Environmental Science

What is Environmental Science?

The study of how humans interact with their environment

Our environment is everything that surrounds us, both natural and man-made.

Do Now: What is environmental science ? What types of issues will we be discussing ?

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SCOPE

- Study the natural history: a forest, a river, a mountain, a desert or a combination of these elements.
- Our dependence on nature:Protect earth’s environmental resources.
- Respect for nature and all living creatures is not new to India.

IMPORTANCE OF ES

- Environment is not a single subject
- Plastic, waste food, solid waste byproducts…
- Air pollution leads to respiratory problems
- Water pollution to gastro-intestinal diseases
- And many pollutants are known to cause cancer.

Application of technological innovations

- Growing more food by using fertilizers and pesticides.
- Developing better strains of domestic animals and crops
- Irrigating farmland through mega-dams and developing industry.

- Non-renewable resources such as minerals and oil are those which will be exhausted in the future if we continue to extract these without a thought for subsequent generations.
- Renewable resources such as timber and water can be regenerated by natural processes such as regrowth or rainfall.
- Natural resouces can be compared with money in a bank. Sustainable development.

NEED FOR PUBLIC AWARENESS

- We feel that everything must be done by Govt.
- Everything is possible through public awareness.
- News papers, TV, Radio must take responsibility.

Suggested further activities for concerned students:

- Join a group to study nature such as WWF-I (World wide Fund for nature –India) or BNHS(The Bombay Natural History Society)
- Begin reading news paper articles and periodicals like Down to earth, WWF-I News letter, Sanctuary magazine etc.
- Join local movements : saving trees in ur area.
- RRR: Reduce, Reuse, Recycle.
- Visit a National Park or Sanctuary….

4th to 10th January	Oil and Gas Conservation Week and Fortnight
22 March	World Water Day
24 March	World Tuberculosis Day
7 April	World Health Day
19 April	Bicycle Day
22 April	Earth Day
23 May	World Turtle Day
31 May	World No Tobacco Day
5 June	World Environment Day
21 June	International Yoga Day
11 July	World Population Day
28 July	World Hepatitis Day

29 July	International Tiger Day
3rd Saturday of August	National Honey Bee Day
September 1 to 7	Nutrition Week
September 2	World Coconut Day
September 16	World Ozone Day
14 November	World Diabetes Day
10 December	Human Rights Day
December 11	International Mountain Day (Recognized by the UN)
December 12	The International Day Of Heavy Metal
December 14	National Energy Conservation Day (India)
December 23	Farmers Day (India)
December 29	International Biodiversity Day

People in Environment

- The following are the well-known names in the last century include environmentalists, administrators, legal experts, educationalists, and journalists.
  - Indira Gandhi
  - S.P.Gadgil
  - M.S.Swaminathan
  - Madhav Gadgil
  - M.C.Mehta
  - Anil Agarwal
  - Medha Patkar
  - Sunderlal Bahuguna

Indira Gandhi

- As PM played a very significant role in the preservation of India’s Wild Life.
- During her period, the network and protected areas grew from 65 to 98.
- Wild life protection act was formulated during her period.

S.P.Godrej

- Was one of the India’s greatest supporter of wild life conservation and nature awareness programs.
- Between 1975 and 1999, received 10 awards for his conservation activities, he was awarded the Padmabhushan in 1999.

M S Swaminathan

- One of the India’s foremost agricultural scientists.
- Founded the MS Swaminathan Research Foundation in Chennai

Madhav Gadgil

- Well known ecologist in India.
- His interests range from broad ecological issues such as developing community Biodiversity registers studies on the behaviour of mammals, birds, and insects.
- He was written several articles, published papers in journals…

M.C.Mehta

- India’s most famous environmental lawyer.
- Since 1984, he has filed several public interest litigations for supporting the cause of environmental conservation.
- His most famous and long-drawn battles supported by the supreme court include protecting the Tajmahal, cleaning up the Ganges river…..

Anil Agarwal

- Was a journalist who wrote the first report on the state of India's Environment in 1982.
- He founded the CES, an active NGO that supports various environmental issues.

Medha Patkar

- Known as one of rural India's Champions, has supported the cause of the downtrodden tribal people whose environment is being affected by the dams on the Narmada River.

Sunderlal Bahuguna

- His chipko movement has become internationally well-known example of a highly successfully conservation action program through the efforts of local people for guarding their forest resources.
- His fight to prevent the construction of Tehri dam in a fragile earthquake-prone setting is a battle that continues to wage

POWER OF COMMON MAN

- A. birdman of India Salim Ali
- B. water man of India Rajendra Singh
- C. mountain man of India Dashrath Manjhi
- D. Ice man of India Chewang Norphel
- E. 384 Ficus (banyan) trees were planted by Saalumarada thimmakka

- “ the earth enables our people to survive, the environment must be respected and maintained. As long as the earth remains healthy, the people remain healthy.” *Long and Fox, 1996)*

What are the challenges we face?

- What are the environmental issues we are facing today?
- Come up with at least 10!

Hunter-Gatherers

- A combination of rapid climate changes and overhunting by hunter-gatherers may have led to the disappearance of some large mammal species, including:
  - giant sloths
  - giant bison
  - mastodons
  - cave bears
  - saber-toothed cats

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We face challenges in agriculture

- Expanded food production led to increased population and consumption

It's one of humanity's greatest achievements, but at an enormous environmental cost

- Nearly half of the planet's land surface is used for agriculture
  - Chemical fertilizers
  - Pesticides
  - Erosion
  - Changed natural systems

Chapter menu

Resources

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Pesticide Resistance

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We face challenges in pollution

- Waste products and artificial chemicals used in farms, industries, and households

Each year, millions of people die from pollution

We face challenges in climate

Scientists have firmly concluded that humans are changing the composition of the atmosphere

The Earth's surface is warming

- Melting glaciers
- Rising sea levels
- Impacted wildlife and crops
- Increasingly destructive weather

Since the Industrial Revolution, atmospheric carbon dioxide concentrations have risen by 37%, to the highest level in 650,000 years

We face challenges in biodiversity

Human actions have driven many species extinct, and biodiversity is declining dramatically

Biodiversity loss may be our biggest environmental problem; once a species is extinct, it is gone forever

Our energy choices will affect our future

- The lives we live today are due to fossil fuels
  - Machines
  - Chemicals
  - Transportation
  - Products
- Fossil fuels are a one time bonanza; supplies will certainly decline

We have used up ½ of the world's oil supplies; how will we handle this imminent fossil fuel shortage?

BASIC NATURAL RESOUCES

- Forest Resources
- Water Resources
- Mineral Resources
- Food Resources
- Land Resources
- Energy Resources

NATURAL RESOURCES

- Natural resources occur naturally within environments that exist relatively undisturbed by mankind, in a natural form.
- Some of them are essential for our survival while most are used for satisfying our wants.
- They are present abundantly in nature.
- Natural resources are materials and components that can be found within the environment. Every man-made product is composed of natural resources. A natural resource may exist as a separate entity such as fresh water, and air, as well as a living organism such as a fish, or it may exist in an alternate form which must be processed to obtain the resource such as metal ores, oil, and most forms of energy.

CLASSIFICATION OF NATURAL RESOURCES BASED ON ORIGIN

- Based on their origin, natural resources are classified into

  1)***Biotic:*** Biotic resources are obtained from the biosphere (living and organic material), such as forests, animals, birds, and fish and the materials that can be obtained from them. Fossil fuels such as coal and petroleum are also included in this category because they are formed from decayed organic matter.

  2)***Abiotic:*** Abiotic resources are those that come from non-living, non-organic material. Examples of abiotic resources include land, fresh water, air and heavy metals including ores such as gold, iron, copper, silver, etc.

CLASSIFICATION OF NATURAL RESOURCES BASED ON AVAILABILITY

- Based on their availability natural resources are classified into

1)Renewable Resources: Renewable resources are ones that can be replenished naturally. Some of these resources, like sunlight, air, wind, etc., are continuously available and their quantity is not noticeably affected by human consumption. Though many renewable resources do not have such a rapid recovery rate, these resources are susceptible to depletion by over-use. Resources from a human use perspective are classified as renewable only so long as the rate of replenishment/recovery exceeds that of the rate of consumption.

2)Non Renewable Resources: Non-renewable resources are resources that form extremely slowly and those that do not naturally form in the environment. Minerals are the most common resource included in this category. By the human perspective, resources are non-renewable when their rate of consumption exceeds the rate of replenishment/recovery; a good example of this are fossil fuels, which are in this category because their rate of formation is extremely slow (potentially millions of years), meaning they are considered non-renewable. Some resources actually naturally deplete in amount without human interference, the most notable of these being radio-active elements such as uranium, which naturally decay into heavy metals. Of these, the metallic minerals can be re-used by recycling them, but coal and petroleum cannot be recycled.

Natural resources: vital to human survival

Natural resources = substances and energy sources needed for survival

- **Renewable resource** :
  - Perpetually available: sunlight, wind, wave energy
  - Renew themselves over short periods: timber, water, soil
    - These can be destroyed
- **Nonrenewable resource** : can be depleted
  - Oil, coal, minerals

MEASURES TO PRESERVE NATURAL RESOURCES

WITHOUT TREES
43°C
36°C
50°C
THE SACRED PLANT
WITH TREES
18°C
20°C
26°C

CONSERVATION OF FOREST RESOURCES

DEFORESTATION: Deforestation is the clearing of natural forests by logging or burning of trees and plants in a forested area. As a result of deforestation, presently about one half of the forests that once covered the Earth have been destroyed. It occurs for many different reasons, and it has several negative implications on the atmosphere and the quality of the land in and surrounding the forest.

CONTROL MEASURES OF DEFORESTATION

- We should not cut trees rapidly.
- We should use trees in smaller quantity.
- Whenever we cut a tree , we should plant a new tree to make the nature in balance.
- We should not burn poly bags , because it produces a lot of smoke and carbon -dioxide.
- The government of a state should ensure that there should be less and less forest fires and the people living near the area should be careful.
- The media can play an important role, by creating awareness.
- Prevent construction of too many dams.
- Reduce mining activity.

WATER

- **Sources of water:** Water is one of the most basic and essential components required to life.
- It is an essential resource for living systems, industrial processes, agricultural production and domestic
- The sources of water can be classified in to two types.
- **1. Surface water and 2. Underground water**

Naturally available sources of water.

Wells

Water reservoirs

Lakes

Rivers

Glaciers

SOURCES OF WATER

RAIN वर्षा

RIVER नदी

GLACIER हिमनद

WATER TAP / POND / WELL नल / तालाब / कुआँ

HAND PUMP हाथ का पम्प

USES OF WATER

DRINKING पानी पीना

TAKING BATH स्नान करना

WASHING CLOTHES कपड़े धोना

COOKING भोजन बनाना

CLEANING सफाई करना

CONSTRUCTION निर्माण कार्य

IRRIGATION सिंचाई

HYDRO-ELECTRIC जल-विद्युत निर्माण

FIRE FIGHTING अग्नि शमन

Published by : INDIAN BOOK DEPOT (MAP HOUSE)® 2017, Banabarganh Road, Near Sadar Bazar, Delhi - 110006 Price Rs. 2.00

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Sources of Water

Glacier

Spring Water

Waterfall

Well

Well

Tube Well

Handpump

Rain Water

Lake

River

Sea

Sea

SPECTRUM® MUMBAI

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SOURCES OF WATER

CHART NO. 156

www.spectrumchart.com

Aquifers and wells

Source: Environment Canada, USGS

WATER SUPPLY SYSTEM

The following stages are necessary to be studied as:

1. **Sources:** Sources of water
2. **Quantity:** Demand of water
3. **Quality :** Treatment of water
4. **Distribution system:** For towns
5. **Distribution system:** For building
6. **Storage:** Storage tanks
7. **Pumps**
8. **Pipes**
9. **Valves, water meter , fire hydrants**

Types of impurities: Impurities of water can be classified in different ways based on different aspects.

Based on the particle size of impurities, they are classified as suspended impurities, colloidal impurities, dissolved impurities and microbiological impurities.

Based on the nature of the impurities, they are classified as organic and inorganic.

Based on the property of water affected by the impurity as physical, chemical and microbiological.

a) Physical impurities: The impurities which cause a change in any physical property of water are called physical impurities. Like **color, *Turbidity* , *taste*, odour .**

b) Chemical impurities: The impurities which cause a change in any chemical property of water are called chemical impurities. **Acidity, Dissolved oxygen, Hardness.**

c) Microbiological impurities: These are usually abundant in surface waters. They include **bacteria, algae, fungi**, etc. The source of this contamination is mainly discharge of domestic and sewage wastes. The water containing these impurities is not at all fit for human consumption.

Point Source and Non Point Source Pollutants

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Water Treatment Processes

WATER TREATMENT PLANT
SURFACE WATER SUPPLY

EWEB Water Filtration Process

Drinking Water Treatment

1RO system Drinking water plant

expert-aqua.en.alibaba.com

OTHER IMPORTANT DAMS IN INDIA

1. Bhakra Nangal Dam
2. Hirakud dam
3. Damodar Valley Dam
4. Krishnarajasagar Dam
5. Nagarjunasagar Dam
6. Koyna Dam
7. Mettur Dam

List of Indian Dams.

1. **Bhakra Dam** is a concrete gravity dam across the Sutlej River, and is near the border between Punjab and Himachal Pradesh in northern India.
2. The **Tehri Dam** is the highest dam in India and one of the tallest in the world. It is a multi-purpose rock and earth-fill embankment dam on theBhagirathi River near Tehri in Uttarakhand, India.
3. **The oldest dam in India was constructed during 1st century A.D. across the river Cauvery in Tamilnadu by Karikala Cholan. This dam was named as "Kallanai Dam" by Karikala Cholan.**
   Kallanai dam is located 48kms away from the temple town Tanjavur. The height of this dam is 320 meters and width is 60 meters.

Nagarjuna Sagar Dam

Tehri Dam
Uttaranchal

Bhakra Nangal Dam
Punjab and Himachal Pradesh

Bhakra Nangal Dam is a gravity dam across the Sutlej river Himachal Pradesh. Bhakra Nangal is the largest dam in India, with a height of 225 meters and second largest Dam in Asia. Its reservoir, known as the "Gobind Sagar Lake" it is the second largest reservoir in India, the first being Indira Sagar dam.

Height: 226 meters

Length: 520 meters

Type: Concrete gravity

Reservoir Capacity: 7,501,775 acre·ft

River: Sutlej River

Location: Punjab and Himachal Pradesh

Installed capacity: 1325 MW

Hirakud dam Orissa

Sardar Sarovar Dam Gujarat

A Watershed
rain
precipitation
snow
watershed divide
tributaries
watershed divide
percolation
percolation
groundwater
(aquifer)

We All Live in a Watershed
Rainfall
Overland flow
Filtration
River
Groundwater

How Watersheds Work
©2008 HowStuffWorks
Catchments
Two or more catchments form sub-watersheds. A group of sub-watersheds form a watershed. A group of watersheds form a basin.
Overland flow
Rainfall
Infiltration
River
Catchments
Underground rivers and groundwater

HOW WATERSHEDS WORK

OBJECTIVES

- To control damaging runoff and degradation and thereby conservation of soil and water.
- To manage and utilize the runoff water for useful purpose.
- To protect, conserve and improve the land of watershed for more efficient and sustained production.
- To protect and enhance the water resource originating in the watershed.

Percolation pits
Entrance
Percolation trench
Pebbles & Boulders
Service well
Gutter
Recharge well
Collection chamber

Catchment
Gutter
Downtake pipe
Storage
Delivery pipelines
First flush
Filter

Rainwater
Harvesting

Other Major Inter-State River Disputes

Ravi and Beas
States Concerned
Punjab, Haryana, Rajasthan

Narmada
States Concerned
MP, Gujarat, Maharashtra, Rajasthan

Madel/ Mandovi/ Mahadayi
States Concerned
Goa, Karnataka, Maharashtra

Krishna
States Concerned
Maharashtra, Andhra Pradesh (AP), Karnataka

Godavari
States Concerned
Maharashtra, AP, Karnataka, Odisha, Madhya Pradesh (MP)

Periyar
States Concerned
TN, Kerala

Godavari
(Bhabli Barrage)
States Concerned
Maharashtra, AP

Vamasadhara
States Concerned
AP, Odisha

*past and current
Source: Unicef report, 2013, and media reports

Ganga

Issue: Pollution and long-pending clean-up efforts

Brahmaputra

Issue: Dispute between India and China

Cauvery

Issue: Water-sharing, primarily between Karnataka and Tamil Nadu, but also Kerala and Puducherry

Narmada

Issue: Building of dams, particularly Sardar Sarovar Dam, and the environmental impact

CONSERVATION OF WATER RESOURCES

- Use less water.
- Use environmentally-friendly household products.
- Apply natural pesticides and fertilizers.
- Don't litter.
- Dispose off toxic products with care.
- Prevent dumping of e-wastes and plastic wastes.
- Stop over-utilisation and over-exploitation of water.
- Adopt water harvesting.

Conservation Of Water

Family can save 10 Lakhs Litres of water/month.
An individual can save 2 Lakhs Litres of water/month

LAY-NOMATSU

ANDHRA PRADESH

- The state has reserves of over 45 minerals. The major minerals produced include coal, limestone, manganese, bauxite, diamond, graphite and sand.

  Accounts for country's largest limestone reserves.

  Produces 96% of the India's barites, 40% limestone and 30% bauxite from 1482 mines.

  Is the country's biggest contributor to the value of minerals produced.

  Of the state's total mineral value, coal alone accounts for a major share (53% in 2004-05).

  About 206,250 ha of land is presently under mining in the state

  Kurnool, Nellore, Anantapur and Kadapa are the big mining districts.

  About 13,532 ha of the state's forest land has been diverted for mining between 1980-2005

  MIning provides employment to over 5 lakh people

  Home to many power and cement plants

  Protests by tribal communities over calcite mining in Nimmalapadu village led to the landmark Samata judgement of the Supreme Court.

  Nalconda and Kadapa is witnessing protests by locals against the proposed uranium mining by UCIL. Simuilarly, bauxite mining in the state's Western Ghats is being strongly opposed, as it may dry up water resources.

- **NIMMALAPADU** The name is synonymous with the first successful mining protest by tribals. The company in question was Aditya Birla Group's Birla Periclase, which wanted to mine calcite in the area.

  A 10-year struggle led to a historical judgement in 1997, widely known as the Samata judgement, in which the Court ruled that the state had no right to grant leases in areas governed by the Fifth Schedule of the Constitution. Only cooperative societies jointly run by tribals could mine in such areas. The tribals were ably supported in this struggle by a Hyderabad-based NGO, Samata.

  Today, the judgement has become the biggest thorn in the side of state governments who want to promote mining and mineral-based industry. They are looking at various ways to circumvent the Samata judgement.

  So far the tribals have resisted any mining companies and they continue to live their own lives. However, they allege that due to their opposition to mining projects, often they are overlooked for government related aid.

CONTROL MEASURES OF MINING

- Reducing the consumption of minerals.
- The efficiency of manufacturing processes can be increased to reduce the amount of new minerals required.
- Substitution of other materials and processes with more environmentally friendly materials and processes.
- Using recycled materials instead of mined materials.
- Improving environmental performance at mines.
- Legislation and regulations to reduce environmental impacts can be enacted and enforced.
- Cleaning up abandoned mine sites.
- Economic measures like tax shifting, can be introduced to provide incentives for practices like product substitution and disincentives for poor environmental performance.
- Biomining or bioleaching.

The Agricultural Revolution

- The agricultural revolution allowed human populations to grow at an unprecedented rate.
- As populations grew, they began to concentrate in smaller areas placing increased pressure on the local environments.

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Land

Labor

Capital

Fossil fuel energy

Industrialized/conventional agriculture in developed countries

Land

Labor

Capital

Shifting cultivation/slash and burn in tropical forests in developing countries. Oxidation of carbon during burning leads to greater inputs of CO and CO2 in the atmosphere

Land

Labor

Capital

Fossil fuel energy

Intensive traditional agriculture in developing countries. In semi-arid environments, intensive traditional agriculture may lead to desertification.

Land

Labor

Capital

Nomadic herding/grazing in developing countries. Is the most sustainable method for soil types with low productivity.

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The Agricultural Revolution

- The slash-and-burn technique was one of the earliest ways that land was converted to farmland.
- Much of this converted land was poorly farmed and is no longer fertile.

End Of Slide

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Improving the Quality of Life

- Many of these products make life easier, but we are now beginning to understand some of the environmental problems they present.
- In fact, much of environmental science is concerned with the problems associated with the Industrial Revolution.

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Skin problems caused by pesticide exposure.

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The shocking tale of India's 'Cancer Train'

The train leaves Bhatinda railway station in the Indian state of Punjab around 9.25 pm and covers a distance of about 325 km with 26 halts to reach Bikaner Acharya Tulsi Regional Cancer Hospital and Research Centre in Prince Bijay Singh Memorial Hospital, in the Indian state of Rajasthan at 6 am.

Passengers aboard the Cancer train.

Patients line up in Bikaner

A farmer sprays pesticides in his field

Chapter mer

Copyrig

Health and the environment

Pesticides

- Threaten environment and people
- Examples: insecticides, fungicides
- “Interaction effects”

Pesticides and pollution

- Persistent organic pollutants (POPs)
- Harm Eskimo health & culture
- Biomagnification
- Bioaccumulation

Herring Gull eggs
50,000x initial concentration
Lake trout
2,000x initial concentration
Rainbow smelt
400x initial concentration
Zooplankton
50x initial concentration
Phytoplankton
initial concentration

Pesticides and pollution

- Rich can afford organic food and to live in places less affected by pollution
- Bell: “vanity food”

the better india
Doon Chetin
Pyaz Imli ki Chutney
Chamba Chukh
Bhaang ki Chutney
Kachri ki Chutney
Lehsun ki Chutney
Amchur Gur ki Chutney
Bhune Tamatar ki Chutney
Dalle Chilli Chutney
Likok Chutney
Kordoi Chutney
Tungtap
Akhuni Chutney
Gor Keri Nu Athanu
Amrud ki Hari Chutney
Beng Saag Chutney
Aamsotto Khejurer Chutney
Hmarcha Rawt
Mosdeng Serma
Chaprah Chutney
Amba Khatta
Mirchi Thecha
Allam Pachadi
Coriander Coconut Chutney
Hurali Kalu Chutney
Gongura Pachadi
Paruppu Thogayal
Thenga Chammanthi
Chutney Map of India

ved.

Jammu & Kashmir
జమ్మూ కాశ్మీర్

Nagaland
నాగాలాండ్

Haryana
హర్యాన

Meghalaya
మేఘాలయ

Manipur
మణిపుర్

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డి.శంకర్
Chhattisgarh
ఛత్తీస్ ఘడ్

డి.శంకర్
Jharkhand
జార్ఖండ్

డి.శంకర్
Arunachal Pradesh
అరుణాచల్ ప్రదేశ్

డి.శంకర్
Uttar Pradesh
ఉత్తర్ ప్రదేశ్

డి.శంకర్
Bihar
బీహార్

erved.

Punjab

పంజాబ్

Madhya Pradesh

మధ్యప్రదేశ్

Odisha

ఒరిస్సా

Telangana

తెలంగాణ

Andhra Pradesh

ఆంధ్రప్రదేశ్

Resources

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Maharashtra
మహారాష్ట్ర

Karnataka
కర్నాటక

Goa
గోవ

Kerala
కేరళ

Tamil Nadu
తమిళనాడు

Resources

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Growing vegetables in multiple layers build symbiotic assemblage that helps plant protect themselves, produce more per unit area with rich in flavor, taste, nutrition and vitality.

Layer 5 Tall canopy vegetables, such as Drumksticks- Moringa, Susbenia, Curry leaf, flowering and fruit trees, etc

Layer 4 Canopycover vegetables such as Creepers and Vines such as all types of Gourds- Bottle gourds, snake gourd, ridge gourds, bitter gourds, sponge gourds, Tinda, Tonde, Parval, Kakri, Cucumber, Wax beans, Avare, etc.

Layer 3 Midcover Fruit bearing vegetables such as Brinjal, Chilli, Cluster beans, Okra-Bindi, Tomato, Broccoli, Brussel sprouts, cauliflower, kohlrabi, sweet peas, snap peas, etc.

Layer 2 Groundcover vegetables such as all types leafy of vegetables like Methi, Coriander, Dill, Amaranth, Purslane, Spinach, Arugula, Lettuce, All kinds of Salad Greens, etc.

Layer 1 Underground vegetables such as carrots, beetroot, onion, garlic, sweet potatoes, potatoes, turnip, radish, zinger, turmeric, yam, etc

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fssai

Food Safety and Standards Authority of India

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Resources

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- CGIAR is a global partnership that unites international organizations engaged in research about food security. CGIAR research aims to reduce rural poverty, increase food security, improve human health and nutrition, and sustainable management of natural resources.
- **International Water Management Institute (IWMI)** is a non-profit, scientific research organization focusing on the sustainable use of water and land resources in developing countries.
- IWMI is a CGIAR Research Center and leads the CGIAR Research Program on Water, Land and Ecosystems (WLE).

ICRISAT
Science with a human face

International Crops Research institute for the Semi-Arid Tropics

About ICRISAT: www.icrisat.org

ICRISAT's scientific information: http://EXPLOREit.icrisat.org

ICRISAT Development Center (IDC)

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About ICRISAT

ICRISAT International Crops Research institute for the Semi-Arid Tropics

Science with a human face

CGIAR

ICRISAT is a member of the CGIAR Consortium

The **International Crops Research Institute for the Semi-Arid Tropics** (ICRISAT) is a non-profit, non-political organization that conducts agricultural research for development in Asia and sub-Saharan Africa with a wide array of partners throughout the world. Covering 6.5 million square kilometers of land in 55 countries, the semi-arid tropics have over 2 billion people, of whom 644 million are the poorest of the poor. ICRISAT innovations help the dryland poor move from poverty to prosperity by harnessing markets while managing risks – a strategy called Inclusive Market-Oriented Development (IMOD).

ICRISAT is headquartered in Patancheru near Hyderabad, Andhra Pradesh, India, with two regional hubs and five country offices in sub-Saharan Africa. It is a member of the CGIAR Consortium. CGIAR is a global research partnership for a food secure future.

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Rural youth & Start-ups.

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INTERNATIONAL COMPETENCE CENTRE FOR ORGANIC AGRICULTURE

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Centre for Sustainable & Organic Farming (C-SOF)

VISION

A learning centre for holistic, sustainable & organic farming:
A demonstration and training centre for farmers and other stakeholders.

BIO VILLAGE MODEL

- Agriculture/horticulture & animal husbandary, mixed farming including, cereals, legumes, vegetables, fodders; dairy piggery and poultry
- Organic input production- FYM, Vermi, NADEP, Biodynamic composting.
- Renewal Energy- Biogas unit, solar
- On-Farm processing and value addition facilities
- Rural Entrepreneurship - Developing village cluster nearby
- Agri and eco tourism development

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PREVENTIVE MEASURES OF MODERN METHODS OF CULTIVATION

- Green Revolution introduced by Norman Borlang.
- Organic farming.
- Organic farming is the combination of traditional farming practices with modern techniques
- Mulching: Layering or adding dry leaves, soil and water which increases the soil fertility.
- Composting: Conversion of complex materials into simpler forms by the aid of micro organisms.
- Crop rotation: Leguminous plants are planted to add nutrients to soil and avoid pesticides.
- Terrace/Contour farming: To avoid water problems and soil erosion, we develop small trenches near the plant so that water stays near the plant.

MEASURES TO PREVENT SOIL EROSION AND MAN INDUCED EARTHQUAKES

- Prevent soil erosion by planting vegetation, trees, ground cover, shrubs and other plants. Roots from these plants will help hold soil in place on the ground. Soil will not blow away due to wind, or be washed away from rain as easily.
- Create windbreaks, which are barrier rows planted along the windward exposure of a plot of land. Windbreaks made out of trees, such as evergreen trees or bushes help prevent erosion by preventing wind from blowing across your land.
- Grow cover crops on farm land. When land is not being used during the off season, cover crops can help prevent soil erosion due to wind and rain. Legumes (beans) are often used as cover crops.
- Apply mulch to retain moisture and also help prevent soil erosion. Topsoil is not as likely to be washed or blown away when it is covered by mulch. Mulch is often used in flower beds.
- Construct surface runoff barriers, such as edging made of bricks or stones, can help prevent soil erosion by minimizing runoff. If runoff is minimized, soil is less likely to be carried away by groundwater runoff.
- Use contour farming when farming on sloped areas. This conservation technique is to follow the actual topography of a slope when planting crops. Using the natural lay of the land in this way can also prevent soil erosion.
- Try terrace farming and gardening to decrease groundwater runoff. Create nearly level layers of crops on a hillside.

Classification of fuels

Refining of Petroleum…

c) Fractional distillation:

Analysis of flue ga Orsat's apparatus

Refining of Petroleum…

Name of fraction	Boiling range	Composition	Uses
Uncondensed gas	< 30 °C	C_1 to C_4	Domestic or industrial fuel under the name L.P.G.
Petroleum ether	30 – 70 °C	C_5 to C_7	Solvent
Gasoline or petrol	40 – 120 °C	C_5 to C_9	Fuel in internal combustion engines, as solvent and in dry cleaning
Naphtha	120 – 180 °C	C_9 to C_{10}	Solvent and in dry cleaning
Kerosene oil	180 – 250 °C	C_{10} to C_{16}	Fuel for stoves, jet engines and for preparing laboratory gas
Diesel oil	250 – 320 °C	C_{10} to C_{18}	Fuel for diesel engines
Lubricating oil	320 – 400 °C	C_{17} to C_{30}	Lubricant
Heavy oil	320 – 400 °C	C_{17} to C_{30}	Refractionation
Refractionation of this fraction gives petroleum jelly, grease, paraffin wax which are used as lubricant, in candles, boot polishes, etc.			
Residue	> 400 °C	≥ C_{30}	As water-proofing of roofs and road making

FORMS OF ENERGY
MECHANICAL ENERGY
NUCLEAR ENERGY
POTENTIAL ENERGY
SOUND ENERGY
ENERGY
KINETIC ENERGY
ELECTRICAL ENERGY
HEAT ENERGY
CHEMICAL ENERGY
LIGHT ENERGY

FORMS OF ENERGY
Nuclear energy (nuclear fusion in stars)
Magnetic energy
Light
Electric energy
BATTERY
Potential energy
Kinetic energy
Chemical energy
Thermal energy

Grid Energy Storage
Distributed Generation
Switches & Power Electronics
Distributed Generation
Monitoring, Communications & Control (MC²)
Energy Storage
Biopower Generation
Microturbine
Electric Vehicles (EV)
Fuel Cells
Distributed Generation
Home Energy System
Distributed Generation
(Source: The Clean Coalition)

Electricity
Oil
Distribution Infrastructure
Commercial
Biomass
Centralized Community Heating & Cooling System
Natural Gas
Industrial
Solar
Coal
Thermal Storage
Residential

Renewable Energy
Solar Energy
Hydropower Energy
Biomass Energy
Energy
The Fuel of Life
Geothermal Energy
Wind Energy
Non-Renewable Energy
Fossil Fuel Oil
Coal
Energy
The Fuel of Life
Nuclear
Natural Gas

Alternative Energy Sources
Geothermal
Nuclear
Wind
Solar
Hydroelectric
Biomass

Renewable Energy
Wind Energy
Solar Energy
Hydropower
Biomass Energy
Non-Renewable Energy
Nuclear
Natural Gas
Coal
Fossil Fuel Oil

AGRICULTURAL CROPS & RESIDUES
FORESTRY CROPS & RESIDUES
SEWAGE
biomass sources
INDUSTRIAL RESIDUES
ANIMAL RESIDUES
MUNICIPAL SOLID WASTE

SOLAR PANELS ON SEA SHORE VISHAKHAPATNAM 2021

Pollution In Relation To Emission of Green House Gas CO_2

Advantages And Disadvantages Of Energy Resources

nuclear power plant
Factories
Thermal power plant
hydraulic power generation
Homes
Smart Grid
Cities and offices
Renewable energy
Photovoltaic
ecological vehicle
Wind generator

MEASURES TO CONSERVE ENERGY

- Do not leave your Air Conditioner on while you are out or it is simply not needed. In fact it is estimated that your Air Conditioner wastes about $0.25 worth of energy in one hour.
- A simple thing as a light switch can effect your consumption rate. Buy a dimmer, which allows you to select the brightness of your light. Which can help you use less of energy but not turning the light bulb on all the way.
- Purchase fluorescent light bulbs. They not only are brighter, but they also last up to 10 times longer then a usual bulb while consuming a quarter of the power.
- Insulate your windows. Heat can easily escape your home through cracks and opening in walls and windows. Spending some cash insulating, can lead to huge savings in the long run.
- Turn your appliances, especially the computer off when you are not using it. Waiting 5 minuets for it to turn on beats the enormous amount of money that you will save on your bill at the end of the month.

CONCLUSION

- The environment we live in is a beautiful place. Let us not pollute it for our selfish needs.
- It is our responsibility to give the next generation a better, hygienic future and to preserve energy for future use.
- It is high time to take a step forward to curb the environmental pollution and make it a place suitable for better standards of living.
- It is imperative on our part to save our environment

IN ORDER TO TRULY UNDERSTAND THE ENVIRONMENT MUCH BETTER YOU MUST LEARN TO SEE FROM OTHER PERSPECTIVE

North Sentinel Island is one of the Andaman Islands, which includes South Sentinel Island, in the Bay of Bengal. It is home to the Sentinelese who, often violently, reject any contact with the outside world, and are among the last people worldwide to remain virtually untouched by modern civilization. As such, only limited information about the island is known.

Nominally, the island belongs to the South Andaman administrative district, part of the Indian union territory of Andaman and Nicobar Islands. In practice, Indian authorities recognise the islanders' desire to be left alone and restrict their role to remote monitoring.

Levels of Ecological Organization

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Organism

Population

Community

Ecosystem

ECOSYSTEM
MOISTURE
SOLAR RADIATION
DISTURBANCES
HABITAT
PLANT COMMUNITY
Nutrients
Minerals
Soil organisms

Nature Selects

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Coevolution

- The process of two species evolving in response to long-term interactions with each other is called **coevolution**.
- An example is the Hawaiian honeycreeper, which has a long, curved beak to reach nectar at the base of a flower. The flower has structures that ensure that the bird gets some pollen on its head.
- When the bird moves the next flower, some of the pollen will be transferred, helping it to reproduce.

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Coevolution

- The honeycreeper's adaptation is along, curved beak.
- The plant has two adaptations:
  - The first is the sweet nectar, which attracts the birds.
  - The second is the flower structure that forces pollen onto the bird's head when the bird sips nectar.

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Evolution by Artificial Selection

- **Artificial selection** is the selective breeding of organisms, by humans, for specific desirable characteristics.
- Dogs have been bred for certain characteristics.
- Fruits, grains, and vegetables are also produced by artificial selection. Humans save seeds from the largest, and sweetest fruits. By selecting for these traits, farmers direct the evolution of crop plants to produce larger, sweeter fruit.

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Evolution of Resistance

- **Resistance** is the ability of an organism to tolerate a chemical or disease-causing agent.
- An organism may be resistant to a chemical when it contains a gene that allows it to break down a chemical into harmless substances.
- Humans promote the evolution of resistant populations by trying to control pests and bacteria with chemicals.

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Pesticide Resistance

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Types of Ecosystem Services……

Provisioning

Regulating

Cultural

The Millennium Ecosystem Assessment found that 60% of ecosystem services are being degraded or used unsustainably

	Degraded	Mixed	Enhanced
Provisioning	• Capture fisheries • Wild foods • Biomass fuel • Genetic resources • Biochemicals, natural medicines, & pharmaceuticals • Freshwater	• Timber and wood fiber • Other fibers (e.g., cotton, hemp, silk)	• Crops • Livestock • Aquaculture
Regulating	• Air quality regulation • Regional & local climate regulation • Erosion regulation • Water purification & waste treatment • Pest regulation • Pollination • Natural hazard regulation	• Water regulation • Disease regulation	• Global climate regulation (carbon sequestration)
Cultural	• Spiritual, religious, or cultural heritage values • Aesthetic values	• Recreation & ecotourism	

Source: Millennium Ecosystem Assessment, 2005

FOOD CHAIN

The *arrow* points to the eater and shows the transfer of energy.

Food Chains and Webs:

- A food chain is the path of food from a given final consumer back to a producer. For instance a typical food chain in a field ecosystem might be:

grass → grasshopper → mouse → snake → hawk

- The real world, of course, is more complicated than a simple food chain. While many organisms do specialize in their diets (anteaters come to mind as a specialist), other organisms do not. Hawks don't limit their diets to snakes, snakes eat things other than mice. Mouse eats grass as well as grasshoppers, and so on.

Food Chains

A three linked food chain

A four linked food chain

A five linked food chain

Trophic Levels

level in a food chain

1. **<u>Producers</u> always first level**

2. **<u>Primary consumers</u> next level (herbivore)**

3. **<u>Secondary consumer</u>- eat herbivores (small carnivore or omnivore)**

4. **<u>Tertiary consumer</u>-carnivores that eat secondary consumers.**

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The Food Chain

Food Chains

a. Grazing Food Chain

These plants produce chemical energy from solar energy

A herbivorous grasshopper eats blades of grass

A 1st level carnivorous shrew eats the grasshopper

A 2nd level carnivorous owl eats the shrew

Grazing and detritus food chains can interact as when a shrew eats a beetle

b. Detritus Food Chain

The dead organic matter (detritus) is the primary source of energy

Primary detritus feeders such as decomposers (bacteria) and some detritivores (carrion beetles) acquire their energy from dead matter

Secondary detritus feeders such as protozoa (that may eat bacteria) and a spider (that may eat the beetle) acquire their energy and nutrients from the primary detritus feeders

http://www.eelsinc.org/id64.html

A more realistic depiction of who eats whom, I called a food web, as an example I show below:

> It is when we have a picture of a food web in front of us that the definition of food chain makes more sense. We can now see that a food web consists of interlocking food chains and that the only way to untangle the chains is to trace *back* along a given food chain to its source.

The Soil Food Web
Nematodes
Root-feeders
Arthropods
Shredders
Arthropods
Predators
Birds
Nematodes
Fungal- and
bacterial-feeders
Fungi
Mychorrhizal fungi
Saprophytic fungi
Plants
Shoots
and roots.
Nematodes
Predators
Organic Matter
Waste, residue and
metabolites from plants,
animals, and microbes.
Bacteria
Protozoa
Amoebae, flagellates,
and ciliates
Animals
First trophic level:
Photosynthesizers
Second trophic level:
Decomposing Mutualists
Pathogens, Parasites
Root-feeders
Third trophic level:
Shredders
Predators
Grazers
Fourth trophic level:
Higher level predators
Fifth & higher
trophic level:
Higher level predators

Tertiary Consumers
Coyote
Mountain lion
Bobcat
Secondary Consumers
Ringtail
Western whiptail
Raven
Black tipped jackrabbit
Pine marten
Primary Consumers
Pika
Red-breasted nuthatch
Pacific tree frog
Edith's checkerspot
Douglas's squirrel
Mule deer
Producers and Decomposers
Plants, Flowers, Nuts, Seeds, Fruit, Insects

Food Web

Top carnivores
carnivores
Herbivores
Photosynthesizers
Decomposers
Birds of prey
Humans
Birds
Mammals
Mammals
Birds
Inorganic nutrients
Anthropods
Meiofauna
Fish
Inorganic nutrients
Bacteria and fungi
Algae
Inorganic nutrients
Mollusks
Annelids

Types of Flow models....

1. Single channel Models

2. Double channel Models (also called Y shaped Models.)

The diagram above shows how both energy and inorganic nutrients flow through the ecosystem.

The dark arrows represent the movement of this energy.

The movement of the inorganic nutrients is represented by the open arrows.

Energy Flow Through the Ecosystem

To summarize the flow of energy and inorganic nutrients through the ecosystem, a few generalizations can be made:

1. The ultimate source of energy (for most ecosystems) is the sun.
2. The ultimate fate of energy in ecosystems is for it to be lost as heat.
3. Energy and nutrients are passed from organism to organism through the food chain as one organism eats another.
4. Decomposers remove the last energy from the remains of organisms.
5. Inorganic nutrients are cycled; energy is not.

Food Chain Pyramid

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More worksheets at www.education.com/worksheets

Numbers
(Individuals / 0.1 ha)
C3=1
C2=90,000
C1 = 200,000
P = 1,500,000
Grassland (summer)
C3=2
C2=120,000
C1=150,000
P=200
Temperate forest (summer)
Biomass
(g / m²)
C1=21
P=4
English Channel
C2=4
C1=11
P=96
Wisconsin Lake
C2=0.01
C1=1
P=500
Georgia oil field
C2=11
C1=152
P=703
Eniwetok coral reef
Energy
(kcal m⁻² yr⁻¹)
C3=21
C2=383
S=5069
C1=3368
P=20,810
Silver Springs, Florida

Succession

Climax Community

Stable mature community.

As soil builds, seeds carried by wind or water allow bushes and grass to grow.

New soil makes it possible for **plants** (weeds and ferns) and **insects** to move into the community.

Pioneer Species such as ***lichens*** break down barren rock into useable soil.

A. Ecological Succession: Predictable orderly replacement of communities in an ecosystem

Young Stage: **Pioneer** → Intermediate Stage: **Seral** → Mature Stage: **Climax**

STEPS OF SUCCESSION

- Nudation
- Invasion
- Competition and co action
- Reaction
- Stabilization (Climax)

Nudation

This is development of bare area without any form of species.

nudation may occur due to-

- Topographic
- Climatic
- Biotic

Invasion

Invasion is the successful establishment of a species (Pioneer organisms) in a bare area.

Invasion include the following three steps:

- Migration
- Ecesis (establishment)
- Aggregation

Competition and coaction

Due to aggregation of a large no. of the species at the limited place, there develops competition for space and nutrition.

Individuals of a species affect each other's life in various way this is called Coaction.

Reaction

Reaction includes mechanism of the modification of the environment through the influence of living organisms on it. Due to this very significant stage, changes take place in soil, water, light conditions, temperature, etc., of the environment. As a result of reaction, the environment is modified and become unsuitable for the existing community which sooner or later is replaced by another community (seral community).

Stabilization (Climax)

The final stage of succession is called the **climax community**.

The final community is not replaced and is known as climax community and the stage as climax stage.

Ecological Succession

Succession- changes which increase the community complexity over time.

- **Nudation:** Succession begins with the development of a bare site, called Nudation (disturbance).
- **Migration:** It refers to arrival of propagules.
- **Ecesis:** It involves establishment and initial growth of vegetation.
- **Competition:** As vegetation becomes well established, grow, and spread, various species begin to compete for space, light and nutrients.
- **Reaction:** During this phase autogenic changes such as the buildup of humus affect the habitat, and one plant community replaces another.
- **Stabilization:** A supposedly stable climax community forms.

Primary Succession- After severe disturbance that remove or bury products of the ecosystem.

- **emerging islands**
- **formation of new lake**

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© From Biosphere 2000: Protecting Our Global Environment, 3d ed. by Donald G. Kaufman and Cecilia M. Franz. (New York: HarperCollins Publishers, 2000), Fig. 5.3, p. 86.

Ecological Succession: Communities in Transition - Type #1

- Slow soil development by weathering, activities of tolerant species
  - pioneer species

Pioneer Species

Lichens break down rock to form soil.

Low, growing moss plants trap moisture and prevent soil erosion

Ecological Succession: Communities in Transition - Type #1

- **Primary succession**

  - begins with barren area, **no soil**

Primary Succession

Secondary Succession

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Mature oak/hickory forest destroyed	Farmland abandoned	Annual plants	Grasses and biennial herbs	Perennial herbs and shrubs begin to replace grasses and biennials	Pines begin to replace shrubs	Young oak and hickory trees begin to grow	Pines die and are replaced by mature oak and hickory trees	Mature oak/hickory forest
		1–2 years	3–4 years	4–15 years	5–15 years	10–30 years	50–75 years	

Secondary succession on land

Secondary Succession- re-colonization following disturbance

- (much faster than primary succession)
- fire, floods, bulldozers, etc

Examples of Natural and Human-Induced Disturbance

Natural

- Mortality
- Age, Density,
- Self-Thinning
- Tree Fall
- Wild Fire
- Volcano
- Flooding
- Sea-level Rise or Retreat
- Hurricane/Tornadoes
- Insects/Disease
- Wind Throw
- Tsunami
- Logging
- Landslides
- Glaciers

Human-Induced

- Logging
- Plowing
- Mining
- Dam Removal
- Fire/Flooding
- Redwood tree fall
- Nuclear blast/Warfare

Primary Succession	Secondary Succession
Begins with no life	Follows removal of existing biota
No soil present	Soil already present
New area (e.g. volcanic island)	Old area (e.g. following a bush fire)
Lichen and moss come first	Seeds and roots already present
Biomass is low	Biomass is higher

During a volcanic eruption, molten lava flows over the ground and into the water. After the eruption is over, the lava cools and hardens into bare rock.

Lichen spores carried on the wind settle on the rock. Lichens release acid that helps break down the rock and create soil. Lichens add nutrients to the soil as they die and decay.

Airborne spores from mosses and ferns settle onto the thin soil and add to the soil when they die. The soil gradually becomes thick enough to hold water. Insects and other small organisms move into the area.

After many years the soil is deep and has enough nutrients for grasses, wildflowers, shrubs, and trees. The new ecosystem provides habitats for many animals. Eventually, a climax community develops.

THE CARBON CYCLE
KEY
Process
Reservoir
Atmosphere
Erupting volcano
Photosynthesis
Soil Respiration
Burning
Respiration
Photosynthesis
Diffusion
Respiration
Plants
Decomposition
Ocean surface
Burning fossil fuels
Food web
Phytoplankton
Soil organic carbon
Food web
Weathering & erosion
Sinking
Coal, oil, gas
Shellfish & corals
Sedimentary rocks
Deep ocean currents
Rock cycle
Deep ocean sediments
CREDITS

CO_2
Carbon Dioxide
in Atmosphere
Pollution
Respiration
Photosynthesis
Feeding
COMBUSTION
ANIMALS
PLANTS
OCEAN
Decomposition
Sedimentation
Extraction
Fossilization
FUELS
(oil, coal & gas)
FOSSILS
$CaCO_3$
(limestone & shells)

The Carbon Cycle
Carbon dioxide is exchanged between the air and the sea
Plants remove carbon dioxide from the atmosphere
Animals eat plants, releasing carbon dioxide into the atmosphere and into water
Humans burn fossil fuels, releasing carbon oxides
Sea creatures build their shells from dissolved carbonates
Ancient animals and plants eventually become fossil fuels such as coal
Carbonates from the shells of sea creatures form limestone

The Basic Carbon Cycle
Carbon Dioxide
Inorganic Carbon
Organic Carbon
burning
respiration
respiration
photosynthesis
assimilation
senescence, death
Non-Living Carbon
Living Carbon

The Oxygen Cycle
Atmospheric O_2
photosynthesis
respiration
assimilated oxygen in biomass
burial of organic matter
small transfer
Sediments
buried organic matter
Hydrologic cycle

ASSIMILATION
"Light-independent reaction"
H_2
"Light-dependent reaction"
CO_2
Carbon cycle
GLUCOSE
Hydrogen cycle
H_2O
Oxygen cycle
O_2
"Glycolysis", "Citric acid cycle"
H_2
"Terminal oxidation"
DISSIMILATION

Most available oxygen comes from photosynthesis by plants on land and phytoplankton on the ocean's surface
Some oxygen is made in the atmosphere, when sunlight breaks down water
The Oxygen Cycle
plants on land
the ocean
Oxygen is used by animals, plants, bacteria, fire, decomposition, and even rusting metal (oxidation).
Most oxygen is stored in the oxide minerals of the Earth's crust and mantle, called the lithosphere, but is bound to rocks and unavailable for use
phytoplankton floating su
the surface of the ocean

The Nitrogen Cycle

Precipitation
Gaseous Atmospheric Nitrogen Store
Lightning Fixation
Fossil Fuel Emissions
Bacteria Fixation
Gaseous Losses N_2 & N_2O
Runoff
Fertilizers
Leaching
Eutrophication
Organic Matter ($R\text{-}NH_2$)
Denitrification
Mineralization
Plant Consumption
Ammonium (NH_4^+)
Leaching
Nitrification
Nitrates (NO_3^-)
Nitrites (NO_2^-)
Nitrification

Atmospheric Nitrogen (N_2)
Plants
Assimilation
Denitrifying Bacteria
Nitrogen-fixing bacteria living in legume root nodules
Decomposers
(aerobic and anaerobic bacteria and fungi)
Nitrates (NO_3^-)
Nitrifying bacteria
Ammonification
Nitrification
Ammonium (NH_4^+)
Nitrites (NO_2^-)
Nitrogen-fixing soil bacteria
Nitrifying bacteria

Phosphorus cycle

Phosphate from fertilizers
Plant phosphate
Weathering
Phosphate in fossils, rocks, guano
Inorganic phosphate stored in soils and dissolved in rivers
Decomposers
Uplifting over time
Run-off to oceans
Animal phosphate
Phosphate in oceanic sediments
Organic wastes and remains

The Phosphorus cycle

Uplifting of rock
Weathering of rock
Phosphates in organic compounds
Phosphates in rock
Runoff
Animals
Plants
Detritus
Phosphates in solution
Phosphates in soil (inorganic)
Decomposition
Detritivores in soil
Rock
Precipitated (solid) phosphates

Types of Ecosystem
Natural
Artificial/Man-made
Terrestrial
Aquatic
Forest
Grassland
Desert
Marine
Fresh water
Lotic - river, stream or spring.
Lentic - lake, pond or swamp

Natural Ecosystems

Man-made Ecosystems

What is the different
between natural and man
Made ecosystem?

Ecosystem
Natural
Artificial
Terrestial
Aquatic
Fresh
Marine
Lentic
Lotic
Ocean
Seas

Schematic Representation of the Structure of an Ecosystem.

AQUATIC ECOSYSTEM

Aquatic systems are those that contain plants and animals that predominantly depend on a significant amount of water to be present for at least part of the year.

Examples Of Ecosystem Include:

LITTORAL ZONE

The region of the shore of a lake or sea or ocean; the shore of a sea or ocean.

LARGE MARINE ECOSYSTEM

- Any marine environment from pond to ocean, in which plants and animals interact with the chemical and physical features of the environment.

jellyfish
turtle
dolphin
bigeye tuna
blue whale
Epipelagic
crab
squid
Mesopelagic
catshark
krill
viperfish
octopus
Bathypelagic
sea star
anglerfish
Abyssopelagic
black swallower
Oceanic divisions
lipari fish
Hadalpelagic
tube worms
sea cucumber

ECOSYSTEM INFOGRAPHIC
Sun Energy
Producers (phytoplankton)
Primary consumers (zooplankton)
Secondary consumers (fish)
Tertiary consumer
Dissolver chemicals
Sediment
Descomposers
designed by freepik.com

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MARINE ECOSYSTEM

- Any marine environment from pond to ocean, in which plants and animals interact with the chemical and physical features of the environment.

CORAL REEF

A large underwater formation created from the calcium carbonate skeletons of coral animals can also refer to the animals living on and near the coral reef.

- **Coral reefs** are diverse underwater ecosystems held together by calcium carbonate structures secreted by **corals**. **Coral reefs** are built by colonies of tiny animals found in marine water that contain few nutrients. Most **coral reefs** are built from stony **corals**, which in turn consist of polyps that cluster in groups.

CORALS OF THE WORLD
BY:
lemon TYK
PHOTOGRAPHY

FLORIDA'S
Coral
Reefs
Coral Reefs Are Important
Coral reefs are beautiful, protect our shorelines, and provide habitat for sea turtles, marine mammals, and thousands of different invertebrates, algae, and fish.
Stony Corals
Octocorals
Sponges
We are Connected
Coral Anatomy and Growth
Corals Need Protection
You Can Help
Loxahatchee River District

Healthy Coral
Coral polyps live in a symbiotic relationship with microscopic algae.
The algae live in the tissue of the coral and provide the polyps a major food source through photosynthesis.
Bleached Coral
Higher temperatures cause the algae to produce excess oxygen, which is poisonous to the polyps.
The algae is expelled, leaving the polyps without a major food source and susceptible to disease.

CORALBLEACHING
Have you ever wondered how a coral becomes bleached?
HEALTHY CORAL
STRESSED CORAL
BLEACHED CORAL
CORAL

1. Marine Ecosystem

Component Of Marine Ecosystem

- **Biotic Component**
  - **Producers**(Photoplankton)
  - **Consumers**
    - Primary(Crustacean)
    - Secondary(Herring,Sheld)
    - Tertiary(Haddock, Big Fish)
  - **Decomposers**(Inorganic Nutrients)
- **Abiotic Component**
  - Dominant Ions(Sodium, Calcium, etc)

2. Pond Ecosystem

Biological Zone Of Pond Ecosystem

Component Of Pond Ecosystem

- **Biotic Component**
  - **Producers**(Hydrilla ,Hyacianyhs)
  - **Consumers**(Small Fish,Crabs)
    - **Decomposers**(Bacteria, Fungi)

- **Abiotic Component**
  - Dominant Ions(Phosphates,nitrates etc)

Component Of Pond Ecosystem

- **Biotic Component**
  - -**Producers**(Green Algue)
  - -**Consumers**(Snails, Fish)
    - -**Decomposers**(Bacteria, Fungie)

- **Abiotic Component**
  - -Solar Radiation , Dissolved Oxizen

3. River Ecosystem

4. Estuarine Ecosystem

Component Of Estuarine Ecosystem

-**Producers**(Sea Grass , Marsh Grasses)
-**Consumers**(Crabs , Crustacen Fish)
-**Decomposers**(Bacteria, Fungie)

Terrestrial Ecosystem

1. Forest Ecosystem

Component Of Forest Ecosystem

- **Biotic Component**
  - **Producers**(bushes , small plants)
  - **Consumers**
    - Primary(Ants , Spiders)
    - Secondary(Snakes , Fox)
    - Tertiary(Lion , Hawks)
  - **Decomposers**(Fungi ,bacteria)
- **Abiotic Component**
  - Water
  - Soil

RAINFOREST

- Mixed rainforest or mixed forest is a rainforest classification where eucalypt forest grows in combination with Cool Temperate rainforest species.

CHAPARRAL

- A dense, impenetrable thicket of shrubs or dwarf tree . A vegetation type dominated by shrubs and small trees, especially evergreen trees with thick sma. leave .

TAIGA

- A moist sub arctic coniferous forest that begins where the tundra ends and is dominated by spruces and fir .

2. Grassland Ecosystem

Component Of Grassland Ecosystem

- **Biotic Component**
  - **Producers**(grass , Green plants)
  - **Consumers**
    - Primary(rabbit , Sheep)
    - Secondary(Lizard , Snake)
    - Tertiary(Eagle, Hawks)
  - **Decomposers**(bacteria)
- **Abiotic Component**
  - Climatic Factor(Temp. , Rainfall)
  - Edaphic Factor(minerals in soil)

SAVANNA

- A tropical or subtropical grassland containing scattered trees and drought-resistant undergrowth.

TUNDRA

- A type of ecosystem dominated by lichens, mosses, grasses and woody plant . Tundra is found at high latitudes (arctic tundra) and high altitudes
- A treeless plain characteristic of the arctic and sub arctic region .

3. Desert Ecosystem

DESERT

A desert is a landscape form or region that receives very little precipitation. Deserts can be defined as areas that receive an average annual precipitation of less than 250 mm (10 in) or as areas in which more water is lost than falls as precipitation. In the Köppen climate classification system, deserts are classed as *BWh* (hot desert) or *BWk* (temperate desert).

Component Of Desert Ecosystem

- **Biotic Component**
  - -Producers(Bushes, Grasses)
  - -Consumers(insect Bird, mammals)
    - -Decomposers(Fungi, Bacteria)

- **Abiotic Component**
  - -Temp.
  - -Soil

The River of Five Colors

- Caño Cristales, located in remote part of Colombia, is just your average river — most of the time. But a few times a year, the river turns into a literal rainbow of water. Caño Cristales is rich in many types of algae, and when the water level is just right, the algae feeds on the sunlight and glows. Reds, greens, yellows, oranges, etc. combine with the blue-appearing water. The river, also known as “The River of Five Colors,” is a sight to be seen — a flowing piece of natural artwork.
- But for a long time, you couldn’t actually visit it. For three years ending late 2009, the Colombian government closed access to the river, citing security concerns, given the area’s paramilitary activity. The area is now open, but is still difficult to access. Tours of no more than 20 people depart a town two hours away, by foot (driving to Caño Cristales is not an option), and overnight stays in the area are forbidden in an attempt to preserve the environment. And one can only visit during the short periods each year when the river is in its abnormal, hyper-color state.

Cano Cristales – Rainbow River

Supports growth of FIVE different Types of ALGAE

HUMAN ECOSYSTEM

- Human ecosystems are complex cybernetic systems that are increasingly being used by ecological anthropologists and other scholars to examine the ecological aspects of human communities in a way that integrates multiple factors as economics, soci political organization, psychological factors, and physical factors related to the environmer .

URBAN ECOSYSTEM

- Is the subfield of ecology which deals with the interaction of plants, animals and humans with each other and with their environment in urban or urbanizing setting. Analysis of urban settings in the context of ecosystem ecology (looking at the cycling of matter and the flow of energy through the ecosystem) can result in healthier, better managed communities. Studying the factors which allow wild plants and animals to survive (and sometimes thrive) in built environments can also create more livable space. It allows people to adapt to the changing environment while preserving the resource .

GLASS BEACH

GREATER YELLOWSTONE ECOSYSTEM

- Greater Yellowstone is the last remaining large nearly intac ecosysten ir the northern temperate zone of the Earth and is partly located in Yellowstone National Par Conflict over management has been controversial anc the ares is s flagshir site among conservation grouns that promote ecosystem managemer The Greater Yellow Ecosystem (GYE) is one of the world's foremost natural laboratories in landscape ecology and geology and is a worl - renowner recreationa sit I is also home to the animals o Yellowston .

SUBSURFACE LITHOAUTOTROPHIC MICROBIAL ECOSYSTEM

- A minute life form : a microorganism, especially a bacterium that causes diseas .

Biodiversity

DEFINITION

Biodiversity or **biological diversity** is the variation of taxonomic life forms within a given ecosystem, biome or for the entire Earth..

Biodiversity refers to variety and variability among all groups of living organisms and the ecosystem complexes in which they occur.

In the convention act of Biological Diversity (1992) biodiversity has been 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 a part.

Biodiversity is often a measure of the health of biological systems to indicate the degree to which the aggregate of historical species are viable versus extinct.

LEVELS OF BIODIVERSITY

Biodiversity ranges from the genetic level with in a species to the biota in a specific region and may extend up to the great diversity found in different biomes.

- **Genetic Diversity** - diversity of genes within a species. There is a genetic variability among the populations and the individuals of the same species.
- **Species Diversity** - diversity among species in an ecosystem. “Biodiversity hotspots" are excellent examples of species diversity.
- **Ecosystem Diversity** - diversity at a higher level of organization, the ecosystem.

GENETIC DIVERSITY

1. **Basic sources of Biodiversity**
2. **Genes are basic units of hereditary information transmitted from one generation to other**
3. **When genes within the same species show different versions due to new combinations, it is called "Genetic Variability".**

SPECIES DIVERSITY

- Variability found within the population of a species or between different species of a community.

- Represents broadly the species richness and their abundance in a community.

Indices of measuring species diversity

1. **Shannon - Wiener Index** -

- It takes into account the number of species and the evenness of the species.
- The index is increased either by having more unique species, or by having a greater species evenness.

2. **Simpson Index –**

- It takes into account the number of species present, as well as the relative abundance of each species.
- The Simpson index represents the probability that two randomly selected individuals in the habitat belong to the same species.

ECOSYSTEM DIVERSITY

- Ecological complexity showing variations in ecological niches, trophic structure, food-webs, nutrient cycling etc.
- Variations exist with respect to physical parameters like moisture, temperature, altitude, precipitation etc.

BIOGEOGRAPHICAL CLASSIFICATION OF INDIA

→ The Bio-geographic Zone
→ The Biotic Province
→ The Land Region
→ The Biome
→ Climate and Topography
→ Variety of Flora and Fauna
→ Rich heritage of Biological Diversity

India stand at 10th position among plant rich nations of the world.

India's Major Biographic Habitats

S. No.	Biogeographic Zone	Biotic Province	Total Area (Sq. Km)
1	Trans Himalayan	Upper Regions	186200
2	Himalayan	North-West Himalayan West Himalayas Central Himalayas East Himalayas	6900 720000 123000 83000
3	Desert	Kutch Thar Ladakh	45000 180000 NA
4	Semi Arid	Central India Gujarat – Rajwara	107600 400400
5	Western Ghats	Malabar Coasts Western Ghat Mountains	59700 99300
6	Deccan Peninsula	Deccan plateau south Central plateau Eastern plateau Chhota nagpur Central highlands	378000 341000 198000 217000 287000
7	Gangetic Plain	Upper gangetic plains Lower gangetic plain	206400 153000
8	North-East India	Brahmaputra valley North-eastern hills	65200 106200
9	Islands	Andaman islands Nicobar islands Lakshadweep islands	6397 1930 180
10	Coasts	West coast East coast	6500 6500

- A bio-geographic Zone is a large distinctive unit of similar ecology, biome representation, community and species.

- The biotic province is secondary unit within bio-geographic zone, giving weight to particular community separated by dispersal barriers or gradual change in environmental factors for example North West and Western Himalayas either side of the Sutlej River.

- A land region is a tertiary se of units within a province, indicating different land forms, e.g. Aravalli Mountain and Malwa Plateau in Gujrat- Rajwara Province.

- A biome is an ecological unit, not a bio-geographical unit. It can be defined as various similar ecosystems throughout the world grouped together.

Fish Diversity in India

- **2,358** fish sp (Source : INDFISHDATABASE, 2011, NBFGR)
- Freshwater – 877 sp.
- Brackish water – 113 sp.
- Marine – 1,368 sp.
- Home for 11.72 % of global fish biodiversity.
- Max. no of endemic fresh water finfish occur in India – 27.8 % of native fish fauna.

Biosphere Reserve

- It is a unique and representative ecosystem of terrestrial and coastal areas which are internationally recognized, within the framework of UNESCO's Man and Biosphere (MAB) programme.
- Initiated by UNESCO in 1973-74.
- According to World Network of Biosphere Reserves (WNBR) , 631 biosphere reserves in 119 countries.

Functions of Biosphere Reserves

Conservation

- To ensure the conservation of landscapes, ecosystems, species and genetic variations.
- To encourage the traditional resource use systems.
- To understand the patterns and processes of functioning of ecosystems.
- To monitor the natural and human-caused changes on spatial and temporal scales.

Development

- To promote, at the local level, economic development which is culturally, socially and ecologically sustainable.
- To develop the strategies leading to improvement and management of natural resources.

Logistics support

- To provide support for research, monitoring, education and information exchange related to local, national and global issues of conservation and development
- Sharing of knowledge generated by research through site specific training and education.
- Development of community spirit in the management of natural resources.

Biosphere Reserves
1. Nanda Devi
2. Nokrek
3. Manas
4. Dibru Saikhowa
5. Dehang Debang
6. Sunderbans
7. Gulf of Mannar
8. Nilgiri
9. Great Nicobar
10. Similipal
11. Khanghendzongo
12. Pachmarhi
13. Agasthyamalai
Newly Added
14. Achanakmar- Amarkantak
15. Kachchh
16. Cold Desert
17. Seshachalam
18. Panna

20 9 2006

22 9 2006

BIOSPHERE AREA ZONATION

Biosphere Reserve Network in India - UNESCO- MAB

Name	States	Year
Nilgiri Biosphere Reserve	TamilNadu, Kerala, Karnataka	2000
Gulf of Mannar Biosphere Reserve	Tamil Nadu	2001
Sundarbans Biosphere Reserve	West Bengal	2001
Nanda Devi Biosphere Reserve	Uttarakhand	2004
Nokrek Biosphere Reserve	Meghalaya	2009
Pachmarhi Biosphere Reserve	Madhya Pradesh	2009
Simlipal Biosphere Reserve	Odisha	2008
Achanakmar-Amarkantak Biosphere Reserve	Chhattisgarh, Madhya Pradesh	2012
Nicobar Islands	Andaman and Nicobar Islands	2013

GOMBR-The Biological Paradise

- First Marine Biosphere Reserve not only in India but also in South and South East Asia (1989).
- It received the recognition of UNESCO –MAB Programme in November, 2001.
- 21 islands, 10500 sq km.
- Core area- GOM National Park-Coral
- 3,600 species of plants and animals.
- Unique endemic species –Balanoglossus.
- Sea turtles, Dugong, Seaweeds, Ornamental fishes, Chank beds.

07' 11.82" E
79°32' 45.49" E

9°19' 27.24" N
8°41' 28.89" N
07' 07.38" E
79°32' 26.83" E

- Three marine ecosystems,
- **The Corals,**
- **The Sea grass beds and**
- **The Mangroves Ecosystem.**

Mangrove Ecosystem

- Mangal – 21 Islands.

- 17 sp of mangroves - act as important fish Nurseries.
- Vegetation consists of species belonging to *Rhizophora, Avicennia, Bruguiera, Ceriops, Lumnitzera* etc.
- *Pemphis acidula* – endemic.

Coral Reef Ecosystem

- Fringing reef, patchy reef - comparatively small, isolated outcrops of coral surrounded by sand and/or seagrass (Pillai ,1971).
- There are 96 species of coral reefs belonging to 36 genera found in this area.
- The majority of the coral genera include ***Acropora, Montipora, Pocillopora, Turbinaria, Echinopora, Favia, Favites, Goniastrea, Leptastrea, Leptoria, Platygyra, Goniopora, Porites, Merulina, Symphyllia, etc...***

Sea grass Ecosystem & Algal Resource

- 11 sp. of sea-grasses of India - with *Enhalus acoroides* being endemic
- Seagrass community include *Halophila ovalis, Halophila ovata, Halophila beccari, Halophila stipulacea, Thalassia lemprichii, Halodule uninervis* etc.
- Ideal feeding ground for the endangered animals.
- **Seaweeds**
- The total productive area estimated is around 10,000ha, with a standing of more than 18,000 tons.
- The common seaweeds found here are *Ulva, Sargassum, Gelidiella, Gracilaria, Caulerpa, Halimeda, Padina, Hypnea, Turbinaria, Chondrococcus* etc.

SUNDARBAN BIOSPHERE RESERVE

- Constituted in 1989.
- It received the recognition of UNESCO – MAB Programme in November, 2001.
- Sundarban is the only mangrove forest in the world which is the home of Tiger.
- The total area of Sundarban region in India is 9600 sq km.
- Sundarban National Park - core area, habitat for the threatened Royal Bengal tiger .
- Largest mangal forest in the world with 81 mangrove sp.

Biodiversity SBR

- 172 sp. of fishes.
- Threatened animals including Estuarine Crocodile (*Crocodilus porosus*), Fishing Cat (*Felis viverrina*), Common otter (*Lutra lutra*), Gangetic Dolphin (*Platinista gangetica*), Snubfin dolphin (*Orcella brevirostris*) etc…

GANGETIC DOLPHIN

GREAT NICOBAR BIOSPHERE RESERVE

- Southern most island - surrounded by the Bay of Bengal and Andaman Sea.
- Created in 1989.
- UNESCO - MAB – 2013
- Occupies about 85 % of the island.
- Core area 885 km^2.
- Distinguished by its tropical wet evergreen forest which inhabits over 1,800 species including 200 species of meiofauna.

Biodiversity in GNBR

- A total of 14 species of mammals, 71 species of birds, 26 species of reptiles, 10 species of amphibians and 113 species of fish have been reported.
- Crab-eating Macaque, Shark varieties, Dugong, Nicobar Megapode, Serpent Eagle, salt water crocodile, Giant clam, Endangered Chank varieties, marine turtles and Reticulated Python are endemic and/or endangered.

GULF OF KUTCH BIOSPHERE RESERVE

- The fifteenth Biosphere Reserve designated by Government of India (2008) represents unique combination of **saline deserts and seasonal wetlands**.
- The Reserve consists of vast areas of Great Rann of Kachchh and Little Rann of Kachh – 42 islands.
- **Indian Wild Ass** – Endangered Animal only found in this reserve.
- The major fauna are Coral reef, Coral Lichen, Coral sponge, Green Sponge, Puffer Fish, Turtles, Dolphins, etc..

Protected Area

- **IUCN** Defines..
- ''A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values''.
- **MPAs**… protected areas whose boundaries include some area of ocean.

How Biosphere Reserves are differ from protected areas?

- Widens the scope of conventional approach of protection.
- Conservation of overall biodiversity.
- Developmental activities.
- Increase in broad-basing of stakeholders, especially local people's participation and Training.
- Research and Monitoring to understand the structure and functioning of ecological system.
- Existing legally protected areas may become part of the BR without any change in their legal status.
- BR will enhance their national value.

National park - IUCN - characteristics

- **Large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities**
- Minimum size of **1,000 hectares** within zones in which protection of nature takes place.
- 166 National Parks in India.

MARINE SANCTUARY

- A marine sanctuary is a general type of marine protected area (MPA).
- An MPA is a section of the ocean where a government has placed limits on human activity.
- Designated area -All species are protected.

Provides

- A secure habitat for endangered species.
- They serve as outdoor Lab.
- Sanctuaries also protect economically important fisheries.

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Marine Sanctuaries in India

Marine Sanctuary	Estd	State	Area
Gahirmatha Marine Sanctuary	1997	Odisha	1,435 km2
Malvan Marine Sanctuary	1987	Maharashtra	29.12 km2
Gulf of Kachchh	1980	Gujarat	295.03 km2

Marine Protected Areas in India

The Indian coastal lines

- Indian coastal line measures about 7500 km and 2000 km wide Exclusive Economic Zone.
- The Indian coastline supports almost 30% of its human population.
- India is the 7th largest marine fishing nation in the world.
- The Bay of Bengal and the Arabian Sea are rich fishing grounds.

VALUE OF BIODIVERSITY

In terms of

- ≈ Commercial Utility
- ≈ Ecological Services
- ≈ Social and Aesthetic Value

The multiple uses of Biodiversity or Biodiversity value has been classified by McNeely et al in 1990 as follows:

- » Consumptive Use Value
- » Productive Use Value
- » Social Value
- » Aesthetic Value
- » Option Value
- » Ecosystem Service Value

Consumptive Use Value

Food

- 80,000 edible plant species
- 90% of food crops domesticated from wild tropical plants

Drugs and Medicines

- 75% of world's population depends upon plants or plant extracts for medicines.

Penicillin, used as an antibiotic is derived from a fungus called *penicillium.*

Tetracyclin *from a bacterium.*

Quinine *is obtained from bark cinchona tree.*

Vimblastin *and* ***Vincristine****, two anti cancer drugs have been obtained from periwinkle(catharanthus) plant.*

Fuel

Forests used for Fuel Wood.

Fossil fuels Coal, Petroleum and natural gas are also products of fossilized biodiversity.

Productive Use Value

Commercially usable values where the product is marketed and sold

- » Wild Gene Resources – traded for use by scientists for introducing desirable traits in the crops and domesticated animals
- » Others – Tusks of Elephants, Musk from Musk deers, Silk from Silk Worms, Wool from Sheep etc.

Industries dependant upon the productive use value of Biodiversity.

- → **Paper and Pulp Industry**
- → **Plywood Industry**
- → **Railway Sleeper Industry**
- → **Textile Industry**
- → **Ivory Works**
- → **Leather Industry**
- → **Pearl Industry**

Social Value

→Values associated with social life, customs, religion and psycho-spiritual aspects of the people.

→Plants like Tulsi, Peepal, Mango, Lotus etc are considered holy and their leaves,fruits and flowers are used in worship.

Ethical Value

→ Ethical issues like

" *all life must be preserved* ".

→ Based on the concept of

" *Live and Let Live*".

Aesthetic Value

→Eco-tourism

→Eco-tourism is estimated to generate about 12 million dollars of revenue annually.

Option Values

→Values include the potential of biodiversity that are presently unknown and need to be explored.

→Option value is the value of knowing that there are biological resources on this biosphere that may one day prove to be an effective option for something important in the future.

Ecosystem Service Value

→Non-consumptive use value related to self maintenance of the ecosystem and various important ecosystem.

→Refers to services provided by ecosystems like:

- » **Prevention of Soil Erosion.**
- » **Prevention of floods.**
- » **Maintenance of soil fertility.**
- » **Cycling of nutrients.**
- » **Pollutant absorption and reduction of the threat of Global Warming.**

Valuing ECOSYSTEM *Services*

CO^2

Different categories of biodiversity value clearly indicate that ecosystem, species and genetic biodiversity all have enormous potential and a decline in biodiversity will lead to huge economic, ecological and socio-cultural losses.

Biodiversity Value of some selected organisms in monetary terms.

A male Lion living up to the age of 7 years can generate up to $ 515000 due to its aesthetic value as paid by tourists.

In a lifetime a Kenyan Elephant can earn worth $ 1 million as tourist revenue.

The mountain Gorillas in Rwanda are fetching up to $ 4 million annually through eco-tourism.

Whale watching on Hervey Bay on Queensland’s coast earns $ 12 million annually.

Tourism to great barrier reef in Australia earns $ 2 billion each year.

A tree provides $ 19,62,150 worth of ecological services as oxygen, clean air, water recycling, fertile soil, erosion control, wild life habitat, toxic gas moderation etc…

Whereas its worth is only $ 590 if sold in market as timber.

Global Biodiversity

→ Roughly 1.8 million species are known till date.

→ Most of the world's bio-rich nations are in the developing nations.

→ The majority of the countries capable of exploiting bio-diversity are developed nations.

International agreements – World Heritage Convention attempt to protect and support such areas

India is a signatory to the convention and has included areas covering Manas on the border between Bhutan and India, Kaziranga in Assam, Nandadevi in the Himalayas and the Sunderbans in the Ganges delta in west Bengal.

Indian Biodiversity

Every country is characterized by its own biodiversity depending upon its climate.

India has rich biological diversity of flora and fauna.

6% of the global species are found in India.

The total number of species found in India is 150,000.

Out of a total of 25 biodiversity hotspots in the world, India posses 2, one in the Eastern Himalayas and one in the western Ghats.

Introduction

•India is one of the 12th mega bio-diversity countries of the world.

•With approximately 47,000 plant species, India ranks 4th in Asia and 10th in the world (in terms of plant diversity).

•India has about 15,000 species of flowering plants and contributes 6 percent to world's total flowering plants.

•India has about 90,000 species of animals.

Wildlife Act

In 1972, a comprehensive Wildlife Act was enacted, which instructed the main legal framework for conservation and protection of the wildlife in India.

Further, in 1991, the Act of 1972 has been comprehensively amended.
In the amendment, punishments have been made more stringent and provisions have also been made for the protection of specified plant species and conservation of endangered species of wild animals.
Besides, some other special schemes such as **Project Tiger** (1973) and **Project Elephant** (1992) have been launched to conserve these species and their habitats.

Biosphere Reserve

A **Biosphere Reserve** is a unique and representative ecosystem of terrestrial and coastal areas, which are internationally recognized within the framework of UNESCO's Man and Biosphere (MAB) Program.
There are 18 Biosphere Reserves in India, out of which 9 Biosphere Reserves have been recognized by the UNESCO on World Network of Biosphere Reserves.
Established in September 1986, the **Nilgiri Biosphere Reserve** is the first biosphere reserves of India.
There are about 2,000 species of birds in India that account to 13 percent of the world's total.
There are about 2,546 species of fish in India that account to 12 percent of the world's total.
India has about 5 to 8 percent of the world's amphibians, reptiles, and mammals.

India is the only country in the whole world where both tigers and lions are found.

Gir forest in Gujarat is the natural habitat of lion in India. Tigers are found in the Sundarbans of West Bengal, and the forests of Madhya Pradesh and Himalayan region.

About 1,300 plant species have been listed as endangered species in India; however, 20 species are already extinct.

The threat on wildlife has increased because of excessive commercial activities, pollution, expansion of human settlement, and of course illegal trade of both animals and plants.

•To protect wildlife, the Government of India has established **18 biosphere reserves**

Regional Biodiversity

Four types – based upon their distribution.

- → Point Richness – refers to the number of species that can be found at a single point in a given space.
- → Alpha Richness – refers to the number of species found in a small homogeneous area.
- → Beta Richness – refers to the rate of change in species composition across different habitats.
- → Gamma Richness – refers to the rate of change across large landscape.

INDIA AS MEGA DIVERSITY NATION

India is one of the 12 mega diversity countries in the world.

- → **Australia**
- → **Brazil**
- → **China**
- → **Columbia**
- → **Ecuador**
- → **The United States**
- → **India**
- → **Indonesia**
- → **Madagascar**
- → **Mexico**
- → **Peru**
- → **The democratic Republic of Congo**

→The ministry of environment and forests, Govt. of India records 47000 species of plants and 81000 species of animals i.e., 7% and 6.5% of the global flora and fauna.

Distribution of species in some major groups of flora and fauna in India

Group wise Species Distribution			
Plants	Number	Animals	Number
Bacteria	850	Lower Groups	9979
Fungi	23000	Mollusca	5042
Algae	2500	Arthopoda	57525
Bryophytes	2564	Pisces	2546
		Amphibia	428
Pteridophytes	1022	Reptiles	1228
Gymnosperms	64	Birds	204
Angiosperms	15000		
		Mammals	372

Endemism – Species which are restricted to a particular area are known as endemic.

About 62% of amphibians and 50% lizards are endemic to India.

Western Ghats are the site of maximum endemism.

→ India is Centre of origin –

A large number of species are known to have originated in India.

→ Marine Diversity – 7500 km long Indian coastline is rich in mangroves, coral reefs etc…

→ More than 340 species of corals of the world are found here.

→ Several species of sea grasses are found in India.

HOT SPOTS OF BIODIVERSITY

→Areas which exhibit high species richness as well as high species endemism are termed as hot spots of biodiversity.

→The term was introduced by Myers(1988).

→There are 25 hot spots at global level.

→According to Myers et al an area is designated as a hotspot when it contains atleast 0.5% of the plant species as endemics.

→The hotspots cover less than 2% of the world’s land but are found to have 50% of the terrestrial biodiversity.

→The Indian hotspots are not only rich in floral wealth and endemic species of plants but also reptiles, amphibians, swallow tailed butterflies and some mammals.

Global Hot Spots of Biodiversity

→ Tropical Andes
→ Mesoamerican Forests
→ Caribbean
→ Brazil’s Atlantic Forests
→ Darien of Panama Western Ecuador
→ Central Chile
→ California Floristic Province
→ Madagascar

→Eastern Arc and Coastal Forest of Tanzania.

→ Western Africa Forests.

→ Cape Floristic Province

→ Succulent Karoo

→ Mediterranean Basin

→ Caucasus

→ Sundal Land

→ Wallacea

→ Philippines.

→ Indo-Burma Eastern Himalayas

→ South Central China

→ Western Ghats of India

→ South Western Australia

→ New Caledonia

→ New Zealand

→ Polynesia/Micronesia

Habitat Destruction

Threatens Biodiversity

We destroy habitat to make room for **crops, livestock,** and the growing **human population.**

Habitat destruction is the **main cause** of biodiversity loss.

Deforestation has destroyed **99%** of the original temperate forests.

© Malene Thyssen

© Beyond My Ken

Agriculture has replaced **nearly all** grasslands in North America.

Tony Iland, US FWS

© Khairuzzaman

The world's **48,000** dams disrupt both aquatic and land ecosystems.

© Sam Beebe, Ecotrust

U.S. Army Corps of Engineers

© Leafcutter Media / Matthew Taylor

Bauxite mine
Soil and tree replacement
Native forest
Eroded coral
Artificial reef
Coral reef
Logged mangrove
Re-planted trees
Mangrove swamp
Arable agriculture
Wildflower sowing
Hay meadow

Threats to Biodiversity

→Extinction or elimination of a species is a natural process of evolution.

→However, the rate of loss of species has been a slow process.

→The process of extinction has become particularly fast in the recent years of human civilization.

→One of the estimates by E O. Wilson puts the figure of extinction at 10,000 species per year.

Major causes for loss of Biodiversity

→Loss of Habitat – Destruction and loss of natural habitat is the single largest cause of biodiversity loss.

→Billions of hectares of forests and grasslands have cleared over the past 10,000 years.

→Sometimes the loss of habitat is in installments so that the habitat is divided in to small and scattered patches – Habitat fragmentation.

→Poaching – Illegal trade of wildlife products.

→Man-Wild Life Conflicts

In Sambhalpur, Orissa 195 humans were killed in the last five years by Elephants. In retaliation the villagers killed 98 elephants and badly injured 30 others.

The Man-Elephant Conflicts in the regions of Kote-Chamrajanagar has arisen because of massive damage done by the elephants to the cotton and sugar cane crops.

In 2004, a man eating tiger was reported to kill 16 Nepalese people and one 4 year child inside the royal Chitwan National Park.

June 2004, two men were killed by leopard in Powai, Mumbai.

Causes for Man-Animal Conflict

- Dwindling habitat of tigers, elephants, rhinos and bears due to shrinking forests.
- Usually the ill and weak animals have tendency to attack humans.
- Insufficient food supply.
- Encroachment of wild-life corridors.
- The cash compensation paid by the government in lieu of the damage caused to the farmers is not enough. The agonized farmer therefore gets revengeful and kills wild animals.

Remedial Measures to Curb the Conflicts.

- Tiger conservation project has made provisions for making available vehicles, tranquillizer guns, binoculars and radio sets etc… to tactfully deal with any imminent danger.
- Adequate crop compensation and cattle compensation scheme must be started, along with substantial cash compensation for loss of human life.

- Solar powered fencing should be provided along with electric current proof trenches to prevent animals from straying into fields.

- Cropping pattern should be changed near the forest borders and adequate fodder, fruit and water should be made available to the elephants with in the forest zone.

- Wild-life corridors should be provided for mass migration of animals during unfavorable periods.

- A species is said to be ***extinct*** when it is not seen in the wild for 50 years at a stretch e.g., Dodo, Passenger Pigeon…

- A species is said to be ***endangered*** when its number has been reduced to a critical level or whose habitats, have been drastically reduced an dif such a species is not protected and conserved, it is in immediate danger of extinction.

- A species is said to be in vulnerable category if its population is facing a continuous decline due to over exploitation or habitat destruction. Such a species is till abundant, but under a serious threat of becoming endangered if casual factors are not checked.
- Species which are not endangered or vulnerable at present, but are at a risk are categorized as rare species. These species are usually endemic.

Endangered Species of India

- Red Data Book published by IUCN includes the list of endangered species of plants and animals.
- In India, nearly 450 plant species have been identified in the categories of endangered.
- Existence of 150 mammals and 150 species of birds is estimated to be threatened while an unknown number of species of insects are endangered.

A few Species of endangered reptiles, birds, mammals and plants:

a. Reptiles: Gharial, Green Sea Turtle, Tortoise, Python.
b. Birds:Great Indian Bustard, Pelican Peacock, Great Indian Hornbill, Siberian White Crane.
c. Carnivores: Indian Wolf, Red Fox, Sloth Bear, Red Panda, Tiger, Leopard Striped Hyena Indian Lion, Golden Cat, Dugong.

d. Primates: Hoolock Gibbon, Lion tailed Macaque, Nilgiri Langur, Capped Monkey, Golden Monkey.

e. Plants: Number of species of Orchids, Rhododendrons, Medicinal plants like *Rauvolfia Serpentina,* the sandal wood tree *Santalum, Cycus Bedoni* etc…

Zoological Survey of India reported that Cheetah Pink headed Duck and mountain Quail have already become extinct from India.

Endemic Species of India

- India has two Biodiversity Hot Spots and thus possesses a large number of endemic species.
- Indian Subcontinent has about 62% endemic flora, restricted mainly to Himalayas, Khasi Hills and Western Ghats.
- Indian endemic flora includes Orchids and species like *Sapria Himalayana, Uvaria Lirida, Nepenthes Khasiana, Pedicularis perroter* etc…

- The Western Ghats are particularly rich in *amphibians* and *reptiles.*
- About 62% amphibians and 50% lizards are endemic to western ghats.
- Different species of *Monitor Lizards, Reticulated Python and Indian Salamandar and Viviparous Toad* are some important species of our country.

ASIATIC LION

BENGAL TIGER

SNOW LEOPARD

RHINO

RED STAG

RED PANDA

NILGIRI TAHR

LION TAILED MACAQUE

BLACKBUCK

BISON

సెప్టెంబరు మాసం...

సీతాకోకచిలుకల కోసం

[illegible]

పోల్కా చుక్కల్లా!

[illegible]

మాయ చేస్తాయి!

[illegible]

అక్షరాలా 88

[illegible]

ఇలా ఎలా ప్రయోగిస్తున్నారు?

[illegible]

రంగెక్కడ?

[illegible]

పెద్దది దొన్నది!

[illegible]

Conservation of Biodiversity

The enormous value of Biodiversity due to their generic, commercial, medical, aesthetic, ecological and optional importance emphasizes the need to conserve Biodiversity.

There are two approaches to Biodiversity Conservation:

→ *In Situ* Conservation – This is achieved by protection of wild life flora and fauna in nature itself. E.g., Biosphere Reserves, National Parks, Sanctuaries, Reserve Forests etc…

→ *Ex Situ* Conservation – This is done by establishment of gene banks, seed banks, zoos, botanical gardens, culture collections etc…

In Situ Conservation

- At present there are 7 major Biosphere Reserves, 80 National Parks, 420 Wild-Life Sanctuaries and 120 botanical gardens in India covering 4% of geographic area.
- The ***Biosphere Reserves*** conserve some representative ecosystems as a whole for long term *in situ* conservation. In India we have Nanda Devi, Nokrek Manas, Sunderbans, Gulf of Mannar, Nilgiri, Great NIcobars and Similipal Biosphere reserves.

- A **National Park** is an area dedicated for the conservation of wild-life along with its environment. It is also meant for enjoyment through tourism but without impairing the environment.
- Each National Park usually aims at conservation specifically of some particular species of wild-life along with others.

- Wild-Life Sanctuaries are protected areas where killing, hunting, shooting or capturing of wild-life is prohibited except under the control of highest authority.
- Private Ownership rights are permissible and forestry operations are also permitted to an extent that do not affect the wild-life adversely.

Ex Situ Conservation

- This type of conservation is mainly done for conservation of crop varieties, the wild relatives of crops and all the local varieties with the main objective of conserving the total genetic variability of the crop species for future crop improvement programs.
- In India there are 4 important gene bank/seed bank facilities:

  → NBPGR

  → NBAGR

  → NFPTCR

  → NBFGR

Environmental Issues

IN Various Countries

WHAT

ARE ENVIRONMENTAL ISSUES ?

- **Environmental issues** are any such issues created due to **human activities** and cause **harm to the environment.**

Air Pollution

Climate Change

Issues In Japan

Japan's environmental policy has reflected a slight balance between **economic development and environmental protection.** As the world's leading importer of both exhaustible and renewable natural resources and one of the largest consumers of fossil fuels, the Japanese government takes **international responsibility to conserve and protect the environment.**

Major issue:-

Nuclear Power

- Japan maintains **one third** of its **electric production from nuclear power plants**.
- However the Fukushima Nuclear power Plant Disaster on 11th march, 2011 proved the failures of nuclear power. **3 out 0f the 5 reactors** in the plant started leaking following an earthquake in the nearby region. Over 1,40,000 people were evacuated from the nearby area.
- The disaster was rated as **7 out of 7 on INES scale.**

Waste Management

Japan’s approach on waste management relies heavily on four major factors: 1) technological advancements in incineration, 2) technological advancements in plastics recycling, 3) Comprehensive production-side recycle stream package labeling, and 4) wide consumer-side/household participation in recycling and waste material separation

Issues In China

- **China** has many **environmental issues**, severely affecting its biophysical environment as well as human health.

- **Rapid industrialization** as well as lax environmental oversight have contributed to the problems.

- The Chinese government has acknowledged the problems and made various responses, resulting in some improvements, but the **responses have been criticized as inadequate.**

Major Issues:-

Deforestation

Desertification

Deforestation

- **China's forest cover is only 20%**.

- In 2011, Conservation International listed the forests of south-west Sichuan as **one of the world's ten most threatened forest regions.**

- Illegal logging and slash and burn agriculture **consume up to 5,000 square kilometers of virgin forest every year.**

- The use of disposable chopsticks uses up **1.3 million cubic meters of timber a year.**

Desertification

- Desertification is expanding at a rate of more than **900 square miles a year, fastest in the world.**
- Approximately **30% of China**'s surface area **is desert**.
- The Gobi desert in china increased by **20,000 square miles** between 1994 and 1999.

Cancer Villages in China

- The existence of “cancer villages” proves China’s disregard for environmental protection.
- The ***CANCER VILLAGES ARE LARGE AREAS THAT ARE SO POLLUTED THAT EVEN LIVING IN THEM CAN CAUSE SEVERAL TYPES OF CANCERS.***
- In Shangba (a cancer village), a city in southern Guangdong province, the river that flows through town changes from white to a shade of orange because of varying types of industrial effluent. Many of the river's contaminants, like cadmium and zinc, are known to cause cancer.

Issues In Gulf countries

- Gulf states are terms that refer to the six Arab states i.e. Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates.
- In the last year tourists have swum amid raw sewage in these states
- The purifying of seawater to feed taps and fountains is raising salinity levels.
- The simple basics of waste treatment and providing fresh water, require so much electricity that the region is turning to a nuclear future.

Air Pollution

We live in a country where

kuru-kshetram

Pollutant Emissions
Lightning
Natural
Volcanos
Wildfires
Forests
Cities
Area
Livestock
Fertilizer
Airplanes
Mobile
Cars, Trucks, Buses, Motorcycles
Stationary
Industry, Power Plants, Sewage Treatment

Wind
Aeroplanes
Primary pollutants
Carbon monoxide
CO
Nitric oxide
NO
Sulphur dioxide
SO_2
Nitrogen dioxide
NO_2
Ammonia
NH_3
Particulates
(PM)
Volatile organic compounds
VOCs
Secondary pollutants
Sulphur trioxide
SO_3
Nitric acid
HNO_3
Sulphuric acid
H_2SO_4
Hydrogen peroxide
H_2O_2
Ozone
O_3
Ammonium
NH_4^+
Particulates
(PM)
Volcanoes
Wildfires
Factories
Towns and homes
Vehicle exhausts
Agriculture
Shipping

Sources
Transport / Transformation
Removal
Photochemistry
Prevailing Winds
Chemical Transformations
Lightning
Cloud Processes
Dispersion
Vertical Mixing
Agriculture
Fire
Industry
Transportation
Wet Deposition
Dry Deposition
Visibility
Sewage Plants
Runoff
Forest Productivity
Estuaries
Effects
Drinking Water
Cultural Resources
Soils
Soils
Aquatic Ecosystem
Ground Water
Agricultural Products
Human Health

Acid rain caused by acid-forming gases
Hole in upper ozone layer due to CFCs
Greenhouse effect caused by greenhouse gases
Ground level ozone caused by sunlight and polluting gases

Water vapor
Halocarbons
CFCs
CHEMICAL TRANSFORMATION
O_3 destruction
STRATOSPHERE
Aircraft emissions
(NO_x Black Carbon, Sulfate)
TROPOSPHERE
LONG-RANGE TRANSPORT OF AEROSOLS AND GASES
CHEMICAL TRANSFORMATION
O_3 production
CHEMICAL TRANSFORMATION
O_3 production
Natural and anthropogenic emissions from the Earth (CH_4, CO, CO_2, VOCs, Sulfate, Black Carbon, Dust, N_2O, CFCs, NO_x, O_3)
CHEMICAL TRANSFORMATION AND
DEPOSITION OF POLLUTANTS
Sulfur emissions from oceans
Evaporation and Convection
FREE TROPOSPHERE
BOUNDARY LAYER
Cities
Industry
Forests and other Ecosystems
Transportation
Transportation
Agriculture
Cattle
Oceans
Desert dust
Biomass Burning

The Formation of Acid Rain

Changing Rain and Snow Patterns
Changes in Animal Migration and Life Cycles
Less Snow and Ice
Higher Temperatures and More Heat Waves
More Droughts and Wildfires
Thawing Permafrost
Stronger Storms
Damaged Corals
Rising Sea Level
Warmer Oceans
Changes in Plant Life Cycles

Climate change --
Floods everywhere In the world ; May be followed by drought

mumbai

Water from the Addicks Reservoir in Houston flows into city neighbourhoods on August 29.

A capsized sailboat boat sits in the water off Key West following the passage of Hurricane Irma.

The increase of **air pollution** over the years has major **effects** on the human skin. The skin is exposed to ultraviolet radiation (UVR) and environmental **air pollutants** such as polycyclic aromatic hydrocarbons (**PAHs**), volatile organic compounds (VOCs), oxides, **particulate matter** (**PM**), ozone (O_3), and cigarette smoke.

Cyclones

Electrostatic Precipitator

Baghouse

Particulate Scrubber

Water Pollution

A diagrammatic representation of a flow chart of conventional sewage treatment plant.

Preliminary
Primary
Secondary
Advanced
Screening
Comminution
Grit Removal
Sedimentation
Effluent
Disinfection
Low Rate Processes
stabilization ponds
aerated lagoons
High Rate Processes
activated sludge
trickling filters
rotating biocontactors
Secondary Sedimentation
Effluent
Disinfection
Effluent
Disinfection
Nitrogen Removal
nitrification - denitrification
selective ion exchange
break point chlorination
gas stripping
overland flow
Phosphorus Removal
chemical precipitation
Suspended Solids Removal
chemical coagulation
filtration
Organics and Metals Removal
carbon adsorption
Dissolved Solids Removal
reverse osmosis
electrodialysis
distillation
Sludge Processing
Biological
thickening
digestion
dewatering
filter
centrifuge
drying beds
Non biological
thickening
conditioning
dewatering
filter
centrifuge
incineration
Disposal

Marine Pollution

What is Marine Pollution ??

Marine pollution includes a range of threats including from land-based sources, oil spills, untreated sewage, heavy siltation, eutrophication (nutrient enrichment), invasive species, persistent organic pollutants (POP's), heavy metals from mine tailings and other sources, acidification, radioactive substances, marine litter, overfishing and destruction of coastal and marine habitats.

Some Examples of Marine Pollution

- *New River in California:*

The water at this point is three colors: *dark green, white (foam)*, and *milky brown/green*. The septic stench is pungent. Fecal coliforms and fecal streptococci have been consistently detected in the New River.

- Acid mine drainage causes severe environmental problems in Rio Tinto river, Spain.

- According to the United States Environmental Protection Agency, mining has contaminated portions of the headwaters of over 40% of watersheds in the western continental US. Much of this pollution finishes up in the sea.

Septic river.

Direct Discharge

- Pollutants enter rivers and the sea directly from urban sewerage and industrial waste discharges, sometimes in the form of hazardous and toxic wastes.

- Inland mining for copper, gold, etc., is another source of marine pollution. Most of the pollution is simply soil, which ends up in rivers flowing to the sea.

- Some minerals discharged in the course of the mining can cause problems, such as copper, a common industrial pollutant, which can interfere with the life history and development of coral polyps.
- Mining has a poor environmental track record.

Deep Sea Mining

- Ocean mining sites are usually around large areas of polymetallic nodules or active and extinct hydrothermal vents at about 1,400 – 3,700 meters below the ocean's surface.

- The deposits are mined using either hydraulic pumps or bucket systems that take ore to the surface to be processed.

- Removing parts of the sea floor disturbs the habitat of benthic organisms, possibly, depending on the type of mining and location, causing permanent disturbances.

- Near bottom plumes occur when the tailings are pumped back down to the mining site.

- Surface plumes cause a more serious problem. Depending on the size of the particles and water currents the plumes could spread over vast areas.

- Aside from direct impact of mining the area, leakage, spills and corrosion would alter the mining area's chemical makeup.

Human Impacts On Marine Environments

1. Eutrophication

- *An increase in chemical nutrients, typically compounds containing nitrogen or phosphorus, in an ecosystem. It can result in an increase in the ecosystem's primary productivity(excessive plant growth and decay), and further effects including lack of oxygen.*
- The biggest culprit are rivers that empty into the ocean, and with it the many chemicals used as fertilizers in agriculture as well as waste from livestock and humans. An excess of oxygen depleting chemicals in the water can lead to hypoxia and the creation of a dead zone.

PLASTIC POLLUTION IN OCEANS—THE CULPRITS

Coastal countries generated close to 275 million tonnes of plastic waste in 2010, and 4.8 to 12.7 million tonnes of that plastic made its way to the oceans.

Considered 192 countries. Countries not included in the study are shaded white.

Global map with each country shaded according to the estimated mass of mismanaged plastic waste (millions of metric tonnes (Mt) generated in 2010 by populations living within 50 km of the coast.

Marine debris is everyone's problem

Worldwide Sources of Marine Debris

64% Shoreline & Recreational Activities
25% Smoking-related Activities
8% Ocean/Waterway Activities
2% Dumping Activities
1% Medical/Personal Hygiene

Top 10 Marine Debris Items

Cigarettes & cigarette filters, plastic bags, food wrappers and containers, caps and lids, plastic beverage bottles, eating utensils, glass beverage bottles, beverage cans, straws and stirrers, paper bags

How long do items remain in the environment?

- Paper Towel 2-4 WEEKS
- Newspaper 6 WEEKS
- Cotton Rope 1-5 MONTHS
- Cotton Shirt 1-5 MONTHS
- Cardboard Box 2 MONTHS
- Waxed Milk Carton 3 MONTHS
- Apple Core 2 MONTHS
- Cigarette Butt 1.5 to 10 YEARS
- Aluminum Cans 200 YEARS
- Plastic Beverage Holder 400 YEARS
- Styrofoam Cup 50 YEARS
- Plastic Grocery Bag 1-20 YEARS
- Disposable Diaper 450 YEARS
- Plastic Bottle 450 YEARS
- Monofilament Fishing Line 600 YEARS
- Glass bottles UNDETERMINED

The National Oceanic and Atmospheric Administration (NOAA) defines marine debris as any manmade object discarded, disposed of or abandoned that enters the coastal or marine environment. Each year, tons of plastic and other litter end up in our oceans, rivers, and beaches. The only way to truly manage the marine debris pollution issue is through prevention – help Woods Hole Sea Grant change behaviors that cause marine debris to enter the environment! Reduce, Reuse, Recycle!

Find out more at www.whoi.edu/seagrant

www.facebook.com/woodsholeseagrant

www.twitter.com/woodsholeseagrant

www.youtube.com/woodsholeseagrant

Northstar Offshore Island Beaufort Sea oil drilling northwest of Prudhoe Bay, Alaska

Our Lady of the Rocks
coast of Perast in Bay of Kotor, Montenegro
is a sovereign state in Southeastern Europe

Palm Island Resort
United Arab Emirates

Palm Jumeirah core

Kansai airport - Osaka Bay Japan

Norway
Submerged floating
underwater tunnel

Subi reef South China Sea

Issues In India

- India has made one of the fastest progress in the world, in addressing its environmental. Still, India has a long way to go to reach environmental quality similar to those enjoyed in developed economies.
- Pollution remains a major challenge and opportunity for India.
- All forms of pollution – air, land, water – are prominently found in India.

Floods are a significant environmental issue for India. It causes soil erosion, destruction of wetlands and wide migration of solid wastes.

India is recognized as has having major issues with water pollution, predominately due to untreated sewage. Rivers such as the Ganges, the Yamuna and Mithi Rivers, all flowing through highly populated areas, are all heavily polluted. Water supply and sanitation continue to be inadequate, despite long-standing efforts by the various levels of government and communities at improving coverage.

Rejuvenating a waterbody in a sustainable manner is about **bringing life back into the waterbody, enhancing it and sustaining it.**

Attempt to build on our legacy of decentralised wastewater treatment (DEWATS^{TM}) to come up with **nature-based solutions (NBS) for rejuvenating waterbodies. Approach is holistic in nature. It looks at the multiple facets of a waterbody** – its role as a water storage and recharge structure in preserving and enhancing our water resources and thereby enhancing water security; its potential as a cleanser i.e. its ability to remove carbon and nutrients from polluted waters; its role as a buffer in flood management; its role in supporting life (biodiversity) and livelihoods (economy); not to mention, its additional roles as glorious public spaces and religious spaces that heal the soul.

Approach also takes into consideration **history, legacy systems, hydrology & hydro-geology, native biodiversity, catchment characteristics, pollution characteristics, social contexts around livelihoods & rights** etc - so as to provide **a highly contextual solution**.

Attempt to unpack this approach and provide a deeper insight into these perspectives. It gives some **frameworks and methodologies** that can be used to come up with **holistic and sustainable solutions**. While the **emphasis is on technical solutions**, the approach locates this in the context of a **broader systems thinking framework**.

Land/Soil Pollution

ఒకప్పుడు రేడియోతో టీవీతో కొంచెం సాంకేతిక జ్ఞానం, ఎక్కువగా అలా పనిచేస్తూ పరిశ్రమించేవి. అప్పటికీ... రిపేర్లకోసం సర్వీసింగ్‌కి పంపాల్సి వచ్చేది. సర్వీసింగ్‌కి పంపాలన్నా లేక పోయేవి. రంధ్రాలుపడి లీకవుతూ పనిచేసేవి... కొత్త మోడల్ వచ్చేసరికి తగిన మోడల్ కొనాల్సిందే. తరానికి ఇప్పట్లో మారే మార్కెట్లూ వాకింగ్‌మెషీన్లూ ఫ్రిజ్‌లూ ఏసీలూ కూలా ఎప్పటికప్పుడు పదో ఒక కొత్త ఫీచర్... కొత్త మోడల్‌తో వస్తాయి. పాతవాటిని తీసుకు కొత్తవి కొనుక్కోవాలనిపిస్తాయి. సహజమే... పెరుగుతున్న ఈ- చెత్త... ఎంజాయిమెంట్ చేస్తే చెత్త పనే మంచిది కాదు. ఈ- చెత్త అనలే మంచిది కాదు. డబ్బు పోయే, శని పట్టే- అన్నట్లు అది ప్రజల ఆరోగ్యాలనూ పరిశీస్తోంది మరి.

ఈ-చెత్త సమస్య... ఇంతింత కాదు!

స్మార్ట్‌ఫోన్ మన చేతుల్లోకి వస్తున్నప్పుడు గాలిలేనివా... ఏదారిలో మారుతూ వస్తే ఇప్పుడు వెంగళి పప్పుగా పెరిగి, మామూలు మధ్యతరగతి మనిషి చేతుల్లోనూ లేటెస్ట్ మోడల్స్ మారి తిరుగుతుంటాయి. చేతులో యాభై కళ్ళ మంచి స్మార్ట్‌ఫోన్లు వాడుతున్నారని గత ఏడాది లెక్కలు చెబుతున్నాయి. అంటే ముందు మోడల్కా అది 15 శాతం ఎక్కువ. ఇప్పటికే చదువుకు ప్రధానమా అని ఈ సంఖ్యలు అది మరి ఎక్కువ శాతమే పెరిగివుంటుంది.

స్మార్ట్‌ఫోన్ అవసరమే... కాదనడం లేదు. కాని వాడేసిన పాత ఫోనును ఏం చేస్తున్నారన్నదే అప్పుడు సమస్య.

గతేడాది మన దేశంలోకి 15 కోట్ల ఫోన్లు దిగుమతి అయ్యాయి. దాదాపు వాటికి సమానంగా పాత ఫోన్లు చెత్త బుట్టలోకి చేరుతున్నాయనే లెక్క అర్థం. ఒక్క అమెరికాలోనే రోజుకు సాగిన లక్ష సెల్‌ఫోన్లు చెత్తబుట్టలో పారేస్తున్నారు. మన దగ్గర బహుశా ఆ లెక్కలు తేలలేదు.

పోనీ అన్ని ఇంటి ఆవరణలోనూ, కార్యాలయాల్లోనూ, ఇళ్ళల్లోనూ వాడి పారేసే ఎల్ఈడీ, ఎలక్ట్రానిక్ పరికరాలన్నీ ఇలా చెత్త అవుతుంటే... అందులోనేమో 'ఉపయోగాల మూడో ప్రమాణాన్ని ముంచేస్తాయి' అని హెచ్చరిస్తోంది పర్యావరణమిత్ర.

అసలేమిటి ఈ- చెత్త అంటే... మనిషి జీవితం అప్పుడు సాంకేతిక దుష్ట ఆలోచనలోంచి. తెల్లారి లేచిందగ్గర్నుంచి మనం వాడేస్తున్నవే. పనిచేస్తున్నవే. విద్యుత్‌తో నడిచేవే. అంటే ప్రతి వస్తువూ సాంకేతిక ఆధిపత్య పీడ అవుతుంటే. ఆ సాంకేతిక ఏరోజు కారోజు కొత్త కొత్త రూపాల్లో అధిపత్య పెడుతూ ఉంటుంది. ఆ అధిపత్యపు అంచు పుచ్చుకోవాలంటే పాతవాడి స్థానంలో కొత్త ఉపకరణాలను కొనుక్కుంటూనే ఉండాలి. మన చేతిలోని స్మార్ట్‌ఫోనుతో మొదలుపెట్టి టీవీలూ, కంప్యూటర్లూ లాప్‌టాప్‌లూ, వాషింగ్‌మెషీన్లు, ఫ్రిజ్‌లూ, ఎయిర్‌కండిషనర్లు, హీటర్లు, కరెంటు స్టోవ్‌లూ, మైక్రోవేవ్ ఓవెన్లు, బ్రెడ్డు, జ్యూసర్‌లూ... ఒక్కమాటలో చెప్పాలంటే కరెంటు, బ్యాటరీలతో పనిచేసే ఉపకరణాలన్నిటివీ జీవితకాలం మారిపోతే, పనిచేయడం లేదనో చేత పాత మోడల్ అయిపోయాయనో... పారేస్తే అది ఈ-చెత్త కిందికే వస్తాయి.

నాలుగు అడుగుల రోడ్డు!

పెట్రోలియంనాలనీ, మరికొన్నాళ్ళలో పారెయ్యక తప్పదనీ అని అనిపించి భయంగా గత ఏడాది రాష్ట్ర అంతర్జాతీయ రోడ్డు మ్యాప్‌లో ఎలక్ట్రానిక్ వస్తువులను పారేయకుండా గ్రేటర్ ఈ-వేస్ట్ మానిటర్ ప్రకటించింది. ఈ చెత్త పరిమాణం అంతకు ముందుతో పోలిస్తే పదేళ్ళలో 21 శాతం పెరిగింది. మరో పదేళ్ళలో ఏటేటా రెట్టింపు అవుతుందని అంచనా. ఇప్పట్లో తయారయ్యే టీవీ, ఫ్రిడ్జ్ చెత్తలో కేవలం 15 శాతం మరోసారి వినియోగిస్తున్నప్పుడు ఎలక్ట్రానిక్ పరికరాన్ని మార్చడం అంటే చేయడం లేదా అంటే- చేస్తున్నాం... కాకపోతే అది చాలా చాలా తక్కువ. మరి తాత్కాలికంగా ఈ- వేస్ట్‌ను సురక్షితంగా పనిచేయడం వల్ల చాలాకు లక్ష్యం కోళ్ళ పెంపకం చేసే బంగారం, ఫ్లెటినం, రాగి, వెండి లాంటి లోహాల్ని చెత్తనుంచి పోగేసుకున్నవుతోంది. దాంతో లక్ష్యం కోళ్ళంటే- కొన్ని రకాల గ్యాస్ లాంటివాటిని పన్నా ఎక్కువ. ఈ చెత్తలో సగానికన్నా ఎక్కువ ఆసియా దేశాల్లోనే తయారవుతోందట. ఇప్పటికే తయారయ్యేది అతి తక్కువ. గత ఏడాది పారేసిన చెత్తనంతా చెత్త చెత్త పరిధిలో నింపితే ఆ పరిధి పదవ వంతు 125 రీలోమీటర్ల పొడవుంటుందట. చూస్తే చూస్తే అంత విలువైన వస్తువుల్ని చెత్తగా పడేస్తున్నామంటే సాంకేతికతని మనం సరిగ్గా ఉపయోగించుకోలేక పోతున్నామనే అంటున్నారు నిపుణులు.

కొంత అవసరం...కొంత మోజు

ఇళ్ళలో తయారయ్యే వస్తువుల్లో వేగంగా పెరుగుతున్న వాటా ఎలక్ట్రానిక్ ఉపకరణాలదే అని అధ్యయనాలు చెబుతున్నాయి. అందుకు కారణాలు రకాలవి ఉన్నాయి.

అవసరం: ఉద్యోగాలకీ వ్యాపారాలకీ తప్పనిసరికీ అవసరమయ్యే స్మార్ట్‌ఫోనూ కంప్యూటరూ లాప్‌టాప్ లాంటి వాటిని అవసరాలను తగిన పరిజ్ఞాన సాఫ్ట్‌వేర్ పని చేసేలా చేస్తే మోడల్స్ కొనుక్కోక

తప్పదు. అలాగే ఇళ్లలో వాడే మిక్సీ, వాషింగ్‌మెషీన్ లాంటి పరికరాలు మరీ పెద్దవైతే వెంటనే కొనుక్కోవాల్సిందే.

అర్థం: కొన్ని వస్తువులను అవి సరిగ్గా పనిచేస్తూనే ఉన్నా కేవలం మరిన్ని కొత్త ఫీచర్లతో కొత్త మోడల్ వచ్చింది కాబట్టి కొనమని ప్రకటనలు ప్రోత్సహిస్తాయి. టీవీలూ అన్నవంటి ఇలా పనిచేసే తళతళల వెత్తలోకి వేడుతున్నాయి.

సాంకేతిక అవసరాలు: ఒకప్పుడు ఒక వస్తువు ఒకే పని చేసేది. దాని నిర్మాణం చాలా సింపుల్‌గా ఉండి ఎక్కువ కాలం మన్నేది. ఇప్పుడు ఒకే వస్తువు ఎన్నో పనులు చేస్తుంది. క్లిష్టమైన సాంకేతికతతో తయారవుతుంది. దాంతో దాని జీవిత కాలమూ తక్కువగానే ఉంటోంది. కొన్ని పనిచేయకపోతే మరమ్మతు చేసే వీలుండదు. మన నేపథ్యంలో కాలం వాటి పెరిగిపోయే. కొన్ని తప్పక మరమ్మతు చేసే వీలున్నా చేసేవాళ్ల అందుబాటులో లేక ఇచ్చి, ఎక్కువగా డబ్బు పెట్టి కొత్తది కొనేస్తున్నారు. వాతావరణ మార్పులకు కారణమవుతున్న పెద్దలో ఇందులో వాడకాన్ని తగ్గించాలని మల్టీక్ దాసాలను ప్రోత్సహిస్తున్నాయి ప్రభుత్వాలన్నీ. 2030 నాటికి వస్తువులు కొత్త ఈ పరిణామాల రోజుపై ఉంటాయని వాటి వల్ల చదరపు అడుగుల వస్తువుల వినియోగం అయిదు బిలియన్ల వెత్తలోకి వేడతాయని అంచనా. నేడే ఎప్పుడప్పుడు వస్తువులు అని అంటేనే అమితంగా ఎదురుతున్నంటే పర్యావరణ ఉద్యమకారులు మాత్రం దానికి మరో కోణాన్ని చూస్తున్నారు. నేడే వాడుకలోకి వస్తే కొత్తది స్వాధీనపరుచుకోవడం, ఇతర పరికరాలా ఆ స్థానాన్ని ఆక్రమించేస్తే కాబట్టి వాటిని పారేసి కొత్తది తీసుకోక తప్పదు. దీని సాంకేతికంగా ఎంత పెద్ద మార్పులో- సెల్‌ఫోన్ తయారీ నుంచి రంగుల్లోకి మారినదాకా, అనలాగ్ నుంచి డిజిటల్‌లోకి మారినప్పటి కన్నా ఎన్నో రెట్లు ఎక్కువ కాబట్టి వస్తువులూ అదే స్థాయిలో ఉంటుందని వారు హెచ్చరిస్తున్నారు.

నాళ్ల వెత్త... మన బంధ

మన దేశంలో ఏటా దాదాపు వేలమై లక్షల టన్నుల ఈ-వేస్ట్ తయారవుతోందని అంచనా. వెత్త సృష్టికర్తల్లో అమెరికా, చైనా, జపాన్, జర్మనీల తర్వాత అదోస్థానంలో మనదేశం ఉంది. అది రాబోయేకాలం ఇంకా పేరుల వెత్త రూపా అధికమే పడ్తోంది. దుబాయ్ వెత్త తీరు పక్కింటి వేయం

కానీ ఈ వస్తువుల దగ్గరికి వచ్చేసరికి మాత్రం దేశాలు అదే పని చేస్తున్నాయి. అధి వృద్ధి పెంచడ దేశాన్ని తమ దగ్గర పనికిరాని వస్తువులన్నిటికీ అభివృద్ధి చెందుతున్న, పేద దేశాలను ఎగుమతి చేస్తున్నాయి. ఒక యూరోపియన్ యూనియన్ నుంచి 11 లక్షల మెట్రిక్ టన్నుల వాడి పడేసిన గిర్యుల్ పదార్థాలు ఎలాంటి పర్యవేక్షణా లేకుండా విదేశాలకు తరలి వెళ్తున్నాయని అంచనా. ఘానా, భారత్, కొన్ని ఆఫ్రికా దేశాలూ ఆ వెత్తని తీసుకుంటున్నాయి. అలాగని వాటికి ఆ వెత్తని సక్రమ పద్ధతిలో రీసైకిల్ చేసే సామర్థ్యం ఉందా అంటే అదీ లేదు. దాంతో యంత్రాలు చేయాల్సిన పనిని అత్యల్పంగా మనుషులే చేత చేయిస్తున్నారు. వాటిల్లోని లోహాలను సేకరించడానికి ఏ పార్శ్వగానాలను వేర్లలో విడదీయడం, కుప్పగా పోసి తగలబెట్టడం, యాసిడ్ పోసి కరగ పెట్టడం... లాంటివి చేస్తారు. పేద దేశాల్లోని ప్రజలు ఇలా డేంజర్‌పెరిగా మారింది. విదేశాలనుంచి వెత్త వచ్చేసి ఈ-వస్తువుల తయారీ మనదేశంలో తగ్గాలేకపోతే ఉన్నాయి. వాటిల్లో అన్నిటికన్నా పెద్దది ఢిల్లీ దగ్గర నోయిడాలో ఉంది. అక్కడ రోడ్ల మీదా, వాళ్లలో, రోడ్ల కొట్లలా ఉన్న ఇళ్లలో... ఎక్కడ చూసినా కుప్పలు కుప్పలుగా ఎలక్ట్రానిక్ పరికరాలు పడివుంటాయి. పిల్లలుసహా మనలో వాళ్లవరూ అందరూ ప్రొఫెషనల్ సుత్తి పట్టుకుని వాటి అందం చూస్తూ ఉంటారు. దేశంలోని అన్ని ప్రాంతాలనుంచీ లారీల్లో వెత్త అక్కడికి చేరుతుంది. మంచులు ఓడరేవు నుంచి ఎక్కువ వాటిలు వస్తాయని స్థానికులు చెబుతారు. ఒక్కో లారీలో పదే టన్నుల ఈ- వస్తువులు ఉంటాయట. వాటి నుంచి పనికొచ్చే భాగాలను తీసుకుని మళ్లీ కొత్త పరికరాన్ని అసెంబుల్ చేసి, తిరిగి అమ్ముతారు. లోహాలను వేరుచేస్తారు. మన కొన్ని భాగాలను తీసుకున్నాక పనికిరానివి కుప్ప వెత్తలుంటుంది. లారీల్లో ఎక్కించి అదేపూర్లకి తీసుకెళ్లి తగలబెడతారు. కొన్ని కాలిపోతాయి. కాలనీలు అలాగే మమ్మంటాయి.

నిజానికి మనమూలు వెత్తతో పోల్చితే

ఎలక్ట్రానిక్ వెత్త పరిమాణం తక్కువే. కానీ దాని వల్ల ప్రమాదం మాత్రం చెప్పలేం అంత ఎక్కువ.

ఆరోగ్యానికి హాని

ఎలక్ట్రానిక్ వస్తువుల వల్ల కలిగే నష్టమూ భూమిలో వాయువూ మాత్రమే కాదు, మన

కొన్ని నిజాలు!

మీ వస్తువులన్నీ జీవితకాలం తీరిన తరువాత తప్పవు. అలా మారేయడమన్నా, కాస్త బాధ్యతగా చేయాలి. ఎలాగంటే...

* లోపలివైపు గాజుతో ఉండే తప్పనిసరి కాలాలకి అమ్మే ఇలాంటివన్నా, మన్నికతో పనిచేసే ఎలక్ట్రానిక్ పరికరాలు ఉపయోగించడం వాటిని తిరిగి బయటకు తీసి, వాటి ఆధారంగా వాడుకోవడానికి అవకాశాలు చెబుతున్నారు. వేరుగా మంచి లోహం నుంచి తీసిన బంగారాన్నా, ఇలా ఒకసారి వాడిన లోహాలు వెంటనే నుంచి 10 రెట్ల వరకు ఎక్కువ సామర్థ్యాన్ని కలిగివుంటాయట.

* ఒక్క కిలోగ్రాములోనే సుమారు 300 వేల కిలోమీటర్లకు సరిపోతాయట. వాటి నుంచి వెయ్యి కిలోల ప్లాస్టిక్, 300 టన్నుల సీసం, 300 టన్నుల రాగి, 40 టన్నుల నికెల్- తీసుకోవచ్చట.

* ఒక మనుషుల సెల్‌ఫోన్లలో వస్తువుల చేస్తే 100000 కిలోల రాగి, 2000 కిలోల వెండి, 34 కిలోల బంగారం 15 కిలోల పలాడియం వస్తాయి.

* ఇదేగా కీబోర్డ్‌లో ఇలాంటివి ప్రమాదకరమే గాక, పాడం చెబుతోంది. దాన్ని 84 కిలోల బరువు, ఉంటే అయితే పరిశ్రమ పరిమితికి పనికొచ్చే ఈ-వస్తువులోనే తయారు చేయగలరని. అంటే వస్తువుల స్థానాలు నుంచే పరికరాలు దొరకవచ్చు లోహాలను తీసుకున్నట్టు.

ఆరోగ్యానికీ, పర్యావరణానికీ చెప్పలేనంత హాని జరుగుతోంది. ఈ పరికరాల్లో సీసం, పాదరసం, క్రోమియం, కాడ్మియం, ఆర్సెనిక్, నికెల్, జింక్, సెలీనియం... ఇలాంటి మూలకాలతో కలిసి మెత్తం అన్ని రకాల గాలిలో రసాయనాలు ఉంటాయి. సీసం, పాదరసం లాంటివి మనిషి నుదుట మీద స్పష్టంగా ప్రభావం చూపుతాయి. అది చెత్త కుప్పలో పడివుంటే నేలలో ఉన్న నేలని కూడా జలాలనీ కలుషితం చేస్తాయి. కాస్త గాలిని కలుషితం చేస్తాయి. ఇవన్నీ మూలకాలూ పక్షిజాతులూ రకరకాల జంతువులూ గాలిలోకీ భూమిలోకీ వదులుతాయి. ఈ కాలుష్యాలు మనిషి ఆరోగ్యం మీద రూపే ప్రభావం గురించి బాసెల్ యాక్షన్ నెట్‌వర్క్ అనే సంస్థ మరింత పరిశోధన చేసింది.

యూరప్ నుంచి ఎండ్రాయిడ్ చెత్తని తెచ్చి మలేషియా ఆగ్నేయాసియా అనే ప్రాంతంలో వేస్తున్నారు. అక్కడ ఉన్న ఎలక్ట్రానిక్ కంపెనీ ఎండ్రాయిడ్ పరిశ్రమలోని విడిభాగాల నుంచి రాగి, ఇనుము లోహాల్ని వేరుచేయడం ద్వారా డబ్బు సంపాదిస్తోంది. అందుకోసం వాళ్ళు ఆయా పరికరాల్ని తగలబెడుతుంటారు. అలా తయారైన బూడిద అంతా అక్కడి భూమిలో కలిసిపోతోంది. ఆ మలేషియాలో పెరిగే కోళ్ళు పెట్టిన గుడ్లను పరిశోధకులు విశ్లేషించారు. ఆ గుడ్లు ఒక్కటి తింటేనే- క్రోమియమ్ రసాయనాలు మనిషి శరీరంలో అంతకుముందున్నదాన్నా 120 రెట్లు ఎక్కువ పెరుగుతాయట. అదే కాక మరెన్నో అరుదైన రసాయనాలూ ఆ గుడ్లలో ఉన్నాయని అధ్యయనం చేసిన పరిశోధకులు పేర్కొన్నారు. అదే రసాయనాలను ఎవరన్నా మళ్ళీ మళ్ళీ వలంటంగా వినియోగిస్తే అది హృదయపుటల్ని కోసి అవుతుంది. కాని అదే పనిని మరో రూపంలో చేస్తున్నారే ప్రమాదాలు పట్టించుకోవడం లేదని సంస్థ ప్రతినిధి జిమ్ పుకెట్ ఆవేదన వ్యక్తం చేశారు. నీలంపూర్‌లో కూడా ఈ పనిచేస్తున్న వాళ్ళ ఆరోగ్య పరిస్థితి దారుణంగా ఉంటోందని వివరాలు వెలువడ్డాయి. సరిగా వాళ్ళ గర్భంలోని పిండ లోపాలు ఆనవాళ్ళు కన్పిస్తున్నాయట. చిన్నపిల్లలలోనే మూర్ఛపిండాలూ, కాలేయమూ పాడవుతున్నాయట.

బాధ్యత అందరిది...

ఎలక్ట్రానిక్ వ్యర్థాల వల్ల జరుగుతున్న వీటిని తగ్గించడానికి ప్రతి ఒక్కరూ బాధ్యత వహించాలి. మొదట... వ్యక్తిగతంగా ఆయా వస్తువుల జీవితకాలం పూర్తయ్యేవరకూ వినియోగించాలి. ఒక వస్తువు పనిచేస్తుండగానే మరొకటి కొన్నప్పుడు పాతదాన్ని అవసరం ఉన్న వారికి అప్పగించాలి. అలా పనిచేసే వస్తువులను అవిలేనూ ఇస్తే కొన్ని దేశాల్లో ప్రభుత్వాలు సమ్మ మినహాయింపు ఇస్తున్నాయి. రెండోది... పాడైపోయిన వస్తువుల్ని ఇంట్లో ఓ మూలన పడేసి ఉంచడమూ పెద్దబుద్ధిలో పనేయడమే. ఏదీ మంచిది కాదు. వాటిని రీసైక్లింగ్ చేసే సంస్థలు అందజేయాలి. కొన్ని కంపెనీలు కొత్తవి అమ్మేటప్పుడు పాతవాన్ని తీసుకుంటాయి. పాతవి ఇస్తే కొత్తదాని ధర తగ్గించినప్పుడు అలా ఇస్తున్నారు కాని తగ్గించకపోతే ఇవ్వడం లేదని కంపెనీలు సిద్ధాంతం చెప్తున్నాయి. పరిశోధనలు తీసుకుని అభివృద్ధి చేయడం మరో బాధ్యత అయితే దాదాపు సన్నద్ధ పద్ధతుల్లో రీసైక్లింగ్ చేయించడం కంపెనీల బాధ్యత.

ఇక, పట్టణ వ్యర్థాలకి వస్తే- మ్యూనిసిపల్ ప్రొడ్యూసర్ రెస్పాన్సిబిలిటీ(పీఆర్) అంటే- ఈ పరికరాల రీసైక్లింగ్ ఖర్చును కూడా ఉత్పత్తిదారులు భరించేలా చట్టాలు తేవాలని యూనిక్, ఇనిక, అమెరికాలోని కొన్ని రాష్ట్రాలూ డిమాండ్ చేస్తున్నాయి. కొన్ని దేశాలలో సొంతంగా బ్యాటరీ ప్రయత్నాలు చేస్తున్నాయి. ఆపిల్ కంపెనీ 2018లో స్వీడన్ లో రోజుకు తయారవుతోంది. అది గంటకు 200 ఐఫోన్లను ఏ పాడ్డుపాడ్డు రూపాన్ని విడదీస్తుంది. అలాగే ఆపిల్ ఉత్పత్తులలో పోలిస్తే అది చాలా రెట్ల ప్రయత్నం. ఈ విషయంలో పోకిరీ వాడ్డలాయలంగా వ్యవహరిస్తూ ప్రశంసలందుకుంది. 2008 గంటే తమ పాత పోస్టును మార్చి తీసుకోవడం మొదలెట్టింది. వాడ్రపత్రికల్లో ప్రకటనలు వేసి మరీ ప్రజలకు ఆ విషయాన్ని తెలియజేసింది. తమ కేర్ సెంటర్లలోనే వాళ్ళ పాతవేళ్ళ ప్రత్యేకంగా బ్రాండ్‌బాక్స్‌లను పెట్టి పాత ఫోన్లను సేకరించింది. వాటిలోని ఆ ఫోన్ నుంచి విడదీసిన వేర్వేరు భాగాలను మరిని మరుజీవాతం తిరిగి ఉపయోగిస్తున్నారు.

భారత ప్రభుత్వం కూడా ఈ-వ్యర్థాలను తగ్గించడానికీ, రీసైక్లింగ్‌కు పెంచడానికీ పదేళ్ళక్రితమే ప్రయత్నాలు మొదలుపెట్టింది. 2011లో ఈ వేస్ట్ మేనేజ్‌మెంట్ రూల్స్‌ను విడుదల చేసింది. వాటి ప్రకారం ఉత్పత్తిదారులు తమ పాతవాటి బాగోగుల్నీ తగినట్లుగా చూసుకుని కూడా రీసైక్లింగ్ చేయించాలి. తమ అమ్మకాల్లో కనీసం 30 శాతానికి సమానంగానైనా జీవితకాలం ముగిసిన వస్తువుల్ని తిరిగి తీసుకోవాలి. దాన్ని ఏలా పని శాతం పెంచుకుంటూ పోవాలి. దీన్ని సరిగ్గా అమలుచేస్తే ఈ చట్టం ఎవరికీ ఏ నష్టమైన కలగకుండా సన్నద్ధ పద్ధతిలో రీసైక్లింగ్‌కి వెళ్తుంది. ★

ప్రపంచంలోనే పెద్దది!

చైనాలోని చాంగ్‌యాంగ్ జిల్లాలో లక్ష్మీపుర జనాభా ఒక్క చిన్న పట్టణం గ్యాయు. ప్రపంచంలోని అతి పెద్ద ఎలక్ట్రానిక్ చెత్త కుప్పగా దీనికి పేరు. అక్కడ దాదాపు ఐదారు కేంద్రాలలో కోటాను కోట్ల టన్నుల వస్తువులను పూర్తిగా అశాస్త్రీయ పద్ధతులలో రీసైక్లింగ్ చేస్తున్నారు. ఆ ఊళ్ళో ప నాయిలో ఈ-వ్యర్థాల రీసైక్లింగ్ జరుగుతోందో అదే నాయిలో ప్రజారోగ్యానికీ ప్రమాదమూ పొంచి ఉందని టైమ్ మ్యాగజైన్ పేర్కొంది. ఆ ప్రాంతానికి దగ్గరలో ఉన్న యాంగ్‌జియాంగ్ నది నీటిలో రకరకాల లోహాలు ఉండడాన్ని గమనించిన మూడు రెట్లు ఎక్కువున్నట్లు తేలింది. ఇక, ఆ ప్రాంతంలోని భూగర్భ జలాల్ని తవ్వి చేయడానికి నీటి కాని నీటిలో కలుషితమైపోయాయట. పలువురి పెత్త శ్రేణం అనేకం మంది సంబంధమైన వ్యధలోయ క్షేత్రం. త్వరగా దక్కలోకెయ్యన్న ఆశతో పొలాలను ఏమయిత్తి సాగిస్తుంటారు ఈ వ్యర్థాల వైపు ఆకర్షితులయ్యారు.

Equilibrium

Physiotherapy Center

Do You Know Our Head Weighs 4 To 5 Kg. If We See Our Cell Phones At An Angle Of 60° It Is Equal To 27 Kg Weight On Our Neck Bones. So Be Very Careful About The Posture While Using Cell Phones. The First One Is Ideal.

SOLID WASTE TREATMENT

- The processing methods available for management of solid waste includes : Segregation , Reduction, Reuse and Recycling, Chemical, Biological And Thermal Conversion, etc.

1. **SEGREGATION**

- Segregation or Waste sorting is the process by which waste is separated into different elements.
- Waste segregation means dividing waste into dry and wet.
- Waste can also be segregated as

✓1. Biodegradable

✓2. No biodegradable

PAPER
GLASS
PLASTIC
METAL

WASTE ROUTE
From homes, BBMP collects wet waste every day and dry waste once a week
BBMP
Dry waste goes to recycling units
WET
DRY
DRY
WET
Bottle
Tetrapack
Can
Kitchen waste
LANDFILL
Wet waste goes to landfill where it is processed to produce compost, biofuel and power

MSW Management
Solid Waste Management Activity
Collection
Initiation of house-to-house collection system
Adoption of large variety of community bins in cities having community bin system
Adoption of front end loaders for mechanical lifting of waste at open collection spots
Adoption of source specific collection system
Emphasis on segregation of dry and wet waste at source
Introduction of spot fining system
Ensuring minimum manual handling of waste
Provision of closed containers at various locations
Transportation
Replacement of older vehicles by newer one
Emphasis on optimization for routing of vehicles
Separate vehicle for transportation of slaughterhouse waste
Preventive maintenance of transportation vehicles periodically
Provision of sheds for parking of transportation vehicles
Processing
Conducting awareness programme on use of compost
Providing appropriate testing facility for assessing quality of compost
Disposal
Emphasis on improvement of existing disposal site keeping in view of MSW Handling Rules, 2000
Avoiding open dumping of MSW
Creation of sanitary landfills
Selection of landfill site as per the guidelines of CPCB/NEERI
Industrial Waste Management
Monitoring of management of hazardous wastes in keeping with the legislation
Adoption of separate treatment and disposal facilities for hazardous waste
Biomedical Waste Management
Discontinuing the mixing of biomedical waste with the MSW
Ensuring proper segregation of various categories of biomedical waste as also treatment and disposal of these wastes as per legislation
Strict compliance on adoption of protective devices such as gumboots, hand gloves, and masks etc.
Provision of medical facility to workers
Establishment of separate healthcare center for workers

HAZARDOUS WASTE

- tubelights & bulbs
- batteries
- cleaning agents
- paints
- oils
- aerosol cans
- cosmetics
- insecticides
- medicines
- syringes
- thermometers
- e-waste (computer and mobile parts)

Collected quarterly. Store at home or deposit at a designated collection point.

SANITARY WASTE

- sanitary napkins
- disposable diapers
- bandages
- any material contaminated with blood.

Hand over daily with wet waste. Wrap in newspaper and mark with a red cross.

GARDEN WASTE

- fallen leaves
- trimmed branches
- lawn trimming
- weeds.

Collected weekly/monthly. Or deliver to your nearest composter.

DEBRIS

- dust
- debris
- drain silt
- ashes
- broken bricks
- mortar
- broken glass
- construction waste
- demolition waste.

Call us to collect for a fee.

WET WASTE

- cooked food
- uncooked food
- fruits
- vegetable peels
- flower waste

Do not collect in plastic bags.

Collected daily from your door or nearest point. Do not mix with any other waste.

DRY WASTE

- glass
- wire
- cloth
- leather
- rubber
- thermacol
- metal
- paper
- plastic
- wood
- rubber
- rexine
- leather
- fabric

Store at home. Hand over to dry waste collectors every week or month. Know your day.

Call helpline 22660000 if BBMP people do not turn up.

Hoarding

From October 1st onwards, BBMP will collect only WET and SANITARY waste DAILY

DRY waste will be collected WEEKLY

OUR WASTE
OUR RESPONSIBILITY

Wet Waste

- cooked food (veg / non-veg)
- uncooked food (veg / non-veg)
- fruit and flower waste
- fallen leaves and similar compostable materials

Dry Waste

- paper / plastic / wood
- metals / fabrics / cloth rags
- glass / wire / leather
- rexin / rubber
- thermocol etc...

Sanitary Waste
wrap in newspaper
marked with a red cross

Contact BBMP control room no : 080-2266 0000
e-mail : swm.bbmp@gmail.com website : www.bbmp.gov.in
f : facebook/bbmp-speak-on-solid-waste-management

Bruhat Bangalore Mahanagara Palike

Join hands to create a garbage-free Bangalore

WET WASTE or KITCHEN WASTE

What is Wet Waste?

- Vegetables Peel
- Fruit Peel
- Tea Leaves
- Coffee Powder
- Flowers & leaves
- Left over food

- Pencil Shaving
- Match sticks
- Hair
- Fruit Kernel
- Coconut Shells
- **NO** animal bones (this goes in Biohazard waste)

DRY WASTE

What is DRY Waste?

PAPERS

- Paper Plates
- Bit of Papers
- Shredded Papers
- Carton Boxes
- News Papers
- Magazines
- Chocolate Wrappers
- Toffee Wrappers
- Chips Wrappers
- Paper Glasses
- Gift Wrappers
- waste Packing Material

PLASTIC

- Plastic Bags
- Plastic Toys
- Utensils
- Plastic Bottles
- Bubble Wraps
- Plastic Containers
- Milk Pouches *
- Idly Batter Pouches*
- Curd Pouches*

METAL and OTHERS

- Aluminum Foils
- Aluminum Cans
- Spray Cans
- Bottle Caps
- Tetra packs
- Thermacole Cups, Plates etc
- Thermacole and Styrofoam Packing
- Glass Bottles
- Juice Packets

PLEASE NOTE *

Milk Pouches ,Idly Batter Pouches, Curd Pouches MUST BE rinsed and dried before trashing it in the dry waste . Please ensure that all waste meant for the Dry Bins is completely dry before disposal.

WASTE SEGREGATION CHART

Wet Waste

Vegetable & Fruit Peel, Food Remains, Expired Food item, Meat, Bone, Egg Shell, Flower, Tea Bag & Coffee Powder, Coconut Shell & Fibre etc.

Do not Put in Plastic Cover
They can be composted

Dry Waste

Plastic, Paper, Wood,
Glass, Rubber, etc items not having medical or sanitary residues.

Clean and Store
Give it to Recyclers

Sanitary Waste

Used Sanitary Napkins,
Diaper, Pead Pest, Ear Buds, Dental Floss, Bandage

Do not throw as it. Wrap in Newspaper.
Mark it with red cross (+) before disposal

Garden Waste

Large Quantity of Leaves, Branches, Dried Plants

Handover Separately to
BBMP Collection Trucks

Hazardous Household Waste

Medicines, Pesticides, Old Paints, Hair Colour
Mosquito Repellent, Syringes, Cosmetics.

DO Not Mix with other Waste
Store Carefully
Hand it over to specific Recyclers

Debris/ Rubbish

Construction Debris, Demolition Waste, Broken Glass, Broken Furniture

Call BBMP or
Other Agencies for Pickup

E-Waste

Tube lights, CD's, Batteries,
Computers, Televisions, Mobile phones,
Laptops, Printer Cartridges, Cables

DO Not Mix with other Waste
Store Carefully
Hand it over to specific Recyclers

Realise, React, Recycle

An initiative by
Swachha
#146/5 A, 7th Cross, Coconut Avenue Road,
Malleswaram, Bangalore 560 003.
Phone: 080 3256 2121.
E-mail: info@swachha.org
Visit us at : www.swachha.org

When we refuse to reuse, its our Earth we abuse

swachha
For the environment... with love

In association with
BBMP

Picture courtesy: Youth for Seva

Infectious waste represents about 10 to 15% of all hospital waste.

Chemical Waste Disposal Guideline

Innocuous aqueous waste

- **Acid** (pH<4)
- **Alkali** (pH>10)
- Harmless soluble inorganic salt
- Alcohol containing salt
- Hypochlorite solution
- Fine (tlc grade) silica and alumina

These chemicals should be washed down with excess water.

Organic Solvent

- **Chlorinated**

Example: DCM, Chloroform, Chlorobenzene etc.

- **Non-Cholronated**

Example: THF, ethyl acetate, hexane, toluene, methanol, etc.

Red List

- Compounds with transitional metals
- Biocides
- Cyanides
- Mineral oils and hydrocarbons
- Poisonous organosilicon compounds
- Metal phosphides
- Phosphorus element
- Fluorides and nitrites.

Solid Waste

- Lightly contaminated

Example: Gloves, empty vials/centrifuge .

Broken Glassware

Broken glassware are usually collected in plastic-lined cardboard boxes for landfilling. Due to contamination, they are usually not suitable for recycling.

Solid Waste Management Plan at Model Apartment Owners Association

Waste Category	Examples	Resident Activities			Association Activities			
		Mode of Collection by Resident	Special instructions to Residents	Mode of Disposal by Resident	Frequency of pickup	Mode of Collection by Association	Further Activities by Association	Mode of Disposal by Association
Wet Waste (Bio-degradable)	Kitchen Waste, Vegetable Peelings, Food etc.	In a dustbin with out any plastic lining	***Do NOT collect in plastic covers. Association encourages individual flats to have small composters to reduce the wet waste***	Keep outside the house or empty in the bin #1 at basement	Three times a day 9:00 AM, 2:00 PM, 6:30 PM	House Keeping Staff will come door-to-door collecting waste. To be emptied into the bin #1	Collect Common Area Wet Waste	Waste will be put into our Organic Composter
Garden Waste	Fallen Leaves, Flowers, Garlands, Broches, Weeds etc.	Combine with wet Waste	-		Three times a day 9:00 AM, 2:00 PM, 6:30 PM	House Keeping Staff will come door-to-door collecting waste. To be emptied into the bin #1	Collect Gardening/Lawn waste	Waste will be put into our Organic Composter. Excess waste will be given to the BBMP pickup truck
Sanitary Waste	Diapers, Ear Buds, Sanitary Napkins, Condoms, Hair, Bandages, Clothes with blood etc.	Wrap in a news paper and mark with a red cross	***Wrap in news paper or paper bag***	Keep outside the house or empty in the bin #2 at basement	Three times a day 9:00 AM, 2:00 PM, 6:30 PM	House Keeping Staff will come door-to-door collecting waste. To be emptied into the bin #2		BBMP Pickup Truck
Dry Waste	Paper, Bottles, Cardboards, Used/Worn out clothes, Shoes, Leather, Packaging Materials, Wires, Glass, Plastic, Wood	Keep them in the house in the white gunny bag	***Ensure all bottles / plastic covers are cleaned and are dry***	Keep the bag filled with waste outside on the collection day the house or empty in the bin #3 at basement	Alternate Saturdays around 10 AM	House Keeping Staff will come door-to-door collecting waste. To be emptied into the bin #3	HK Staff to further segregate Dry Waste	Handed over / Picked up by the Dry Waste Collection centre
Hazardous Waste	Aerosol Cans, Insecticides, Medicines, Syringes, Paints, Clothes with paints, Oils etc.	Keep them in the house in a separate bin	-	Keep the bag filled with waste outside on the collection day the house or empty in the bin #4 at basement	1st Saturday of every month	House Keeping Staff will come door-to-door collecting waste. To be emptied into the bin #4	-	Handed over / Picked up by the Dry Waste Collection centre
e-Waste	Batteries, CFL Bulbs, Tubelights, CDs, Floppies, Mobiles, Chargers, PDAs, Computer parts etc.	Keep them in the house in a separate bin	-	No pickup. Resident to drop in bin #5 at basement	-	-	-	Handed over / Picked up by the Dry Waste Collection centre
Debris Waste	Drain silt, ashes, construction waste, bricks etc.	Keep them in a separate cover, if in small quantities. Else, check with Facility Manager	-	Check with Facility Manager where to empty	On Need basis	-	-	Custom arrangement on case to case basis

YELLOW BAGS	RED BAGS	BLUE BAGS	BLACK CARBOY
Infectious waste, bandages, gauze, cotton or any other objects in contact with body fluids, human body parts, placenta etc.	Plastic waste such as catheters,injection syringes tubings, iv bottles	All types of glass bottles and broken glass articles, outdated & discarded medicines	Needles without syringes, blades, sharps and all metal articles.

BANANA LEAVES FOR PACKING FOOD

Global human population growth

- More than 6.7 billion humans
- Why so many humans?
  - Agricultural revolution
    - Stable food supplies
  - Industrial revolution
    - Urbanized society powered by fossil fuels
    - Sanitation and medicines
    - More food

(a) World population growth

(b) Urban society

- **Human population growth exacerbates all environmental problems**
  - *The growth rate has slowed but we still add more than 200,000 people to the planet each day* We depend completely on the environment for survival
  - Life has become more pleasant for us so far (Increased wealth, health, mobility, leisure time)
  - But natural systems have been degraded and environmental changes threaten long term health and survival

Environmental science: how does the natural world work?

Environmen ← impacts →
Humans

It has an applied goal: developing solutions to environmental problems

An interdisciplinary field

- Natural sciences: information about the world
- Social sciences: values and human behavior
- politics, economy, etc.

What is an "environmental problem"?

- The perception of what constitutes a problem varies between individuals and societies
- Ex.: DDT, a pesticide
  - In developing countries: welcome because it kills malari carrying mosquitoes
  - In developed countries: not welcome, due to health risks

Environmental science is not environmentalism

Environmental science

- The pursuit of knowledge about the natural world
- Scientists try to remain objective

Environmentalism

- A social movement dedicated to protecting the natural world

The "ecological footprint"

- The environmental impact of a person or population
  - Amount of biologically productive land + water for raw materials and to dispose/recycle waste
- **Overshoot**: humans have surpassed the Earth's capacity

We are using 30% more of the planet's resources than are available on a sustainable basis!

Ecological footprints are not all equal

- The ecological footprints of countries vary greatly
  - The U.S. footprint is almost 5 times greater than the world's average
  - Developing countries have much smaller footprints than developed countries

2017

ఈ అడుగును..

చెరిపేద్దాం

Types of drought

We can define drought in three main ways:

- Meteorological drought: related to rainfall amounts
- Hydrological drought: determined by water levels in reservoirs
- Agricultural drought: related to the availability of water for crops

Types of drought

- There are fore types of drought. These are follows:

Meteorological drought

Hydrological drought

Agricultural drought

Socioeconomic drought

Types of Drought

- **Agricultural Drought**
  - Meteorological drought that impacts agriculture
  - Usually the first economic sector to be hit
  - Precipitation shortages, ET, soil moisture, etc…
  - **Plant water demand versus available soil moisture**

Different Types of Drought

Meteorological Drought	A Significant Deviation from the Long-term Mean Precipitation
Hydrological Drought	A Major Deficit in Supply & Availability of Surface & Groundwater
Soil Moisture Drought	A Major Deficit in Soil Moisture as a Result of Climatic & Hydrologic Deficits
Groundwater Drought	During a Meteorological Drought Using Groundwater is an Adaptive Approach but can lead to Aquifer Depletion During Extended Droughts

Types of Drought

- **Meteorological Drought:-** It is related to deficiencies in rainfall compared to the average mean seasonal rainfall in an area.
- **Agricultural Drought:-** Deficit rainfall over cropped areas during their growth cycle can destroy crop or lead to poor crop yields.
- **Hydrological Drought:-** It is a deficiency in surface and sub-surface water supply. It is measured as stream flows and also as lake, reservoir and groundwater levels.

Natural climate variability
Precipitation deficiency (amount, intensity, timing)
High temp., high winds, low relative humidity, greater sunshine, less cloud cover
Reduced infiltration, runoff, deep percolation, and groundwater recharge
Increased evaporation and transpiration
Meteorological drought
Soil water deficiency
Agricultural drought
Plant water stress, reduced biomass and yield
Hydrological drought
Reduced streamflow and inflow to reservoirs, lakes, ponds and wetlands
Economic impacts
Social impacts
Environmental impacts
Time (duration)

Natural Climate Variability
Precipitation deficiency (amount, intensity, timing)
High temperature, high winds, low relative humidity, greater sunshine, less cloud cover
Reduced infiltration, runoff, deep percolation, and ground water recharge
Increased evaporation and transpiration
Soil water deficiency
Plant water stress, reduced biomass and yield
Reduced streamflow, inflow to reservoirs, lakes and ponds; reduced wetlands, wildlife habitat
Economic Impacts
Social Impacts
Environmental Impacts
TIME (duration)
Meteorological Drought
Agricultural Drought
Hydrological Drought

Definition of drought: Four different types

Measurement of Drought Resistance in Plant Breeding
Various procedures are used for measuring drought resistance in crop plants. The most commonly used procedures include:

1)Leaf water retention
2) Photosynthesis
3) Yield performance,
4) Root lengths of seedlings.

These techniques can be used for large scale screening of segregating populations in breeding programme.

Severity of drought
Nil
Severe
Unpredictable
Drought tolerance traits
Potential yield
YIELD
Drought escape
Predictable

What has happened in our DROUGHT ?
Low rain and snow pack
High temperature (part of climate change)
Weather
Loss water entering soil and groundwater
More plant evapotranspiration and water evaporation
Not Enough water in soil
Plants and Ag
Stressed plants, Low crop yields and wildlife food sources
Time (duration)
Low stream flow, low water in reservoirs, lakes and groundwater aquifers
Reduced wildlife habitat and health
Dropping groundwater levels, ground subsidence and more deep pumping
Water Storage
Economic Impacts
Social Impacts
Environmental Impacts

levels affected
WORLD
starvation, famine, international conflict; world social systems disrupted; severe health effects
NATION
food shortages, rising prices, foreign trade losses, increased government payments to the agricultural sector
REGION
disrupted regional economy, increased unemployment and migration; regional instability
AGRICULTURAL PRODUCERS
dislocation, bankruptcy, increased indebtedness, loss of income

INTRODUCTION

- Drought is a period or condition of unusually dry weather within a geographic area where there is a lack of precipitation.
- Drought is governed by various factors, the most prominent being extremes in temperature, photon irradiance and paucity of water.
- The characteristics features of drought stress is **low water potential** due to high solute concentration.
- Low water supply causes soil mineral toxicities and can make a plant more susceptible to damage from high irradiance.
- **Affected area(s):**Rajasthan, parts of Gujarat, Haryana and Andhra Pradesh.

Causes

Drought can be caused by a number of factors. The most important one though relates to the amount of water vapor in the atmosphere as this is what creates precipitation. If there is an above average presence of dry, high pressure air systems instead, less moisture is available to produce precipitation. Even, deforestation for agriculture and/or building combined with the resultant erosion can also cause drought to begin because as soil is moved away from an area it is less able to absorb moisture when it falls.

Causes of drought

Natural / Physical causes:

- Weather: increased amount of *anticyclone* weather (hot + dry) means air holds less moisture so you get less rain
- Global warming: weather patterns change (e.g. Sahel is becoming hotter + drier)
- Hotter weather = more evaporation than precipitation
- El Nino: random weather event that reverses normal weather patterns (e.g. Australia has years of drought + then years of flood)

Human causes:

- Overpopulation: too many people living in an area using too much water
- Overcultivation: planting too many crops which use up too much water
- Overextraction: removing too much water from wells so they dry up
- Deforestation: cutting down trees which otherwise store water + hold soil together
- Politics: fighting over water, or companies being greedy + taking too much water to then sell on

Causes of Desertification

- Nomads moving to less arid areas disrupt the local ecosystem and increase the rate of erosion of the land.
- Increased population and livestock pressure on marginal lands .By pounding the soil with their hooves, livestock compact the substrate, increase the proportion of fine material, and reduce the percolation rate of the soil, thus encouraging erosion by wind and water.
- Grazing and the collection of firewood reduces or eliminates plants that help to bind the soil.

2018

గోదావరి - పెన్నా నదుల సంగమం
9.61 లక్షల ఎకరాల సాగుకు సుగమం

గౌరవ ముఖ్యమంత్రి చంద్రబాబు నాయుడు గారి దూరదృష్టితో గోదావరి-కృష్ణా పవిత్ర సంగమంతో నదుల అనుసంధానం అనే దశాబ్దాల జాతీయ కలను మొట్ట మొదటి సారిగా మన రాష్ట్రంలో సాకారం చేసుకున్నాం. తెలుగువారి సత్తా లోకానికి గర్వంగా చాటాం. ఈరోజు గోదావరి-పెన్నా నదుల అనుసంధానానికి నాంది పలికి దేశ సాగునీటి చరిత్రలో సరికొత్త అధ్యాయానికి శ్రీకారంచుడుతున్నాం.

వృథాగా సముద్రం పాలవుతున్న గోదావరి జలాలను ఒడిసి పట్టి, రాష్ట్రాన్ని కరువు రహితంగా తీర్చిదిద్ది సాగు, త్రాగు నీరు మరియు పారిశ్రామిక అవసరాలకు శాశ్వత పరిష్కారంగా ప్రభుత్వం అనేక పథకాలు చేపట్టింది. ఎంతో ముందుచూపుతో మన ముఖ్యమంత్రి శ్రీ నారా చంద్రబాబు నాయుడు గారు రాష్ట్రంలోని అన్ని నదుల అనుసంధానానికి రూపకల్పన చేశారు. గుంటూరు, ప్రకాశం మరియు రాయలసీమ జిల్లాలను కరువు రహితంగా మార్చే నదీ సంగమమే గోదావరి-పెన్నా నదుల అనుసంధానం. ఐదు దశల్లో పూర్తికానున్న ఈ గోదావరి-పెన్నా నదుల అనుసంధానము రూ. 6020.15 కోట్లతో మొదటి దశ పనుల శంఖుస్థాపన కార్యక్రమంలో భాగస్వాములుకండి.

గోదావరి నది

కృష్ణా నది

పెన్నా నది

గౌరవనీయులు రాష్ట్ర ముఖ్యమంత్రి

శ్రీ నారా చంద్రబాబు నాయుడు గారి

గోదావరి-పెన్నా నదుల అనుసంధాన మొదటి దశ పనులకు శంఖుస్థాపన

తేదీ: 28-11-2018, స్థలం: సదరలపల్లి, గుంటూరు జిల్లా

సమయం: ఉదయం 10:30 గం.లకు

ప్రాజెక్టు ప్రధానాంశాలు

క్రమ సంఖ్య	వివరణలు	మొత్తం
1	నీటి ప్రవాహ సామర్థ్యం (క్యూసెక్కులు)	7000
2	కాలువ పొడవు (కి.మీ)	56.35
	కృష్ణా పొడవు (కి.మీ)	10.25
	మొత్తం పొడవు (కి.మీ)	66.60
3	భూసేకరణ (ఎకరాలలో)	3541
4	నీరు పోకాల సంఖ్య మరియు రకం	5/148.66
5	కాలువపై విద్యుత్ (మెగావాట్లు)	877.62
6	పథకం అంచనా వ్యయం (రూ. కోట్లలో) భూసేకరణతో సహా	6020.15

మొదటిదశలో లబ్ధిపొందు ప్రాంతాలు:

గోదావరి పెన్నా నదుల అనుసంధాన మొదటి దశలో భాగంగా గుంటూరు మరియు ప్రకాశం జిల్లాలలోని 19 మండలాలకు త్రాగునీరు, సాగునీరు మరియు పారిశ్రామిక నీటి అవసరాలకు పూర్తి పరిష్కారం.

జిల్లా	మండలాల సంఖ్య	మండలాల పేర్లు
గుంటూరు	39	గుంటూరు, దాచేపల్లి, అమీనాబాద్, పెదకాకాని, పిడుగురాళ్ళ, మాచర్ల, యడ్లపాడు, నకరికల్లు, నరసరావుపేట, గురజాల
ప్రకాశం	40	యర్రగొండపాలెం, కొండేపి, ఒంగోలు, దర్శి, పంగులూరు, పర్చూరు, అద్దంకి

ప్రతి చివరి ఎకరాకు సాగునీరు. ప్రతి జిల్లా సస్యశ్యామలం.

ప్రకాశం బ్యారేజీ నుంచి నకరికల్లుకు
నీటిని ఎత్తిపోసే 5 పంపు హౌస్‌లు
1
హరిశ్చంద్రపురం
పంపు హౌస్
ప్రకాశం బ్యారేజీ
ఎగువున కృష్ణా జలాలు
2
లింగాపురం
పంపు హౌస్
3
ఉయ్యందన-తాళ్లూరు
పంపు హౌస్
4
రాజాపాలెం
పంపు హౌస్
5
నకరికల్లు
పంపు హౌస్
ఈ
జలాలను
సాగర్ కుడి
కాలువలోకి
మళ్లిస్తారు
సాగర్ కుడి కాలువ

Over view

- Definitions for disaster and floods
- Objectives
- Types of floods
- Causes of floods
- Floods impacts
- Methodology
- Flood forecasting
- Flood management
- Flood zoning
- Case study(Vijayawada)

TYPES OF FLOODS

- Types of floods
  - •Flash floods
  - •River floods
  - •Coastal Floods
  - •Urban Flood
- According to their duration flood can be divided into different categories:
  - •Slow Onset Floods: Slow Onset Floods usually last for a relatively longer period, it may last for one or more peeks, or even months.
  - •Rapid Onset Floods: Rapid1Onset Floods last for a relatively shorter period, they usually last for one or two days only.
  - •Flash Floods: Flash Floods may occur within minutes or a fe1w hours after heavy rainfall, tropical storm, failure of dams or levees or releases of ice dams. And it causes the greatest damages to society.

Flood forecasting

- Anticipating floods before they occur allows for precautions to be taken and people to be warned so that they can be prepared in advance for flooding conditions.
- For example,
  - Farmers can remove animals from low-lying areas and utility services can put in place emergency provisions to re-route services if needed. Emergency services can also make provisions to have enough resources available ahead of time to respond to emergencies as they occur.
- In order to make the most accurate flood forecasts for waterways, it is best to have a long time-series of historical data that relates stream flows to measured past rainfall events
- Radar estimates of rainfall and general weather forecasting techniques are also important components of good flood forecasting.

rain
tsunami
high
storm
area
floods
water
gutter
capacity
areas
heavy
downstream
flood
flooding
coastal
surge
rainfall
plain
inundation
tide
river
excess
causes

Causes of flooding
Geology
State of ground / antecedent conditions
Drainage
Relief
Catchment size
Vegetation
Attempts at management
Meteorological
Catchment shape
Land use

Causes of flooding

Physical

- Intense precipitation
- Prolonged rainfall
- Snow Melt or Ice Thaw
- Storm Surges
- Landslides
- Volcanic Eruptions

Human

- Changes in land use
- Urbanisation
- Climate Change
- Poor dam construction
- Poverty

Human causes

- Construction of small bridges; blocked by cars and vegetation, so water had to flow around the bridge, flooding properties.
- There wasn't any type of flood defences
- The river had been narrowed down to allow the construction of bridges, so there wasn't enough space to carry a such amount of water.

Causes of Floods

1) **Natural causes of flood-**
   a) Heavy rainfall
   b) Snowmelt
   c) Sudden water release
   d) Coastal flood

2) **Man-made causes of flood-**
   a) Deforestation
   b) Poor water management
   c) Population pressure
   d) Catastrophic failure

Causes of flooding in New Brunswick

Floods

- Floods are the most common and most destructive geologic hazard
- Causes of flooding
  - Naturally occurring
  - Human-induced factors
- Types of floods
  - Regional floods
  - Flash floods
  - Ice-jam floods
  - Dam failure

FACTORS

VEGETATION COVER
This varies seasonally. The type and amount will affect interception and stemflow/ throughfall. Overland flow is reduced. Lag time will be increased.

ROCK TYPE
Impermeable rocks prevent groundwater flow and encourage through flow and overland flow. These rocks will decrease lag time. Permeable rock will have the opposite effect.

CLIMATE
The distribution of rainfall over the year and the temperatures will affect the lag times.

LAKES & RESERVOIRS
These will store floodwater and thus reduce lag time and control river response to heavy rainfall.

SLOPES
Steep slopes will encourage overland flow and gentle slope will slow run off down.

RAINFALL INTENSITY & DURATION
Intense rain will increase overland flow and reduce lag times. Gentle rain over a longer time will allow more infiltration.

LAND USE
Impermeable surfaces created by urbanisation will reduce infiltration and encourage overland flow. Different types of crops affect interception rates e.g. cereals 7-15%.

SOIL TYPE & DEPTH
Deep soils store more water, pipes in the soil encourage through flow. Soils with small pore spaces will reduce infiltration and increase overland flow.

Four main types of flood events

1 Spring breakup

The annual breakup and thaw produces regular flooding associated with rising temperatures and thaw of stored waters from winter-accumulated snow.

While March has been the most typical time for this flooding, the current window is January through April.

Thaw is one of the leading causes of flooding in the watershed, ice jamming during these events provides a unique component to this hazard.

2 Cyclonic disturbances

Precipitation from large-scale atmospheric systems such as hurricanes, remnants of hurricanes and stalled frontal systems can produce enormous quantities of rain in the watershed.

The flooding in 2006 in the upper part of the watershed was due to these types of events which resulted in over $200 million in damages.

3 Localized summer outburst

Thunderstorms and other summer disturbances that result in intense local precipitation may cause severe flooding in small tributaries.

The July 2008 event caused intense scour, sediment transport and over $3 million in damage to infrastructure in Schenectady County.

4 Catastrophic release from lakes/reservoirs

Failure of upstream impoundments, such as reservoirs, could cause devastating floods in the watershed.

A catastrophic event of this type has not occurred yet, but dam break analyses[1] have shown how problematic such an event would be.

inland
estuary
coast
flash floods
river floods
coastal floods
tsunamis
discharge
discharge
water level
& waves
waves
rainfall
rainfall
storm surge
earthquake
time
key factors

What are floods?

Floods are caused by heavy rainfall.
There are three types.

①

reverine floods

②

estuarine floods

coastal floods

Snow melt
Flash floods
Rain-on-snow
Low lands:
synoptic floods

Different Types of Floods

- Monsoon floods
- Flash floods
- Rainfall-induced floods
- Tidal floods

Types of floods

- Flash floods -are local floods of great volume and short duration.
- A flash flood generally results from a torrential rain or "cloudburst" on relatively small and widely-dispersed streams.
- Riverine floods -are caused by precipitation over large areas or by melting of the winter's accumulation of snow, or by both.
- Storm surge or tidal surge is an offshore rise of water associated with a low pressure weather system, typically a tropical cyclone.
- Storm surge is caused primarily by high winds pushing on the ocean's surface

Various types of floods.

- **Riverine floods**
- **Slow kinds:** Runoff from sustained rainfall or rapid snow melt exceeding the capacity of a river's channel. Causes include heavy rains from monsoons, hurricanes and tropical depressions, foreign winds and warm rain affecting snow pack. Unexpected drainage obstructions such as landslides, ice, or debris can cause slow flooding upstream of the obstruction.
- **Fast kinds:** include flash floods resulting from convective precipitation or sudden release from an upstream impoundment created behind a dam, landslide, or glacier.
- **Estuarine floods**
- Commonly caused by a combination of sea tidal surges caused by storm-force winds. A storm surge, from either a tropical cyclone or an extra tropical cyclone, falls within this category.

Types of Floods

http://en.wikipedia.org/wiki/Flood

Estuarine and coastal

- Flooding in estuaries is commonly caused by a combination of sea tidal surges caused by winds and low barometric pressure, and they may be exacerbated by high upstream river flow.
- Coastal areas may be flooded by storm events at sea, resulting in waves over-topping defences or in severe cases by tsunami or tropical cyclones.
- A storm surge, from either a tropical cyclone or an extratropical cyclone, falls within this category.

Catastrophic

- Catastrophic flooding is usually associated with major infrastructure failures such as the collapse of a dam, but they may also be caused by damage sustained in an earthquake or volcanic eruption.
- See outburst flood.

Flooded I-10/I-610/West End Blvd interchange and surrounding area of northwest New Orleans and Metairie, Louisiana

Types of Floods

http://en.wikipedia.org/wiki/Flood

Urban flooding

- Urban flooding is the inundation of land or property in a built environment, particularly in more densely populated areas, caused by rainfall overwhelming the capacity of drainage systems, such as storm sewers.
- Although sometimes triggered by events such as flash flooding or snowmelt, urban flooding is a condition, characterized by its repetitive and systemic impacts on communities, that can happen regardless of whether or not affected communities are located within formally designated floodplains or near any body of water.
- There are several ways in which stormwater enters properties:
  - Backup through sewer pipes, toilets and sinks into buildings
  - Seepage through building walls and floors;
  - The accumulation of water on property and in public rights-of-way;
  - The overflow from water bodies such as rivers and lakes.

Floods in 2013 in Boulder, Colorado

Types of Floods

http://en.wikipedia.org/wiki/Flood

Riverine

- River flows may rise to floods levels at different rates, from a few minutes to several weeks, depending on the type of river and the source of the increased flow.
- Slow rising floods most commonly occur in large rivers with large catchment areas. The increase in flow may be the result of sustained rainfall, rapid snow melt, monsoons, or tropical cyclones.
- Localised flooding may be caused or exacerbated by drainage obstructions such as landslides, ice, or debris.
- Rapid flooding events, including flash floods, more often occur on smaller rivers, rivers with steep valleys or rivers that flow for much of their length over impermeable terrain.
- The cause may be localised convective precipitation (intense thunderstorms) or sudden release from an upstream impoundment created behind a dam, landslide, or glacier.
- Dam-building beavers can flood low-lying urban and rural areas, occasionally causing some damage.

October 12, 2005

September 19, 2005

- Dozens of villages were inundated when rain pushed the rivers of northwestern Bangladesh over their banks in early October 2005. The MODIS instrument on NASA's Terra satellite captured the top image of the flooded Ghaghat and Atrai Rivers on October 12, 2005.
- The deep blue of the rivers is spread across the countryside in the flood image

Principal types of flood

Flooding can be divided into different categories according to their **duration**:

1. Slow-Onset Floods

Slow-Onset Floods usually last for a relatively longer period, it may last for one or more weeks, or even months. As this kind of flood last for a long period, it can lead to lose of stock, damage to agricultural products, roads and rail links.

FLOODS IMPACTS

- Human Loss
- Property Loss
- Affects the Major Roads
- Disruption of Air / Train / Bus services
- Spread of Water-borne Communicable Diseases
- Communication Breakdown
- Electricity Supply Cut off
- Economic and Social Disruption
- Increase in Air / Water Pollution

Effects of Floods

Primary Effects

- Loss of life
- Infrastructure damage, including buildings, bridges, sewerage systems, transport, and electricity facilities, that affect relief, communication, and drinking water
- Agriculture
- Water born diseases

Secondary and Long-term Effects

- Post-traumatic stress disorder
- Livelihood

Impact Differences

Flood Impacts	Droughts Impacts
Flood impacts occur in individual watersheds Floodplains are the main impacted areas	Droughts cover very large areas The impact can be over large watersheds
The source of the flood water usually is long distance away from the flood impact	The impact is regional and not specific to floodplains
The impact is over relatively short time periods (Days-Weeks)	The impact is over longer periods (Months- Years)

Floodwater Management Practices

Traditional Approach	New Ecological Approach
Engineering, Structural	Natural, Ecological
Upstream Quick flow & Conveyance Push high water downstream Stormwater Pipes Streightening Channels Armoring Channels	**Upsteam** Spread & retain water Infiltration and slow release Raingardens, Pervious Pavement Temporary Storage Ponds, Swales Wetlands, Wide Buffers
In Floodplain Structural Engineering Dykes, Levees, Dams Protection Systems Flood Proofing Non-structural: Zoning	**In Floodplain** Recreate Natural Channels Wide Riparian Zone with Wetlands Create Side Channels Designate areas for Temporary Water Storage, Zoning,

Earthquakes

Earthquakes occur along plate margins (where plates meet). When plates move past, towards or away from each other the movement is not smooth. Friction causes the plates to get stuck. This causes pressure to build up. Earthquakes occur when this build up of pressure is released. The point where the earthquake starts is called the focus. Energy waves race rapidly from this point.The point at ground level, directly above the focus, is called the epicentre.

What Causes Earthquakes?

- Most earthquakes occur when rocks fracture, or break, deep within Earth.
- Fractures form when stress exceeds the strength of the rocks involved.
- **Stress** is the forces per unit area acting on a material.
- **Strain** is the deformation of materials in response to stress.

What causes?

- Earthquakes are caused by tectonic movements in the Earth crust.
- The main cause are the tectonic plates.
- One rides over the other, causing orogeny (mountain building), earthquakes and volcanoes.

Earthquakes shake buildings in California.

This image was tweeted by @ashbel_nialler

CYCLONE HUDHUD

GITTS

Before
After

- **Extremely Severe Cyclonic Storm Hudhud** was a strong tropical cyclone that caused extensive damage and loss of life in eastern India and Nepal during October 2014.
- Hudhud originated from a low pressure system that formed under the influence of an upper-air cyclonic circulation in the Andaman Sea on October 6. Hudhud intensified into a cyclonic storm on October 8 and as a Severe Cyclonic Storm on October 9. Hudhud underwent rapid deepening in the following days and was classified as a Very Severe Cyclonic Storm by the IMD. Shortly before landfall near Visakhapatnam, Andhra Pradesh, on October 12, Hudhud reached its peak strength with three-minute wind speeds of 185 km/h (115 mph) and a minimum central pressure of 960 mbar (28.35 inHg). The system then drifted northwards towards Uttar Pradesh and Nepal, causing widespread rains in both areas and heavy snowfall in the latter.
- Hudhud caused extensive damage to the city of Visakhapatnam and the neighbouring districts of Vizianagaram and Srikakulam of Andhra Pradesh. Damages were estimated to be ₹21908 crore (US$3.4 billion) by the Andhra state government. At least 124 deaths have been confirmed, a majority of them from Andhra Pradesh and Nepal, with the latter experiencing an avalanche due to the cyclone.

Indian Ocean tsunami 2004

(a secondary impact of an earthquake)

Causes

- The earthquake that caused the tsunami struck at 7:58am on December 26th 2004
- The earthquake was caused by the subduction of the Indo-Australian plate (oceanic) under the Eurasian plate (continental) 240km off the coast of Indonesia
- This mega-thrust earthquake involved a 20 metre uplift of the sea floor all the way along a fault line which was over 1000km in length
- The uplift of the sea floor caused a displacement of billions of tonnes of water setting in motion a tsunami wave which hit the coast of Indonesia within half an hour of the earthquake

Indian Ocean tsunami 2004

(a secondary impact of an earthquake)

Secondary effects of the tsunami

- Diseases such as cholera and dysentery spread due to the lack of clean water and sanitation in the refugee camps killing an estimated 150,000
- Incomes were lost due to the destruction of fishing boats and damage to the ocean bed
- Loss of foreign income from tourism was significant in Thailand
- Emotional and psychological impacts on the survivors and aid workers
- Land disputes broke out as documents were lost in the devastation and in some cases land was destroyed by erosion from the wave

Boxing Day Tsunami

- In the Indian Ocean in 2004.
- At destructive plate margin.
- 9.1 on Richter Scale.
- Plates moving down into the mantle cracked, moved quickly, lots of water displaced. Triggered tsunami, 30m high waves.

abstract

The recent **cloudburst** centered on the North Indian state of **Uttarakhand** caused devastating floods and landslides - the country's worst natural disaster since the 2004 Tsunami.

The subsequent natural disaster in the form of massive inundation should make many of us sit up and take notice. It is true that notwithstanding all disaster management plans, man is helpless against the vagaries of nature also borne out by regular loss of lives and property.

The tardiness of the information flow undoubtedly reflects both the exceptionally difficult terrain in this area and the magnitude of the damage. However, we can definitely be better prepared to face any such contingency for minimising the losses and damages.

The clinched but hoary dictum rightly says, "**prevention is always better than cure**".

- They occur most often in desert and mountainous regions, and in interior regions of continental landmasses.
- During a cloudburst, more than 20 mm of rain may fall in a few minutes. They are called 'bursts' probably because it was believed earlier that clouds were solid masses full of water. So, these violent storms were attributed to their bursting.
- When there are instances of cloudbursts, the results can be disastrous. Cloudburst is also responsible for *Flash flood* creation.

NATURAL REASON…

- This caused the melting of Chorabari Glacier at the height of 3800 meters , and eruption of the Mandakini river which led to heavy floods near Gobindghat, KedarDome, Rudraprayag district, Uttarakhand, Himachal Pradesh and Western Nepal ,and acute rainfall in other near by regions of Delhi, Haryana, Uttar-Pradesh and some parts of Tibet.

Causes

- Flooding in rivers is generally caused by heavy concentrated rainfall in the catchments during the monsoon season, which is sometimes augmented by snowmelt flows.
- The inadequate existing discharge capacity of some of the important structures (Barrages and Rail or Road Bridges) on Rivers Indus, Chenab and Ravi are another major reason of flooding.

CAUSES!!!

NATURAL

- Cloud Bursting.
- Flood.
- Landslide.

MANMADE

- Roads destabilizing mountains.
- Threat from dams (Hydel projects)
- Deforestation.
- Tourism (Resorts, Hotels)
- Infrastructure.

- Overview of Uttarakhand
- Flooding in Uttrakhand
- Other affected regions
- How local people looted pilgrims.
- Consequences
- Rescue and relief operations.
- Causes of the disaster
- Measures to reduce the intensity

Role of Media

During disaster: Media Organizations take lead in relief and rehabilitation projects. The media plays the roles of relaying the measures being taken.

- Providing latest information and update.
- Broadcast for the assistance of the Medical, Police, Civil Defence
- Make Announcements of the disaster and the preventive measures to be taken by the search & rescue.
- Food, water, medicines and other immediate need material. Sanitation and hygiene in the effective area and camps.
- Identify needy spots and cautioning the affected people of the do's & don'ts. Establishing contacts, informing and assuring the affected ones of the assistance and the measures of relief

GANGOTRI
KEDARNATH
BADRINATH
HEMKUND
GAURIKUND
JYOTIRMATH
ROOPKUND
WORST AFFECTED
AREAS

UTTARAKHAND FLOOD '13
The Himalayan Tsunami
MAN'S OWN
DOING ?

NewsClick.in

What Causes Volcanic Eruptions?

- Earths crust is comprised of 17 tectonic plates that continually move on top of earths mantle (a layer between the crust and the outer core). Volcanic eruptions occur when these tectonic plates diverge movement of these tectonic plates. Volcanoes also form when there is stretching and thinning of the earth's crusts.
- Volcanic eruptions occur when gas trapped beneath these tectonic plates violently extrudes onto earths crust along with molten rock from within earths mantle.
- The strength of volcanic eruptions depends on gas pressure, and the ease with which lava is able to flow.

Climatic Effects of Volcanic Ejecta

- Volcanic dust blasted into the atmosphere causes temporary cooling.
- Volcanoes that release huge amounts of sulfur compounds affect the climate more strongly than those that eject just dust. Combined with atmospheric water, they form a haze of sulfuric acid that reflects a great deal of sunlight which may cause global cooling for up to two years. Much more at:

http://www.cotf.edu/ete/modules/volcanoes/vclimate.html

EFFECTS OF VOLCANO

- Positive Effects:

b) Ash add to the soil fertility – farming

c) New minerals may be discovered

d) Promotes Tourism

e) Research and education purposes.

f) Geothermal Energy – renewable energy.

- Negative effects

b) Loss of life

c) Loss of property (economic loss)

d) Air Pollution (ash, smoke, gases, acid rain etc)

e) Water pollution

f) Lahars (mudflows with water)

g) Earthquakes

h) Increase in temperature of the area

ash/gas
side vent
crater
layers of ash
and lava
lava flow
magma

Ash Cloud
Vent_Crater
Side Vent
Lava Flow
Flank
Pipe
Rock Layers
Magma Chamber

Shifting ground
Some homes in southwest Colorado Springs were built on a large, slow-moving, ancient landslide, parts of which were awakened by heavy rains spring. Now, homeowners in the area are seeking buyout grants, while others are trying to fix their properties. Below is what these slides look like.
CROWN
MAIN SCARP
Crown cracks
MINOR SCARP
Toe of surface of rupture
Transverse cracks
ROTATIONAL SLIP PLANE
EARTH FLOW TOE
Sharp blocks and intermediary scarps
Surface of separation where landslide material has overridden intact soil or bedrock

LAND SLIDE

LAND SLIDE -AVALANCHE

At least 2,000 people are believed to have been killed after a massive avalanche of rocks and ice buried an entire mountain village and several settlements in north-west Peru.

Role Of Information Technology In Environment and Human Health

- One of the important fields of IT for environmental studies is Geometrics.
- Geometrics is a science and technology for collecting, analyzing, interpreting, distributing and using geographic information.

  Geometrics involves the following,

  - **Surveying and mapping**
  - **Remote sensing**
  - **Geographic information system(GIS)**
  - **Global positioning system(GPS)**

Role of IT in Environment:

- Remote Sensing and GIS (Geographic Information System) provides data and knowledge concerning the global environment as it is used for mapping and monitoring various natural resources.
- IT is used for computer based modeling and simulation of environmental scenarios for analysis and prediction of climate change and weather.
- IT enables environmental scientists and researchers around the world to communicate, collaborate and coordinate.

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Role of IT in Environment

John researches and tests on different soil samples and plants and in a way shows his love for his motherland. He then submits this project as his major project.

Shah And Anchor Kutchhi Engineering College

Role of IT in Environment

GIS operations

Sensor data resource
Weather resource
Weather data
Structured data resource
Services resource
Location date/time
Geocoder
Agricultural database
Soil survey
Lawrence, KS
Weather data
Farm helper
Crowd intelligence
Latitude: 38° 57′36″ N
Longitude: 95° 15′12″ W
Date: 10-9-2007, Time: 1345h
Soil information, pest information ...
"Looks bad, but I don't know what it is. Any help would be appreciated."

Remote Sensing
Satellite
Sun
Incident Solar Radiation
Reflected Solar Radiation
Atmosphere
Forest
Water
Grass
Bare Soil
Paved Road
Built-up Area

Remote Sensing
Information Management
Earthquakes
Precipitation
Tsunamis
Cyclones

Shrinking & swelling clays
Flooding
Quarrying
Drainage systems
Coastal erosion
Urban development & landuse change
Landslides
Groundwater abstraction
Use of underground space
Landfill
Energy
Mobilisation of pollutants

GPS
Outdoor Wireless LAN facilities
Distributed Vision system
Electric Tag
Electric Tag
Intelligent Car for the elderly / Robot car
Informationally Structured Store and Building (Convenience store, Restaurant, Hospital, Pharmacy) Electric Tag, Indoor Map

Ways To Protect The Environment

There are many ways we can prevent environmental problems, especially Global Warming. Common and simple ways we can help save our environment are as follows:

1. Stop using spray products with CFC's
2. Stop burning wastes especially non-biodegradable.
3. As individuals, the only thing we can help prevent environmental problems is to keep our environment clean.
4. Plant more and more trees. Stop Deforestation.
5. Use Public transport to Travel as it will save money, fuel and there will be less air pollution.

Spectrum of environmental concern and activism

Radical change

Sustainable Development

Market-based solutions

Eco-centric

Anthropocentric

Deep ecology

Environment Ministry

Conservationists, Hunters

Development of environmentalism

- Rising awareness
- National legislation
- First Earth Day: 1970

THE GAYLORD NELSON NEWSLETTER

Washington, D.C.

Earth Day - 1970

Mass Movement Begins

Thousands Marched

"Everyone's Beautiful"

Special Legislation

900 Invitations

Competing social functions of the environment

About 1900

Today

(Hannigan 2006:19; Dunlap 1997)

HOW WE'RE HURTING THE ENVIRONM

- We are destroying the ocean & polluting the air by making & using plastic bags.
- We are polluting the ocean by throwing Garbage.
- We are polluting the air, soil & ocean by using pesticides & Chemicals.

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CONSERVE & PROTECT OUR ENVIRONMENT

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Trees

Save Trees

Cutted Trees

fppt.com

Save Trees! Save Environment

Today, when environment is being polluted so rigorously, everyone has only one question on his / her lips and mind that is how to save environment from being polluted. How to protect earth from disaster? The strongest way to protect environment is save trees. Trees are one of the main creations of God that play an important role to keep air clean. If there will be no fresh air available then how human beings, animal, and birds survive; therefore, a clean environment is the need for every living object on this earth. Many big organizations, schools, colleges, and NGOs are taking initiatives to save trees for a better future, clean air, and unpolluted environment, in short healthy life for living objects.

One of the biggest initiatives to save trees is taken by Idea Cellular Ltd. - a part of Aditya Birla Group. Today, trees are being cut with a great speed for full filling daily needs of human beings. It is true that we need to cut trees for our daily needs but cutting trees in such a furious way is leading towards a disaster. You might have noticed that as the number of trees is reducing; disasters are being continuously increasing, which is ultimately leading into high death rate. A big part of the trees is cut to make paper to help us do our personal and official works. If the use of paper will be minimized then we can save a large number of trees from being cut, which leads into healthy and clean environment that is fresh air and healthy life.

Oxygen

Oxygen-Cycle

Oxygen Chart

fppt.com

The Cost of Oxygen !! Very Interesting !!

In one day a human beong breathes oxygen equivalwnt to 3 cylinders. Each oxygen cylinder on an averafe costs Rs. 700/-, without subsidy.

So, in a dat one uses Oxygen worth Rs. 2,100/- and for a full year it is Rs. 7,66,500/- and, If we consider an average life span of 65 years; the costs of oxygen we use become a staggering sum of Rs. 500,00,000/- = Rs. 50 million. All this oxygen is derived free of cost from the surrounding trees.
Very few people look at trees as a RESOURCE and there is rampant tree cutting going on everywhere which must stop

Oxygen is a colorless, odorless, tasteless, gaseous chemical element with the chemical symbol O and atomic number 8

Plastic Bags

Garbage of Plastic Bags

Plastics in the Oceans

fppt.com

Every year, around 500 billion (500000000000) plastic bags are used worldwide. So many that over one million bags are being used every minute and they're damaging our environment.
(Environmental Cosmos)

- 12 million barrels of oil used to produce 30 billion plastic bags a year
- Millions of these bages are dumped every year.
- Averaged use time of a bag is only 12 min!
- These bags are not only hurting our oceans but they are wasting energy & polluting our environment.

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Water

Save water, it will save you later!

There's no doubt that water is important. Not only do we humans use it just about every day, but every living thing needs it to live. It has helped form the Earth as we know it, and it covers over 70% of the Earth. Even where there is land, much of it is covered in ice, which is obviously just solid water. The importance of water is clear to us in many ways, and we can't overlook it.

Where would people be without water? Well aside from, you know, not being alive, we may never have evolved the big brains that make us such a unique species. Some say that that learning how to keep, and transport water over land was the key to our survival when other similar species just kept dying off.

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How we can Save the Water ?

Did you know?...

Flushing the toilet accounts for 30% of household water usage. By placing a brick in the toilet cistern we could save 10 million litres of water a day.

Water is a precious natural resource that is often taken for granted. The Greater Dublin Region consumes 110 million gallons (500MI) of drinking water per day. This puts an enormous strain on the water supply to meet an ever-increasing demand. To help you ease the strain and save this precious resource, here are a few tips on how to save water around your home, office or school.

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discharging untreated wastewater
BEFORE the project
using poison for fishing
drinking water directly from marshes
removing organic nutrients and pollutants
packeged treatment units for purifying water
AFTER the project
no poison for fishing!
cleaner water
safe drinking water

Pestisides

The **environmental impact of** pesticides is often greater than what is intended by those who use them. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, including nontarget species, air, water, bottom sediments, and food. Though there can be benefits using pesticides, inappropriate use can counterproductively increase pest resistance and kill the natural enemies of pests. Many users are inadequately informed about potential short and long-term risks, and the necessary precautions in the correct application of such toxic chemicals are not always made. Pesticides can contaminate unintended land and water when they are sprayed aerially or allowed to run off fields, or when they escape from production sites and storage tanks or are inappropriately discarded.

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Sustainable solutions exist

- We must develop solutions that protect both our quality of life and the environment
- Organic agriculture
- Technology
  - Reduces pollution
- Biodiversity
  - Protect species
- Waste disposal
  - Recycling
- Alternative fuels

Are things getting better or worse?

- Many people think environmental conditions are bette Human ingenuity will solve any problem)
- Some think things are much worse in the world (predict doom and disaster)
- How can you decide who is correct?
  - Are the impacts limited to humans, or are other organisms or systems involved?
  - Are the proponents thinking in the long or short term?
  - Are they considering all costs and benefits?

Sustainability: a goal for the future

- How can humans live within the planet's means?
- **Sustainability**
  - Leaves future generations with a rich and full Earth
  - Conserves the Earth's natural resources
  - Maintains fully functioning ecological systems
- **Sustainable developmer** the use of resources to satisfy current needs without compromising future availability of resources

Will we develop in a sustainable way?

- The **triple bottom line**: sustainable solutions that meet
  - Environmental goals
  - Economic goals
  - Social goals

- Requires that humans apply knowledge from the sciences to
  - Limit environmental impacts
  - Maintain functioning ecological systems

Conclusion

- Environmental science helps us understand our relationship with the environment and informs our attempts to solve and prevent problems.
- Solving environmental problems can move us towards health, longevity, peace and prosperity
- Environmental science can help us find balanced solutions to environmental problems

SAVE THE EARTH
DO SOMETHING
YOU MATTER
VOTE
Google
research
REDUCE, REUSE, RECYCLE
reusable shopping bags
print on both sides
aluminum bottles
FOOD
eat local
cut back on meat
GREEN ENERGY
use the sun open windows
turn off lights
switch to fluorescent
TRANSPORTATION
public transit
walk
bike
carpool
reduce air travel
AT HOME
turn off the H2O when brushing your teeth
shut down at night
washing with cold water = less electricity

Different looks of SMART CITY

FEMS example:-

- Visualization system interconnected with various production information such Monitoring & Control on a real time basis

BEMS : Bettery Energy Management System
CEMS : Community Energy Management System
EV : Electric Vehicle
FEMS : Fuel Energy Management System
HEMS : Home Energy Management System
SCADA : Supervisory Control and Data Acquisition

Community Energy Managemenet System

REPLACING PLASTIC CARRY BAGS (LIAN @ BHAVANI)

Jute bags shall be distributed free of cost to the employees in techno park to create awareness to switching them to natural fiber bags. The plastic bottles as well as plastic cover will be collected from the employees and in return they will be given jute bags. The durability of jute bags will help us to replace plastic bags in the long run. CSR activities can be initiated to build a plastic free future.

GREEN CLUB COUNTERS

(@ NILA,BHAVANI,THEJASWANI,PARK CENTRE)

To Develop a culture of going green we should unite. A green movement has to be developed with the participation of youngsters. We are in the move to raise our efforts via green club. Implementing green projects through green club and giving the youngsters its benefits is what GGSE follow. Join us and be part of the movement. Free registration and reap the unlimited benefits from GGSE.Together we can make change. Counters can be sponsored by the companies.

PLANTING SAPLING

Planting a sapling on a special occasion is better than wasting money on partying. Develop a culture of gifting a sapling. Show your respect to mother Earth.

GREEN PAVILION

Kerala is known to be Gods own county with its unique beauty with its greenery. Walk through the beauty of Kerala by the exhibition arranged. Employees can participate by exhibiting their unique clicks of nature.

GREEN WALK

(4:30 FROM THEJASWANI TO BHAVANI BUILDING)

A tribute to Mother Earth by a walk is what GGSE wish. We need employee participation. The Employees can join and celebrate Earth Day. Free Medical check up is arranged to the Green Club members.

SAPLING DISTRIBUTION

Free sapling Distribution shall be done by GGSE.Plant a sapling, water a sapling and create a green future. As the famous saying Prevention is better than cure, let us prevent a dry,polluted,high humid future.

GREEN SHOP

A shop that delivers Organic fruits,vegetables,homely food, healthy juice etc at low cost. Vegetables shall be cultivated from the green club and the same shall be placed in the green shop.Crafts,art works and other hand made items from the green club members can be displayed in the green shop. Actions speak more louder than words. Let us act now for a better tomorrow.

GREEN THOUGHT

Express your thoughts by scribbling on the board. Scribble your suggestions ,your ideas and much more green initiatives. Spread the message and support for going green.

GREEN HOME

Green homes through out the district,state,country change the polluted scenario. Let us join hands to implement each and every concept of going green. A biogas plant, Solar power, rain water harvesting system and waste management system is what GGSE wish to implement.

GREEN PARK

A medicinal garden with lawn, Park benches, Lighting system and light music system. A good place to breathe and stay relaxed. wish to implement.

GO GREEN BE HEALTHY

A free medical camp to the employees. Ayurveda can change many life style diseases to the techies.Free consultation shall be arranged. Medicines shall be given on a 20% discount to the Green club members.

http://www.homeharvestfarms.com/
artwork: Sam Bradd

"WE HAVE MET THE ENEMY AND HE IS US."
...POGO

make choices based on your reflection
CHOOSE
ACT
ACTION CYCLE
think about the local & global consequences of your actions
Carry through with your choices
REFLECT

Economy
Society
labor & regulations
Environment

HOW TO HELP SAVE THE ENVIRONMENT

Reduce, reuse and recycle metal, paper and plastic.

Reduce: Try to use less (for example, use both sides of paper).
Reuse: Try to use again (for example, reuse your plastic bags.).
Recycle: Put in the recycling bin (for example, save your empty drink cans to put in the recycling bin.

You can find recycling bins in your building or on the street...

Set up special bins at home

- Hong Kong produces more than 6 million tonnes of waste - let's try and cut it down! Our landfills will be full in the next few years.
- We can also recycling some bigger things. Give old toys to friends and go to gov.hk/en/residents/environment/waste to see how we can recycle these things... →

* Computers
* Rechargeable batteries
* Televisions
* Refrigerators
* Washing machines
* Video or audio equipment
* Microwave ovens
* Fans
* Water heaters
* Rice cookers
* Air-cons and heaters

TIPS TO SAVE THE EARTH

A UN report entitled 'Kick the CO_2 Habit: The UN Guide to Climate Neutrality' outlines ways for people to combat global warming

Pack lighter suitcases. It says that world savings would be **2 million tonnes a year** if every airline passenger cut the weight of baggage to below 20kg and bought duty free goods on arrival

Use a wind-up alarm clock rather than an electric one: **Save 48 grams of CO_2 a day**

Dry clothes on a washing line rather than in a tumble dryer **Save 2.3kg of CO_2 per load**

Go jogging in a park rather than on an electric treadmill

Use a non-electric toothbrush **Save 48 grams a day**

Heat bread rolls in a toaster rather than in the oven for 15 minutes – **Save 170 grams of CO_2 each time**

Take a train rather than a car for a daily commute of 8km **Save 1.7kg CO_2 a day**

Reduce winter heating: Cutting the temperature by a couple of degrees **Saves 6% in energy bills**

Avoid 'carbon binges': A return flight across the Atlantic is **equivalent to running a car for a year for each passenger**

Source: Reuters

5 WAYS TO SAVE THE ENVIRONMENT — BY FUNHLIFE

PRESERVATION AND CONSERVATION OF ENVIRONMENT

Definition of preservation and conservation of the environment

Preservation is an unchanged or perfect condition without disturbing the balance of nature while conservation is a systematic and sustainable use of natural resources without harming living things and the environment.

The importance of preservation and conservation of the environment

The importance of conserving our countryside and environment is colossal. The environment is our home and our food source, and we would have a hard time surviving if we did not conserve it. Trees and plants make oxygen, prevent soil erosion, and keep the air cool so we can have an ideal living environment.

The practise of reusing materials

Reuse is an incredibly important functionality in our society when flexed and can (and does) divert millions of tons of garbage from landfills every year.

The practise of recycling materials

Recycling is a process to change material (waste) into new products to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution (from incinerator) and water pollution (from landfilling) by reducing the need for "conventional" waste disposal, and lower greenhouse gas emissions as compared to plastic production

17th Century has been described as the

AGE OF FAITH

18th Century is considered as the

AGE OF REASONING

19th Century was

AGE OF PROGRESS

20th Century was AGE OF STRESS

Will 21st Century be

Age of Panic or Age of Peace?

You have to decide.