18CE0406T GLOBAL WARMING AND CLIMATE CHANGE

UNIT – 5

[S4 – S6]

S4: SLO 1: Clean Technology, biodiesel, compost, biodegradable plastics,

SLO 2: Concept of sustainable development

Clean Technology

- Clean technology, in short cleantech, is any process, product, or service that reduces negative environmental impacts through significant energy efficiency improvements, the sustainable use of resources, or environmental protection activities.

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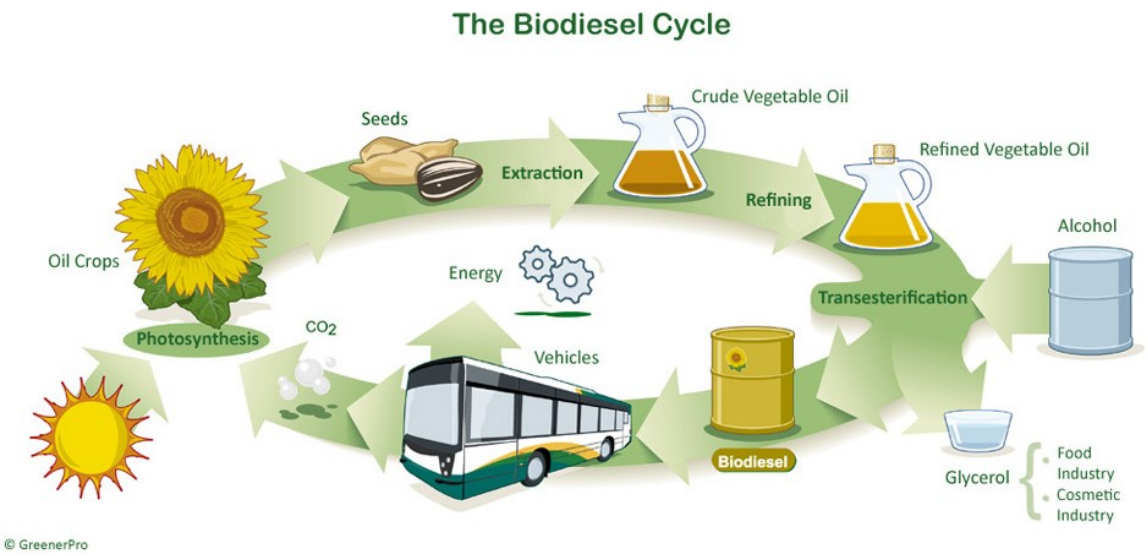
BIODIESEL

- Biodiesel is a domestically produced, renewable fuel that can be manufactured from vegetable oils, animal fats, or recycled restaurant grease for use in diesel vehicles.
- Biodiesel's physical properties are similar to those of petroleum diesel, but it is a cleaner-burning alternative.
- Using biodiesel in place of petroleum diesel, especially in older vehicles, can reduce emissions.
- Biodiesel is a liquid fuel often referred to as B100 or neat biodiesel in its pure, unblended form. Like petroleum diesel, biodiesel is used to ***fuel compression-ignition*** engines, which run on petroleum diesel.

- How well biodiesel performs in cold weather depends on the blend of biodiesel. The smaller the percentage of biodiesel in the blend, the better it performs in cold temperatures.



1) Biodiesel is a clean burning renewable fuel made using natural vegetable oils and fats.
2) Biodiesel is made through a chemical process which converts oils and fats of natural origin into fatty acid methyl esters (FAME) through a process called trans-esterification.
3) Biodiesel is intended to be used as a replacement for petroleum diesel fuel, or can be blended with petroleum diesel fuel in any proportion.
4) Biodiesel does not require modifications to a diesel engine to be used.
5) Biodiesel has reduced exhaust emissions compared to petroleum diesel fuel.
6) Biodiesel has lower toxicity compared to petroleum diesel fuel.
7) Biodiesel is safer to handle compared to petroleum diesel fuel.
8) Biodiesel quality is governed by ASTM D 6751 quality parameters.
9) Biodiesel is biodegradable.

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COMPOST

- Composting is the process that speeds up decomposition of organic materials by providing ideal conditions for microorganisms to thrive.
- Compost is rich in nutrients. It is used, for example, in gardens, landscaping, horticulture, urban agriculture and organic farming. The compost itself is beneficial for the land in many ways, including as a soil conditioner, a fertilizer, addition of vital humus or humic acids, and as a natural pesticide for soil.
- Compost is simply decayed organic matter — and "organic matter" is a pretty wide-ranging label. A twig can be organic matter, but so can a banana peel. When you mix a bunch of these items together in a compost pile, they break down naturally into a nutrient-rich fertilizer that helps gardens grow.enhouse gas emissions.
- Studies further show that compost can aid in **carbon sequestration**. When applied to soil, compost potentially functions as a "carbon sink," trapping and containing the element in the dirt. And if the carbon is in the ground, it isn't in our atmosphere, where it can wreak havoc on the planet.

Types of Composting

- Composting Basics.
- Onsite Composting.
- Vermicomposting.
- Aerated (Turned) Windrow Composting.
- Aerated Static Pile Composting.
- In-Vessel Composting.

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Biodegradable plastics

- **Biodegradable plastics** are **plastics** that can be decomposed by the action of living organisms, usually microbes, into water, carbon dioxide, and biomass. **Biodegradable plastics** are commonly produced with renewable raw materials, micro-organisms, petrochemicals, or combinations of all three.
- While the words "bioplastic" and "biodegradable plastic" are similar, they are not synonymous. Not all bioplastics are biodegradable.

Which plastic is biodegradable?

- One set of degradable plastics are **materials** such as PLA (**Polylactic Acid**) that are unique plastics for which biological degradation potential is part of the nature of the plastic. The second set is **materials** of the standard #1 **PET**, #2 HDPE, #4 LDPE, #5 PP and #6 PS with special degradable additives included.
- **Biodegradable plastics** are very rarely recyclable, and **biodegradable** does not mean **compostable**–so they often up in the landfill. **Compostable** and bioplastic goods can be a better choice than **biodegradable** ones, but often still end up in landfills unless you can compost appropriately.

What are the problems with biodegradable plastics?

- When some biodegradable plastics decompose in landfills, they produce methane gas. This is a very powerful greenhouse gas that adds to the problem of global warming. Biodegradable plastics and bioplastics don't always readily decompose.
- Biodegradable plastics take **three to six months** to decompose fully. That's much quicker than synthetic counterparts that take **several hundred years**. Exactly how long a biodegradable bag takes to break down depends on various factors, such as temperature and the amount of moisture present.

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Concept of Sustainable development

- Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.“
- The aim of sustainable development is to balance our economic, environmental and social needs, allowing prosperity for now and future generations. ... These include social progress and equality, environmental protection, conservation of natural resources and stable economic growth.
- Sustainable development is maintaining a delicate balance between the human need to improve lifestyle and feeling of well being on one-hand and preserving natural resources and ecosystems on which we and future generations depend.
- Political **barriers**: Inadequate economic, social and environmental **methods** for policies, plans and projects are the **major barrier** combating the implementation of **sustainable development.**

The aim of sustainable development

The aim of sustainable development is to define viable schemes combining the economic, social, and environmental aspects of human activity. That is making sure that there is a balance between the three types of sustainable development:

***Environmental sustainable development**

***Economic sustainable development**

***Social sustainable development**

It is Constant tussle between the Planet(environment), the People(social) and Profit(profits)

Why sustainable Development is Important

It's no secret that people are living longer and that the global population is on the rise. In fact, the United Nations projects that there will be more that 10 billion people living on the Earth by the year 2100. This explosion in population is perhaps one of the greatest reasons why sustainable development is so important.

Provide Basic Human Needs (social)

A rising population will also make use of the bare essentials of life such as food, water, and shelter.

Agricultural Necessity

Agriculture will have to catch up with that growing population as well, figuring out ways to feed around 3 billion more people than it currently does

Accommodate City Development (social)

As populations rise, cities will need to become larger to accommodate the influx of new residents.

Control Climate Change

Climate change is another issue that can be at least partially remedied through sustainable development. Sustainable development practices would mandate a lower use of fossil fuels, which are not sustainable and which produce greenhouse gases.

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S5: Concept of Carbon sequestration, Terrestrial sequestration

S6: Ocean sequestration

Concept of Carbon sequestration

Carbon Sequestration is capturing and securely storing carbon dioxide emitted from the global energy system. Carbon sequestration is the placement of CO_2 into a depository in such a way that it remain safely and not released back into the atmosphere.

Sources of CO_2 emission	
Natural sources	**Manmade sources**
Volcanoes	Industries
Wild fires	Transportation
Decomposition	Soil cultivation
Respiration	Biomass burning

Objectives of carbon sequestration

i. Reducing pollution in air as well as improving natural carbon content in soil.
ii. Improvement of soil structure
iii. Restoring degraded soil leading to increase yield in crops.
iv. Developing technology to reduce rate of concentration of green house gases in air

Types of carbon Sequestration:

i. Ocean Sequestration: Carbon stored in oceans through direct injection or fertilization.
ii. Geologic Sequestration: Natural pore spaces in geologic formations serve as reservoirs for long-term carbon dioxide storage.
iii. Terrestrial Sequestration: A large amount of carbon is stored in soils and vegetation, which are our natural carbon sinks.

The main strategies for using forests for carbon sequestration

Active forest management

Avoided deforestation

Forest preservation

Afforestation

Challenges in soil carbon sequestration

- Deforestation
- Residue burning
- Conventional tillage
- Imbalanced use of fertilizers
- Reduced inputs of organic matter

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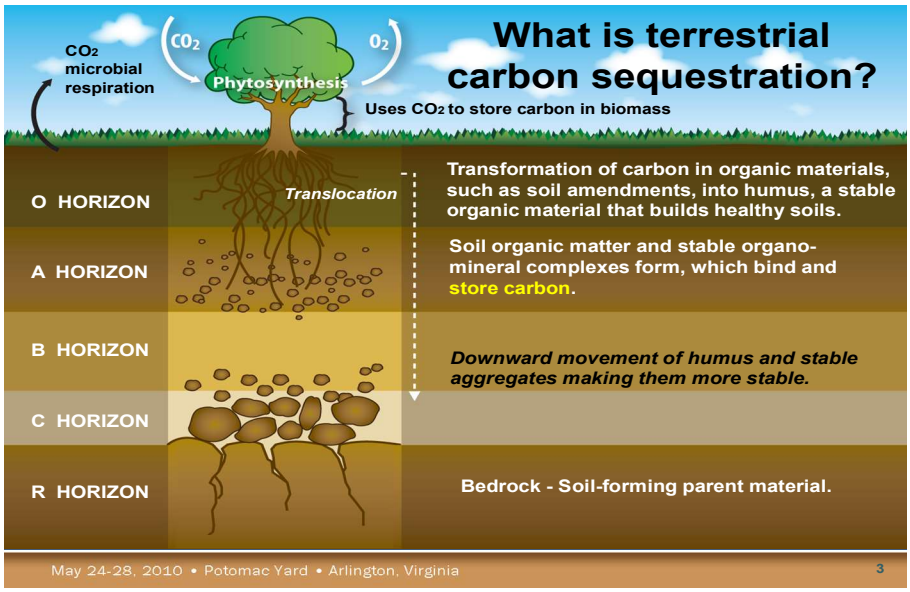
Terrestrial Sequestration

Terrestrial sequestration is a process that captures and stores carbon dioxide (CO_2) in vegetation and soil within a few feet of the Earth's surface, providing them with the components they need to live and grow and reducing CO_2 in the atmosphere.

The process through which CO_2 from the atmosphere is absorbed naturally through photosynthesis and stored as Carbon in biomass and soil.



The amount of carbon stored in terrestial carbon sequestration is obtained through the process of **photosynthesis.**

The carbon from corbon di oxide is biochemically transformed into carbohydrates necessary for plant growth and structure.

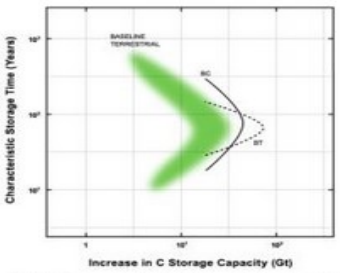
Most of the carbon eventually cycles back to the atmosphere through the decomposition of plant material, but a fraction is retained in soil and wetland sediments.

Terrestrial Biological Carbon Sequestration Science for Enhancement and Implementation

• Terrestrial sequestration using best management practices in agriculture and forestry could contribute to greenhouse gas mitigation in the coming decades. Introduction of new technologies could enhance this contribution.

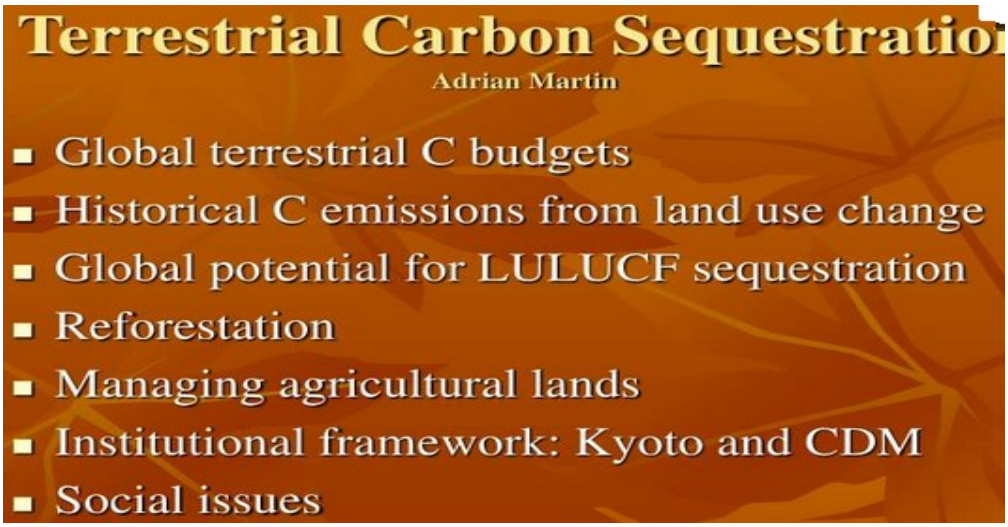
• Current best land management practices can be scaled to achieve rates of 0.5 Pg C y^{-1} by 2040 and accumulated 23-41 Pg C by 2100.

• Our analyses show that aggressive adoption of advanced C sequestration technologies could greatly increase this potential cumulative increase by 2100:
  Biotechnology – 53 Pg C
  Biomass Carbonization – 19 Pg C
  Deep-soil sequestration – 165 Pg C



Global C sequestration by 2100 with known practices (green), and with advanced technologies including biotechnology (BT) or biomass carbonization (BC).

• With the development and implementation of selected technologies, biosequestration could be enhanced several fold. This would allow for a much-needed bridge to the future when new energy systems and a transformed energy infrastructure can fully address the climate challenge.



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S6: Ocean Sequestration

The ocean represents the largest potential sink for anthropogenic CO_2. Discharging CO_2 directly to the oceanwould accelerate the ongoing, but slow, natural processes by which over 90% of present-day emissions arecurrently entering the ocean indirectly and would reduce both peak atmospheric CO_2 concentrations and their rateof increase.

In the ocean, carbon sequestration, a fancy word for the process by which carbon dioxide is removed from the atmosphere, is achieved through various chemical and biological processes. Plankton at the ocean surface use photosynthesis to convert carbon dioxide into sugars in the same way trees and land plants do on land.

Carbon is naturally stored in the ocean via two pumps, solubility and biological and there are analogous man made methods, direct injection and ocean fertilization, respectively. At the present time, approximately one third of human generated emission are estimated to be entering the ocean.

Carbon sequestration by direct injection into the deep ocean involves the capture, separation, transport and injection of CO_2 from land or tankers. One-third of CO_2 emitted a year already enters the ocean. Ocean has 50 times more carbon than the atmosphere.