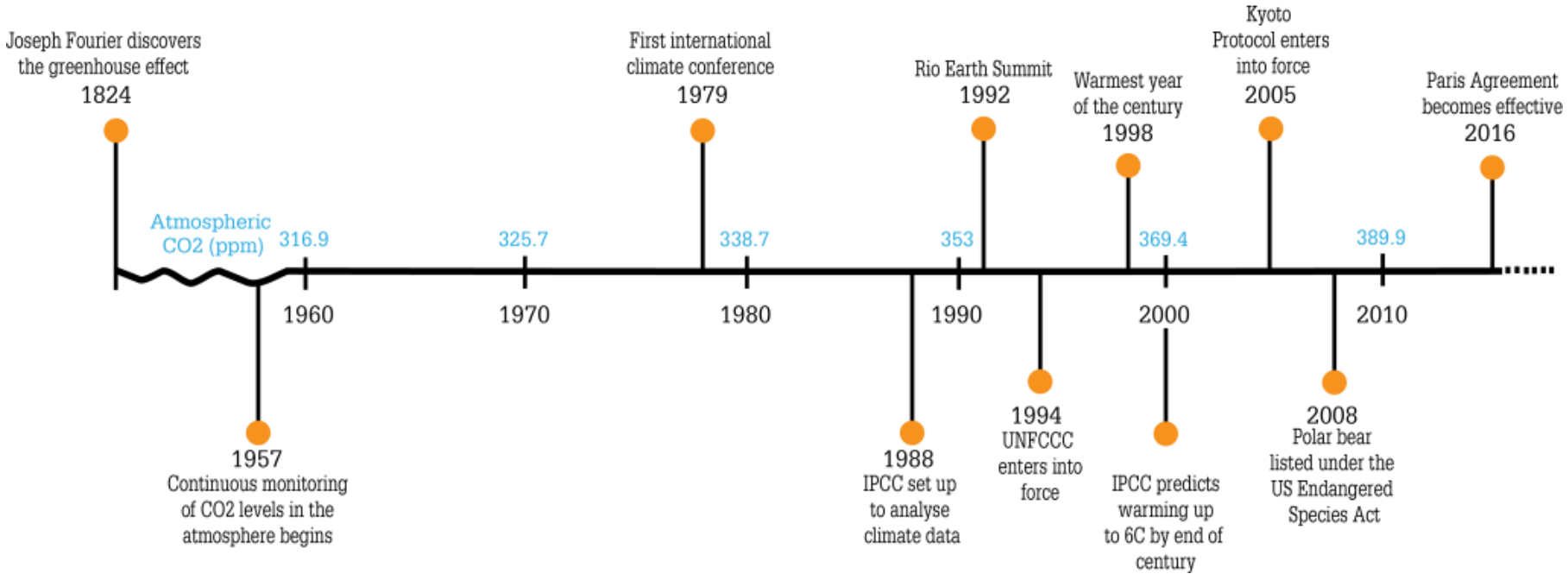
Developing the Next Generation of Female Environmentalists

Introduction to Climate Change



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May 10, 2023

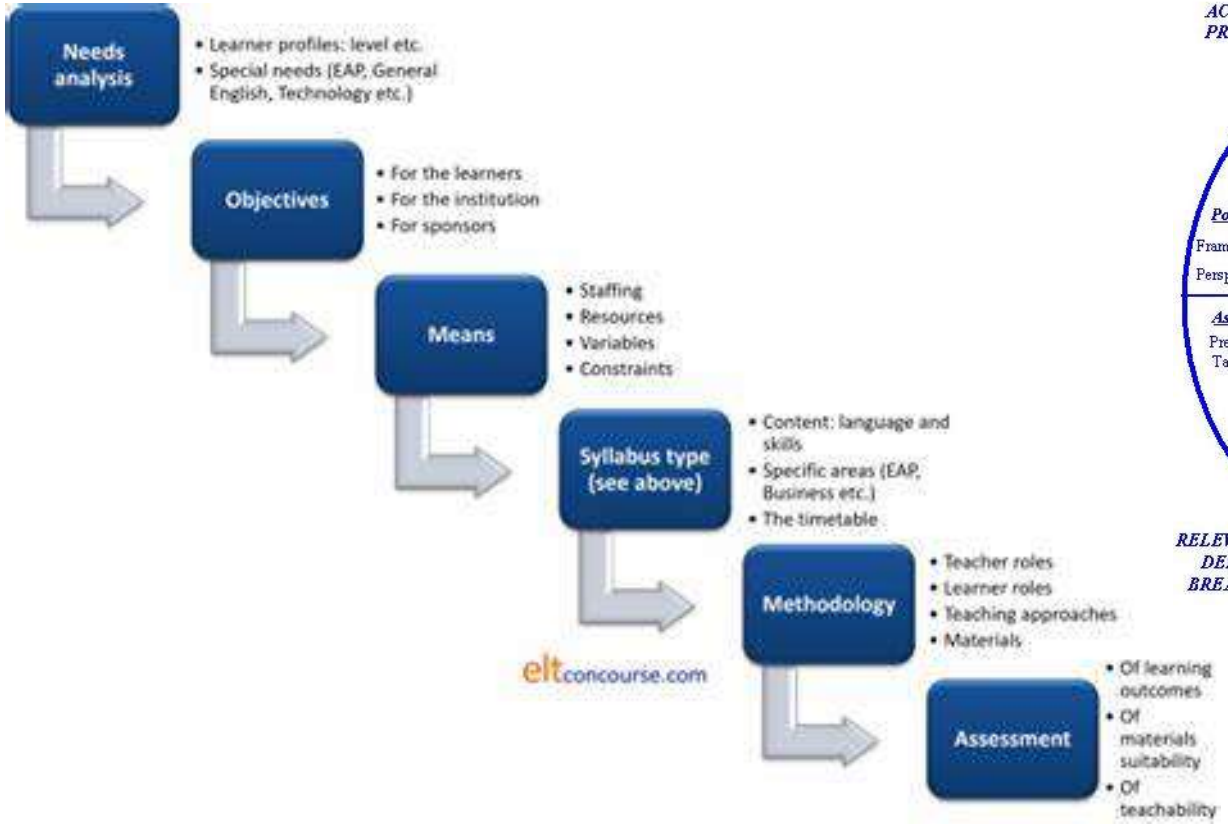
University of Nebraska Lincoln

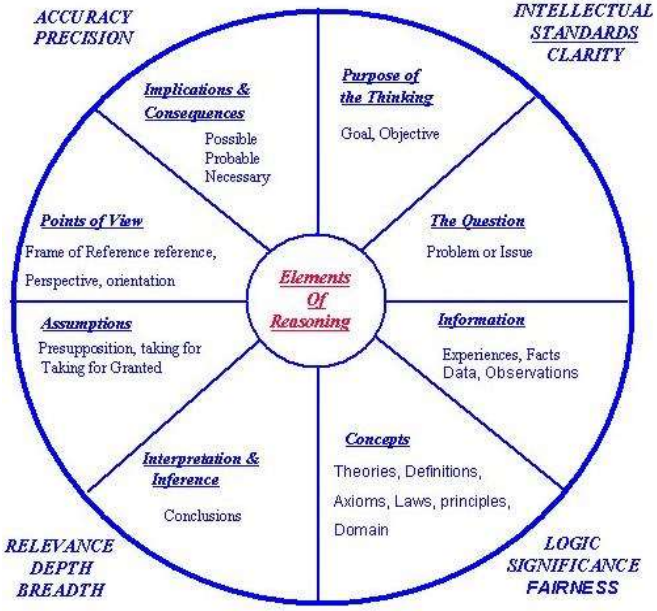
The Peter Kiewit Institute

Course Description & Training outcomes

- **Course description: This course will:**
  - Explain the pedagogy−how to teach it
    - Ways of thinking, methods, strategies, rationales, and theoretical justifications for teaching climate issues at the university level
    - Demonstrate how to teach some topics, e.g., greenhouse effects; impacts and how to cope with climate change
- **Training outcomes:** Understand how to:
    - Find info (sources)
    - Tailor the course materials as per audiences
    - Develop a syllabus with major course contents
    - Consider the interactions between the audience & instructor
    - Address related issues
    - Reflect different social, political, and cultural contexts.

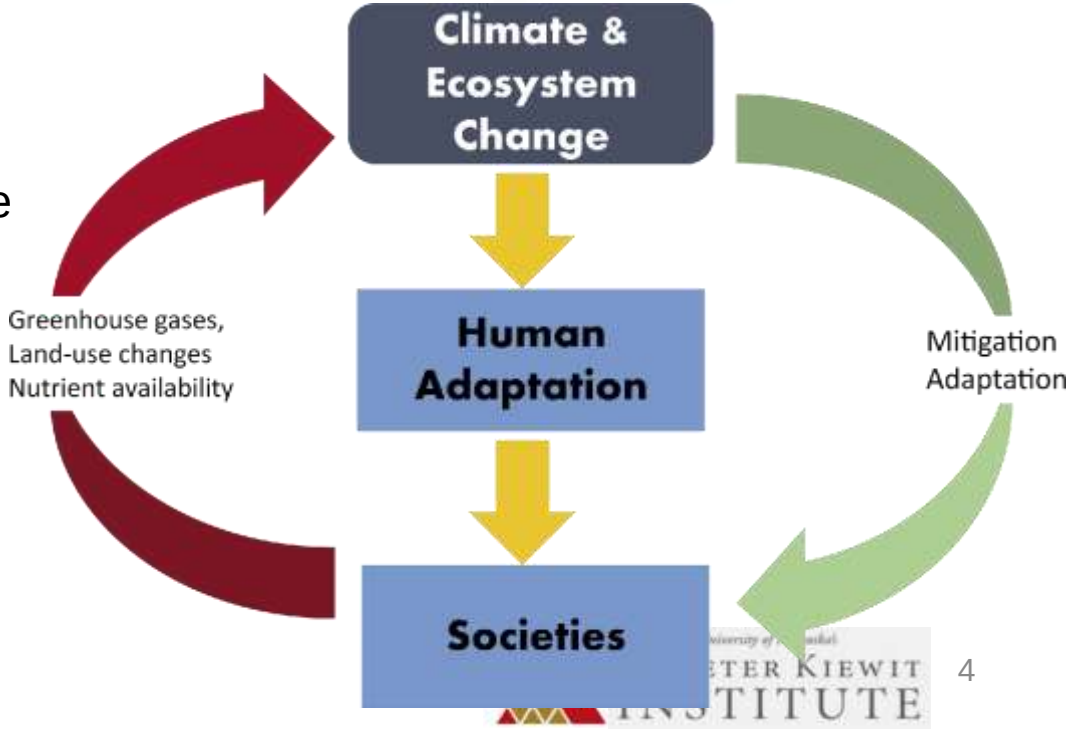
Part I: Ways of Thinking in Info Collection, Course Design & Delivery





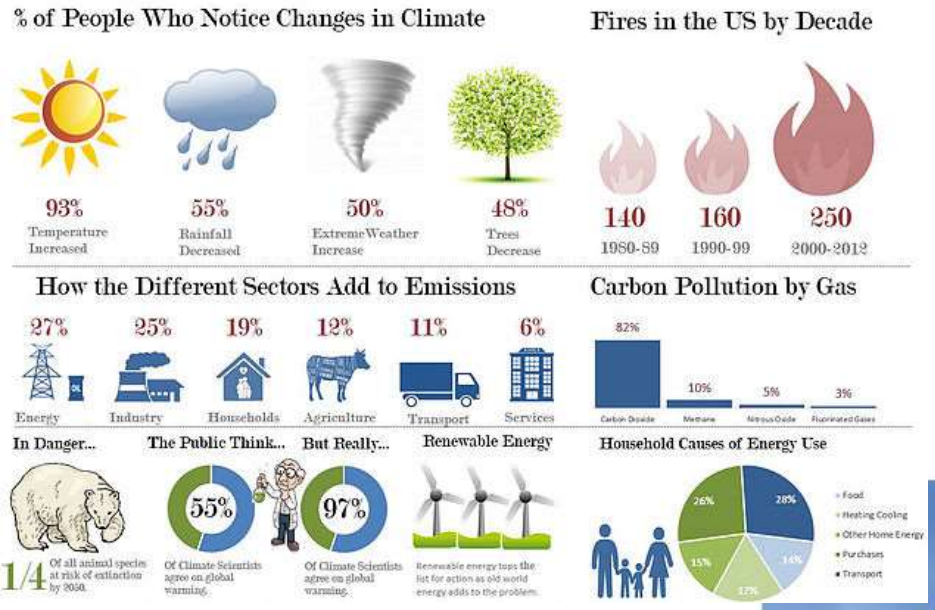
Understanding Audiences & Course Boundary

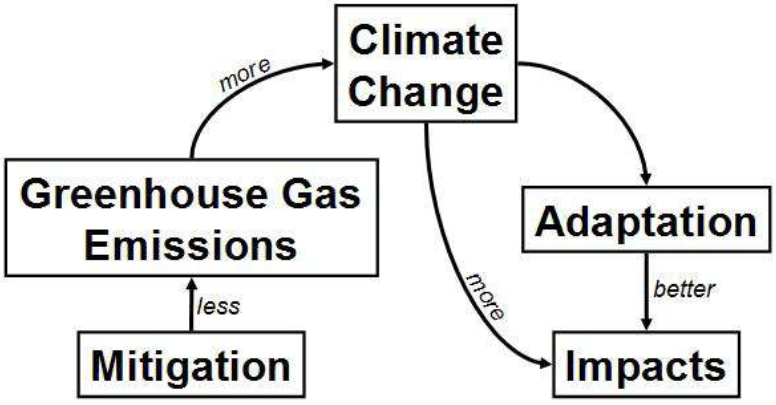
- Your audience? A wide range of disciplines
  - STEM students
    - General Sci./Eng. (e.g., IT, Agricultural/Natural Sci.)
    - Civil Eng., Environ. Sci./Eng., Chem. Eng.
  - Social/human Sci./Education/Fine Arts/Public Affairs
    - Journalism & Mass Communications
  - Law School/Business Adm./Medical School….
- Broader institutional focus/thinking
  - Difference between
    - Law school
    - Medical school
    - Business school
    - College of engineering
- Engagement of resources/knowledge
- Other factors
  - Environmental/economic factors
  - Global/cultural/social



Focus to What?

Complexity of Climate Change





Source: Corporate interviews conducted by BCG in Q3-4 2019; most interviewees are part of the World Economic Forum Alliance of CEO Climate Leaders

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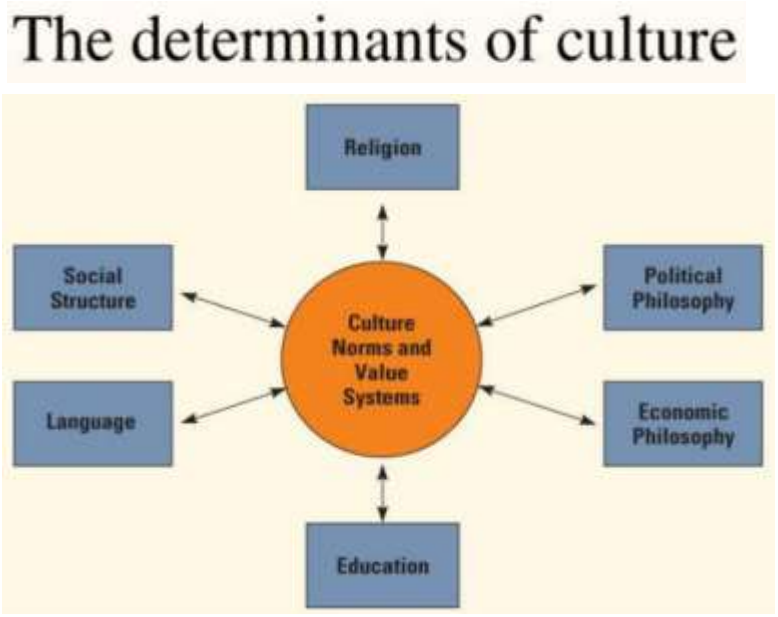
Locations and Cultural Difference



Cultural Difference

<Korea>	<Israel>
Respect for authority(ages)	Against authority
Relationship first	Targeting subject first
Development of Verb	Development of Noun
Afraid of losing face	Chutzpah
Afraid of failure/Risk averter	Not afraid of failure/Risk lover
Euphemistic/Indirect	Straight forward/Direct
Long-term goal-oriented	Short-term improvised
Compliance & concession	Resistance & struggle
Self-restraint	Independent judgment
Narrow window of conscience	Wide window of conscience

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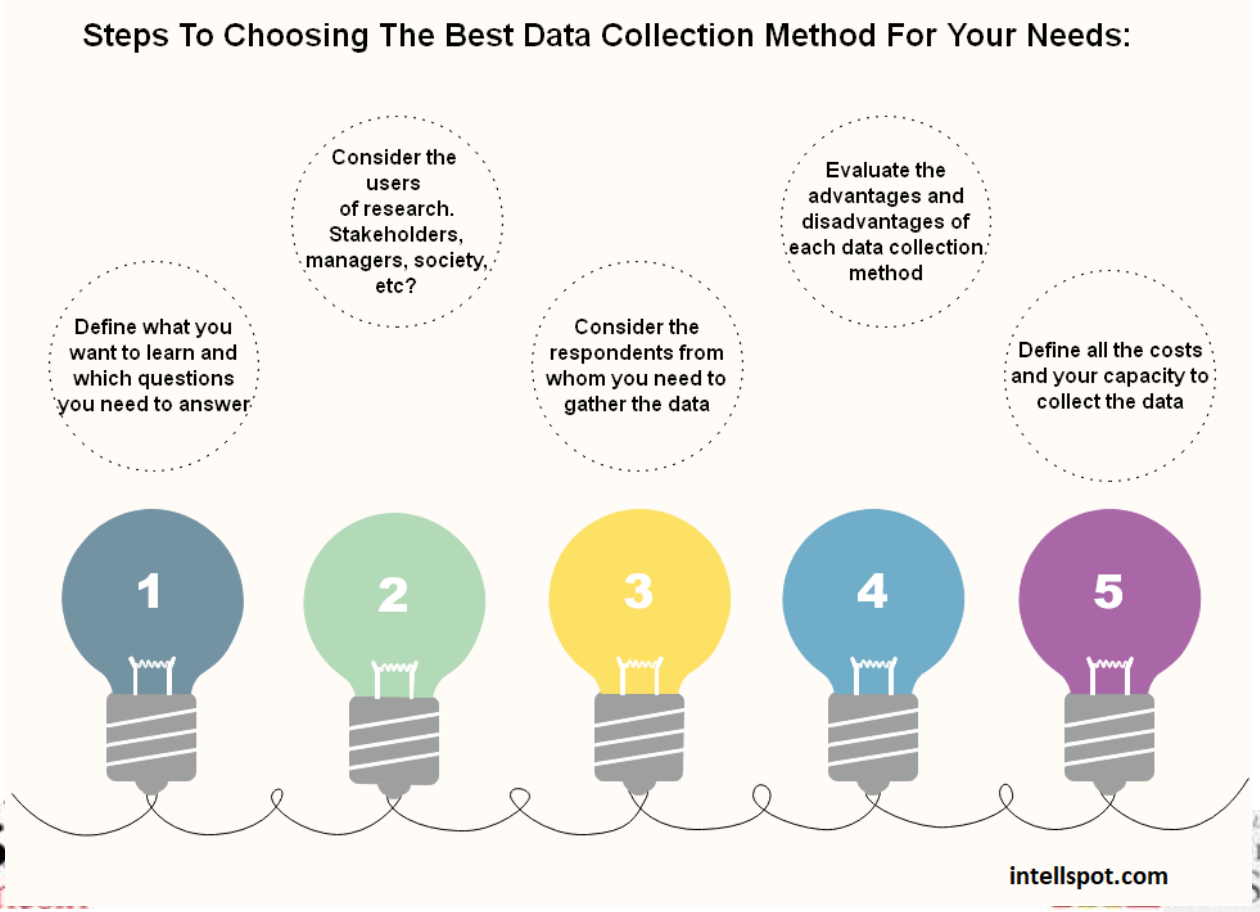
Part II: Collecting/tailoring Course Info/Materials



Where to find Info?

- 350.orgInternational campaign that is building a movement to unite the world around solutions to the climate crisis. Their mission is to inspire the world to rise to the challenge of the climate crisis—to create a new sense of urgency and of possibility for our planet. The focus is on the number 350--as in parts per million CO2. Scientists say that if we can't get below that number, the damage we're already seeing from global warming will continue and accelerate.
- Architecture 2030Non-profit, non-partisan and independent organization whose mission is to rapidly transform the US and global Building Sector from the major contributor of greenhouse gas emissions to a central part of the solution to the global-warming, energy consumption, and economic crises.
- Association for the Advancement of Sustainability in Higher Education (AASHE)
- BiocharCharcoal used for agricultural purposes. Created using a pyrolysis process, heating biomass in a low oxygen environment. Once the pyrolysis reaction has begun, it is self-sustaining, requiring no outside energy input.
- Biodiversity for a Livable ClimatePromotes the great potential of inexpensive, low-tech and powerful Nature solutions to the biodiversity and climate crises, and works to inspire urgent action and widespread implementation of many regenerative practices.
- Biodiversity for a Living ClimateCollaborates with organizations around the globe to advocate for the restoration of soil, and of grassland, forest, wetland, coastal and ocean ecosystems–along with the associated carbon, water and nutrient cycles – to draw down excess atmospheric greenhouse gases, cool the biosphere, and reverse global warming, for the benefit of all people and all life on earth.
- Climate + Energy ProjectSupports lively, informed conversations about our energy future. Helps halt the Midwest's contributions to global warming and climate change. Supports the reduction of greenhouse gas emissions by increasing energy efficiency and developing renewable energies in a sustainable manner.
- Climate CountsA collaborative effort to bring consumers and companies together in the fight against global climate change.
- Climate Science CentersProvides scientific information, tools and techniques that land, water, wildlife and cultural resource managers and other interested parties can apply to anticipate, monitor and adapt to climate and ecologically-driven responses at regional-to-local scales.
- Committee on Global Warming & Climate Change - House
- Committee on Global Warming & Climate Change - Senate
- Intergovernmental Panel on Climate ChangeUnited Nations body for assessing the science related to climate change.
- Kyoto ProtocolInternational agreement linked to the United Nations Framework Convention on Climate Change. Its major feature is a binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions by an average of 5% against 1990 levels over the five-year period 2008-2012.
- Mothers Out Front
- Regeneration InternationalProject of the Organic Consumers Association and a 501(c)(3) nonprofit dedicated to building a global network of farmers, scientists, businesses, activists, educators, journalists, governments and consumers who will promote and put into practice regenerative agriculture and land-use practices that: provide abundant, nutritious food; revive local economies; rebuild soil fertility and biodiversity; and restore climate stability by returning carbon to the soil, through the natural process of photosynthesis.
- Savory InstituteLivestock management brain trust that connects the dots between climate change, water scarcity, energy shortages, global health, food security and women's empowerment. Develops innovative tools and enhanced curricula, inform policy, establish market incentives, increase public awareness, and coordinate relevant research, cultivating relationships with aligned partners.
- Soil4Climate: Restoring Soil to Reverse Global WarmingNonprofit organization that advocates for soil restoration as a climate solution. We promote regenerative land management practices to capture atmospheric carbon and encourage collaboration with the larger body of climate activism.
- U.S. Environmental Protection Agency Provides information on climate change for communities, individuals, businesses, states, localities and governments.
- United Nations Framework Convention on Climate ChangeAn international treaty signed by most countries in order to reduce global warming and cope with whatever temperature increases are inevitable.

Example 1: USEPA Climate Change Website (1)

Added security | https://www.epa.gov/climate-change

An official website of the United States government Here's how you know

EPA United States Environmental Protection Agency

Search EPA.gov

Environmental Topics | Laws & Regulations | Report a Violation | About EPA

- Climate Change Science
- Greenhouse Gas Emissions
- Climate Change Indicators
- Climate Change Impacts
  - Climate Change and Human Health
  - Impacts by Sector
  - Climate Equity

- What EPA Is Doing
  - Regulatory Actions and Initiatives
  - Partnership Programs
  - International Climate Partnerships
  - Bipartisan Infrastructure Law
  - Inflation Reduction Act
- What You Can Do
- Climate Change Resources for Educators and Students

- Energy and the Environment
- State and Local Climate and Energy Program
- Climate and Transportation
- Climate and Waste
- Climate and Water
- Climate and Indoor Air Quality
- Climate Change Research
- Climate Adaptation
- Tribal Air and Climate Resources

Example 1: USEPA Climate Change Website (2)

The earth's climate is changing. Multiple lines of evidence show changes in our weather, oceans, ecosystems, and more. EPA is committed to providing the most up-to-date and accurate climate-science information, including basics, causes, indicators, and impacts of climate change.

"Climate facts are back on EPA's website where they should be... Trustworthy, science-based information is at the foundation of strong, achievable solutions."

— U.S. EPA Administrator Michael S. Regan

Basics

Learn about some of the key, foundational concepts related to climate change.

Learn the basics

Causes

Get to know the main drivers of climate change and how they contribute to a warming climate.

See the causes

Impacts

As the climate changes, U.S. regions will experience that change differently.

View the impacts

Example 1: USEPA Climate Change Website (3)

Climate Change Impacts by Sectors:

Explore the sectors:

- Agriculture and Food Supply
- Air Quality
- Built Environment
- Coasts
- Ecosystems
- Energy
- Freshwater Resources
- Forests
- Health
- Ocean and Marine Resources
- Transportation

Climate Equity: Impacts on vulnerable populations

Part of understanding climate equity is recognizing specific populations that are particularly vulnerable to climate change impacts. You can learn more about the relationship between exposure, vulnerability, and human health by how they interact within communities. In addition, you can explore the impacts on certain groups in greater detail by visiting the following pages:

- Children
- Socially Vulnerable People
- Indigenous Populations
- Older Adults
- People with Chronic Medical Conditions
- People with Disabilities
- Workers
- Pregnant Women

Related Resources

Learn more about environmental justice and climate equity:

- Environmental Justice at EPA
- EJScreen: Environmental Justice Screening and Mapping Tool
- Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts
- Creating Equitable, Healthy, and Sustainable Communities
- National Environmental Justice Advisory Council
- Heat Islands and Equity
- Environmental Justice Primer for Ports

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Example 2: UN's IPCC Website (1)

- Four working groups (WGs)
  - WG1: assesses the physical science of climate change.
  - WG2: Impacts, Adaptation and Vulnerability
  - WG3: Mitigation of Climate Change
  - TFI: The Task Force on National Greenhouse Gas Inventories

Example 2: UN's IPCC Website (2)

Reports

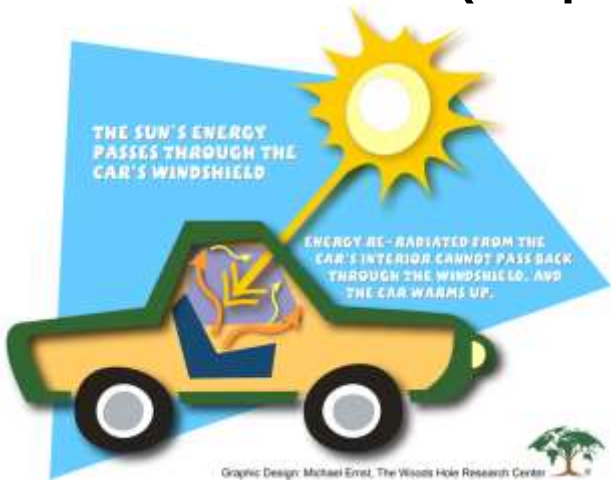
Since the IPCC was created in 1988, there have been 6 Synthesis Reports:

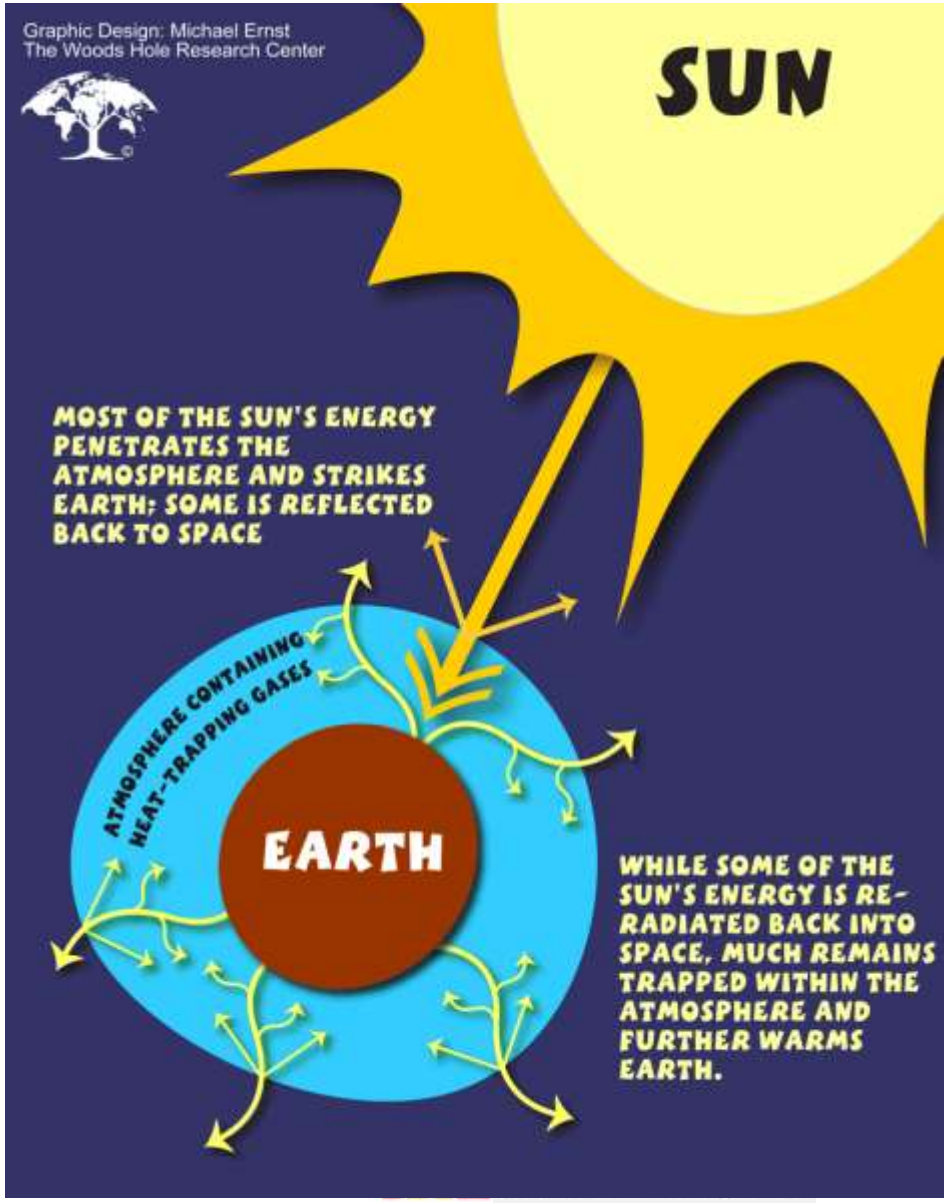
- The Overview of the First Assessment Report (1990)
- The IPCC Second Assessment Report Synthesis of Scientific-technical Information Relevant to Interpreting Article 2 of the UNFCCC (1995)
- The Synthesis Report of the Third Assessment Report (2001)
- The Synthesis Report of the Fourth Assessment Report (2007)
- The Synthesis Report of the Fifth Assessment Report (2014)
- The Synthesis Report of the Sixth Assessment Report (2023) – Subject to copy edit

The AR6 Synthesis Report is based on the three Working Group contributions to the AR6 as well as on the three Special Reports prepared in this assessment cycle.

Tailoring Info Accordingly (1)

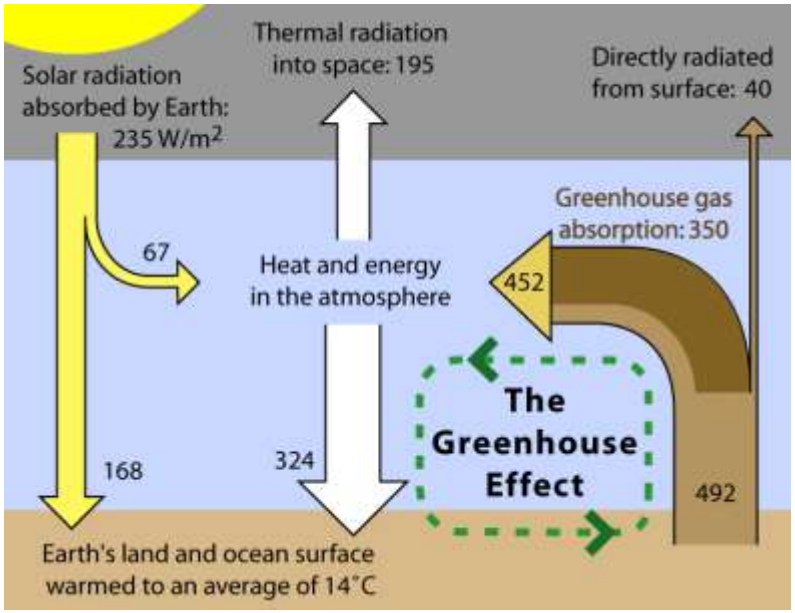
Greenhouse effect (simpler way):

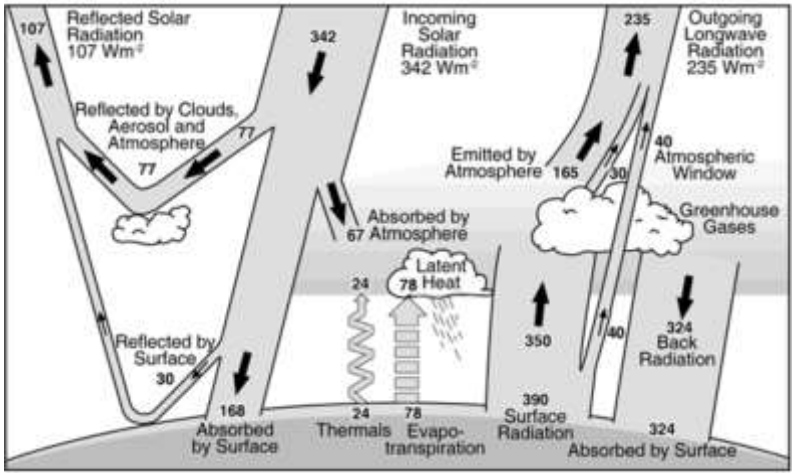


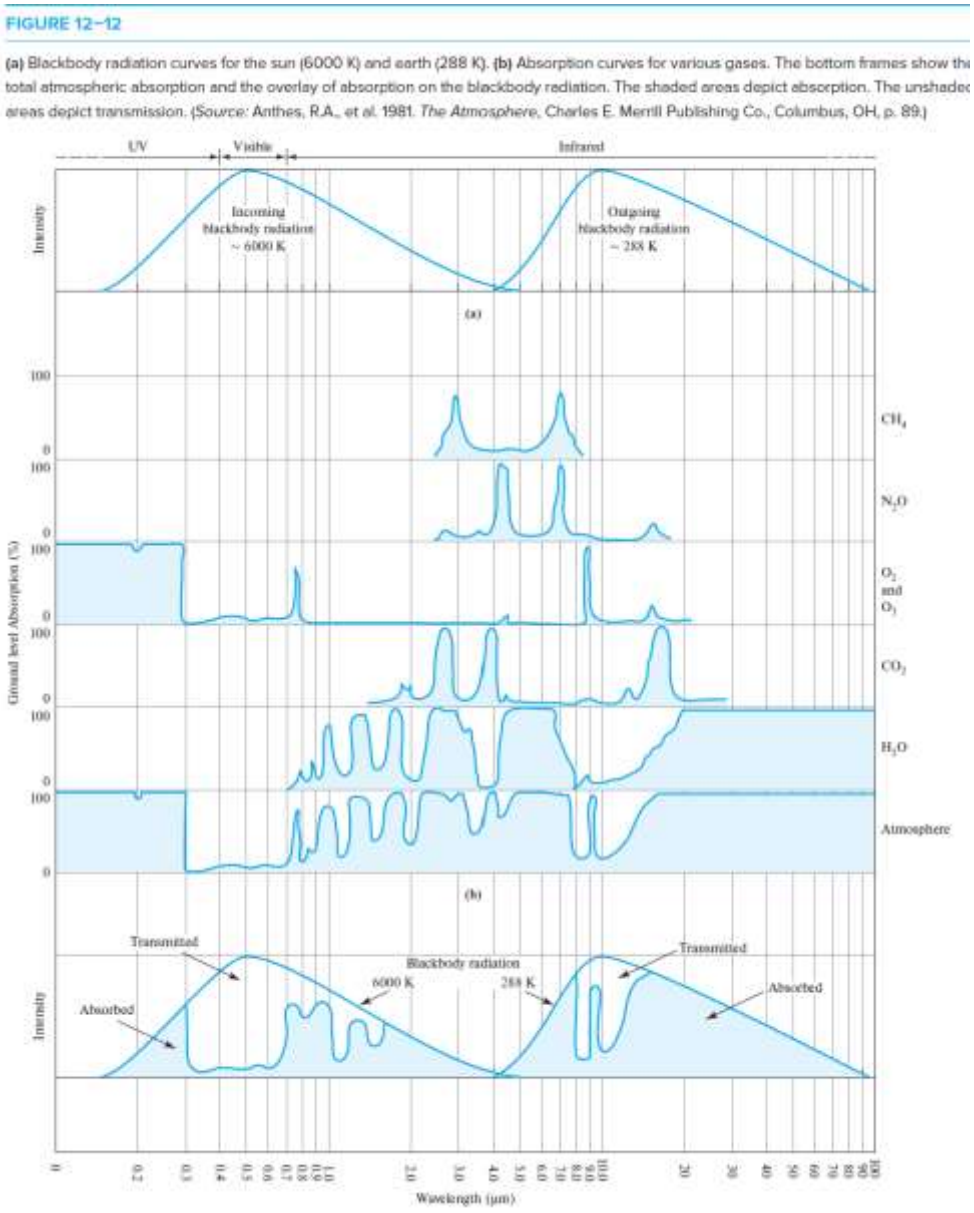


Tailoring Info Accordingly (2)

Greenhouse effect (more sci. way):

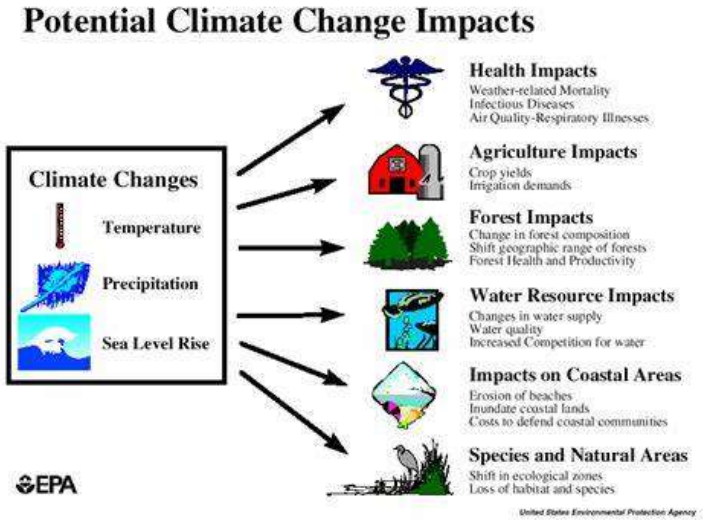


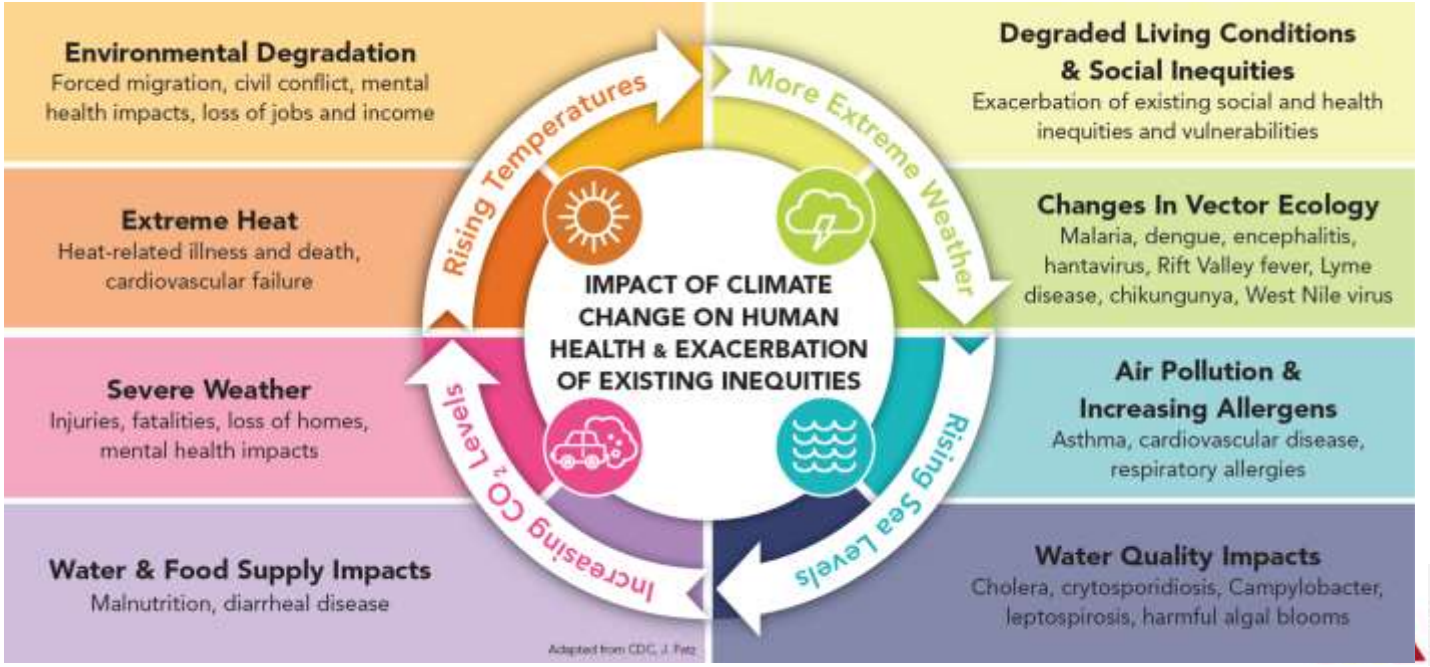




Tailoring Info Accordingly (3)

Climate Impacts (simple way):





Tailoring Info Accordingly (4)

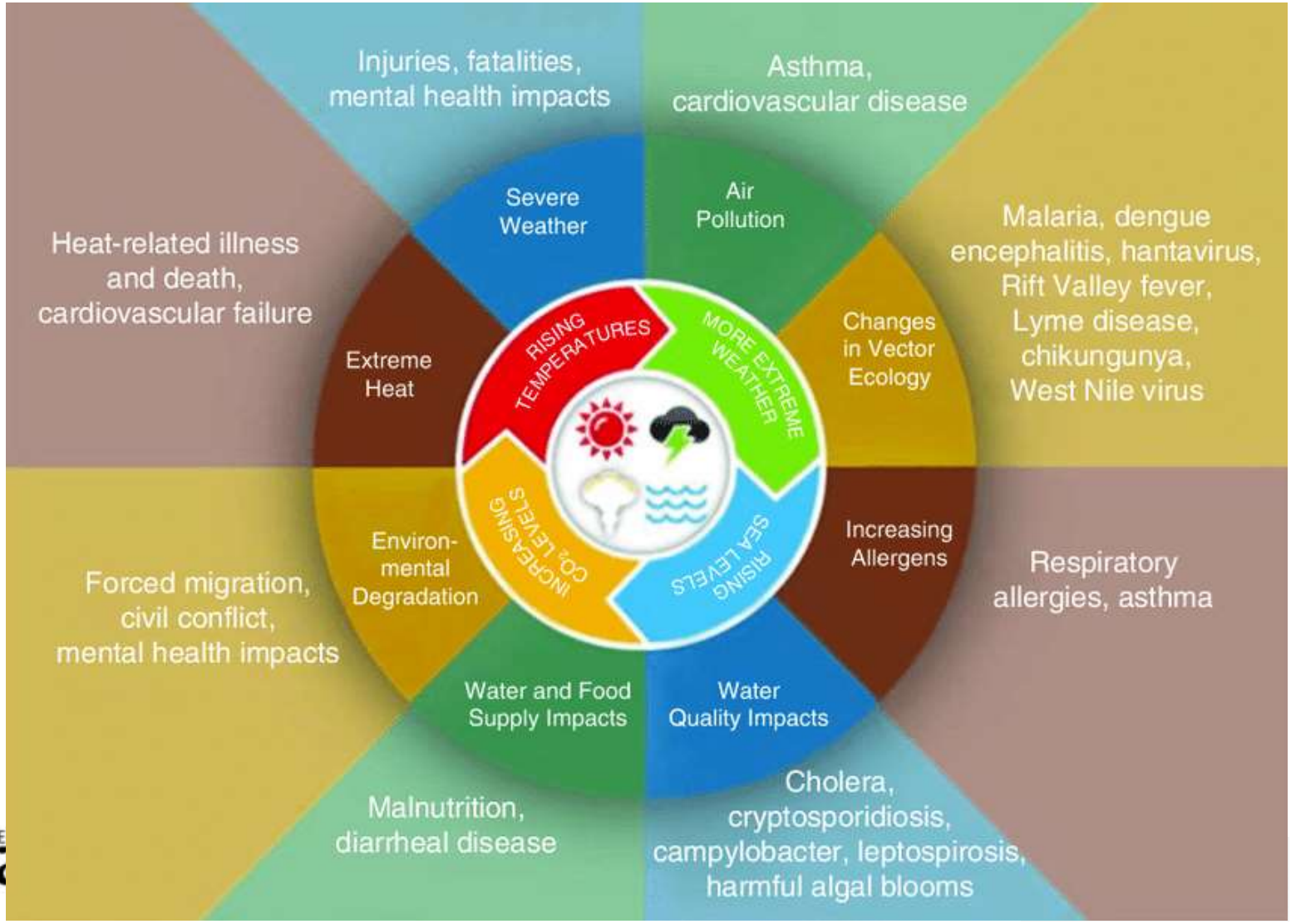
Climate Change Impacts (more sci. way):

Major impacts of GHG emissions and climate changes

Impact	Brief description
Higher temperatures	The five hottest years on record have all occurred since 1997. About 93.4% of global warming goes into the ocean.
Changing landscapes	Climate change is causing vegetation shifts and conservation challenges.
Rising seas	Sea level rises from climate change could displace tens of millions of people, causing a huge negative environmental impact.
Increased risks of natural disasters	Global warming is speeding up the cycling of water between the ocean, atmosphere and land, making natural disasters more frequent and severe.
More threats of human health	Climate change brings more health risks associated with heat-related morbidity/mortality, disease, and worse air quality.
Biodiversity and wildlife at risk	Through a complex interaction of species and their habitats, climate change impacts biodiversity via changes in habitats and their ecological functions.
Social/economic impacts	Climate change also contributes to social disruption, economic decline and displacement of regional populations.

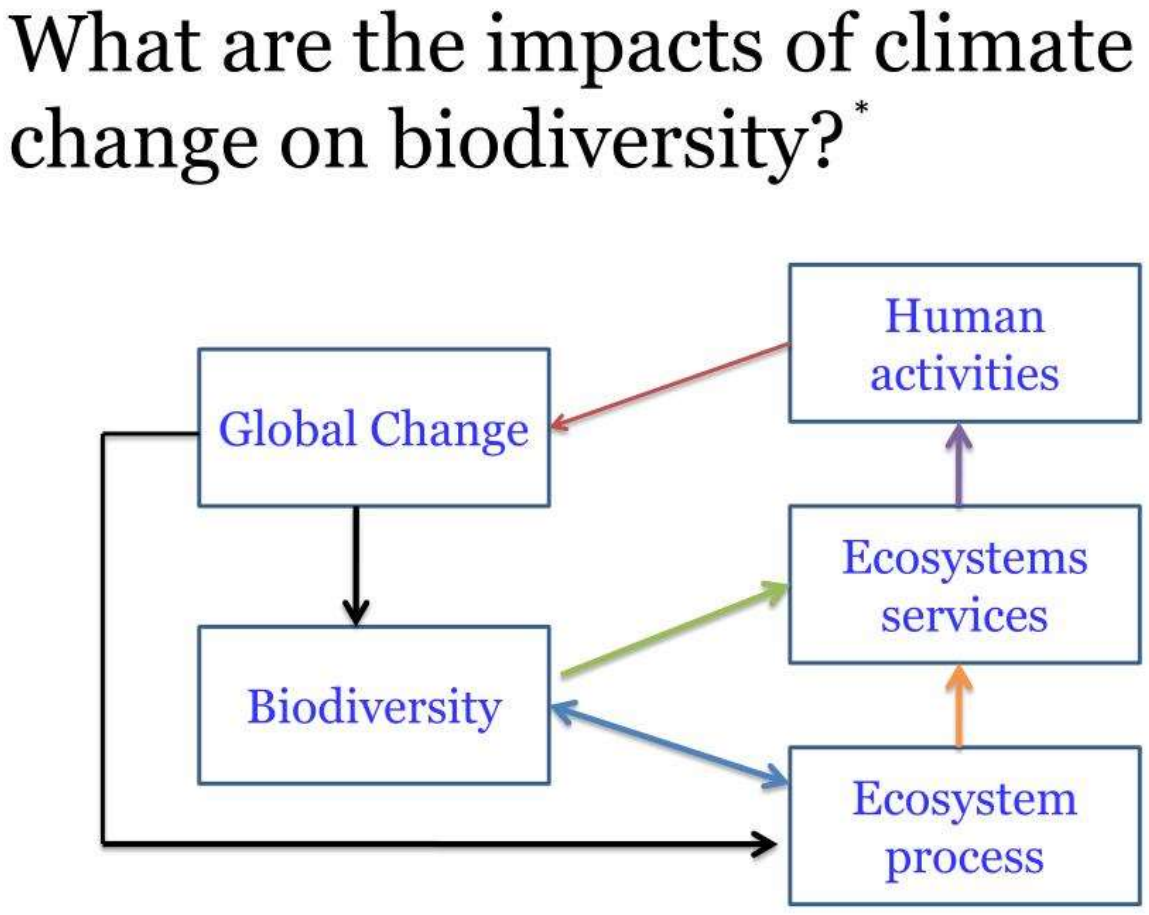
Tailoring Info Accordingly (5)

Climate Change Impacts (more sci. way):



Tailoring Info Accordingly (6)

Climate Change Impacts (more sci. way):



Tailoring Info Accordingly (7)

Mitigation of Climate Change (simples way):

Mitigation Strategy #1: Transportation Efficiency

A car that gets 30 mpg releases 1 ton of carbon into the air for every 10,000 miles of driving

Fuel efficient cars get more miles per gallon (mpg)

Increasing the fuel efficiency of cars will reduce the amount of CO_2 emitted into the atmosphere

Mitigation Strategy #2: Transport Conservation

With more cars on the road, the amount of CO_2 emitted steadily increases.

Reducing the time and number of cars on the road will reduce emissions.

Increasing the use of public transportation would reduce the amount of individual driving time.

Mitigation Strategy #3: Building Efficiency

Providing electricity, transportation, and heat for buildings produces high levels of CO_2 emission.

Reducing heating and energy use would reduce the amount of carbon released into the atmosphere.

Insulating buildings, using alternative energy sources, and solar water heating are ways to reduce emissions.

Mitigation Strategy #4: Efficient Electricity Production

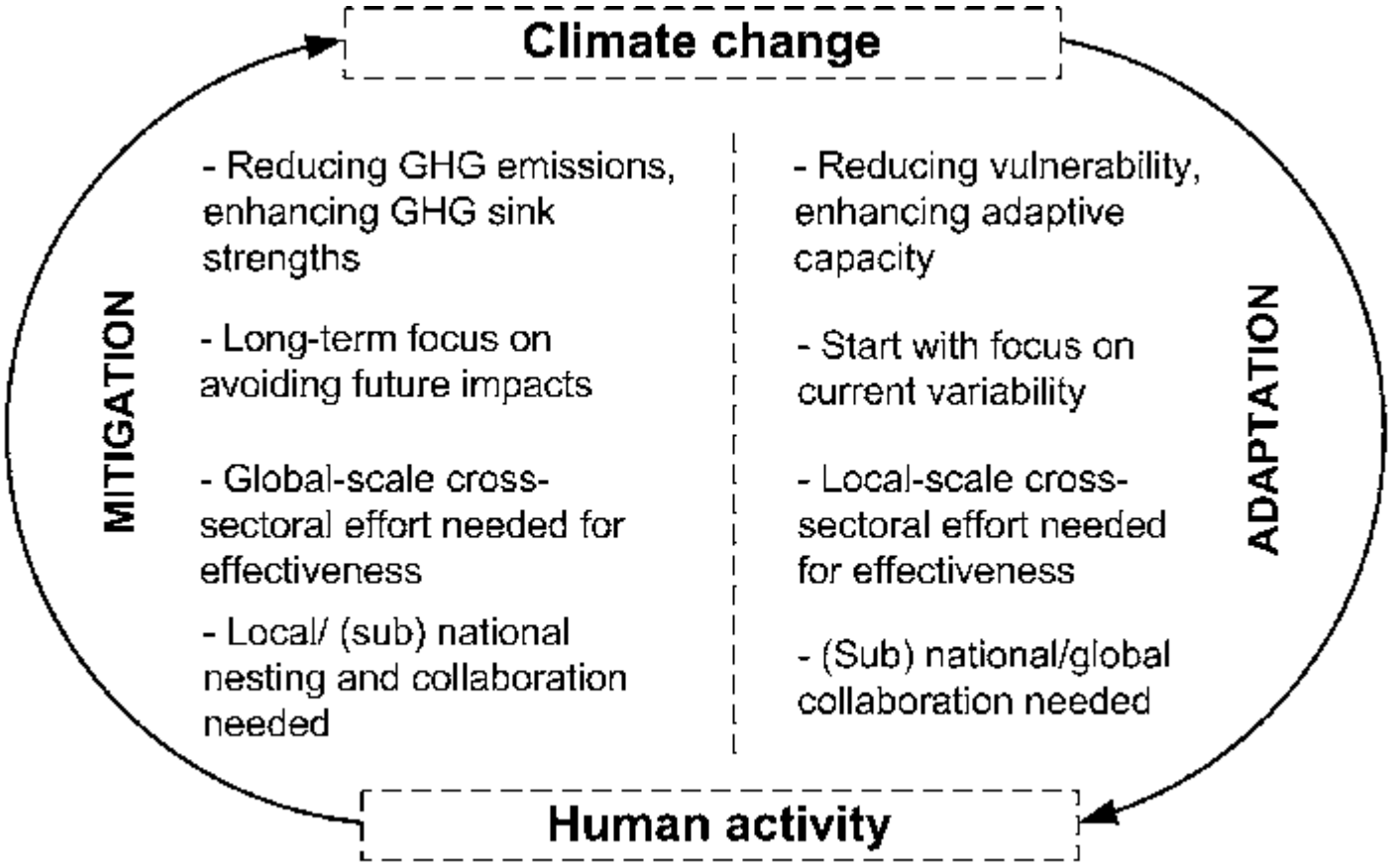
25% of the world's carbon emissions come from the production of electricity at coal plants.

Since nearly 50% of electricity comes from coal combustion, improving coal plant efficiency will significantly reduce carbon emission.

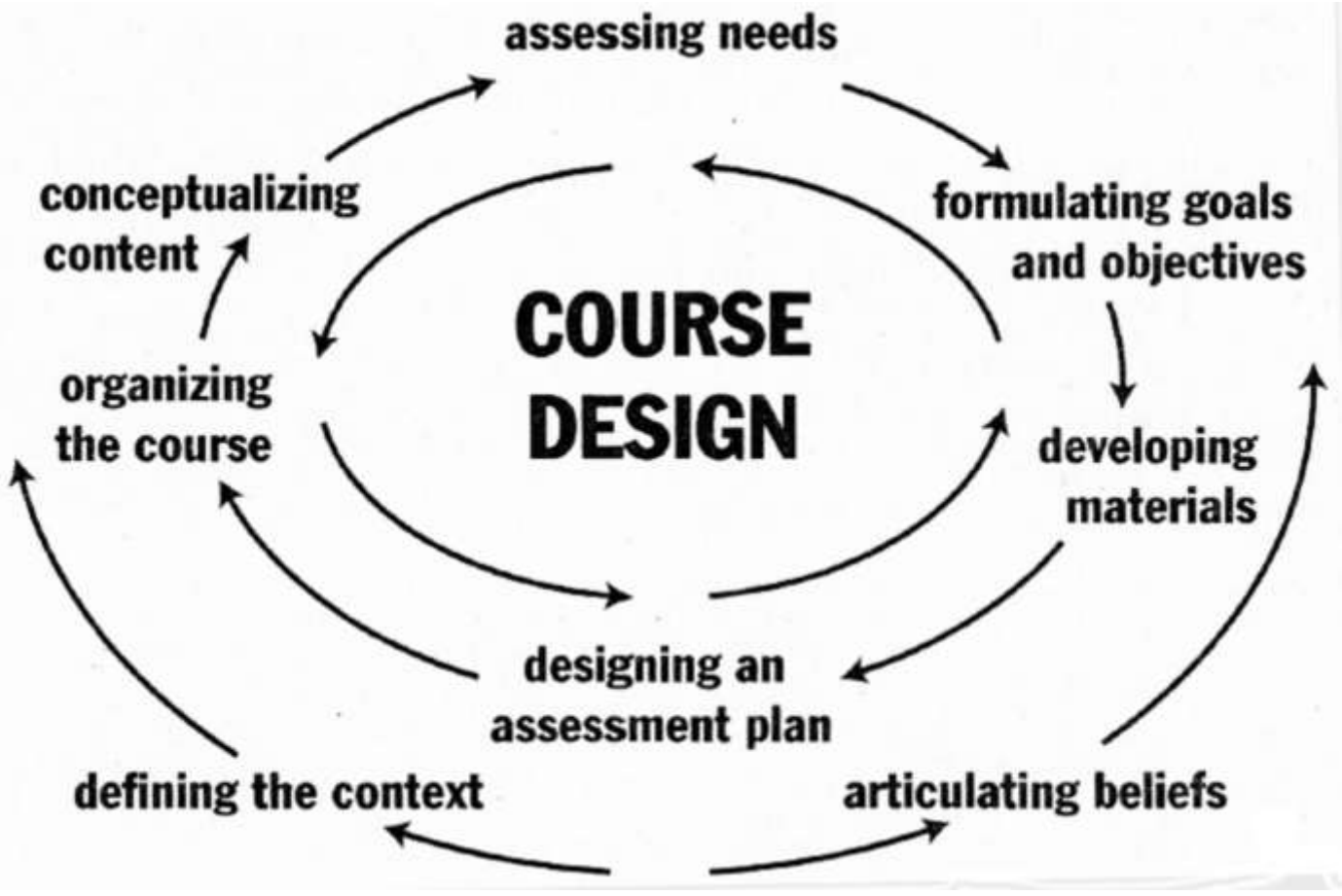
To do this requires alternative ways of using coal to produce electricity.

Tailoring Info Accordingly (8)

- **Techniques for mitigating climate change (16 h)**
  - GHG emissions↓(fossil fuel/coal usage↓)
  - Carbon capture and storage (CCS)
  - Adaptation (e.g., green energy)



Part III: Syllabi Design

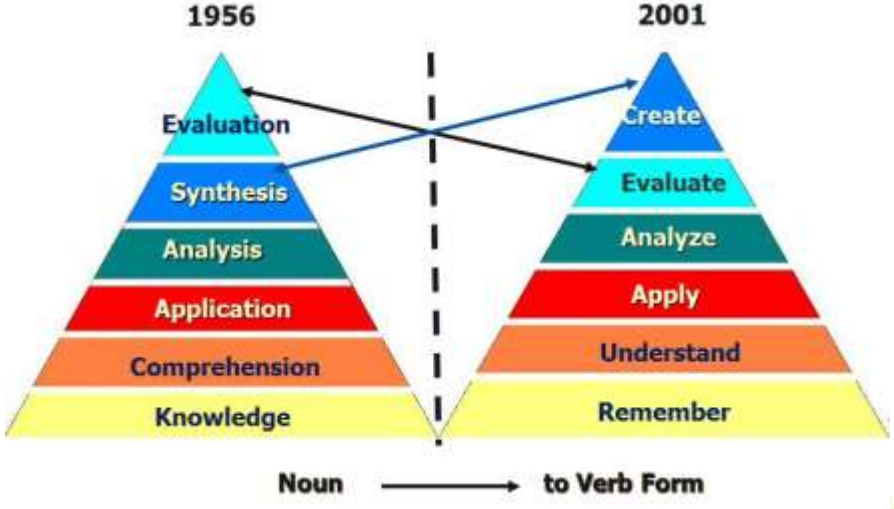


Elements of a Good Syllabus

- General course information
- Text references
- Instructor information
- Course definition and goals
- Learning objectives
- Grading scale
- Expectations
- Safety/university polices
- Tentative course schedule (with weekly/daily topics)

Effect Learning Objectives (1)

- Select clear objectives
  - Do not use vague terminology
  - Be direct and to the point
- Each objective should be singular
  - Do not lump multiple objectives together
- Base lessons on learning objectives
- Draw quiz and test questions from learning objectives (no surprises)
- Use bloom's taxonomy to develop a course appropriate range of learning objectives



Effect Learning Objectives (2)

Examples

Bad:

Solve hydrostatics problems

Better:

Student will be able to calculate hydrostatic forces and their positions

Best:

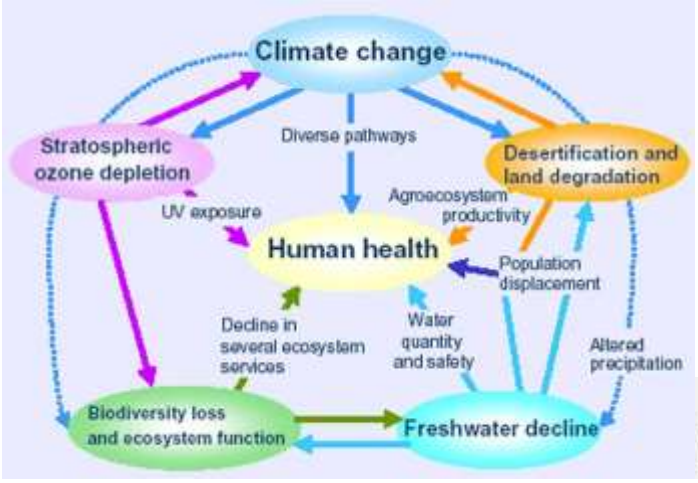
1. Student will be able to calculate the hydrostatic force on a submerged flat surface
2. Student will be able to find the line of action of a hydrostatic force on a submerged flat surface

Part IV: Lectures Delivered In CEE Dept. at UNL Related to Introduction to Climate Change

Short Topics at the CEE Dept. of UNL (1)

About Global Atmospheric Change (a direct topic) (Taught in CIVE 321 Principles of Environ. Eng., 2 lectures = 150 min)

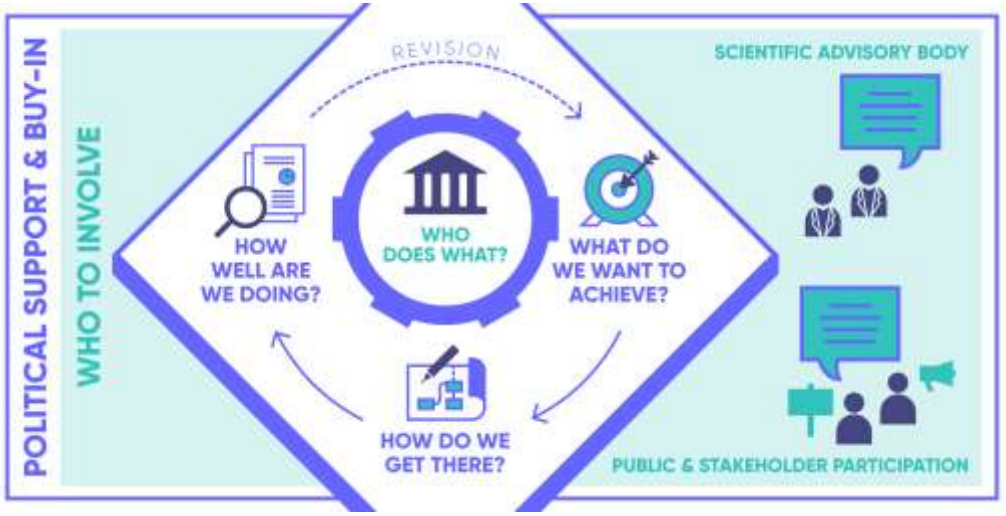
- The composition of the earth's atmosphere
- Global temperature model
- The greenhouse effect
  - Solar energy & energy radiated from the ground
  - GHGs & the atmospheric radiative window/global energy balance
  - Global warming effects
- Changes in stratospheric ozone
  - Ozone formation/removal
  - Ozone hole at Antarctica/destruction of stratospheric ozone
  - Impacts of involved gases (CFCs, CH_4, N_2O, O_3, methyl chloroform, CCl_4, etc.)
- Perspective on global atmospheric change
  - Policy areas
  - Coping with climate change
    - Mitigation
    - Adaptation



Short Topics at the CEE Dept. of UNL (2)

- **Indirect topics:**
  - Intro air pollution (= 4 x 75 min)
    - The Clean Air Act
    - Criteria Pollutants (micro & macro)
    - Meteorology
    - Atmospheric dispersion (models)
    - Indoor air quality
    - Emission controls
  - Sustainability (= 75 min)
    - Basic concepts of sustainability
      - Definition/UN's goals/basic concepts
      - Boundary/recent trends
    - Brief intro to textbook contents (Ch. 8)
    - Three major considerations
      - Resources used
      - Resource conservation/waste management
      - Life cycle assessment (LCA)
  - One student presentations (20 min)

Note: Thus, I only taught
150 min directly + 400 min indirectly
about climate change and the related topics!



Summary


How to be a Successful
Instructional Designer
Simplify the Content
Design from a Learner's Point of View
Make Your Learning Experience Fun and Engaging
Keep Innovating
Be Tech Savvy
totem

Sample Files

Name	Date modified	Type	Size
Sample 1-Book-1-Climate Change, Modeling, Mitigation and Adaptation	5/8/2023 5:12 PM	File folder	
Sample 1-Book-2-Carbon Capture and Storage	5/8/2023 5:19 PM	File folder	
Sample 1-Book-3-Sustainability	5/8/2023 5:20 PM	File folder	
Sample 1-Book-4-Green Technologies for Sustainable Water Management	5/8/2023 5:24 PM	File folder	
Sample 1-Book-5-Sustainable Water Resources Management	5/8/2023 5:25 PM	File folder	
Sample 1-Book-6-Sustainable Solid Waste Management	1/14/2021 7:23 PM	File folder	
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Sample 2-1-2-UAEPA-Energy Resources for State, Local, and Tribal Governments-05072023.pdf	5/7/2023 3:11 PM	Adobe Acrobat Docu...	343 KB
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Questions?

Thank You!