for mammals as they take parental care. Certain birds and mammals like squirrel build nests to suit their arboreal life.

Subterranean animals prefer burrows for breeding cover. Tigers use caves and overhangs as cubbing places.

While the covers have been classified as above, they are in fact interchangeable; one type of cover may serve the purpose of another.

2.3.3 Cover management

Cover management in a wildlife habitat comprises (1) protecting and improving the natural covers, and (2) making covers artificially.

2.3.3.1 Improvement of natural covers

Following measures may be taken.

- **Ground nesting cover** may be improved by
  - By maintaining a permanent cover along fences, ditch banks and wastelands;
  - Controlling fire;
  - Planting of legumes and grasses in wastelands;
  - Fencing nesting areas wherever possible;
  - Planting shrubby thickets along gullys and ravines;
- **Existing den and nesting areas** may be improved by
  - Protecting the existing den or nesting trees;
  - Making inventory of nest sites and checking the status of the sites from time to time;
  - Maintaining a buffer zone around the nesting trees;

2.3.3.2 Making covers artificially

Following covers may be introduced artificially in a habitat.

(1) **Hedgerows** – These provide escape, refuge and travel lanes for animals and birds. Hedgerows are raised by planting of woody vegetation along fence rows, in gully beds, along ponds, springs, nesting and breeding grounds. Planting stock may be nursery raised seedlings and root-shoot cuttings. Seedlings/cuttings amy be planted after preparing the land by ploughing or contour furrowing.

(2) **Brush piles** – These are preferred when cover for small animals and birds is inadequate. They consist of loose heaps of small trees, tree limbs or shrubs, logs and old fencing posts. They are useful when the species of birds or mammals that will use them have easy access to the brush piles, and they are located close to water source.

(3) **Nest boxes** – These are artificial nests erected and maintained for the benefit of birds, squirrels etc. The boxes should satisfy the biological needs of the species for which they are meant, and should be such as to bar the entry of predators.

(4) **Nest baskets, platforms, cones etc** - These are covers meant for birds. One or the other form of such nests may be introduced depending on the requirement of the species concerned.

2.4 Space

Animals need physical space to live and meet their day-to-day requirements that include finding food, water, cover and mates from this space. Whether or not a habitat is providing enough space for an animal to meet its requirements depends on the span and diversity of the habitat, population size of the species, and the habits and body size of the animal species. Adequacy of space for an animal is also determined by factors like presence of ecotones, edges, home and territory ranges of the animal and availability of mates. Availability of mates significantly affects the quality of habitat with regard to space. *In the recent past, at Jaldapara, the rhino population was affected because the habitat could not provide sufficient mates to the rhinos (which are monogamous) (Rajesh Gopal Fundamentals of Wildlife management).*

2.5 Miscellaneous aspects of habitat management

2.5.1 Removal of weeds and alien species

(Source: http://extension.psu.edu/publications/uh107)

Invasive or aggressive plant species often are easily established, and once established they expand beyond those areas where they are found initially. Invasive species are generally **alien** or non-native species that can out-compete native species and reduce the diversity of natural plant communities. Invasive plant species can be dispersed by wildlife, livestock, and/or humans. Many were deliberately or inadvertently introduced by humans. Although some of these species provide benefits for wildlife, they can create problems and, in the long run, have limited value for most wildlife. Consequently, it becomes necessary to control invasive species and replace them with native plants. Controlling the expansion of non-native plant species also contributes to conserving biological diversity.

2.5.1.1 In the context of wildlife habitat, weeds are those undesirable plants that have little or no use for the wildlife for their food and shelter, and damage the desirable species. Weeds, normally in the form of grass, herbs and shrubs, are troublesome plants. They grow profusely in forest floor, particularly in the blanks, cleared lands and in young plantations . If left unchecked, the weeds will suppress the seedlings of many of the native species, retard their growth and, in extreme circumstances, can annihilate them. Weeds are invasive in nature and cause major harm to the biodiversity of the habitat. Plants identified as weeds should be removed, and blanks and cleared lands should be planted with fodder and fruit species.

2.5.2 Saltlick

(Source: http://cdn.intechopen.com/pdfs-wm/38683.pdf)

Salt licks are deposit of mineral salts used by animals to supplement their nutrition, ensuring enough minerals in their diets. A wide assortment of animals, **primarily herbivores** use salt licks to get essential nutrients like calcium magnesium, sodium and zinc. Salt licks are **natural mineral** which are mineral outcrops in the soil which are visited by herbivores for soil eating (biting and chewing) or licking (with tongue). Animals regularly visit licks in the ecosystem which are composed of primarily common salt (sodium chloride). Salt licks occur naturally in certain locations in the forest where mineral salt are found on the ground surface. Waterholes also serve as salt licks for the animals in dry season. When a salt lick appears, animals may travel to reach it, so the salt lick becomes a sort of rally point where lots of wildlife can be observed.

2.5.2.1 Types of salt lick

Salt licks can be **natural or artificial**. Artificial salt lick comes in two forms; blocked and bagged. Bagged salt licks are designed to be buried in pits to create a more realistic form of salt lick with the salt and mineral leaching out in wet weather to form a salt deposit which will attract animals. While blocked licks are installed directly or mounted on platforms.

2.5.2.2 Significance of natural salt lick

Natural salt licks are utilized by wildlife to supplement their mineral requirements. Wild game especially the herbivores can always identify the spots in their habitat where the essential minerals could be found.

There are, however, some negative factors associated with saltlicks. Water holes which usually serve as salt licks for animals during dry season may become heavily contaminated with infectious pathogens which can survive to the dry season. Salt lick can be infected with anthrax spores and can act as focal point for the spread of the disease. There is also a high increase in predation near licks which often lead to high mortalities.

Reference Material:

(1) Rajesh Gopal Fundamentals of Wildlife Management
(2) S S Negi A Text Book of Forestry and Wildlife Management
(3) http://extension.psu.edu/publications/uh107
(4) http://www.in.gov/dnr/fishwild/files/water.pdf
(5) http://extension.psu.edu/natural-resources/wildlife/habitat-management
(6) http://cdn.intechopen.com/pdfs-wm/38683.pdf

Wildlife Management

Lesson 11

Time 1 hour

Lesson Plan

To study

- **Wild animals in captivity**
  - ➢ Zoological Park
    - Definition, approval
    - National Zoo Policy 1998
    - Recognition of Zoo Rules, 2009 with (Amendment) Rules, 2013
    - CZA Guidelines for Zoo management
    - Additional Guidelines by CZA
    - CZA Guidelines for establishing Safari Parks
- **Backward Linkage** – Previous lessons
- **Forward Linkage** – To see management practices in the zoos during tour.
  Training material required – copy of Lesson 11 to be circulated beforehand;
- **Allocation of time**
  - **Wild animals in captivity**
    - ➢ Zoological Park
      - Definition, approval 5 mts
      - National Zoo Policy 1998 10 mts
      - Recognition of Zoo Rules, 2009 with (Amendment) Rules, 2013 3 mts
      - CZA Guidelines for Zoo management 23 mts
      - Additional Guidelines by CZA 7 mts
      - CZA Guidelines for establishing Safari Parks 7 mts
  - **Discussion/Miscellaneous** 5 mts

Wild animals in captivity

1. Zoological park

Definition: Zoo means an establishment, whether stationary or mobile, where captive animals are kept for exhibition for the public (and include rescue centers and circuses, but does not include an establishment of a licensed deal in captive animals.)

The zoos serve as a **bio-diversity hub** and **green lungs** in urban landscape.

(Member Secretary's Report on The Central Zoo Authority at http://www.performance.gov.in/sites/default/files/document/presentations/central-zoo-authority.pdf)

1.1 Approval

No zoo can be established without **prior approval** of Central Zoo Authority (CZA) and orders of Hon'ble Supreme Court. No zoo can run without being recognized by CZA. CZA is a statuary body under the Ministry of Environment and Forests, Government of India, established in 1992.

2. National Zoo Policy 1998 (Salient Points)

(Zoos in India 2014 Central Zoo Authority at http://cza.nic.in/publication.html)

2.1 Objectives of Zoos

According to **National Zoo Policy, 1998**, the main objective of the zoos shall be to **complement** and **strengthen** the national efforts in **conservation of the rich biodiversity** of the country, **particularly the fauna**.

2.2 The objective can be achieved through the **following protocol**:-

- Supporting the **conservation of endangered species** by giving species, which have no chance of survival in wild, a last chance of survival through **coordinated breeding under ex-situ condition** and raise stocks for rehabilitating them in wild as and when it is appropriate and desirable.
- To inspire amongst zoo visitors empathy for wild animals.
- Providing opportunities for scientific studies.
- To function as rescue centres for orphaned wild animals.

2.3 Strategy for Achieving the Objectives - General Policy about Zoos

- Zoos shall prepare a **long-term master plan** for development.
- Every Zoo shall **maintain a healthy, hygienic and natural** environment in the zoo, so that the visitors get an adequate opportunity to experience a natural environment.
- Zoos shall give **priority to endangered species** in their **collection** and **breeding plans**.

- Zoos shall **regulate** the number of animals of various species in their collection in such a way that each animal serves the objectives of the zoo.
- Every zoo shall endeavor to avoid keeping single animals of nonviable sex ratios of any species.
- Zoos shall avoid keeping surplus animals of prolifically breeding species and if required, appropriate population control measures shall be adopted.

2.3.1 Acquisition of Animals

- Except for obtaining **founder animals** for approved breeding programme and infusion of **new blood** into inbred groups, no zoo shall collect animals from the wild.
- Zoos **shall not** enter into any **transaction i**n respect of their **surplus animals** with any commercial establishment. Even the **animal products** should **not** be utilised for **commercial purposes**. The **trophies** of the animals could, however, be used for educational or **scientific purposes**.

2.3.2 Animal Housing

- Every animal in a zoo shall be provided housing, upkeep and health care.
- The enclosure for all the species displayed or kept in a zoo shall be of such size that all animals get adequate space for free movement and exercise.
- Each animal enclosure in a zoo shall have appropriate shelters, perches, withdrawal areas, wallow, pools, drinking water points.

2.3.3 Upkeep of Animal Collections

- Zoos shall provide diet to each species, which is similar to its feed in nature.
- Round the clock supply of potable drinking water shall be made available to all animals kept in the zoo.
- With the objectives of avoiding human imprinting and domestication of animals, zoos shall prevent physical handling of animals by the staff to the extent possible.
- Zoos shall not allow any animal to be provoked or tortured for the purpose of extracting any performance or tricks for the benefit of the visitors or for any other reason.

2.3.4 Health Care

- Zoos shall ensure availability of the highest standards of veterinary care to all the animals in their collection.
- Appropriate vaccination programmes shall also be taken up for safeguarding against infectious diseases.

2.3.5 Breeding programme for species

- Before taking up breeding programmes of any species, zoos shall clearly identify the objectives for which the breeding programme is being taken up.
- All zoos shall cooperate in successful implementation of identified breeding programmes by way of loaning, pooling or exchanging animals.
- Breeding programme shall be taken up by zoos after collection of adequate data like biology, behaviour and other demographic factors affecting the programme.
- Programmes for breeding of zoo animals for re-introduction in the wild shall be taken up after getting approval of the State Government, the Central Zoo Authority and the Central Government as the case may be.
- Zoos shall give priority in their breeding programmes to endangered species representing the zoo-geographic zones in which they are located.
- Zoos shall take utmost precaution to prevent inbreeding. They shall avoid artificial selection of traits and make no explicit or implicit attempts to interbreed various genera, species and sub-species.

3. Recognition of Zoo Rules, 2009 with (Amendment) Rules, 2013

With a view to give proper direction and thrust to the operations of the zoos, the Central Government had notified Recognition of Zoo Rules, 1992. In supersession of the said rules, the Central Government later made the Recognition of Zoo Rules 2009. These Rules were further rationalized as Recognition of Zoo (Amendment) Rules, 2013. However, considering that some further technical guidance and procedural details need to be provided to the zoos, Central Zoo Authority has issued **further guidelines**.

4. CZA Guidelines for Zoo management

In consonance with **Rule 10 of Recognition of Zoo Rules, 2009, (Amendment) Rules, 2013, the CZA** has issued guidelines to facilitate scientific and effective management of zoos. Some of the guidelines are briefly mentioned below.

4.1 General requirements

4.1.1 Providing naturalistic environment in the zoo

Zoo should endeavour to **maintain** the **basic naturalistic features** of the zoo site such as water bodies, natural ridges and vegetation thereon intact.

4.1.2 Regulation of the movement of the visitors

Movement of the visitors should be regulated in a manner that the animals are not disturbed. Zoo **should not permit** in its premises the activities like **meetings, conferences, exhibitions**, **melas** and **social functions**.

4.1.3 Provision of appropriately designed barrier

The perimeter barrier and the entry gate of each zoo should be so designed, constructed and maintained that stray dogs, domestic livestock and feral animals can not get access into the zoo.

4.2 Administrative and Staffing Pattern

Every zoo should have a detailed chart indicating duties and responsibilities of all levels of staff, also indicating the chain of command for reporting.

4.3 Development & Planning

4.3.1 Preparing the Master Plan for development of zoos

Master plan of a zoo should be a comprehensive document giving a detailed **road map for 20 years** with a provision of review every 10 years regarding development and improvement of the available facilities and infrastructure and capacity building for greater efficiency.

4.3.1.1 Thematic display of animals

Grouping or sequencing the animal displays for achieving any or more than one of the following objectives:-

I. Facilitate the visitors to understand the biology and behaviour of the species displayed.
II. Facilitate the visitors to understand the geographical habitat range of various species
III. Highlight the mythological and cultural significance of various species of wild animals.
IV. . Apprise the visitors of the composite and complex nature of different ecosystems.

4.3.1.2 Visitor circulation plan

The zoo should have only **one main approach road** to take the visitors to the zoo animal display areas. The main road should be connected to various animal exhibits with **loop roads and sub-loop roads**. The loop roads and sub-loop roads should intersect the main road at prominent junction points, where appropriate **signage** indicating the directions of prominent animal exhibits and visitor facilities should be available.

4.3.1.3 Animal collection plan

Every zoo shall take a strategic review of the species of animals and their number to be housed in the zoo for preparation of appropriate animal collection plan. Following should be the guiding principles for finalizing the collection plans for different categories of zoos in Indian conditions

I. Large Zoo (National Collection)

Wild animal species of the area/ locality/ ecosystem	around 30% of the total species displayed
Representative wild animal species of the region	around 30%
Rrepresentative wild animal species of the nation Which are comfortable in the climate of the zoo	around 30%

Exotic wild animal species.	not more than 10%

II. Medium Zoo (Regional Collection)

Wild animal species of the area/ locality/ ecosystem	around 40% of the total species displayed
Representative wild animal species of the region	around 40%
Rrepresentative wild animal species of the nation which are comfortable in the climate of the zoo	Not more than 10%
Exotic wild animal species.	not more than 10%

III. Small Zoo (Local Collection)

Wild animal species of the area/ locality/ ecosystem	around 60% of the total species displayed
Representative wild animal species of the region	around 20%
Rrepresentative wild animal species of the nation which are comfortable in the climate of the zoo	around 10%
Exotic wild animal species.	around 10%

IV. Mini Zoo (Local common wild animal collection)

- A few identified common wild animal species of the area/locality/ecosystem the zoo is part of;
- May be 1-2 common exotics wild animal species.

V. Rescue Centre

- Wild animal species identified with problem, and orphaned, infirm captive animals not fit for display; animals being of the area/ locality/ ecosystem the Rescue Centre is part of.

  (i) All rescued sick or injured wild animals should be rehabilitated back in wild or in regular lifetime care facility/zoo/rescue centre within 30 days of treatment/ healing depending upon the condition/suitability ofthe individuals.

  (ii) All seized wild animals should also be rehabilitated back in wild or in regular lifetime care facility/ zoo/ rescue centre depending upon the condition/ suitability of the individuals with 30 days of the seizure after getting permission of the court dealing with the case.

  (iii) All rescued/ abandoned young wild animal should only be reared in nurseries attached to the Veterinary facilities/ hospitals of the recognized zoos/ rescue centres.

V. Specialized Zoo

Exclusive (Reptile/ Snake/ rodent/ bird/nocturnal/ aquatic park and aquarium etc.) specialized zoo may decide housing animals of one step above level i. e. small of region, medium of nation, large of international level in its collection plan.

4.3.1.4 Master Layout plan for the zoo

Master layout plan is a detailed landscape map of the existing zoo site in a scale of 1:1000 to 1:5000 depending on the area of the zoo. All the existing facilities and infrastructure and the locations of the proposed developmental activities should be clearly indicated on the map.

4.3.1.5 Disaster and crisis management plan

Every zoo should prepare a detailed plan to deal with crisis in management, arising out of natural disasters like cyclone, flood, drought and earth quake or accidental happenings like fire, animal escapes, outbreak of diseases etc.

4.3.1.6 Management Plan

Every zoo should prepare a management plan listing out the activities to be taken up by the zoo for implementing the master plan over next 5 years indicating realistic costs of executing the identified activities and financial year wise targets both physical and financial including anticipated source of funding.

4.4 **Animal housing, display of animals and animal enclosures**

4.4.1 Dimensions and size of animal enclosures

The land area to be given to any animal exhibit enclosure should be decided having due regard to the maximum number of animals that can be displayed in the animal enclosures. The area of the enclosure should have adequate land space for facilitating the animals to have free movement and exercise, adequate area to rest in shade and bask in the sun and have safe refuge from dominant animals and express their natural, social and reproductive behaviour. The animal exhibit enclosures should not be given geometrical shapes.

4.4.2 Making the animal enclosures safe for animals, animal keepers and the visitors

Barrier of every enclosure should be of a design, dimension and material that can effectively contain the animals housed within the enclosure and safeguard against any animal escaping from the enclosure.

4.4.2 Providing effective Stand off Barriers

Minimum height and distance of stand off barriers from the enclosure barriers should be as follows:

Sl No.	Barrier type	Height	Distance from the barrier
1	A long moated viewing barrier 75 cm 75 cm	75 cm	75 cm
2	A long chain-link barrier	75 cm	150 cm

4.5 Upkeep and healthcare of animals

(1) Zoo operators should keep a close watch on the animals housed in every enclosure, and any animal that is unduly aggressive and its continuance at the enclosure is risky to the life of other animals of the enclosure shall be removed from the group/ herd at the earliest and taken to isolation enclosures off the display area and kept under close observation.

(2) Zoo operators should ensure that the number of animals housed in every enclosure is within the carrying capacity of the enclosure.

4.5.1 Quality of food for animals

(1) Feed supplied to animals should not only meet the nutritional requirements but should also meet the functional need of animals.

(2) The feed should be hygienic and of high quality.

(3) Appropriate food supplements should be added in the animal feeds to avoid nutritional deficiencies or specific needs.

(4) Larger cat should be provided meat with bones. Occasionally, they should be allowed to feed on full carcasses, if feasible, pieces of liver should always be added to the meat supplied to the carnivores.

(5) Ungulates should be provided with tree fodder, wherever feasible in addition to other fodders. Salt licks should also be provided at appropriate places in their enclosures.

4.5.2 General behaviour and healthcare

Veterinary care/ treatment to any animal should be provided causing minimum possible stress to it. With this objective, every enclosure should have inbuilt facilities for restraining/ examining and treating the animal at the enclosure itself.

4.5.3 Record Keeping

Every zoo should have mechanism for recording of observations regarding social, biological and reproductive behaviour and health status of zoo animals including preventive and curative treatment provided, birth and care of young ones, sicknesses and mortalities etc.

4.6 Population Control Measures

The zoo operator should ensure that the number of each species housed in the zoo remains within the limit stipulated in the collection plans of the zoo and the carrying capacity of the housing facilities available with the zoo. Number of animals of various species housed in the zoo should not exceed the number indicated below:

Category of zoo	Optimum number of animals to be housed in a zoo			
	Tiger	Leopard	Bear	Ungulates/Herbivores of each species
Large	10	10	10	20
Medium	6	6	6	12
Small	4	4	4	10

4.7 Maintenance of Records & Submission of Inventory

Every zoo shall maintain an inventory register for all the animals in stock. Any change in number by acquisition, birth, death or disposal should immediately be made in the inventory register. Annual and quarterly inventory reports of the animals in the zoo as prescribed shall be submitted to the Central Zoo Authority.

5. Additional Guidelines by CZA

Some of these guidelines are briefly mentioned below.

- No residential colonies for staff shall be constructed within the zoo.
- No zoo should allow boating activities inside the water bodies used as wintering ground by migratory birds.
- Zoos larger than 50 hectares may have train/ trolley facilities if such facilities enable visitors to get a better view of the animals housed in various enclosures, without causing the disturbance and pollution. No Train/ trolley facilities should be permitted for recreation.
- The creation of rest houses/ hotels within the zoo premises should not be permitted.
- The zoo should not be allowed to be used for morning/ evening walking and cycling by public.
- It is recommended that for better management all the recognized zoos should be closed for a day in a week.
- The zoos should be kept open to visitors for a period as decided by the management of the zoo between the sun rise and sun set.
- No animal, forming part of the display, should be used for animal ride. Elephants and Yaks could be used for joy rides as per Zoo Recognition Rules but the same would be operated and housed outside the zoo display area.
- Animal feeding by the visitors in a zoo is not permitted.

6. CZA Guidelines for establishing Safari Parks in the existing Zoos

Some major guidelines are given below.

(i) The area of the outdoor enclosures for herbivore safari and carnivore safari should not be less than 30 hectares and 20 hectares respectively. Mini zoos being operated as Deer Parks and displaying mega species should not be of less than five hectares.

(ii) Entry and exit to every drive through enclosure should be through a system of double gates. There should be sufficient space in between the two gates.

(iii) Arrangement should be in place to ensure that the two gates provided under the double gate entry and exit system do not open simultaneously. The second gate should open when the first gate has been securely locked.

(iv) Visitors should be allowed to enter in the enclosure of large cats and Bears only in closed top vehicle and the windows and glasses of the vehicle should be kept securely locked during the period the vehicle remains in the drive through enclosure.

(v) Supervisory staff accompanying the vehicle should be armed with appropriate weapons and communication equipment and should be authorized to use the same effectively, if required to do so.

(vi) Trained personnel shall be suitably positioned over the entire drive through enclosure, on appropriately designed watch towers to keep a watch on the movement of vehicles, the animals and intruders, if any, and to provide necessary guidance.

(vii) A rescue vehicle should always be available at the command of supervisory staff.

(viii) The layout of roads in the drive through enclosure should be such that the visitors can be shown all the highlights of the enclosure without disturbing the animals in their withdrawal areas.

7. Zoos and Recue Centres in West Bengal

Locations of the zoos and rescue centres of the State may be seen in the annexure.

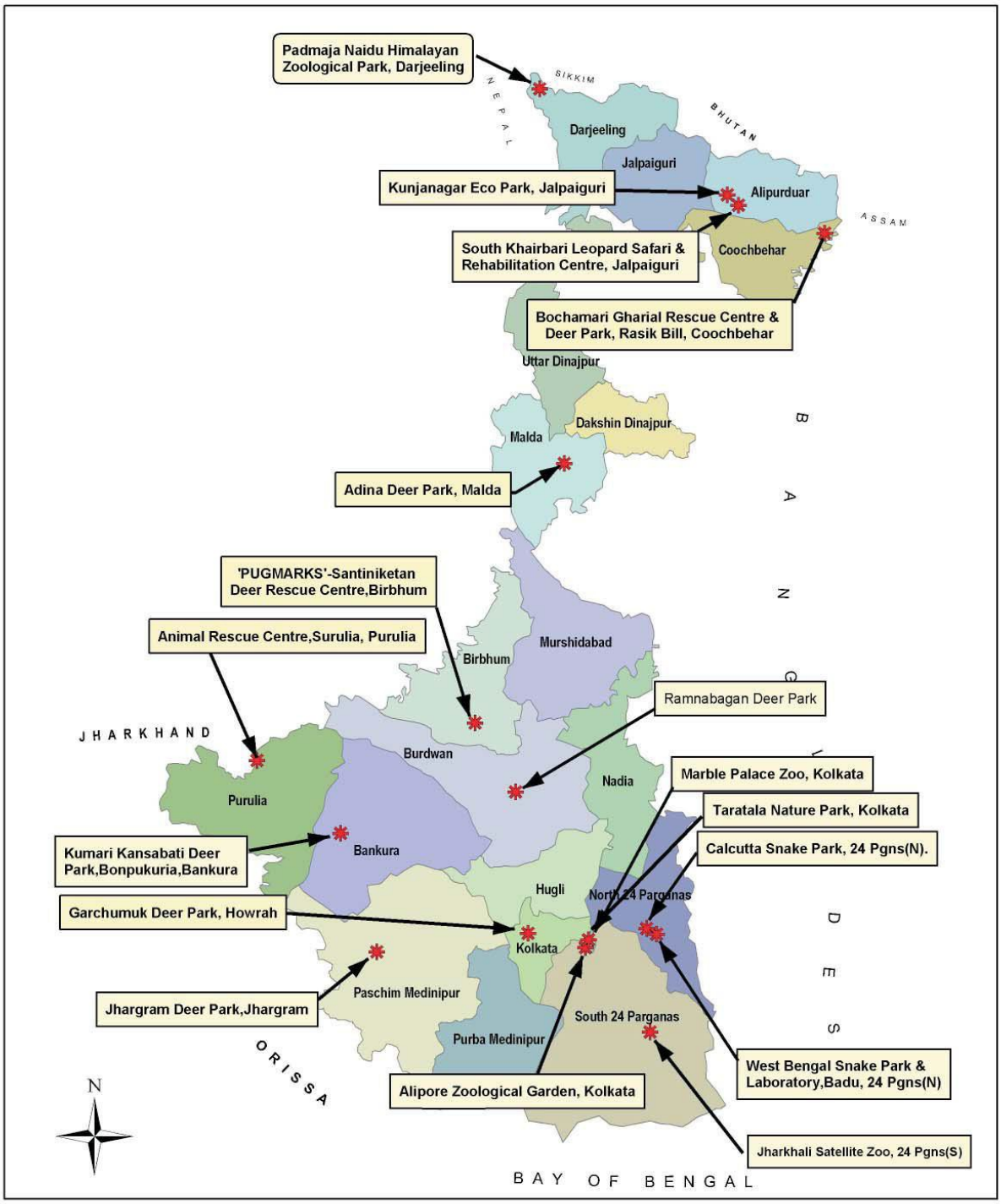
Reference Material:

(1) Zoos in India 2014 Legislation, Policy, Guidelines and Strategy Central Zoo Authority at http://cza.nic.in/publication.html

(2) Member Secretary's Report on The Central Zoo Authority at http://www.performance.gov.in/sites/default/files/document/presentations/central-zoo-authority.pdf

Annexure (Source: Annual Report 2013-14, Wildlife Wing, Directorate of Forests, WB; http://www.wildbengal.com/)

Location of Zoos & Rescue Centres in West Bengal



Wildlife Management

Lesson 12

Time 1 hour

Lesson Plan

To study

- **Tourism management**
  - Ecotourism
    - Definition, Principles
    - Awareness of law
    - Awareness of Environment
  - Tourism management in wildlife areas
    - Tourism zone
    - Tourism activities
    - Facilities and amenities
    - Tourist guides and brochures
    - Carrying capacity
    - Website and on-line booking
- **Backward Linkage** – Previous lessons
- **Forward Linkage** – To see management practices in wildlife tourism spots during tour.
- **Training material required** – copy of Lesson 12 to be circulated beforehand;
- **Allocation of time**
- **Tourism management**
  - Ecotourism
    - Definition, Principles 7 mts
    - Awareness of law 3 mts
    - Awareness of Environment 3 mts
  - Tourism management in wildlife areas
    - Tourism zone 5 mts
    - Tourism activities 7 mts
    - Facilities and amenities 7 mts
    - Tourist guides and brochures 7 mts
    - Carrying capacity 10 mts
    - Website and on-line booking 6 mts

- **Discussion/Miscellaneous** 5 mts

Tourism management

1. Ecotorism

1.1 Definition

Ecotourism is now defined as **responsible travel to natural areas** that conserves the environment, sustains the well-being of the local people, and involves interpretation and education. Education is meant to be inclusive of both staff and guests.
(https://www.ecotourism.org/what-is-ecotourism)

1.2 Principles of Ecotourism

Ecotourism is about *uniting conservation, communities, and sustainable travel*. This means that those who implement, participate in and market ecotourism activities should adopt the following ecotourism principles:

- Minimize impacts;
- Build environmental and cultural awareness and respect.
- Provide positive experiences for both visitors and hosts.
- Provide direct financial benefits for conservation.
- Generate benefits for both local people and tourism entrepreneurs.
- Deliver memorable interpretative experiences to visitors that help raise sensitivity to environmental and social climates.
  (https://www.ecotourism.org/what-is-ecotourism)

1.3 Awareness of the Law

Wildlife areas have now become popular ecotourism spots. This has added to the responsibility of the organising agencies and the tourists so as to ensure that ecotourism activities should in no way violate the prevalent laws and regulations relating to wildlife. Those who organize or participate in any capacity in ecotourism should -

- be aware of wildlife related laws and restrictions that are operative in general and in particular to the area concerned;
- choose such places for tourism and restrict to such activities as are permissible; this aspect assumes more importance in respect of tourism activities in or close to Protected Areas.
- make the tourists aware of the importance and implications of the laws and regulations.

1.4 Awareness of Environment

It is necessary to be aware of how man and the environment can live symbiotically for more time to come. Eco-tourism is an effective way to maximize the economic, environmental and social benefits of tourism. Everyone is a stakeholder in the process. Some basic norms to be followed are listed below:

- The wildlife areas housing ecotourism should be plastic free zones. Carriage and use of plastic bags should be prohibited.
- The tourists may carry back all non-degradable litter such as empty bottles, tins etc. These must not litter the environment or be buried.
- The tourists should observe the sanctity of holy sites and local cultures.
- The tourists should not blare aloud radios, tape recorders or other electronic entertainment equipment in nature resorts, sanctuaries and wildlife parks.
- The tourists should use only permanent toilets provided at the tourism sites.
- The tourists should respect people's privacy while taking photographs, and ask for prior permission before taking a photograph.

2. Tourism management in Wildlife areas

2.1 Tourism zone

Tourism zone in a wildlife area means the zone where the tourists are allowed to have access. It forms only a part of the Protected Area (PA) that remains open to the visitors. Parts other than the tourism zone are restricted for entry by tourists. Tourism zone should be in the buffer areas of the PA. Restriction in access is essential to minimize the likely disturbance to wildlife and their habitat. Wildlife managers are required to manage the tourism zone.

2.2 Tourism activities

Subject to strict observance of legal provisions and regulations, following activities are normally permitted in the tourist zone.

- Viewing wildlife on foot, elephant (if permitted), vehicles (as permitted), machan or hide;
- Walking and trekking through forest;
- Camping in the forest (as permitted);
- Visit to local fairs, historic buildings, festivals, cultural programmes, dams etc.
- Sporting activities such as mountaineering, rafting, boating, etc.

2.3 Facilities and amenities

In consonance with prevalent regulations, following facilities and amenities may be provided in the tourism zone.

- Eco-cottages with suitable boarding and lodging facilities;
- Visitors centre with cafe and toilet facilities to serve as day centre;
- Nature camp, nature trails;
- Provision of safari to view wildlife;
- Parking lots;
- Hides and machans;
- Tour guides.
- Signs and maps

2.3.1 Signs and maps

Signs are used to guide the visitors and reduce their need for inquiries. Signs may serve the following purposes.

- **Directional signs** to show the way to a place.
- **Orientation signs** to help a visitor orient himself or to convey instructions
- **Interpretative signs** to highlight conservation message.

Maps are an important facility for the visitors in a tourism zone. They give the following information.

- Position of the visitor
- Extent and boundary of the area
- Points of entry, exit, gates etc.
- Roads or areas open for use by visitors; parking lots
- Water bodies, mountains etc.
- Major amenities like accommodation, toilets, camping sites, hide outs, machans etc.
- Distance of any spot.

2.3.2 Hides and machans

Hides and **machans** are made to facilitate viewing of wildlife**.** Use of such facilities by the tourists should be in presence of and under the guidance of trained wildlife personnel. Generally, they are of following types.

- **Bunker type –** This is excavated below the ground with the viewing slot just above the ground level;
- **Ground level type –** This is at or near the ground level

- **Elevated type** – This is above the ground level. This may be a watch tower or built suitably on a tree.

Preferable locations for hides and machans are -

- overlooking wallows and marshes,
- overlooking rivers, lakes and waterholes
- overlooking saltlicks
- overlooking grasslands and other feeding areas.

2.4 Tourist guides and brochures

The wildlife manager and other personnel associated with the tourism site should have detailed knowledge about the place, its wildlife resources, and subjects of interest that the area may provide. The department or the agency organising tours may bring out **tourist guides and brochures** covering the following aspects.

- General information
    - Location, altitude, climate, land features, vegetation
    - transportation facilities to reach the place
- Areas of interest
    - wild viewing areas
    - interesting landforms
    - rivers, streams and lakes.
- Points of interest
    - Scenic viewpoints
    - Waterholes and saltlicks
    - Historical sites and shrines
- Wildlife
    - Major wildlife of the area
    - Viewing facilities
    - Available arrangement of safari for viewing wildlife, related tariff etc.
- Miscellaneous
    - Day centre – facilities available
    - Eco cottages for accommodation, facilities available, tariff, mode of booking
    - Persons to contact for information, and contact details
    - Best season to visit
    - Period when the tourism site remains closed.
    - Map showing outlay of facilities and features of the tourism zone

2.5 Carrying capacity

"Tourism Carrying Capacity" is defined by the World Tourism Organisation as "The **maximum number of people** that may visit a tourist destination **at the same time**, without causing destruction of the physical, economic, socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction". It has been also defined as "the level of human activity an area can accommodate without the area deteriorating, the resident community being adversely affected or the quality of visitors experience declining". What both these definitions pick up on is **carrying capacity is the point** at which a destination or attraction starts experiencing adverse impact as a result of the number of visitors.

(https://en.wikipedia.org/wiki/Tourism_carrying_capacity)

2.5.1 The use of **Carrying Capacity** as the predominant concept in tourism management **assumes** that there is a **direct relation** between the number of visitors to a tourist site and the impacts produced in the environment and on wildlife, and that these impacts can be managed via regulation of the number of people or groups of people that access visitor sites.
(http://www.galapagos.org/wp-content/uploads/2012/04/socio8-carrying-capacity.pdf). The concept of carrying capacity in managing tourism is however disputed by many. It is also true that it is difficult to determine the carrying capacity parameters and even if possible to determine, it is difficult to administer.

2.5.2 There are number of different forms of carrying capacity referred to in tourism. However, the four most commonly used are described below.

(1) Physical carrying capacity

This is the maximum number of tourists that an area is actually able to support. In the case of an individual tourist attraction it is the maximum number that can fit on the site at any given time and still allow people to be able to move.

(2) Economic carrying capacity

This relates to a level of acceptable change within the local economy of a tourist destination. it is the extent to which a tourist destination is able to accommodate tourist functions without the loss of local activities. Take for example a souvenir store taking the place of a shop selling essential items to the local community. Economic carrying capacity can also be used to describe the point at which the increased revenue brought by tourism development is overtaken by the inflation caused by tourism.

(3) Social carrying capacity

This relates to the negative socio-cultural effect related to tourism development. The indicators of when the social carrying capacity has been exceeded are a reduced local tolerance for tourism. Reduced visitor enjoyment and increased crime are also indicators of when the social carrying capacity has been exceeded.

(4)) Bio-physical carrying capacity

This deals with the extent to which the natural environment is able to tolerate interference from tourists. It deals with ecology which is able to regenerate to some extent, so in this case the carrying capacity is when the damage exceeds the habitat's ability to regenerate.

((https://en.wikipedia.org/wiki/Tourism_carrying_capacity))

2.6 Website and on-line booking

One prerequisite to popularize nature tourism in general and individual tour destinations in particular is that the people should know about the tourism areas, their unique features and the way they can organize their tours to such places. As stated earlier, the tourist guides and brochures may disseminate such information, but the easiest way to reach larger sections of people is to post the information on the website. Willing tourists may then get most of the information from the website with ease and comfort. It will be more facilitating, if the tourists have the option to book on line entry to wildlife areas and accommodation at the eco-cottages. Technological advancement can enhance the popularity of wildlife tourism.

Reference Material:

(1) S S Negi A text Book of Forestry and Wildlife Management
(2) http://www.incredibleindia.org/en/travel/eco-tourism
(3) https://en.wikipedia.org/wiki/Tourism_carrying_capacity
(4) http://www.galapagos.org/wp-content/uploads/2012/04/socio8-carrying-capacity.pdf
(5) https://www.ecotourism.org/what-is-ecotourism

Wildlife Management

Lesson 13

Time 1 hour

Lesson Plan

To study

- **Man animal conflict**
  - Definition
  - Causes
  - Conflict Scenario in the State
  - Steps to reduce conflict and check animal depredation
  - Eco-development activities around the Protected Areas
  - Award of compensation
- **Backward Linkage** – Previous lessons
- **Forward Linkage** – To know about conflict scenarios during tour.
- **Training material required** – copy of Lesson 13 to be circulated beforehand;
- **Allocation of time**
  - **Man animal conflict**
    - Definition 3 mts
    - Causes 7 mts
    - Conflict Scenario in the State 23 mts
    - Steps to reduce conflict and check animal depredation 12 mts
    - Eco-development activities around the Protected Areas 5 mts
    - Award of compensation 5 mts
  - **Discussion/Miscellaneous** 5 mts

Man animal conflict

1. Man animal conflict – Definition

Human–wildlife conflict is defined by the World Wide Fund for Nature (WWF) as "any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment."

A 2007 review by the United States Geological Survey defines human-wildlife conflict in two contexts; firstly, actions by wildlife conflict with human goals, i.e. life, livelihood and life-style, and, secondly, human activities threaten the safety and survival of wildlife. However, in both cases, outcomes are decided by human responses to the interactions.

(https://en.wikipedia.org/wiki/Human%E2%80%93wildlife_conflict)

2. Causes

(Source: http://www.wildbengal.com/urls/man-animal-conflict.html;
https://en.wikipedia.org/wiki/Human%E2%80%93wildlife_conflict;
http://www.projectwaghoba.in/docs/human_wildlife_conflict_athreya_naqash_linnell.pdf)

Except for some stray incidents inside forests, the conflict mostly occurs in human habitations in the fringe of forests. *Conflicts usually arise out of straying of wild animals into habitations and result into either killing of the wild animals, or, death/injury of human beings and loss of crop/cattle/houses.*
(http://www.wildbengal.com/urls/man-animal-conflict.html)

Man-elephant and Man-tiger conflict and also conflict with other wild animals of late, have become more acute due to following causes.

- **Shrinkage and displacement of wildlife habitat** - As human populations expand into wild animal habitats, natural wildlife territory is displaced and shrunk. Under such anthropogenic pressure it is impossible for our limited Protected Areas to confine all the wildlife inside their small islands of forest. To compound the problem, all the large wildlife species are biologically programmed to move large distances, resulting in greater chances of conflict.
- **Overlap in space usage** - The population density of wildlife and humans increase with overlaps in geographical areas used, increasing their interaction and thus resulting in increased physical conflict. As a result, in certain situations, man and animal compete for and share the same space for survival and daily activities. Competition for food resources also occurs when humans attempt to harvest natural resources such as fish, honey and grassland pasture. This overlap in space usage between potentially dangerous species of wildlife, and humans sets the stage for conflict.

- **Loss of fodder/prey base** - Reduction in the availability of natural prey/food sources leads to wild animals seeking alternate sources. Alternately, new resources created by humans draw wildlife resulting in conflict. By-products of human existence offer un-natural opportunity for wildlife in the form of food and shelter, resulting in increased interference and potentially destructive threat for both man and animals.
- **Destruction of animal corridors** - *Rapid expansion of habitations, agriculture and tea gardens had not only encroached upon the forests and grasslands, but also cut off the corridors needed for migration of wide-ranging animals like elephants*. (http://www.wildbengal.com/urls/man-animal-conflict.html)
- **Cattle grazing** – *Wanton grazing of cattle in the forest fringes and other forest areas have created acute pressure on the fodder of the large herbivores. Reduction of natural grassland and conversion of natural forests into value-added plantations of commercial species, until a couple of decades back, has further restricted the fodder base of the elephants and other wild animals*. (http://www.wildbengal.com/urls/man-animal-conflict.html)
- **Poaching of prey animals** - *Poaching of deer and other smaller prey-animals has resulted into reduction in prey-base of big cats like tiger and leopard.* (http://www.wildbengal.com/urls/man-animal-conflict.html)

3. Conflict scenario in the state

3.1 North Bengal

3.1.1 In North Bengal, man-animal conflict and the resulting depredation is mainly due to large herbivores like elephants and gaur, and the carnivorous species leopard. The elephant population in North Bengal forests has been increasing over the years and a sizable number is available in forests outside the Protected Areas. The elephant population has risen from 175 in 1989 to 529 in 2010. (Source: Annual Report 2013-14 WB Forest Directorate; elephant population of the state in 1989 reported to be 175 was presumably from North Bengal only). It is only natural that with increasing population and simultaneous increase in pressure on its habitat, the elephant has turned out to be the most menacing animal in North Bengal. According to the said Annual Report, elephants have killed 31 persons and injured 62 persons in North Bengal during 2013-14. This is in addition to the enormous damage the elephants have caused to human settlements and crops.

3.1.2 Population of gaur has also seen a sharp rise from 240 in 1989 to 1180-1284 in 2002. In 2013-14, in Buxa Tiger Reserve (West) alone 782 gaurs have been recorded. (Source: Annual Report 2013-14 WB Forest Directorate). In 2013-14, gaurs have killed 1 person and injured 15 persons.

3.1.3 A complete census of leopard done in 2002 reported 247 leopards from Garumara, Buxa, Jaldapara and Mahananda. In 2012, population of leopard in Buxa Tiger Reserve(West) alone was reported to be 105. In 2013-14, leopards killed 1 person and injured 74 persons.

3.1.4 Fragmentation of habitat by the presence of tea gardens, roads and railway tracks resulting in barriers to natural movement of animals has adversely impacted the wildlife in north Bengal. The most visible effect has been on the elephants. After the railway line connecting Siliguri Junction with Alipurduar Junction was made broad gauge in 2003, there has been increasing elephant casualty due to collision with trains on this railway track.

3.2 South West Bengal

3.2.1 South West Bengal presents a unique scenario where depredation is mainly, if not entirely, due to elephants and a major part of the population is actually migratory from the neighbouring state Jharkhand. According to the Annual Report 2013-14 of Forest Directorate, the resident population of elephants in south Bengal was 25 in 2007. In 2010, a total population of 118 has been reported. The said Annual Report has revealed one interesting point. While population of elephants in south Bengal is much lower than that in North Bengal, the damage caused in 2013-14 by the south Bengal herds is not only comparable to their north Bengal counterpart, the human killing figure in south Bengal has surpassed that of North Bengal. In 2013-14 number of persons killed in south Bengal was 36 (in comparison to 31 in North), and number of persons injured in south Bengal was 52 (in comparison to 62 in the North).

3.2.2 Migration of elephants from Jharkhand started in late eighties. The number of migrant elephants from Jharkhand has risen over the years. Of late this migrant group (about 80-90 elephants) comprising 2-3 herds coupled with two resident herds – one of 25-30 elephants moving in groups of 3-4 and the other of 25-30 known as Mayurjharna herd – has made the conflict scenario very complex in the districts of Paschim Medinipur and Bankura. These herds follow variant paths and stay for varying periods in different places. There has also been report of 2 distinct migrant groups of elephants entering Purulia district and having separate path of movement.

3.2.3 Reasons for migration and prolonged stay

1. The migration is mainly in search of food.
2. Agriculturally the eastern bank of Kangsabati River is very fertile and most of the land is under crop throughout the year providing food to the elephants.
3. In most of the Forest patches water is available throughout the year.
4. Elephants easily get refuge shelter in these forests patches.
5. In some of the forest patches they get good fodder.

(Source: Subhamay Chanda man - elephant conflict in south West Bengal)

3.2.4 Reasons for extensive damage

1. Forests here are mostly in patches, interspersed with habitation and agriculture field.
2. Elephant migratory routes are gradually encroached by construction resulting in invention of new route causing extensive damages.
3. Elephants find agricultural crops very palatable and prefer these to what is available in the forests.

3.3 Man-tiger conflict in Sundarban

3.3.1 One of the prominent zones of man-animal conflict is Sundarban. Straying of tigers from the Reserved Forests into the habitations along the Northern and Western fringes of Sundarban Forest occasionally result into death of cattle/human beings as well as tiger. Illegal entry of fishermen into core areas as well as entry of honey-collectors into the forest also leads to killing of a number of people by the tigers.
(http://www.sundarbanbiosphere.org/html_files/man_animal_conflict.htm)

3.3.2 Sundarban tigers have been ill-famed as man eaters. The various groups of human that fall victim of tiger include honey collectors, fishermen including crab collectors, tiger prawn seed collectors and even Forest Department staff. Figures for human casualty and injury by tigers in Sundarban may be seen in Annexure I.

3.3.3 Tiger straying

[Source: Nilanjan Mallick Control of human tiger conflict in Sundarban Tiger Reserve(STR)]

The major issue in managing Human- Tiger conflict in STR is the straying of tiger into fringe villages and rescue of the tiger without causing any harm on either side. It is worth mentioning here that STR's only north – western boundary has interface with 25 fringe villages which are densely populated with human and cattle. Many times it becomes possible for the staff and local villagers to drive the tiger back to the forest by using drums, crackers, fire etc. Sometimes the tiger also goes back to the forest on its own. These straying incidents are termed as Temporary Straying, where in case of repeated phenomenon, trap cage with live bait is being used to trap the tiger and then relocate the same. In Permanent Straying, the tiger takes refuge in a cattle shed or inside any village hut, when tranquilization is used to rescue the animal.

3.3.3.1 Tigers in Sundarban stray into the neighboring villages because they are situated in the reclaimed forest land. In same places the boundary between the forest and agricultural land is not distinct. Some villages have small patches of mangrove forests where a tiger sometimes moves in by losing direction. Sometimes tigers easily cross small creeks in search of easy prey like cow and goat. Tigress sometimes litters inside the paddy field as she wants to avoid the danger of male tiger. Old aged and diseased tigers like the ones with broken canine also stray,

because hunting a prey in forest is difficult for them and domestic cattle becomes their easy prey.

3.3.3.2 Strategies with respect to tiger straying

(a) **To develop a protocol for reduced reaction time in case of permanent tiger straying**. The protocol requires (i) provision for quick and easy communication among the forest personnel, police, panchayet and EDC members; (ii) a speed boat in readiness; (iii) Tiger Straying Combat Force (TSCF) to be in readiness with tranquilization equipment, translocation cages, tiger guard and other necessary tools like nylon net, crackers, flame torch, search light etc for the operation;

(b) **Protocol to be followed in Tiger rescue operation**

(i) The TSCF must be well equipped; should be accompanied by a Veterinary Surgeon and one trained staff for tranquilization.

(ii) In case of acting in dark, proper search light, flame torch etc along with proper arms and ammunition to cover the man who is darting is necessary. Use of tiger guard is a must.

(iii) Before tranquilization, necessary instructions for mob clearance should be pronounced by hand- mike and the police may be requested for securing the area.

(iv) After tranquilization, the animal may be caged immediately by using stretcher under the supervision of the Veterinary Surgeon.

(v) The caged animal should be boarded urgently and the boat must move to an open space, preferably in a nearby forest for post- tranquilization care, to be executed by Veterinary Surgeon.

(vi) The animal should be kept under observation for minimum of 24 hrs and instruction, if any, from Chief Wild Life Warden has to be followed.

(vii) The animal may be released after obtaining "Fit for release" certificate from Veterinary Surgeon.

(viii) All such strayed out animal should be properly photographed and an ID Catalogue should be maintained to check if the animal repeats straying behaviour.

4. Steps to reduce conflict and check animal depredation

Following are some general steps and strategies that are adopted to mitigate man-animal conflict and contain animal depredation. All the steps need not apply to each and any case. Suitability of any of the steps, priority of the available options, and formulating detailed plan of actions should depend on the nature of circumstances to be dealt with. In a particular situation, the steps may be suitably modified as per requirement.

1. Eco-restoration of the wildlife habitats by afforestation with fodder tree species, indigenous grasses and bamboos in blank areas and degraded forests.

2. Identification and mapping of critical elephant migration corridors and routes.

3. Enrichment of the natural habitats through development of cover, water resources, salt-licks, soil and water conservation etc. wherever necessary;

4. Close co-ordination with the neighbouring states, viz. Jharkhand etc. to check migration of Elephant herds as far as possible.

5. Direct measures to mitigate man-animal conflict including creation of electric fencing at strategic locations, driving of elephants from human habitation by elephant depredation control squads, early warning systems, use of kunkee elephants for driving of elephants etc.

6. Eco-development activities in the fringe villages to reduce biotic pressure inside forest areas.

7. Indirect measures to mitigate man-animal conflicts through development of pasture lands and woodlands on available community land and Government land outside the animal habitats, control of grazing, establishment of alternate systems to meet sustenance need of forest-dependent human populations, popularisation of Non-Conventional Energy systems, changes in socio-economic practices which lead to intensification of conflict with wildlife and elephant populations.

8. Payment of ex-gratia grant to the victims of animal depredation and adoption of alternative schemes, such as group insurance scheme for villagers.

9. Capture and translocation of problem populations of animal; translocation and/or elimination of established rogue elephants.

10. Training of captured elephants including establishment of required infrastructure, and holding of training programmes for elephant managers and handlers.

11. Strengthening of anti-poaching measures and infrastructure; payment of rewards / incentives.

12. . Radio-collaring, periodic monitoring of movements of elephant population and directional driving of elephant herds.

13. . Research on various aspects of wildlife management; compilation and publication of research material; holding of seminars, workshops and meetings.

14. Veterinary care for elephants in the wild as well as in captivity.

15. Increasing awareness among people by publication of education material, slide shows, film shows and street plays etc. as well as campaign through electronic media.

(Source: http://www.wildbengal.com/urls/man-animal-conflict.html)

5. Eco-development activities around the Protected Areas

5.1 Management of National Parks and Sanctuaries has taken new dimensions with inclusion of ecological considerations and incorporation of regional planning. Emphasis is also being given to management of Reserve Forests and other lands surrounding Protected Areas in such a manner to reduce biotic pressures on National Parks and Sanctuaries as well as to meet the demands of local people living in the fringe of the forests. It is well understood that programme of Wildlife Conservation will succeed with active involvement and cooperation of local people in planning, implementation and monitoring from the very beginning.

5.2 Since 1991, **participatory protected area management** has been initiated in the fringe villages bordering Jaldapara Wildlife Sanctuary, Mahananda Wildlife Sanctuary, and Buxa Tiger Reserve. Gradually the eco development programme has been expanded to all the PAs. **Eco-development is basically a strategy which aims to conserve biodiversity by reducing the negative impact of people on the PA as well as reducing the negative impact of PA on local people.** The efforts are basically to improve the socio-economic conditions of fringe villages through some prioritized, site specific and need based eco activity package.

5.3 Around 103 eco-development committees and 127 forest protection committees have been formed in the fringe villages of National Parks and Sanctuaries with around 62, 030 members who are protecting more than 1,82,406.24 ha. of forests. The fringe area population around various PAs are now less dependent on the forest resources to earn their livelihood, as alternate employment options have been created through eco-development programme in majority of these areas. The local communities are not only coming forward to protect the nearby forests but are also helping the forests staff to apprehend poachers. This active involvement of local people will make the task of bio diversity conservation more effective in the long term.

(Source: http://www.wildbengal.com/urls/initiatives-habitat.html)

6. Award of compensation

The compensation in the form of ex-gratia grant to the victims or legal heirs of the victims of depredation caused by wild animals has been enhanced by the State Government in January 2015. The relevant Government order may be seen in the Annexure II.

Reference Material:

(1) http://www.wildbengal.com/urls/man-animal-conflict.html
(2) Annual Report 2013-14 Directorate of Forests, Govt of W.B
(3) https://en.wikipedia.org/wiki/Human%E2%80%93wildlife_conflict
(4) http://www.sundarbanbiosphere.org/html_files/man_animal_conflict.htm
(5) Subhamay Chanda man - elephant conflict in south West Bengal at http://www.teriuniversity.ac.in/mct/pdf/assignment/SUBHAMAY-CHANDA.pdf
(6) Kalyan Das Man –Elephant Conflicts in North Bengal at http://www.teriuniversity.ac.in/mct/pdf/assignment/Kalyan-Das.pdf
(7) Nilanjan Mallick Control of human tiger conflict in Sundarban Tiger Reserve at http://www.teriuniversity.ac.in/mct/pdf/assignment/NILANJAN-MALLICK.pdf
(8) Vidya Athreya et.al. Lessons from human-wildlife conflicts at http://www.projectwaghoba.in/docs/human_wildlife_conflict_athreya_naqash_linnell.pdf.

Annexure I

(Source: Nilanjan Mallick Control of human tiger conflict in Sundarban Tiger Reserve at http://www.teriuniversity.ac.in/mct/pdf/assignment/NILANJAN-MALLICK.pdf)

Person killed / Injured by Tiger					
(Report based on STR)			(Report based on other sources) *RCHP, Gosaba; BPHC Death Registar Office, Gosaba and NGO's*		
Financial Year	Died	Injured	Calendar Year	Died	Injured
1985-86	32	6	1985	31	4
1986-87	25	6	1986	26	7
1987-88	21	7	1987	19	7
1988-89	14	3	1988	21	3
1989-90	12	10	1989	6	4
1990-91	43	8	1990	53	10
1991-92	38	7	1991	41	6
1992-93	34	5	1992	40	5
1993-94	31	4	1993	47	2
1994-95	5	-	1994	16	2
1995-96	4	0	1995	15	2
1996-97	2	2	1996	6	3
1997-98	5	2	1997	12	3
1998-99	2	2	1998	21	2
1999-2000	13	-	1999	35	0
2000-01	15	4	2000	40	3
2001-02	12	-	2001	2	-
2002-03	14	-	2002	1	-
2003-04	8	-	2003	1	-
2004-05	2	-	2004	-	-
2005-06	-	-	2005	-	-
2006-07	-	-	2006	-	-
2007-08	6	-	2007	3	1
2008-09	9	-	2008	1	-
2009-10	8	1	2009	4	2

(Source: Tiger conservation plan of Sundarban tiger reserve, 2012)

Annexure II

Government of West Bengal
Department of Forests
Aranya Bhawan, Block-LA-10A, Sector-III, Salt Lake City, Kolkata-700098.

No. 195-For/11M-95/2011(Pt.I). Dated, Kolkata the 30th January, 2015.

From :The Joint Secretary to the Govt. of West Bengal.

To : The Principal Chief Conservator of Forests, Wildlife & Chief Wildlife Warden, W.B.

Sub : Payment of compensation for the loss of life and property due to depredation by wild animals.

Ref : 3886/WL/1E-5/2014 dt.04/08/2014.

The undersigned is directed by order of the governor to say that the matter of enhancement of payment of compensation for the loss of life and property due to depredation by wild animals has been reviewed by the governments.

The governor is now pleased to accord sanction that exgratia grant will be given to the victims or the legal heirs of the victims of depredation caused by wild animals in the scales shown in the table below.

Sl.No.	Categories	Rate
1	Person killed by wild Animal	2,50,000/-
2	Person injured by wild animals	Free medical treatment in Govt.Hospital
3	Person against permanent disability incapacitation	1,00,000/-
4	Grievous injury	33,000/- + free medical treatment in govt.Hospital
5	Damage to crops by wild animals	15,000/- per ha
6	Damage to livestock by wild animals	500/- to 2000/- subject to actual quantum of loss
7	Damage to huts/Bldgs. caused by wild animals	Total damage for Kuchha house = 6,000/- partial damage for Kuchha house = 3000/-
8	Damage of semi permanent house (G.I sheet or tali roof)	Upto 10,000/-
9	Damage of permanent house with RCC roof	Upto 20,000/-

This order issues with the concurrence of Finance Deptt. vide their u.o. No.0168, dt.28.01.2015.

The Principal A.G. W.B. is being informed.

Joint Secretary to the Govt. of West Bengal

No.195/1(10)-For Dated, Kolkata the 30th January, 2015.

Copy forwarded for information and necessary action to :-

1) Principal A.G. W.B. Treasury Bldgs.,Kolkata.
2) P.C.C.F. Bio-diversity & CWLW,W.B.
3) P.C.C.F. Research and Monitoring
4) M.D. WBFDC Ltd. FD,
5) Sunderban Tiger Reserve
6) Sunderban Bio-sphere Reserve
7) Finance Deptt. Gr.I
8) P.S. to M.I.C.
9) P.S. Secretary
10) Guard file.

Joint Secretary to the Govt. of West Bengal

d/chandan/195

Wildlife Management

Lesson 14

Time 1 hour

Lesson Plan

To study

- **Census of wild animals**
  - Definitions and concept
  - Methods of Estimating Animal Numbers
  - Census of deer

- **Backward Linkage** – Previous lessons
- **Forward Linkage** – To know about animal census during tour; Lesson 15.
- **Training material required** – copy of Lesson 14 to be circulated beforehand;
- **Allocation of time**

Census of wild animals	
- Definitions and concept	10 mts
- Methods of Estimating Animal Numbers	10 mts
- Census of deer	30 mts
Discussion/Miscellaneous	10 mts

Census of Wild Animals

1. Definitions and concept

(Source: Rajesh Gopal Fundamentals of Wildlife management)

1.1 Census – This is a complete count or tally of animals **over a specified area** at a **specified point in time**. It can also mean complete count of animals over a **specified interval of time** at a **specified point in** an area. In a total census all the animals are counted, so there is no question of variance or confidence limits. However, some errors may creep in the counting process, and therefore it is necessary to provide a critical evaluation of the method adopted, indicating the constraints in the methodology.

1.1.1 Total count of animals is possible if the area to be covered is relatively small and the animals are easily visible and identifiable. Total count is also possible in special circumstances, say when the animals are concentrated temporarily in some areas like water holes or saltlick.

1.2 Sample census – It is the process where counting is conducted on a part (sample) of the habitat, which is representative of the whole. Sample census provides a statistical estimate of the population. There are various methods to select the sampling units over which counting is done. The results from the sample census are projected for the area such samples represent. If sample selection is done properly, sample census can give an estimate of actual numbers for the whole area within reasonable limits of error.

1.3 Population estimate – The numerical approximation of the true population size as calculated from the sample census data is known as 'population estimate'.

2. Methods of Estimating Animal Numbers

(Source: Rajesh Gopal Fundamentals of Wildlife management)

There are various methods of population estimation having their respective norms of application and limitations. It is however essential that a population estimation model relevant to a particular locality is constructed and appropriate statistical techniques are used. Certain census models evolved in countries like U.S.A and Canada cannot be applied as such to Indian situations. The various methods of population estimation can be broadly grouped as follows.

(a) Direct methods (Visual/complete counts) –

- Direct count (total count, herd count)
- Aerial count
- Waterhole, saltlick – count
- Total capture (trapping)
- Beats (drive beat, silent beat)

- Point counts
- Total counts using sample plots
- Territory / spot mapping
- Breeding bird census
- Use of thermal scanners/radar

(b) Indirect Methods (Count of animal signs and evidences)

- Pugmark census
- Nest count
- Counts of dens and burrows
- Pellet group count
- Faecal deposit count
- Kill evidence count
- Call count (auditory count)
- Count of tracks and trails

(c) Population Estimation Methods when all animals are not observed

(Methods based on observation)

- Distance sampling – Line transects, point transects
- Double sampling (complete counts on a sub-sample)
- Multiple observer approaches

(Methods based on capture)

- Capture – mark – recapture methods
- Removal methods

3. Census of Deer

(Source: Rajesh Gopal Fundamentals of Wildlife management)

3.1 Pellet group count method

We discuss here the pellet group count method of deer census, which is an indirect method of population estimation. Every deer defecates a number of times a day as pellets deposited in groups. Each group represents the passage of one animal. The term 'pellet group' is used for the small pellets deposited during a single defecation at one place, irrespective of the quantum of defecation. Presuming that the rate of defecation, on an average, is constant, the population

density of deer can be estimated by finding out their pellet densities and the rates at which they have been deposited.

3.1.1 The method can be applied to animals which use the entire habitat, and are well distributed throughout the area such as spotted deer, sambar and barasingha. The method consists of keeping a sample area clean of all faecal matter and subsequently counting the same after a fixed period of time which is statistically determined. Using the data the population of deer is calculated as explained below.

(a) **Determination of defecation rate** – The objective is to find how many pellet groups, on an average, an animal defecates in a day. In a given habitat, the defecation rate of a given species is assumed to be constant. For example, if 25 groups of pellets are deposited by an animal in 5 days, the defecation rate is 5 groups per day. *For Indian conditions, the defecation rate can be assumed as 15; according to some observations made on the spotted deer in the Kanha National Park of Madhya Pradesh, the rate was found to be 15.4. (Rajesh Gopal Fundamentals of Wildlife management)*

(b) Calculation of Deer days –

$$\textit{Deer days} = \frac{\qquad\qquad}{\qquad\qquad}$$

(c) Total Deer Population

The total deer population (P) is given by the following equation

$$P = \frac{\qquad\qquad}{\qquad\qquad}$$

The number of deer days is calculated from the relation given in (b) above and the number of days of census means the period of time during which the area was left undisturbed for the purpose of pellet deposition after the initial clearing.

The deer population P can also be expressed by the following equation:

$$P = \frac{\qquad\qquad}{\qquad\qquad}$$

Thus by clearing old pellets from a number of sample plots and, after a fixed number of days, counting the new pellet groups deposited in them, pellet group density can be

found. An estimate of population density can then be calculated from pellet group density with the help of above formula.

3.1.2 In habitats which are prone to biotic disturbances, deer pellets may be confused with those of goats. In such areas it is essential that deer pellets are identified accurately.

3.1.3 Recommendations on the plot size and shape have differed. Some of the recommendations are –

- Plot size of 100 sq.ft
- Circular plots of $1/50^{th}$ acre
- Rectangular $1/50^{th}$ acre plot, 12 by 72.6 ft, divided into half longitudinally.

3.1.4 The pellet group count method is not suitable for areas having dense, tall ground cover, because locating pellet group is difficult in such sites. It is again not advisable to clear ground vegetation to facilitate pellet visibility, as it may bring considerable bias to the results by attracting or repelling certain animals to or from the plot. The method is also not suitable in extremely warm and humid climate where pellets undergo rapid decomposition, and thus days of census (time interval between initial clearing and counting)) get shortened.

Reference material

(1) Rajesh Gopal Fundamentals of Wildlife management

(2) Census the Deer Initiative at http://www.thedeerinitiative.co.uk/uploads/guides/104.pdf

(3) DOCDM-323171 Animal pests: faecal pellet counts v1.0 at http://www.doc.govt.nz/Documents/science-and-technical/inventory-monitoring/im-toolbox-animal-pests-faecal-pellet-counts.pdf

Wildlife Management

Lesson 15

Time 1 hour

Lesson Plan

To study

- **Census of wild animals**
  - Census of Tiger
    - Census process
  - Tiger status 2014
  - Population Status of some wild animals

- **Backward Linkage** – Lesson 14
- **Forward Linkage** – To know about animal census during tour.
- **Training material required** – copy of Lesson 15 to be circulated beforehand;
- **Allocation of time**

- **Census of wild animals**
  - Census of Tiger 12 mts
    - Census process
  - Tiger status 2014 13 mts
  - Population Status of some wild animals 25 mts

- **Discussion/Miscellaneous** 10 mts

Census of Wild Animals
Lesson 15

1. Tiger Census

The old methodology of estimating the tiger population in the country using pugmarks has been replaced by a **refined methodology**. In this methodology census is done through double sampling based on determining spatial occupancy of tigers throughout potential tiger forests and sampling such forests using camera traps in a statistical framework.

1.1 Salient features of census process

(Source: Rajesh Gopal Fundamentals of Wildlife Management)

The salient features of the process are as follows.

(1) Estimation of tiger densities using camera traps at several sites;
(2) Estimation of encounter rate for signs (number of tiger tracks, scats, seen per unit distance walked, besides other covariates on prey, forest types etc.) at the same sites.
(3) Using a regression model to build a relationship between sl no (1) and (2).
(4) Applying the relationship to larger landscapes where only data at sl no (2) has been collected at the Beat level by field personnel.
(5) Arriving at the tiger numbers for larger landscapes and subsequently at the country level.

1.1.1 The methodology basically amounts to assessment of tiger abundance from their signs. It has been found that the indices of abundance provide a cost-effective and rapid method to estimate tiger population across larger landscapes. However, the use of indices has been controversial owing to their potential to be biased. The methodology uses double sampling to estimate two indices of tiger abundance (encounters of pugmarks and scats per km searched), and calibrates those indices against contemporaneous estimates of tiger densities obtained using camera-trap mark-recapture(CTMR).

2. Tiger Status 2014:

(Source: Status of Tigers in India 2014, National Tiger Conservation Authority, New Delhi and the Wildlife Institute of India Dehradun;
http://www.wii.gov.in/images//images/documents/Tiger_Status_2014.pdf)

2.1 National Tiger Conservation Authority (NTCA) in collaboration with State Forest Departments, National Conservation NGOs and the Wildlife Institute of India(WII) conducts a national assessment for the "Status of tigers, Co-predators, Prey and their Habitat" every four years.

2.2 The **report** titled **'Status of Tigers in India 2014"** issued by the NTCA and WII gives a country level assessment of tiger in 2014 using the refined methodology. Some salient points of the Report are mentioned below.

Method: The countrywide assessment of tiger status uses a double sampling approach to estimate the distribution and abundance of tigers in India. The first component of the double sampling consists of ground surveys (Phase 1) of all potential tiger occupied forests in 18 states wherein the ground survey data is collected by the State Forest Department personnel:

1) Trail surveys for occupancy of habitat patches by tigers and other predators
2) Line transects to estimate prey abundance
3) Sampling plots on the line transects to assess
    a) habitat characteristics
    b) human impacts and
    c) prey dung density

and from recent remotely sensed data (Phase 2) following variables

a) landscape characteristics,
b) human "foot-print", and
c) habitat attributes

were used to model tiger abundance and occupancy.

The second component (Phase 3 & 4) of the double sampling consists of scientifically rigorous abundance estimation in select sampling units using a) remote camera trap based capture-recapture technique for estimating tiger and other carnivore abundance, b) line transect based Distance sampling for estimating prey abundance, and c) camera trap based habitat covariates and vegetation quantification on plots at each transect. This sampling was done by the trained State Forest Department personnel, competent National Non-Government Organizations and the Wildlife Institute of India.

Results:

Population estimated in 2014

- The **countrywide population** (of age greater than 1.5 years) in 2014 was estimated to be 2226. (1945-2491).
- Population in **Northern West Bengal** was reported as **3** (from camera trap data and scat DNA). **Two tigers** were identified in **Buxa** on the basis of scat based DNA. The research team has found no tiger sign in Buxa. The Buxa tiger population is declining and needs special attention.
- Tiger populations in the **Sundarbans** has remained stable and estimated to be about **76** (62-96) tigers. The report mentions population in **2010 as 70** (64-90)

(Source: Status of Tigers in India 2014, National Tiger Conservation Authority, New Delhi and the Wildlife Institute of India Dehradun;
http://www.wii.gov.in/images//images/documents/Tiger_Status_2014.pdf)

- **It may be noted** in this connection that the tiger population figure in Buxa (2011) and Sundarban (2012 and 2013) is reported in the Annual Report 2013-14 of Wildlife Directorate WB as follows.

Buxa (2011)
20 during 2011 (as per Scat analysis through DNA fingerprinting technique) by CCMB-Hyderabad, Aranyak, Assam & BTR authority)

Sundarbans (2012 & 2013)
Tiger estimation by camera trapping In STR - 80 (minimum) during 2013 (conducted by WWF and Wildlife Institute of India) In 24-Parganas (South) - 22 (minimum) during 2012 (conducted by WWF) **Total Sundarbans – 102 (Minimum)**

3. Population Status of some animals in West Bengal
(Source: Annual Report 2013-14, Wildlife Directorate, WB)

Leopard

Year	Gorumara	Buxa	Jaldapara	Mahananda	Other areas	Total
1984	14	8	7	12	41	**82**
1989	14	50	5	10	29	**108**
1992	-	63	-	-	-	**-**
1993	2	-	9	2	94	**107**
2002	47	149	33	18	84	**331**
2004	43	Not done	28	26	67	**164**
2012		105 (BTR-West)				

Gaur

Year	Total Number
1989	240
1993	425
1997	550
1998	530-560
2002	1180-1284
2009-10	Not less than 901 (Gorumara NP & Chapramari WLS only)
2012-13	414 BTR(W)
2013-14	782 BTR(W)

Crocodile (Salt water crocodile)

STR & 24-Parganas (South) Division

Year	Indirect sighting	Direct sighting			
		Adult	Juvenile	Hatchling	Total
2012	99	69	61	10	140

Elephant

Year	Total Number
1989	175
1993	186
1997	230-250
1998	230-250
2002	327
2002	328*
2005	N.B.300-350 + S.B.96
2007	N.B.300-350 + S.B.25 (excluding migratory population)
2010	N.B.529 + S.B. 118

Rhinoceros

Year	Jaldapara	Gorumara	Total
1969	75	12	87
1974	21	6	27
1978	19	8	27
1986	14	8	22
1989	27	12	39
1993	33	12	45
1996	42	14	56
1997	44	14	58
1999	55	19	74
2000	54	19	73
2002	74	22	96
2004	96	25	121
2006	108	27	135
2008		31	
2009	125		
2011	149	35*	184
2012		43*	
2013	186		
2014		50*	

*(Gorumara, Chapramari & adjoining areas of Gorumara NP & Chapramari WLS)

Reference Material:

(1) Rajesh Gopal Fundamentals of Wildlife Management

(2) Status of Tigers in India 2014, National Tiger Conservation Authority, New Delhi and the Wildlife Institute of India Dehradun; http://www.wii.gov.in/images//images/documents/Tiger_Status_2014.pdf

(3) Annual Report 2013-14, Wildlife Directorate, WB