Biodiversity and the Healthy Society

Specific Issues in STS

DIVERSITY OF LIFE

Figure 1.13 The three domains of life.

(a) Domain Bacteria

Bacteria are the most diverse and widespread prokaryotes and are now classified into multiple kingdoms. Each rod-shaped structure in this photo is a bacterial cell.

(b) Domain Archaea

Some of the prokaryotes known as **archaea** live in Earth's extreme environments, such as salty lakes and boiling hot springs. Domain Archaea includes multiple kingdoms. Each round structure in this photo is an archaeal cell.

(c) Domain Eukarya

▲ **Kingdom Plantae** consists of terrestrial multicellular eukaryotes (land plants) that carry out photosynthesis, the conversion of light energy to the chemical energy in food.

► **Kingdom Fungi** is defined in part by the nutritional mode of its members (such as this mushroom), which absorb nutrients from outside their bodies.

◄ **Kingdom Animalia** consists of multicellular eukaryotes that ingest other organisms.

► **Protists** are mostly unicellular eukaryotes and some relatively simple multicellular relatives. Pictured here is an assortment of protists inhabiting pond water. Scientists are currently debating how to classify protists in a way that accurately reflects their evolutionary relationships.

BIODIVERSITY

Is defined as the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems (SCBC, 2010).

In other words, the occurrence of different types of ecosystems, different species of organisms with the whole range of their variants and genes adapted to different climates, environments along with their interactions and processes.

BIODIVERSITY

- Vast variety of life forms in the entire Earth
- It encompasses all kind of life forms, from single-celled organism to the largest multi-celled organisms.
- Study on the relationship between the biotic and abiotic component of the ecosystem.
- Plays a major role in this natural dynamics

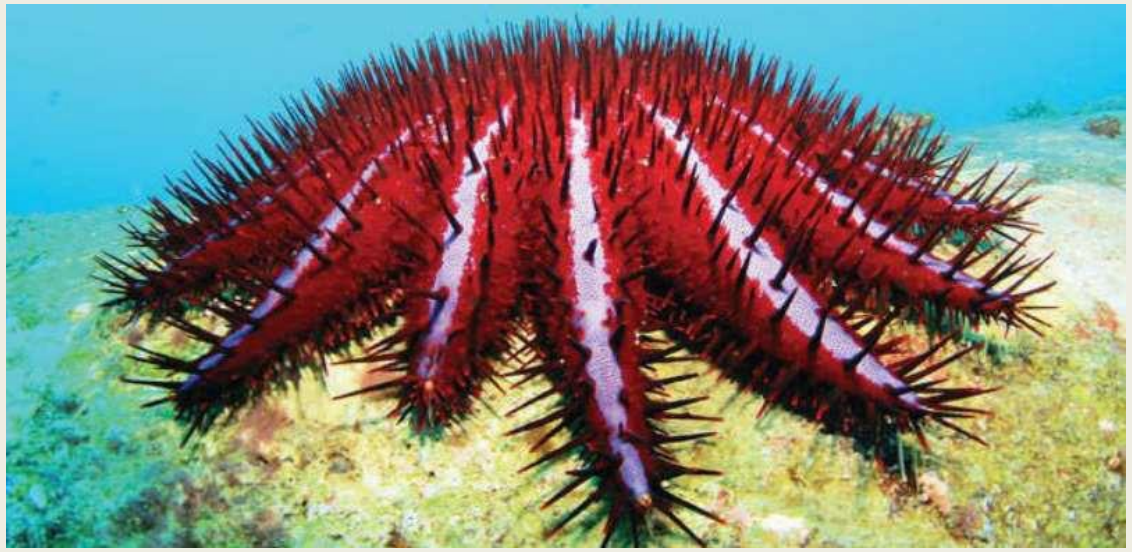
BIODIVERSITY

- A large number of golden snail in a rice field
  - Can predict low production of rice harvest since their eggs are considered as pests
  - Indicator of sustainable life in that area
- Sustainability of the ecosystem ensures a better survival rate against any natural disaster.

3 TYPES OF BIODIVERSITY

- Ecosystem
- Species
- Genetic

https://www.youtube.com/watch?v=GK_vRtHJZu4



Crown of Thorns Starfish (COTS)

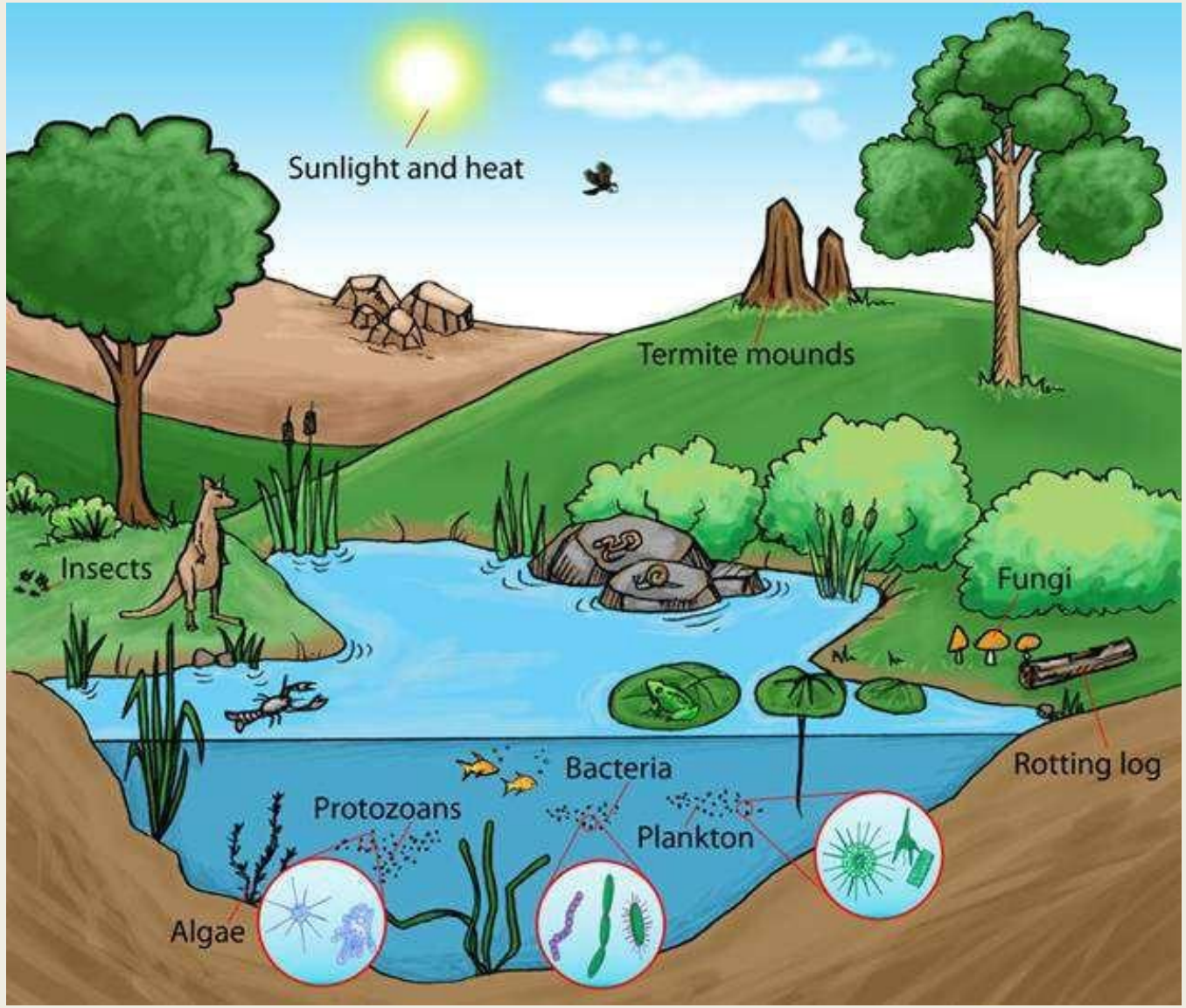
COTS – threat to coral reefs because it eats the coral polyp. It can grow to a diameter of 1 meter.

https://www.youtube.com/watch?v=-ardrFZuFkU

BIODIVERSITY

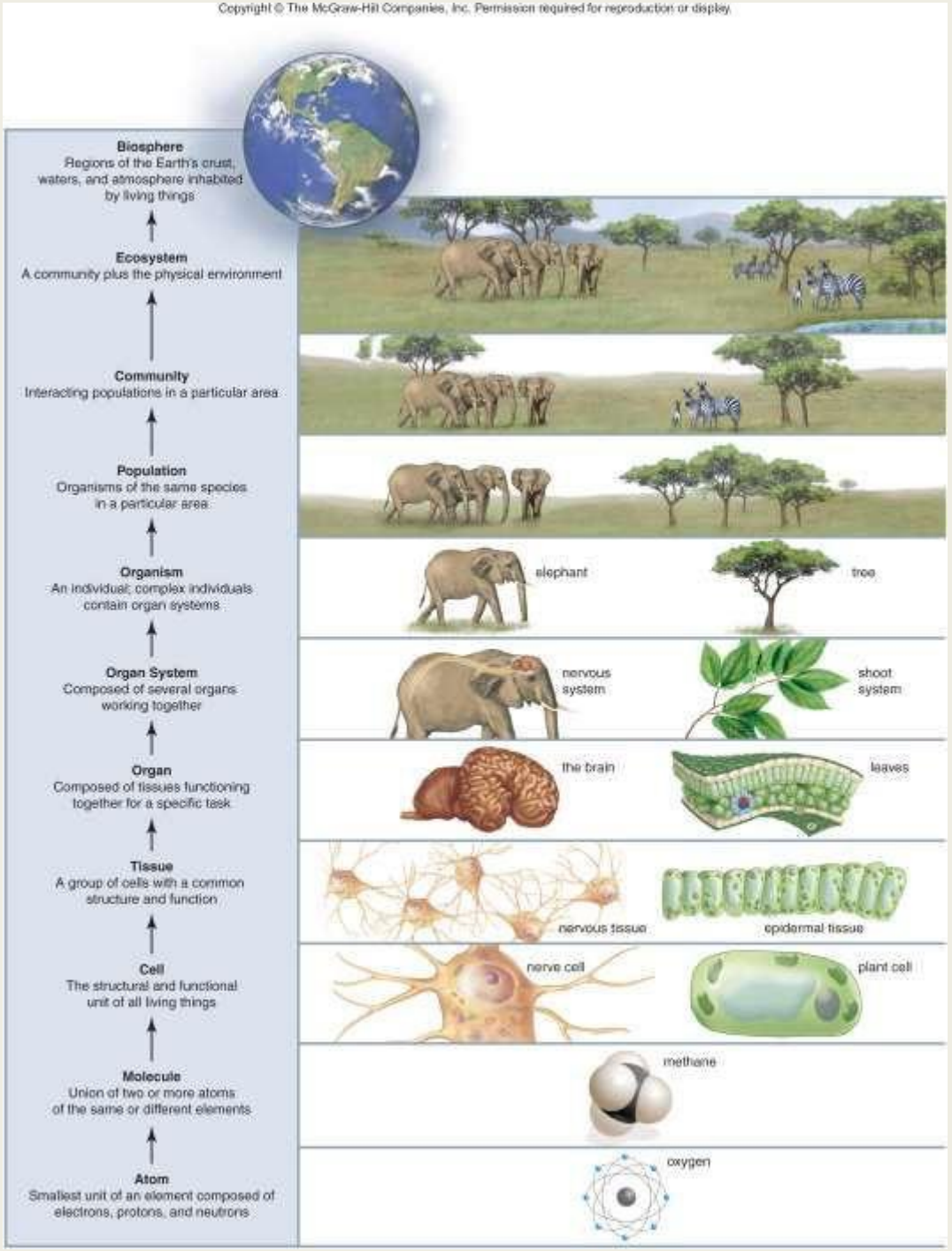
- Ecological System: encompassing a community and all the physical aspects of its habitat (e.g. soil, water, and weather)

- The study of interactions of living organisms with one another and with their physical environment is called *ecology*.
  - Coined by Ernst Haeckel, a German naturalist.



COMMUNITY

- The many different species that live together in a habitat.
- The place where a particular population of species lives is its *habitat*.
- *Population* is all the organisms from one species in an ecosystem.



TAXONOMY

- The science of naming and classifying organisms.

- *Carl von Linne (Carolus Linnaeus)*: Swedish biologist/naturalist, assigned organisms two-word names – *binomial nomenclature*.

- *Scientific name* is the unique two-word name for a species.

Table 1.1 Levels of Classification

Category	Human	Corn
Domain	Eukarya	Eukarya
Kingdom	Animalia	Plantae
Phylum	Chordata	Anthophyta
Class	Mammalia	Monocotyledones
Order	Primates	Commelinales
Family	Hominidae	Poaceae
Genus	*Homo*	*Zea*
Species*	*H. sapiens*	*Z. mays*

**To specify an organism, you must use the full binomial name, such as Homo sapiens.*

SCIENTIFIC NAME

- The first word is the *genus* (based on its major characteristics)
- The second word is the *species* (identifies one particular kind of organism within the genus)
- The first letter of the genus is always CAPITALIZED and the first letter of the second word is always lowercase.
- Either *italicized* or underlined.

SCIENTIFIC NAME

Oryza sativa – Asian Rice

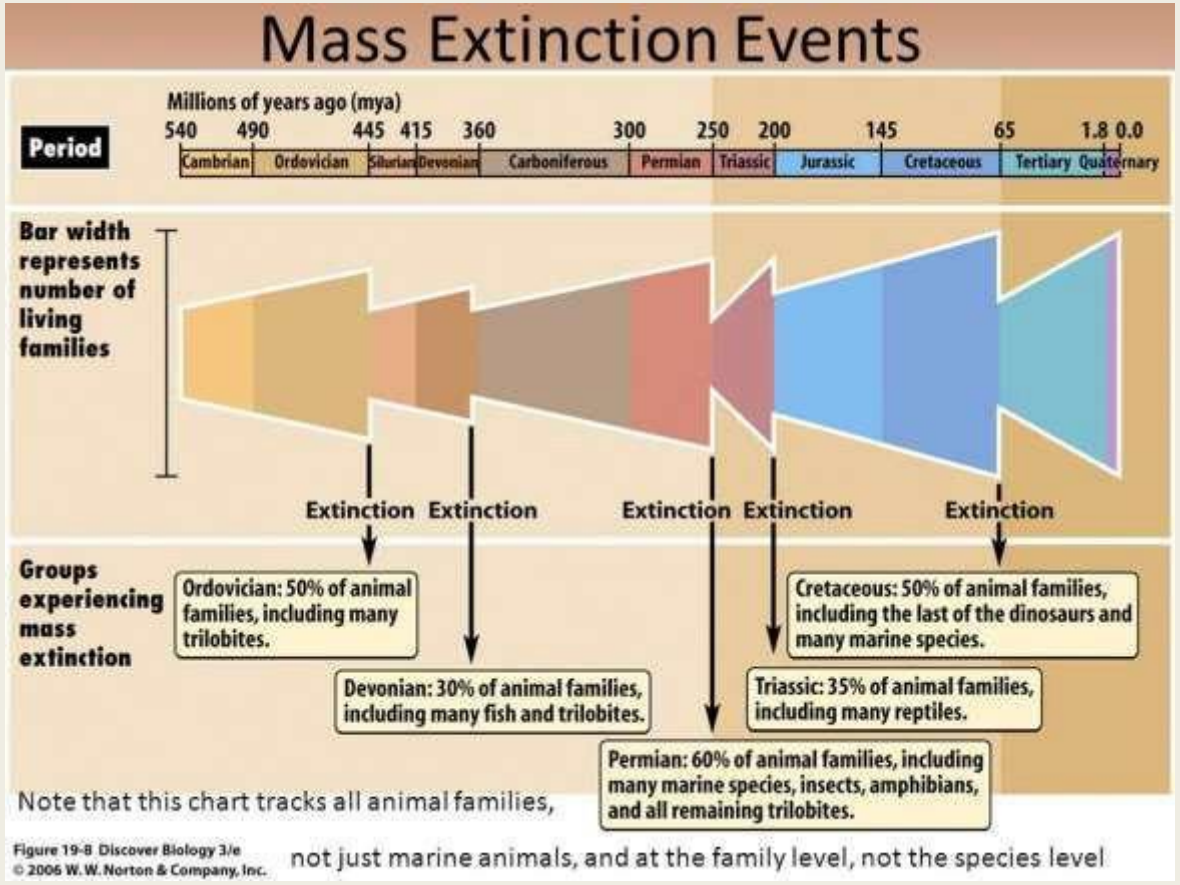
Oryza glaberrima – Afrcian Rice

BIODIVERSITY CONSERVATION

- Vertebrates fell to 60% from the 1970s due to human causes
- The World Wide Fund for Nature and Zoological Society of London reported an annual decrease in wildlife by 2%.
- By 2020, wildlife decline will be 67% of the present number
- Humans have industrialized the natural habitat of wildlife and marine life.
- Earth might enter the *sixth mass extinction* event, experts say

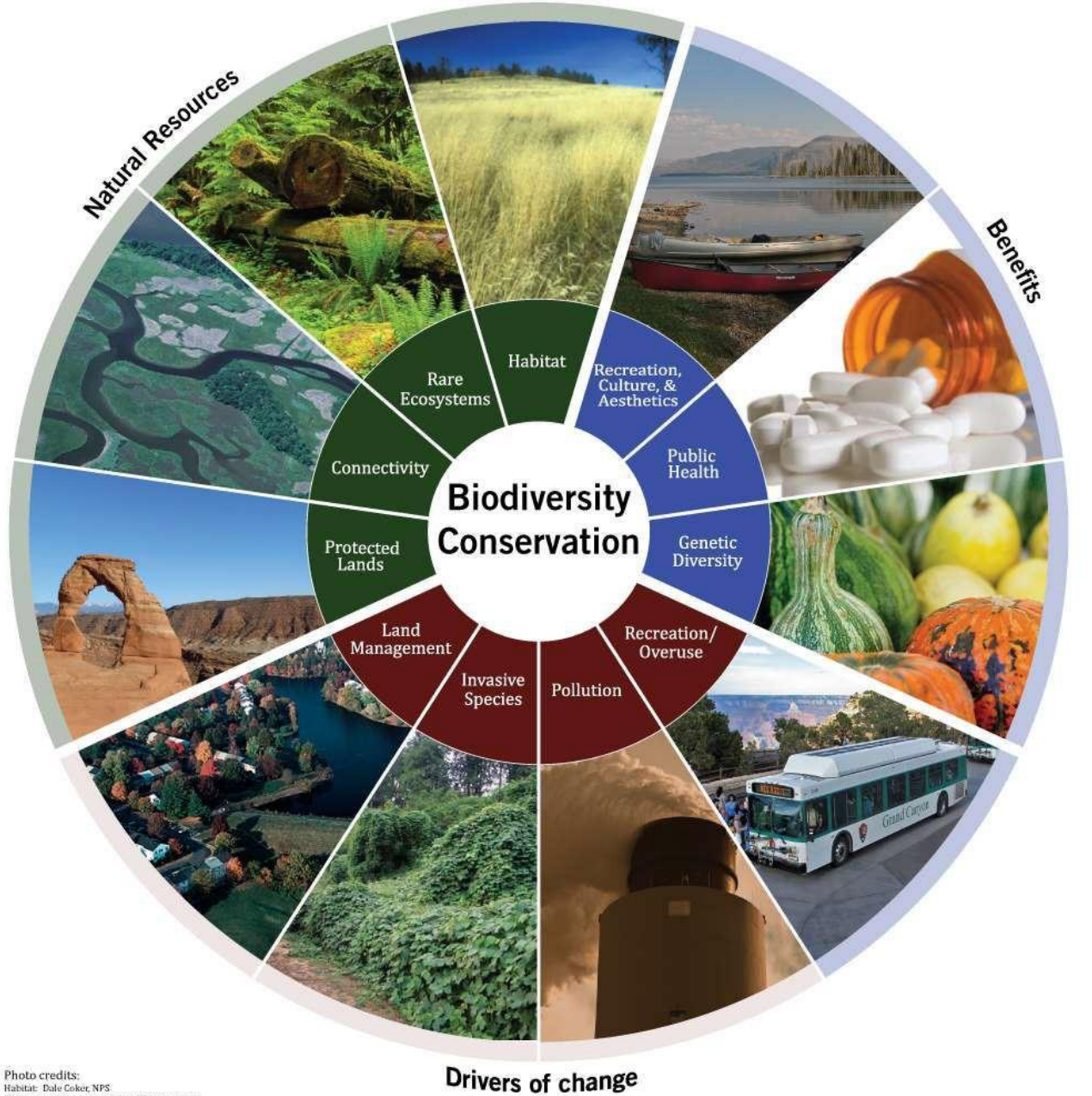
BIODIVERSITY CONSERVATION

- *Mass Extinction* – the disappearance of species at a rate of 1000 times faster than usual.
- The disappearance of species in a certain environment causes an imbalance in the ecosystem, producing more chaotic changes that harm the entire ecosystem (inquirer.net, 2016).
- As inhabitants of the ecosystem, humans must preserve and conserve the biodiversity of all the creatures.



BIODIVERSITY CONSERVATION

- The practice of protecting and preserving the wealth and variety of species, habitats, ecosystems, and genetic diversity on the planet.



Biodiversity and human health

Health "is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".

Biological diversity (biodiversity) is "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."

Biodiversity underpins ecosystem functioning and the provision of goods and services that are essential to human health and well being.

The links between **biodiversity and health** are manifested at various spatial and temporal scales. Biodiversity and human health, and the respective policies and activities, are interlinked in various ways.

Direct drivers of biodiversity loss include land-use change, habitat loss, over-exploitation, pollution, invasive species and climate change. Many of these drivers affect human health directly and through their impacts on biodiversity.

Women and men have different roles in the conservation and use of biodiversity and varying health impacts.

Human population health is determined, to a large extent, by social, economic and environmental factors.

The social and natural sciences are important contributors to biodiversity and health research and policy. Integrative approaches such as the Ecosystem Approach, Ecohealth and One Health unite different fields and require the development of mutual understanding and cooperation across disciplines.

World Health Organization

Convention on Biological Diversity

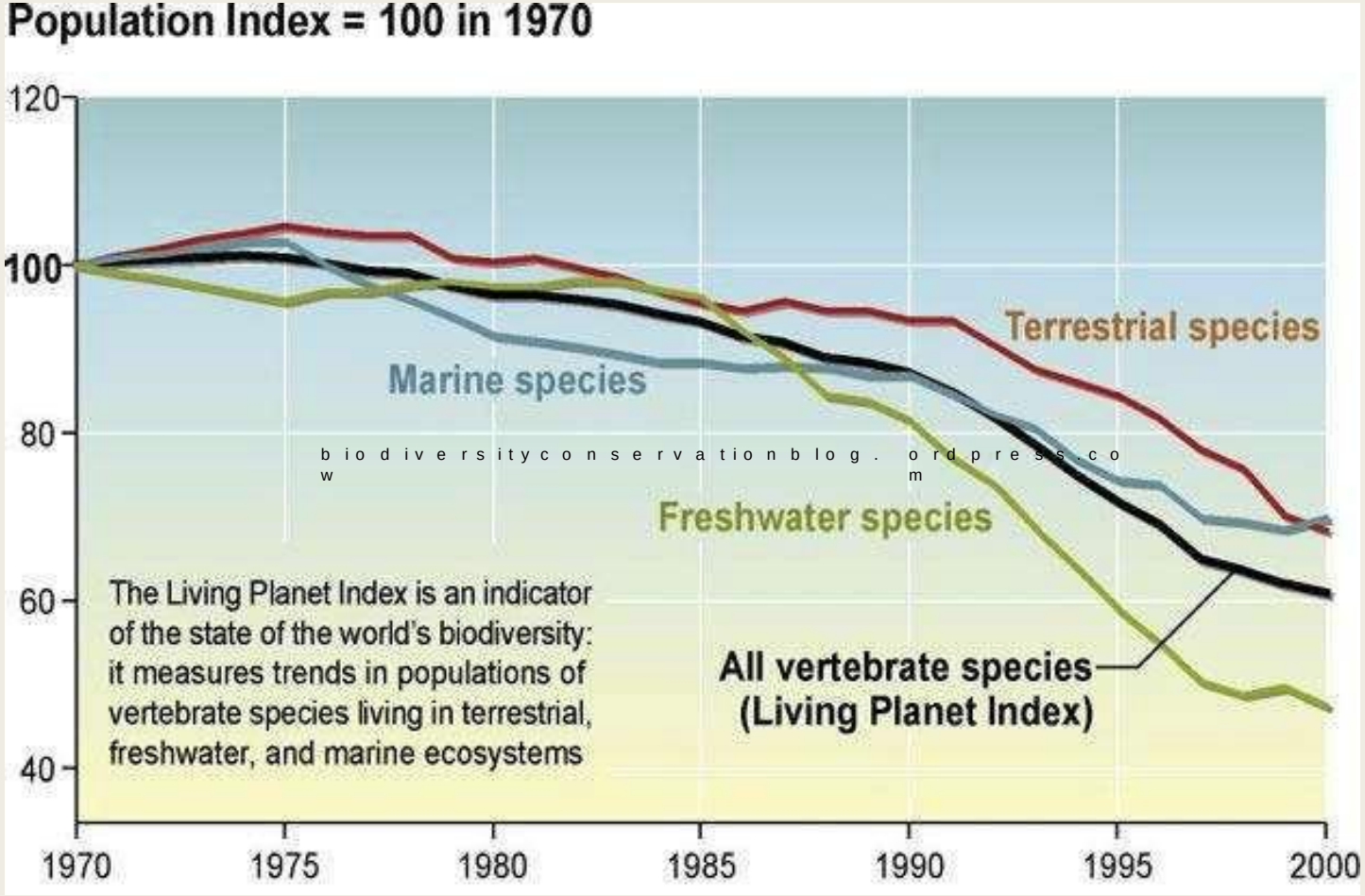
BIODIVERSITY and SOCIETY

- The need to drink clean and fresh water
- The need to eat healthy vegetables and food
- The need of a man to transportation (rely on fuel)

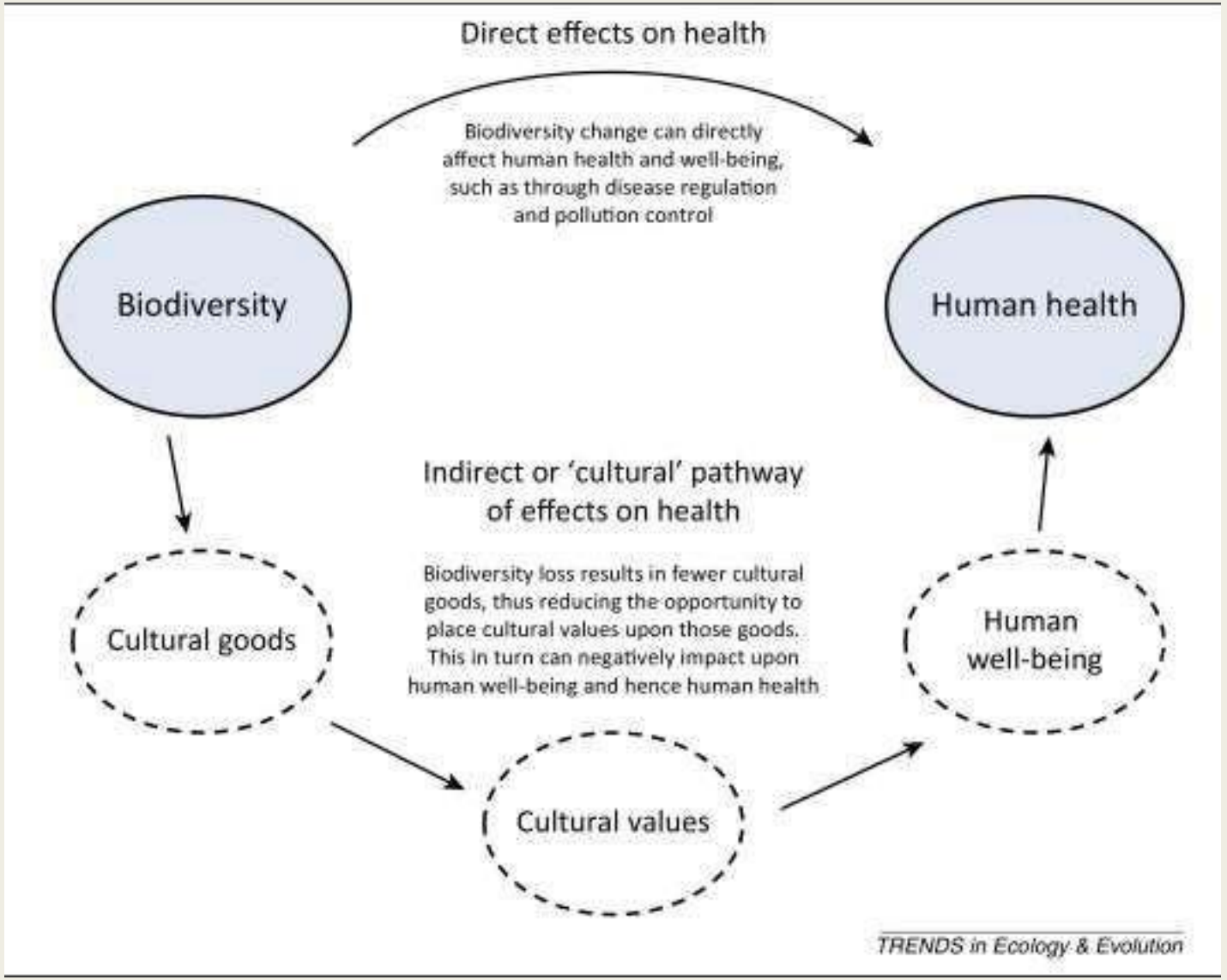
BIODIVERSITY DECLINE/LOSS

- Direct impact on society: ecosystem can no longer provide the physical and social needs of human beings

- Indirect impact: changes in the ecosystem affect livelihood, income, and may cause political conflict



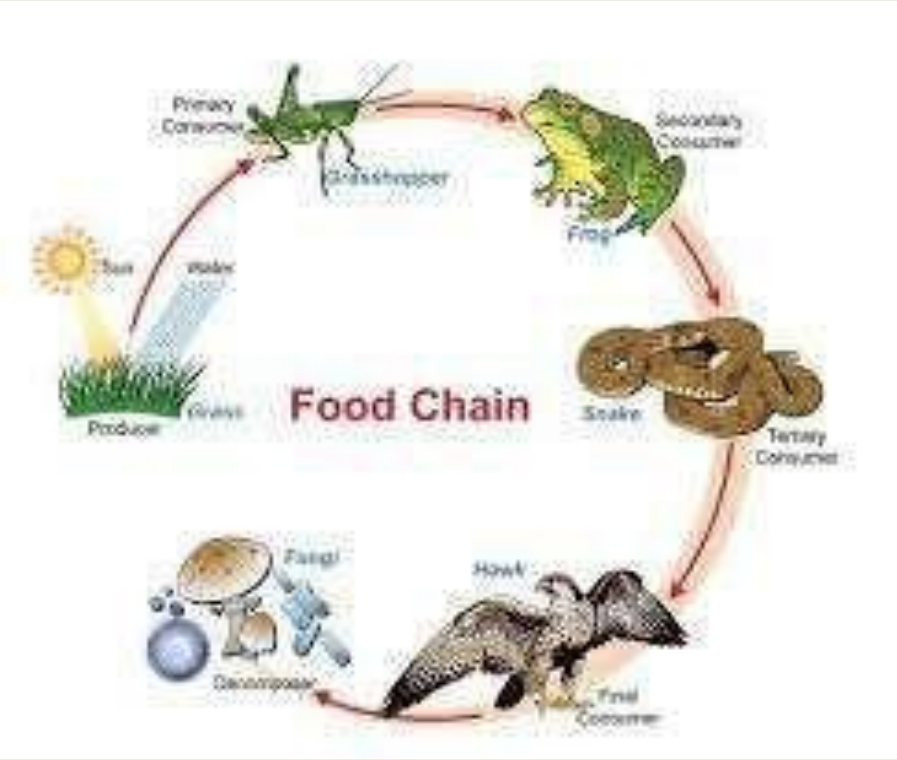
IMPACT OF BIODIVERSITY DECLINE/LOSS



THREATS TO BIODIVERSITY

- **Habitat loss and destruction** - major contributing factor is the inhabitation of human beings and the use of land for economic gains (logging, mining, conversion of forests into agricultural, residential or industrial land.

THREATS TO BIODIVERSITY



Climate Change

Converting forests into palm oil plantations is 'total devastation' for the planet

Living on Earth

December 28, 2018 · 11:00 AM EST

Writer **Adam Wernick**

Land cleared of tropical rainforest for establishment of oil palm plantation in Sabah, Malaysian Borneo.

Credit: T. R. Shankar Raman/Wikimedia Commons/CC BY-SA 4.0

Demand for palm oil is booming. It's a common ingredient in a wide variety of food and household products, from cookies, bread, and chocolate to soap and shampoo. But as it turns out, the conversion of tropical forest into land fro palm oil plantations has created huge risks for the entire planet.

Palm oil plantations exist in Malaysia, Indonesia, Philippines, and some countries in Africa.

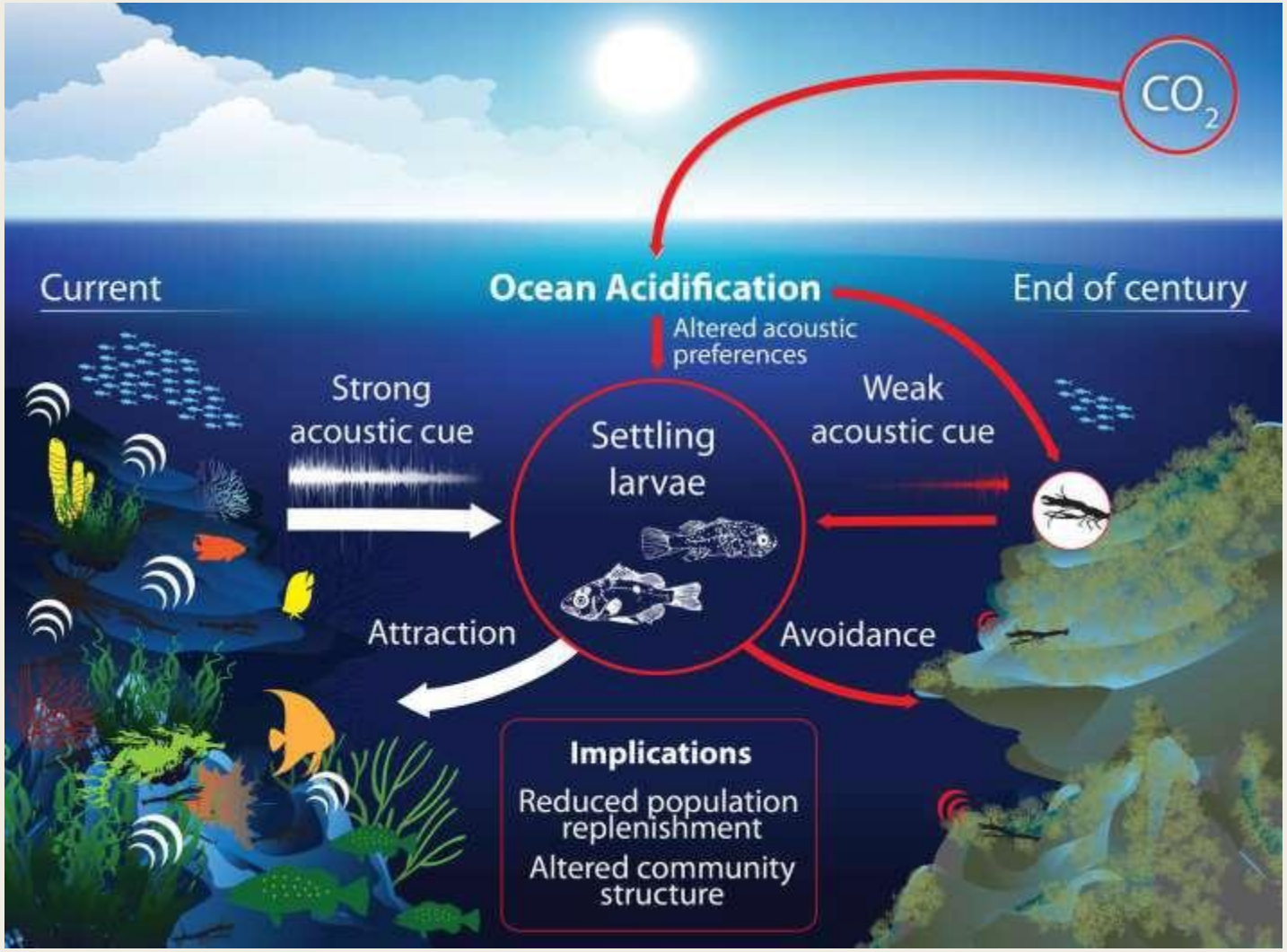
https://www.pri.org/stories/2018-12-28/converting-forests-palm-oil-plantations-total-devastation-planet

THREATS TO BIODIVERSITY

- **Lack of wildlife corridors** – wildlife corridors are structures or patches of forests which link two or more wildlife habitats and help animals to cross over; lack of wildlife corridors lead to decrease in species diversity (animals may not find mates or may mate with close relatives only, decreasing overall species fitness.

THREATS TO BIODIVERSITY

- **Alteration in ecosystem composition** – alterations and sudden changes, either within species group or within the environment, could begin to change the entire ecosystems. This is a critical factor to species and habitat loss.



THREATS TO BIODIVERSITY

- **Over-exploitation** – overhunting, overfishing, over-collecting species can quickly lead to its decline. Changing consumption patterns of humans is often cited as the key reason for this unsustainable exploitation of natural resources.
  - *Threatened* – any species that is likely to become an endangered species within the foreseeable future throughout all or significant portion of its range.
  - *Endangered* – are at the brink of extinction
  - *Extinct* – something that no longer exists and has no living representative.

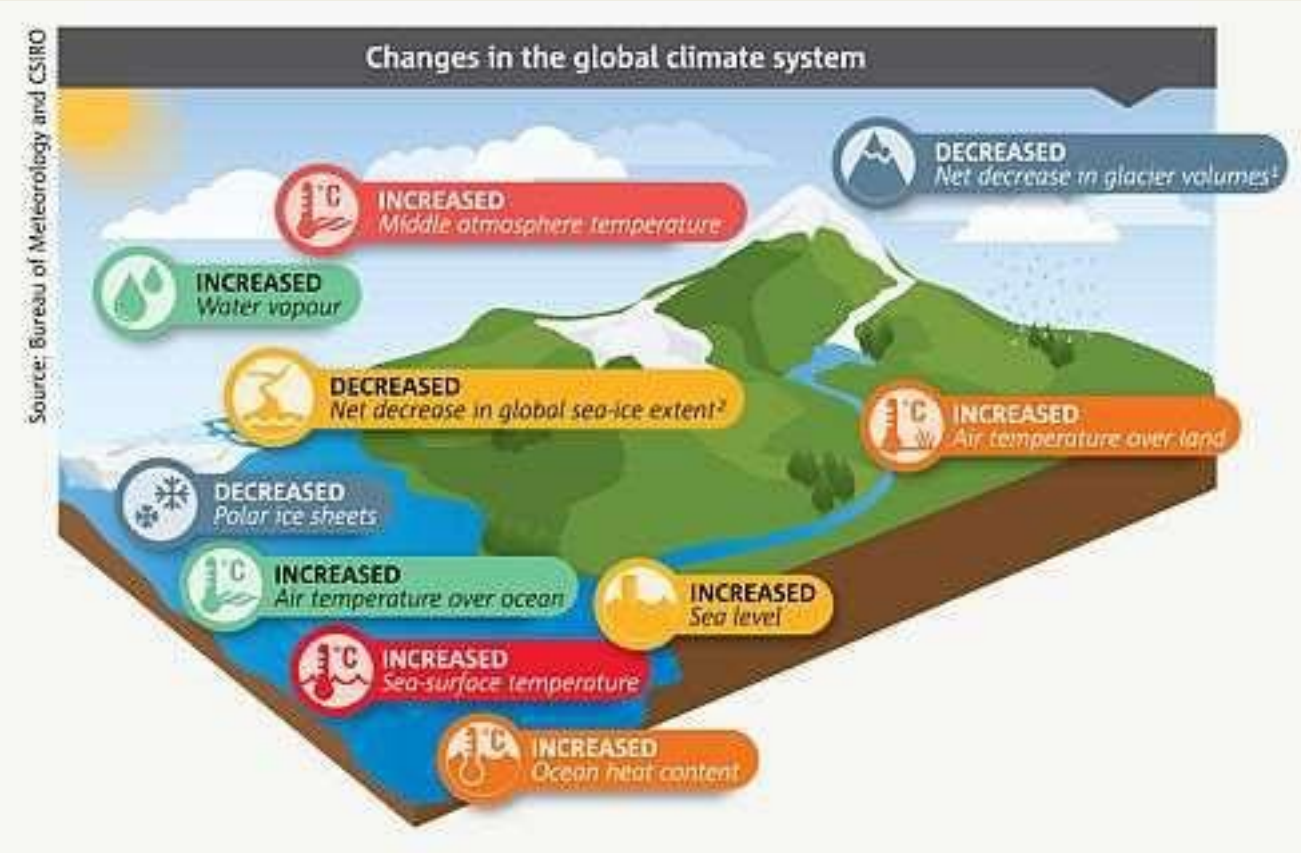
THREATS TO BIODIVERSITY

- **Pollution and contamination** – biological systems respond slowly to changes in their surrounding environment. Pollution and contamination cause irreversible damage to species and varieties

https://www.youtube.com/watch?v=iim-2KbPHcA

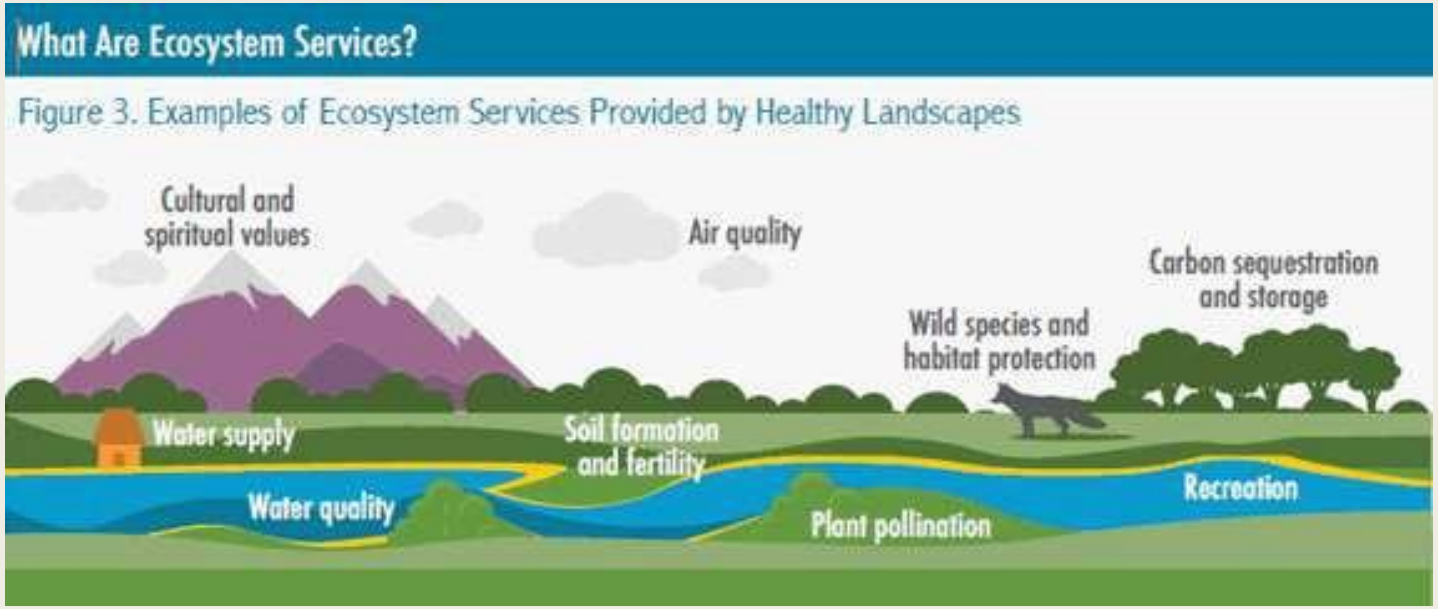
THREATS TO BIODIVERSITY

- **Global climate change** – both climate variability and climate change cause biodiversity loss. Species and populations may be lost permanently if they are not provided with enough time to adapt changing climate conditions.



CONSEQUENCES OF BIODIVERSITY LOSS

- Intact ecosystem functions best since organisms composing them are specialized to function in that ecosystem to capture, transfer, utilize, and ultimately lose both energy and nutrients.
- They also determine its productivity, affect nutrient cycles, soil contents, and influence environmental conditions such as water cycles, weather patterns, climate and other abiotic aspects.



NUTRITIONAL IMPACT OF BIODIVERSITY

- According to World Health Organization, biodiversity is a vital element of a human being's nutrition because of its influence to food production.

- A society or a population must have access to a sufficient variety of nutritious food as it is a determinant of their health as human beings.

NUTRITIONAL IMPACT OF BIODIVERSITY

- Nutritional composition between foods and among varieties/breeds of the same food can differ therefore affecting micronutrient availability in the diet.
- Intensified or enhanced food production through irrigation, use of fertilizer, plant protection (pesticides), or introduction of crop varieties and cropping patterns affect biodiversity and thus has an impact on global nutritional status and human health.
- Habitat simplification, species loss, and species succession often enhance vulnerability of a certain community to be receptive to illnesses (WHO, 2007).

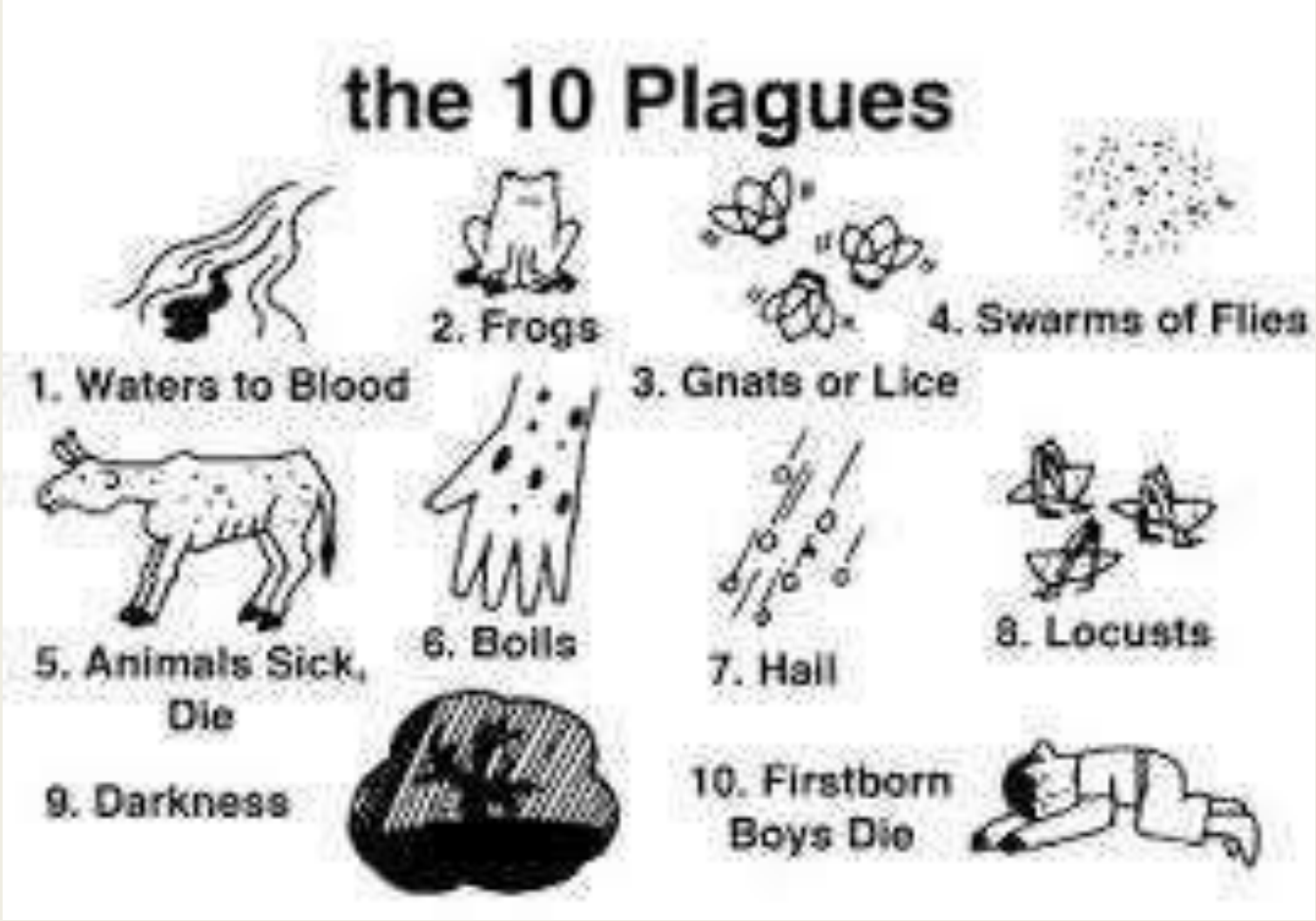
HEALTH, BIOLOGY, AND BIODIVERSITY

- Living organisms are dependent to their environment to live and reproduce
- Basic needs such as air, water, food, and habitat are provided by the environment
- The environment can also cause diseases and illnesses
- Physical hazards such as pollution, toxic chemical, food contaminants

HEALTH, BIOLOGY, AND BIODIVERSITY

- Social hazards such as dangerous work, poor housing conditions, urban sprawl and poverty.
- Unsafe drinking water and poor sanitation can lead to infectious diseases such as diarrhea, cholera, meningitis, and gastritis.
- In 2015, appx. 350,000 children under the age of five died from diarrhea due to unsafe drinking water.
- Appx. 1.8 B people used drinking water contaminated with feces.

THE TEN PLAGUES OF EGYPT



SUMMARY

- The value of biodiversity is the value of everything (Rainforest Conservation Fund, n.d.)

- As humans, we must recognize the value of the organisms with which we share the planet.