Module 6:
Wildlife Conservation

Forestry Training Institute

Tubmanburg, Liberia

Key Topics

- Fundamentals of Wildlife Conservation
- Animal Behavior
- Population Ecology
- Benefits of Wildlife
- Human Threats to Wildlife
- Diseases and Zoonosis
- Wildlife Conservation Strategies
- Wildlife Management in Liberia
- The Role of Local Communities

Fundamentals of Wildlife Conservation: Definitions

Wildlife includes all free-ranging vertebrates in their naturally associated environments.

Wildlife Conservation is the practice of protecting wildlife species and their habitats. Wildlife provide balance and stability to natural processes and so are a critical part of the world's ecosystems and human survival.

Fundamentals of Wildlife Conservation: Definitions

Wildlife Conservation has four interrelated components:

- **Research** - using science to better understand the requirements of wildlife.
- **Education** - learning and sharing the best means to conserve wildlife and the broader environment.
- **Law Enforcement** - ensuring that all laws related to wildlife are followed.
- **Wildlife Management** - managing wildlife populations and habitats to achieve policy goals.

Fundamentals of Wildlife Conservation

Wildlife conservationists try to manage wildlife population levels with:

- Habitat improvements to increase birth rates and survivorship.
- Eliminating threats such as poaching and invasive species.

In-Class Participatory Exercise

In a group of 2-4 students…

1. Make a list of as many wildlife species as you can in 5 minutes.
   - Each group share 3 examples of wildlife species
2. From your list, choose 3 animals and describe their shapes, sizes, colors and behaviors.
   - e.g., wildlife may have antlers, horns, hooves, claws, beaks, teeth, fur, wool, scales or feathers.

Fundamentals of Wildlife Conservation: Definitions

What is the difference between wildlife and domestic animals?

Taming: Elimination of tendencies to flee from man. Wild animals may be tamed whereas most domesticated animals do not require taming.

Feral animals: Domestic animals can REVERT to a wild state.

In-Class Participatory Exercise

What is the difference between wildlife and domestic animals?

In a group of 2-4 students…

1. List 2-3 examples of wildlife and domestic animals.
2. *How are they different? How are they similar?*

Animal Behavior: Definitions

Animal Behavior: the ways animals interact with each other, with other living beings, and with the environment.

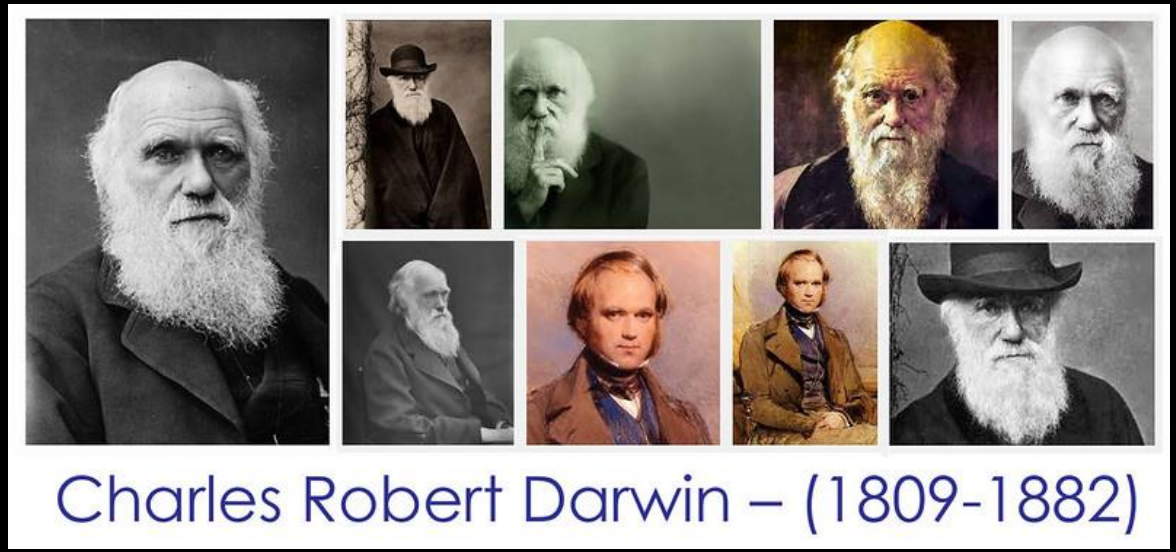
Wildlife scientists study how animals find and defend resources, avoid predators, choose mates, reproduce, and care for their young.

Animal Behavior: Importance to Conservation

- Behavior plays a key role in animal survival and evolution and its variation may allow species to respond to changes in the environment.
- Understanding animal behavior can help limit the impact of humans on the environment.
- Researchers working on endangered species often use behavioral measurements to monitor animals' health.

Animal Behavior: Fitness and Natural Selection

- Animal behavior is shaped by natural selection: many behaviors directly increase an organism's fitness, that is, they help it survive and reproduce.
- What ultimately drives animal behavior is survival. Nature tends to reward the behaviors that best ensure an individual can escape predators or find food, i.e., survival of the fittest.



Animal Behavior: Reproductive Fitness

What Influences Animal Behavior?

- Reproductive success is a powerful force in nature and is the impetus for behaviors that ensure such success.
- In evolutionary terms, a life only matters in so far as the individual reproduces and passes along the genes that code for adaptive physical traits or behaviors.

Animal Behavior: Innate vs. Learned

To understand animal behavior, we study what causes it, how it develops in an individual and a community, how it benefits an organism and the broader population, and how this behavior evolved.

- Some behaviors are innate (genetically hardwired), while others are learned, or developed through experience.
- In many cases, behaviors have both an innate component and a learned component.

What kind of behaviors does a turtle display?

Animal Behavior: Territoriality

Territoriality occurs when individuals (usually males) establish dominance over a particular region and, oftentimes, the females of that region. They defend their territories from other males, violently when necessary, to ensure that they have exclusive access to resources and mating rights.

Male bighorn sheep clash heads in battle over rights to harems of females.

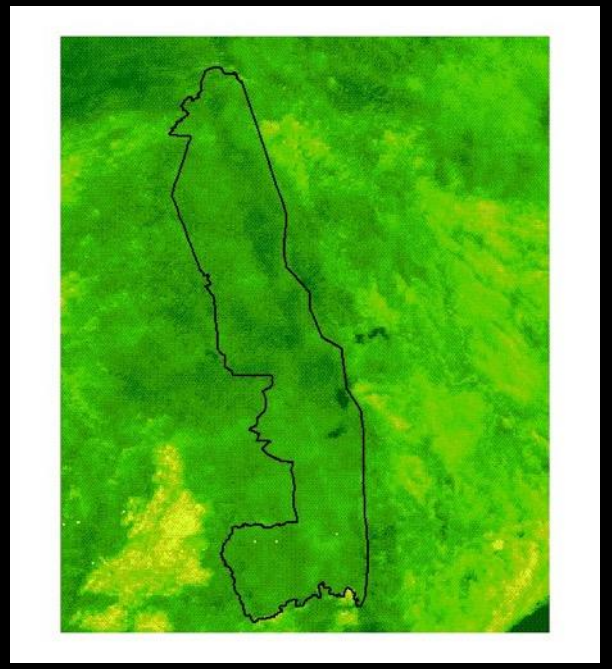
Animal Behavior: Territoriality

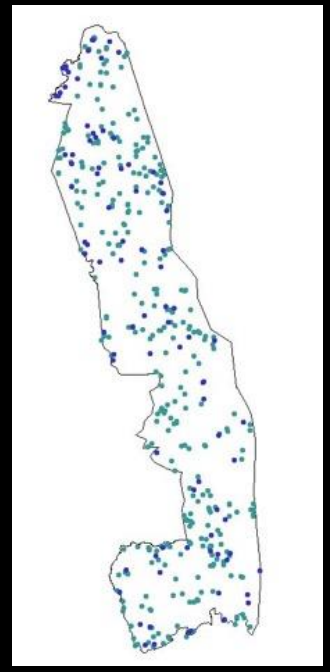
Territoriality occurs when individuals (usually males) establish dominance over a particular region and, oftentimes, the females of that region. They defend their territories from other males, violently when necessary, to ensure that they have exclusive access to resources and mating rights.

Males clash heads in a territorial battle over the rights to females.

Animal Behavior: Ranges

Home range is the area in which an animal lives. Home range size is related to habitat quality. Daily movements include those for normal day-to-day activities. In higher-quality habitat, home ranges tend to be smaller than in poor habitat, because movements necessary to meet life requirements are reduced. the spatial distribution and qualities of resources that structure animal behavior.

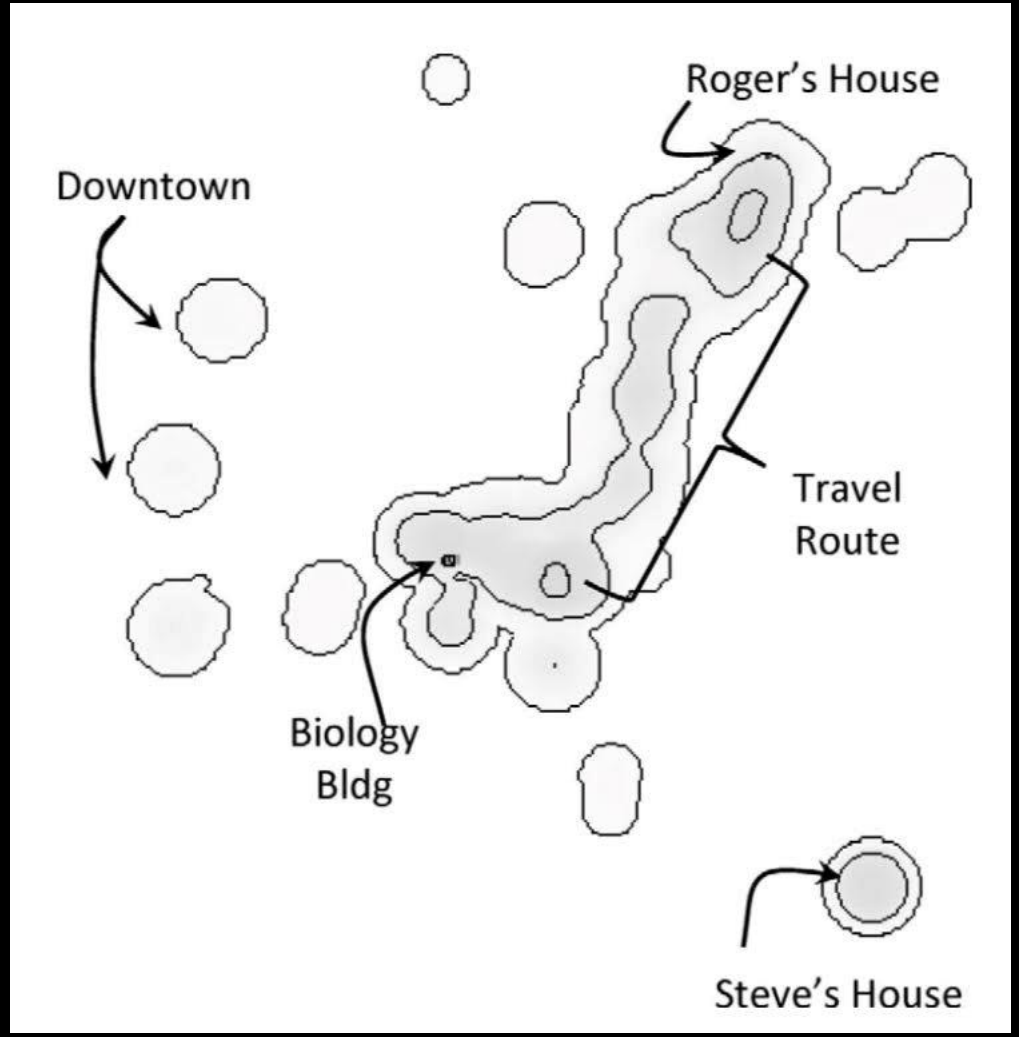




Animal Behavior: Ranges

To describe the size and dimensions of home ranges, researchers must collect data on habitat, resources, and other attributes of the landscape. Home range data helps us understand the basic behaviors of animals and how animals may view their environment.

A seasonal home range is the area an animal uses in a particular season of the year.



READING

Newing, “Behavioral ecology of duikers, Cote d'Ivoire”

Animal Behavior: Migration

A seasonal movement, or migration, is made when an animal moves from one seasonal home range to another. Migration may represent movements to and from wintering and nesting areas, such as waterfowl and songbirds.

Animal Behavior: Migration

Migration distances may be short or very long, depending on the species. Long migrations for some species require habitat along the route to stop, rest and eat. This means habitat conditions might have to be considered among counties, countries, or even continents.

Animal Behavior

Practicum: Animal Behaviour

In small groups, record some wildlife behaviour you observe. Use these observations to highlight a few of the behaviours discussed and how this affects the animal population observed

Benefits of Wildlife

All ecosystems are interdependent, so the deterioration or extinction of one species damages the ecosystem as a whole.

Wildlife are an essential component of various food webs, chemical cycles, and energy flows at various trophic levels.

Wildlife are critical elements in the complex web of mutualistic relationships that help maintain the diversity of tropical forests.

Benefits of Wildlife

Wildlife influence forest ecosystems in many ways, including:

- Herbivory
- Predation
- Seed Germination & Dispersal
- Habitat Engineering

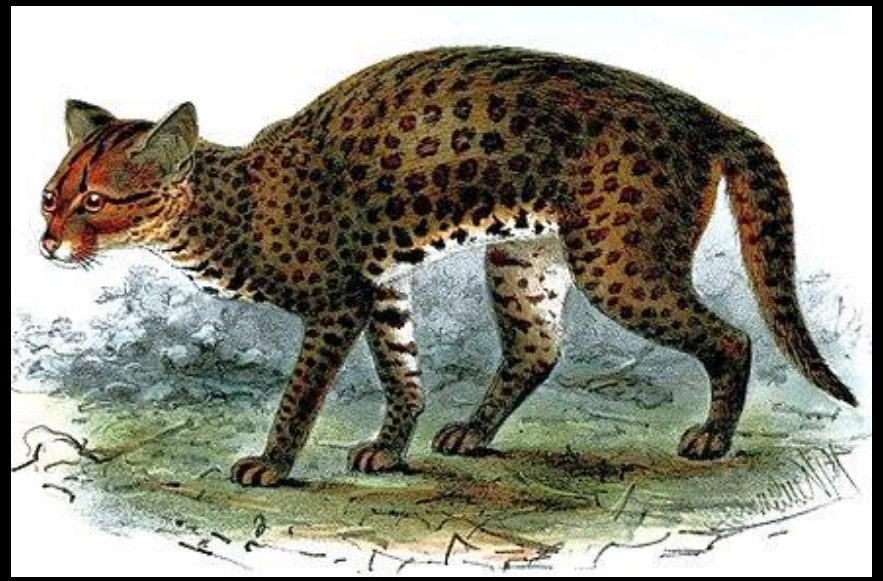
Benefits of Wildlife: Herbivory

Herbivory - grazing and browsing animals influence the structure and composition of vegetation, while heavy and hoofed animals locally compact and break up soils, thereby helping to break up organic matter and influencing erosion.

Benefits of Wildlife: Predation

Predation on potential animal pest species. Predators large and small can check outbreaks of pest species.

Liberian Mongoose (*Liberiictis kuhni*)



African golden cat (*Caracal aurata*)

Benefits of Wildlife: Pollination

Commercial crops such as coffee (Coffea canephora) benefit from pollinator species, which in turn depend on the preservation of natural forests and forest fragments in the vicinity of those coffee agroforestry systems

Benefits of Wildlife: Germination

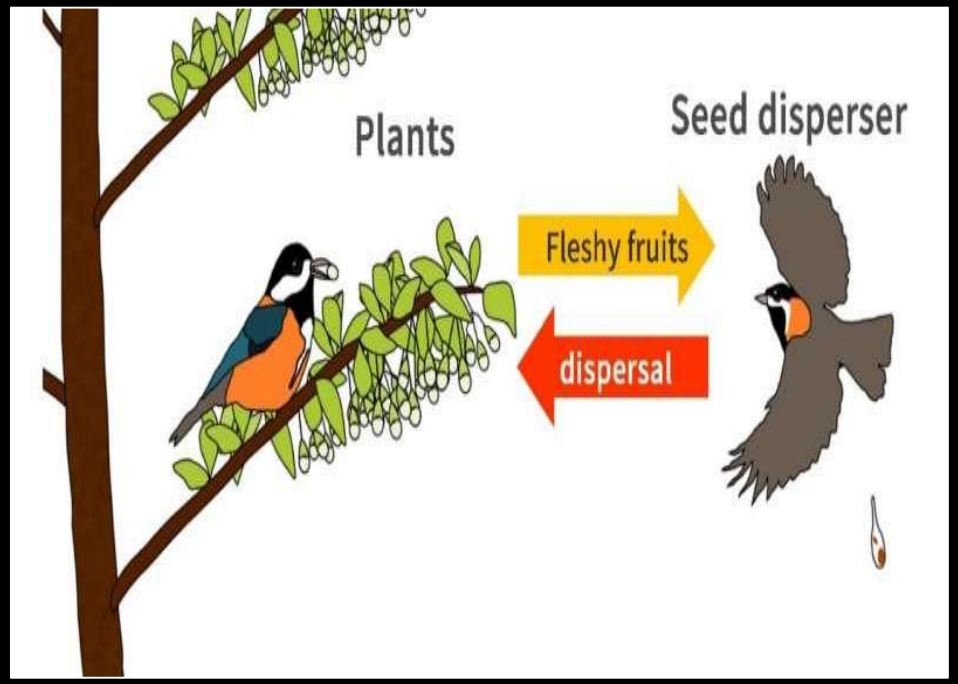
Seed germination - the seeds of certain plant species benefit from passing through the digestive tract of a mammal or bird in order to germinate or to increase ultimate viability. Furthermore, animals bury seeds, or turn them up.

At least 450 economic products including timber, fruits, fuelwood, fiber, medicines, tannins and dyes, are derived from plants for which fruit bats are pollinators.

Benefits of Wildlife: Seed Dispersal

Seed dispersal is one of the most important roles of mammals and birds in tropical forests.

- Many mammals and birds consume fruits or their parts.
- Many plants rely upon vertebrates as seed dispersers or pollinators.
- Such services by vertebrates regulate the recruitment of trees by selectively predating and/or dispersing seeds.



Benefits of Wildlife: Habitat Engineering

Habitat engineering - animals excavate holes, create pools and wallows, turn and aerate soil and litter, and help process and break down organic matter.

OUT OF CLASS EXERCISE

In small groups, walk the FTI campus and identify some of the benefits of wildlife that you can observe.

Habitat Quality: Definitions

Habitat represents the physical and biological resources (food, cover, water, space) required by a particular wildlife species for survival and reproduction. Habitat requirements are species specific, ie.e., not all species require the same resources in the same amount or distribution.

Habitat Quality: Definitions

Habitat quality incorporates factors such as soil, topography, climate, precipitation, and more. The productivity of a given site will vary according to the specific combination of site factors. Sites that produce high amounts of biomass, will generally support more wildlife species with larger populations than poor quality sites.

Habitat Quality: Definitions

Every species has a minimum space requirement. Space is needed to obtain life's necessities. A large predator, such as a leopard, needs more space in which to meet its needs than a lizard.

Habitat Quality: Habitat Requirements

Food and water are obvious needs of every living thing. During the course of a year, availability and quality of food and water can change dramatically. Wildlife, not just birds, will often migrate to avoid lean times.

Habitat Quality: Habitat Requirements

Shelter serves a variety of purposes, for instance …

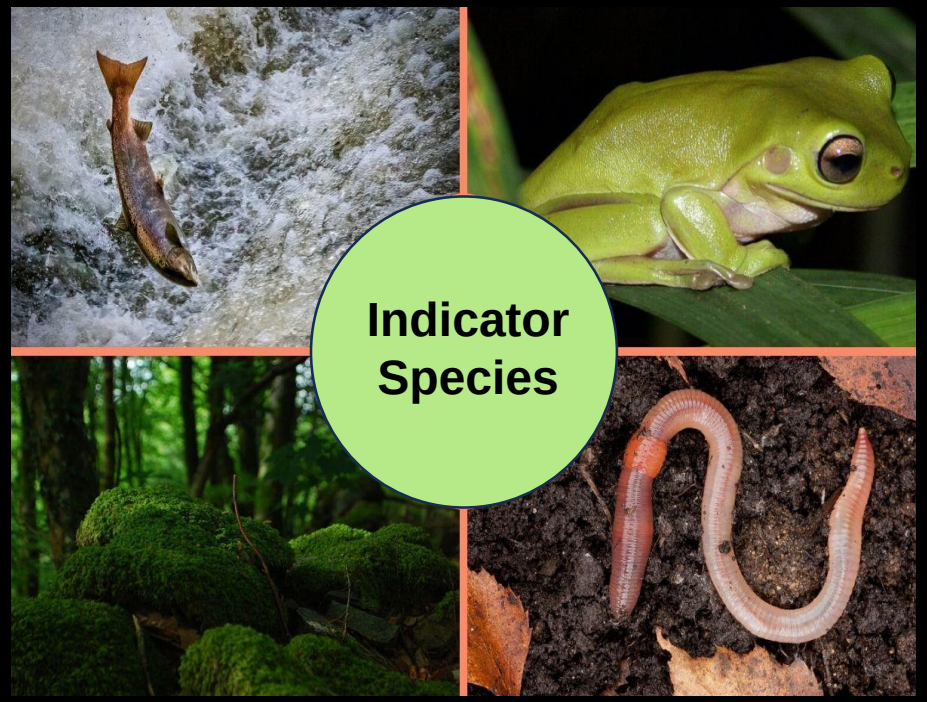
- Protection against adverse weather
- Place to escape predators.
- Home area for rearing young and roosting or loafing.

Habitat Quality: Habitat Requirements

A species that is flexible in its habitat adaptability is sometimes called a generalist. A species with a rather narrow and specific range of requirements may experience severe population fluctuations with changes in the environment is referred to as a specialist.

Habitat Quality: Habitat Requirements

Species that are very sensitive to certain environmental changes are sometimes used as indicator species. These species alert wildlife managers to subtle environmental conditions and changes that would otherwise be difficult to measure or assess. For instance, the presence and abundance of invertebrate larvae in streams will tell us much about the conditions in that stream and the adjacent upland habitat.



Habitat Quality: Interspersion

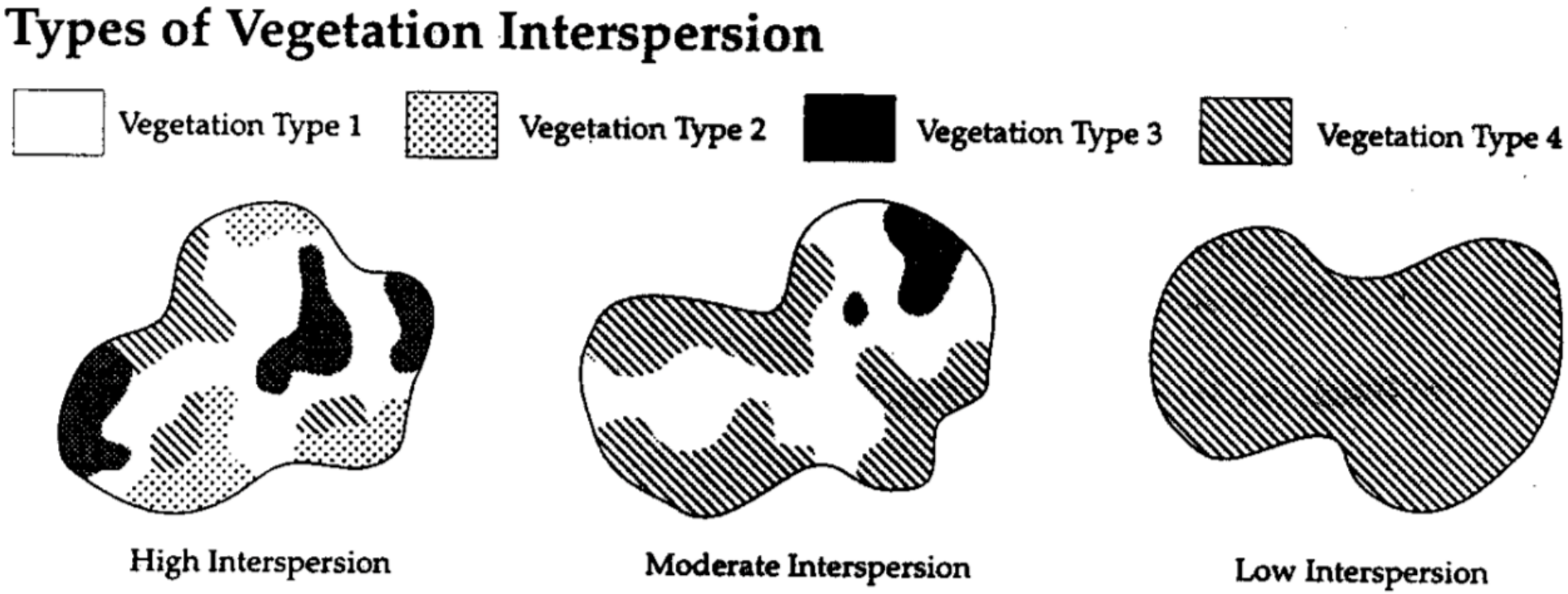
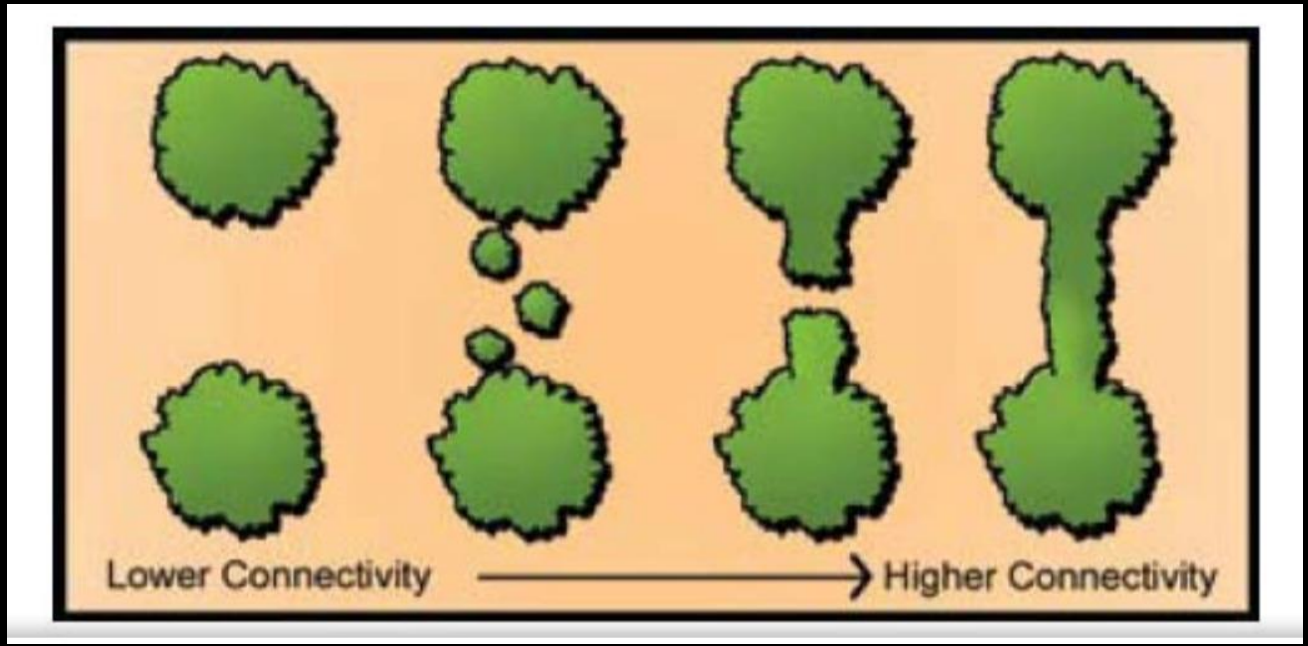


Figure 16. The degree of interspersion or "mixing" of habitat types can be important for some species.

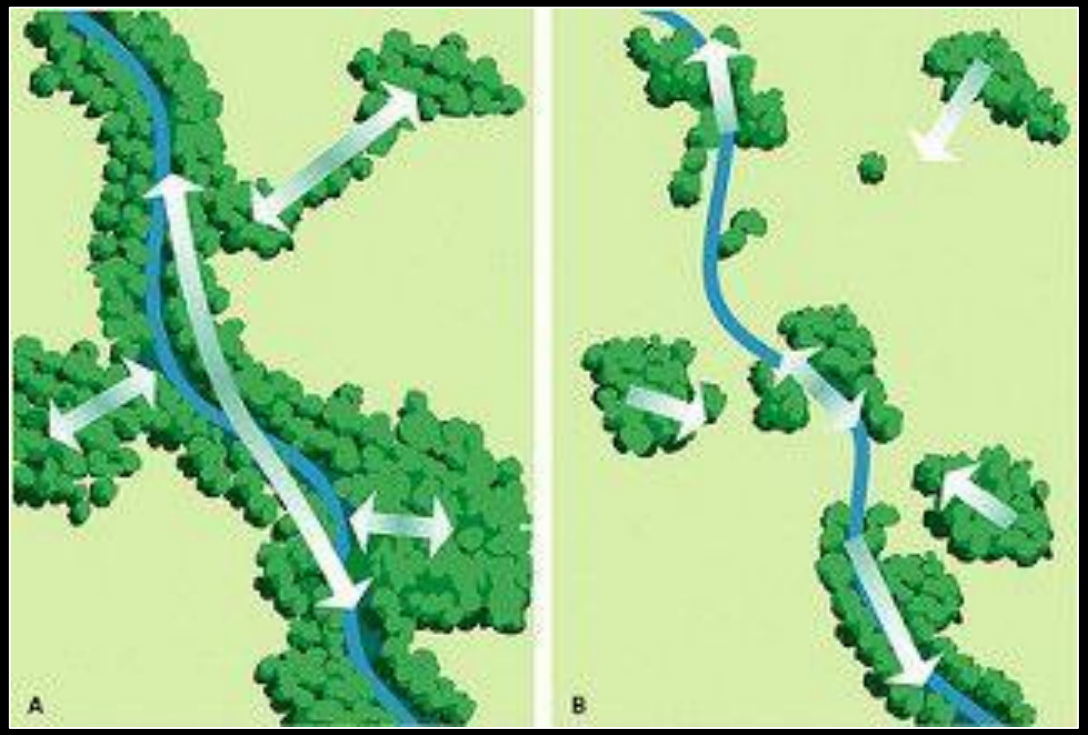
Habitat Quality: Corridors

Corridors are of continuous habitat that permit animals to travel securely from one habitat to another. The type of vegetation within and the size (both width and length) of the corridor varies depending on the animal.



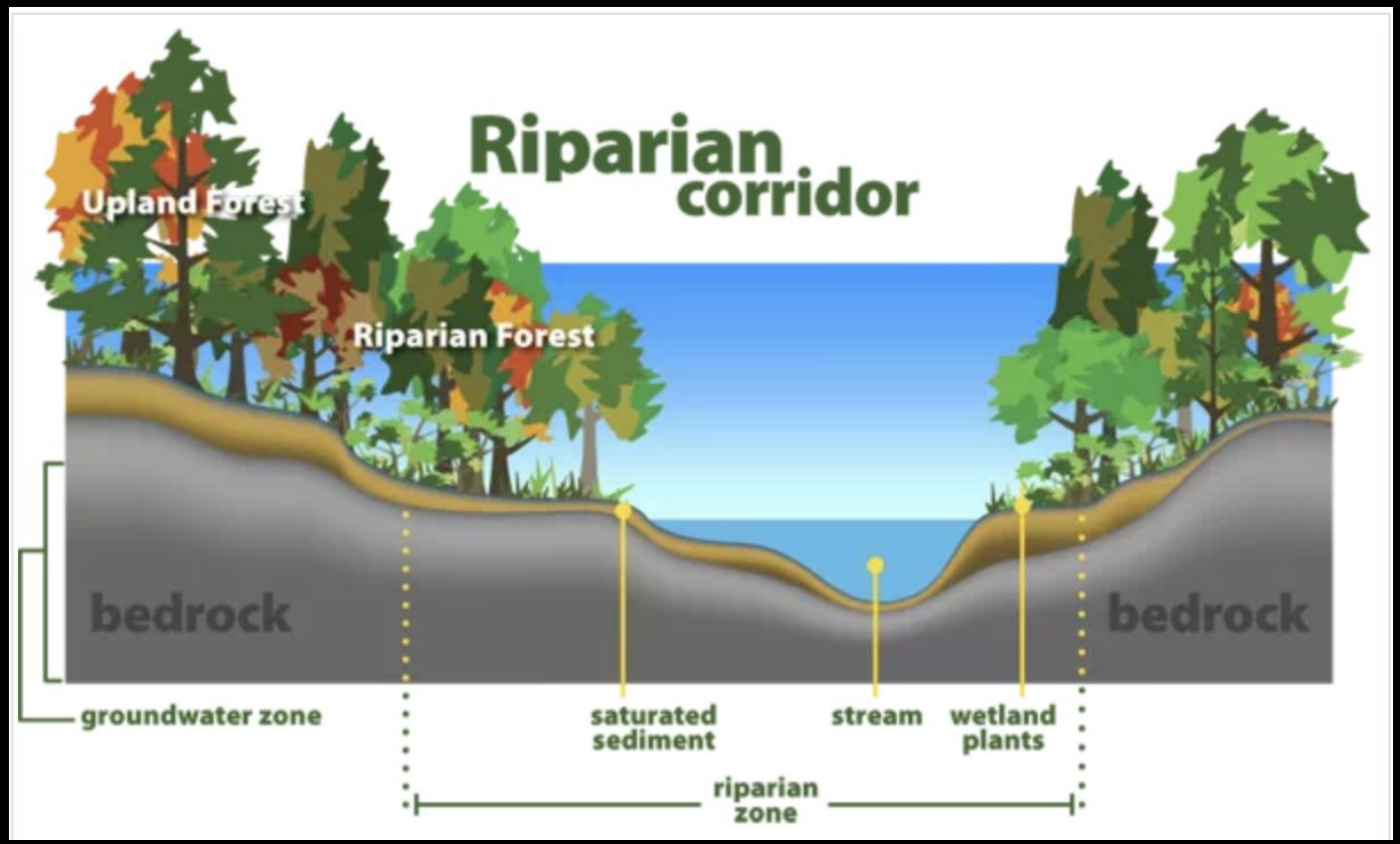
Habitat Quality: Corridors

An example of a corridor might include a stream with trees and shrubs along both sides (the riparian zone). The wooded, riparian corridor facilitates movement for species that require the security of wooded cover to cross a broad open area.



Habitat Quality: Corridors

A corridor allows various wildlife species to travel through areas of otherwise unsuitable habitat. In exposed or open areas, riparian areas can act as corridors for wildlife.



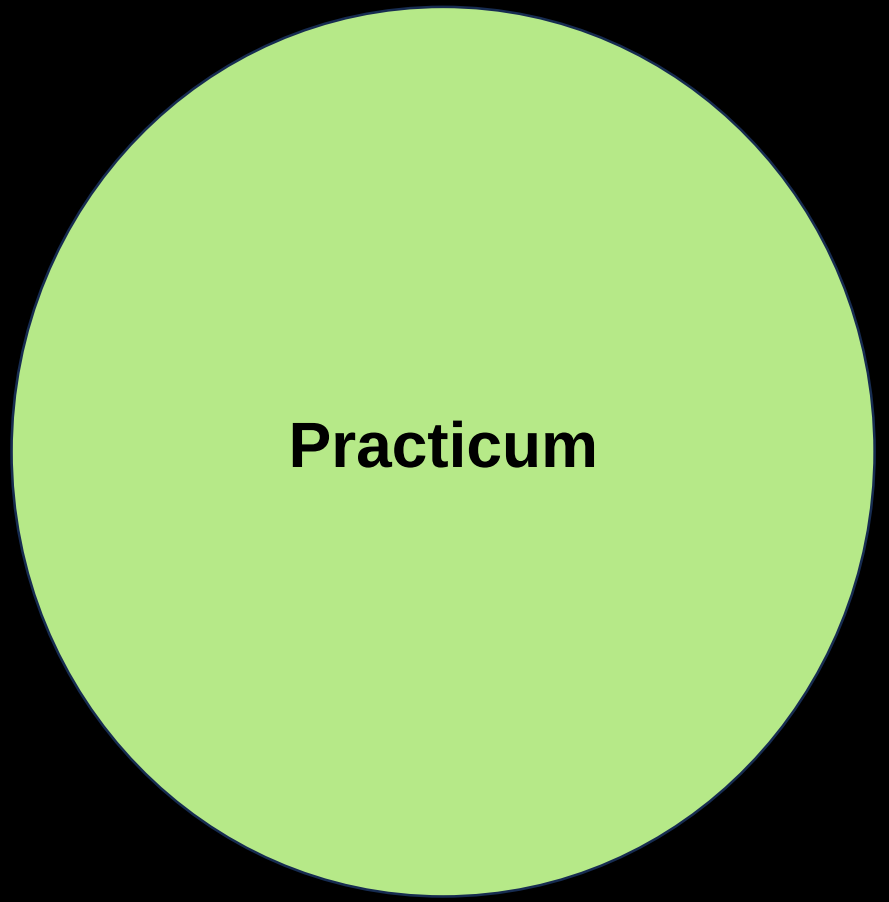
Habitat Quality: Habitat Fragmentation

Habitat Fragmentation may occur from road construction, urban development, timber harvesting, clearing for agriculture, natural disturbances, charcoal production, etc. When landscape becomes fragmented, smaller islands of vegetation suitable for wildlife remain.

Habitat Quality

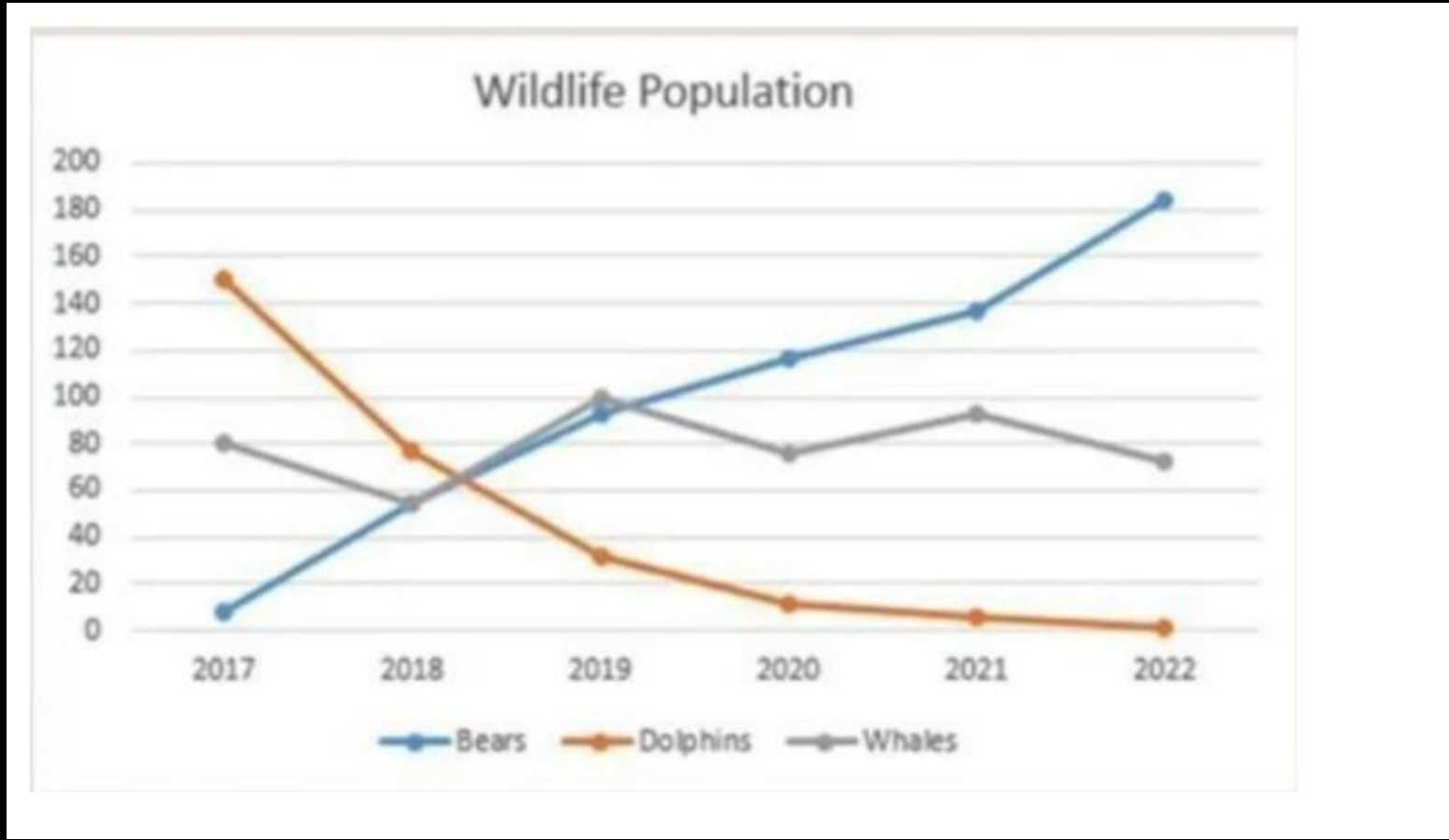
Practicum: Habitat Assessment

You will use wildlife habitat requirements to assess potential animal habitat based on available information about the various habitats on FTI campus



Wildlife Populations

Population is the number of individuals in a given area. That number is constantly changing because of new births, deaths, individuals leaving the area and individuals moving into the area.



Population Ecology

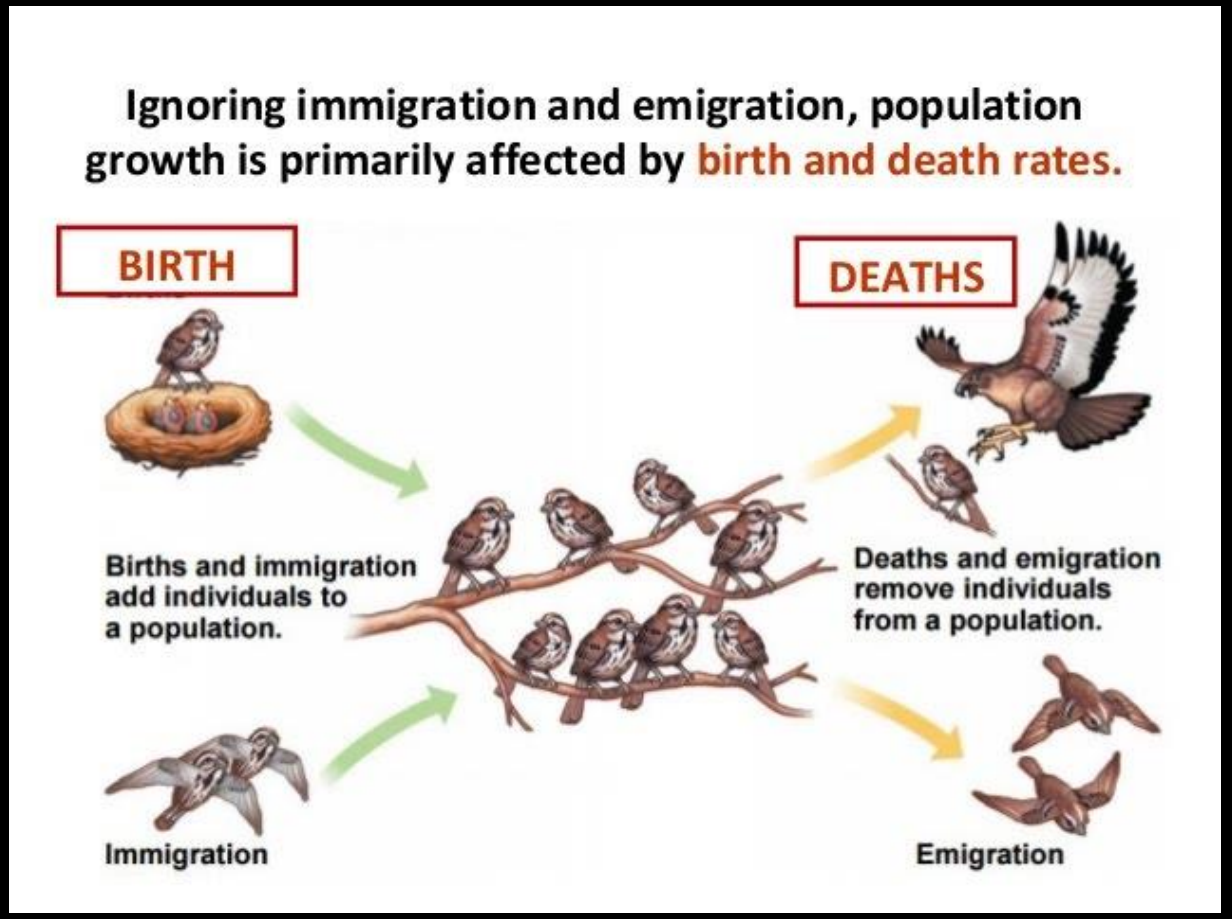
Population ecology is the study of populations in relation to their environment and its influences on density and distribution, age structure, and population size.

Population Ecology

- Density is the population – the # of individuals – in a given area.
- Immigration is the influx of new individuals from other areas.
- Emigration is the movement of individuals out of a population.

Population Growth

Change in population size = Births + Immigrants – Deaths – Emigrants



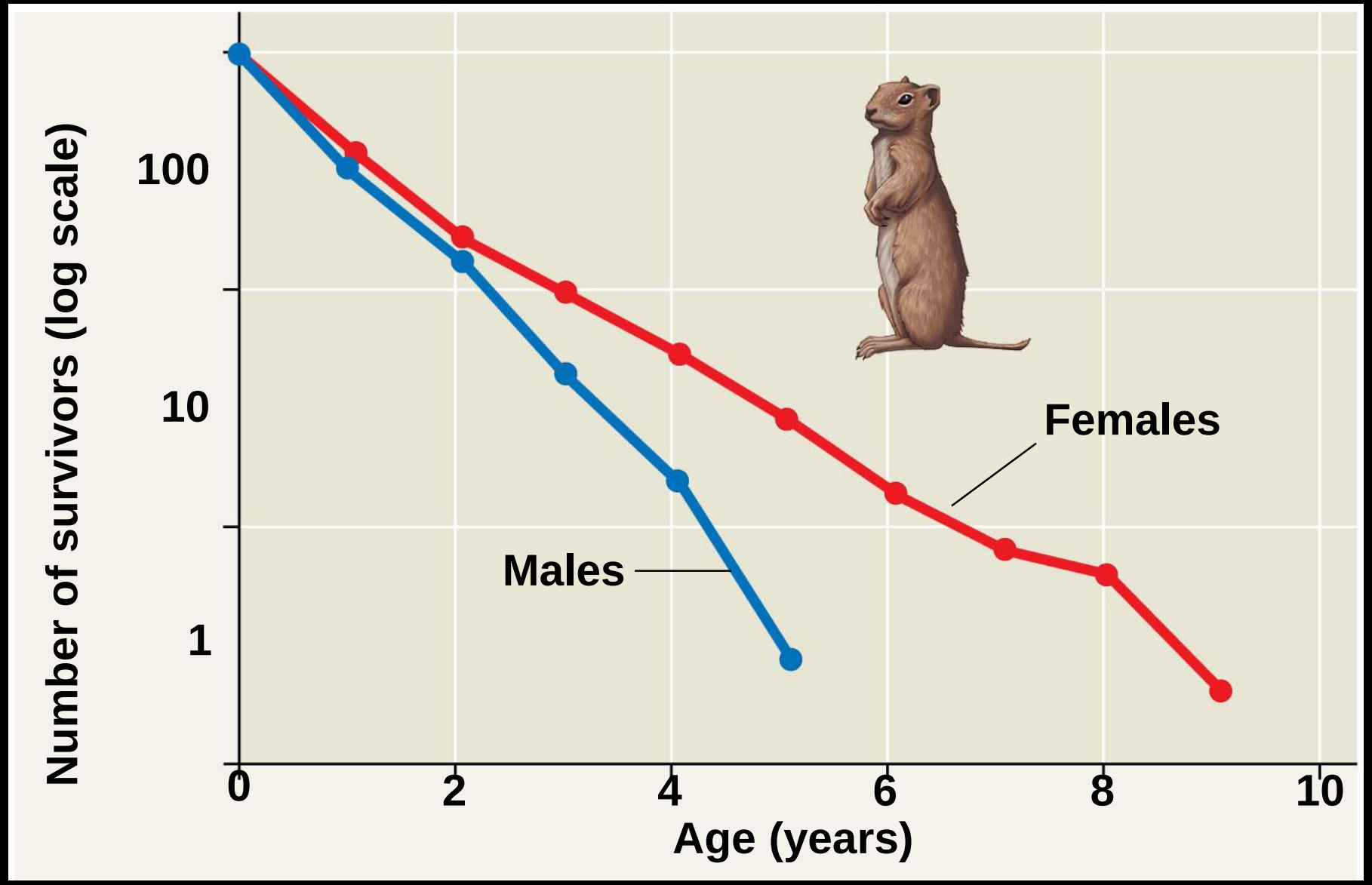
Fundamentals of Wildlife Conservation: Populations

Table 53.1 Life Table for Belding's Ground Squirrels

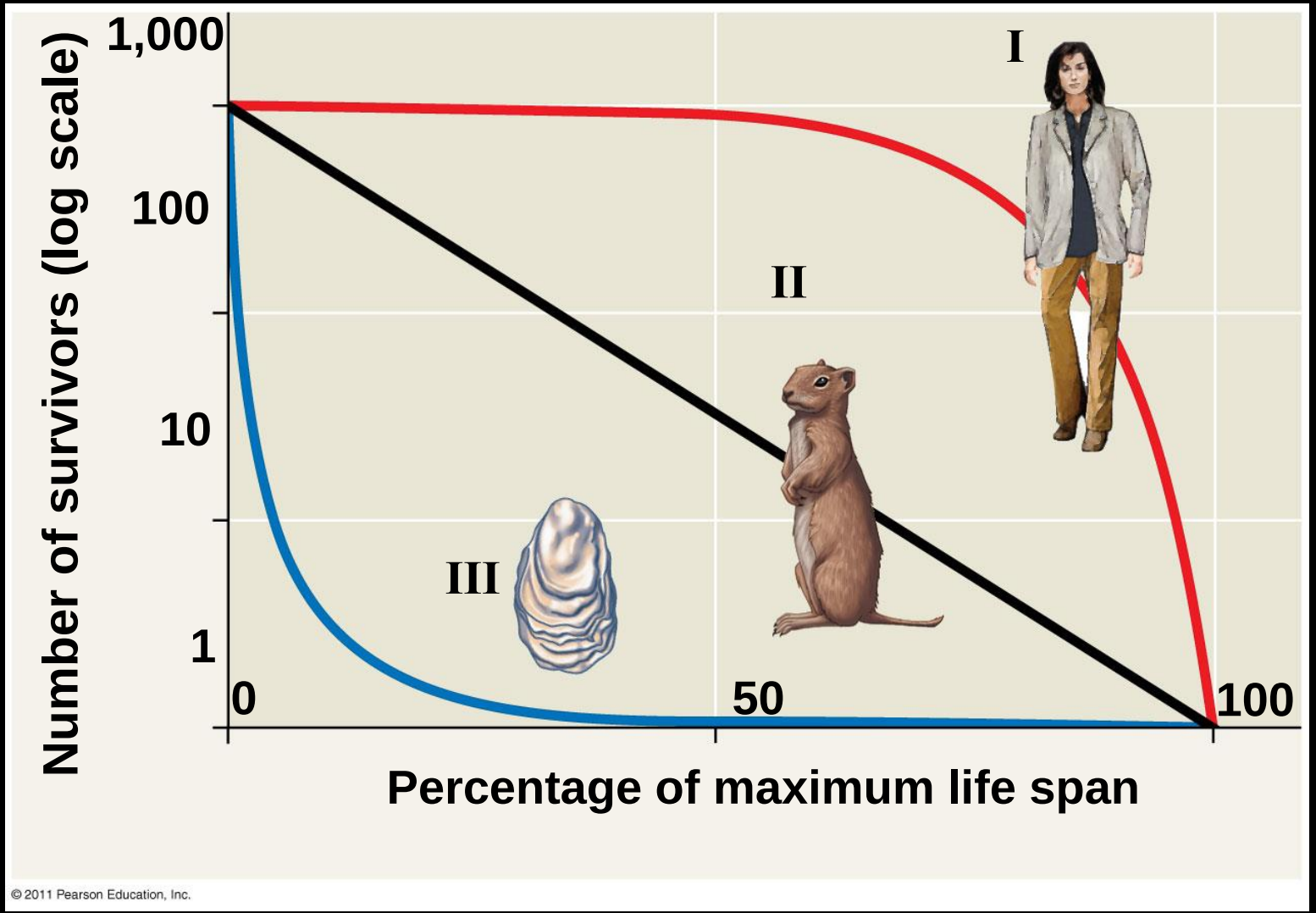
Age (years)	FEMALES				
	Number Alive at Start of Year	Proportion Alive at Start of Year	Number of Deaths During Year	Death Rate†	Average Additional Life Expectancy (years)
0–1	337	1.000	207	0.61	1.33
1–2	252‡	0.386	125	0.50	1.56
2–3	127	0.197	60	0.47	1.60
3–4	67	0.106	32	0.48	1.59
4–5	35	0.054	16	0.46	1.59
5–6	19	0.029	10	0.53	1.50
6–7	9	0.014	4	0.44	1.61
7–8	5	0.008	1	0.20	1.50
8–9	4	0.006	3	0.75	0.75
9–10	1	0.002	1	1.00	0.50

- A life table is an age-specific summary of the survival pattern of a population.
- It is best made by following the fate of a cohort, a group of individuals of the same age.
- Life tables reveal important aspects about wildlife populations.
  - e.g., life tables provide data on the proportions of males and females alive at each age

- A survivorship curve is a graphic way of representing the data in a life table
- The survivorship curve for Belding's ground squirrels shows a relatively constant death rate



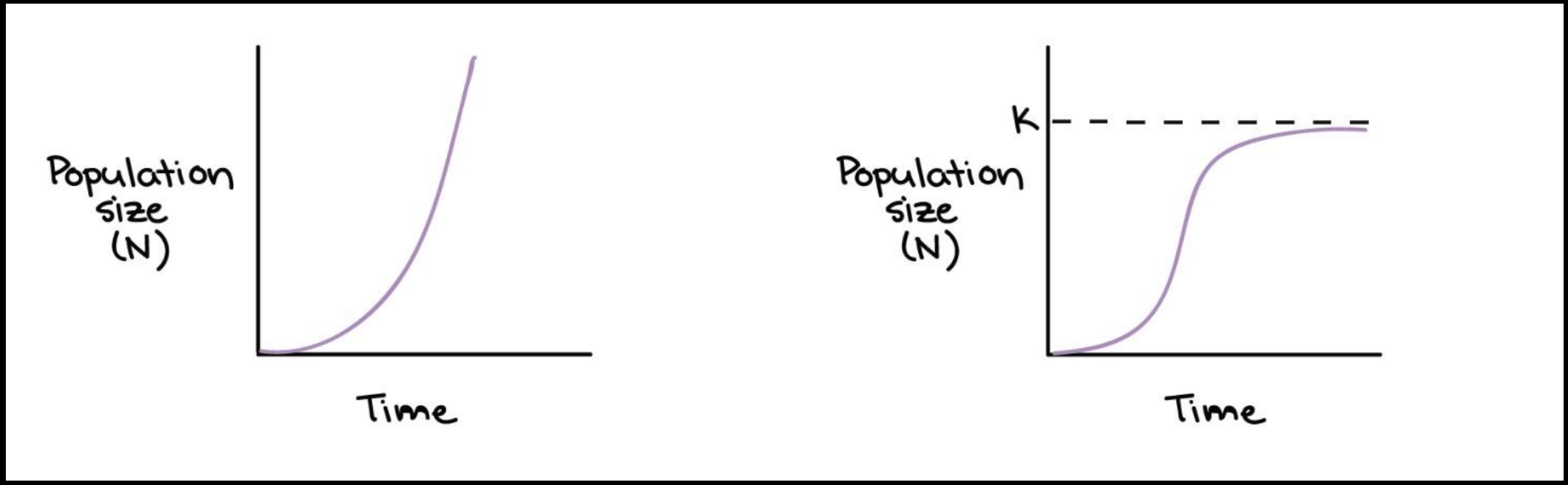
- Large-bodied animals which produce a few offspring often once a year or less often (e.g. humans, whales, elephants, pygmy hippos) have a k-selected growth curve.
- Smaller animals which produce many offspring, several times a year (e.g. clams, mice, Monrovia Doctorfish, flies) have a r-selected growth curve.

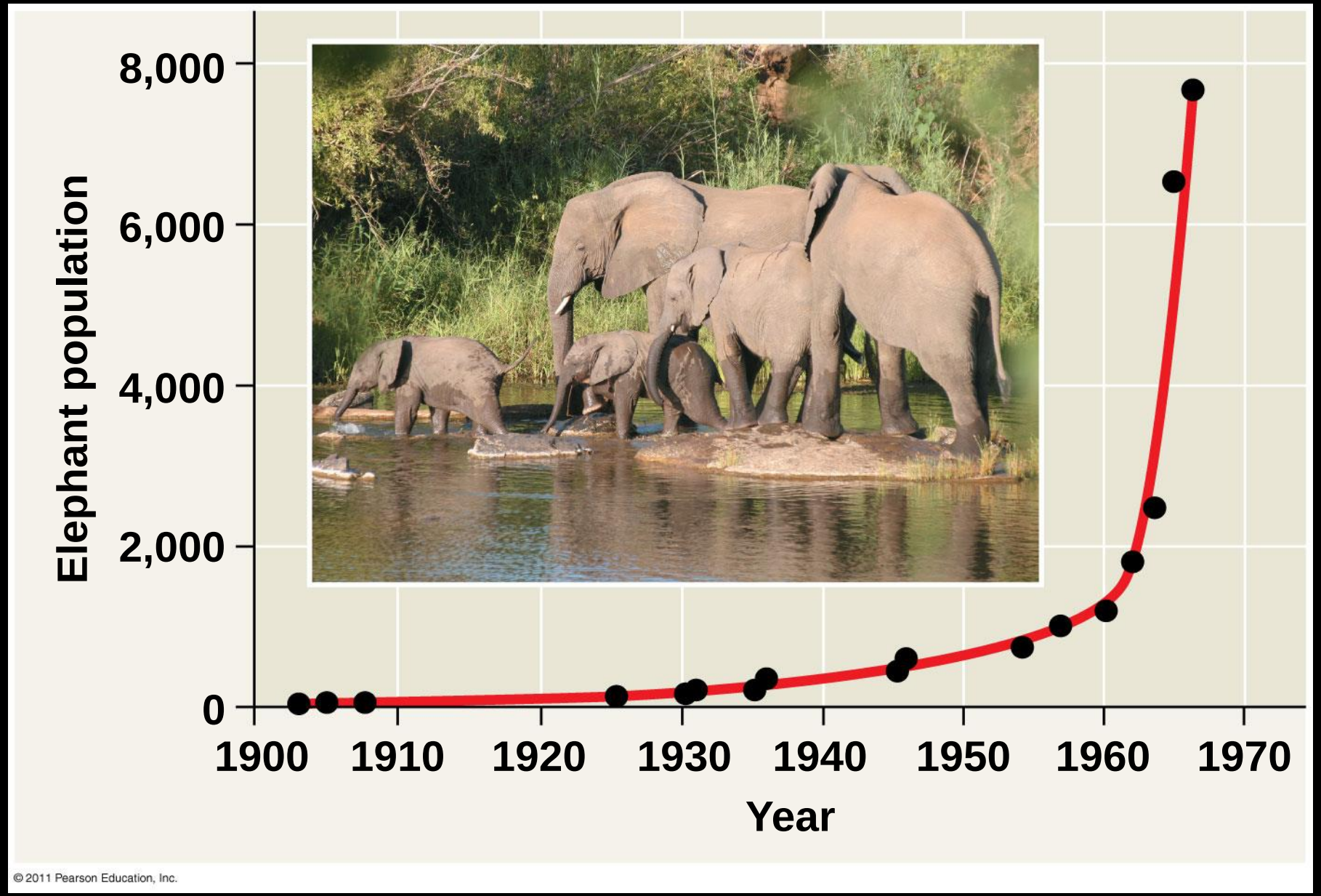


Population Growth

Exponential growth cannot be sustained for long in any population

Logistic growth describes how a population grows more slowly as it nears its carrying capacity



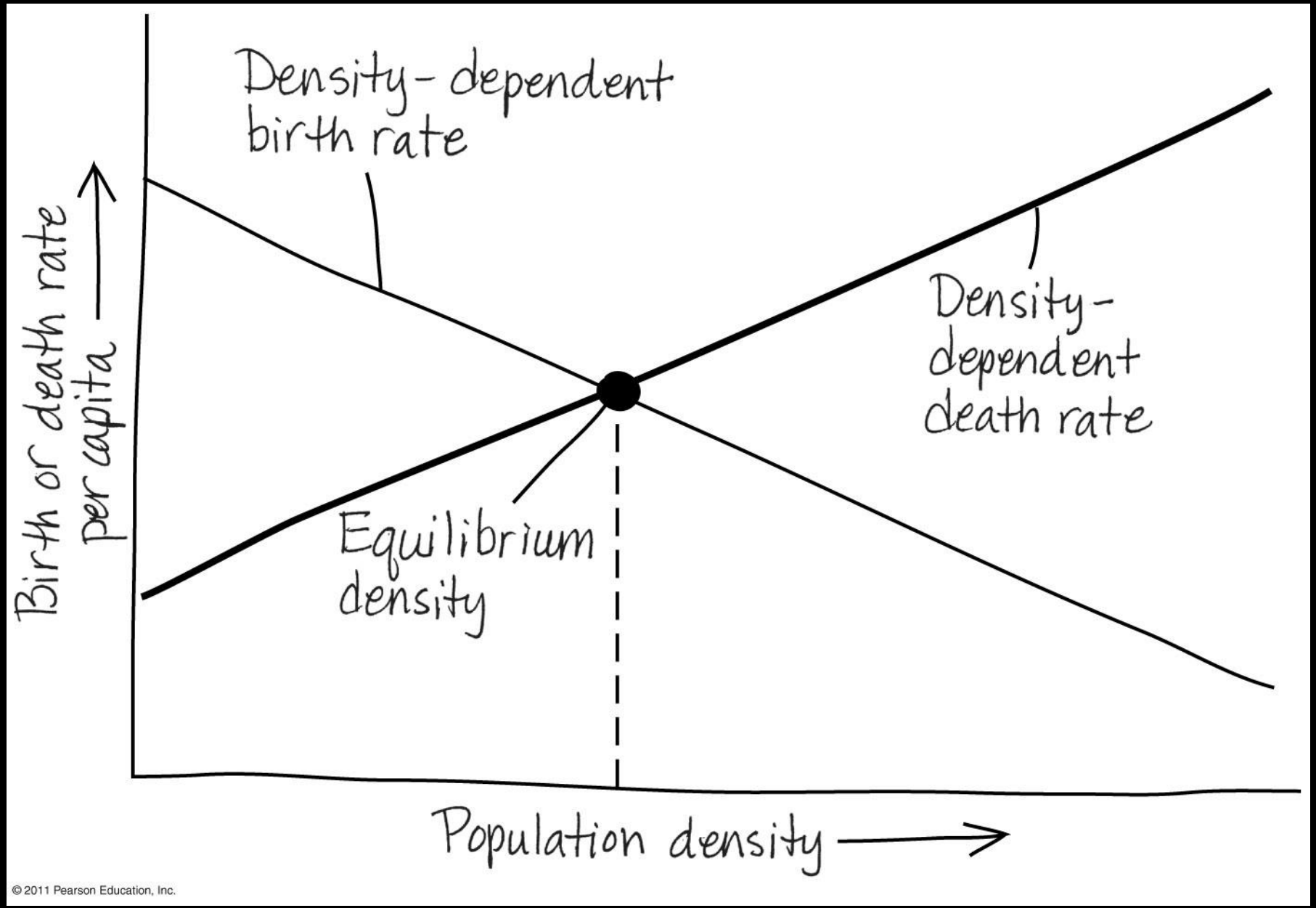


Life history traits are products of natural selection

- An organism's life history are the stages that affect its reproduction and survival.
  - The age at which reproduction begins
  - How often the organism reproduces
  - How many offspring are produced during each reproductive cycle
- Life history traits are evolutionary outcomes reflected in the development, physiology, and behavior of an organism.

Population Change and Population Density

- *K*-selection, or density-dependent selection, selects for life history traits that are sensitive to population density
- *r*-selection, or density-independent selection, selects for life history traits that maximize reproduction
- The concepts of *K*-selection and *r*-selection are oversimplifications but help us to understand the life history of wildlife species.



Population Change and Population Density

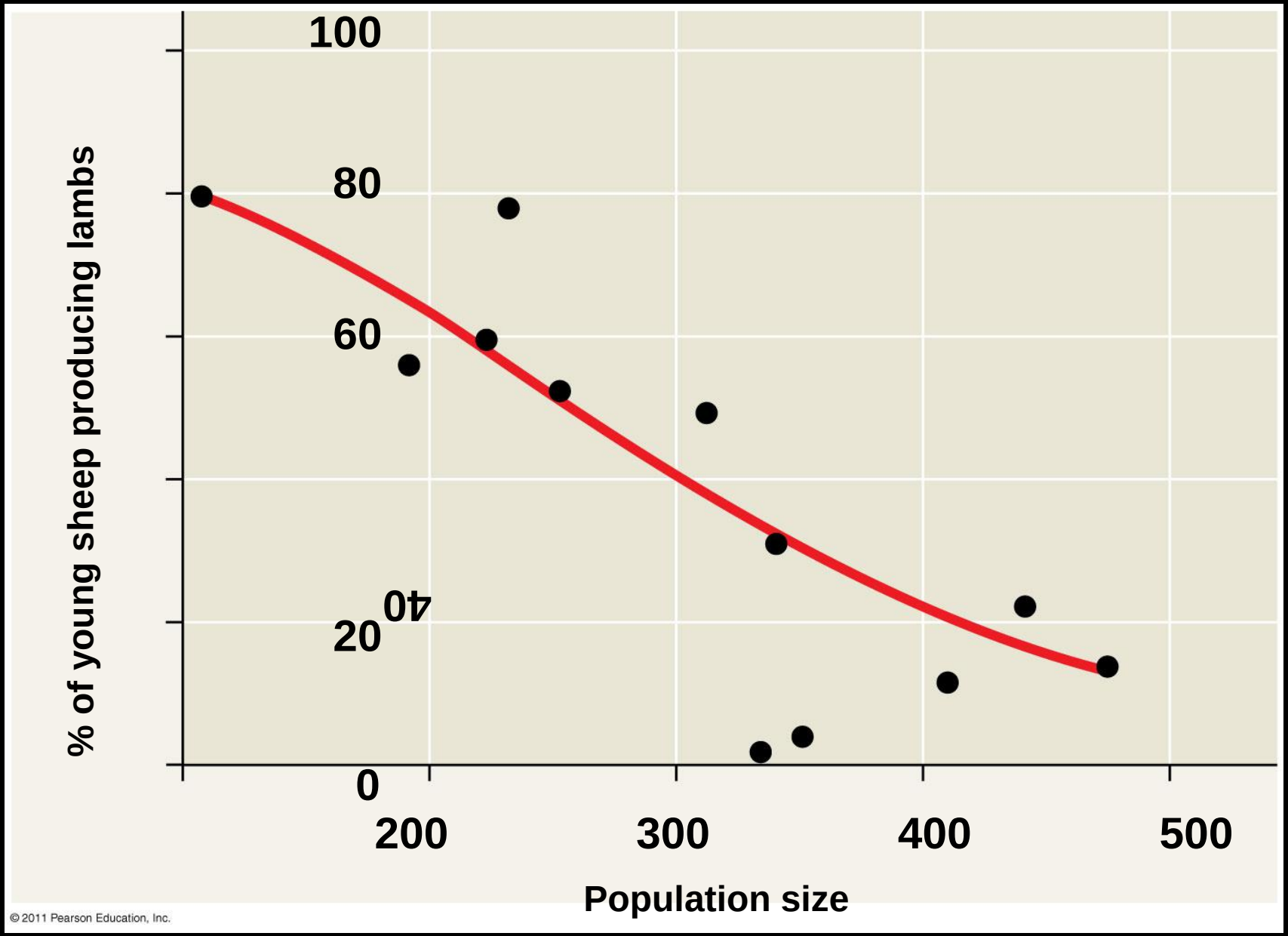
- Many factors that regulate population growth are density dependent.
- There are two general questions about regulation of population growth:
  - What environmental factors stop a population from growing indefinitely?
  - Why do some populations show radical fluctuations in size over time, while others remain stable?

Population Change and Population Density

- In density-independent populations, birth rate and death rate do not change with population density
- In density-dependent populations, birth rates fall and death rates rise with population density

Mechanisms of Density-Dependent Population Regulation

- Density-dependent birth and death rates are an example of negative feedback that regulates population growth
- Density-dependent birth and death rates are affected by many factors, such as competition for resources, territoriality, disease, predation, toxic wastes, and intrinsic factors



In crowded populations, increasing population density intensifies competition for resources and results in a lower birth rate.

Population & Hunting

Concentration

- Some species have aggregation behaviors that make them vulnerable to disturbance or hunting.
  - For example, bats may congregate in large numbers in particular caves to have their young, making significant portions of their total population especially susceptible when their habitat is disturbed by human visitation or damaged by the cave's commercialization or flooding.
- Various species of groupers (fish species) often come together to spawn on a few nights of each year tied to phases of the moon and at traditional mating sites. Fishermen who know these sites and the timing of spawning can devastate large populations of these species by concentrating their efforts during this most vulnerable time in the fish's life cycle.

Populations & Dispersal

Dispersal

Because small populations are so much more at risk than large ones, individuals of species that can readily disperse can rescue local populations on the verge of extinction. Species that have low dispersal rates are at a disadvantage because it is unlikely that one population can save another.

Predation and Populations

As a prey population builds up, predators may feed preferentially on that species

Population: Intrinsic Factors

For some populations, intrinsic (physiological) factors appear to regulate population size

Population: Territoriality

In many vertebrates and some invertebrates, competition for territory may limit density

Population: Disease

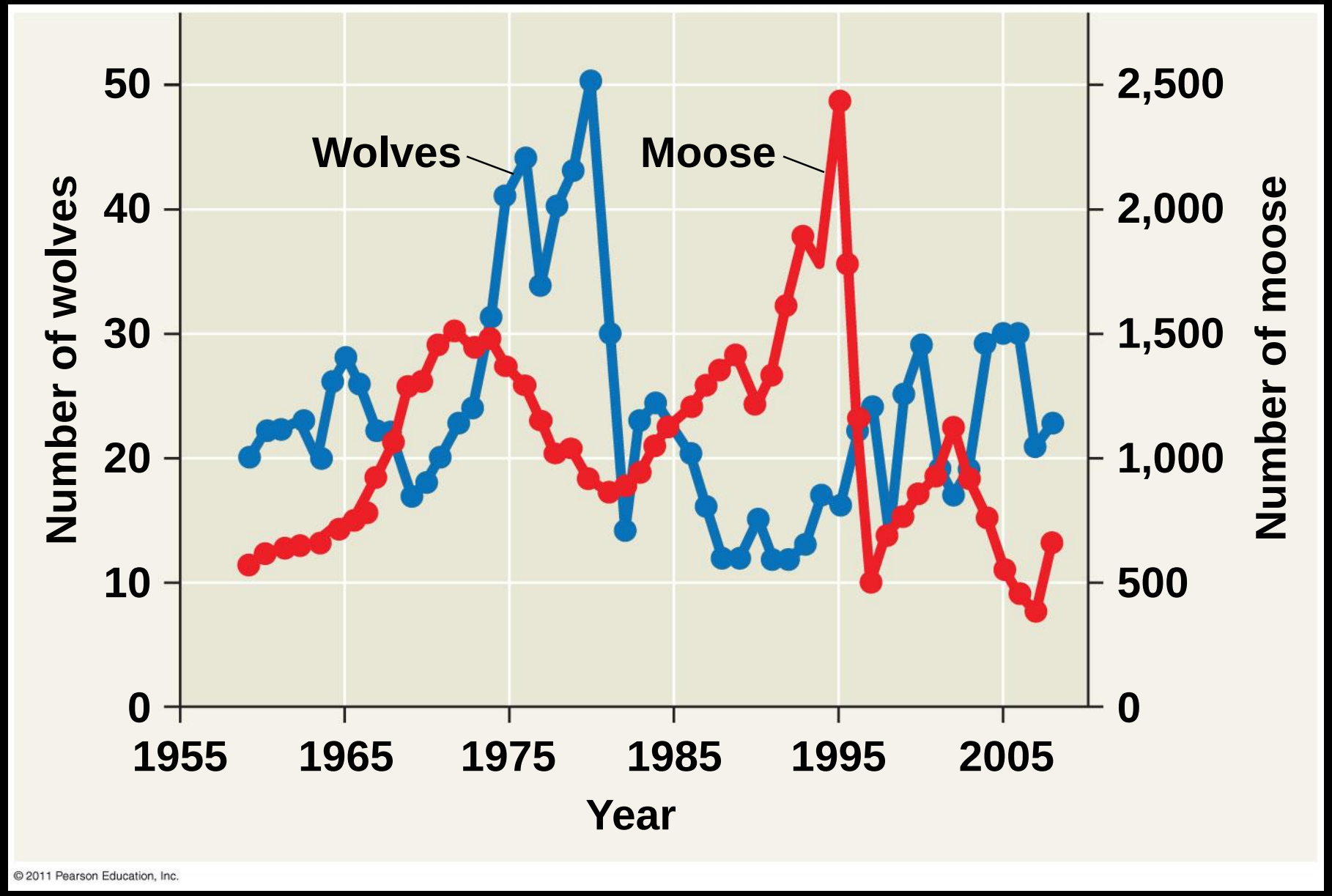
- Population density can influence the health and survival of organisms.
- In dense populations, pathogens can spread more rapidly.
- Virtually all diseases that can harm humans can harm the great apes since we share so many genetic and physiologic properties.

Population Dynamics

The study of population dynamics focuses on the complex interactions between biotic and abiotic factors that cause variations in population size.

Stability and Fluctuation

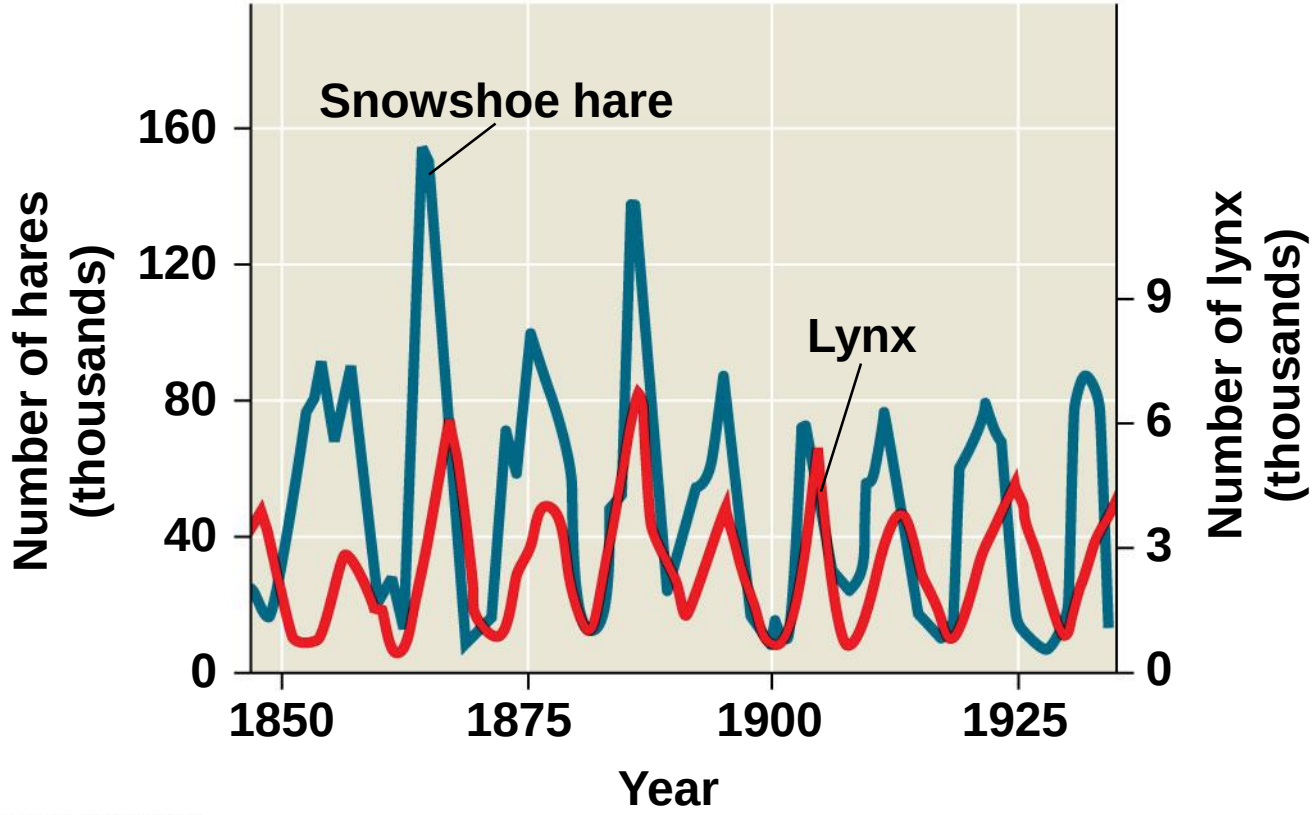
- Long-term population studies have challenged the hypothesis that populations of large mammals are relatively stable over time.
- Both weather and predator population can affect population size over time.
    - For example, the moose population on Isle Royale in Michigan (USA) collapsed BOTH during a harsh winter and when wolf numbers peaked.



Population Cycles

Case Study: Lynx (predator) and hare (prey) populations

- Some populations undergo regular boom-and-bust cycles.
- Lynx populations follow the 10-year boom-and-bust cycle of hare populations.
- Three hypotheses have been proposed to explain the hare's 10-year interval.



What Explains Population Patterns among Hares?

- Hypothesis: The hare's population cycle follows a cycle of winter food supply.
- If this hypothesis is correct, then the cycles should stop if the food supply is increased.
- Additional food was provided experimentally to a hare population, and the whole population increased in size but continued to cycle.
- These data do not support the first hypothesis.

- Hypothesis: The hare's population cycle is driven by pressure from other predators.
- In a study conducted by field ecologists, 90% of the hares were killed by predators.
- These data support the second hypothesis.

- Hypothesis: The hare's population cycle is linked to sunspot cycles.
- Sunspot activity affects light quality, which in turn affects the quality of the hares' food.
- There is good correlation between sunspot activity and hare population size.

- The results of all these experiments suggest that both predation and sunspot activity regulate hare numbers and that food availability plays a less important role.

Fundamentals of Wildlife Conservation: Sampling

- In most cases, it is impractical or impossible to count all individuals in a population
- Sampling techniques can be used to estimate densities and total population sizes
- Population size can be estimated by either extrapolation from small samples, an index of population size (e.g., number of nests), or the mark-recapture method.

Fundamentals of Wildlife Conservation: Sampling

Mark-recapture method

- Scientists capture, tag, and release a random sample of individuals(s) in a population
- Marked individuals are given time to mix back into the population
- Scientists capture a second sample of individuals (n), and note how many of them are marked (x)
- Population size (N) is then estimated by statistical inference.

Fundamentals of Wildlife Conservation: Sampling

Photo by C. N. Cassell-Jud (Black-shouldered Kite)

Birds

- A variety of techniques are used to survey birds, including transects, point counts, mist nets, and camera traps for larger ground-dwelling birds.
- Observations may be visual or made by identifying vocalizations. Because birds are small and mobile, in some habitats the ability to reliably detect certain species is a challenge.
- Distinct surveys must be carried out for diurnal versus nocturnal birds. Surveys are typically carried out during both the breeding and the nonbreeding seasons and usually early in the morning when activity levels and detectability are greatest.

Fundamentals of Wildlife Conservation: Sampling

Photo by C. N. Cassell-Jud (Black-shouldered Kite)

READING

Demey, “Rapid survey of birds in North Lorma, Gola, Grebo national forests”

Fundamentals of Wildlife Conservation: Sampling

Large mammals

- Mammal inventory methods include walking transects of fixed length to obtain either direct or indirect measures of mammal abundance, conducting aerial transect surveys, and setting out systematic grids of camera traps over large areas.
- Large mammals may exhibit large-scale seasonal movements, and so it is important that surveys are carried out during the time or times of year when they are most likely to be present.

Fundamentals of Wildlife Conservation: Sampling

READING

Demey, “Rapid survey of large mammals in North Lorma, Gola, Grebo national forests”

Steward, “Report on chimpanzee and elephant status in Mano River countries”

Tweh et al, “Chimpanzee nest counts, Sapo NP, Liberia”

Fundamentals of Wildlife Conservation: Sampling

Great ape survey techniques

- The conservation of wild great apes requires a detailed understanding of their population size, spatial distribution, and demographic trends.
- The conservation status of most wild ape populations is still poorly known. Great apes occur at low densities throughout their range, and often in remote places with difficult access.
- When these factors are combined with their cryptic nature, the implementation of efficient survey and monitoring programs is notoriously difficult.

Fundamentals of Wildlife Conservation: Sampling

Great ape survey techniques

- There are a variety of methods used to survey apes but the most commonly used is nest counts from line transects (a path along which one records and counts occurrences of nests and other signs).
- Recently non-invasive genetic sampling (e.g., for great apes, fecal samples tend to be the most reliable source of DNA).
- Camera trapping has become an increasingly popular tool to assess species' presence in a given area, monitor population trends, and identify individuals.

Fundamentals of Wildlife Conservation: Sampling

Practicum: Biomonitoring – Camera Trapping Basics

- Camera trapping is an appealing method for sampling the wildlife in an area because of the strong results visual results can cause in the public, as well as because of the low effort for large amount of data.
- Use the FTI Camera traps to collect data for a week at selected areas, following guidelines for deploying the camera in Practicum notes.

Fundamentals of Wildlife Conservation: Sampling

<u>Small mammals (rodents, bats, insectivores < 1 kg)</u>

- Bats are usually surveyed using mist nets and harp traps, or with sonograms.
- A variety of capture techniques are used to survey non-flying small mammals, including non-lethal baited box-type traps; snap traps, which kill the animal; and drift fences to direct small mammals to pitfall traps.

Fundamentals of Wildlife Conservation: Sampling

<u>Amphibians and reptiles</u>

- Amphibians and reptiles are surveyed along transects or within plots of fixed area.
- Survey methods include active searches as well as trapping including the use of drift fences and pitfall traps.
- Diurnal and nocturnal surveys are required to provide a complete picture of the amphibian and reptile communities.
- Most amphibians have an aquatic larval stage and so surveys may look for eggs and larvae in aquatic habitats.
- In tropical systems, surveys are ideally carried out in both the wet and dry seasons.

READING

Miller, “Distribution and Status of Crocodiles in Sapo NP, Liberia”

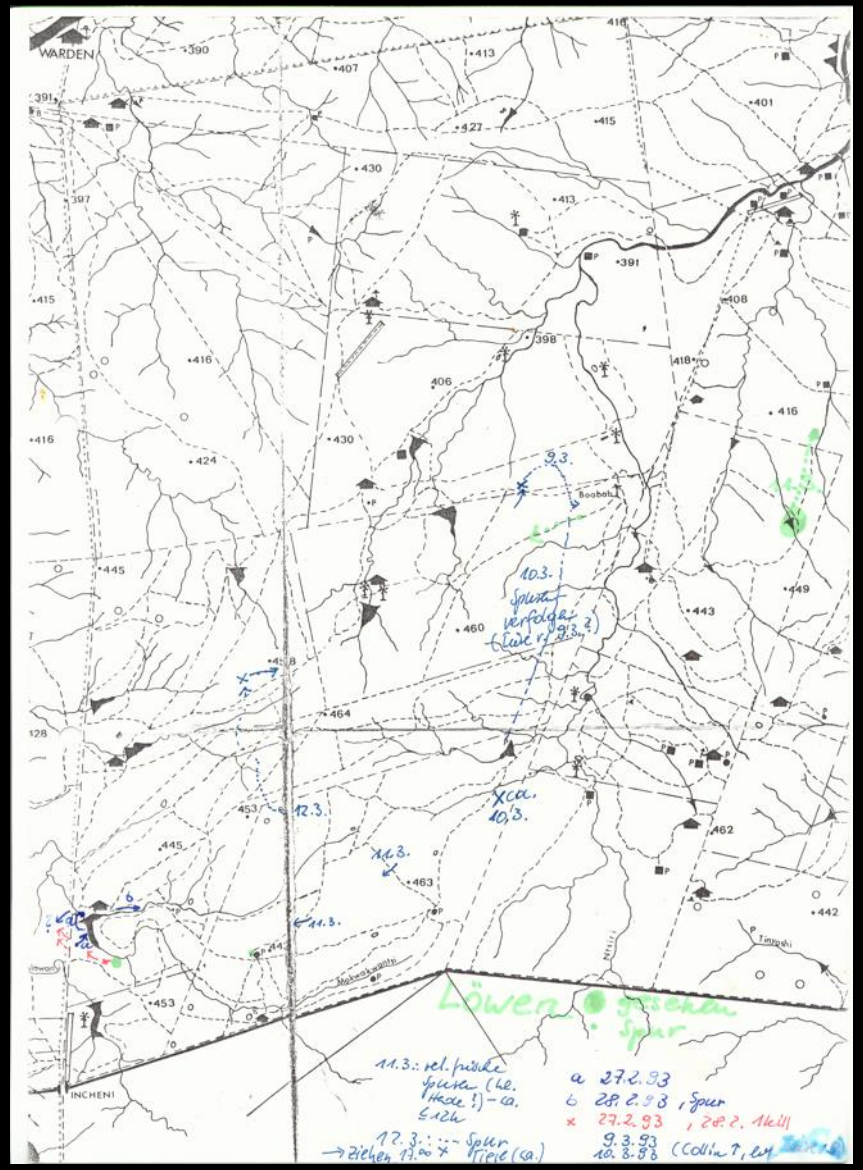
Fundamentals of Wildlife Conservation: Sampling

Fish

- Fish are surveyed at specific sampling locations using a standardized effort of active or passive collecting techniques, including the use of seine nets, dip nets, trap nets, short-set gillnetting, push nets, visual counts (snorkeling) and electrofishing.
- In tropical systems surveys are ideally carried out in both the wet and dry seasons.
- Sampling for fish surveys may often be seasonal, either due to water levels and habitat, or life history, or a combination of both.
- In many parts of the world, important fish specimens can be obtained from local fish markets.

How do we collect spatial data about wildlife?

- Radio collars
- Direct observation and paper maps
- Museum records of collection locations

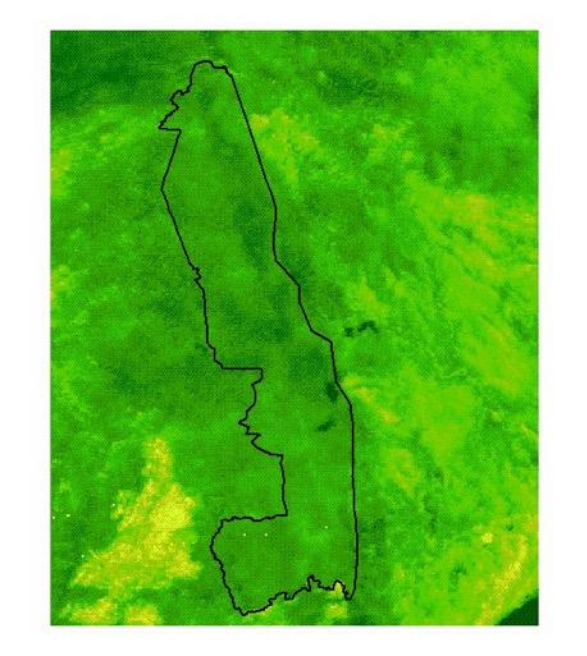


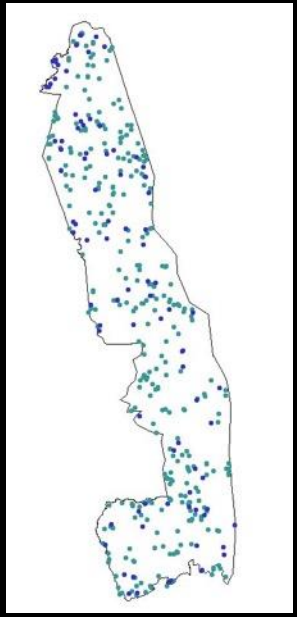
How do we collect spatial data about wildlife?

- GPS
  - Collars/patches that upload
  - Field indicators
    - scat, tracks
- Remotely sensed data
  - Satellite imagery
    - Vegetation, landcover, climate
  - Aerial photography
  - Radar etc.

How do we use spatial data about wildlife?

- Home ranges
- Habitat selection
- Biogeography questions



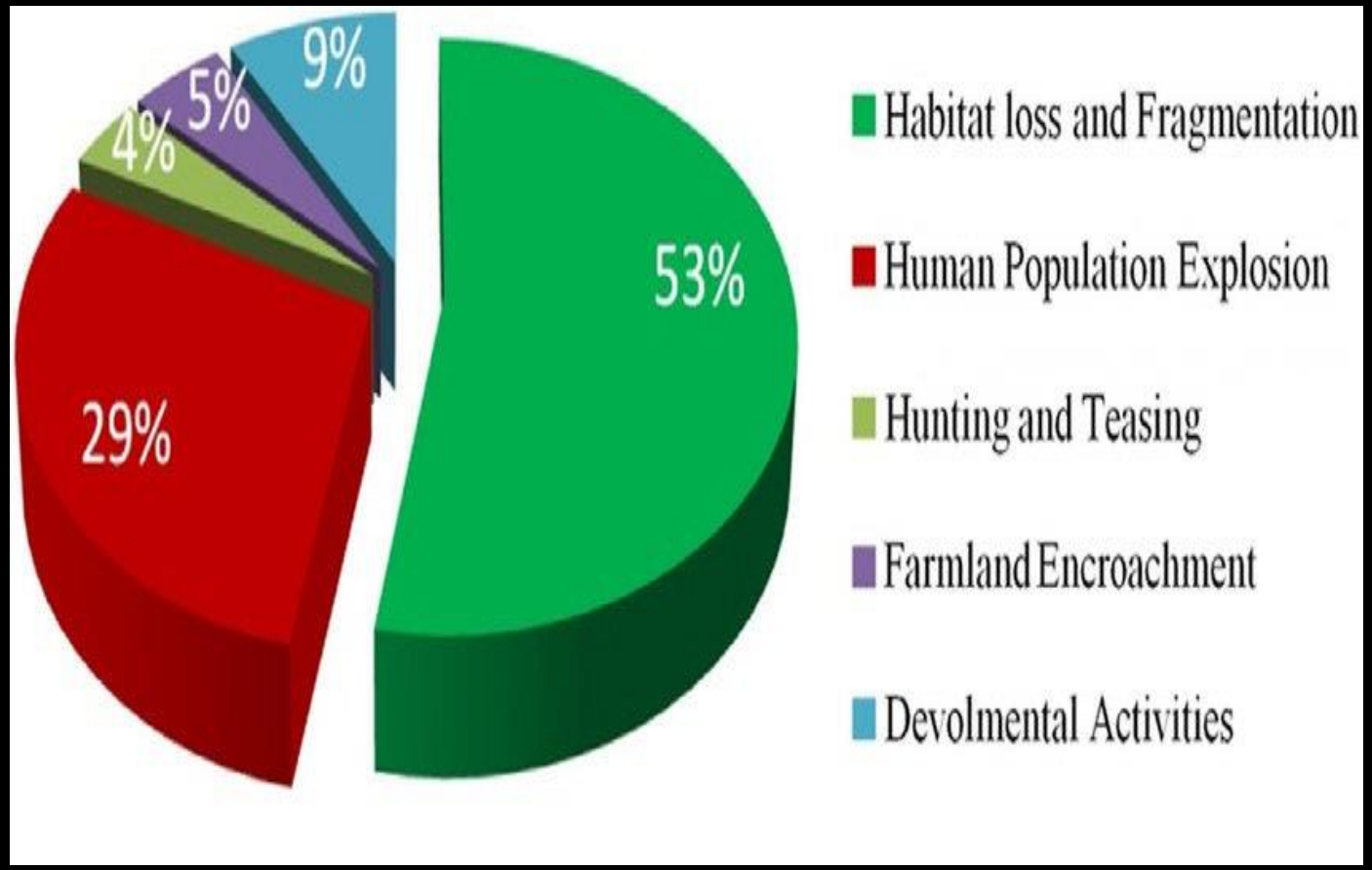


Collecting and using Wildlife Data

Practicum: Working with Wildlife Data

- Work in the Biomonitoring data_FFI_Sapo excel sheets provided to conduct simple statistical tests of the wildlife species recorded.

Fundamentals of Wildlife Management



Wildlife conservationists try to manage wildlife population levels with:

- Habitat improvements to increase birth rates and hunting to decrease or stabilize populations.
- Eliminating threats such as poaching and invasive species.

Wildlife Management: *in situ* vs. *ex situ* conservation

in situ:

- Conservation of species in their natural habitat
  - e.g. natural parks, nature reserves

ex situ:

- Conserving species in isolation of their natural habitat
  - e.g. zoos, botanical gardens, seed banks

The advantages of *in situ* conservation

- The species will have all the resources that it is adapted too
- The species will continue to evolve in their environment
- The species have more space.
- Bigger breeding populations can be maintained.
- It is cheaper to keep an organism in its natural habitat.

READING

Tweh et al, “Conservation status of chimpanzees in Liberia”

Steward_Report on chimpanzee & elephant status in Mano River countries

However there are problems with In-situ conservation…

- It is difficult to control illegal exploitation (e.g. poaching).
- The environment may need restoring and alien species are difficult to control.

Ex situ conservation Captive breeding

- The Hawaiian goose was practically extinct in the wild.
- 12 birds were taken into captivity.
- A population of 9000 was released back into the wild.
- The experiment failed because the original cause – rats – had not been eliminated.
- The rats eat the eggs and the nestlings of the geese.

Pere David's deer success or failure?

- Pere David's deer was a native species of China
- In 1865 18 were taken into zoological collections
- Meanwhile it became extinct in the wild
- By 1981 there were 994 individuals scattered through zoological collections

Ex situ conservation

- Captive breeding of endangered species is a last resort.
- These species have already reached the point where their populations would not recover in the wild.
- It works well for species that are easily bred in captivity but more specialised animals are difficult to keep.
- Isolated in captivity they do not evolve with their environment.

Zoos: The land of the ‘living dead’?

- They have a very small gene pool in which to mix their genes - Inbreeding is a serious problem
- Zoos and parks try to solve this by exchanging specimens or by artificial insemination where it is possible
- ***In vitro* fertilisation** and fostering by a closely related species has even been tried.
- Even if it is possible to restore a population in captivity the natural habitat may have disappeared in the wild.
- Species that rely on this much help are often considered to be **“the living dead”.**

Threats to Wildlife

- Wildlife everywhere on earth is under threat of extinction and struggling for survival.
- Habitat loss: population growth, industrialization, urbanization have all contributed to large-scale destruction of natural habitat of plants and animals.
- Pollution: air, water, soil, and noise pollution of a magnitude and toxicity never seen before. Natural habitats have been destroyed or damaged by the indiscriminate use of synthetic materials release of radiation and oil spills in the sea, generation of effluents and waste of various kinds and toxicity.
- Hunting: indiscriminate killing and poaching of wild animals food, horn, fur, tusk, pets, etc. has resulted in the reduction and extinction of many wild species.

Threats to Wildlife

- Habitat loss and clearing is caused through a myriad of human activities, most notably:
- Logging: Clearing of forested areas for harvest of timber and other products is a huge threat to biodiversity, as these forests are among the richest habitats on earth.
- Agricultural expansion: Clearing of tropical forests and habitats is common practice for large commercial farms, which then replace the diverse species with monocultures such as oil palm, rubber, aloe vera, pineapple, avocado (butterpear) or other product in response to human demand.
- Mining: Large tracts of forest are often cleared for excavation of large mining projects, while smaller artisanal mining activities disturbs species locally and releases pollutants into the water source. The event of artisanal mining also brings with it hunting as miners spend long periods in the forest during their mining trips.

Threats to Wildlife: Amphibians

- Amphibians reach their highest diversity in the tropical forests of the world, and represent a significant portion of the vertebrate fauna of tropical forests. They are important components of tropical food webs, where they are probably the principal terrestrial insectivores
- Amphibians, and especially tropical forest amphibians, appear to be in dramatic global decline due to a range of factors including habitat loss, climate change and disease, although unidentified processes are estimated to threaten many rapidly declining species, and are driving species most quickly to extinction.
- Declines are non-random in terms of species' ecological preferences, geographic ranges and taxonomic associations.
- The lack of conservation remedies for these poorly understood declines means that hundreds of amphibian species now face extinction.

Threats to Wildlife: Birds

Birds

- Timber extraction and fragmentation affect species in different ways. Timber extraction modifies the physical environment, such as nest sites, cover, home range needs, or a moist leaf litter and understorey, and thereby affects species that depend on these features.
- Larger-scale fragmentation, on the other hand, is more likely to influence population characteristics such as demography and dispersal processes because it reduces effective population sizes.
- Fragmentation also affects species on individual and autecological levels, including survival rates in smaller patches. This in turn influences reproductive rates, recruitment, and demographic ratios.

Threats to Wildlife: Fish

Habitat disturbance and clearing poses serious threats to tropical freshwater fish:

1. Many species are dependent on animals and plant material falling into water from overhanging vegetation. Clearing of streamside vegetation reduces food for fish;
2. Water temperature rises with decreased shading. This leads to decreased oxygen levels in the water, while warmer water raises the metabolic rate of fish and thereby their oxygen demand;
3. Increased turbidity can directly kill fish, as the silt can accumulate on the gills, resulting in death from suffocation. When the flow in a river slows, silt settles and can smother food resources, eggs and spawning grounds, as well as reduce the depth and the width of the water channel;
4. Forests create habitat diversity and heterogeneity which is reflected by species diversity of fish and other aquatic species

Threats to Wildlife: Logging

- One of the problems associated with assessing the impact of logging on mammals is that the distribution of many species appears patchy even in undisturbed forest, and densities vary considerably between sites.
- Primates, especially the more generalist feeders, appear somewhat adaptable to selective logging, changing their ranging patterns and diets to accommodate changes in forest structure and composition.
- Studies have shown that selective logging results in serious effects on primates, including an abrupt decrease in biomass, direct mortality, decreases in recruitment, adverse shifts in diet, and high levels of infant malnutrition, abandonment and mortality, among other effects.

Threats to Wildlife: Logging

- In general, primate densities decline following logging, and in some cases they are markedly lower, particularly over the long term; in addition, felling operations raise infant mortality.
- Primate species are typically constrained in space after logging due to their historical territorial affinity; others are unable to move to new areas due to either …
  a) isolation in forest patches surrounded by inhospitable terrain,
  b) excessive canopy gaps requiring ground travel between trees (this is particularly problematic for arboreal species), or
  c) competitive exclusion and territorial aggression from conspecifics.

Threats to Wildlife: Logging

- A second feature that can influence a primate's adaptability to logging is its degree of terrestriality.
- Some species are primarily arboreal or have strong affinities to canopy strata—canopy gaps may disrupt arboreal pathways for these species.
- Most Old World species capable of colonizing secondary forest are at least semi-terrestrial in habits, which must facilitate survival in small patches. This behaviour, however, also predisposes them to crop raiding, making them vulnerable to hunting.

Threats to Wildlife: Agricultural Expansion

In response to a growing human population (which is projected to be most drastic in tropical nations), major expansion of tropical agriculture is expected.

- This will entail the clearing of forests and semi-arid environments across the tropics.
- These changes will be most dramatic in South America and Sub-Saharan Africa.
- The accompanying construction of roads is also expected to impact remaining tracts of tropical habitat through disturbance, fragmentation, and increased access by disease, poachers, and invasive species.

Threats to Wildlife: Mining

The impact of mining can be simplified into the habitat destruction at the excavation site through habitat destruction, but it has ripple effects:

- Chemical Pollution
- Sediment increase
- Habitat fragmentation
- Hunting
- Migratory species stopover site disturbance
- Increased access due to road construction
- Increased population following development

Threats to Wildlife: Hunting

- Hunting poses a greater threat to large forest fauna than timber harvesting in many areas of the humid tropics; it is even sometimes a greater threat to wildlife than habitat loss
- Overhunting alters wildlife population densities, distributions, and demography, which can then lead to shifts in seed dispersal, browsing, competition, predation, and other community dynamics.

Threats to Wildlife: Hunting

- Traditional hunting is often non-selective, using traps or snares; animals are often killed irrespective of their condition—fat or thin, with litter, pregnant or not—and hunting is sometimes wasteful, with only part of the animal taken.
- Other factors increasing hunting's impact on wildlife include:
  - increased forest accessibility;
  - improved transport with cars, motor bikes, motorized canoes, and light planes;
  - guns and ammunition;
  - the erosion of traditional prohibitions on killing and eating certain animals;
  - increased immigration by non-indigenous people to interior areas; and an
  - increasing market for wildlife products either as food, trophies, or medicine.

Threats to Wildlife: Roads

Roads result in over-harvesting and greatly depleted wildlife populations by:

- Facilitating increased immigration;
- Increased forest clearance along road sides, thereby reducing and fragmenting habitats and increasing human population density in the remaining forest;
- Loss of inaccessible and undisturbed ‘source’ areas to replenish populations.

Threats to Wildlife: Roads

Roads result in over-harvesting and greatly depleted wildlife populations by:

- Increased access to markets. This allows local people to sell wild meat, and buy in technology such as shotguns, cartridges, snare wires, batteries, vehicles and fuel. These technologies facilitate indiscriminate and excessive hunting while obscuring permitted subsistence hunting and raising the catch to unsustainable levels;
- Increased access by locals and outsiders, often from towns many tens of kilometres away. Some people are hunters, others are traders who buy wild meat or wildlife body parts.

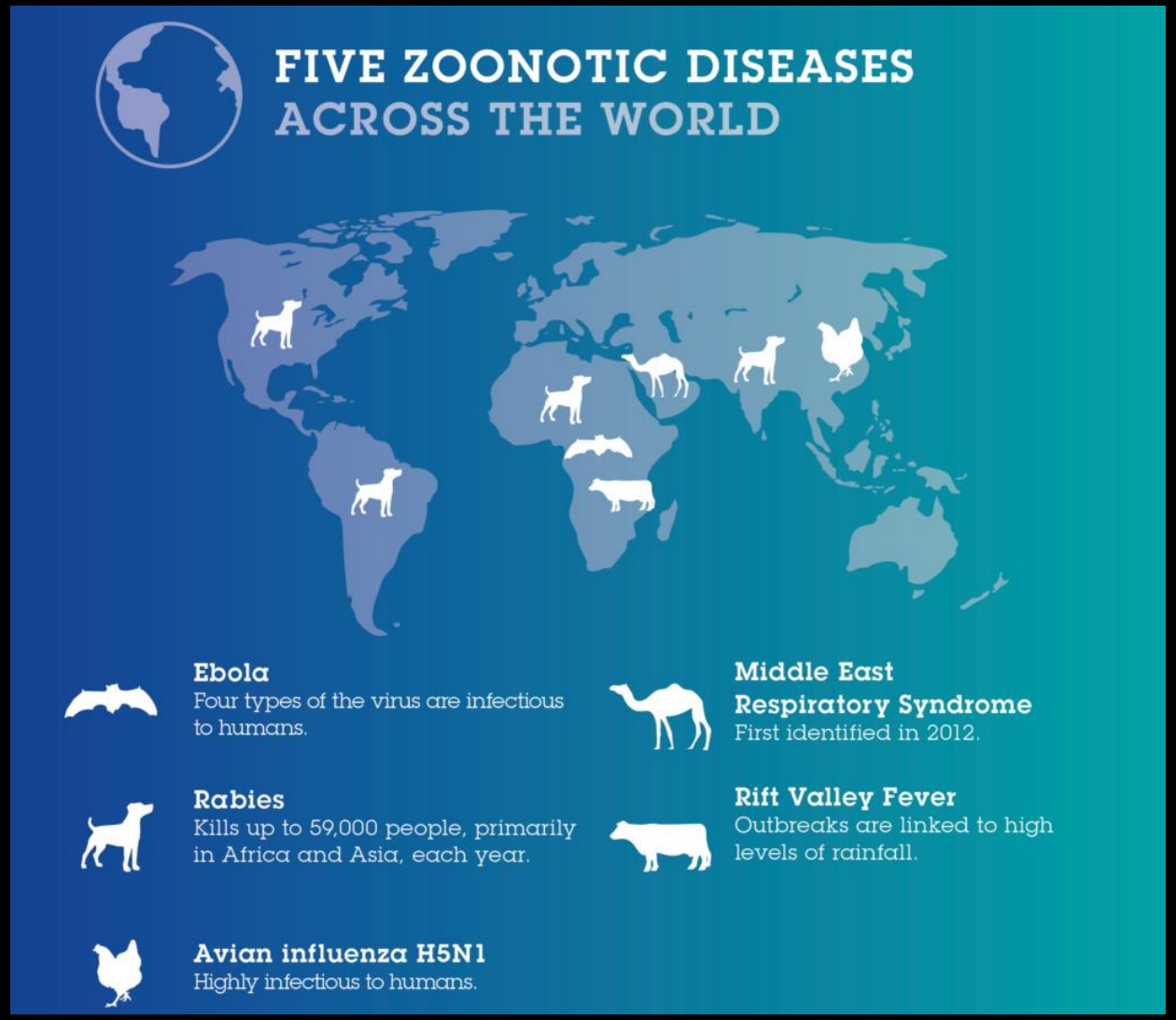
Threats to Wildlife: Exotic/Invasive Species

- The introduction of exotic flora and fauna into fragmented forests via logging infrastructures threatens wildlife populations.
- The increased proximity of feral animals to their wild relatives increases the transfer of diseases.

Diseases and Zoonosis: Overview

- Pathogens are microbial biodiversity that can cause infection and lead to diseases.
- Bacteria, Viruses, Parasites, and Fungus are different types of pathogens.
- Most infectious diseases in humans have origins in being transmitted from animals.
- Bats, non-human Primates, and rodents are highly diverse groups, and are considered the highest risk for transmitting diseases to humans.
- Ebola, Lassa, and rabies virus are some examples of zoonotic diseases in Liberia

Human practices that change ecosystem dynamics and increase contact with wildlife are the cause of pathogen spillover!



Diseases and Zoonosis: Pathogen Spillover

Some examples of practices and industries that change conditions and put humans and wildlife into close contact include:

- Consumption of wildlife
- Keeping wildlife
- Selling wildlife
- Hunting wildlife
- Farming wildlife (and livestock)
- Wildlife Tourism
- Intrusion into wildlife areas
- Deforestation which causes wildlife redistribution

Photo: Wildlife Conservation Society

Diseases and Zoonosis: Threat to Conservation

Wildlife health and survival can be threatened by infections from humans and domestic animals.

Responses to disease can negatively affect wildlife, such as killing of bats out of fear of disease.

Human activity (such as trade) can lead to the spread of disease into wildlife habitats.

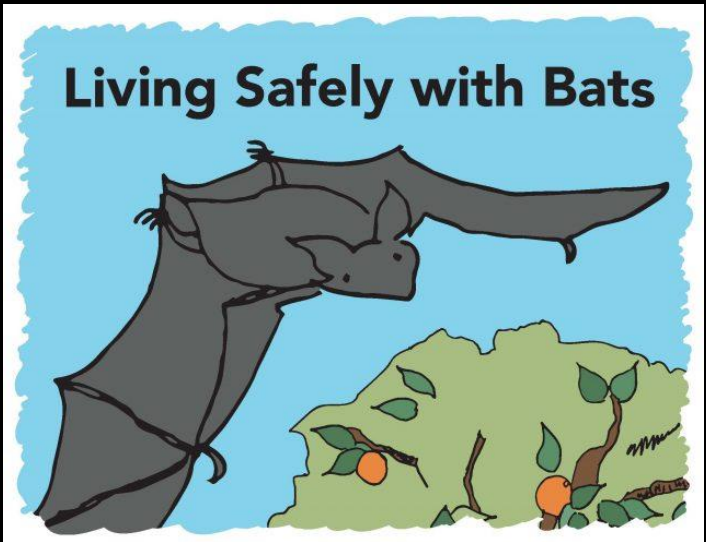
Infectious and non-infectious diseases can result from ecosystem changes, e.g. the distribution and abundance of mosquitos and ticks, (vector-borne-diseases such as malaria) and water quality (water-borne diseases such as typhoid).

Diseases and Zoonosis: OUT OF CLASS EXERCISE

Working in small groups, record where you see wildlife coming into contact with domestic animals or human populations.

For each record, make a list of 2 or 3 factors that may increase or decrease disease risk.

Diseases and Zoonosis: One Health Approach



- Wildlife, forestry, and conservation experts have an important role to play in keeping people, animals and ecosystems healthy.
- Practical strategies can help avoid or reduce disease risks.
- Protected area managers can consider disease risk in their site management practices, to inform decisions concerning site uses, animal reintroduction protocols, and community awareness.
- Rangers can report unusual disease events and signs of ecosystem degradation that that threaten humans, animals and the environment.

Diseases and Zoonosis: Suggested Reading

IUCN. “Healthy people and wildlife through nature protection : guidelines for prevention, detection, response, and recovery from disease risks in and around protected and conserved areas”. 2022.

EcoHealth Alliance. “Living Safely with Bats”

Liberia One Health Coordination Platform Website: https://onehealthliberia.org

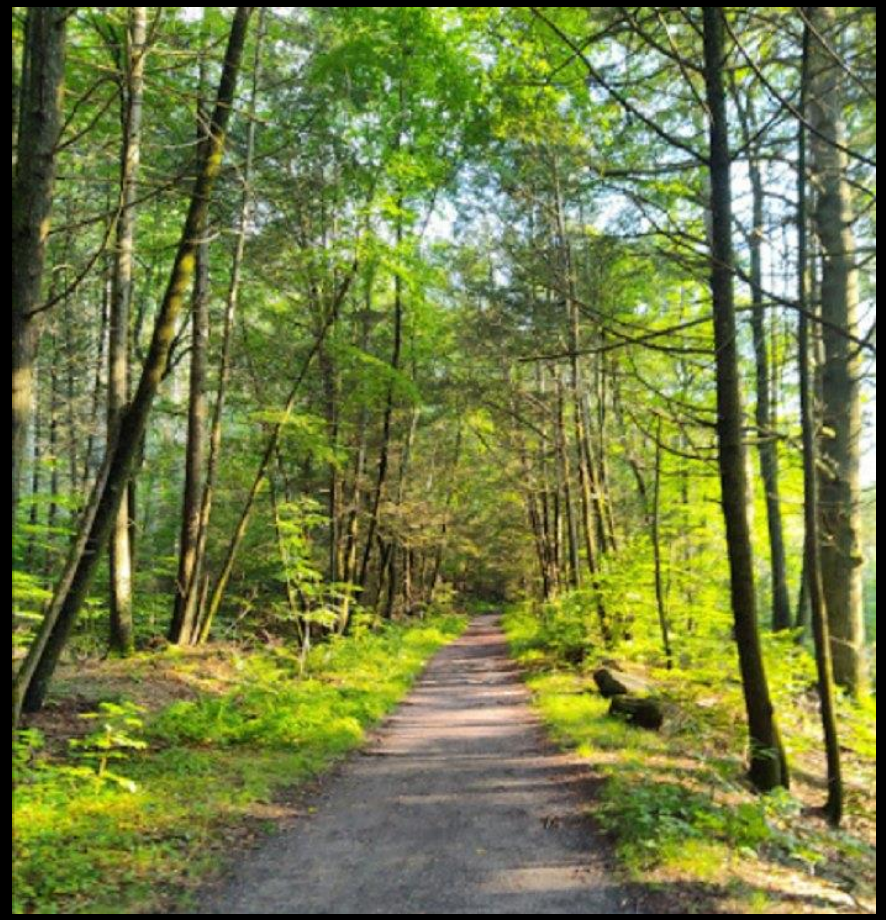
Wildlife Conservation Strategies

Wildlife Conservation carries a lot of implications for the planet and future generations. It goes beyond preserving wildlife species, to mean maintaining ecosystem health, protecting habitats, elimination pollution and overharvesting, and playing our roles in controlling the wildlife trade. Some strategies are:

- Habitat Conservation
- Sustainable Land Use Practices
- Research and Monitoring
- Recycling
- Public Education and Awareness
- Creating Wildlife Areas
- Planting Trees

Photo: World Atlas

Wildlife Conservation Strategies



Habitat Conservation

Management practices with the aim to conserve, protect, and sometimes restore habitats and maintain the species within them.

Natural habitats such as forests and wetlands often need to be protected from conversion and development in order to ensure wildlife populations can persist.

Wildlife Conservation Strategies

Sustainable Land Use Practices

Refers to the use of land resourves to meet changing human needs, while ensuring long-term functions of the land.

These can include promotion of sustainable agriculture, decrease in pesticide and harmful chemicals, and eco-friendly forestry and industrial practices.

Wildlife Conservation Strategies

Research and Monitoring

Refers to the exploration of species and ecosystems usign diverse ways, and the repeated collection of data for analysis and compasison across time and space.

It can provide information on status and trends in wildlife.

Can also identify opportunities for conservation and inform policy and management decisions.

Wildlife Conservation Strategies

Recycling

Refers to the repurposing of materials after use towards other uses.

It reduces the demand for new products, and contributes to carbon offsetting by lowering waste (less to be incinerated, and less to pollute habitats).

Wildlife Conservation Strategies

Public Education and Awareness

Refers to engaging wit people, communities, and entities to create a dialogue about wildlife.

Creates a culture of responsibility, sustainable behaviour and awareness of the impact of human activity on wildlife.

This is achieved through outreach programs, school programmed, and public awareness campaigns.

Wildlife Conservation Strategies

Creating Wildlife Areas

Refers to the adaptation of unsuitable, damaged, or urban areas to accommodate use by wildlife.

Can provide a refuge for wildlife, allowing them to feed, nest, and relax in safety.

This can be achieved by planting trees and shrubs that small wildlife can use for cover and shelter, growing flowers that can attract birds, bees, and butterflies, organizing rock or wood piles, and building ponds or other water sources wildlife can use.

Wildlife Conservation Strategies

Planting Trees

The cultivation of tree from seeds or other parts for outplanting.

Helps provide habitat spaces and resources for wildlife to prosper. Trees are used for food, shelter, resting, hunting and breeding by many animal species.

Planted trees also contribute to offsetting carbon emissions.

Wildlife Management

Wildlife Management can focus on the restoration and management of habitats or focus on endangered species.

Management of Wildlife can be divided basically into 2 types:

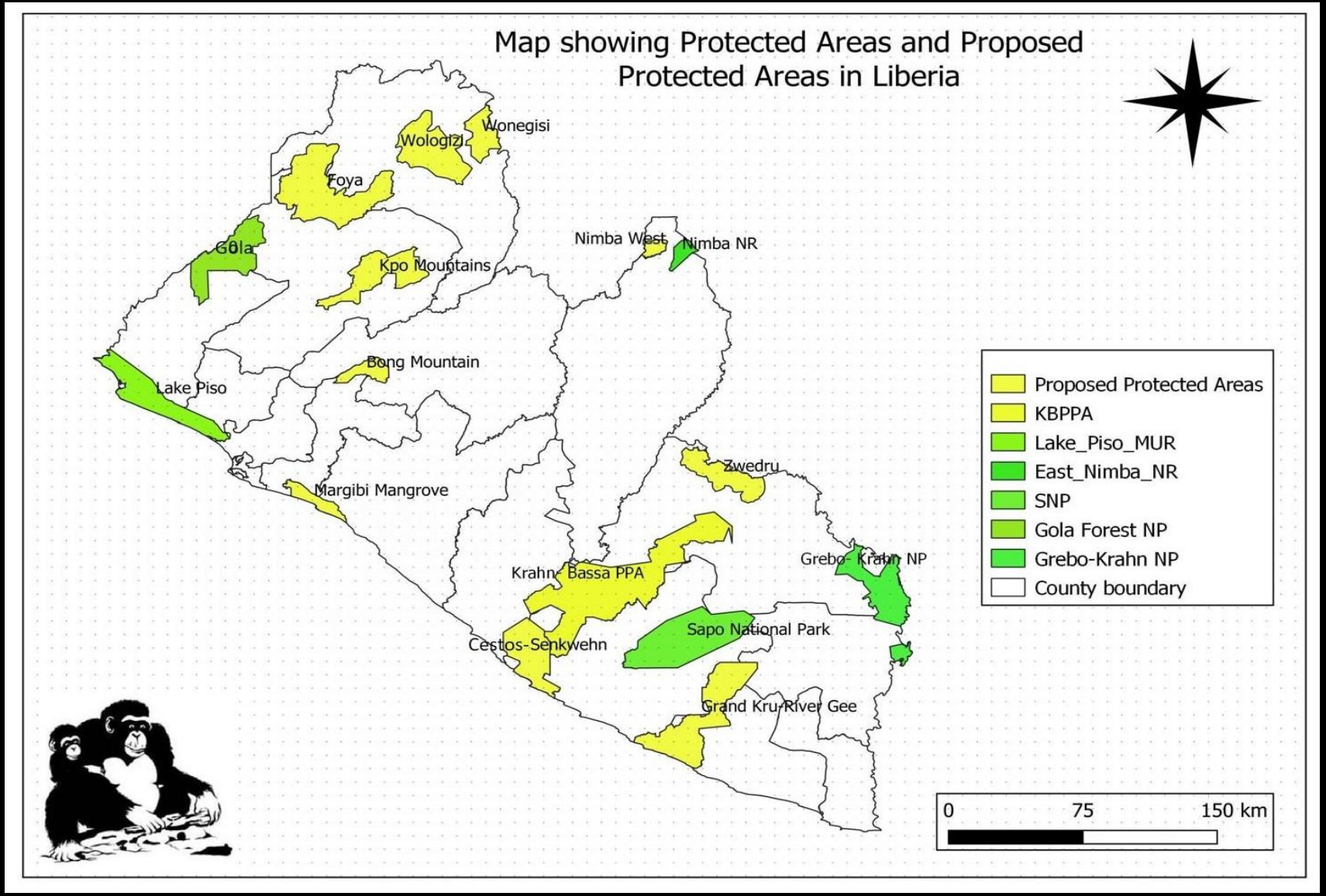
Manipulative management – managing number of animals directly

Custodial management – protective measures to reduce external influences on the population

Liberia favors custodial management strategies, centered around its protected area network through:

- Law Enforcement – preventing and persecuting illegal activities which adversely affect wildlife populations
- Research and monitoring – determining areas of high threat and monitoring the status of endangered populations.

Wildlife Management in Liberia

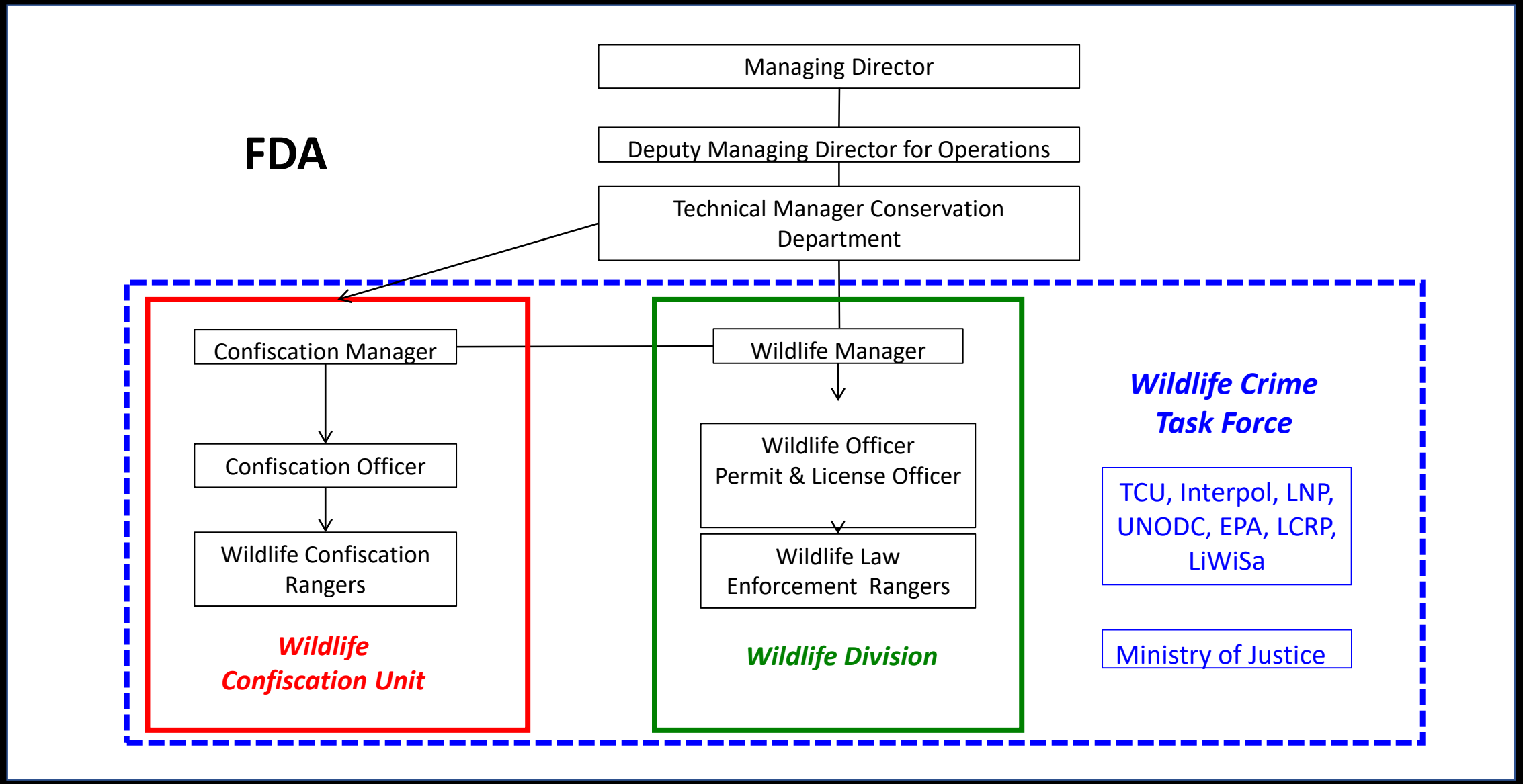


Wildlife Management in Liberia: Wildlife Crime

Wildlife that is rescued from poachers outside of their natural habitat are sent to the Libassa Wildlife Sanctuary, if they require care or need to be held until arrangements for transport are made. Otherwise, they are sent to the nearest protected area with suitable habitat.

The Wildlife Trade is a massive threat to wildlife in Liberia, with large- and small-scale incidents ongoing every day across the country.

Wildlife Management in Liberia: Wildlife Crime



Wildlife Management in Liberia: Wildlife Crime

In addition to ensuring wildlife traders are persecuted, the wildlife trade is discouraged by public burning of confiscated by products.

Wildlife Management in Liberia: Human-Wildlife Conflict

Instances of Human-Wildlife Conflict are recorded around protected areas, as these may be a source of retaliatory hunting by local communities whose farms and properties are often damaged by wildlife venturing outside the borders of protected areas.

Methods for decreasing HWC are discussed with frequently affected communities.

The Role of Local Communities

Social factors play a critical role in almost every conservation problem.

There is a need for conservationists to understand the intertwined dimensions of humanity and ecology of their systems.

The initial approach to conservation prioritized biodiversity, and as a result most protected areas were established at the expense of the surrounding communities.

In addition to sudden restricted access to ancestral areas, communities close to protected areas also suffer from crop-raiding animals or predator attacks against livestock.

The Role of Local Communities

Only initiatives interlinked with poverty alleviation can be successful in conservation, as the search of wealth/means of living (poverty) is the root cause of environmental disturbance.

Community conservatin has 2 main elements:

- Active participation of local communities in protected area management
- Linkage of conservation objectives with community development needs

The Role of Local Communities

Participatory management and integrated conservation-development projects have become best practices for the management of Protected areas, since they emerged in the 1970s.

This means conservation entities engage with local communities throughout their projects for long term success.

The Role of Local Communities

Reading:

Hillers et al, “Community based conservation is needed for the survival of the endangered pygmy hippo.”