Sustainability: Theory and Practice

Definition: Development without destruction. (Sustain means - keep alive or in existence). World commission on Environment and Development 1987, defined as "**meeting the needs of the present without compromising the ability of future generation to meet their own needs**". Sustainable development basically means that the process of development needs to be sustained. Sustainable development is a multi dimensional concepts aiming at benefits derived from interactions between Economy, civil society, culture, environment and living system.

The day will come when the progress of nations will be judged not by their military or economic strength not by the splendor (magnificence) of their capital cities and public buildings but the well-being of their people, by their levels of health, nutrition and education, by their opportunities to earn a fair reward for their labours.

Our technological development has strong impacts on the natural as well as the social components. Until two decades ago the world looked at economic status alone as a measure of human development. Thus countries that were economically well developed and where people were relatively richer were called advanced nations and the rest were called developing countries. World has begun to realize that their lives were being seriously affected by the environmental consequences of development based on economic growth alone. By the 1970s most development specialists began to appreciate the fact that economic growth alone could not bring about a better way of life for people unless environmental conditions were improved.

Both developed and developing countries, efforts to achieve quick results in economic development have damaged natural resources by

1. Intensive cultivation
2. Deforestation
3. Wetlands exploitation
4. Over fishing
5. Have affected the ability of renewable sources to renew themselves.
6. Taking more now from the nature leaves less for the future

A continuation of current trends would put in question the survival of the more and more human communities because

1) Accelerating climate change
2) Growing food and energy shortage
3) Pollution of air, water, soil
4) Destruction of Ozone layer and reduction of biodiversity
5) Continued loss of atmospheric oxygen,
6) Increasing drought and floods

Therefore, the developmental activities should be altered. It is very clear that long economic development is interlinked with environmental protection. To accomplish sustainable development, a number of things to be organized

a) Improving energy efficiency
b) Saving forest
c) Safe guarding biodiversity
d) Adopting water resource management
e) Managing coastal zones and ocean fisheries
f) Arresting pollution
g) Planning cities better
h) Accomplishing a second green revolution
i) Stabilizing world population
j) Shift from exhaustible to less harmful renewable energy sources
k) Use potentially renewable and non-renewable resources and use them no faster than the rate at which they are generated
l) Recycle, reduce and reuse
m) Add waste and pollutants to environment sinks no faster than the rate at which they can be recycled, reused, absorbed or rendered harmless to us
n) Emphasize pollution prevention and waste reduction instead of pollution cleanup and waste management.
o) Conserve natural resources like water, forest, soil, biodiversity

p) Reduce the waste of matter and energy resources
q) Making things that last longer and are easier to reuse, recycle and repair
r) Shift to more dependence on locally available renewable energy from the sun, wind, flowing water and biomass
s) Development and propagation of eco-friendly technologies for sustainable development
t) Supporting environmental education in all educational institution
u) Undertake special measures in afforestration and harvesting waste lands
v) Change personal attitudes and practices
w) Create global alliance

Unsustainable development:

1. The worldwide growth of human population and its increasing use of the plants physical resources and biological life-supports systems
2. The accelerating depletion of many of the planets physical resources and improvement of its biological life support systems.

Encouraging sustainable development

1) Learning where and how people are living sustainably, and not disrupting such cultures.
2) Involving local residents – in planning and execution
3) Making use of local wisdom, skills and resources.

Sustainable development will require the greatest changes in the wealthiest nations, which consumes the most resources, release the most pollution and have the greatest capacity to make necessary changes.

Concept of Mahatma Gandhi

Simplicity based on Mahatma Gandhi "Principles of enoughness". "The earth provides to satisfy every person, need not every person's greed."

However all existing models that describe sustainability dimensions focus on three major dimensions namely Social, Economic and Environmental. Development is a complex system, Economical, environmental, social and technical.

Sustainability may be divided into three types

Social	Economic	Environmental
1. Worker health and safety 2. Impact on local communities, quality of life 3. Benefits to disadvantaged groups, for example the disabled 4. Protection of human rights 5. Protection of human health 6. Child mortality 7. Food security	1. Continuous improvement in economic well being 2. Creation of new markets and opportunities for sales growth 3. Cost reduction through efficiency improvements and reduced energy and raw materials inputs 4. Creation of value added products 5. Protection of commercial rights 6. Investment in infrastructure, goods, and services that elevate the standard of living	1. Renewal of natural resources 2. Reduced waste, effluent generation, emissions into environment 3. Reduced impact on human health 4. Use of renewable raw materials 5. Elimination of toxic substances

At present the environment is being degraded because of a number of reasons.

a) High population
b) Accelerating consumption of natural resources
c) Degradation of land, soil
d) Degrading biological diversity
e) Pollution

Two concepts are involved in sustainable development

a) **Carrying capacity** – carrying capacity of a region/system could be described broadly as number of individuals of a species that it can sustain. Carrying capacity can be divided into two parts.

I. **Supporting** - The capacity to regenerate. The supporting capacity of a region / system provides an assessment of the stock of available resources with their regenerative capacity on natural / sustainable basis.
II. **Assimilative** – the assimilative component of carrying capacity is an assessment of the maximum amount of pollution load that can be discharged without violating best designated use of these basic components of environment

b) **Green Accounting**: it conveys by providing us an economic interpretation of both resource base and environment quality as against the conventional accounting in terms of GDP (Gross Domestic product).

Sustainable: - Carrying capacity
Development: - Economic growth

In order to attain sustainability it is very important to utilize the resources based upon the above two properties of the system. Consumption should not exceed regeneration and changes should not be allowed to occur beyond the tolerance capacity of the system. The commonly used economic measures of welfare or well being are GDP (Gross domestic production) and GNP (Gross National product). The former is the value of final goods and services produced in the domestic economy, where as latter is the value of goods and services produced in the domestic economy plus overseas income other than exports. Many decades ago, Mahatma Gandhi envisioned a reformed village community based on sound environmental management.

Green Revolution

The term **Green Revolution** is used to describe the transformation of agriculture in many developing nations that led to significant increases in cereal production between the 1940s and 1960s. This transformation occurred as the result of programs of agricultural research, extension, and infrastructural development largely funded by the Rockefeller Foundation, the Ford Foundation, and national governments. The term "Green Revolution" was first used by former USAID director William Gaud in 1968 who stated, "[The rapid spread of modern wheat and rice varieties throughout Asia] and other developments in the field of agriculture contain the makings of a new revolution... I call it a Green Revolution based on the application of science and technology

Why Green Revolution

The world's worst recorded food disaster happened in 1943 in British-ruled India. Known as the Bengal Famine, an estimated **four million** people **died** of hunger that year alone in eastern India (that included today's Bangladesh). The initial theory put forward to 'explain' that catastrophe was that there as an acute shortfall in food production in the area. However, Indian economist Amartya Sen (recipient of the Nobel Prize for Economics, 1998) has established that while food shortage was a contributor to the problem, a more potent factor was the result of hysteria related to World War II which made food supply a low priority for the British rulers. The hysteria was further exploited by Indian traders who hoarded food in order to sell at higher prices.

Nevertheless, when the British left India four years later in 1947, India continued to be haunted by memories of the Bengal Famine. It was therefore natural that food security was a paramount item on free India's agenda. This awareness led, on one hand, to the Green Revolution in India and, on the other, legislative measures to ensure that businessmen would never again be able to hoard food for reasons of profit.

However, the term "Green Revolution" is applied to the period from 1967 to 1978. Between 1947 and 1967, efforts at achieving food self-sufficiency were not entirely successful. Efforts until 1967 largely concentrated on expanding the farming areas. But starvation deaths were still being reported in the newspapers. In a perfect case of Malthusian economics, population was growing at a much faster rate than food production. This called for drastic action to increase yield. The action came in the form of the Green Revolution.

The term "Green Revolution" is a general one that is applied to successful agricultural experiments in many Third World countries. It is NOT specific to India. But it was most successful in India.

What was the Green Revolution in India?

There were three basic elements in the method of the Green Revolution:

(1) Continued expansion of farming areas;

(2) Double-cropping existing farmland;

(3) Using seeds with improved genetics.

Continued expansion of farming areas

As mentioned above, the area of land under cultivation was being increased right from 1947. But this was not enough in meeting with rising demand. Other methods were required. Yet, the expansion of cultivable land also had to continue. So, the Green Revolution continued with this quantitative expansion of farmlands. However, this is NOT the most striking feature of the Revolution.

Double-cropping existing farmland

Double-cropping was a primary feature of the Green Revolution. Instead of one crop season per year, the decision was made to have two crop seasons per year. The one-season-per-year practice was based on the fact that there is only natural monsoon per year. This was correct. So, there had to be two "monsoons" per year. One would be the natural monsoon and the other an artificial 'monsoon.' The artificial monsoon came in the form of huge irrigation facilities. Dams were built to arrest large volumes of natural monsoon water which were earlier being wasted. Simple irrigation techniques were also adopted.

Using seeds with superior genetics

This was the scientific aspect of the Green Revolution. The Indian Council for Agricultural Research (which was established by the British in 1929 but was not known to have done any significant research) was re-organized in 1965 and then again in 1973. It developed new strains of high yield value (HYV) seeds, mainly wheat and rice but also millet and corn. The most noteworthy HYV seed was the K68 variety for wheat. The credit for developing this strain goes to Dr. M.P. Singh who is also regarded as the hero of India's Green revolution.

Statistical Results of the Green Revolution

(1) The Green Revolution resulted in a record grain output of 131 million tons in 1978-79. This established India as one of the world's biggest agricultural producers. No other country in the world which attempted the Green Revolution recorded such level of success. India also became an exporter of food grains around that time.
(2) Yield per unit of farmland improved by more than 30 per cent between 1947 (when India gained political independence) and 1979 when the Green Revolution was considered to have delivered its goods.
(3) The crop area under HYV varieties grew from seven per cent to 22 per cent of the total cultivated area during the 10 years of the Green Revolution. More than 70 per cent of the wheat crop area, 35 per cent of the rice crop area and 20 per cent of the millet and corn crop area, used the HYV seeds.

Economic results of the Green Revolution

(1) Crop areas under high-yield varieties needed more water, more fertilizer, more pesticides, fungicides and certain other chemicals. This spurred the growth of the local manufacturing sector. Such industrial growth created new jobs and contributed to the country's GDP.
(2) The increase in irrigation created need for new dams to harness monsoon water. The water stored was used to create hydro-electric power. This in turn boosted industrial growth, created jobs and improved the quality of life of the people in villages.
(3) India paid back all loans it had taken from the World Bank and its affiliates for the purpose of the Green Revolution. This improved India's creditworthiness in the eyes of the lending agencies.
(4) Some developed countries, especially Canada, which were facing a shortage in agricultural labour, were so impressed by the results of India's Green Revolution that they asked the

Indian government to supply them with farmers experienced in the methods of the Green Revolution. Many farmers from Punjab and Haryana states in northern India were thus sent to Canada where they settled (That's why Canada today has many Punjabi-speaking citizens of Indian origin). These people remitted part of their incomes to their relatives in India. This not only helped the relatives but also added, albeit modestly, to India's foreign exchange earnings.

Sociological results of the Green Revolution

The Green Revolution created plenty of jobs not only for agricultural workers but also industrial workers by the creation of lateral facilities such as factories and hydro-electric power stations as explained above.

Political results of the Green Revolution

(1) India transformed itself from a starving nation to an exporter of food. This earned admiration for India in the comity of nations, especially in the Third World.

(2) The Green Revolution was one factor that made Mrs. Indira Gandhi (1917-84) and her party, the Indian National Congress, a very powerful political force in India (*it would however be wrong to say that it was the only reason*).

Limitations of the Green Revolution

(1) Even today, India's agricultural output sometimes falls short of demand. The Green Revolution, howsoever impressive, has thus NOT succeeded in making India totally and permanently self-sufficient in food. In 1979 and 1987, India faced severe drought conditions due to poor monsoon; this raised questions about the whether the Green Revolution was really a long-term achievement. In 1998, India had to import onions. Last year, India imported sugar.

(2) India has failed to extend the concept of high-yield value seeds to all crops or all regions. In terms of crops, it remain largely confined to foodgrains only, not to all kinds of agricultural produce. In regional terms, only Punjab and Haryana states showed the best results of the Green Revolution. The eastern plains of the River Ganges in West Bengal state also showed reasonably good results. But results were less impressive in other parts of India.

(3) Nothing like the Bengal Famine can happen in India again. But it is disturbing to note that even today, there are places like Kalahandi (in India's eastern state of Orissa) where famine-like conditions have been existing for many years and where some starvation deaths have also been reported. Of course, this is due to reasons other than availability of food in India, but the very fact that some people are still starving in India (whatever the reason may be), brings into question whether the Green Revolution has failed in its overall social objectives though it has been a resounding success in terms of agricultural production.

(4) The Green Revolution cannot therefore be considered to be a 100 percent success

1950-1965 – first Green revolution-high yielding varieties-requires high water, pesticides, fertilizers
1967-1996 - second green revolution – development of seed for pest and draught resistant
2000- third green revolution - biotechnology

Effects

a) Excessive use of fertilizers and pesticides had their detrimental impact on
   1) air 2) land 3) fresh water 4) Oceans
b) Depletion of natural nutrients
c) Loss of fertility
d) Water logged
e) Water scarcity
f) Global climate change
g) Suicide of formers
h) Falling productivity overtime
i) Ground water depletion - Excessive with draw of water
j) A greater propensity (tendency) for disease
k) Soil eroding - Topsoil eroding faster than it forms on about 35% of the world's cropland.
l) Salinization - Crop productivity on one-third of the earth's irrigated cropland has been reduced by salt build up in topsoil.
m) Deforestation -Almost half of the world's original forests has been cleared
n) Millions of hectares of grass lands have been overgrazed

o) Loss of biodiversity - the cultivation of many fewer varieties of crops
p) Malnutrition
q) Health effects – due to the pesticides to human and animals
r) Corporate dependence – many hybrid strains are sterile, or are sold on the condition that farmers cannot save their seed.
s) Social change
t) Fossil fuel dependence
u) Pollution
v) Land degradation

Water scarcity and ground water depletion

Water scarcity is defined as less than 1000 m^3 of water available per person per year
Water stress is defined as less than 1500 m^3 of water available per person per year
With urbanization and high rise buildings blocking recharge of ground water during rainy days

Drinking & cooking –5 lts
Washing cloth, utensils – 60 lts
Animal drinking and others – 70 lts
Total – 135 lts

"In popular usage, "scarcity" is a situation where there is insufficient water to satisfy normal requirements.
Four terms have been developed for the purposes of greater clarity: water shortage, water scarcity, water stress and water security. The use of these terms is the subject of considerable international debate.
Water shortage is used to describe an absolute shortage where levels of available water do not meet certain defined minimum requirements. The actual quantity that determines a per capita minimum may differ from place to place.
Water scarcity is a more relative concept describing the relationship between demand for water and its availability. The demands may vary considerably between different countries and different regions within a given country depending on the sectoral usage of water. A country with a high industrial demand or which depends on large scale irrigation will therefore be more likely to experience times of scarcity than a country with similar climatic conditions without such demands. Countries such as Rwanda, for example, would be classified by most standards as suffering water shortage but, because of low industrial and irrigation utilization would not be classified as water scarce.
Water stress is the symptomatic consequence of scarcity which may manifest itself as increasing conflict over sectoral usage, a decline in service levels, crop failure, food insecurity etc.. This term is analogous to the common use of the term "drought".
Water security is a situation of reliable and secure *access* to water over time. It does not equate to constant quantity of supply as much as predictability, which enables measures to be taken in times of scarcity to avoid stress.

Determining water shortage and water scarcity
The Food and Agriculture Organization (FAO) of the United Nations regards water as a severe constraint on socio-economic development and environmental protection at levels of internal renewable water availability of less than 1 000 m^3/capita. At levels of water availability of less than 2000 m^3/capita, water is regarded as a potentially serious constraint and a major problem in drought years.

Causes of water scarcity
- Population growth
- Food production
- Climatic change and variability
- Land use
- Water quality
- Water demand
- Sectoral resources and institutional capacity
- Poverty and economic policy
- Legislation and water resource management
- International waters
- Sectoral professional capacity
- Political realities
- Sociological issues

Methods to preserve water

a) If organic farming is promoted on a large scale, the cultivable lands become not only more fertile but also they trap more water to recharge the underground reservoirs
b) Massive programme of rain water harvesting
c) Surface reservoirs

Managing Water Scarcity for Water Security

Water scarcity and water stress
In popular usage, "scarcity" is a situation where there is insufficient water to satisfy normal requirements. Terms such as water scarcity, shortage and stress are commonly used interchangeably, though have the following specific meanings:
Shortage
One possible starting point is to stipulate a minimum amount of renewable water per head of the population, and to treat countries having less than this as "water short". At levels of internal renewable water availability of less than 1,000 cubic meters per head, FAO regards water as a severe constraint on socio-economic development and environmental protection. It has been estimated that 20 countries will be at or below this level by the year 2000 (FAO, 1995).
Scarcity
The picture changes if account is taken of the level of water use as well as availability. For instance, Tunisia, Algeria, Kenya and Rwanda, all countries with levels of availability of less than 1,000 cu. m., have levels of water use currently below this. Comparing levels of use and availability produces a different, and sometimes surprising, picture of scarcity.
The causes of water scarcity
Some causes of water scarcity are natural, others are of human agency.
Growth in population and incomes: The world's population is growing rapidly - in 2020 it is projected to be 7.9 billion, 50% larger than in 1990 (Dyson, 1996).
Climatic change and variability: On one definition, a "desert" receives less than 100 mm of rain annually, while a "dry land" includes arid and semi-arid areas receiving annual rainfall of less than 1500 mm
Modifications to landscapes and land use. The degradation and land use conversion of watersheds and catchments may reduce the amount of usable water available downstream, if there is greater run-off (e.g. temporary floods) which can not be captured.
The impact of water scarcity
Affluent societies in dry regions may be able to secure their hydrological future by heavy spending on long distance water transfer.
Managing water scarcity
A basic distinction can be drawn between approaches which are supply-oriented and those which rely on demand management.
Summarising the main policy measures in a supply-oriented water management approach:

- surface water capture and storage
- long distance conveyance & inter-basin transfer
- groundwater exploitation
- watershed management
- conjunctive use of surface- and ground-water
- desalination
- other non-conventional solutions
- pollution control
- new water-sharing agreements

Groundwater depletion
About 2 billion people, approximately one-third of the world's population, depend on groundwater supplies, withdrawing about 20 per cent of global water (600-700 km^3) annually — much of it from shallow aquifers.

Groundwater aquifers are being over-pumped nearly everywhere.

Agriculture is responsible for most of the depletion of groundwater, along with up to 70 per cent of the pollution. Both are accelerating.

Many of the world's most important grainlands are consuming groundwater at unsustainable rates. Collectively, annual water depletion in India, China, the United States, North Africa and the Arabian

Peninsula adds up to a 160 billion cubic metres a year - an amount equal to the total annual flow of two Nile Rivers.

1) Surveys in northern India found that water tables are dropping 0.6 to 0.7 metres a year in parts of Haryana State and half a metre a year across large areas of Punjab. In the State of Gujarat, on the northwest coast, 87 out of 96 wells monitored showed significant groundwater depletion during the 1980s and early 1990s. However, according to the International Water Management Institute, 25 per cent of India's harvest is threatened by unsustainable groundwater use.
2) In northern China groundwater depletion has reached catastrophic levels. Across the northern half of the country, groundwater over-pumping amounts to some 30 billion cubic metres a year. China's northern and central plains produce roughly 40 per cent of the country's grain. Across a wide area of this region, water tables have been dropping between 1 and 1.5 metres a year for a decade, even as water demands continue to rise.

Controversies on major dams

1. Submergence of forest lands
2. Faster rate of reservoir sedimentation or siltation
3. Socio-economic implications due to relocation and rehabilitation of people
4. Increased seismic risk
5. Soil erosion
6. Loss of Biodiversity
7. Loss of flora and fauna
8. High capital cost
9. Water logging and salinity
10. Sharing of benefits
11. Location
12. Resettlement and rehabilitation
13. Displacement of population
14. Dam failure

Resettlement and rehabilitation of people: problems and concerns

Developmental projects are planned to bring benefits to the society and requires large areas of lands. However, in the process of development, very often there is over-exploitation of natural resources and degradation of the environment. Besides this, quite often, the native people of the project site are displaced and resettled at other places. The compulsory acquisition of land for public purposes displaces people, forcing them to give up their homes, assest and means of livelihood and to start their life all over again at a new location. These native people are generally the poorest of the poor, tribal people. The native people who undergo tremendous economic and psychological distress, as the socio-economic and ecological base of the local community is disturbed. Society at large that gets direct and indirect benefits from the development process has a social and rural obligation towards these victims of development to not only restore their living standards and earning capacities but also make them partners in the accrued benefits. Different states are following different practices in this regard. There is a need for a comprehensive National Rehabilitation Policy.

Problems of Displacement:

a) Increases poverty due to loss of land, home, jobs, food insecurity, loss of access to common property assets.
b) Face disintegration as the people are resettled at different places
c) The social and cultural activities and kinship systems of tribal people vanish with their displacement

National resettlement and rehabilitation policy (Draft)

Rehabilitation policy was first mooted in 1985 by ministry of Welfare. The committee of approved the draft policy in 1998.

Objectives of the Draft national resettlement and Rehabilitation policy are

a) Minimize displacement by exploring non-displacing or less-displacing options.
b) Higher income and better standard of living to Project Affected Peoples (PAPs).
c) Reduce trauma of loss of livelihood systems, productive assets and income sources.

d) Promote mutual understanding between PAPs and project authorities through right to information and transparency.

The policy is based on the principle that R&R is the joint responsibility of the state government and the project authorities, the later bearing the entire cost all RR benefits

Salient features of the draft national policy are

a) intensive survey and identification of the people likely to be affected by a project, to be completed within three months from the date of notification
b) The PAPs to include all persons whose source of livelihood, place or residence or other property resources are affected notwithstanding the legal stats enjoyed by them.
c) The cut-off date for the identification of PAPs shall be minimum three years of residence before the date of publication of notification.
d) Survey to be made public in local language, both in writing or orally, at each panchayat and district/ taluka headquarters.
e) The PAPs to be given due opportunity to raise objections.

Salient features of the minimum packages

a) **Land for land:** Removal of poverty should be an objective of the rehabilitation policy and therefore some land for all should be provided. The quantum of agricultural land proposed for resettlement and rehabilitation of displaced families will be equal to the extent acquired and subject to a ceiling of one standard hectare of agricultural land. All occupiers of government land for a period of five years or more before the date of acquisition of land who are otherwise landless or marginal farmers, primarily dependent on cultivation for their livelihoods, shall be treated as owners of the land for the purposed of resettlement and rehabilitation.
b) **Homesteads and dwelling houses**. Homestead land has to be provided to all displaced families and its quantum shall be in between 50 m^2 to 150 sq.m in urban areas and in between 100 m^2 to 250 m^2 in the rural areas, depending on the quantum of homestead land acquired from such families. Constructed house shall be provided to all entitled displaced families on such allotted homestead and the type and standard of construction shall not be below what has been prescribed under Indira Awaas Yojana.
c) **Transportation cost**: Actual cost of transportation / trans-shipment of a family, its domestic animals, movable properties, moveable building materials and other belongings from the place of displacement to the place of resettlement shall be entirely borne by the project.
d) **Training and other support services**: The RR authorities shall provide at project cost necessary training to develop entrepreneurship and assist the adult members of the displace families to take up economically viable self-employment projects. Facilities should be set up to upgrade the skills of affected people
e) **Employment including self-employment**: all unskilled and semi-skilled direct employment in the project must always go to PAPs, as long as any such positions are available for employment. (reservation in jobs should be made for willing adults among the evacuees)
f) **Rehabilitation grant to compensate loss of income**: all families, who have not been provided agricultural land or a regular job in the project shall be entitled to a rehabilitation grant equivalent to two years minimum agricultural wages (for rural beneficiaries) and minimum wages for unskilled industrial workers (for urban beneficiaries) prevailing in the concerned state /UT at the relevant point of time.
g) **Some special provisions for the tribal**: Tribal should be resettled close to their natural habitats ensuring continuation of their traditional rights on minor forest produce and common property resources. They shall be compensated for loss of their customary rights/usage on forest produce in case the new site does not provide for gathering of such forest produces. Such compensation should be 450 days the minimum wages which a tribal family would have earned at the rates fixed by the respective state government.
h) **Other additional provision of the packages**: Upward revision of RR amounts as per consumer price Index.

Other provisions

a) Better village
b) Education facility
c) Medical facilities at project dispensaries
d) Better work and Employment
e) Reconstruction of religious places
f) Vocational training
g) Water supply
h) Communication facility
i) The advantages of rehabilitation should be on par with those of the beneficiaries of the proposed project.

j) Resettlement should be in the neighborhood of their environment
k) If resettlement is not possible in the command area, top priority should be given to the development of a) irrigation facilities 2) supply of basic inputs for agriculture 3) drinking water 4) wells 5) grazing ground for cattle's 6) school for children 7) primary health care units and other amenities should be arranged
l) In partially affected village, villagers should be given the option of shifting out with others with the same compensation as available to evacuees
m) The people displaced should get an appropriate share in the fruits of development
n) Tribal rights in land and forests should be preserved. We should try to encourage their own traditional arts and culture in every way.

CLOUD SEEDING

A technique for producing rain by dropping chemicals or small objects into clouds.

Cloud seeding is the attempt to change the amount or type of precipitation that falls out of clouds or the structure of clouds by dispersing substances into the air which allow water droplets or ice crystals to form more easily. The most common chemicals used for cloud seeding include silver iodide and dry ice (frozen carbon dioxide).

These chemicals may be dispersed by aircraft or by dispersion devices located on the ground. For example, silver iodide flares will be ignited as an aircraft flies through a cloud. When released by devices on the ground, air currents may pull the fine particles up into the air. These chemicals provide a nucleus for moisture in the cloud to form around (*heterogeneous nucleation*), which in turn will usually cause the precipitation to increase from the clouds or cause the clouds to become less dense.

While cloud seeding has shown to be effective in reducing the amount of cloud cover, it is more controversial whether cloud seeding increases the amount of precipitation from a cloud. Part of the problem is that it is impossible to know how much precipitation would have occurred had the cloud not been 'seeded'.

Today, cloud seeding is used

a) To increase precipitation in areas experiencing drought,
b) To reduce the size of hailstones that form in thunderstorms,
c) And to reduce the amount of fog in and around airports.
d) Cloud seeding is also occasionally used by major ski resorts to induce snowfall.

ENVIRONMENT IMPACT ASSESSMENT

Environmental Impact Assessment (EIA) is a tool used for decision making regarding developmental projects and programmes. It may be defined as a formal process used to predict the environmental consequences of any development project. After the environmental protection Act of 1986 was passed, an EIA to get an environmental clearance for a project became mandatory.

EIA is intended to identify the environmental, social and economic impacts of a proposed development project prior to decision-making. EIA is the formal process to predict environmental consequences of human developmental activities and to plan appropriate measures to eliminate or reduce adverse effects and to augment positive effects.

New projects are called 'green field projects' where no development has been done. Projects that already exist but require expansion must also apply for clearance. These are called 'brown field projects'.

INFORMATION TO BE CONTAINED IN AN EIS

The EIA is carried out by the Developer. Environment assessment is carried out in order to produce an environmental report or statement. The environmental statement must include:

A description of the project: location, design, scale, size etc
Description of significant effects
Mitigating measures
A non-technical summary

The Different dimensions of environment should be assessed

1) Physical Environment
    a) Land and climate
    b) Vegetation, wild life, Ecological and natural areas

c) Infrastructure
d) Pollution – air, water, marine and soil

2) Social Environment
a) Health impact assessment
b) Community composition (can not build a temple near to Muslim area)
3) Economic Environment: Employment, trade
4) Aesthetic Environment

POSSIBLE CHANGES WITH PROJECT ACTIVITIES

a) Air
b) Water
c) Solid waste
d) Vegetation
e) Energy and natural resources
f) Soils and local Geology
g) Natural hazards
h) Man-made facilities and activities
i) Cultural status
j) Ecological relationship

FUNCTIONS of EIA

a) To predict problems
b) To find ways to avoid them
c) To enhance positive effects

BENEFITS OF EIA

a) The most environmentally suitable option at the early stage
b) Reduced cost and time of project implementation
c) Improved project performance
d) Improved human health

EIA PROCESS

a) Define proposal
b) Screening –Deciding whether an EIA is required
c) Scoping - Identification of the key issues and concerns of interested parties
d) Identifying and evaluating alternatives
e) Impact predication and mitigation (Pubic informed and consulted)
f) Preparation of draft EI Statement (review by regulatory authority and public)
g) Preparation of final EIS
h) Management and monitoring - feed back

SCREENING

The process of deciding on whether EIA is required or not

a) Depends on two issues
1. Policies of the country based on project type or size
2. Preliminary study to determine impact significance
b) The out put of screening is called initial environmental examination or evaluation (IEE)
c) If the IEE results indicate EIA is not required, then environmental protection measures or monitoring programme should be designed
d) If EIA required the IEE is useful as tool for the identification of key environmental issues

SCOPING

a) Outline planning and pre-feasibility study
b) Identifying key environmental issues- mitigation measures
c) Sharing the information
d) Canvassing their views
e) Design changes
f) Identify the key interested groups
g) Needs and views of affected population

PREDICTION & MITIGATION

a) Central part of EIA
b) Prediction of environmental impacts
c) Identify the mitigation measures
d) Information to public
e) Recommendations for mitigation measures
f) Preparation of environmental impact statement (EIS)

PROJECTS WHICH REQUIRE AN EIS

There are 30 different industries listed by MoEF that require a clearance before they are set up. Examples of projects and associated thresholds, for which an EIS is required

- Industrial estate development projects where the area would exceed 15 hectares.
- Urban development projects which would involve an area greater than 50 hectares in the case of projects for new or extended urban areas and an area greater than 2 hectares within existing urban areas.
- Waste water treatment plants with a capacity greater than 10,000 population equivalent.
- Oil and gas pipelines exceeding 80 kilometres in length.
- All fish meal and fish oil factories.
- All extraction of petroleum (excluding natural gas).
- All installations for the manufacture of cement.