

Mitigation of Climate Impacts

What is mitigation?

Agriculture:

- Agricultural practices make up about 10% of GHG emissions in the U.S.
- Half of these emissions come from soil management practices.
 - Over-application of fertilizers can lead to nitrous oxide emissions (a potent greenhouse gas).
 - tilling, irrigation, and land cover practices can affect the susceptibility of the soil to erosion. Erosion drains soils of nutrients and releases greenhouse gases stored in the soils.
- Livestock and livestock manure, especially cattle, make up most of the other half of agriculture emissions in the form of methane as a result of normal digestive processes
- 10% may seem relatively small, but reductions in this sector can go a long way *and* help with emission reduction in other sectors! For instance, a reduction in agricultural land needed can allow for reforestation in those areas.
 - Over 50% of the contiguous U.S. land is cropland, pastures, or ranges.
 - 90% of that land is being used for livestock, mainly cattle.

How can we mitigate agriculture emissions and still feed the country?

Land Use/Forestry:

- In the contiguous U.S., the major uses of land are: Pastures and Ranges (35%), Cropland (21%), and Forests (28%).
 - Less than 4% of land is urban (i.e., cities, stores, neighborhoods) but it is the fastest growing use of land.
- Forests and forest soils are incredibly important carbon sinks.
 - U.S. Forests currently absorb 742 Tetragrams of carbon dioxide per year (over 730 million tons!), which is equivalent to 11-12% of annual U.S. emissions.
- Over the past 20 years, there has been a small increase in overall forestland, but forests are projected to start declining in 2030, primarily due to expanding urbanization.
 - As deforestation occurs, carbon sinks are lost and previously stored carbon in the vegetation and soil is released.
- Forest ecosystems are weakening due to drought, wildfires, and outbreaks of pests (insects and fungi) caused by a warming climate and precipitation extremes. This decreases forest growth, and less carbon is absorbed.

How can we improve land use and expand/preserve forests to mitigate emissions?

Transportation

- The Transportation sector makes up about 29% of emissions in the U.S., making it the largest contributor to GHG emissions.
 - The majority of emissions from this sector are carbon dioxide from the combustion of petroleum products (gasoline, diesel, and jet fuel).
 - Over half of the emissions from this sector come from personal vehicles (cars, trucks, minivans) and commercial trucks.
 - Other major sources come from commercial aircraft, ships, boats, trains, and pipelines.
- Many cities in the U.S. lack a robust and efficient public transportation system.

How can we improve transportation and mitigate transportation emissions?

Industry

- The industrial sector makes up about 23% of emissions in the U.S., making it the third largest contributor to GHG emissions.
 - Direct emissions are produced from the burning fuel at the facility for power generation, chemical reactions, and leaks from industrial machinery (i.e., natural gas extraction).
 - Most emissions come directly from burning fuels (roughly two-thirds)
 - The other third of emissions come from the production of petroleum products (plastics and fuels) and chemical production, leaks in machinery, and cement and metal production.
 - Indirect emissions come in the form of electricity used to power the machinery in the industries, which contributes to the electricity sector's emissions.
- The creation of virgin products from raw materials often has higher emissions than recycled products

How can we mitigate industrial emissions?

Electricity

- The Electricity sector makes up about 25% of emissions in the U.S., making it the second largest contributor to GHG emissions.
 - Most emissions from this sector are carbon dioxide from combustion of fossil fuels.
 - Coal makes up 61% of GHG emissions in this sector, but only creates 24% of national electricity.
 - Natural Gas creates 37% of national electricity.
- Nuclear, hydroelectric, wind, and solar, are “non-emitting” sources of energy.
 - Nuclear power generates 20% of national electricity.
 - Renewable energy generates only 18% of national electricity.
 - Non-emitting sources can create other problems (i.e., radioactive waste from nuclear power or a blocked river from a dam).
- Emissions from electricity production can contribute to the emissions of other sectors that use the electricity, like Transportation, Industry, and Commercial/Residential sectors (i.e., an electric car that is charged with electricity generated from coal)

How can we mitigate energy emissions and power the country?

Commercial/Residential

- The Commercial and Residential Sector makes up about 13% of emissions in the U.S.
 - Emissions from this sector include:
 - Fossil fuel combustion for heating and cooking
 - Methane emissions from organic waste in landfills
 - hydrofluorocarbons (HFCs) leaking from air conditioners and refrigerators
 - Methane emissions from wastewater/sewage storage and treatment
- Note that electricity used in this sector contribute to the emissions in the Electricity sector (i.e., In Indiana, the lights in our homes are powered with electricity made from coal and natural gas).

How can we mitigate Commercial/Residential emissions AND mitigate electricity usage?