ECS 205 A –Environmenta

Introdu
Environmental S

Syllabus

ESC205A- Environmental Sciences

Credits: 2

Pre-requisites – No pre-requisites required for this

Post Condition (on student capability after success

At the end of the course, the student will be able to

- Understand the importance of environment and
- Analyse and incorporate the essence of environn

decision makin

1	Introduction to Environmental Science and Su and environment, ecosystem, pathways in ecos Biological factors in the environment. Concep Development	1.5	1 (project work bas
2	Ecology and Biodiversity - Structure & functio it's conservation	1.5	
3	Natural Resources – Forest resources, water re resources and mineral resources	1.5	
4-5	Air quality management – air pollution source air pollution control and management	3	
5	Water quality management – water pollution, w management	1.5	

6	Solid and hazardous waste management – type issues and waste management 1.5 Quiz	
7-8	Environmental Management System - ISO 140 environmental policy, environmental performa ecolabelling and corporate social responsibility	
9	Energy and Environment – Renewable and nor its impact on human health and environment	

10 - 11	Environmental Decision Making Tools - En Environmental risk assessment, Monitoring assessment and Environmental modelling 3
12 - 13	Contemporary Environmental Issues - Rain climatic change, climate vulnerability, carbo economy and sustainable urbanism 1.5 foot-prints - hands-on)

Field Visit *

- * A possible visit in NCR, W
  Campus or A virtual Visit t
  Video may be there at the
  depending upon the time a
  facilities.

Evaluation

- **Mid Term Examination 20 %**
- **Assignments – 15 %**
- **Quizzes – 5 %**
- **Project Work (Based on Field V**
- **Interactions in class and Attenda**
- **End Semester Examination – 30**

Project Work

- Visit to a Local Area to Docume River/Forest/Grassland*/Flora# Mountain* etc.
- Visit to Some Local Polluted Sit Industrial/Agricultural
- Study of Common Plants, Insec Principles of Identification
- Identification of Insects
- Identification of Common Inse
- Identification of Birds
- Identification of Some Commo
- Study of Simple Ecosystems – Hill Slopes*, Delhi Ridge#

Texts/Other Resources

1. Gilbert M. M. and Wendell E. (2008). Introd
environmental engineering and science, Prent

- 2. Canter L.W. (1996) Environmental Impac
  2nd Edn. New York, McGraw Hill.

- 3. Odum E.P. (2007) Ecology: A Bridge betw
  Society.
- 4. Any book on Environment and Ecology by
  Authors or Foreign Authors, Internet, Envir
  Reports, Research Papers or Current or Old

Introduction to Environmental Sustainable development

As per Environment Protectio
Environment is defined as the sum
air, and land and the inter-relation
among them and with the human
living organisms and materials

What is Environ Science

The study of how hum their environment

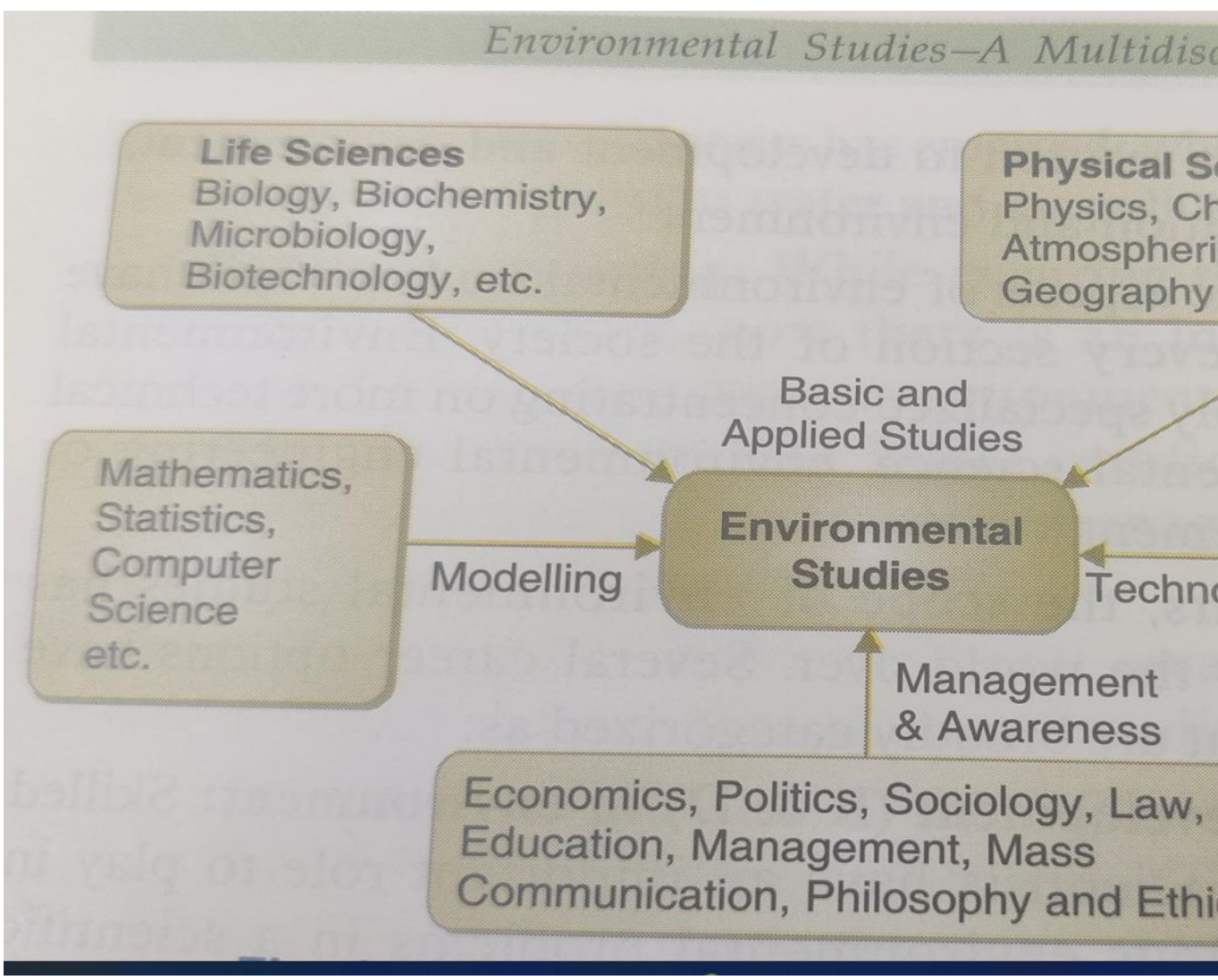
Our environment is surrounds us, both man- made.

Environment: the
surroundi

- **All the things around
which we interact:**
  - **Living things**
    - **Animals, plants, forests
etc.**
  - **Nonliving things**
    - **Oceans, clouds, soil, ro**
  - **Our built environment**
    - **Buildings, human-creat
centers**
  - **Social relationships an**

SEGMENTS OF ENVIRONM

- **Atmosphere** – it is comp
  distinct layers such as tro
  stratosphere, mesospher
- **Hydrosphere** – Water –
- **Lithosphere** – Solid part
  - The crust includes minera
  - Largest volume of Earth's
- **Biosphere** – It is the par
  includes Air, Land, Water
  life occurs.


Environmental Studies—A Multidisc
Life Sciences
Biology, Biochemistry,
Microbiology,
Biotechnology, etc.
Physical Sc
Physics, Ch
Atmospheri
Geography
Basic and
Applied Studies
Mathematics,
Statistics,
Computer
Science
etc.
Modelling
Environmental
Studies
Techno
Management
& Awareness
Economics, Politics, Sociology, Law,
Education, Management, Mass
Communication, Philosophy and Ethi

Earth, Man & Environment

- Humans impact the physical environment in mar
  overpopulation, pollution, burning fossil fuels, a
  Changes like these have triggered climate chang
  poor air quality, and undrinkable water.
- Earth is like a mother to the mankind who are to
  it. Age of earth is estimated to be about 4.6 billi
- Our ancestors depended on earth resources for t
  world and they started giving due importance to
  as trees, plants, sun , water , air etc. Plants, tre
  were also exploited as ancient medicines by the

- Today this is continuing as Ayurveda or U
  medicines.Cows were exploited to get m
  life form on this earth is being created t
  recycling of the remains from the dead b
  plants , minerals etc.We are not sure ab
  but recycling through DNAs (N and P bas
  chemicals etc. etc.possibly through rema
  and these materials is happening.
- Man has slowly developed techniques to
  nature , in fact earlier he was scared of
  nature like lightning, rains, fires, hot wa
  oceans etc.
- Necessity is the mother of invention.

- Agricultual practices were started almos
  ago.Human brains developed science an
  devise more and more products and proc
  harness natural resources
- Several inventions took place with time.
  revolution started in 1760 and it is consi
  lasted up to 1840. Digitalization is happe
  Industry 4.0/5th period. Agricultural rev
  replaced by the industrial revolution an
  entered the space and computer age. W
  mobiles commercially earlier till 1983 -
  Technology etc.

- 1. Emission of greenhouse gases such
  NOx, water vapours etc., besides CFC,
  ozone layer depletion.

- 2. Hazardous chemicals (xenobiotics
  animal life) or anthropogenic compoun

recalcitrant to biological degradation in n
agriculture and industries.

- 3. Production of nuclear materials.
- 4. Nuclear wastes.
- 5. Biological warfare.
- Drones etc.

Environmental Policy Inte
Climate (EPIC)

- The Near Extinction of Indian V
  Led to the Death of a Half Milli
- A new EPIC study shows that w
  millions of vultures were unint
  poisoned in India, it removed "
  sanitation service" and allowed
  bacteria and infections to prol

Ecology

- These activities have grave impac
  environment and these are challe
  survival of man on this terrestrial
  may have to be controlled to mal
  sustainable on this earth.

Ecology

**The term ecology was described by Earnst
1869. Ecology deals with the study of inte
organisms in their natural space with their**

Caution - Number of Slides are
because of bigger Font Size Plea
This may also help you in reduc
dependence on materials.
These may help you in acquiring
knowledge.

- Example is the interaction of tiny
  forest with other insects, anima
  soil, water, air etc.
- Thus, ecology is a science which
  the interaction and relationship
  or a group of organisms.

Ecosystem AND Ecological E

- Tansley in 1935 defined ecosystem a regulating group of biotic community interacting with each other and with non-living environment exchanging e matter.
- This helps us to understand the conne between organisms and their abiotic
- Ecology is then the study of ecosyste
- Ecological engineering is defined as t restoration, or creation of ecosystem strong emphasis on ecosystem self-de self-organization and controlling the disturbed situations.Self regulations / interdependence, cooperative or anta domains etc. etc.

- **Ecosystem - living things in a gi**
  non-living chemical and physic
  environment, linked together th
  cycle and energy flow

Types of Ecosystems

Natural **Arti**

Terrestrial (Forest, Grass land, Desert)

Aquatic

Marine **Fresh wa**

Lotic -river, stream or spring.

What causes ecosystems

Natural caus

1

Drought

Disease

2

3

Fire

What causes ecosystem

Changes caused

1 

Water poll

Air polluti

3 

Land pollu

Construct

How can humans help
changes in ecosystems

1 

Use resource

Laws that control pol

3 

Clean up litte

Keep rivers and lake

Ecosystems
Fundamental Chara

ABIOTIC compo

- Solar energy provides practi
  for ecosystems.
- Inorganic substances, e.g., s
  tend to cycle through ecosy
- Organic compounds, such a
  carbohydrates, lipids, and ot
  molecules, form a link betwe
  components of the system.

Ecosystems: Func

BIOTIC compo

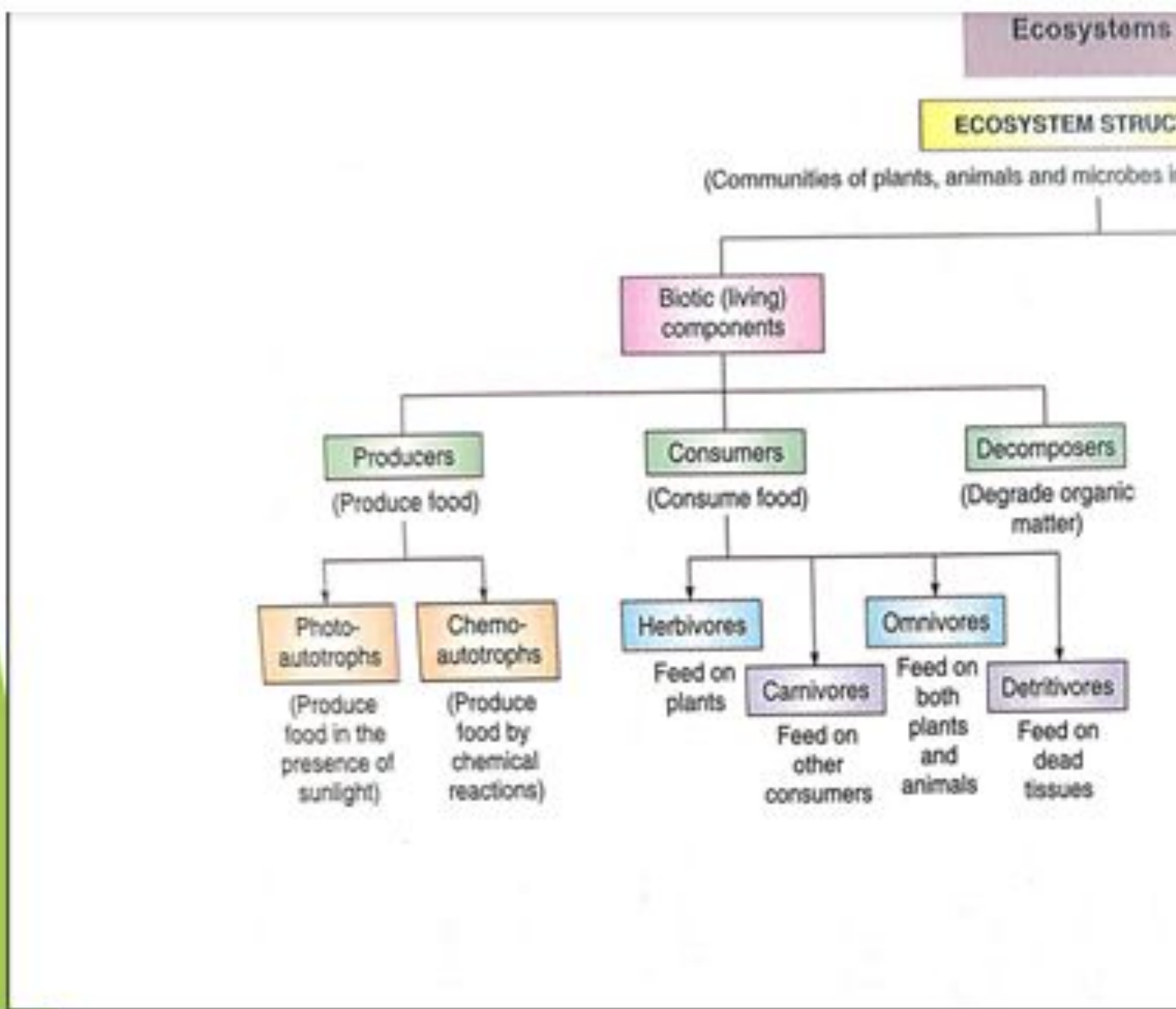
- The biotic components of an
  classified according to their
  acquisition.
- In this type of classification,

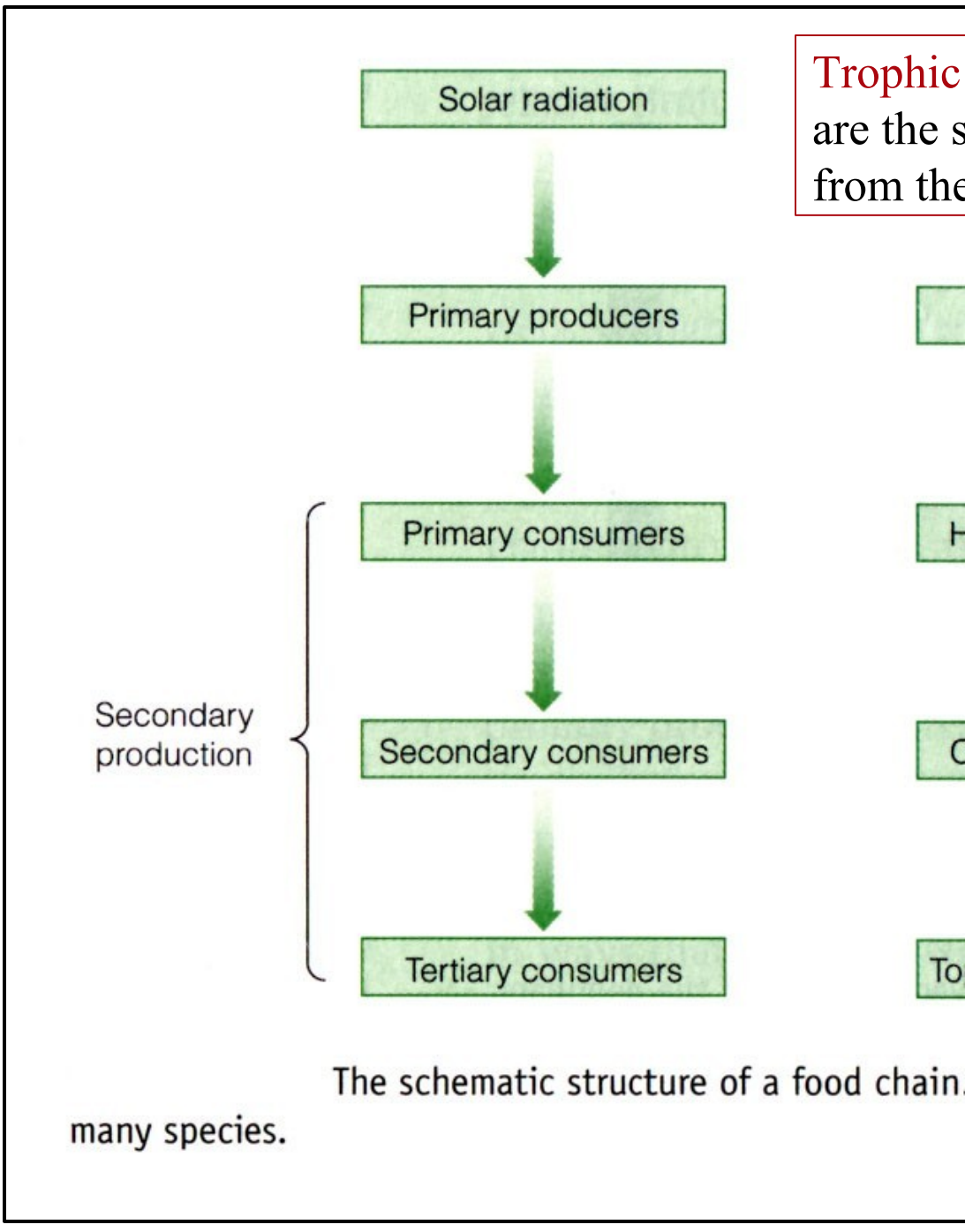
- Autotrophs and Heterotro

- Organisms that produce thei
  energy source, such as the s
  compounds.
- Organisms that consume oth
  food source.

Structure of ecosystem

- The structure of ecosystem involves mainly i.e., food chains and food web through wh nutrients move through the ecosystems.
- Sun is the driving force of ecosystems. This described in 5 levels :
- Producers
- Herbivores
- Carnivores
- Detrivores
- Decomposers


Ecosystems
ECOSYSTEM STRUC
(Communities of plants, animals and microbes i
Biotic (living) components
Producers
(Produce food)
Consumers
(Consume food)
Decomposers
(Degrade organic matter)
Photo-autotrophs
(Produce food in the presence of sunlight)
Chemo-autotrophs
(Produce food by chemical reactions)
Herbivores
Feed on plants
Carnivores
Feed on other consumers
Omnivores
Feed on both plants and animals
Detritivores
Feed on dead tissues



Trophic
are the s
from the

The schematic structure of a food chain.

many species.

Examples of interactions

Symbiosis is a term describing any relation
interaction between two dissimilar organis
specific kind of symbiosis depends on whe
both organisms benefit from the relationsl

For example, the close relationship betwe
and **sea anemones :**
The Stingging Tentacles of sea anemones
partners a protection from predators and
anemone is getting advantage as food fro
fish waste - Mutualism mostly.
Mutualism is defined as an interaction bet
individuals of different species that result
(beneficial) effects on per capita reproduc
survival of the interacting populations.. Ex

Honey guide bird takes human t
the eats wax left after the recov
honey.

and algae, honeyguides bird guides humans t

Commensalism, in biology, a relationship betw
two species in which one species obtains food
from the other without either harming or ben
Example - orchids growing on tree branches-
Tree frogs use plants as protection. Golden ja
feed on the remains of its kills.

Antagonism, in ecology, an association betwe
which one benefits at the expense of the oth
evolved, natural selection has favoured organ
to efficiently extract energy and nutrients fro
environment.Example opposing action of insu
blood sugar, Mosquitoes, pests and man.

Physico-chemical and biologic in Environment

- Physico-chemical properties are the intrinsi chemical characteristics of a substance. The appearance, boiling point, density, volatilit solubility and flammability etc
- **Physical factors of ecosystem and e**

Critical physical factors are temperature, ligh (such as rainfall, soil moisture, flow rates, and well as infrequent events that reshape ecologi as fires, floods, and storms.

Cloudbursts occur when warm, moist air from is pushed upward along mountain slopes throu lifting. As this air rises to higher altitudes with atmospheric pressure, it expands and cools ad

Climate Modeling depends up

- Physical attributes reflect, in part, th
  solar radiation. Solar radiation warms
  masses, drives hydrologic cycles, and
  photosynthesis (which is essential to
  systems).

- Biochemical factors include microbia
  photobiological or electrobiological c

Factors that alter the critical chemical
characteristics of ecological systems inc
pH, electrochemical (redox) potential,
transparency of air and water. pH of hu

Video on Environmental Engi

- https://www.google.com/search?q=why+should+the+en
ng+be+taoght+video&sca_esv=0de3656c54fa3244&rlz=1C
45&sxsrf=AE3TifNGgPvnxqHI_-RYmIy3dlTt7gaZsA%3A175
Ov1IsqRseMPl--u-Qg&ved=0ahUKEwir2fre5ISPAxXKSGwGH
act=5&oq=why+should+the+environmental+engineering+
p=Egxnd3Mtd2l6LXNlcnAiOHdoeSBzaG91bGQgdGhlIGVudr
5naW5lZXJpbmcgYmUgdGFvZ2h0IHZpZGVvMgcQIRigARgK
gARgKMgQQIRgVSJcmUO4KWPkecAF4AZABAJgB7wGgAb0
QD4AQGYAgSgAtcEwgIKEAAYsAMY1gQYR8ICBRAhGJ8FmA
BgiSBwUxLjIuMaAH5BayBwUwLjIuMbgHzATCBwcwLjIuMS
iz-serp#fpstate=ive&vld=cid:392ef1f5,vid:d-4itpao5Dc,st

Pathways of ecosystem :

- There are three major pathways through tree biomass is degraded into the forms nutrients again available to plants: micr decomposition; vertebrate herbivores; a
- Here microbes, herbivores, and wildfires role in the functioning of ecosystems . T diversity of mechanisms regulate the bio

Chemical factors of ecosystem

- Critical chemical attributes include level
  nutrients, pH, salinity, and other chemic
  environment.

- Biochemical factors include all biological
  including microbial and other biological

- Physical, chemical, and biological proces
  influenced by the amount and timing of
  temperature and weather conditions, ph
  chemicals, mutations, and the timing of
  cycles. Solar radiation can have potentia
  effects on some species.
- Reproduction and other activity patterns
  often related to physical and chemical c
  temperature, light, and salinity. They m
  linked to physical disturbances (such as
  floods).

Food Chains

- Transfer of energy through eating and being
  step is called a trophic (relating to feeding
  level..
- The main source of energy for food chain is
  animals or waste produced from living anim
  of energy source there are two types of foo

Types of food chains :

- 1. Grazing food chain - Starting with plants
- 2. Detritus food chain - Starts with dead or

Trophic Le

- A trophic (food and nutrition) position occupied by an orga chain.
- Trophic levels can be analyze pyramid.
- **Producers** are found at the b comprise the **first trophic lev**
- **Primary consumers** make up **level.**
- **Secondary consumers** mak **level**.

- Living green plants produce food through photosynthesis with the help of UV light plants, trees, grasses. These are eaten b Carnivores depend upon herbivores for t depends upon the sun and this autotroph moves into herbivores and then into carn omnivores. Most of the ecosystems in na food chain.
- Grass → Caterpillar or Grasshopper → Snake → Hawk

Detritus Food chain

- This starts from the dead animals and m
  feeding on these (detritus) and their pr
  does not depend so much on solar energ
  depends on the organic matter produced
  system.

- Leaf litter - Earthworms or insects - Sp
  or Black birds or Vultures - Hawk or Eag

Food Web

- In fact feeding relationship in the ecosys
  complex. Some feed on producers and **s**
  carnivores also feed on dead organic ma
  carnivores are dependent on varied diet
  feed on plants, animals, and fungi also. S
  are called **omnivores**, e.g., bears, birds,
  foxes, certain insects, nightingales, and

- Most of the times the detritus food chain
with grazing food chain in a complex ma
- Example is that the earthworm may feed
and on detrivore , waste produced from
animals and on dead bodies of plants or
source of energy. The inter-linking food
mesh and it is known as Food web.
- This will be discussed in details later alo

Functions of ecosystems

- 1. **Energy flow**
- **2. Nutrient cycling**

Energy flow

- **Autotrophic organisms use sun light to p energy through photosynthesis. This ene other trophic levels to remain alive and**

Chronobiology - Cir

Rhythms

- Circadian Rhythms- are physical, mental
  changes that follow a 24-hour cycle. The
  processes respond primarily to light and
  most living things, including animals, pla
  microbes.
- It permits organisms to synchronize and
  daily or seasonal changes depending on t
  environmental conditions including dark
- Circadian rhythms exist in species throu
  of life, from single-cell organisms (e.g., c
  and Trypanosomes) to humans.

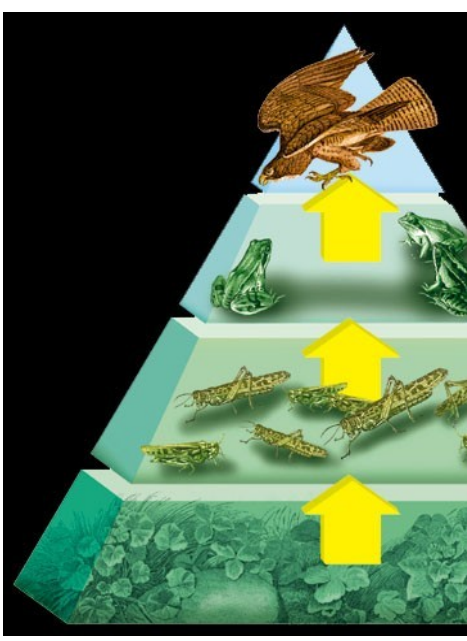
2. Nutrient cycling

- Bacteria and fungi decompose the dead bod
  produced from the living animals and even
  nutrients, chemicals and energy is circula
  ecosystem are known as biogeochemical cy

- C, N, S and P cycles etc.
- Recycling of humans
- Dynosaurs used the same water as we are d
- **Remains of dynosaurs?**

Trophic Levels F
an Energy

- The greatest amount of energy is
the pyramid.
- The least amount of energy is fou
pyramid.



Source:
corpuschristiisd.org/user_files/91702/Ecosyst

Food Cha

Transfer of energy and nut
feeding group of organisr

- The producers, consume
decomposers of each ec
a food chain.
- There are many food cha
ecosystem.
- Food chains show where
transferred and not who

Types of Food

1. Grazing food chain

Plants

Herbivores

(cattle, elephant

Prime.Carniv

(tigers, lions, snak

Second.Carnivores (hawl

Types of Food

2. Detritus Food Chain - Th

waste and dead matter derive
food chains are called detritus

Dead Organic Materials (D
.matter)

↓

Detrivores (Algae, Fungi, Bacte

↓

Chemical Energy -- Simp
Compounds- CO_2 +H_2O + Mine

Biomagnific

- Biological Magnification-
  & getting into human late
  concentration of a substa
  increase at higher levels
  - Ecological Balance :
    - Maintaining and Regulating
    - Overpopulation - All organ
    - Challenges of availability of

  In addition, at each troph
  concentration of food c
  increasing,

Food We

In ecosystems, some consume
single species, but most consu
multiple food sources.

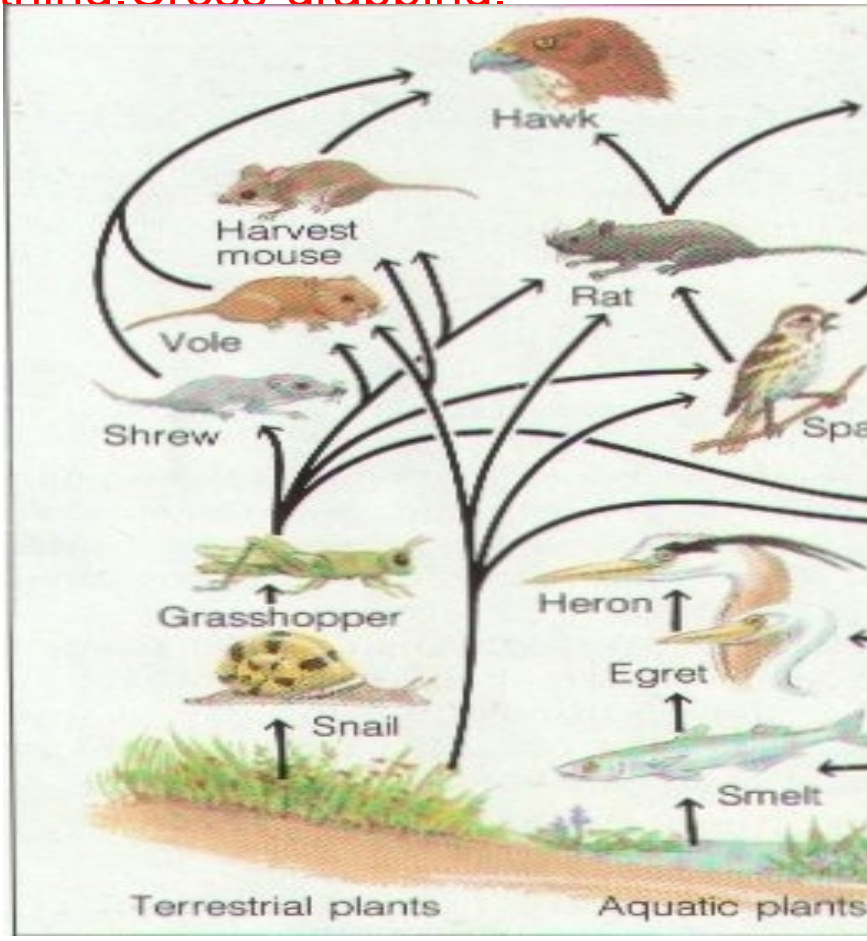
Hawk/ Eagle eats both mouse a

- In this way, individual food c
  connected to form a food we

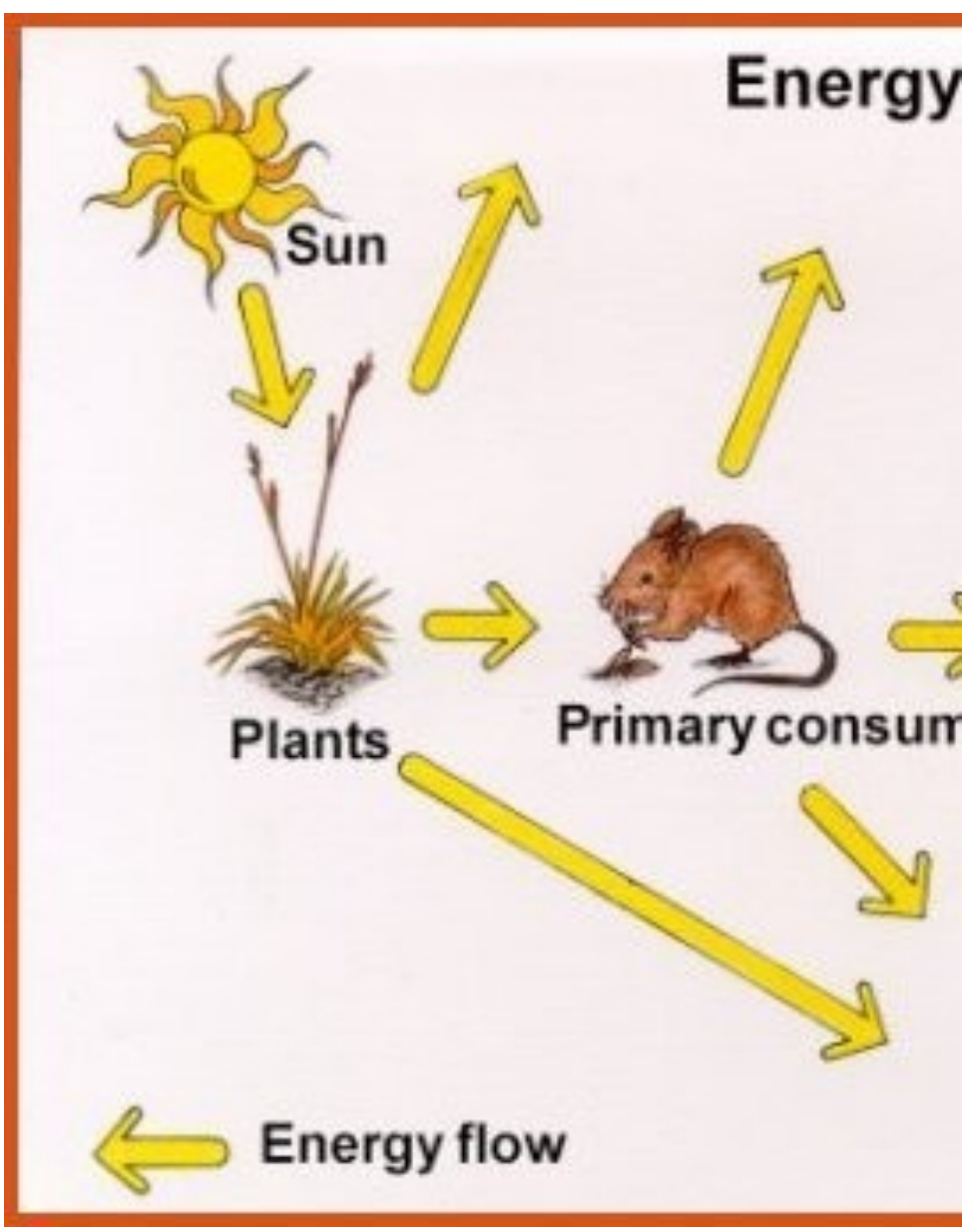
Food We

All the food chains in an area make up t

- Maintaining the stability of an ecosyster
- Mad hunt for quick food. Something is b nothing.Cross-grabbing.



ENERGY FLOW IN ECO



ENERGY FLOW IN ECO

- **All organisms must obtain a supp**
  nutrients from their environment
- The transformations of energy in an
  the input of energy from the sun.
- Because, it is the first step in the pro
  living things, it is called "Primary pro
- *Photosynthesis* -- Chemical reaction
  water and carbon dioxide to store t
- glucose.

  ENERGY is stored in glucose. Gluco
  plants

  The energy contained within produc
  ultimately passed to the decompose
  the constant recycling of nutrients.

ENERGY FLOW IN ECO

- **Thus, there is a one-way flow o**
  biotic community and a cycling
  between the biotic and abiotic
- **ecosystem**
- Energy flow cannot occur in reve
  The amount of energy decreases
- levels.
  Only About 1% of energy from th
- plants & rest remains unutilized.
- Similarly, there is loss of energy i
  The transfer of food energy betwe
  ecosystem can be tracked by cor
  food webs, pyramids of numbers,

NUTRIENT CY

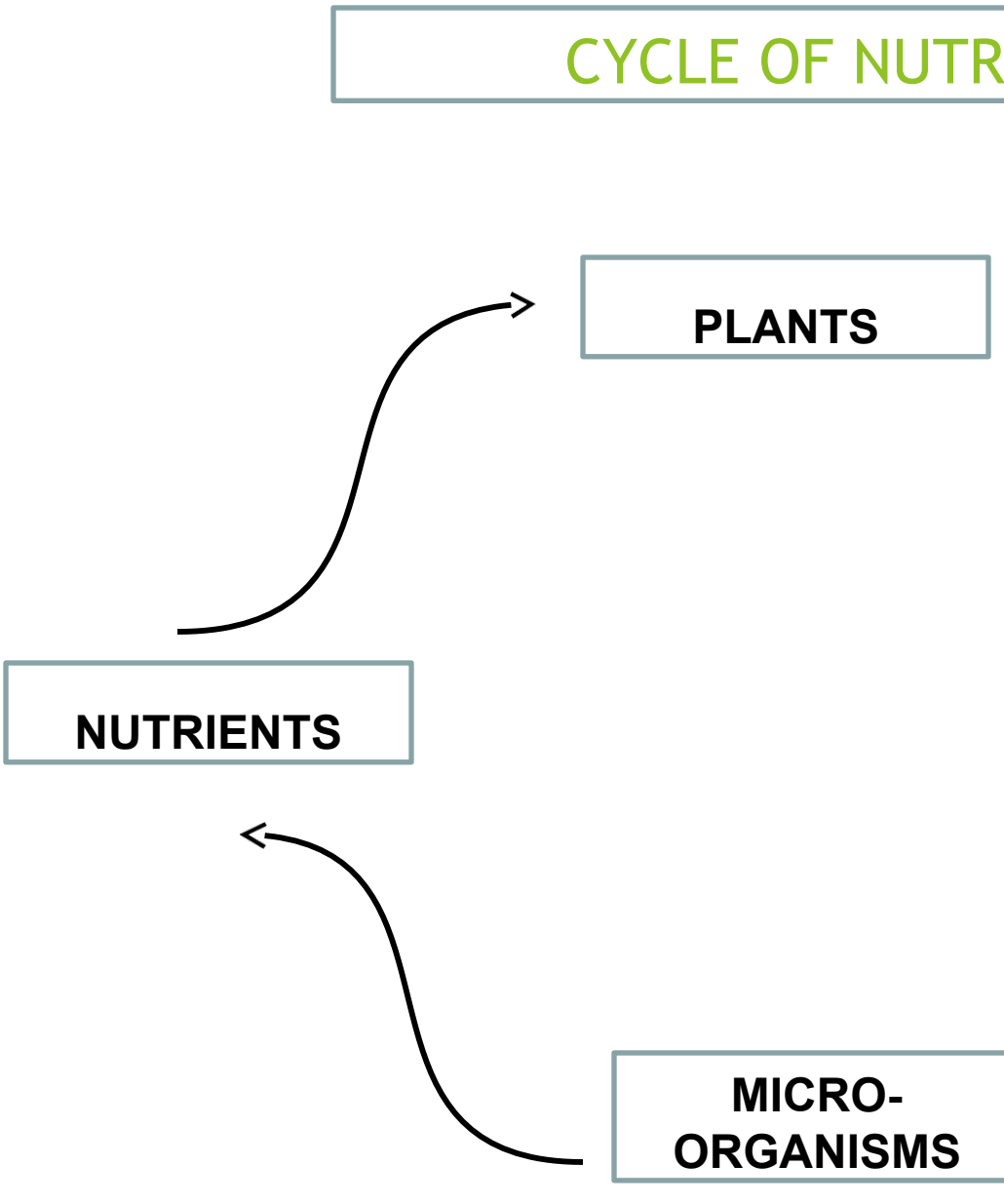
- Nutrient cycles involve st
  transfer of nutrients throu
  components of the ecosy
  nutrients are repeatedly u
- The cyclic movements of
  elements of the biospher
  organisms and environm
  as **“BIOGEOCHEMICAL**

Human body is an ecosystem biome

- A **biome** is an area classified according to th live in that location. These form the niches species, e.g., **rain forests, grassland, desert**

The biosphere is made up of the parts of Earth exists—all ecosystems. The biosphere extends deepest root systems of trees, to the dark env ocean trenches, to lush rain forests, high mou transition zones like this one, where ocean an ecosystems meet.

The Central Amazon Biosphere Reserve is a microcosm/representative of the Amazon's so and ecological diversity. - Green Anaconda- 9 230 kgs.


CYCLE OF NUTR
PLANTS
NUTRIENTS
MICRO-
ORGANISMS

BIOGEOCHEMICAL

- It involves biological, geolog
  systems and all are interlinke
  chain.
- It is the complete pathway th
  element flows from the atmo
  or soil to the living organisms
  the atmosphere, water, rock
- The return of chemical elem
  organisms to abiotic compor
  Mineralization.

- There are 4 different bioc
  - Hydrological cycle (water)
  - Carbon cycle
  - Nitrogen cycle
  - Phosphorous cycle

HYDROLOGIC

- In this cycle, fresh water condenses on the earth. main source of evaporat leaves behind salts.
- Water also evaporates fr bodies, from land and pla

HYDROLOGIC

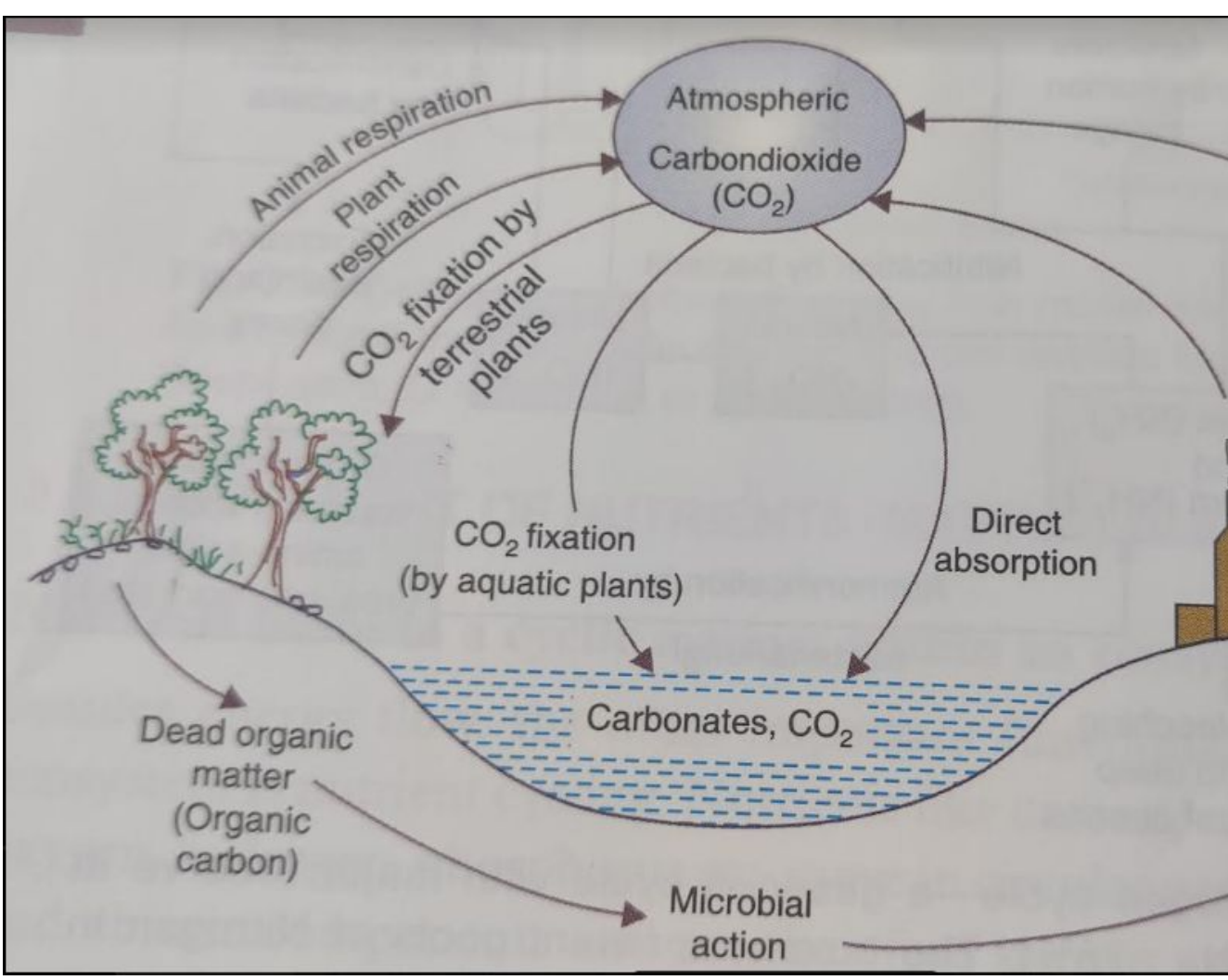
The steps involved in hydr

- evaporation
- condensation
- infiltration
- runoff
- Precipitation
- Cloud bursts

CARBON CYC

- **Carbon enters plants as CO_2**
  - Bacteria and enzymes process that allows it to be recycled.
  - Obtain energy from the molecu carbohydrates to carbon dioxid respiration.
- Photosynthesis removes carbon fr environment (fixes carbon into org
- Carbon moves through food chain of one organisms by another
- Cellular respiration, combustion, a limestone return carbon to the atm abiotic environment.

Carbon cycle



RESPIRATION

AIR CO2 PLANTS

DEATH FOOD

RESPIRATION

BURNING

COMBUSTION

Carbon Cyc

The source of atmospheric carbon dioxide is variable but on
carbon directly

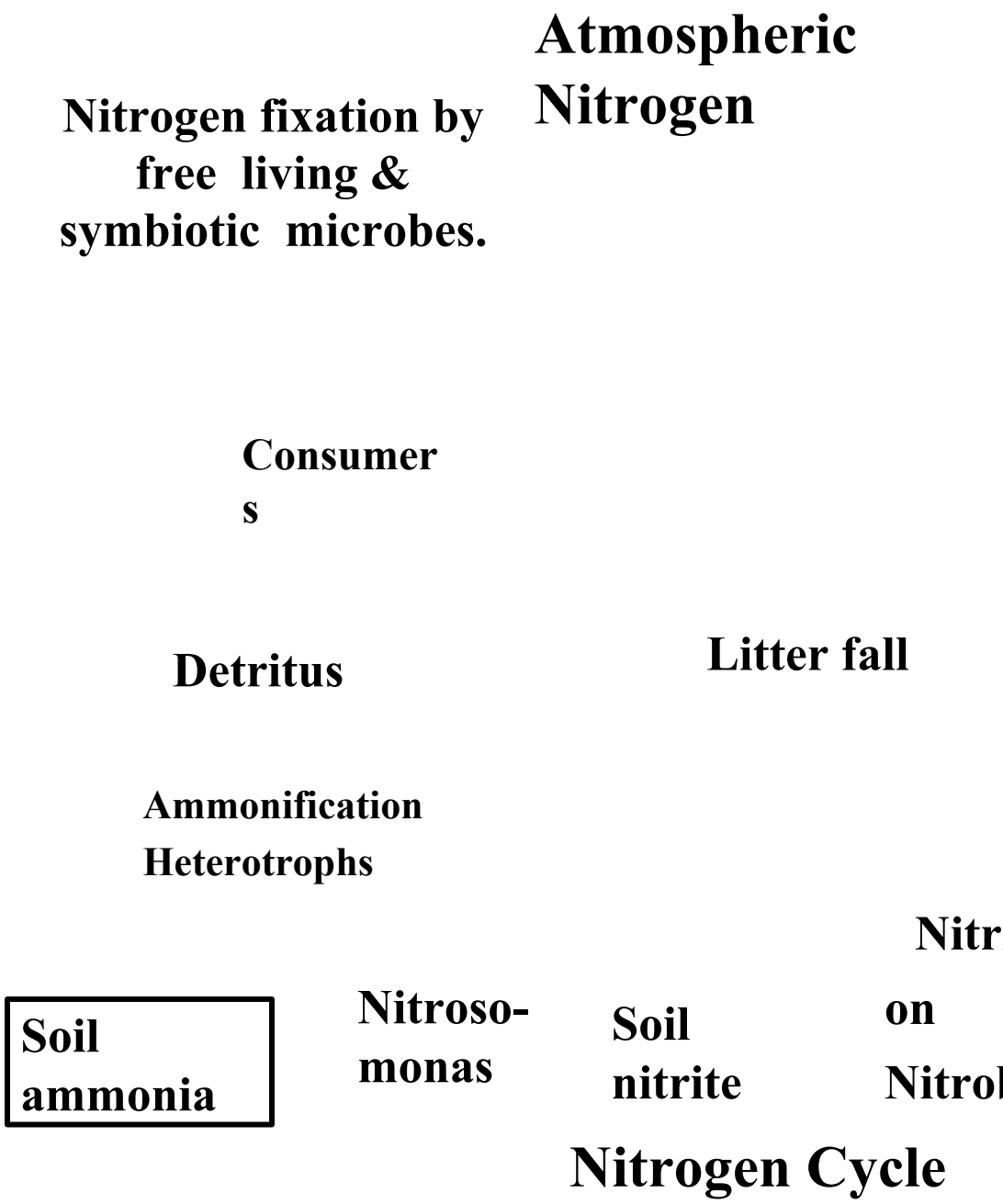
NITROGEN CY

- Nitrogen is crucial for all
  - Nucleic acids and DNA, R
  - Proteins
  - Chlorophyll
- Nitrogen- 78% in Atmosphere
- N_2 is very stable and must
  by organisms, combined w
  into a usable form.
- **The process of entering at**
  the organism and again ba

Nitrogen Fixation (NF) can be carried ou
non-symbiotic N fixer and other natu
process.

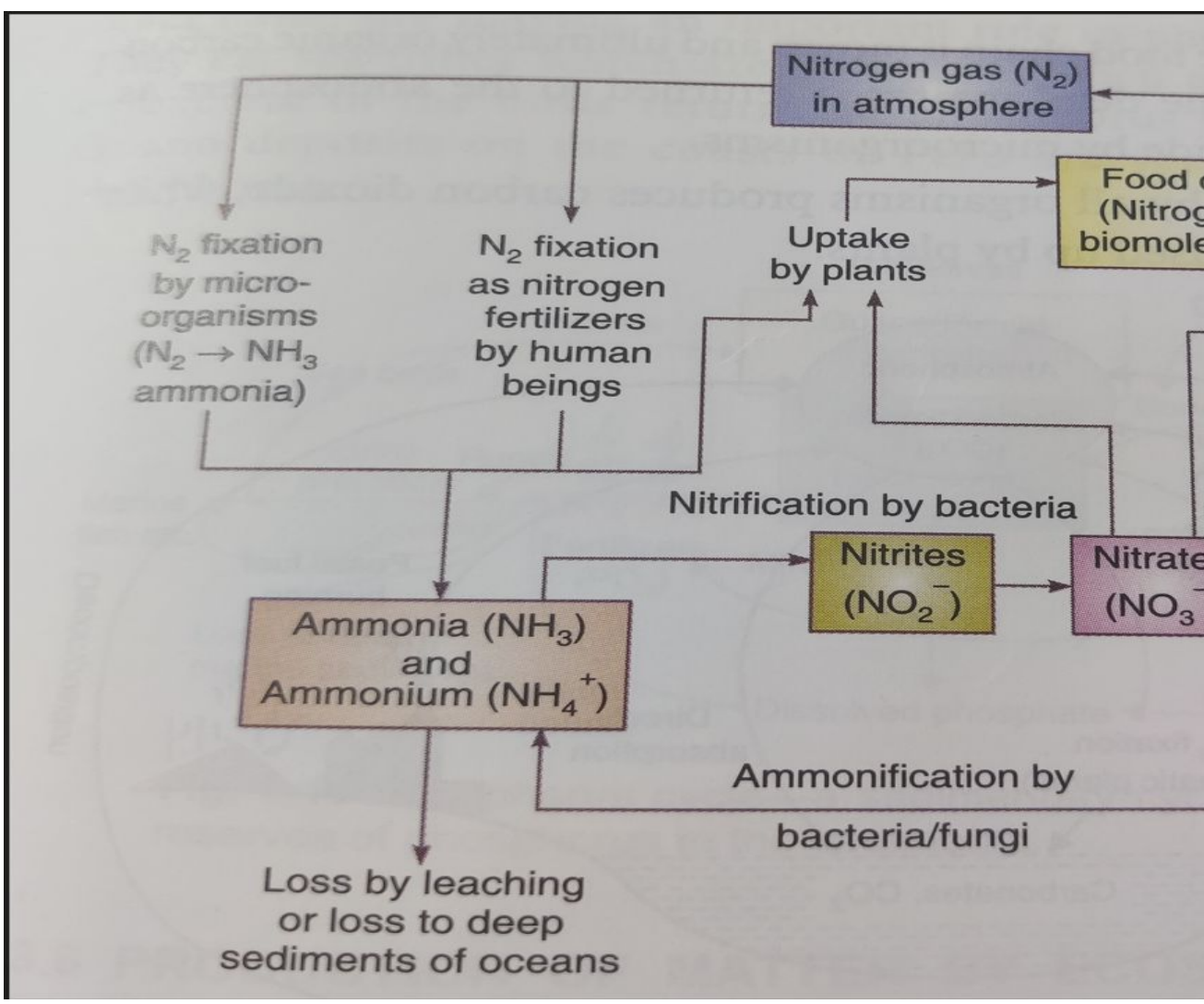
– Conversion of $N_2 \rightarrow NH_3$

- Symbiotic bacteria, associated with
flowering plants. eg. Rhizobium whi
organic nitrogen for their own cells.
die or leave wastes certain other ba
the N to the soils and atmosphere.
- Non-symbiotic N fixers are both aero
bacteria as well as cyanobacteria. T
and fresh water.
- Lightning storms convert atmospher
reaches the soil through rain water.
converted to ammonia by denitrifyi



Nitrogen Cycle

Nitrogen cycle



PHOSPHOROUS C

- The only cycle that does not have a
- **Inorganic phosphate PO_4^{3-} is relea**
- **and**
- **sediments through the action**
- **Soil PO_4^{3-} is absorbed by plants and inc**
- **acids, phospholipids and ATP (adenos**
- **Animals obtain most of their P by cons**
- **animals and from**
- PO_4^{3-} is released to the soil again by deco
- **Dissolved PO_4^{3-} gets absorbed by algae**
- Decomposers break down waste and retu

sediments on the seabed.

Soluble PO_4^{3-} in soil.
(orthophosphates)

Bacteria

Plants (Roots)/Algae

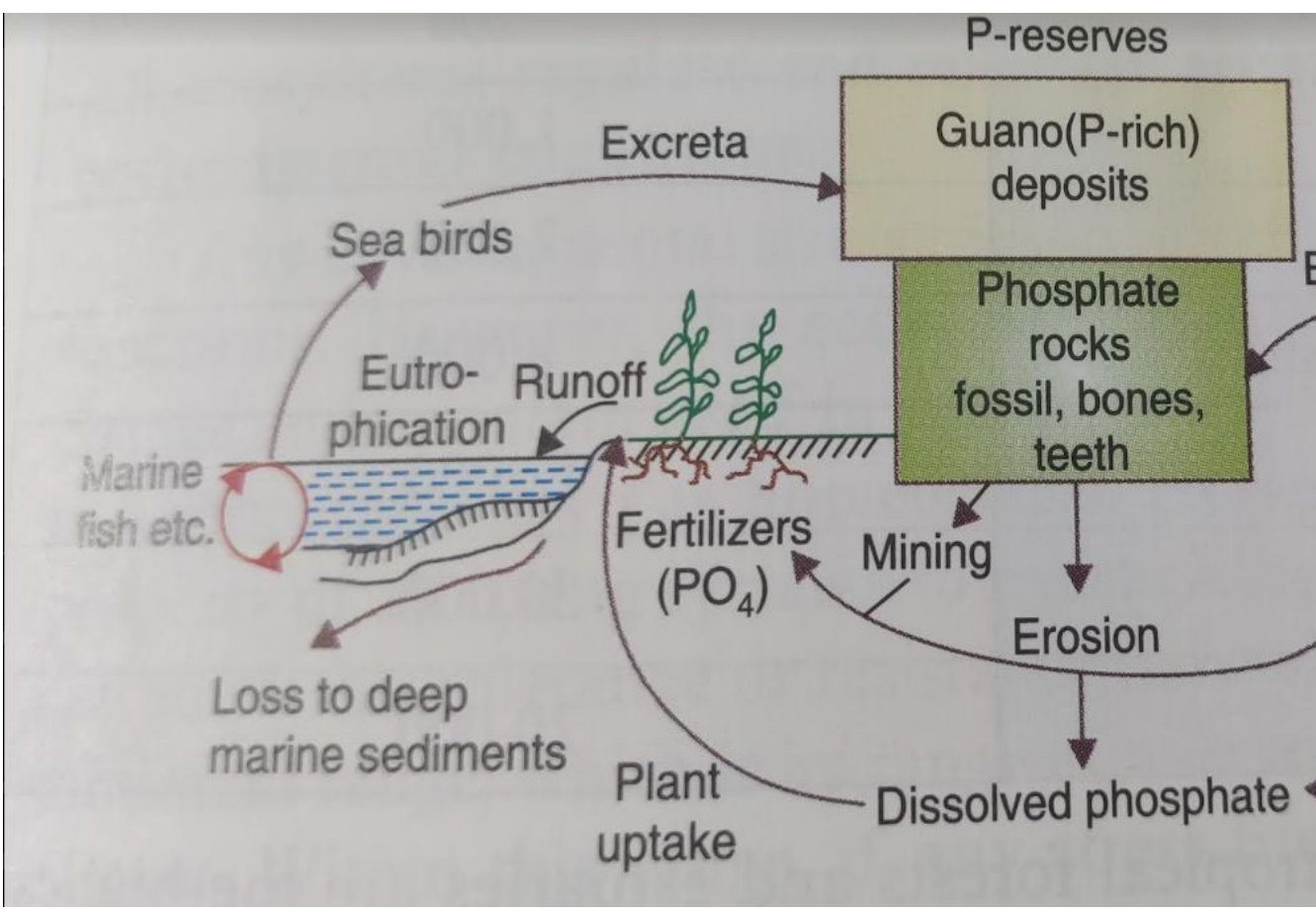
Animals

Bacterial Decomposition

Bone/ Teeth

Phosphorus Cycle

Phosphorous cycle



Oxygen C

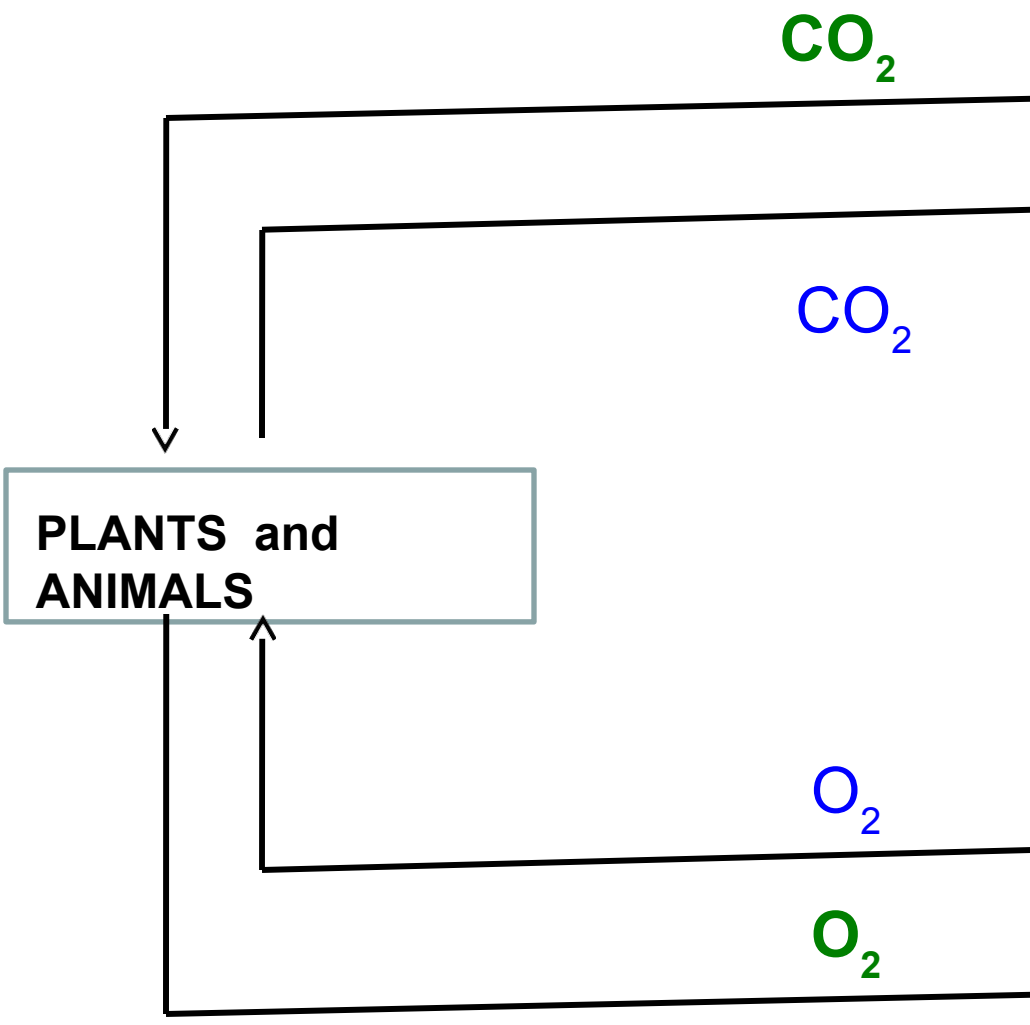
Oxygen is the most import. e
life.

About 21% of Oxygen is pre

As free O_2.

Plants and animals can tak
the atmosphere through
respiration and it release
the atm. Some plants do e

Oxygen C



Video on Bioigeochemical cy

- https://www.google.com/search?q=biogeochemical+cyc
c2c48b035966a68&sxsrf=AE3TifNrV_RuFTeNMdNPf6Y-nki
639869&ei=h-GlaMzhNLuL4-EPk42AsAI&ved=0ahUKEwiMv
ZMGACYQ4dUDCBE&uact=5&oq=biogeochemical+cycles+
Mtd2l6LXNlcnAiHGJpb2dlb2NoZW1pY2FsIGN5Y2xlcyB2aW
EAAYFhgeMgYQABgWGB4yCxAAGIAEGIYDGIoFMgsQABiABI
BRAAGO8FMgUQABjvBTIFEAAY7wVIuSZQngdY8yBwAXgBkA
MwLje4AQPIAQD4AQGYAgigAvUIwgIKEAAYsAMY1gQYR8IC
XCAgUQABiABMICChAAGIAEGEMYigWYAwCIBgGQBgqSBwM
AfqCMIHBTItNy4xyAct&sclient=gws-wiz-serp#fpstate=ive
d:C_qbmUAw-5c,st:0

Types of ecosystems

- On the basis of the presence of abiotic a
  factors and their interaction amongst ea
  are 2 main ecosystems i.e., terrest
  and aquatic ecosystem.

- As habitat varies on the earth with clima
  further subdivided into many subtypes.

Terrestrial ecosystem

- **Terrestrial ecosystem is basically the lar**
  Major reservoirs are lithosphere and **atm**
- **Major terrestrial system is also called Bio**

- On the basis of the presence of biotic an
  factors the **terrestrial ecosysrems are-**
- **the Forest ecosystem, Grassland ecosy**
  Desert ecosystem.

Forest ecosystem

- **Forest occupies approximately 40 % of t earth. In India forest cover is almost 21 area.**

- **These are the ecosystems having a pred trees that are interspersed with a large species of herbs, shrubs, climbers, liche wide variety of wild animals and birds.**

Producers: Different tree sp

Consumers in a Forest Ec

Decom

Components of forest ecosyte
follows :

Abiotic components

- **In addition to inorganic substances these**
  organic debris, e.g., fallen leaves, seeds
- It has canopy and sub-canopy , middle fl
  ground flora zone, litter zone and rhizos
  with sun light penetration.

Biotic components

Living organisms present in the food chains.

Autotrophs (Producers)

Produce their food through photosynthesis. Trees
species. There are herbs, shrubs, climbers, epiphy
and ground flora.

There are 3 main forest types –

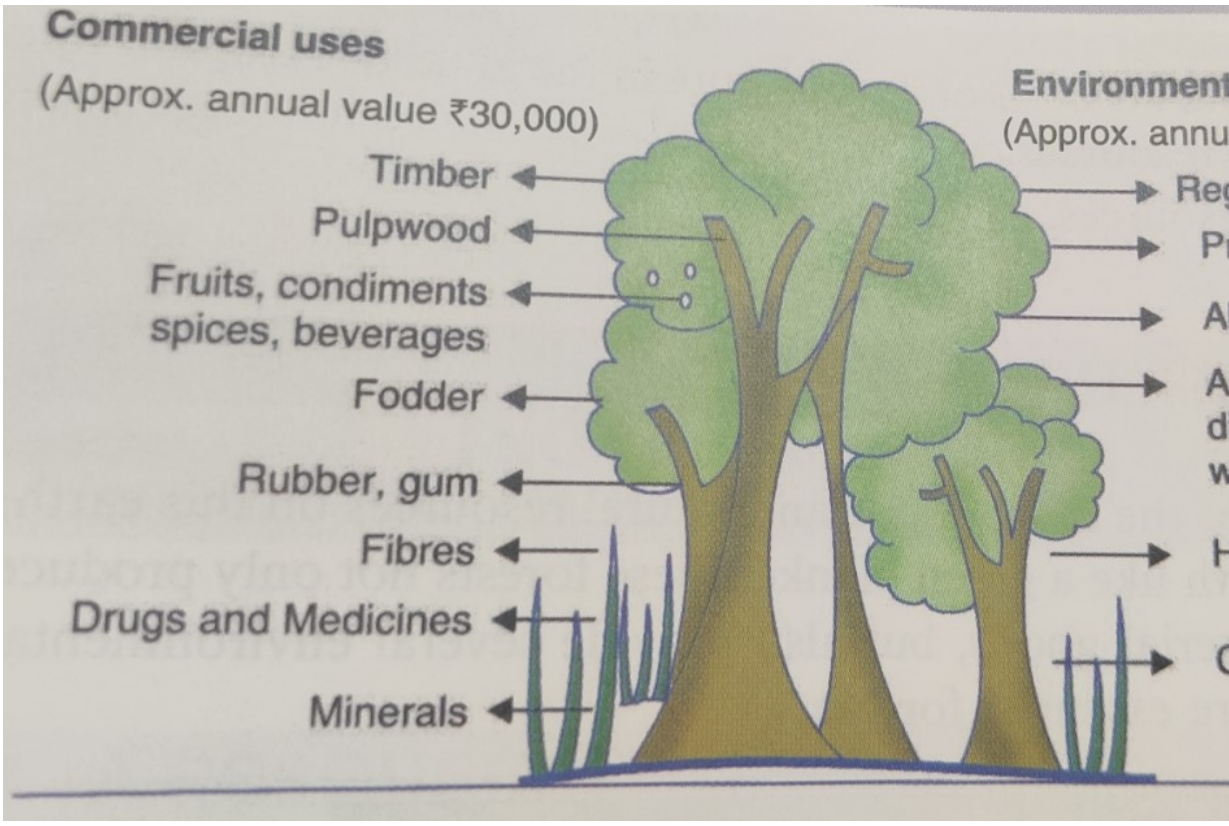
(1). Boreal (snow) forests, found farthest north, e
cold winters with short growing seasons.

(2). Temperate forests, located in the mid-latitude
distinct seasons. Mostly Coniferous vegetation/ no

(3). Tropical (warm) forests, found along the equa
high temperatures and long growing seasons and h
amounts of biodiversity and are thicker than temp
leaves annually.

Soft wood (pine) and Hard wood.

Economic vs Environmental va tree



Animals

- **Heterotrophs**

Herbivores, carnivores, omnivores (Consumer

a. **Primary consumers**

- These feed on the tree leaves as ants, flies, etc. Other larger animals feed on tree shoo Asian antelope (Nilgai), mongoose, bats etc.

b. **Secondary consumers**

- Organisms depending on herbivores for thei snakes, birds etc.

c. **Tertiary consumers**

- These are top carnivores depending on secc
  e.g., lion, tiger, man etc.

Saprotrophs (Decomposers)

- Various microrganisms such as fungi like Asp
  Trichoderma spp. etc. and bacteria such as
  Clostridium spp., Pseudomonas spp. etc. Ac
  Acinetobacter, Alkanindiges, Alteromonas,
  Burkholderia, Dietzia, Enterobacter, Kocuri
  can degrade aromatic and aliphatic compou

- Thus these degrade organic chemicals for b
nature through biological and biogeochemic

GRASSLAND ECOSYSTEMS

- Grasslands are dominated by grass species b
also allow the growth of a few trees and shr
average but erratic.
- Approximately 20-40 % of earth surface is g
ecosystem.

Abiotic components

- Main abiotic factors are nutrients from eart
environment.

Biotic components

Autotrophs ; There are about a dozen diff

- All grass forms such as Cyanadon spp/ Berm
spp./ flowering grass, Brachiaria spp/ anima
Dactyloctinium spp./ crowfoot grasses etc.
and shrubs. Switch grass, Miscanthus, Niper
- **Heterotrophs** : Herbivores and carnivores (

- These make available chemicals in nature a nutrient cycling.

Desert Ecosystem

- These type of ecosystem occupies 20-33 %
- India- 12 %. Extreme whether conditions, le rainfall, high temperature, harsh climate a to desertification.
- Abiotic components : Sandy

- **Biotic components** : Desert biomass and an
- Less trees but mainly cactus type plants, sh bushes, are dominant. Some species of liche are also present.
- Plants in this region are known as xerophyt
- **Heterotrophs (Consumers)**
- Herbivores and carnivores , the reptiles (sn etc.), insects, birds and rodents (mice, squ which can sustain extreme weather conditi animal which is predominantly present. Car storage.

Biodegradations

- **Decomposers** : Some fungi and bacteria whi
  and survive on the plant species etc.

Aquatic ecosystem

- Interaction of biotic and abiotic component
- There are 3 main Aquatic ecosystems
- 1. Freshwater ecosystem
- 2. Marine ecosystem
- 3. Astuary ecosystem

- Fresh water ecosystem is of 2 types:
- Lotic ecosystem and lentic ecosystem,
- Lotic / moving ecosystem - Flowing wat
  springs, streams etc.

- Lentic /Still ecosystem (Pond ecosy
- Stagnant water
- Small but several biotic and abiotic comp
  interrelated in several ways here.

Shorter Slide ?

- **Abiotic components such as temperature organic and inorganic compounds such a proteins, CO2, O2,**
- **Phosphate, nitrogen etc.**

- **Biotic components**
- **Producers** : Photosynthetic bacteria (*Rhodo*
  rubrum, *Cosmarium*, *Autotrophs spp*., *Clo*
  Spirulina etc., phytoplankton and green pla
  of inorganic compounds these produce prot
  carbohydrates etc.

- **Some plants are submerged in the ponds**
  hyacinth, Hydrilla etc.

Fish, lizards, snakes – Ants- numb
Collaborative Efforts – Traction t

- **Consumers** : Some detritivores also eat matter. Mollusc, fish, frog etc. Fish eat fish eat small fish, frogs etc.

- **Decomposers** : Fungi and bacteria.
- **Lotic ecosystem (Rivers)** : Flow
- **a.Producers** : Green algae, diatoms, mos
- **b. Consumers** : Snails, flatworms, fish et
- **c. Decomposers** : Fungi and bacteria.

Marine ecosystem

Marine ecosystem

- **Major ecosystem on earth as almost 70 % of covered with water.**
- **Abiotic components : Physicochemical factc waves, tides, light, temperature, pressure,**
- **Biotic components :**
- **Producers :**
- **Microalgae, dianoflagellates, diatoms, micrc macroalgae..**

- **Consumers** : Herbivores such as fish larv molluscs, and carnivores such as Bombay fish, cod fish etc.
- **Decomposers** : Fungi and bacteria.

Estuary ecosystem

- Here river meets sea.

Allelopathy- Neem inhibits pe

Eucalyptus- inhibits the growt

- **Abiotic components** : Change in salinity. survive the change in salinity and there nutrients here

- **Biotic components**
- **Producers** : Sea weeds, Azolla, sea grass mangroove/ mangrove forests (the tree
- Mangrooves can tolerate salinity.

- **Consumers** : Small fish, zooplanktons, la
  Crustaceans and amphibians are also pre
- **Decomposers** : Fungi and bacteria.

PHOTOSYNTHESIS REACTION

- Carbon dioxide is converted into sugars
  called carbon fixation; photosynthesis ca
  from sunlight to convert carbon dioxide
  carbohydrates. Carbon fixation is an enc
  reaction.
- Photosynthesis takes place in two distinc

In the light reactions, energy from sunligh
synthesis of Adenosine triphosphate (ATP)
nicotinamide adenine dinucleotide phospha
coupled to the formation of O2 from H2O.

- In the dark reactions, so named because
  require sunlight, the ATP and NADPH pro
  light reactions drive glucose synthesis.

PHOTOCHEMICAL PATHWAYS
ECOSYSTEM

- Photosynthesis
- Light dependent reactions
- This reaction takes place in chloroplast
- Light is converted into chemical energy
  ATP i.e., photophosphorylation and the
  water takes place resulting in the forma
  and evolution of O2..

Chloroplast in Pla

Light Independent Reactions

- This reaction takes place in the stroma o chloroplast. By using products of light de reaction the CO2 is fixed as glucose.

- Plants use some energy for their surviva growth i.e., respiration. Remaining is us herbivores for their activities. Then furt remaining is used by carnivores in the f

- OVERALL PHOTOSYNTHESIS REACTION
- $6CO_2 + 6H_2O = C_6H_{12}O_6 + 6O_2$
- Rubisco the Reversible Enzyme (Lithargic)

- Carbonic anhydrase is an enzyme that facil
  conversion between carbon dioxide (CO_2) a
  to form carbonic acid (H_2CO_3) and its disso
  (HCO_3^- and H^+). It plays a key role in regul
  aiding in the transport of CO_2 in biological

- **Sustainable development**: using resources to satisfy current n
  without compromising future availability of resources
- Sustainability involves:
  - Renewable energy sources
  - Soil conservation, high-efficiency irrigation, organic agric
  - Pollution reduction
  - Habitat and species protection
  - Recycling
  - Fighting global climate change

End of the slide

Relevant Information

- Respiration
- External respiration
- Here oxygen is inhaled and carbon dioxide i
  and lungs are used in this gaseous exchange
- Internal Respiration
- This is also called cellular respiration. Chem
  the organic molecules is released through o
  form of ATP.When oxygen is required it is c
  respiration and when this takes place in the
  this is called anaerobic cellular respiration.

- Organic molecules such as carbohydrates, glycerides etc. are transferred to energy i ATP, some is used and some is lost as heat respiration takes place in almost every cel

Photorespiration

- The reaction takes place in the chlorophyl
- Chlorophyll-b absorbs light and passes it o chlorophyll-a where light energy is conver chemical energy.

Biochemistry of Photosynthesi

- **6 CO2 + 12 NADPH + 10 H2O +**
  2[C3H5O3 - (PO3)(2-)] + 4 H+ +
  + 18 ADP + 16 Pi

Reactions in Bacteria

- 6 CO_2 + 6 H_2S = $C_6H_{12}O_6$ + 6 S (bacterial anaerol
- Actually, the balanced equation is: 6 CO_2 + 12 H_2 + 12S
- 6 CO_2 + 18 ATP + 12 NADPH + 12H^+ => 2[$C_3H_6O_3$ - (P 16 Pi + 12 $NADP^+$ + 6 H_2O
- where
- Pi = PO_3H
- ATP = ADP + Pi
- NADPH = $NADP^+$ +
-)

oxygenic photosynthesis

- **The net-reaction of all light-dependent r**
  oxygenic photosynthesis is:

- **$2H_2O + 2NADP^{++} + 3ADP + 3Pi \rightarrow O_2 + 2 H$**
  3ATP

Light independent reactions

- This reaction takes place in the stroma of th
  By using products of light dependent reactio
  fixed as glucose.
- The products of the light independent react
  NADP+, and H2O. The reactants are CO2, NA
- Plants use some energy for their survival i.e
  Remaining is used by herbivores for their ac
  Remaining is used by carnivores in the foo

Respiration

- **External respiration**
- Here oxygen is inhaled and carbon dioxide i
  and lungs are used in this gaseous exchange

Photorespiration

- The reaction takes place in the chlorophyll
- Chlorophyll-b absorbs light and passes it on
  where light energy is converted into chemic

Internal Respiration

- This is also called cellular respiration. Ch
in the organic molecules is released thro
in the form of ATP. When oxygen is requ
aerobic cell respiration and when this ta
absence of O2 this is called anaerobic ce
respiration. Organic molecules such as c
proteins, fats , glycerides etc. are transf
in the form of ATP, some is used and son
heat. Such respiration takes place in alm
in the body.

- **Sustainable development**: using resources to satisfy current
  without compromising future availability of resources
- Sustainability involves:
  - Renewable energy sources
  - Soil conservation, high-efficiency irrigation, organic agri
  - Pollution reduction
  - Habitat and species protection
  - Recycling
  - Fighting global climate change

Table 4.1. India's major biogeographic h

Sr. No.	Biogeographic zone	Biotic province	Total area (Sq. Km.)	fl
1.	Trans-Himalayan	Upper Regions	186200	• Pi • Wi Ti Le W cr
2.	Himalayan	North-West Himalayas West Himalayas Central Himalayas East Himalayas	6900 720000 123000 83000	• Pi D C • W Le St
3.	Desert	Kutch Thar Ladakh	45000 180000 NA	• Ac K • Ca W ca
4.	Semi-arid	Central India Gujarat-Rajwara	107600 400400	• Ac Pe • Gi Sa Ra (T
5.	Western Ghats	Malabar Coast Western Ghat Mountains	59700 99300	• Sh Tu • To Li
6.	Deccan Peninsula	Deccan Plateau South-Central Plateau Eastern Plateau Chhota Nagpur Central Highlands	378000 341000 198000 217000 287000	• Ac Tu • Sa Ti Fo W W

7.	Gangetic Plain	Upper Gangetic Plain Lower Gangetic Plain	206400 153000	• Sal, Acacia, J Mango, Bael • Black chinkar Rhinoceros, Alligator, Tu
8.	North-East India	Brahmaputra Valley North-Eastern Hills	65200 106200	• Bamboo, Sal, fruit, Tuna C Castor • Elephant, Rhinoceros, Deer, Porcup
9.	Islands	Andaman Islands Nicobar Islands Lakshadweep Islands	6397 1930 180	• Bahera, Hara fruit, Cardam Coconut, Clo • Dolphin, All Molluscs
0.	Coasts	West Coast East Coast	6500 6500	• Coconut, Bar Cashew nut • Dugong, Dol Turtle, Alliga Molluscs

Table 4.5 Global Hot spots of biodiver

Hot spots	Plant species	Endemic plants	% of Global plants
1. Tropical Andes	45000	20000	6.7
2. Mesoamerican Forests	24000	5000	1.7
3. Caribbean	12000	7000	2.3
4. Brazil's Atlantic Forest	20000	8000	2.7
5. Choc/Darien of Panama Western Ecuador	9000	2250	0.8
6. Brazil's Cerrado	10000	4400	1.5
7. Central Chile	3429	1605	0.5
8. California Floristic Province	4426	2125	0.7
9. Madagascar	12000	9704	3.2
). Eastern Arc and Coastal Forest of Tanzania/Kenya	4000	1500	0.5
Western African Forests	9000	2250	0.8
Cape Floristic Province	8200	5682	1.9
Succulent Karoo	4849	1940	0.6
Mediterranean Basin	25000	13000	4.3

	Population Reduction Rates	Geographic Range		Population Size
		Extent of Occurrence	Area of Occupancy	
Least Concern	A species that has a widespread and abundant population			
Near Threatened	A species that is likely to qualify for a threatened category in			
Vulnerable Species	30-50% population decline	<20,000 km^2	<2,000 km^2	<10,000 mature individuals
Endangered Species	50-70% population decline	<5,000 km^2	<500 km^2	<2,500 mature individuals
Critically Endangered	>80-90% population decline	<100 km^2	<10 km^2	<250 mature individuals
Extinct in the wild	Only survives in cultivation (plants), in captivity (animals), established range			
Extinct	No remaining individuals of the species			