

Current Issue of 2023:

Climate Change



There will be 4 Key Topics Covered

- Factors Contributing to climate change in New York
- Measuring and monitoring climate change and the forecast for New York's future
- Risks and impacts to natural resources and communities in New York from changing climate
- New York policies and programs for adapting to a changing climate

Key Topic 1:

Factors Contributing to Climate Change in NY

Climate and Energy

Greenhouse Effect

Humans

What is causing climate change?

- 97% of climate scientists conclude that human activities are changing the climate.
 - Decades of human generated greenhouse gases are the major driving force.
- Human activities— burning fossil fuels and deforesting large areas— have a profound influence on earth's climate
- Levels of greenhouse gases are rising
 - Greenhouse gases supercharge the climate
 - 3 key heat trapping gases in the atmosphere
 - Carbon dioxide, methane, nitrous oxide
 - Carbon Dioxide (CO₂) began to rise in the 19th century as people burned fossil fuels.
- Gradual changes in earth's rotation and orbit around the sun change the intensity of sunlight received in our planets polar and equatorial regions.

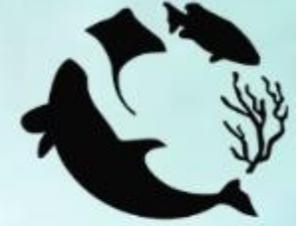
CLIMATE CHANGE & it's causes!



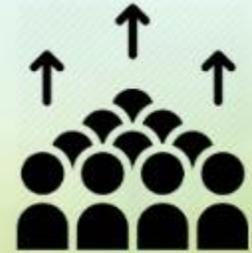
Deforestation



Greenhouse
Effect



Destruction of
Marine
Ecosystem



Population
Increase

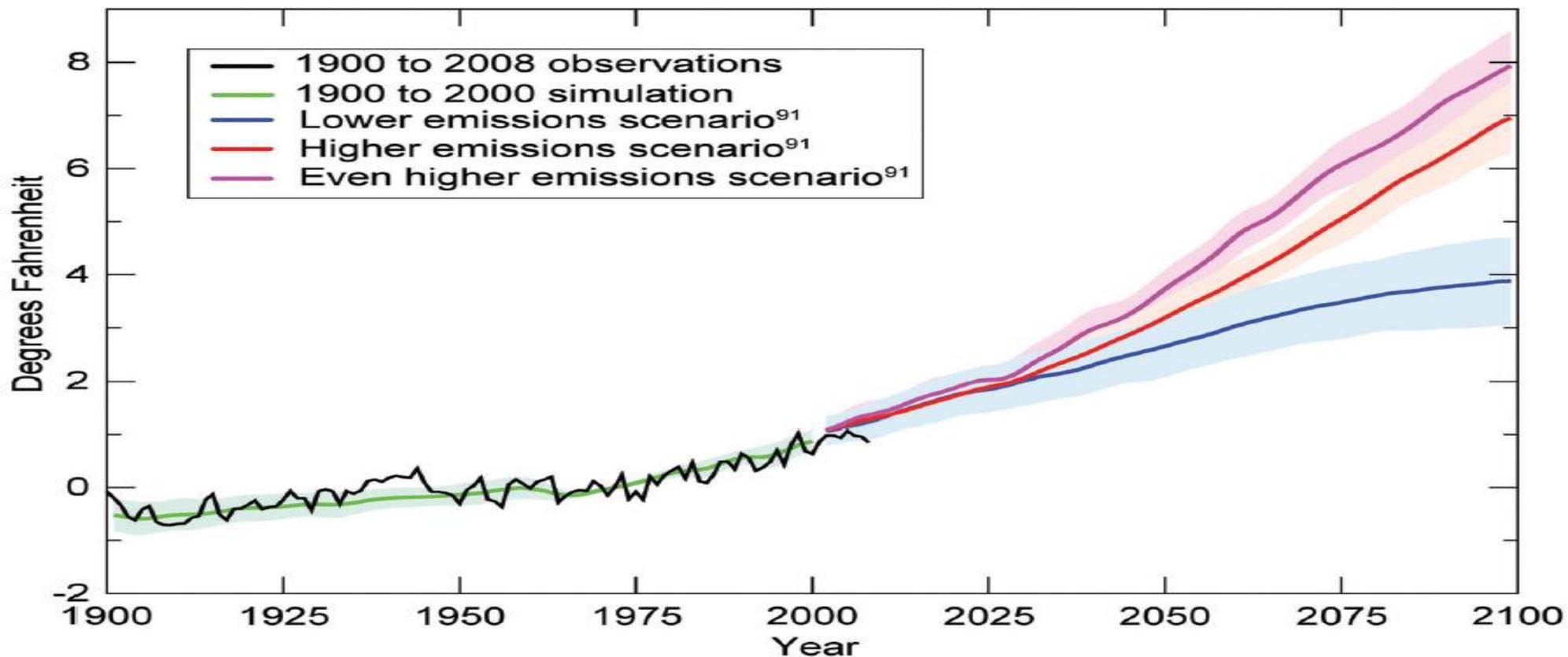


Climate and Energy

- The sun is the primary source of energy for earth's climate system
 - Much of the sunlight that reaches earth is absorbed and warms the planet
 - When earth emits the same amount of energy as it absorbs the energy budget is in balance, the average temperature remains stable.
- A significant increase or decrease in the sun's energy output would cause the earth to warm or cool
 - Measurements via satellite over the past 30 years show that the sun's energy output has changed slightly in both directions
- Earth's climate is influenced by interactions involving the sun, ocean, atmosphere, clouds, ice, land and life. Climate varies by region as a result of local differences in these interactions.

Climate and Energy

- The ocean exerts a major control on climate by dominating earth's energy and water cycles. Changes in ocean circulation caused by tectonic movements or large influxes of fresh water from melting polar ice can lead to significant and even abrupt changes in climate.
- The amount of solar energy absorbed or radiated by earth is modulated by the atmosphere and depends on its composition. Small increases in carbon dioxide concentration have a large effect on the climate system.



Observed (black curve) and projected (colored curves) changes in global average surface temperature for three of the illustrative scenarios of future emissions.

Greenhouse Effect

- Natural phenomenon where heat-trapping gases in the atmosphere keep the earth's surface warm
- Without greenhouse gases, the earth would be a giant ice ball
- Human activities, primarily burning fossil fuels and changing land cover patterns, are increasing the concentrations of some of these gases, amplifying the natural greenhouse effect.



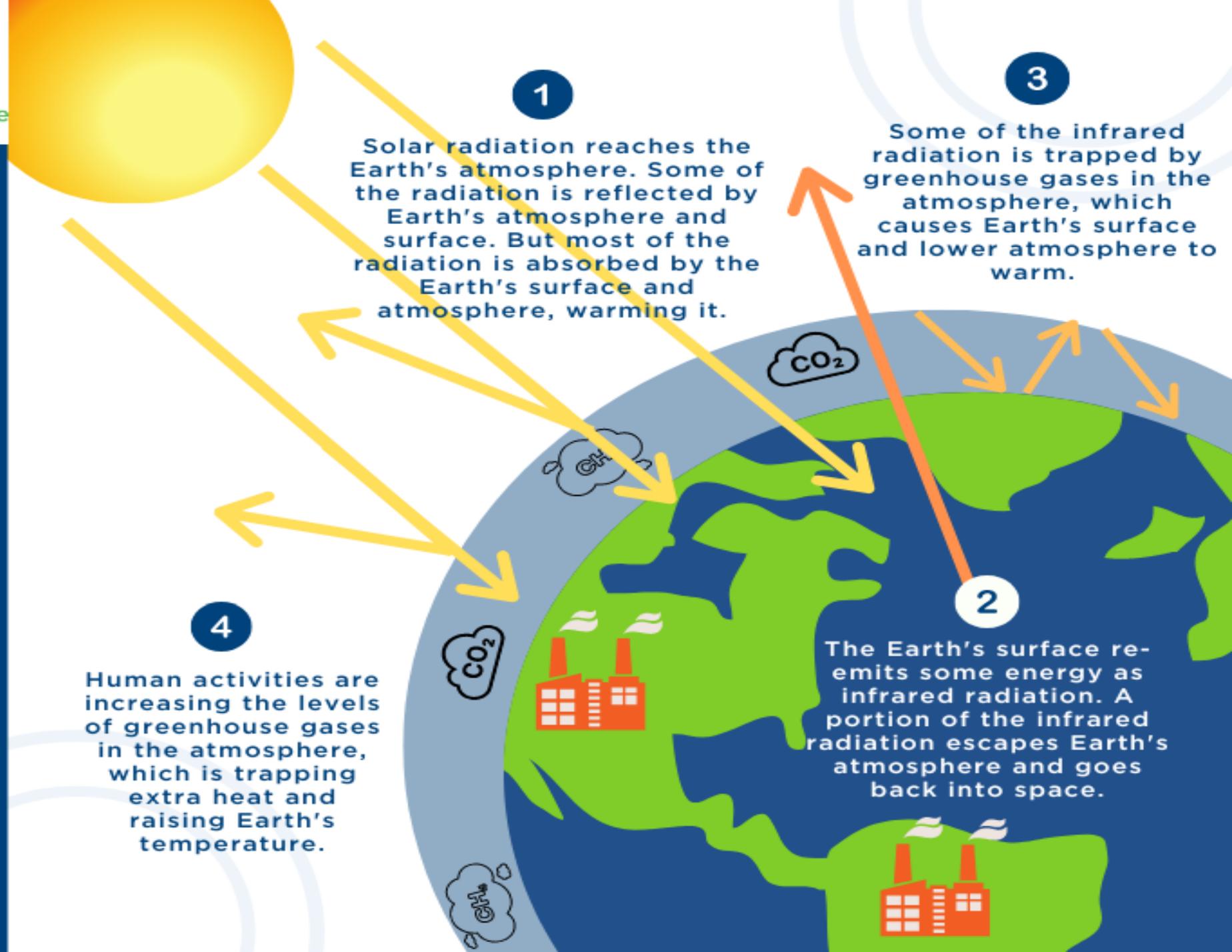
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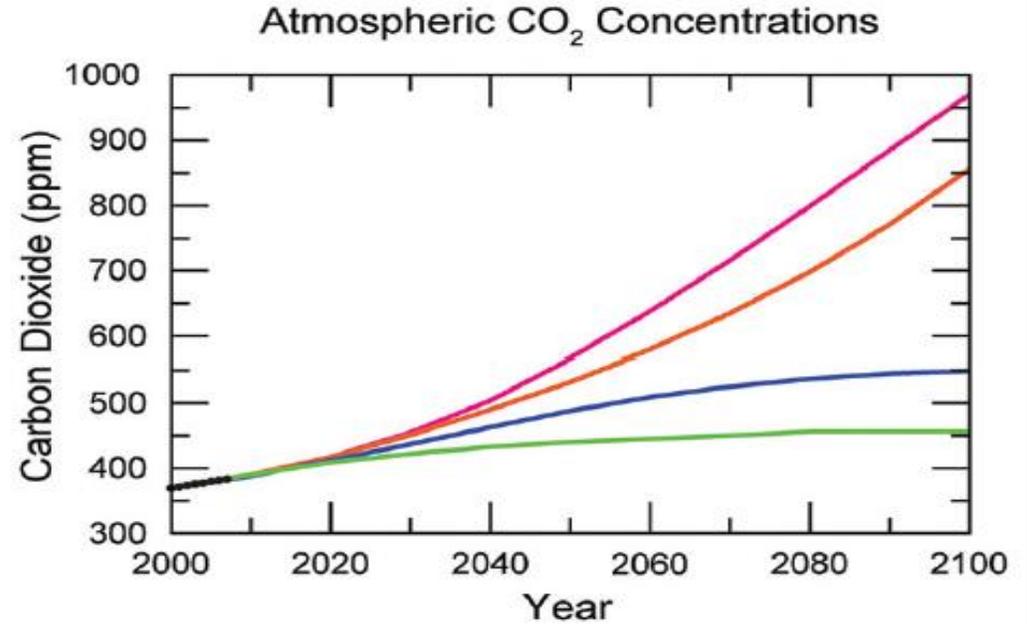
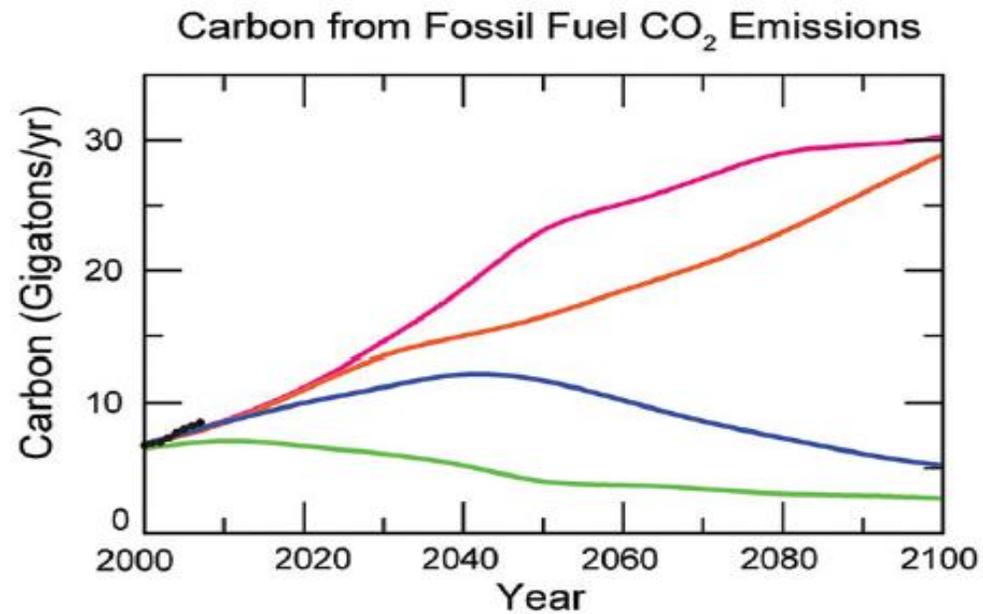
Environmental and
Energy Study Institute

GUIDE TO THE GREENHOUSE EFFECT

The greenhouse effect is a natural process in which atmospheric gases trap the sun's heat and warm the Earth's surface and lower atmosphere. This makes Earth hospitable for life.

Human activities, such as burning fossil fuels for transportation and electricity generation, are increasing the concentration of greenhouse gases in the atmosphere. This enhances the greenhouse effect, trapping extra heat in the Earth's atmosphere and slowly warming the planet.





Observed (black curve) and projected (colored curves) changes in global CO₂ emissions (left, in gigatons of carbon) and atmospheric CO₂ concentrations (right) for four illustrative scenarios of future emissions.

Humans

- 95% chance that rising global temperatures are primarily due to human activities
- Principal driver of climate change over the past century has been increasing levels of atmospheric greenhouse gases associated with fossil-fuel combustion, changing land-use practices and other human activities.
 - Atmospheric concentrations of the greenhouse gas carbon dioxide are now approximately 40% higher than in preindustrial times.
 - Concentrations of other important greenhouse gases, including methane and nitrous oxide, have increased rapidly as well.

Key Topic 2: Measuring and monitoring climate change and the forecast for New York's future

Climate Analysis

Temperature, Precipitation, Sea level,
Snowfall and Extreme Events

Forecast

How is NY looked at?

- NYS is split into 7 ClimAID regions
- These regions are grouped together based on various factors
 - ❖ Climate
 - ❖ Ecosystems
 - ❖ Watershed
 - ❖ dominate agriculture system
 - ❖ economic activities



Climate Analysis

- Meteorological observing stations that look at temperature, precipitation, sea level rise, and extreme events.
- Variables to the stations include, heat indices, precipitation, lightning, intense precipitation of short duration, storms.
- New climate projections for NYS use methods developed by the New York City Panel on Climate Change
- There are now 35 climate models versus the 16 originally used.

Temperature and Precipitation

- New York State's climate is humid continental.
- Average temperature varies from 40°F in the Adirondack region to 55°F in the NYC region.
- Average warming rate of 0.25°F per decade since 1900.
- Wettest parts of the state can get 50" of precipitation.
- WNY gets approximately 30" of precipitation.
- Precipitation is consistent on a per region basis.
- All 7 stations are showing an increase in precipitation over the past century.
 - In addition to mean precipitation, year to year precipitation variability has been more pronounced as well.

a. Annual Temperature (1901 – 2012)

Observed Weather Station	Temperature Trend (°F/decade)
Region 1 – Rochester	0.32**
Region 2 – Port Jervis	0.35**
Region 3 – Elmira	0.09*
Region 4 – New York City	0.33**
Region 5 – Albany	0.22**
Region 6 – Watertown	0.22**
Region 7 – Indian Lake	0.21**

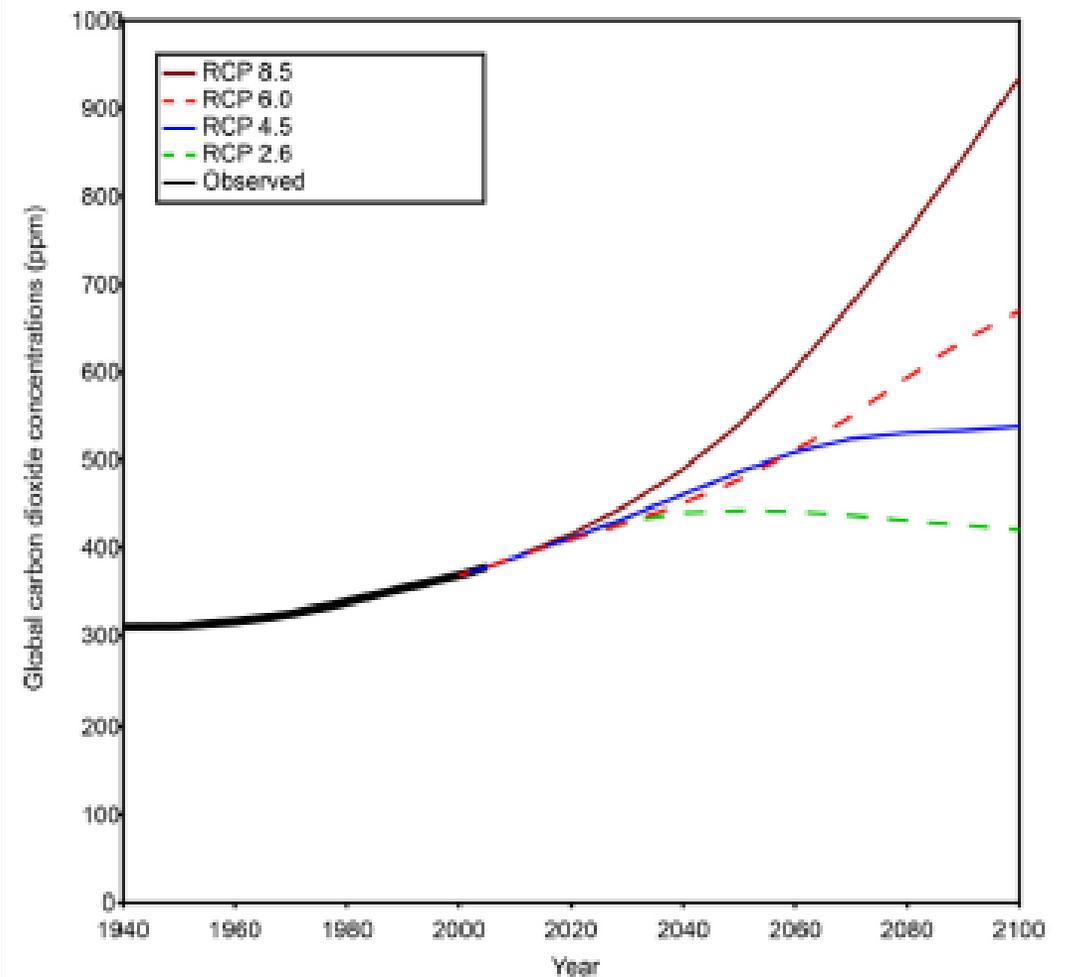
b. Annual Precipitation (1901 – 2012)

Observed Weather Station	Precipitation Trend (in/decade)
Region 1 – Rochester	0.34**
Region 2 – Port Jervis	0.35
Region 3 – Elmira	0.58**
Region 4 – New York City	0.76**
Region 5 – Albany	0.90**
Region 6 – Watertown	0.54**
Region 7 – Indian Lake	0.19

* Trend is significant at the 95% significance level

** Trend is significant at the 99% significance level

Figure 2. Carbon Dioxide Concentrations



Observed CO₂ concentrations through 2005, and future carbon dioxide concentrations

Sea Level

- Currently, rates of sea level rise on New York State's coastlines have ranged across the region from 0.86 to 1.5 inches per decade, averaging 1.2 inches per decade since 1900.
- This increase includes effects of global warming since the Industrial Revolution and residual crustal adjustments to the removal of the ice sheets.
- Most observed climate related rise in sea level over the past century can be attributed to the expansion to oceans as they warm- melting glaciers and ice sheets is gradually becoming the dominating contributor to rising sea level.

Snowfall and Extreme Events

- NY averages 40" per year in snowfall.
- Tug Hill and Adirondack region along with WNY region will get approximately 175" per year of snowfall.
- The warming influence of the Atlantic Ocean keeps snow in the New York City metropolitan area and Long Island below 36 inches per year.
- Heat waves, defined as three consecutive days with maximum temperatures above 90 °F.
- The two types of storms with the largest impact on the coastal areas of the State are tropical cyclones and nor'easters.

Climate Projections

- Model based distributions for temperature, precipitation, sea level rise, and extreme events are made based on global climate model simulations (GCM) and representative concentrative pathways (RCP).
 - GCM are mathematical representations of the behavior of the earth's climate system overtime. They can be used to estimate how sensitive the climate system is to changes in atmospheric concentrations of greenhouse gases and aerosols.
 - Each model simulates physical exchanges among the ocean, atmosphere, land and ice.
 - RCP is a set of trajectory of greenhouse gas emissions, aerosols and land use changes developed for climate modeling community as a basis for long term and near-term modeling experiments.

CLIMATE CHANGE IS AFFECTING OUR LOCAL COMMUNITIES

- Environmental impact
- Health impact
- Economic impact



HOTTER AND DRIER SUMMERS

LESS SNOWPACK IN THE MOUNTAINS

MORE HEAVY RAIN

MORE RIVER FLOODING

Floods from rivers and the ocean can damage homes, neighborhoods and businesses.

WILD FIRES

RISING SEA LEVELS
Warmer temperatures are heating up the ocean and making ice and glaciers melt, causing the sea level to rise. This can flood coastal homes and communities.

HEALTH
Changes in environment harms people's health

BAD AIR QUALITY
Hotter summers can make air quality worse. This can harm people with asthma and heart problems.

MORE HOT DAYS
More high heat days can make people sick.

DISEASES
Warmer temperatures can create more bacteria in seafood and fresh water and could make people sick. Diseases from ticks and mosquitos can increase.

EXTREME WEATHER
Extreme weather like wind storms can damage homes and make places less safe.

ECONOMY
Changes in environment will cost people more money and impact jobs.

FOOD
Crops can be damaged by heat, drought, and insects. This can affect what food is sold in the market and how much it costs.

Key Topic 3: Risks and impacts to natural resources and communities in New York from a changing climate

Risks

Challenges

Impacts

What will we see next?

- Milder winters, warmer summers, heavier rainfall events and seasonal changes in plants and trees on farms
- According in ClimAID– NYer's can expect to see an increase in extreme weather events
 - More frequent heat waves, heavy downpours, increased summer droughts, rising sea levels
 - ❖ This will impact public health, energy, transportation, communication, agriculture, natural resources, natural ecosystems
- Many commodities that currently dominate the NY agriculture sector– dairy, apples, cabbage, potatoes– are not well suited for the warming trends

Flooding Challenges/Risks for Agriculture

- Spring Flooding can delay planting
- Root damage can reduce yields
- Soil loss from erosion during heavy rain events
- Soil compaction from use of heavy machinery on wet soils.
- Water contamination from run off



Drought Challenges/Risks for Agriculture

- Declining and more variable yields of rain-fed crops.
- Decline in quality of high-value fruit and vegetable crops.



Heat Stress Challenges/Risks in Agriculture



Warmer summer temperatures have been shown to lower yields for certain varieties of grain crops (field corn, wheat, and oats) by speeding the development cycle and shortening the period during which grain heads mature



Hot daytime or nighttime temperatures during critical phases of plant development can reduce yield and quality of even those crops considered heat-adapted

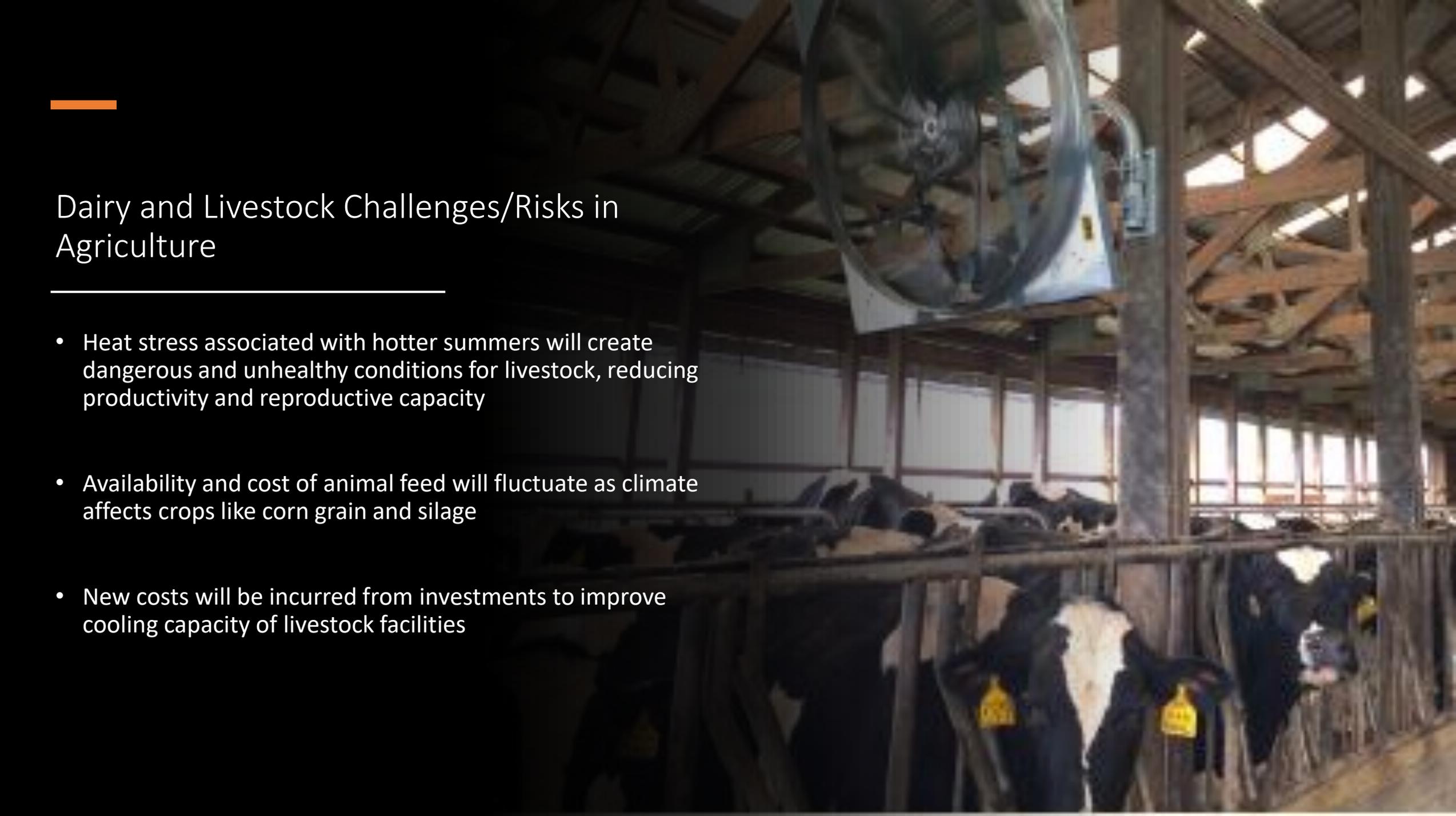


Warmer and more variable winters can ironically increase the chance of frost and freeze damage for perennial fruit crops by inducing premature leaf-out and interfering with cold-mediated winter hardening

Insect/Pest Challenges/Risks in Agriculture

- Evidence suggests that climate change will require NY farmers to invest in more intense pest and weed management
- Spring pest populations and over wintering will increase
- Longer growing season means more insect generations per season
- Weeds will have to be controlled longer and weed seed production will be greater
- Weeds may migrate north and become stronger competition
- Climate change may reduce the effectiveness of chemicals





Dairy and Livestock Challenges/Risks in Agriculture

- Heat stress associated with hotter summers will create dangerous and unhealthy conditions for livestock, reducing productivity and reproductive capacity
- Availability and cost of animal feed will fluctuate as climate affects crops like corn grain and silage
- New costs will be incurred from investments to improve cooling capacity of livestock facilities

Public Health Challenges/Risks

- COP26 (United Nations climate change conference) has referred to Climate Change as a “public health emergency”
- According to the NYS Department of Health Climate and Health Profile there are several potential climate related impacts in the state:
 - ❖ Increased heat stress (such as heat adema, heat stroke, heat cramps, and dehydration)
 - ❖ Exacerbation of respiratory conditions (pneumonia, asthma, and chronic objective pulmonary disease) and cardiovascular disease Increased risk for food and water borne disease due to increasing temperatures and flooding
 - ❖ Increased duration and severity of allergy symptoms due to increased duration and intensity of pollen season

Continued...

- Increased risk for vector borne diseases (Lyme disease, West Nile Virus)
- Increased risk of injury and death following extreme precipitation events and flooding
- Droughts
- Rising sea levels that threaten infrastructure
- Saltwater intrusion of our groundwater resources, which could impact drinking water supplies
- Poor indoor air quality (such as mold and moisture)
- Deteriorating outdoor air quality
- Partially ground-level ozone that increases with rising temperatures.

COMMUNITIES OF COLOR

Some communities of color living in risk-prone areas face cumulative exposure to multiple pollutants.

Adaptation plans that consider these communities and improve access to healthcare help address social inequities.

OLDER ADULTS

Older adults are vulnerable to extreme events that cause power outages or require evacuation.

Checking on elderly neighbors and proper emergency communication can save lives.

CHILDREN

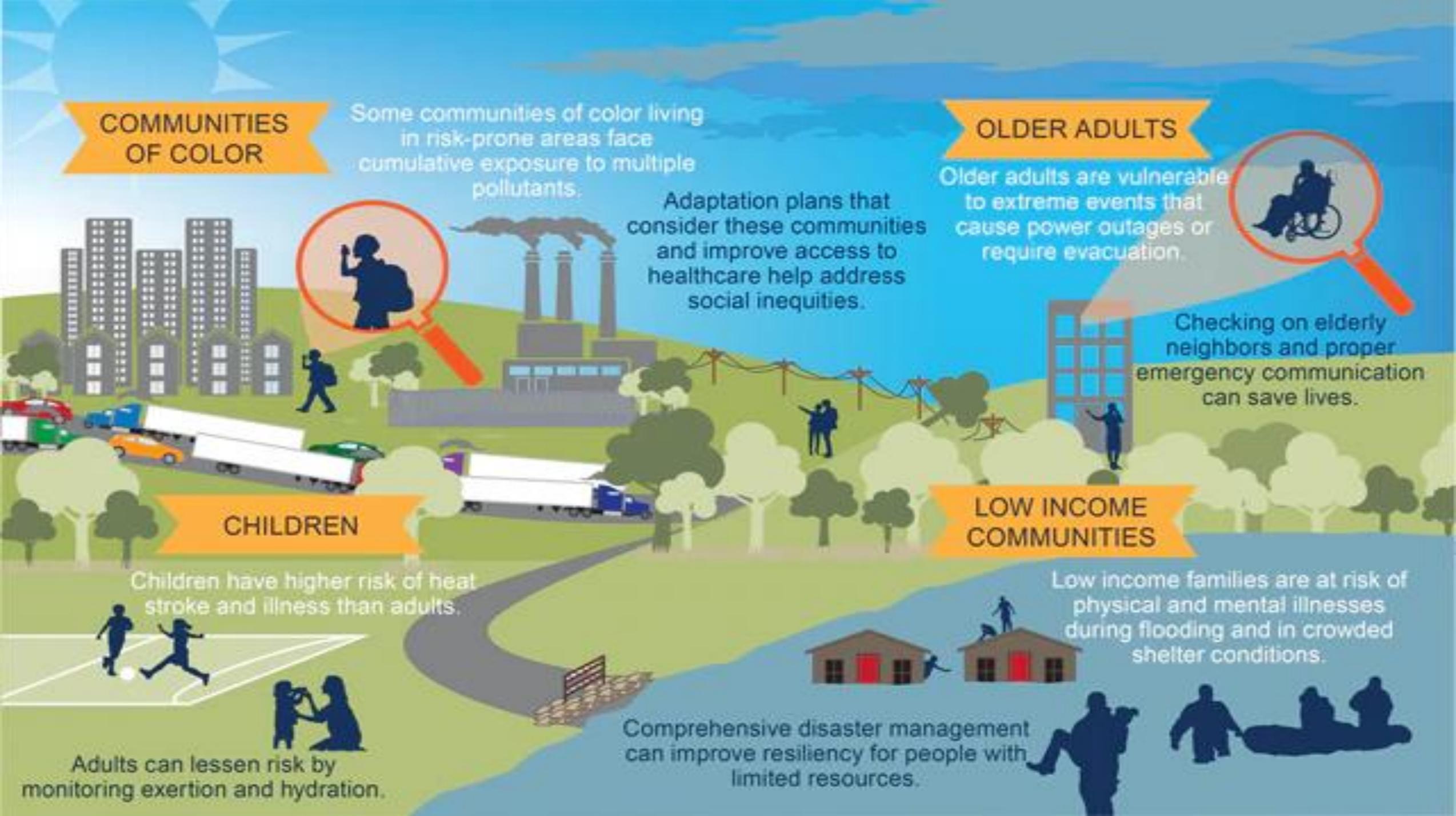
Children have higher risk of heat stroke and illness than adults.

Adults can lessen risk by monitoring exertion and hydration.

LOW INCOME COMMUNITIES

Low income families are at risk of physical and mental illnesses during flooding and in crowded shelter conditions.

Comprehensive disaster management can improve resiliency for people with limited resources.



Key Topic 4:
New York policies and
programs for adapting to
a changing climate

Policies for Climate Change

- DEC Commissioner's policy 49 provides guidance to agency divisions, offices, and regions regarding the incorporation of climate change considerations into agency activities.
 - ❖ CP-49 was revised to reflect the requirements of Sections 7 and 9 of the Climate Act
- New York's Reforming the Energy Vision, NY-Sun Program, the Clean Energy Standard, Evolve NY, Drive Clean Rebates, Clean Energy Communities and the Clean Energy Fund are all examples of existing climate leadership
- Climate Smart Communities is a multi agency program that helps local governments take action to reduce GHG emissions and adapt to a changing climate, including grants for climate mitigation and adaptation projects.

The Climate Act

- Signed into law on July 18, 2019
- Cemented the State's position as a leader in combating climate change
- Builds up the state's clean energy and GHG emission reduction policies, codifying critical goals as statutory requirements

Policies

- Editors from over 200 medical journals united to issue to call for urgent government action to address global warming and protect public health and nature.
- Policies to limit the magnitude of climate change may offer direct ancillary benefits such as reducing the emission of air pollutants and lowering the dependence on imported petroleum fuels.
- The use of offsets as a climate policy may have indirect but beneficial effects of forestry and agriculture practices

Policies

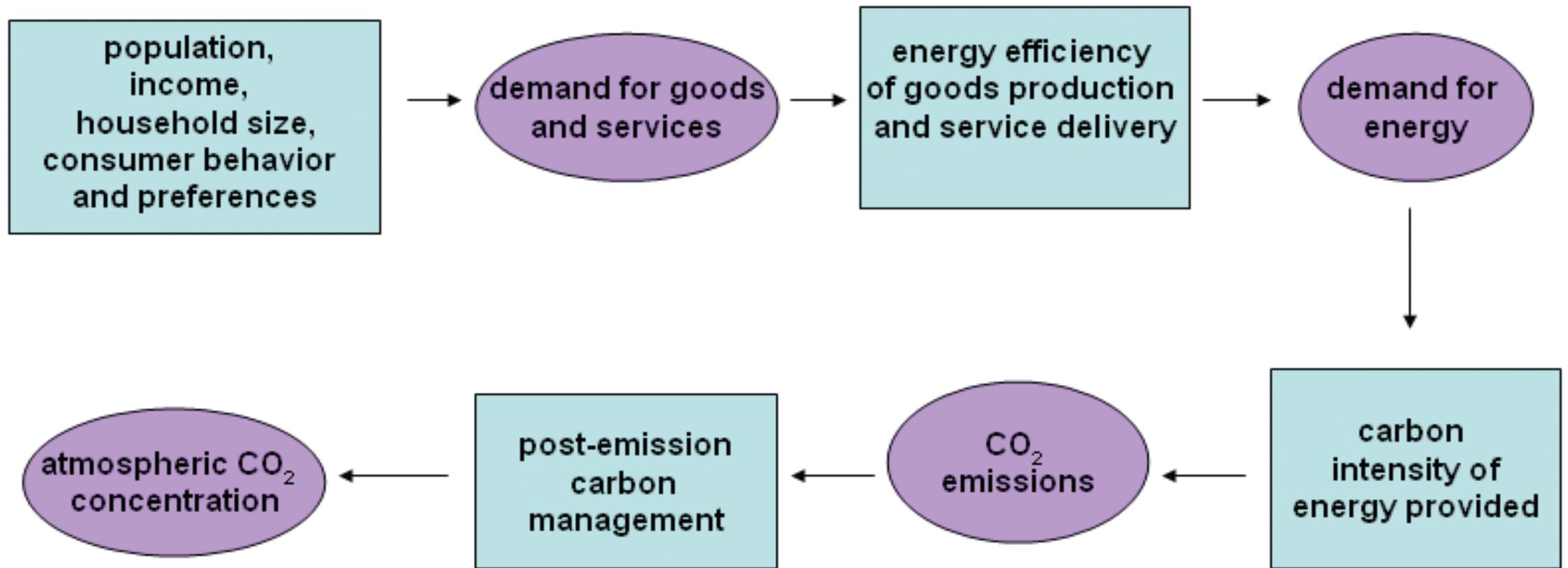
- The development of sound policy to mitigate GHG emissions and adapt to the changing climate will provide direct and indirect public health benefits.
- Direct benefits:
 - ❖ Reducing many public health impacts associated with climate change
- Indirect benefits:
 - ❖ Reducing air pollutant emissions
 - ❖ Encouraging active transport (such as walking and cycling)
 - ❖ Reducing home health risks through building energy efficiency retrofit interventions

Policies

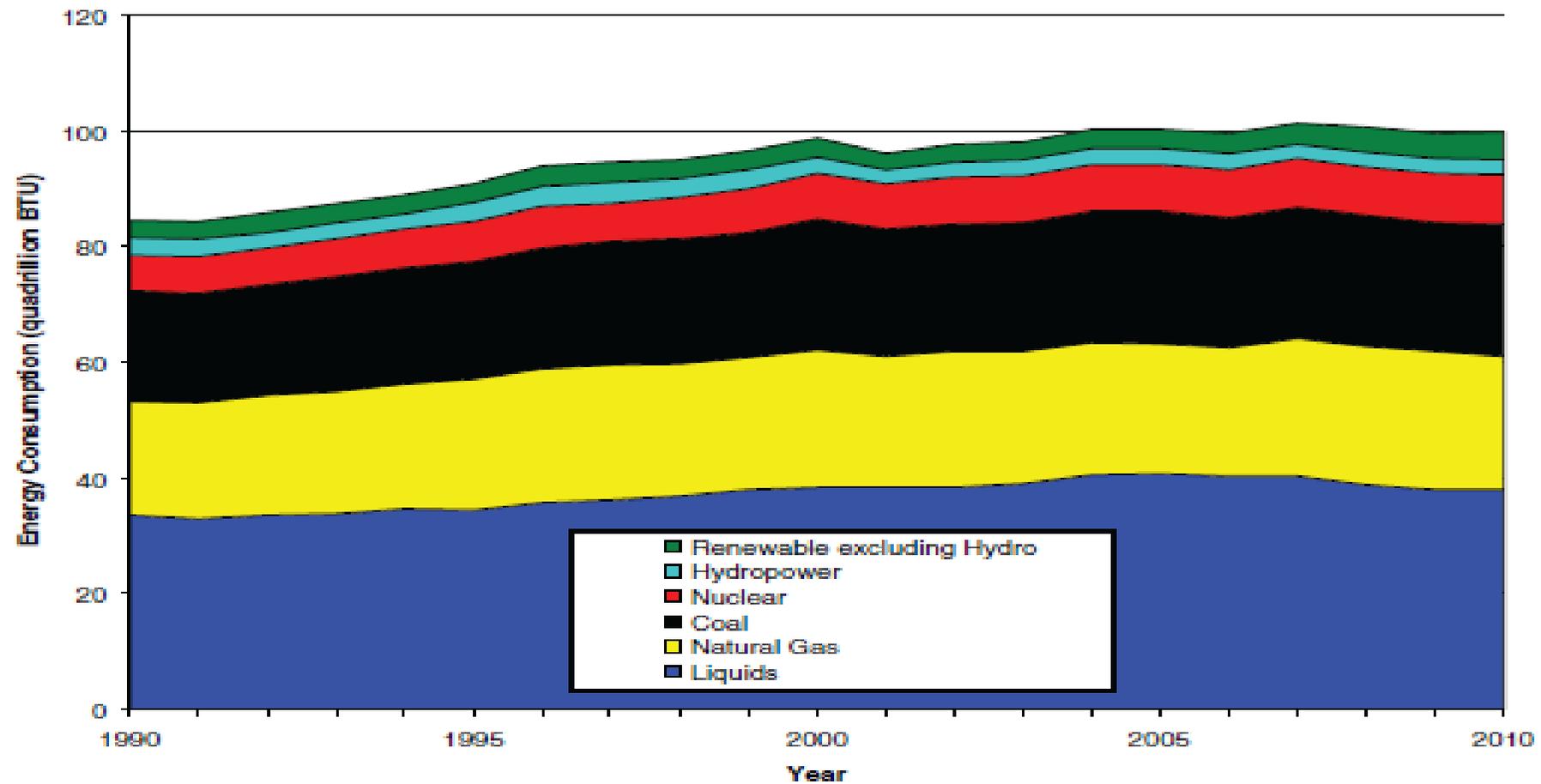
- State and federal government programs to control air pollutant emissions through regulations and permitting have contributed to greatly improved air quality in NY over the last 40 years.
- Concentrations of non-criteria pollutants attributed to fuel combustion have also decreased significantly over the last decade, due to programs and regulations directed at reducing transportation source pollution.
- Recent studies of long-term air quality trends in NYC demonstrate that enactment of local and regional clean air regulations as well as change in fuel usage significantly reduced ambient levels of particulate matter

Policies

- To accelerate the reduction of oil use in the transportation sector
 - ❖ Savings of \$45-55 per ton of CO₂
- To capture the full benefit of emissions-limiting actions, especially in low and middle income countries
 - ❖ Benefits associated with reducing air pollution and improving forestry and agriculture practices can be particularly large in low and middle income countries
- To reduce emissions of methane, short-lived pollutants and potent GHG's
 - ❖ These emissions lead to adverse human health effects on broad region levels
- To encourage climate policy actions that result in closure or upgrading of electric power plants with large health impacts.



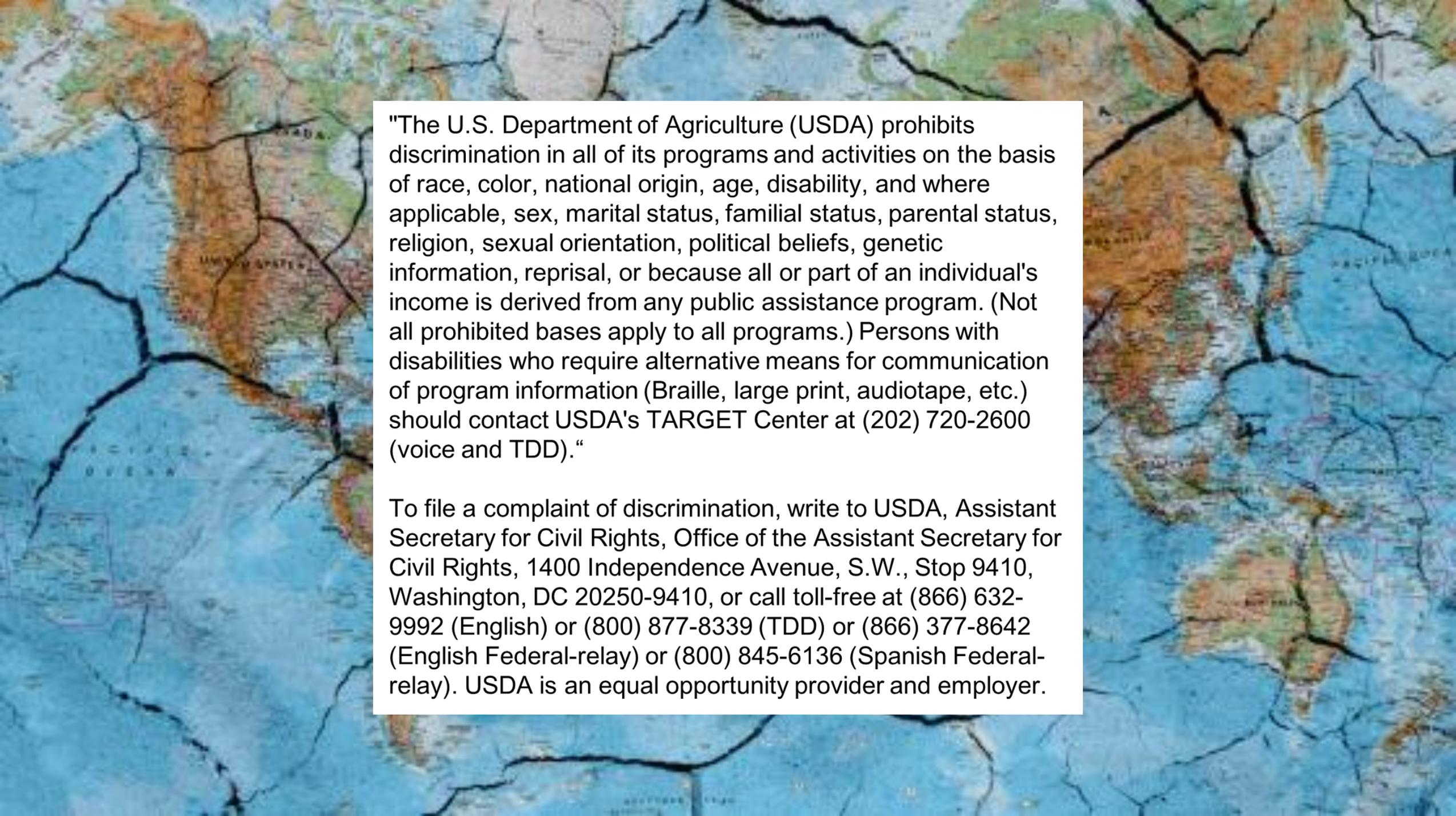
The chain of factors that determine how much CO₂ accumulates in the atmosphere. The blue boxes represent factors that can potentially be influenced to affect the outcomes in the purple circles.



U.S. primary energy use, 1990 to 2010. Fossil fuels are the dominant energy source over this period. “Liquids” refers petroleum products including gasoline, natural gas plant liquids, and crude oil burned as fuel, but it does not include the fuel ethanol portion of motor gasoline. SOURCE: EIA (2009).

A satellite-style image of Earth showing clouds and landmasses, with the word "Questions?" overlaid in white text. The image is framed by a thin white circular border. The Earth's surface is covered in a complex pattern of white and grey clouds, with green and brown landmasses visible. The word "Questions?" is centered in the middle of the image in a white, sans-serif font. Below the text, there is a thin orange horizontal line.

Questions?



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