APES STUDY GUIDE

Test Date: _____

- **Topics:**

I. Earth Systems and Resources (10–15%)

II. The Living World (10–15%)

III. Population (10–15%)

IV. Land and Water Use (10–15%)

V. Energy Resources and Consumption (10–15%)

VI. Pollution (25–30%)

VII. Global Change (10–15%)

I. Earth Systems and Resources

- **A. Earth Science Concepts**

  Geologic time scale; plate tectonics, earthquakes, volcanism; seasons; solar intensity and latitude

- **B. The Atmosphere**

  Composition; structure; weather and climate; atmospheric circulation and the Coriolis Effect; atmosphere–ocean interactions; ENSO

- **C. Global Water Resources and Use**

  Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation

- **D. Soil and Soil Dynamics**

  Rock cycle; formation; composition; physical and chemical properties; main soil types; erosion and other soil problems; soil conservation

A. Earth Science Concepts

- **Geological Time Scale**
  - **Eon**
  - **Era**
  - **Period**
  - **Epoch**
  - **Age**

A. Earth Science Concepts

- **Radiometric Dating & Half Life**

- **Continental Drift & Seafloor Spreading**

A. Earth Science Concepts

- **Earth Structure- Diagram includes: crust (continental/oceanic), lithosphere, asthenosphere, mantle, inner core, outer core**

A. Earth Science Concepts

- **3 types of plates/boundaries (tectonics)-**

- **Convection Currents-**

A. Earth Science Concepts

- **How do Earthquakes arise?**
- **Body vs Surface Waves**
- **What are Tsunamis?**

A. Earth Science Concepts

- **How do volcanos work?**

- **What are the effects of volcanos?**

A. Earth Science Concepts

- **What are the factors that control seasons?**

- **What is the relationship between solar intensity and latitude?**

B. The Atmosphere

- **Composition of Atmosphere**
  - **7 different compounds, their formula & % composition**

B. The Atmosphere

- **Structure/Layers of Atmosphere**

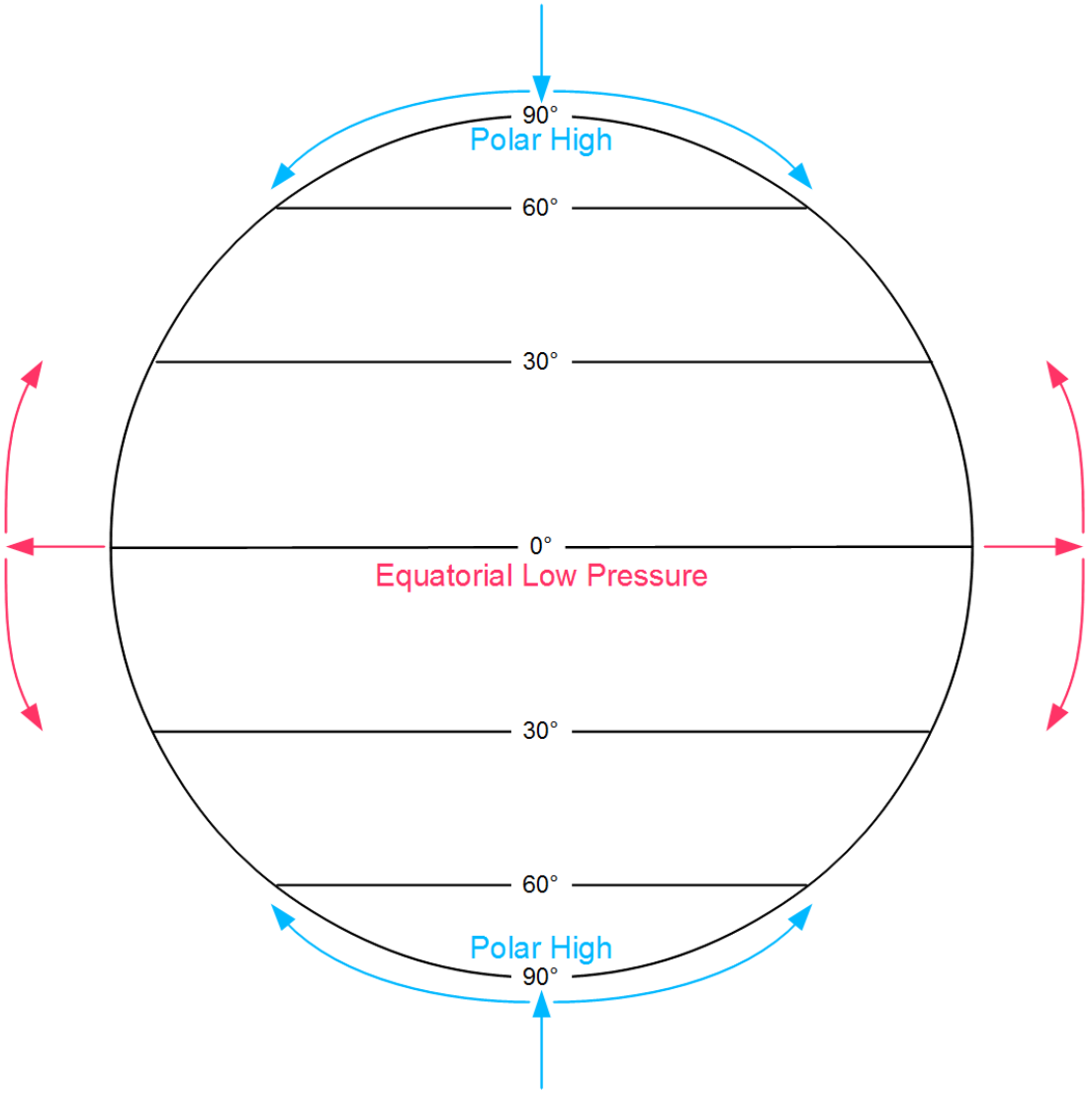
B. The Atmosphere

- **Difference between weather and climate?**

- **Factors that influence climate-**

B. The Atmosphere

- **Air Circulation Cells**



B. The Atmosphere

- **What is the relationship between atmospheric circulation and the Coriolis Effect?**

- **El Nino (ENSO) vs La Nina**

C. Global Water Resources and Use

- **Important Properties of Water**
  - **Solubility**
  - **Specific Heat**
  - **Adhesion**
  - **Cohesion**
  - **Density of Ice**

C. Global Water Resources and Use

- **Percent of Freshwater _____ Saltwater _____**

- **How is the water in the oceans circulated?**

C. Global Water Resources and Use

- **List use & conservation in each sector.**
- **Agricultural**
- **Industrial**
- **Domestic**

C. Global Water Resources and Use

- **What are some issues facing water resources?**
- **Surface Issues**

- **Ground water issues**

C. Global Water Resources and Use

- **Global Water Problems**
  - **Subsidence vs. Sinkhole**
  - **Saltwater Intrusion**
  - **Water Shortages**
  - **Dams**

C. Global Water Resources and Use

- **Water Case Studies**
  - **Case Study: Ogallala Aquifer**
  - **Case Study: Mexico City**
  - **Case Study: Aswan High Damn**
  - **Case Study: California Water Project**

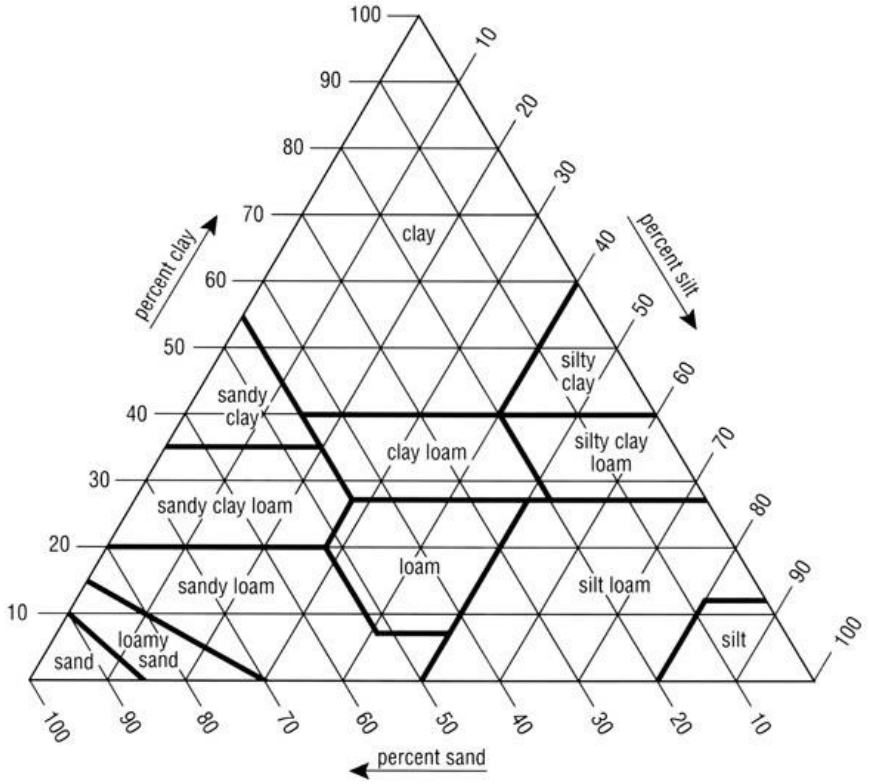
D. Soil and Soil Dynamics

- **Rock Cycle - formation/composition, physical & chemical properties**

D. Soil and Soil Dynamics

- **Soil Composition (clay, gravel, loam, sand, silt)**

- **Soil triangle**



D. Soil and Soil Dynamics

- **Soil Horizons**

- **What are some problems associated with soil and explain importance of soil management?**

D. Soil and Soil Dynamics

- **Components of Soil Quality**
  - **Aeration**
  - **Compaction**
  - **Permeability**
  - **pH**
  - **Nutrient-Holding**
  - **Water-Holding**

D. Soil and Soil Dynamics

- **Soil Degradation**
  - **Desertification**
  - **Salinization**
  - **Waterlogging**

D. Soil and Soil Dynamics

- **What are ways to conserve soil?**

II. The Living World

- **A. Ecosystem Structure**

  Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial & aquatic biomes

- **B. Energy Flow**

  Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids

- **C. Ecosystem Diversity**

  Biodiversity; natural selection; evolution; ecosystem services

- **D. Natural Ecosystem Change**

  Climate shifts; species movement; ecological succession

- **E. Natural Biogeochemical Cycles**

  Water, Carbon, Nitrogen, Phosphorus, Sulfur, Conservation of Matter

A. Ecosystem Structure

- **Ecosystem Properties-**
  - **Define & list examples**
  - **Abiotic factors**
  - **Biotic factors**

A. Ecosystem Structure

- **Difference between biological populations and communities**

- **What are ecological niches?**

A. Ecosystem Structure

- **Population Distribution**
  - **Clumped**
  - **Uniform**
  - **Random**
- **Population Density**

A. Ecosystem Structure

- **Species Interactions – describe & provide an example**
  - **Commensalism**
  - **Ammensalism**
  - **Mutualism**
  - **Parasitism**

A. Ecosystem Structure

- **Species Interactions – describe & provide an example**
  - **Predation/Herbivory**
  - **Competition**
  - **Saprotrophism**
  - **Trophic Cascade**

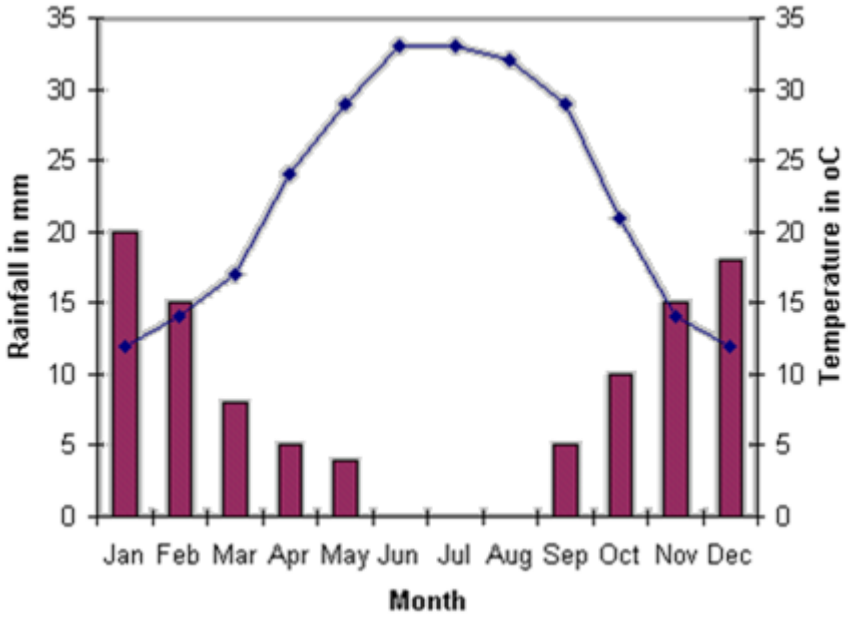
A. Ecosystem Structure

- **What are keystone species? List examples/why?**
- **What are foundation species? List examples/why?**
- **What are edge effects?**

A. Ecosystem Structure

- **What are factors that determine different Biomes?**

- **Reading a Climatograph**



A. Ecosystem Structure

- **Aquatic Biomes**
  - **Lentic vs Lotic**
  - **Zones of Freshwater/Lakes**
  - **Zones of Saltwater/Marine**

A. Ecosystem Structure

- **Aquatic Biomes**
  - **Wetlands**
  - **Coral Reefs**
  - **Lakes**
  - **Rivers & Stream**

A. Ecosystem Structure

- **Terrestrial Biomes – Major Properties**
  - **Savanna**
  - **Taiga**
  - **Temperate Deciduous Forests**
  - **Temperate/Tropical Forests**

A. Ecosystem Structure

- **Terrestrial Biomes – Major Properties**
  - **Chaparral**
  - **Coniferous Forest**
  - **Tundra**
  - **Desert**

A. Ecosystem Structure

- **Terrestrial Biomes – Major Threats**
  - **Savanna**
  - **Taiga**
  - **Temperate Deciduous Forests**
  - **Temperate/Tropical Forests**

A. Ecosystem Structure

- **Terrestrial Biomes – Major Threats**
  - **Chaparral**
  - **Coniferous Forest**
  - **Tundra**
  - **Desert**

SYSTEM CHARACTERISTICS

Feedback Loops- explain and give an example

- Positive (enhance flow)

- Negative (inhibit flow)

B. Energy Flow

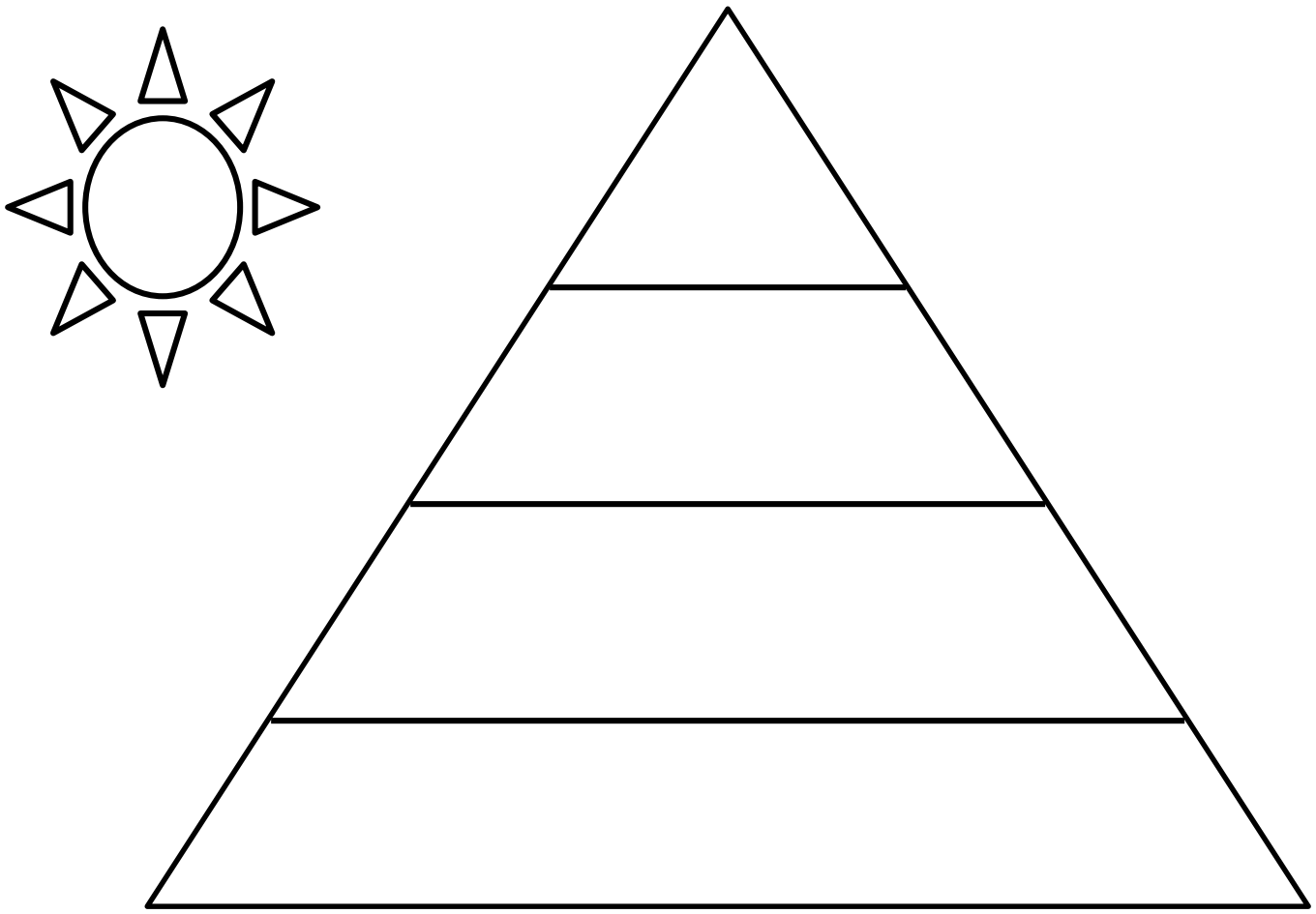
- **What is the initial source(s) of all energy?**

- **Relationship between Photosynthesis and Cellular respiration (include equations)**

B. Energy Flow

Ecological Pyramids/Trophic Levels (label for each)

10% Rule



C. Ecosystem Diversity

- **What is Biomass?**
- **What is Productivity?**
- **How is it measured?**

C. Ecosystem Diversity

- **What is Biodiversity?**

- **How is it measured?**

C. Ecosystem Diversity

- **Relationship between Evolution & Natural Selection (provide an example)**

- **What is extinction?**

- **What makes species vulnerable to extinction?**

C. Ecosystem Diversity

- **What services do ecosystems provide?**

D. Natural Ecosystem Change

- **How can climate shifts impact ecosystems?**

- **Factors that influence species movement.**

D. Natural Ecosystem Change

Ecological Succession

- **Primary Succession:**

- **Secondary Succession:**

D. Natural Ecosystem Change

- **Characteristics of succession within plant communities-**
  - **structure**
  - **diversity**
  - **net primary productivity**
  - **nutrient cycling by decomposers**
  - **photosynthesis efficiency**

E. Biogeochemical Cycle

- Explain the statement: “Energy Flows, Matter Cycles”

- What is a reservoir?

E. Biogeochemical Cycle

- **Explain the role of each in the human body**
  - **Water**
  - **Carbon**
  - **Nitrogen**
  - **Phosphorus**
  - **Sulfur**

E. Biogeochemical Cycle: WATER

Include-

- Precipitation, Condensation, Evaporation, Transpiration, Infiltration, Percolation, Runoff, Surface Water, Groundwater
- Human impact on the water cycle
  - withdrawing from lakes, aquifers, and rivers,
  - clearing land for agriculture and urbanization
  - destruction of wetlands, pollution of water
  - resources, sewage runoff, building of industry

E. Biogeochemical Cycle: WATER

E. Biogeochemical Cycle: CARBON

Include-

- **Release of carbon back into the atmosphere**
- **Carbon sink**
- **Trapping carbon**
- **Releasing carbon**
- **Human impact on the carbon cycle**

E. Biogeochemical Cycle: CARBON

E. Biogeochemical Cycle: NITROGEN

Include-

****FNAAD → ANPAN****

- **Nitrogen Fixation**
- **Nitrification**
- **Assimilation**
- **Ammonification**
- **Denitrification**
- **Impacts of excess nitrogen in water and in the air**
- **Human impact on the nitrogen cycle**

E. Biogeochemical Cycle: NITROGEN

PROCESS	→	PRODUCT(S)
F		A
N		N
A		P
A		A
D		N

E. Biogeochemical Cycle: NITROGEN

E. Biogeochemical Cycle: PHOSPHOROUS

- **How does the absence/presence affect productivity in an ecosystem?**

- **ONLY cycle WITHOUT a GAS phase**
- **Human impact on the phosphorous cycle**

E. Biogeochemical Cycle: PHOSPHOROUS

E. Biogeochemical Cycle: SULFUR

- Include- Sulfur, Sulfates, & Sulfur Dioxide
- Sulfur release/trapping
- Human impacts on the sulfur cycle

E. Biogeochemical Cycle: SULFUR

III. Population

- **A. Population Biology Concepts**

  Population ecology; carrying capacity; reproductive strategies; survivorship

- **B. Human Population**

  1. Human population dynamics

  Historical population sizes; distribution; fertility rates; growth rates and doubling times; demographic transition; age-structure diagrams

  2. Population size

  Strategies for sustainability; case studies; national policies

  3. Impacts of population growth

  Hunger; disease; economic effects; resource use; habitat destruction

A. Population Biology Concepts

- **J curve vs. S curve**

- **Boom/Bust Cycles- Overshoot vs. Dieback**

- **Factors that limit population growth**
  - **Abiotic**
  - **Biotic**

A. Population Biology Concepts

- **What is carrying capacity (K) and what factors affect it?**

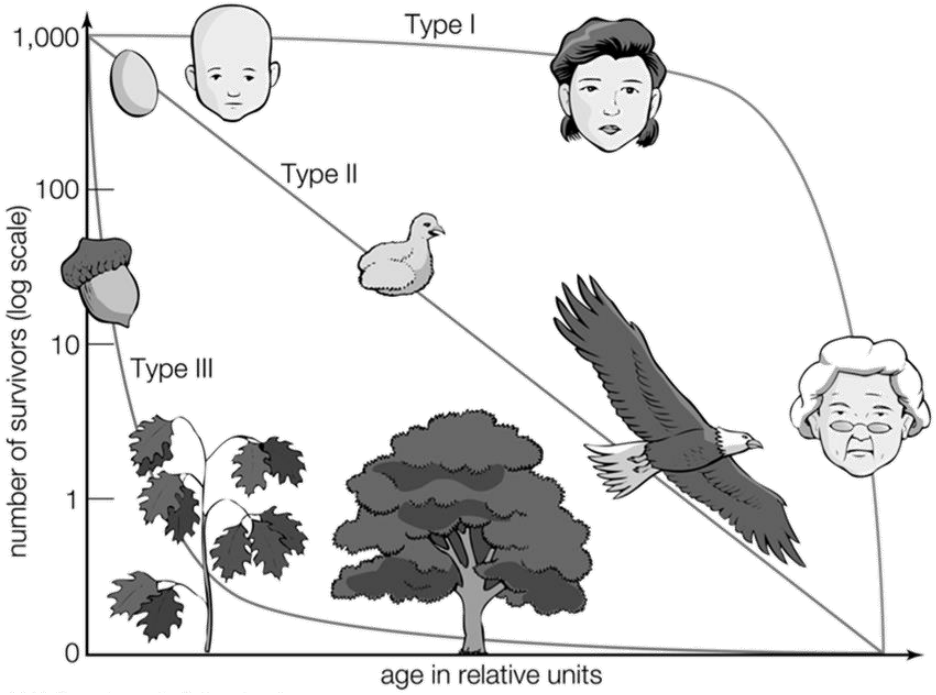
A. POPULATION GROWTH

- **Reproductive strategies**

K- adapted	r-adapted

A. POPULATION GROWTH

- **Survivorship Curves-**



A. POPULATION GROWTH

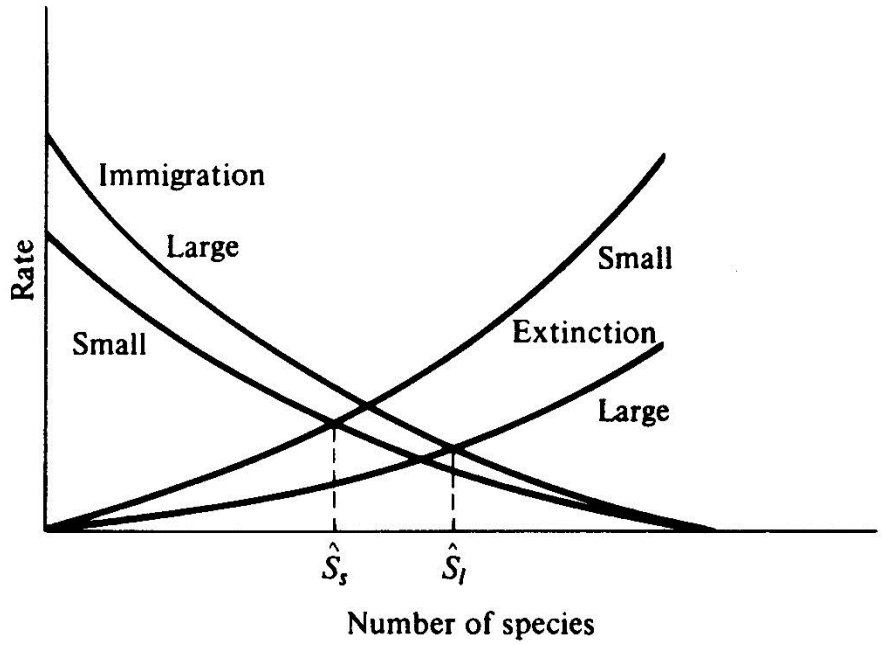
- **Factors regulate population growth**
  - **Measures of Birth Rate:**
    - **Natality**
    - **Fecundity**
    - **Fertility**
  - **Immigration**
  - **Emigration**
  - **Measures Longevity:**
    - **Mortality**
    - **Survivorship**

A. POPULATION GROWTH

- **Factors regulate population growth**
  - **Abiotic Factors**
  - **Biotic Factors**
  - **Density Dependent Factors**
  - **Density Independent Factors**

A. POPULATION GROWTH

- **The Theory of Island Biogeography**



B. HUMAN POPULATION

- Historical Population Growth

- Human Demography

Total population= _____

US Population = _____

B. HUMAN POPULATION

DEVEOPLED	DEVELOPING

B. HUMAN POPULATION

URBAN	RURAL

B. HUMAN POPULATION

- **Population Momentum**

- **Replacement Fertility**

- **Zero Population Growth**

B. HUMAN POPULATION

- **Doubling Times**

- **Calculate Growth Rate (r) –provide equation**

- **Crude Birth/Death Rate (per thousand)**

B. HUMAN POPULATION

- **Demographic Transition- Graph & explain 4 stages (pre-industrial, transitional, industrial, post-indust.)**

B. HUMAN POPULATION

- **Draw Age Structure Diagrams- 3 types**

B. HUMAN POPULATION

- **Population size**
  - Strategies for Sustainability

  - Case studies/national policies

    China

    India

B. HUMAN POPULATION

- **Impacts of population growth**
  - Hunger/disease
  - Economic effects
  - Resource use/habitat destruction

IV. Land and Water Use

- **A. Agriculture**

  1. Feeding a growing population

  Human nutritional requirements; types of agriculture; Green Revolution; genetic engineering and crop production; deforestation; irrigation; sustainable agriculture

  2. Controlling pests

  Types of pesticides; costs and benefits of pesticide use; integrated pest management; relevant laws

B. Forestry

Tree plantations; old growth forests; forest fires; forest management; national forests

C. Rangelands

Overgrazing; deforestation; desertification; rangeland management; federal rangelands

IV. Land and Water Use

- **D. Other Land Use**
  - **1. Urban land development**

    Planned development; suburban sprawl; urbanization
  - **2. Transportation infrastructure**

    Federal highway system; canals and channels; roadless areas; ecosystem impacts
  - **3. Public and federal lands**

    Management; wilderness areas; national parks; wildlife refuges; forests; wetlands
  - **4. Land conservation options**

    Preservation; remediation; mitigation; restoration
  - **5. Sustainable land-use strategies**
- **E. Mining**

  Mineral formation; extraction; global reserves; relevant laws and treaties
- **F. Fishing**

  Fishing techniques; overfishing; aquaculture; relevant laws and treaties
- **G. Global Economics**

  Globalization; World Bank; Tragedy of the Commons; relevant laws & treaties

A. Food & Agriculture

- **Human Nutritional Requirements**
- **Undernutrition vs Malnutrition vs Overnutrition**
- **Kwashiorkor & Marasmus**

A. Food & Agriculture

- **Types of agriculture**-
  - Alley cropping
  - Crop rotation
  - Intercropping
  - Low-till/No-till
  - Monoculture
  - Polyculture
  - Subsistence agriculture

A. Food & Agriculture

- **First Green Revolution**

- **Second Green Revolution**

A. Food & Agriculture

- **Genetic engineering (GMOs) & Crop production**

  Pros vs Cons

A. Food & Agriculture

- **Fertilizers-**
- **Organic vs. inorganic fertilizers**
- **Common forms**
- **Advantages**
- **Disadvantages**
- **Eutrophication**

A. Food & Agriculture

- **Deforestation**
- **Irrigation**
- **Methods of sustainable agriculture**

A. Pest Control

- **Pests & Types of Pesticides**

A. Pest Control

Pesticide Use	
PROS/BENEFITS	**CONS/COSTS**

A. Pest Control

- **Integrated Pest Management (IPM)**

- **Relevant laws**
  - **Federal Insecticide, Fungicide and Rodenticide Control Act (FIFRA)**
  - **Federal Environmental Pesticides Control Act**
  - **Food Quality Protection Act (FQPA)**

B. FORESTRY/LAND USE

- **Tree plantations- pros vs cons**
- **Old growth forests- characteristics**
- **Forest fires- crown vs. ground vs surface fires, ecological importance and methods to control fires**

B. FORESTRY/LAND USE

- **Methods of Tree Harvesting & Pros/Cons**
  - **Clear-Cutting**
  - **High Grading**
  - **Strip Cutting**
  - **Tree Plantation**

C. Rangelands

- **What are Rangelands?**

- **Major Impacts – Consequences & Mitigations**
  - **Overgrazing**
  - **Desertification**

D. Other Land Use

- **Urban land development**

  Planned development; suburban sprawl; urbanization, smart growth

D. Other Land Use

Urbanization	
PROS/BENEFITS	**CONS/COSTS**

D. Other Land Use

- **Transportation infrastructure**

  Federal highway system; canals and channels; roadless areas; ecosystem impacts

D. Other Land Use

- **Public and federal lands**

  Management; wilderness areas; national parks; wildlife refuges; forests; wetlands

D. Other Land Use

- **Land conservation options**

  Preservation

  Remediation

  Mitigation

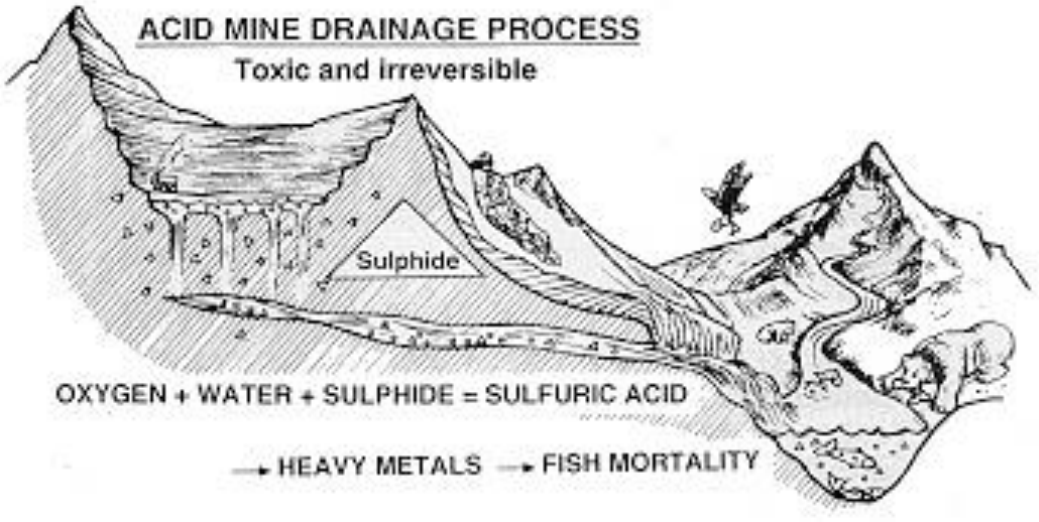
  Restoration

E. Mining

- **Methods of Extraction**
  - **Surface Mining**
  - **Underground Mining**
  - **In situ Leaching**

E. Mining

- **Acid Mine Draining / Acid Rock Drainage**



E. Mining

- **Location & Supply (%)**

Global reserves-

- Oil reserves
- Coal reserves
- Natural gas reserves
- Global mineral reserves

Relevant laws and treaties

F. Fishing

- **Fishing techniques-**

  Bottom Trawling

  Drift Net

  Long Line

  Purse Seine

- **Bycatch –**

F. Fishing

- **Overfishing- remediation techniques**
- **Aquaculture- pros vs. cons**
- **Relevant laws and treaties**

G. Global Economics

- **Significance-**

  Globalization

  World Bank

  International Monetary Fund

  World Trade Organization

G. Global Economics

- **Tragedy of the Commons – summary & examples**

V. Energy Resources & Consumption

- **A. Energy Concepts**

  Energy forms; power; units; conversions; Laws of Thermodynamics

- **B. Energy Consumption**

  1. History

  Industrial Revolution; exponential growth; energy crisis)

  2. Present global energy use

  3. Future energy needs

- **C. Fossil Fuel Resources and Use**

  Formation of coal, oil, and natural gas; extraction/purification methods; world reserves and global demand; synfuels; environmental advantages/disadvantages of sources)

V. Energy Resources & Consumption

- **D. Nuclear Energy**

  Nuclear fission process; nuclear fuel; electricity production; nuclear reactor types; environmental advantages/disadvantages; safety issues; radiation and human health; radioactive wastes; nuclear fusion

- **E. Hydroelectric Power**

  Dams; flood control; salmon; silting; other impacts

- **F. Energy Conservation**

  Energy efficiency; CAFE standards; hybrid electric vehicles; mass transit

- **G. Renewable Energy**

  Solar energy; solar electricity; hydrogen fuel cells; biomass; wind energy; small-scale hydroelectric; ocean waves and tidal energy; geothermal; environmental advantages/disadvantages

A. ENERGY CONCEPTS

Laws of Thermodynamics

- 1st Law:

- 2nd Law:

A. ENERGY CONCEPTS

- **Potential vs. Kinetic Energy**

- **Give an example of each energy form:**
  - **Mechanical -**
  - **Thermal -**
  - **Chemical -**
  - **Electrical -**
  - **Nuclear -**
  - **Electromagnetic -**

A. ENERGY CONCEPTS

- **Units of Energy/Conversions-**
- **Power-**
  - **BTU**
  - **Horsepower**
  - **Watt**
  - **Calorie**

B. ENERGY CONSUMPTION

- **History**
  - **Industrial Revolution**
  - **Exponential growth**
  - **Energy crisis**

B. ENERGY CONSUMPTION

- **Present U.S. & global energy use**

- **Future energy needs**

C. Fossil Fuel Resources & Use: COAL

- **Formation of Coal**
- **Extraction methods**
- **Environmental advantages/disadvantages**
- **World reserves and global demand**

C. Fossil Fuel Resources & Use: COAL

- **Methods to Reduce Pollutants from Coal**
  - **Beneficiation**
  - **Filters**
  - **Scrubbers**
  - **Electrostatic Precipitators**

C. Fossil Fuel Resources & Use: OIL

- **Formation of Oil**
- **Extraction methods**
- **Environmental advantages/disadvantages**
- **World reserves and global demand**

C. Fossil Fuel Resources & Use: Natural Gas

- **Formation of Natural Gas**
- **Extraction methods**
- **Environmental advantages/disadvantages**
- **World reserves and global demand**

D. NUCLEAR ENERGY

- **Nuclear Fission process**

- **Fertile vs Fissile**

- **Nuclear Fuel → U-235,U-238, Pu-239**

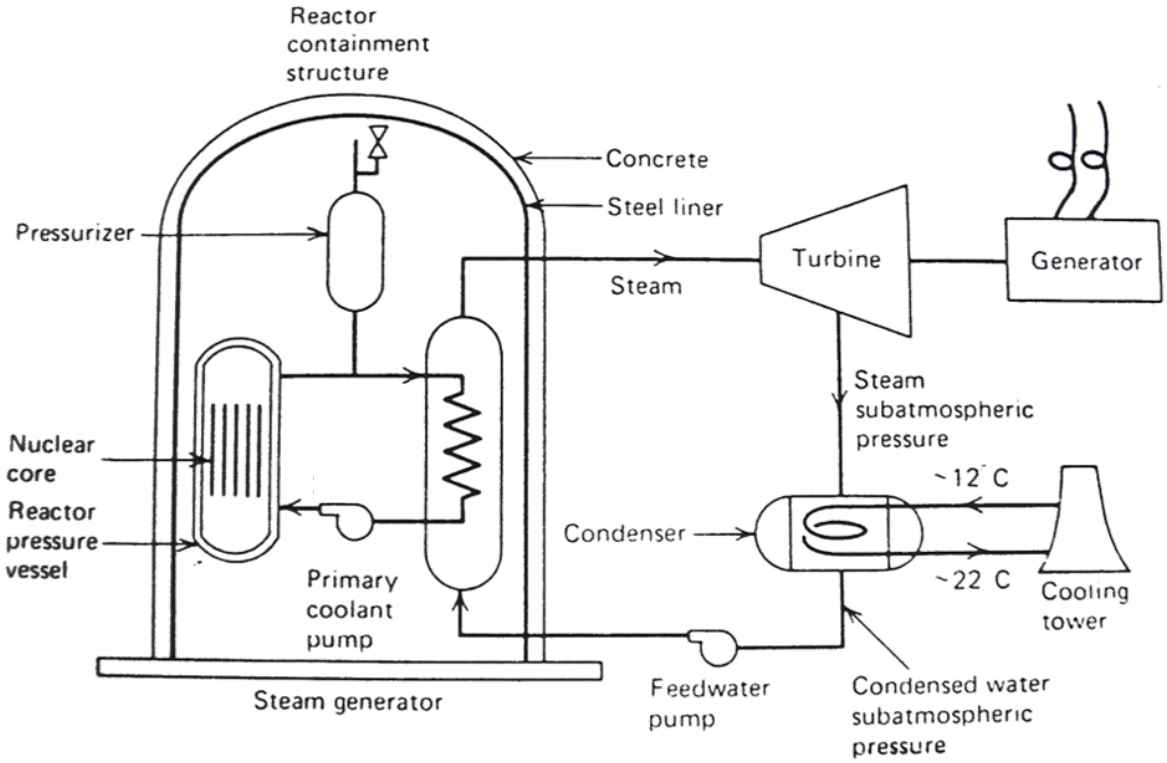
D. NUCLEAR ENERGY

- **Uranium Fuel Cycle**

1. **Mining**
2. **Milling**
3. **Conversion**
4. **Enrichment**
5. **Fuel Fabrication**
6. **Nuclear Reactor**
7. **Spent Fuel Reprocessing**

D. NUCLEAR ENERGY

- **Electricity production process**



D. NUCLEAR ENERGY

- **Environmental advantages/disadvantages**

- **Safety issues**

* Other Nonrenewable Energy Sources

- **Methane Hydrates**
- **Oil Shale**
- **Oil Sands / Tar Sands**
- **Synfuels**

E. HYDROELECTRIC POWER

- Energy Generation Process

- Advantages/Disadvantages to Dams

E. HYDROELECTRIC POWER

- Flood Control Methods
  - Channelization
  - Dams
  - Levees or Floodwalls

F. ENERGY CONSERVATION

- **List 5 conservation methods-**
    1.
    2.
    3.
    4.
    5.

F. ENERGY CONSERVATION

- **Smart Grids**
- **CAFÉ Standards**
- **Environmental Advantages of Mass Transit**

G. RENEWABLE ENERGY

- **Describe & Provide Advantages/Disadvantages**
  - **Passive Solar**
  - **Active Solar**
  - **Photovoltaic Cells**

G. RENEWABLE ENERGY

- **Describe & Provide Advantages/Disadvantages**
  - **Biogas (Ethanol & Biodiesel)**
  - **Biomass**
  - **Biofuel**

G. RENEWABLE ENERGY

- **Describe & Provide Advantages/Disadvantages**
  - **Geothermal**
  - **Wind**

G. RENEWABLE ENERGY

- **Describe & Provide Advantages/Disadvantages**
  - **Ocean Waves & Tidal Energy**
  - **Small-Scale Hydroelectric**

G. RENEWABLE ENERGY

- **Describe & Provide Advantages/Disadvantages**
  - **Passive Solar**
  - **Active Solar**
  - **Photovoltaic Cells**

VI. Pollution

- **A. Pollution Types**

  1. Air pollution

  Sources — primary and secondary; major air pollutants; measurement units; smog; acid deposition — causes and effects; heat islands and temperature inversions; indoor air pollution; remediation and reduction strategies; Clean Air Act and other relevant laws

  2. Noise pollution

  Sources; effects; control measures)

  3. Water pollution

  Types; sources, causes, and effects; cultural eutrophication; groundwater pollution; maintaining water quality; water purification; sewage treatment/septic systems; Clean Water Act and other relevant laws

VI. Pollution

4. Solid waste

Types; disposal; reduction

- **B. Impacts on the Environment and Human Health**

  1. Hazards to human health

  Environmental risk analysis; acute and chronic effects; dose- response relationships; air pollutants; smoking & other risks

  2. Hazardous chemicals in the environment

  Types of hazardous waste; treatment/disposal of hazardous waste; cleanup of contaminated sites; biomagnification; relevant laws

- **C. Economic Impacts**

  Cost-benefit analysis; externalities; marginal costs; sustainability

A. POLLUTION TYPES: AIR

- **Primary Sources - Cause & Effects**
- **CO**
- **CO_2**
- **SO_2**
- **NO**
- **NO_2**

A. POLLUTION TYPES: AIR

- **Primary Sources - Cause & Effects**
- **VOCs**
- **PM_X (PM_{10})**
- **Lead (Pb)**
- **Mercury (Hg)**

A. POLLUTION TYPES: AIR

- **Secondary Sources - Cause & Effects**
- **SO_3**
- **H_2SO_4**
- **HNO_3**
- **PANs**
- **Tropospheric O_3**

A. POLLUTION TYPES: AIR

- **Industrial vs Photochemical Smog Formation & Health Effects-**

A. POLLUTION TYPES: AIR

- **Indoor air pollution: sources of contaminants**

- **Remediation and reduction strategies for indoor/outdoor air pollution**

A. POLLUTION TYPES: AIR

- **Catalytic Converters**
- **Thermal Inversion**
- **Clean Air Act and other relevant laws**

A. POLLUTION TYPES: NOISE

- **Sources & Effects**

A. POLLUTION TYPES: WATER

- **Sources & Effects**

A. POLLUTION TYPES: WATER

- **Cultural Eutrophication**
- **Groundwater Pollution**
- **Urban Runoff**

A. POLLUTION TYPES: WATER

- **Water quality and purification processes**

- **Clean Water Act and other relevant laws-**

A. POLLUTION TYPES: WATER

- **Sewage treatment/septic systems-**
- Primary treatment
- Secondary treatment
- Tertiary treatment

A. POLLUTION TYPES: WATER

Water Quality Tests	
Test	**Impact**
Temperature	
pH	
Hardness	
Dissolved Oxygen	
Biological Oxygen Demand	
Fecal Coliform	
Turbidity	
Nitrate, Nitrite, & Phosphates	

A. POLLUTION TYPES: SOLID WASTE

- **Types & Disposal**
  - Organic
  - Radioactive
  - Soiled
  - Toxic
  - Recyclable

- **Reduction**

A. POLLUTION TYPES: SOLID WASTE

- **Reduction Strategies - Pros vs Cons**
- **Composting**
- **Remanufacturing**
- **Detoxifying**
- **Exporting**
- **Anaerobic Digestion**

A. POLLUTION TYPES: SOLID WASTE

- Reduction Strategies - Pros vs Cons
- Land-disposal- (sanitary landfills & open dumping)
- Ocean dumping
- Recycling& Reuse
- Incineration

A. POLLUTION TYPES: SOLID WASTE

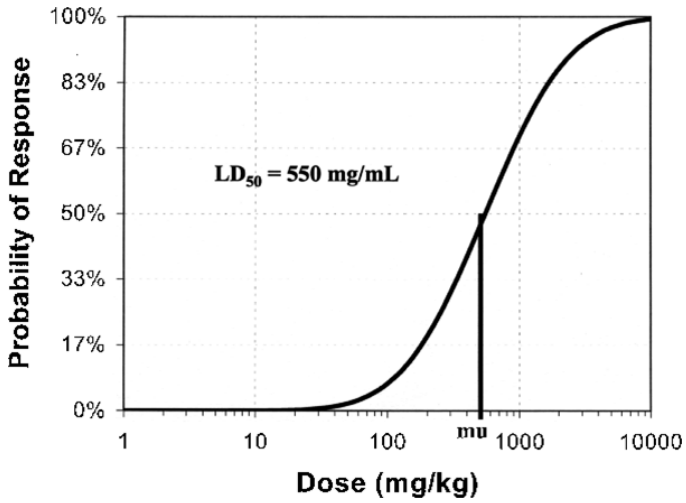
- **Relevant Laws :**
- **RCRA**
- **CERCLA**

B. IMPACTS ON ENVIROMENT & HUMAN HEALTH

- **Environmental Risk Analysis**

- **Acute vs. Chronic Effects**

- **Dose-response relationships- TD-50 vs LD-50**



B. IMPACTS ON ENVIROMENT & HUMAN HEALTH

- **Hazardous chemicals in the environment**
  - Corrosive
  - Ignitable
  - Toxic
  - Radioactive
  - Mutagen
  - Carcinogen
  - Teratogen

B. IMPACTS ON ENVIROMENT & HUMAN HEALTH

- **Brownfield –**

- **Cleanup of contaminated sites-**
  - **Bioremediation**
  - **Phytoremediation**
  - **Incineration**
  - **Storage – Surface Impoundments & Deep Well Injection**

B. IMPACTS ON ENVIROMENT & HUMAN HEALTH

- **Persistent Organic Pollutants**

- **Bioaccumulation vs. Biomagnification**

B. IMPACTS ON ENVIROMENT & HUMAN HEALTH

- **Cost-benefit Analysis**

- **Externalities:** Positive (external benefits) and Negative (external costs)

- **Marginal Costs**

- **Sustainability**: common threads, EPA

VII. Global Change

- **A. Stratospheric Ozone**

  Formation of stratospheric ozone; ultraviolet radiation; causes of ozone depletion; effects of ozone depletion; strategies for reducing ozone depletion; relevant laws and treaties

- **B. Global Warming**

  Greenhouse gases and the greenhouse effect; impacts and consequences of global warming; reducing climate change; relevant laws and treaties)

- **C. Loss of Biodiversity**

  1. Habitat loss; overuse; pollution; introduced species; endangered and extinct species

  2. Maintenance through conservation

  3. Relevant laws and treaties

A. STRATOSPHERIC OZONE

- **Formation of stratospheric ozone**

- **Ultraviolet radiation-**
  - **UVA**
  - **UVB**
  - **UVC**

A. STRATOSPHERIC OZONE

- **Cause & Effects of Ozone Depletion**

Include Equations →

A. STRATOSPHERIC OZONE

- **Strategies for Reducing Ozone Depletion**

- **Relevant laws and treaties**:

  Montreal Protocol

B. GLOBAL WARMING

- What is the Greenhouse Effect?

- Identify & Describe the Sources of the Major GHGs

B. GLOBAL WARMING

- **List Impacts & Consequences of Global Warming**

B. GLOBAL WARMING

- **Mitigating Factors for Climate Change**

- **Relevant laws and treaties**

BENEFITS TO BIODIVERSITY

C. LOSS OF BIODIVERSITY

- **Identify the factor and describe how it is harming biodiversity**

1. **H**
2. **I**
3. **P**
4. **P**
5. **C**
6. **O**

C. LOSS OF BIODIVERSITY

- **Endemic Species –**
- **Threatened Species –**
- **Endangered Species –**
- **Characteristics that have contributed to endangerment or extinction**

C. LOSS OF BIODIVERSITY

- **What is a biodiversity hotspot?**

- **Identify & Describe the Major Methods to Maintain Biodiversity**

C. LOSS OF BIODIVERSITY

- **Introduced Species/Invasive Species**: definition, types, consequences, examples

C. LOSS OF BIODIVERSITY

Relevant Laws and Treaties:

- CITES

- Endangered Species Act

ADDITIONAL: Experimental Design

- Identify Question
- Hypothesis (If…Then statement)
- Procedures (list)
- Data/results
- Analysis Conclusion