Ministry of environment

- The power ministry has decided that the enforcement of the standards would be postponed by another two years — from 2015 to 2017, that would lead to lost savings of hundreds of millions of dollars in oil imports.
- The standard called Corporate Average Fuel Economy (CAFE) will ask auto manufacturers to raise fuel efficiency of cars by about 18%, up from the average of 14.1 km/litre of petrol to 17.3. With it, cars will have one to five star labels depending on their fuel efficiency.
- The CAFE standard is the average annual fuel efficiency for a manufacturer fleet and is measured in terms of global warming causing carbon dioxide emissions.
- The standard will ensure fuel efficient and lighter cars and use biofuels and hybrid technologies such as electricity and hydrogen cells.
- The Indian auto-industry had started at a better footing than the car markets in many developed countries on this ground. The sale of smaller cars remained at a relatively higher level than that of SUVs and bigger cars.
- For some years the industry notched an improvement in the efficiency of the engines even as the average car weight of the fleet sold continued to increase but in the past couple of years this has changed. The sales of heavier vehicles have begun to increase and the average fuel efficiency of the fleet on road has dipped.

ANALYSIS

- India cannot afford to delay its own programme on the wrong premise that it will affect the growth of the automotive industry. If anything, vehicle manufacturers should welcome the Power Ministry's notification on fuel efficiency norms and its 2017 deadline — already pushed back from 2015 — for compliance, as it enables long-term planning.
- The sharp growth in demand for petrol and diesel, and the rising burden of oil imports make that a priority. Countries with major manufacturing capacities are working to achieve higher average efficiency in their vehicles, with the twin goals of conserving fuel and reducing the emission of carbon dioxide, a greenhouse gas.
- As the Global Fuel Economy Initiative of the U.N. Environment Programme points out, a major manufacturing country can afford to set clear standards in advance to facilitate suitable long term investments by industry.
- So it is wrong to argue for an even longer delay in standard-setting on the ground that the industry is experiencing sluggish growth.
- As it embarks on the efficiency quest, India should actually look for a leapfrog effect to ensure that only the most efficient vehicles are produced and sold.
- To address the 'rebound effect' — people driving more because cars give better mileage — it must incentivise alternative modes such as inter-city rail services and urban public transport.
- Also important is to achieve clarity of planning — the responsibility of achieving fuel efficiency should squarely lie with a single Ministry. That would avoid the kind of wrangling witnessed between the Ministries

NGT ON SAND MINING

- The National Green Tribunal (NGT) ordered a nationwide stay on sand mining on river beds without Environment Ministry clearance.
- The interim order came on a petition filed by the NGT Bar Association as a reaction to the suspension of IAS officer Durga Shakti Nagpal, who had been overseeing a drive against illegal sand mining in Gautam Budh Nagar district in Uttar Pradesh.
- At the same time, the Ministry has decided to approach the Supreme Court to seek clarification on the process for according environmental clearances for minor mineral mining projects occupying less than five hectares, as well as send an inspection team to U.P. to look into illegal sand mining there.
- On February 27, 2013, the supreme court ordered mandatory environmental clearance from the Environment and Forests Ministry for excavation of all minor minerals.
- The recent NGT decision does not go beyond the pronouncement of the Supreme Court orders but only pushes implementation of the orders.
- The court order was opposed by many State governments with the construction industry lobbying hard against it.
- This led to the Prime Minister's Office intervening for brick kiln owners and the Cabinet Committee on Infrastructure also debating the issue.
- The Environment Ministry, is likely to plead before the court to let State authorities give environmental clearance for less than 5-hectare plots.
- The Ministry believes that instead of it itself dealing with thousands of clearances for small projects, it would be wiser to let the States handle them under strict guidelines laid down by the Centre.
- The Ministry will also ask for a stipulation that miners should not seek clearances for a cluster of less than 5-hectare plots as that will add up to a large area.

CRITICISM

- The ministry of environment and forests created a panel to investigate sand mining along the Yamuna in Uttar Pradesh, which found evidence of rampant illegality and recommended more compliance hoops to jump through. The National Green Tribunal took up the matter and banned all sand mining in riverbeds, even on small patches, without permission from the MoEF or state environment impact assessment authorities.
- With the construction sector booming in the country, the demand for sand has grown consistently over the past decade. Instead of balancing the legitimate needs of the economy and the environment, and seeking effective local monitoring of mining activity, the dominant impulse has been to tighten the grip on approvals.
- Removing certain amounts of sand and boulders prevents riverbed aggradation, which can worsen the impact of floods — but the zealous green tribunal has ignored that logic. This is action replay of the Supreme Court's disastrous decision in February 2012 to freeze all mining without elaborate permissions, including minor minerals like earth, sand, gravel and other stones.
- Apart from the small businesses shut down and livelihoods lost, effects of that ban cascaded across the economy, as the price of construction raw material shot up. Material that was in plentiful supply now began to be hoarded, distorting the market further.
- While illegal sand mining must be tackled, making regulation cumbersome and centralised will only deter legal mining, an activity that underpins construction and has a direct impact on infrastructure creation and growth.
- Withholding leases beyond a point for a necessary economic activity, only encourages illegal mining. Many politicians and officials profit from this gap between demand and supply, and the courts have given greater weight to this counterproductive approach.
- This only encourages more indiscriminate and environmentally unsafe mining practices, through furtive arrangements between local people, middlemen and businesses.

Panchayat Biodiversity Registers (PBR)

- It have details of biological resources and native wisdom of the region.
- Biodiversity registers are meant to help in sustainable use and conservation besides being an authentic reference document for researchers and students of schools and colleges.
- The PBR is not a catalogue of information, it is a legal document that can be presented in a court of law.
- It can be used as a proof to deal with misappropriation and benefit sharing.

Why is it in news:

- In the past, a range of institutions and agencies had been developing PBRs in their own format and style resulting in no uniformity, clarity or authenticity. The National Biodiversity Authority (NBA), set up under Biological Diversity Act, is coming up with elaborate guidelines on access to Panchayat Biodiversity Registers (PBRs).

Green Toilets

- All trains maintained by the Delhi Division will have green toilets.
- Open discharge toilets on trains have been under constant criticism because of creating the problem of manual scavenging which led to a series of trials with green toilets on train.
- The new toilets will have a collection tank fitted with anaerobic bacteria to decompose faecal matter completely and only a colourless, odourless benign liquid that does not pollute the environment will be released.

Bio-Digester

- A biodigester is an anaerobic tank (oxygen-free), which digests organic material biologically.
- It is used to treat black water (human waste) on site, eliminating pathogens and malignant bacteria, so the treated water can be used for irrigation.

Benefits of using a Biodigester:

- It digests organic solids in an ecological way;
- It prevents human waste and untreated water from contaminating groundwater;
- It offers an alternative to dumping sewage into rivers, lakes and fields in rural and semi-rural areas where there are no city sewage systems;
- The effluent of water can be used as fertilizer for soil, to water plants, or for fish ponds;
- It's cleaner, more effective and easier to use than a septic tank because it doesn't need to be cleaned or emptied and doesn't create leakage problems;
- It is odorless, as opposed to composting toilets and septic tanks;

Project SOS

- The Nature Forever Society (NFS) has decided to launch Project **Save Our Sparrows(SOS)** by distributing 52,000 bird feeders to interested citizens, institutions and organisations across the country.
- It as a unique functional conservation programme involving common people.

Biodiversity

International Framework

1. Genetic diversity vs genetic variability: Genetic diversity refers to the amount of genetic variations in a species. It is distinguished from genetic variability which describes the tendency of genetic characteristics to vary. Genetic diversity serves as a way for populations to adapt to changing environments. With more variation, it is more likely that

some individuals in a population will possess variations that are suited for the environment. When humans initially started farming, they used selective breeding to pass on desirable traits of the crops while omitting the undesirable ones which leads to monocultures with no genetic diversity making crops extremely susceptible to widespread disease. Among oceanic plankton, viruses aid in the genetic shifting process. Ocean viruses, which infect the plankton, carry genes of other organisms in addition to their own. When a virus containing the genes of one cell infects another, the genetic makeup of the latter changes.

2. Genetic pollution: It is uncontrolled hybridization and genetic swamping and threatens specially the endemic species. Genetic pollution leads to homogenization or replacement of local genomes as a result of either a numerical and/or fitness advantage of an introduced species. These phenomena can be especially detrimental to rare species that come into contact with more abundant ones. The abundant species can interbreed with the rare species, swamping its gene pool.
3. Genetic Use Restriction Technology (GURT): It prevents seeds from germinating in the next growing season unless treated chemically by the seed company prior to planting. When seeds of crop varieties (containing this kind of genetic manipulation) are purchased from the company and planted, they germinate and grow normally but produce seeds that do not germinate when saved by the farmers for sowing during the following season.

IUCN Red List

Species are classified on the basis of rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation.

1. Extinct (EX) - No individuals remaining.
2. Extinct in the Wild (EW) - Known only to survive in captivity, or as a naturalized population outside its historic range.
3. Critically Endangered (CR) or Possibly Extinct - Extremely high risk of extinction in the wild.
4. Endangered (EN) - High risk of extinction in the wild.
5. Vulnerable (VU) - High risk of endangerment in the wild.
6. Near Threatened (NT) - Likely to become endangered in the near future.
7. Least Concern (LC) - Lowest risk.

Biodiversity Hotspot

1. (a) It must contain ≥ 0.5% or 1500 species as endemic and (b) It must have lost at least 70% of its primary vegetation.
2. India's 2 hotspots are W Ghats and E Ghats. #rd one is in NE jointly shared with Myanmar.

Andaman and Nicobar and Lakshwadeep Islands have been named as the new "hope spots" by the International Union for Conservation of Nature (IUCN) and oceanographer Sylvia Earle of Mission Blue, an organisation involved in the study of oceans.

A hope spot is an area of ocean that merits special protection because of its wildlife and significant underwater habitats. The two islands are the first spots in India and part of 31 new hope spots across the world added to the existing 19 spots.Andamans and Nicobar islands have been declared a hope spot as it has some of world's unique species of birds and plants. In the case of Lakshadweep, the coral reefs are quite sensitive to the ocean environment and that needs protection.

Genetic Colonialism

1. It refers to attempt by MNCs to use biopiracy and usurp the traditional knowledge and practices of local people. These MNCs then present the product as an invention by them and get patents and deprive the locals of their right to use such products.

India & Biodiversity

ESZs

1. Proposals for declaring ESZs have been shot down on grounds of impeding development. Further, ESZ guidelines so far have had a focus around protected areas. It should also include other fragile areas.
2. In 2002, the National Board for Wildlife discussed the concept of the ESZ, the idea being to create a “shock absorber” or a “zone of transition” around national parks, sanctuaries and protected areas. States were free to declare such areas in other places as well.
3. Construed by several States as a no go for development, they did not come forward to declare an ESZ around all their protected areas.
4. In 2006, the Supreme Court reminded the States to declare these zones, saying that non-compliance would have the Court stepping in to enforce a default 10 kilometre ESZ around protected areas.
5. Still met with a silence, MoEF issued guidelines in 2011. But since then the ESZs so notified focused mostly around major polluting sources and extractive industries to be kept out from the protected sanctuaries. Very few notifications tackle deal with places which are not protected areas but are ecologically sensitive.

1. India has only 2.4% of world land area and 4% of fresh water, yet accounts for 7.3% of recorded species making it 3rd most mega-diverse country (after Brazil and Costa Rica). Plant species: 45K, animal species: 91K. India's highest concentration of species is in Agasthymalai Hills in W Ghats.

Sanctuary, National Parks, Conservation Reserves & Community Reserves

1. Conservation reserves & community reserves: They act as buffer zones or connectors between established national parks, wildlife sanctuaries and reserved and protected forests of India. Such areas are designated as conservation areas if they are uninhabited and completely owned by the Government of India but used for subsistence by communities, and community areas if part of the lands are privately owned. Administration of such areas is through local people. Community reserves allow communally owned for-profit wildlife resorts. These categories were added because of sometimes large areas around national parks were left unprotected.
2. Sanctuaries & national parks: While in sanctuaries some rights of local population are recognized, in national parks, no such rights are recognized. Removal of any forest produce from national parks requires the approval of national board for wildlife protection while it is allowed in a regulated way in sanctuaries. A sanctuary can be converted into a national park on the recommendation of state wildlife board which is then approved by the national wildlife board and finally MoE and the notification is released. Thus a sanctuary is at the state level whereas a national park is at the national level.

Biosphere Reserves

1. Core zone: This is the central area and has to be kept undisturbed of all activities except research activities (which don't disturb wildlife).
2. Buffer zone: Only some light activities like tourism, fishing, grazing etc. are allowed which don't disturb the core zone. Research activities are encouraged here.
3. Transition zone: Outmost part and not delimited. Activities have to be harmonious with the biosphere reserve.

Sacred Groves of India

1. They are communally + NGO protected forests which usually have a significant religious connotation for the protecting community. Hunting and logging are usually strictly prohibited but other forms of forest usage like honey collection and deadwood collection are sometimes allowed on a sustainable basis.
2. Sacred groves did not enjoy protection via federal legislation in India until the introduction of the protected area category community reserves under the Wildlife (Protection) Amendment Act of 2002.

3. Myristica swamps: THey are the sacred grove in Kerala which are one of the densest groves. They are typically found in valleys making them prone to inundation. But they are being converted into paddy fields. Their water holding capacity is immense and thus their depletion can lead to floods in rains and dry valley in other seasons.

Western Ghats (Gadgil Panel)

Ecologically Sensitive Zones or Ecologically Sensitive Areas

1. Current system: Currently ecologically sensitive zones owe their existence to initiatives of civil societies or a resolution of Indian Board for Wildlife in 2002 to protect areas up to 10 km from the boundaries of wildlife sanctuaries and national parks. Human activities are restricted here. The activities are classified into 3 types: (a) Prohibited: which include mining, industries, use of hazardous substances etc. (b) Regulated: which include tourism, felling of trees etc. (c) Permitted: which include ongoing agriculture by local communities, rainwater harvesting etc.
2. Mandate: It had a mandate to demarcate areas within the Western Ghats Region which need to be notified as ecologically sensitive, and make recommendations for conservation, protection and rejuvenation of the Western Ghats following consultations involving people and State governments. It was also required to recommend the modalities for the establishment of the Western Ghats Ecology Authority (WGEA) under the Environment (Protection) Act, 1986 (EPA).
3. Panel recommendations: The panel recommended large parts of the Ghats to be declared ecologically sensitive zones. The zonation will be 3 tiered - ESZ 1 or highest sensitivity, ESZ 2 and ESZ 3. In ESZ1 all mining has to stop by 2016. In ESZ2 and 3 no new mining can be allowed. Even this mining has to be subject to extensive regulations. Total area of W Ghats under ESZ1 and ESZ2 is 75% and under ESZ1 alone is 60%. After looking at available research and meeting a cross-section of people in over a dozen sites, the WGEEP concluded that the entire Western Ghats are an ecologically sensitive area. However, within this overall category, it has defined three types of Ecologically Sensitive Zones (ESZs). In all three zones, it has recommended that there should be no SEZs, no new hill stations, no inter-basin linking of rivers and that dams which have outlived their utility should be decommissioned. In ESZ 1, the highest sensitive zone, it suggests no new mines, existing ones to be phased out by 2016, no new polluting industries, existing ones to be converted to zero pollution, no large storage dams or thermal power plants and no new railway lines or national highways. New mines will also not be permitted in ESZ 2 but existing ones can operate under strict conditions. In addition, no new polluting industries, existing ones to be made zero pollution, no new large storage dams but existing thermal plants can continue if they eliminate pollution. And in ESZ 3, new mines, new industries and thermal power plants will be permitted under strict conditions and a social audit.

Proposed Administrative Architecture

1. Central and state level: It wants to create Western Ghats Ecology Authority as a statutory authority appointed by MoEF with powers under the EPA, 1986. The body will have

ecologists, scientists, civil society representatives, tribal groups, officials, planning commission (because western ghat development plan is funded by the FYP), national biodiversity authority, central pollution control board and state government members and would administer the ESZs. Correspondingly each state will have a state WGEA which will interact closely with state planning departments, state biodiversity boards and state pollution boards and will work with the WGEA.

2. District level: Currently each ESA (ecologically sensitive area) is administered by a high level monitoring committee appointed only by MoEF which doesn't have any regulatory powers, financial resources pr human resources. In many ESZs no committee existed for many years. The panel recommends it to be replaced by District Ecology Committees which should work in collaboration with zila parishad as well as district planning committee. It should have authority over location of industry, land use, storage dams etc.
3. It has also recommended "adaptive co-management" where decisions are taken after full consultation and involvement of the local gram sabhas. A good example of how localised authorities can be effective is the Dahanu Taluka Ecology Authority in Maharashtra, set up on directions of the Supreme Court, which has succeeded in protecting the eco-sensitive nature of that area despite its proximity to Mumbai and pressure from strong political and business interests.

Implications of Heritage Site Recognition

1. India will have to inform the World Heritage Committee (WHC) of any proposed infrastructure development, major construction etc. before an irreversible decision has been taken. Moreover any such permission from the Indian authorities should be granted only after through EIA.
2. India will also have to ensure proactive sustainable tourism in the areas.

Environment Performance Index

1. Every state will be rated on environment performance to check the illegal mining, coastal abuse and environment degradation. It would be implemented by 2013 and will be used in allocating grants.

Social Forestry

1. It means raising fast growing trees near the habited areas so as to serve the needs of the local population (timber, fodder etc.) and thus relieve pressure on the forests.
2. Initially the selection of trees was done by the government and had no local inputs. So eucalyptus were planted and it failed to relieve pressure on the forests. But subsequently the planning, execution and monitoring was handed over to village panchayats.
3. It can include farm forestry (individual farmers planting trees in their fields to meet domestic family needs), agro forestry (trees being planted at field boundaries) and area extension forestry (trees being planted on road sides, canals etc).

Government Norms

Environmental Violation

1. Serious: A violation of this type will immediately lead to the closure of the unit. Example is non treatment of nuclear waste from a nuclear plant.
2. Not so Serious: The violating unit may get up to 3 warnings to correct its practices. Example is non treatment of non nuclear waste from a nuclear plant, pollution of nearby water resources by an industry.

Bharat Stage Emission Norms

1. Bharat 3: Since 2010, Bharat stage III norms have been enforced across the country.
2. Bharat 4: In 13 major cities, Bharat stage IV emission norms are in place since 2010.
3. Bharat norms vs Euro norms: The Bharat Stage norms have been styled to suit specific needs and demands of Indian conditions. Euro-III is tested at sub-zero temperatures in European countries. In India, where the average annual temperature ranges between 24 and 28 degree Celsius, the test is done away with. Another major distinction is in the maximum speed at which the vehicle is tested. A speed of 90 km/h is stipulated for BS-III, whereas it is 120 km/h for Euro-III, keeping emission limits the same in both cases.

Catalytic Converter

1. It was made mandatory for petrol vehicles in 1995 and unleaded petrol was introduced.
2. It is an exhaust emission control device which converts toxic chemicals into less toxic. It has a catalyst which oxidizes CO and unburned hydrocarbons (HC) and reduces NO_x to CO_2, N_2 and H_2O. 2 way catalytic converters used to treat only HC and CO.
3. If the concentration of HC is abnormally high (as in partially burnt fuel), it may lead to high temperatures and meltdown of the converter.
4. Catalyst poisoning occurs when the catalytic converter is exposed to exhaust containing substances that coat the working surfaces so that it cannot contact and treat the exhaust. The most-notable contaminant is lead, so vehicles equipped with catalytic converters can be run only on unleaded fuels. Other contaminants are S, Mn, P.

Shipping Emissions

1. The sulphur content in fuel of ships has to be reduced to 3.5% from 4.5%. In the Emission Control Area (ECA), it has to be reduced to 1% from 1.5%.

Forest Classification

1. Very dense forest: Tree canopy density of ≥ 70%. It covers 2.5% of total area.
2. Moderately dense forest: 40% ≤ Tree canopy density < 70%. It covers 9.75% of total area.
3. Open forest: 10%≤ Tree canopy density < 40%. It covers 8.75% of total area.

Largest forest cover is in MP followed by Arunachal Pradesh.

Biochemical Oxygen Demand

1. This is the amount of O2 needed by the aerobic micro-organisms in a sample of water to break down the organic compounds present in it @ 20º C over 5 days. The limit in India is 3 mg per liter.
2. There are aquatic micro-organisms which break down the organic compounds in the water into energy for reproduction and food. The higher the number of compounds, the higher the

microbial activity and higher their reproduction. The higher the number, the higher their demand for dissolved O2 in water which if exceeds the rate of dissolution of O2 from air into water can lead to depletion of dissolved O2 in water and death of fishes etc.

Land Use Classification

1. It divides land form class 1 to class 8.
2. Classes 1 to 4 are cultivable with 4 being suitable for only subsistence agriculture (water-logged soils commercially unusable) and class 3 suffering from erosion etc.
3. Class 5 is suited for moderate grazing while class 6 for limited grazing.
4. Class 7 is suited only for forestry and class 8 for wild life.

Coastal Regulation Zone

1. CRZ-I: Areas that are ecologically sensitive and important, such as national parks/marine parks, mangroves, coral reefs, areas close to breeding and spawning grounds, areas likely to be inundated global warming and area between low tide line (low neap tide) and the high tide line (high spring tide). No new construction shall be permitted except atomic energy projects and pipelines.
2. CRZ-II: The areas that have already been developed on the shore. Construction and new activities shall be permitted only on the landward side.
3. CRZ-III: Areas that are relatively undisturbed and those which do not belong to either Category-I or II. No construction is possible up to 200 m of high tide line. Between 200-500 m construction is possible only subject to local traditional rights (for residential units) and government approval (for commercial enterprises).
4. CRZ-IV: Coastal stretches in the Andaman & Nicobar, Lakshadweep and small islands, except those designated as CRZ-I, CRZ-II or CRZ-III. All activities are to be regulated by government.

Air Pollutants Limits

1. RSPM: 100 µg/m3.
2. CO: 80 µg/m3.
3. SO_2: 80 µg/m3.
4. O_3: 80 µg/m3.

Government Initiatives

Solar Cities

1. The Solar City programme aims to address the energy problem of the urban areas in a holistic manner. The various initiatives like promoting solar water heating systems; deploying solar cells; designing solar buildings and promoting urban and industrial biomass to energy projects would be consolidated under the programme.
2. The programme aims at minimum 10% reduction in projected demand of conventional energy and increasing energy production through renewable energy.
3. It will motivate the local Governments for encouraging and adopting renewable energy technologies and energy efficiency measures. A total of 60 cities/towns were identified to be supported for development as Solar Cities during the 11th Plan period.

Environment (Protection) Act, 1986

1. It empowers the government to frame rules regarding regulating pollution, setting norms, industries etc.
2. It creates procedures and safeguards for accidents which may cause environmental pollution and handling hazardous substances.

National Environment Appraisal and Monitoring Authority (NEAMA), 2011

1. This authority will appraise and monitor the compliance of various projects. It will be a fully professional, science-based and autonomous body. The Ministry of Environment will continue approval of the projects based on NEAMA's appraisal.
2. This marks a major improvement over the current system as it separates the appraisal and approval parts.

Wildlife Habitat Guidelines (Revised), 2011

1. Critical Wildlife Habitats (CWH) are areas which are absolutely essential for survival of endangered species and hence should be left unviolated. But declaring areas as CWH conflicts with the interests of the tribals as it displaces them.
2. In the previous guidelines, the decision to declare the area as CWH rested with the forest officials with token participation of other stake holders. In the new guidelines, a committee of gram sabha members, forest officials, tribal NGOs and scientists will together take the decision. For any relocation to be carried out, the free and informed consent of the gram sabha is necessary.

National Afforestation Programme

1. Its objective is to improve the forests with community participation and specially benefit people living on the forest-rural fringe.
2. It devolves the forest management and protection responsibilities to decentralized institutions of Joint Forest Management Committee at village level and Forest Development Authority at the forest division level. The JFMCs consist of women, SC/STs etc. and the FDA is an aggregate of JFMC. Funds are dispatched directly at FDA and JFMC level. Training etc. are also organized for their members.
3. Apart from afforestation activities, emphasis is also on soil and moisture conservation techniques, fencing, monitoring etc.

National Bamboo Mission

1. Launched in 2006-07, a central assistance of Rs. 8000/- per hectare is provided in order to harness the potential of bamboo crop for enhancing income of the farmers.
2. Its aim is to increase yield from 3 tonnes to 20 tonnes per hectare.
3. Components of the scheme include mass production of quality planting material, improved post harvest management, development of human resources and marketing facilities.

Pollution in Leather Industry

1. Leather industry in India has become 0 discharge industry as ~80% of the effluents are treated and recycled back into use and remaining 20% are solidified and their salts used for

other purposes. As a result, Indian leather industry is REACH compliant (EU norms) and exported $4.5 bio in 2011-12 and the target is $14 bio by 2015-16 (growth rate of 20% p.a.).

2. In 11th FYP, government provided 75% assistance (60% centre + 15% states) for setting up effluent treatment plants.

National Action Plan on Climate Change

National Solar Mission

1. To increase the share of solar energy in India's total energy pie significantly by creating 20 GW capacity by 2020.
2. To use refractor types technology to setup MW scale solar plants.

(a) Monocrystalline Silicon Technology

1. A single crystal of silicon is prepared and the wafer cut out of that. It has high efficiency (17%) as the entire lattice is continuous with no grain boundaries (and hence less resistance) but higher costs since a single crystal is expensive to generate and there is a lot of wastage.

(b) Multicrystalline / Polycrystalline Silicon Technology

1. Here there is no need to cut the wafer entirely out of single crystal. A wafer can have multiple crystals. This lowers the costs but also lowers the efficiency (to 10%).

(c) Thin Film Technology

1. They are cheaper to manufacture as they use very less material. A thin film of silicon material is printed between two sheets of other material. But they are less durable.

(d) Concentrated Photovoltaic / CPV Technology

1. It uses mirros and lenses to concentrate sun light and improve efficiency (40%). But challenges are they don't work in diffused light and need direct sunlight.

(e) Graphene Solar Cells

1. They can be cheaper but have very low efficiencies (3% proven). Recent researches have been able to increase the efficiency up to 8.5% by treating them with a chemical.
2. When graphene and silicon are put together they form a Schottky junction which helps in conducting electrons.

National Mission for Enhanced Energy Efficiency

1. The objective was to save 10 GW by 2012 and 19 GW by 2015 (~100 MT CO_2 reduction). It has achieved it through star labeling. Star labeling is an energy efficiency rating scheme in electrical appliances and buildings. Scale is 1 to 5 stars with more stars meaning more efficiency. The idea was to develop standards and to make consumers aware while making the purchasing decision. But it remains voluntary.
2. Perform, Achieve, Trade scheme: To induce market based energy savings. All institutions will be given a emissions savings target. Ones achieving more savings will get carbon credits which can be sold to the non performers or else penalties. It is mandatory for all large industrial units. During the first cycle of PAT scheme i.e. from 2012-13 to 2014-15, eight energy intensive sectors such as thermal power, iron & steel, cement, fertilizer, aluminum, textile, pulp & paper, chemicals have been included. 685 accounts in these

sector account for about 165 million tonnes oil equivalent of energy consumption annually (~35% of India's energy consumption). Savings will be 6.6 MToE by 2015. The penalty will be a fixed amount (only Rs. 10 lac) + target savings unachieved * cost of 1 tonne of oil equivalent (thus little incentive to cut cost)!

3. Green technologies: Fiscal support, innovation, easier financing for green technologies.
4. Coal plants: This includes encouraging super critical thermal plants (60% of coal plants in 12th FYP and 100% in 13th FYP will be super critical), shifting of freight from road to railways and Integrated Gasification Combined Cycle (converting coal into gas and removing impurities).
5. Residential lighting: The penetration of CFLs in the domestic sector has been relatively limited because of the high costs. The Bachat Lamp Yojana (BLY) provides CFLs to households at the cost of incandescent bulbs. Discoms select qualified investors to sell high quality CFLs in their region. The investors earn carbon credits due to the lower energy use by the CFLs.
6. Energy efficiency in agricultural pumping: Replacement of inefficient agricultural pumps by efficient pumps is enabled through the performance contracting mode. Pumps are evaluated for their current energy consumption, and then the existing pumps are replaced with efficient pumps. The resultant energy savings are evaluated, and the replacer is paid a share .
7. Development in technology for Carbon Capture and Storage (CCS) need to be carefully monitored to assess the suitability and cost effectiveness of this technology for Indian conditions. A major effort must be made to expand energy from clean energy sources. The share of new renewable energy in total commercial energy use at this juncture is around 10.0 per cent with conventional hydro-electricity accounting for another 20 per cent. The share of new and renewable energy could go up to 15.0 per cent by 2020.

National Mission on Sustainable Habitat

1. The objective is sustainable urban development. It will be accomplished through: (a) Promoting the Energy Conservation Building Code. (b) Encouraging shift to public transport. (c) Better urban waste management by higher recycling and to invest in R&D thereof.

National Water Mission

1. To increase water use efficiency by 20%.
2. To meet the urban needs mostly through recycled water and coastal needs through low temperature desalination of ocean water.

National Mission for Green India

1. To increase the forest cover from 23% to 33%.
2. To increase community participation in afforestation.
3. To setup Compensatory Afforestation Management and Planning Authority (CAMPA) and campa funds.

National Mission for Sustaining Himalayan Ecosystem

1. To share information on Himalayan Ecology with neighbors.

2. To setup monitoring centers for Himalayan ecology.
3. To keep 67% of Himalayan land under forest cover and to include community in it.

National Mission for Sustainable Agriculture

1. To develop climate resistant crop varieties.
2. To develop alternate cropping patterns.
3. To use traditional knowledge along with modern.
4. To make rain fed agriculture more resilient.

National Mission for Strategic Knowledge on Climate Change

1. An open source platform will be maintained and all information would be shared.
2. Increasing research by a Climate Science Research Fund as well as private research.

National Watershed Management Programme

Objectives

1. Developing wastelands/degraded lands, drought-prone and desert areas on watershed basis. A watershed is a unit of 500 ha which drains into a common point.
2. Mitigating the adverse effects of extreme climatic conditions.
3. Restoring ecological balance.
4. Encouraging village community for community action and local traditional knowledge.

Activities

1. It will cover projects like soil treatment, erosion check, afforestation, local embankments etc.
2. It will have greater role of PRIs and village forest committees.

National Lake Conservation Programme

1. Prevention of pollution from point sources which includes water treatment.
2. In situ measures of lake cleaning such as de-silting, de-weeding, bioremediation, aeration, bio-manipulation.
3. Catchment area treatment which may include afforestation, storm water drainage, silt traps etc.
4. Prevention of pollution from non-point sources by providing low cost sanitation.

National Wetland Conservation Programme

Activities

1. Wetlands in India are disappearing @ 2-3% p.a. Major threats are conversion into paddy fields and encroachment by real estate developers. India is a party to Ramsar convention which was based on the 'wise use (sustainable development)' principle. Yet there is no legal framework to conserve wetlands. So a draft framework is being prepared to notify in EPA, 1986.
2. The identification of wetlands is done on the basis of ecological importance, level of endangered species being supported etc. So far 115 wetlands have been so identified.

3. Programmes covered are catchment area management, point source pollution treatment, weed control, inventorization etc.

Role of Wetlands

1. Wetlands aid in water filtration by removing excess nutrients, slowing the water allowing particulates to settle out of the water which can then be absorbed into plant roots. Studies have shown that up to 95% of nitrogen can be removed from passing water through a wetland. Wetlands also let pollutants settle and stick to soil particles, up to 70% of sediments in runoff. Some wetland plants have even been found with accumulations of heavy metals more than 100,000 times that of the surrounding waters concentration.
2. Through wetlands ability to absorb nutrients, they are able to be highly biologically productive. Freshwater wetlands are even comparable to tropical rainforests in plant productivity

National Green Tribunal

Powers

1. It investigates matters related to pollution, diversion of forest land to non-forest use, environmental clearances granted to projects under EIA notification 2006, environment, biological material, traditional knowledge etc. It replaced National Environment Appellate Authority in 2010.
2. It was established under the Art 21 and also under India's commitments under the Rio Summit to provide a forum for judicial and administrative remedies for environmental damage.
3. The Tribunal is not guided by Code of Civil Procedure 1908 but is guided by the principles of natural justice. Also being a dedicated tribunal it is expected to regulate emissions (thus helping in carbon markets) and provide speedy justice.

Composition

1. It contains experts from environment and related sciences + administration + judicial appointees. This lends an expert color to NGT.
2. It has a central bench in Delhi and 4 regional benches @ Bhopal, Chennai, Kolkata, Pune.

Expert Group on Low Carbon Strategies for Inclusive Growth

1. Power: In the power sector, it has suggested action both on supply and demand side. On the supply side, we need to adopt super-critical technologies in coal. Gas being in limited supply, its best use is not in base load power, but in combined heat and power systems in large establishments. We need to invest in renewable technologies, particularly solar, wind, hydel and second generation bio-fuels. On the demand side, we need to accelerate adoption of super-efficient electrical appliances and pump sets through a combination of market and regulatory mechanisms. We need to modernize our transmission and distribution systems.
2. Transport: On the transport front, we need to increase the share of rail. This is not possible unless we drastically improve the efficiency of rail freight transport, and also make it price competitive by bringing down the levels of cross subsidization between freight

and passenger transport. Completion of dedicated rail corridor must be taken up on top priority. We need to improve the fuel efficiency of our vehicles through both market based and regulatory mechanisms.

3. Industry: The Expert Group has identified major sources of industrial emissions and made specific recommendation for sectors like Iron & Steel and Cement, which account for over 60% of industrial emissions. It is important that green-field plants in these sectors adopt best technology; while existing plants, particularly, small and medium ones, modernize.
4. Buildings: India is fortunate that most of our commercial buildings that will be extant in 2030 are yet to be built. We need to both evolve and institutionalize Green Building Codes.
5. Forestry: Up to the Eleventh Plan, our focus was on increasing area under forest and tree cover. Given the scarce land availability, achievement in this front has been limited. However, there is a tremendous scope for increasing the stock and quality of existing forests. 'Green India Mission' is being designed to regenerate at least 4 million hectares of degraded forest; increase density of cover on 2 million hectares of moderately dense forest; and overall, increase the density of forest and tree cover on 10 million hectares of forest lands, waste lands and community lands.

Environment protection

International Initiatives

Mercury Treaty-2013

- An international treaty, adopted by 140 nations, that legally binds the nation to limit the use of health hazardous mercury.
- It will aim at
  - Reduction of global emission levels of the toxic heavy metal or the quick silver
  - Reduce the production and the use of mercury in industrial processes and product production
  - To cut mercury pollution from utility plants, mining, a host of products and industrial processes, and set enforceable limits as well as to encourage alternatives where mercury in not used or released.

Impact of Mercury on Human Being

- The natural element Mercury cannot be created or destroyed, but is released in air, water and land from different activities like coal powder plants, gold mining activities as well as electrical goods and other consumer products.

- Mercury enters the food-chain via fish and poses a threat to the living being more likely to pregnant women and children.
- As per the data released by the World Health Organisation intake of mercury or any of its compounds to any limit is not safe and it may lead to memory loss, language impairment and kidney damage.

United Nations Environment Programme (UNEP) report:

- In the past 100 years, man-made emissions have raised the mercury concentrations in the top 100 metres of the world's oceans to double.
- Concentrations in deeper waters have increased by up to 25%.
- Much human exposure to mercury is through the consumption of contaminated fish.
- Around 200 tonnes of the substance are deposited in the Arctic every year.
- Developing countries were especially vulnerable to direct mercury contamination mainly due to the extensive use of the element in small-scale gold mining and to the burning of coal for electricity generation.

Ecological Footprint

1. It is a measure of human demand on the earth's resources standardized in terms of biologically productive area used in making a product and to assimilate its waste. Using this assessment, it is possible to estimate how many planet earths it would take to support humanity if everybody followed a given lifestyle.
2. For 2007, humanity's total ecological footprint was estimated at 1.5 planet Earths. The number is published each year with a 3 year lag. Qatar, Kuwait, UAE, Denmark and US are biggest footprint countries.

Roundtable on Sustainable Palm Oil

1. India is the biggest importer of palm oil (consumption 16 MT and imports 8 MT) and palm oil is a source of calories. Most of the palm oil is imported from Indonesia where they are cutting the tropical forests for the cultivation of palm oil in plantations. Such is the extent of deforestation that Indonesia has become the 3rd largest emitter of GHGs.
2. Indian importing companies are too small individually to enforce any bargaining power so as to ensure that none of the plantations is established after deforestation. This is a classic case of market failure and this is where the roundtable steps in. But its provisions are not strict enough.

Bonn Convention (1979)

1. This was a convention to preserve migratory species. A list of threatened migratory species was chalked out and numerous MoUs were signed for their conservation. India's olive ridley turtle was one such species.

Ramsar Convention (1971)

1. It came up with a list of recognized wetlands (area under a marsh, fenn, peatland or water not more than 6 meter of submergence in low tide) and their conservation. Canada has the highest area under wetland and UK has highest number of wetlands.

Montreux Record

1. Wetlands of international importance which have or are likely to undergo critical changes in their ecosystem due to human action are placed under Montreux Record. Once placed it may benefit from Ramsar rules.

Nagoya Protocol & Convention on Bio Diversity

1. The CBD was adopted in the Earth Summit in 1992 and was the first global agreement which addresses all aspects relating to biodiversity. It recognizes sovereign rights of nations over their biological resources. It has three main goals: (i) conservation of biological diversity, (ii) sustainable use of its components and (iii) fair and equitable sharing of benefits arising out of the use of genetic resources between the people and countries which is also called access and benefit sharing (ABS).
2. Nagoya protocol was devised to implement the ABS objective. The process of ratifications has been slow for Nagoya protocol because it requires the countries to put in legal and institutional measures to implement ABS provisions which runs against the interests of powerful domestic groups. Very few countries have domestic ABS mechanisms in place.

Basel Convention

1. It seeks to control the trans-boundary movement of hazardous wastes including e-wastes. Initially it provided for a notification only and allowed consented exchange. But later any exchange for any purpose was banned.

Oriental Nicety oil tanker

1. It is laden with hazardous chemicals and came to Bhavnagar in Gujarat for dismantling against the Basel convention. It was responsible for the worst oil spill in Alaska in 1986. Under the convention rules, a ship has to be decontaminated by the exporting country before it can be dismantled in the destination country.

Cartagena Protocol (2000)

1. The Cartagena protocol on biosafety seeks to protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology.
2. It follows the precautionary principle which allows developing nations to ban imports of a living modified organism if they feel there is not enough scientific evidence that the product is safe and requires exporters to label such shipments. Information exchange is a must.

Socio Economic Considerations of Bt Crops

1. The issue has figured in the Cartagena protocol talks i.e. whether the socio economic impact of Bt crops can be taken into consideration while determining the "safety" of the products. While developing countries were in favor of doing so developed countries opposed it. As a compromise, SEC were included in the Protocol with a rider that their application should be consistent with existing international trade obligations.

Stockholm Convention

1. It requires the developed countries to provide new and additional resources to (a) eliminate production and use of intentionally produced POPs (Annex A), (b) restrict the disposal of POPs wastes in an environmentally-sound manner (Annex B), and (c) eliminate unintentionally produced POPs (Annex C).
2. The Committee first determines whether the substance fulfills POP screening criteria detailed in Annex D of the Convention, relating to its persistence, bioaccumulation, potential for long-range environmental transport (LRET), and toxicity. If a substance is deemed to fulfill these requirements, the Committee then drafts a risk profile according to Annex E to evaluate whether the substance is likely to lead to significant adverse human health. Finally, if global action is warranted, it develops a risk management evaluation, according to Annex F.
3. Endosulfan is a controversial pesticide believed to be injurious to the nervous system. Hence it has been banned world wide including the Stockholm Convention where it was put in the elimination list. India is a signatory to the convention.
4. Last year, the apex court, acting on a writ petition had banned the production and sale of endosulfan in India. The court had directed the state and Centre to freeze the production licences granted to manufacturers of endosulfan till further orders. Last week Centre but forward an affidavit in Supreme Court to allow states to use endosulfan except in Kerala and Karnataka. India is the world's second largest producer of endosulfan.

Rotterdam Convention

1. A listing in the convention implies the substance being labeled as a hazardous substance and the exporting country giving full data to the importing country so that it could take an

informed decision on the import. Export would then be permitted only if the importing country gave its consent.

Chrysotile

1. Chrysotile is white asbestos often mixed with cement to create a mixture applied to corrugated steel sheets and pipes and used in construction. Its alternatives are cellulose and other agricultural fibers but are not as cheep.
2. Canada is the major producer of white asbestos called chrysolite. So it opposed listing. India is a leading importer and it supported the listing.

Mercury Emissions

1. The United Nations Environment Programme (UNEP) hosted a meeting to establish legally binding targets on controlling mercury emissions. The main sources of Mercury Emissions are thermal power plants and fluorescent bulbs.
2. Given India's heavy reliance on both, India has refused to be bounded by international legal targets and has instead agreed to prepare by 2013 a voluntary draft to reduce emissions. India has also asked the developed countries to give money.

Montreal Protocol

1. It relates to protection of ozone layer by phasing out use of ozone harming substances like CFCs and halogens, CCl_4, methyl chloroform.
2. NO_2 is another gas which harms ozone layer and is emitted by aircrafts and rockets.

Reduced Emissions from Deforestation and Forest Degradation

1. Deforestation is the permanent removal of forests and withdrawal of `land from forest use. Forest degradation refers to negative changes in the forest area that limit its production capacity. REDD is a set of steps designed to use market/financial incentives in order to reduce the emissions from deforestation and forest degradation which account for 15-25% of GHG emissions.
2. Kyoto Protocol excluded deforestation and degradation due to the complexity of measurements and monitoring for the diverse ecosystems and land use changes. This resulted in the formation of the Coalition of Rainforest Nations. In 2005, the Coalition of Rainforest Nations initiated a request to consider 'reducing emissions from deforestation in developing countries.' The matter was subsequently adopted in Bali conference.
3. REDD activities are undertaken by national or local governments, dominant NGOs, the private sector, or any combination of these. The genuine actors of REDD, however, will be the populations whose livelihoods derive from forests.
4. It has been criticized for ignoring the rights of indigenous peoples, for relying on failing carbon markets for its success.

REDD+

1. The REDD"+" is more than just avoided deforestation and forest degradation, it also includes the possibility of offsetting emissions through “sustainable forest management”, “conservation” and “increasing forest carbon stocks”. REDD need not refer solely to the establishment of national parks or protected areas; it could include land use practices such as shifting cultivation by indigenous communities and reduced-impact-logging, provided sustainable rotation and harvesting cycles can be demonstrated.
2. According to some critics, REDD+ is another extension of green capitalism, subjecting the forests and its inhabitants to new ways of expropriation and enclosure at the hands of polluting companies and market speculators.

Sustainable Development

3 Pillars

1. Produce differently: More efficient production i.e. use less resources to produce same.
2. Consume differently: Make consumption resource friendly.
3. Organize differently: Increase public participation.

Rights of Nature

1. A court in Ecuador fined Chevron for $18 bio for causing pollution in the country. It did so based on the rights given to nature in the country. SImilarly Bolivia also has given rights to the nature like right to life and to exist, right to be free from human alteration, not to be affected by mega projects, not to have cellular structure genetically modified.

E-Waste Recycling

1. So far e-waste has been shipped to developing countries where this poses dangers as it is handled by informal sector.
2. India generated 0.8 MT of e-waste in 2012 (up from 0.15 MT in 2005)

E-Waste (Management, Handling and Trans Boundary Movement) Rules, 2008

1. Import of such wastes for disposal is not permitted except for recycling by the registered units only and with the permission of the Ministry of Environment and Forests and/or Directorate General of Foreign Trade. For effective implementation of provisions related to import and export, a co-ordination committee including representatives from revenue department, DGFT, ministry of shipping, Central Pollution Control Board has been constituted. This committee has been working to sensitize the customs authorities regarding enforcement of these rules in order to check illegal import of e-waste into the country.

E-Waste (Management and Handling) Rules, 2011

1. The concept of extended producer responsibility has been enshrined in these rules to make it a mandatory activity for the manufacturers of electronic and electrical equipments. Under this the producers are responsible for collection of e-waste generated from the end of life of their products by setting up collection centers. The concept originated in Switzerland.

2. E-waste recycling can be undertaken only in authorized facilities. Government has started a scheme to provide financial assistance for setting up of treatment plants in PPP mode.

Pharmaceutical Pollution

1. Most drugs are insoluble in water and are non bio-degradable. Thus the drug residues tend to build up in the environment and accumulate in our bodies. Many drugs also interfere with degradation of other substance in the sewage since antibiotics kill the microbes decomposing sewage. Another concern is that the microbes tend to mutate into drug resistant varieties. This is made even more potent because often in waste water one would find a cocktail of antibiotics and only the deadliest of pathogens will survive.
2. Human and animal excreta is the primary route via which drugs enter the environment. Hospital and manufacturing waste is another major route.

Acid Rain & Stone Cancer

1. It contains traces of H_2SO_4, HCl and HNO_3. It occurs due to fossil fuels and forest fires.
2. The Taj Mahal is threatened by acid rain from Mathura refinery. This is called stone cancer.

Acid Drainage

1. When rain water and oxygen combines with sulphide bearing minerals like pyrite (iron) they form sulphuric acid.

Bioremediation / Biogenidiation / Bioaugmentation

1. Bio-Remediation technology uses microbes to remove pollutants. It can be *in situ* or *ex situ.*
2. It can be natural or induced (where microbes are added externally and fertilizers are applied to create suitable environment for them to grow).
3. Such a technology can be used to clean the 350 tonnes of toxic waste in Bhopal. It can be used to treat municipal waste water.

Biostimulation

1. It means modifying the environment to make it more suitable for bioremediation by addition of certain substances.

Bio-accumulation vs Bio-concentration vs Bio-magnification

1. Bio-accumulation occurs within a trophic level and is increase in concentration of a substance in our bodies through food and environment.
2. Bio-concentration occurs within a trophic level through absorption from water (when intake from water > excretion rate).
3. Bio-magnification occurs across different trophic levels in a food chain.

Biodilution

1. As opposed to bio-magnification it means decrease in the concentration of a substance with increase in trophic level. Substances of concern are heavy metals like mercury, cadmium.

2. This occurs when the nutrient content of an ecosystem is high. So the numbers of autotrophs (phytoplankton) is also very high and their biomass is high. So the metals get diluted and even in next layer of the food chain their concentration is less. Thus by increased use of nitrogen and phosphorus fertilizers, bio-accumulation can be reduced.

Carbon Cycle

Oceans

1. Oceans contain largest amount of C, mostly near their surface and as HCO_3-. The typhoons and storm bury a lot of C as they wash away sediments.
2. In regions of upwelling, C is released into the atmosphere and in regions of downwelling, it is absorbed into the ocean.
3. Revelle factor: The level of carbon in oceans doesn't vary in unity with the partial pressure of atmospheric CO_2. It varies by a factor called Revelle factor which is ~10 i.e. for 10% increase in partial pressure of CO_2, oceanic carbon content will increase by 1%.
4. Towards the pole, water becomes cooler and hence more CO_2 becomes soluble into the water and hence more C absorption.

Salt Marsh Ecosystem

1. Salt marshes occur in temperate and high-latitudes coasts in sheltered environments such as embankments, estuaries and the leeward side of barrier islands. In the tropics they are replaced by mangroves; an area that differs to a salt marsh in that instead of herbaceous plants, they are dominated by trees. A herbaceous plant has leaves and stems that die down at the end of the growing season to the soil level. They have no persistent woody stem above ground. Annual herbaceous plants die completely at the end of the growing season and they then grow again from seed. Herbaceous perennial and biennial plants have stems that die at the end of the growing season, but parts of the plant survive under or close to the ground from season to season (for biennials, until the next growing season, when they flower and die).
2. Elevation is an important aspect of salt marsh ecosystem. At higher elevations, there is much less and variable tidal inflow, resulting in lower and variable salinity levels (salinity will depend on evaporation and flooding which can both be unpredictable). Soil salinity in the lower marsh zone is fairly constant due to everyday annual tidal flow.

Littoral Ecosystems

Supralittoral Zone

1. It is the area above the spring high tide line that is regularly splashed, but not submerged by ocean water. Seawater penetrates these elevated areas only during storms with high tides. Organisms here must cope also with exposure to bad air, fresh water from rain, variations and predation by land animals and seabirds.

Eulittoral Zone (Inter-tidal zone)

1. It extends from the spring high tide line, which is rarely inundated, to the neap low tide line, which is rarely not inundated. The wave action and turbulence of recurring tides shapes and reforms cliffs, gaps, and caves, offering a huge range of habitats for sedentary organisms.
2. Productivity is progressively lower towards the land.

Sublittoral Zone / Neritic Zone

1. It starts immediately below the eulittoral zone. This zone is permanently covered with seawater. The sunlight reaches the ocean floor. This results in high primary production and makes the sublittoral zone the location of the majority of sea life. As in physical oceanography, this zone typically extends to the edge of the continental shelf.

Coral Reef Ecosystems

Formation

- As the volcano / island subsides, coral growth includes a fringing reef often including a shallow lagoon between the reef and the island. 
- As the island continues to subside, the reef and the lagoon becomes larger and larger. 
- Finally an atoll emerges as the island sinks. 

Types

1. Barrier reef: It is separated from the mainland by a deep channel or lagoon.
2. Patch reef: It is an isolated, comparatively small reef outcrop usually within a lagoon often circular and surrounded by sand or seagrass.
3. Apron reef: A short reef resembling a fringing reef, but more sloped.
4. Micro atoll: Certain species of corals form communities called micro atolls. It is not a single reef but a collection of reefs resembling atolls.
5. Cays: They are small, low-elevation, sandy islands formed on the surface of coral reefs. Material eroded from the reef piles up on parts of the reef or lagoon, forming an area above sea level. Plants can stabilize cays enough to become habitable by humans.
6. Seamount/guyot: When a coral reef cannot keep up with the sinking of a volcanic island, a seamount or guyot is formed.

Reef Ecosystem

1. The reef surface: It is the shallowest part of the reef. Due to shallowness, waves surge and increase in height. This means the water is often agitated. These are the precise condition under which corals flourish. Shallowness means there is plenty of light and agitated water promotes the ability of coral to feed on plankton for which they have tentacles. However, other organisms must be able to withstand the robust conditions to flourish in this zone.

2. The off-reef floor: It is the shallow sea floor surrounding a reef on a continental shelf. Usually sandy, the floor often supports seagrass meadows which are important foraging areas for reef fish.
3. The reef drop-off: It is a habitat for many reef fish who find shelter on the cliff face and plankton in the water nearby.
4. The reef face: It is the zone above the reef floor or the reef drop-off. It is usually the richest habitat. There are cracks and crevices on the reef face (due to algae growth) which provide protection, and the abundant invertebrates and algae provide an ample source of food.

Corals and Climate Change

1. Coral bleaching: Corals contain plant-like organisms called zooxanthellae that live symbiotically within their tissue. Zooxanthellae provide their coral host with food and oxygen and in return, the zooxanthellae receive nutrients, carbon dioxide, and an enemy-free shelter. When water temperatures increase this critical yet delicate symbiotic relationship breaks down and the zooxanthellae are expelled, often leading to the coral's death. The phenomenon is called "coral bleaching" because the coral animal appears to turn white after the zooxanthellae loss. This is because without their zooxanthellae symbionts, which contain various photosynthetic pigments, corals are nearly transparent and the white.
2. Coral disease: As temperatures increase the activities of harmful bacteria also increases harming corals. Higher temperature also causes stress in coral leading to lower immunity.
3. Ocean acidification: Increased CO_2 means increased acidification of water making it difficult for corals to secrete their $CaCO_3$ skeleton.

Estuary Ecosystem

1. An estuary is a partly enclosed coastal body of water with one or more rivers flowing into it, and with a free connection to the open sea. The inflow of both seawater and freshwater provide high levels of nutrients making estuaries among the most productive natural habitats. But they suffer from pollution, surface runoffs, over fishing and eutrophication leading to dead zones.
2. Two of the main challenges of estuarine life are the variability in salinity and sedimentation. Many species of fish and invertebrates have various methods to control or conform to the shifts in salt concentrations and are termed osmo-conformers and osmo-regulators. Large numbers of bacteria are found within the sediment which have a very high oxygen demand. This reduces the levels of oxygen within the sediment.
3. Phytoplankton are key primary producers in estuaries. They move with the water bodies and can be flushed in and out with the tides. Their productivity is largely dependent upon the turbidity of the water.

Bank Ecosystem

1. A bank is a part of the sea which is shallow compared to its surrounding area such as the top of an underwater hill. There is upwelling and strong currents around the banks resulting sometimes in nutrient rich currents. Because of this, some large banks are among the richest fishing

grounds in the world.

Pelagic Ecosystem

1. Any water in a sea or lake that is not close to the bottom or near to the shore can be said to be in the pelagic zone. In deep water, the pelagic zone is sometimes called the open-ocean / oceanic zone and can be contrasted with water that is on the continental shelf. However in other contexts, coastal water that is not near the bottom is still said to be in the pelagic zone.
2. The demersal zone is the part of the ocean comprising the water column that is near to (and is significantly affected by) the seabed.

1. Epipelagic zone (sunlight): It extends

   from the surface down to around 200 m where light penetrates and is enough for photosynthesis.

Consequently, plants and animals are largely concentrated in this zone.

2. Mesopelagic (twilight): It extends from 200 m to around 1,000 m. Although some light penetrates this second layer, it is insufficient for photosynthesis. At about 500 m the water also becomes depleted of oxygen. Still, life copes, with gills that are more efficient or by minimizing movement.
3. Bathypelagic (midnight): It extends from 1,000 m to around 4,000 m. At this depth the ocean is pitch black, apart from occasional bioluminescent organisms. Most animals living here survive by consuming the detritus falling from the zones above, which is known as marine snow.
4. Abyssopelagic (lower midnight): It extends from 4,000 m to above the ocean floor. Many of the species living at these depths have adapted to be transparent and eyeless as a result of the total lack of light in this zone. Organisms live around hydrothermal vents.
5. Hadopelagic: It refers to the deep water in ocean trenches.

Benthic Ecosystem

1. It is the ecological region at the lowest level including the sediment surface and some sub-surface layers. Organisms living in this zone are called benthos. The benthic region of the ocean begins at the shore line and extends in the sea. The pressure difference can be one atmosphere for each 10 meters of water depth.
2. Benthic organisms can be divided into two categories based on whether they make their home on the ocean floor or an inch or two into the ocean floor. Those living on the surface of the ocean floor are known as epifauna. Those who live burrowed into the ocean floor are known as infauna.
3. Because light does not penetrate very deep ocean-water, the energy source for the benthic ecosystem is often organic matter from higher up in the water column which drifts down to the depths. Some microorganisms use chemosynthesis.

Hydrothermal Vent Ecosystem

1. Hydrothermal vents in the deep ocean typically form along the mid-ocean ridges. These are locations where two tectonic plates are diverging and new crust is being formed. The water emerging from the hottest parts of some hydrothermal vents can be a supercritical fluid. Besides being superheated, the water is also extremely acidic, often having a pH value as low as 2.8.
2. White smokers: They are vents that emit lighter-hued minerals, such as those containing barium, calcium, and silicon. These vents also tend to have lower temperature plumes.
3. Black smokers: They typically emit particles with high levels of sulfur-bearing minerals, or sulfides.
4. Vent organisms depend on chemosynthetic bacteria for food. The water that comes out of the hydrothermal vent is rich in dissolved minerals. These bacteria use sulfur compounds, particularly hydrogen sulfide to produce organic material. Tube worms form an important part of

the community around a hydrothermal vent. They have no mouth or digestive tract and absorb nutrients produced by the chemosynthesis bacteria in their tissues. They transfer H_2S to the bacteria living inside and in return the bacteria nourish the worm with carbon compounds.

Cold Seep Ecosystem

1. A cold seep is an area of the ocean floor where hydrogen sulfide, methane and other hydrocarbon-rich fluid seepage occurs. Cold seep doesn't mean water is cooler than the surrounding water. It simply means it is not as hot.
2. The first level organisms are chemosynthesis bacteria. In the initial stage, methane is relatively abundant and dense mussel beds form. The mussels use bacteria feeding on methane. Unlike the mussels, tube worms rely on bacteria which feed on hydrogen sulfide instead of methane for survival.
3. Cold seeps do not last indefinitely. As the rate of gas seepage slowly decrease, the shorter-lived, methane-hungry mussels start to die. At this stage, tube worms become the dominant organism in a seep community. This is called ecological succession.

Ecological succession

1. It is the phenomenon or process by which an ecological community undergoes more or less orderly and predictable changes following disturbance in a habitat. The community which is able to get into equilibrium with the new environment is called the climax community.
2. Primary succession is the succession process which starts when there were no previous organisms in that place. Secondary succession is the succession process when there were already some organisms.

Hydrarch and Xearch Successions

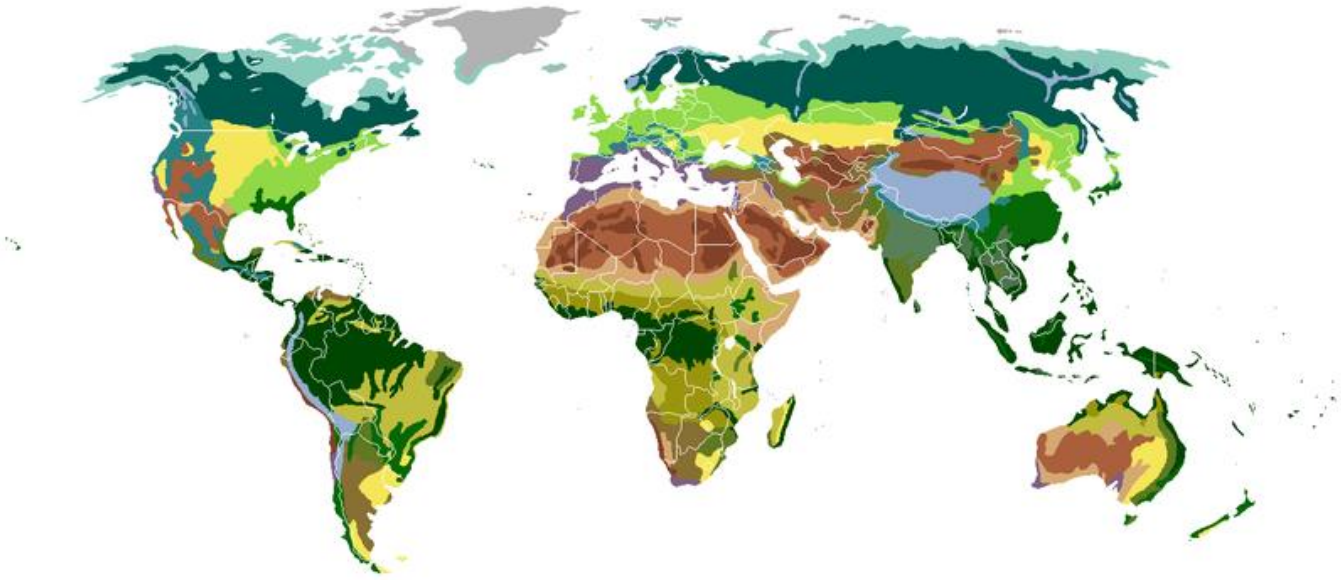
1. Mesic condition is the medium water condition. Hydrarch succession takes place in a wet place where plants grow so as to take it to mesic level. Xearch succession takes place in a dry place where plants grown so as to take it to mesic level.

Lake Ecosystem / Lentic Ecosystem

1. Phytoplankton are found in epipelagic zone. Many species have a higher density than water which should making them sink and end up in the benthos. To combat this, phytoplankton have developed density changing mechanisms, by forming vacuoles and gas vesicles or by changing their shapes to induce drag, slowing their descent. Photosynthesis is often low at the top few millimeters of the surface, likely due to inhibition by ultraviolet light.
2. Bacteria feed on detritus, they are consumed by protozoa which are in turn consumed by zooplankton, and then further up.
3. Acid rains can lead to acidification of water. Lakes that contain bedrock that is rich in carbonates have a natural buffer, resulting in no alteration of pH. But those without such bedrock, are very sensitive to acid inputs. At a pH of 5-6 algal species diversity and biomass decrease considerably, leading to an increase in water transparency – a characteristic feature of acidified lakes. Eutrophication and invasive species are other human induced threats.
4. Below the epipelagic zone is the limnetic zone well lighted as well and dominated by plankton. Then comes the thermocline zone where there is a rapid change in water temperature with depth.

River Ecosystem

1. The temperature is cooler at the source. The water has higher oxygen and is clearer.
2. In the middle the volume, width and biodiversity increases.
3. In the lower reaches the water becomes muddy, less sunlight penetration, less oxygen and less biodiversity.



sheet and polar desert	steppe	xeric shrubland	savanna	tundra
tundra	subtropical rainforest	dry steppe	tree savanna	mountain forest
taiga	Mediterranean vegetation	semiarid desert	subtropical dry forest	
temperate broadleaf forest	monsoon forest		tropical rainforest	

Stratification

1. It is the vertical distribution of different species into different levels like trees @ top, grasses @ bottom.

Net Primary Productivity

1. Gross primary productivity - Rate of respiration.
2. Gross primary productivity is the rate of biomass production.

Standing State

1. It is the amount of nutrient present in the soil at any given time.

Tropical Forests

1. Soils: The soils are acidic and nutrient poor because of leaching and heavy saprophytic activity.

Boreal or Taiga Forests

1. Soils: The soil is acidic and nutrient poor.
2. The canopy permits only low light penetration.

Savanna Grasslands

1. Soils: Soils are porous and poor humus content.

Deserts

1. Vegetation modifications: Plants have longitudinal ridges and grooves on their stems which swell as water fills up in them. As the water gets used up they shrink again. They also have thick, fleshy leaves and stems.

Asian Brown Cloud

1. It is a 3 km thick layer of air pollutants over S Asia.

HCH (Hexa Chloro CycloHexane)

1. It is a pesticide used in Asia but has accumulated on W coast of Canada and Alaska as the low temperature there reduces its evaporation and degradation rates.

Phyto-filtration

1. It is a technique by which ferns can be grown on contaminated water which absorb As from it.

Spent Wash

1. It is the pollutants released from distilleries which are rich in organic pollutants exhausting water oxygen.

Bay of Plenty

1. It is in New Zealand. An oil leak happened here.

Climate Change

IPCC

The IPCC's Summary for Policymakers report addresses the question directly, arguing that the current slowdown in global warming will not affect long-term rise in temperatures.

Global temperatures have on average risen by 0.12 degrees Celsius per decade since 1951 but the warming rate in the 1998-2012 period is considerably lower at 0.05 degrees C.

The report attributes a number of reasons for this slowdown. One, it says, 15 years is too short a period for making generalizations. "Due to natural variability, trends based on short records are very sensitive to the beginning and end dates and do not in general reflect long-term climate trends," it says.

"If you take away the first year — 1998, which was exceptionally hot because of a strong El Nino — the graph looks very different,

The report says the slowdown in warming since 1998 could be due to two factors. One, the Earth retained less heat during this period primarily due to volcanic eruptions and a downward phase in the 11-year solar cycle. And two, much of the energy generated by global warming went into the ocean.

The novel aspect of the latest report is the concept of a “carbon budget” for the world. The IPCC holds that if the earth’s temperature is not to exceed two degrees celsius above the present temperature, the total amount of GHGs in the atmosphere should not exceed 800-880 gigatonnes. In other words, if the emission of CO2 and other GHGS is not curbed adequately to prevent such an

accumulation, the earth will become two degrees warmer. The real worry is the fact that the earth already has 530 gigatonnes of accumulated GHGS. In other words, more than half the carbon budget has already been exhausted. So business as usual will not work

"Monsoon onset dates are likely to become earlier or not to change much while monsoon withdrawal rates are very likely to delay, resulting in a lengthening of the season."

North India is likely to heat up more than the southern parts of the country while the entire Indian subcontinent may see longer rainy seasons in second half of the century,

though the Indian summer monsoon circulation will weaken, rainfall will increase due to higher atmospheric moisture resulting from a rise in temperatures.

Burma, Bangladesh and India can expect stronger cyclones; Although the global frequency of tropical cyclones is expected to decrease or remain essentially unchanged, they may become more intense, with stronger winds and heavier rainfall.

High latitude countries, such as in Europe or North America, are expected to receive more rainfall, but many … subtropical arid and semi-arid regions will likely experience less precipitation … Over wet tropical regions, extreme precipitation events will very likely be more intense and more frequent in a warmer world,

Scientists have also lowered projections of sea-level rises. Depending on future greenhouse gas emissions, sea levels will rise an average of 16-24in (40-62cm) by 2100.

Much higher temperatures could reduce the length of the growing period in some parts of Africa by up to 20%,

t is certainly the first since negotiations for a global treaty reining in carbon emissions collapsed in Copenhagen in 2009; the first since questions were raised about the integrity of the IPCC itself following mistaken claims about the speed of glacier melt in the Himalayas and, most important, the first since evidence became incontrovertible that global surface air temperatures have risen much less quickly in the past 15 years than the IPCC had expected.

The latest iteration identifies radiative forcing, the difference between the amount of heat coming into the climate and the amount reflected back, as the immediate cause of warming. Radiative forcing is expressed in watts per square metre (W/m2), a unit of energy. A rise indicates that heat is building up in the system.

Total radiative forcing from man-made sources since 1750 (ie, before industrialisation) has risen

from 0.29-0.85W/m2 in 1950 to 0.64-1.86W/m2 in 1980 to 1.13-3.33W/m2 in 2011. The average has jumped from 0.57 to 1.25 to 2.29, respectively—a four-fold increase in 60 years.

“The rate of warming over the past 15 years,” it says, “[is] 0.05ºC per decade...smaller than the rate calculated since 1951.” In its 2007 report the panel had said the rate of warming was 0.2ºC per decade in 1990-2005 (four times the current rate). It predicted that this would continue for the next two decades.

But it plays down the long-term significance of the shift, saying that “due to natural variability, trends based on short records are very sensitive to the beginning and end dates and do not in general reflect long-term climate trends.” The start of the recent 15-year trend, in 1998, was a year of a strong worldwide fluctutation in the climate known as El Niño. This produced a temperature spike.

Still, all the extra heat implied by higher radiative forcing has to go somewhere. It isn’t going into the air. It is possible that not all that much is going into the surface waters of the oceans, either. The report says that “it is about as likely as not that ocean heat content from 0-700 metres increased more slowly during 2003-2010 than during 1993-2002.” That only leaves one other heat sink: the deep oceans below 700 metres, where it could be locked up in the deep oceans without affecting other parts of the climate.

For the first time, the IPCC gives some credence to the possibility that Earth’s climate may not be responding to higher concentrations of greenhouse gases quite as sharply as was once thought.

NEW DELHI: Brazil, South Africa, India and China, called the BASIC countries, appear to have moderated their opposition to discussions on phasing out hydrofluorocarbons (HFCs) as refrigerants.

HFCs are among the six greenhouse gases that are covered under the Kyoto Protocol, which is the only legally binding agreement to deal with global warming and climate change. These countries have opposed discussions on the matter in any multilateral forum other than the United Nations Framework Convention for Climate Change. But at a meeting this week in Foz du iguacu in Brazil, they decided that the HFC issue should be dealt "through relevant multilateral fora" and that these discussions should be guided by the principles and provisions of UNFCCC and Kyoto Protocol.

The meeting is significant as it marks a departure from the position these countries have held in the past. The four advanced developing countries, which are the growing markets for refrigerators and

air conditioners, have also decided that availability of safe, technically and economically viable alternatives to HFCs should also be considered provided industrialised countries make available additional financial resources to developing countries.

The change in stance could open the door for the beginning of an open-ended discussion on the phasing out of HFCs under the Montreal protocol, which is a global agreement for the protection of the ozone layer. At the June meeting of the working group on the Montreal Protocol, India had raised the issue of better evaluation of alternatives to HFCs in terms of technical and economic viability.

HFCs present a peculiar problem for the entire gamut of environment-related global negotiations. They were identified as cooling agents under the 1987 Montreal Protocol. The idea was to move from the use of ozone depleting cholofluorocarbons (CFCs) and hydro cholorofluorocarbons (HCFCs) to a refrigerating agent like HFCs which was not harmful to the ozone layer.

HCFC 22 (hydro cloroflurocarbons) is the most common refrigerating agent used in India. Under the Montreal Protocol, India has to phase out use of HCFC by 2030. India's transition from HCFC began in January this year.

The replacement refrigerant agent HFC while addresses the issue of ozone depletion also comes with the attendant problem of contributing to global warming. It is among the six greenhouses gases identified for elimination or reduction under the global climate change agreement, Kyoto Protocol. The US and other industrialized countries, therefore, want India to move directly from HCFC to the new technology which may not contribute to global warming. They also want the HFC should be brought under the purview of the Montreal Protocol.

HFC is, however, listed as one of the greenhouse gases under the Kyoto Protocol which is only binding on the industrialized countries. The Montreal Protocol, on the other hand, is applied for all countries including India which signed it in June, 1992.

Officials here explained that the BASIC's decision won't contradict what was decided in the recent G20 summit. They said the G20 took a balanced approach by incorporating concerns of both the developed and developing countries. It recognized the need of making "economically viable and technically feasible alternatives" available to the developing countries while keeping HFC within the scope of UNFCCC and its Kyoto Protocol for accounting and reporting emissions.

Warsaw Talks

Bio Carbon Fund

The Warsaw talks ended on a hopeful note on Sunday with negotiators taking a significant step towards reducing greenhouse gas emissions from deforestation by agreeing to result-based payment to developing countries which cut carbon by leaving trees standing. The money — to be collected through contributions from rich nations — will be used for increasing forest cover. Known as REDD+ (Reducing Emissions from Deforestation and Forest Degradation) initiative The money to be collected for this purpose will be managed by the World Bank's Bio-Carbon Fund.

Though only three countries — the UK, Norway and the US — have so far pledged money to the tune of $280 million to finance the initiative, the move is seen as a step in the right direction as deforestation accounts for nearly 20% of global emissions of carbon dioxide.

3 Legs of UNFCC

One observer at the talks described "loss and damage" as the UNFCCC's "third leg". The first leg is mitigation, when countries cut emissions and issue targets.

The second leg is adaptation, when you make advance preparations for the impacts of climate change that are already locked in (building sea walls, cyclone shelters or developing hardier varieties of food crops – that sort of thing).

L&D and GCF

Loss and damage was one of the key rows in the early stages of the meeting, as some developing countries demanded "compensation" from rich countries for the damage they suffered from extreme weather. A compromise was reached with a new "Warsaw international mechanism" by which the victims of disaster will receive aid, but it will not be linked to any liability from developed countries.

The decision to set up an international mechanism on 'Loss and Damage' and a baby step towards capitalization of Green Climate Fund may also be seen in positive light The Warsaw agreements reached a compromise in which a Warsaw mechanism for loss and damage will be set up under the existing institutions that are supposed to fund projects that help poor countries to adapt to climate change. That decision, however, will be reviewed after three years. But what the agreed text conspicuously avoids is any suggestion that contributions made by developed countries should be worked out based on their overall contribution to the 40%

increase in greenhouse gases in the atmosphere since the start of the industrial revolution.

In short, this would be seen as an admission of liability and rich nations do not want a court case.

The GCF will open its headquarters in Incheon, South Korea on December 4 - a beginning of the process where rich nations have been asked to start their contributions before the next climate conference i

At the recent Commonwealth Heads of Government meeting in Colombo,Australia joined Canada in insisting on a footnote to the official communiqué, which said the two countries could not support a Green Climate Fund

LMDCs

The emissions goals, to come into force from 2020, will be set at a national level, but after they are published there will be a chance for other countries to scrutinise them and assess whether they are fair and sufficiently ambitious. At the insistence of a small group of developing countries, they will take the form of "contributions" rather than the stronger "commitments" that most other countries wanted.

These were the self-styled "like-minded developing countries", a group that comprises several oil-rich nations, including Venezuela, Saudi Arabia, Bolivia and Malaysia. Several have large coal deposits and are heavily dependent on fossil fuels, such as China and India, and some countries with strong links to some of the others, including Cuba, Nicaragua, Ecuador and Thailand.

The "like-minded developing countries" group takes the view that the strict separation of nations into "developed" and "developing", which was set at the first international climate talks in 1992, and enshrined in the 1997 Kyoto protocol – in which developed countries were obliged to cut emissions but developing countries had no obligations – must remain as the bedrock of any future agreement. They argue that the "historical responsibilities" for climate change lie with the first nations to industrialise.

That view is firmly rejected by the US and the EU, both of which have agreed to take a lead in cutting emissions, but have also repeatedly pointed out that the tables have turned on historic responsibilities. Emissions from rapidly emerging economies such as China and India are growing so fast that by 2020, the date when any new agreement will come into force, the cumulative emissions from developing countries will overtake those of rich nations

At Warsaw, the efforts of the LMDC focused on attempting to reintroduce into the key texts a restatement of the separation of countries into "developed" and "developing" that was first set out in 1992 and enshrined in the 1997 Kyoto protocol, under which developing countries bore no

obligations on their emissions and rich nations faced steep cuts.

The US, the EU and other developed countries regarded this separation as having been left behind at Copenhagen in 2009, which marked the first time both developed and developing countries signed up under a single agreement to curb their emissions.

Reduction in Emissions

members of the 'Like Minded Group of Nations', including China, pushed back against a proposal that would have seen all countries required to come forward with 'commitments', preferring instead to talk about 'contributions' without 'prejudice to their legal form'.

The UNFCCC "parties" (almost 200 countries) agreed to go back home and "initiate or intensify domestic preparations for their intended nationally determined contributions" to whatever deal might be brokered in Paris in 2015.

Countries will be able to start putting their "contributions" to cutting emissions on the table from April 2015 – these "contributions" might be targets but could be other efforts to keep emissions down.

In the agreement reached at Warsaw, the developing countries, including the largest and fourth largest emitters of greenhouse gases—China and India—forced the rich countries to drop their insistence that all countries make "commitments" to address climate change. Instead, countries will now make vague nationally determined "contributions" toward addressing man-made global warming.

The United States and European negotiators in Warsaw had sought an agreement in which each country would use a common transparent framework for calculating its emissions reductions. In the new Warsaw agreement, countries set their own baselines and define their own reduction strategies, thus making comparisons between countries' efforts far less transparent and harder to calculate

The developed country negotiators also wanted all countries to put forward their initial commitments no later than the first quarter of 2015. That deadline would make it possible for the initial commitments to be critiqued before the 2015 Paris conference. The goal of the pre-Paris scrutiny would be to see if they were collectively adequate to keep the world on track toward restraining future global temperatures to an increase of no more than two degrees centigrade. Instead, countries will announce their contributions only when they were good and "ready to do so."

Carbon Budget

	Total energy demand [Mtoe][a]		Growth rate [%]	Share in total energy demand [%]	
	2008	2035	2008-2035[b]	2008	2035
OECD	**5,421**	**5,877**	**0.3**	**44.2**	**32.6**
Non-OECD	**6,516**	**11,696**	**2.2**	**53.1**	**64.8**
Europe/Eurasia	1,151	1,470	0.9	9.4	8.1
Asia	3,545	7,240	2.7	28.9	40.1
China	2,131	4,215	2.6	17.4	23.4
India	620	1,535	3.4	5.1	8.5
Middle East	596	1,124	2.4	4.9	6.2
Africa	655	948	1.4	5.3	5.3
Latin America	569	914	1.8	4.6	5.1
World[c]	**12,271**	**18,048**	**1.4**	**100.0**	**100.0**

1. 450 ppm of CO2 in atmosphere is considered to be the limit at which the world will irreversibly heat up by 2 degrees. When that happens we cannot talk anymore of mitigation i.e. taking steps to prevent global warming, but would have to talk about steps for adapting to the climate change. It has gone up from 280 in 1750 to 380 now. By 2015 we will emit 90% of it and hit the ceiling by 2017 and the doors would be shut for ever.
2. This necessitates a peaking of global emissions by 2015 and a 50% reduction (compared to 2005 levels) by 2050. G-8 have already announced a cut of 80%. For this IEA estimates that renewable energy will have to account for ~30% of total and other reduction will come via sequestration and efficiency. Investment costs in solar PV declines by around 25% for a doubling in production compared to only 5% in coal. Thus the future holds great potential.

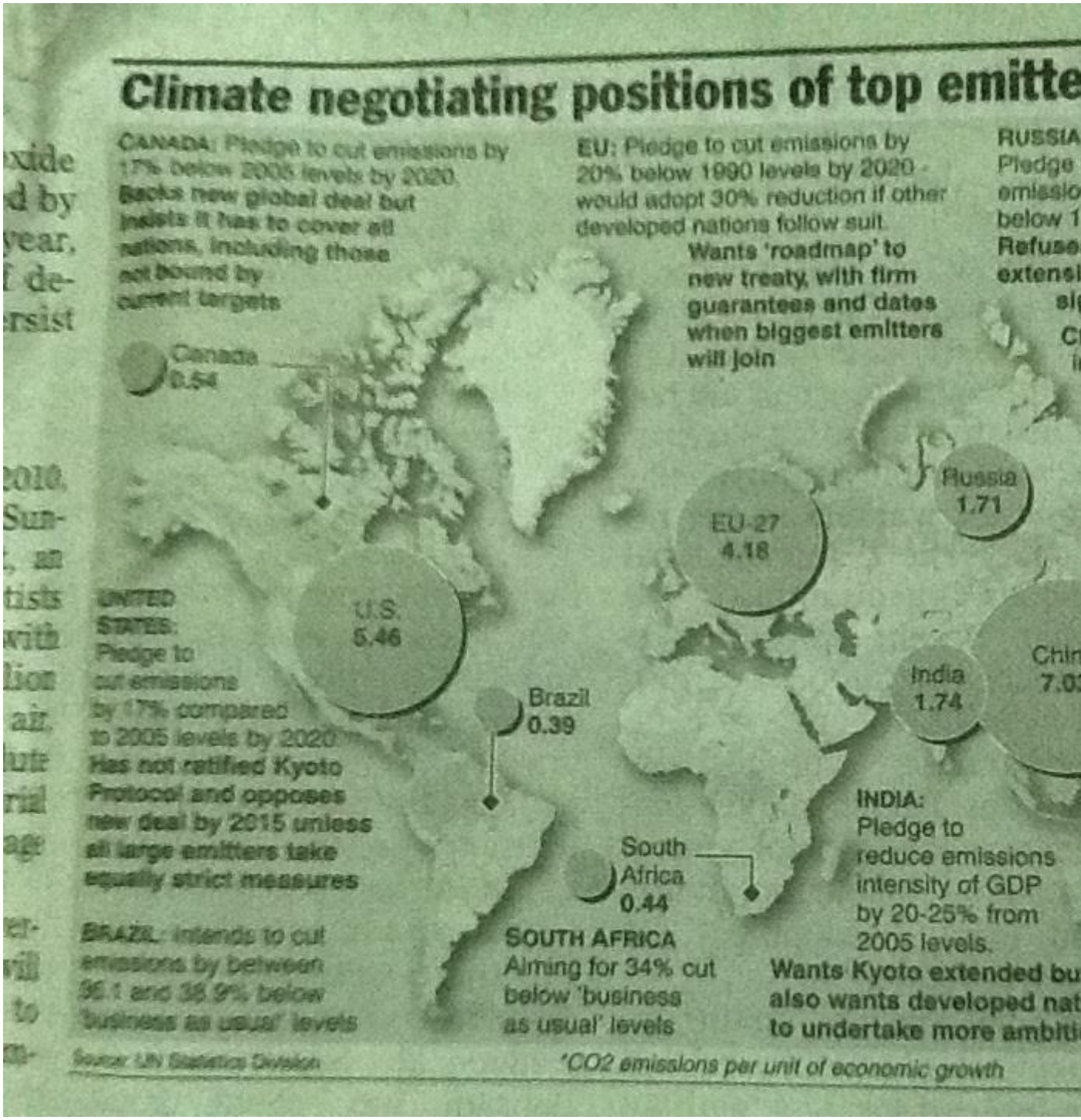
Effect on Arctic Ocean

1. Due to less ice, open Arctic water will absorb more CO_2.
2. The marine productivity will increase as more sunlight penetrates through. This also means larger staying periods for whales in Arctic.
3. Warm Arctic means more tundra vegetation and taller shrubs compared to small mosses and lichens presently.

4. As more Arctic waters are exposed, the microbial activity in the surface waters increases and more CH_4 is released into the atmosphere thus creating a positive feedback loop.

Science & Economics

1. Methane is ~21x GHG than CO, CFC is ~1000x. Concentration of CO_2 has gone up from 280 ppm to 379 ppm from 1750 to 2005 and temperature by 0.75ºC. NO_2 is the other GHG gas. CO_2 accounts for 77% GHG effect, CH_4 for 15%, NO_2 for 8%. Other GHGs are HFC, PFC, CO. Globally agriculture contributes 15% of GHG emissions and buildings contribute 12%.
2. UNFCC has estimated developing countries need to invest ~$30-70 bio p.a. in green technologies and global investment should be $60-180 bio p.a. Considering this the corpus of GCF of $100 bio is insufficient. Even for that developed countries are trying to shift the responsibility to G20.
3. Equity is of 2 types: inter-generational and intra-generational. Higher social discount rate will lead to more focus on intra-generational equity while lower one will lead to focus on inter-generational equity. Developed countries focus more on inter-generational while developing countries focus on intra-generational.
4. US accounts for ~30% of cumulative CO_2 emissions, EU for ~25%, China for ~10%. In terms of per capita, Annex 1 countries emission is ~ 10 MT, non-Annex 1 countries has gone up from 2.8 MT in 1990 to 3.7 MT in 2008 and India has gone up from 0.8 MT in 1990 to 1.5 MT in 2008.



India & GHG

1. India's CO_2 emissions are growing @ 3% p.a. Contributing sectors are energy (55%) growing @ 5.5%, industry (22%) and agriculture (17%) declining @ -0.2%.
2. Indian planners are expecting per capita emission of 4 MT by 2030 but climate agreement may cap it much closer to current emissions.
3. Paddy cultivation leads to CH_4 and NO_2 emissions.

Green Economy

Renewable Energy

1. China has the largest installed renewable energy capacity (133 GW) followed by US (93 GW) and Germany (61 GW) and other EU countries (60 GW). India has 22 GW. In terms of investments US has the largest investments followed by China (but this si going to be short lived as China will pick up again).
2. India's investment in renewable energy is growing @ 50% rate and was $10 bio in 2011 with ~ half of it going in wind. Going forward solar energy is expected to pick up.

Rationale for Green Accounting

1. Current GDP accounting includes many things which don't make us richer while leaves out many which do make us richer. For example, pollution makes us poorer but doesn't reduce GDP. If we pay to clean up pollution, this increases GDP, but no wealth has been created. When wastewater is naturally cleaned by wetlands we are richer but GDP doesn't increase.
2. GDP accounting also doesn't value various ecosystem services and thus doesn't enable us to value them properly and make economic decisions. For example a swamp's value can be calculated by the amount one would need to spend in order to achieve what it does naturally. So any alternative use should be made only if the benefits are higher than the ecological costs. Once armed with information like how much a mangrove contributes to fish breeding and how much a coral reef protects a coastline from storm surges, then countries are in a better position to decide whether to keep these natural assets intact or allow their destruction for commercial uses

Case Against Green Accounting

1. While it makes sense to move to green accounting system where all environmental services are valued on the above grounds, it also has many drawbacks. One such drawback is that there are limitations in calculating potential benefits of the projects and this may hinder development. Green accounting might easily have led our forefathers not to cut down forests, because this would entail losing a valuable resource. But converting forests to agriculture led to cities and civilization. Innovation and substitution followed, which ultimately produced many more calories and much more wealth.
2. “We’ll be selling off the river! The sky! Even the biodiversity! Sumatran tigers, they’re for sale too. You thought there wasn’t more profit in the world, but there is. Banks, come and get your profits!” It constitutes a vast expansion of the market into the commons, a new wave of enclosure and privatization of previously public goods. The property rights are tough to enforce on commons and are liable to be misused by the rich. Without ensuring rights of the marginalized section, any green economy implementation will be a disaster.
3. Green economy is essentially a utilitarianism philosophy which justified any action if it increases total utility no matter what its distributional aspects be. It ignores the fact that the benefits of destroying the natural resource are likely to accrue to investors rather than the

poor, who are often the most dependent on free natural resources. So a government or private company may decide to let the resource die because the overall monetary return of preserving it is less, ignoring the fact that the people impacted by the decision will be the poorest.

4. Tools such as biodiversity bonds would take control of natural capital away from governments and the people who depend on it and put it at the mercy of financial markets.

Debate - Green Economy Approach Should be Local

1. The first is the liberal view is that every individual has rights and every life is precious. The global arrangements with the declared purpose of improving the world for everyone suffer from a democratic deficit when a few, claiming superior wisdom, will make the rules for the rest. There is also a colonial odor: a burden to manage the world because otherwise the natives may make a mess of it. It goes against the spirit of local self-governance.
2. Any solution imposed from the top will ignore local property rights and is more likely to be misused by strong and powerful and will have unfavorable distributional aspects.

Rio +20

Sustainable Development Goals

1. Developing countries: They accepted the concept of sustainable goals but want the three pillars i.e. social, economic and environment to be represented in a balanced way in selecting the goals. They also wanted the national governments to formulate the SDGs.
2. Developed countries: EU on the other hand was concerned only with environmental goals. Thus for instance, one goal is improved access to water but EU wants it to be achieved via a global water partnership that promotes PPP in various parts of the world and also for effective PPP implementation, countries should treat water as an economic good and price water so as to recover all costs including the environmental one. Similarly another proposal to increase assistance to small farmers means to EU an improved access for farmers to global markets i.e. open up agriculture. They wanted that SDGs should be formulated by UN Secretary General and his 'experts'.
3. Compromise: It was decided to leave it to UN to decide on them. This will be done in the next year through a 30-member working group in the UN nominated by governments.

Technology and Finance

1. Technology politics: The developing countries proposed a new technology transfer mechanism since there has been little transfer in the past two decades. However, the developed countries refused to reaffirm their commitment to transfer technology to developing countries. They insisted that instead of using "transfer" the statement should read "voluntary technology exchange on mutually acceptable terms" which means on commercial basis. This was to prevent compulsory licensing and imposition of technology transfer requirements by developing countries.

2. Finance politics: The developed countries dropped the commitment of “new and additional financial resources” instead made references in the text to getting funds from a “variety of sources” and "new partnerships" which means from the market and also urged south to raise more resources (which was rejected by the developing countries and didn't find a place in the final draft). Importance of fulfilling ODA target of 0.7% of GDP has been reaffirmed though. The developing countries had asked for a new fund be created with ≥ $30 billion a year be provided in 2013-17 and rising to $100 billion a year from 2018. But this was rejected by developed countries.
3. Compromise: Developing countries wanted that the statement should reaffirm that developing countries require technology and financial support to meet their obligations which would be provided by the developed countries. To save the show, it was agreed that there would be a follow-up process in both finance and technology after Rio+20.

Global Feed In Tariff

1. India can't afford energy produced by many of the green technologies because of their high costs. So the global feed in tariff mechanism was a proposal devised which would ensure the the funding of the differential between the costs of green energy and fossil fuel energy. The mechanism proposes creating a global fund to fund this gap.

Green Economy Politics

1. EU: It wanted that Rio+20 should draw a clear road map with specific goals, targets and deadlines for issues such as water, forests, agriculture and oceans.
2. Developing countries: They rejected EU's proposal for they feared that - (a) it would be used to justify trade protectionism by EU, (b) it would lead to creation of new markets for developed countries since they hold the advantage in such areas like green technologies, green finance etc., (c) it would lead to commodification of nature and suffering of poor, (d) it would become a new conditionality in aid, (e) it would replace the sustainable development concept, (e) it would entail additional commitments for developing countries without any additional financial or technical assistance from developed countries. Moreover countries like India which depend heavily on fossil fuels for their energy mix are in no position to phase out the subsidies on fossil fuels.
3. Compromise: It was agreed to state that green economy was one of the many measures of achieving sustainable development. It was also agreed that green economy should respect national sovereignty, promote inclusive growth, not be used for trade protectionism, not be used as a condition for aid, help close N-S technology gap and address poverty and inequality. For the future action, UN is asked to coordinate between and match the interested countries and to provide best practices for green economy, evaluating policies and develop platforms.

UNEP

1. Politics: There was an agreement that UNEP should be strengthened but a dispute on how it should be strengthened. EU and African countries wanted UNEP to become a UN specialized agency while most developing countries wanted to retain its status as a programme but strengthened.
2. Compromise: It was finally agreed that the UNEP would be strengthened and upgraded, including through universal membership of its governing council and increased financing. But the proposal to convert it to a specialised agency did not succeed.

CBDR & Equity

1. US was resisting its inclusion but it was included finally.

Financing of the Green Economy

1. IEA report shows that to reduce global emissions by 50% by 2050, additional investments required will likely be in the range of 1 to 2.5% of global GDP per year from 2010 to 2050.
2. Financial investment, banking and insurance are the major channels of private financing for a green economy. The financial services and investment sectors control trillions of dollars that could potentially be directed towards a green economy. In 2009, the global market size for institutional assets was estimated at just over US$ 121 trillion. More importantly, long-term public and private institutional investors, banks and insurance companies are increasingly interested in acquiring portfolios that minimize environmental, social and governance risks, while capitalizing on emerging green technologies.
3. Microfinance: Microfinance has a potentially important role at the community and village level to enable the poor to invest in resource and energy efficiency as well as increase their resiliency to risk.
4. Role of public sector: Governments should involve the private sector in establishing clear, stable and coherent policy and regulatory frameworks. In addition, governments and multilateral financial institutions should use their own resources to leverage financial flows from the private sector and direct them towards green economic opportunities. Public finance is important for triggering a green economic transformation, even if public resources are significantly smaller than those of private markets. Development Finance Institutions can adopt the goal of supporting development of the green economy, allocate significant proportions of their new lending towards financing green economy transition projects and link it to specific targets such as reduction in greenhouse gas (GHG) emissions, access to water and sanitation, biodiversity promotion and poverty alleviation. Policies can be designed to improve the "green efficiency" of their portfolios, for example, by examining the carbon and ecological footprints of their investment portfolios.

5. Renewable energy: Financial markets have already been mobilizing substantial amounts in renewable energy. A total of around US$ 557 billion was deployed to the renewable energy market between 2007 and mid-2010. Investment costs in renewable energy decline much faster than in conventional energy.
6. Green property assets: Numerous green property development funds have come up and the increasing preference of occupants for green offices and residences are key indicators of green property becoming an attractive asset class. The built environment, through its construction and use accounts for 40% of both global energy use and carbon dioxide emissions. As a result green properties yield premium rental returns.
7. Forestry (REDD+): The biggest challenge is in understanding and developing markets related to biodiversity and ecosystems services. However, several recent initiatives have begun to frame the potential in nascent existing markets and prospective future ones.
8. Green bonds: The green bond market is still relatively small, but has the support of triple AAA rated institutions and growing momentum. Green bonds are simply a variant of general bonds wherein the issuer of the bond guarantees to use the money raised for some specific environmental purposes. They are designed to particularly attract investors who wish to lend money for these purposes. Recently WB, IFC, EIB, ADB, African Development Bank have come up with green issues. They have also been used at municipal levels.
9. Green insurance in carbon markets: Carbon markets have not tackled emissions from the loss of natural forests. There are several concerns: the issues of likely permanence, leakage, measuring and monitoring. As much as 20 % of anthropogenic GHGs are estimated to originate from land use change. Unlike the reduction or avoidance of GHG emissions with all other types of mitigation activities, GHG sequestration into biomass is non-permanent. Sooner or later, the sequestered carbon will be re-released into the atmosphere. In the case of forestry this can happen due to natural hazards, land-use decisions. To date, regulators have treated forest-based GHG permits as temporary, which has greatly reduced their value and thus demand. An alternative is the deployment of insurance to guarantee the permanence of carbon sequestered through forests. Private sector providers of forest insurance focus on plantations, not public and natural forests. The primary reason is the more sophisticated risk management systems (e.g. watchtowers and firebreaks, fire-fighting personnel, equipment and procedures) in place for privately owned forests, where there is a clear financial interest. Also, forest risks require specialist knowledge, and the valuation of forest carbon is difficult.

Convention on Bio-Diversity

Funding Issue

1. In the Hyderabad conference, the poor nations wanted enhanced funding commitments from the rich nations. But the rich nations wanted the poor nations to conduct an

assessment of the biodiversity conservation needs and to install accountability procedures. This was seen as stalling tactics by the poor nations.

2. Compromise: The compromise text showed doubling of proposed fund flow from rich to poor nations by 2015 (over average of fund flows from 2006 to 2010). In return the poor countries promised that by 2015, over 75% of them will do their homework, include biodiversity in national development needs and prepare assessment of their needs and conservation plans. On accountability, these countries would submit information by 2014 summit. Also the document urges countries to explore 'all possible sources' of funding including market based.
3. However this is only an interim target. This target is to be revised in the next summit in Korea in 2014 and revised up in the subsequent summits until 2020. This would entail a continuous rise in the contribution by the rich countries by 2020 which they are unwilling to accept. EU is willing to increase aid only until 2015 and then wants it to be frozen until 2020.

Subsidies

1. The countries have agreed to phase out biodiversity harming subsidies by 2014.

Alchi Targets

1. These are the ambitious goals setup by countries under CBD to protect plants, animals and natural habitats by 2020. But the countries could not agree on how to raise money needed to achieve these goals at Hyderabad.

Post Durban Diplomacy

1. LDCs and AOSIS: They warned that EU's insistence on an eight-year second commitment period from 2013 would delay action from all big emitters. They want only a 5 year second commitment period of Kyoto Protocol as they think it is ineffective and fresh and deeper commitments should be undertaken. They argue that countries bound under the 2nd commitment period only account for 15% of the world's emissions.
2. EU: It wanted an 8 year second commitment period of KP as it would coincide with its domestic target to cut emissions 20% below 1990 levels by 2020.

2015 Agreement *Prior Politics*

USA'S CLIMATE CHANGE PLAN

- President Obama recently laid out USA's first blueprint on the domestic and international initiatives to tackle climate change.
- It holds some troubling implications for both multilateral climate change negotiations and the economic policies of developing countries, India in particular.
- It effectively allows developed countries to abandon their end of the equity bargain — i.e. to provide technology transfer and financial support to developing and Least Developed Countries (LDCs) — in return for their promise of sustainable growth.
- The discourse has now turned to market-oriented approaches to foreign investment and de-regulation that emerging economies must welcome to "green" their development, if they want to be seen as responsible stakeholders.

DOMESTIC PROPOSALS

- Obama's commitment to reduce carbon emissions to 17 per cent below 2005 levels by 2020 is a hollow one. By most estimates, an emissions reduction of 17 per cent from 2005 levels is equivalent to a 4-6 per cent reduction from levels that persisted in 1990. On the other hand, the Kyoto Protocol, which the U.S. has not

ratified, requires industrialised countries to reduce, by 2020, their greenhouse gas emissions by 18 per cent below 1990 levels.

- The proposal to regulate carbon emissions from power plants (that run on conventional fossil fuel) has been billed as another important step, but it does have certain issues involved.
    - First, these, if at all formulated, will be federal limits imposed by the U.S. Environmental Protection Agency. Each State in the U.S. is free to 'opt out' from their implementation; some no doubt will, given enormous pressure from their coal and steel lobbies.

IMPACT ON INDIA

- Towards India, USA's thrust is simple: encourage "innovation" and "investment" in clean energy technology to reduce reliance on fossil fuels. These buzzwords have now been institutionalised through the setting up of a U.S.-India working group on climate change.
- Shifting the spotlight away from immediate carbon cuts to long-term solutions like "clean energy" provides the West with a legal-moral basis to ask developing countries to further open up their economies. In fact, the success of the U.S. clean energy sector is contingent on how well American companies perform in lucrative markets like India.
- The renewable energy sector in India alone is worth billions of dollars. High financing costs, stringent government regulations and widespread public scepticism on the efficacy of solar and wind power have stunted the growth of the Indian domestic sector.
- For American 'green companies' armed with subsidies and tax breaks, dominating this market will be a walk in the park. All they need to do is to hope that the Indian government continues its foot-dragging renewable energy policy — one that currently permits 100 per cent FDI with little regulatory guidance — while pressing for tougher intellectual property laws bilaterally, in line with the 'TRIPS-plus' vision.
- New Delhi has thus far held out on restrictive IP laws, but faced with the threat of harsher immigration rules and limits on Indian exports, concessions on this front may be a matter of time. Moreover, the U.S. has a powerful carrot in the form of shale gas exports, which India has eyed keenly.

EFFECT ON PRINCIPLE OF 'EQUITY'

- Above all, U.S. attempts to tackle climate change on a bilateral basis sounds the death knell for the principle of equity in international climate talks.
- In the run-up to the Paris conference in 2015, most developing countries have made it amply clear that any multilateral agreement must address the issue of technology transfer and funding. The U.S., opposed to such preferential treatment, has fired the first shot with President Obama calling for an "inclusive" climate deal. His administration has cleverly shifted the goalposts of technology transfer, from its original, unconditional premise to one based on "innovation" and "investment" in clean energy, which invariably skews the market in favour of western companies.
- With powerful tools of negotiation at its disposal, the Obama administration would much rather talk to major emitters individually than confront the combined might of the BASIC (Brazil, South Africa, India and China) group.

1. US
    1. It has proposed a mechanism by which countries define their own "contribution" to emission cuts.
    2. Once such contributions have been agreed upon, a peer review mechanism could be put in place for monitoring and compliance. This is a step back from the language of "commitments" under the UNFCC.
    3. There should also be flexibility to countries to update their contributions with time.
    4. The international community has shown a warm reaction to it.

Durban Conference

Pre Conference Diplomacy

1. Alliance of Small Islands: They want nothing short of a legally binding agreement in Durban.
2. European Union: They will let Kyoto Protocol provisions to be extended for the transition period provided a firm deadline based commitment is expressed in Durban towards moving towards a legally binding solution.
3. US: It wants that if and when a new legally binding agreement is reached, it should be symmetric in nature i.e. same provisions for developed as well as developing countries.

India's Stand

1. India wanted extension of KP.
2. India wanted to include equity, IPR and trade barriers as a core issue of discussion. Trade barriers important in light of EU ban on foreign airlines not having carbon credits. So trade issues should not be mixed with environment issues. BAP created technology mechanism but nothing has been done on the IPRs of technologies to be transfered.
3. India wanted CBDR to stay.

Outcome of Durban Conference

1. The Long-Term Cooperative Action (LCA) launched after Bali would be abandoned by end of 2012. New negotiations on a 'agreed outcome with legal force under the Convention' would begin by 2013 and end by 2015. The new Agreement will come into force by 2020.
2. Until then provisions of Kyoto Protocol will be extended but KP serves little purpose without US, Canada, Australia anyways.
3. The Green Climate Fund would be given a legal personality and capacity. It will be operationalized soon.
4. On Carbon Capture and Storage, 5% of the credits will be put in a reserve for 20 years and will be released only if it is established that none of the carbon stored underground has leaked into the atmosphere.
5. On the Technology Mechanism, the terms and conditions of the operational arm - Climate Technology Centre and Network - were decided.

Cancun Summit, 2010

1. The bifurcation into KP track and Long Term Track were formalized.
2. All major economies were to report their progress.
3. $100 bio commitment was formalized.

Copenhagen Summit, 2009

1. A target of 2 degrees celsius was adopted with a further scope of limiting it to 1.5.
2. A Green Climate Fund to the tune of $30 bio initially and $100 bio by 2020 will be established to help poorer nations.
3. Projects to reduce GHGs in Annex 3 countries will be subject to international monitoring if internationally funded.
4. Annex 2 countries must make commitments for emission reduction and Annex 3 countries must report their plans to reduce GHG emissions.

Bali Action Plan, 2007

1. It bifurcated the climate talks into a Kyoto Protocol Track and a Long Term Cooperative Action track.
2. It could only request the developed countries to help in mitigating climate change.

Kyoto Protocol, 1997

1. It targeted 6 GHGs - CO_2, CH_4, NO_2, HFC, PFC and SF_6.
2. The countries should reduce emissions through national measures though 3 international mechanisms are also provided. The target was reduction by 5.2% (4.2% without US) below 1990 levels by 2012.
3. An Adaptation Fund was also setup to help developing countries.

Mechanism 1. Joint Implementation

1. Any Annex 1 (developed) country can invest in emission reduction projects in any other Annex 1 (developed) country.

Mechanism 2. Emission Trading

1. Any country can buy the unused quota of another country.

Mechanism 3. Clean Development Mechanism

1. Any Annex 2 country can implement a project in Annex 3 (developing) country and claim carbon credits for the additional carbon reduction.
2. It will have to prove that this carbon reduction was not possible without its project.

Rio Summit 1992

1. Its major contributions were - (a) linking “development” and poverty to the environment and recognizing that environmental issues can't be resolved unless poverty is eliminated. This led to CBDR, equity etc. (b) Agenda 21 which set out a road map for the 21st century which was a substantive document that could inform and guide nations as they formulated their environmental policies. (c) CBD. (d) UNFCC.
2. The UNFCC categorized countries into 3 Annexures - Annex 1 is countries which have committed themselves to reducing GHG emissions; Annex 2 is its subset and includes developed economies which must pay for he costs; Annex 3 is developing economies.

Wildlife protection

International Initiatives

Mercury Treaty-2013

- An international treaty, adopted by 140 nations, that legally binds the nation to limit the use of health hazardous mercury.
- It will aim at
  - Reduction of global emission levels of the toxic heavy metal or the quick silver
  - Reduce the production and the use of mercury in industrial processes and product production
  - To cut mercury pollution from utility plants, mining, a host of products and industrial processes, and set enforceable limits as well as to encourage alternatives where mercury in not used or released.

Impact of Mercury on Human Being

- The natural element Mercury cannot be created or destroyed, but is released in air, water and land from different activities like coal powder plants, gold mining activities as well as electrical goods and other consumer products.

- Mercury enters the food-chain via fish and poses a threat to the living being more likely to pregnant women and children.
- As per the data released by the World Health Organisation intake of mercury or any of its compounds to any limit is not safe and it may lead to memory loss, language impairment and kidney damage.

United Nations Environment Programme (UNEP) report:

- In the past 100 years, man-made emissions have raised the mercury concentrations in the top 100 metres of the world's oceans to double.
- Concentrations in deeper waters have increased by up to 25%.
- Much human exposure to mercury is through the consumption of contaminated fish.
- Around 200 tonnes of the substance are deposited in the Arctic every year.
- Developing countries were especially vulnerable to direct mercury contamination mainly due to the extensive use of the element in small-scale gold mining and to the burning of coal for electricity generation.

Ecological Footprint

1. It is a measure of human demand on the earth's resources standardized in terms of biologically productive area used in making a product and to assimilate its waste. Using this assessment, it is possible to estimate how many planet earths it would take to support humanity if everybody followed a given lifestyle.
2. For 2007, humanity's total ecological footprint was estimated at 1.5 planet Earths. The number is published each year with a 3 year lag. Qatar, Kuwait, UAE, Denmark and US are biggest footprint countries.

Roundtable on Sustainable Palm Oil

1. India is the biggest importer of palm oil (consumption 16 MT and imports 8 MT) and palm oil is a source of calories. Most of the palm oil is imported from Indonesia where they are cutting the tropical forests for the cultivation of palm oil in plantations. Such is the extent of deforestation that Indonesia has become the 3rd largest emitter of GHGs.
2. Indian importing companies are too small individually to enforce any bargaining power so as to ensure that none of the plantations is established after deforestation. This is a classic case of market failure and this is where the roundtable steps in. But its provisions are not strict enough.

Bonn Convention (1979)

1. This was a convention to preserve migratory species. A list of threatened migratory species was chalked out and numerous MoUs were signed for their conservation. India's olive ridley turtle was one such species.

Ramsar Convention (1971)

1. It came up with a list of recognized wetlands (area under a marsh, fenn, peatland or water not more than 6 meter of submergence in low tide) and their conservation. Canada has the highest area under wetland and UK has highest number of wetlands.

Montreux Record

1. Wetlands of international importance which have or are likely to undergo critical changes in their ecosystem due to human action are placed under Montreux Record. Once placed it may benefit from Ramsar rules.

Nagoya Protocol & Convention on Bio Diversity

1. The CBD was adopted in the Earth Summit in 1992 and was the first global agreement which addresses all aspects relating to biodiversity. It recognizes sovereign rights of nations over their biological resources. It has three main goals: (i) conservation of biological diversity, (ii) sustainable use of its components and (iii) fair and equitable sharing of benefits arising out of the use of genetic resources between the people and countries which is also called access and benefit sharing (ABS).
2. Nagoya protocol was devised to implement the ABS objective. The process of ratifications has been slow for Nagoya protocol because it requires the countries to put in legal and institutional measures to implement ABS provisions which runs against the interests of powerful domestic groups. Very few countries have domestic ABS mechanisms in place.

Basel Convention

1. It seeks to control the trans-boundary movement of hazardous wastes including e-wastes. Initially it provided for a notification only and allowed consented exchange. But later any exchange for any purpose was banned.

Oriental Nicety oil tanker

1. It is laden with hazardous chemicals and came to Bhavnagar in Gujarat for dismantling against the Basel convention. It was responsible for the worst oil spill in Alaska in 1986. Under the convention rules, a ship has to be decontaminated by the exporting country before it can be dismantled in the destination country.

Cartagena Protocol (2000)

1. The Cartagena protocol on biosafety seeks to protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology.
2. It follows the precautionary principle which allows developing nations to ban imports of a living modified organism if they feel there is not enough scientific evidence that the product is safe and requires exporters to label such shipments. Information exchange is a must.

Socio Economic Considerations of Bt Crops

1. The issue has figured in the Cartagena protocol talks i.e. whether the socio economic impact of Bt crops can be taken into consideration while determining the "safety" of the products. While developing countries were in favor of doing so developed countries opposed it. As a compromise, SEC were included in the Protocol with a rider that their application should be consistent with existing international trade obligations.

Stockholm Convention

1. It requires the developed countries to provide new and additional resources to (a) eliminate production and use of intentionally produced POPs (Annex A), (b) restrict the disposal of POPs wastes in an environmentally-sound manner (Annex B), and (c) eliminate unintentionally produced POPs (Annex C).
2. The Committee first determines whether the substance fulfills POP screening criteria detailed in Annex D of the Convention, relating to its persistence, bioaccumulation, potential for long-range environmental transport (LRET), and toxicity. If a substance is deemed to fulfill these requirements, the Committee then drafts a risk profile according to Annex E to evaluate whether the substance is likely to lead to significant adverse human health. Finally, if global action is warranted, it develops a risk management evaluation, according to Annex F.
3. Endosulfan is a controversial pesticide believed to be injurious to the nervous system. Hence it has been banned world wide including the Stockholm Convention where it was put in the elimination list. India is a signatory to the convention.
4. Last year, the apex court, acting on a writ petition had banned the production and sale of endosulfan in India. The court had directed the state and Centre to freeze the production licences granted to manufacturers of endosulfan till further orders. Last week Centre but forward an affidavit in Supreme Court to allow states to use endosulfan except in Kerala and Karnataka. India is the world's second largest producer of endosulfan.

Rotterdam Convention

1. A listing in the convention implies the substance being labeled as a hazardous substance and the exporting country giving full data to the importing country so that it could take an

informed decision on the import. Export would then be permitted only if the importing country gave its consent.

Chrysotile

1. Chrysotile is white asbestos often mixed with cement to create a mixture applied to corrugated steel sheets and pipes and used in construction. Its alternatives are cellulose and other agricultural fibers but are not as cheep.
2. Canada is the major producer of white asbestos called chrysolite. So it opposed listing. India is a leading importer and it supported the listing.

Mercury Emissions

1. The United Nations Environment Programme (UNEP) hosted a meeting to establish legally binding targets on controlling mercury emissions. The main sources of Mercury Emissions are thermal power plants and fluorescent bulbs.
2. Given India's heavy reliance on both, India has refused to be bounded by international legal targets and has instead agreed to prepare by 2013 a voluntary draft to reduce emissions. India has also asked the developed countries to give money.

Montreal Protocol

1. It relates to protection of ozone layer by phasing out use of ozone harming substances like CFCs and halogens, CCl_4, methyl chloroform.
2. NO_2 is another gas which harms ozone layer and is emitted by aircrafts and rockets.

Reduced Emissions from Deforestation and Forest Degradation

1. Deforestation is the permanent removal of forests and withdrawal of `land from forest use. Forest degradation refers to negative changes in the forest area that limit its production capacity. REDD is a set of steps designed to use market/financial incentives in order to reduce the emissions from deforestation and forest degradation which account for 15-25% of GHG emissions.
2. Kyoto Protocol excluded deforestation and degradation due to the complexity of measurements and monitoring for the diverse ecosystems and land use changes. This resulted in the formation of the Coalition of Rainforest Nations. In 2005, the Coalition of Rainforest Nations initiated a request to consider 'reducing emissions from deforestation in developing countries.' The matter was subsequently adopted in Bali conference.
3. REDD activities are undertaken by national or local governments, dominant NGOs, the private sector, or any combination of these. The genuine actors of REDD, however, will be the populations whose livelihoods derive from forests.
4. It has been criticized for ignoring the rights of indigenous peoples, for relying on failing carbon markets for its success.

REDD+

1. The REDD"+" is more than just avoided deforestation and forest degradation, it also includes the possibility of offsetting emissions through “sustainable forest management”, “conservation” and “increasing forest carbon stocks”. REDD need not refer solely to the establishment of national parks or protected areas; it could include land use practices such as shifting cultivation by indigenous communities and reduced-impact-logging, provided sustainable rotation and harvesting cycles can be demonstrated.
2. According to some critics, REDD+ is another extension of green capitalism, subjecting the forests and its inhabitants to new ways of expropriation and enclosure at the hands of polluting companies and market speculators.

Sustainable Development

3 Pillars

1. Produce differently: More efficient production i.e. use less resources to produce same.
2. Consume differently: Make consumption resource friendly.
3. Organize differently: Increase public participation.

Rights of Nature

1. A court in Ecuador fined Chevron for $18 bio for causing pollution in the country. It did so based on the rights given to nature in the country. SImilarly Bolivia also has given rights to the nature like right to life and to exist, right to be free from human alteration, not to be affected by mega projects, not to have cellular structure genetically modified.

E-Waste Recycling

1. So far e-waste has been shipped to developing countries where this poses dangers as it is handled by informal sector.
2. India generated 0.8 MT of e-waste in 2012 (up from 0.15 MT in 2005)

E-Waste (Management, Handling and Trans Boundary Movement) Rules, 2008

1. Import of such wastes for disposal is not permitted except for recycling by the registered units only and with the permission of the Ministry of Environment and Forests and/or Directorate General of Foreign Trade. For effective implementation of provisions related to import and export, a co-ordination committee including representatives from revenue department, DGFT, ministry of shipping, Central Pollution Control Board has been constituted. This committee has been working to sensitize the customs authorities regarding enforcement of these rules in order to check illegal import of e-waste into the country.

E-Waste (Management and Handling) Rules, 2011

1. The concept of extended producer responsibility has been enshrined in these rules to make it a mandatory activity for the manufacturers of electronic and electrical equipments. Under this the producers are responsible for collection of e-waste generated from the end of life of their products by setting up collection centers. The concept originated in Switzerland.

2. E-waste recycling can be undertaken only in authorized facilities. Government has started a scheme to provide financial assistance for setting up of treatment plants in PPP mode.

Pharmaceutical Pollution

1. Most drugs are insoluble in water and are non bio-degradable. Thus the drug residues tend to build up in the environment and accumulate in our bodies. Many drugs also interfere with degradation of other substance in the sewage since antibiotics kill the microbes decomposing sewage. Another concern is that the microbes tend to mutate into drug resistant varieties. This is made even more potent because often in waste water one would find a cocktail of antibiotics and only the deadliest of pathogens will survive.
2. Human and animal excreta is the primary route via which drugs enter the environment. Hospital and manufacturing waste is another major route.

Acid Rain & Stone Cancer

1. It contains traces of H_2SO_4, HCl and HNO_3. It occurs due to fossil fuels and forest fires.
2. The Taj Mahal is threatened by acid rain from Mathura refinery. This is called stone cancer.

Acid Drainage

1. When rain water and oxygen combines with sulphide bearing minerals like pyrite (iron) they form sulphuric acid.

Bioremediation / Biogenidiation / Bioaugmentation

1. Bio-Remediation technology uses microbes to remove pollutants. It can be *in situ* or *ex situ.*
2. It can be natural or induced (where microbes are added externally and fertilizers are applied to create suitable environment for them to grow).
3. Such a technology can be used to clean the 350 tonnes of toxic waste in Bhopal. It can be used to treat municipal waste water.

Biostimulation

1. It means modifying the environment to make it more suitable for bioremediation by addition of certain substances.

Bio-accumulation vs Bio-concentration vs Bio-magnification

1. Bio-accumulation occurs within a trophic level and is increase in concentration of a substance in our bodies through food and environment.
2. Bio-concentration occurs within a trophic level through absorption from water (when intake from water > excretion rate).
3. Bio-magnification occurs across different trophic levels in a food chain.

Biodilution

1. As opposed to bio-magnification it means decrease in the concentration of a substance with increase in trophic level. Substances of concern are heavy metals like mercury, cadmium.

2. This occurs when the nutrient content of an ecosystem is high. So the numbers of autotrophs (phytoplankton) is also very high and their biomass is high. So the metals get diluted and even in next layer of the food chain their concentration is less. Thus by increased use of nitrogen and phosphorus fertilizers, bio-accumulation can be reduced.

Carbon Cycle

Oceans

1. Oceans contain largest amount of C, mostly near their surface and as HCO_3-. The typhoons and storm bury a lot of C as they wash away sediments.
2. In regions of upwelling, C is released into the atmosphere and in regions of downwelling, it is absorbed into the ocean.
3. Revelle factor: The level of carbon in oceans doesn't vary in unity with the partial pressure of atmospheric CO_2. It varies by a factor called Revelle factor which is ~10 i.e. for 10% increase in partial pressure of CO_2, oceanic carbon content will increase by 1%.
4. Towards the pole, water becomes cooler and hence more CO_2 becomes soluble into the water and hence more C absorption.

Salt Marsh Ecosystem

1. Salt marshes occur in temperate and high-latitudes coasts in sheltered environments such as embankments, estuaries and the leeward side of barrier islands. In the tropics they are replaced by mangroves; an area that differs to a salt marsh in that instead of herbaceous plants, they are dominated by trees. A herbaceous plant has leaves and stems that die down at the end of the growing season to the soil level. They have no persistent woody stem above ground. Annual herbaceous plants die completely at the end of the growing season and they then grow again from seed. Herbaceous perennial and biennial plants have stems that die at the end of the growing season, but parts of the plant survive under or close to the ground from season to season (for biennials, until the next growing season, when they flower and die).
2. Elevation is an important aspect of salt marsh ecosystem. At higher elevations, there is much less and variable tidal inflow, resulting in lower and variable salinity levels (salinity will depend on evaporation and flooding which can both be unpredictable). Soil salinity in the lower marsh zone is fairly constant due to everyday annual tidal flow.

Littoral Ecosystems

Supralittoral Zone

1. It is the area above the spring high tide line that is regularly splashed, but not submerged by ocean water. Seawater penetrates these elevated areas only during storms with high tides. Organisms here must cope also with exposure to bad air, fresh water from rain, variations and predation by land animals and seabirds.

Eulittoral Zone (Inter-tidal zone)

1. It extends from the spring high tide line, which is rarely inundated, to the neap low tide line, which is rarely not inundated. The wave action and turbulence of recurring tides shapes and reforms cliffs, gaps, and caves, offering a huge range of habitats for sedentary organisms.
2. Productivity is progressively lower towards the land.

Sublittoral Zone / Neritic Zone

1. It starts immediately below the eulittoral zone. This zone is permanently covered with seawater. The sunlight reaches the ocean floor. This results in high primary production and makes the sublittoral zone the location of the majority of sea life. As in physical oceanography, this zone typically extends to the edge of the continental shelf.

Coral Reef Ecosystems

Formation

- As the volcano / island subsides, coral growth includes a fringing reef often including a shallow lagoon between the reef and the island. 
- As the island continues to subside, the reef and the lagoon becomes larger and larger. 
- Finally an atoll emerges as the island sinks. 

Types

1. Barrier reef: It is separated from the mainland by a deep channel or lagoon.
2. Patch reef: It is an isolated, comparatively small reef outcrop usually within a lagoon often circular and surrounded by sand or seagrass.
3. Apron reef: A short reef resembling a fringing reef, but more sloped.
4. Micro atoll: Certain species of corals form communities called micro atolls. It is not a single reef but a collection of reefs resembling atolls.
5. Cays: They are small, low-elevation, sandy islands formed on the surface of coral reefs. Material eroded from the reef piles up on parts of the reef or lagoon, forming an area above sea level. Plants can stabilize cays enough to become habitable by humans.
6. Seamount/guyot: When a coral reef cannot keep up with the sinking of a volcanic island, a seamount or guyot is formed.

Reef Ecosystem

1. The reef surface: It is the shallowest part of the reef. Due to shallowness, waves surge and increase in height. This means the water is often agitated. These are the precise condition under which corals flourish. Shallowness means there is plenty of light and agitated water promotes the ability of coral to feed on plankton for which they have tentacles. However, other organisms must be able to withstand the robust conditions to flourish in this zone.

2. The off-reef floor: It is the shallow sea floor surrounding a reef on a continental shelf. Usually sandy, the floor often supports seagrass meadows which are important foraging areas for reef fish.
3. The reef drop-off: It is a habitat for many reef fish who find shelter on the cliff face and plankton in the water nearby.
4. The reef face: It is the zone above the reef floor or the reef drop-off. It is usually the richest habitat. There are cracks and crevices on the reef face (due to algae growth) which provide protection, and the abundant invertebrates and algae provide an ample source of food.

Corals and Climate Change

1. Coral bleaching: Corals contain plant-like organisms called zooxanthellae that live symbiotically within their tissue. Zooxanthellae provide their coral host with food and oxygen and in return, the zooxanthellae receive nutrients, carbon dioxide, and an enemy-free shelter. When water temperatures increase this critical yet delicate symbiotic relationship breaks down and the zooxanthellae are expelled, often leading to the coral's death. The phenomenon is called "coral bleaching" because the coral animal appears to turn white after the zooxanthellae loss. This is because without their zooxanthellae symbionts, which contain various photosynthetic pigments, corals are nearly transparent and the white.
2. Coral disease: As temperatures increase the activities of harmful bacteria also increases harming corals. Higher temperature also causes stress in coral leading to lower immunity.
3. Ocean acidification: Increased CO_2 means increased acidification of water making it difficult for corals to secrete their $CaCO_3$ skeleton.

Estuary Ecosystem

1. An estuary is a partly enclosed coastal body of water with one or more rivers flowing into it, and with a free connection to the open sea. The inflow of both seawater and freshwater provide high levels of nutrients making estuaries among the most productive natural habitats. But they suffer from pollution, surface runoffs, over fishing and eutrophication leading to dead zones.
2. Two of the main challenges of estuarine life are the variability in salinity and sedimentation. Many species of fish and invertebrates have various methods to control or conform to the shifts in salt concentrations and are termed osmo-conformers and osmo-regulators. Large numbers of bacteria are found within the sediment which have a very high oxygen demand. This reduces the levels of oxygen within the sediment.
3. Phytoplankton are key primary producers in estuaries. They move with the water bodies and can be flushed in and out with the tides. Their productivity is largely dependent upon the turbidity of the water.

Bank Ecosystem

1. A bank is a part of the sea which is shallow compared to its surrounding area such as the top of an underwater hill. There is upwelling and strong currents around the banks resulting sometimes in nutrient rich currents. Because of this, some large banks are among the richest fishing

grounds in the world.

Pelagic Ecosystem

1. Any water in a sea or lake that is not close to the bottom or near to the shore can be said to be in the pelagic zone. In deep water, the pelagic zone is sometimes called the open-ocean / oceanic zone and can be contrasted with water that is on the continental shelf. However in other contexts, coastal water that is not near the bottom is still said to be in the pelagic zone.
2. The demersal zone is the part of the ocean comprising the water column that is near to (and is significantly affected by) the seabed.

1. Epipelagic zone (sunlight): It extends

   from the surface down to around 200 m where light penetrates and is enough for photosynthesis.

Consequently, plants and animals are largely concentrated in this zone.

2. Mesopelagic (twilight): It extends from 200 m to around 1,000 m. Although some light penetrates this second layer, it is insufficient for photosynthesis. At about 500 m the water also becomes depleted of oxygen. Still, life copes, with gills that are more efficient or by minimizing movement.
3. Bathypelagic (midnight): It extends from 1,000 m to around 4,000 m. At this depth the ocean is pitch black, apart from occasional bioluminescent organisms. Most animals living here survive by consuming the detritus falling from the zones above, which is known as marine snow.
4. Abyssopelagic (lower midnight): It extends from 4,000 m to above the ocean floor. Many of the species living at these depths have adapted to be transparent and eyeless as a result of the total lack of light in this zone. Organisms live around hydrothermal vents.
5. Hadopelagic: It refers to the deep water in ocean trenches.

Benthic Ecosystem

1. It is the ecological region at the lowest level including the sediment surface and some sub-surface layers. Organisms living in this zone are called benthos. The benthic region of the ocean begins at the shore line and extends in the sea. The pressure difference can be one atmosphere for each 10 meters of water depth.
2. Benthic organisms can be divided into two categories based on whether they make their home on the ocean floor or an inch or two into the ocean floor. Those living on the surface of the ocean floor are known as epifauna. Those who live burrowed into the ocean floor are known as infauna.
3. Because light does not penetrate very deep ocean-water, the energy source for the benthic ecosystem is often organic matter from higher up in the water column which drifts down to the depths. Some microorganisms use chemosynthesis.

Hydrothermal Vent Ecosystem

1. Hydrothermal vents in the deep ocean typically form along the mid-ocean ridges. These are locations where two tectonic plates are diverging and new crust is being formed. The water emerging from the hottest parts of some hydrothermal vents can be a supercritical fluid. Besides being superheated, the water is also extremely acidic, often having a pH value as low as 2.8.
2. White smokers: They are vents that emit lighter-hued minerals, such as those containing barium, calcium, and silicon. These vents also tend to have lower temperature plumes.
3. Black smokers: They typically emit particles with high levels of sulfur-bearing minerals, or sulfides.
4. Vent organisms depend on chemosynthetic bacteria for food. The water that comes out of the hydrothermal vent is rich in dissolved minerals. These bacteria use sulfur compounds, particularly hydrogen sulfide to produce organic material. Tube worms form an important part of

the community around a hydrothermal vent. They have no mouth or digestive tract and absorb nutrients produced by the chemosynthesis bacteria in their tissues. They transfer H_2S to the bacteria living inside and in return the bacteria nourish the worm with carbon compounds.

Cold Seep Ecosystem

1. A cold seep is an area of the ocean floor where hydrogen sulfide, methane and other hydrocarbon-rich fluid seepage occurs. Cold seep doesn't mean water is cooler than the surrounding water. It simply means it is not as hot.
2. The first level organisms are chemosynthesis bacteria. In the initial stage, methane is relatively abundant and dense mussel beds form. The mussels use bacteria feeding on methane. Unlike the mussels, tube worms rely on bacteria which feed on hydrogen sulfide instead of methane for survival.
3. Cold seeps do not last indefinitely. As the rate of gas seepage slowly decrease, the shorter-lived, methane-hungry mussels start to die. At this stage, tube worms become the dominant organism in a seep community. This is called ecological succession.

Ecological succession

1. It is the phenomenon or process by which an ecological community undergoes more or less orderly and predictable changes following disturbance in a habitat. The community which is able to get into equilibrium with the new environment is called the climax community.
2. Primary succession is the succession process which starts when there were no previous organisms in that place. Secondary succession is the succession process when there were already some organisms.

Hydrarch and Xearch Successions

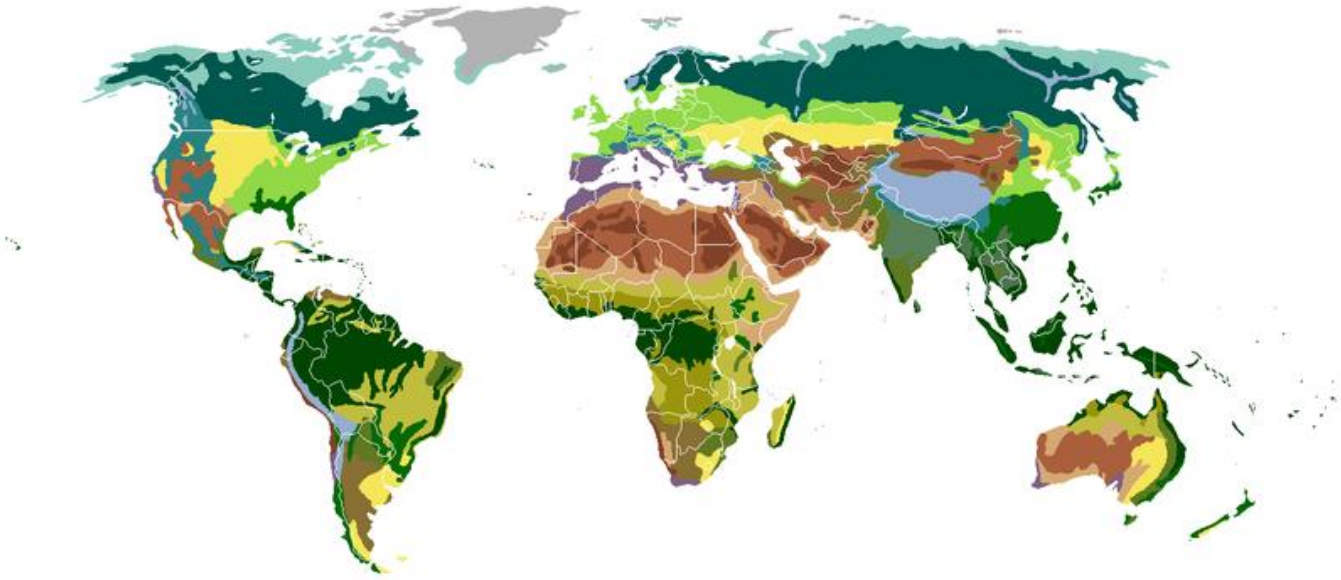
1. Mesic condition is the medium water condition. Hydrarch succession takes place in a wet place where plants grow so as to take it to mesic level. Xearch succession takes place in a dry place where plants grown so as to take it to mesic level.

Lake Ecosystem / Lentic Ecosystem

1. Phytoplankton are found in epipelagic zone. Many species have a higher density than water which should making them sink and end up in the benthos. To combat this, phytoplankton have developed density changing mechanisms, by forming vacuoles and gas vesicles or by changing their shapes to induce drag, slowing their descent. Photosynthesis is often low at the top few millimeters of the surface, likely due to inhibition by ultraviolet light.
2. Bacteria feed on detritus, they are consumed by protozoa which are in turn consumed by zooplankton, and then further up.
3. Acid rains can lead to acidification of water. Lakes that contain bedrock that is rich in carbonates have a natural buffer, resulting in no alteration of pH. But those without such bedrock, are very sensitive to acid inputs. At a pH of 5-6 algal species diversity and biomass decrease considerably, leading to an increase in water transparency – a characteristic feature of acidified lakes. Eutrophication and invasive species are other human induced threats.
4. Below the epipelagic zone is the limnetic zone well lighted as well and dominated by plankton. Then comes the thermocline zone where there is a rapid change in water temperature with depth.

River Ecosystem

1. The temperature is cooler at the source. The water has higher oxygen and is clearer.
2. In the middle the volume, width and biodiversity increases.
3. In the lower reaches the water becomes muddy, less sunlight penetration, less oxygen and less biodiversity.



ice	temperate	arid desert	grass	alpine

sheet and polar desert	steppe	xeric shrubland	savanna	tundra
tundra	subtropical rainforest	dry steppe	tree savanna	mountain forest
taiga	Mediterranean vegetation	semiarid desert	subtropical dry forest	
temperate broadleaf forest	monsoon forest		tropical rainforest	

Stratification

1. It is the vertical distribution of different species into different levels like trees @ top, grasses @ bottom.

Net Primary Productivity

1. Gross primary productivity - Rate of respiration.
2. Gross primary productivity is the rate of biomass production.

Standing State

1. It is the amount of nutrient present in the soil at any given time.

Tropical Forests

1. Soils: The soils are acidic and nutrient poor because of leaching and heavy saprophytic activity.

Boreal or Taiga Forests

1. Soils: The soil is acidic and nutrient poor.
2. The canopy permits only low light penetration.

Savanna Grasslands

1. Soils: Soils are porous and poor humus content.

Deserts

1. Vegetation modifications: Plants have longitudinal ridges and grooves on their stems which swell as water fills up in them. As the water gets used up they shrink again. They also have thick, fleshy leaves and stems.

Asian Brown Cloud

1. It is a 3 km thick layer of air pollutants over S Asia.

HCH (Hexa Chloro CycloHexane)

1. It is a pesticide used in Asia but has accumulated on W coast of Canada and Alaska as the low temperature there reduces its evaporation and degradation rates.

Phyto-filtration

1. It is a technique by which ferns can be grown on contaminated water which absorb As from it.

Spent Wash

1. It is the pollutants released from distilleries which are rich in organic pollutants exhausting water oxygen.

Bay of Plenty

1. It is in New Zealand. An oil leak happened here.

Climate Change

IPCC

The IPCC's Summary for Policymakers report addresses the question directly, arguing that the current slowdown in global warming will not affect long-term rise in temperatures.

Global temperatures have on average risen by 0.12 degrees Celsius per decade since 1951 but the warming rate in the 1998-2012 period is considerably lower at 0.05 degrees C.

The report attributes a number of reasons for this slowdown. One, it says, 15 years is too short a period for making generalizations. "Due to natural variability, trends based on short records are very sensitive to the beginning and end dates and do not in general reflect long-term climate trends," it says.

"If you take away the first year — 1998, which was exceptionally hot because of a strong El Nino — the graph looks very different,

The report says the slowdown in warming since 1998 could be due to two factors. One, the Earth retained less heat during this period primarily due to volcanic eruptions and a downward phase in the 11-year solar cycle. And two, much of the energy generated by global warming went into the ocean.

The novel aspect of the latest report is the concept of a “carbon budget” for the world. The IPCC holds that if the earth’s temperature is not to exceed two degrees celsius above the present temperature, the total amount of GHGs in the atmosphere should not exceed 800-880 gigatonnes. In other words, if the emission of CO2 and other GHGS is not curbed adequately to prevent such an

accumulation, the earth will become two degrees warmer. The real worry is the fact that the earth already has 530 gigatonnes of accumulated GHGS. In other words, more than half the carbon budget has already been exhausted. So business as usual will not work

"Monsoon onset dates are likely to become earlier or not to change much while monsoon withdrawal rates are very likely to delay, resulting in a lengthening of the season."

North India is likely to heat up more than the southern parts of the country while the entire Indian subcontinent may see longer rainy seasons in second half of the century,

though the Indian summer monsoon circulation will weaken, rainfall will increase due to higher atmospheric moisture resulting from a rise in temperatures.

Burma, Bangladesh and India can expect stronger cyclones; Although the global frequency of tropical cyclones is expected to decrease or remain essentially unchanged, they may become more intense, with stronger winds and heavier rainfall.

High latitude countries, such as in Europe or North America, are expected to receive more rainfall, but many … subtropical arid and semi-arid regions will likely experience less precipitation … Over wet tropical regions, extreme precipitation events will very likely be more intense and more frequent in a warmer world,

Scientists have also lowered projections of sea-level rises. Depending on future greenhouse gas emissions, sea levels will rise an average of 16-24in (40-62cm) by 2100.

Much higher temperatures could reduce the length of the growing period in some parts of Africa by up to 20%,

t is certainly the first since negotiations for a global treaty reining in carbon emissions collapsed in Copenhagen in 2009; the first since questions were raised about the integrity of the IPCC itself following mistaken claims about the speed of glacier melt in the Himalayas and, most important, the first since evidence became incontrovertible that global surface air temperatures have risen much less quickly in the past 15 years than the IPCC had expected.

The latest iteration identifies radiative forcing, the difference between the amount of heat coming into the climate and the amount reflected back, as the immediate cause of warming. Radiative forcing is expressed in watts per square metre (W/m2), a unit of energy. A rise indicates that heat is building up in the system.

Total radiative forcing from man-made sources since 1750 (ie, before industrialisation) has risen

from 0.29-0.85W/m2 in 1950 to 0.64-1.86W/m2 in 1980 to 1.13-3.33W/m2 in 2011. The average has jumped from 0.57 to 1.25 to 2.29, respectively—a four-fold increase in 60 years.

“The rate of warming over the past 15 years,” it says, “[is] 0.05ºC per decade...smaller than the rate calculated since 1951.” In its 2007 report the panel had said the rate of warming was 0.2ºC per decade in 1990-2005 (four times the current rate). It predicted that this would continue for the next two decades.

But it plays down the long-term significance of the shift, saying that “due to natural variability, trends based on short records are very sensitive to the beginning and end dates and do not in general reflect long-term climate trends.” The start of the recent 15-year trend, in 1998, was a year of a strong worldwide fluctutation in the climate known as El Niño. This produced a temperature spike.

Still, all the extra heat implied by higher radiative forcing has to go somewhere. It isn’t going into the air. It is possible that not all that much is going into the surface waters of the oceans, either. The report says that “it is about as likely as not that ocean heat content from 0-700 metres increased more slowly during 2003-2010 than during 1993-2002.” That only leaves one other heat sink: the deep oceans below 700 metres, where it could be locked up in the deep oceans without affecting other parts of the climate.

For the first time, the IPCC gives some credence to the possibility that Earth’s climate may not be responding to higher concentrations of greenhouse gases quite as sharply as was once thought.

NEW DELHI: Brazil, South Africa, India and China, called the BASIC countries, appear to have moderated their opposition to discussions on phasing out hydrofluorocarbons (HFCs) as refrigerants.

HFCs are among the six greenhouse gases that are covered under the Kyoto Protocol, which is the only legally binding agreement to deal with global warming and climate change. These countries have opposed discussions on the matter in any multilateral forum other than the United Nations Framework Convention for Climate Change. But at a meeting this week in Foz du iguacu in Brazil, they decided that the HFC issue should be dealt "through relevant multilateral fora" and that these discussions should be guided by the principles and provisions of UNFCCC and Kyoto Protocol.

The meeting is significant as it marks a departure from the position these countries have held in the past. The four advanced developing countries, which are the growing markets for refrigerators and

air conditioners, have also decided that availability of safe, technically and economically viable alternatives to HFCs should also be considered provided industrialised countries make available additional financial resources to developing countries.

The change in stance could open the door for the beginning of an open-ended discussion on the phasing out of HFCs under the Montreal protocol, which is a global agreement for the protection of the ozone layer. At the June meeting of the working group on the Montreal Protocol, India had raised the issue of better evaluation of alternatives to HFCs in terms of technical and economic viability.

HFCs present a peculiar problem for the entire gamut of environment-related global negotiations. They were identified as cooling agents under the 1987 Montreal Protocol. The idea was to move from the use of ozone depleting cholofluorocarbons (CFCs) and hydro cholorofluorocarbons (HCFCs) to a refrigerating agent like HFCs which was not harmful to the ozone layer.

HCFC 22 (hydro cloroflurocarbons) is the most common refrigerating agent used in India. Under the Montreal Protocol, India has to phase out use of HCFC by 2030. India's transition from HCFC began in January this year.

The replacement refrigerant agent HFC while addresses the issue of ozone depletion also comes with the attendant problem of contributing to global warming. It is among the six greenhouses gases identified for elimination or reduction under the global climate change agreement, Kyoto Protocol. The US and other industrialized countries, therefore, want India to move directly from HCFC to the new technology which may not contribute to global warming. They also want the HFC should be brought under the purview of the Montreal Protocol.

HFC is, however, listed as one of the greenhouse gases under the Kyoto Protocol which is only binding on the industrialized countries. The Montreal Protocol, on the other hand, is applied for all countries including India which signed it in June, 1992.

Officials here explained that the BASIC's decision won't contradict what was decided in the recent G20 summit. They said the G20 took a balanced approach by incorporating concerns of both the developed and developing countries. It recognized the need of making "economically viable and technically feasible alternatives" available to the developing countries while keeping HFC within the scope of UNFCCC and its Kyoto Protocol for accounting and reporting emissions.

Warsaw Talks

Bio Carbon Fund

The Warsaw talks ended on a hopeful note on Sunday with negotiators taking a significant step towards reducing greenhouse gas emissions from deforestation by agreeing to result-based payment to developing countries which cut carbon by leaving trees standing. The money — to be collected through contributions from rich nations — will be used for increasing forest cover. Known as REDD+ (Reducing Emissions from Deforestation and Forest Degradation) initiative The money to be collected for this purpose will be managed by the World Bank's Bio-Carbon Fund.

Though only three countries — the UK, Norway and the US — have so far pledged money to the tune of $280 million to finance the initiative, the move is seen as a step in the right direction as deforestation accounts for nearly 20% of global emissions of carbon dioxide.

3 Legs of UNFCC

One observer at the talks described "loss and damage" as the UNFCCC's "third leg". The first leg is mitigation, when countries cut emissions and issue targets.

The second leg is adaptation, when you make advance preparations for the impacts of climate change that are already locked in (building sea walls, cyclone shelters or developing hardier varieties of food crops – that sort of thing).

L&D and GCF

Loss and damage was one of the key rows in the early stages of the meeting, as some developing countries demanded "compensation" from rich countries for the damage they suffered from extreme weather. A compromise was reached with a new "Warsaw international mechanism" by which the victims of disaster will receive aid, but it will not be linked to any liability from developed countries.

The decision to set up an international mechanism on 'Loss and Damage' and a baby step towards capitalization of Green Climate Fund may also be seen in positive light The Warsaw agreements reached a compromise in which a Warsaw mechanism for loss and damage will be set up under the existing institutions that are supposed to fund projects that help poor countries to adapt to climate change. That decision, however, will be reviewed after three years. But what the agreed text conspicuously avoids is any suggestion that contributions made by developed countries should be worked out based on their overall contribution to the 40%

increase in greenhouse gases in the atmosphere since the start of the industrial revolution.

In short, this would be seen as an admission of liability and rich nations do not want a court case.

The GCF will open its headquarters in Incheon, South Korea on December 4 - a beginning of the process where rich nations have been asked to start their contributions before the next climate conference i

At the recent Commonwealth Heads of Government meeting in Colombo,Australia joined Canada in insisting on a footnote to the official communiqué, which said the two countries could not support a Green Climate Fund

LMDCs

The emissions goals, to come into force from 2020, will be set at a national level, but after they are published there will be a chance for other countries to scrutinise them and assess whether they are fair and sufficiently ambitious. At the insistence of a small group of developing countries, they will take the form of "contributions" rather than the stronger "commitments" that most other countries wanted.

These were the self-styled "like-minded developing countries", a group that comprises several oil-rich nations, including Venezuela, Saudi Arabia, Bolivia and Malaysia. Several have large coal deposits and are heavily dependent on fossil fuels, such as China and India, and some countries with strong links to some of the others, including Cuba, Nicaragua, Ecuador and Thailand.

The "like-minded developing countries" group takes the view that the strict separation of nations into "developed" and "developing", which was set at the first international climate talks in 1992, and enshrined in the 1997 Kyoto protocol – in which developed countries were obliged to cut emissions but developing countries had no obligations – must remain as the bedrock of any future agreement. They argue that the "historical responsibilities" for climate change lie with the first nations to industrialise.

That view is firmly rejected by the US and the EU, both of which have agreed to take a lead in cutting emissions, but have also repeatedly pointed out that the tables have turned on historic responsibilities. Emissions from rapidly emerging economies such as China and India are growing so fast that by 2020, the date when any new agreement will come into force, the cumulative emissions from developing countries will overtake those of rich nations

At Warsaw, the efforts of the LMDC focused on attempting to reintroduce into the key texts a restatement of the separation of countries into "developed" and "developing" that was first set out in 1992 and enshrined in the 1997 Kyoto protocol, under which developing countries bore no

obligations on their emissions and rich nations faced steep cuts.

The US, the EU and other developed countries regarded this separation as having been left behind at Copenhagen in 2009, which marked the first time both developed and developing countries signed up under a single agreement to curb their emissions.

Reduction in Emissions

members of the 'Like Minded Group of Nations', including China, pushed back against a proposal that would have seen all countries required to come forward with 'commitments', preferring instead to talk about 'contributions' without 'prejudice to their legal form'.

The UNFCCC "parties" (almost 200 countries) agreed to go back home and "initiate or intensify domestic preparations for their intended nationally determined contributions" to whatever deal might be brokered in Paris in 2015.

Countries will be able to start putting their "contributions" to cutting emissions on the table from April 2015 – these "contributions" might be targets but could be other efforts to keep emissions down.

In the agreement reached at Warsaw, the developing countries, including the largest and fourth largest emitters of greenhouse gases—China and India—forced the rich countries to drop their insistence that all countries make "commitments" to address climate change. Instead, countries will now make vague nationally determined "contributions" toward addressing man-made global warming.

The United States and European negotiators in Warsaw had sought an agreement in which each country would use a common transparent framework for calculating its emissions reductions. In the new Warsaw agreement, countries set their own baselines and define their own reduction strategies, thus making comparisons between countries' efforts far less transparent and harder to calculate

The developed country negotiators also wanted all countries to put forward their initial commitments no later than the first quarter of 2015. That deadline would make it possible for the initial commitments to be critiqued before the 2015 Paris conference. The goal of the pre-Paris scrutiny would be to see if they were collectively adequate to keep the world on track toward restraining future global temperatures to an increase of no more than two degrees centigrade. Instead, countries will announce their contributions only when they were good and "ready to do so."

Carbon Budget

	Total energy demand [Mtoe][a]		Growth rate [%]	Share in total energy demand [%]	
	2008	2035	2008-2035[b]	2008	2035
OECD	**5,421**	**5,877**	**0.3**	**44.2**	**32.6**
Non-OECD	**6,516**	**11,696**	**2.2**	**53.1**	**64.8**
Europe/Eurasia	1,151	1,470	0.9	9.4	8.1
Asia	3,545	7,240	2.7	28.9	40.1
China	2,131	4,215	2.6	17.4	23.4
India	620	1,535	3.4	5.1	8.5
Middle East	596	1,124	2.4	4.9	6.2
Africa	655	948	1.4	5.3	5.3
Latin America	569	914	1.8	4.6	5.1
World[c]	**12,271**	**18,048**	**1.4**	**100.0**	**100.0**

1. 450 ppm of CO2 in atmosphere is considered to be the limit at which the world will irreversibly heat up by 2 degrees. When that happens we cannot talk anymore of mitigation i.e. taking steps to prevent global warming, but would have to talk about steps for adapting to the climate change. It has gone up from 280 in 1750 to 380 now. By 2015 we will emit 90% of it and hit the ceiling by 2017 and the doors would be shut for ever.
2. This necessitates a peaking of global emissions by 2015 and a 50% reduction (compared to 2005 levels) by 2050. G-8 have already announced a cut of 80%. For this IEA estimates that renewable energy will have to account for ~30% of total and other reduction will come via sequestration and efficiency. Investment costs in solar PV declines by around 25% for a doubling in production compared to only 5% in coal. Thus the future holds great potential.

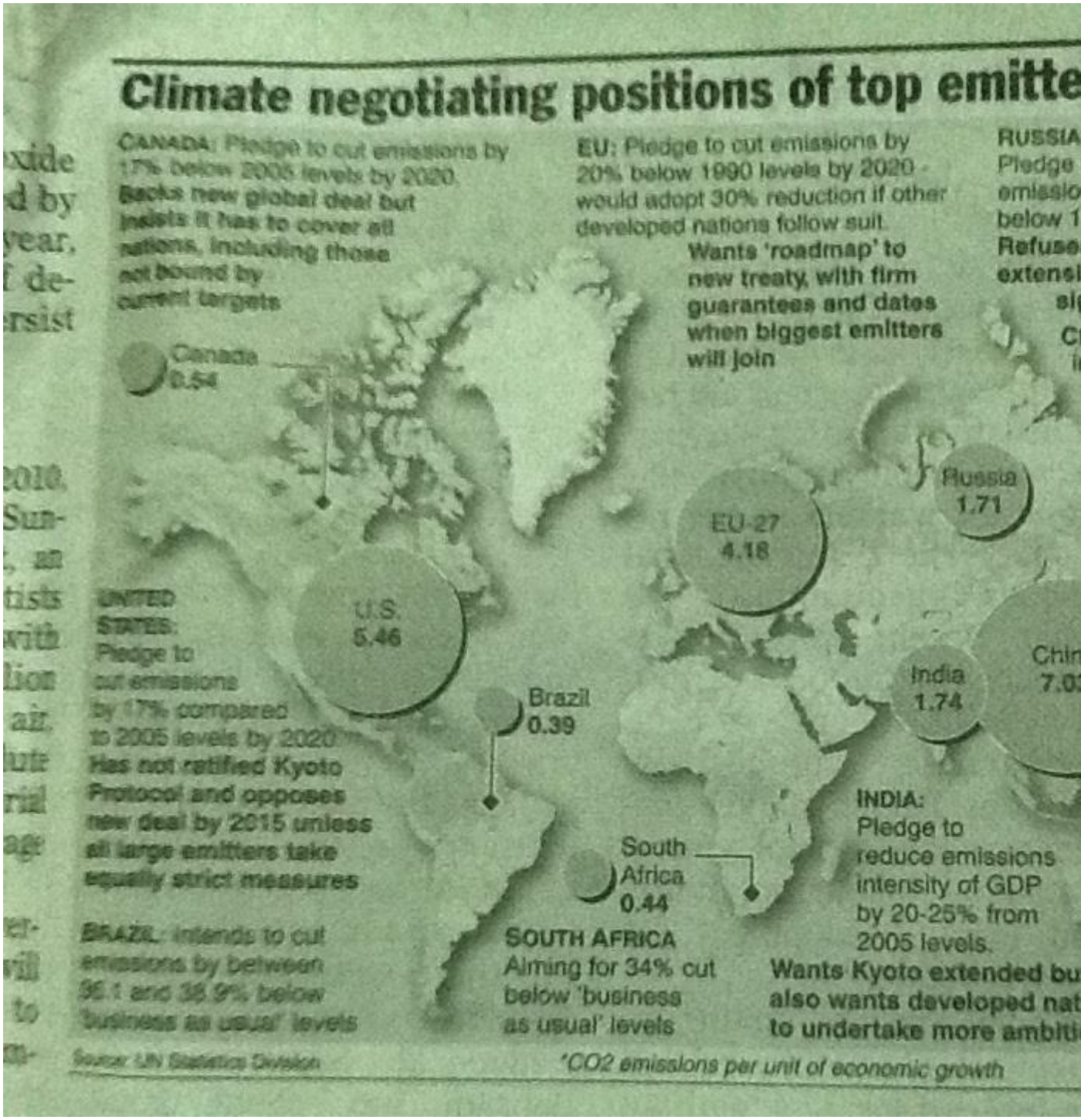
Effect on Arctic Ocean

1. Due to less ice, open Arctic water will absorb more CO_2.
2. The marine productivity will increase as more sunlight penetrates through. This also means larger staying periods for whales in Arctic.
3. Warm Arctic means more tundra vegetation and taller shrubs compared to small mosses and lichens presently.

4. As more Arctic waters are exposed, the microbial activity in the surface waters increases and more CH_4 is released into the atmosphere thus creating a positive feedback loop.

Science & Economics

1. Methane is ~21x GHG than CO, CFC is ~1000x. Concentration of CO_2 has gone up from 280 ppm to 379 ppm from 1750 to 2005 and temperature by 0.75ºC. NO_2 is the other GHG gas. CO_2 accounts for 77% GHG effect, CH_4 for 15%, NO_2 for 8%. Other GHGs are HFC, PFC, CO. Globally agriculture contributes 15% of GHG emissions and buildings contribute 12%.
2. UNFCC has estimated developing countries need to invest ~$30-70 bio p.a. in green technologies and global investment should be $60-180 bio p.a. Considering this the corpus of GCF of $100 bio is insufficient. Even for that developed countries are trying to shift the responsibility to G20.
3. Equity is of 2 types: inter-generational and intra-generational. Higher social discount rate will lead to more focus on intra-generational equity while lower one will lead to focus on inter-generational equity. Developed countries focus more on inter-generational while developing countries focus on intra-generational.
4. US accounts for ~30% of cumulative CO_2 emissions, EU for ~25%, China for ~10%. In terms of per capita, Annex 1 countries emission is ~ 10 MT, non-Annex 1 countries has gone up from 2.8 MT in 1990 to 3.7 MT in 2008 and India has gone up from 0.8 MT in 1990 to 1.5 MT in 2008.



India & GHG

1. India's CO_2 emissions are growing @ 3% p.a. Contributing sectors are energy (55%) growing @ 5.5%, industry (22%) and agriculture (17%) declining @ -0.2%.
2. Indian planners are expecting per capita emission of 4 MT by 2030 but climate agreement may cap it much closer to current emissions.
3. Paddy cultivation leads to CH_4 and NO_2 emissions.

Green Economy

Renewable Energy

1. China has the largest installed renewable energy capacity (133 GW) followed by US (93 GW) and Germany (61 GW) and other EU countries (60 GW). India has 22 GW. In terms of investments US has the largest investments followed by China (but this si going to be short lived as China will pick up again).
2. India's investment in renewable energy is growing @ 50% rate and was $10 bio in 2011 with ~ half of it going in wind. Going forward solar energy is expected to pick up.

Rationale for Green Accounting

1. Current GDP accounting includes many things which don't make us richer while leaves out many which do make us richer. For example, pollution makes us poorer but doesn't reduce GDP. If we pay to clean up pollution, this increases GDP, but no wealth has been created. When wastewater is naturally cleaned by wetlands we are richer but GDP doesn't increase.
2. GDP accounting also doesn't value various ecosystem services and thus doesn't enable us to value them properly and make economic decisions. For example a swamp's value can be calculated by the amount one would need to spend in order to achieve what it does naturally. So any alternative use should be made only if the benefits are higher than the ecological costs. Once armed with information like how much a mangrove contributes to fish breeding and how much a coral reef protects a coastline from storm surges, then countries are in a better position to decide whether to keep these natural assets intact or allow their destruction for commercial uses

Case Against Green Accounting

1. While it makes sense to move to green accounting system where all environmental services are valued on the above grounds, it also has many drawbacks. One such drawback is that there are limitations in calculating potential benefits of the projects and this may hinder development. Green accounting might easily have led our forefathers not to cut down forests, because this would entail losing a valuable resource. But converting forests to agriculture led to cities and civilization. Innovation and substitution followed, which ultimately produced many more calories and much more wealth.
2. “We’ll be selling off the river! The sky! Even the biodiversity! Sumatran tigers, they’re for sale too. You thought there wasn’t more profit in the world, but there is. Banks, come and get your profits!” It constitutes a vast expansion of the market into the commons, a new wave of enclosure and privatization of previously public goods. The property rights are tough to enforce on commons and are liable to be misused by the rich. Without ensuring rights of the marginalized section, any green economy implementation will be a disaster.
3. Green economy is essentially a utilitarianism philosophy which justified any action if it increases total utility no matter what its distributional aspects be. It ignores the fact that the benefits of destroying the natural resource are likely to accrue to investors rather than the

poor, who are often the most dependent on free natural resources. So a government or private company may decide to let the resource die because the overall monetary return of preserving it is less, ignoring the fact that the people impacted by the decision will be the poorest.

4. Tools such as biodiversity bonds would take control of natural capital away from governments and the people who depend on it and put it at the mercy of financial markets.

Debate - Green Economy Approach Should be Local

1. The first is the liberal view is that every individual has rights and every life is precious. The global arrangements with the declared purpose of improving the world for everyone suffer from a democratic deficit when a few, claiming superior wisdom, will make the rules for the rest. There is also a colonial odor: a burden to manage the world because otherwise the natives may make a mess of it. It goes against the spirit of local self-governance.
2. Any solution imposed from the top will ignore local property rights and is more likely to be misused by strong and powerful and will have unfavorable distributional aspects.

Rio +20

Sustainable Development Goals

1. Developing countries: They accepted the concept of sustainable goals but want the three pillars i.e. social, economic and environment to be represented in a balanced way in selecting the goals. They also wanted the national governments to formulate the SDGs.
2. Developed countries: EU on the other hand was concerned only with environmental goals. Thus for instance, one goal is improved access to water but EU wants it to be achieved via a global water partnership that promotes PPP in various parts of the world and also for effective PPP implementation, countries should treat water as an economic good and price water so as to recover all costs including the environmental one. Similarly another proposal to increase assistance to small farmers means to EU an improved access for farmers to global markets i.e. open up agriculture. They wanted that SDGs should be formulated by UN Secretary General and his 'experts'.
3. Compromise: It was decided to leave it to UN to decide on them. This will be done in the next year through a 30-member working group in the UN nominated by governments.

Technology and Finance

1. Technology politics: The developing countries proposed a new technology transfer mechanism since there has been little transfer in the past two decades. However, the developed countries refused to reaffirm their commitment to transfer technology to developing countries. They insisted that instead of using "transfer" the statement should read "voluntary technology exchange on mutually acceptable terms" which means on commercial basis. This was to prevent compulsory licensing and imposition of technology transfer requirements by developing countries.

2. Finance politics: The developed countries dropped the commitment of “new and additional financial resources” instead made references in the text to getting funds from a “variety of sources” and "new partnerships" which means from the market and also urged south to raise more resources (which was rejected by the developing countries and didn't find a place in the final draft). Importance of fulfilling ODA target of 0.7% of GDP has been reaffirmed though. The developing countries had asked for a new fund be created with ≥ $30 billion a year be provided in 2013-17 and rising to $100 billion a year from 2018. But this was rejected by developed countries.
3. Compromise: Developing countries wanted that the statement should reaffirm that developing countries require technology and financial support to meet their obligations which would be provided by the developed countries. To save the show, it was agreed that there would be a follow-up process in both finance and technology after Rio+20.

Global Feed In Tariff

1. India can't afford energy produced by many of the green technologies because of their high costs. So the global feed in tariff mechanism was a proposal devised which would ensure the the funding of the differential between the costs of green energy and fossil fuel energy. The mechanism proposes creating a global fund to fund this gap.

Green Economy Politics

1. EU: It wanted that Rio+20 should draw a clear road map with specific goals, targets and deadlines for issues such as water, forests, agriculture and oceans.
2. Developing countries: They rejected EU's proposal for they feared that - (a) it would be used to justify trade protectionism by EU, (b) it would lead to creation of new markets for developed countries since they hold the advantage in such areas like green technologies, green finance etc., (c) it would lead to commodification of nature and suffering of poor, (d) it would become a new conditionality in aid, (e) it would replace the sustainable development concept, (e) it would entail additional commitments for developing countries without any additional financial or technical assistance from developed countries. Moreover countries like India which depend heavily on fossil fuels for their energy mix are in no position to phase out the subsidies on fossil fuels.
3. Compromise: It was agreed to state that green economy was one of the many measures of achieving sustainable development. It was also agreed that green economy should respect national sovereignty, promote inclusive growth, not be used for trade protectionism, not be used as a condition for aid, help close N-S technology gap and address poverty and inequality. For the future action, UN is asked to coordinate between and match the interested countries and to provide best practices for green economy, evaluating policies and develop platforms.

UNEP

1. Politics: There was an agreement that UNEP should be strengthened but a dispute on how it should be strengthened. EU and African countries wanted UNEP to become a UN specialized agency while most developing countries wanted to retain its status as a programme but strengthened.
2. Compromise: It was finally agreed that the UNEP would be strengthened and upgraded, including through universal membership of its governing council and increased financing. But the proposal to convert it to a specialised agency did not succeed.

CBDR & Equity

1. US was resisting its inclusion but it was included finally.

Financing of the Green Economy

1. IEA report shows that to reduce global emissions by 50% by 2050, additional investments required will likely be in the range of 1 to 2.5% of global GDP per year from 2010 to 2050.
2. Financial investment, banking and insurance are the major channels of private financing for a green economy. The financial services and investment sectors control trillions of dollars that could potentially be directed towards a green economy. In 2009, the global market size for institutional assets was estimated at just over US$ 121 trillion. More importantly, long-term public and private institutional investors, banks and insurance companies are increasingly interested in acquiring portfolios that minimize environmental, social and governance risks, while capitalizing on emerging green technologies.
3. Microfinance: Microfinance has a potentially important role at the community and village level to enable the poor to invest in resource and energy efficiency as well as increase their resiliency to risk.
4. Role of public sector: Governments should involve the private sector in establishing clear, stable and coherent policy and regulatory frameworks. In addition, governments and multilateral financial institutions should use their own resources to leverage financial flows from the private sector and direct them towards green economic opportunities. Public finance is important for triggering a green economic transformation, even if public resources are significantly smaller than those of private markets. Development Finance Institutions can adopt the goal of supporting development of the green economy, allocate significant proportions of their new lending towards financing green economy transition projects and link it to specific targets such as reduction in greenhouse gas (GHG) emissions, access to water and sanitation, biodiversity promotion and poverty alleviation. Policies can be designed to improve the "green efficiency" of their portfolios, for example, by examining the carbon and ecological footprints of their investment portfolios.

5. Renewable energy: Financial markets have already been mobilizing substantial amounts in renewable energy. A total of around US$ 557 billion was deployed to the renewable energy market between 2007 and mid-2010. Investment costs in renewable energy decline much faster than in conventional energy.
6. Green property assets: Numerous green property development funds have come up and the increasing preference of occupants for green offices and residences are key indicators of green property becoming an attractive asset class. The built environment, through its construction and use accounts for 40% of both global energy use and carbon dioxide emissions. As a result green properties yield premium rental returns.
7. Forestry (REDD+): The biggest challenge is in understanding and developing markets related to biodiversity and ecosystems services. However, several recent initiatives have begun to frame the potential in nascent existing markets and prospective future ones.
8. Green bonds: The green bond market is still relatively small, but has the support of triple AAA rated institutions and growing momentum. Green bonds are simply a variant of general bonds wherein the issuer of the bond guarantees to use the money raised for some specific environmental purposes. They are designed to particularly attract investors who wish to lend money for these purposes. Recently WB, IFC, EIB, ADB, African Development Bank have come up with green issues. They have also been used at municipal levels.
9. Green insurance in carbon markets: Carbon markets have not tackled emissions from the loss of natural forests. There are several concerns: the issues of likely permanence, leakage, measuring and monitoring. As much as 20 % of anthropogenic GHGs are estimated to originate from land use change. Unlike the reduction or avoidance of GHG emissions with all other types of mitigation activities, GHG sequestration into biomass is non-permanent. Sooner or later, the sequestered carbon will be re-released into the atmosphere. In the case of forestry this can happen due to natural hazards, land-use decisions. To date, regulators have treated forest-based GHG permits as temporary, which has greatly reduced their value and thus demand. An alternative is the deployment of insurance to guarantee the permanence of carbon sequestered through forests. Private sector providers of forest insurance focus on plantations, not public and natural forests. The primary reason is the more sophisticated risk management systems (e.g. watchtowers and firebreaks, fire-fighting personnel, equipment and procedures) in place for privately owned forests, where there is a clear financial interest. Also, forest risks require specialist knowledge, and the valuation of forest carbon is difficult.

Convention on Bio-Diversity

Funding Issue

1. In the Hyderabad conference, the poor nations wanted enhanced funding commitments from the rich nations. But the rich nations wanted the poor nations to conduct an

assessment of the biodiversity conservation needs and to install accountability procedures. This was seen as stalling tactics by the poor nations.

2. Compromise: The compromise text showed doubling of proposed fund flow from rich to poor nations by 2015 (over average of fund flows from 2006 to 2010). In return the poor countries promised that by 2015, over 75% of them will do their homework, include biodiversity in national development needs and prepare assessment of their needs and conservation plans. On accountability, these countries would submit information by 2014 summit. Also the document urges countries to explore 'all possible sources' of funding including market based.
3. However this is only an interim target. This target is to be revised in the next summit in Korea in 2014 and revised up in the subsequent summits until 2020. This would entail a continuous rise in the contribution by the rich countries by 2020 which they are unwilling to accept. EU is willing to increase aid only until 2015 and then wants it to be frozen until 2020.

Subsidies

1. The countries have agreed to phase out biodiversity harming subsidies by 2014.

Alchi Targets

1. These are the ambitious goals setup by countries under CBD to protect plants, animals and natural habitats by 2020. But the countries could not agree on how to raise money needed to achieve these goals at Hyderabad.

Post Durban Diplomacy

1. LDCs and AOSIS: They warned that EU's insistence on an eight-year second commitment period from 2013 would delay action from all big emitters. They want only a 5 year second commitment period of Kyoto Protocol as they think it is ineffective and fresh and deeper commitments should be undertaken. They argue that countries bound under the 2nd commitment period only account for 15% of the world's emissions.
2. EU: It wanted an 8 year second commitment period of KP as it would coincide with its domestic target to cut emissions 20% below 1990 levels by 2020.

2015 Agreement *Prior Politics*

USA'S CLIMATE CHANGE PLAN

- President Obama recently laid out USA's first blueprint on the domestic and international initiatives to tackle climate change.
- It holds some troubling implications for both multilateral climate change negotiations and the economic policies of developing countries, India in particular.
- It effectively allows developed countries to abandon their end of the equity bargain — i.e. to provide technology transfer and financial support to developing and Least Developed Countries (LDCs) — in return for their promise of sustainable growth.
- The discourse has now turned to market-oriented approaches to foreign investment and de-regulation that emerging economies must welcome to "green" their development, if they want to be seen as responsible stakeholders.

DOMESTIC PROPOSALS

- Obama's commitment to reduce carbon emissions to 17 per cent below 2005 levels by 2020 is a hollow one. By most estimates, an emissions reduction of 17 per cent from 2005 levels is equivalent to a 4-6 per cent reduction from levels that persisted in 1990. On the other hand, the Kyoto Protocol, which the U.S. has not

ratified, requires industrialised countries to reduce, by 2020, their greenhouse gas emissions by 18 per cent below 1990 levels.

- The proposal to regulate carbon emissions from power plants (that run on conventional fossil fuel) has been billed as another important step, but it does have certain issues involved.
    - First, these, if at all formulated, will be federal limits imposed by the U.S. Environmental Protection Agency. Each State in the U.S. is free to 'opt out' from their implementation; some no doubt will, given enormous pressure from their coal and steel lobbies.

IMPACT ON INDIA

- Towards India, USA's thrust is simple: encourage "innovation" and "investment" in clean energy technology to reduce reliance on fossil fuels. These buzzwords have now been institutionalised through the setting up of a U.S.-India working group on climate change.
- Shifting the spotlight away from immediate carbon cuts to long-term solutions like "clean energy" provides the West with a legal-moral basis to ask developing countries to further open up their economies. In fact, the success of the U.S. clean energy sector is contingent on how well American companies perform in lucrative markets like India.
- The renewable energy sector in India alone is worth billions of dollars. High financing costs, stringent government regulations and widespread public scepticism on the efficacy of solar and wind power have stunted the growth of the Indian domestic sector.
- For American 'green companies' armed with subsidies and tax breaks, dominating this market will be a walk in the park. All they need to do is to hope that the Indian government continues its foot-dragging renewable energy policy — one that currently permits 100 per cent FDI with little regulatory guidance — while pressing for tougher intellectual property laws bilaterally, in line with the 'TRIPS-plus' vision.
- New Delhi has thus far held out on restrictive IP laws, but faced with the threat of harsher immigration rules and limits on Indian exports, concessions on this front may be a matter of time. Moreover, the U.S. has a powerful carrot in the form of shale gas exports, which India has eyed keenly.

EFFECT ON PRINCIPLE OF 'EQUITY'

- Above all, U.S. attempts to tackle climate change on a bilateral basis sounds the death knell for the principle of equity in international climate talks.
- In the run-up to the Paris conference in 2015, most developing countries have made it amply clear that any multilateral agreement must address the issue of technology transfer and funding. The U.S., opposed to such preferential treatment, has fired the first shot with President Obama calling for an "inclusive" climate deal. His administration has cleverly shifted the goalposts of technology transfer, from its original, unconditional premise to one based on "innovation" and "investment" in clean energy, which invariably skews the market in favour of western companies.
- With powerful tools of negotiation at its disposal, the Obama administration would much rather talk to major emitters individually than confront the combined might of the BASIC (Brazil, South Africa, India and China) group.

1. US
    1. It has proposed a mechanism by which countries define their own "contribution" to emission cuts.
    2. Once such contributions have been agreed upon, a peer review mechanism could be put in place for monitoring and compliance. This is a step back from the language of "commitments" under the UNFCC.
    3. There should also be flexibility to countries to update their contributions with time.
    4. The international community has shown a warm reaction to it.

Durban Conference

Pre Conference Diplomacy

1. Alliance of Small Islands: They want nothing short of a legally binding agreement in Durban.
2. European Union: They will let Kyoto Protocol provisions to be extended for the transition period provided a firm deadline based commitment is expressed in Durban towards moving towards a legally binding solution.
3. US: It wants that if and when a new legally binding agreement is reached, it should be symmetric in nature i.e. same provisions for developed as well as developing countries.

India's Stand

1. India wanted extension of KP.
2. India wanted to include equity, IPR and trade barriers as a core issue of discussion. Trade barriers important in light of EU ban on foreign airlines not having carbon credits. So trade issues should not be mixed with environment issues. BAP created technology mechanism but nothing has been done on the IPRs of technologies to be transfered.
3. India wanted CBDR to stay.

Outcome of Durban Conference

1. The Long-Term Cooperative Action (LCA) launched after Bali would be abandoned by end of 2012. New negotiations on a 'agreed outcome with legal force under the Convention' would begin by 2013 and end by 2015. The new Agreement will come into force by 2020.
2. Until then provisions of Kyoto Protocol will be extended but KP serves little purpose without US, Canada, Australia anyways.
3. The Green Climate Fund would be given a legal personality and capacity. It will be operationalized soon.
4. On Carbon Capture and Storage, 5% of the credits will be put in a reserve for 20 years and will be released only if it is established that none of the carbon stored underground has leaked into the atmosphere.
5. On the Technology Mechanism, the terms and conditions of the operational arm - Climate Technology Centre and Network - were decided.

Cancun Summit, 2010

1. The bifurcation into KP track and Long Term Track were formalized.
2. All major economies were to report their progress.
3. $100 bio commitment was formalized.

Copenhagen Summit, 2009

1. A target of 2 degrees celsius was adopted with a further scope of limiting it to 1.5.
2. A Green Climate Fund to the tune of $30 bio initially and $100 bio by 2020 will be established to help poorer nations.
3. Projects to reduce GHGs in Annex 3 countries will be subject to international monitoring if internationally funded.
4. Annex 2 countries must make commitments for emission reduction and Annex 3 countries must report their plans to reduce GHG emissions.

Bali Action Plan, 2007

1. It bifurcated the climate talks into a Kyoto Protocol Track and a Long Term Cooperative Action track.
2. It could only request the developed countries to help in mitigating climate change.

Kyoto Protocol, 1997

1. It targeted 6 GHGs - CO_2, CH_4, NO_2, HFC, PFC and SF_6.
2. The countries should reduce emissions through national measures though 3 international mechanisms are also provided. The target was reduction by 5.2% (4.2% without US) below 1990 levels by 2012.
3. An Adaptation Fund was also setup to help developing countries.

Mechanism 1. Joint Implementation

1. Any Annex 1 (developed) country can invest in emission reduction projects in any other Annex 1 (developed) country.

Mechanism 2. Emission Trading

1. Any country can buy the unused quota of another country.

Mechanism 3. Clean Development Mechanism

1. Any Annex 2 country can implement a project in Annex 3 (developing) country and claim carbon credits for the additional carbon reduction.
2. It will have to prove that this carbon reduction was not possible without its project.

Rio Summit 1992

1. Its major contributions were - (a) linking “development” and poverty to the environment and recognizing that environmental issues can't be resolved unless poverty is eliminated. This led to CBDR, equity etc. (b) Agenda 21 which set out a road map for the 21st century which was a substantive document that could inform and guide nations as they formulated their environmental policies. (c) CBD. (d) UNFCC.
2. The UNFCC categorized countries into 3 Annexures - Annex 1 is countries which have committed themselves to reducing GHG emissions; Annex 2 is its subset and includes developed economies which must pay for he costs; Annex 3 is developing economies.

Water resources

Issues with Water User Associations

1. WUAs which are male dominated. Membership rules which provide for land holders or heads of households preclude women from becoming members.
2. Their relationship with PRIs is not clear. The PRIs by their constitution are more inclusive (with mandatory inclusion of women, SCs and STs) whereas WUAs represent only landholder interests.

Ganga Action Plan

Objectives of Phase 1

1. Phase 1 was launched in 1985 and completed in 2000. Parts of Phase 2 projects began in 1993. As a part of it, NGRBA was created and currently a sewage processing capacity of 1100 mm litres per day has been installed. Total 2900 mlpd gets discharged.
2. Also focus was laid on reducing non point pollution sources like open defecation, disposal of dead bodies and runoff from solid garbage dumps.

Limitations of Phase 1

1. States were unable to provide their share of the operational costs of sewage treatment plants and pumping stations. Sewage connection plants need to be ultimately connected to home sewers which is the responsibility of states. They also need electricity to run.
2. Industrial discharge is only 20% of total discharge but contains toxic chemicals. Environment protection norms need to be strengthened.
3. Acceptance of electric crematoria has been low.

Objectives of Phase 2

1. To ensure that by the year 2020, no untreated municipal sewage and industrial effluents flow into the Ganga. The sewage treatment plant (STP) capacity in the Ganga basin is only 31% of the domestic sewage generation. As a result, in many locations along the Ganga, the BOD/COD has worsened.

Changes from Phase 1

1. The capital cost was to be shared equally between centre and states while the cost of maintenance to be borne fully by states.
2. Decentralized approach and survey based designed to be used in deciding projects. A study has been conducted by IIT Roorkee to recommend the ecological flow requirement of Ganga.
3. Maintenance of minimum flow requirement to be considered while approving major projects like dams.
4. Improved wood based crematoria to replace electric crematoria.

Reasons of Failure - Parliamentary Standing Committee Report

1. One of the reasons for the failure of government schemes lies in the fact that government has so far adopted only engineering centric approach to solve the problem with undue emphasis on creation of sewage treatment plants. It should also approach it as a social engineering problem through which people living on or around the banks of the rivers are involved.
2. It recommended that services of various institutes of social sciences, apart from IITs should be sought by the government to seek a viable solution of pollution.
3. Another reason for the failure is that the catchment areas especially of Yamuna has been encroached upon and diverted for construction and development activities. Unless the flow of the rivers is maintained at a reasonable level, no other effort is going to be successful

and recommended that the flow of Ganga and Yamuna upstream is not disturbed or blocked.

4. Despite justification and persuasion, the Planning Commission did not allocate adequate resources for prevention and control of pollution and sufficient budgetary allocations must be made.

Threat by Illegal Sand Mining

1. Sand has the ability to let water percolate through deep and release slowly. Thus if we take away the sand form around the river beds we are left with scenarios of heavy floods in rains and dry beds in summers.
2. It also increases the risk of river breaking its bank and overflowing or altering course. Allahbad's Shankargarh area is the worst affected area.
3. It also leeds to rapid fall in water table of the area.

Indo - Israeli Cooperation in Ganga

1. 92% of Israel's waste water is treated and about three quarters of that re-used for agriculture. Israel will help India to establish a test farm for drip irrigation in India. This will imply changes in the old farming practices where monsoons are relied upon for flooding resulting in chemical run off into Ganga.
2. Another Israeli company is looking at natural constructed wetlands as a way to rehabilitate the Ganges. It involves a series of bypasses that divert domestic and industrial waste water from the river to cleanse it naturally and it needs almost no maintenance.

Yamuna Action Plan

1. Phase 1 of YAP was from 1993 to 2003 and Phase 2 began from 2004. A sewage treatment capacity of 700 mlpd has been installed.
2. The new phase envisages recycling raw sewage by setting up treatment plans and creation of better sanitation facilities in Uttar Pradesh, Haryana and Delhi.

Radon contamination

1. The becquerel is the SI-derived unit of radioactivity. One Bq is defined as the activity of a quantity of radioactive material in which one nucleus decays per second. 1 siveret = 100 rem. 5.5% chance of eventually developing cancer. It is joules absorbed per kg of body tissue.
2. Radon is a radioactive, colorless, odorless, tasteless noble gas, occurring naturally as the decay product of uranium or thorium. Its most stable isotope, ^{222}Rn, has a half-life of 3.8 days. Radon is one of the densest substances that remains a gas under normal conditions. It is also the only gas that only has radioactive isotopes, and is considered a health hazard due to its radioactivity.
3. As the radioactive gas of radon decays, it produces new radioactive elements called radon daughters or decay products. Radon daughters are solids and stick to surfaces such as dust particles in the air. If contaminated dust is inhaled, these particles can stick to the airways of the lung and increase the risk of developing lung cancer.

4. Radon gas from natural sources can accumulate in buildings, especially in confined areas such as attics and basements. It can also be found in some spring waters and hot springs. Typical domestic exposures are about 100 Bq/m^3 indoors, and 10–20 Bq/m^3 outdoors

International Laws on Sharing River Waters

Doctrines on Water Sharing

1. Harmon Doctrine / Territorial sovereignty: It states that riparian states have sovereign rights over waters flowing in their territories, irrespective of the effect it has on others. This theory favors upper riparians.
2. Territorial integrity theory: It states that lower riparians have a right to the natural flow of a river, and upper riparian can use it but must allow the waters to flow unchanged in quantity and quality. It favors lower riparians.
3. Prior appropriation theory: It argues that the prior users have priority in law. It argues in favor of those who have asserted their rights earlier, to the detriment of those who even for valid reasons could not exercise their rights.
4. Equitable apportionment theory: It argues in favor of the needs of all claimants to be settled under a legal arbitration.
5. Equitable utilization and community of interests theory: It recognizes that water is a common property and even when shared must be treated as one unit. It should serve the interests of larger number of people. It relies more on discussion and negotiation and less on arbitration.

Historical Agreements

1. In 1815 the Congress of Vienna laid down the framework of international river law for almost a century. The Barcelona Convention in 1921 declared that states are forbidden to create obstacles for navigation in any way. The Pan American Declaration (1933) stated that states can exploit rivers as long as the use of the river will not effect the activities of another state through which the river flows. Also the declaration was made that navigation could not be impaired by agriculture.

UN Framework

1. All nations agree that only riparian nations—nations across which, or along which, a river flows—have any legal right, apart from an agreement, to use the water of a river. Beyond that there is lack of agreement.
2. The upper-riparian nations initially base their claims on absolute territorial sovereignty, typically claiming the right to do whatever they choose with the water regardless of its effect on other riparian nations. Downstream nations, on the other hand, generally begin with a claim to the absolute integrity of the river, claiming that upper-riparian nations can do nothing that affects the quantity or quality of water that flows in the watercourse.

Concept of Equitable Utilization

1. The rule of equitable utilization, based on the concept that an international drainage basin is a coherent legal and managerial unit, embodies a theory of restricted sovereignty under

which each nation recognizes the right of all riparian nations to use water from a common source and the obligation to manage their uses so as not to interfere unreasonably with likely uses in other riparian nations. The rights are defined according to some selected historic pattern of use, although occasionally some other more or less objective measure of need is advanced (e.g., population, area, arable land).

2. What amounts to an "equitable" share of the waters of an international water basin often is not clear. Some have argued that "equitable" sharing must mean equal sharing. The standards are found in Article 6 of the UN Convention, which contains a long list of relevant factors: (a) The geographic, climatic, ecological factors; (b) The social and economic needs of the watercourse nations; (c) The effects of the use or uses of the watercourse in one watercourse nation on other watercourse nations; (d) The existing and potential uses of the watercourse; (e) The conservation, protection and the economy of use of the water; and (f) The availability of alternatives.

The UN Convention on the Non-Navigational Uses of International Watercourses

1. Art 5: It is based on the rule of equitable utilization. It requires the riparian nations to utilize an international river in an equitable and reasonable manner with a view to attaining optimal and sustainable development.
2. The no harm rule - Art 7: The UN Convention also originally embraced a second principle, termed the no-harm rule. But it was very controversial because it seemed to contradict the rule of equitable utilization. The final version of the rule makes clear that the "no-harm rule" is subordinate to the rule of equitable utilization. This requires riparian nations, in utilizing an international watercourse, to take all "appropriate measures" to prevent the causing of significant harm to other watercourse nations. If significant harm nevertheless is caused to another watercourse nation, the nation whose use causes such harm must, in the absence of agreement for the use, take all appropriate measures in consultation with the affected nation, to eliminate or mitigate the harm and, where appropriate, to discuss the question of compensation.
3. Art 5 vs Art 7 controversy: If an upstream State A has not significantly developed its water resources because of its mountainous terrain. The topography of the downstream states on the watercourse, B and C, is flatter, and they have used the watercourse extensively for irrigation for centuries, if not millennia. State A now wishes to develop its water resources for hydroelectric and agricultural purposes. States B and C cry foul, on the ground that this would significantly harm their established uses. Hence the controversy between Art 5 and Art 7.

Other Features of the Convention

1. Each member state would be required to provide information about the condition of the watercourse and about their planned uses, allowing sufficient time for others to study the use and object if the use is perceived to be harmful.
2. The convention permits a state with urgent need to immediately utilize a watercourse, providing that it notifies sharing states both of the use and the urgency. In the event that a

use is perceived to be harmful, it would have required members states to negotiate a mutually acceptable solution, appealing for arbitration to the International Court of Justice if needed.

3. It also requires states to take reasonable steps to control damage, such as caused by pollution or the introduction of species not native to the watercourse and to take corrective actions or compensate sharing states for the loss.
4. It includes emergency provisions like floods and droughts.