11 SOME MISCELLANEOUS TOPICS RELATED TO ECOLOGY AND ENVIRONMENT

GREEN ECONOMY

The Green Economy Group defines a green economy as follows:

What is the green economy? The green economy is defined as a sustainable economy and society with zero carbon emissions and a one-planet footprint where all energy is derived from renewable resources which are naturally replenished. A green economy rigorously applies the triple bottom line of people, planet and profits across all corporations at the microeconomic level and throughout the entire economy at the macroeconomic level. In contrast to a green economy, a traditional "black" energy economy is based on carbon-intensive fossil fuels such as coal and petroleum. By definition, a low-carbon economy is distinct from a green economy because it still generates carbon emissions.

A green economy exhibits the following characteristics:

- an energy infrastructure with zero carbon emissions that is powered 100 percent by renewable energy — made possible through a combination of proven, renewable energy technologies; breakthrough cleantech solutions; as well as enabling regulation and carbon markets
- the water, waste and wastewater infrastructure is based on long-term sustainability
- The preservation and protection of the world's ecosystems, biological diversity and forests in partnership with indigenous peoples and all relevant stakeholders through the creation of sustainable governance models, markets and business models for delivering, maintaining and paying for ecosystem services
- sustained and successful adaption to climate change at a local, regional and global level.

The green economy is comprised of the 25 industries listed below (in alphabetical order):

1. Biofuels
2. Biomass
3. Carbon capture and storage
4. Carbon markets and renewable energy credits
5. Climate change adaptation services
6. Distributed generation
7. Ecosystem services
8. Energy efficiency, recycling, conservation, software and controls
9. Energy storage, batteries and fuel cells
10. Geothermal energy
11. Green design
12. Green IT
13. Green buildings, materials and construction products
14. Green transportation technologies and green vehicles
15. Hydropower
16. Ocean power
17. REDD
18. Smart grid
19. Solar energy
20. Sustainable and organic agriculture, food and products
21. Waste management
22. Wastewater management
23. Waste-to-energy
24. Water and water technologies
25. Wind energy

By definition, coal and petroleum are not a part of a green economy due to their high carbon emissions. Although nuclear energy generates relatively low carbon emissions on a lifecycle basis it is excluded from a green economy due to its potential for long-term adverse environmental impacts.

WHAT IS A CARBON FOOTPRINT – DEFINITION

A carbon footprint is defined as:

The total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO_2).

In other words: When you drive a car, the engine burns fuel which creates a certain amount of CO_2, depending on its fuel consumption and the driving distance. (CO_2 is the chemical symbol for carbon dioxide). When you heat your house with oil, gas or coal, then you also generate CO_2. Even if you heat your house with electricity, the generation of the electrical power may also have emitted a certain amount of CO_2. When you buy food and goods, the production of the food and goods also emitted some quantities of CO_2.

Your carbon footprint is the sum of all emissions of CO_2 (carbon dioxide), which were induced by your activities in a given time frame. Usually a carbon footprint is calculated for the time period of a year.

The best way is to calculate the carbon dioxide emissions based on the fuel consumption. In the next step you can add the CO2 emission to your carbon footprint.

ECOLOGICAL FOOTPRINT

The ecological footprint is a measure of human demand on the Earth's ecosystems. It is a standardized measure of demand for natural capital that may be contrasted with the planet's ecological capacity to regenerate. It represents the amount of biologically productive land and sea area necessary to supply the resources a human population consumes, and to assimilate associated waste. Using this assessment, it is possible to estimate how much of the Earth (or how many planet Earths) it would take to support humanity if everybody followed a given lifestyle. For 2007, humanity's total ecological footprint was estimated at 1.5 planet Earths; that is, humanity uses ecological services 1.5 times as quickly as Earth can renew them. Every year, this number is recalculated to incorporate the three-year lag due to the time it takes for the UN to collect and publish statistics and relevant research.

Although the term ecological footprint is widely used and well known, it goes beyond the metaphor. It represents an accounting system for biocapacity that tracks how much biocapacity there is, and how much biocapacity people use. Calculation methods have converged thanks to standards released in 2006 and updated in 2009.

ENVIRONMENTAL IMPACT ASSESSMENT

Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse.

UNEP defines Environmental Impact Assessment (EIA) as a tool used to identify the environmental, social and economic impacts of a project prior to decision-making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers. By using EIA both environmental and economic benefits can be achieved, such as reduced cost and time of project implementation and design, avoided treatment/clean-up costs and impacts of laws and regulations.

Although legislation and practice vary around the world, the fundamental components of an EIA would necessarily involve the following stages:

- Screening to determine which projects or developments require a full or partial impact assessment study;
- Scoping to identify which potential impacts are relevant to assess (based on legislative requirements, international

conventions, expert knowledge and public involvement), to identify alternative solutions that avoid, mitigate or compensate adverse impacts on biodiversity (including the option of not proceeding with the development, finding alternative designs or sites which avoid the impacts, incorporating safeguards in the design of the project, or providing compensation for adverse impacts), and finally to derive terms of reference for the impact assessment;

- Assessment and evaluation of impacts and development of alternatives, to predict and identify the likely environmental impacts of a proposed project or development, including the detailed elaboration of alternatives;
- Reporting the Environmental Impact Statement (EIS) or EIA report, including an environmental management plan (EMP), and a non-technical summary for the general audience.
- Review of the Environmental Impact Statement (EIS), based on the terms of reference (scoping) and public (including authority) participation.
- Decision-making on whether to approve the project or not, and under what conditions; and
- Monitoring, compliance, enforcement and environmental auditing. Monitor whether the predicted impacts and proposed mitigation measures occur as defined in the EMP. Verify the compliance of proponent with the EMP, to ensure that unpredicted impacts or failed mitigation measures are identified and addressed in a timely fashion.

Strategic Environmental Assessment

Sadler and Verheem (1996) define Strategic Environmental Assessment (SEA) as the formalized, systematic and comprehensive process of identifying and evaluating the environmental consequences of proposed policies, plans or programmes to ensure that they are fully included and appropriately addressed at the earliest possible stage of decision-making on a par with economic and social considerations.

Since this early definition the field of SEA has rapidly developed and expanded, and the number of definitions of SEA has multiplied accordingly. SEA, by its nature, covers a wider range of activities or a wider area and often over a longer time span than the environmental impact assessment of projects.

SEA might be applied to an entire sector (such as a national policy on energy for example) or to a geographical area (for example, in the context of a regional development scheme). SEA does not replace or reduce the need for project-level EIA (although in some cases it can), but it can help to streamline and focus the incorporation of environmental concerns (including biodiversity) into the decision-making process, often making project-level EIA a more effective process.

SEA is commonly described as being proactive and 'sustainability driven', whilst EIA is often described as being largely reactive.

NATIONAL GREEN TRIBUNAL (NGT)

The National Green Tribunal has been established on 18.10.2010 under the National Green Tribunal Act 2010 for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal right relating to environment and giving relief and compensation for damages to persons and property and for matters connected therewith or incidental thereto. It is a specialized body equipped with the necessary expertise to handle environmental disputes involving multi-disciplinary issues. The Tribunal shall not be bound by the procedure laid down under the Code of Civil Procedure, 1908, but shall be guided by principles of natural justice.

The Tribunal's dedicated jurisdiction in environmental matters shall provide speedy environmental justice and help reduce the burden of litigation in the higher courts. The Tribunal is mandated to make and endeavour for disposal of applications or appeals finally within 6 months of filing of the same. Initially, the NGT is proposed to be set up at five places of sittings and will follow circuit procedure for making itself more accessible. New Delhi is the Principal Place of Sitting of the Tribunal and Bhopal, Pune, Kolkata and Chennai shall be the other four place of sitting of the Tribunal.

ACID RAIN

Acid rain is rain consisting of water droplets that are unusually acidic because of atmospheric pollution - most notably the excessive amounts of sulfur and nitrogen released by cars and industrial processes. Acid rain is also called acid deposition because this term includes other forms of acidic precipitation such as snow.

Acidic deposition occurs in two ways: wet and dry. Wet deposition is any form of precipitation that removes acids from the atmosphere and deposits them on the Earth's surface. Dry deposition polluting particles and gases stick to the ground via dust and smoke in the absence of precipitation. This form of deposition is dangerous however because precipitation can eventually wash pollutants into streams, lakes, and rivers.

Acidity itself is determined based on the pH level of the water droplets. PH is the scale measuring the amount of acid in the water and liquid. The pH scale ranges from 0 to 14 with lower pH being more acidic while a high pH is alkaline; seven is neutral. Normal rain water is slightly acidic and has a pH range of 5.3-6.0. Acid deposition is anything below that scale. It is also important to note that the pH scale is logarithmic and each whole number on the scale represents a 10-fold change.

Today, acid deposition is present in the northeastern United States, southeastern Canada, and much of Europe including portions of Sweden, Norway, and Germany. In addition, parts of South Asia, South Africa, Sri Lanka, and Southern India are all in danger of being impacted by acid deposition in the future.

ECOTOURISM

The Nature Conservancy adopts the definition articulated by the World Conservation Union (IUCN):

"Environmentally responsible travel to natural areas, in order to enjoy and appreciate nature (and accompanying cultural features, both past and present) that promote conservation, have a low visitor impact and provide for beneficially active socio-economic involvement of local peoples."

Most tourism in natural areas today is not ecotourism and is not, therefore, sustainable. Ecotourism is distinguished by its emphasis on conservation, education, traveler responsibility and active community participation. Specifically, ecotourism possesses the following characteristics:

- Conscientious, low-impact visitor behavior
- Sensitivity towards, and appreciation of, local cultures and biodiversity
- Support for local conservation efforts
- Sustainable benefits to local communities
- Local participation in decision-making
- Educational components for both the traveler and local communities

Increased tourism to sensitive natural areas without appropriate planning and management can threaten the integrity of ecosystems and local cultures. The increase of visitors to ecologically sensitive areas can lead to significant environmental degradation. Likewise, local communities and indigenous cultures can be harmed in numerous ways by an influx of foreign visitors and wealth.

Additionally, fluctuations in climate, currency exchange rates, and political and social conditions can make over-dependence upon tourism a risky business.

However, this same growth creates significant opportunities for both conservation and local communities. Ecotourism can provide much-needed revenues for the protection of national parks and other natural areas - revenues that might not be available from other sources.

Additionally, ecotourism can provide a viable economic development alternative for local communities with few other income-generating options. Moreover, ecotourism can increase the level of education and activism among travelers, making them more enthusiastic and effective agents of conservation.

THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC OR FCCC)

The United Nations Framework Convention on Climate Change (UNFCCC or FCCC) is an international environmental treaty that was produced at the United Nations Conference on Environment and Development (UNCED) (informally known as the Earth Summit) in Rio de Janeiro, June, 1992.

The treaty is aimed at stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system – commonly believed to be around 2°C above the pre-industrial global average temperature.

The treaty as originally framed set no mandatory limits on greenhouse gas emissions for individual nations and contained no enforcement provisions; it is therefore considered legally non-binding. Rather, the treaty included provisions for updates (called "protocols") that would set mandatory emission limits. The principal update is the Kyoto Protocol, which has become much better known than the UNFCCC itself.

One of its first achievements was to establish a national greenhouse gas inventory, as a count of greenhouse gas (GHG) emissions and removals. Accounts must be regularly submitted by signatories of the United Nations Framework Convention on Climate Change.

The UNFCCC was opened for signature on May 9, 1992 after an Intergovernmental Negotiating Committee produced the text of the Framework Convention as a report following its meeting in New York. It entered into force in March, 1994. Countries who sign up to the UNFCCC are known and as 'Parties', there are currently 192 signed up Parties.

Since the UNFCCC entered into force, the parties have been meeting annually in Conferences of the Parties (COP) to assess progress in dealing with climate change, and beginning in the mid-1990s, to negotiate the Kyoto Protocol to establish legally binding obligations for developed countries to reduce their greenhouse gas emissions.

The UNFCCC is also the name of the United Nations Secretariat charged with supporting the operation of the Convention. Since 2006 the head of the secretariat has been Yvo de Boer.

A key element of the UNFCCC is that parties should act to protect the climate system "on the basis of equality and in accordance with their common but differentiated responsibilities and respective capabilities." The principle of 'common but differentiated responsibility' includes two fundamental elements. The first is the common responsibility of Parties to protect the environment, or parts of it, at the national, regional and global levels. The second is the need to take into account the different circumstances, particularly each Party's contribution to the problem and its ability to prevent, reduce and control the threat.

Another element underpinning the UNFCCC is the polluter pays principle. This means that the party responsible for producing pollution is responsible for paying for the damage done to the natural environment.

RENEWABLE ENERGY

Renewable energy is generally defined as energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat. Renewable energy replaces conventional fuels in four distinct areas: electricity generation, hot water/space heating, motor fuels, and rural (off-grid) energy services.

Wind power

Airflows can be used to run wind turbines. Modern utility-scale wind turbines range from around 600 kW to 5 MW of rated power, although turbines with rated output of 1.5–3 MW have become the most common for commercial use; the power available from the wind is a function of the cube of the wind speed, so as wind speed increases, power output increases dramatically up to the maximum output for the particular turbine. Areas where winds are stronger and more constant, such as offshore and high altitude sites, are preferred locations for wind farms. Typical capacity factors are 20-40%, with values at the upper end of the range in particularly favourable sites.

Globally, the long-term technical potential of wind energy is believed to be five times total current global energy production, or 40 times current electricity demand, assuming all practical barriers needed were overcome. This would require wind turbines to be installed over large areas, particularly in areas of higher wind resources, such as offshore. As offshore wind speeds average ~90% greater than that of land, so offshore resources can contribute substantially more energy than land stationed turbines.

Hydropower

Energy in water can be harnessed and used. Since water is about 800 times denser than air, even a slow flowing stream of water, or moderate sea swell, can yield considerable amounts of energy. There are many forms of water energy:

- Hydroelectric energy is a term usually reserved for large-scale hydroelectric dams. The largest of which is the Three Gorges Dam in China and a smaller example is the Akosombo Dam in Ghana.
- Micro hydro systems are hydroelectric power installations that typically produce up to 100 kW of power. They are often used in water rich areas as a remote-area power supply (RAPS).
- Run-of-the-river hydroelectricity systems derive kinetic energy from rivers and oceans without the creation of a large reservoir.

Hydropower is produced in 150 countries, with the Asia-Pacific region generating 32 percent of global hydropower in 2010. China is the largest hydroelectricity producer, with 721 terawatt-hours of production in 2010, representing around 17 percent of domestic electricity use. There are now three hydroelectricity plants larger than 10 GW: the Three Gorges Dam in China, Itaipu Dam across the Brazil/Paraguay border, and Guri Dam in Venezuela.

Solar energy

Photovoltaic SUDI shade is an autonomous and mobile station in France that provides energy for electric vehicles using solar energy. Solar energy, radiant light and heat from the sun, is harnessed using a range of ever-evolving technologies such as solar heating, solar photovoltaics, solar thermal electricity, solar architecture and artificial photosynthesis.

Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy. Active solar techniques include the use of photovoltaic panels and solar thermal collectors to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air.

Solar power is the conversion of sunlight into electricity, either directly using photovoltaics (PV), or indirectly using concentrated solar power (CSP). Concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. Commercial concentrated solar power plants were first developed in the 1980s. Photovoltaics convert light into electric current using the photoelectric effect. Photovoltaics are an important and relatively inexpensive source of electrical energy where grid power is inconvenient, unreasonably expensive to connect, or simply unavailable. However, as the cost of solar electricity is falling, solar power is also increasingly being used even in grid-connected situations as a way to feed low-carbon energy into the grid.

In 2011, the International Energy Agency said that "the development of affordable, inexhaustible and clean solar energy technologies will have huge longer-term benefits. It will increase countries' energy security through reliance on an indigenous, inexhaustible and mostly import-independent resource, enhance sustainability, reduce pollution, lower the costs of mitigating climate change, and keep fossil fuel prices lower than otherwise. These advantages are global. Hence the additional costs of the incentives for early deployment should be considered learning investments; they must be wisely spent and need to be widely shared".

Biomass

Biomass is biological material derived from living, or recently living organisms. It most often refers to plants or plant-derived materials which are specifically called lignocellulosic biomass. As an energy source, biomass can either be used directly via combustion to produce heat, or indirectly after converting it to various forms of biofuel. Conversion of biomass to biofuel can be achieved by different methods which are broadly classified into: thermal, chemical, and biochemical methods.

Wood remains the largest biomass energy source today; examples include forest residues (such as dead trees, branches and tree stumps), yard clippings, wood chips and even municipal solid waste. In the second sense, biomass includes plant or animal matter that can be converted into fibers or other industrial chemicals, including biofuels. Industrial biomass can be grown from numerous types of plants, including miscanthus, switchgrass, hemp, corn, poplar, willow, sorghum, sugarcane, bamboo, and a variety of tree species, ranging from eucalyptus to oil palm (palm oil).

Plant energy is produced by crops specifically grown for use as fuel that offer high biomass output per hectare with low input energy. Some examples of these plants are wheat, which typically yield 7.5–8 tons (tonnes?) of grain per hectare, and straw, which typically yield 3.5–5 tons (tonnes?) per hectare in the UK. The grain can be used for liquid transportation fuels while the straw can be burned to produce heat or electricity. Plant biomass can also be degraded from cellulose to glucose through a series of chemical treatments, and the resulting sugar can then be used as a first generation biofuel.

Biomass can be converted to other usable forms of energy like methane gas or transportation fuels like ethanol and biodiesel. Rotting garbage, and agricultural and human waste, all release methane gas—also called "landfill gas" or "biogas." Crops, such as corn and sugar cane, can be fermented to produce the transportation fuel, ethanol. Biodiesel, another transportation fuel, can be produced from left-over food products like vegetable oils and animal fats.[39] Also, biomass to liquids (BTLs) and cellulosic ethanol are still under research.

There is a great deal of research involving algal, or algae-derived, biomass due to the fact that it's a non-food resource and can be produced at rates 5 to 10 times those of other types of land-based agriculture, such as corn and soy. Once harvested, it can be fermented to produce biofuels such as ethanol, butanol, and methane, as well as biodiesel and hydrogen.

The biomass used for electricity generation varies by region. Forest by-products, such as wood residues, are common in the United States. Agricultural waste is common in Mauritius (sugar cane residue) and Southeast Asia (rice husks). Animal husbandry residues, such as poultry litter, are common in the UK.

Biofuel

Biofuels include a wide range of fuels which are derived from biomass. The term covers solid biofuels, liquid biofuels, and gaseous biofuels. Liquid biofuels include bioalcohols, such as bioethanol, and oils, such as biodiesel. Gaseous biofuels include biogas, landfill gas and synthetic gas.

Bioethanol is an alcohol made by fermenting the sugar components of plant materials and it is made mostly from sugar and starch crops. These include maize, sugar cane and, more recently, sweet sorghum. The latter crop is particularly suitable for growing in dryland conditions, and is being investigated by ICRISAT for its potential to provide fuel, along with food and animal feed, in arid parts of Asia and Africa.

With advanced technology being developed, cellulosic biomass, such as trees and grasses, are also used as feedstocks for ethanol production. Ethanol can be used as a fuel for vehicles in its pure form, but it is usually used as a gasoline additive to increase octane and improve vehicle emissions. Bioethanol is widely used in the USA and in Brazil. The energy costs for producing bio-ethanol are almost equal to, the energy yields from bio-ethanol. However, according to the European Environment Agency, biofuels do not address global warming concerns.

Biodiesel is made from vegetable oils, animal fats or recycled greases. Biodiesel can be used as a fuel for vehicles in its pure form, but it is usually used as a diesel additive to reduce levels of particulates, carbon monoxide, and hydrocarbons from diesel-powered vehicles. Biodiesel is produced from oils or fats using transesterification and is the most common biofuel in Europe.

Biofuels provided 2.7% of the world's transport fuel in 2010.

Geothermal energy

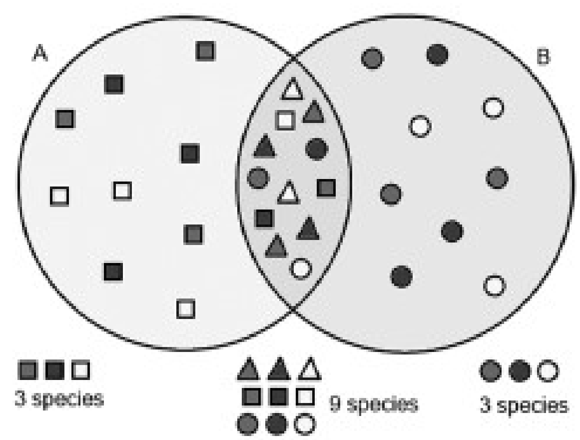
Geothermal energy is from thermal energy generated and stored in the Earth. Thermal energy is the energy that determines the temperature of matter. Earth's geothermal energy originates from the original formation of the planet (20%) and from radioactive decay of minerals (80%). The geothermal gradient, which is the difference in temperature between the core of the planet and its surface, drives a continuous conduction of thermal energy in the form of heat from the core to the surface. The adjective geothermal originates from the Greek roots geo, meaning earth, and thermos, meaning heat.

The heat that is used for geothermal energy can be from deep within the Earth, all the way down to Earth's core – 4,000 miles (6,400 km) down. At the core, temperatures may reach over 9,000 °F (5,000 °C). Heat conducts from the core to surrounding rock. Extremely high temperature and pressure cause some rock to melt, which is commonly known as magma. Magma convects upward since it is lighter than the solid rock. This magma then heats rock and water in the crust, sometimes up to 700 °F (371°C).

From hot springs, geothermal energy has been used for bathing since Paleolithic times and for space heating since ancient Roman times, but it is now better known for electricity generation.

ECOTONE

An ecotone is a transition area between two biomes. It is where two communities meet and integrate. It may be narrow or wide, and it may be local (the zone between a field and forest) or regional (the transition between forest and grassland ecosystems). An ecotone may appear on the ground as a gradual blending of the two communities across a broad area, or it may manifest itself as a sharp boundary line.



EDGE EFFECT

Ecotones often have a larger number of species and larger population densities than the communities on either side. This tendency for increased biodiversity within the ecotone is referred to as the "edge effect." Those species which occur primarily or most abundantly in the ecotones are called "edge" species. Although ecotones support an increase in density for some species, other species need interior habitat blocks to survive and show avoidance or poor survival on edges. An increase in anthropogenic fragmentation of landscapes creates more ecotones, which may result in an increased occurrence of edge species while simultaneously resulting in increased negative effects for interior species.

KEYSTONE SPECIES

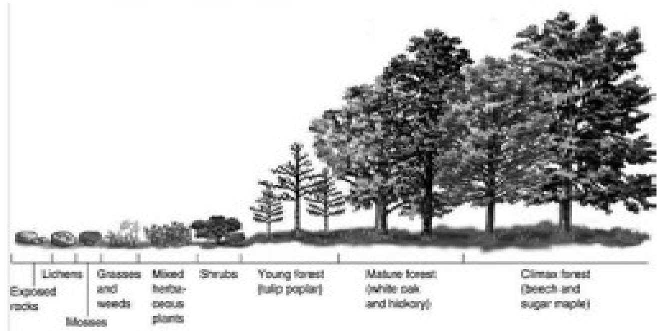
A keystone species is a species that has a disproportionately large effect on its environment relative to its abundance.[1] Such species are described as playing a critical role in maintaining the structure of an ecological community, affecting many other organisms in an ecosystem and helping to determine the types and numbers of various other species in the community.

The role that a keystone species plays in its ecosystem is analogous to the role of a keystone in an arch. While the keystone is under the least pressure of any of the stones in an arch, the arch still collapses without it. Similarly, an ecosystem may experience a dramatic shift if a keystone species is removed, even though that species was a small part of the ecosystem by measures of biomass or productivity. It became a popular concept in conservation biology.

Although the concept is valued as a descriptor for particularly strong inter-species interactions, and it has allowed easier communication between ecologists and conservation policy-makers, it has been criticized for oversimplifying complex ecological systems.

PLANT SUCCESSION

Over periods of years or decades, the plants that grow in any given place change. New species take the place of those that came before. This process is called plant succession or, more broadly, ecological succession, because as the plants change so do the microorganisms and animals.



PRIMARY AND SECONDARY SUCCESSION

Successional dynamics beginning with colonization of an area that has not been previously occupied by an ecological community, such as newly exposed rock or sand surfaces, lava flows, newly exposed glacial tills, etc., are referred to as primary succession. The stages of primary succession include pioneer plants (lichens and mosses), grassy stage, smaller shrubs, and trees. Animals begin to return when there is food there for them to eat. When it is a fully functioning ecosystem, it has reached the climax community stage. Parts of Acadia National Park in Maine went through primary succession.

Successional dynamics following severe disturbance or removal of a pre-existing community are called secondary succession. Dynamics in secondary succession are strongly influenced by pre-disturbance conditions, including soil development, seed banks, remaining organic matter, and residual living organisms.

Because of residual fertility and pre-existing organisms, community change in early stages of secondary succession can be relatively rapid. Woody plants have colonized more rapidly (per unit area) on large and near by passage.

Secondary succession is much more commonly observed and studied than primary succession. Particularly common types of secondary succession include responses to natural disturbances such as fire, flood, and severe winds, and to human-caused disturbances such as logging and agriculture. Secondary succession has been occurring in Shenedoah National Park following the 1995 flood of the Mormon River, which destroyed plant and animal life. Today, plant and animal species are beginning to return.

Mechanisms

In 1916, Frederic Clements published a descriptive theory of succession and advanced it as a general ecological concept. His theory of succession had a powerful influence on ecological thought. Clements' concept is usually termed classical ecological theory. According to Clements, succession is a process involving several phases:

1. *Nudation:* Succession begins with the development of a bare site, called Nudation (disturbance).
2. *Migration:* It refers to arrival of propagules.
3. *Ecesis:* It involves establishment and initial growth of vegetation.
4. *Competition:* As vegetation became well established, grew, and spread, various species began to compete for space, light and nutrients. This phase is called competition.
5. *Reaction:* During this phase autogenic changes affect the habitat resulting in replacement of one plant community by another.
6. *Stabilization:* Reaction phase leads to development of a climax community.

Seral communities

A seral community is an intermediate stage found in an ecosystem advancing towards its climax community. In many cases more than one seral stage evolves until climax conditions are attained. A prisere is a collection of seres making up the development of an area from non-vegetated surfaces to a climax community. Depending on the substratum and climate, a seral community can be one of the following:

Hydrosere

Community in freshwater

Lithosere

Community on rock

Psammosere

Community on sand

Xerosere

Community in dry area

Halosere

Community in saline body (e.g. a marsh)

EUTROPHICATION

Eutrophication (Greek: eutrophia—healthy, adequate nutrition, development; German: Eutrophie) or more precisely hypertrophication, is the ecosystem response to the addition of artificial or natural substances, such as nitrates and phosphates, through fertilizers or sewage, to an aquatic system. One example is the "bloom" or great increase of phytoplankton in a water body as a response to increased levels of nutrients. Negative environmental effects include hypoxia, the depletion of oxygen in the water, which causes a reduction in specific fish and other animals. Other species (such as Nomura's jellyfish in Japanese waters) may experience an increase in population that negatively affects other species.

BIOCHEMICAL OXYGEN DEMAND (BOD)

Biochemical oxygen demand or B.O.D is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period. The term also refers to a chemical procedure for determining this amount. This is not a precise quantitative test, although it is widely used as an indication of the organic quality of water. The BOD value is most commonly expressed in milligrams of oxygen consumed per litre of sample during 5 days of incubation at 20 °C and is often used as a robust surrogate of the degree of organic pollution of water.

CHEMICAL OXYGEN DEMAND (COD)

In environmental chemistry, the chemical oxygen demand (COD) test is commonly used to indirectly measure the amount of organic compounds in water. Most applications of COD determine the amount of organic pollutants found in surface water (e.g. lakes and rivers) or wastewater, making COD a useful measure of water quality. It is expressed in milligrams per liter (mg/L) also referred to as ppm (parts per million), which indicates the mass of oxygen consumed per liter of solution.

EL NIÑO AND GLOBAL WARMING

Normally the West Pacific is moist. Warm air rises over there and decends in the East Pacific. This is the Pacific Walker Cell. Over the equator an Easterly wind blows. Together with Southerly winds along the Chilean and Peruvian coasts this causes upwelling of colder water. Most years around Christmas some warmer water appears along the Ecuadorian and Northern Peruvian coasts. This phenomenon was called El Niño (the boy-child) by the local people. Every 2-7 years the warming of the water in the East Pacific is much more widespread, with dramatic (local, but also larger scale) consequences. This phenomenon is referred to in the literature as ENSO (El Niño/Southern oscillation), or just the initial name of the local people of Peru: El Niño.

During El Niño the moist (and warm water) area around Indonesia moves to the middle of the Pacific. Indonesia, The Philipines, SE Asia and Eastern Australia are (much) dryer than normal, while Ecuador and North Peru are much wetter than normal. During strong El Niño's the (Pacific) Walker Cell circulation is shifted to quite an extent.

How is Global Warming Related to El Niño and La Niña?

Some scientists believe that the increased intensity and frequency—now every two to three years—of El Niño and La Niña events in recent decades is due to warmer ocean temperatures resulting from global warming. In a 1998 report, scientists from NOAA explained that higher global temperatures might be increasing evaporation from land and adding moisture to the air, thus intensifying the storms and floods associated with El Niño.

Another take on what's happening is from Kevin Trenberth, a climatologist at the Colorado-based National Center for Atmospheric Research. Trenberth believes that the Southern Oscillation may be functioning like a pressure release valve for the tropics. With global warming driving temperatures higher, ocean currents and weather systems might not be able to release all the extra heat getting pumped into the tropical seas; as such an El Niño occurs to help expel the excess heat.

GANGA ACTION PLAN

Ganga Action Plan or GAP was a program launched by Government of India in April 1985 in order to reduce the pollution load on the river. The program was launched with much fanfare, but it failed to decrease the pollution level in the river, after spending 901.71 crore (approx. 1010) rupees over a period of 15 years.

The activities of GAP phase 1 initiated in 1985 were declared closed on 31 March 2000. The steering Committee of the national river conservation Authority reviewed the progress of the GAP and necessary correction on the basis of lessons learned and experiences gained from the GAP phase; 1.69 schemes have been completed under this plan. A million liters of sewage is targeted to be intercepted, diverted and treated.

The Ganga Action Plan (GAP) was an ambitious plan to clean the River Ganga. It originated from the personal intervention and interest of the late Prime Minster Mrs Indira Gandhi, who requested a comprehensive survey of the situation in 1979. After five years, the Central Pollution Control Board (CPCB) published two comprehensive reports, which formed the base from which the action plan to clean up the Ganga, was developed.

Department of Environment, in December 1984, prepared an action plan for immediate reduction of pollution load on the river Ganga. The Cabinet approved the GAP (Ganga Action Plan) in April 1985 as a 100 per cent centrally sponsored scheme. To oversee the implementation of the GAP and to lay down policies and programmes, Government of India constituted a Central Ganga Authority (CGA) in February 1985, later renamed as the National River Conservation Authority (NRCA) in September 1995, under the chairmanship of the Prime Minister. The Government also established the Ganga Project Directorate (GPD) in June 1985 as a wing of Department of Environment, to execute the projects under the guidance and supervision of the CGA. The Government renamed the GPD as the National River Conservation Directorate (NRCD) in June 1994.

CARBON CAPTURE AND STORAGE

Carbon capture and storage, or CCS, is a family of technologies and techniques that enable the capture of CO2 from fuel combustion or industrial processes, the transport of CO2 via ships or pipelines, and its storage underground, in depleted oil and gas fields and deep saline formations. CCS can, therefore, have a unique and vital role to play in the global transition to a sustainable low-carbon economy, in both power generation and industry.

Current short, mid- and long-term projections for global energy demand still point to fossil fuels being combusted in quantities incompatible with levels required to stabilise greenhouse gas (GHG) concentrations at safe levels in the atmosphere.

All technologies along the CCS chain have been in operation in various industries for decades, although in relatively small scale. These technologies have only been put together in industrial scale (>1Mt CO2 captured and stored per year) in a small number of installations. No large-scale installations exist yet in electricity production.