HARAMAYA SPECIAL BOARDING SECONDARY SCHOOL

BIOLOGY G-12

UNIT-6

CLIMATE CHANGE

Contents

- Climate change ;cause and effect
- Definition of Climate change
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- Effects of Climate change on **biodiversity**
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- The united nations framework convention Kyoto protocol on climate change

Objectives

- Explore the key scientific concepts of climate change
- Analyze the cause of climate change and how human activities affect of the climate
- Discuss the effect of climate change on living things
- Elaborate the measure to combat climate change

Atmosphere

- It is the blanket of air that surrounds the earth, moving both horizontally and vertically and thus causing variations in weather and climate.
- It absorbs energy from the sun, recycles water and other chemicals, and works with electrical and magnetic forces to provide a moderate climate.
- It also protects the earth from high-energy radiation.

Weather

- It is the day-to-day state of the atmosphere
- its short-term (from hours to a few weeks) variations such as temperature, humidity, precipitation, cloudiness, visibility or wind

Climate

- Climate is "average" weather for a given place or a region.
- It defines typical weather conditions for a given area based on long-term averages.

- Climate is usually based on the weather in one locality averaged for at least 30 years.

Climate variability

- Climate variability is the way aspects of climate (such as temperature and precipitation) differ from an average.

- Climate variability occurs due to natural and sometimes periodic changes in the circulation of the air and ocean, volcanic eruptions, and other factors.

Climate Change: Causes and effects

- **Climate change** is a long-term change in the earth's climate, especially change due to an increase in the average atmospheric temperature.
- It is the global phenomenon of climate transformation characterized by the changes in the usual climate of the planet (temperature, precipitation, and wind) that especially caused by human activities.

What Causes Climate change?

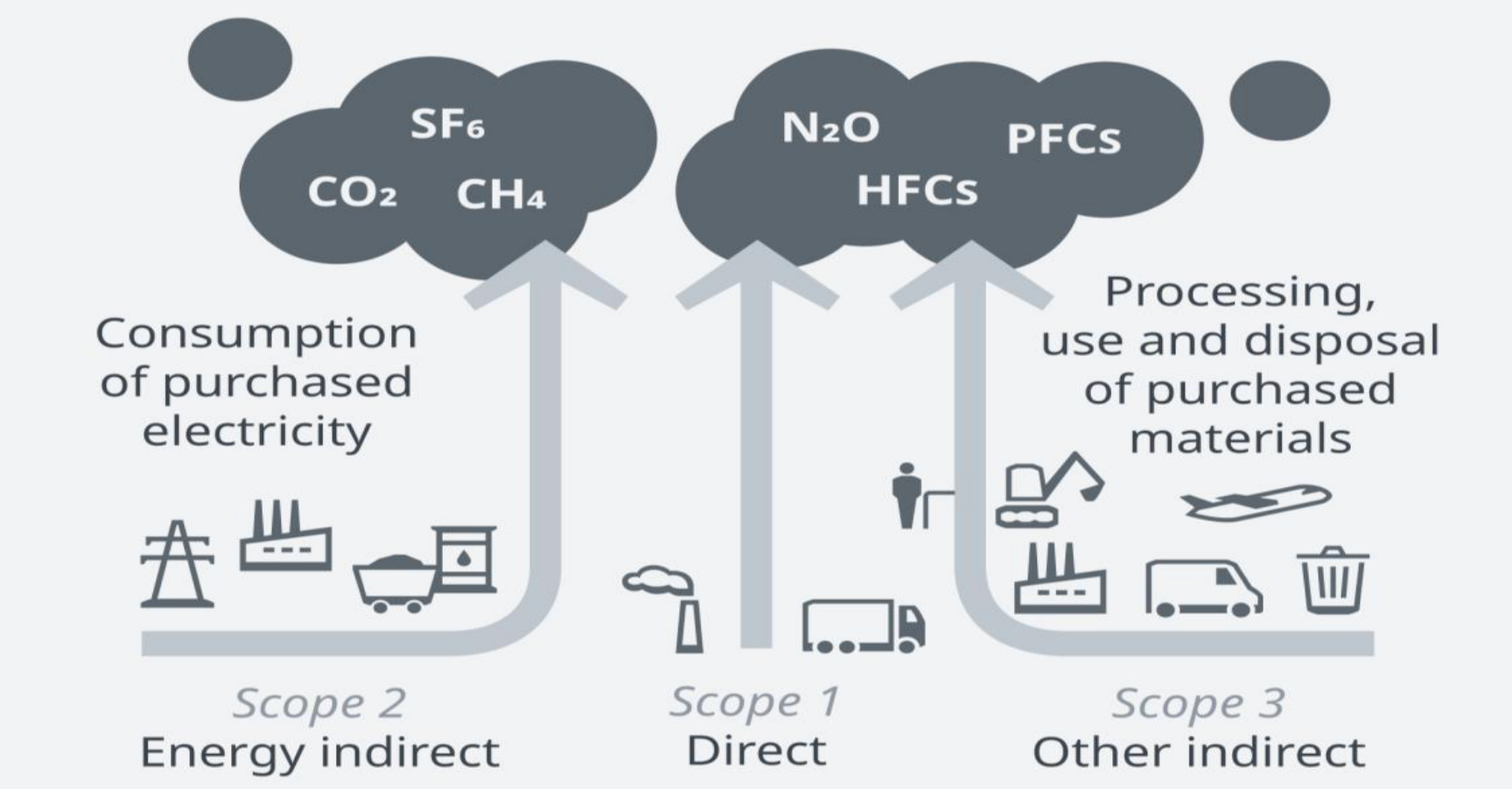
- Humans factors
  - Anthropogenic activities (Burning of fossil fuel, deforestation, farming, livestock, transportation, electricity, industry.
  - that increases the concentration of atmospheric CO2 and methane gases
- Natural factors
  - Volcanic eruption, Fluctuation in solar radiation, Tectonic shift
  - High temperature and precipitation
  - Volcanic activities, wild fires release Co2 into atmosphere
- Natural and anthropogenic Substances and processes that alter the Earth's energy budget are drivers of climate change

What is green house gases?

Greenhouse gases(GHGS)

- A gas that absorbs and emit radiant energy with in the thermal infrared range, causing the greenhouse effect.
- Primary greenhouse gases are: water vapor, CO2, CH4, N2O, HFCs. PFCs, SF6, Ozone.
- When the concentration of GHG is too high,
  - too much heat is trapped, and the earth's temperature rises outside the range of natural variability.
- Each GHG is with a different ability to trap heat and a different half-life in the atmosphere.
- GHG are some times called "climate active pollutants" because most have additional notable effects on human health.

Source–Path relationship of Green house gases



Types of green house gases and their major sources

GHG Categories	Major Sources
❖Carbon dioxide (**CO2)**	Fossil fuel combustion, deforestation
❖Methane **(CH4)**	Landfills ,Rice paddies, Digestive tracts of cattle and sheep
❖Nitrous oxide **(N2O)**	Fertilizer ,animal waste
❖ Hydro fluorocarbon **(HFCS)**	Semiconductor manufacturing and other industrial processes
❖ Perfluor0Carbon **(PFCS)**	Same as HFCS ,plus aluminums melting
❖ Sulfur hexafluoride**(SF6)**	Electrical transmission system ,management and aluminum production

Carbon dioxide(CO_2)

- Carbon dioxide(CO_2)is the GHG responsible for greatest amount of warming to date.

- Major of it is released from the incomplete combustion of
  - ✓ fossil fuels-coal,
  - ✓ oil, and
  - ✓ Gas

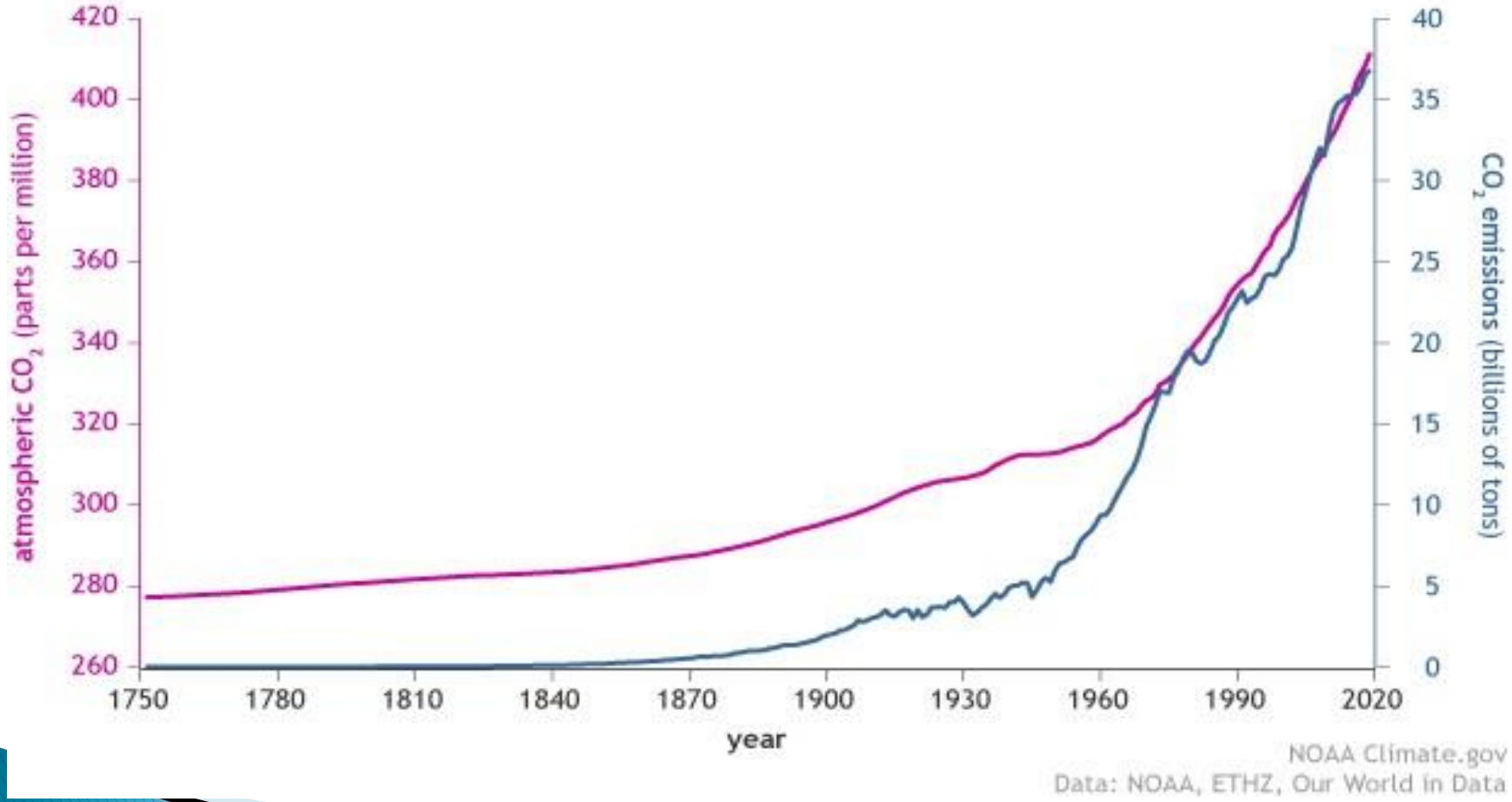
  } used for electricity production, transportation and industrial processes

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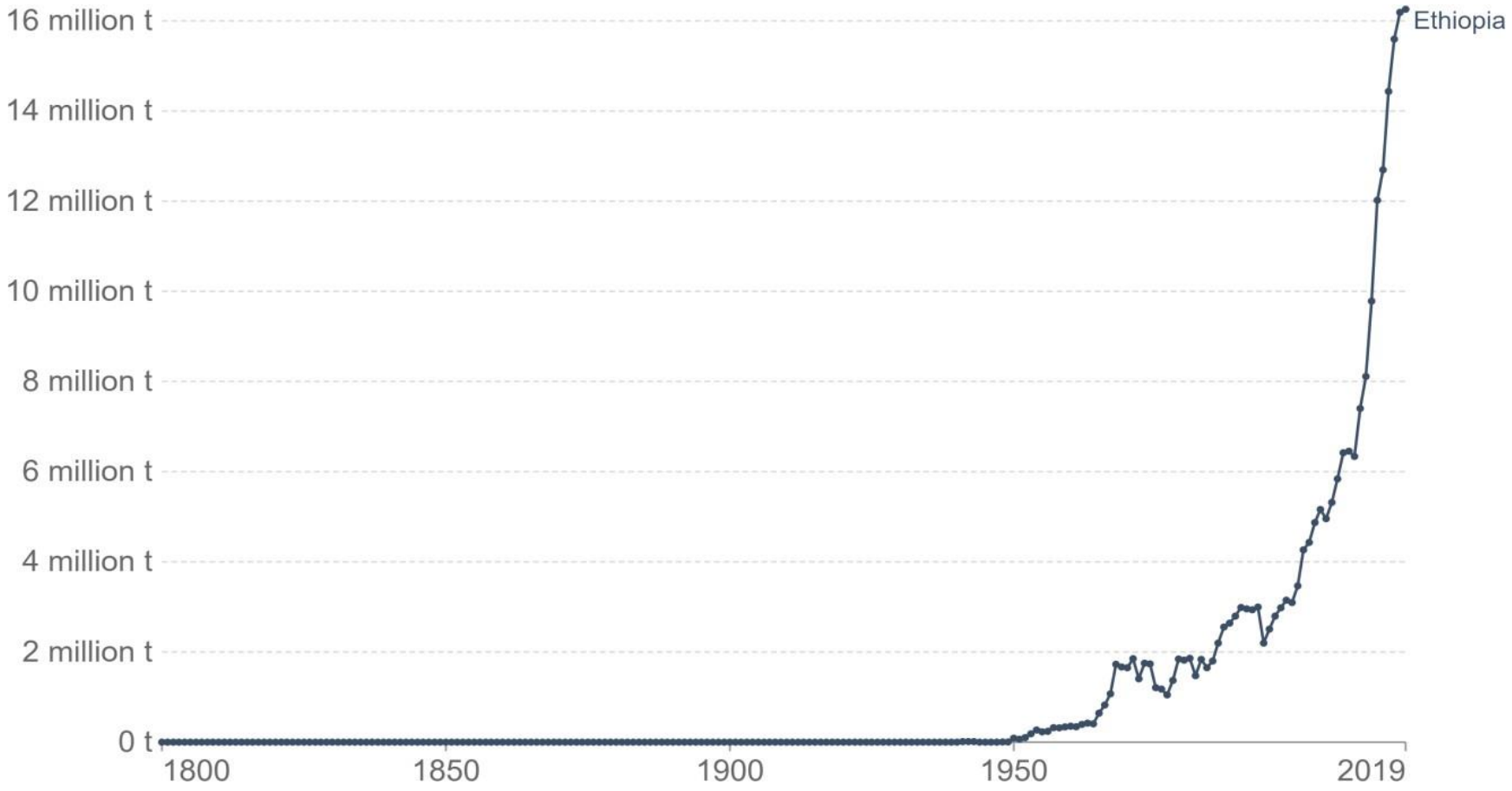
Carbon dioxide

- It is one of the most important elements of the earth's long-lived green house gases.
- It absorbs less heat per molecule than methane or nitrous oxide, but it's more abundant and stays in the atmosphere much longer.
- are responsible for about two-thirds of the total energy imbalance that is causing the earth's temperature to rise.

CO_2 in the atmosphere and annual emissions (1750-2019)



Ethiopia'sannualCO2emission



Cont…

- In nature,CO2 is exchanged continually between the atmosphere, plants, and animals through
  - photosynthesis,
  - respiration, and
  - decomposition, and
  - As gas exchange between the atmosphere and ocean through.
- The CO2 level in2019 was more than 40% higher than it was in the 19th century.
- Most of this CO2 increase has taken place since 1970 when the global energy consumption accelerated.

Cont…

- The rise in CO2 is largely from
  - Combustion of fossil fuels.
  - Deforestation and other land use changes have also released carbon.
- It has disturbed the balance of the carbon cycle because the natural processes that could restore the balance are too slow compared to the rates at which human activities are adding CO2 to the atmosphere.

Effect of climate change

- You say you love your children above all else, and yet you are stealing their future in front of their very eyes.”Greta Thunberg



Cont…

- Climate change destabilizes the earth's temperature equilibrium.
- Global warming **the energy balance and change of the temperature earth** posing a significant impact on **humans and the environment.**
- **It will increase the probability of extreme weather events**.

The direct consequences of man-made climate change include:

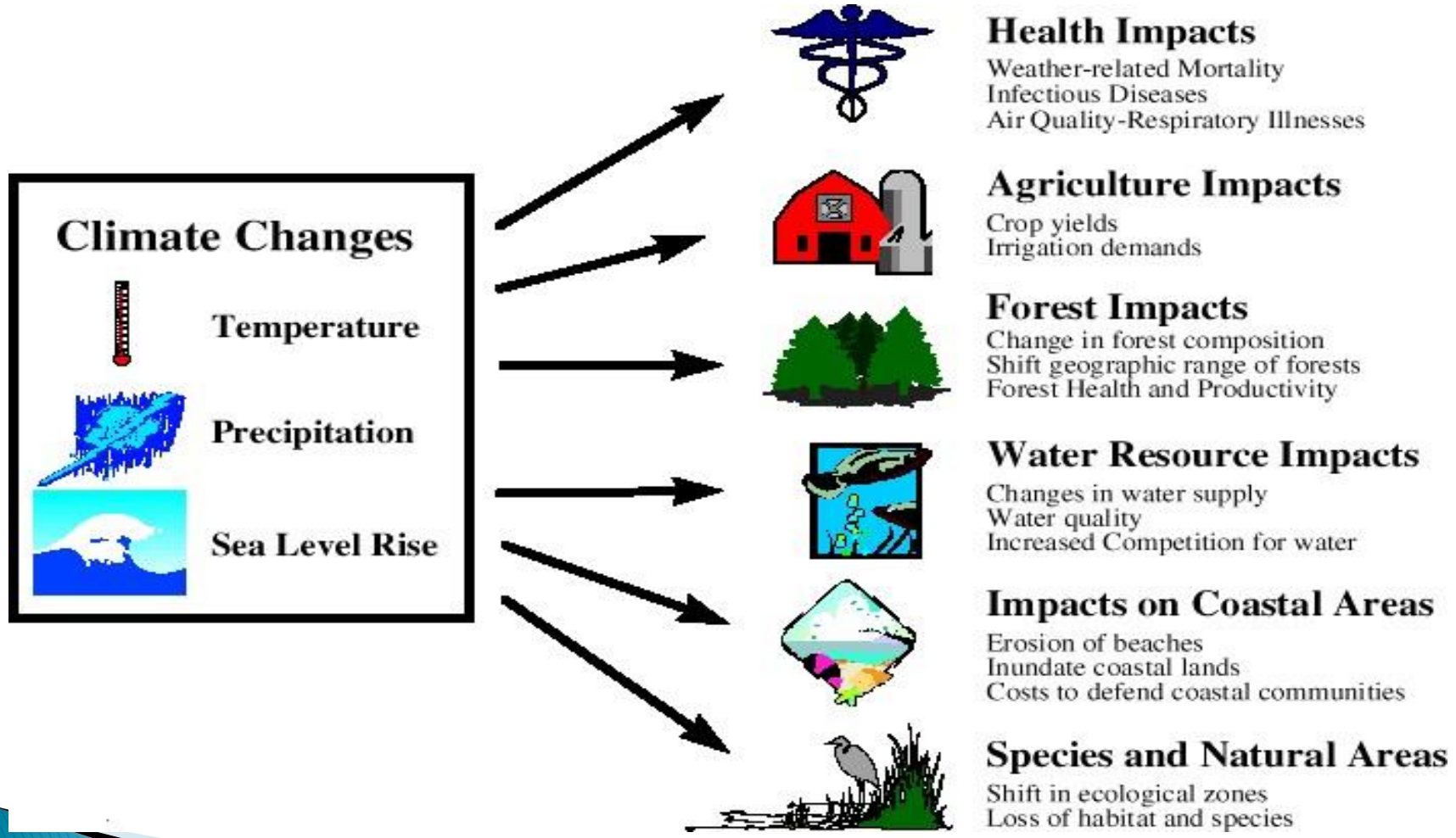
- Rising maximum temperatures
- Rising sea levels
- Higher ocean temperatures an increase in heavy precipitation and shrinking of glaciers thawing of permafrost

Cont…

The indirect consequences of climate change which affect humans and our environment include:

- An increase in **hunger and water crises**, especially in developing countries
- **Health risks** due to the rising air temperatures and heat waves
- **Economic crisis**
- Increasing spread of pests and pathogens
- **loss of biodiversity** due to limited adaptability of flora and fauna
- **Ocean acidification** due to increased HCO3 concentrations in the water as a consequence of increased CO_2 concentrations

Potential climate change impacts



Effects of climate change on Biodiversity

- Biodiversity provides immense/vast direct benefits to humans with at least 40% of the world's economy being derived from biological resources.
- Maintaining biodiversity provides
  - greater food security,
  - opportunities for economic development, and
  - provides a foundation for new pharmaceuticals and other medical advances

Cont…

- Climate change is direct driver of biodiversity loss:

  Projected changes in climate combined with land use change cause

  - The spread of exotic or alien species
  - Some species to migrate to other places and
  - It affects habitat of many species therefore will accelerate their loss.

Changes in rainfall patterns can damage land,plants and animals



Effects of climate change on Agriculture

Agricultural biodiversity refers to all components of biological diversity of relevance to food and agriculture.

It includes plants genetic resources

- crops,
- wild plants harvested and managed for food,
- trees on farms,
- pastures,
- rangeland species,
- medicinal plants and
- ornamental plants of aesthetic value.

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Animal genetic resources include

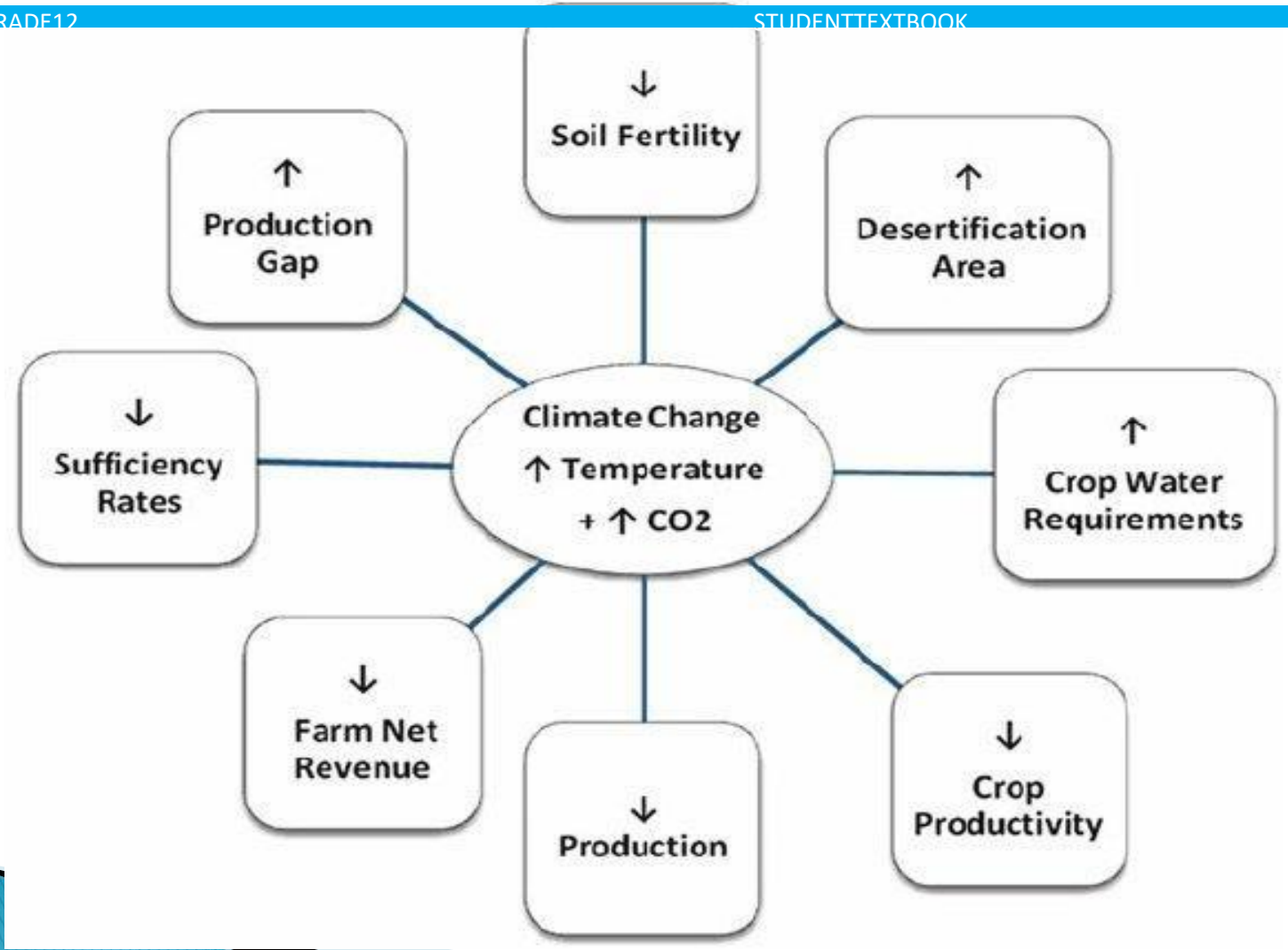
- domesticated animals,
- wild animals hunted for food,
- wild and farmed fish and other aquatic organisms,
- insect pollinators and
- microbial and fungal genetic resources.

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Climate change can disrupt food availability, reduce access to food, and affect food quality.

For example, projected increases in temperatures, changes in precipitation patterns, changes in extreme weather events, and reductions in water availability may all result in reduced agricultural productivity

Climate change and its potential impacts on Agriculture.



Effect of climate change on forest productivity

- Climate change could alter **the frequency and intensity of forest** disturbances such as pest out breaks, invasive species, wildfires, and storms.
- These disturbances can reduce forest productivity and change the distribution of tree species.
- In some cases, forests can recover from a disturbance.

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- In other cases, existing species may shift their range or die out.
- In these cases, the **new species of vegetation** that colonize the area create a new type of forest.
- **Insect out breaks** often defoliate, weaken, and kill trees.
- **Warm temperatures** and drought conditions during the early summer triggered wild fire, which can consume millions of acres of forest.(1acres=43560 squarefeet)

Galema forest on fire in Chilalo Oromia State, Ethiopia



Climate change and natural disasters

- Climate hazards are natural events in weather cycles.
- We have always had hurricanes, droughts and wildfires, high winds and flooding .
- With the increasing global surface temperatures ,the possibility of more droughts and increased intensity of storms will likely to occur.
- As more water vapor is evaporated into the atmosphere, it becomes fuel for more powerful storms to develop

Heavy rains and storms caused damage and flooding to the Lietchuor camp in Ethiopia, Gambella region



Dust storms in Eastern Ethiopia



Melting ice and rising seas

- When water warms up it expands.
- At the same time global warming causes polar ice sheets and glaciers to melt.
- The combination of these changes is causing sea levels to rise resulting in flooding and erosion of coastal and low lying areas.

Extreme weather,shifting rainfall

- Heavy rain and other extreme weather events are becoming more frequent.
- This can lead not only to floods and decreasing water quality but also to decreasing availability of water resources in some regions .

Failed crops as a result of climate change,Ethiopia



Risks of climate change for human health

- Climate change is already having an impact on health:
- There has been an increase in the number of heat-related deaths in some regions of the earth and a decrease in cold-related deaths in other parts of the world.
- We are already observing changes in the spread of some water-borne illnesses and disease vectors

Safety rules /precautions during natural disaster

- Disaster risk management is a comprehensive approach involving the identification of threats through implementation of the proposed mitigation measures.

- Natural disasters are catastrophic events that often occur without warning and disrupt the ecosystem causing damage to personal lives, property, transportation, and livelihood.

- As such, every natural disaster has its own set of precautions to be taken, which must be followed to save precious lives.

Elements of Comprehensive risk management



Here under are a few precautions to be taken during natural disasters

- **Earthquakes**
- The shifting of tectonic plates under the earth's crust causes earthquakes, which are responsible for mass destruction.
- When faced with an earthquake, these tips can be of use:
- **If you are indoors**
- Take cover under a sturdy table or other pieces of furniture, and hold on until the shaking stops.

Cont…

- Stay away from glass,windows,outside doors and walls, and anything that could fall, such as lighting fixtures or furniture.
- Stay inside until the shaking stops, and it is safe to go outside.
- Most injuries occur to people trying to move a different location inside the building or try to leave.

Cont…

- Do not use the elevators
- **If you are out doors**
- Stay away from buildings, streetlights, and utility wires.
- Stand in open ground until the shaking stops.

- It’s dangerous to stay directly out side buildings, at exits, and along side exterior walls.

- Ground movement during an earthquake is seldom the direct cause of death or injury.

- Most earthquake-related casualties result from collapsing walls, flying glass, and falling objects

Tsunamis

- Tsunamis are a series of enormous ocean waves caused by earthquakes, under water landslides, or volcanic eruptions.
- Tsunami waves range from tens to hundreds of feet tall and can travel twenty to thirty miles per hour.
- When faced with this phenomenon,these tips are to be followed:

Cont…

- Turn on your radio/TV to learn and follow the precautionary instructions during a tsunami warning, primarily when you reside near a coastal area.
- Move in land to higher ground immediately and stay there
- Check for a noticeable recession in water away from the shoreline as this is nature’s tsunami warning and should be heeded.

Cont…

- It would help if you moved away immediately
- Stay away from flooded and damaged areas until officials say it is safe to return.
- Keep yourself away from debris in the water; it may pose a safety hazard to boats and people

Cyclones

- Cyclones are tropical storms, caused by atmospheric disturbances around a low-pressure area.
- Cyclones are accompanied by strong winds, moving at a speed of sixty-two Kmph or more.
- When faced with hurricane, keep these tips in mind

Cont…

- Be alert to the changing weather conditions.
- Listen to radio/TV for the latest information.
- Look for approaching storms.
- Look for the following warning signs: – Dark,
- often greenish sky – Large hailstones,
- a large, dark,
- low-lying cloud (particularly if rotating)
- ,roars,
- similar to a freight train.

Cont…

- If you see approaching storms or any of the danger signs, be prepared to take shelter immediately.
- If you are under tornado warning, seek shelter immediately.
- NOTE: In places where you have designated cyclone shelters, take refuge there

Floods

- Floods are among the earth's most common and dangerous natural hazards formed due to a flow of water on areas of land that are usually dry.
- Excessive rains can damage near by dams where tsunamis are some of its causes.
- When faced with flooding, these tips are to be followed:

Cont…

- Do not attempt to walk,swim,or drive through the floods.
- Flood water contains debris and contamination and can also be deadly due to fallen electrical lines in the water.
- Stay clear of bridges over fast-moving water.
- Keep an eye out for evacuation alerts.
- Move to higher ground. If your vehicleis trapped in flood and water starts filliing side the car, seek refuge on the roof.

Mitigation Measures

- There are three main climate change mitigation approaches.
- The first route is **conventional mitigation** effort that employs decarbonization to reduce CO2 emissions
- This include
  - Use renewable energy,
  - fuel switching (coal to gas)
  - efficiency gains (industrial upgrades–waste heat recovery)
  - nuclear power, and
  - carbon capture storage and utilization.

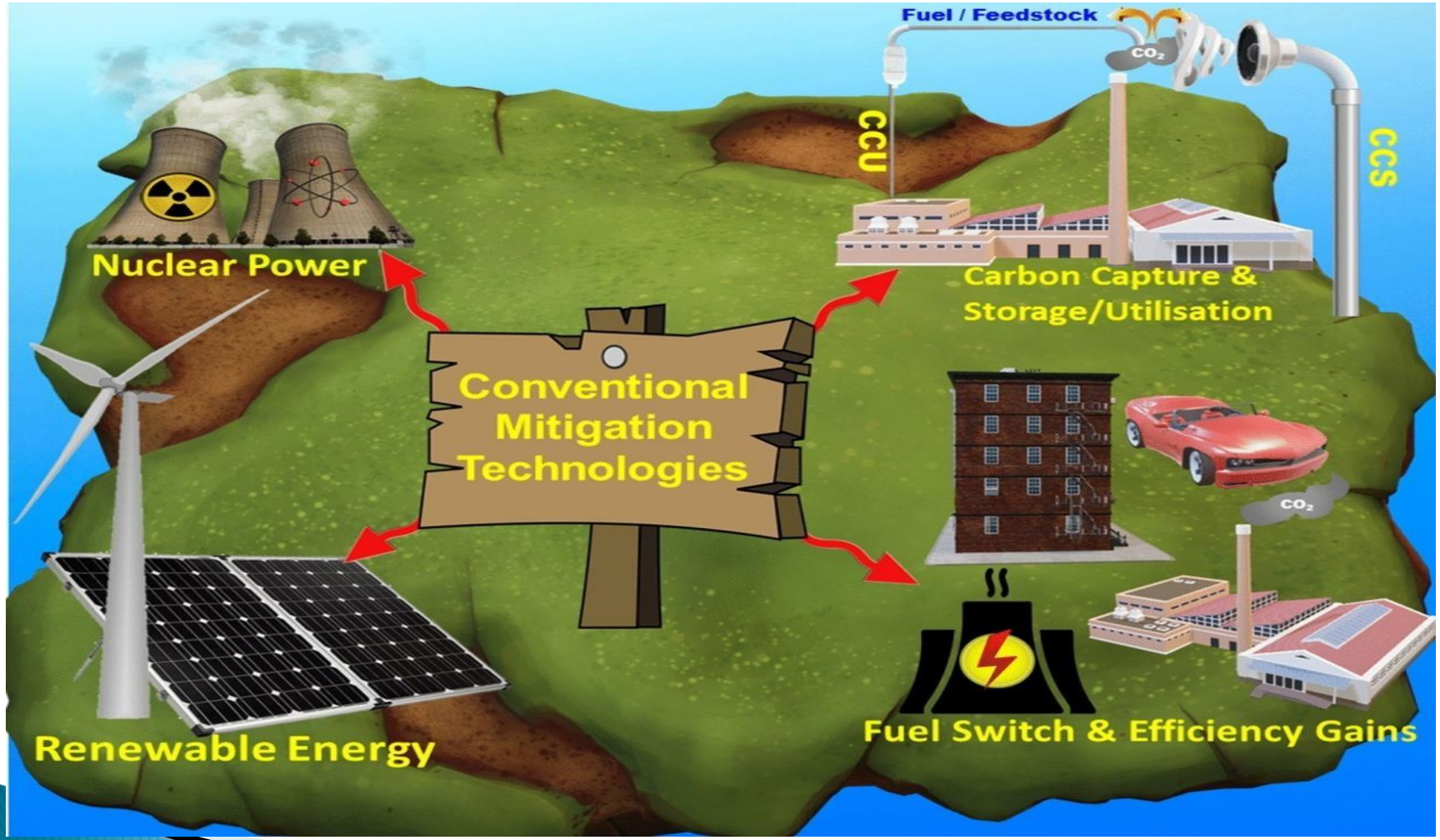
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- The second route focuses on **capturing and sequestering of CO2 from the atmosphere** through ocean fertilization /ocean nourishment , ocean alkalinity enhancement, soil carbon sequestration, afforestation and reforestation, wetland construction and restoration.

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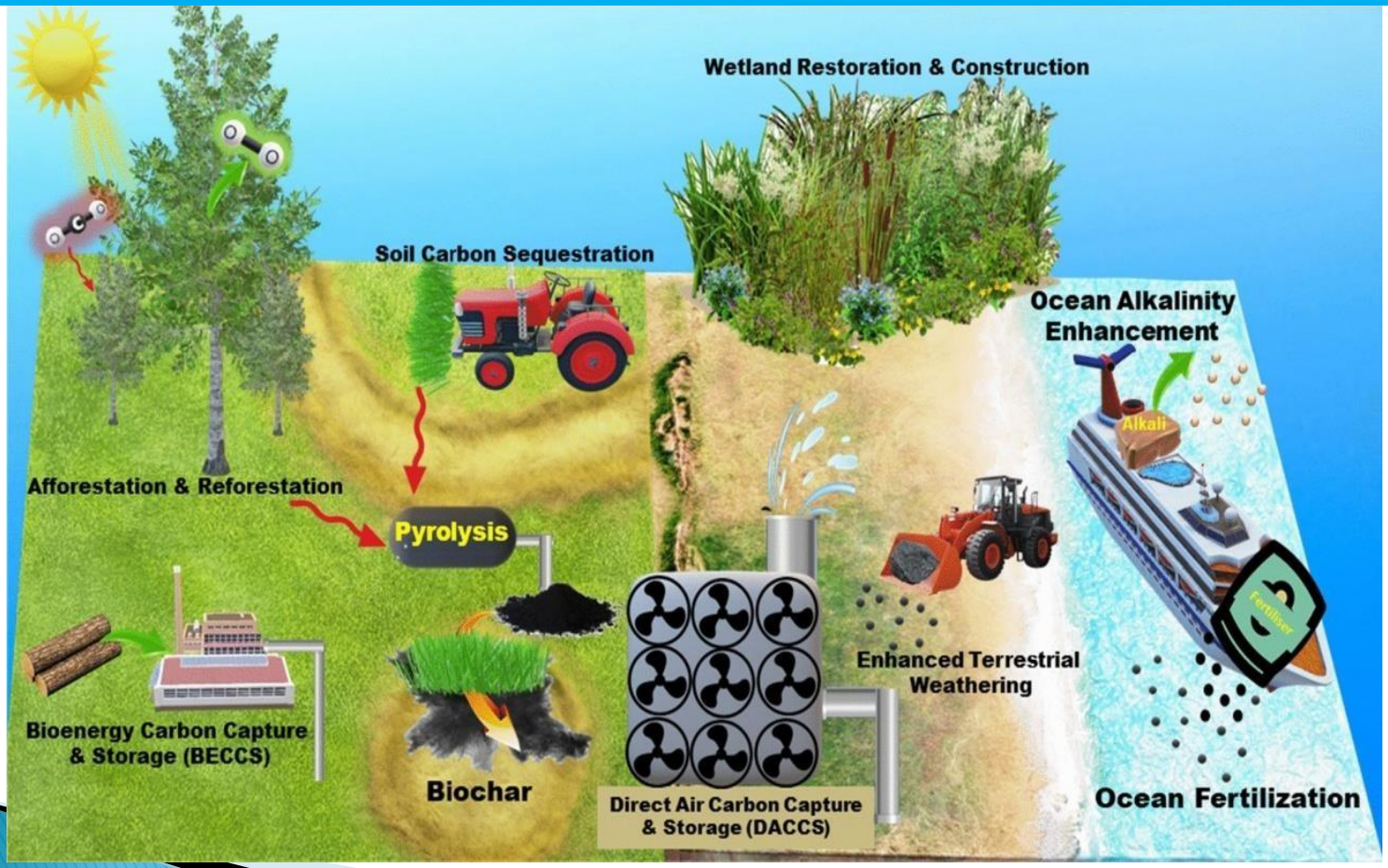
- The third route is the principle of **altering the earth's radiation balance** through the management of solar and terrestrial radiation.

Conventional mitigation effort that employ decarbonization



A mitigation measure that involves carbon sequestration

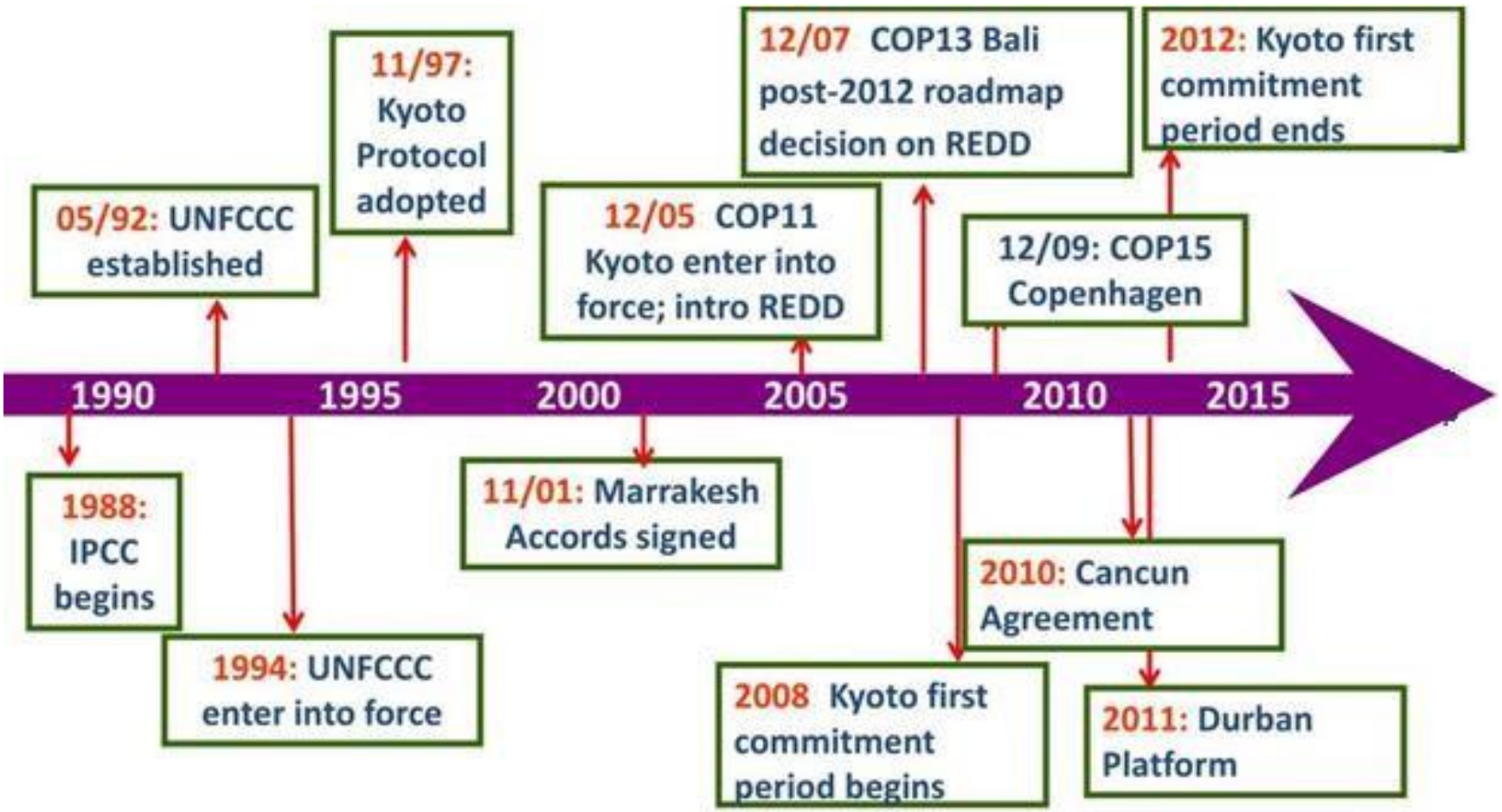
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International conventions

- International conventions
- Climate change is a long-term, global problem.
- Long-term problems generally require stable but flexible policy implementation overtime.

Climate Policy Timeline



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- In 2009 in Copenhagen (COP15), for the first time it was decided that each country would propose a national contribution (INDC, Intended Nationally Determined Contributions).
- All the **195** UNFCCC countries pledged to reduce their green house gas emissions by 2025-2030.
- It aimed "**to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty** "and contained three key requirements:

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I. Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;

II. Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development

III. Making **finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient** development

The United Nations Frame work Convention

- The United Nations Frame work Convention on Climate Change (UNFCCC), agreed in 1992, is the main international treaty to combat "**dangerous human interference with the climate system**", in part by stabilizing greenhouse gas concentrations in the atmosphere.
- Its objective is to prevent dangerous man-made interference with the global climate system.
- The UNFCCC is an international environmental treaty Ethiopia and all its member countries are among the 197 Parties of the Convention

Kyoto Protocol on Climate Change

- The Kyoto Protocol was adopted on 11 December 1997.
- The Kyoto Protocol operationalizes the UNFCCC by committing industrialized countries and economies in transition to limit and reduce GHG emissions in accordance with agreed individual targets.

Cont…

- That means **the Kyoto Protocol** is an international agreement that called for industrialized nations to reduce their greenhouse gas emissions significantly.
- Other accords, like the Doha Amendment and the Paris Climate Agreement, have also tried to curb/check the global-warming crisis

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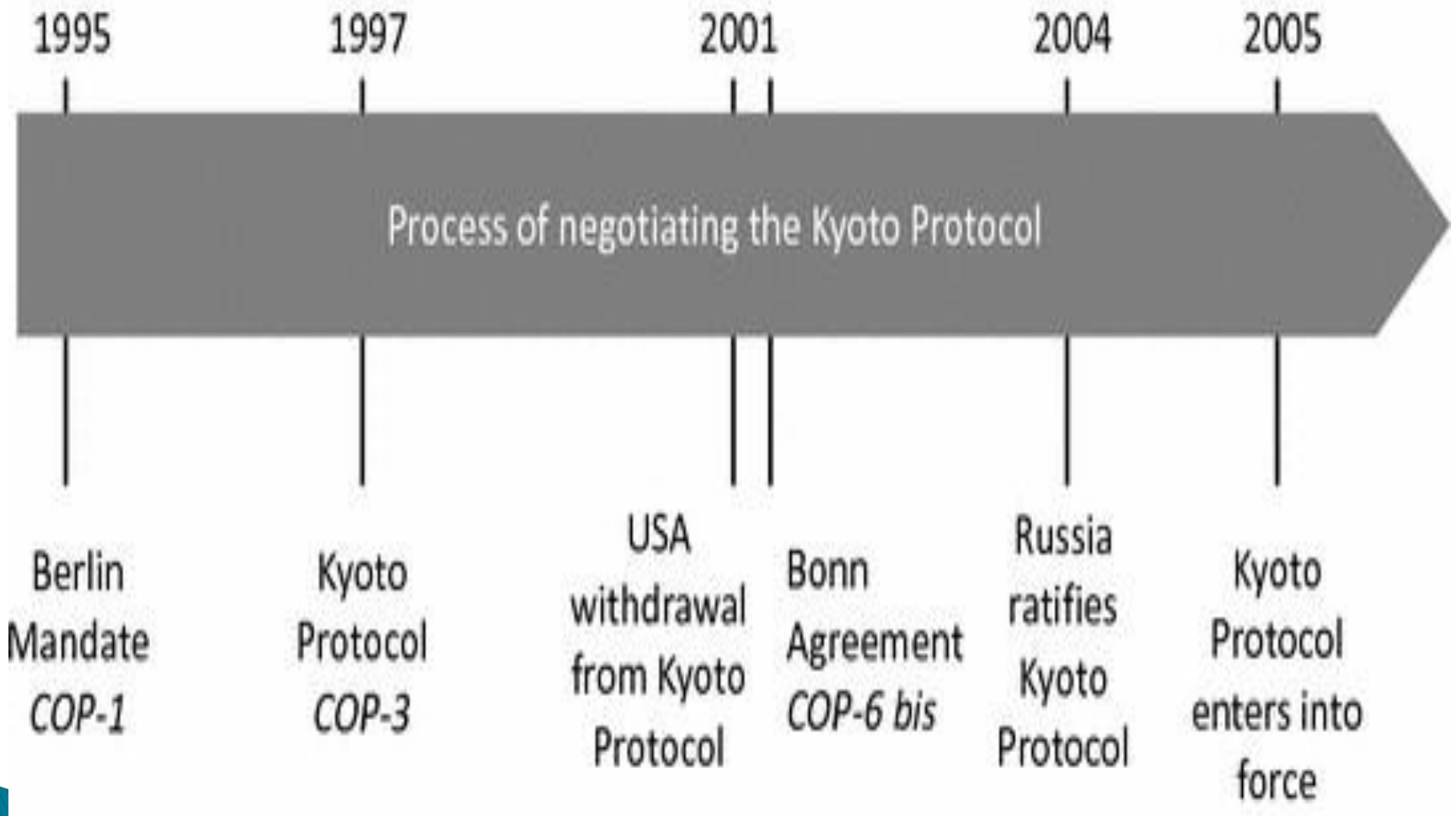
- First agreed in 1997,it took eight years for participating countries to ratify/approve the Kyoto Protocol.
- The deal was simple.
- Industrialized countries would be legally obliged to cut their greenhouse gas emissions 5% on 1990 levels by 2008-2012.

- Developing countries –including China, India, Brazil and South Africa– would face no restriction on their emissions but were encouraged to adopt policies to promote greener growth.

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- To help countries meet targets, Kyoto also offered arrange of market mechanisms that could help rich countries off set emissions by investing in low carbon projects in poorer parts of the world.

The Negotiation process leading to the Kyoto Protocol



Cont…

- International and national practices of implementation of conventions

- Ethiopia is one of the world most drought prone countries.
- It is high degree of vulnerability to hydro meteorological hazards and natural disasters.
- Dependence on sectors that are climate change sensitive such as rain fed agriculture ,water ,tourism, and forestry as well as a high level of poverty are the main factors that make worse Ethiopia vulnerability.

Cont…

- Ethiopia policy response to climate change has progressively evolved since the ratification of the UNFCCC in 1994.

- Ethiopia launched the National Adaptation Plan of Action in 2007 and the Ethiopian Program of Adaptation on climate change and National Appropriate Mitigation Actions in 2010.

- More over ,Ethiopia endorsed a climate Resilient economy .

Cont…

- Over the years Ethiopia has been implementing various program with in those policy frameworks .
- One among them ,and by far the most consequential ,has been the Green Legacy Initiative (GLI) launched in 2019 with a vision of building a green and climate resilient
- Ethiopia and targeted to plant 20 billion seedlings with in a period of four years .

Cont…

- The Green Legacy Initiative is a demonstration of Ethiopia long term commitment to a complicated response to the impacts of climate change and environmental degradation that encompasses agro forestry, forest sectore development ,greening and renewal of urban areas ,and integrated water and soil resource management .

Great Ethiopian renaissance dam

- the GERD is construction Since 2011 with the primary purpose of generating electricity with a capacity of 5.15 giga watts to relieve .
- The GERD is one of the best example in Ethiopian to support climate Resilient Green Economy (CRGE) strategy to protect the country against the adverse effect of climate change and build green economy .

THE END