– MMS3003 –

ENVIRONMENT – ISSUE AND GLOBAL PERSPECTIVE

CHAPTER 1

GLOBAL ISSUE AND SUSTAINABILITY

These lecture material are for the **Marine Coastal and Delta Sustainability for Southeast Asia (MARE)**(Project No 610327-EPP-1-2019-1-DE-EPPKA2-CBHE-JP)

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LECTURE OUTLINE

- What is Environmental Science?
- What is an environmental sustainable society?
- How can environmentally society grow economically?
- How are our ecological footprints affecting the earth?
- What is pollution, and what can we do about it?
- Why do we have environmental problems?
- How we can work together to solve environmental problems?

GLOBAL ISSUE

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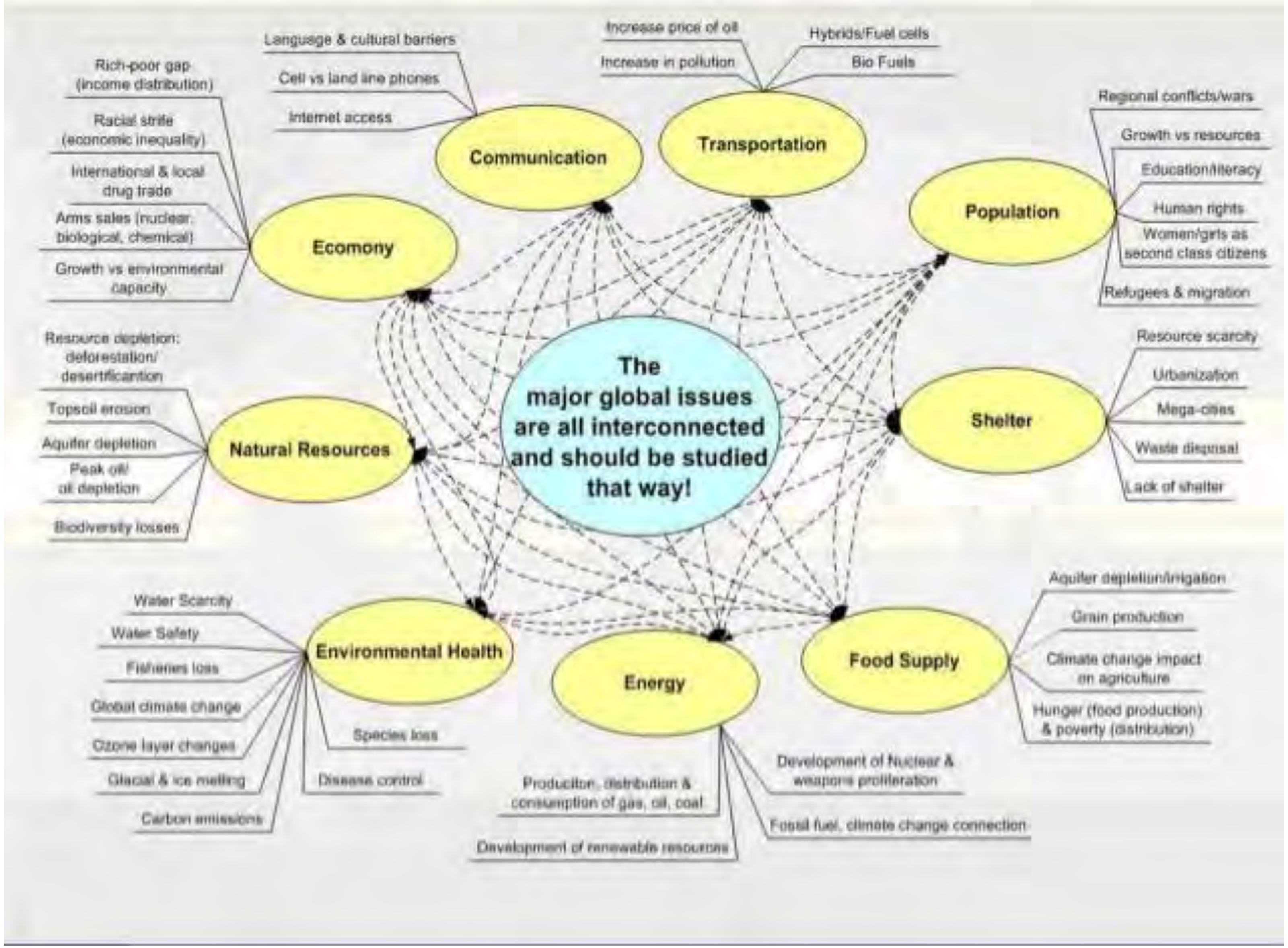

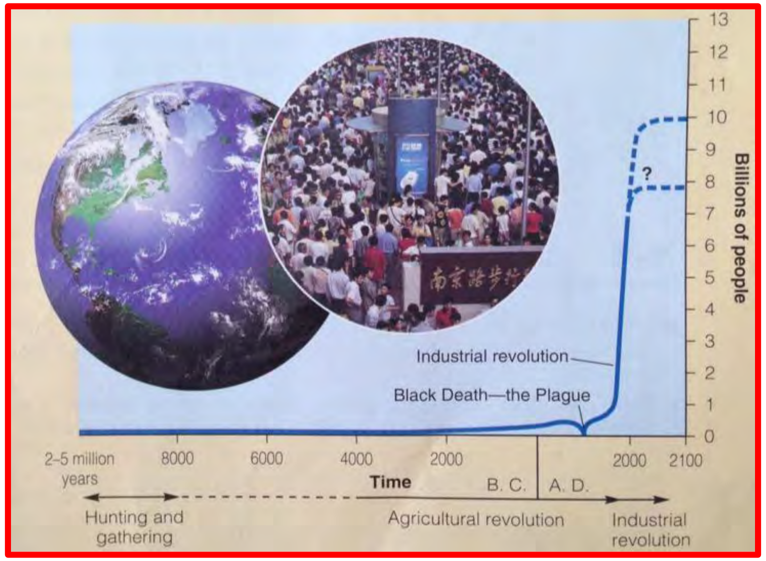

ENVIRONMENTAL SCIENCE

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- Environmental Science is a **study of connections in nature**.
- The environment is everything around us. It includes all of the **living and the non living things** with which we interact.
- We depend on the environment for air, water, food, shelter, energy and everything else we need, to stay alive and healthy.
- An **interdisciplinary study of how humans interact with the environment of living and non-living things**.

ENVIRONMENTAL SCIENCE

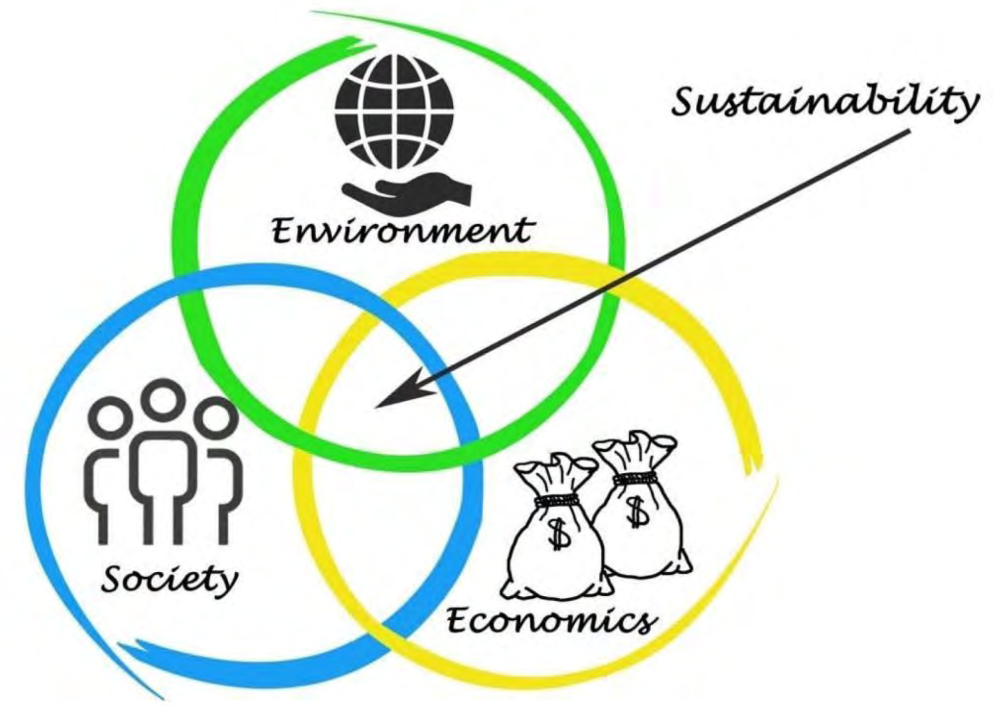
- **Ecology** – The biological science that studies how organisms, or living things, interact with their environment and with each other.
- **Species** – A group of organisms with distinctive traits and, for sexually reproducing organisms, can mate and produce fertile offspring
- **Ecosystem** – A set of organisms interacting with another and with their environment of non-living matter and energy within a defined area or volume.
- **Environmentalism** – A social movement dedicated to protecting the earth’s lifesupport systems for us and all other forms of life.

ENVIRONMENTAL SUSTAINABLE SOCIETY

- Our lives and economies depend on **energy**.
- Living sustainably means living off the earth’snatural income without **depleting or degrading the natural capital** that supplies it.

SUSTAINABILITY

The **ability** of the earth's various natural systems and human cultural systems and economies to **survive and adapt to changing environmental conditions** indefinitely.



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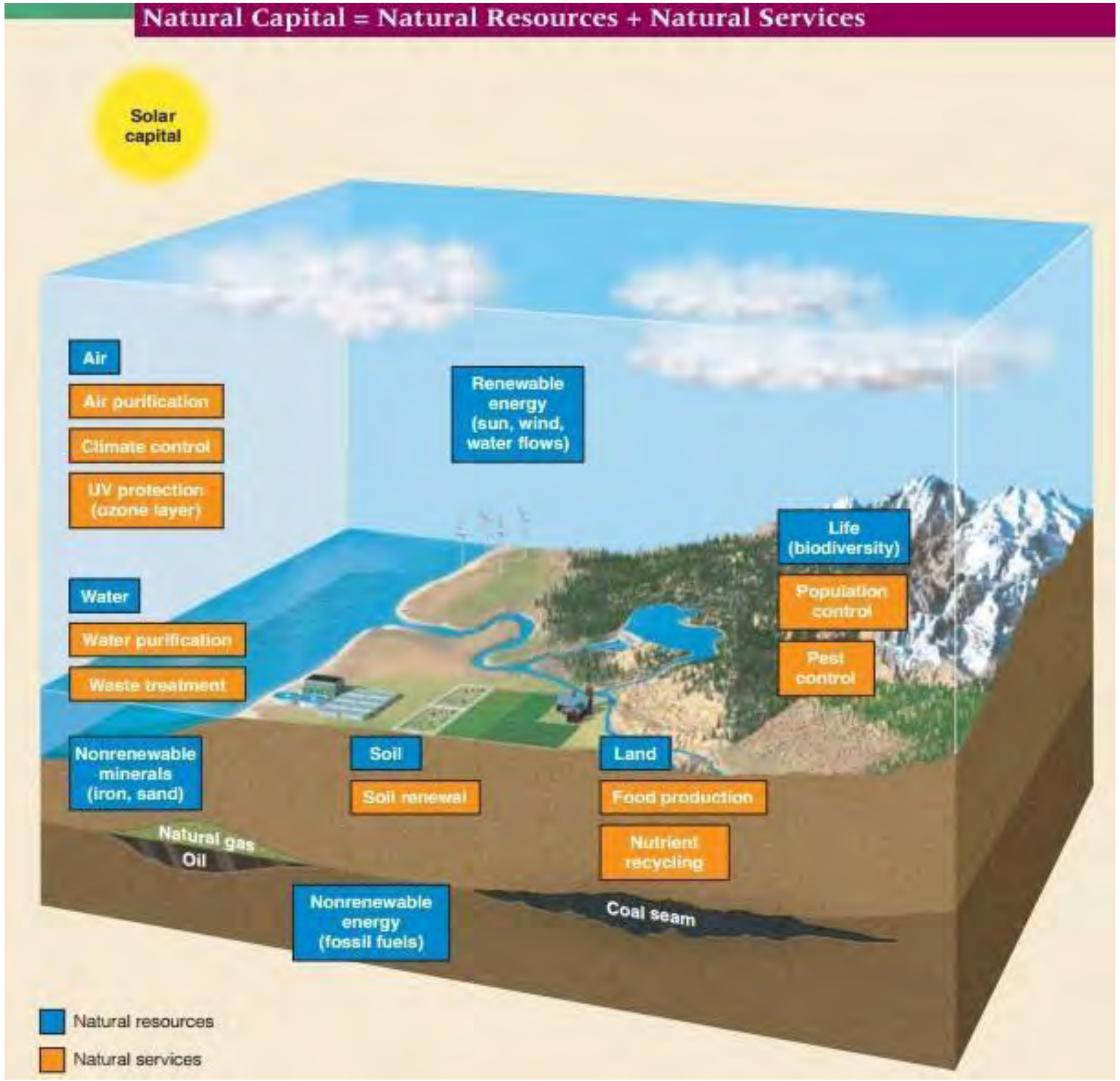
SUSTAINABILITY

Natural Capital – The natural resources and natural services that keep us and other forms of live alive and support our economies.

•**Natural Services** – Functions of nature, such as purification of air and water, which support life and human economies.



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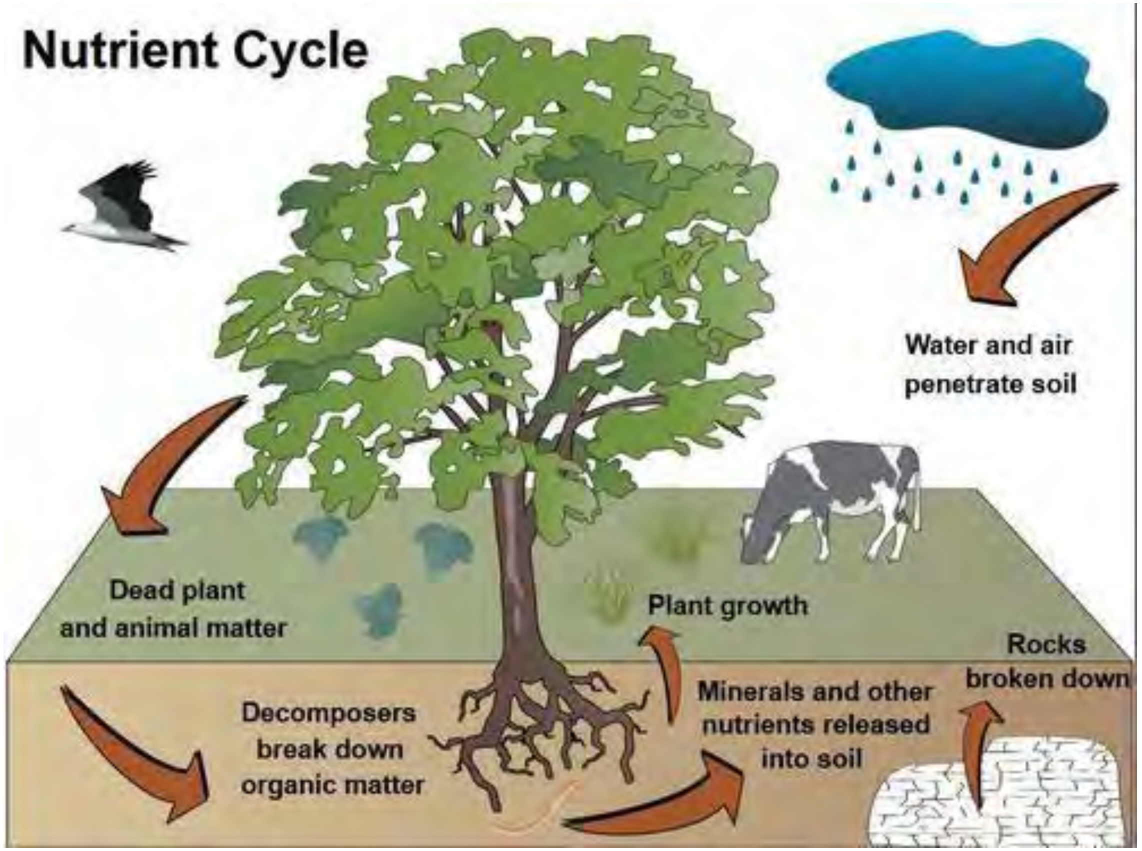
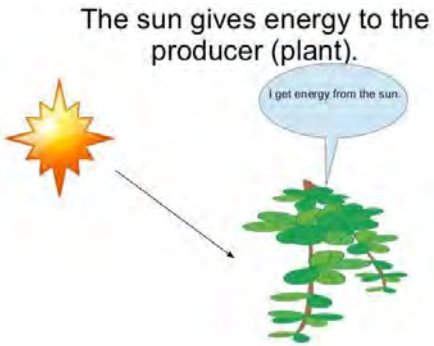
SUSTAINABILITY

- **Nutrient Cycling** – The circulation of chemicals necessary for life, from the environment (mostly water) through organisms and back to the environment.
- **Solar Capital** – Energy from the sun. Solar energy warms the planet and support photosynthesis.





FOUR SCIENTIFIC SUSTAINABILITY PRINCIPLES

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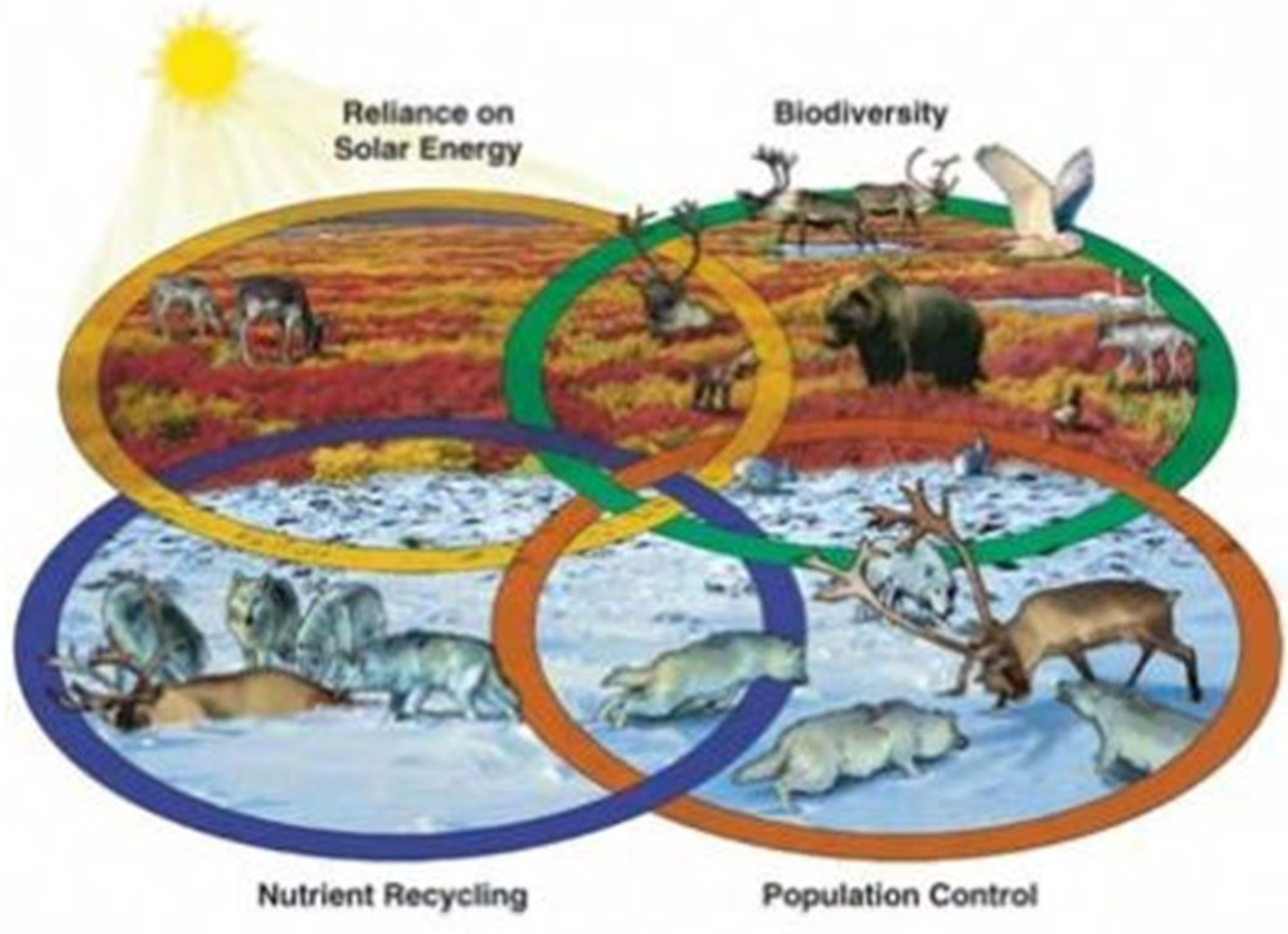

FOREST – ECONOMIC AND ECOLOGICAL SERVICES

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Ecological Services

- Support energy flow
- Reduce soil erosion
- Absorb and release water
- Purify water and soil
- Influence local and regional climate
- Store atmospheric carbon
- Provide habitat

Economic Services

- Fuelwood
- Lumber
- Pulp to make paper
- Livestock grazing
- Recreation
- Jobs

EFFECT OF DEFORESTATION

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- Decreased **soil fertility** from erosion
- **Runoff of eroded soil** into aquatic systems
- Premature **extinction of species** with specialized niches
- **Loss of habitat** for native species and migratory species such as birds and butterflies
- Regional **climate change** from extensive clearing
- **Release of CO_2** into atmosphere
- Acceleration of **flooding**

HOW TO MANAGE AND SUSTAIN FOREST?

- Identify and protect forest areas high in biodiversity
- Rely more on selective cutting and strip cutting
- No clear cutting on steep slopes
- No logging of old-growth forests
- Plant tree plantations primarily on deforested and degraded land
- Include ecological services of forests in estimating their economic value.

MAJOR THREATS TO AQUATIC BIODIVERSITY

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- Habitat loss
- Invasive species
- Pollution
- Climate change
- Overfishing

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HOW TO PROTECT AND SUSTAIN MARINE BIODIVERSITY?

- ❖ Using laws and economic incentives to protect species
- ❖ Marine reserves to protect ecosystems
- ❖ Integrated coastal management
- ❖ Identify severely threatened areas and protect those with high plant diversity (biodiversity hotspots)
- ❖ Rehabilitate and restore damaged ecosystems

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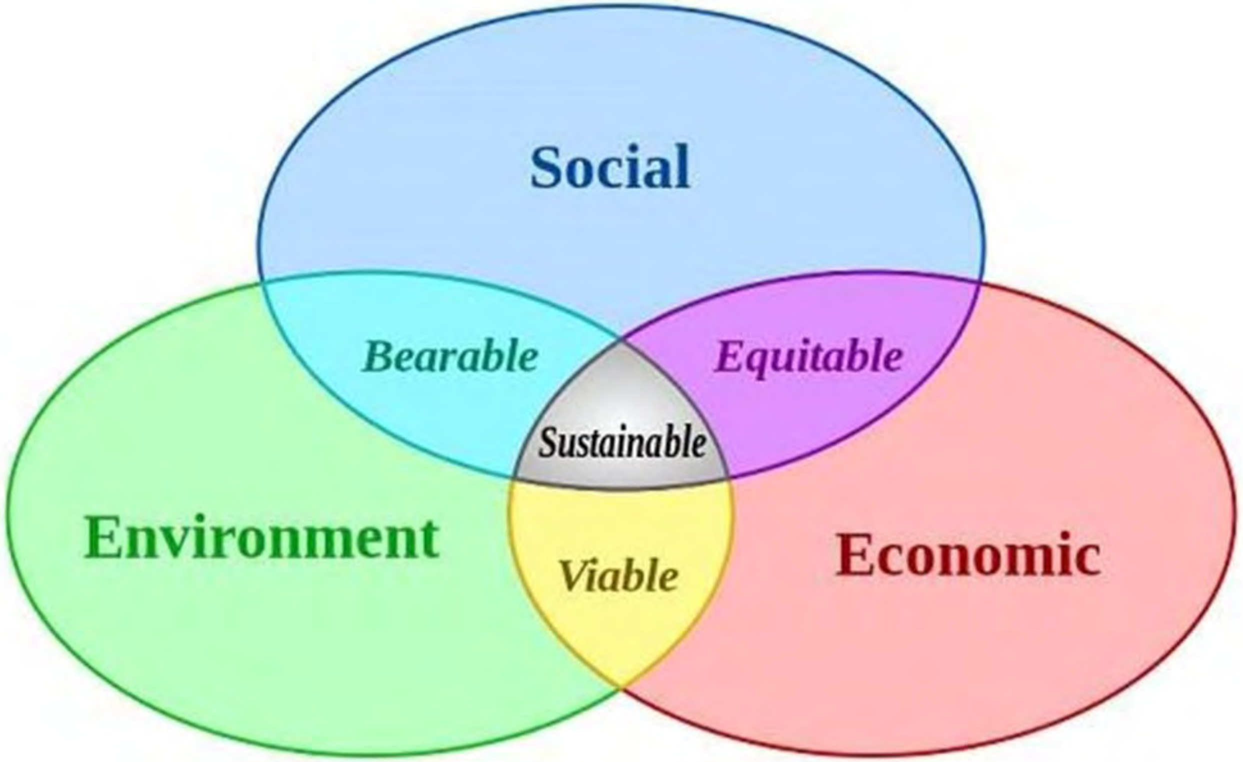
SUSTAINABLE SOCIETIES

How can environmentally sustainable societies grow economically?



SUSTAINABLE SOCIETIES

SUSTAINABLE SOCIETIES

- Societies can become more environmentally sustainable through economic development dedicated to improving the quality of life for everyone **without degrading the earth's life support systems**.
- Using political and economic systems to discourage environmentally harmful and unsustainable forms of economic growth that degrade natural capital, and to encourage **environmentally beneficial and sustainable forms of economic development** that help sustain natural capital.

SUSTAINABLE SOCIETIES

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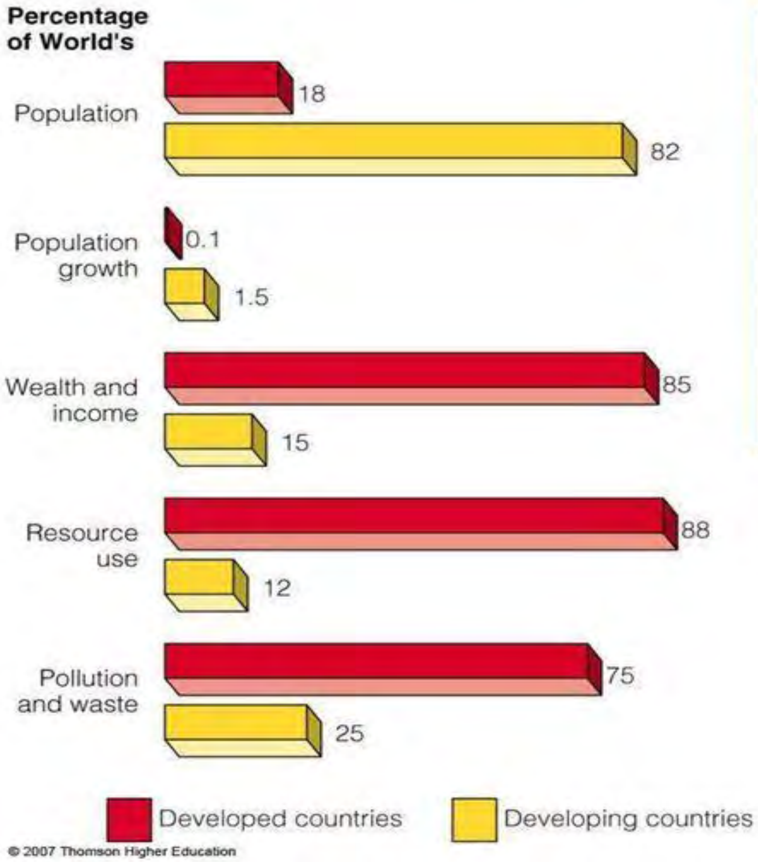
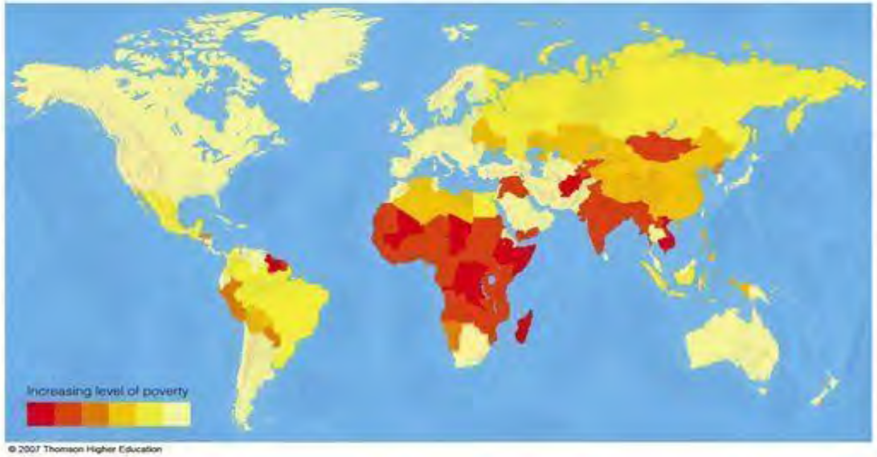
Global Outlook

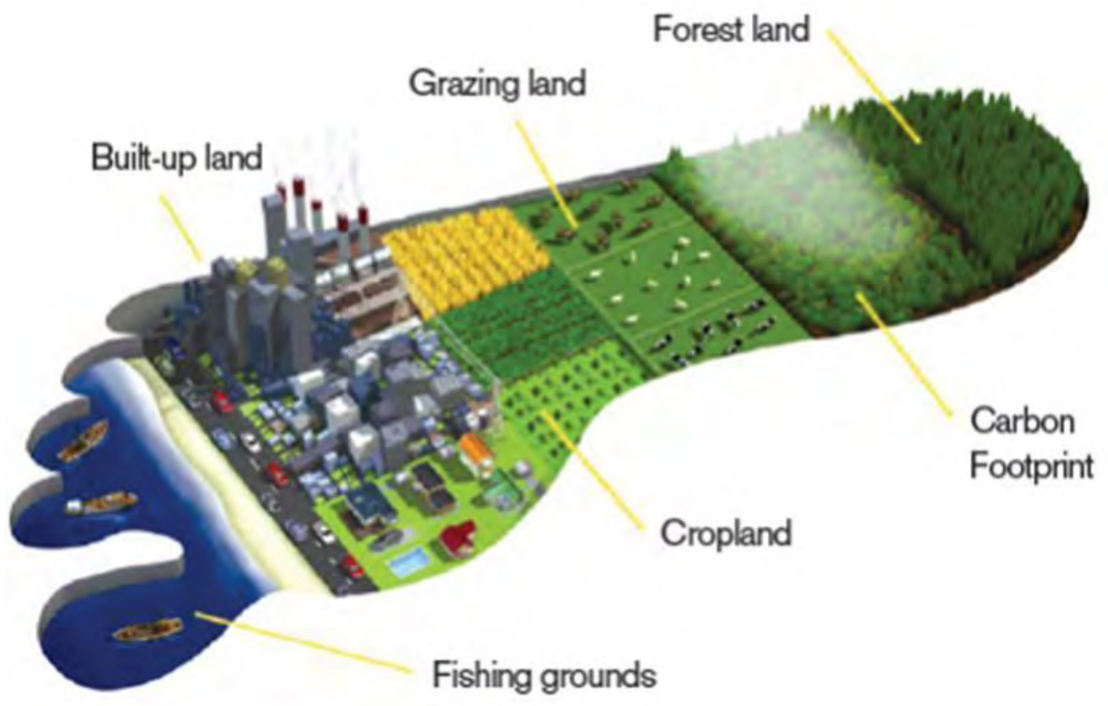




- Comparison of developed and developing countries.

ECOLOGICAL FOOTPRINTS

- **Measures human demand in nature**.
- **Quantity of nature it take to support** people or an economy.



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ECOLOGICAL FOOTPRINTS

How are our ecological footprints affecting the earth?

ECOLOGICAL FOOTPRINTS

- Ecological footprint analysis is widely used around the Earth as an **indicator of environmental sustainability**.

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POLLUTION

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- **Introduction by human**, directly or indirectly, of substances or energy into natural environment which **resulting in such deleterious effects** as harmful to living resources and hazards to human health.
- **Preventing pollution** is more effective and less costly than cleaning up pollution.
- Pollutants **can enter the environment naturally**, such as from of volcanic eruptions, or through human activities, such as burning coal and gasoline and discharging chemicals into rivers and the ocean.
- Pollutants and three types of unwanted effects:
  - ✓ They can disrupt or degrade life-support systems for humans and other species.
  - ✓ They can damage wildlife, human health and property.
  - ✓ They can create nuisance such as noise and unpleasant smells, tastes and sights

POLLUTION

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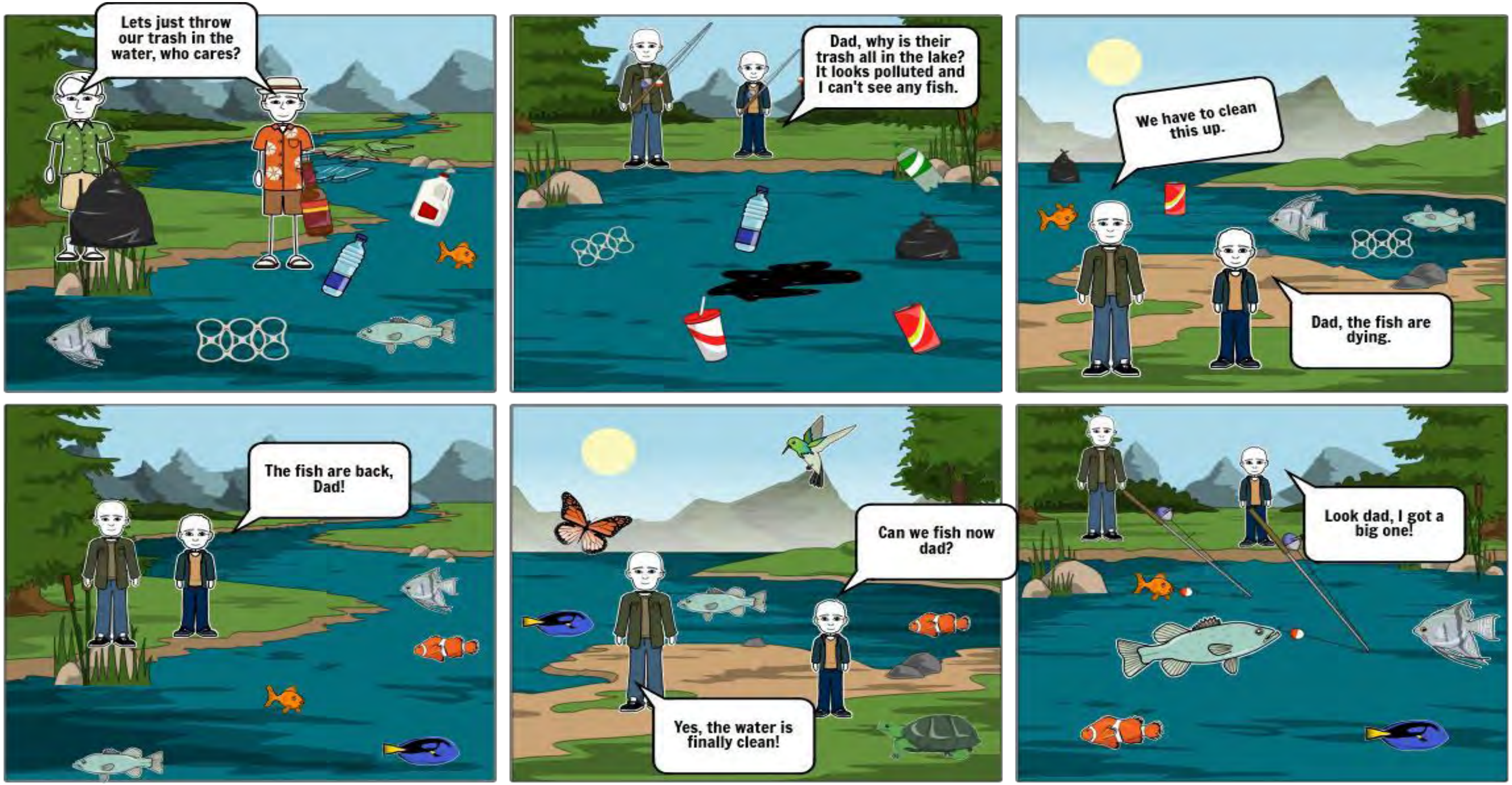

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POLLUTION

Pollution prevention

Treat

Reuse

Segregate

Reduce

Pollution Prevention & Control

Dispose

ENVIRONMENTAL PROBLEMS

- Why do we have environmental problems?

Four basic causes of environmental problems.

WHAT CAN WE DO FOR OUR EARTH?

- Any proposed solution has short and long-term advantages and disadvantages that must be evaluated.
- What is our role?
- Why should we care about the environment?

We do not inherit the Earth from our Ancestors,

We borrow if from our Children

HOW TO LIVE MORE SUSTAINABLY

Current Emphasis	Sustainability Emphasis
Pollution cleanup	Pollution prevention
Waste disposal	Waste prevention
Protecting species	Protecting habitat
Environment degradation	Environmental restoration
Increasing resource use	Less resource waste
Population growth	Population stabilization
Depleting & degrading natural capital	Protecting natural capital

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ENVIRONMENT – ISSUE AND GLOBAL PERSPECTIVE

CHAPTER 2

Environmental and Human Health Hazards

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LECTURE OUTLINE

- What major health hazards do we face?
- What types of biological hazards do we face?
- What types of chemical hazards do we face?
- How can we evaluate and deal with chemical hazards?
- How do we perceive risks and how can we avoid the worst of them?

What Major Health Hazards Do We Face?

Four major hazards:

1. Biological hazards
2. Chemical hazards
3. Physical hazards
4. Cultural hazards

BIOLOGICAL HAZARDS

(Bacteria, viruses, parasites, protozoa and fungi) all can infect humans.

CHEMICAL HAZARDS

Harmful chemicals in water, air, soil, food.

PHYSICAL HAZARDS

Fire, earthquake, volcanic eruption, flood, tornado and hurricanes.

CULTURAL HAZARDS

Smoking, unsafe working conditions, poor diet, drugs, Alcoholism, crimes, poverty, unsafe sex.

BIOLOGICAL HAZARDS

Disease Pathways to Humans

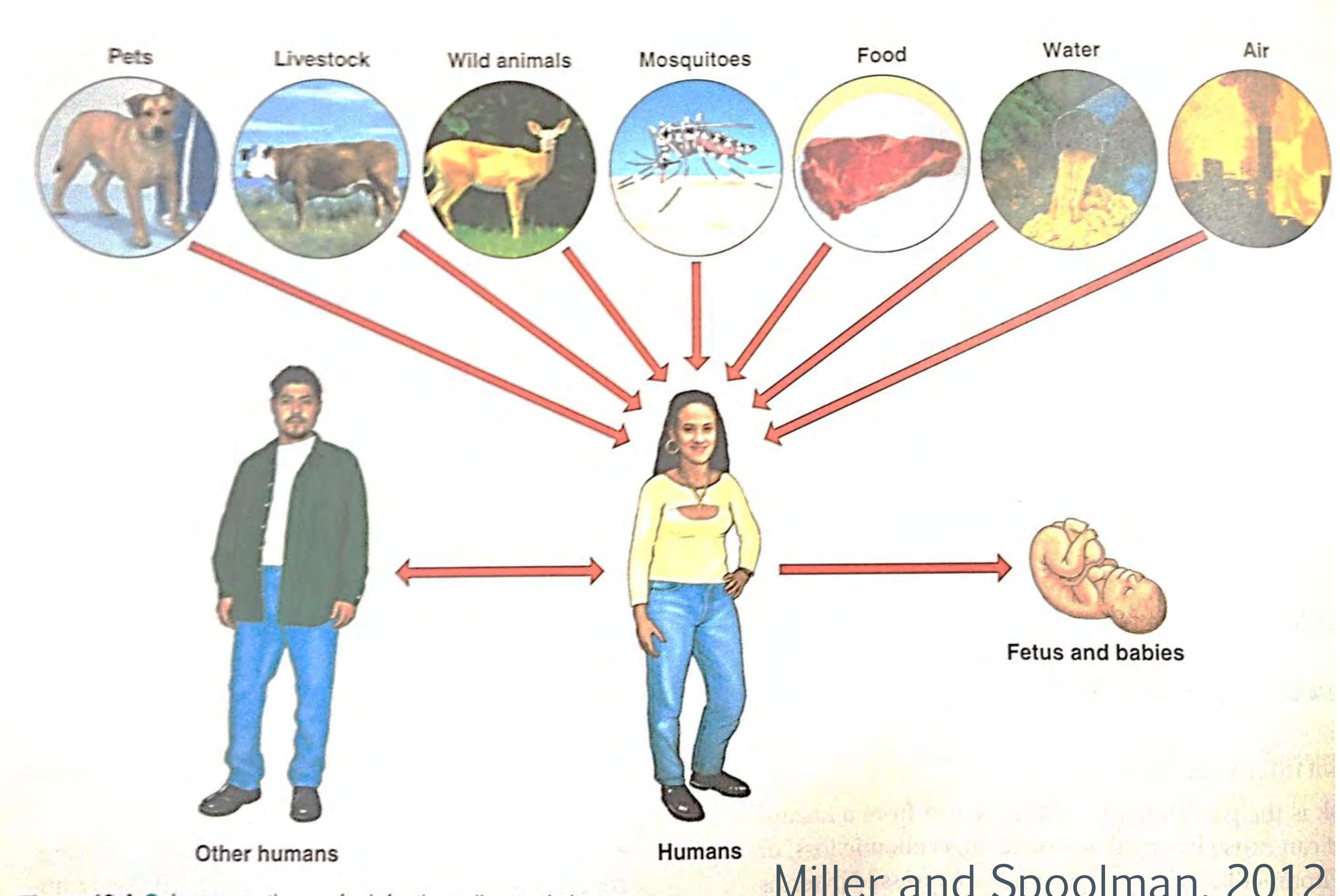

Figure 18-4 Science: pathways for infectious disease in humans.

Miller and Spoolman, 2012

What Types of Biological Hazards Do We Face?

In terms of death rates, the most serious infectious diseases are flu, AIDS, diarrheal disease, malaria and tuberculosis; most of these occur in developing countries.

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Two types of diseases:

b. Non-transmissible disease:

Not caused by living organism, does not spread. It develop slowly and have multiple causes (cultural hazard).

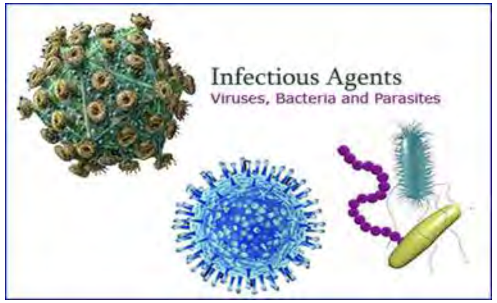
Examples: Cardiovascular diseases, asthma, malnutrition.

More examples?

a. Transmissible (Infectious) disease:

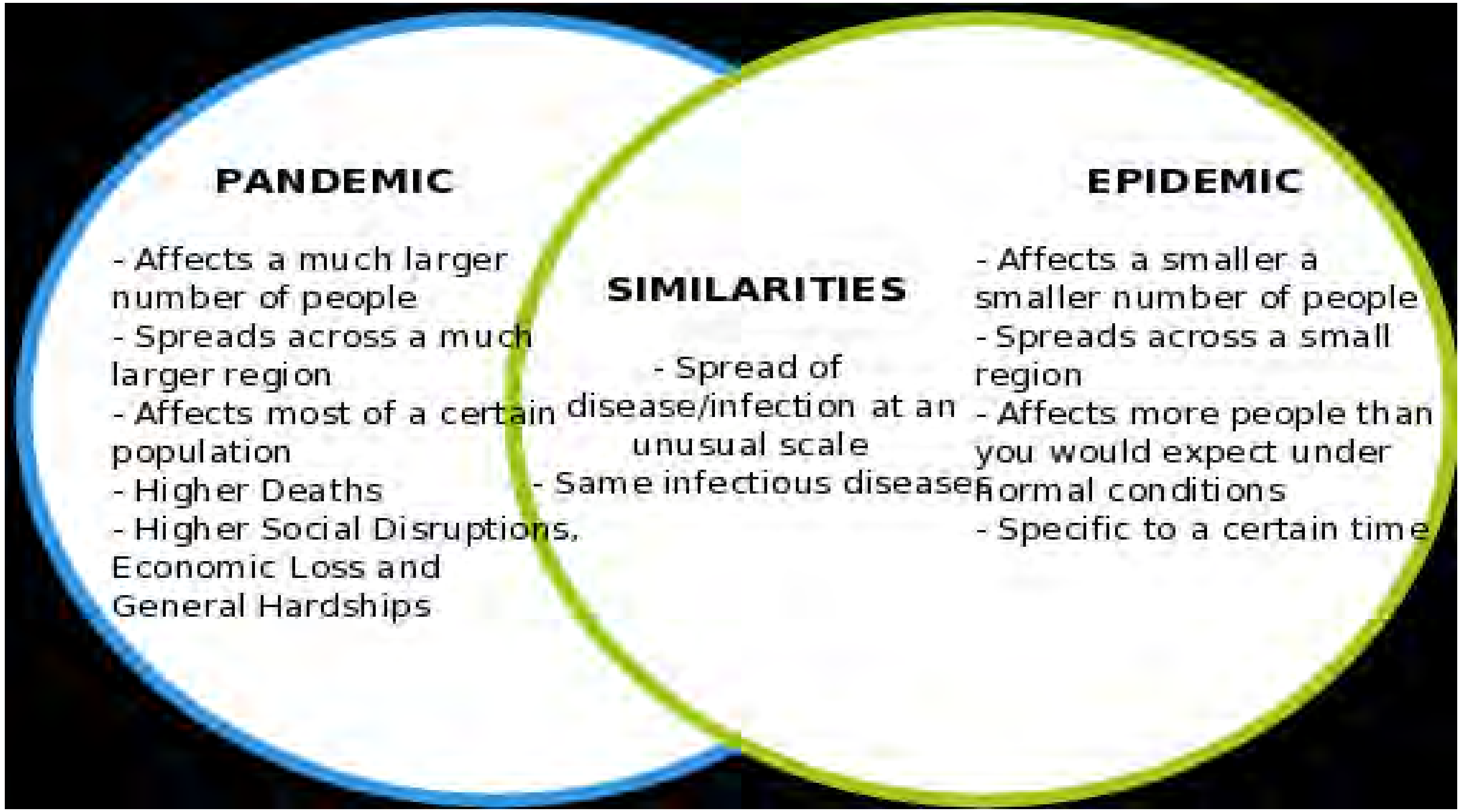
Infectious pathogen (example) invades the body and multiplies in its cells and tissues.

Examples: Tuberculosis, Malaria, Hepatitis, Trypanosomiasis



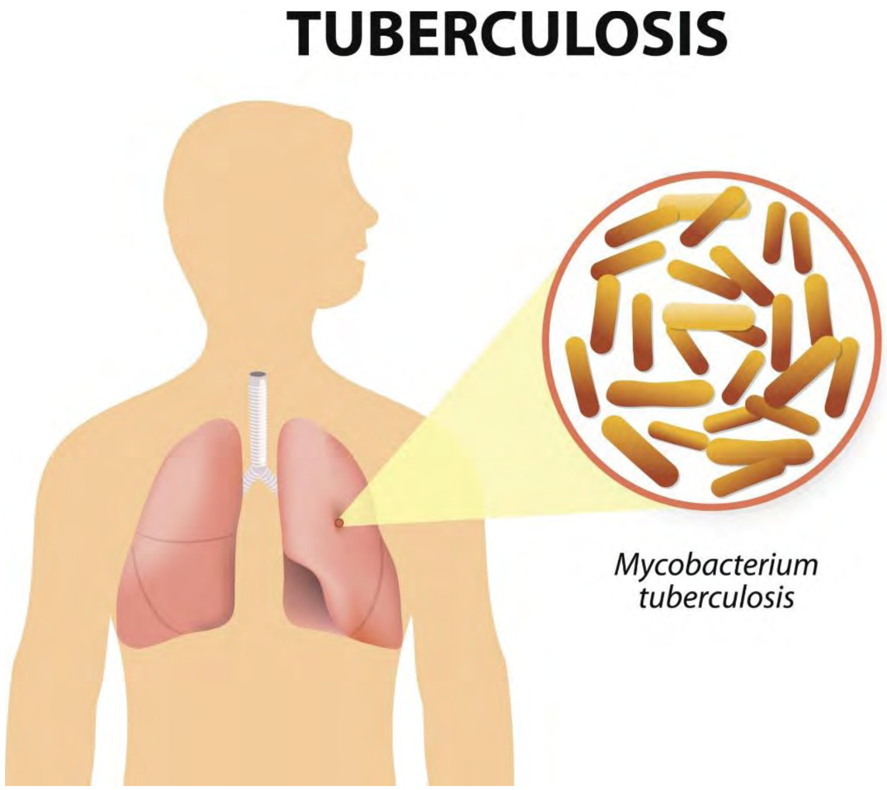
Epidemic vs Pandemic

- Epidemic: large scale outbreak of an infectious disease in and area or a country.
- Pandemic: Global Epidemic of infectious disease.



CASE STUDY 1. TUBERCULOSIS

- According to WHO, this highly infectious bacterial disease strikes about 9.2 million per year and kills 1.7 million- about 84% of them in developing countries.
- Many TB-infected people do not appear to be sick, and about half of them do not they are infected.
- If left untreated, each person with active TB typically infects 10-15 other people.



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Factors for the recent increase in TB incidence:

- Only a few TB screening and control programs (95% of the new cases are in developing countries).
- Most strains of the TB bacterium have developed genetic resistance to the majority of the effective antibiotics.
- Population growth
- Urbanization
- Air travel

Ebola virus disease (EVD) is described by the World Health Organisation (WHO) as "a severe, often fatal illness in humans." It first appeared in 1976 in two simultaneous outbreaks – in Nzara, Sudan; and in Yambuku, in the Democratic Republic of Congo.

CASE STUDY 2. EBOLA

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Ebola virus disease (EVD) is described by the World Health Organisation (WHO) as "a severe, often fatal illness in humans." It first appeared in 1976 in two simultaneous outbreaks – in Nzara, Sudan; and in Yambuku, in the Democratic Republic of Congo.

- How is the virus transmitted?
- The virus is known to live in fruit bats, and normally affects people living in or near tropical rainforests. It is introduced into the human population through close contact with the sweat, blood, secretions, organs or other bodily fluids of infected animals such as fruit bats, chimpanzees, forest antelope and porcupines found ill or dead or in the rainforest.
- The virus spreads among populations through human-to-human transmission, with infection resulting from direct contact, through broken skin or mucous membranes, and indirect contact with environments or objects contaminated with such fluids, such as door handles and telephones.

What does Ebola do?

- Symptoms begin with fever, muscle pain and a sore throat, escalating rapidly to vomiting, diarrhea and internal and external bleeding, leading quickly to death. Health workers are at serious risk of contracting the disease and need to wear a protective suit covering their entire body.

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CASE STUDY 2.
ZIKA VIRUS

- Zika virus disease is caused by a virus transmitted by Aedes mosquitoes (*Aedes aegypti*)
- People with Zika virus disease usually have symptoms that can include mild fever, skin rashes, conjunctivitis, muscle and joint pain, malaise or headache. These symptoms normally last for 2-7 days.
- There is no specific treatment or vaccine currently available.
- The best form of prevention is protection against mosquito bites.
- The virus is known to circulate in Africa, the Americas, Asia and the Pacific.

Diagnosis

- Infection with Zika virus may be suspected based on symptoms and recent history (e.g. residence or travel to an area where Zika virus is known to be present).
- Zika virus diagnosis can only be confirmed by laboratory testing for the presence of Zika virus RNA in the blood or other body fluids, such as urine or saliva.

We Can Reduce the Incidence of Infectious Diseases

- **Good news:**

60% drop in infectious disease (ID)caused deaths. 84% of Children immunised against ID (WHO). Some rich people donate to combat ID (Bill & Melinda Gates?)

- **Bad news:**

Only 10% of global medical research and money goes to preventing ID in developing countries (WHO).

CHEMICAL HAZARDS

What Types of Chemical Hazards Do We Face?

- A Toxic chemical can cause temporary or permanent harm or even death to humans and animals.

- A Hazardous chemical is harmful because it is flammable or explosive or irritating or damaging to skin or lungs, interfere with oxygen up-take or induce allergic reactions.

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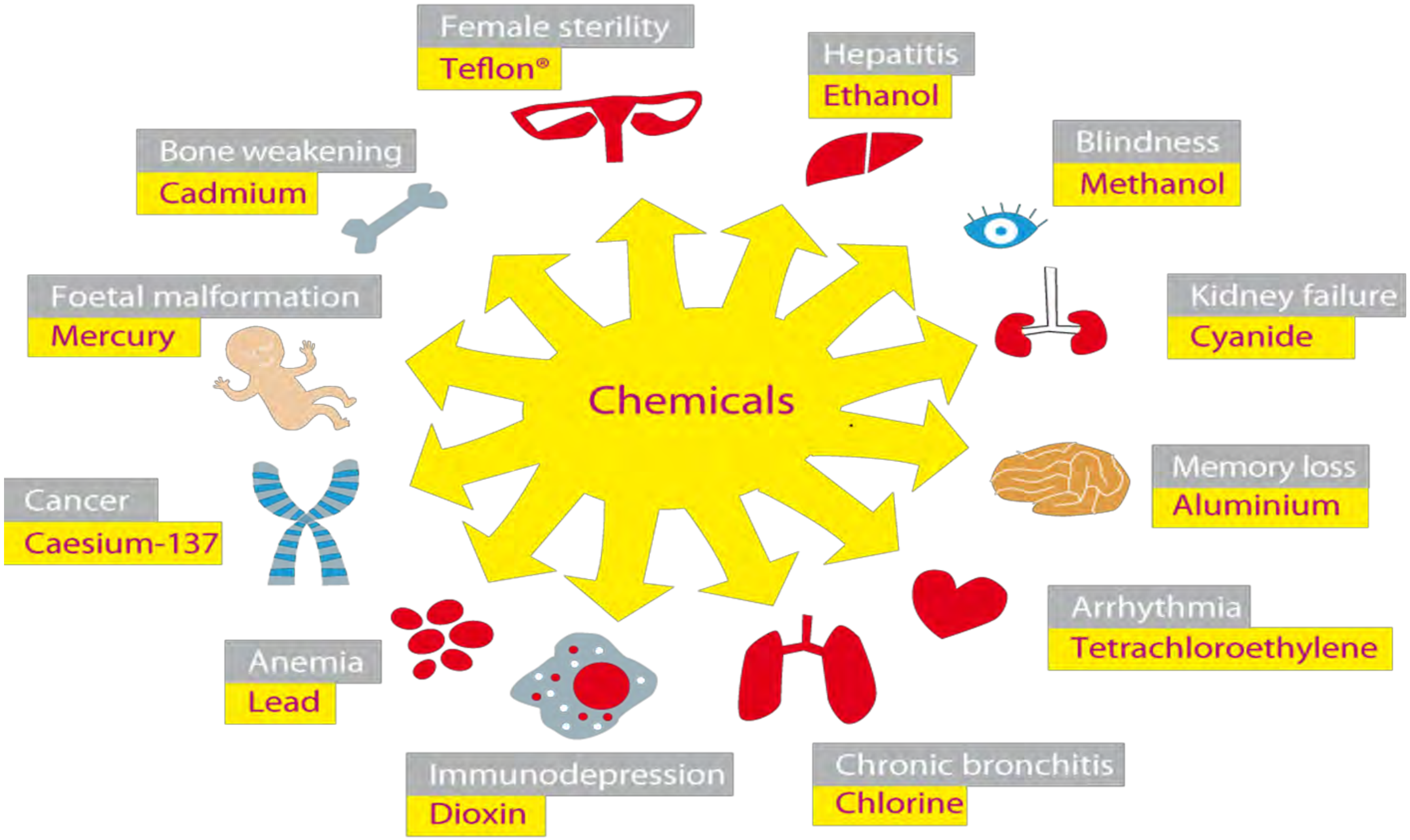


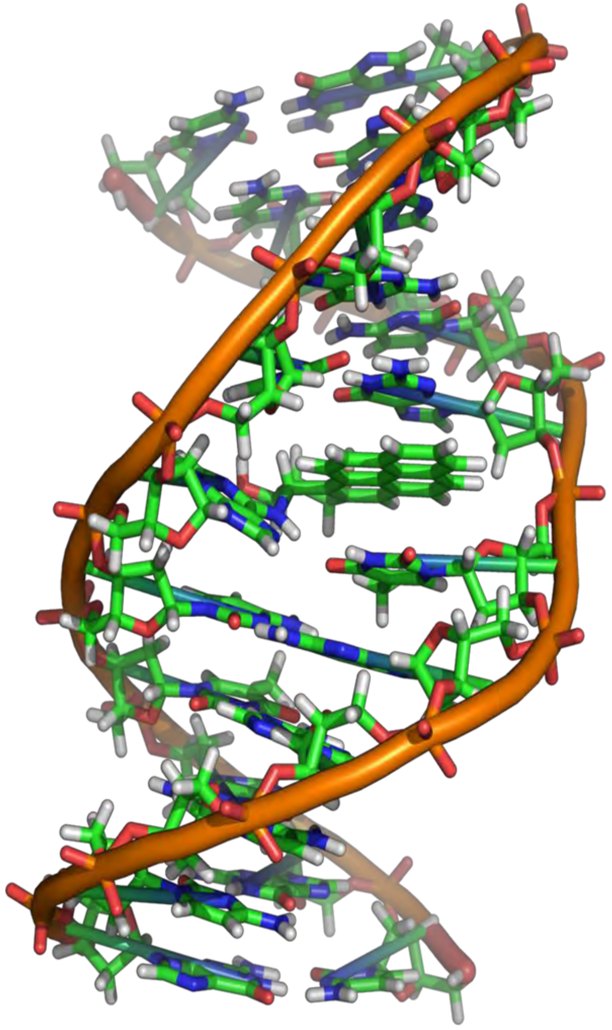
www.chemical-pollution.com

THREE Types of Toxic agents

1. Mutagens

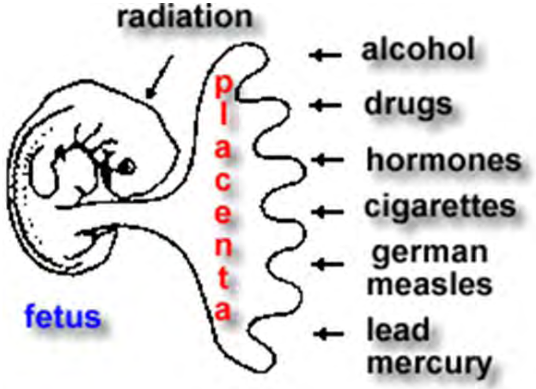
Chemicals or forms of Radiation that cause or increase frequency of mutations
(changes of DNA sequence).

Mutations in reproductive cells can be passed to offspring and future generations.



2. Teratogens

Chemicals (or radiation) that cause birth defects to a foetus or Embryo.



Examples:
- Drinking during pregnancy (Alcohol)
- Arsenic
- Benzene
- DDT
- Lead
- Mercury
....etc.

3. Carcinogens

Chemicals or Radiation type that can cause or promote cancer.

An uncontrolled proliferation of malignant cells, creating tumors that can damage the body and often lead to death.

Examples:

Arsenic

Benzene

Vinyl chloride

Asbestos

Chemicals in tobacco smoke

How can we evaluate and deal with chemical hazards?

- Scientist use live laboratory animals, non-animal tests, case reports of poisonings and epidemiological studies to estimate the toxicity of chemicals, but these methods have limitations.

- Many health scientists call for much greater emphasis on pollution prevention to reduce our exposure to potentially harmful chemicals.

PHYSICAL HAZARDS

- **Physical hazards** are natural processes that occur naturally like earthquakes, volcanic eruptions, fires, floods, blizzards, hailstorms, landslides, hurricanes, and droughts.

- But they also include ongoing natural phenomena, like ultraviolet (UV) radiation from sunlight, which can cause skin cancer, cataracts, and immune suppression in case of excessive exposure.

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National Weather Service defines a **blizzard** as a storm which contains large amounts of snow OR blowing snow, with winds in excess of 35 mph and visibilities of less than 1/4 mile for an extended period of time (at least 3 hours). When these conditions are expected, the National Weather Service will issue a "Blizzard Warning". When these conditions are not expected to occur simultaneously, but one or two of these conditions are expected, a "Winter Storm Warning" or "Heavy Snow Warning" may be issued.

Earthquake

- An earthquake is a sudden shaking of the Earth's surface caused by rock breakage deep within the Earth. This is the result of stresses that have built up within the Earth's brittle crust.

- Earthquakes affect almost every part of the Earth and like rain they can be either mild or catastrophic.

- Over the course of geological time, earthquakes, floods, and other natural events have helped to shape the surface of our planet.

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Factors affecting impact of earthquake

<u>Structural failures:</u>

- -Brittle building materials cause more damage
- -Building height oscillation

Haiti – over 200,000 deaths

New Zealand – 0 deaths

Ultraviolet (UV) Radiation

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- The sun emits energy over a broad spectrum of wavelengths: visible light that you see, infrared radiation that you feel as heat, and UV radiation that you can’t see or feel.
- UV radiation has a shorter wavelength and higher energy than visible light. It affects human health both positively and negatively. Short exposure to UVB radiation generates vitamin D, but can also lead to sunburn depending on an individual’s skin type.
- Fortunately for life on Earth, our atmosphere’s stratospheric ozone layer shields us from most UV radiation.

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Protection Against Exposure to UV Radiation

For hazards like exposure to UV light, the risk can be reduced by using clothing and sunscreen to shield our skin from intense sunlight.

- Avoid Sun Tanning and Tanning Beds
- Use Sunscreen
- Cover Up
- Seek Shade
- Watch for the UV Index
- Get Vitamin D Safely

CULTURAL HAZARDS

- **Cultural hazards**, also known as **social hazards**, result from your location, socioeconomic status, occupation and behavioral choices.
- For example, smoking cigarettes is hazardous to your health, and this is a behavioral choice. If you live in a neighborhood with lots of crime, this is a hazard based on your location.
- Similarly, your diet, exercise habits and primary mode of transportation all influence your health and the health of the environment around you.

Smoking

Tobacco smoking is a major cause of chronic bronchitis, emphysema and lung cancer, as well as a major risk factor for heart attack, certain pregnancy-related and neonatal disorders and a number of other serious health problems, and that it also has harmful effects on those who are involuntarily exposed to tobacco smoke.

Poor Diet

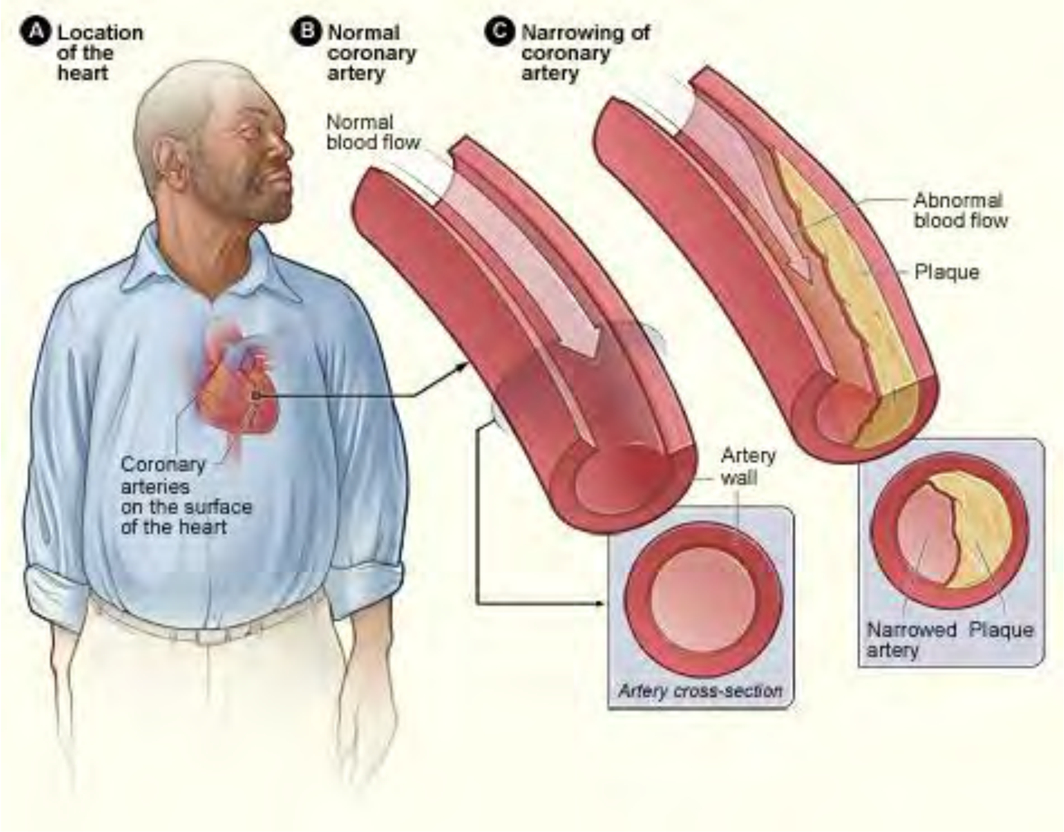
What causes poor nutrition? Poor eating habits include eating too many or too few calories per day, not eating from all the food groups, consuming too much fat, sugar and salt or eating foods which are non-nutritive. For instance, a person with poor nutrition might frequent fast food restaurants, drink soda instead of water and forget to eat fruits and vegetables.

The Effects of Poor Diet on Health

Weight Control

- The most obvious consequence of bad nutrition is the overweight and obesity epidemic seen in the developed countries.

Being overweight or obese compounds your risk of heart disease, diabetes, stroke, cancer and osteoporosis.



High blood cholesterol.
Coronary heart disease is a condition in which plaque builds up inside the coronary (heart) arteries. Plaque is made up of cholesterol, fat, calcium, and other substances found in the blood.

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Malnutrition

- It's one of the ironies of modern culture that someone who eats too much can still be malnourished. The symptoms of malnutrition depend on which vitamins or minerals are lacking in your diet.

- Iron deficiency, for instance, can cause fatigue, dizziness and shortness of breath. The best treatment for malnutrition is to improve your diet and eat a wide variety of foods. In some circumstances, supplements may be necessary to overcome a nutritional deficiency.

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ENVIRONMENT – ISSUE AND GLOBAL PERSPECTIVE

CHAPTER 2

ENVIRONMENTAL POLLUTION ISSUES – TYPES AND CAUSES OF POLLUTION

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LECTURE OUTLINE

- Major pollutants in our environment
- Sources of these pollution
- Impact to environment
- How we can work together to solve the problems

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POLLUTION

- **Any change in the environment** due to anthropological activities.

- Direct or indirect introduction as a result of human activity, of substances, vibration, heat or noise into the air, water or land which may be harmful to human health or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment.

- BUT not all pollution is caused by substance? Example?

SEVERITY OF POLLUTION

- **Three factors** determine severity of pollution:

Concentration → The amount of substance in unit volume of air, water or other medium. ppm 1 part of pollutant in million parts of the gas, liquid or solid substance.

- **Persistence** → Measure of how long the pollutant stays in air, water, soil of body.
- **Chemical nature**

POLLUTANT

- Pollutants are **four categories** up on their persistence:

Degradable Pollutants:

Breakdown completely or reduced to acceptable levels by natural physical, chemical and biological processes – microorganism

Example : Paper products, vegetable, seed, leaves

Biodegradable Pollutants:

- Complex chemical pollutants that breakdown by living organisms (Bacteria).
- Example: Human sewage

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Slowly degradable Pollutants:

- Degradable in decades
- Example : Plastics, cans

Non-degradable Pollutants:

- Chemicals that natural process cannot breakdown.
- Example : DDT, mercury, lead, arsenic, silicon-based materials

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TYPES OF POLLUTION

Major types of pollution

•Water Pollution
•Air Pollution
•Thermal Pollution
•Noise Pollution
Soil Pollution

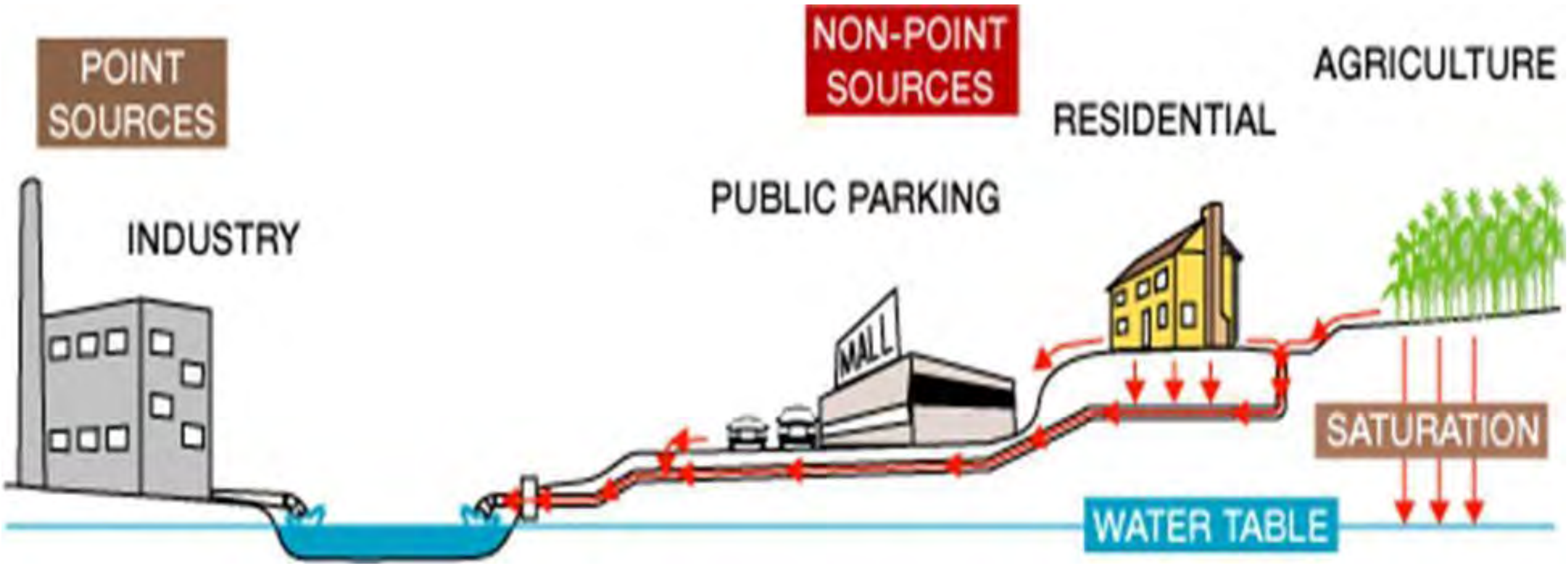



WATER POLLUTION

- Water pollution is any **chemical, biological or physical change in water quality** that **harms living organisms** or makes water unsuitable for desired uses.
- The substances that cause water pollution are called **pollutants**.
- Water pollution causes illness and death in humans and other species and disrupt ecosystems.
- The main sources of water pollution are agricultural activities, industrial facilities, and mining, but growth in population and source use makes it increasingly worse

WATER POLLUTION

- Water pollution can come from **single (point) source**, or from **larger and dispersed (nonpoint) sources**.
- **Point Source Pollution** ❼ Specific source of pollution that can be identified. Example: A pipe gushing colored water into a river
- **Nonpoint Source Pollution** ❼ A widely spread source of pollution that can't be tied to a specific point of origin is called nonpoint source pollution. Example: Runoff from a farm field, a street, or a construction site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NON-POINT SOURCES
AGRICULTURE
RESIDENTIAL
PUBLIC PARKING
INDUSTRY
MALL
SATURATION
WATER TABLE

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WATER POLLUTION

The three major sources of water pollution are **human wastes**, **industrial wastes**, and **chemical runoff**.

Sewage in cities

During heavy rains or floods, sanitary sewers sometimes overflow and can pollute the surface water.

Sewage in Rural Areas

In rural areas, people must be careful where they locate septic tanks. If a tank is too near a stream or on a hill, wastewater can leak into the stream or flow downhill to the area of a well.

Wastes from cattle, pigs, and chickens can also be a problem in rural areas. Animal wastes can run off from pastures and barn yards and pass diseasecausing bacteria and other kinds of pollution into bodies of water.

Industrial wastes

- Chemicals, smoke , and heated water are three types of pollutants produced by factories, mines, and other industries.
- Heated water: the change in temperature decreases oxygen supply and affects ecosystem composition

Chemicals

- Many factory processes involve toxic chemicals and strong acids.
- Other toxic wastes are produced as a result of manufacturing and mining processes.
- Although laws control many point sources of chemical pollution, some factories still release toxic chemicals directly into nearby rivers and lakes.

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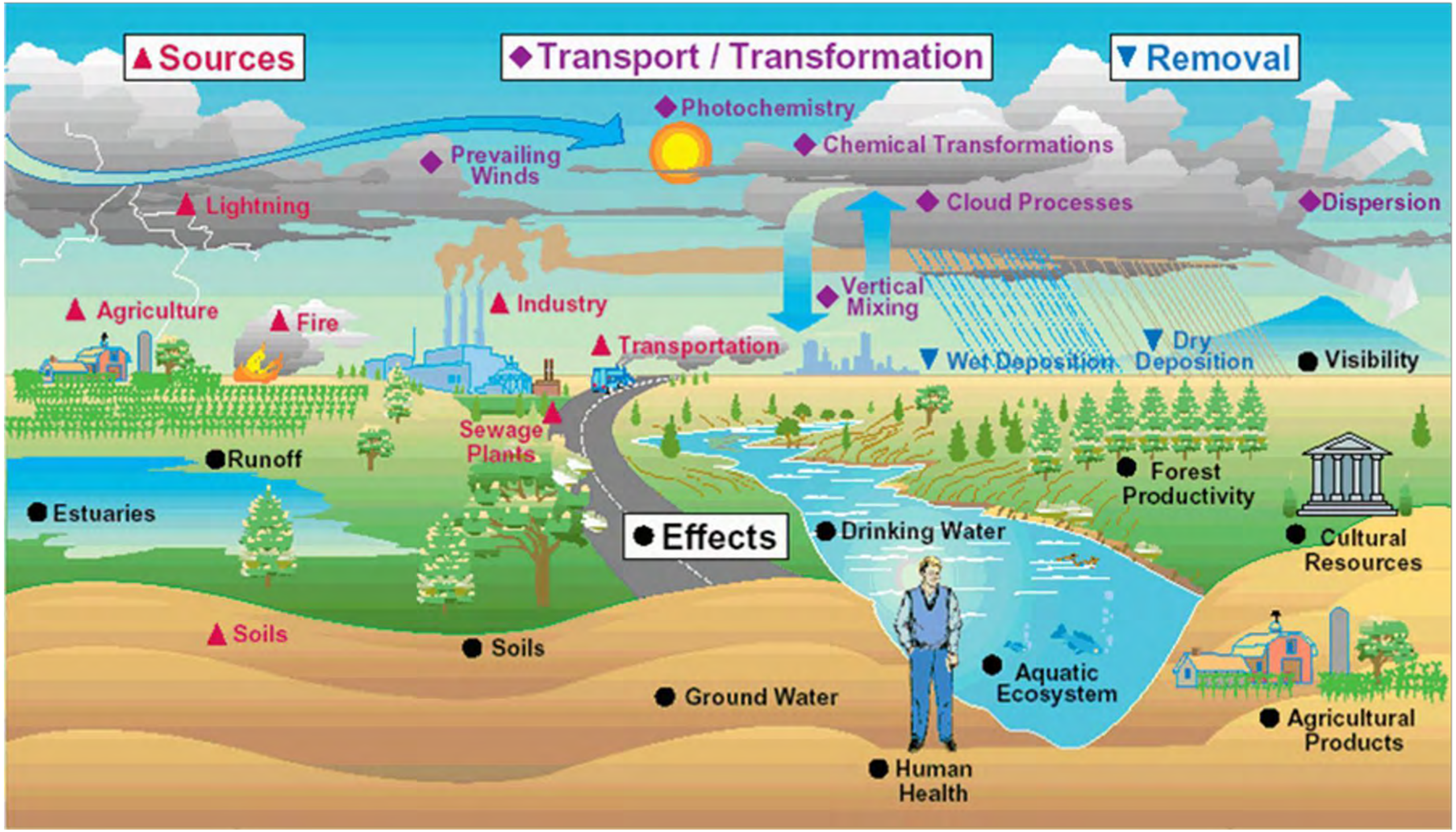
•Major pollution problems

- Chemicals used in agriculture, industry, transportation, and homes can spill and leak into groundwater and make it undrinkable.

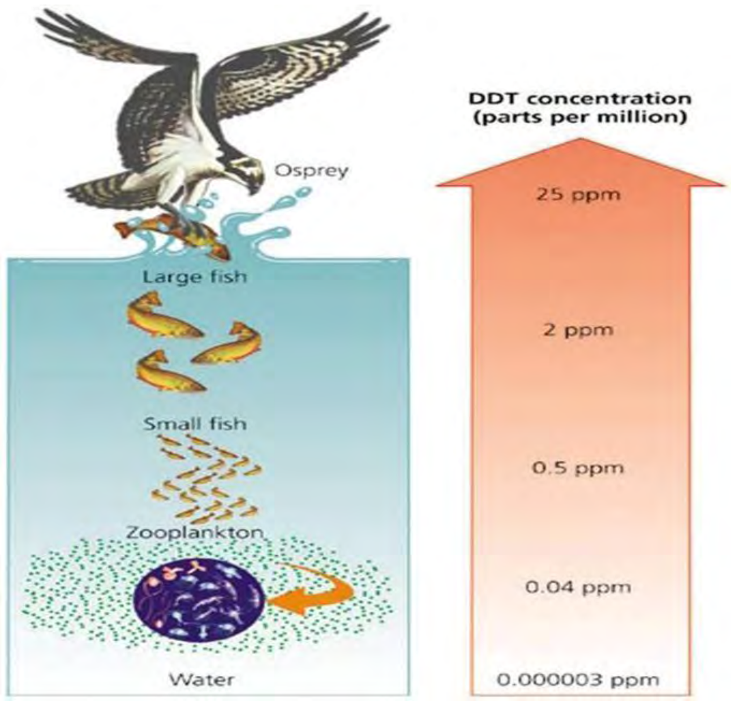
- There are simple ways and complex ways to purify drinking water, but protecting it through pollution prevention is the least expensive and most effective strategy.


▲Sources
◆Transport / Transformation
▼Removal
◆Photochemistry
◆Chemical Transformations
◆Prevailing Winds
▲Lightning
◆Cloud Processes
◆Dispersion
▲Agriculture
▲Fire
▲Industry
◆Vertical Mixing
▲Transportation
▼Wet Deposition
▼Dry Deposition
●Visibility
Sewage Plants
●Runoff
●Forest Productivity
●Estuaries
●Effects
●Drinking Water
●Cultural Resources
▲Soils
●Soils
●Ground Water
●Aquatic Ecosystem
●Agricultural Products
●Human Health

WATER POLLUTION

Major water pollution problems affecting oceans

- The great majority of ocean pollution originates on land and includes oil and other toxic chemicals and solid wastes, which threaten aquatic species and other wildlife and disrupt marine ecosystems.
- The key to protecting the oceans is to reduce the flow of pollutants from land and air and from streams emptying into these waters.
- A very small amount of DDT in water can build up to harmful levels in living organisms.



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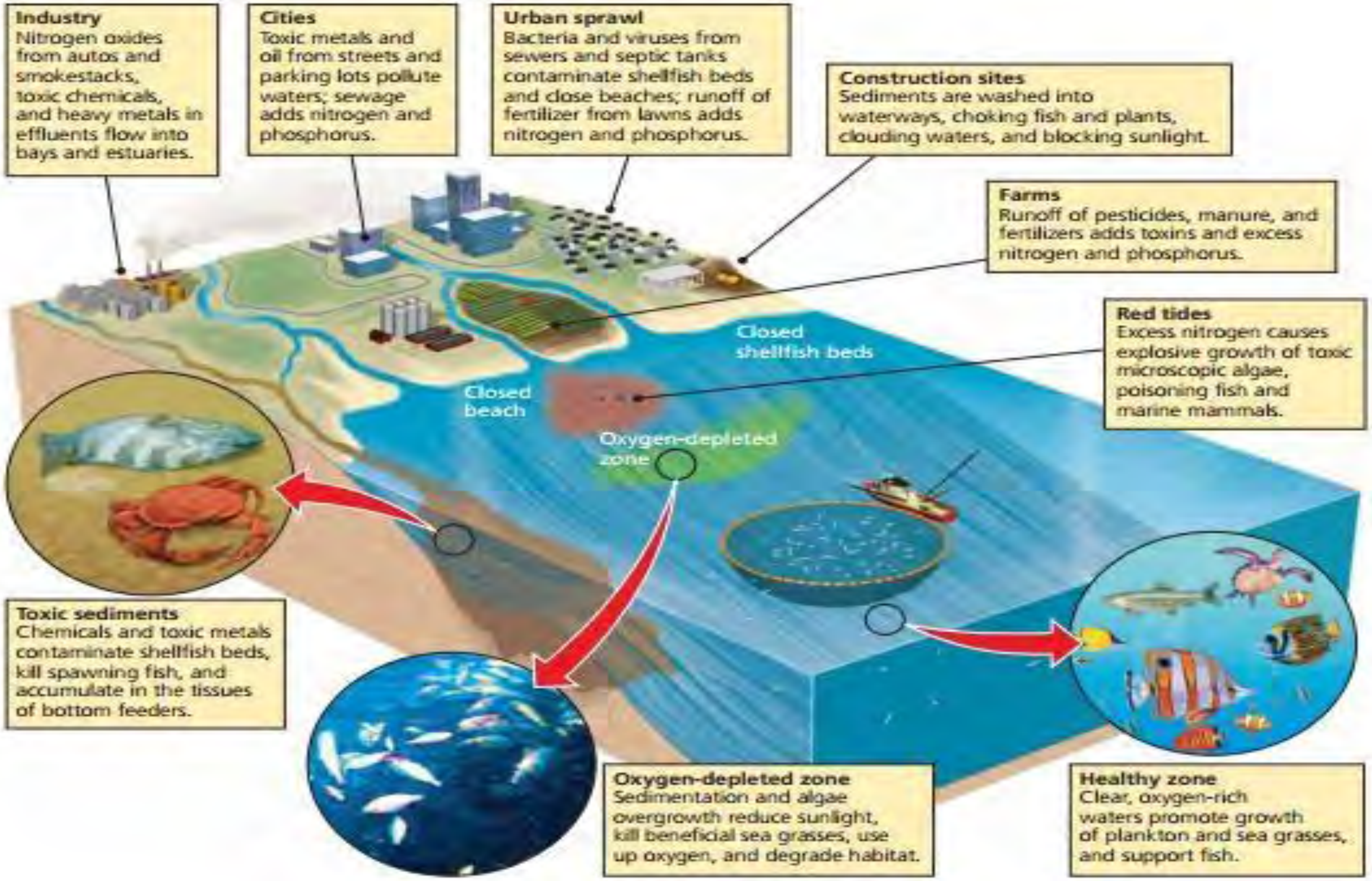
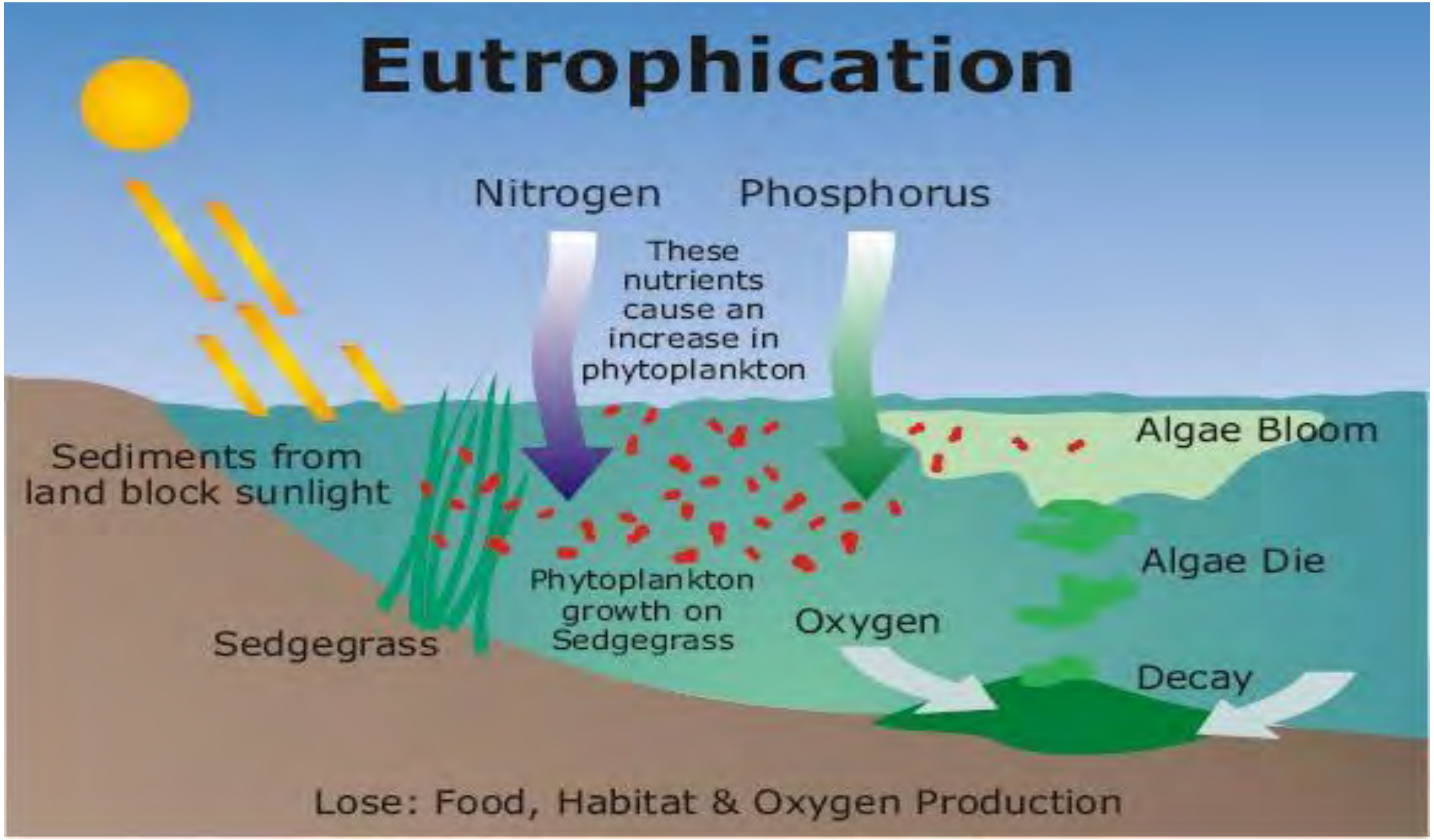


WATER POLLUTION

Microbeads

- Microbeads are small pieces of plastic (ranging in size from 10 micrometers to 1 mm) commonly found in facial cleansers, body scrubs and soap.
- They are washed into waterways where they settle into sediment.
- The small plastic pieces can be consumed by marine life, and scientists believe they are also likely to attract other pollutants such as oils and pesticides.
- Humans can ingest microbeads when eating contaminated fish.


Beauty Stuff Inc.
EXFOLIATING
FACIAL SCRUB
NOW WITH MICROBEADS
GREENBERG steve@greenberg-art.com
NOW WITH MICRO-BEADS
NOW WITH MICROBEADS
NOW WITH MICROBEADS


Eutrophication
Nitrogen
Phosphorus
These nutrients cause an increase in phytoplankton
Sediments from land block sunlight
Algae Bloom
Algae Die
Phytoplankton growth on Sedgegrass
Oxygen
Sedgegrass
Decay
Lose: Food, Habitat & Oxygen Production

Bioremediation

- Living organisms helping cleanup pollution.
- Plant roots filter larger particles from the water.
- Certain bacteria consume oil and have been used to cleanup oil spills.
- Natural and artificial wetlands can be used to clean up water pollution.
- Wetlands have been built near coal mines to treat acidic mining runoff before it returns to the environment.

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How Can We Best Deal with Water Pollution?

AIR POLLUTION

- Air pollution is the **presence of chemicals in the atmosphere** in concentrations high enough to **harm organisms, ecosystems, or human-made materials**.
- The effects of air pollution range from annoying to lethal.

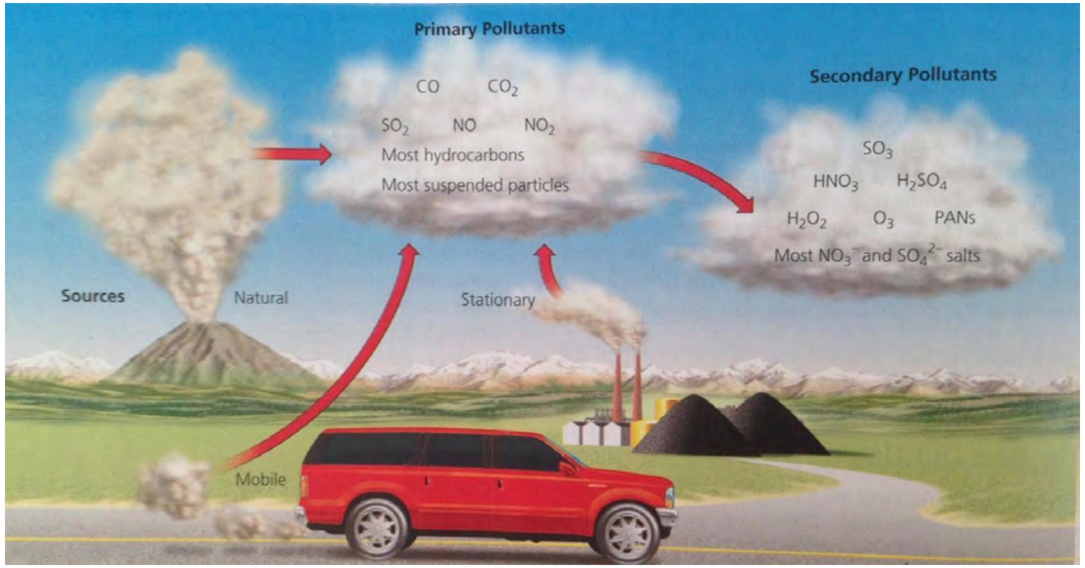
AIR POLLUTION

- Air pollution comes from **natural and human sources**
- Natural sources include dust blown by wind, pollutants from wildfires, volcanic eruptions.
- Most natural air pollutants are spread out over the globe or removed by chemical cycles, precipitation and gravity.
- Human inputs of outdoor air pollutants occur mostly in industrialized and urban areas where people, cars, are factories are concentrated.
- Pollutants of major public health concern include particulate matter, carbon monoxide, nitrogen dioxide and sulphur dioxide.

Scientist classify outdoor air pollutants into two categories.

•**Primary pollutants** → Harmful chemicals emitted directly into the air from natural processes and human activities.

Secondary pollutants → While in the atmosphere, some primary pollutants react with one another and with the basic components of air to form new harmful chemicals



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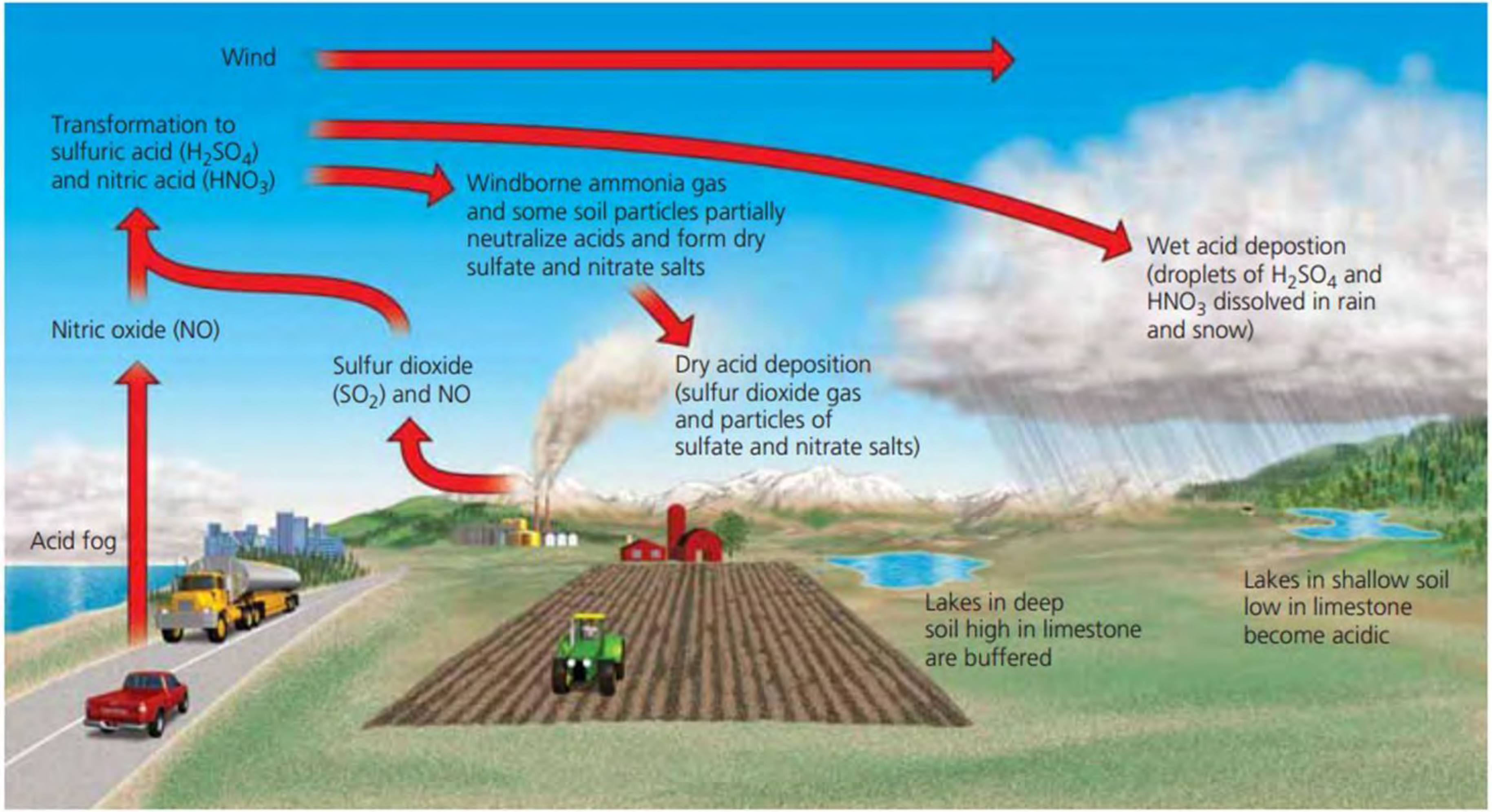

CENGAGENOW™ **Active Figure 18-12** **Natural capital degradation:** *acid deposition,* which consists of rain, snow, dust, or gas with a pH lower than 5.6, is commonly called acid rain. Soils and lakes vary in their ability to neutralize excess acidity. *See an animation based on this figure at* CengageNOW. **Question:** What are three ways in which your daily activities contribute to acid deposition?

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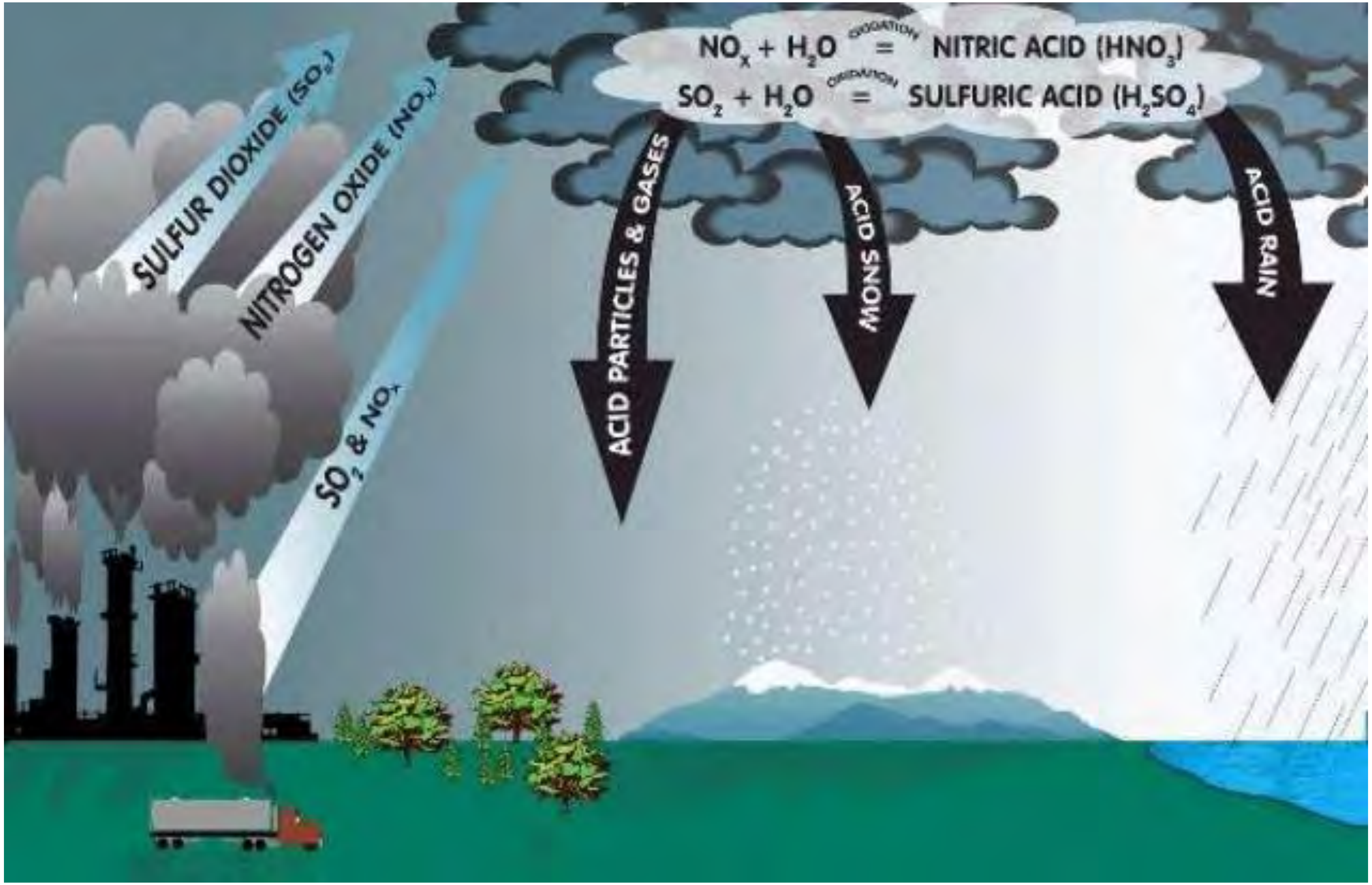

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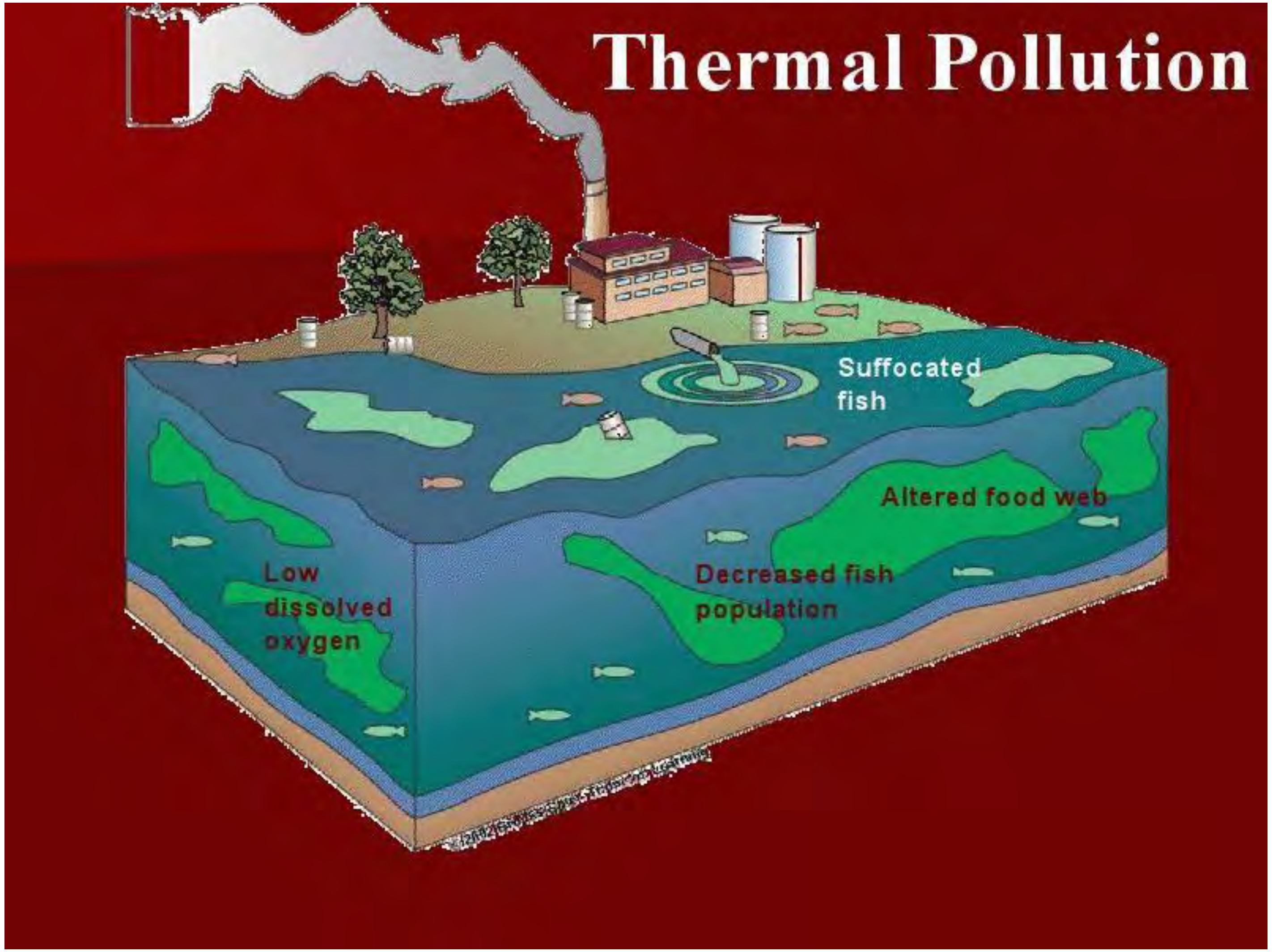
THERMAL POLLUTION

- Much of the water in factories is used to **cool machinery or metal objects**.
- The hot water alone can act as a pollutant.
- Many water organisms can live in only a **narrow range of temperatures**.
- Warm water released by factory into a nearby river or pond raises the temperature of the water, sometimes enough to harm the living things there.
- When water used as a coolant is returned to the aquatic environment at a higher temperature, the change in temperature **decrease oxygen supply** and affect the ecosystem composition.
- Urban run-off and storm water discharge to surface waters from road and parking lots can also be a source of elevated water temperatures.


Thermal Pollution
Suffocated fish
Altered food web
Low dissolved oxygen
Decreased fish population

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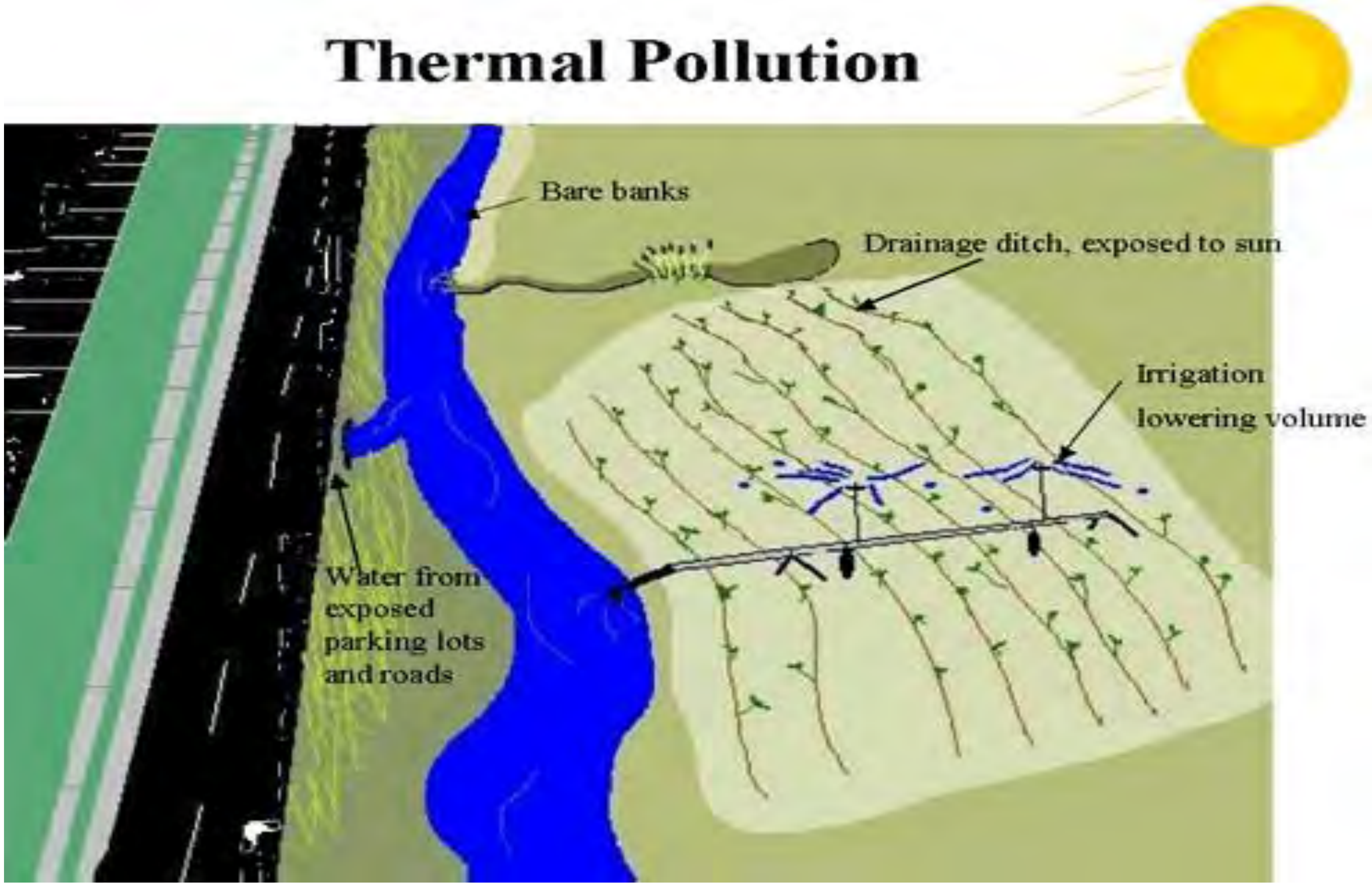
Thermal Pollution



When a power plant first opens or shuts down for repair or other causes, fish and other organism adapted to particular temperature range can be killed by the abrupt change in water temperature ❼ **THERMAL SHOCK**

Any suggestion to solve/minimize the problem?

NOISE POLLUTION

- Most urban dwellers are subjected to noise pollution: any **unwanted, disturbing, or harmful sound** that impairs or interferes with hearing, causes stress, hampers concentration and work efficiency, or causes accidents.
- Noise levels are measured in decibel (dB) sound pressure units that vary with different human activities.
- Sound pressure becomes damaging at about 85 dB and painful at around 120 dB. At 180 dB it can kill.
- Prolonged exposure to sound levels above 85 dB can cause permanent hearing damage.

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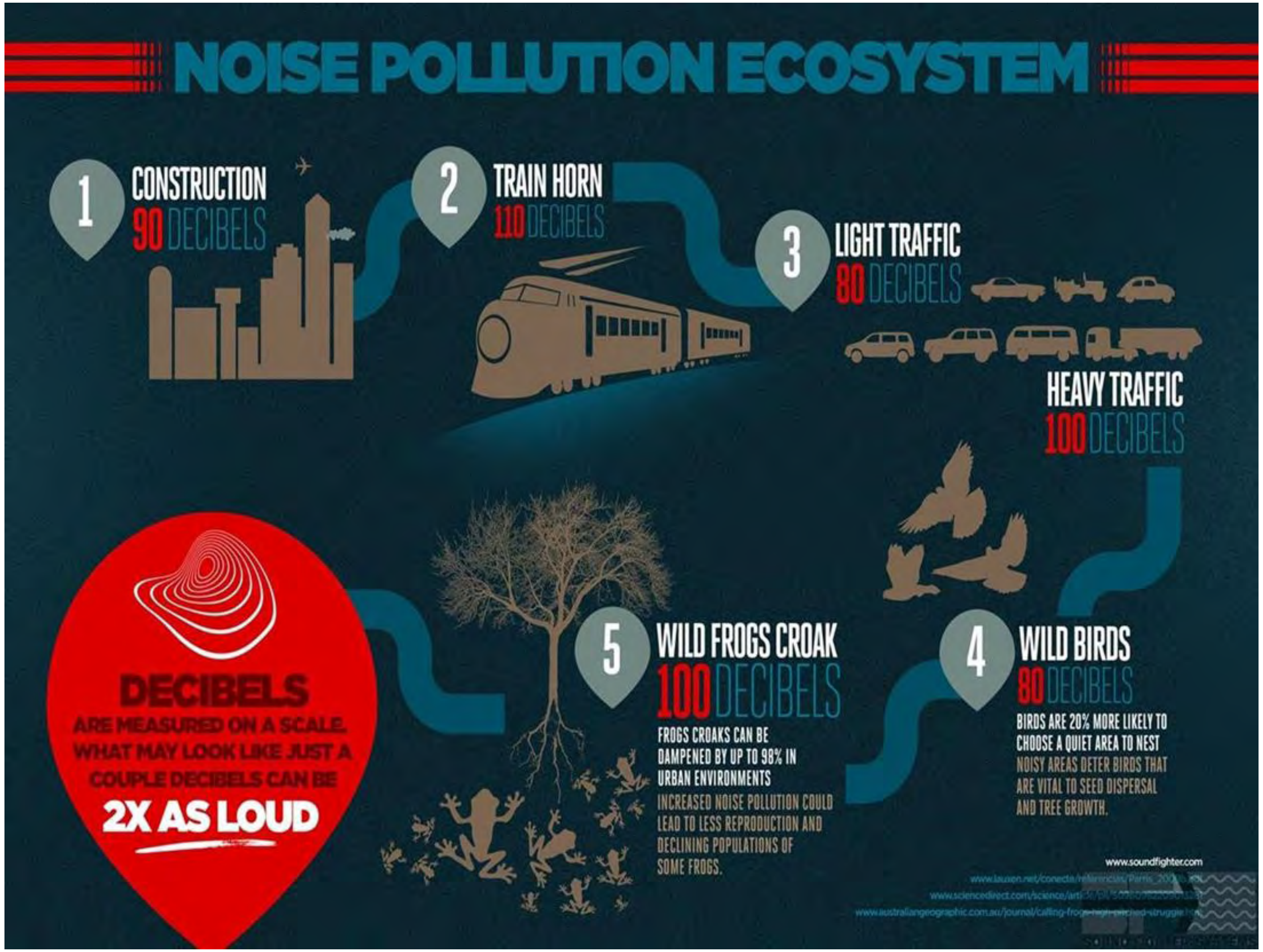
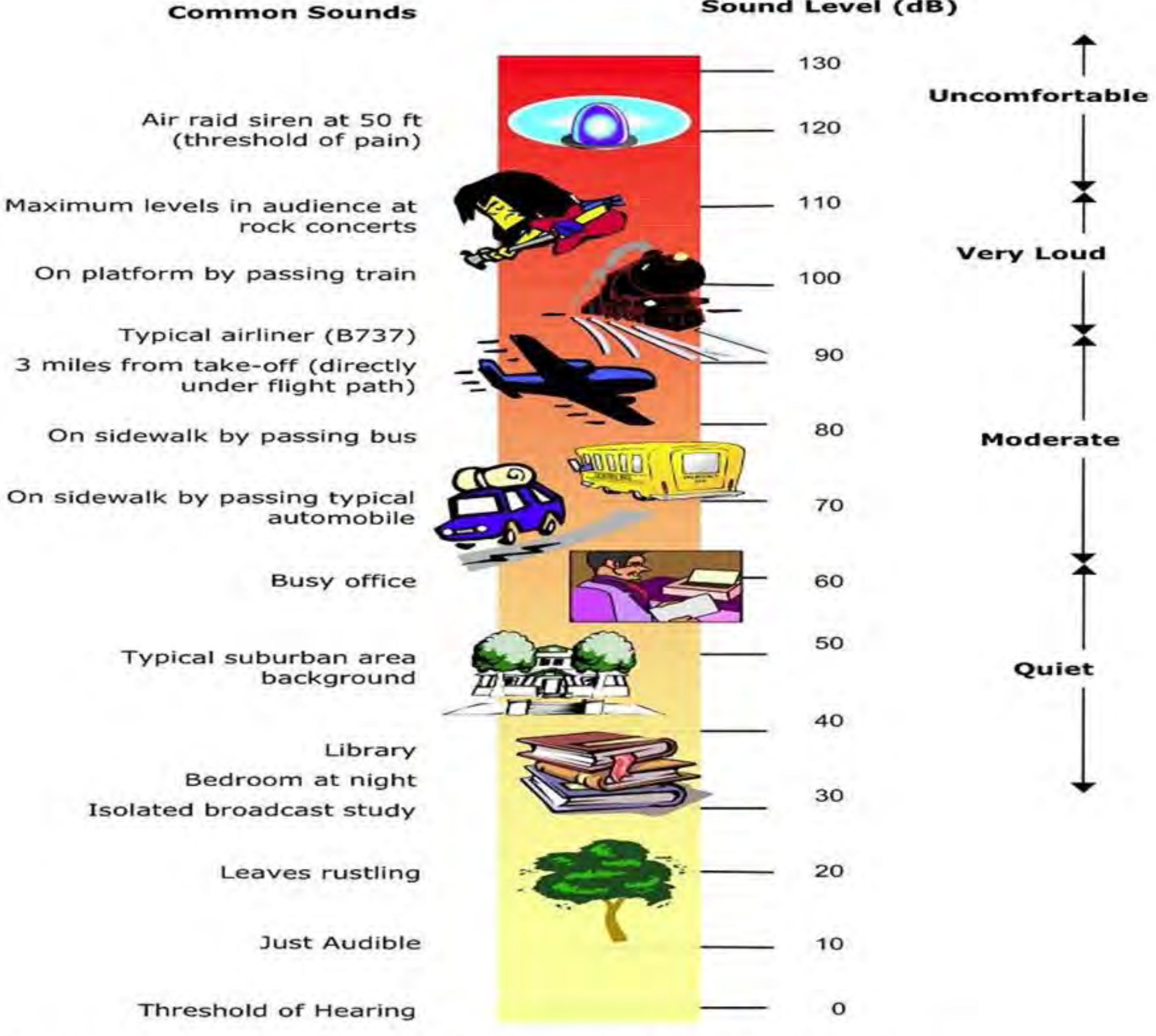
NOISE POLLUTION





Source: *Handbook of Environmental Acoustics, James P. Cowan, 1994*

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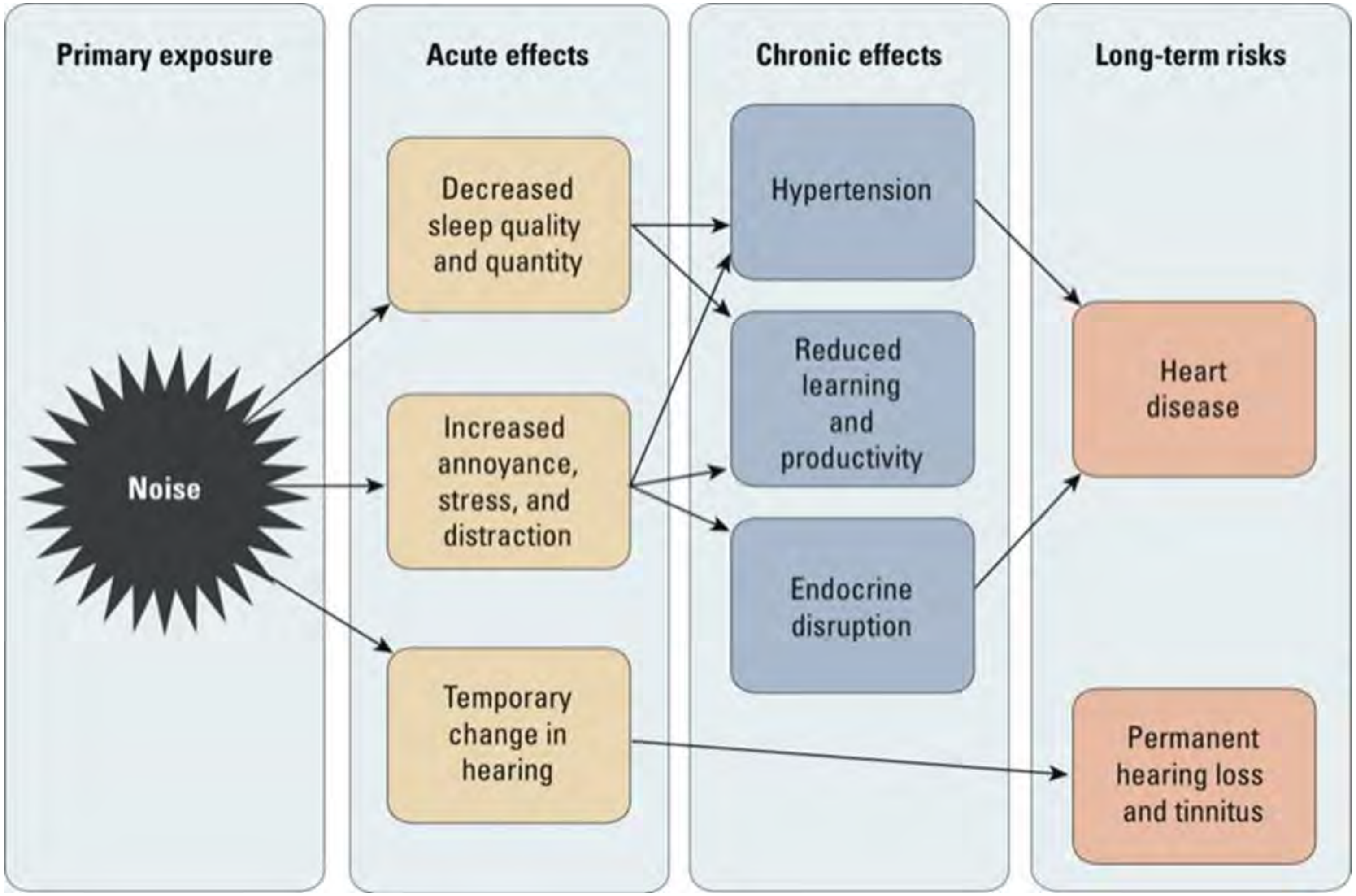
Effects of noise pollution



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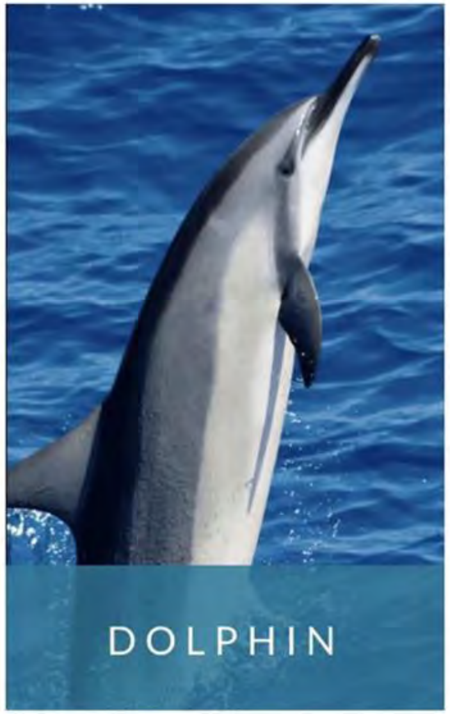
Impact to marine organisms?



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SOIL POLLUTION

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- Dumping garbage, waste, and other toxins making the **land contaminated** or **polluted**.
- Degradation of earth's land surfaces often caused by human activities and its misuse.
- Deposition of solid or liquid waste materials on land or underground in a manner that can contaminate the soil and groundwater, threaten public health, and cause unsightly conditions and nuisances.
- Waste materials that cause land pollution are broadly classified as municipal solid waste, construction and demolition waste or debris, and hazardous waste.

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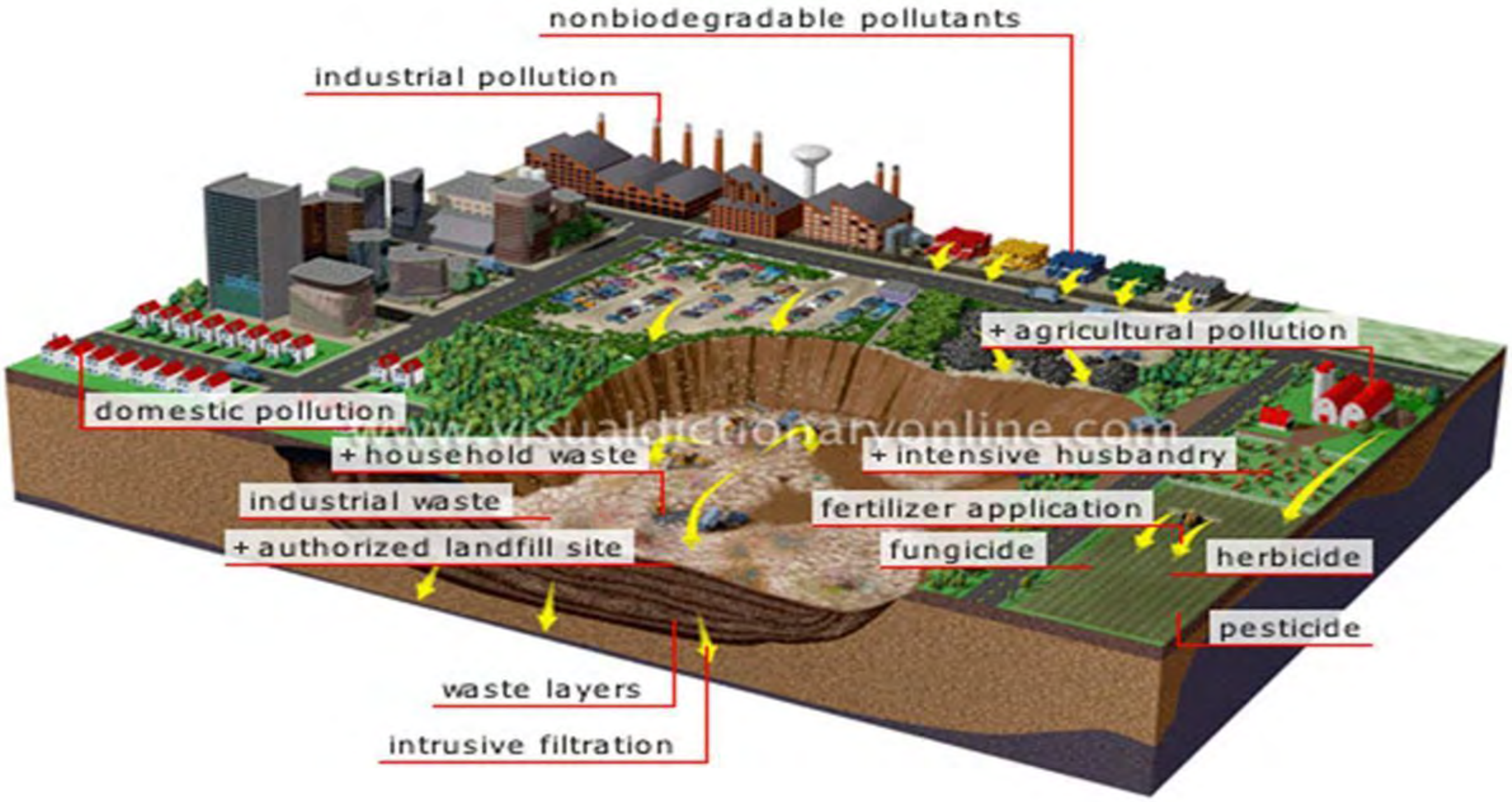

SOIL POLLUTION

- Type of pollution
- Agriculture
- Industrial
- Landfill
- Deforestation
- Mining

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Our problems? What we can do?

— MMS3003 —

ENVIRONMENT – ISSUE AND GLOBAL PERSPECTIVE

CHAPTER 4

Solid and Hazardous Waste

These lecture material are for the **Marine Coastal and Delta Sustainability for Southeast Asia (MARE)**(Project No 610327-EPP-1-2019-1-DE-EPPKA2-CBHE-JP)
This project has been funded with support from the **European Commission**. This publication **reflects the views only of the authors**, and the Commission cannot be made responsible for any use which may be made from the information contained herein.

What Are Solid Waste and Hazardous Waste, and Why They Problems?

- Solid waste represents pollution and unnecessary waste of resources, and hazardous waste contributes to pollution, natural capital degradation, health problems and premature deaths.

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- One major category is **solid waste**.
- Solid waste- any unwanted or discarded material we produce that is not a liquid or gas.

Solid waste can be divided into two types:

Industrial solid waste produced by mines, agriculture and industries that supply people with goods and services.

Municipal solid waste (MSW). Often called garbage or trash, which consist of the combined solid waste produces by homes and workplace.

E.g. paper and cardboard, food wastes, cans, bottles, furniture, plastics, metals, glass, wood and e-waste, sanitation residue, and waste from streets.

INDUSTRIAL SOLID WASTE

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Mining wastes

- In most mining operations – large amounts of rock and soil need to be removed to get to the valuable ore
- Generally left on the surface at the mine site
- Milling operations use various technologies vary from grinding and sorting to sophisticated chemical separation processes.
- Solid materials are typically dumped on the land near the milling site, and liquid wastes are typically sorted in ponds.
- Difficult for vegetation to grown on these piles of waste rock and tailings.
- The water that drains or is pumped from mines or that flows from piles of waste rock or tailings often contains hazardous materials (such as asbestos, arsenic, lead and radioactive materials).

Agricultural waste

- Second most common form of waste and includes waste from the raising of animals and the harvesting and processing of crops and trees.

Industrial solid waste

- From sources other than mining is variously estimated to be between 200million and 600 million metric tons of solid waste per year
- Demolition waste, foundry sand and scraps from manufacturing processes, sludge, ash from combustion and other similar materials.

MUNICIPAL SOLID WASTE

- With rising urbanization and change in lifestyle and food habits, the amount of municipal solid waste has been increasing rapidly and its composition changing.

- Over the last few years, the consumer market has grown rapidly leading to products being packed in cans, aluminium foils, plastics, and other such nonbiodegradable items that cause incalculable harm to the environment.

- One positive note is that in many large cities, shops have begun packing items in reusable or biodegradable bags.
- Certain biodegradable items can also be composted and reused.

- In fact proper handling of the biodegradable waste will considerably lessen the burden of solid waste that each city has to tackle.


Day 1
Day 28
Day 38
Day 58
Day 80
Day 1
Day 28
Day 38
Day 58
Day 80


lafuma


What biodegradable plastic looks like

The type of litter we generate and the approximate time it takes to degenerate	
Type of litter	Approximate time it takes to degenerate the litter
Organic waste such as vegetable and fruit peels, leftover foodstuff, etc.	a week or two.
Paper	10–30 days
Cotton cloth	2–5 months
Wood	10–15 years
Woolen items	1 year
Tin, aluminium, and other metal items such as cans	100–500 years
Plastic bags	one million years?
Glass bottles	undetermined

- In developed countries, most MSW is buried in landfills or burned in incinerators.
- In many developing countries, much of it ends up inopen dumps, where poor people eke out a living finding items they can sell for reuse or recycling.

Looking for a living in garbage

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A waste incinerator building in UK

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LOJI RAWATAN TERMAL (LRT) MINI

Pulau Pangkor, Perak

Kapasiti: 20 Tan/Sehari

Pulau Langkawi, Kedah

Kapasiti: 100 Tan/Sehari

Pulau Tioman, Pahang

Kapasiti: 15 Tan/Sehari

Cameron Highlands, Pahang

Kapasiti: 40 Tan/Sehari

HAZARDOUS WASTE

- Another major category of waste is hazardous or toxic, waste, which threatens human health or the environment because it is poisonous, dangerously chemical reactive, corrosive or flammable.

- Examples include industrial solvents, hospital medical waste, car batteries (containing lead and acids), households pesticide products, dry cell batteries (containing mercury and cadmium) and incinerator ash.

- Hospital waste contaminated by chemicals used in hospitals is considered hazardous.

- These chemicals include formaldehyde and phenols, which are used as disinfectants, and mercury, which is used in thermometers or equipment that measure blood pressure.

- In the industrial sector, the major generators of hazardous waste are the metal, chemical, paper, pesticide, dye, refining, and rubber goods industries.

- Direct exposure to chemicals in hazardous waste such as mercury and cyanide can be fatal.

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- Hospital waste is generated during the diagnosis, treatment, or immunization of human beings or animals or in research activities in these fields or in the production or testing of biological.

- It may include wastes like sharps, solid waste, disposables, anatomical waste, cultures, discarded medicines, chemical wastes, etc.

- These are in the form of disposable syringes, swabs, bandages, body fluids, human excreta, etc.

- This waste is highly infectious and can be a serious threat to human health if not managed in a scientific and discriminate manner.

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What Harmful Chemicals Are in Your Home?

Cleaning

Gardening

Paint Products

Automotive

General

What Harmful Chemicals Are in Your Home?

Cleaning

- Disinfectants
- Drain, toilet, and window cleaners
- Spot removers
- Septic tank cleaners

Gardening

- Pesticides
- Weed killers
- Ant and rodent killers
- Flea powders

Paint Products

- Paints, stains, varnishes, and lacquers
- Paint thinners, solvents, and strippers
- Wood preservatives
- Artist paints and inks

Automotive

- Gasoline
- Used motor oil
- Antifreeze
- Battery acid
- Brake and transmission fluid

General

- Dry-cell batteries (mercury and cadmium)
- Glues and cements

The Effects of Solid Waste Disposal

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Waste-disease relationship

Improper treatment and disposal of waste is conducive to the spread of diseases.

The more important diseases in this category are dysentery (amoebic and bacillary), typhoid fever, leptospirosis, cholera, plague, endemic typhus, and infectious hepatitis.

These diseases are contracted through the ingestion of food or water that has become contaminated with infected human or animal waste, or they can be spread by insect vectors whose principal hosts are rodents and vermin.

- United States Public Health Service (USPHS) has traced 22 human diseases to improper solid waste management.

- Public health authorities have shown that rats, flies, and other disease vectors breed in open dumps, as well as in poorly constructed or poorly maintained housing, in food storage facilities, and in many other places where food and harbourage are available for rats and the insects associated with them.

- Solid wastes also have a great potential to pollute the air and water. Mining tailings from Colorado gold and silver mines will probably being spilling arsenic into the water supply forever.

- U.S. volume of garbage has increased more than 50% since 1960 (although stabilized since 1990) .

- Countries with higher standard of living produce more waste.

- Traditional Methods (dumping and burning) are no longer accepted.

- Urban areas running out of places to put garbage.

- The best way to reduce solid wastes is not to create them in the first place. Others methods include: decrease consumption of raw material and increase the rate of recovery of waste materials.

Methods of Waste Disposal

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- From prehistory through the present day, the favored means of disposal was simply to dump solid wastes outside of the city or village limits.
- To minimize the volume of the waste, the dump was often burned.
- As better waste-disposal technologies were developed and as values changed, more emphasis was placed on the environment and quality of life.
- Dumping and open burning of wastes is no longer and acceptable practice from an environmental or health perspective.
- Five techniques are used: landfills, incineration, composting, source reduction and recycling.

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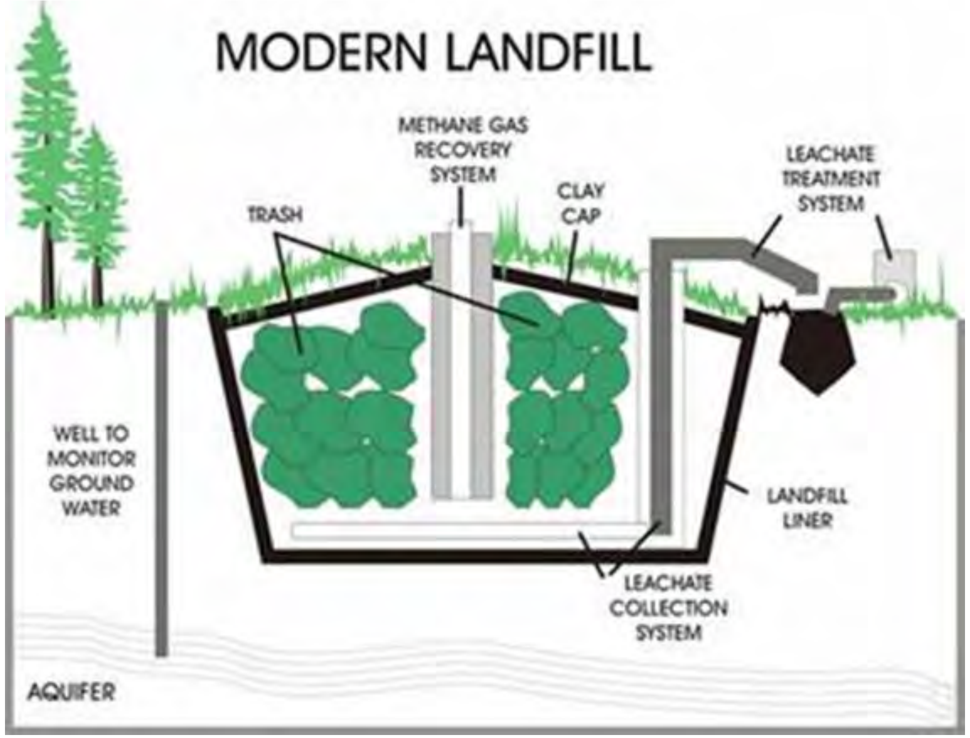
Landfills

- The primary method of waste disposal – cheapest and most convenient and because the threat of groundwater contamination was not initially recognized.

- Although the amount of waste has increased, composting and recycling have removed significant amounts of materials from the waste stream and the amount of material entering landfills has declined.

- Landfill of today is far different from a simple hole in the ground into which garbage is dumped.

- Modern landfill is typically constructed above an impermeable clay layer that is lined with an impermeable membrane and includes mechanisms for dealing with liquid and gas materials generated by the contents of the landfill.



High levels of methane can displace oxygen in the air and cause oxygen deprivation, which can lead to suffocation. Breathing high levels of the **gas** can also lead to **agitation**, slurred speech, **nausea**, **vomiting**, and **headache.**

Landfill gas is approximately forty to sixty percent *methane*, with the remainder being mostly carbon dioxide.

- Each day's deposit of fresh garbage is covered with a layer of soil to prevent it from blowing around and to discourage animals for scavenging for food.
- Selection of landfill sites is based on an understanding of local geologic condition – presence of a suitable clay base, groundwater geology and soil type.
- It is also important to address local citizen's concerns.
- New landfills have complex bottom layers to trap contaminant-laden water = leachate – leaking through the buried trash.
- The water that leaches through the site must be collected and treated.

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Depending on the landfill waste, the leachate can contain:

1. dissolved organic matter
2. inorganic macro compounds
3. heavy metals
4. xenobiotic organic compounds (hydrocarbons, phenols, pesticides etc.)

- In addition, monitoring systems are necessary to detect methane gas production and groundwater contamination.

- In some cases, methane produced by decomposing waste is collected and used to produce heat or generate electricity.

- As a result of the technology involved, new landfills are becoming increasingly more complex and expensive.

- A prolonged public debate over how to replace lost landfill capacity is developing where population density is high and available land is scarce.

- Over the past year, state and country still battled with the landfill’s location even there are a total 230 landfill in Malaysia.

- Landfilling is the only waste disposal method that can deal with all kinds of materials in the solid waste stream and it is also the simplest and cheapest way of disposing solid waste.

- The solid waste generated in Malaysia per capital has increased from 0.5kg/capital/day in the 1980´s to current volume of 1kg/capital/day. This represents a 200% increased in 20 years.

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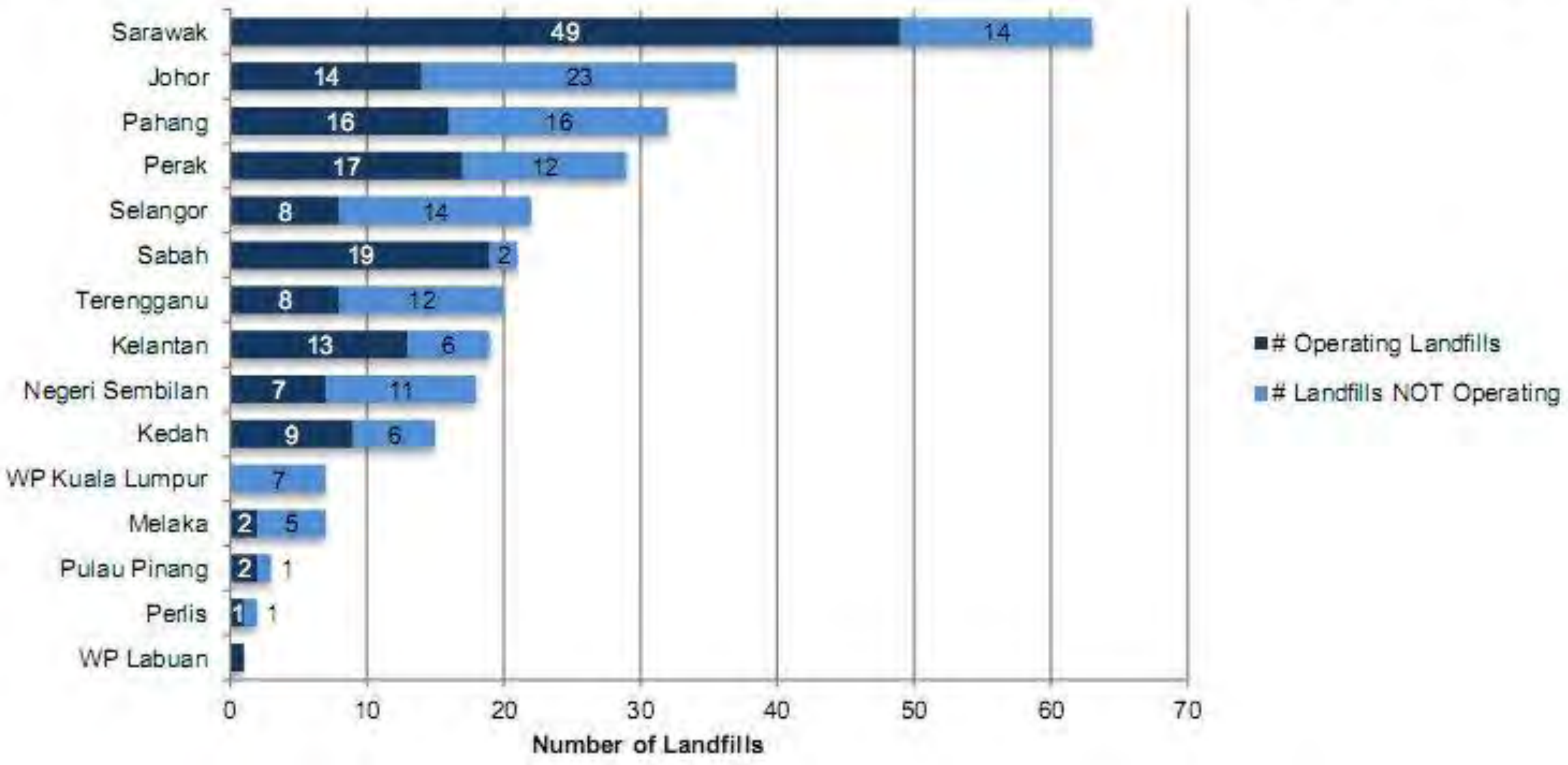
Waste extraction: Heaps of old rubbish, unearthed from the Kelana Jaya dump which was closed in 1996. Through landfill mining, valuable materials such as metal scraps, plastics and rubber can be retrieved from old dumps.

- The current municipal solid waste management in Malaysia is far from sufficient and efficient in handling the increased amount of solid waste and its different composition due to lack of funds and expertise.

- Most of the municipalities are lack of adequate funds for waste treatment and disposal. Local authorities spend up to 60 per cent of their annual budget on waste management, which costs Malaysia between RM110 and RM130 to collect and dispose one tonne of garbage. That sums up to RM1.98 million to RM2.34 million per day or RM854 million per year at the current generation of 18,000 tonnes of solid wastes per day.

Figure 104. Almost half of Malaysia's landfills for municipal solid waste are no longer in operation



Operator	Landfill	Source of waste	Capacity	Area (acre)	Opened in	Est.lifespan (year)
KUB-Berjaya Enviro Sdn Bhd	Bukit Tagar, Hulu Selangor	• Kuala Lumpur • MPS • Private waste collectors	120 million metric tonne	700	2005	50 – 60
Worldwide Holdings Bhd	Jeram, Kuala Selangor	• MBPJ • MBSA • MPSJ • MPK • MPAJ • MDKS • Private waste collectors	8 million cubic metre	160	2007	16
Tanjung Dua Belas,	Kuala Langat	• MDKL • MPSepang • Perbadanan Putrajaya • KLIA • Private waste collectors	9.2 million cubic metre	160	2010	20

- The current disposal system in Malaysia is not conducted in an environmentally sound manner and thus it entire ecosystem and leaves various environmental problems.

- Since most of the current landfills in Malaysia have a poor code of landfill practice, it is important for the authorities to improve the current state of landfilling practice and the authorities also must be careful in meeting all of the regulatory requirements when a landfill sitting evaluation is performed.

- To protect human health and the environment, it is essential to tackle the problems from the root cause, i.e. to reduce the waste from being generated.

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E-Waste:
An Exploding Problem

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Electronic waste, or *e-waste,* consists of discarded television sets, cell phones, computers, e-toys, and other electronic devices

It is the fastest-growing solid waste problem in the United States and in the world

Most e-waste ends up in landfills and incinerators.

E-waste is also a source of toxic and hazardous pollutants, including polyvinylchloride (PVC), brominated flame retardants, lead, and mercury, which can contaminate air, surface water, groundwater, and soil and cause serious health problems and even early death for e-waste workers

According to a 2005 report by the U.N.-sponsored Basel Action Network, about 70% of the world's e-waste is shipped to China, while most of the rest goes to India and poor African nations where labor is cheap and environmental regulations are weak.

Workers there—many of them children—dismantle such products to recover valuable metals and reusable parts. As they do this, they are exposed to toxic metals and other harmful chemicals.

The remaining scrap is dumped in waterways and fields or burned in open fires, exposing many people to toxic dioxins.

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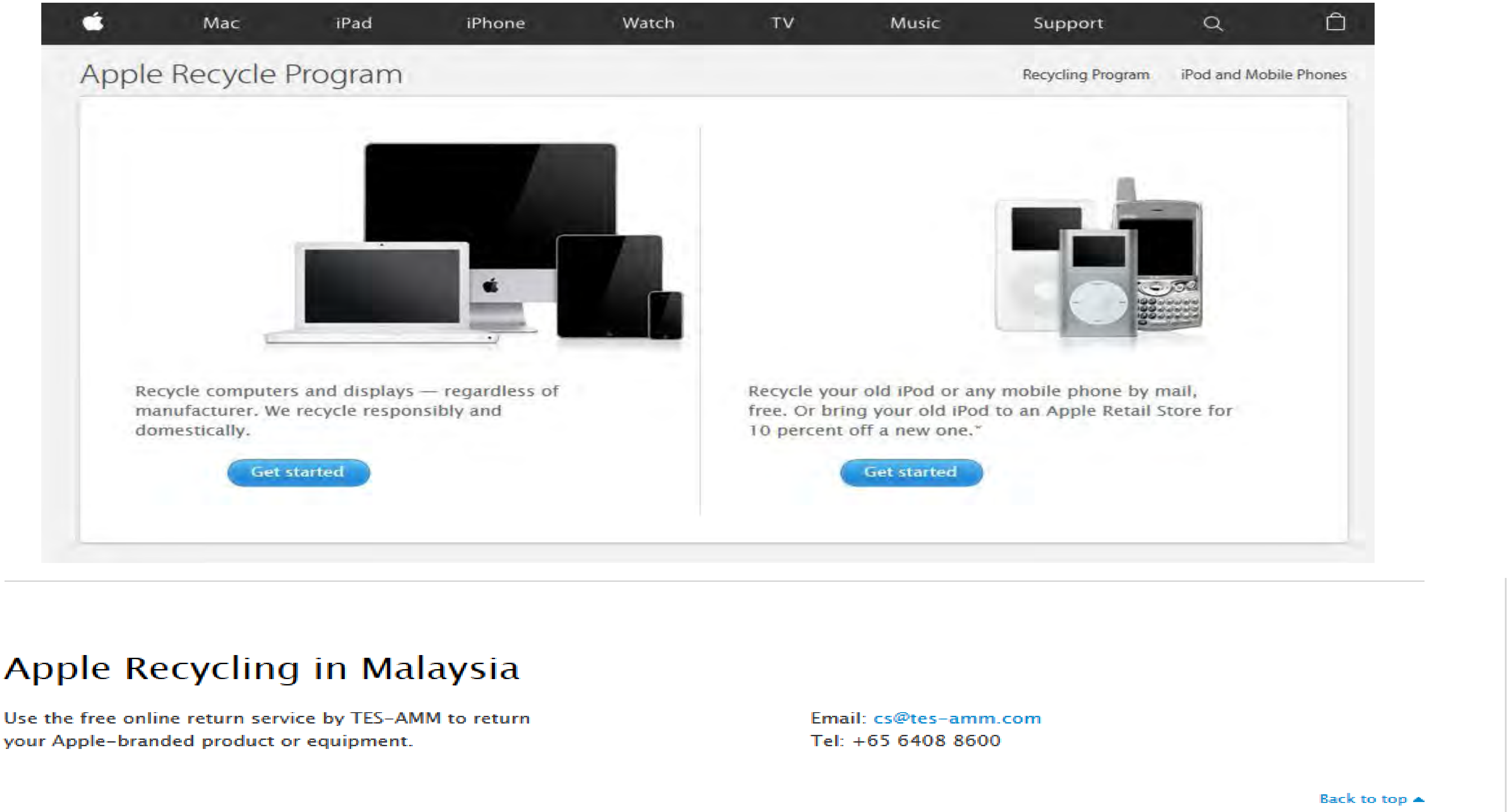
Transferring hazardous waste from developed to developing countries is banned by the International Basel Convention. Even so, much e-waste is not classified as hazardous waste or is illegally smuggled to countries such as China.

The European Union (EU) has led the way in dealing with e-waste. Its cradle-to-grave approach requires manufacturers to take back electronic products at the ends of their useful lives for repair, remanufacture, or recycling, and e-waste is banned from landfills and incinerators.

Japan is also adopting cradle-to-grave standards for electronic devices and appliances.

Some electronics manufacturers, including Apple, Intel, Hewlett-Packard, Dell, Sharp, Panasonic, and Sony, have free recycling programs for consumers, which are described on their websites. Some manufacturers will arrange for pickups or pay shipping costs.



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A sustainable approach to hazardous waste

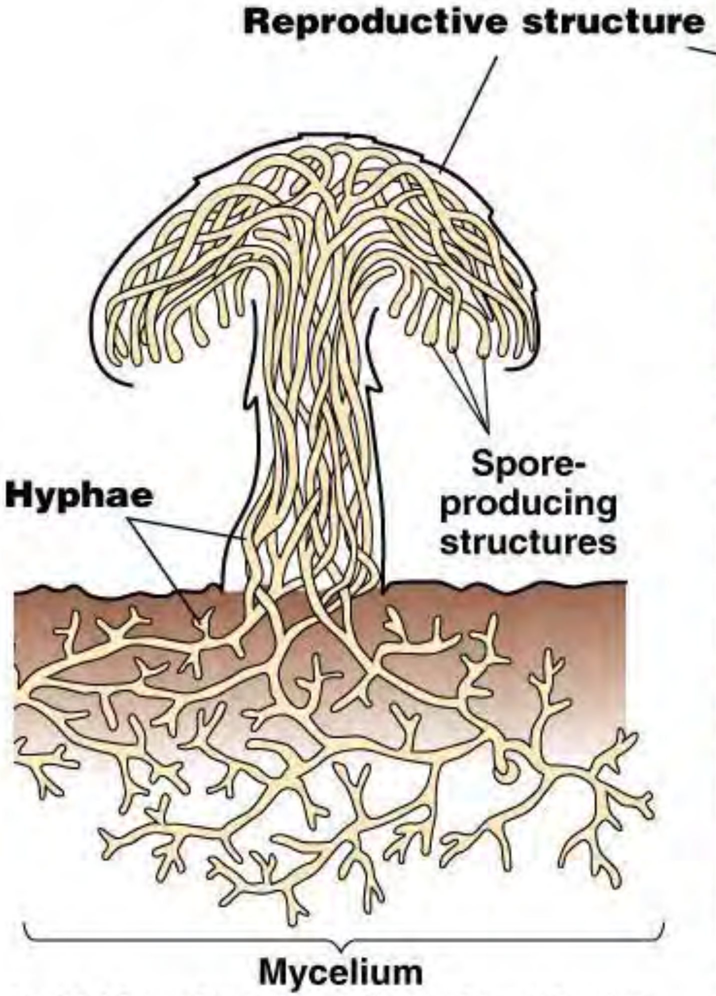
A sustainable approach to hazardous waste is first to produce less of it, then to reuse or recycle it, then to convert it to less hazardous materials and finally, to safely store what is left.

Sustainable packaging is the development and use of **packaging** which results in improved sustainability and reduces the environmental impact and ecological footprint.

Green Packaging

'Air' plastic and mushroom cushions - Dell packages the future

"It's bio-magic," says Dell's head of packaging, Oliver Campbell, Dell's director of packaging, with a packing cushion made from mushroom mycelium.


Reproductive structure
Hyphae
Spore-
producing
structures
Mycelium

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Carbon copy: This plastic bag is made from carbon that would otherwise end up in the air we breathe

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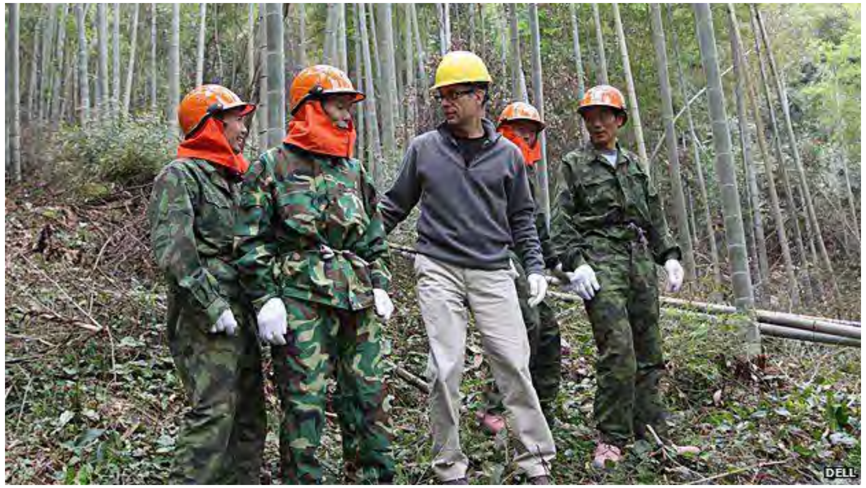
The process has been certified as carbon negative by Trucost and NSF Sustainability, and actually costs less to produce than oil-based plastics.

It's one of the sustainable packaging materials - including bamboo, wheat grass and even sponges grown from mushroom spores



The bamboo used for packing is sourced from sustainably managed forests

Baby pandas can rest assured Dell's bamboo packaging won't interfere with dinner

Mr. Campbell stepped into his role in Dell's packaging department in 2006 - and has been instrumental in implementing the company’s ‘3Cs’ cube (reduce packing size), content (what it's made of), and curb (meaning to limit something that is not wanted).

Dell bamboo is certified by the Forest Stewardship Council and sourced far away from panda habitats.

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Not only is it completely biodegradable and compostable - it appears to be even more durable and flexible than the man-made alternative, and is also flame retardant.

When we looked at the cellular structure under a microscope, you are looking at a root structure and these roots have little tendrils and they are interlocking, it's kind of like Velcro and it's flexing and absorbing the energy in ways that your foam can't.

On the left is the packing sponge made from mushroom spores; on the right is packaging made from wheatgrass

Leaves of grass

Another company has partnered with is YFY Jupiter, creating packaging using wheatgrass, an agricultural by-product.

Before Dell began buying waste straw from these Chinese farmers, they would burn the surplus stalks

Smoke from burning straw after the harvest contributes to high levels of pollution in cities like Beijing

- In countries like China they burn this material, so they are contributing to particulate matter in the atmosphere, it contributes to smog.

- Now farmers in rural areas in China now are getting paid for something that they didn't before, so it's increasing incomes, [it helps] keep people in rural areas.

- But is there really enough wheatgrass produced each year to keep Dell in cardboard?

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Research indicates that there's enough waste straw material in China to potentially produce enough paper to satisfy global demand. And again, the wheatgrass cardboard is cheaper to produce.

Dell plans to source 100 percent of packaging from sustainable material 100 that will be recyclable or compostable by 2020.

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Conclusions

The growing problem of e-waste and other topics discussed in this chapter represent the problems of maintaining a high-waste society.

The challenge is to make the transition from a high-waste, throwaway mode to a low waste, reducing-reusing-recycling economy

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Such a transition will require applying the four scientific principles of sustainability.

Shifting from reliance on fossil fuels and nuclear power (which produces long-lived, hazardous, radioactive wastes) to greater use of renewable solar energy, wind, and flowing water will reduce our outputs of solid and hazardous waste, as will reusing and recycling materials by mimicking nature's chemical cycling processes.

Using a diversity of approaches with emphasis on waste reduction and pollution prevention, is another useful way to mimic nature.

Reducing the human population and the resources used per person would also decrease the demand for materials that eventually become solid and hazardous wastes.

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ENVIRONMENT – ISSUE AND GLOBAL PERSPECTIVE

CHAPTER 3

ACT LOCALLY THINK GLOBALLY

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This project has been funded with support from the **European Commission**. This publication **reflects the views only of the authors**, and the Commission cannot be made responsible for any use which may be made from the information contained herein.

ACT LOCALLY THINK GLOBALLY

- The phrase has been echoed around the world millions of times in recent years.
- Focus on your local environment and your **small acts will add up, slowly leading to change in an office, then a neighbourhood, then a community, a city, a state, and so on**.
- This idea has traditionally been associated with the environment and sustainability, but it can be applied to food consumption, politics, the arts, and much more.
- In today's changing markets, it's time for us to consider what 'think globally, act locally' can mean for corporate social responsibility.

ACT LOCALLY THINK GLOBALLY

- Example : Issue of reducing or even eliminating the use of plastics (especially single-use).
- The move could potentially serve many environmental goals that include, most prominently, the reduction of marine litter.
- Elimination of plastics could also seem consistent with climate action since plastic production requires fossil fuels as a feedstock.
- These products also release methane and carbon during decomposition, which contrasts with plastics that actually sequester carbon and decompose very slowly.

ACT LOCALLY THINK GLOBALLY

- To think globally means that we must be really conscious that all human beings live on the same planet, in a moving environment managed by biodiversity within the frame of nature's laws.
- And that each of our acts has an impact for all.

Earth is one. Life is one.

- If we cut ourselves from this idea, we are lost.

So, that means that we must have a holistic view of the world — with its differences insides cultures and societies, in each territory, in each community

- To act local is obvious.

- In the economical frame, it means that particularly food products should be proposed on the base of local resources and sold locally for the most fresh of them.

- Of course, transformed products (canned in a glass jar for example) can have a longer life and eventually can travel anywhere, but provided that the means of transport has no impact on the environment.

- To act locally by thinking globally: **to provide answers to a territory by adapting them to the environment and by anticipating their consequences on the planet**.

- Here, the concept of sustainable development fits into this approach.

- Another way of describing the meaning of the phrase is that people should think about the global significance on the environment while they take action to improve their local environment.

- For instance, you can think about the problem with trash disposal across the world, but to avoid being stymied by the scope of the problem, you can reduce your own waste and recycle more which is a step in solving the world-wide problem.

- To the extent that more and more people take local actions, the positive effects spread wider and wider.

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THINK GLOBAL,
ACT LOCAL

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Our role to care and protect environment? Our responsibility?

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Our role to care and protect environment? Our responsibility?


Q&A

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ENVIRONMENT – ISSUE AND GLOBAL PERSPECTIVE

CHAPTER 6

CLIMATE CHANGE AND GLOBAL WARMING

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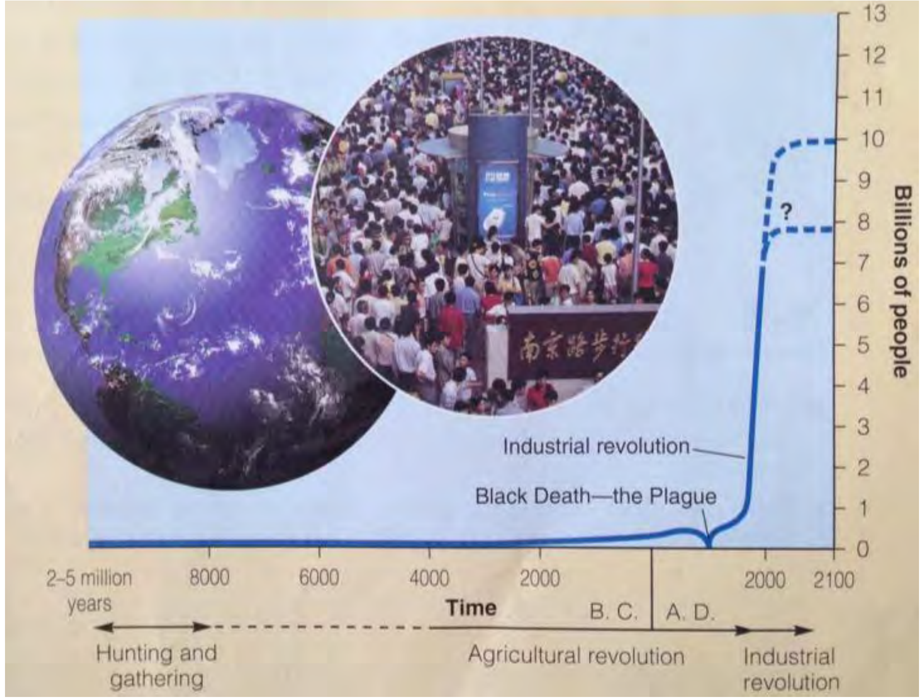
LECTURE OUTLINE

- Climate Change vs Global Warming
- How weather affected climate change and global warming
- Impact to environment
- How to solve the problems



GLOBAL WARMING

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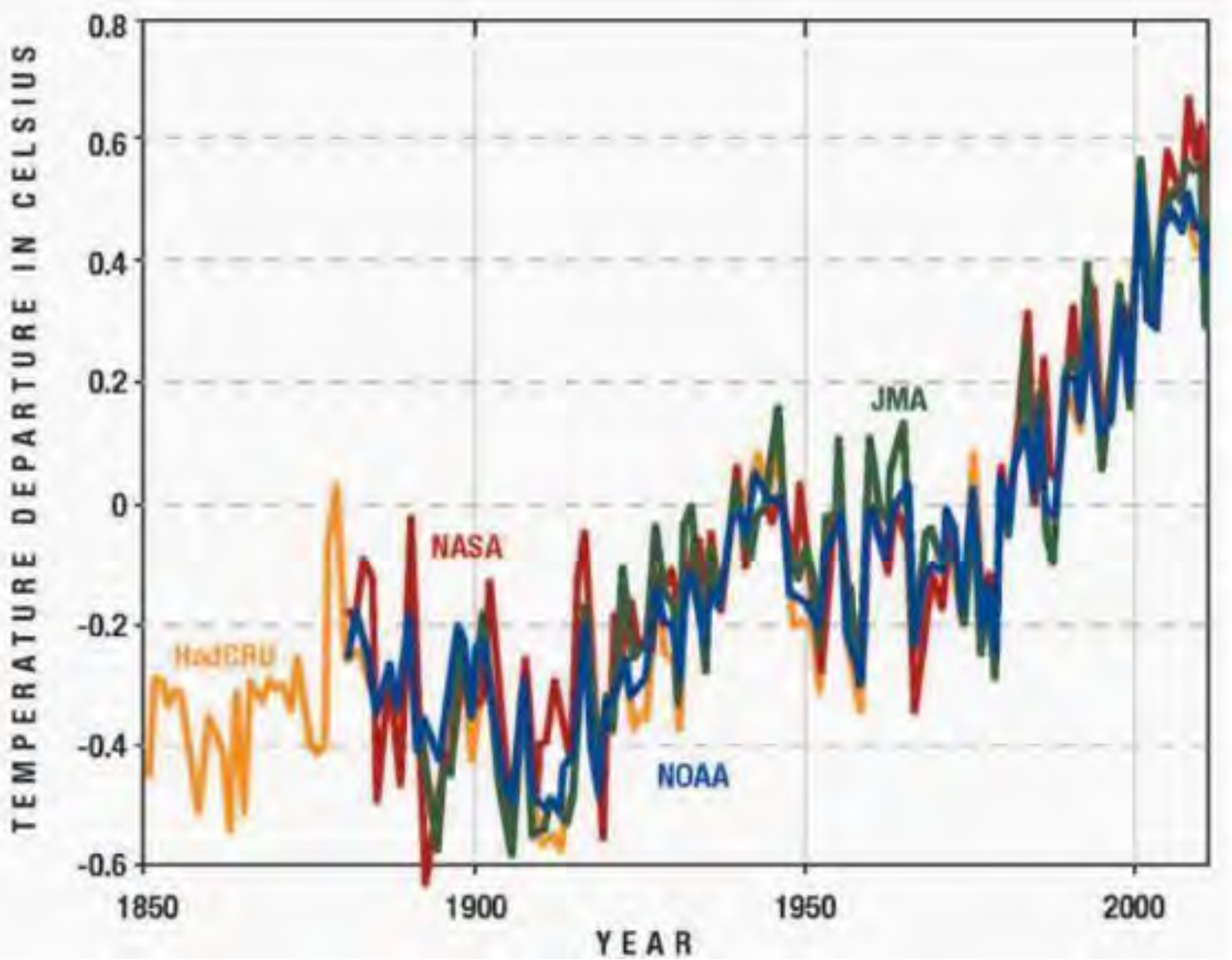

FIGURE 20.2 The temperature difference between the average at the end of the 19th century and the years between 1860 and today. This graph shows the difference between calculated world surface temperatures for each year and the average at the end of the 19th century. Temperature departure refers to changes in mean global temperature from some standard such as 1951–1980. Climatologists studying climate change prefer, in general, to look at the difference between temperatures at one time compared to another, rather than the actual temperature, for a variety of technical reasons. (*Source:* Hadley Meteorological Center, Great Britain.) http://www.metoffice.gov.uk/corporate/pressoffice/myths/2.html)

GLOBAL WARMING

- The modern concern about global warming arise from two kinds of observations:
  1. **average surface temperature of the Earth from 1850 to the present**
  2. **measurement of carbon dioxide concentrations in the atmosphere**

- Several questions need to be answered
  - **To what extent, have people caused it?**
  - **What are likely to be the effects on people?**
  - **What are likely to be the effects on all life on Earth?**
  - **How can we make forecasts about it and other kinds of climate change?**
  - **What can we do to minimize potential negative effects?**

GLOBAL WARMING

Loa Mountain, Hawaii, by Charles Keeling and are now known as the Keeling Curve. Taken at 3,500 m (11,500 ft) on an island far from most human activities, these measurements provide an excellent estimate of the background condition of the atmosphere.

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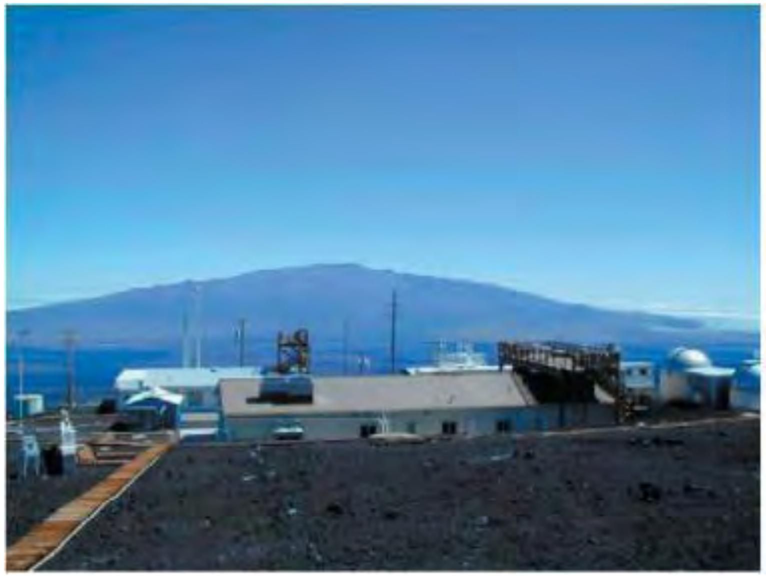

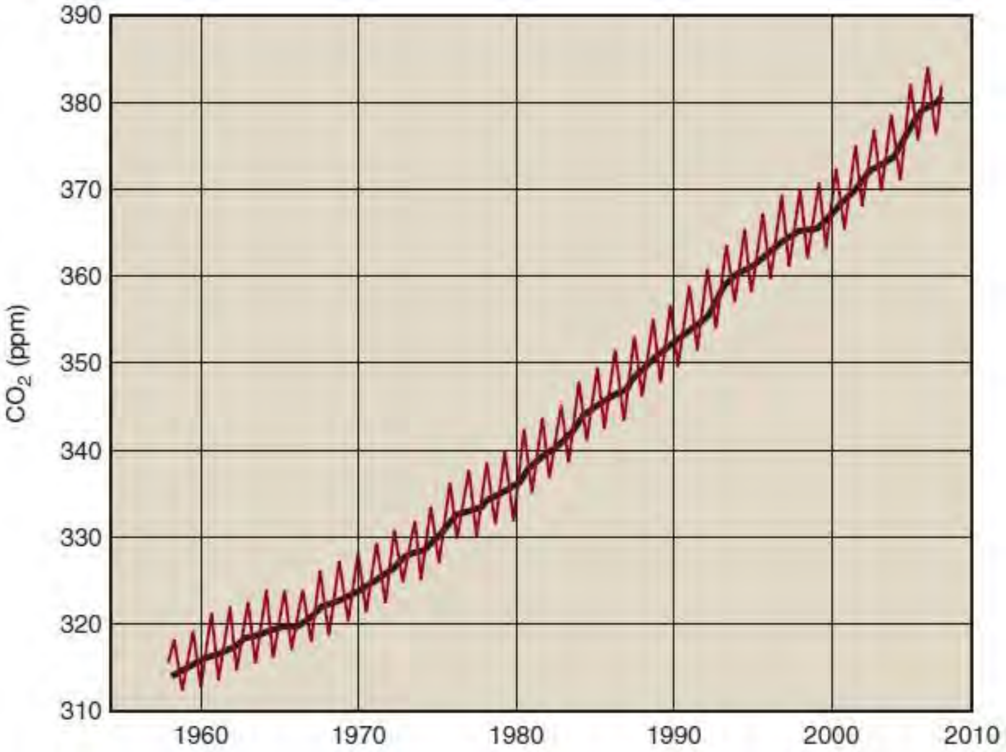

WEATHER AND CLIMATE

- Weather is **what's happening now** or over some short time period—this hour, today, this week—in the atmosphere near the ground: its temperature, pressure, cloudiness, precipitation, winds.

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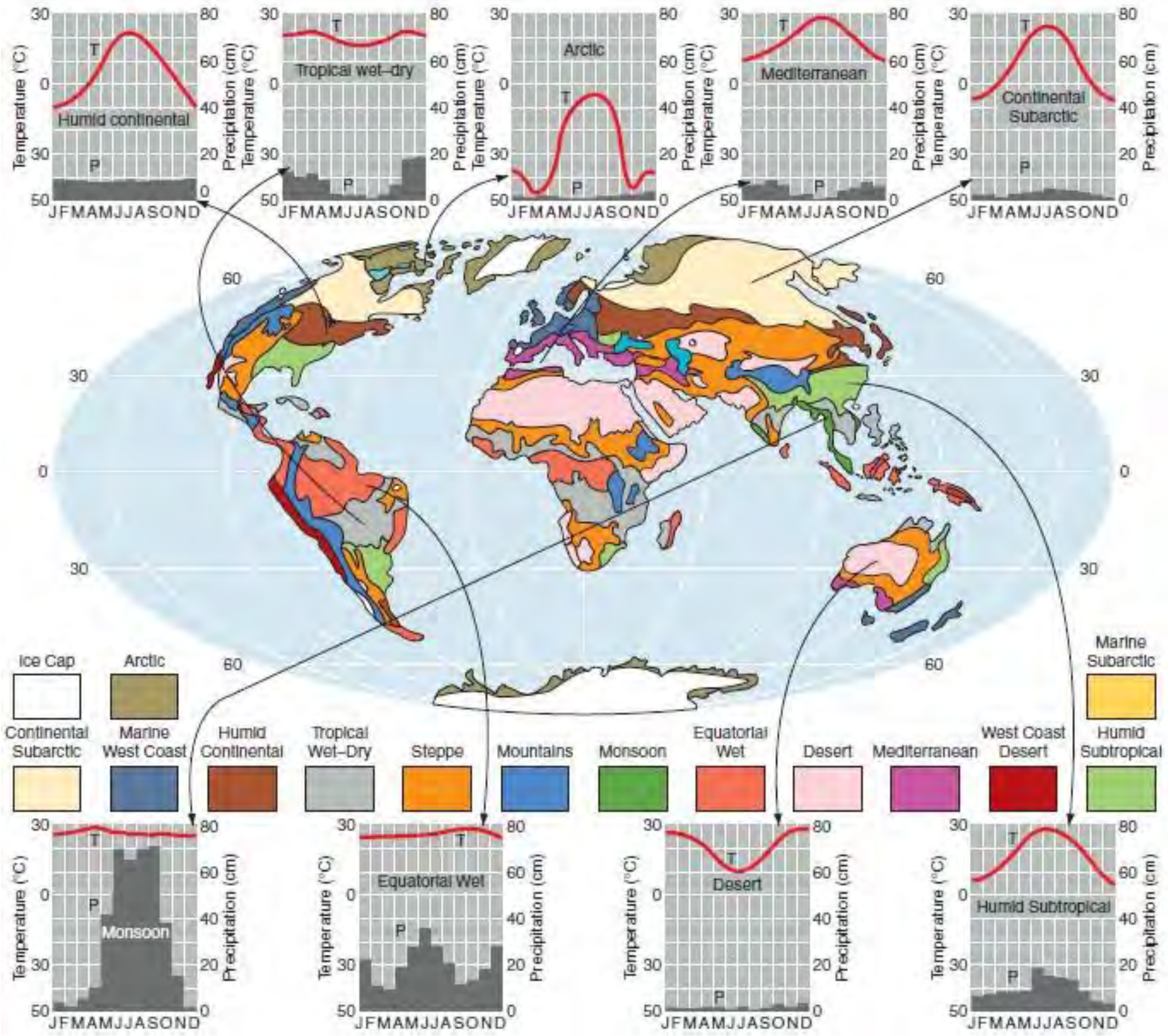
- Climate is the **average weather** and usually refers to average weather conditions over long periods, at least seasons, but more often years or decades.

- When we say it's hot and humid in New York today or raining in Seattle, we are speaking of weather. When we say Los Angeles has cool, wet winters and warm, dry summers, we are referring to the Los Angeles climate.

- Since climates are characteristic of certain latitudes, they are classified mainly by latitude—tropical, subtropical, midlatitudinal (continental), sub-Arctic (continental), and Arctic—but also by wetness/dryness, such as humid continental, Mediterranean, monsoon, desert, and tropical wet–dry.

WEATHER AND CLIMATE



WEATHER AND CLIMATE

https://www.ksat.com/news/local/2020/10/06/explained-the-difference-between-weather-and-climate/

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THE ATMOSPHERE

- This atmosphere is the **thin layer of gases** that envelop Earth. These gases are almost always in motion, sometimes rising, sometimes falling, most of the time moving across Earth's surface.
- The atmosphere's gas molecules are held near to the Earth's surface by gravity and pushed upward by thermal energy—heating—of the molecules. Approximately 90% of the weight of the atmosphere is in the first 12 km above Earth's surface.
- Major gases in the atmosphere include nitrogen (78%), oxygen (21%), argon (0.9%), carbon dioxide (0.03%), and water vapor in varying concentrations in the lower few kilometers.

THE ATMOSPHERE

- The atmosphere also contains trace amounts of methane ozone, hydrogen sulfide, carbon monoxide, oxides of nitrogen and sulfur, and a number of small hydrocarbons, as well as synthetic chemicals, such as chlorofluorocarbons (CFCs). Methane at about 0.00017% of the atmosphere is emerging as an important gas that tracks closely with climate change (more so than CO_2).

STRUCTURE OF THE ATMOSPHERE

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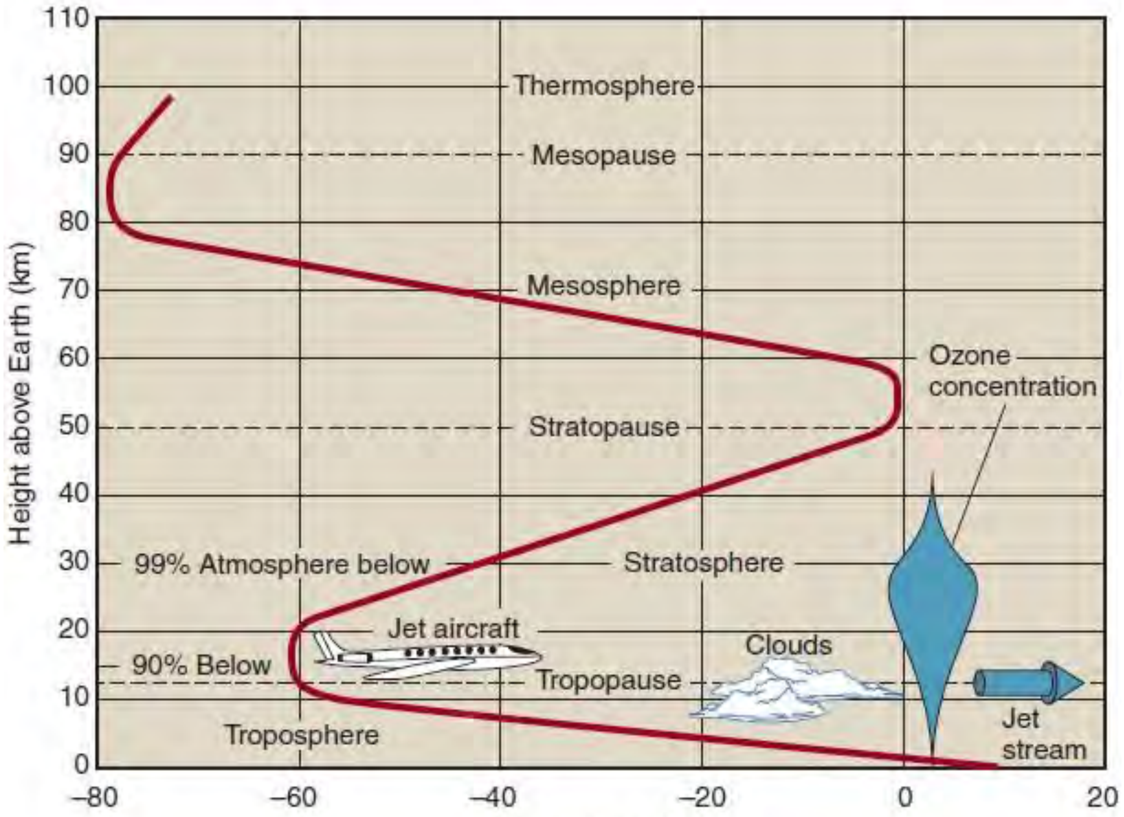
- Stratospheric ozone (O3) protects life in the lower atmosphere from receiving harmful doses of ultraviolet radiation.
- Stratosphere, which we visit occasionally when we travel by jet airplane..
- Troposphere, we spend most of our lives in it.
- Troposphere has a constant temperature (–60°C) and acts as a lid, or cold trap because it is where almost all remaining water vapor condenses.



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STRUCTURE OF THE ATMOSPHERE

ATMOSPHERIC PROCESSES

Temperature, Pressure, and Global Zones of High and Low Pressure

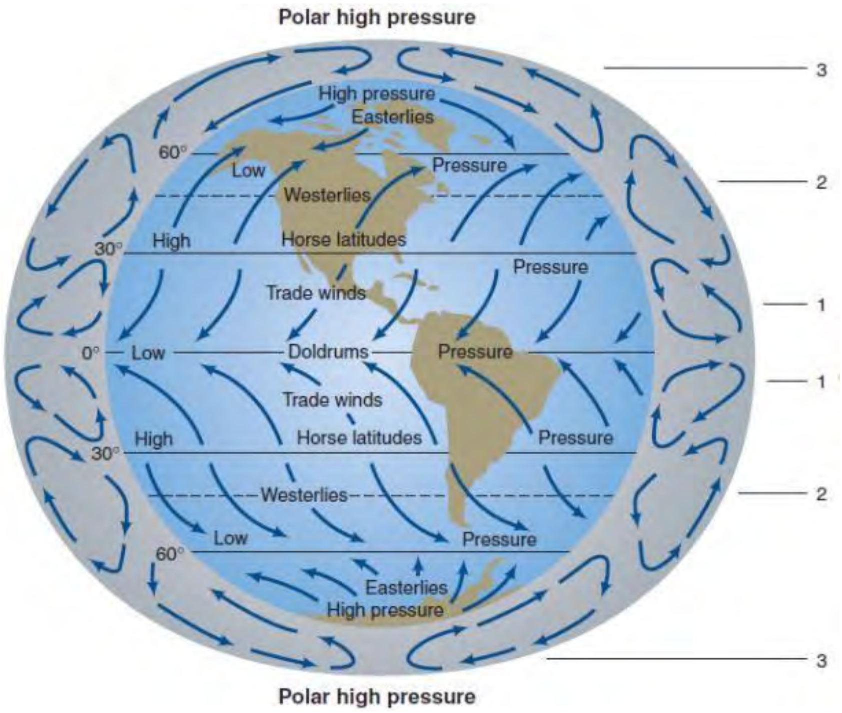
- Two important qualities of the atmosphere are pressure and temperature. Pressure is force per unit area. Atmospheric pressure is caused by the weight of overlying atmospheric gases on those below and therefore decreases with altitude. At sea level, atmospheric pressure is 105 N/m^2 (newtons per square meter).
- Temperature, familiar to us as the relative warmth or coldness of materials, is a measure of thermal energy, which is the kinetic energy—the motion of atoms and molecules in a substance.
- Water vapor content varies from less than 1% to about 4% by volume, depending on air temperature, air pressure, and availability of water vapor from the surface.

ATMOSPHERIC PROCESSES

- The atmosphere moves because of the Earth's rotation and differential heating of Earth's surface and atmosphere. These produce global patterns that include prevailing winds and latitudinal belts of low and high air pressure from the equator to the poles.

Air moves toward the poles at higher elevation. Sinking cool air at the poles produces the polar highpressure zones at both poles (Cell 3)

Air moves to higher latitudes, creating a region of high pressure, with sunny skies and low rainfall, where many of the world' s deserts are found (Cell 2)



Low air pressure develop at the equator. The heated air rises, creating an area of low pressure and a cloudy and rainy climate (Cell 1)

ATMOSPHERIC PROCESSES

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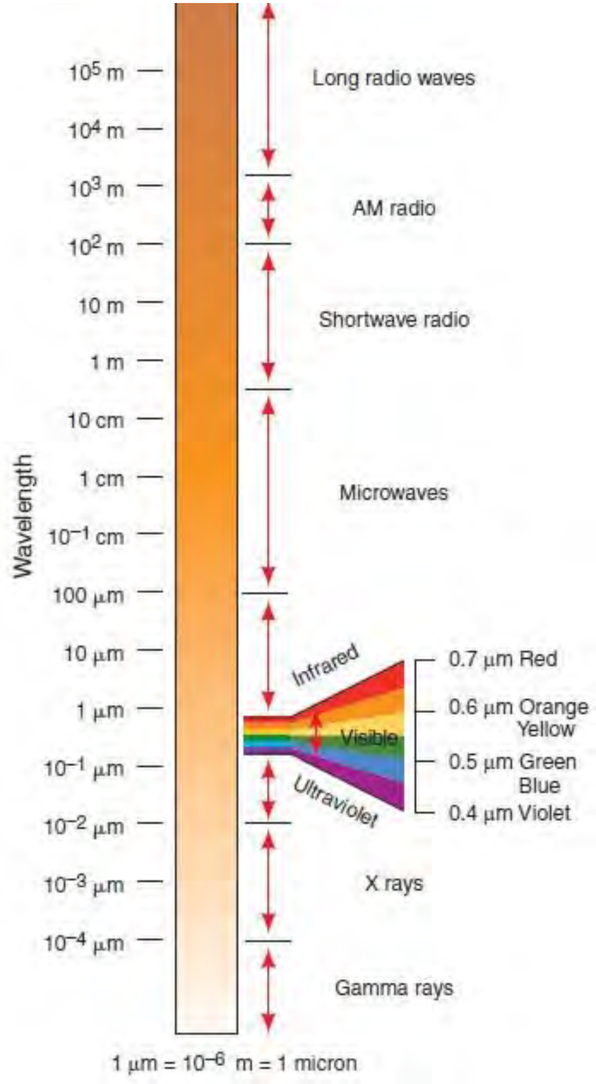
What Makes the Earth Warm

- Almost all the energy the Earth receives is from the sun. Sunlight comes in a wide range of electromagnetic radiation, from very long radio waves to much shorter infrared waves, then shorter wavelengths of visible light, even shorter wavelengths of ultraviolet, and then on to shorter and shorter wavelengths



ATMOSPHERIC PROCESSES

- Under typical conditions, the Earth's atmosphere reflects about 30% of the electromagnetic (radiant) energy that comes in from the sun and absorbs about 25%. The remaining 45% gets to the surface. The warmed atmosphere radiates some of its energy upward into outer space and some downward to the Earth's surface.

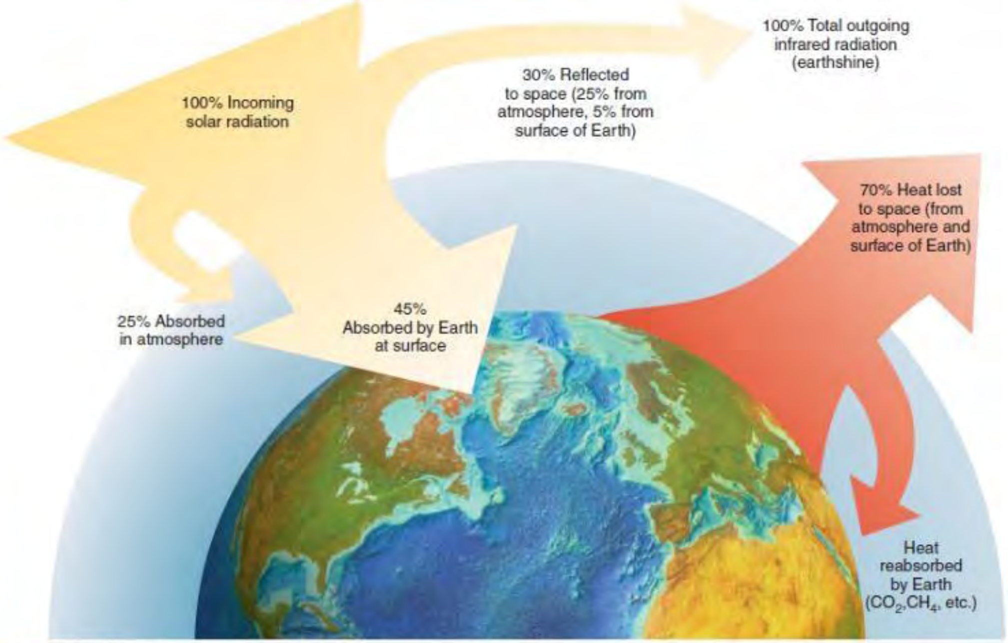


FIGURE 20.10 Earth's energy budget.

HOW WE STUDY CLIMATE

Data to document and understand climate change come from three main time periods grouped as the

- Instrumental Record
- Historical Record
- Paleo-Proxy Record

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HOW WE STUDY CLIMATE

The Instrumental Record

- The use of instruments to make climate measurements began around 1860. Recently, the extrapolation methods used to make these reconstructions have come under criticism, and today there is controversy over the reliability and usefulness of such attempts.
- Temperature measurement has improved greatly in recent years thanks to such devices as ocean platforms with automatic weather-monitoring equipment, coordinated by the World Meteorological Organization. Thus, we have more accurate records since about 1960.

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HOW WE STUDY CLIMATE

The Historical Record

- Historical record would be people's written recollections in books, newspapers, journal articles, personal journals, ships' logs, travelers' diaries, and farmers' logs, along with dates of wine harvests and small-grain harvests.

- For example, a painting of a mountain glacier in Switzerland can be used to determine the elevation to which the glacier had descended by the year it was painted.

HOW WE STUDY CLIMATE

The Paleo-Proxy Record

Information gathered as proxy data includes natural records of climate variability as indicated by tree rings, sediments, ice cores, fossil pollen, corals, and carbon-14 (14C).

HOW WE STUDY CLIMATE

The Paleo-Proxy Record - Ice Cores

- Polar ice cores often contain small bubbles of air deposited at the time of the snow, and we can measure the atmospheric gases in these. Two important gases being measured in ice cores are carbon-dioxide (CO2) and methane (CH4), the most relevant proxy for climate change. The ice cores also contain a variety of chemicals and materials, such as volcanic ash and dust, which may provide additional insights into possible causes of climate change.

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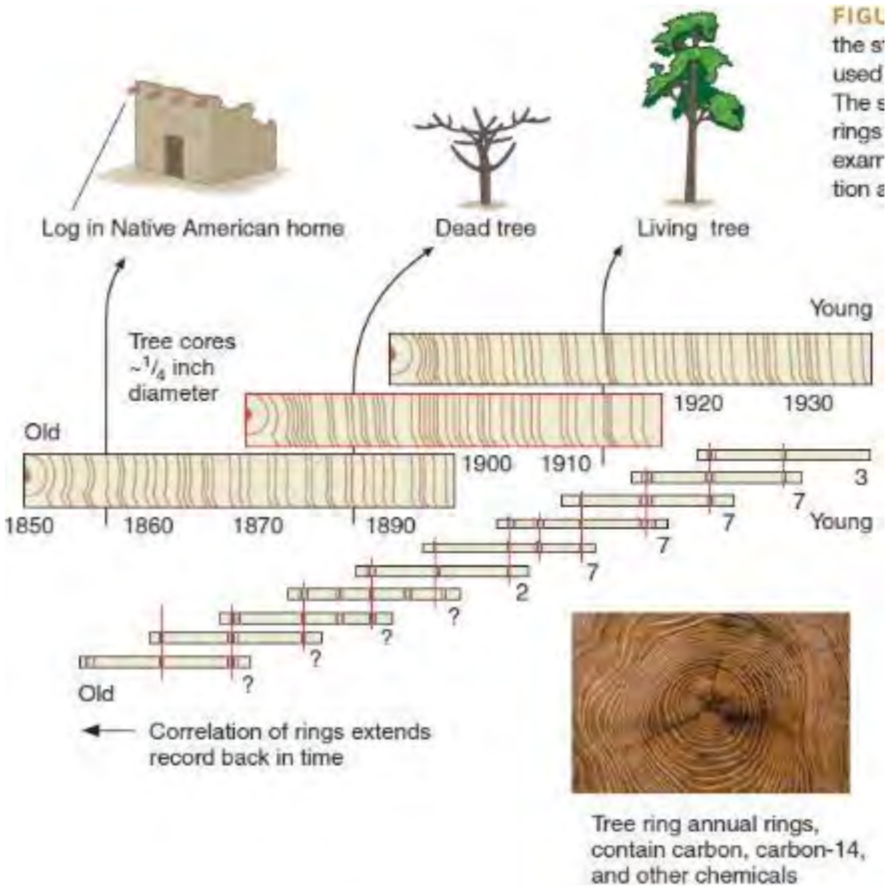
HOW WE STUDY CLIMATE

The Paleo-Proxy Record - Tree Rings

- The growth of trees is influenced by climate, both temperature and precipitation. Many trees put one growth ring per year, and patterns in the tree rings—their width, density, and isotopic composition—tell us something about the variability of the climate. When conditions are good for growth, a ring is wide; when conditions are poor, the ring is narrow. Tree-ring chronology, known as dendrochronology, has produced a proxy record of climate that extends back over 10,000 years.



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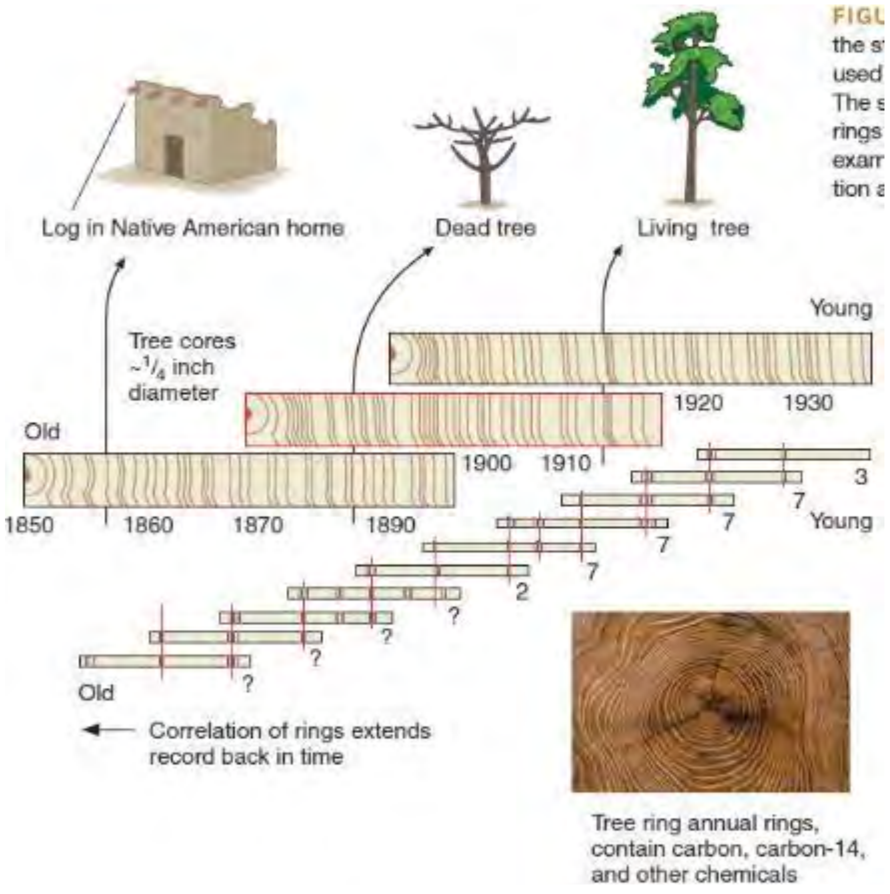

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HOW WE STUDY CLIMATE

The Paleo-Proxy Record - Sediment

- Biological material, may be taken of very small fossils and of chemicals in the sediments, and these may be interpreted to study past climates and extend our knowledge back hundreds of thousand years. Sediments recovered by drilling in the bottom of the ocean basin provide some of the very strongest evidence of past climate change.

HOW WE STUDY CLIMATE

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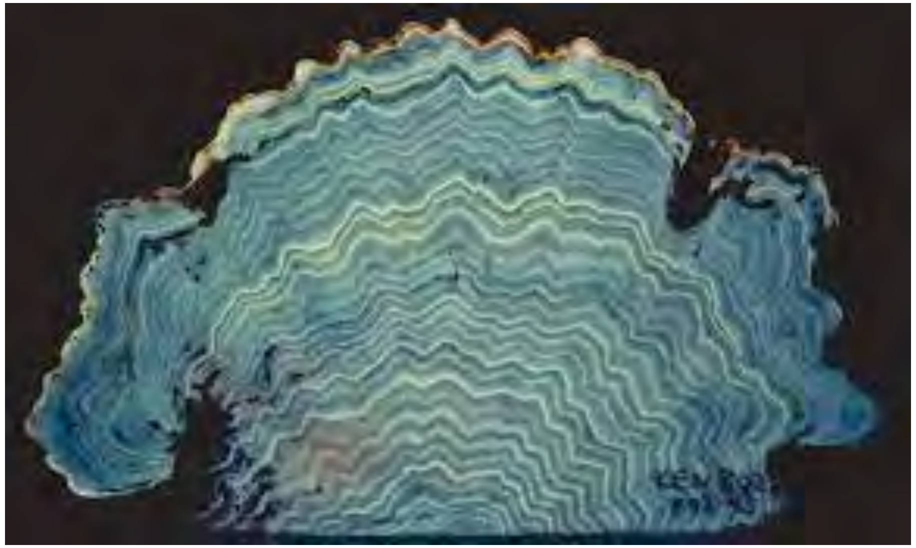
HOW WE STUDY CLIMATE

The Paleo-Proxy Record - Corals

Corals have hard skeletons composed of calcium carbonate ($CaCO_3$), a mineral extracted by the corals from seawater. The carbonate contains isotopes of oxygen, as well as a variety of trace metals, which have been used to determine the temperature of the water in which the coral grew. The growth of corals has been dated directly with a variety of dating techniques over short time periods of coral growth thereby revealing the chronology of climate change over variable time periods.



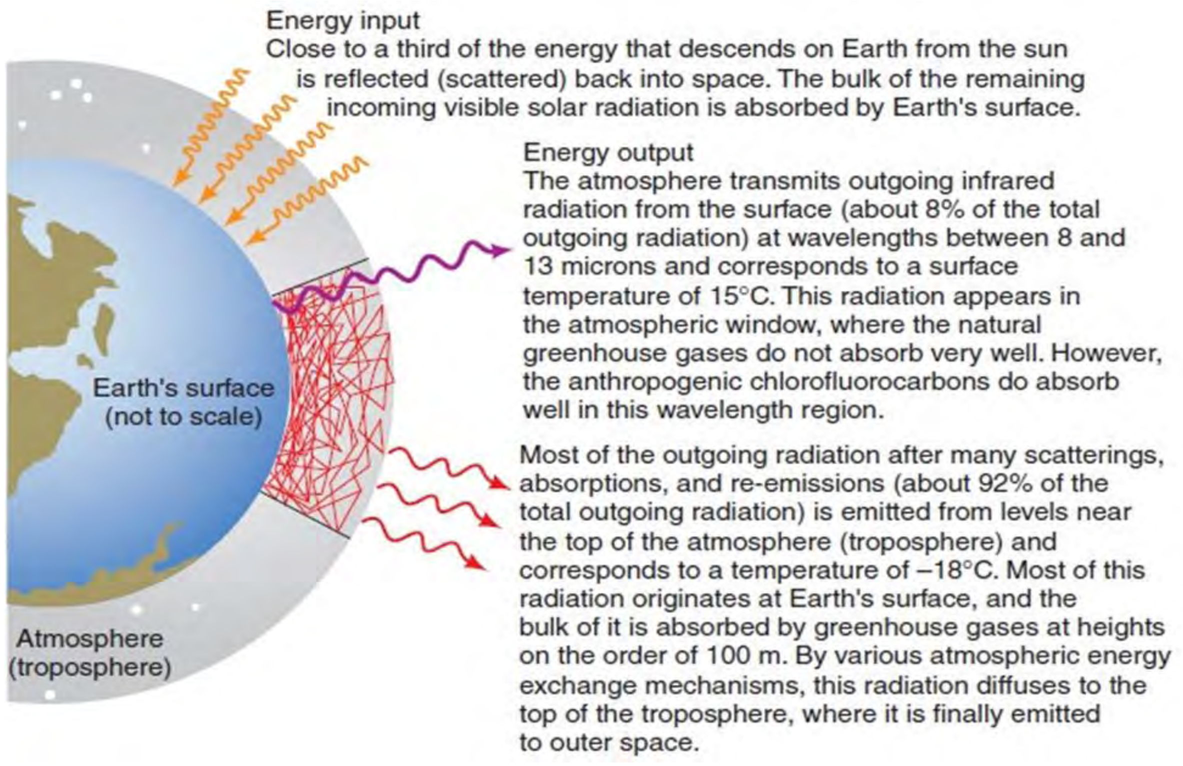
HOW WE STUDY CLIMATE

The Paleo-Proxy Record - Carbon-14 (Dating Element)

Radioactive carbon-14 (14C) is produced in the upper atmosphere by the collision of cosmic rays and nitrogen-14 (14N). Cosmic rays come from outer space; those the Earth receives are predominantly from the sun. The abundance of cosmic rays varies with the number of sunspots, so called because they appear as dark areas on the sun. The radioactive 14C is taken up by photosynthetic organisms—green plants, algae, and some bacteria—and stored in them. If these materials become part of sediments, the year at which they were deposited can be estimated from the decay rate of the 14C.

THE GREENHOUSE EFFECT

The major greenhouse gases are water vapor, carbon dioxide, methane, some oxides of nitrogen, and chlorofluorocarbons (CFCs).



THE MAJOR GREENHOUSE GASES

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Carbon Dioxide

- Current estimates suggest that approximately 200 billion metric tons of carbon in the form of carbon dioxide (CO2) enter and leave Earth's atmosphere each year as a result of a number of biological and physical processes: 50 to 60% of the anthropogenic greenhouse effect is attributed to this gas.

- About 140 years ago, just before the major use of fossil fuels began as part of the Industrial Revolution, the atmospheric concentration of carbon dioxide was approximately 280 ppm. Since then, and especially in the past few decades, the concentration of CO2 in the atmosphere has grown rapidly. Today, the CO2 concentration is about 392 ppm, and at its current rate of increase of about 0.5% per year, the level may rise to approximately 450 ppm by the year 2050—more than 1.5 times the preindustrial level.

THE MAJOR GREENHOUSE GASES

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Methane

- The concentration of methane (CH4) in the atmosphere more than doubled in the past 200 years and is thought to contribute approximately 12 to 20% of the anthropogenic greenhouse effect.
- Certain bacteria that can live only in oxygenless atmospheres produce methane and release it. These bacteria live in the guts of termites and the intestines of ruminant mammals, such as cows, which produce methane as they digest woody plants. These bacteria also live in oxygenless parts of freshwater wetlands, where they decompose vegetation, releasing methane as a decay product. Methane is also released with seepage from oil fields and seepage from methane hydrates.
- Our activities also release methane. These activities include landfills (the major methane source in the United States), the burning of biofuels, production of coal and natural gas, and agriculture, such as raising cattle and cultivating rice.

THE MAJOR GREENHOUSE GASES

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Chlorofluorocarbons (CFC)

- Chlorofluorocarbons (CFCs) are inert, stable compounds that have been used in spray cans as aerosol propellants and in refrigerators.

- The rate of increase of CFCs in the atmosphere in the recent past was about 5% per year, and it has been estimated that approximately 15 to 25% of the anthropogenic greenhouse effect may be related to CFCs.

- Each CFC molecule may absorb hundreds or even thousands of times more infrared radiation emitted from Earth than is absorbed by a molecule of carbon dioxide. Furthermore, because CFCs are highly stable, their residence time in the atmosphere is long.

THE MAJOR GREENHOUSE GASES

Nitrous Oxide

Nitrous oxide (N2O) is increasing in the atmosphere and probably contributes as much as 5% of the anthropogenic greenhouse effect. Anthropogenic sources of nitrous oxide include agricultural application of fertilizers and the burning of fossil fuels. This gas, too, has a long residence time; even if emissions were stabilized or reduced, elevated concentrations of nitrous oxide would persist for at least several decades.

CAUSES OF CLIMATE CHANGE

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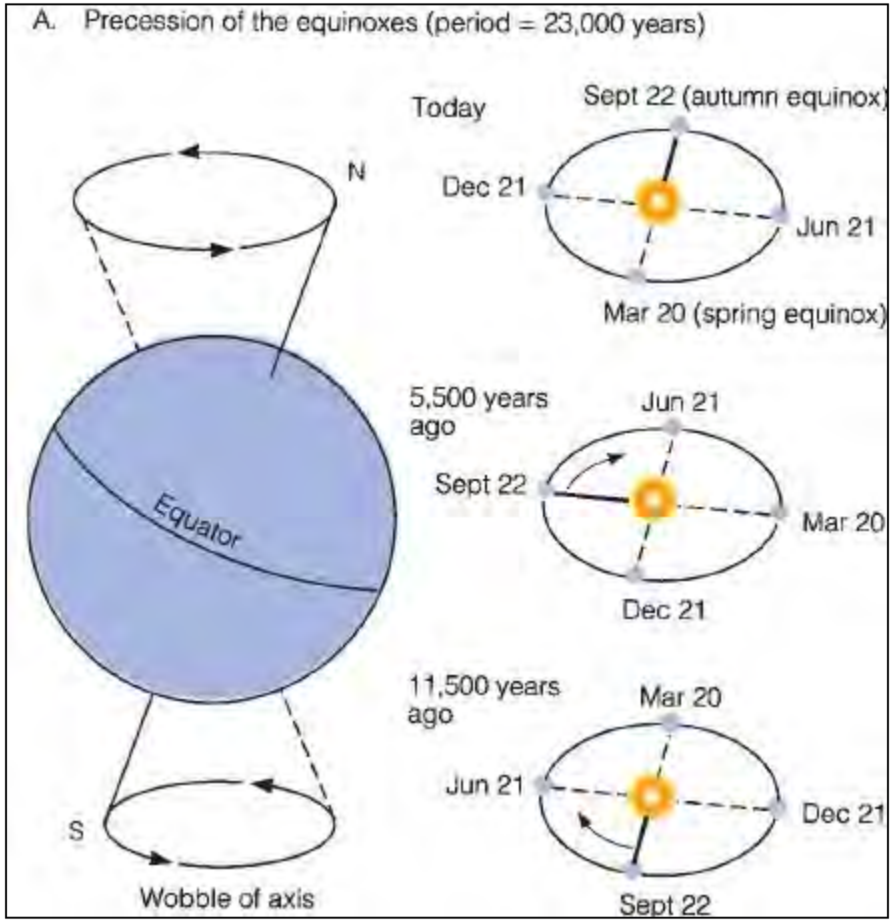
Milankovitch Cycles

•Milankovitch cycles describe the collective effects of changes in the Earth's movements on its climate over thousands of years. The term is named for Serbian geophysicist and astronomer Milutin Milanković.

•The wobble means that the Earth is unable to keep its poles at a constant angle in relation to the sun. Right now, the North Pole points to Polaris, the North Star, but this changes as the planet wobbles.

•The wobble makes a complete cycle in 26,000 years.



CAUSES OF CLIMATE CHANGE

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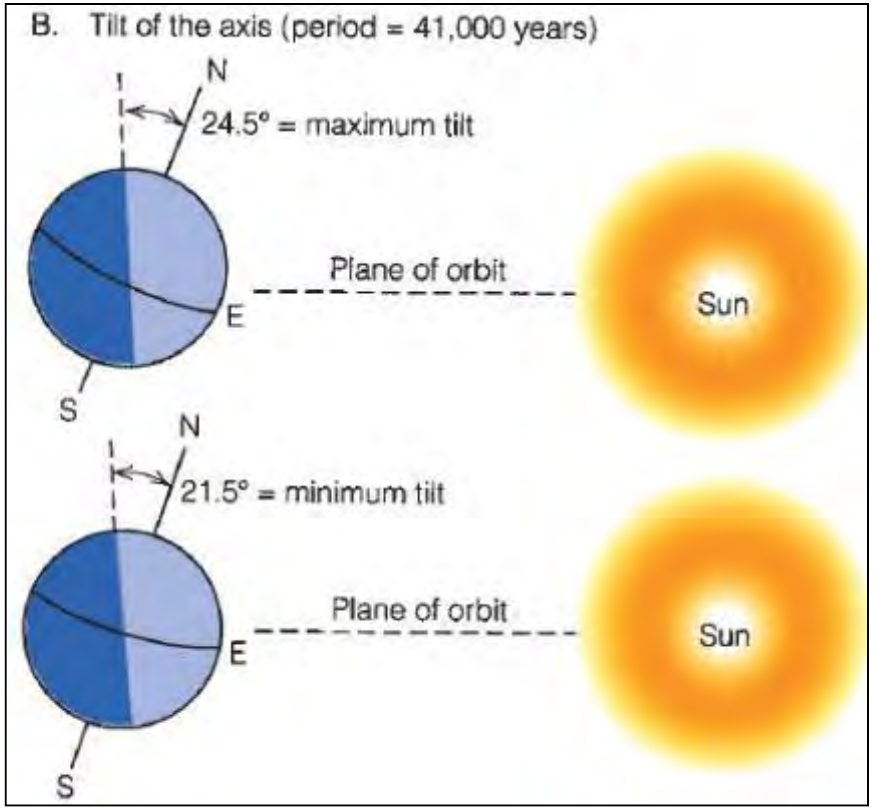
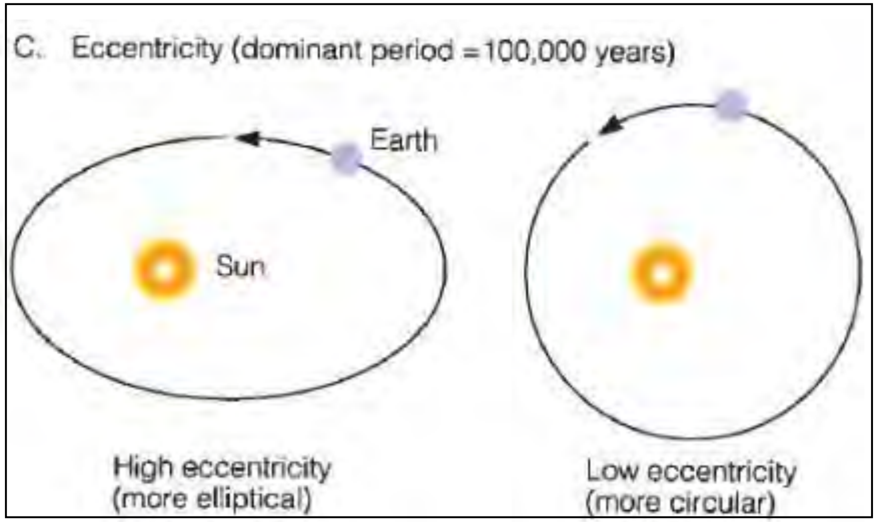
The tilt of Earth's axis varies over a period of 41,000 years. The elliptical orbit around the sun also changes. Sometimes it is a more extreme



ellipse; at other times it is closer to a circle, and this occurs over 100,000 years.



The combination of these changes leads to periodic changes in the amount and distribution of sunlight reaching the Earth.

UMT MARE Co-funded by the Erasmus+ Programme of the European Union

CAUSES OF CLIMATE CHANGE

Solar Cycles

Variations in the sun's intensity in the past can be determined because hotter and cooler sun periods emit different amounts of radionuclides—atoms with unstable nuclei that undergo radioactive decay (such as beryllium-10 and carbon-14), which are trapped in glacial ice and can then be measured. Thus, it appears that the variability of solar energy input explains a small part of the Earth's climatic variability.

CAUSES OF CLIMATE CHANGE

The Surface of Earth and Albedo (reflectivity) Affects

- Albedo is the reflectivity of an object that is measured as the percentage of incoming radiation that is reflected.
- A dark rock surface exposed near the North Pole absorbs more of the sunlight it receives than it reflects in the summer, warming the surface and the air passing over it. When a glacier spreads out and covers that rock, it reflects more of the incoming sunlight than the darker rock cooling both the surface and the air that comes in contact with it.
- Vegetation also affects the climate and weather in the same way. If vegetation is a darker color than the soil, it warms the surface. If it is a lighter color than the soil, it cools the surface. Now you know why if you walk barefoot on dark asphalt on a hot day you feel the heat radiating from the surface (you may burn the bottom of your feet).

CAUSES OF CLIMATE CHANGE

Roughness of the Earth’s Surface Affects the Atmosphere

Above a completely smooth surface, air flows smoothly—a flow called “laminar.” A rough surface causes air to become turbulent—to spin, rotate, reverse, and so forth. Turbulent air gives up some of the energy in its motion (its kinetic energy), and that energy is turned into heat. This affects the weather above. Forests are a much rougher surface than smooth rock or glaciers, so in this way, too, vegetation affects weather and climate.

CAUSES OF CLIMATE CHANGE

The Chemistry of Life Affects the Atmosphere

The emission and uptake of chemicals by living things affect the weather and climate. Thus, a planet with water vapor, liquid water, frozen water, and living things has a much more complex energy-exchange system than a lifeless, waterless planet. This is one reason (of many) why it is difficult to forecast climate change.

CAUSES OF CLIMATE CHANGE

Climate Forcing

- Climate forcing—defined as an imposed perturbation of Earth’s energy balance.
- Factors that affect and are in turn affected by regional global temperature changes include higher ice-sheet temperatures; changes in vegetation; changes in atmospheric gases, such as carbon dioxide, methane, and nitrous oxide; and changes in sunlight intensity.
- Positive forcings cause warm and negative forcings cause cooling. In recent decades human caused forcings have dominated over natural forcings.

THE OCEANS AND CLIMATE CHANGE

- The oceans play an important role in climate because two thirds of the Earth is covered by water. Moreover, water has the highest heat-storage capacity of any compound, so a very large amount of heat energy can be stored in the world's oceans.
- If carbon dioxide **increases in the atmosphere**, it will also **increase in the oceans**, and, over time the oceans can absorb a very large quantity of CO_2.
- This can cause seawater to become more acidic (**H_2O+CO_2 ❼ H_2CO_3**) as carbonic acid increases.

THE OCEANS AND CLIMATE CHANGE

- Part of what may drive the climate system and its changes is the “ocean conveyor belt”—a global circulation of ocean waters characterized by strong northward movement of upper warm waters of the Gulf Stream in the Atlantic Ocean.
- Natural oscillations of the ocean linked to the atmosphere can produce warmer or cooler periods of a few years to a decade or so. The effect of the oscillations can be ten times as strong (in a given year) as long-term warming that we have observed over the past century—larger.

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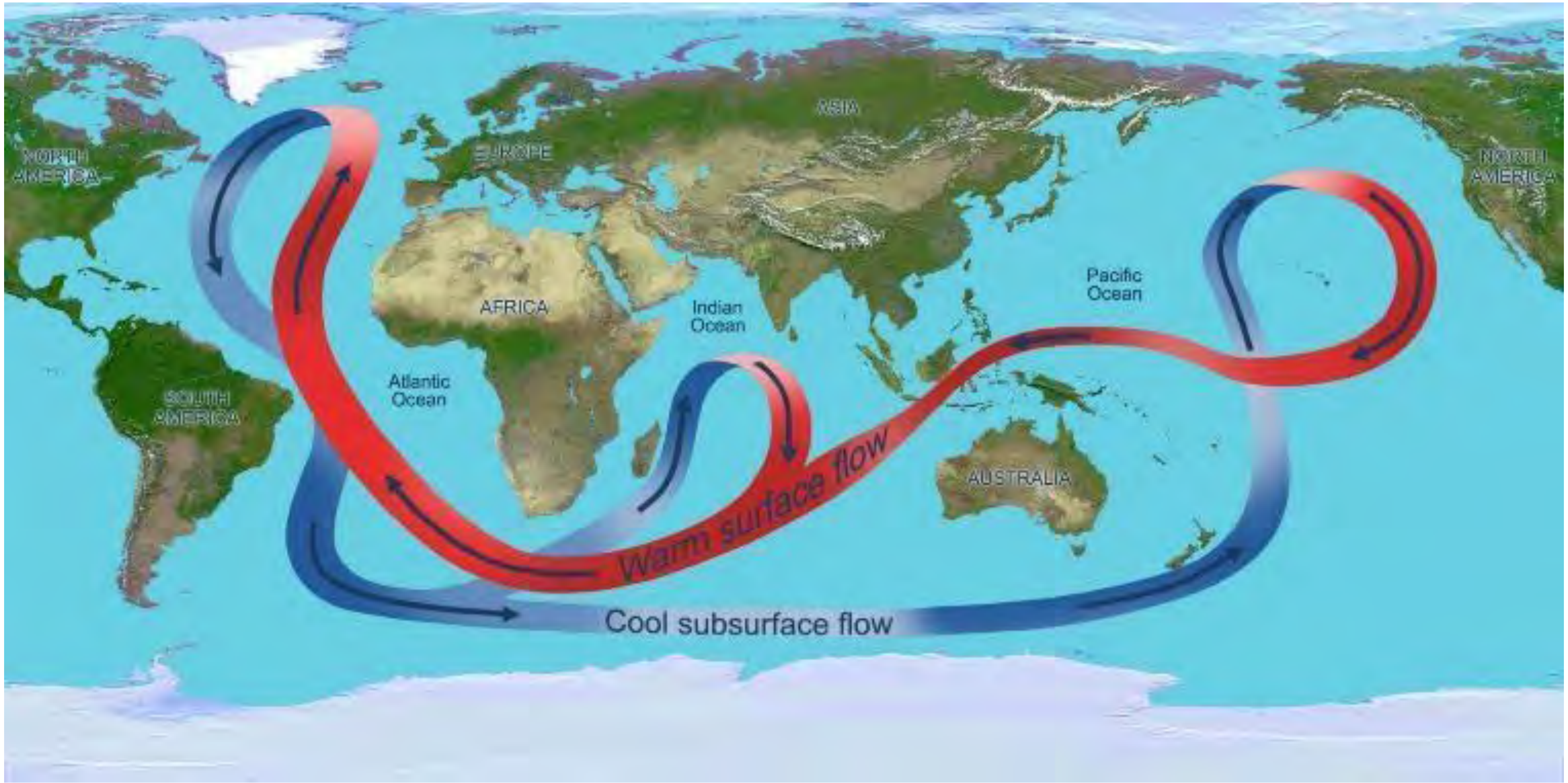
THE OCEANS AND CLIMATE CHANGE



THE OCEANS AND CLIMATE CHANGE

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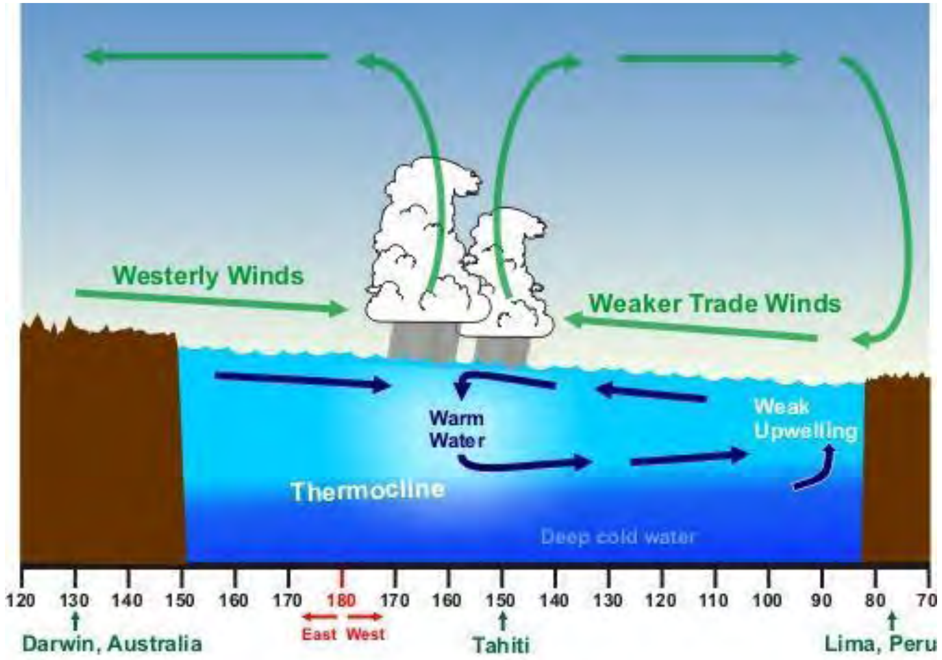
By comparison, the annual increase in warming due mostly to human activity is about two-hundredths of a degree Celsius per year.

Some scientists attribute the cool winter of 2009–2010 to natural ocean–atmosphere oscillations, and also suggest that these caused a cool year in 1911 that froze Niagara Falls. The more famous El Niño oscillations that occur in the Pacific Ocean are connected to large-scale but short-term changes in weather.

THIS PICTURE WAS TAKEN
WHEN NIAGARA FALLS WAS COMPLETELY FROZEN IN THE YEAR 1911.
A VERY RARE PHOTO.
I've read of this but never saw the photo before. Makes you wonder just HOW COLD and HOW LONG it was that cold!!

EL NIÑO AND CLIMATE

El Niño occurs when those cold upwellings weaken or stop rising altogether. As a result, nutrients decline, algae grow poorly, and so do the fish, which either die, fail to reproduce, or move away. Because rainfall follows warm water eastward during El Niño years, there are high rates of precipitation and flooding in Peru, while droughts and fires are common in Australia and Indonesia. Because warm ocean water provides an atmospheric heat source, El Niño changes global atmospheric circulation, which causes changes in weather in regions that are far removed from the tropical Pacific.



FORECASTING CLIMATE CHANGE

Past Observations

- The use of empirical records is based on the idea of uniformitarianism—the idea that processes occurring in the past occur today and that processes occurring today occurred in the past.
- The argument that human actions are leading to global warming is heavily based on this kind of empirical evidence, in particular measurements from the past 150 years and proxy evidence over the past few hundred years that suggest relationships between Earth's average surface temperature with both the concentrations of carbon dioxide and methane in the atmosphere.

FORECASTING CLIMATE CHANGE

Experiments and Laboratory Research

- Laboratory research has taught scientists some fundamental things about the cause and effect of climate change. For example, the understanding that carbon dioxide absorbs in specific infrared wavelengths that are different from those of the other gases in the atmosphere comes from a long history of laboratory studies of the air around us, beginning with the work of one of the first modern chemical scientists, the Englishman Joseph Priestley (1733–1804).

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FORECASTING CLIMATE CHANGE

Computer Simulations

- Computers are much faster today, and the major theoretical method used today to forecast climate change is a group of computer models called general circulation models (GCMs). Mathematically, these are deterministic differential equation models.
- They are all steady-state models, meaning that for any given set of input information about the climate at the beginning, the result will always be the same— there is no chance or randomness involved. These models assume that the climate is in a steady state except for specific perturbations, especially those believed to be caused by human activities. Thus an assumption of these models, and a necessary outcome, is that the climate, if left to itself, will be in balance, in a steady state. This is unlike the real world's global environmental systems, which are inherently nonsteady-state.

EFFECTS OF GLOBAL WARMING

Changes in River Flow

- With a continuation of global warming, melting of glacial ice and reductions in snow cover are anticipated to accelerate throughout the twenty-first century.
- California, which depends on snowmelt from the Sierra Nevada for water to irrigate one of the richest agriculture regions in the world, will have problems storing water in reservoirs if these forecasts became true. Rainfall will likely increase, but there will be less snowpack with warming. Runoff, will be more rapid than if snow slowly melts. As a result, reservoirs will fill sooner and more water will escape to the Pacific Ocean.

EFFECTS OF GLOBAL WARMING

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Rise in Sea Level

- Sea level rises from two causes:
  1. **Liquid water expands as it warms; and**
  2. **ice sheets on land that melt increase the amount of water in the oceans.**
- About half the people on Earth live in a coastal zone, and about 50 million people each year experience flooding due to storm surges. As the sea level rises and the population increases, more and more people become vulnerable to coastal flooding.
- This could lead to further investments to protect cities in the coastal zone by constructing seawalls, dikes, and other structures to control erosion. In short, coastal erosion is a difficult problem that is very expensive to deal with.
- Groundwater supplies for coastal communities could also be threatened by saltwater intrusion.

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EFFECTS OF GLOBAL WARMING

Rise in Sea Level

(a) (b)

FIGURE 20.23 The world's smallest nation, Tuvalu, may succumb to sea-level rise. Tuvalu consists of nine coral islands in the South Pacific, with a total area smaller than Manhattan, and its highest elevation above sea level is 4.5 meters. Sea levels have been rising since the end of the last ice age, a natural response. But global warming could accelerate this rise, making the 12,000 citizens of Tuvalu the world's first sea-level-rise refugees.

EFFECTS OF GLOBAL WARMING

Glaciers and Sea Ice

- A major concern is whether global warming will lead to a great decline in the volume of water stored as ice, especially because melting of glacial ice raises the mean sea level and because mountain glaciers are often significant sources of water for lower-elevation ecosystems.
- Since they were first observed in 1912, the glaciers of Kilimanjaro have decreased in area by about 80%. The ice is disappearing not from warmer temperatures at the top of the mountain, which are almost always below freezing, but because less snowfall is occurring and ice is being depleted by solar radiation and sublimation (ice is transformed from solid state to water vapor without melting). More arid conditions in the past century led to air that contained less moisture and thus favored sublimation.

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1941

2004

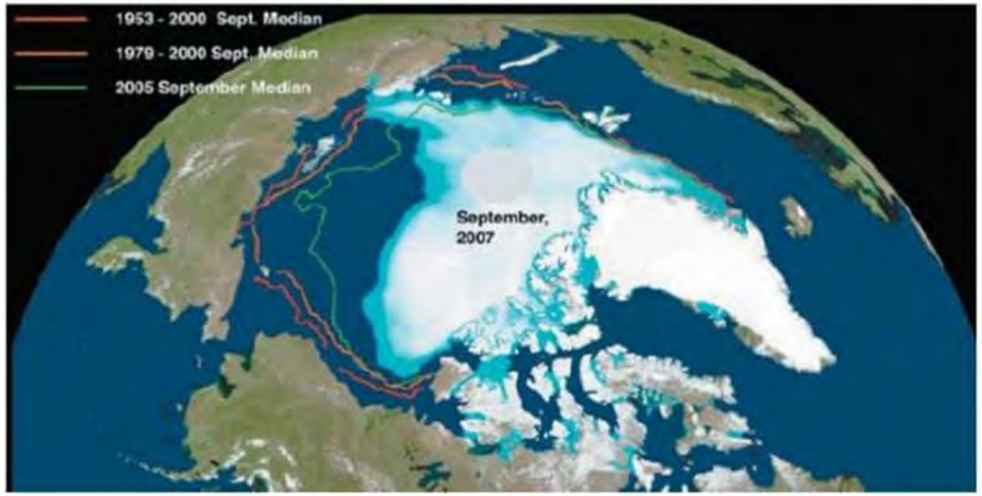

FIGURE 20.25 Satellite observations, which began in 1977, show that Arctic sea ice reached a minimum in September 2007 and has increased since then. The sea ice coverage varies greatly between summer and winter, with July marking the summer minimum. The rapid decline in 2007 was partly due to atmospheric circulation that favored melting. (*Source*: Modified after Stroever et al., 2008. EOS 89 [2] 13–14.)

EFFECTS OF GLOBAL WARMING

Changes in Biological Diversity

- Warming is one change, but others—such as availability of nutrients, relations with other organisms (predator and prey), and competition for habitat and niches in ecosystems—also affect biodiversity.
- The abundance of black guillemots, birds that nest on Cooper Island, Alaska has declined since temperature increases in the 1990s caused the sea ice to recede farther from Cooper Island each spring.

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EFFECTS OF GLOBAL WARMING

Changes in Biological Diversity

- The parent birds feed on Arctic cod found under the sea ice and must then return to the nest to feed their chicks, who are not yet mature enough to survive on their own. For the parents to do this, the distance from feeding grounds to nest must be less than about 30 km, but in recent years the ice in the spring has been receding as much as 250 km from the island.
- As a result, the black guillemots on the island have lost an important source of food. The future of black guillemots on Cooper Island depends on future springtime weather.

EFFECTS OF GLOBAL WARMING

Agricultural Productivity

- Globally, agricultural production will likely increase in some regions and decline in others. A climate shift could have serious negative effects on midlatitude food production. Meanwhile, lands in the southern part of the Northern Hemisphere may become more arid. Prolonged drought as a result of future warming as evidently occurred during the Medieval warming period with loss of agricultural productivity could be one of the serious impacts of global warming.

EFFECTS OF GLOBAL WARMING

What are the impacts of global warming to human population?

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ADJUSTING TO POTENTIAL GLOBAL WARMING

- People can adjust to the threat of global warming in two ways:
- **Adapt** ❼ Learn to live with future global climate change over the next 20 years because there is warming in the pipeline from greenhouse gases already emitted.
- **Mitigate** ❼ Work to reduce the emissions of greenhouse gases and take actions to reduce the undesirable effects of a global warming.

HOW TO COPE WITH GLOBAL WARMING?

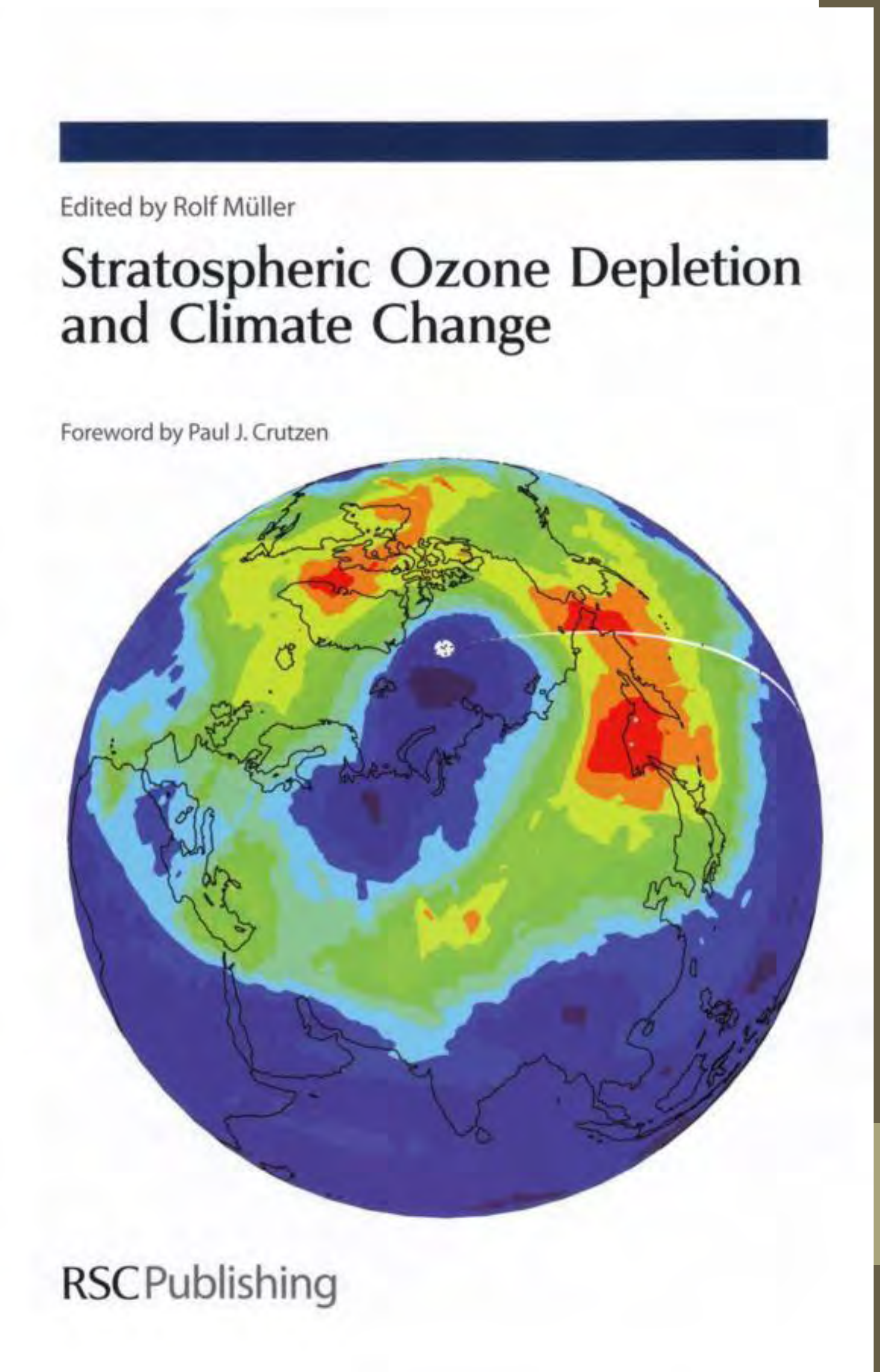
What is your role?


Q&A

Lecture outline

- Ozone Depletion
  - o What is ozone?
  - o What is the function of ozone?
  - o What is ozone depletion?
  - o Causes of ozone depletion

Ozone Depletion



What is Ozone

- Ozone (O3) is a highly reactive gas composed of three oxygen atoms. It is both a natural and a man-made product that occurs in the Earth's upper atmosphere.
- Discovered in 1800
- **Gas**: three atoms of oxygen (O_3)
- Bluish, highly oxidative, volatile (less stable than O_2)
- ~10% = trophosphere, 0-16 km;
- ~ 90% = stratosphere (ozone layer), 15-30 km from surface

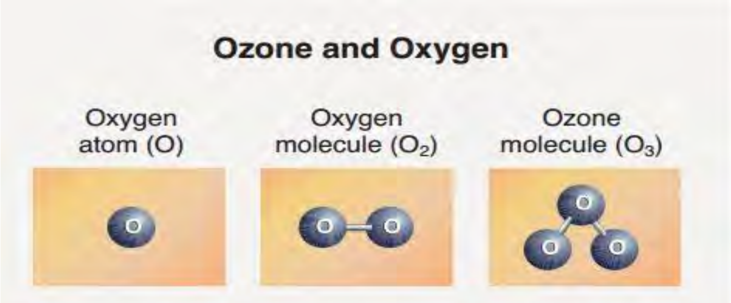
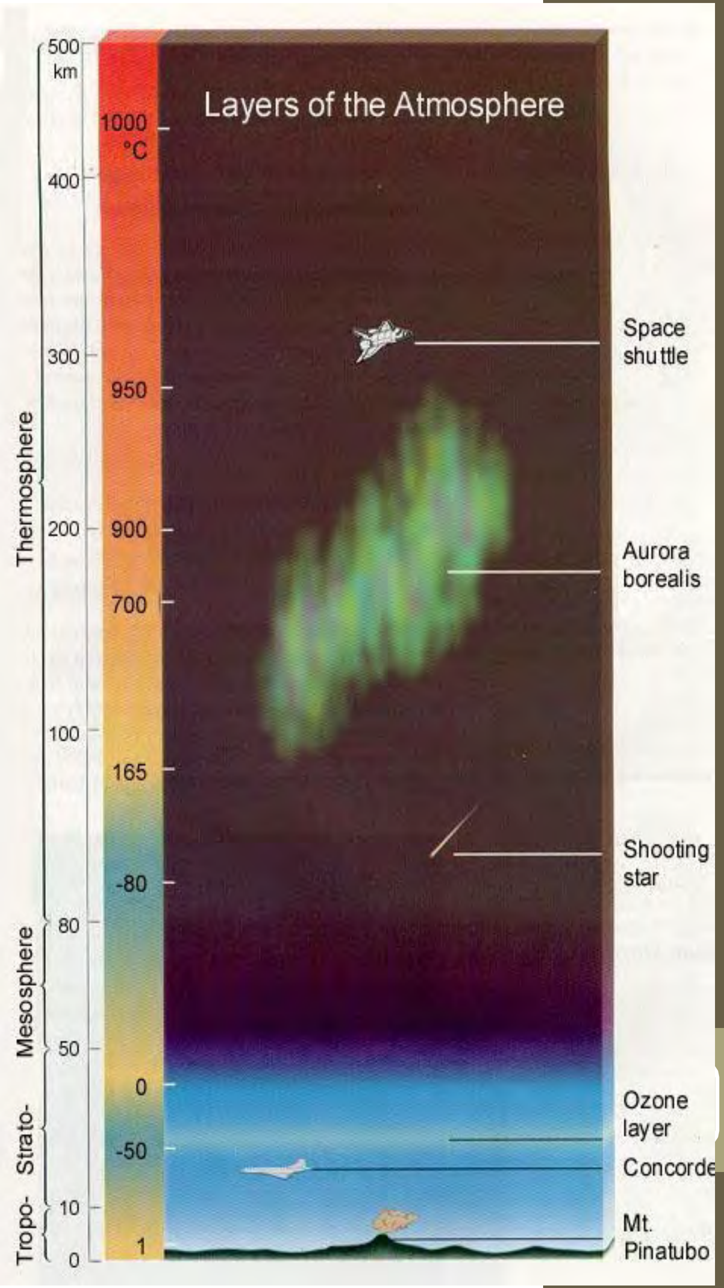


Figure Q1-1. Ozone and oxygen. A molecule of ozone (O_3) contains three oxygen (O) atoms bound together. Oxygen molecules (O_2), which constitute 21% of the gases in Earth's atmosphere, contain two oxygen atoms bound together.



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— MMS3003 —

ENVIRONMENT – ISSUE AND GLOBAL PERSPECTIVE

CHAPTER 6

OZONE DEPLETION

These lecture material are for the **Marine Coastal and Delta Sustainability for Southeast Asia (MARE)**(Project No 610327-EPP-1-2019-1-DE-EPPKA2-CBHE-JP)
This project has been funded with support from the **European Commission**. This publication **reflects the views only of the authors**, and the Commission cannot be made responsible for any use which may be made from the information contained herein.

What is Ozone

In 1785, Dutch chemist Martinus van Marum noticed a strange smell from generating electrical sparks above water. While van Marum realized the odor came from a chemical reaction, he did not understand its source.

German-Swiss chemist Christian Friedrich Schönbein repeated van Marum's experiment and realized the odor was identical to the smell in the air after a lightning strike. In 1839, he successfully isolated the gas from air and named it "ozone." The name comes from the Greek word ozein, which means to smell."

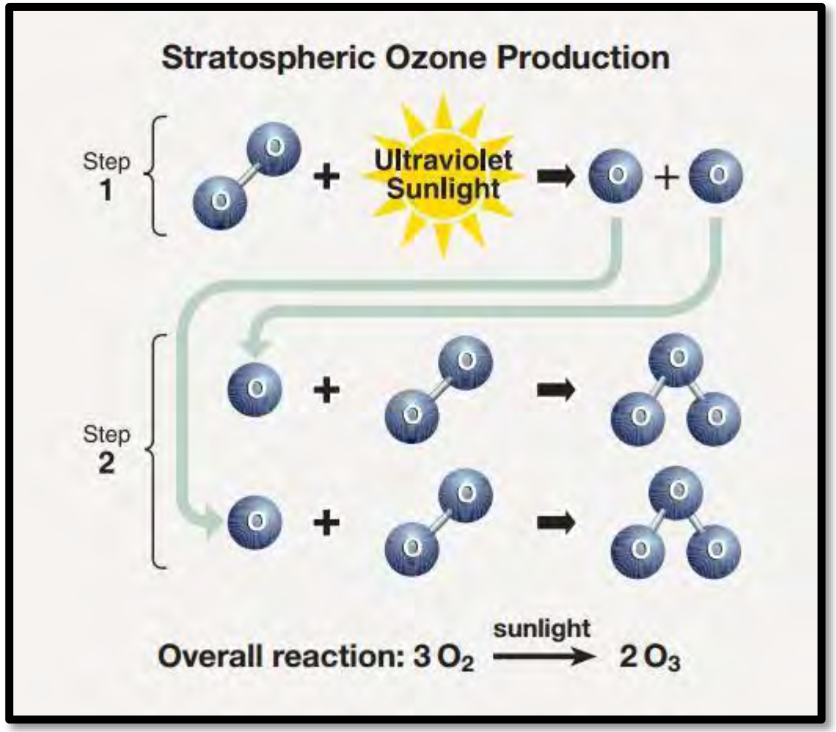
The chemical formula for ozone was determined in 1865 by Jacques-Louis Soret.

What is Ozone

Ozone production

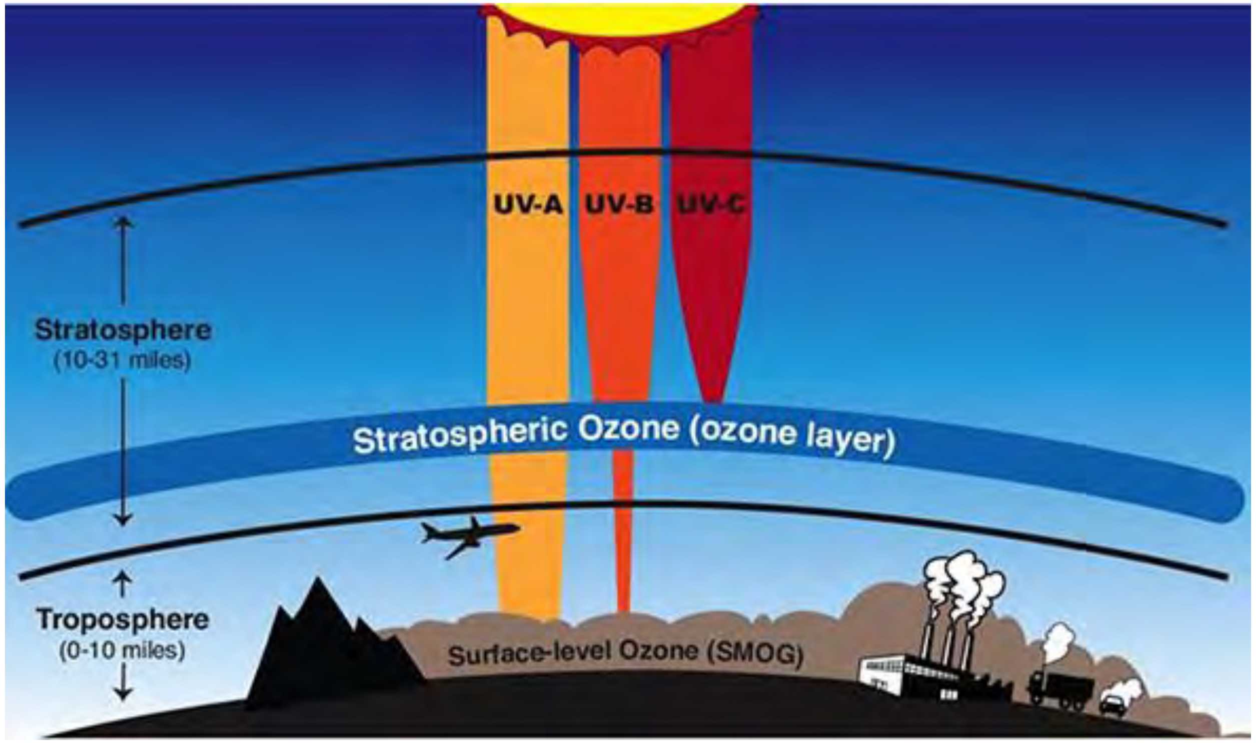
- Trophospere = reactions between pollutants (industrial activities, combustion etc.) and naturally occurring gases.

- Stratosphere = reactions between solar ultraviolet (UV) and oxygen molecules



The Distribution of Ozone in the Stratosphere

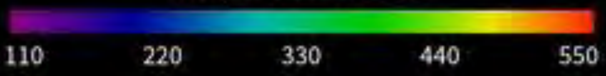
- **Total ozone** – sum of all ozone in the atmosphere directly above a location
- **Varies** – latitude, longitude, season
- **Natural variations** - stratospheric air movements, chemical production, ozone destruction
- **Global distribution** - lowest at equator, highest at polar regions



Antarctic Ozone

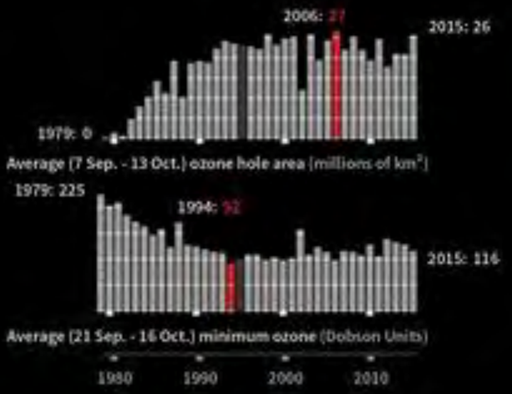
These images are false-color views of total ozone over the Antarctic pole on October 1 starting in 1979. The purple and blue colors are where there is the least ozone, and the yellows and reds are where there is more ozone.

Ozone (Dobson Units)



Annual Records

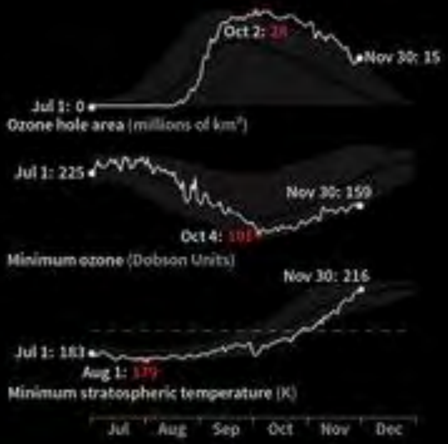
These two graphs show the variations of ozone from year to year. The red bars indicate the largest area and the lowest minimum value.

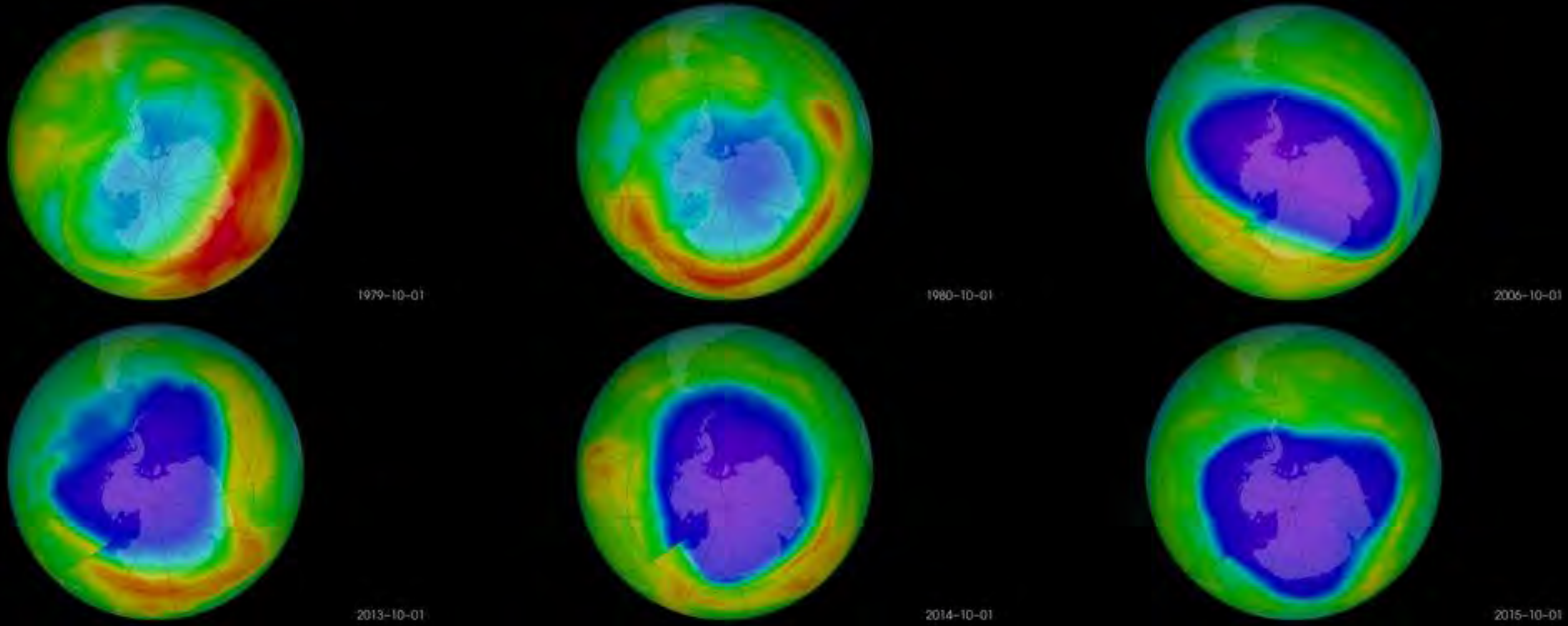


Note: No data were acquired during the 1995 season

2014 Season

These three graphs show the progress of 2014's ozone hole. The gray shading indicates the highest and lowest values measured since 1979. The red numbers are the maximum or minimum observed values so far this year. The stratospheric temperature and the amount of sunlight reaching the south polar region control the depth and size of the Antarctic ozone hole.





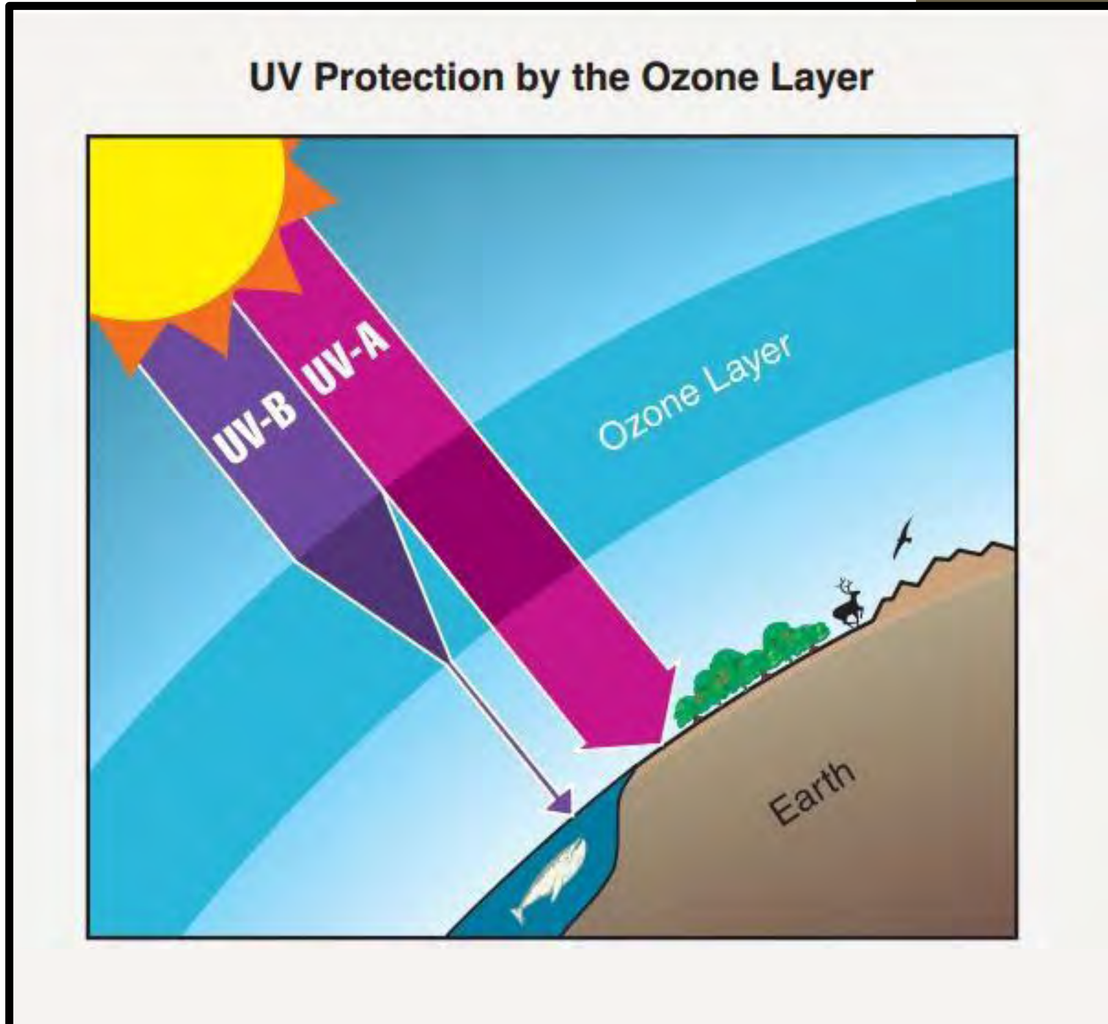
What is the function of ozone?

Stratosphere

- ‘Good ozone’
- Absorbs ultra-violet B (UV-B) from the Sun

Troposphere

- ‘Bad ozone’
- Harmful to life forms – oxidation (bleaching effect)
- Green house gas



Effects of UV-B

Life forms

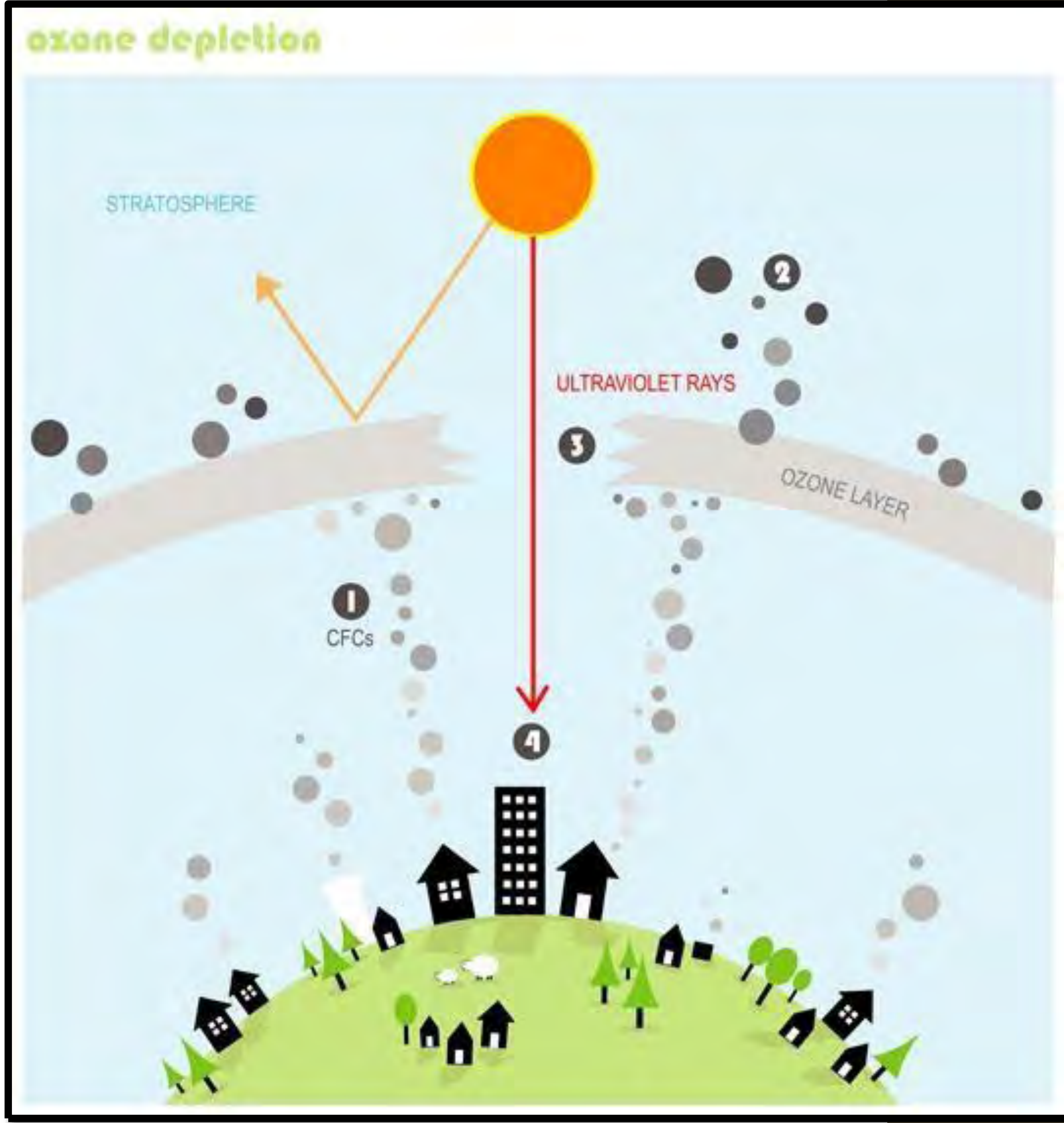
- Skin Cancer (melanoma and non-melanoma)
- Premature aging of the skin and other skin problems
- Cataracts and other eye damages; 10% ozone thinning = ~ 2 million new cases of cataracts (Environment Canada, 1993)
- Immune system suppression

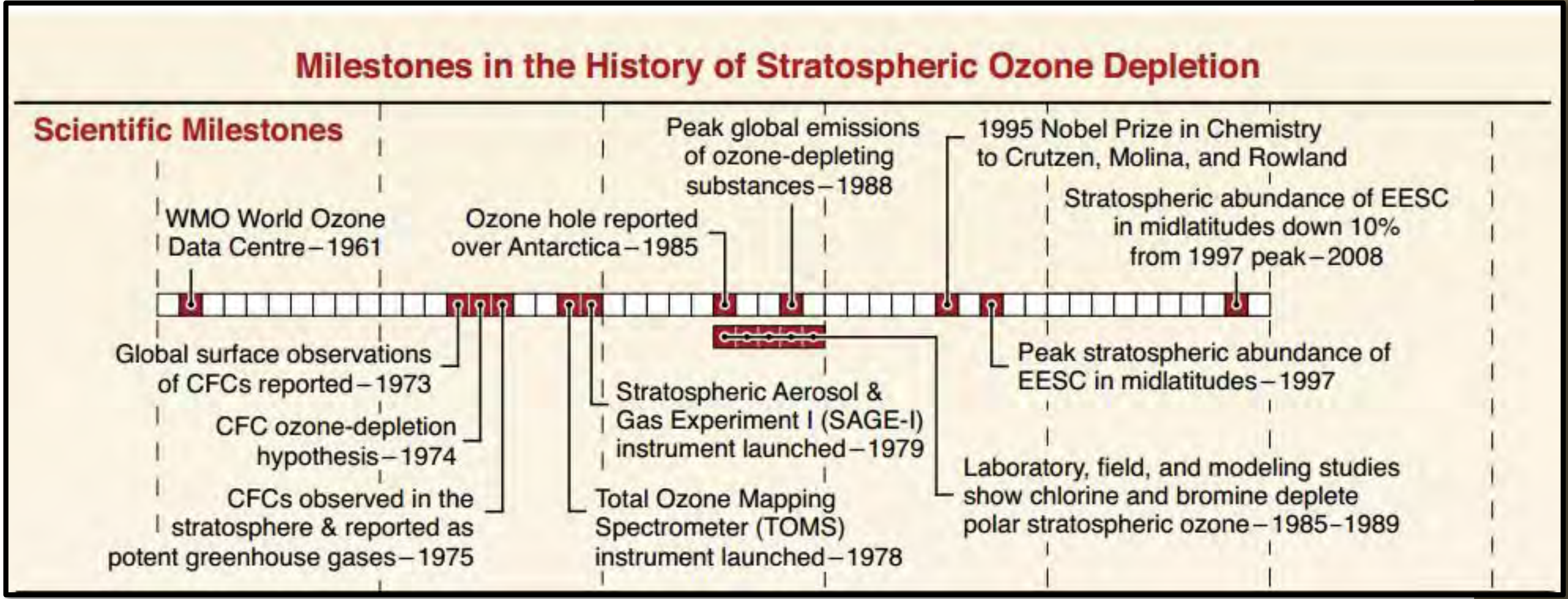
Agriculture, forestry and natural ecosystems, materials:

- Reduced growth, photosynthesis and flowering (wheat, rice, barley, oats, corn, soybeans, peas, tomatoes, cucumbers, cauliflower, broccoli and carrots).
- Accelerate material breakdown especially natural polymers

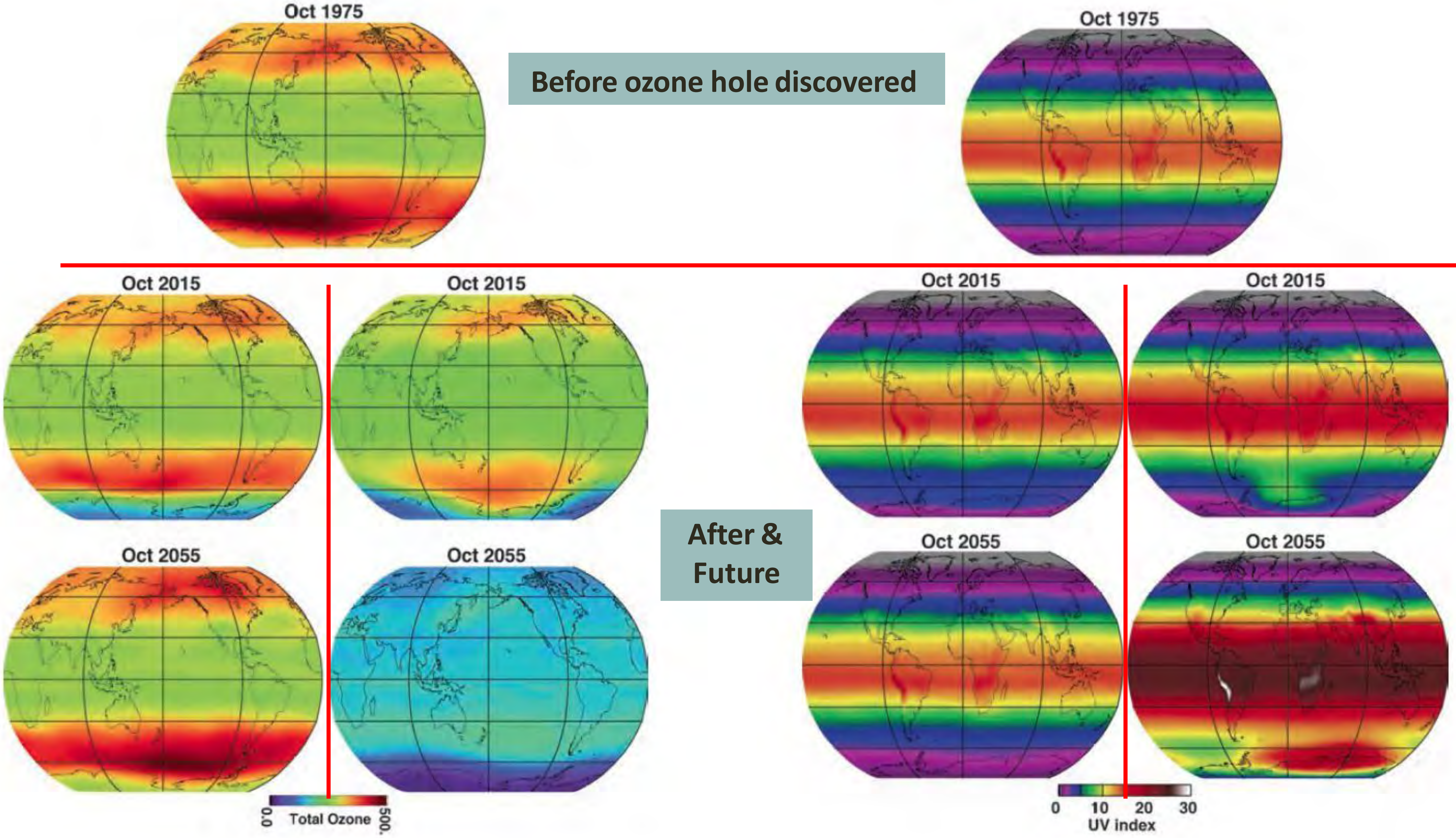
What is ozone depletion?

- Decline in the total volume of ozone in Earth's stratosphere (the ozone layer)
- larger springtime decrease in stratospheric ozone around Earth's polar regions (ozone hole)

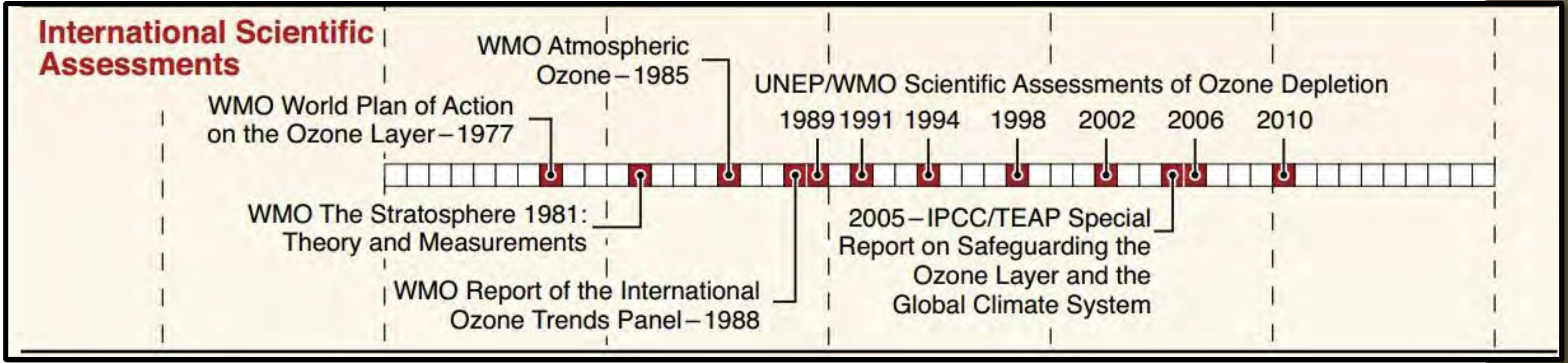




Milestones in the History of Stratospheric Ozone Depletion
Scientific Milestones
WMO World Ozone Data Centre – 1961
Global surface observations of CFCs reported – 1973
CFC ozone-depletion hypothesis – 1974
CFCs observed in the stratosphere & reported as potent greenhouse gases – 1975
Total Ozone Mapping Spectrometer (TOMS) instrument launched – 1978
Stratospheric Aerosol & Gas Experiment I (SAGE-I) instrument launched – 1979
Ozone hole reported over Antarctica – 1985
Peak global emissions of ozone-depleting substances – 1988
Laboratory, field, and modeling studies show chlorine and bromine deplete polar stratospheric ozone – 1985–1989
1995 Nobel Prize in Chemistry to Crutzen, Molina, and Rowland
Peak stratospheric abundance of EESC in midlatitudes – 1997
Stratospheric abundance of EESC in midlatitudes down 10% from 1997 peak – 2008

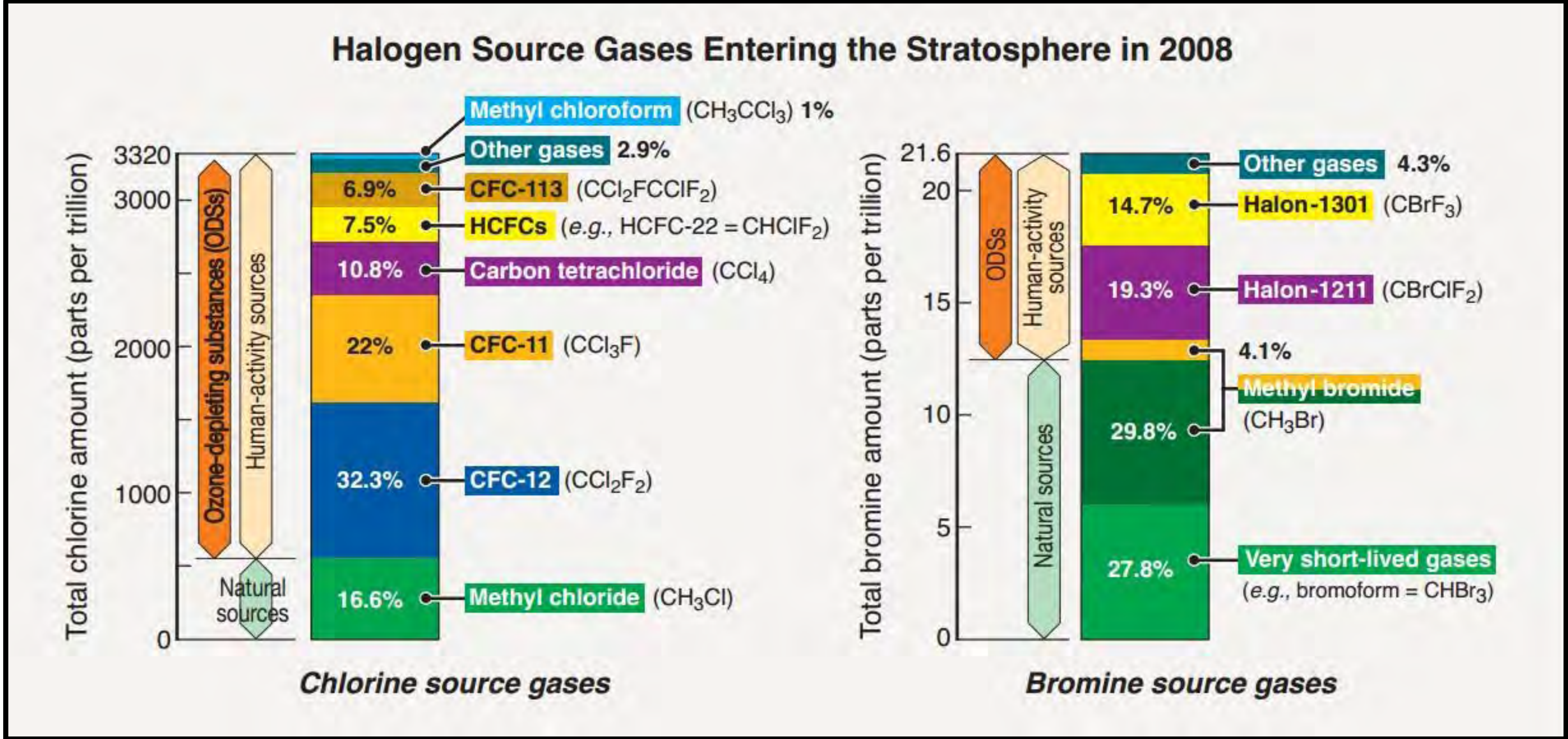


Oct 1975
Before ozone hole discovered
Oct 1975
Oct 2015
Oct 2015
Oct 2015
Oct 2015
After &
Future
Oct 2055
Oct 2055
Oct 2055
Oct 2055
0.0
Total Ozone
500.
0
10
20
30
UV index


International Scientific Assessments
WMO Atmospheric Ozone – 1985
WMO World Plan of Action on the Ozone Layer – 1977
UNEP/WMO Scientific Assessments of Ozone Depletion
1989 1991 1994 1998 2002 2006 2010
WMO The Stratosphere 1981: Theory and Measurements
WMO Report of the International Ozone Trends Panel – 1988
2005 – IPCC/TEAP Special Report on Safeguarding the Ozone Layer and the Global Climate System

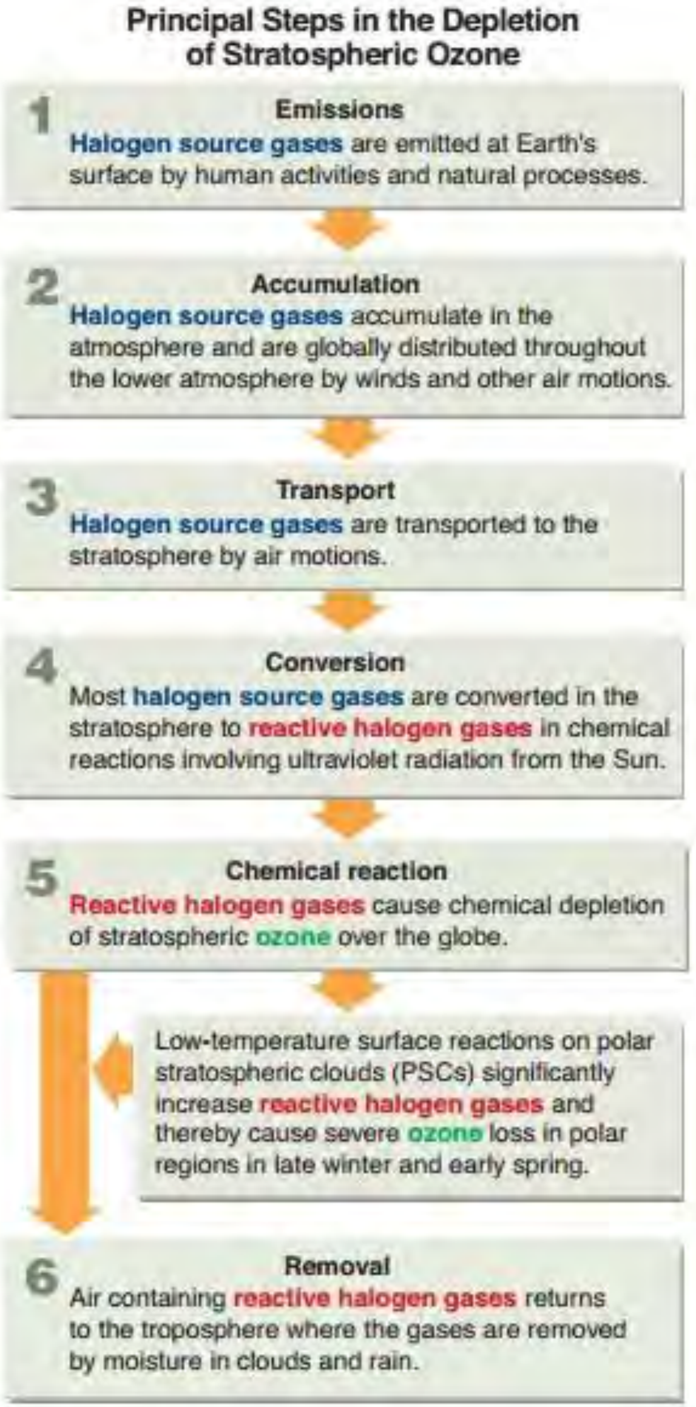
Causes of ozone depletion

- Human activities = emission of **Ozone-depleting substances (ODSs)**
- **ODSs** = halogen source gases contain **chlorine and bromine atoms**
- **Chlorine ODSs** = carbon, chlorine, fluorine (chlorofluorocarbons – **CFC**)
- **Bromine ODSs** = halons, methyl bromide



Halogen Source Gases Entering the Stratosphere in 2008
Methyl chloroform (CH3CCl3) 1%
Other gases 2.9%
6.9% CFC-113 (CCl2FCClF2)
7.5% HCFCs (e.g., HCFC-22 = CHClF2)
10.8% Carbon tetrachloride (CCl4)
22% CFC-11 (CCl3F)
32.3% CFC-12 (CCl2F2)
16.6% Methyl chloride (CH3Cl)
Total chlorine amount (parts per trillion)
3320
3000
2000
1000
0
Ozone-depleting substances (ODSs)
Human-activity sources
Natural sources
Chlorine source gases
Total bromine amount (parts per trillion)
21.6
20
15
10
5
0
ODSs
Human-activity sources
Natural sources
Other gases 4.3%
14.7% Halon-1301 (CBrF3)
19.3% Halon-1211 (CBrClF2)
4.1%
Methyl bromide (CH3Br)
29.8%
27.8% Very short-lived gases (e.g., bromoform = CHBr3)
Bromine source gases

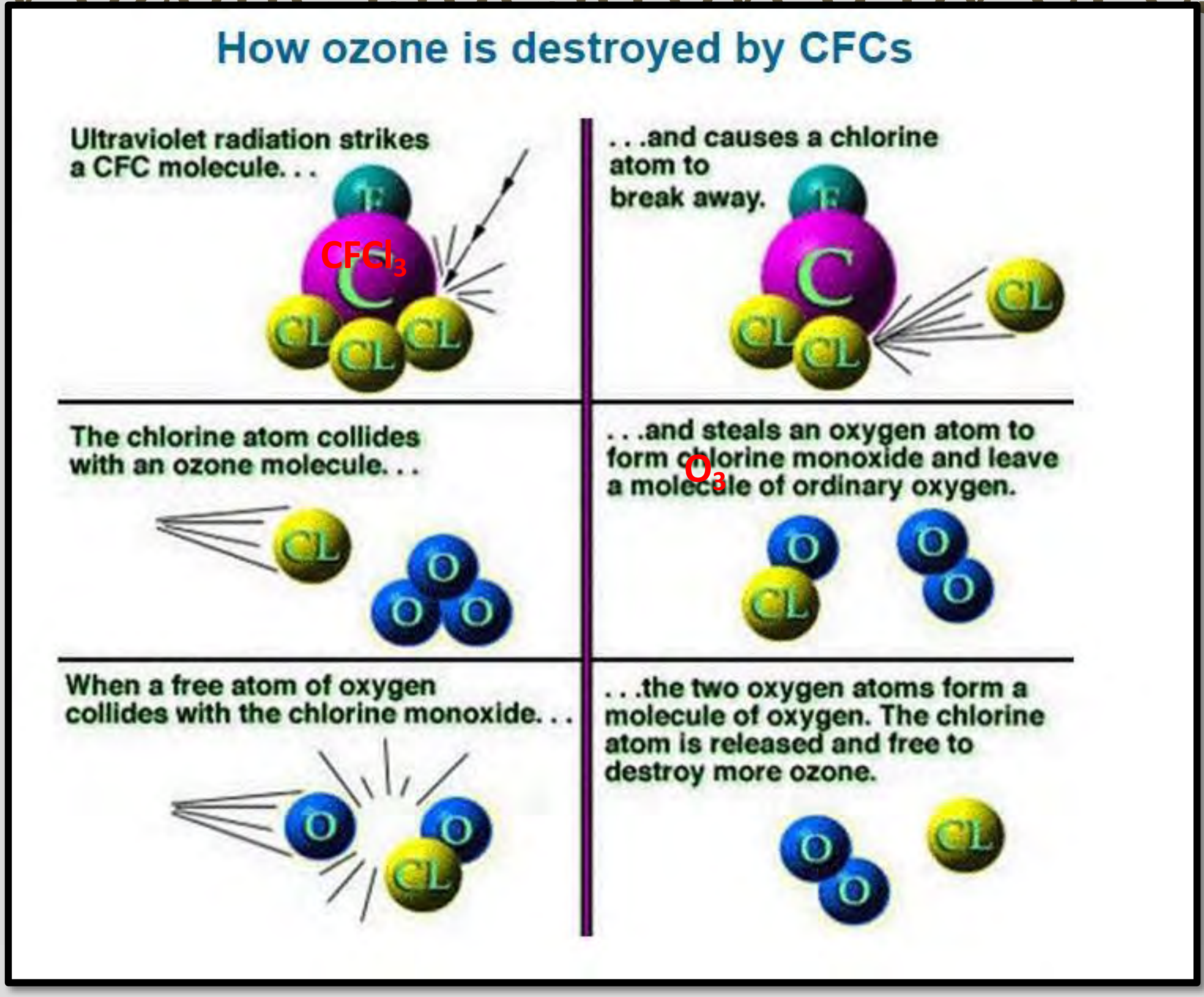
Various sources


Principal Steps in the Depletion of Stratospheric Ozone
1
Emissions
Halogen source gases are emitted at Earth's surface by human activities and natural processes.
2
Accumulation
Halogen source gases accumulate in the atmosphere and are globally distributed throughout the lower atmosphere by winds and other air motions.
3
Transport
Halogen source gases are transported to the stratosphere by air motions.
4
Conversion
Most halogen source gases are converted in the stratosphere to reactive halogen gases in chemical reactions involving ultraviolet radiation from the Sun.
5
Chemical reaction
Reactive halogen gases cause chemical depletion of stratospheric ozone over the globe.
Low-temperature surface reactions on polar stratospheric clouds (PSCs) significantly increase reactive halogen gases and thereby cause severe ozone loss in polar regions in late winter and early spring.
6
Removal
Air containing reactive halogen gases returns to the troposphere where the gases are removed by moisture in clouds and rain.

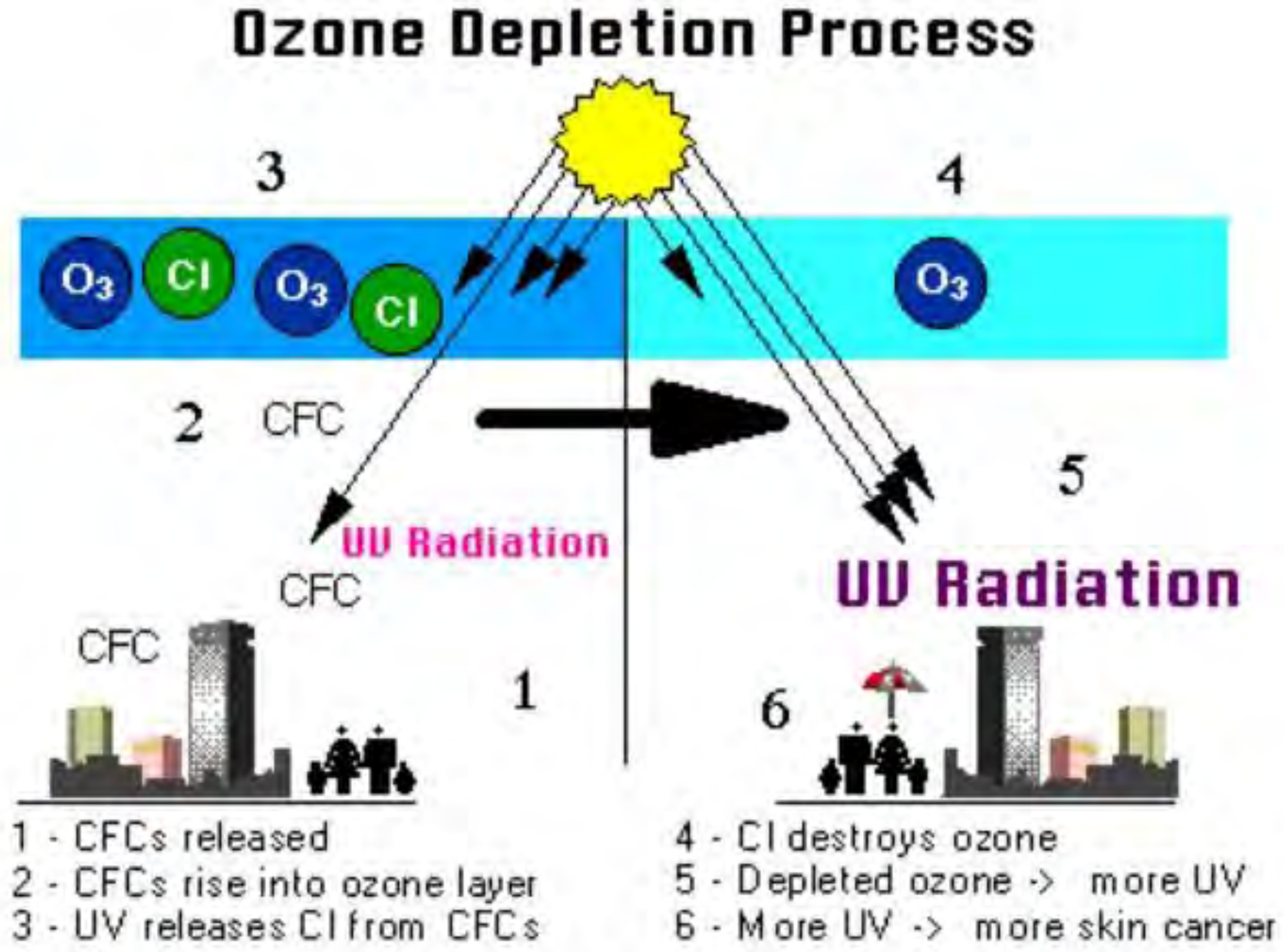
How ozone is destroyed by CFCs?

$Cl + O_3 ==> ClO + O_2$

$ClO + O ==> Cl + O_2$

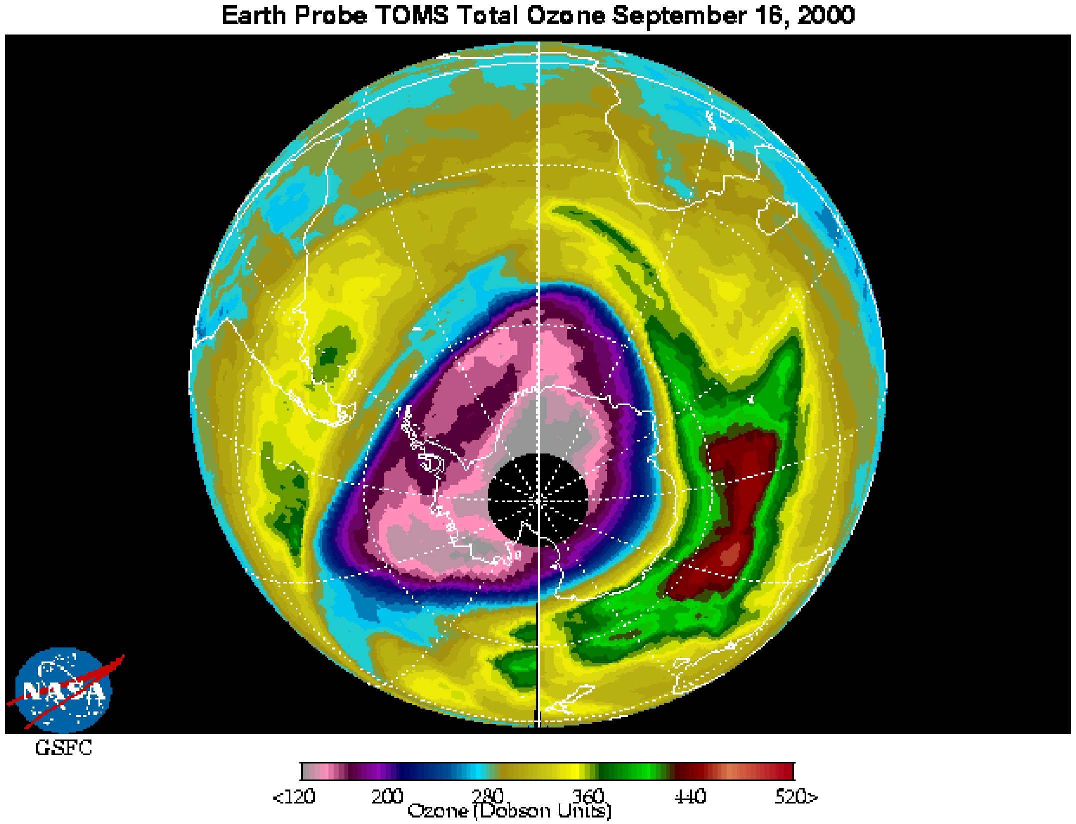


- 1 atom Cl can destroy 100,000 ozone
- CFC's have a 60-100 year lifespan



Ozone Depletion Process
3
4
O3
Cl
O3
Cl
O3
2
CFC
5
UV Radiation
CFC
UV Radiation
CFC
1
6
1 - CFCs released
2 - CFCs rise into ozone layer
3 - UV releases Cl from CFCs
4 - Cl destroys ozone
5 - Depleted ozone -> more UV
6 - More UV -> more skin cancer

The Antarctic Ozone Hole



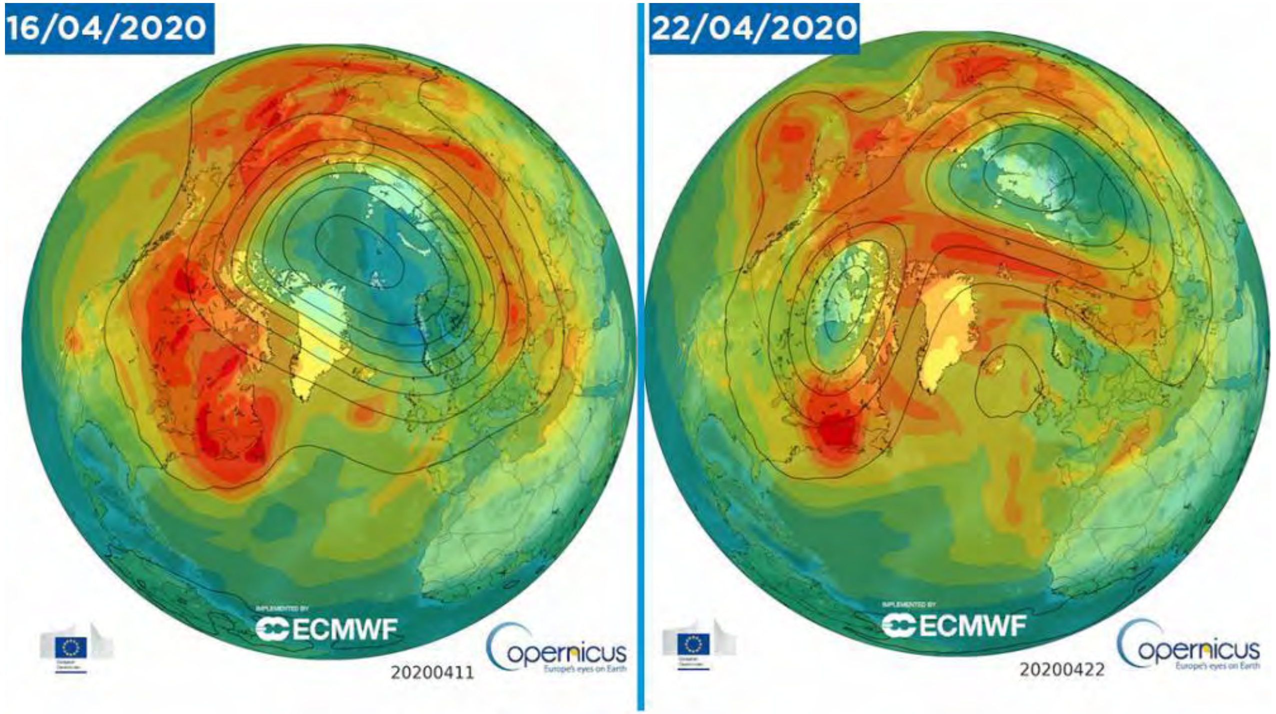
- Area having less than **220** (DU) of ozone in the overhead column (i.e., between the ground and space)
- Discovered in the 1980s
- 1985 = ozone levels were about **35 % lower**
- than the average in 1960s.
- Ozone hole also occurs in Arctic but less
- severe than Antarctic

Source: http://jwocky.gsfc.nasa.gov/multi/recent_ozone91200.gif

WORLD

Largest-ever hole in the ozone layer above Arctic finally closes

COMMENTS



Factors lead to Antarctic ozonehole

- Distributing halogen gases

Halogen source gases emitted at Earth’s surface are present in comparable abundances throughout the stratosphere in both hemispheres even though most of the emissions occur in the Northern Hemisphere. The abundances are comparable because most source gases have no significant natural removal processes in the lower atmosphere and because winds and convection redistribute and mix air efficiently throughout the troposphere on the timescale of weeks to months. Halogen gases (in the form of source gases and some reactive products) enter the stratosphere primarily from the tropical upper troposphere.

- Low polar temperature

The severe ozone destruction represented by the ozone hole requires that low temperatures be present over a range of stratospheric altitudes, over large geographical regions, and for extended time periods. Low temperatures are important because they allow liquid and solid PSCs to form. Reactions on the surfaces of these PSCs initiate a remarkable increase in the most reactive chlorine gas, chlorine monoxide (ClO). Stratospheric temperatures are lowest in both polar regions in winter.

Factors lead to Antarctic ozonehole (continued)

- Isolated conditions

Stratospheric air in the polar regions is relatively isolated from other stratospheric regions for long periods in the winter months. The isolation comes about because of strong winds that encircle the poles, forming a polar vortex, which prevents substantial motion of air into or out of the polar stratosphere. This circulation strengthens in winter as stratospheric temperatures decrease, with the result that the isolation of air in the vortex is much more effective in the Antarctic than the Arctic.

- Polar stratospheric clouds

Reactions on the surfaces of liquid and solid PSCs can substantially increase the relative abundances of the most reactive chlorine gases. These reactions convert the reservoir forms of reactive chlorine gases, chlorine nitrate ($ClONO_2$) and hydrogen chloride (HCl), to the most reactive form, ClO. ClO increases from a small fraction of available reactive chlorine to comprise nearly all chlorine that is available. With increased ClO, additional catalytic cycles involving ClO and BrO become active in the chemical destruction of ozone whenever sunlight is available

Mitigation efforts on climate change and global warming

Setting Green House Gases Mitigation Goals
Setting Green House Gases Mitigation Goals

Target: limit global mean temperature increase

What is a "safe" amount of climate change? What "limits" should be adopted as goals?

Target: limit atmospheric GHG concentrations

How do limits on global mean temperature change or other key impacts translate into limits on atmospheric GHG concentrations?

Target: limit global GHG emissions

How do atmospheric GHG concentration limits translate into limits on global GHG emissions?

Target: limit (develop-ed or ing country) GHG emissions

What is a reasonable share of (develop-ed or ing) emission reductions relative to the global targets? What is the implied emissions "budget"?

Emission reduction: Stabilisation of emissions

Two possibilities:

- allowing emissions to double **OR**
- keeping emissions at current levels for the next 50 years
- Keeping emissions flat = cutting projected carbon output by about 8 billion tonnes per year by 2060, keeping a total of ~400 bT of carbon from entering the atmosphere

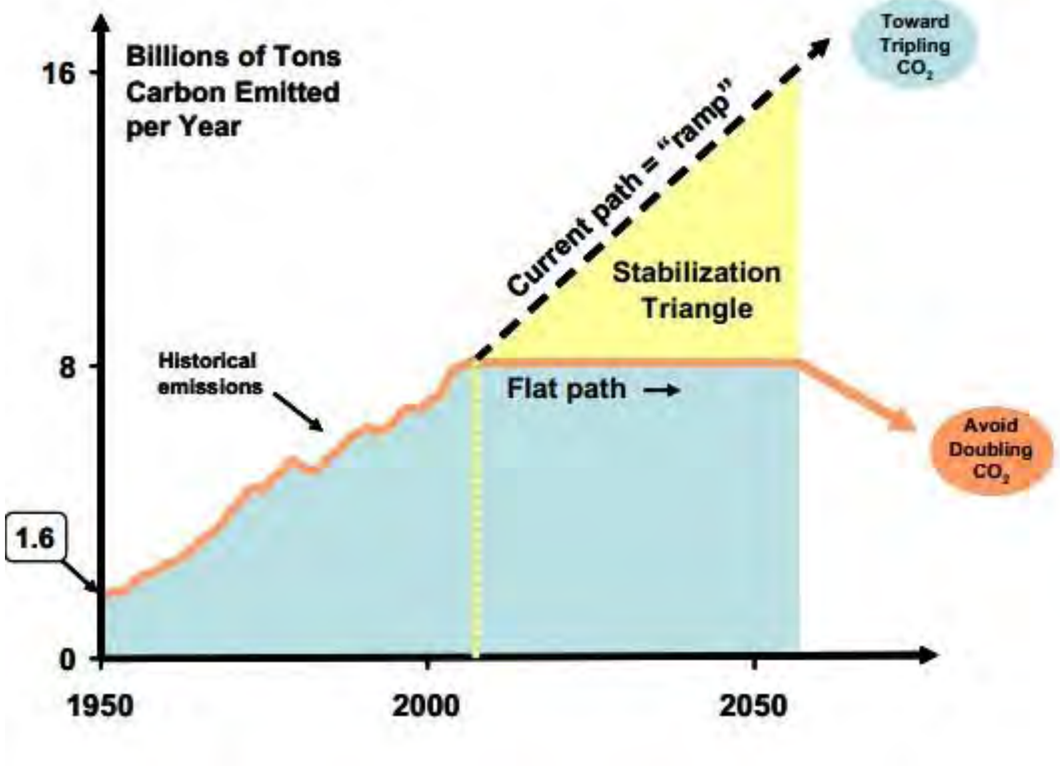


Table 1: Key indicators for 1993, 2011 and 2020

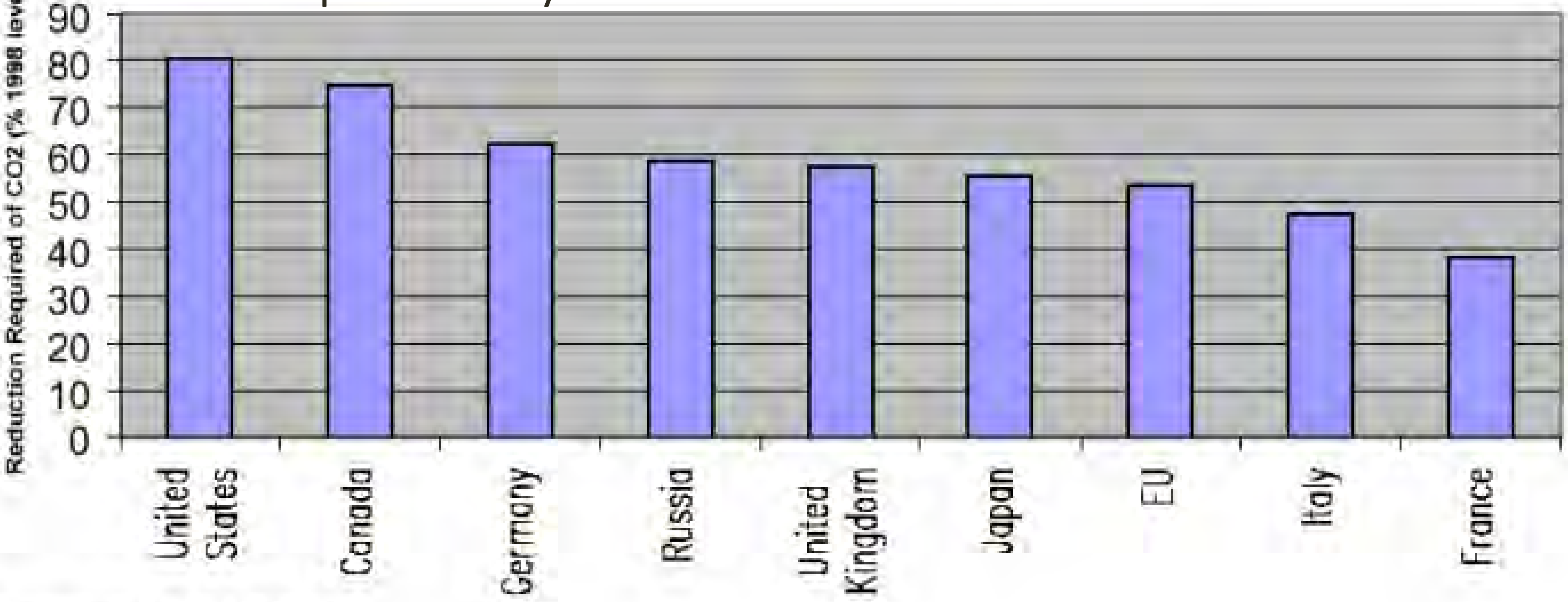
Source: 1993, 2020 figures from Energy for Tomorrow's World (WEC, 1995). 2011 figures from World Energy Resources (WEC, 2013). Other renewables 2020 figure from World Energy Scenarios report (WEC, 2013)

	1993	2011	2020	% Growth 1993–2011
Population, billion	5.5	7	8.1	27%
GDP				
Trillion USD	25	70	65	180%
TPES Mtoe	9 532	14 092	17 208	48%
Coal Mt	4 474	7 520	10 108	68%
Oil Mt	3 179	3 973	4 594	25%
Natural Gas bcm	2 176	3 518	4 049	62%
Nuclear TWh	2 106	2 386	3 761	13%
Hydro Power TWh	2 286	2 767	3 826	21%
Biomass Mtoe	1 036	1 277	1 323	23%
Other renewables* TWh	44	515	1 999	n/a

	1993	2011	2020	% Growth 1993–2011
Electricity Production/year				
Total TWh	12 607	22 202	23 000	76%
Per capita MWh	2	3	3	52%
CO_2 emissions/year				
Total CO_2 Gt	21	30	42	44%
Per capita tonne CO_2	4	4	n/a	11%
Energy intensity koe, 2005 USD	0.24	0.19	n/a	-21%

* Includes figures for all renewables, except Hydro

Annex 1: Developed country



Source: IAG, 2002

Annex I countries such as the United States need to hit a target of 80 percent by 2050.

Carbon dioxide emission by fossilfuels

- 21% - natural gas (heat and electricity)
- 35% - oil (transportation fuels)
- 44% - coal (electricity)

(Source: US Energy Information Administration, 2011)

Ways to Reduce Emissions

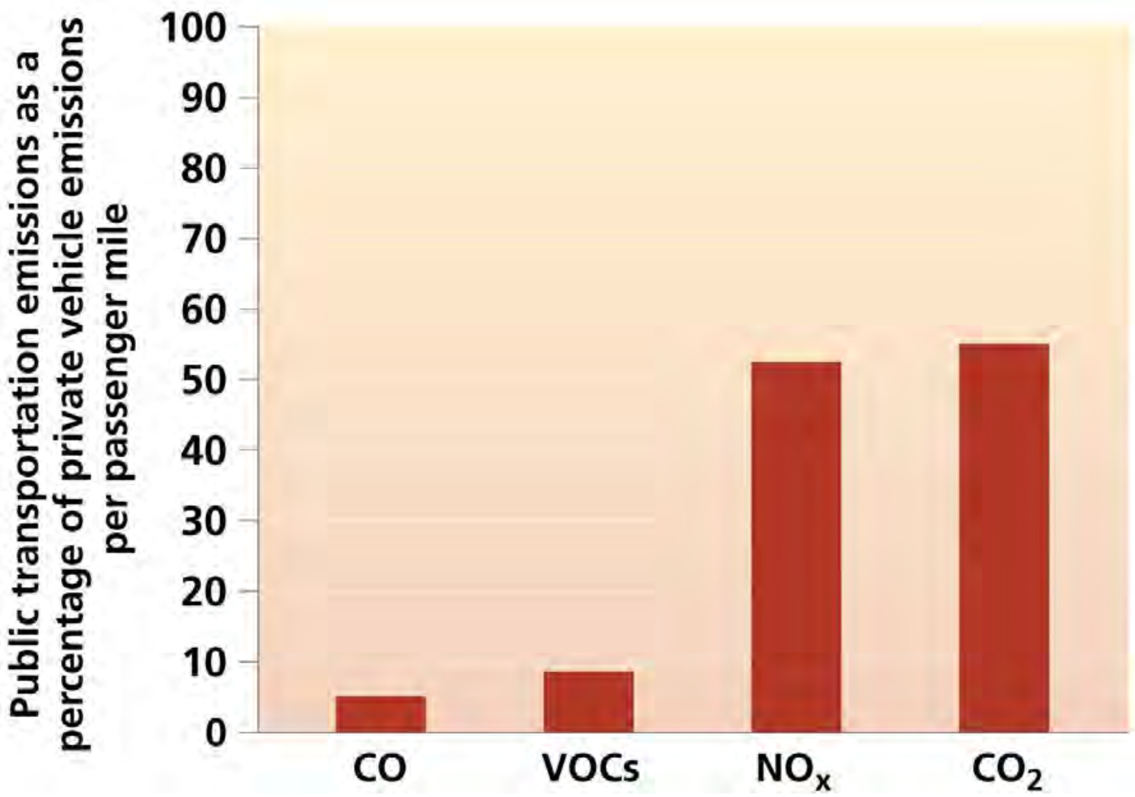
Ways to Reduce Emissions

- INCREASED ENERGY EFFICIENCY
- LOW-CARBON ELECTRICITY
- DECARBONIZED FUELS
- CARBON CAPTURE AND STORAGE

INCREASED ENERGY EFFICIENCY

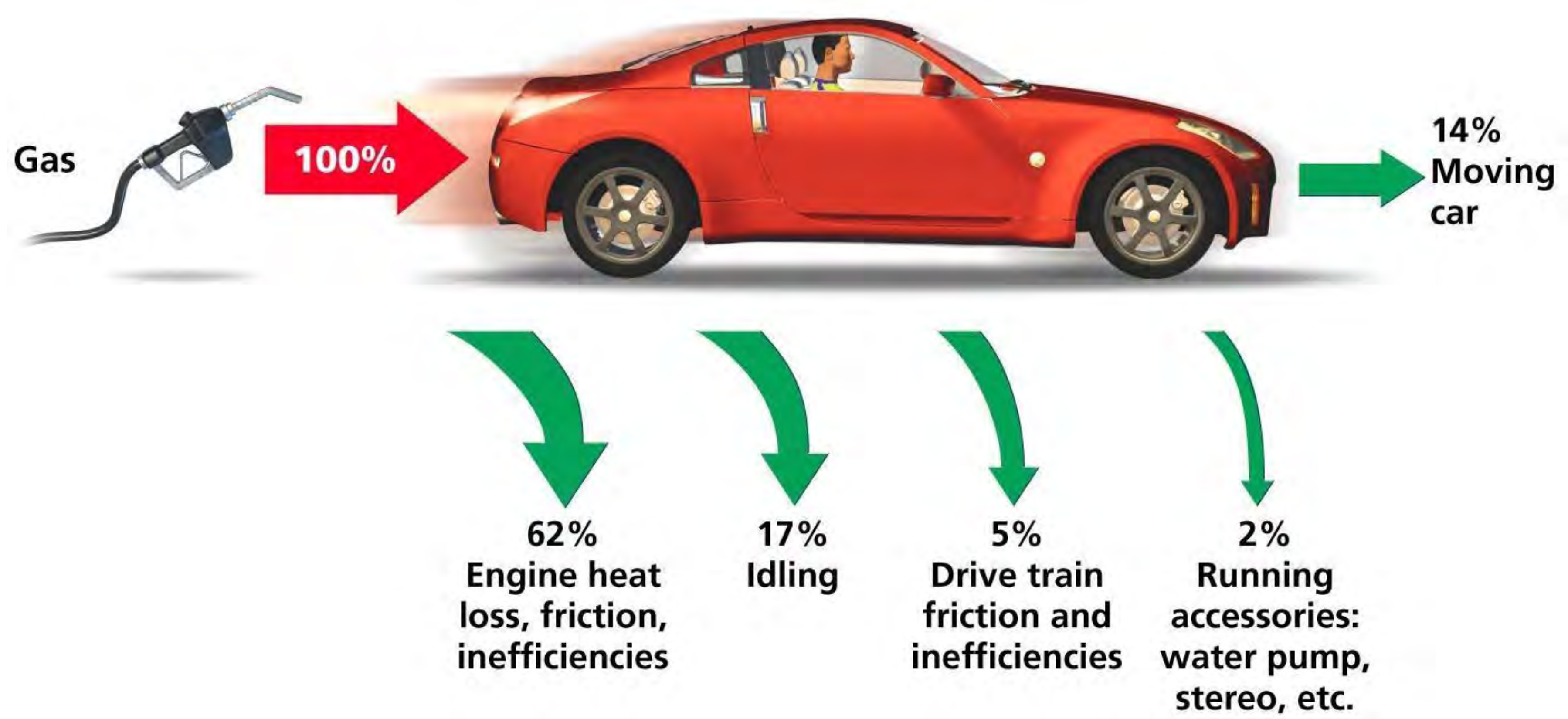
- **Transportation systems**
  - Public transportation
  - More efficient engine - hybrid and diesel
  - Lighter materials
  - **Building design and systems, Industrial processes**
  - The largest potential savings in the buildings sector are in space heating and cooling, water heating, lighting, and electric appliances. The buildings sector as a whole has the technological and economic potential to cut emissions in half.

Emissions reductions: Public transportation



Higher public transportation usage = less privately owned on the road

Emissions reduction: Inefficient autos



Emissions reductions: Biking and walking

LOW-CARBON ELECTRICITY

Renewable energy sources:

- Hydroelectric power
- Geothermal energy
- Photovoltaic cells
- Wind power
- Nuclear

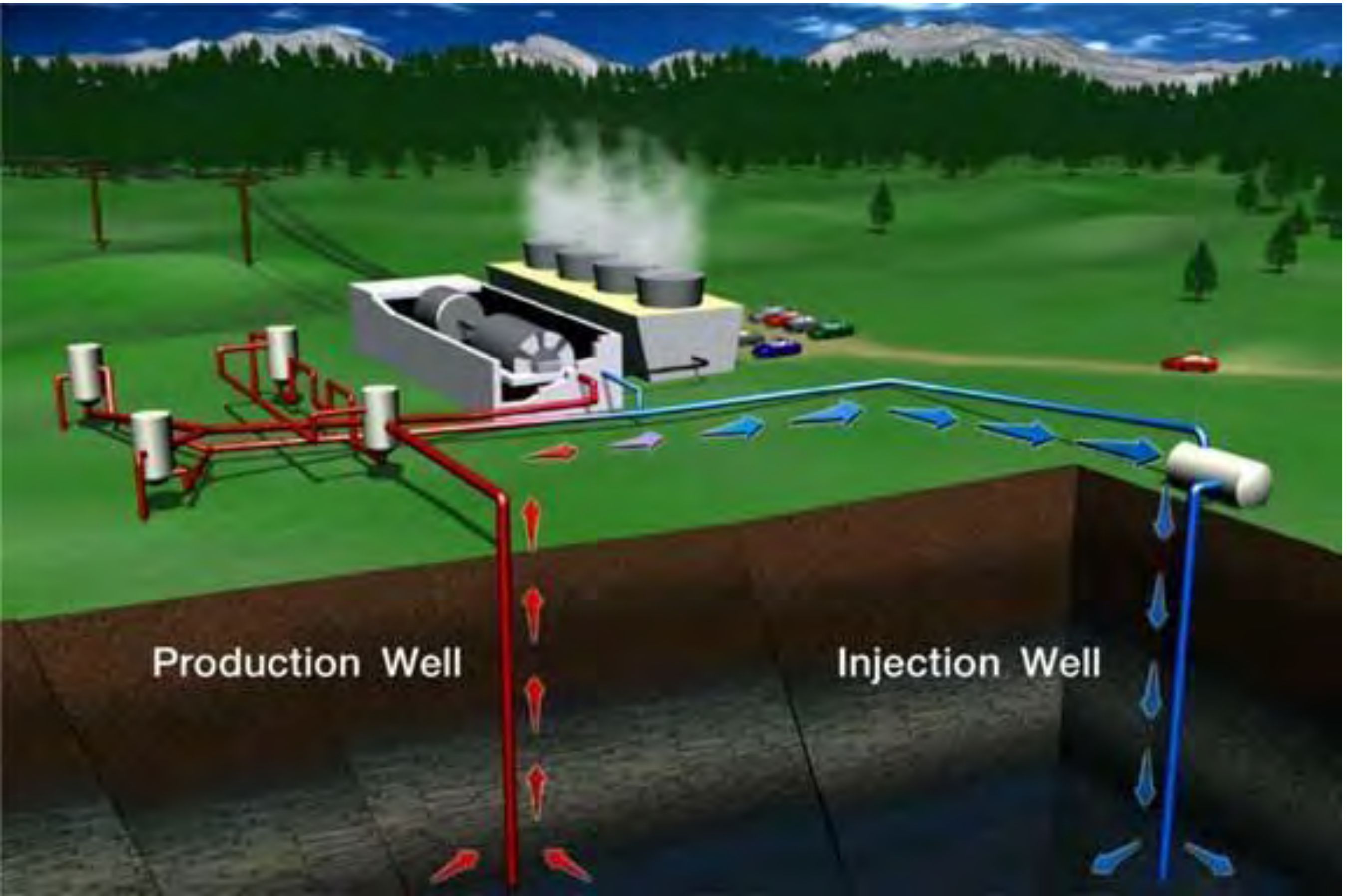
Many Power Plants Use Coal…

TABLE 1. Top 10 coal-producing countries as of 2012[3]

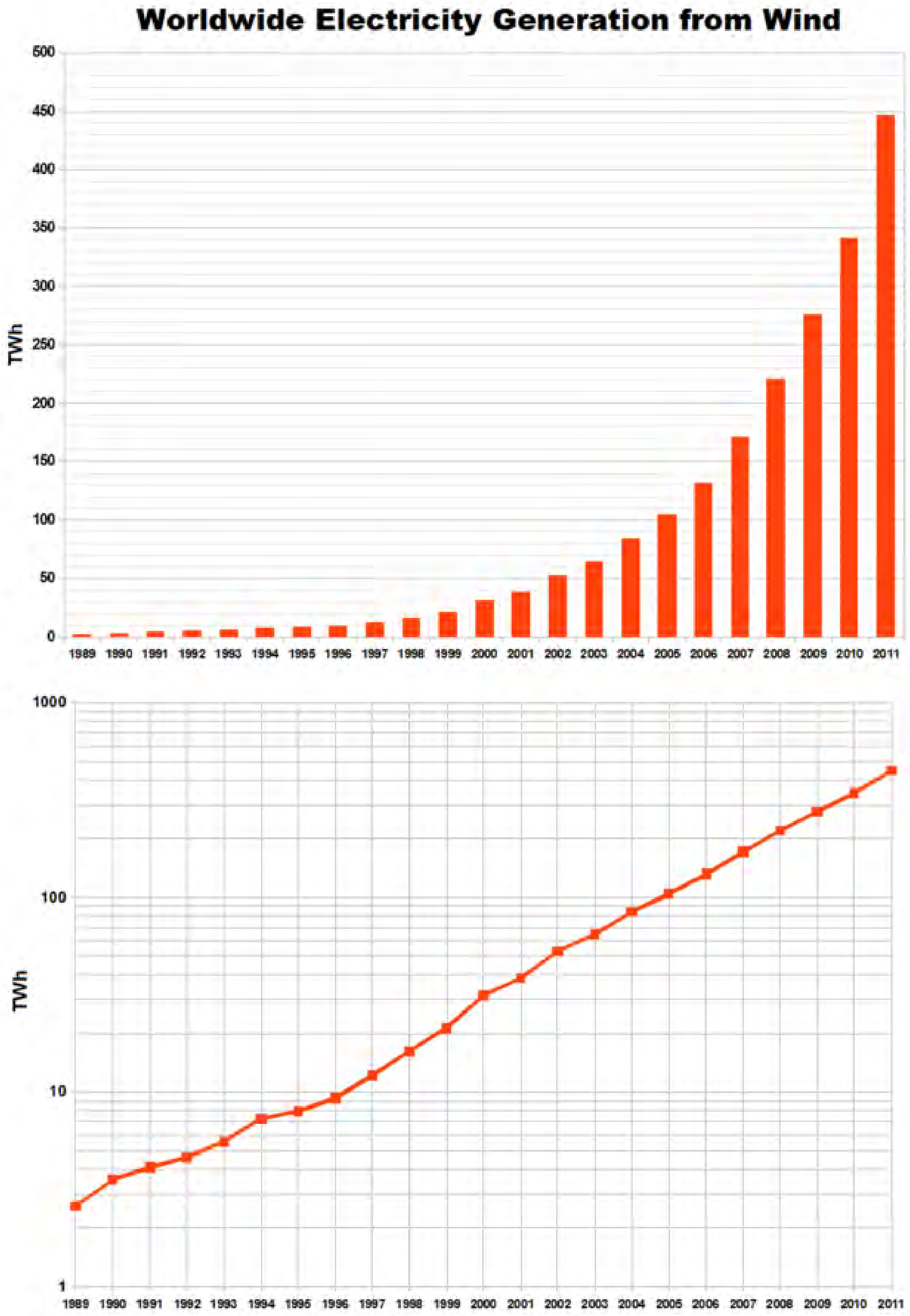
Ranking	Country	Coal Production (Mtoe)
1	China	1825.0
2	U.S.	515.9
3	Australia	241.1
4	Indonesia	237.4
5	India	228.8
6	Russian Federation	168.1
7	South Africa	146.6
8	Kazakhstan	58.8
9	Poland	58.8
10	Colombia	58.0

TABLE 2. Top 10 coal-consuming countries as of 2012[3]

Ranking	Country	Coal Consumption (Mtoe)
1	China	1873.3
2	U.S.	437.8
3	India	298.3
4	Japan	124.4
5	Russian Federation	93.9
6	South Africa	89.8
7	South Korea	81.8
8	Germany	79.2
9	Poland	54.0
10	Australia	49.3


Production Well
Injection Well

Wind farm: group of wind turbines



- Nuclear power = ~ 17% of the world's electricity, and produces no CO_2.

DECARBONIZED FUELS

- **Biofuels:** ethanol based biofuels from plant corn, sugarcane, palm oil; methane from organic waste; waste
- cooking oils

Carbon capture and storage, or **CCS**

Cane ethanol

Brazil rivals the U.S. in ethanol production because sugarcane yields 600 to 800 gallons an acre, twice as much as corn. The stalk is 20 percent sugar—fermented to make the alcohol—and the waste cane can be burned to power the distillery, lowering fossil-fuel use.

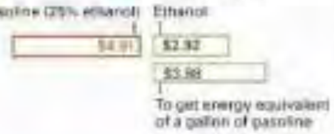
• BRAZIL PRODUCTION

3.96 billion gallons (2005)

BRAZIL PRODUCTION COST

$0.87 per gallon

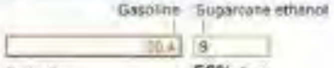
• BRAZIL RETAIL PRICE (per gallon, June 2007)



• ENERGY BALANCE

Fossil-fuel energy used to make the fuel (input) compared with the energy in the fuel (output)

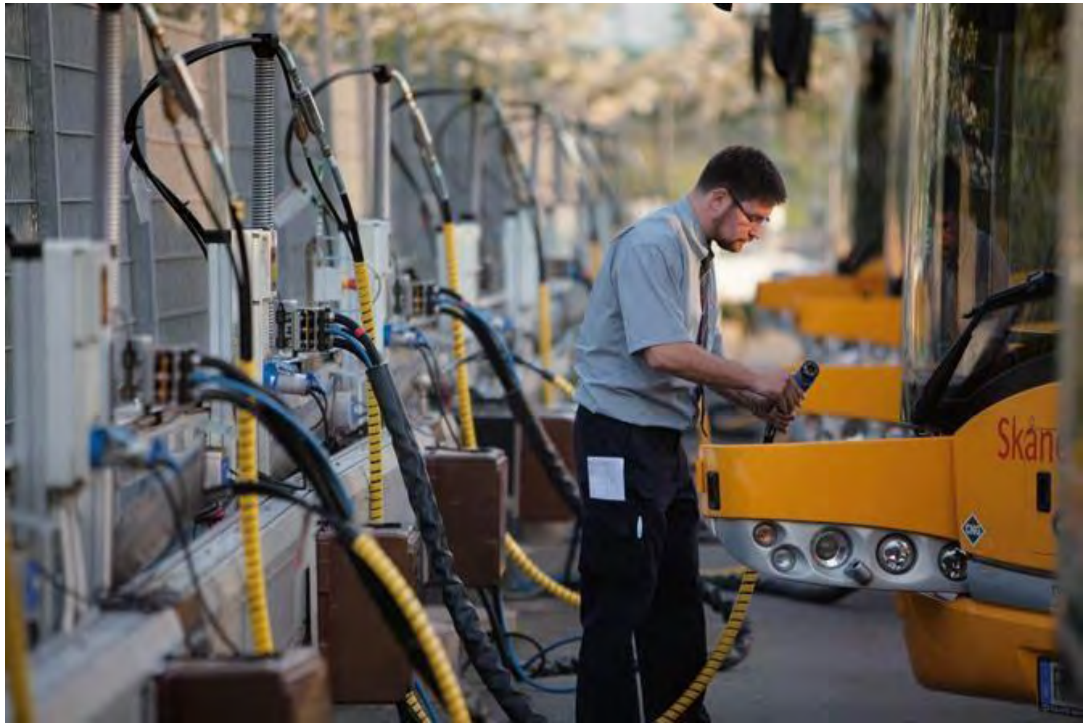
• GREENHOUSE GAS EMISSIONS

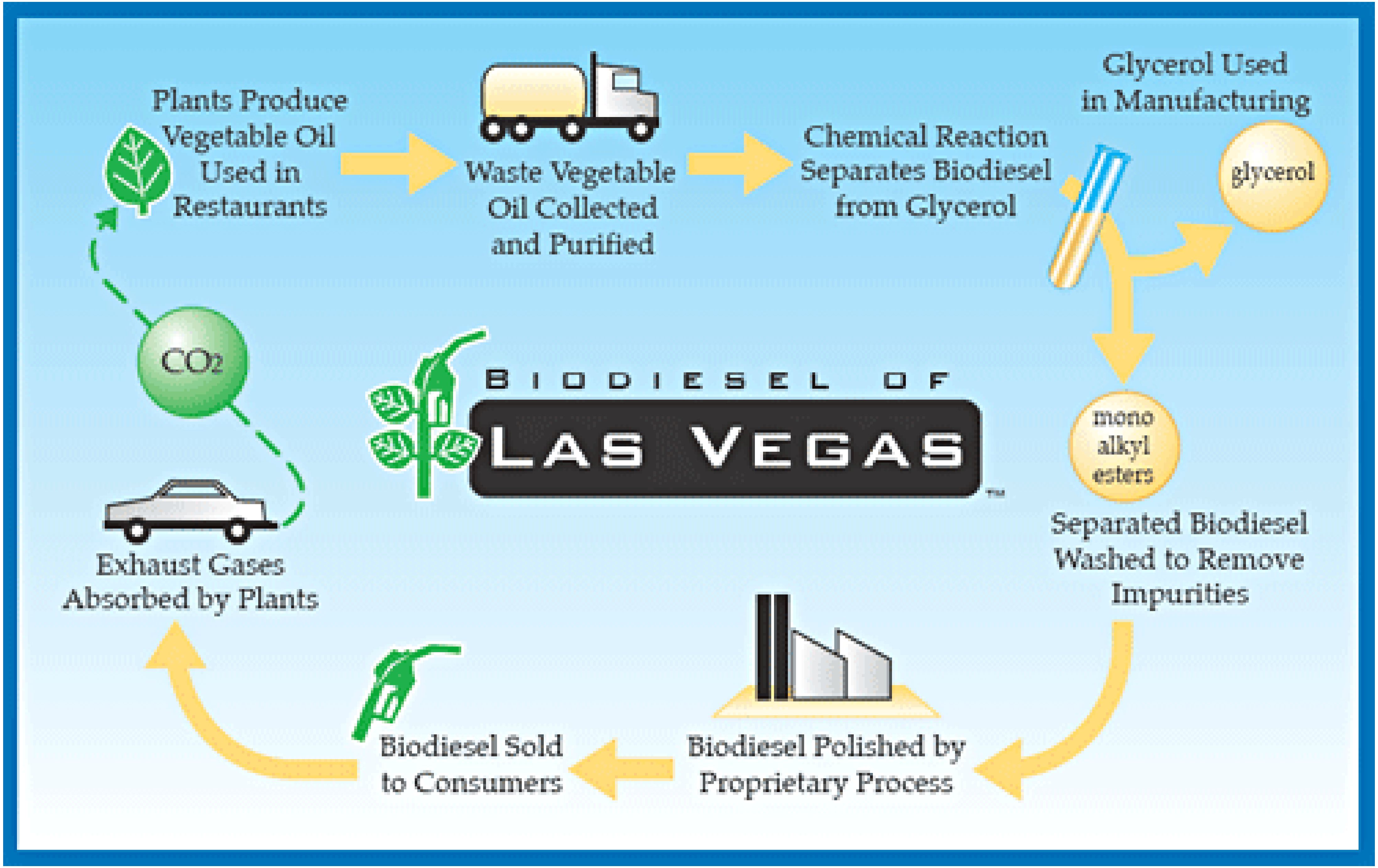


is where those cows come in. They plan to fire their boilers with methane from two giant four-million-gallon biodigesters fed with cattle manure from the feedlot next door—in effect using biogas to make biofuel. The increased efficiency, she says, isn't only good for the environment, it's also good business, especially if the price of corn keeps rising or oil drops below $45 a barrel or so, the lowest price at which ethanol backers say the fuel can compete with gasoline in the U.S. "The last people standing," Wietzki says, "will be highly efficient producers like us."

It's easy to lose faith in biofuels if corn ethanol is all you know. A more encouraging picture unfolds some 5,500 miles southeast of Mead, where the millions of drivers of São Paulo, Brazil, spend hours a day jammed to a standstill in eight lanes of traffic, their engines, if not their tempers, idling happily on *álcool* from Brazil's sprawling sugar belt. The country had been burning some ethanol in its vehicles since the 1920s, but by the 1970s it was importing 75 percent of its oil. When the OPEC oil embargo crippled the nation's economy, Brazil's dictator at the time Gen. Ernesto Geisel—decided to kick the country's oil habit. The general heavily subsidized and financed new ethanol plants, directed the state-owned oil company, Petrobras, to install ethanol tanks and pumps around the country, and offered tax incentives to Brazilian carmakers to crank out cars designed to burn straight ethanol. By the mid-1980s, nearly all the cars sold in Brazil ran exclusively on álcool.

Formula One–loving Brazilian drivers embraced the cars, especially since pure ethanol has an octane rating of around 113. It burns best at much higher compression than gasoline, allowing alcohol engines to crank out more power. Best of all, the government subsidies made it significantly cheaper. Not that ethanol didn't hit a few bumps in the road. By the early 1990s, low oil prices led the government to phase out the subsidies, and high sugar prices left the sugar mills, or *usinas*, with no incentive to produce the fuel. Millions of alcohol car drivers like




Plants Produce Vegetable Oil Used in Restaurants
Waste Vegetable Oil Collected and Purified
Chemical Reaction Separates Biodiesel from Glycerol
Glycerol Used in Manufacturing
glycerol
mono alkyl esters
Separated Biodiesel Washed to Remove Impurities
Biodiesel Polished by Proprietary Process
Biodiesel Sold to Consumers
Exhaust Gases Absorbed by Plants
CO_2
BIODIESEL OF LAS VEGAS™

DECARBONIZED FUELS

Synthetic fuels: liquid fuel, or sometimes gaseous fuel, obtained from syngas, a mixture of carbon monoxide and hydrogen, derived from gasification of solid feedstocks such as coal or biomass or by reforming of natural gas

Maverick Oasis converts methane-rich feedstock into high-quality methanol for the production of synthetic chemicals and fuels.

MAVERICK SYNFUELS

Methane-to-Methanol Conversion Process

Methanol synthesis is a well-known commercially proven process. For the first time, Maverick brings that proven technology to smaller gas applications in an efficient, compact and mobile configuration.

1. Maverick's proprietary conversion process starts with methane gas. This methane gas can come from a variety of sources including biogas from anaerobic digesters or natural gas from oil and gas wells.

2. The first step in Maverick's process removes sulfur and/or other impurities from the gas source in order to protect the performance of the downstream catalysts.

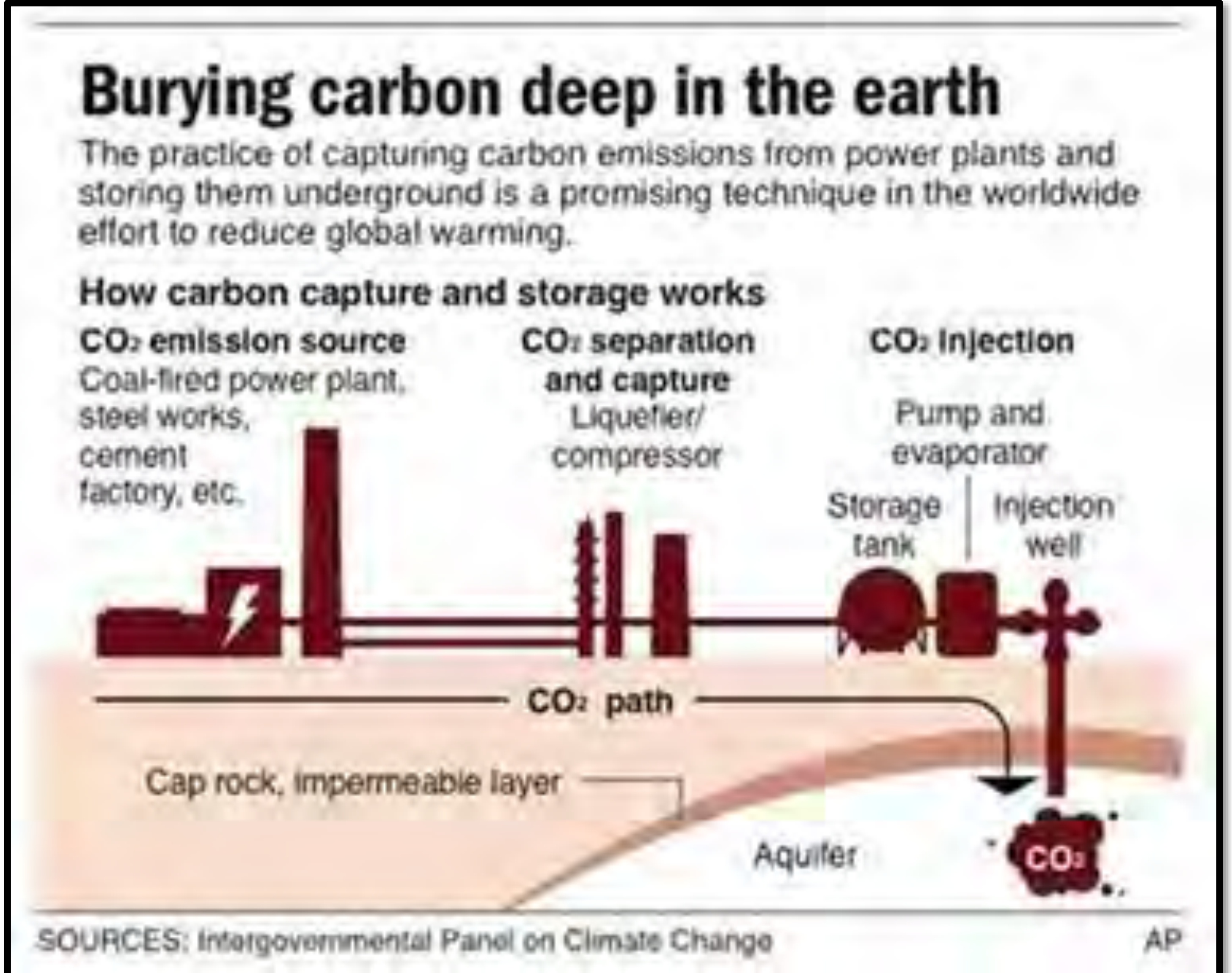
3. After sulfur removal, if there is a high concentration of carbon dioxide in the methane gas, it can be removed and adjusted to yield an ideal gas composition for methanol synthesis.

4. The methane is reacted with steam over a catalyst to produce a synthesis gas composed primarily of hydrogen and carbon monoxide. This syngas will serve as the 'building blocks' for Maverick's methanol production.

5. After a gas compression step, the adjusted syngas is fed to Maverick's methanol generation block where it is converted into 'crude' methanol.

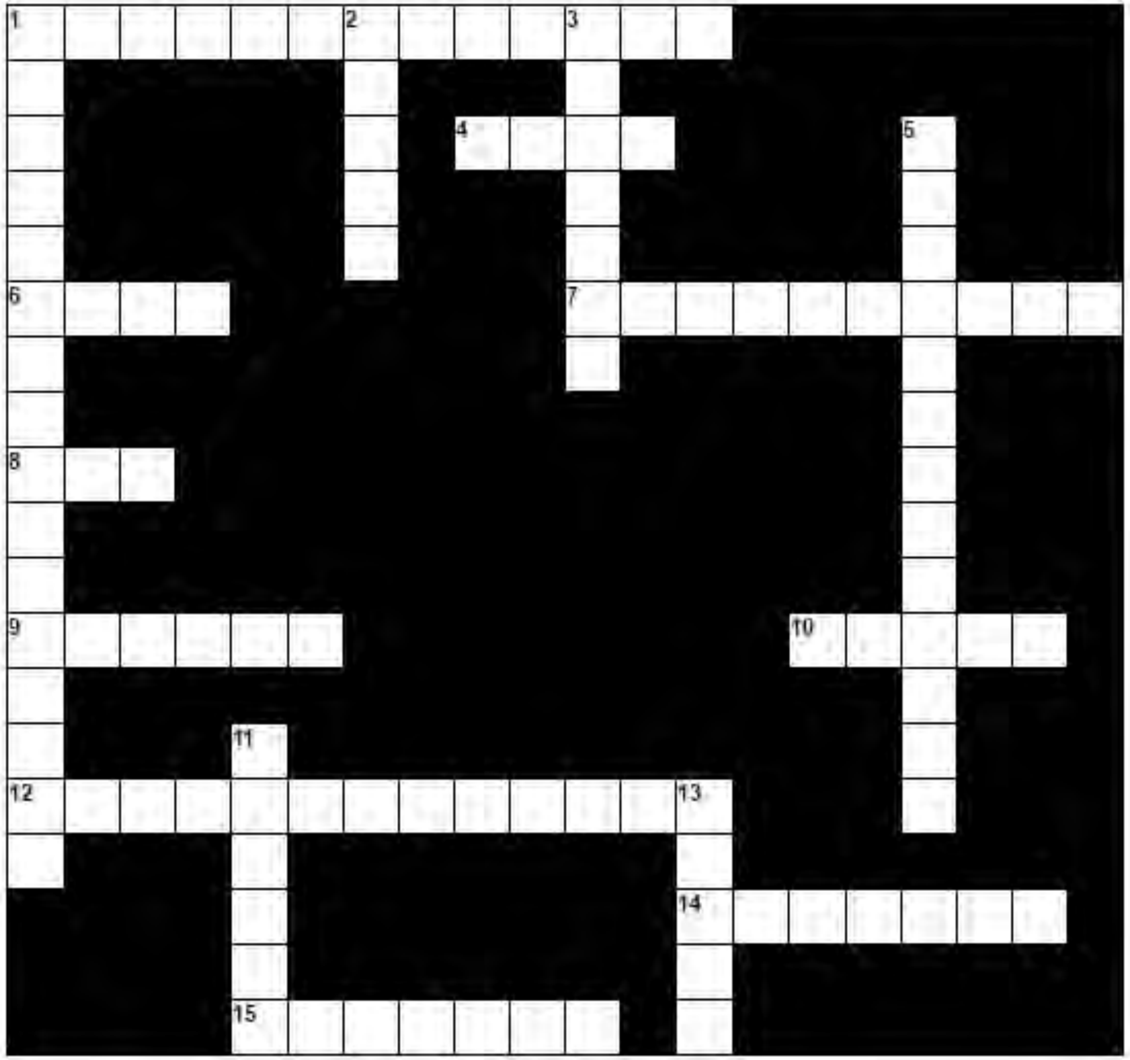
6. This 'crude' methanol is purified, mostly for water removal, through two distillation steps until it meets industry standards for AA grade quality – a minimum of 99.85% purity.

Carbon Capture and Storage



Thank you

-End-



ACROSS

1.______ ________ is the increase in the average temperature of Earth.
4. Plant a _____.
6. ____ from the sun is part of what is causing global warming.
7. ______ are animals native to the Arctic circle that could become extinct if global warming continues.
8. The ___ helps provide heat and light.
9. ____ fuels.
10. The _____ Layer has holes in it due to global warming.
12. ______ _______ is another name individuals use to describe global warming.
14. You can ______ a plastic bottle.
15. ______ gases such as (fossil fuels) can also help cause global warming.

DOWN

1. The ______ ______is the rise in temperature that the Earth experiences because certain gases in the atmosphere trap energy from the sun.
2. _____ vapor is a leading natural cause of global warming.
3. ___ _____ in the Arctic Circle are melting because of global warming.
5. Most major ________ nationals agree that global warming is a problem.
11. ______ dioxide is what we breathe out.
13. Planet ______ is heating up because of global warming.

Co-funded by the Erasmus+ Programme of the European Union

—MMS3003 —

ENVIRONMENT – ISSUE AND GLOBAL PERSPECTIVE

CHAPTER 7

Concept of Sustainable Development

Politics, Socioeconomics, Environment & Sustainable Development

These lecture material are for the **Marine Coastal and Delta Sustainability for Southeast Asia (MARE)**(Project No 610327-EPP-1-2019-1-DE-EPPKA2-CBHE-JP)
This project has been funded with support from the **European Commission**. This publication **reflects the views only of the authors**, and the Commission cannot be made responsible for any use which may be made from the information contained herein.

(World Commission on Environment and Development)
The Brundtland Commission's report defined sustainable development as "development which meets the needs of current generations without compromising the ability of future generations to meet their own needs".

- **The Brundtland Commission**, named after Norway's former prime minister, Gro Harlem Brundtland, who chaired it, found an eager audience for its proposals at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992.

- The documents approved at the Conference, notably the comprehensive Agenda 21, included ambitious commitments by world leaders to ensure sustainable development in many areas and on all levels of society.

- **The Rio Conference** gave a boost to both national and local action. National committees for sustainable development were established on a high political level in many countries.

- **Local Agenda 21** (the strategy and action programme for implementing sustainable development at a **local** level) documents and action plans were drawn up in a great number of municipalities. The newly established United Nations Commission for Sustainable Development started to scrutinize the implementation of the Rio decisions at its annual meetings.

- Local Agenda 21 *http://www.gdrc.org/uem/la21/la21.html*

Urban Environmental Management

Local Agenda 21

Local Agenda 21 is a local-government-led, community-wide, and participatory effort to establish a comprehensive action strategy for environmental protection, economic prosperity and community well-being in the local jurisdiction or area. This requires the integration of planning and action across economic, social and environmental spheres. Key elements are full community participation, assessment of current conditions, target setting for achieving specific goals, monitoring and reporting.

Local Agenda 21 Action21

UEMRI Research Output	
	• Localizing Agenda 21

Documents and Information Repositories on the Local Agenda 21

- Agenda 21, Chapter 28: LOCAL AUTHORITIES' INITIATIVES IN SUPPORT OF AGENDA 21
- Fact Sheet: Local Agenda 21 in Australia

Local Agenda 21: Programmes and Initiatives

- ICLEI: Local Agenda 21 Initiative
- Japan: Local authorities' initiatives in support of Agenda 21
- Localising Agenda 21: Action Planning for Sustainable Urban Development

- The concept supports strong economic and social development, in particular for people with a low standard of living. At the same time it underlines the importance of protecting the natural resource base and the environment.

- Economic and social well-being cannot be improved with measures that destroy the environment.

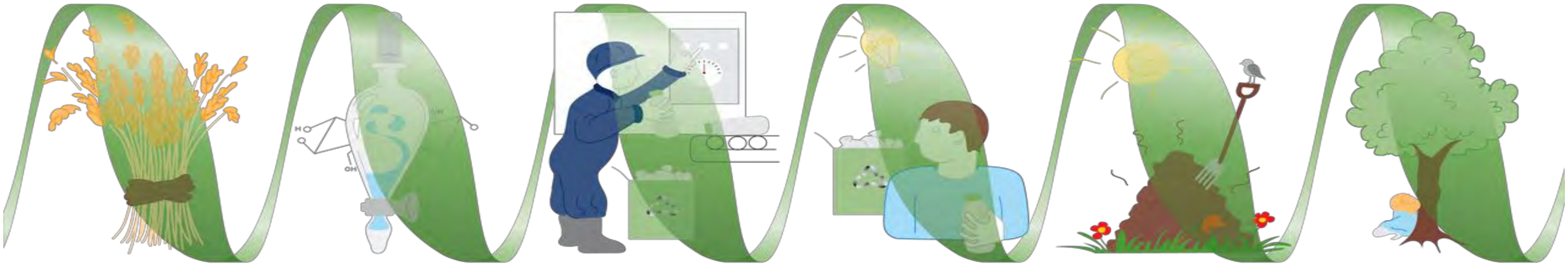
- Intergenerational solidarity is also crucial: all development has to take into account its impact on the opportunities for future generations.

- The preparations for the **2002 Johannesburg Summit** on Sustainable Development showed that the enthusiasm of Rio had started to wane, but high-level political support for the process persisted.

- Johannesburg also highlighted the implementation of commitments rather than spending time on drafting new declarations. In this context the United Nations regional commissions were given stronger recognition than before. It was felt that better implementation demanded a devolution of the global process.

The Principles of Sustainable Development

The Helix of Sustainability



Plants grow, making sugars, starches, oils, cellulose and other complex molecules from simple raw materials, mostly water, CO_2 and sunshine.

In addition to harvesting food, people extract fuel
and base materials for industry and commerce.

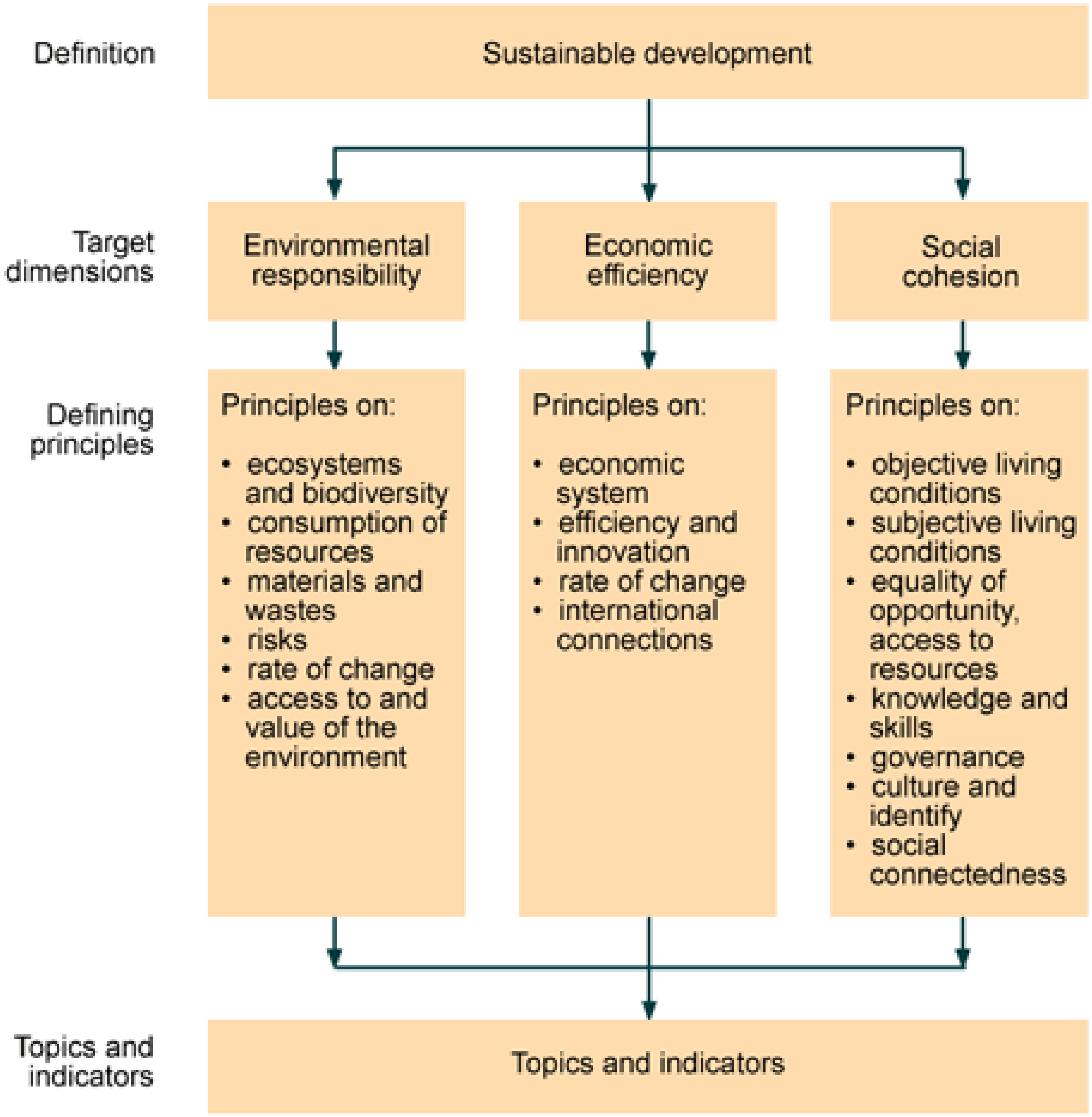
Manufacturers make wares, measuring profitibility in environmental and social terms as well as financial.

The end-user reuses and repairs, only recycling after as long a useful life as possible.

At the end of its life the article decays, reducing large complex molecules to simple raw materials by the action of bacteria and fungi
- composting

Plants grow, making sugars, starches, oils, cellulose and other complex molecules from simple raw materials, mostly water, CO_2 and sunshine.

Source: The New Zealand Institute for Crop and Food Research



**Example:
Statistics New Zealand's framework for measuring sustainable development**

Available online at www.sciencedirect.com

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Procedia - Social and Behavioral Sciences 120 (2014) 299 – 307

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Social and Behavioral Sciences

The 3rd International Geography Symposium - GEOMED2013

Malaysia's efforts toward achieving a sustainable development: Issues, challenges and prospects

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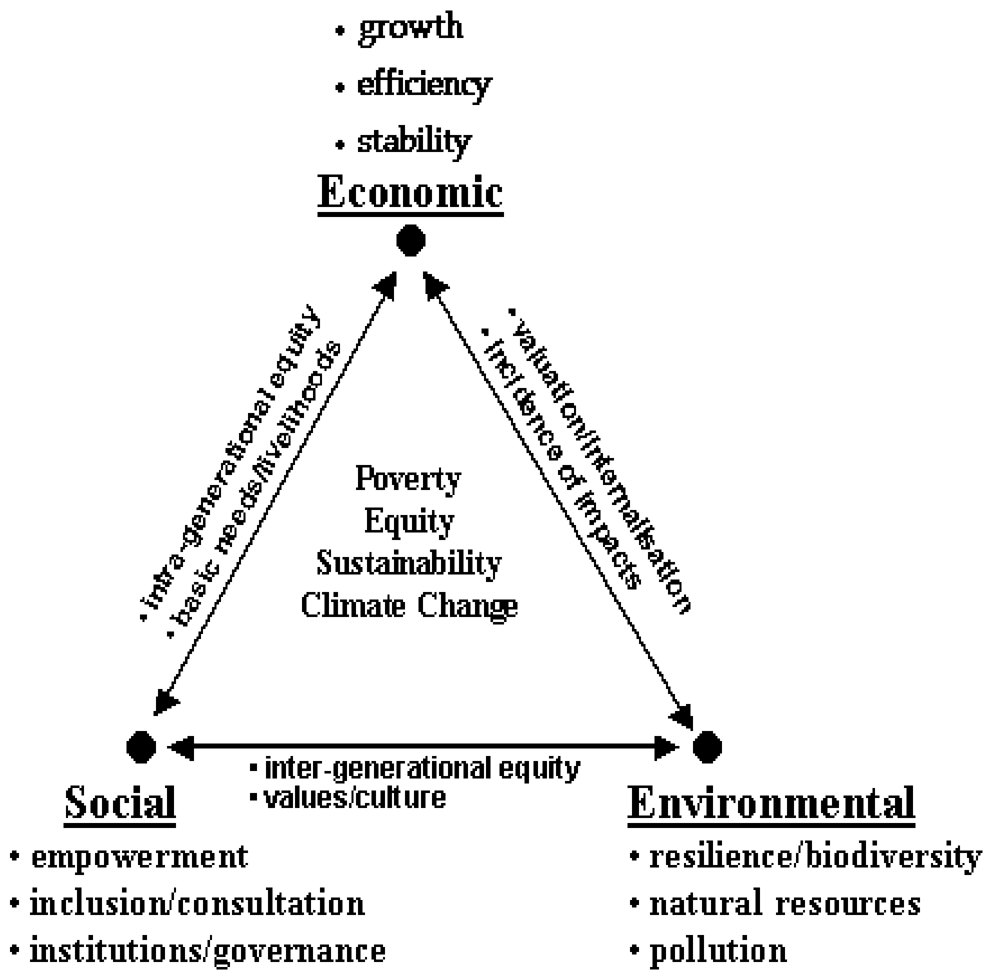
Abstract

Malaysia is classified as a middle-income country. In recent years, Malaysia has been transformed from an agro-based economy to a manufacturing economy. Malaysia is the fastest growing economies amongst ASEAN countries. This rapid growth rate is attributed mainly in the ability to exploit the very environmental resource base available for the country. The early European Colonialists who came over to Malaysia driven to vigorously exploit the country rich environmental resource base and the exploitation trend continues after the country independence till today. Government programs to develop and promote investment in the key sectors of agriculture, manufacturing, and services will need to be dealt with in a holistic manner. Environmental resources exploitation are important generators of economic growth but since the colonial periods environmental resources exploitation also have led to a steady increase in environmental degradation. Environmental degradation issues are becoming more intense and frequent in the last half decade or so not only in Malaysia but for the Southeast Asia Region as a whole. Environmental degradation would impact on the country societal wellbeing and quality of life. The last half decade also witnesses the emerging importance of trans boundary issues which further impact the well-being and quality of life in Malaysia. This paper discusses the attempts by Malaysia to address the environmental degradation within the whole fabric of sustainable development at both the National and International levels. The discussion is examining the issues, challenges and prospects of environmental management strategies, formulation of national policies and responsible ministries including implementation agencies, constraint factors and the role of the country in addressing environmental degradation at the Regional and Global scales. The discussion is based on frequency analysis of secondary information derived from literature search, government publications and information appraised from the internet.

Selection and peer-review under responsibility of the Organizing Committee of GEOMED2013.


Create Value
PROFIT
Eliminate Waste
Recognize Interdependence
SUSTAINABLE DEVELOPMENT MATRIX
Energy Flows
Share Knowledge
PLANET
PEOPLE
Model Nature
Humans & Nature Co-exist
Accept Responsibility
Quality of Life


• growth
• efficiency
• stability
Economic
• intra-generational equity
• basic needs/livelihoods
• valuation/internalisation
• incidence of impacts
Poverty
Equity
Sustainability
Climate Change
• inter-generational equity
• values/culture
Social
• empowerment
• inclusion/consultation
• institutions/governance
Environmental
• resilience/biodiversity
• natural resources
• pollution

UNITED NATIONS ENVIRONMENT PROGRAMME

Programme des Nations Unies pour l'environnement   Programa de las Naciones Unidas para el Medio Ambiente

Программа Организации Объединенных Наций по окружающей среде   برنامج الأمم المتحدة للبيئة

联合国环境规划署

UNEP

UNITED NATIONS ENVIRONMENT PROGRAMME

UNEP Environmental, Social and Economic Sustainability Framework

January 2015

Approved by UNEP Executive Director
Achim Steiner

Date: 31/12/14

http://www.unep.org/about/eses/Portals/50272/Documents/UNEP_Environmental_Social_and_Economic_Sustainability_Framework.pdf

SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD

HOME | ABOUT | SECRETARY-GENERAL | GOALS | TAKE ACTION | KEY DATES | MEDIA | WATCH AND LISTEN

Launch of new sustainable development ag to guide actions for next 15 years

1-6

- POVERTY
- HUNGER AND FOOD SECURITY
- HEALTH
- EDUCATION
- GENDER EQUALITY AND WOMEN'S EMPOWERMENT
- WATER AND SANITATION

7-12

- ENERGY
- ECONOMIC GROWTH
- INFRASTRUCTURE, INDUSTRIALIZATION
- INEQUALITY
- CITIES
- SUSTAINABLE CONSUMPTION AND PRODUCTION

13-17

- CLIMATE CHANGE
- OCEANS
- BIODIVERSITY, FORESTS, DESERTIFICATION
- PEACE AND JUSTICE
- PARTNERSHIPS

National Policy

National Policy on the Environment (DASN) has been established for continuous economic, social and cultural progress and enhancement of the quality of life of Malaysians through environmentally sound and sustainable development.

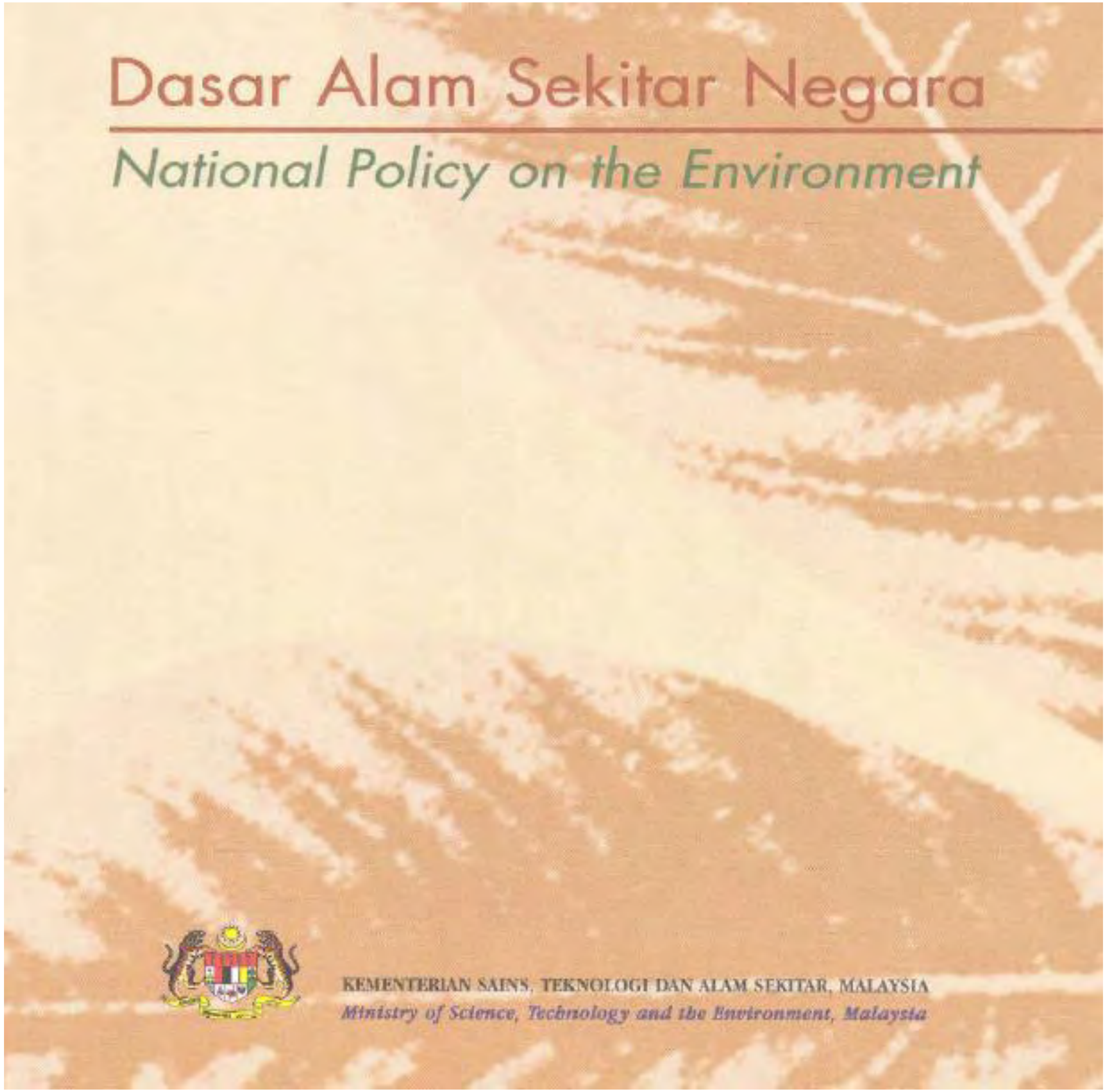
The objectives of DASN are to achieve;

(1) A clean environment, safe, healthy and productive environment for present and future generations,
(2) Conservation of country's unique and diverse cultural and natural heritage with effective participation by all sectors of society, and
(3) Sustainable lifestyles and patterns of consumption and production.

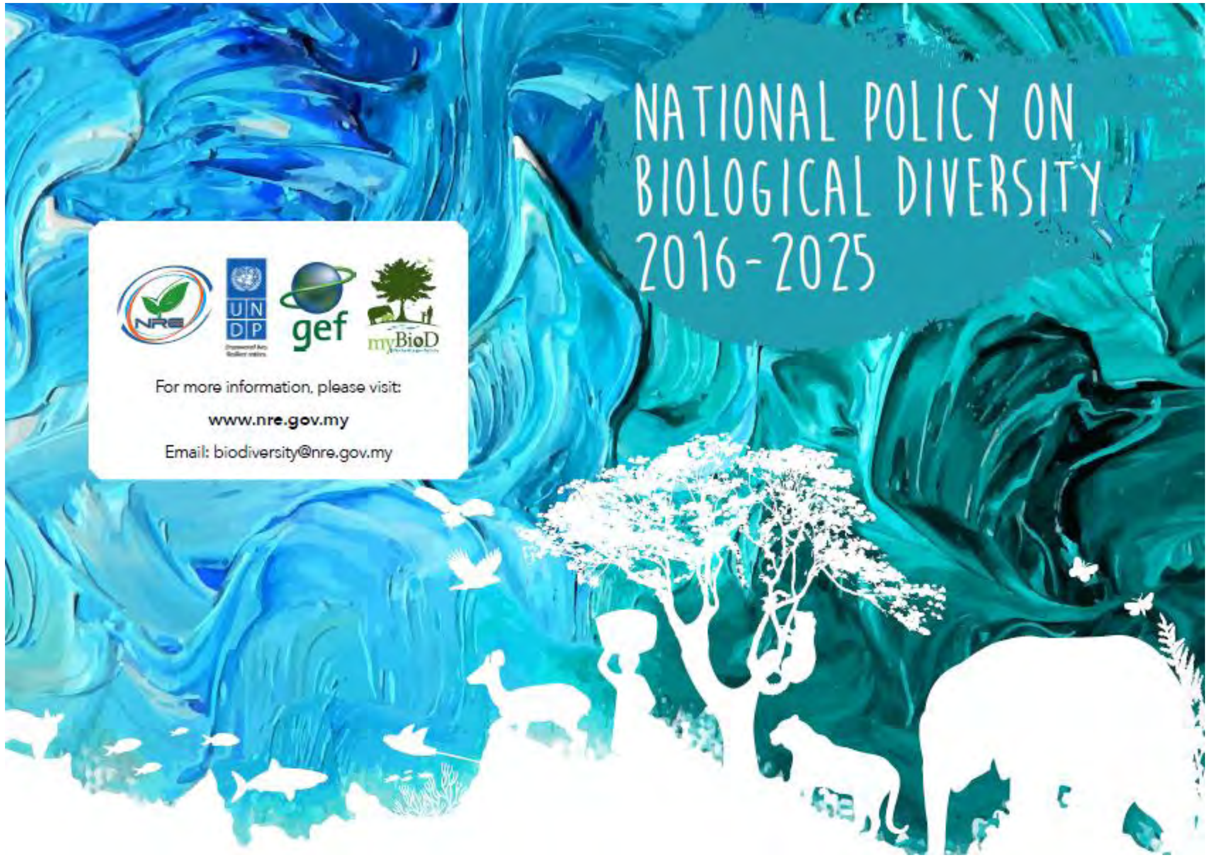
There are eight (8) principles listed under DASN to harmonise economic development goals with environmental imperatives:

1. Stewardship of the Environment
2. Conservation of Nature’s Vitality and Diversity
3. Continuous Improvement in the Quality of the Environment
4. Sustainable Use of Natural Resources
5. Integrated Decision-Making
6. Role of the Private Sector
7. Commitment and Accountability
8. Active Participation in the International Community

DASN seeks to integrate environmental considerations into development activities and in all related decision-making processes, to foster long-term economic growth and human development, and to protect and enhance the environment. It complements and enhances the environmental dimensions of other national policies, such as those on forestry and industry, and takes cognizance of international conventions on global concerns.



https://www.doe.gov.my/portalv1/en/tentang-jas/pengenalan/dasar-alam-sekitar



QUICK FACTS

This Policy is a revised version of the National Policy on Biological Diversity 1998.

- The Policy revision was conducted from 2014 to 2015.
- The purpose of revision is to meet the current biodiversity management needs as well as to fulfil Malaysia's obligation under the United Nations Convention on Biological Diversity (CBD).
- A total of 29 comprehensive stakeholder consultations were carried out in the process.
- The Policy is expected to be finalised by the end of December 2015.

POLICY STATEMENT:

Malaysia is committed to conserve its biological diversity, promote its sustainable use and ensure fair and equitable sharing of the benefits arising out of the utilisation of biological resources.

NEW ELEMENTS OF NPBD 2016-2025:

- Has clear implementation period of 10 years from 2016 to 2025;
- Specifies 17 national biodiversity targets to be implemented by all segments of stakeholder and society; and
- Identifies implementing agencies and key partners to take actions as regards to implementing the action plans to meet the 17 national biodiversity targets.

PRINCIPLES:

NPBD 2016-2025 outlines 5 key principles on biodiversity management:

P1: Heritage. Biological diversity is a national heritage. It must be sustainably managed, wisely utilised and conserved for future generations.

P2: Precautionary. The lack of full scientific certainty should not be used as a reason to postpone measures to minimise threats of significant loss of biodiversity.

P3: Shared responsibility. The conservation and sustainable utilisation of biodiversity are the shared responsibility of all sectors of society.

P4: Participatory. Planning and management of biodiversity must be carried out in a participatory manner.

P5: Good governance. Good governance, including accountability and transparency, is crucial to biodiversity conservation.

NATIONAL BIODIVERSITY GOALS AND TARGETS:

The 5 overarching goals on biodiversity and their corresponding targets are:

GOAL 1: We have empowered and harnessed the commitment of all stakeholders to conserve biodiversity.

Target 1: By 2025 more Malaysians are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Target 2: By 2025, the contributions of indigenous peoples and local communities, civil society and the private sector to the conservation and sustainable utilisation of biodiversity have increased significantly.

GOAL 2: We have significantly reduced direct and indirect pressures on biodiversity.

Target 3: By 2025, biodiversity conservation has been mainstreamed into national development planning and sectoral policies and plans.

Target 4: By 2025, our production forests, agriculture production and fisheries are managed and harvested sustainably.

Target 5: By 2025, tourism is sustainably managed and promotes biodiversity conservation.

GOAL 3: We have safeguarded all our key ecosystems, species and genetic diversity.

Target 6: By 2025, at least 20% of terrestrial areas and inland waters, and 10% of coastal and marine areas, are conserved through a representative system of protected areas and other effective area-based conservation measures.

Target 7: By 2025, vulnerable ecosystems and habitats, particularly limestone hills, wetlands, coral reefs and seagrass beds, are adequately protected and restored.

Target 8: By 25, important terrestrial and marine ecological corridors have been identified, restored and protected.

Target 9: By 2025, the extinction of known threatened species has been prevented and their conservation status has been improved and sustained.

Target 10: By 2025, poaching, illegal harvesting and illegal trade of wildlife, fish and plants are under control and significantly reduced.

Target 11: By 2025, invasive alien species and pathways are identified, priority species controlled and measures are in place to prevent their introduction and establishment.

Target 12: By 2025, a comprehensive biosafety system inclusive of a liability and redress regime is operational to manage potential adverse impacts of modern biotechnology on the conservation and sustainable use of biodiversity and human health.

Target 13: By 2025, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives is adequately conserved.

GOAL 4: We have ensured that the benefits from the utilisation of biodiversity are accrued equitably to all.

Target 14: By 2025, Malaysia has an operational ABS framework that is consistent with the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their utilisation.

GOAL 5: We have improved the capacity, knowledge and skills of all stakeholders to conserve biodiversity.

Target 15: By 2025, capacity for the implementation of the national and subnational biodiversity strategies, the CBD and other related Multilateral Environmental Agreements (MEAs) has significantly increased.

Target 16: By 2025, knowledge and the science base relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are significantly improved and applied.

Target 17: By 2025, there is a significant increase in funds and resources mobilised for the conservation of biodiversity from both government and non-government sources.

National Policy on Climate Change?

Please search and read about this policy

—MMS3003 —

ENVIRONMENT – ISSUE AND GLOBAL PERSPECTIVE

CHAPTER 8

PERSPECTIVE GLOBAL ENVIRONMENT & ETHICAL ENVIRONMENT

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Resourcism is a kind of modern religion which casts all of creation categories of utility. By treating everything as homogeneous matter in search of a use it devalues all. Yes its most dangerous aspects is its apparent good intention. By describing something as a resource we seen to have cause to protect it. But all we really have is a license to exploit it.

Neil Evernden, The Natural Alien, 1985

… human pressure risks causing widespread, abrupt and possibly irreversible changes to basic earth-system processes. Water shortages, extreme weather, deteriorating conditions for food production, ecosystem loss, ocean acidification and sea-level rise are real dangers that could threaten development and trigger humanitarian crises across the globe.

See Griggs, D. J., M. Stafford-Smith, O. Gaffney, J. Rockstrom, M. Ohman, P. Shyamsundar, W. Steffen, G. Glaser, N. Kanie and I. Noble, 'Sustainable Development Goals for People and Planet', *Nature*, vol. 495, 2013, pp. 305–9, at p. 306.

ENVIRONMENTAL CHANGE

Sudden and dramatic natural changes to the environment have occurred in the distant past,but only relatively recently has one species had the potential to upset the whole balance of the Earth's ecosystem

The global population has risen dramatically during the last century

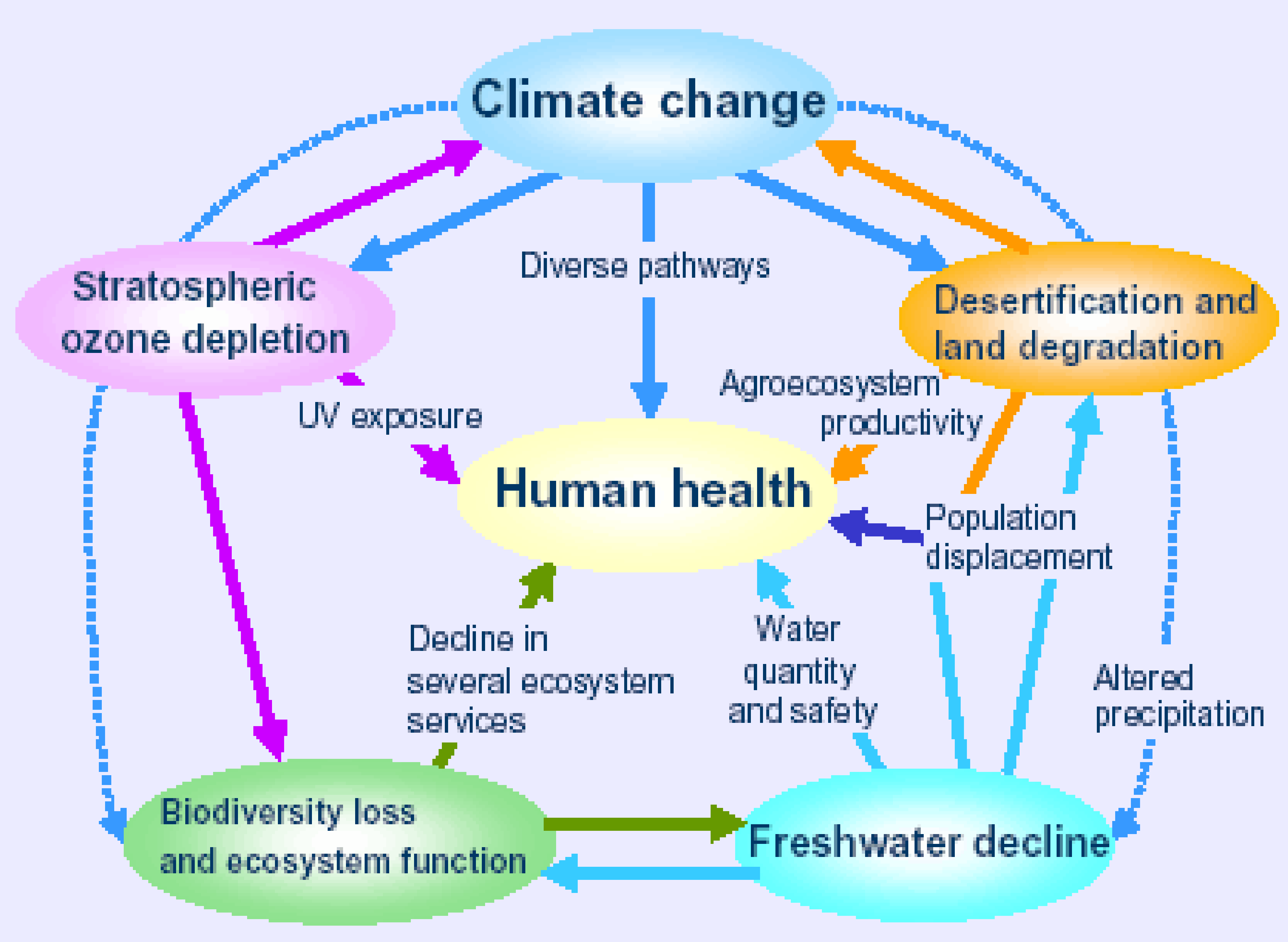
The rise of industry and its rapid expansion has been a major source of pollution. This has caused changes in the balance of our environment

GLOBAL ENVIRONMENTAL CHANGE

Numerous environmental changes have been identified as issues of global concern:

- desertification;
- the depletion of fuelwood;
- the destruction of tropical rainforest and rapid declines in forest cover;
- the modification of coastal ecosystems;
- the reduced availability and quality of drinking water;
- the depletion of soil resources; the over-exploitation of fisheries;
- food shortages;
- species extinction and the loss of biodiversity; stratospheric ozone depletion; rapidly rising levels of

The sheer number, magnitude and complexity of these issues can seem overwhelming and some commentators have argued that they amount to a cumulative, sustained human impact on the environment that has profoundly transformed the surface of the Earth.


Climate change
Stratospheric ozone depletion
Desertification and land degradation
Diverse pathways
UV exposure
Agroecosystem productivity
Human health
Population displacement
Decline in several ecosystem services
Water quantity and safety
Altered precipitation
Biodiversity loss and ecosystem function
Freshwater decline

GLOBAL ENVIRONMENT FACILITIES (GEF)

The Global Environment Facility (GEF), established on the eve of the 1992 Rio Earth Summit, is a catalyst for action on the environment. Through its strategic investments, the GEF works with partners to tackle the planet's biggest environmental issues.

The funding also helps reduce poverty, strengthen governance and achieve greater equality between women and men. They occupy a unique space in the global partnership for a more sustainable planet.

GEF is a:

A UNIQUE PARTNERSHIP of 18 agencies — including United Nations agencies, multilateral development banks, national entities and international NGOs — working with 183 countries to address the world's most challenging environmental issues. The GEF has a large network of civil society organizations, works closely with the private sector around the world, and receives continuous inputs from an independent evaluation office and a world-class scientific panel.

A FINANCIAL MECHANISM for 5 major international environmental conventions: the Minamata Convention on Mercury, the Stockholm Convention on Persistent Organic Pollutants (POPs), the United Nations Convention on Biological Diversity (UNCBD), the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Framework Convention on Climate Change (UNFCCC).

AN INNOVATOR AND CATALYST that supports multi-stakeholder alliances to preserve threatened ecosystems on land and in the oceans, build greener cities, boost food security and promote clean energy for a more prosperous, climate-resilient world

www.thegef.org/

ETHICAL ENVIRONMENT

Ethics is assumed to mean a moral philosophy prescribing what is right and what is wrong. In other words it states how the world ought to be rather than describing how it is.

Environmental ethics prescribes what is right because it is good for the environment, which means that it is good for the earth and for creation.

What is good for the earth and creation is good for humanity although it may not necessarily follow that what is good for humanity is good for the earth and creation.

ENVIRONMENTAL ETHICS

MORAL AGENTS : those who have the freedom and rational capacity to be responsible for choices; those capable moral reflection & decision; i.e. adults humans of sound minds, infants & mentally infirm adults are not moral agents

MORAL STANDING: If you have moral standing; your continued existence or welfare is valuable in itself (intrinsic value); your interests and well-being must be weighed when deciding what is permissible to do. i.e. humans of all kinds, babies, children, adults, old people; women, different races, different cultures

MORAL DUTIES: that which is owed by moral agents to those with moral standing. i.e. it is wrong to kill our children because we have a moral duty toward them

BASIC PRINCIPLES OF ENVIRONMENTAL ETHICS

The principle of minimum harm

The principle of coordination

The principle of moderate consumption

The principle of distributive justice

The principle of fair compensation

THE ETHICAL VALUES OF POLLUTION CONTROL

We should recognize our moral duty to protect the welfare not only human beings, but also of other non human parts of this system

Usefulness of non-human world for human purposes

Human have no rights to reduce the richness & diversity expect to satisfy vital needs

The ideological changes is mainly that of appreciating life quality, rather than to increase higher standard of living

ETHICAL VALUES FOR CONSERVING DEPLETABLE RESOURCES

Proper utilization of resources i.e. the people should maintain ecological balance

We should adopt voluntary measures to conserve the resources

If we are to preserve enough scarce resources, so that future generation can maintain their quality of life at a satisfactory level

MAN HAS MORAL RESPONSIBILITY TOWARDS NATURE

We know that we can cause permanent damage to natural landscapes, resources & ecosystems

We know that we can cause them damage

We know how we can prevent or remedy them

BIOCENTRIC

Life-centred morality:

All and the only living beings, specifically individual organisms have intrinsic value and moral standing

Humans are not superior to other life forms nor privileged and must respect the inherent worth of every organism

Humans should minimize harm and interference with nature; eat vegetarian since less land needs to be cultivated

ECO-CENTRIC HOLISM

Ecosystem centred morality

Non-individuals (the earth as an interconnected ecosystem, species, natural processes) have moral standing or intrinsic value and are deserving of respect

Individuals must be concerned about the whole community of life/nature

Human should strive to preserve ecological balance and stability

Various World Views and Ethical Perspectives

Philosophy	Intrinsic Value	Instrumental Value	Role of Humans
Anthropocentric	Humans	Nature	Masters
Stewardship	Humans and Nature	Tools	Caretakers
Biocentric	Species	Abiotic Nature	One of many
Ecocentric	Processes	Individuals	Preservers
Ecofeminism	Relationships	Roles	Caregivers

"The care of the Earth is our most ancient and most worthy, and after all our most pleasing responsibility. To cherish what remains of it and to foster its renewal is our only hope." ~ Wendell Berry


ROUTE
Sustainable Development
RIO+20


DO INDIVIDUALS MATTER?
Should I leave the trash or take it with me?
Study.com


Value theory?