ANUDEEP DURISHETTY
AIR 1, CSE 2017

# Env$^t$ Impact Assessment

Intro

def$^n$ (Wiki): UNEP defines EIA as an assessment of the +ve and -ve impact that a proposed project may have on the env$^t$ consisting of env$^t$, Social & economic Costs.

Assess$^n$ for Int$^l$ Impact Assess$^t$ ↑ (UNEP) : the process of identifying, predicting, evaluating and mitigating the biophysical, social and other relevant effects of development proposals prior to decisions being taken and commitments made. (one-stop)

- EIAs make policy makers justify their decisions in light of detailed env$^t$ studies and public comments on the potential impacts of the proposal.
- Nat. Env$^t$ Policy Act (NEPA) (of USA) was enacted in 1970 — basis of EIA.

## Summary Notes

Process: 2 Stages before full scale EIA Commences — a) Screening
b) Preliminary assess$^t$

These are regulatory in nature. These 2 tiers of assessment should be applied to the project before EIA.

EIA, then is of 2 types < Rapid EIA (incorporate data from 1 season (but not monsoon)
Comprehensive EIA (incorporates data from all 4 seasons)

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

**Screening**: helps clear of those types, which from past experiences are not likely to cause Significant env problems.

Involves: measurements using simple criteria – size/location

Comparing with projects rarely needing EIA (school) must need EIA

estimates broad impacts.

**drawbacks**: – Even some small scale industrial (eg: Rubber) projects might have –ve impact.

– Giving caste blanche is undesirable. No objective study done that demonstrates that projects under a given value always have no impact

**Preliminary Assessment**: If screening doesnot clear a project, developer may undertake this.

involves:
- Sufficient research, review of available (the key words) data
- identify broad/key impacts.
- predict extent of impacts, evaluate their importance

P.A helps as an early warning system. Once cleared, EIA commences

**EIA team formation**: taken up by developer to prepare EIA

drawback:
a) no proper repn of Social Scientists, Anthropologists, Eco experts
b) conflict of interest.

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

**Scoping** : Aim is to ensure that study's scope address all issues of importance comprehensively to the d-m^rs.

✓ Team's outlook - broadened by discussions with stakeholders → govt, envt, cs, local community etc

**drawback** - a) public comments → not taken seriously
b) Coverage of scope → limited to only major impacts ⇒ not comprehensive enough

**MAIN EIA** - 5 Stages : (5 questions)

✓ IDENTIF^N : What will happen as a result of the project?
✓ PREDIC^N : What will be the extent of changes?
✓ EVALUAT^N : Do the changes matter?
✓ MITIG^N : What can be done to mitigate adverse impacts?
✓ DOCUMENT^N : Determining how & when EIA's finding will be communicated to d-m^rs

---

**Identif^n:**
✓ Compiles list of key impacts (eg: on air quality, soil toxif^n, water pattern etc)
✓ names sources of impacts (smoke emiss^n, labour mig^n etc)

drawbacks: a) lack of reliable data, dubious at times
b) data collectors do not pay heed to local people's indigenous knowledge

**Predic^n:** Implies evaluating the extent of changes within a single parameter
eg: toxic effluents, effect on fisheries etc,

Employs mathematical models, techniques to quantify impacts
By their very nature, these type of exercises involve some degree of uncertainty

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

**Drawback** : Detailed method use to arrive at predicted impacts ~~& mon~~ mentation

**Eval$^n$** : - asks : do the changes matter ?

is evaluates in light of predictn whether changes are significant enough to warrant mitigation.

Judgement based on :
1) acceptability to local community ✓
2) Consult$^n$ with d-m$^{rs}$ ✓
3) Comparision with accepted standards / laws / rules ✓

**Mitigation** : Measures proposed ✓ to prevent / remedy / reduce . by

→ Changing project sites, routes, processes, raw-mat ✓
→ introducing pollution controls, waste treatment ✓
→ Offering restoration of damaged sources → money to displaced persons, CSR etc

* The study team should explicitly analyse the implications of adopting differe alternatives, to help make choices clearer for d-m$^{rs}$

Cost-benefit analyses, Matrix method, OR etc are used

**Drawbacks** - a) Lacuna in implement$^n$ of mitig$^n$ measures, they remain only on pap
b) Some are kept confidential Eg : nuke project etc,
c) Community not involved
d) disaster red$^n$ plans not prepared (Eg : Showcased by UK floods)

**Document$^n$** : Providing d-m$^{rs}$ with a comprehensive report enlisting all inputs/ measures for easy d-m.

Includes exec summary, inputs, mitig$^n$ measures, overview of gaps, Summary fo general public.

Scanned by CamScanner

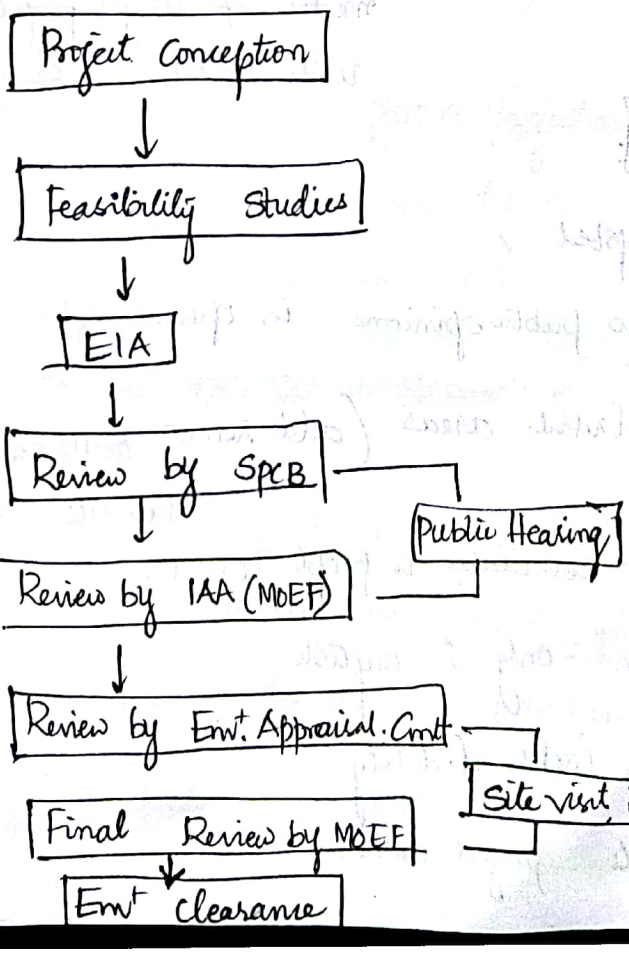
ANUDEEP DURISHETTY
AIR 1, CSE 2017

drawback : ( Imp part)

- Quality of EIA report : incomplete in analysis, false data, (∵ no centralised data bank)
  Single season data - Rapid EIA
- Conflict of interest : leads to biases ∵ consultant paid by project proponent
- Expertise of consultant is doubtful/questionable : (Eg: Orissa - Reliance project EIA entrusted to Dept of * Behrampur univ - no expertise on Olive Ridley Turtles near Orissa Coast)
- Bulky, technical report ✓
- Not published in local language ✓
- Community not involved, if involved not taken seriously. ✓

✓ Green Peace activists also cry foul about the Mithivirdi Nuclear plant's EIA

## Env$^t$. Appraisal procedure




Useless layers of bureaucracy

SPCB
IAA
Env$^t$ Appraisal Cmt

IAA : Impact Assessment Agency

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

## I Drawbacks with Appraisal procedure

(Need to memorise this section well)

a) Project developers often indulge in site clearance even before EIA is done

b) Env^t clearance is granted despite public objection : reasons are not conveyed

c) Infact, env^t clearance process after public hearing is a closed door secretive process

→ ie, people have no access to the rationale behind which clearance is given

no rationale given

### Public Hearing (Check pg 13, 14 of pdf - nothing much imp)

Panel mem : SPCB rep ✓

DC ✓

State env^t ministry rep ✓

State govt ministry dealing with the project (eg: Coal, Power etc.) ✓

≤ 3 reps from local bodies - PRI/ULB ✓

≤ 3 senior citizens nominated by DC from that area ✓


Projects exempted from P. Hearing : mining projects ≤ 25 ha ✓

Widening of highways ✓

modern of irrign projects ✓

Units located in SEZ/EPZ ✓

## II Drawbacks in p-hearing :

- no. of projects exempted ✓
- Little value given to public opinions ie, opinions often not taken into acct before giving clearance
- Lack of literacy esp. tribal areas (add recent palli sabha example - Niyamgiri bauxite @ Orissa)
- Documents are seldom available to people on time
- Local language : EIA - only in english
- Minutes of meeting lacks fidelity
- Local admn Supports project owners.

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

(V) **Other drawbacks**: (Others than those related to Screening, Scoping, Mitign, Document$^n$, Appraisal procedure, P. hearing)

Reg. MoEF Offices are lax in monitoring.
reg. to Monitor as per set stds, but people rarely know what are these stds. Besides SPCB has its own stds

Monitoring ✓
Capacity building ✓
Grievance Redressal ✓ → People, Judiciary ✓

Check highlighted portion (pg. 16, 17)

↳ Nat$^l$ Env$^t$ Appellate Authority (NEAA) heard only ~~20~~ 15 cases in last 8 yrs.

**Recommendations**

Independent EIA Authority ✓ needed.

1. Capacity building ✓ (local communities, NGO, judges sitting over these cases)
2. Redressal : NEAA's scope expanded to look into all violation of EIA norms
3. Monitoring : MoEF → reg offices must be set up with experts : eco, socio etc, involve local communities in effective monitoring.
4. Composition of expert cmt : Present exec committee must reflect a fair balance : need for reputed env$^t$ sociologists
5. Grant of clearance : – Reasons for approval/rejection must be communicated in clear/unambiguous terms.
   – Minutes of expert meetings can be made public
6. Public hearing : Can be done in 3 phases : explaining ✓, discussing ✓, voting ✓
   Video recording be made mandatory
   Minutes of meeting must reflect fidelity
   ← Rectify loopholes given in prev page.
7. Quality of EIA reports : Independent EIA Authority (with jud. officers & reps from Cs, env$^t$, Scientists etc.)

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

- Sector wide EIA needed for Conducting Strategic Env Assessment
- Creation of Info desk to which anyone can write reg. Status of clearance
- Prep of "disaster red$^n$ plan" ✓
- Exceptions to be trimmed down
- EIA must also assess Bio-div of the region & projects impact
- no rapid EIA – only Comprehensive EIA.
- Independent EIA. Sol$^n$ → a central fund can be created to be deposited by developers while seeking EIA.

+ SG, CG can maintain Credible list of Competent agency to Conduct EIA.

i.e, an accreditation agency is needed.

---

GIST

EIA drawbacks

- Screening
- P. Assessmt
- Scoping, Id$^n$, Predict$^n$, Evaluation, Mitig$^n$, Documents
- Public hearing
- Appraisal procedure.
- Monitoring, Cap. Building, Grievance redressal ✓

Sol$^n$ :

- Indep authority
- exempted list ↓
- involving Communities
- Reg MoEF – n monitoring
- disaster red$^n$ plan
- NEAA : Scope, experts as judges
- Reasons
- public hearing ← explain during voting

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

# Envt Pollution [Barucha + pdfs]

Pollution is the introduction of contaminants (undesirable materials) into natural envt that cause adverse change. Pollutants can take the form of ✓ foreign substances (chemical) ✓ energy (heat, noise etc.)

Natural pollutants :
- Volcanic eruption ✓
- Natural radio activity ✓
- Forest fires ✓
- Soil erosion ✓

Sources :

| Air pollution | Sources | Effect |
|---|---|---|
| $SO_2$ | Vehicular combustion<br>Fossil fuel burning | Irritation of eyes<br>Acid rain |
| CO, $CO_2$ | — V. Combustion<br>— burning of Hydrocarbons & biomass | — GW, GH effect<br>CO → Carboxy Hgb → fatal |
| Smoke, Fly ash, Soot | Vehicular exhaust<br>Thermal power station | Respiratory disease |
| Lead, Hg | Dental equipment<br>CFC bulbs, Gasoline, Paints, batteries | Brain damage<br>circulatory system |
| CFC | Refrigerants, Halogens<br>Aerosans, Rubber Vulcanis" | Kidney damage<br>Ozone depletion |

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

# Nos material

Natural Resources
- Biotic : animal : food, domestic etc,
  plant : medicine, food, fuel
- Abiotic : Land -
  Water
  Energy - Sunlight
  Mineral - oil, NGas, iron-ore etc
  Air

**Env$^t$ Degradation def$^n$. (UNEP)** : E. degrad$^n$ is the **deterioration** of the env$^t$ through **depletion of natural resources** – air, water, soil, destruction of ecosyste – extinction of ~~plant &~~ wildlife (includes all plants & animals that are non-domesticated)

✓ I = PAT (Impact/Degradation = Pop$^n$ × Affluence × degrading Technology)

Environmental degradation is quintessentially a man-made phenomena

UNEP captures this in its equation I = P×A×T (pop$^n$ × affluence × degrading techn

## Man-made Causes of Env$^t$ Degradation (7)

→ Population Growth ✓
→ Deforestation ✓
→ Mining ✓
→ Industrialis$^n$ ✓ } related
→ Modernized Agriculture ✓
→ Urbanis$^n$ ✓ } related

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

**Pop$^n$ Growth** :

Causes : ↑ food prod$^n$, agri practices
↑ medicine & drugs
↑ vaccination, ↓ diseases

**Impact on env$^t$** :

(Land, water, air)
+
plant & animal species
+
Mineral resources)

clearing land for more cultiv$^n$
Water scarcity
Slum prolifer$^n$
Materialism
River water degradation

2. **Deforestation**

Causes :
- ✓ over-grazing
- ✓ Shifting agri / normal agri / plantation agri
- ✓ industrialis$^n$, urb$^n$
- ✓ Fuel / MFP
- ✓ Land use change → dev$^t$ projects (dams etc.,)

**Consequences** :

↓ carbon sequestration ✓
Soil erosion ✓
land slides ✓
deforest$^n$ of mangroves → no protection against storms ✓
silting ✓
loss of habitat ✓ - biodiversity loss
Pollution ✓

3. **Mining** :

loss of vegetation
Air, water pollution
Land subsidence
Dumping of debris — soil toxif$^n$

4. **Industrialis$^n$** ✓

5. **Agri** —
- Fertilizers — Bio accumulation, soil toxif$^n$, bio magnif$^n$, Eutrophic$^n$
- Excessive irrigation : Salinis$^n$, Calcif$^n$
- HYV — monoculture, soil degradation
- Cutting down forests

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

**Urbⁿ** : Slum proliferⁿ
Transport, Industry : air pollution
deforestⁿ
Solid waste → river pollution

## Envᵗ Backlash : Consequences

**Local level :**
→ Salination of irrigated soils
→ Eutrophicⁿ
→ Minamata disease (Bio mg of Hg : toxic agents such as $(CH_3)_2Hg$ is formed
→ Extinction of wild life (Eg : Bombay duck, an edible fish extinct due to effluent discha

**Regional Level :**
→ Floods
→ Drought
→ Acid Rain
→ Oil spills

**Global level :**
GW/GHG/CC
Ozone depletion
Freak climate phenomena
Sea level rise

## 9. Desertifⁿ & Deforestⁿ

Forests - are complex ecosystems that comprise mainly of trees & wide variety of fauna.

3 roles <
- productive role (Cinchona (quinine, morphine, cocaine))
- protective role
- regulative role

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

**Deforestn**: Removal of vegetation to the extent that it no longer supports its natural flora & fauna.

Area: 328 m ha
Forest: 67 m ha

**Stats**: Forest Cover: 22.8% Ideal - 33%.

forest cover ↑ from 19% to 22.8% from 1990 → 2012.

UNEP: says
- ✓ 7 m ha rich tropical forests ✓
- ✓ 14 ha every minute ✓

} are lost via deforestation

**Causes**:
- ✓ Industrialn, urb"
- ✓ Agri - Shifting/nomad/plant"
- ✓ Over grazing
- ✓ Devt - mining/dams/urb"
- ✓ Fuel wood - (India: 40% depend on fuel wood for cooking)

**Consequences**:
a) Soil erosion, flash flood, land slides
b) Climate change (rainfall, freak phenomena, El Nino, La Nina, El Nino Modoki)
c) Loss of biodiv
d) No Carbon sequestration

India top soil loss is 18% of global soil loss

Scanned by CamScanner

SREEJA DURISHETTY
AIR 1, CSE 2017

# 10. Env Pollution

Types

- ✓ Air P
- ✓ Water P
- ✓ Soil P
- ✓ Noise P
- ✓ Thermal P
- ✓ Radiation P } new

P.O. Pollutants — dirty dozen
↳ not are resistant to env degrad
↳ called 'dirty dozen': They bioaccumulate on bodies, biomagnify in food chains.
Eg: Pesticides: DDT, Aldrin, Dieldrin, PCB, Toxaphene.
More via food chain: Eg: fish, meat
Health: Lesion, breast cancer, reproductive, neuron, endocrine damage

## Air Pollution

defined as the presence of any solid/liq/gaseous substance including noise/radi in atmosphere in such conc. that may be directly/indirectly injurious to humans/living organisms.

Pollutants → Particulate/suspended material — SPM (dioxins
→ Gaseous material

SPM — usually < 10 μm size; <0.02 μm — aerosols that suspend forever

Sources → Exhaust, power plants, Rail yard, industry etc ✓

Eg: Fly Ash, Lead, etc,
- Fly Ash: Used in making bricks; ejected by power plants
- Lead + Oxides of Mn, Al, Zn etc,
- Lead: Dental equipment, Cement, fertilizer plant, Tetra Ethyl lead — Leaded petrol

SPM: permissible: Residential (140–200 mg/m3)
Actual: Delhi → 370 mg/m3
Industrial (360–500 mg/m3) → 425 mg/m3

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

## Gaseous pollutants

$CO$, $CO_2$, $NO_2$, $CO$, $SO_2$ ✓

Sulphur — Causes Chlorosis : loss of chlorophyll

## Prevention

**Indoor air poll$^n$ control** : Biogas / CNG / Kerosene / Electricity instead of wood fuel / cowdung

Well ventilated household

**Industrial poll$^n$ control**

a) Use of LNG in power / fertilizer plants ✓

b) use of filters, electrostatic precipitators, gravel bed filter, inertial collectors, Scrubbers ✓

c) Afforestation near the plant.

**Vehicular poll$^n$** : a) Public transport must be encouraged ✓

b) Pollution Under Control Cert (PUC) ✓

---

## Noise Pollution

W.Ho. optimum level : 45 dB — day
35 dB — night

> 80 dB : hazardous

Measures : ✓ pg : 9, chap 10

---

**Water poll$^n$** : a) Industrial · effluents

Surface Groundwater b) Agri — fert / chemicals

Eg : Biomagnif$^n$ : DDT, Endosulphan

Arsenic pollution, Uranium poll$^n$ : pb, Fluoride — Ap (Nalgonda)

↳ Orissa, BJ, WB

Eutrophic$^n$, Minamata disease ($Hg$, $(CH_3)_2Hg$) (Hg). Itai-Itai disease (Cadmium) pb (dysplasia) lead

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

# Ground Water poll"

- Caused by industrial, agricultural, ... domestic improper sewage disposal, agri chemicals, dumping of farm yard manures industrial effluents, seepage through land-fills ✓

- ~~Stage~~ **Methods to control water poll"**

**Sewage Water Treatment:** — (A)

2 Stage: primary, Secondary, Tertiary

Primary:
- Sedimentn
- Coagulation
- Filtration
- Disinfection
- Softening
- Aeration

1st 3 Steps — removes SPM
↓
Sludge

→ Secondary treatment removes organic matter left out after primary treatm by microbial treatment

→ Tertiary treatment to remove $H_2S$, $N_2$ matter to prevent eutrophic'n. + (aeration, disinfectant used)

- Israel: 30% of sewage water reused for agri, plans to ↑ to 80% by 2025.
- Add London sewage treatment plant example that generates 40MW of power + Aviation turbine fuel via biomass gasification.
- S'pore technology — so advanced that treated water is reused for drinking.

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

State: Yamuna : [fecal coliform count : acceptable for bathing 500 MPN/100L
→ actual : 1700 Cr MPN (most probable no) /100 ml ⇒ Yamuna : not a river but an open sewer
~ 17000000 MPN/100L
@ Nizamuddin, Okhla, Yamuna nagar
500 MPN ⟶ 17 Lakh MPN.

---

(B) Water Recycling : IWMP ✓
Organic farming ✓
Rainwater harvesting ✓

## Soil Pollution

Sources : plastic bags
industrial sources
agri sources
domestic sources – solid waste

Soln: SWM properly implemented
- segregation
- incineration/landfills of non-biodegradable
- SW treatment of biodegradable

Controlling

Treatment of ~~green~~ non-biodegradable waste :
→ recycling plastics
→ using jute bags instead
→ Combustion (to reduce volume) ✓
→ land fills (to prevent seepage) ✓

Radiation pollution – fig 15. (Fukushima, Chernobyl etc.)

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

# e-Waste : Treatment and Disposal methods

**Def":** e-waste describes discarded electical / electronic devices.

e-waste Contains : Pb, Cd, Be, Br etc.,

**Hazards :**

CRT : Pb, Ba, Cd - other such heavy metals.

PCB : (printed circuit Boards) : open burning ⇒ water pollution

Hg, $(CH_3)_2Hg$ → Nerve damage

Computer wires, plastics from printers : Hydrocarbons, particulate matter release etc.,

**Diff dimension** : E-waste not properly disposed (eg: Hard drives) pose info security risk to

**E-Waste Mgt**

**Recycling & Re-use**

**Consumer Awareness Efforts**

**Incineration**

**Landfills** (provided with impervious / impregnable liners to prevent seepage)

Case Study : In Ghana, e-waste is incinerated in open env which is even worse for personnel & env.

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

# 14. Global Env$^{t}$ Issues

→ GHG / GW / CC ⟷ related to → Sea level Rise, Glacier melting
→ Biodiv loss
→ Ozone depletion
→ Acid Rain
→ Dumping of hazardous wastes
→ Deforest$^{n}$ / Desertif$^{n}$
→ Oil spills

Glacier melting ← Himalayas
Aral Sea ← dry up (∵ Amu Darya, Syr Darya } div$^{n}$)

GW effects:
- melting glacier, ↑ Sea level
- agri prod$^{g}$ ↓
- changed climate: more floods, droughts, climate pattern (El-Nino, La-Nina)
- Opening of opportunities (Arctic Sea Route)

## Bio div loss

Biodiv — 3 types
- Species biodiv (taxonomical species)
- Genetic biodiv (ie, within species)
- Ecosystem biodiv

Reason for biodiv loss:
1) Loss of Habitat
2) Pollution
3) Over exploitation ~~= Degradation~~ (Whales for oil; fish for food; forest for Wood, Overgrazing)
4) Introduc$^{n}$ of for. (exotic) Species (eg: Eucalyptus, Parthenium, Water hyacinth @ Indian plains)
5) Env Degradation

## Ozone depletion

12 - 50 Km : Stratosphere : Contains Ozone

UV A < UV B < UV C in terms of damage & Energy

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

# Conservation

**Conservation**

- Biodiv conservation → Biotic resource conserv$^n$ — Plant, Animal
- Natural resource conservation
- Soil & Land conservation
- Water & Energy "

→ Abiotic resource conserv$^n$

- ✓ Land
- ✓ Water
- ~~Air~~
- ✓ Energy
- ✓ Mineral resource

**Biodiv :** Sum total of all the **variety** of living org$^n$sm on earth constitute bio-diversity.

Biodiv – conceptualised @ 3 levels
- Genetic div (within species)
- Species div
- Ecosystem div (land, lake, forest etc)

**Genetic div :** ⇒ Variety of genes contained within a species
helps in adaptation
Monoculture etc; → Can lead to extinction easily

India high genetic diversity – Considered as **Vavilov's centre** of ↑ genetic div
after Russian Scientist N. Vavilov.

**Species diversity :**
- Species richness ✓
- Species abundance ✓
- Taxonomic diversity ✓ (~ genetic r/ship b/w diff species)

**Ecosys div :** Encompasses broad differences b/w ecosystems, and the diversity of the habitats and ecological processes within each ecosystem type. Eg. Him ecosystem → deserts → grasslands etc, → Corals } India rich eco diversity

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

**Hotspots** : Norman Myers – devd concept of Hotspots. – to designate areas for in-situ conservation.

Criteria for hotspot : > 1500 endemic species
> 70% must have lost original habitat.

25 bio-div hotspots identified ✓

Eg : Tropical Andes, Caribbean, W^n Ghats, Indo-Burma [E^n Himalayas], Med^n basin etc, ; Brazilian Amazon forests, Polynesia

## Importance of Bio-div

a) Ecosystem services : Supporting (↗ Seed dispersal ✓, nutrient cycling ✓), Provisioning, Regulating (↗ Geo-chem cycles, C Sequestration, purif^n etc;), Cultural
b) Biological resources
c) Social benefits

Cr. Endangered : Pigmy Hog ✓
Endangered : Red Panda ✓

---

Conservation : (UNEP) def^n : C^n is the planned mgt of natural resources to retain the balance in nature & retain the diversity. ✓

---

Conservation is necessary to : prevent loss of bio div ✓
Save species from extinc^n ✓
protect ecosys damage & degradation. ✓

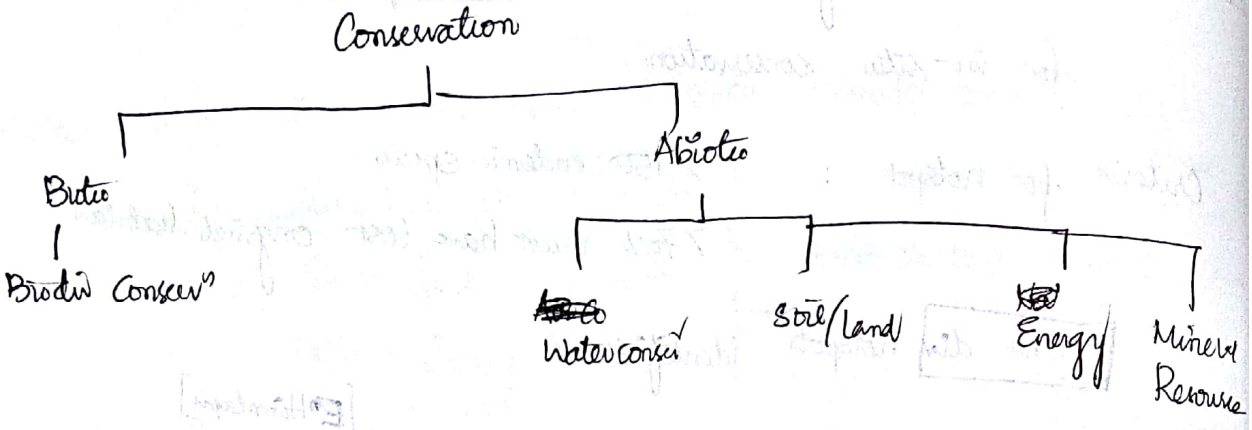
In-situ : NP, WS, BR

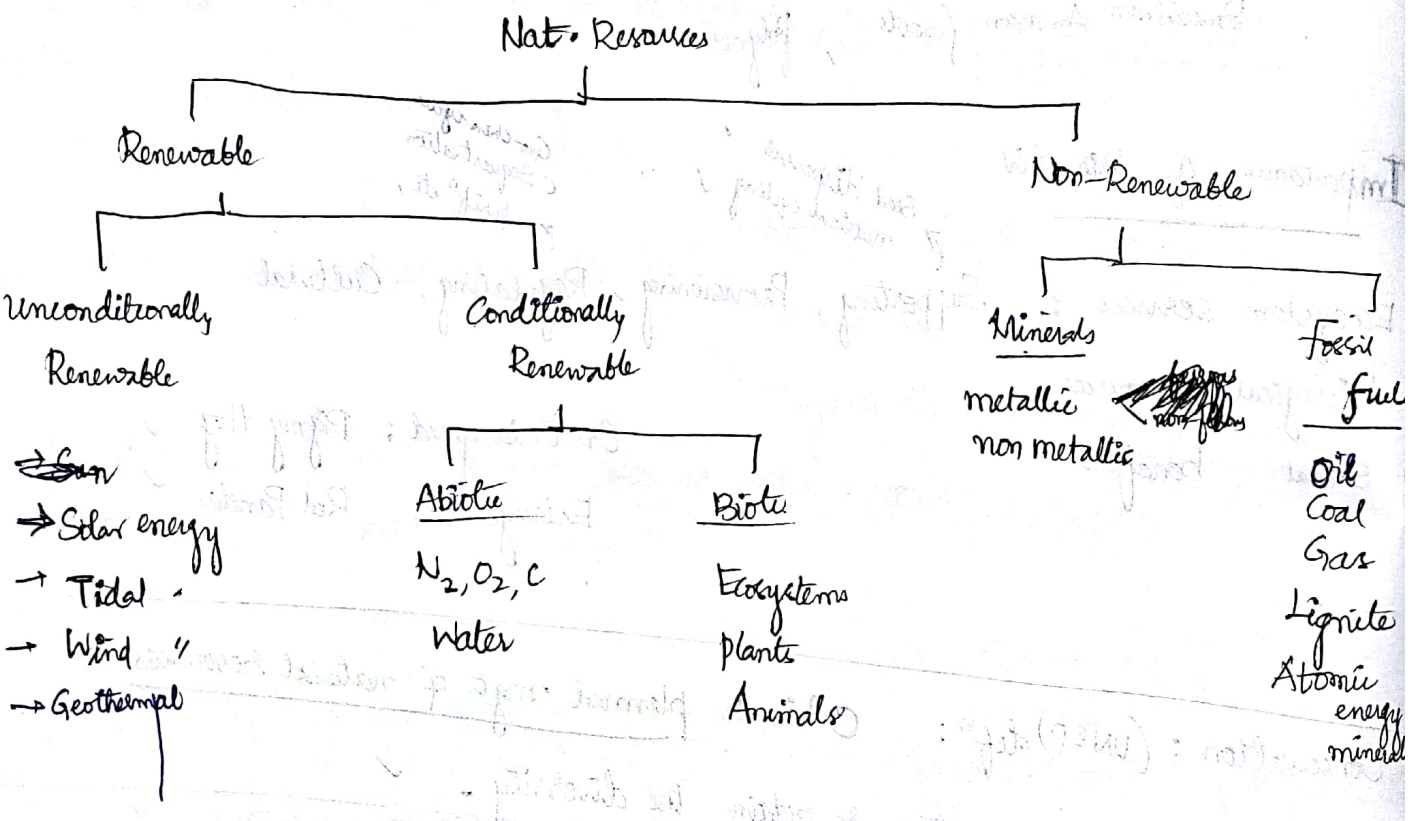
Ex-Situ conservation : Botanical gardens
Gene banks
Cryopreservation (liq. $N_2$ −196°C)
Conservation at molecular level (ie: DNA, germplasm (cloned one) Conservation)

(← Nat Bureau of Plant Genetic Resources (NBPGR, Delhi))

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017




✓ Bio-mining : an alternative to make mining sustainable.

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

# 17. Soil Erosion & Land Degradation

17.1. of earth's land has been degraded due to anthropogenic causes

**Soil erosion**: is the loosening and displacement of topsoil particles from the land.

Land degradation is the deterioration in the quality of land. This results in loss of crop production capacity of the land.

Pace of Soil erosion
- Geological erosion (very slow, natural)
- accelerated erosion (reasons: defores$^{n}$, floods, etc)

Types of soil erosion
- Water erosion (coastal erosion can also be clubbed here)
- Wind erosion
- Coastal erosion

✓ Water erosion (induced): rain drop erosion, sheet, rill, Gully, Stream bank erosion, Land slides, Coastal erosion

**Preventing soil erosion**:

- Improve veg$^{n}$ cover ✓
- Control cattle grazing ✓
- Afforestation programs ✓
- Crop rotation / Contour bunding / Strip cropping ✓
- Protective veg$^{n}$ along beaches (Mangroves) to prevent Coastal erosion
- dams can prevent rapid Stream bank erosion

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

Soil erosion caused by human activities → Deforest, Farming, Mining, Dev Work, Transport etc

Tilling, Mono culture, farming along slopes, Continous cropping → leads to Soil erosion

Overgrazing

## Land Degradation *

Degraded land is classified on the basis of productive capacity of land ✓

Slight degradation : crop yield potential ↓ by 10%

Moderate : ↓ by 10-50%

Severe : ↓ by >50%

Causes : a) Use of Agrochemicals (fert, pesticides)
b) Excessive irrigation
c) Cultiv^n of HYV

### Adverse effects of

**AGRO-CHEMICALS**

**Fertilizers**

a) Eutrophic^n of water bodies

b) Imbalance of Soil nutrients (Soil becomes ↓ in micro-nutrients Zn, Fe, Cu etc)

c) Health problems (leaching of nitrates) Methaemoglobinaemia

**Pesticides**

→ Contaminates food & water

→ disrupts eco-sys balance by killing useful org'sms too.

→ increases tolerance in pests gradually ✓

→ Bio magnification & Bio accumulation

**Excessive Irrig^n**

→ Water Logging (in case of lack of drainage)

→ Salt encrustation (White effervescence) (Pb, Hg)

**HYV**

Requires :
✓ irrigation
✓ extensive fertilizers
✓ Pesticides

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

# Agri Technologies to prevent Soil/Land degradation

imp

1) **Bio-fertilizers** : Rhizobium, Azotobacter, Blue Green Algae, Nostoc, Anabena (Azolla)
2) **Bio-Pest-Control** : (lady bird beetle, Cottony Cushion Scale pest are examples) — focus on
3) **Organic Farming** — Legume plant ($N_2$ fixing) + Cow dung, agri wastes as manure

**Bio-fertilizers** : Rhizobium, Azotobacter ($N_2$ fixation), Anabena, Nostoc ($N_2$), Cyanobacteria ($N_2$), Mycorrhiza (Phosphorous fixation)

**Bio-pesticides** : ✓ lady bird beetle, Bacillus thuringenesis (Bt) (this toxin directly incorporated by genetic engineering)

microbial pest :
- a) Bacillus Subtilis, Trichoderma, Bt, Cydia Pomonella granulo virus
- b) Weeds, Rodents, Lady Bird Beetle
- c) plant derived products : alkaloids, Cannabis,
- d) Baking Soda ($NaHCO_3$)

Contains :
- bacterium ✓
- fungus ✓
- virus ✓
- protozoans ✓

★ Bio-pest → Bt, Ladybird beetle; Baking Soda

## Measures to prevent Soil/Land degradation :

a) Afforestation

b) Farming Techniques — Ploughing Style (@ Tangles), Strip cropping, multiple cropping, Terracing, No-till cultivn.

c) Control overgrazing

**Dryland def$^n$** : Annual rainfall < 75cm → and there is no irrigation facility are called drylands. 69.1% of India dryland.

Dryland crops : All such crops which are drought resistant and can complete their life cycle w/o irrigation needs in drylands. Eg : Pearl millets, Maize, Jowar, Ragi etc, ✓

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

## Indian Scenario

- 69% of India – dryland (arid, semiarid, dry subhumid)
- GoI launched 22 progs under Green India Mission to combat deserti", drought, deforest" under NAPCC
- Poverty & land degradation interlinked ∵ trees – [fuel, food, fodder & support poor rural livelihoods]
  ↓ accentuates poverty

Report of UN Conv" to Combat Deserti" (UNCCD):

69% – dryland → heavily populated albeit
Degradation – accentuates poverty
32% of dryland under deserti" threat
Water induced soil erosion – major cause of degradation
factors: unsustainable agri practices, diversion of land → devt, mining, deforest", overgrazing

Land Rehab policies:
- DDP
- IWMP
- I-Wasteland Devt
- Nat Affn Prog
- NREGA
- N. Rural Drinking Water Prog (NRDWP)

Ley farming: used in drylands – as a way to restore soil fertility
involves: rotation of grasses & food grains in dryland area

Ley farming actually involves using field for grain + cash crops for a no. of years and laid down to ley, i.e. left fallow & grasses grown to cultivate fodder.

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

World example : Israel - a pioneer in irrigation : reuses 30% of its mun. Sewage water for crop prodⁿ & plans to ↑ to 80% by 2025

## Energy Conservation

**Conventional sources of energy** — ~~fossible~~ fossil fuels ∴ are non renewable.

Eg: Oil, N.G, Coal, Lignite

**Non-conv sources** : Solar, wind, hydel, tidal, geothermal, biomass energy,

∴ are renewable

Biomass energy : Bio-fuels are extracted from plant material.

Eg: Jatropha ✓
Euphorbia ✓

Bio gas is an example of ~~bio gas~~ fuel.

Ethanol " " " . — Can be used as fuel in cars

Bio diesel is an example of biofuel. These are extracted from veg oils

Eg: Jatropha, Honge champa, Rubber Seeds

Biofuel < Biogas, Bio diesel

# 19. Sust. Devt

~~Ha~~ Carrying Capacity : Max load/pressure that the envt can withstand by economic / other human activities.

Ecological footprint : amount of biologically productive area of the earth needed to produce the req'd resources as well as to absorb the wastes produced from such resources use.

India : 0.8 ha/person ; USA : 9.6 ha

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

# 22. Cleaner Technologies (6)

- Agri
- industry
- domestic - MSW
- Radio active
- Gaseous
- e-Waste

## Types of wastes:

Solid waste

1) Industrial: coal ash / fly ash : thermal
   - blast furnace slag : Fe & steel
   - press mud : sugar industries
   - gypsum : fertilizers & allied industries

Talk about Nat clean Energy Fund: int (one Note)

1a) Liquid effluents from industry: Oil refineries, petro chem, fert, textile, Tanneries, drug & pharma, pulp etc

2) MSW (Solid): Vegetable rejects, domestic waste

2a) MSW (liq): Sewage water, effluents (aerated drinks etc)

~~3) MSW (S~~

3) Gaseous Waste: These are mainly emitted from industrial installation

Eg: ONGC, flares gas worth ₹ 750 cr/annum - This can be converted to methanol, petrol

$CO_2$ emitted can be used to produce $CaCO_3$

$SO_2$ " " " produce Sulphur / Gypsum

4) Radio-Active waste < Hazardous / Non-Hazardous

5) e-Waste

6) Agri waste: esp from livestock etc,

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

Examples

→ Recycle technologies

→ Resource exchg industries ie waste of one industry → utilized as raw-mat by another (similar to food web).

→ Bioremediation: (oil zapper, MSW plant organisms)

- Renewable energy technologies

Waste Mgt:

1st priority: Waste prevention ✓
2nd " : Reuse, Recycle ✓
3rd " : Waste Mgt. — (incineration, Land fills, treatment) "gasify"

Nuclear Waste

2 types: Low Level Radioactive Waste (LLW) - Civilan applications of nucleotides ✓
High Level Radioactive Waste (HLW) - from spent nuke fuel rods, obsolete nuke weapon

Methods:

- deep sea burial: but now outlawed
- Changing its to less harmful isotopes: Currently no method is known but it'd be costly.
- bury deep underground in insulated containers ✓

Potential sites must have following characteristics:

→ low precipⁿ
→ deep water table
→ slow-moving ground water
→ near absence of exploitable minerals
→ low possibility of tectonic movt
→ adequate buffer zone (in case waste gets leaked)

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

## 21. Sustainable Agriculture (FAO)

S.A is that form of agri which attempts to produce Suffient food to meet the needs of present day population w/o exhausting Soil fertility and irreversibly damaging the env$^t$.

Methods: ✓ Crop Rotation (>1) ~ multiple cropping (>2 within a year in Succession)
✓ intercropping (>1 @ same time)
✓ Mixed farming
✓ Bio fert, Bio-pest, Organic farming, IPM

Bio-fert: fix atmospheric $N_2$ – Rhizo, Nostoc, BGA, Anabena ✓
Solubilize phosphorous :– Micorrhizae fungi ✓
Oxidise Sulphur

## Organic Farming (FAO)

O. Farming is a type of agriculture or farming which avoids the use of Synthetic fertilizers, pestcides, growth regulators and livestock feed additives.

O.F relies on — Crop rotation, Crop residues, legumes, green manure
mechanical tillage, bio fert, bio pest, IPM etc,

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

# IPM

In this approach, each crop and its pests are evaluated as part of an ecological system. IPM involves a control prog that involves

- ✓ Cultiv^n
- ✓ bio & chemical methods

} applied in proper sequence & proper timing.

Aim of IPM is not to eradicate the pest popn, but to keep crop damage to tolerable levels. (aims to ↓ below EIL Economic injury Level)

Polyculture × monoculture
↳ Ley farming
multi-cropping
inter-cropping
mixed-farm

## Biological Control Methods

✓ Natural predators, parasites, pathogens of pests are used.

Eg: Pest on cucumber — red spider mite controlled by a predatory mite

Citrus fruits in California $\frac{\text{pest}}{\text{it}}$ Controlled by Aus. ladybird.

## Cultivn practices

1) Croprotn, polyculture, inter cropping — to get rid of pests.

2) Some ↓ amount of insecticides mostly of plant origin → applied as last resort.

3) GM crops ex: Bt

## GM Crops

⇒ Potato Cry3A

+ Bt cotton (Yield)
- Ethylene inhibn (tomato)

VitA (Golden Rice)
Salt tolerant

1) Bt toxin — Bt cotton
2) Golden Rice — enhanced Vit A content
3) Salt tolerant gene in Bt rice — China → now grows in saline soils
4) Ethylene inhibition gene in tomato — retards growth/metabolism thus ripening

Scanned by CamScanner

ANUDEEP DURISHETTY
AIR 1, CSE 2017

## Benefits of GM:

**Crops:** ↑ taste, quality
↓ maturation, Shelf life ↑
Salt tolerant
resistant to pest, drought, diseases

**Animals:** ↑ fodder content
↑ animal health, diagnostics
Better yields of ~~health~~ meat
milk

**Envt:** Better waste mgt
- Friendly bioherbicides, bioinsecticides
- reduces input amount of fer
- Soil concern

**Society:** Food & Nutrition Security

## Controversies

### Safety:

potential health impact: immunogens
allergens
resistance ge
markers

Unintended transfer of transgenes via cross pollination ⇒ unknown effects on organisms — biodiv threat

### IPR

Monopoly
Bio-piracy
↑ Dependence on West

### Ethics

: violation of natural life's value
Objection to transferring animal genes in plants & vice versa

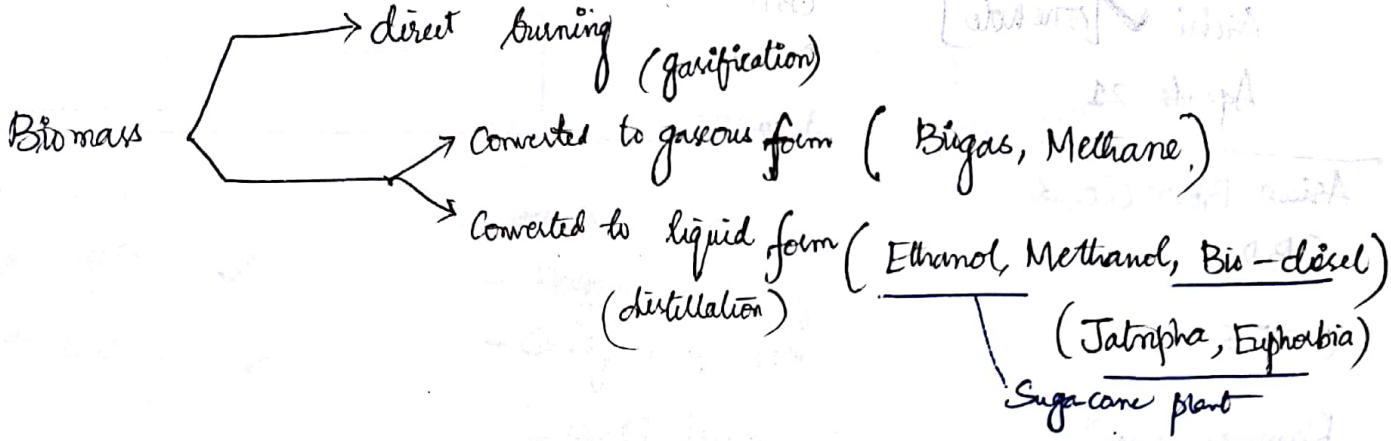
### Labeling

: Ntt mandatory in some countries (Eg: USA)

Thus GM & non GM mixing
⇒ no informed decision-making for Consumer

Scanned by CamScanner

# Renewable Energy




**Fuel cell Technology** – Converts chemical energy → electrical energy.

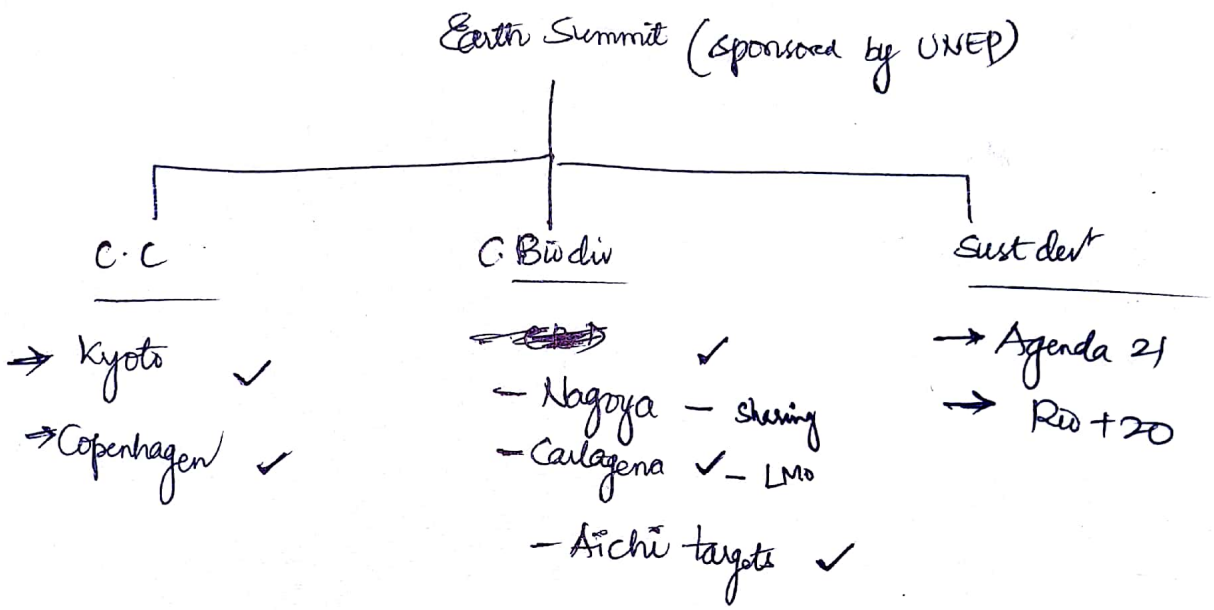
$2H_2 + O_2 \rightarrow 2H_2O$ + Energy

highly efficient power-generating systems that produce electricity by combining fuel (hydrogen) and oxygen in an electrochemical reaction.

## Water Conservation

Catchment Area Protection : called watershed protection. Involves construction of check bunds across streams in hilly terrains to prevent run off so that greater amount of water seeps underground.

Scanned by CamScanner




Scanned by CamScanner