

# Intro. to Environmental Earth Science



# Major Human Actions Affecting the Environment

These pages highlight some of the more important impacts that the ever-increasing human population is having on Earth. As we explore these impacts in this text, we will discuss how we can modify our actions to be more sustainable.

## Freshwater Usage

Humans use more than half of the freshwater that falls on land each year. This leaves less water to be used or stored by Earth's natural systems.



## Harvesting the Ocean

Humans take more than one-third of the ocean life from the ocean areas nearest land.

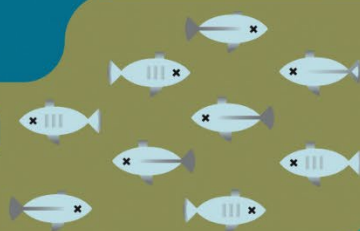
This area holds the most easily accessible of Earth's fisheries, and nearly one-third of these are considered overharvested.



## Increasing Acidity of Oceans

The surface water in the oceans absorbs human-caused CO<sub>2</sub> emissions, which makes them more acidic.

This phenomenon affects the survival of marine organisms, especially coral reefs and the life systems dependent on them and any sea animal that has a shell.



## Decreasing the Variety of Life

Humans are causing a rapid decline in biological diversity—the variety of life-forms on Earth—such that many biologists estimate that species extinction rates are 100 to 1,000 times more than the background rate that has persisted over much of Earth's history.


## Nitrogen Conversion

Humans now convert more free nitrogen from the atmosphere into other compounds than that converted from all other processes on Earth.

Most of this is to produce synthetic fertilizers for agriculture. This use of nitrogen contributes to air pollution and low-oxygen marine "dead zones."

## Consumption of Plants

Each year, humans use more than 40% of Earth's net primary productivity—the green plant matter produced on Earth—and the amount we use is increasing.

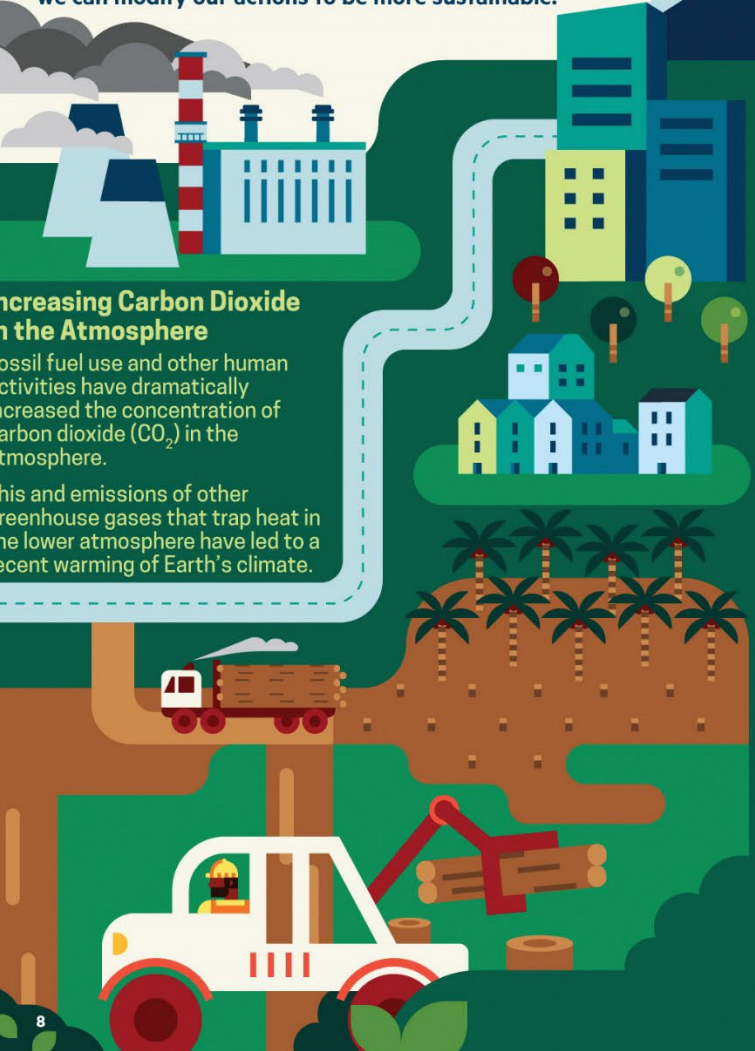


**What Can I Do?**  
A challenge for all of us is to find ways to use these resources more sustainably. We will help you explore practical changes that can make a positive impact on Earth as you read this book.

## Increasing Carbon Dioxide in the Atmosphere

Fossil fuel use and other human activities have dramatically increased the concentration of carbon dioxide (CO<sub>2</sub>) in the atmosphere.

This and emissions of other greenhouse gases that trap heat in the lower atmosphere have led to a recent warming of Earth's climate.



# Sustainability



- What is **Sustainability**?
  - *The management of natural resources in ways that do not diminish or degrade Earth's ability to provide them in the future.*
  - *Humans using resources in a way that ensures they will be available for use in the future.*
  - *3E-s: Environment, economy, equity*

# SUSTAINABLE DEVELOPMENT GOALS

2016

1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS

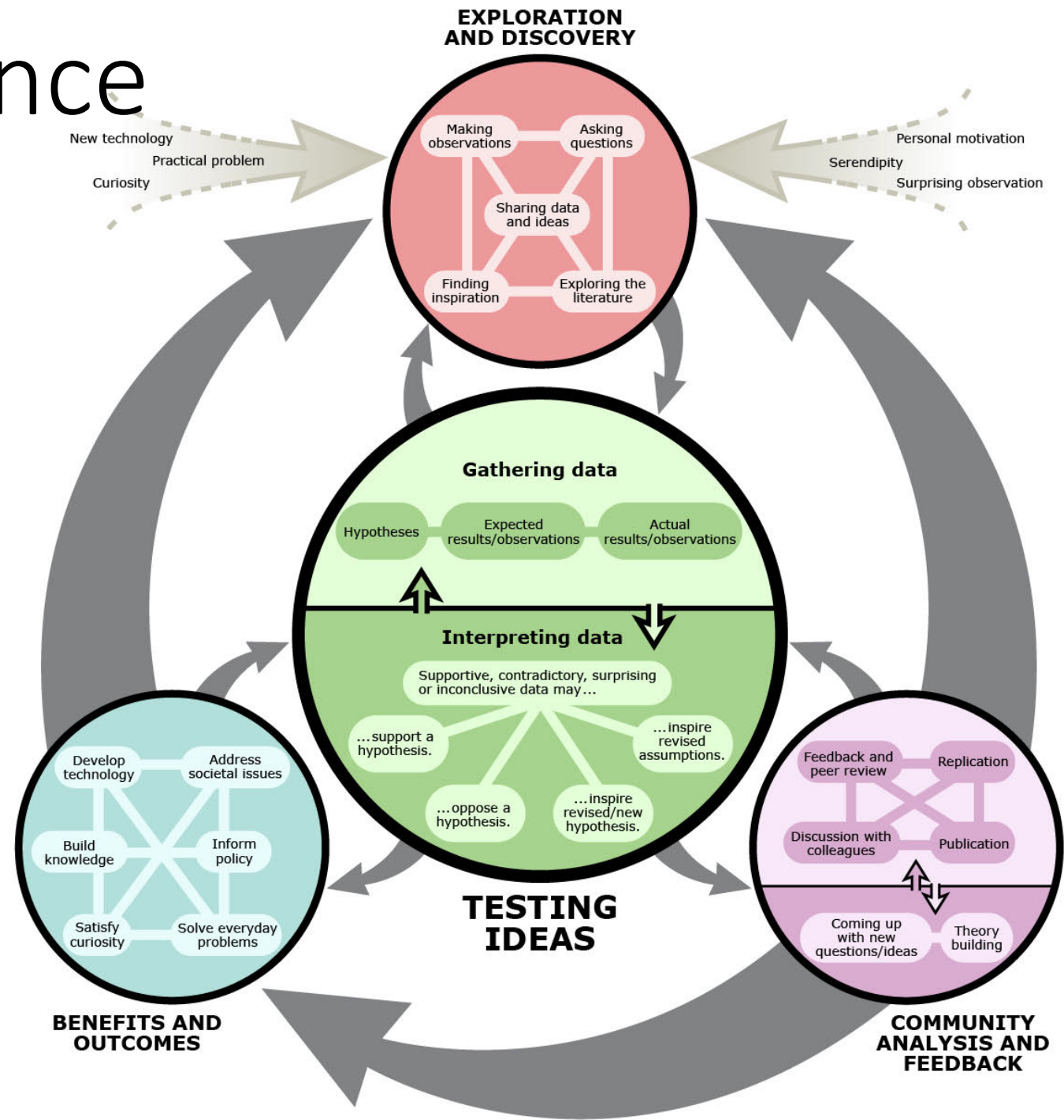
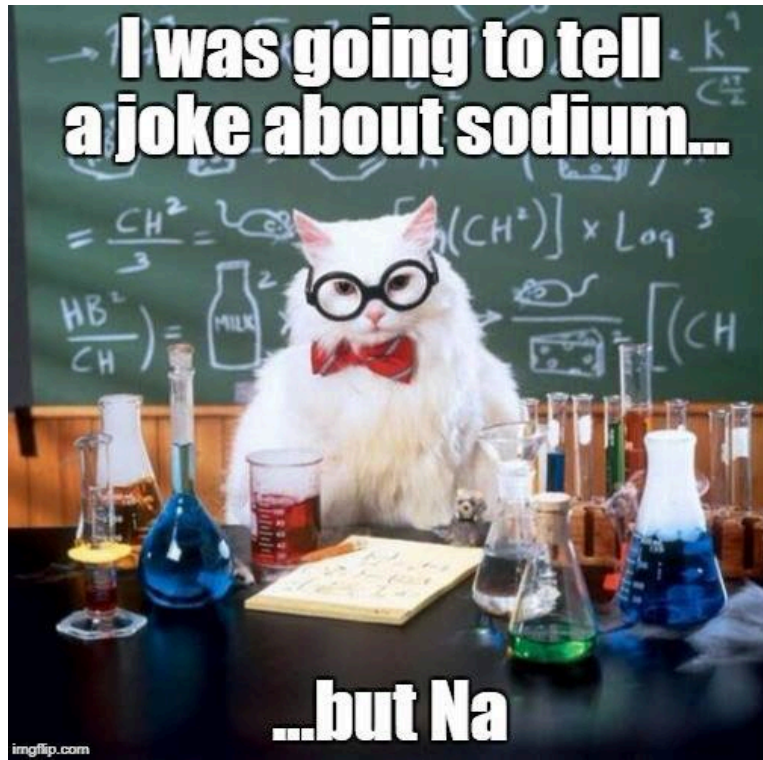


17 PARTNERSHIPS FOR THE GOALS

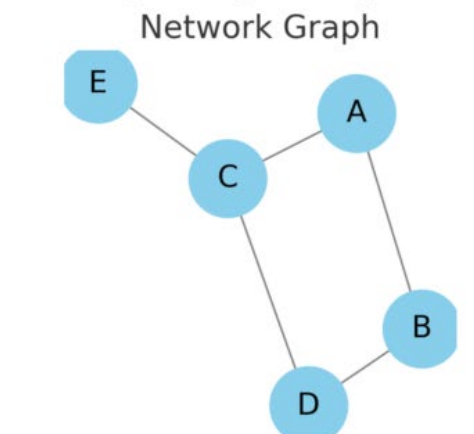
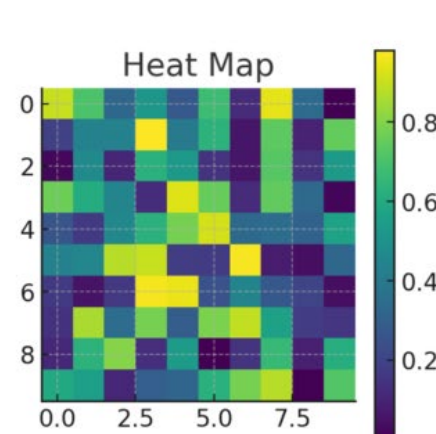
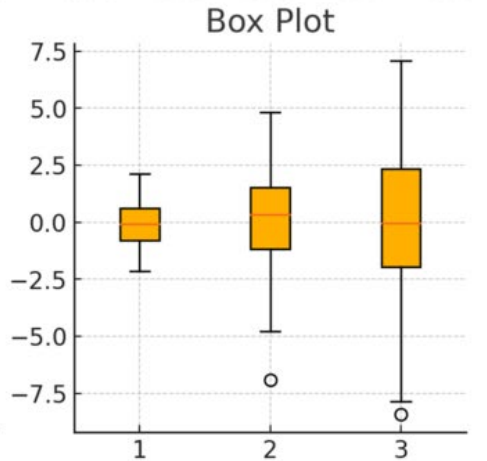
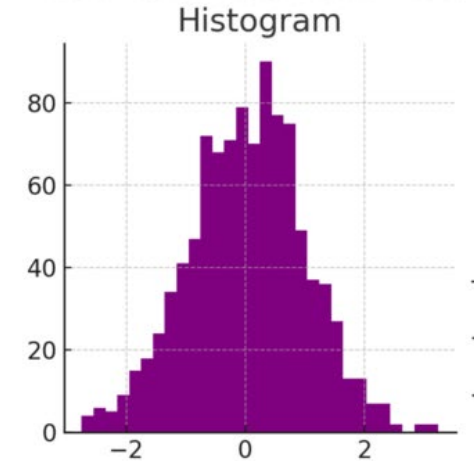
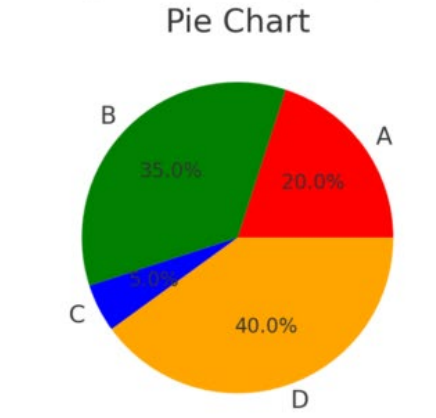
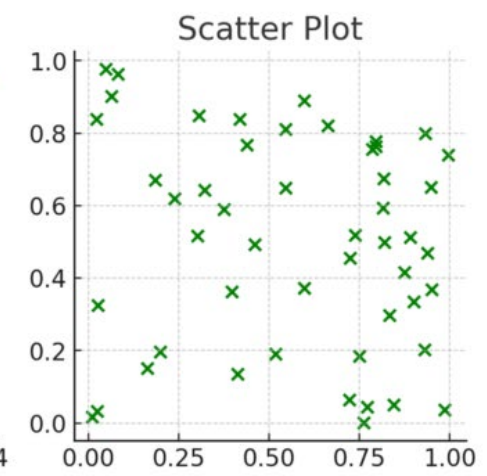
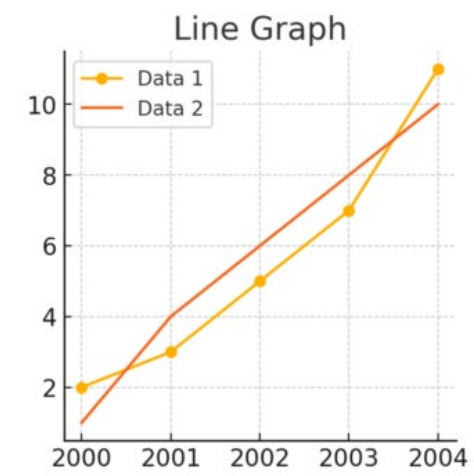
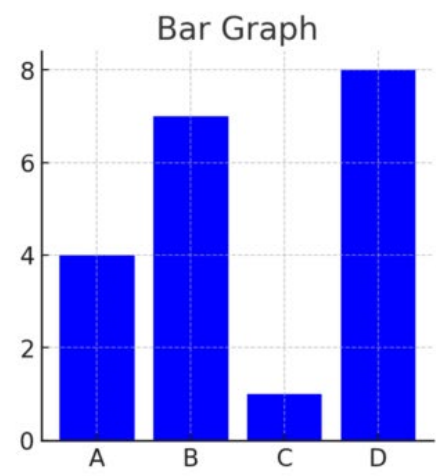
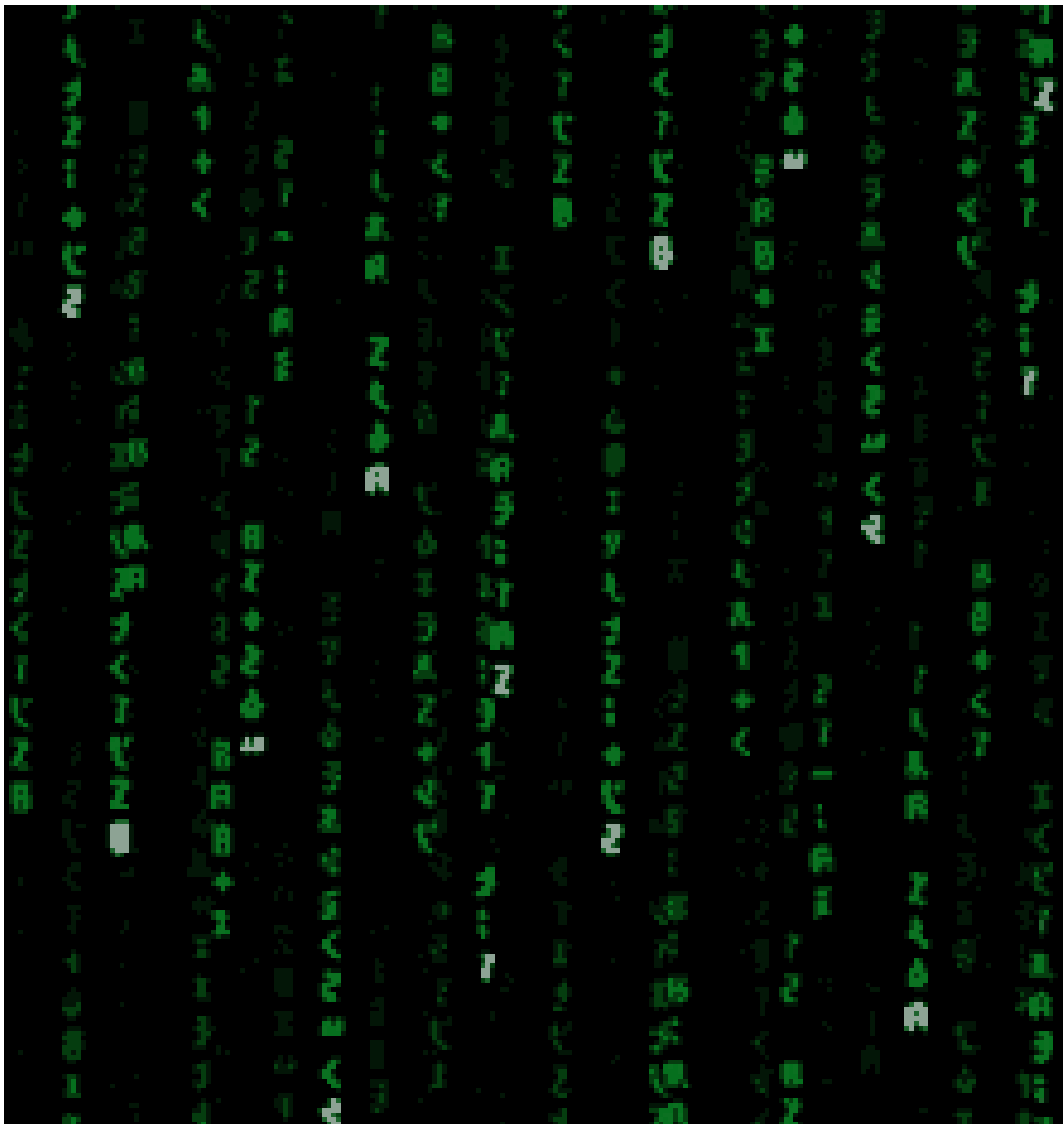


# Environmental Science

- What is Science?
  - The scientific method
  - Observing and testing
  - Models

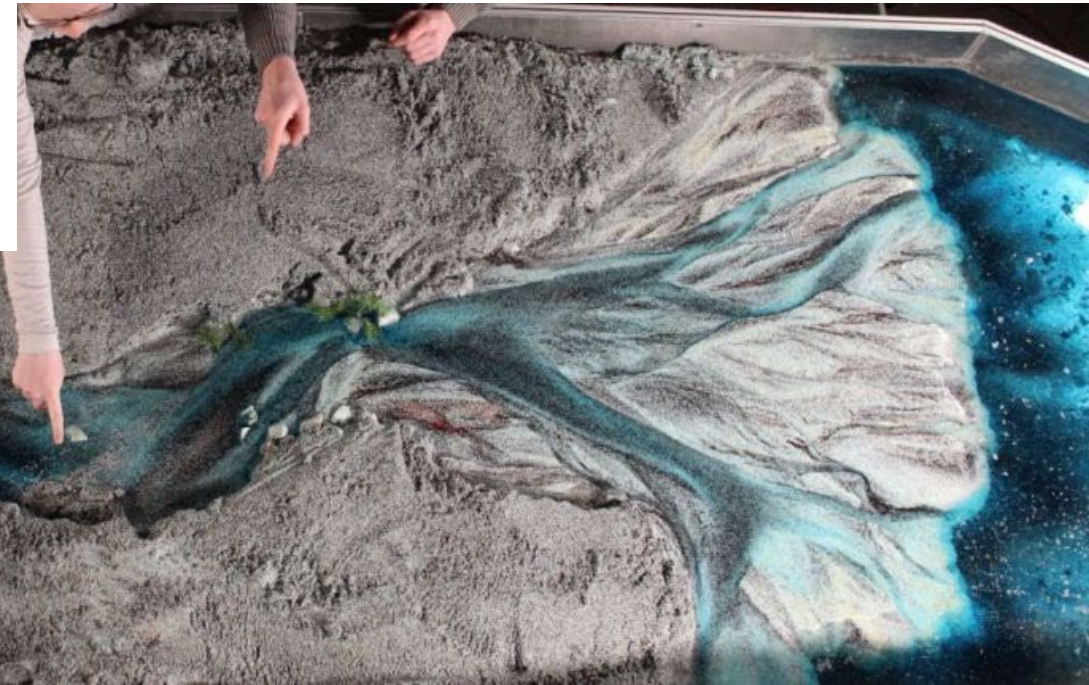
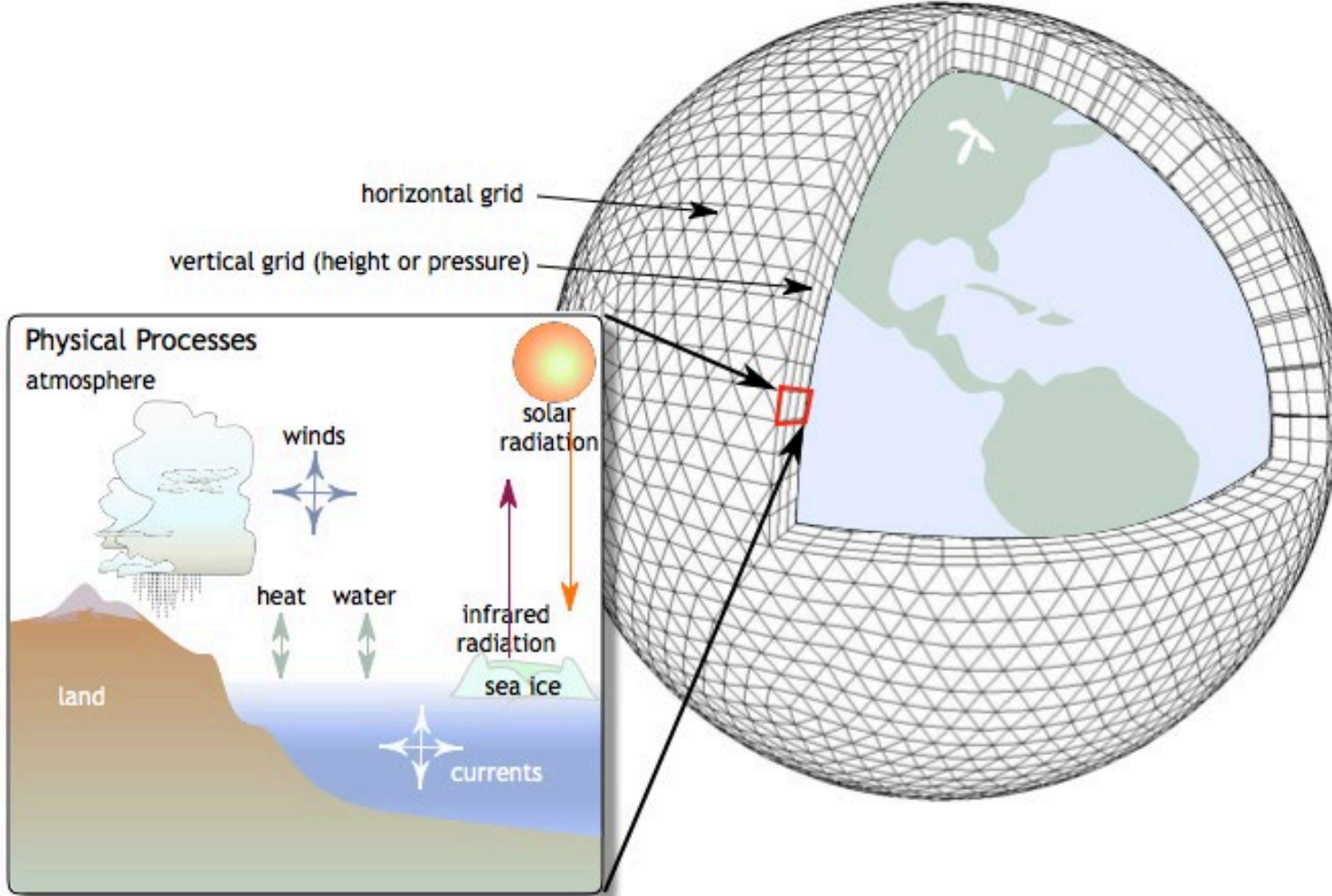


# Graphing – Advantage?



# Models

Global Circulation Model –  
(GCM)



EM River Stream table

# Challenges to good Scientific Inquiry

- Fraud

- An attempt to deceive people by communicating fabricated findings.

- Pseudoscience

- Often uses scientific sounding terms, images,
- Claims to be 'proved by science' but has not followed the process and/or is not peer reviewed.

- Bias

- An unreasonable weighing, inclination or prejudice of one's thinking that leads to misunderstandings and errors
- Unintentional to intentional

- Misinformation

- False or incorrect information
- Unintentional to intentional



# CRAAP, Is it...?

- **C**urrent?
  - Date published? New references?
- **R**elevant?
  - Does it relate to your topic?  
Audience? Appropriate level?
- **A**uthoritative?
  - Author/organization status?  
Qualified? Peer-Reviewed?
- **A**ccurate?
  - Information source? Errors?  
Broken links.
- **P**urposeful?
  - How is the info. to be used?  
Advertising?

# Rigorous Peer Review

Publishing in Peer Reviewed Journals  
Global, Geographic, Discipline specific

*Science is: collaborative, continual,  
Product of testing, retesting, retesting...*

*Findings must be repeatable and open to  
revision.*

*Follows a global collective scientific standard*

A woman wearing a black hijab is shown from the chest up. Her eyes are closed, and her mouth is slightly open, suggesting she is in a state of discomfort or distress. The background is dark and out of focus, with some indistinct shapes that could be furniture or objects in a room. The overall lighting is dim, creating a somber atmosphere.

**THAT DOESN'T PASS THE SMELL TEST.**

| Stage of Denial                                    | Coronavirus   | Climate Change  |
|--|---|---|
| <p><b>Stage 1</b><br/>It's not happening</p>       | <p>"The Democrats are politicizing the coronavirus ... This is their new hoax"<br/>[REDACTED]</p>   | <p>"It's a hoax; I think the scientists are having a lot of fun."<br/>[REDACTED]</p>  |
| <p><b>Stage 2</b><br/>It's not our fault</p>       | <p>"China is to blame because the culture where people eat bats and snakes and dogs and things like that, these viruses are transmitted from the animal to the people"<br/>[REDACTED]</p> | <p>"China does not do anything to help climate change. They burn everything you could burn; they couldn't care less"<br/>[REDACTED]</p> |
| <p><b>Stage 3</b><br/>It's not that bad</p>        | <p>"One day like a miracle it will disappear"<br/>[REDACTED]</p>  | <p>"[The climate] will change back."<br/>[REDACTED]</p>   |
| <p><b>Stage 4</b><br/>Solutions are too costly</p> | <p>"We cannot let the cure be worse than the problem itself."<br/>- [REDACTED]</p>  | <p>"I think the climate change is just a very, very expensive form of tax."<br/>[REDACTED]</p>  |
| <p><b>Stage 5</b><br/>It's too late</p>            | <p>"It is going to spread further and I must level with you ... many more families are going to lose loved ones before their time"<br/>- [REDACTED]</p>                                   | <p>"The climate apocalypse is coming. To prepare for it, we need to admit that we can't prevent it."<br/>- Author [REDACTED]</p>        |

# What is environmental justice? *3E - Equity*

- “No community should bear more environmental burdens than others”
- Every community deserves access to clean/useable:
  - Air
  - Recreation/Parks
  - Soil
  - Water



# SUSTAINABLE DEVELOPMENT GOALS

2016

1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



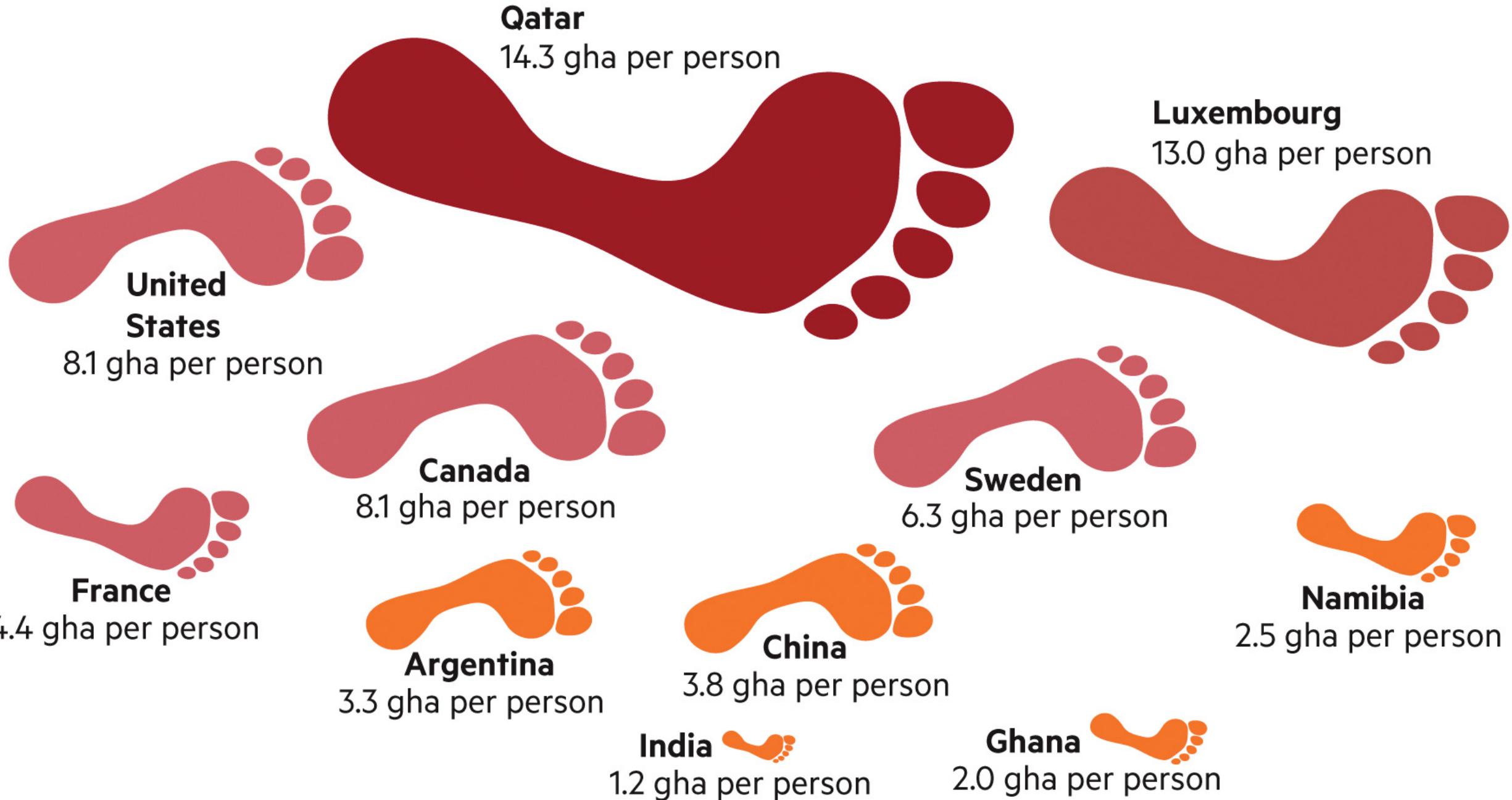
17 PARTNERSHIPS FOR THE GOALS



# Sustainability Decisions – Values

- Individual vs Communal
  - Trade-offs
  - Communication Strategies
  - Incentives
  - Footprint analyses
  
  - Unintended consequences
  - Lifestyle project
- Topics we will explore:
    - Population
    - Agriculture and food
    - Energy
    - Minerals, Rocks and Mining
    - Water – quantity and quality
    - Consumption and waste
    - Urbanization and land use

# Per Person Ecological Footprint by Country (gha = global hectates)





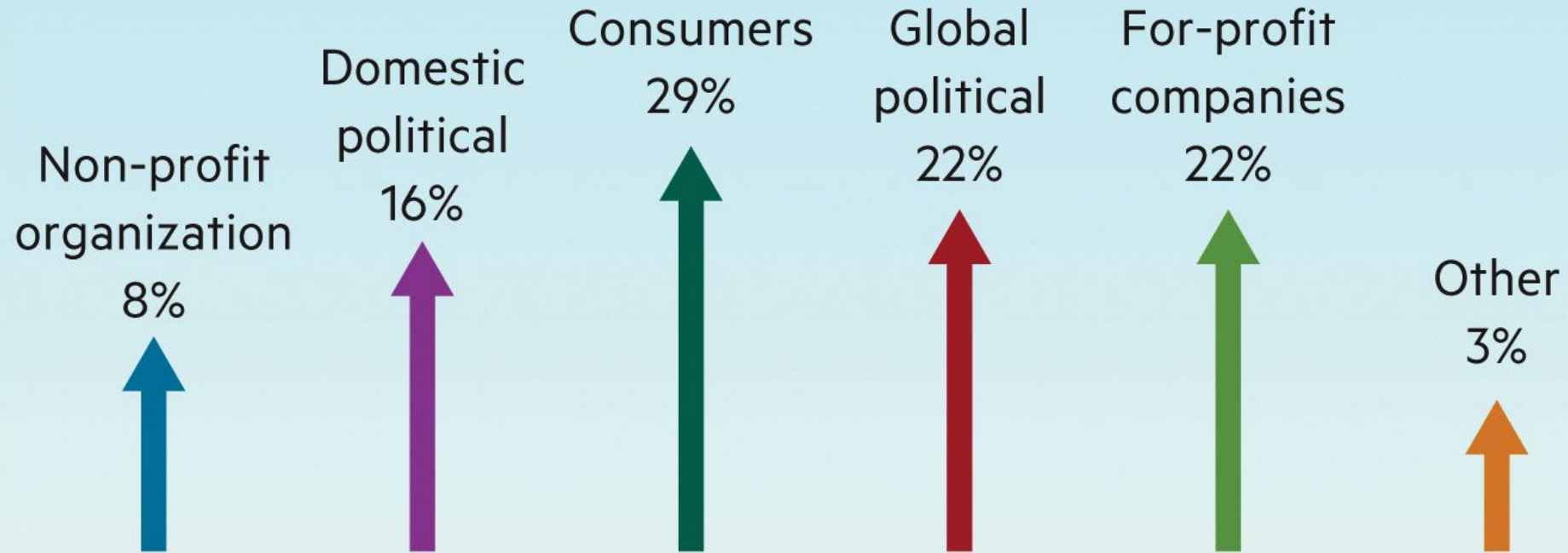
जय बाबा  
मामा-भान्जा  
BLOW  
HORN  
दास  
कीजय  
ट्रासपोर्ट कंपनी

बुरा नजर वाला तेरा मुह काला

32GA3544



# WHO WILL DRIVE SUSTAINABILITY?



Consumers believe their actions are most likely to drive changes, followed by the actions of for-profit companies and international groups.

# Chapter 2: Environmental Economics

- Demand
    - How much of the product/service is desired by consumers? How much is someone willing to pay for a product/service?
  - Supply
    - Total quantity of the product of service available
- Determine price*  
*Buy low / Sell high = maximized profit*
- Economic systems shape the production, distribution and consumption of products and services.
  - Markets bring buyers and sellers together.
  - Governments try to adjust prices by regulating production and/or the distribution of products.

# Ethics

- A set of moral principles that provides guidelines for personal to collective behaviors
- Ideally ethics are a major component to decision making processes.
- Utilitarianism
- Biocentrism/Ecocentrism

- PHIL/RELS 2550 T/Th @2-3:15
  - Environmental Ethics
  - Prof. Robert Earle



# Using Economics to help Frame Environmental Problems

- Externalities – market failures that do not account for all of the costs and benefits of products or services.
- Negative
  - Unintentional adverse impacts to a person or community
- Positive
  - Unintentional favorable impacts to a person or community
- *Unintended consequences*



# Negative externalities/Adverse unintended consequences



The Appalachian region



Adapted from Epstein et al. (2011)



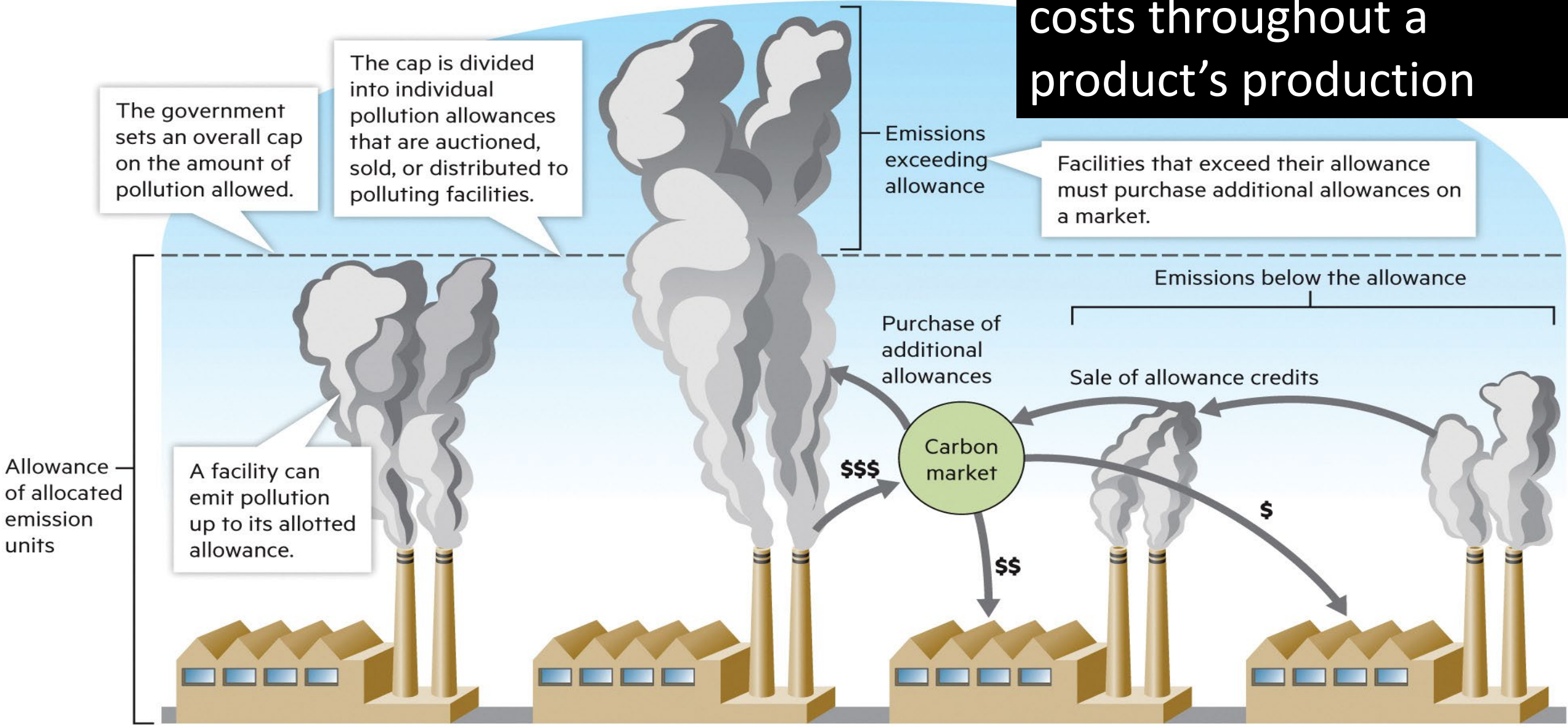
| Health and environmental impacts   | Costs (per year)             |
|--|------------------------------|
| Land disturbance   | \$54 million–\$3.3 billion   |
| Methane emissions from mines   | \$684 million–\$6.8 billion  |
| Fatalities in the public due to coal transport                                   | \$1.8 billion                |
| Public health burden of communities in Appalachia                                | \$74.6 billion               |
| Emissions of air pollutants from combustion                                      | \$65 billion–\$187 billion   |
| Excess cardiovascular disease from mercury emissions                             | \$246 million–\$17.9 billion |
| Climate damage from combustion emissions of CO <sub>2</sub> and N <sub>2</sub> O | \$20 billion–\$205 billion   |
| Climate damage from combustion emissions of black carbon                         | \$12 million–\$161 million   |





# Companies: True Cost Accounting

Accounting method that uses direct AND indirect costs throughout a product's production



# Tragedy of the Commons / Negative Externality



Ross Anania/Getty Images

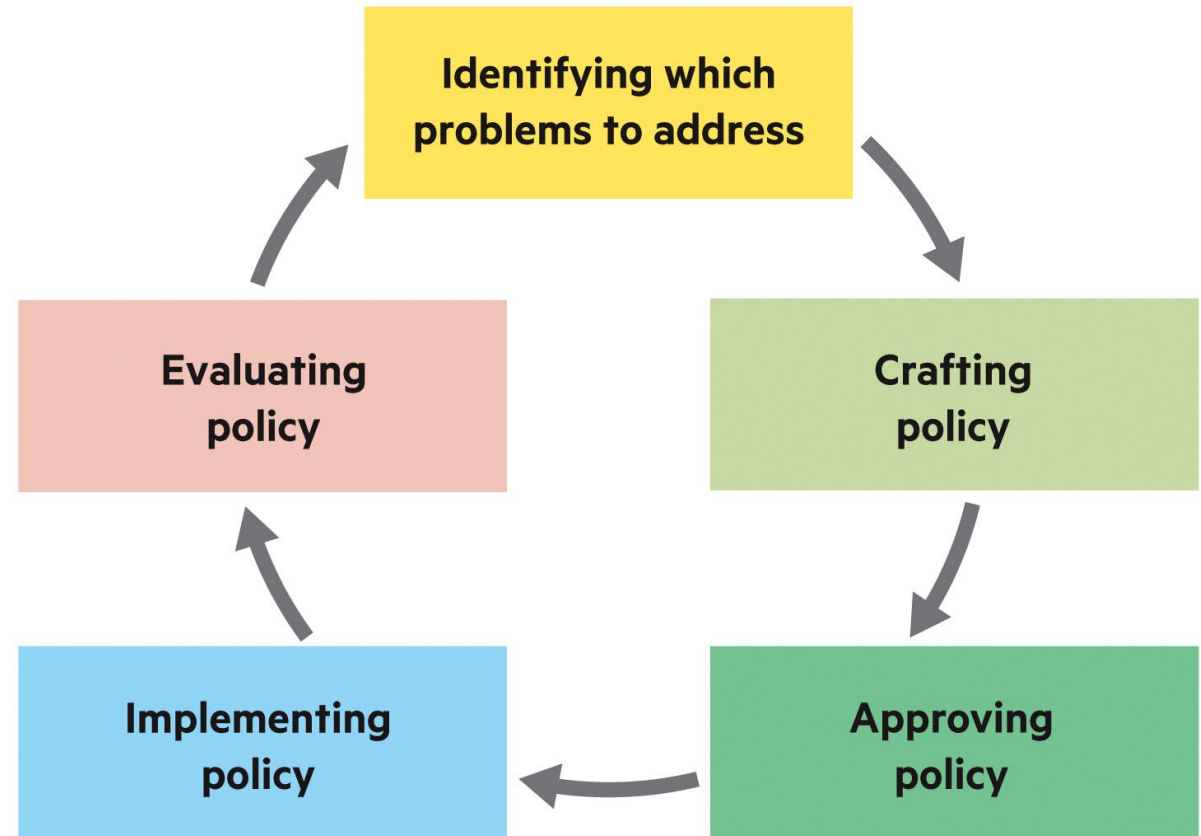
- A socioeconomic dilemma
- A situation where there is open access to a resource without adequate social structures, formal policies or costs to limit individual use. This often leads to the degradation of the common benefit provided by the resource.



# Governments and Policy

- **Policy**

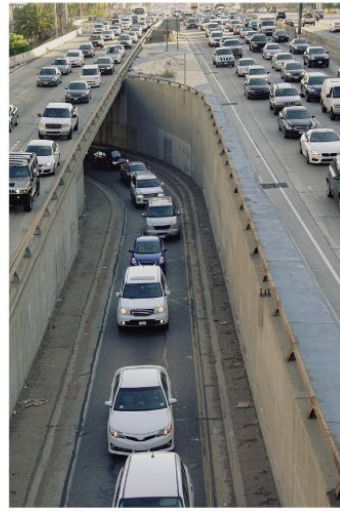
- Authoritative decisions such as laws, regulations, and court rulings that guide human and economic behaviors.





# Politics and How Policies are Made/Changed.

- Elections
- Legislative (Senate/House)
- Hearings/Discussions/Votes
- Governor(state) to President (federal) signs or vetos the policy



(top left): Brandon Klein Video/Shutterstock; (top center): All Canada Photos/Alamy Stock Photo; (top right): Nikita Sursin/Stocksy; (bottom left): VegterFoto/Stocksy; (bottom center): Bonminstudio/Stocksy; (bottom right): Per Swantesson/Stocksy

# Environmental Policies in the United States

In the United States, environmental policies fall into two broad categories—pollution regulation and natural resource management—and are administered by federal, state, and local governments.

- **Offshore oil-drilling permits and leases** are managed by the Department of the Interior.
- **The Ocean Dumping Ban Act (1988)** prohibits dumping waste into the ocean.

- **The Oil Pollution Act (1990)** establishes standards for oil vessels and pipelines and protocols and liability for oil spills.
- **The Marine Mammal Protection Act (1972)** prohibits the taking and importation of marine mammals.

- **The Bureau of Land Management** issues permits and leases for grazing and oil, gas, and coal leases on federal lands.
- **The Clean Water Act** also regulates development that affects wetlands.

- **The Clean Water Act (1972)** regulates water pollution from industrial facilities and water-treatment plants.

- **The Safe Drinking Water Act (1974)** sets standards for public drinking water supplies.

- **The National Forest System** is managed for timber harvest, wildlife habitat, and recreation by the US Forest Service.

- **State water laws** govern surface and groundwater use as well as water pollution from sources such as agricultural water runoff.

- **The Food Quality Protection Act (1996)** establishes safety standards for pesticide use.

- **The National Wildlife Refuge System** is managed by the US Fish and Wildlife Service.

- **The Wilderness Act (1964)** designates certain federal lands as wilderness areas.

- **State and local governments** make and enforce land-use laws, zoning laws, and building codes and determine transportation planning.

- **The Federal Energy Regulatory Commission** regulates and issues permits for hydroelectric dams.

- **The Clean Air Act (1970) and the Energy Policy and Conservation Act (1975)** set emissions and fuel-economy standards for vehicles.

- **The Clean Air Act (1970)** regulates emissions from sources such as factories and power plants.

- **The National Environmental Policy Act (1970)** requires federal agencies to prepare Environmental Impact Statements.

- **The Endangered Species Act (1973)** protects species that are threatened or in danger of extinction.

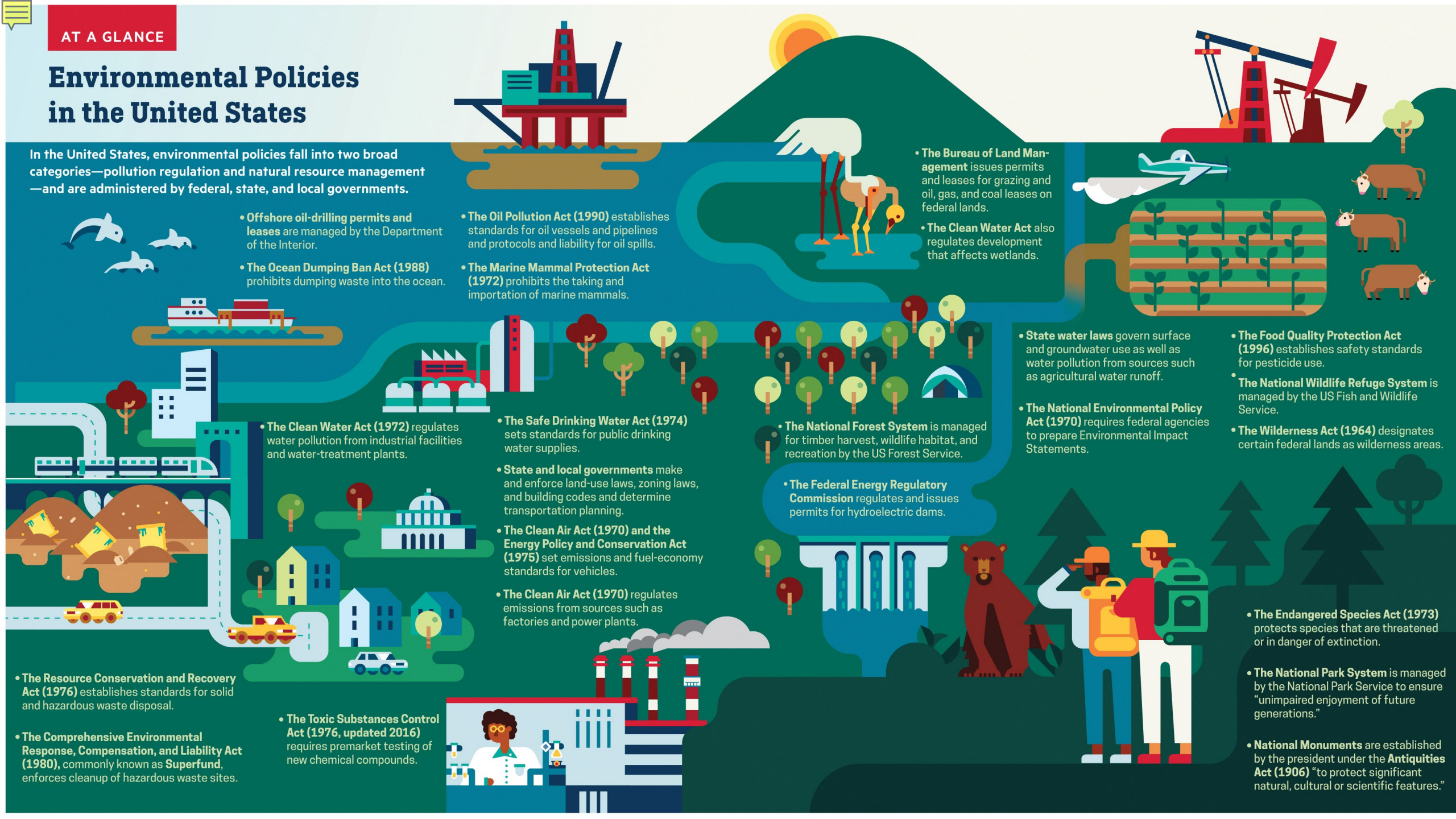
- **The National Park System** is managed by the National Park Service to ensure “unimpaired enjoyment of future generations.”

- **National Monuments** are established by the president under the **Antiquities Act (1906)** “to protect significant natural, cultural or scientific features.”

- **The Resource Conservation and Recovery Act (1976)** establishes standards for solid and hazardous waste disposal.

- **The Comprehensive Environmental Response, Compensation, and Liability Act (1980)**, commonly known as **Superfund**, enforces cleanup of hazardous waste sites.

- **The Toxic Substances Control Act (1976, updated 2016)** requires premarket testing of new chemical compounds.



A close-up photograph of a man with dark hair and glasses, wearing a red jacket. He has a smug, slightly mischievous expression on his face. The background is blurred, showing what appears to be an indoor setting with a blue light source.

**I SEE YOU BROUGHT UP POLITICS  
AT THANKSGIVING DINNER**

**I TOO LIKE TO LIVE DANGEROUSLY**

A meme featuring a close-up of a man with glasses and a serious expression, wearing a light blue shirt and a dark tie. The background is a blurred office setting with another person in a light blue shirt visible in the background.

**FACT:**

**COMMUNICATION IS KEY**

# Sustainability leadership (past, present and future)

