INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

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Department of Civil Engineering

ENVIRONMENTAL STUDIES

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Ecosystems

UNIT 1

What is Ecology?

- Ecology is the study of relationships between living things and between living things and their environment.

What is an ecosystem?

- Ecosystem is a system of living things that interact with each other and with the physical world.

- A Biome is a collection of related ecosystems.

Main Ecosystems:

- Desert
- Rainforest
- Ocean
- Taiga
- Tundra
- Chaparral
- Grassland
- Temperate Forrest

However…….

- An ecosystem can be as large as the Sahara Desert, or as small as a puddle!!!
- Ecosystems are more than just the organisms they contain. Geography,weather,climate and geologic factors also influence the interactions within an ecosystem.

Abiotic Factors

- Are nonliving physical factors of an environment.

- Abiotoic Factors include amount of water and oxygen, temperature, amount of sunlight and water pressure.

Biotic Factors

- Are the living, physical factors of an environment.

Balance

- Ecosystems will fail if they do not remain in balance.
- No community can carry more organisms than its food, water and shelter can accommodate.

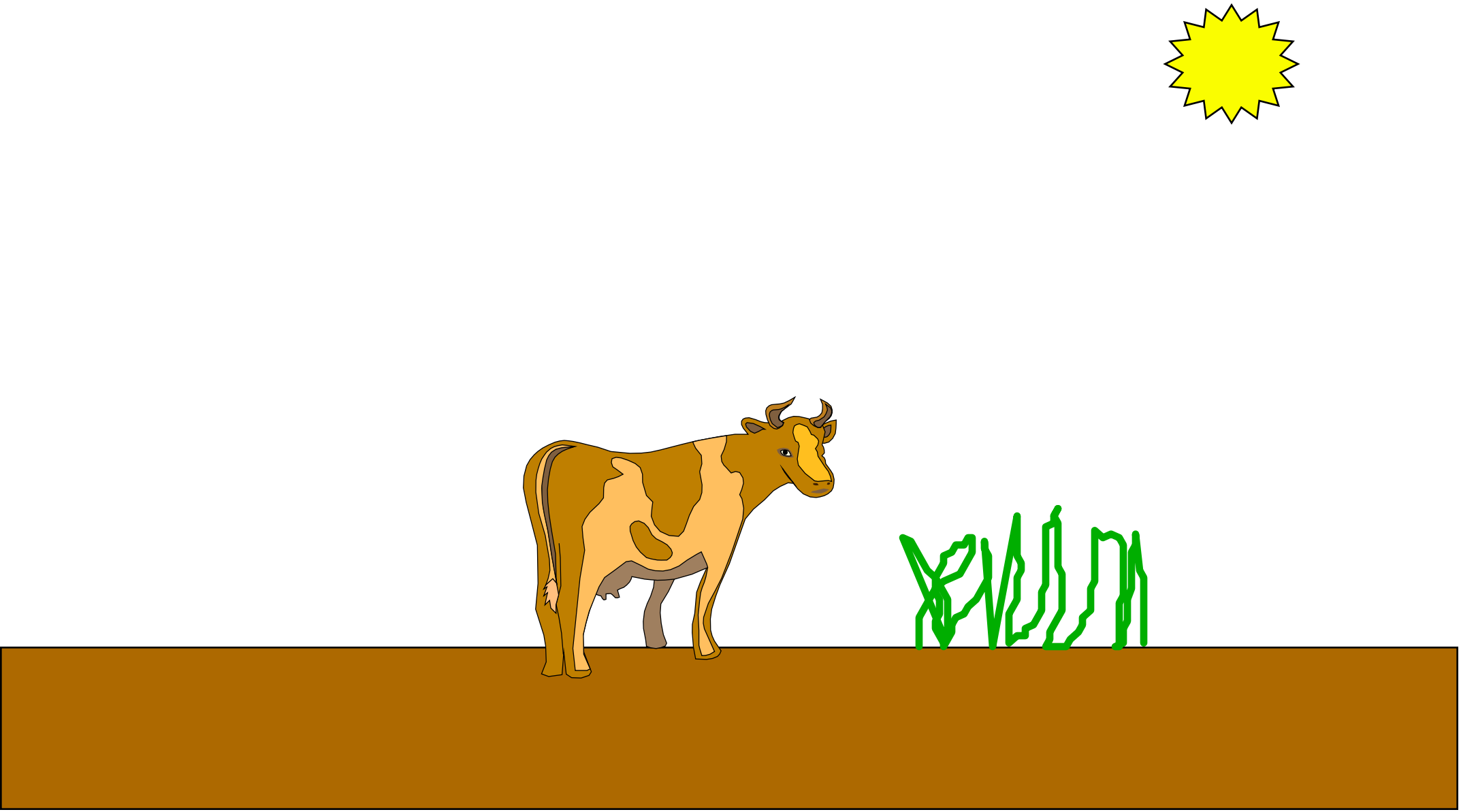
How do they stay balanced?

- To succeed in an ecosystem, plants and animals have special structures and behaviors called adaptations.
- Ex) Chameleon

  Polar Bear

  Can you think of more examples of adaptation?

Energy flow in ecosystems



What is an ecosystem?

System = regularly interacting and interdependent components forming a unified whole

Ecosystem = an ecological system;

= a community and its physical environment treated together as a functional system

OR, MORE SIMPLY

an ecosystem is composed of the organisms and physical environment of a specified area.

SIZE: micro to MACRO

An ecosystem has abiotic and biotic components:

ABIOTIC components:

Solar energy provides practically all the energy for ecosystems.

Inorganic substances, e.g., sulfur, boron, tend to cycle through ecosystems.

Organic compounds, such as proteins, carbohydrates, lipids, and other complex molecules, form a link between biotic and abiotic components of the system.

BIOTIC components:

The biotic components of an ecosystem can be classified according to their mode of energy acquisition.

In this type of classification, there are:

Autotrophs

and

Heterotrophs

Autotrophs

Autotrophs (=self-nourishing) are called primary producers.

Photoautotrophs fix energy from the sun and store it in complex organic compounds

(= green plants, algae, some bacteria)

Other chemoautotrophs:

Nitrifying bacteria in the soil under our feet!

Heterotrophs

Heterotrophs (=other-nourishing) cannot produce their own food directly from sunlight+ inorganic compounds. They require energy previously stored in complex molecules.

(this may include several steps, with several different types of organisms)

Consumers feed on organisms or particulate organic matter.

Decomposers utilize complex compounds in dead protoplasm.

Bacteria and fungi are the main groups of decomposers.

Bacteria are the main feeders on animal material.

Fungi feed primarily on plants, although bacteria also are important in some plant decomposition processes.

The Laws of Thermodynamics

Energy flow is a one-directional process.

sun---> heat (longer wavelengths)

FIRST LAW of THERMODYNAMICS:

Energy can be converted from one form to another, but cannot be created or destroyed.

SECOND LAW of THERMODYNAMICS

Transformations of energy always result in some loss or dissipation of energy

or

In energy exchanges in a closed system, the potential energy of the final state will be less than that of the initial state

or

Entropy tends to increase (entropy = amount of unavailable energy in a system)

or

Systems will tend to go from ordered states to disordered states (to maintain order, energy must be added to the system, to compensate for the loss of energy)

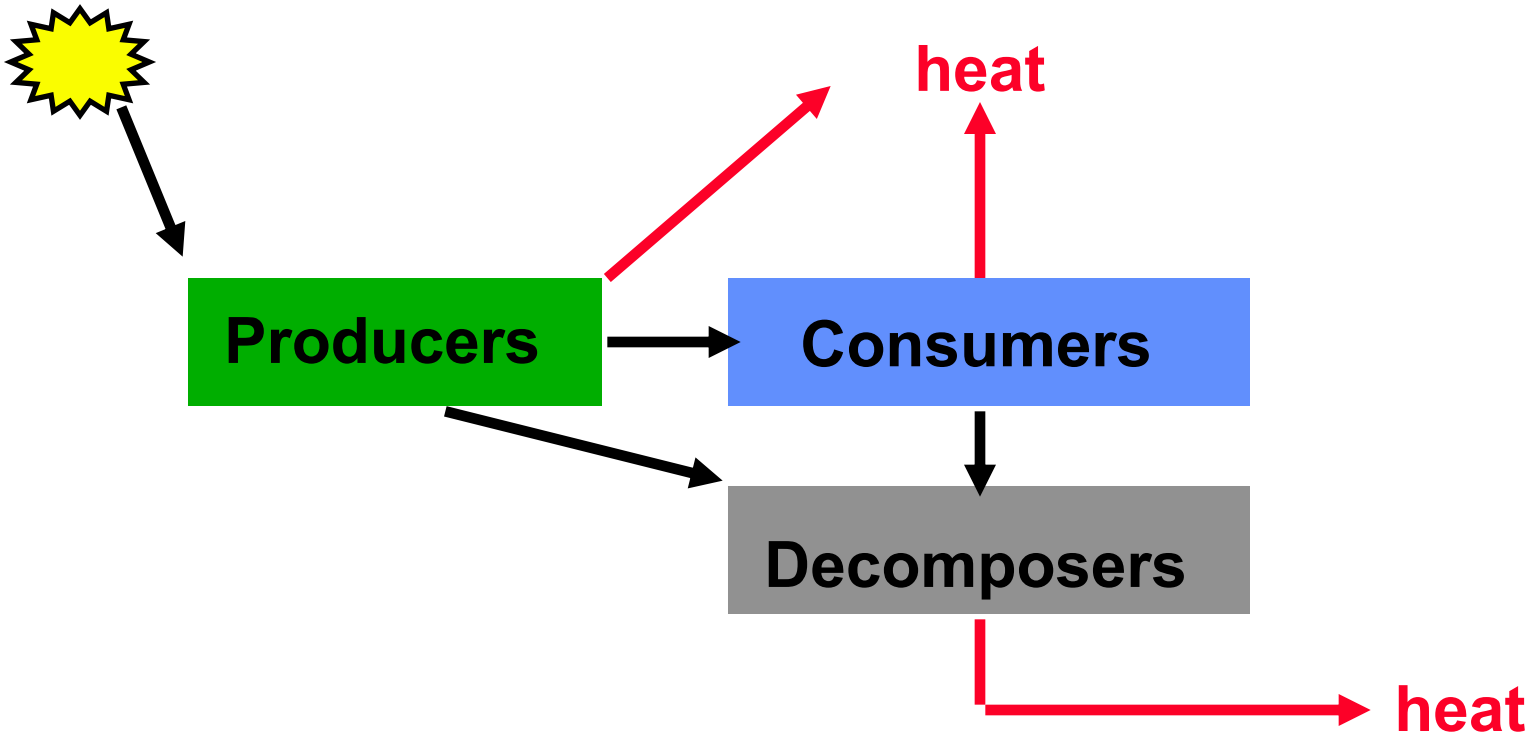
Examples

Internal combustion engines in cars are 25% efficient in converting chemical energy to kinetic energy; the rest is not used or is lost as heat.

My house, particularly my girls' rooms, goes from a complex, ordered state to a simpler, disordered state.

Energy flow

Simplistically:



This pattern of energy flow among different organisms is the TROPHIC STRUCTURE of an ecosystem.

It is useful to distinguish different types of organisms within these major groups, particularly within the consumer group.

Terminology of trophic levels

We can further separate the TROPHIC LEVELS, particularly the Consumers:

Producers (Plants, algae, cyanobacteria; some chemotrophs)--capture energy, produce complex organic compounds

Primary consumers--feed on producers

Secondary consumers--feed on primary consumers

Tertiary consumers--feed on secondary consumers

More trophic levels:

Detritivores--invertebrates that feed on organic wastes and dead organisms (detritus) from all trophic levels

Decomposers--bacteria and fungi that break down dead material into inorganic materials

Alternate Terminology

Producers = plants etc. that capture energy from the sun

Herbivores = plant-eaters

Carnivores = animal-eaters

Omnivores--eat both animals and plants

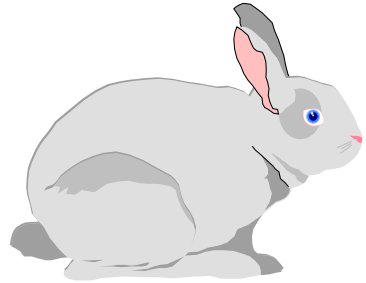
Specialized herbivores:

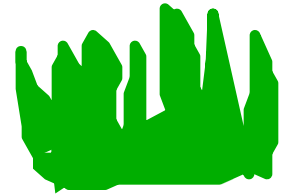
Granivores--seed-eaters

Frugivores--fruit-eaters

Together, these groups make up a FOOD CHAIN

E.g., grass, rabbit, eagle





Carnivore **Herbivore** **Producer**

Carnivores

Carnivores can be further divided into groups:

quaternary carnivore (to

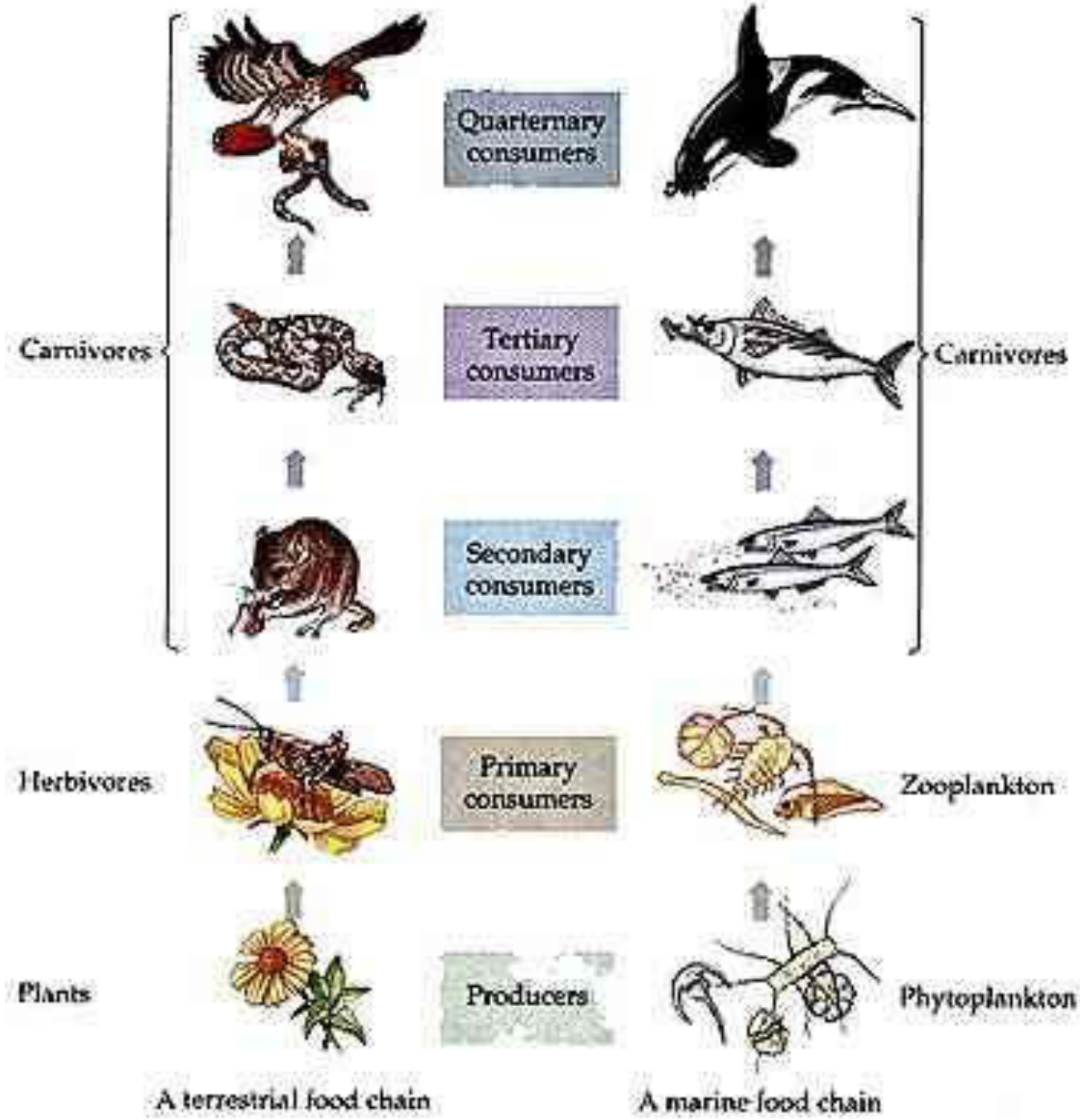
tertiary carnivore

secondary carnivore

primary carnivore

The last carnivore in a chain, which is not usually eaten by any other carnivore, is often referred to as the top carnivore.

Food chains

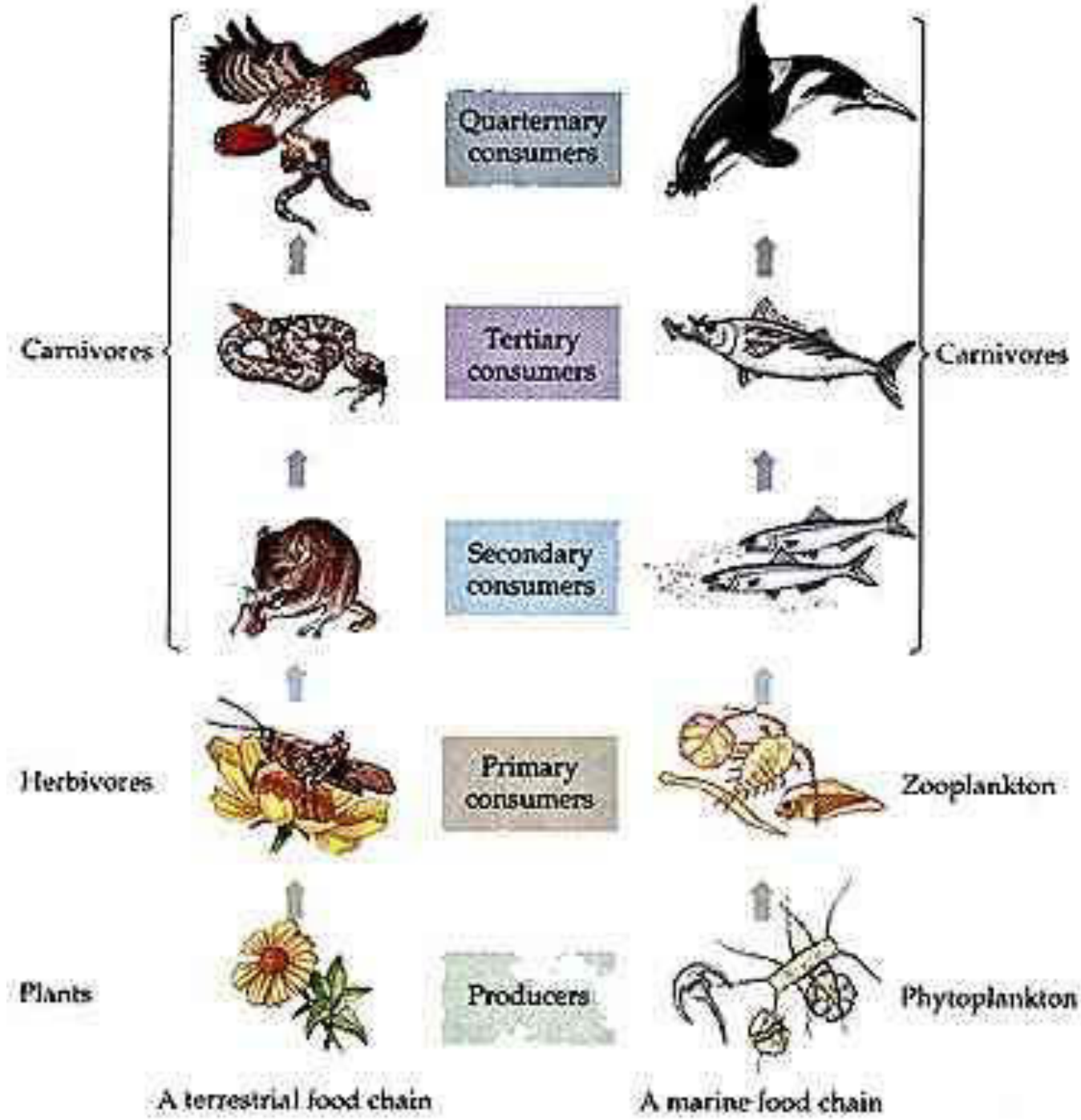

Quarternary consumers
Tertiary consumers
Secondary consumers
Primary consumers
Producers
Carnivores
Herbivores
Plants
Carnivores
Zooplankton
Phytoplankton
A terrestrial food chain
A marine food chain

Problems

Too simplistic

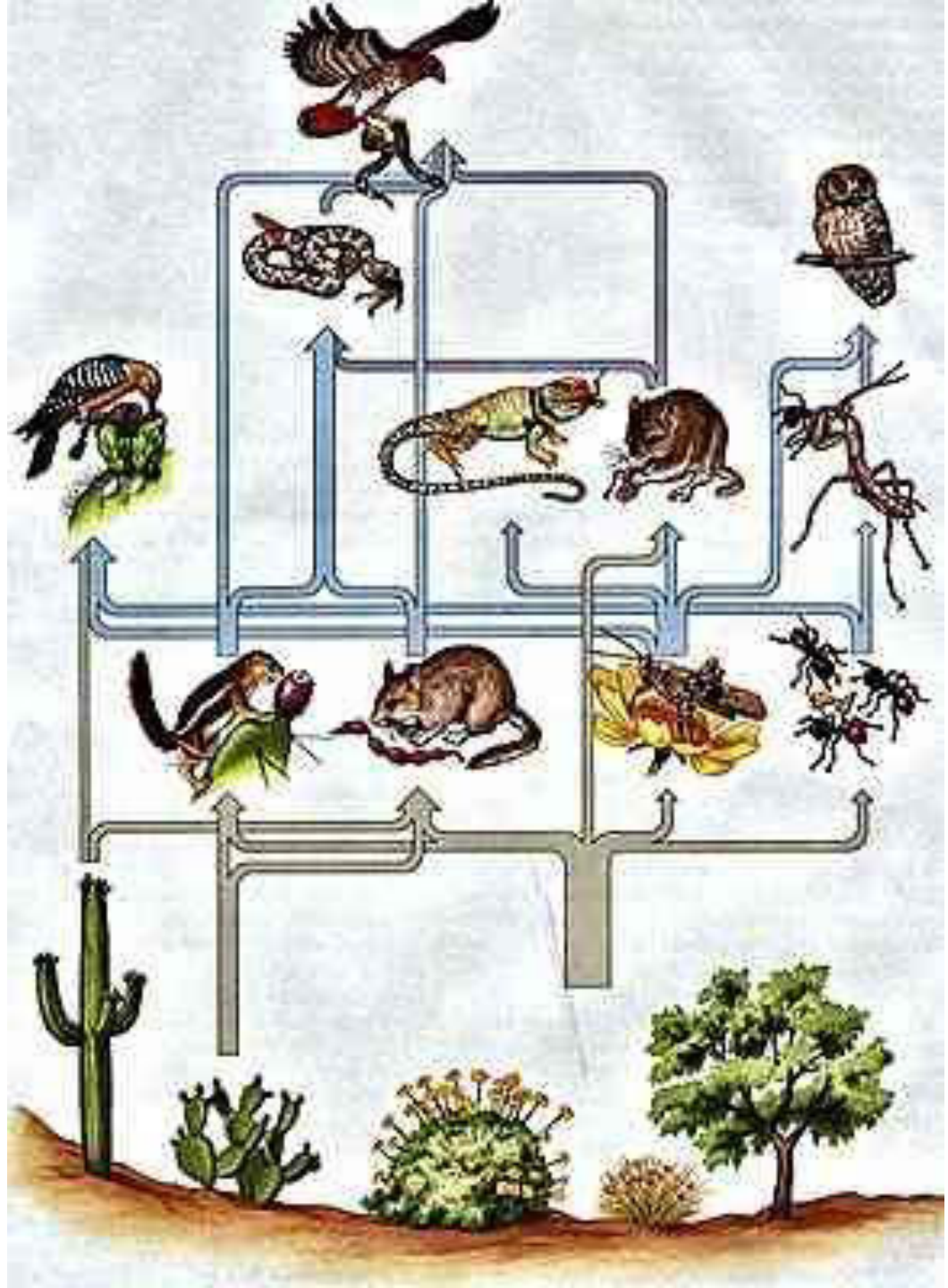
No detritivores

Chains too long



Rarely are things as simple as grass, rabbit, hawk, or indeed any simple linear sequence of organisms.

More typically, there are multiple interactions, so that we end up with a FOOD WEB.



Energy transfers among trophic levels

How much energy is passed from one trophic level to the next?

How efficient are such transfers?

Biomass--the dry mass of organic material in the organism(s).

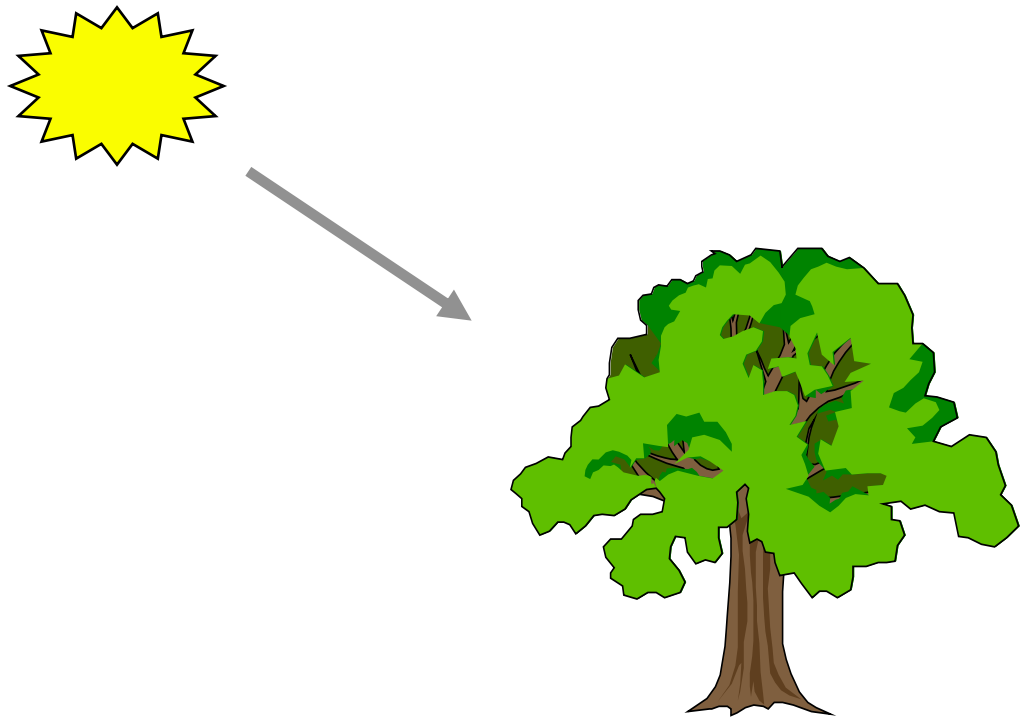
(the mass of water is not usually included, since water content is variable and contains no usable energy)

Standing crop--the amount of biomass present at any point in time.

Primary productivity

Primary productivity is the rate of energy capture by producers.

= the amount of new biomass of producers, per unit time and space



Gross primary production (GPP)

= total amount of energy captured

Net primary production (NPP)

= GPP - respiration

Net primary production is thus the amount of energy stored by the producers and potentially available to consumers and decomposers.

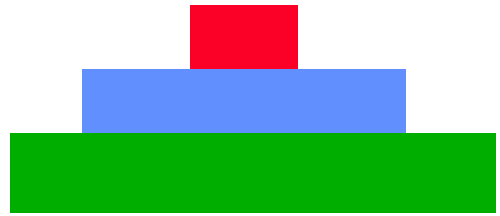
Secondary productivity is the rate of production of new biomass by consumers, i.e., the rate at which consumers convert organic material into new biomass of consumers.

Note that secondary production simply involves the repackaging of energy previously captured by producers--no additional energy is introduced into the food chain.

And, since there are multiple levels of consumers and no new energy is being captured and introduced into the system, the modifiers gross and net are not very appropriate and are not usually used.

Ecological pyramids

The standing crop, productivity, number of organisms, etc. of an ecosystem can be conveniently depicted using "pyramids", where the size of each compartment represents the amount of the item in each trophic level of a food chain.



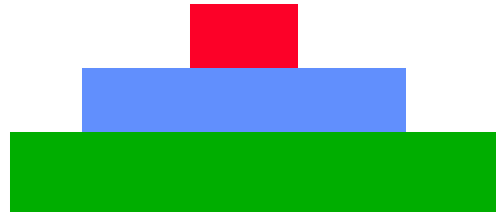
carnivores
herbivores
producers

Note that the complexities of the interactions in a food web are not shown in a pyramid; but, pyramids are often useful conceptual devices--they give one a sense of the overall form of the trophic structure of an ecosystem.

Pyramid of energy

A pyramid of energy depicts the energy flow, or productivity, of each trophic level.

Due to the Laws of Thermodynamics, each higher level must be smaller than lower levels, due to loss of some energy as heat (via respiration) within each level.



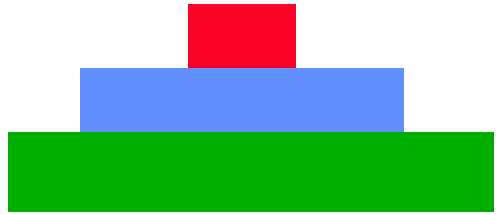
Energy flow in :

carnivores
herbivores
producers

Pyramid of numbers

A pyramid of numbers indicates the number of individuals in each trophic level.

Since the size of individuals may vary widely and may not indicate the productivity of that individual, pyramids of numbers say little or nothing about the amount of energy moving through the ecosystem.

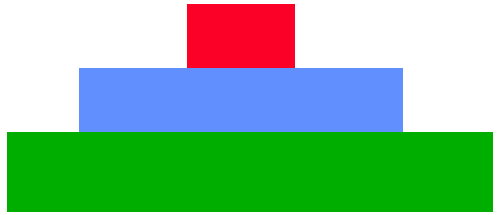


# of carnivores
# of herbivores
# of producers

Pyramid of standing crop

A pyramid of standing crop indicates how much biomass is present in each trophic level at any one time.

As for pyramids of numbers, a pyramid of standing crop may not well reflect the flow of energy through the system, due to different sizes and growth rates of organisms.



biomass of carnivores
biomass of herbivores
biomass of producers

(at one point in time)

Note that pyramids of energy and yearly biomass production can never be inverted, since this would violate the laws of thermodynamics.

Pyramids of standing crop and numbers can be inverted, since the amount of organisms at any one time does not indicate the amount of energy flowing through the system.

E.g., consider the amount of food you eat in a year compared to the amount on hand in your pantry.

Examples of pyramids

Terrestrial and fresh-water communities

Ocean communities--English Channel

NATURAL RESOURCES

UNIT-2

What are Natural Resources?

- Natural resources occur naturally within environments
- Natural resource is often characterized by amounts of biodiversity and geo diversity existent in various ecosystems.
- Any material which is part of earth and satisfy human need and add value is called as resource. Example: rocks, minerals, soil, rivers, plants & animal.
- Human is a resource because developing his skill, he can develop other resource by adding value to the physical material .

Source: www.slideshare.net/naturalresource

Value of Natural Resources

- Economic value- Production of things from natural resources
- Legal value- Clean air, Fresh water, Healthy animal and human beings
- Aesthetic value- Beauty of village, roads, ponds and their agricultural fields

Types of Natural Resources

- **BIOTIC :** Resources which are living in nature. Example: Forests ,Animals etc.

- **A BIOTIC :** Resources which are non-living in nature. Example: Air ,Water etc.

- **OTHERS RENEWABLE :** Resources which can be replenished easily. Example: Sunlight

Study of Natural Resource at Ahirori Block

NATURAL RESOURCE	FORM	INSTITUTIONS	STAKEHOLDERS		POWERS	HOW STAKEHOLDERS ARE AFFECTED OR HOW THEY ARE AFFECTING N.R	CHALLENGES / ISSUES	CULTURAL ISSUES / TRADITIONAL ASPECT	CONFLICTS
			Direct	Indirect					
1. Water	Pond, River, Canal, Well, Lake, Ground Water	Department of Water management, Department of Irrigation Uttar Pradesh	Villagers, Farmers, Fisherman & Washer man	Department of Irrigation	Gram Pradhan and their colleagues	Stakeholders are benefiting but they are polluting water and excess using of ground water	Challenges: Give the irrigation and drinking facility to every villagers Issue: Every farmers are not benefiting from canal for irrigation	Villagers disposed their worship materials in rivers, Canal and Well	Ownership of Canal water
2. Plants	Vegetables, Fruits, Herbs, Flowers, Shrubs, Trees & Houseplants	KVK, Department of Agriculture, Uttar Pradesh Forest Corporation	Input Suppliers, Villagers, Farmers, Gardeners, Consumers, Woodcutters, Carpenters, Animals &	Traders, Retailers, Food Processing, Timbers and Pharmaceuticals Industries	Villagers and Farmers	Increasing income but decrease Tree day by day	Challenge: More Profit in less investment Issue: No Market linkage	Some plants are used in worship, rituals and Rites like Neem, Tulsi, Peepal etc.	Cannot plant tree in Gram Samaaj land because it is public property

			Birds						
3. Animals	Pets & Wilds	Department of Animals Husbandry	Villagers, Farmers, Butcher, Scavenger, Carnivores	Animal Merchants, End Consumers	Villagers and Farmers	Increasing income and getting more value for their livelihoods	Challenge: More Profit with investment Issue: No Market linkage	Some animals are worshiped like Cow.	None
4. Air	O_2, Co_2, No_2 etc.	None	Every living beings	None	None	Air pollution	None	None	None
5. Land & Soil	Agricultural land, Wasteland, Fallow land, Grazing land etc.	Department of Agriculture, KVK	Input Suppliers, Villagers, Farmers, Animals	End Users, Traders, Retailers, Food Processing Units	Villagers and Farmers	Stakeholders are benefiting but they are polluting their soil from excess using of pesticides and chemicals	Challenge: More Profit with investment Issue: No Market linkage	None	Ownership of Land specially Public land
6. Sun Energy	Sunlight	Gopal Solar Lamp, Kanpur	Every living beings	None	None	None	None	None	None

FOREST

- In Ahirori, there are no forest but some villagers have planted Mango, Eucalyptus, Popular, Sagaun etc in their own field for commercial purpose.
- For this some local level traders support him for growing such trees in their own land for commercial purpose only.
- Uttar Pradesh Forest Corporation also plants Shrubs plant in public land every year but people can care of it because they don't aware for natural resources in their future.

SOLAR LIGHT

- **In Ahirori, The Solar street lights are being setup which is under " 13th Vitta Yojaya" in year 12-13.**
- **There are some private companies who have entered into the solar light business where they collect larteins in morning and charge them in their grid station and dispatch in evening to each household.**
- **They only have to pay minimal cost of Rs 100 per month. So this model saves environment and even money burns in buying kerosene oil for lightening.**

Soil / Land Resources

- In the area of study the soil was found very productive as availability of water is excellent.
- The pulses grown there are good in quality and quantity wise.
- The agricultural land is large than other lands like grassing land & fallow land.
- Soils are getting polluted day by day by excess use of fertilizer and pesticides.

Water Resources

- In the natural resources, Ahirori is very rich in water resources like Wells, Canal, Ponds, Mini Lake, Rivers etc.
- Generally wells are private property there but Canal, Ponds, Rivers and Mini Lake are public property.
- Department of Water management, Department of Irrigation Uttar Pradesh are major institutions, who manage the water resources.

ANIMALS

- Animals are major resource of livelihood after agriculture.
- In the wild animals, Nilgai and Jackal is a most populated animal who's affected negatively to farmers.
- The quality and population of pet animal are increasing day by day for only commercial propose.
- Fodders are getting polluted day by day by excess use of fertilizer and pesticides. This is directly impacting to animals.

Resource: www.google.co.in

Uses of Natural Resources

Natural Resources	Uses
Air (Wind)	Required for all living things for breathing, Use to produce wind energy.
Animals / Plants	Provide food, cloth, shelter, medicine. Used as mode of transport. Animal dung can be used as fuel/fertilizer.
Soil	Used as the primary nutrient source for plants. It is the habitat of many organisms.
Solar Light	Provide light, energy and help to plants for making their foods
Wood / Tree	Used as construction material. Used to make utensils, furniture and sporting equipments.
Water	Used in household, agriculture and transportation.

Major problems with Natural Resource conservation

- Low awareness for conservation of natural resources.
- Exploitation of living natural resources for economic gain.
- Values and knowledge about the species and ecosystem inadequately known.
- Unplanned urbanization and uncontrolled industrialization.

Major Natural Resource threats

- Habitat destruction
- Extension of agriculture
- Filling up of wetlands
- Conversion of rich bio-diversity site for human settlement and industrial development
- Uncontrolled commercial exploitation

FLOOD


FLOOD

Policy gaps

- Lack of policies for protection of wetlands, grasslands and other areas.

- Inadequate enforcement of existing laws

- Inadequate implementation of eco-development programmers

- Need for enhanced role of NGOs and other institutions

- Need for political commitment and good will.

- Need for providing Institutional support like Banks, FI

- Lack of Local community participation


Think Green
INDIA

Thank You....

AIR POLLUTION
UNIT-4

What is it?

- Any visible or invisible particle or gas found in the air that is not part of the original, normal composition.

CLASSIFICATION OF AIR POLLUTANTS:

PRIMARY POLLUTANTS:

These are emitted directly from the point source.

EXAMPLES:

- CARBON MONOXIDE
- OXIDES OF NITROGEN
- OXIDES OF SULPHUR
- HYDROCARBONS

SECONDARY POLLUTANTS:

These are formed by interaction of primary pollutants with other primary pollutant (or) with some natural constituents of atmosphere.

EXAMPLES:

OZONE

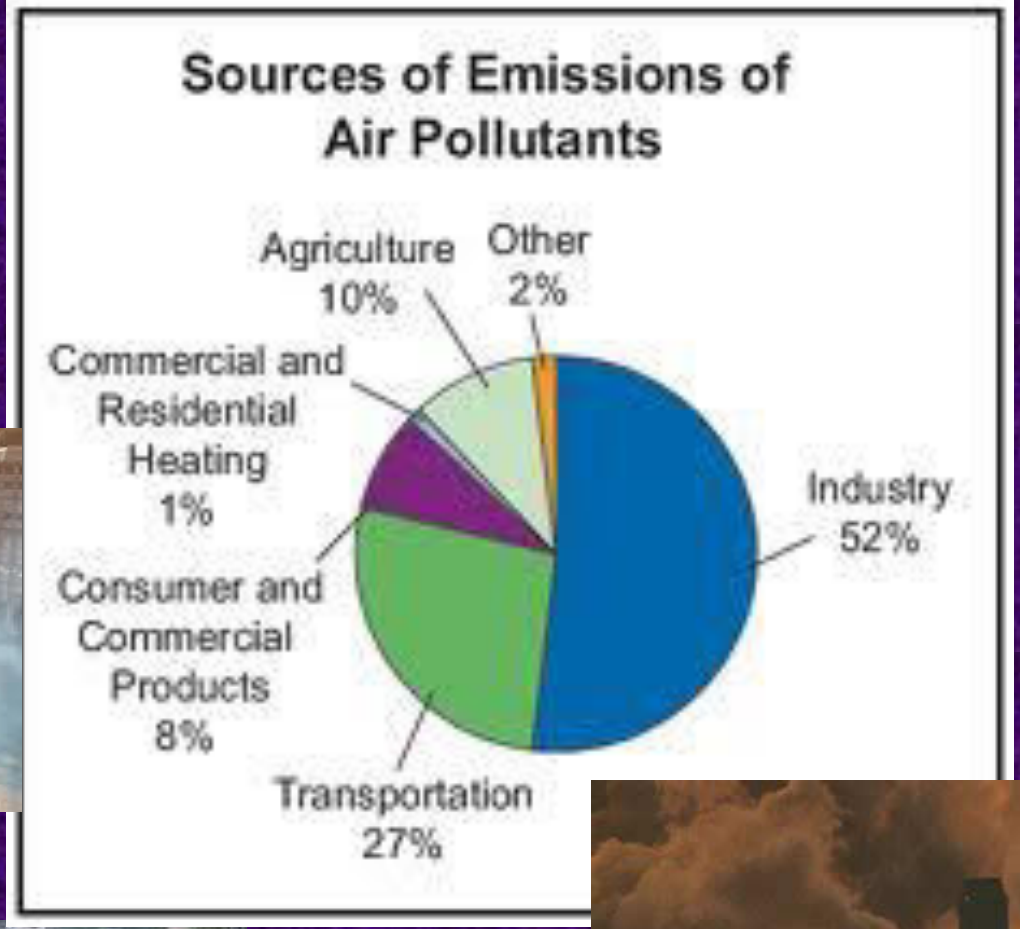
PEROXY ACETYL NITRATE (PAN)

PHOTOCHEMICAL SMOG etc

SOURCES OF AIR POLLUTION

Natural: forest fires, pollen, dust storm

Unnatural: man-made; coal, wood and other fuels used in cars, homes, and factories for energy


Sources of Emissions of Air Pollutants
Agriculture 10%
Other 2%
Commercial and Residential Heating 1%
Industry 52%
Consumer and Commercial Products 8%
Transportation 27%

5 Major Pollutants:

1..) Carbon Monoxide

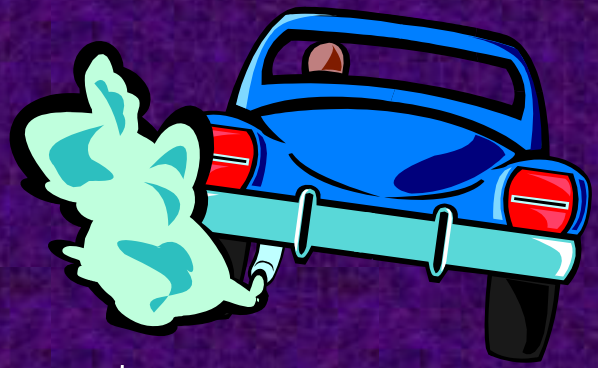
2.) Sulfur Dioxide

3.) Nitrogen Dioxide

4.) Particulate Matter

5.) Ground Level Ozone

Carbon Monoxide

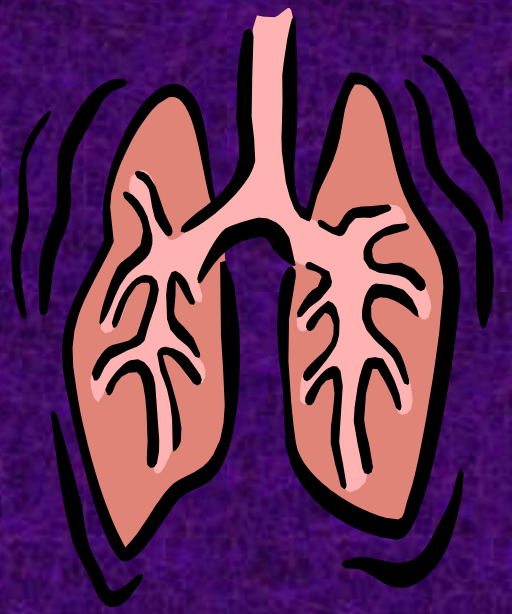


- colorless, odorless
- produced when carbon does not burn in fossil fuels
- present in car exhaust
- headaches, fatigue, and impaired vision

Sulfur Dioxide

- produced when coal and fuel oil are burned
- present in power plant exhaust
- causing wheezing and shortness of breath, especially in those with asthma

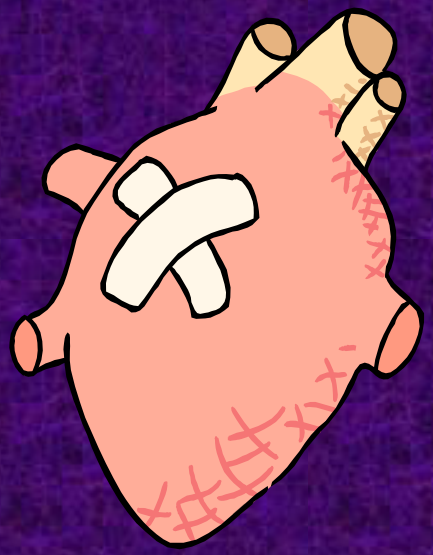
Nitrogen Dioxide



- reddish, brown gas
- produced when nitric oxide combines with oxygen in the atmosphere
- present in car exhaust and power plants
- affects lungs and causes wheezing; increases chance of respiratory infection

Particulate Matter

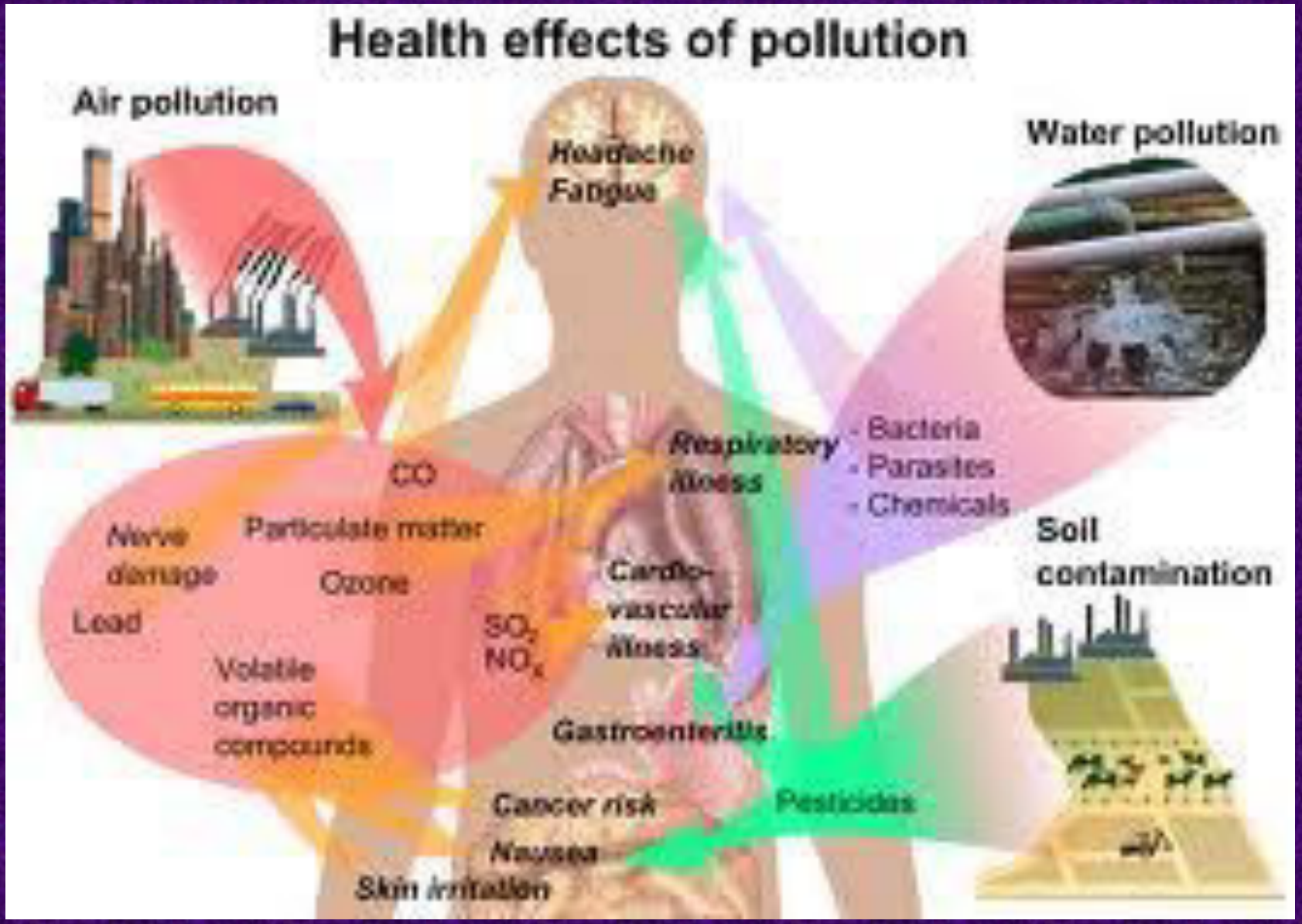
- particles of different sizes and structures that are released into the atmosphere
- present in many sources including fossil fuels, dust, smoke, fog, etc.
- can build up in respiratory system
- aggravates heart and lung disease; increases risk of respiratory infection



Ground Level Ozone

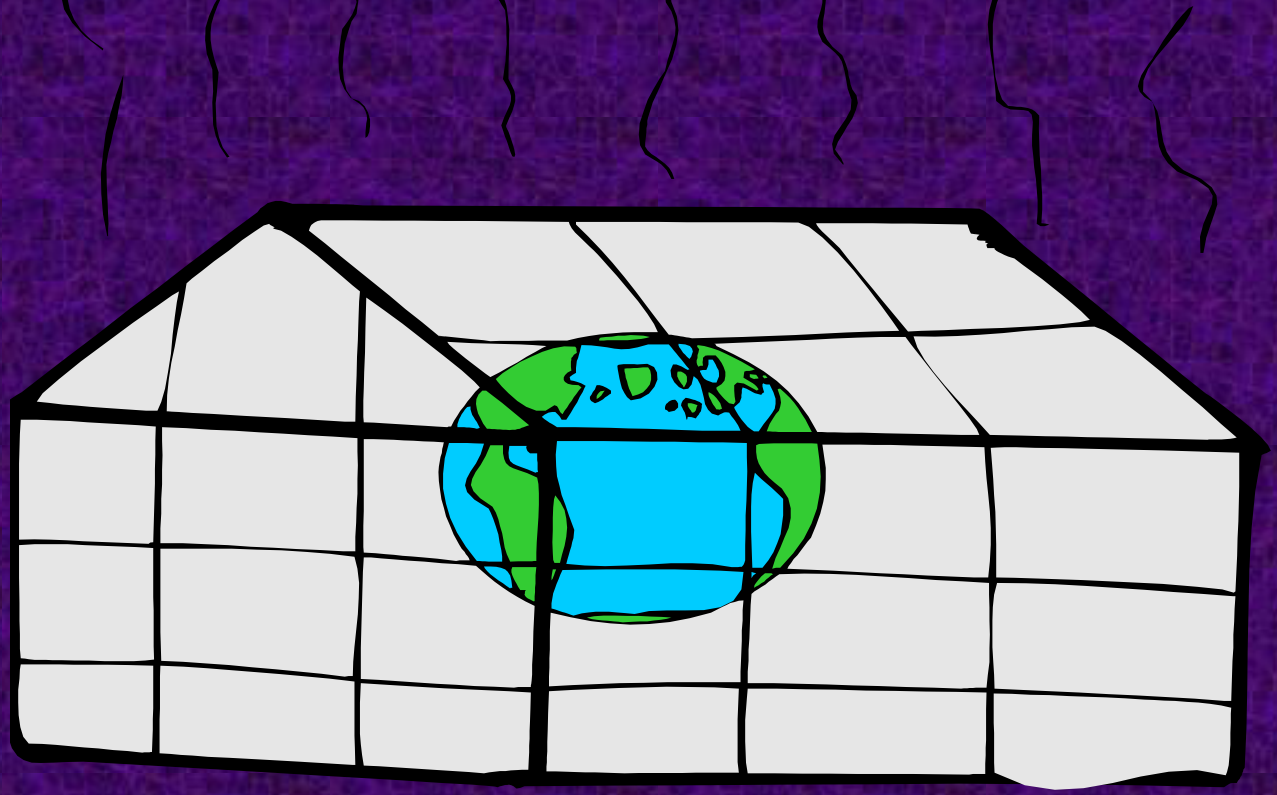
- at upper level, ozone shields Earth from sun's harmful UV rays
- at ground level, ozone is harmful pollutants
- formed from car, power and chemical plant exhaust
- irritate respiratory system and asthma; reduces lung function by inflaming and damaging lining of lungs

EFFECTS OF AIR POLLUTION


Health effects of pollution
Air pollution
Water pollution
Soil contamination
Headache
Fatigue
CO
Particulate matter
Ozone
Lead
Volatile organic compounds
Nerve damage
SO_2
NO_x
Respiratory illness
Cardio-vascular illness
Gastroenteritis
Cancer risk
Nausea
Skin irritation
- Bacteria
- Parasites
- Chemicals
Pesticides

The other problems.....

The Greenhouse Effect



Green House Gas: water vapour, methane, carbon dioxide,nitrous oxide and Ozone


Global Warming

Thinning of Upper OZone Layer

Acid Rain

Indoor Air Pollution

So, What can YOU do?

- Ride your bike

- Tell your friends and family about pollution

- Make sure your parents get pollution checks on their cars

- Ride the school bus

- Learn more; stay up to date

- Join a group to stop pollution

- Encourage your parents to carpool to work

- Switch off lights, fan, heat, etc. when you leave the room

We only have one world.....

Do you want it like this?

THANK YOU

Towards Sustainable Future

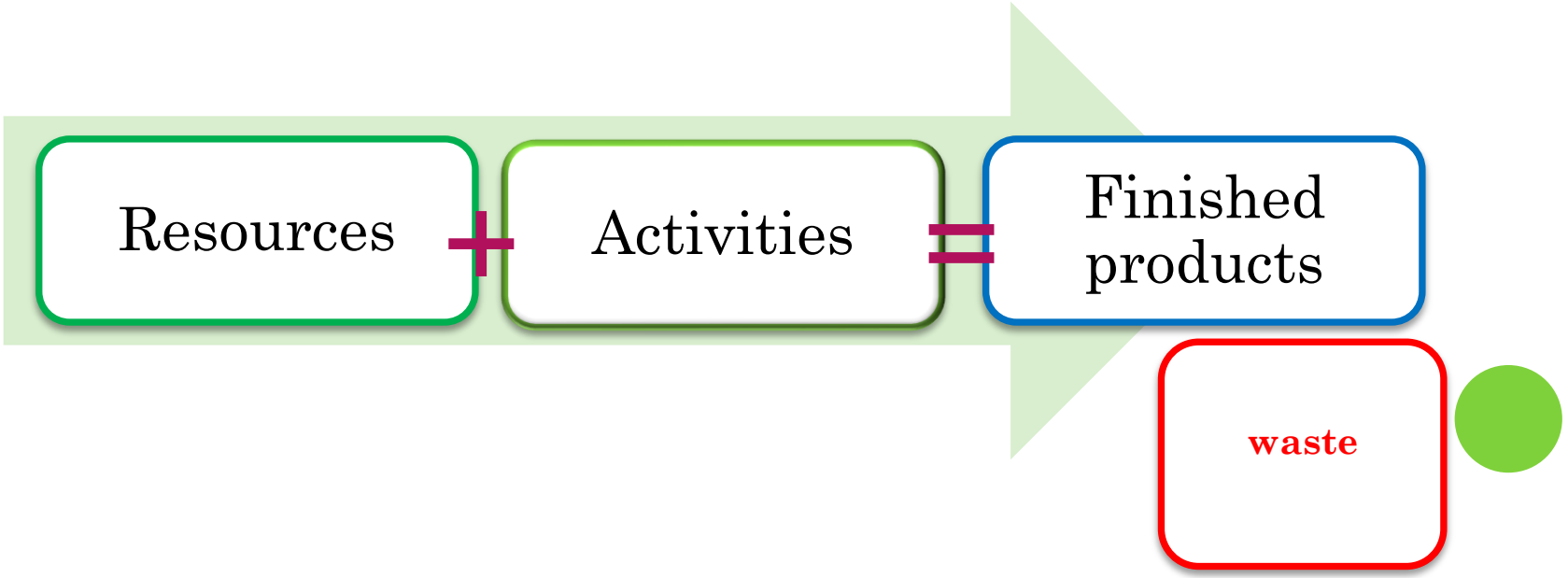
UNIT-5

Resources

Any thing that we take from the **physical landscape to** make other things that we **need** or **want** for our lives, eg

- Drink
- Food
- Shelter
- Fuel/Power
- Manufactured goods

But, using resources can lead to a lot of **waste**

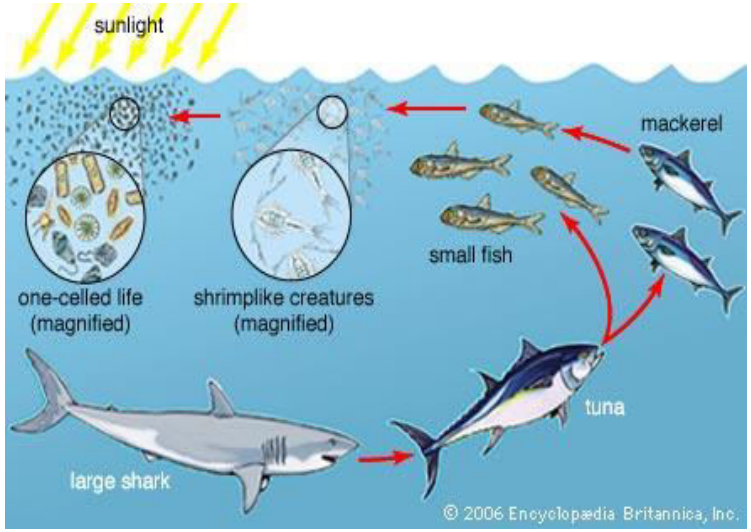


Resources: coal, oil, gas and minerals

Coal, oil and gas are **Fossil Fuels.**
We dig up coal and drill for oil.
We then burn the coal and oil (and gas) to generate electricity

Resources: seas and oceans

70 % of the Earth's surface is water



To think about:
What do you think will be the **impact** of these types of fishing on the resources of the sea?

Resources: forests

Resources: minerals

Iron ore mine, Australia

Granite quarry, Glensanda, Argyll

Sustainable development

- **Development** means making life **better, eg,** to have a better standard of living and an improved quality of life
- **Sustainable Development** means making sure that the things we do, the goods we buy and the lifestyle we have today will not harm the environment for us, for people in other places and for future generations

Sustainable development means

- Looking at levels of consumption and waste

- Thinking about our careful use of the Earth's resources

- Realising that we are each responsible for our actions, and that what we do can have a huge effect on other people, and places

Threats to sustainability

- Population explosion

➢Consumerism

Over-Exploitation of Resources

overexploitation of resources responsible for changes in rainfall patterns

Strategies for Sustainable Development

- Using appropriate Technology

cottage industry appropriate technology

photo voltaic generating electricity from sunlight

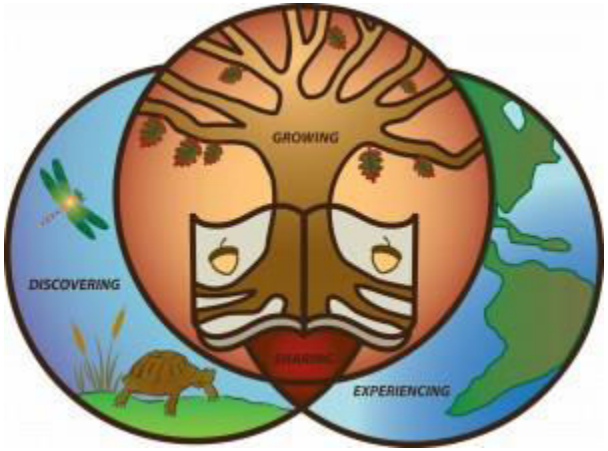
- Reduce, Reuse , Recycle Approach

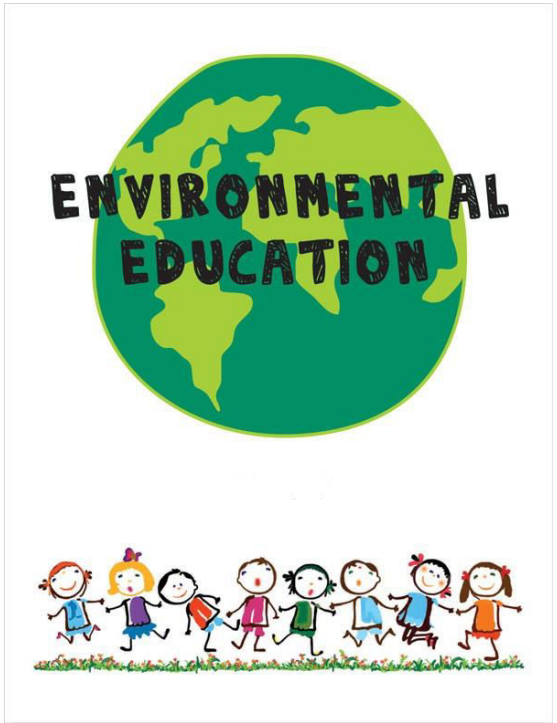
➢Promoting Environmental Education and Awareness

- Resource utilization as per carrying Capacity

- Improving Quality of life including Social, Cultural and Economic Dimensions

ENVIRONMENTAL EDUCATION





CONSERVATION OF RESOURCES

- Water Conservation
- Soil Conservation
- Conservation of Biodiversity

URBAN SPRAWL

So, big question:
How many people can the Earth sustain, and at what standard of living?

1950 2 Billion

2013 7 Billion

Contrasting lifestyles, Manilla

1.5 million tons of clothes a year are thrown out

...9,000 garments thrown into landfill every five minutes

Is this sustainable?

Sustainable living-recycling clothes and other textiles

Where do recycled clothes go?

60% of old clothes go abroad

35% used for mattress stuffing

Sustainability? what's the message here?

Think Global
Act Local !

Bag 4 Life
The Eco Friendly Bag Company
www.bag4life.co.uk

What do you do with your plastic bags?

Is this sustainable?

If you recycle a tonne of paper, how many trees are you saving?

A. 12 trees.

B. 17 trees.

C. 23 trees.

D. 28 trees.

Recycling just one aluminium can saves enough energy to run a television for how long?

A. 3 hours.
B. 6 hours.
C. 9 hours.
D. 12 hours.

How many years does it take a single aluminium can to decompose?

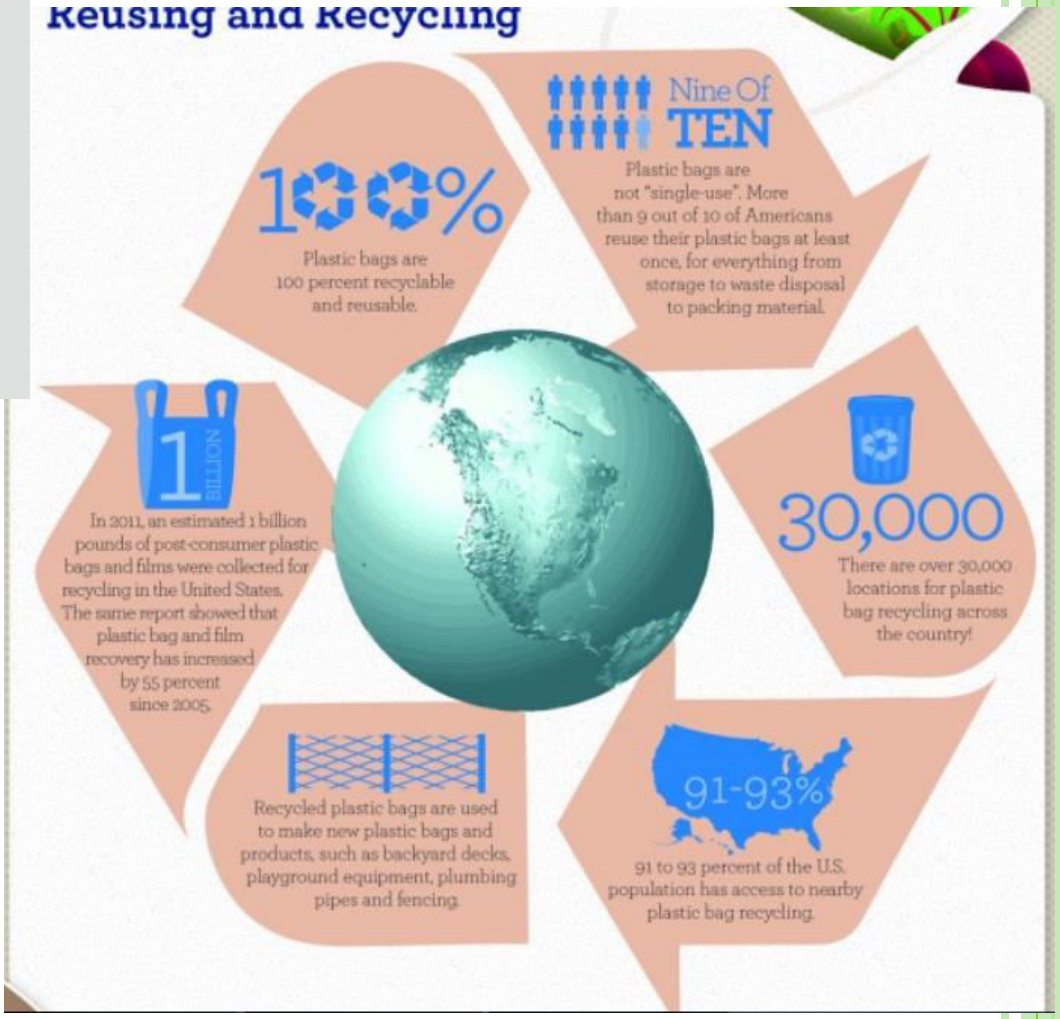
A. 20 – 40 years.

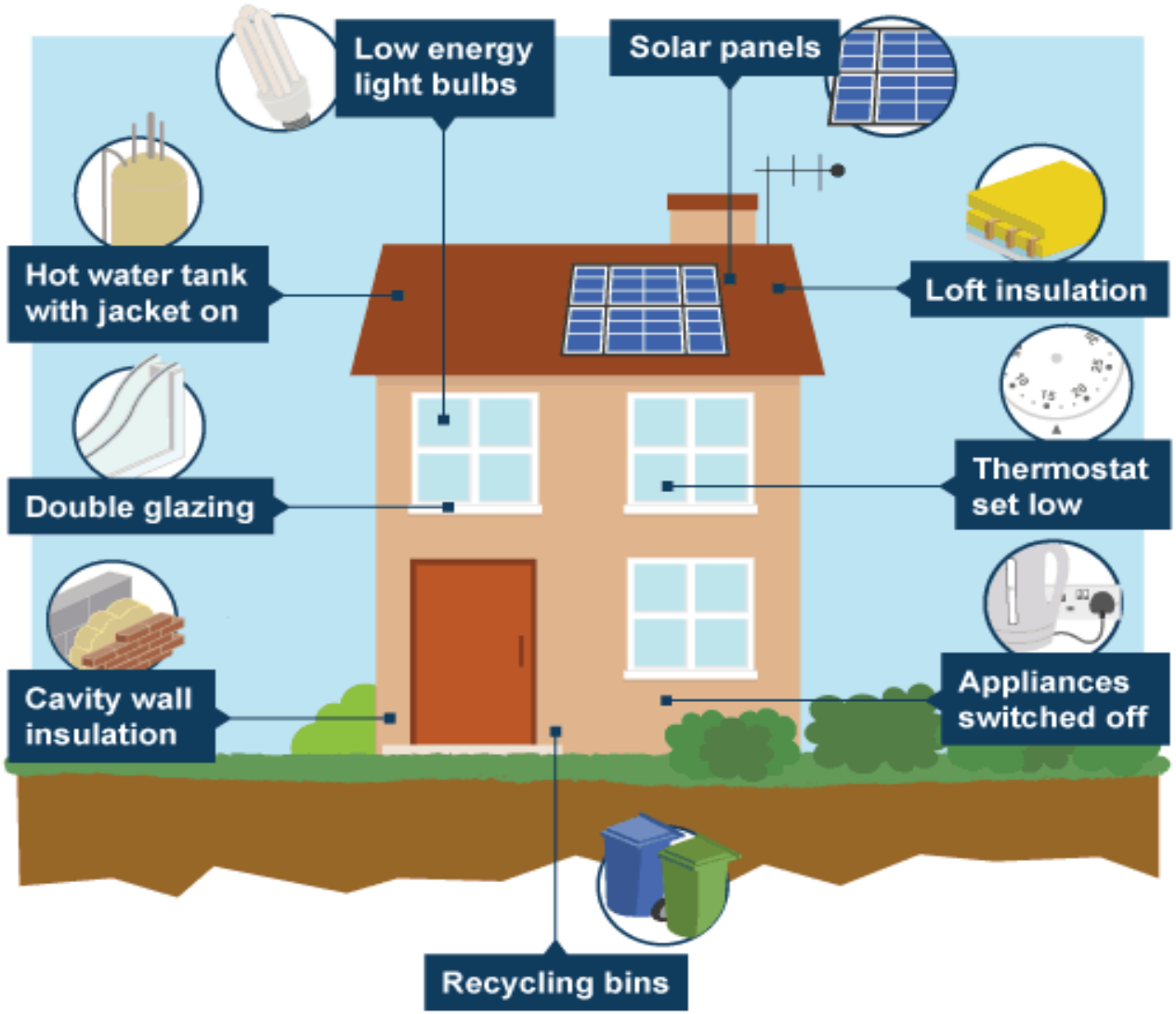
B. 60 – 80 years.

C. 80 – 100 years.

D. 100 – 120 years.

Sustainability: plastic bags; a problem or not?




Low energy light bulbs
Solar panels
Hot water tank with jacket on
Loft insulation
Double glazing
Thermostat set low
Cavity wall insulation
Appliances switched off
Recycling bins

Landfill is becoming a growing problem….

ENVIRONMENT AND HUMAN HEALTH

- Infectious Organisms
- Chemicals
- Noise
- Radiations
- Diet
- Settlement

CONCEPT OF GREEN BUILDING

A) Green Building Materials

- The materials to be used in the green building should be ecofriendly.
- These should be obtained from renewable resources
- These should be Recyclable

B)Energy Consideration in Green Building

- Compact Florescent Lamps (CFLs) can reduce electricity requirements
- Natural day light reduces electricity requirement during day time

C) Water Requirement in Green Building

- Water is used efficiently by employing water efficient applicences.

D) Health Consideration in Green buildings

- Green building provides sufficient air circulation.
- The Non-Toxic Materials and breathable walls help and maintain indoor air quality

THANK YOU