

Snazzlefrag's

Environment and Humanity: Race to Save the Planet DSST Study Notes

Contact: <http://www.degreeforum.net/members/snazzlefrag.html>

Hosted at: <http://www.free-clep-prep.com>

Acid Rain: Sulfur Dioxide(SO₂) Nitrogen Oxides (NO_x) <-- electric power generation (burning fossil fuels/coal) = Sulf acid, nitric acid.

pH Value (Potential of Hydrogen): lower = more acidic. Water: 7.0 (neutral pH). Rain 5.5. Acid rain 4.3.

Human Effects: resp Disease, leaching of toxic metals into drinking water, decrease atmospheric visibility.

Aquatic Effects: Loss of fish species (if pH <4.5), lost leaves, leaching of nutrients from soil, increase acid-loving mosses=kill trees.

Agroforestry: "Alley cropping" crops planted between trees/shrubs. Trees provide shade, retain water in ground, provide mulch(trimming)

Aldo Leopold: Land ethicist. Ethically bound to preserve wild nature. Forestry service, U of Wisconsin, founded **Wilderness Society**.

Antarctica: 98% of ant=ice. 70% world's freshwater. 90% world's ice. Core Ice show today's CO₂ highest in 650k yrs. Average temp -49°C

Air Pollution: Coal=54% electricity. Biggest air polluter in US=smog, soot, acid rain, glob warm. 600 US coal plants 1.4m tons coal each

Reduce: Low-sulfur coal, rem sulf from coal, convert it into liquid/gas, clean fuels, mass transit, tax breaks for hybrid cars

Most: Region 9: CA Least: Region 4: Southern States.

Autotrophs: Create own food (plants, grass, trees). **Heterotrophs:** Consume autotrophs for food/energy.

Biodiversity: Range of life forms and life maintaining processes.

Genetic/Species/Ecological/Functional Diversity.

Loss of Biodiversity = reduction in natural ecosystem services, adaptability of species to altered environments.

= Less food, fuel, fiber, paper, medicine, lumber

Biogeochemical Cycling: Cycle of Natural Abiotic Resources: Water, Nitrogen, Sulfur, Carbon. (AKA **Nutrient Cycles**)

Hydrologic Cycle:

Evap(ocean)>Condens(clouds)>Transport(wind)>Precip(rain)>Infiltration/Perc(soil)>Run off(back to sea).

Nitrogen: (78% of Atmos) Nitro attaches to soil > Used by Plants > Back to gas when plant dies/eaten. Smog, Ammonia.

Fixation, Nitrification, Assimilation, Ammonification, Denitrification.

Sulfur: (all orgs need) Same cycle as Nitro. Reacts with chems in atmos, and water.

Sulfur causes erosion, acid rain.

Carbon: (key element of life) Plants use CO₂ in photosynth = Sugar(carbs) & Oxygen.
Coal/Petroleum. Coal+Pressure=diamond.

Phosphorus: Cycled by water, Earth's crust, living organisms. Found in dust, rock, sediment. From fertilizers. Eutrophication

Biomes: Major, classified, recognized community with well-recognized plant and animal life. Based on rain/climate.

Forests: Coniferous Forest: Evergreen (Tundra gives way to trees). V.Cold winter, pleasant summer. (pine, spruce, fir etc.)

Taiga: Largest Land Biome. Alaska, Canada, Sweden, Finland, Siberia.
Freezing Winters, Warm Summers

Deciduous Forest: "Turns" with seasons. Trees lose leaves, snow...experiences all four seasons.

Tropical Rain Forest (2% of earth, 50-80% of all land species,multiple layers of plant/animals=biodiversity)

Temperate Rain Forest: Cooler than rainforest, less diverse plantlife, but still humid.

Boreal/Polar Forest (sub-arctic, tall coniferous trees, not many species, too cold)

Deserts: <25cm/yr (10") of Rain/yr. Sparse, spaced out low vegetation, few animals.

Waxy leaves (to prevent water loss), deep roots (groundwater), Dormant in dry periods (moss, lichen).

Grasslands: Grazing/browsing animals. Not enough moisture for trees to grow.

Chaparral (can withstand/regenerate after fires, hardy roots store food, seeds sprout only AFTER fire)

Tropical (long dry season, low/med rain, wide belt either side of the Equator)

Temperate (cold winters, hot/dry summers, sparse uneven rainfall, fertile soil) grass die/decompose = fertilize soil.

Tundra (polar, just south of arctic ice cap). Short growing period, no trees.

Winter=-70°F. Permafrost. Cold/Windy

Savannah (yr round warm climate, 2 dry seasons, rainfall rest of the year, Africa, Australia, SE Asia)

Few Trees, Large Game: **Grazers:** grass, herbs. **Browsers:** Leaves, shoots. (different foods=reduced competition).

Mountains: 20% of land surface. High ground sanctuary for animals, forests, role in hydrologic cycle

Aquatics: 70.8% of Earth (2.5% fresh water). Salt water, fresh water, estuaries.

Climate Change: Temp increased 1°F in past century, faster increase in last 2 decades. (**Average World Temp = 60°F**) 1998 hottest.

Humans alter chem comp of atmos thru build-up of greenhouse gases = trap heat (Water Vapor, CO₂, Methane, Nitrous Oxide, Ozone).

Since Indus Revolution: CO₂ up by 30%, Methane doubled, Nitrous Oxide up by 15%.

US emits 1/5 of total global greenhouse gases.

Future: By 2100 CO₂ projected to be 30-150% higher than today. Average Global Temp projected to rise by 1-4.5°F in next 50 yrs.

Evaporation will increase > increase average global precipitation. Soil moisture decline, intense rainstorms. Sea rise 2ft in US Coast.

Deforestation: Degradation of Tropical Rainforests. We lose lots of ecological services. 24% less forest now than in 1700 (most conv to crop)

Causes: Increased human resource need (pop growth), poverty, govt policies encouraging deforestation (roads for logging/mining etc).

Effect: Once roads built & logging complete, locals come in to farm (cash crops). Soil cannot sustain. Indonesia, Malaysia, Mexico, Brazil.

Farmers burning to clear forest can cause mammoth wildfires = increased air pollution, risk to health. Millions fall ill, hundreds die.

Deforestation degrades tropical rivers when vast quantities of eroded soil enters. Muddy silt=Suffocates coral reefs, overloads estuaries.

Removal of trees speeds up flooding. No trees = runoff into soil = nowhere for rain to go.

Fix: Education, concessions for conservation, sustainable schedule of logging, reforestation programs.

Desertification: When semiarid or arid land loses it's productive potential by 10% or more. Long term drought, or hum pop reduce topsoil.

Topsoil = Renewable (but slow) 200-1000 years to produce 1inch of topsoil.

1991 UN Conference to Combat Desertification "25% of world, and 40% of US is affected by desertification." US Bureau Land Managemnt

Fix: Plant trees, grasses to stabilize topsoil and retain water, limit overgrazing, deforestation, and harmful farm,irrig,mining.

Earth: 70.8% Water (2.5 fresh water),29.2 land (20 mountain,2 rainforest,1.5 Urban,32 Forest,4.7 crop,26 pasture,13.13 arable. 7 desert)

Ecology: Interaction between organisms and their nonliving environment. Organisms, Populations, Communities, Ecosystems, Biospheres.

Organisms: Producers, Consumers, Decomposers (detritus feeders)

Producers: Create their own food from the env's compounds (green plants, algae, phytoplankton).

Consumers: Herbivores, Omnivores, Carnivores, Scavengers, Detrivores

Omnivores: Pig, bear, primates, rodents, opossums, raccoons, foxes, chickens, crows, pigeons.

Carnivores: Cats, dogs, Polar bear, scavenger birds, snake, lizard, octopus/squid, spider/scorpion, frog/toad, seal/walrus

Detrivores: Decomposers: Recycle/Make shit (bact,fung). Detritus Feeders: Eat shit (crabs/worms/vultures).

Species: Classification of Organisms. Differentiated by the way they reproduce.

Asexual (single cells, bacteria = clones), Sexual (requires sex cells from both parents).

Population: Each individual species in an ecosystem. Must be interbreeding/reproducing. Eg, All deer, All penguins.

Community: Various species live together in the same space, intricate network of animals, plants, organisms.

Ecosystem: Community of species(plants,animals,microbes) interacting in their environment (temp,seasons,water,air).

Requires chemicals, energy, organisms. **Abiotic:** nonliving,water,air. **Biotic:** plants,animals.

Ecosystem Performs: Water purification, biological control of pests, natural (good) greenhouse effect (keeps us warm).

Ecotone: When ecosystems join up with neighboring ecosystems to form transitional areas (Ecotones). Marsh, wetland

Biosphere: All of the planet's Ecosystems: air/lands/rocks/water in which LIFE occurs.

Ecological Niche: All factors affecting life/reproduction of a species. tolerance, energy flow, recycling.

Generalists: Survive in varied places (cockroach, rats, humans). Specialists: Limited adaptability (Pandas, Salamanders)

Eutrophication: Natural nutrient enrichment of lakes. Cultural Eutroph=Humans add nitrates/**phos**/carbon > low O₂, algae growth.

Eutrophic Lakes: Asia 54%, Europe 53%, North America 48%, South America 41%, Africa 28%.

Oligotrophic: Nutrient-poor water. **Turbid:** Murky.

Fix: Waste treatment (remove nit/phosph), reduce phosphate use in detergents, soil conserv to control runoff (plants/trees)

Evolution: single-cell Prokaryotic (no nucleus) Bacteria > Single-cell Eukaryotic Bacteria > Multicellular Organisms.

Natural Selection: Alleles (more than one form so can adapt).

Coevolution: Change in one species requires change in another.

Speciation: New species by natural selection. Two species come from one. Reqs: Geographic Isolation, Reprod Isolation

Indicator Species: react quickly to enviro changes (early warning). **Keystone Species:** Affect health/survival of other species.

Keystone: pollination, cycling of waste, dispersing seeds, predation (eating). Shark, wolf, alligator > regulate pop.

Competitive Exclusion: A species can destroy another by competing for limited resources.

Resource Partitioning: Species share limited resources. Eg, Lions hunt larger prey, leave leopards to hunt for smaller ones.'

Symbiosis: Live together. Parasitism(mosq, tapeworm, ticks), Mutualism(both benefit), Commensalism/Symbiotic(one benefits).

Farming: 2 types of Agricultural Systems: Industrialized and Traditional. **66% of Earth's land disturbed by human activities.**

Traditional Subsistence: Only enough human/animal labor for farmer's family to survive.

Traditional Intensive: More human/animal labor, fertilizers, and water to increase crop yields to feed family AND sell.

Interplanting: Several crops on the same plot. Reduces risk to farms of loss of crops due to bad weather and pests.

Polyvarietal, Intercropping, Agroforestry, Polyculture (plant all seeds though they mature at different times).

(Agr-rev) **Slash & Burn Farming:** (sustainable). Fast way to clear land for planting, ash used as fertilizer.

(Agr-rev) **Shifting Cultivation:** (sustainable). Clear an area, plant, then move to

another area. Leaving fallow makes soil fertile again.

Industrialized: Plantation: Tropical = LDCs, cash crops (coffee, bananas, sold to MDCs), large areas of land.

(Ind-rev) Reliance on fossil fuelled farming machinery (coal, then nat gas)

(Ind-rev) Plant-breeding=Crop yields rose, protected biodiversity (less land needed), fewer farmers required > migrated to cities.

Industrialization = env degradation, pollution, not enough water for irrigation, overgrazing, overfishing.

Low-input Farming: Same food yields as traditional farming, less CO₂, half the energy, soil fertile, better habitat, more profitable

Crops: 30,000 edible plant species on earth. But only 3 grain crops: **Rice, wheat, corn** (50% of food humans consume).

Future of Farming: Genetic Engineering, or Sustainable Agriculture (maintain and replenish Earth's natural systems).

Fertilizers: Organic Fertilizer(dung, manure, compost, plant spores), Commercial Inorganic Fertilizer

Drawbacks of CIF: no humus added to soil, water pollution, reduces soil ability to hold water, lowers O₂ in soil, few nutrients

...energy expensive (not energy efficient), releases nitrous dioxide in the atmosphere (enhances greenhouse effect).

Food Production: Croplands, Rangelands, Oceanic Fisheries.

Increased food production since 1950s: Irrigation, ferts, pest, high-yield crops, mechanization, feedlots/cages to rear food animals.

Food Chain: Eg, Plant(prim producer) > Rabbit (primary consumer) > Fox (sec cons) > Hyena (tert cons). Eat/Be Eaten By.

Trophic Level: "Pyramid". Amount of each organism req to support next level up...until Final Consumer (top of food chain).

Ecological Efficiency: Level of energy transferred from one Trophic level to the next (10%) 90% loss at each step in the chain.

Food Web: Overlapping Food Chains. Eg, Plant>Rabbit>Fox>Hyena + Plant>Rabbit>Human

Fossil Fuels: Compressed plant/bacteria. CO₂ not released into air until fuel is mined or burned.

Future: Fossil fuels will run out. Hydrogen Gas(from H₂O) proposed as fuel of future (produces clean water vapor when burned).

Global Warming: Human activities began about 1750 (Indus Rev). Fossil Fuels, deforest, inorganic ferts (esp. since 1950).

Causes: CO₂ (#1=industrial plants), Burning fossil fuels (700m vehicles in world), deforestation.

Humans add CFCs to atmosphere, cause depletion of Ozone(blocks 98 UV) in Stratosphere.

Evidence: Increased temp, precip, reduced glaciers, raised sea levels (10-20cm last century), Ozone Layer: skin cancers, smog

Green Rev: First 1950-70. Increasing crop yields per unit of area. (selective breeding/genetic eng, pest, fert, multiple cropping)

Second 1967-present: Fast-growing dwarf varieties of rice and wheat introduced to

tropical/sub-tropic LDC.

Dwarfs increase crop yields by 2-5 times. Require lots of water, pesticides, fertilizer > so more machinery needed.

Problems: Green Rev uses 8% of Earth's oil output. 17% of all commercial energy is used for industrial agriculture.

It takes 10 units of non-renewable fossil fuel to place 1 unit of food on the table in the US.

A piece of food travels an average of 2100km (1300mi) before being eaten.

Greenhouse Gases: Sun > shortwave radiation > absorbed by earth > reflected as longwave radiation > trapped by gases.

Carbon Dioxide, Methane, Nitrous Oxide, HFC/PFC, Water Vapor. Hold in heat to keep Earth warm.

GH Gases have increased 25% since Industrial Revolution (1750). 30billion tons/yr into atmosphere.

CO₂: colorless,odorless,nonflam, From solid waste/fossil fuels (oil,nat gas,coal),wood products,photosynth. **82% of GH**

US emits the most CO₂ (25% of global emissions). Biggest increase is LDC (3x increase of MDC). 550m tons/yr

By Sector: CO₂ = Power Plants 33%, Industry 33%, Vehicles 22%, Major transportation 12%. 360ppm (280ppm 200 yrs ago).

Methane: Emitted during productions/transport of coal,nat gas, oil. Also decomp of organic waste in landfills. Livestock. 9%

"swamp gas". Colorless, odorless, flam. 350-500m tons/yr. +100% since 1750. Rice farming. 20yr life in atmos.

Nitrous Oxide: Emitted during agricultural and Industrial activities, during combustion of solid waste and fossil fuels. 5%

"Laughing gas". Colorless, sweet odor. Nature=bacteria in soil, oceans. +15% since 1750. 7-13m tons/yr. 100 yr life in atmos.

Hydrofluorocarbons(HFC),Perfluorocarbons(PFC),Sulfur Hexafluoride(SF₆) <-- Industrial processes. 2%. A/C, fridges, aerosols.

CFCs (bad) breakdown ozone. HFCs don't breakdown ozone but do trap heat (global warming).

HFC/PFC most heat absorbing. Methane traps 21x more heat than CO₂. Nitrous Oxide absorbs 270 more heat than CO₂

Emissions Measurement: Millions of Metric Tons of Carbon Equivalent (MMTCE). Global Warming Potential (GWP) of each gas.

Gross Primary Product (GPP): Rate producers/plants create more plant material(biomass) via photosynth.High:Reefs,Low:desert,ocean

Groundwater: 75% of drinking water Europe. 51% US, 32% Asia, 29% Latin America. (US water quality set by EPA)

LDC = wells, contaminated stream, rivers, mudholes. **Biggest User of Water = Agriculture.** 1.5b don't have safe drinkwater.

HABs (Algae Blooms): Lakes! Deplete oxygen, kill marine species. kill birds, release toxins, damage fisheries, reduce tourism.

Homo: Tchadensis (1st). Habilis (Afr 2.5-1.5mya) "handyman". Pleistocene. Short, long

arms (ape-like), brain=halfsize. Primitive stone **tools**.

Erectus (Afr,Eurasia 2-0.3mya) "uprightman". Pleistocene. Like humans, brain=75%. Stone tools. **Migration. FIRE. Hunt/Gath.** Early Speech

Ergaster (E&S Afr 1.9-1.25) "workingman". Pleistocene. 6ft tall. Less sexual dimorphism. **Basic Weapons:** Hand-axe, cleavers.

Neanderthal (Eur,Asia 230k-30kya) "Neander Valley" Paleolith. Short/robust(cold) 5'6". Brain=100%. Adv Weaps/Sprs/**Shelt/Fire/Bury/Mus?**

Sapien (250kya-pres) "thinking man". Afri Savan. US 10kya. Competition for resources with Neand.Hunt/gath/herd/Lang/Art. Cromagnon

Inversion: Temperature Inversion - air close to earth is cooler than the air above it. Pollution cannot rise/disperse = trapped.

Winter Inversions = Particulate & Carbon Monoxide pollution. Summer Inversions = Smog.

Irrigation: Flood (Africa), Overhead(lawn/golf), Center Pivot(expenive), Lateral(less exp, lab int), Drip/trickle, Subirrigation (BEST).

Land: 66% of Earth's land disturbed by human activities, 35% Federally owned (73% is in Alaska, 22% in Western states).

Multiple-use Land: National Forestry System(156 forests,22 grasslands), National Resource Lands. Farm,fish,mining,grazing.

Moderately Restricted-use Land: National Wildlife refuges. Hunting.fishing,mining.

Restricted-use Land: National Parks, National Wilderness Preserve Systems. Hiking, camping, non-motor boats etc.

Layers: Atmosphere, Troposphere, Stratosphere, Mesosphere, Thermosphere, Exosphere. (Hydrosphere, Lithosphere, Biosphere)

Atmosphere: "Air", Gravity. 78% Nitrogen, 21% oxygen, 1% water vapor, trace amounts of Arg,CO₂,Neon,Hel,Meth,Kryp,Hydr,Oz

Troposphere: "lower atmosphere". Surface to 4(poles)-12miles(equator). Our Weather. Temp decreases with height (62°f dwn -60°f).

Tropopause: Between trop and strat. Where temperature reverses (trop=decrease w/ height, strat=increase w/ height).

Stratosphere: Upto 31mi. 19% of Atmosphere's gases (very little water vapor) **Ozone** (O₃), filters sun's UV rays (-76°f up 5°f)

Mesosphere: Upto 53mi. Meteors burn up. (5°f dwn -184°f)

Thermosphere: "upper atmosphere". Upto 430mi. (upto 3,600°f at top)

Exosphere: Upto 6200mi. Satellite orbit.

Biosphere (Surface/Life occurs). **Hydrosphere** (Water: Liquid, solid, vapor).

Lithosphere (Rocks, outermost shell of Earth,Crust).

Net Primary Productivity: # of consumers limited by biomass output of prods.

NPP=remainder after prods meet own needs. Hum: 3.2%

Oil Spills: Crude Petroleum takes marine life 3 yrs to recover. Refined Petroleum takes 10 or more years.

Organic Substances: Plant and Animal products. **Inorganic Substances:**

Water,rocks,soil,gases.

Ozone: Stratosphere. Not emitted directly by cars/industry...hydrocarbons & nitrogen oxides react w/ sunlight to form ozone.

Industrial Uses: bleach, disinfect bottled water (instead of chlorine), plastics, kill

bacteria, medicine.

Antarctic Ozone Hole: Discovered in 1985.

Pesticides: Herbicides, insecticides, fungicides, rodenticides, nematocides (roundworms).

Insurance Spraying (ensure pests are totally eradicated), Cosmetic Spraying (to ensure products LOOK good).

Proponents: Saves lives, fast, effective, minimal health risks when used correctly, increase farmer's profits

Manufacturers Say: Every \$1 spent on pesticide = increase crop yield of \$4 (studies show only \$2 after accounting for harmful effects).

Opponents: Speeds up genetic resistance, kills unintended organisms, spreads beyond target area, harms wildlife/human health.

US Dept Agriculture says: Pesticides kill 60m birds, 6-14m fish, 20% honey bee colonies, harms 20% of endangered species each year.

Economic Threshold: Point at which economic losses caused by pest damage outweigh cost of applying pesticide.

Alternatives: Crop rotation, polyculture, biological control, birth control, insect trapping (Pheromones), hot water, food irradiation.

Integrated Pest Management (IPM): biological, cultivation, chemical methods - aim is to reduce pests to economic threshold.

prevents pollution, but high starting costs, req expertise, slow-acting, req monitoring...no govt subsidies (unlike pesticides).

Photosynthesis: Plants, algae, bacteria. Sunlight > Sugar > ATP (fuel). Plants use green pigment (chlorophyll) > convert CO₂ to O₂ and Sugar.

Aerobic Respiration: Living Organisms convert O₂ to CO₂.

Primary Pollutants: released directly into the troposphere. **Secondary Pollutants:** Formed in trop when prim pollutants react w/ air/one another.

Future: Pollution Control by **5 R's: Refuse to use, Replace w/ alternatives, Reduce usage, re-use instead of disposing, Recycle.**

Population: 6.47 billion. China + India = 38% of world population. US = 4.6%. By 2025: LDC = >95% of population growth.

TFR is 2.9 (1998), at that rate > human pop would reach 694 billion by 2150. 2.3 TFR = **9.3b by 2050**. US pop by 2050 = 383-507 million (est).

Population stabilize by 2050. 1.3b live in MDC. 4.6b live in LDC (12% of wealth). Urban pop. growing 4x faster than rural.

Life Expectancy in MDC = 75, LDC = 50. Jap=79, Afr/Asia=47 **Pre-Industrial Revolution Population = <1 billion**

r-Selected: small size, short lifespan, lots of offspring (unstable). **k-Selected:** large size, long lifespan, few offspring (stable)

Demographic Transition: 1) High birth/High death. 2) Lower death/High birth. 3) Low birth/Low death. 4) Birth/death=Equal.

1=slow/no pop growth. 2=rapid pop growth. 3=slow pop growth. 4=zero pop growth.

Rates: Crude Birth Rate: Live births divided by midyear population. #live births/1000 population.

Crude Death Rate: Deaths divided by midyear population. #deaths/1000 population.

Fetal Mortality Rate: 20+ weeks of gestation. Fetal Deaths divided by sum of live births

+ fetal death. #FD/1,000 LB+FD.

Late Fetal Mortality: 28+ weeks.

Infant Mortality Rate: Infant deaths (<1yr) divided by live births. #ID/1,000 live births.

Neonatal Mortality Rate: <28 days. #NnD/1,000 live births.

Postneonatal Mortality Rate: 28-365 days. #PNnD/1,000 live births.

Birth Cohort Rate: Deaths in same yr or following yr after birth. #ID/100,000 live births.

Maternal Mortality Rate: #MD/100,000 live births.

Fertility Rate: #Live Births(regardless of age)/1,000 women of reproductive age (15-44yrs).

Replacement Level Fertility: # of children a couple must produce to replace themselves. **2.1 MDC. 2.5 LDC.**

Total Fertility Rate(TFR): Average expected births in 1,000 women (if Birth Rate is followed). Compares pops over time/diff grps.

Global TFR is Decreasing over time. Currently 2.7

1.6 MDC, 2.9 LDC. Highest TFR: Africa 5.5/woman. Lowest Scandinavia **Future:** Est. 1.9 MDC, 2.3 LDC.

Gross Production Rate (GPR): Average # daughters in 1,000 women (if birth rate is followed).

Annual Rate of Natural Population Change (%) = (birth rate - death rate)/(1000 persons) x 100.

Population Change Rate: [Births + Immigration] - [Deaths + Emigration]

Recycling: Primary/Closed-loop (same product), Secondary (different product, lower quality). Some resources cost more than landfill

23% if municipal waste is recycled in North America. Paper can only be recycled 6-8 times. Plastics also degrade each time.

Resources: Anything obtained from environment which meets human needs and desires.

Natural resources: Solar Energy, Fertile Soil, Fresh Air. Human Ingenuity: Fossil Fuels, Groundwater.

Perpetual: Does not run out, continuously regenerated (solar)

Renewable: Solar, geothermal, tidal (hydroelectric), Ocean Thermal Energy Conversion (OTEC), wind.

Can regenerate quite quickly(hours to decades) if not depleted faster than can replenish (forests, wild animals)

If demand/use for a resource exceeds **Sustainable Yield**, then **Environmental Degradation** occurs (deforest,pollut,overgrazing).

Non-renewable: Fixed stock. Oil, Gas, Coal, Iron, uranium, Sand (recycling helps)

Risk: Analysis/Assessment, Management Hazards: Cultural(smoking, diet, poverty, work conditions), Chemical, Physical, Biological.

Pimentel Study(1998): Environmental factors (smoking, pollution, nutrition, pesticides) = 40% of Earth's annual deaths.

Revolutions: Agricultural (10-12k yrs ago - **plough:** farm instead of hunt), Industrial (275yrs ago), Infor/Globalization Revolution (50yrs ago).

Sewage: Primary, Secondary, Advanced(chemicals) treatment. Also, membrane-based technology (reverse osmosis, microfilt, nanofilt)

Soil Conservation: Limit erosion/replenish fertility. Nutrients lost by erosion, crop harvesting, leaching. Fertilizers partly restore fertility.

Conservation-tilling: (limits erosion) minimal (loosen only topsoil) or no tilling (inject into slits in the ground).

Terracing, contour farming, strip cropping, agroforestry, gully reclamation, constructing windbelts.

Smog/Brown Air: Fossil Combust. Photochem (trigger by light). Prim and Sec Pollutants mix in sunlight. Smog = photochem oz (bad oz).

Worse in Sunny, warm, dry climates w/ lots of cars. Cars release unburned hydrocarbons (ie, nitrogen oxide), reacts with light = smog.

Industrial Smog: When coal, heavy oil are burned > Carbon sets off chain reaction > Soot & Ammonium Sulfate = GREY Indus Smog.

Solid Waste: unwanted, discarded material neither gas nor liquid. 85% from Agr/min/oil & gas production, 15% from indust/municipal waste.

Sanitary Landfill: spread out, compacted, covered with clay or plastic foam every day, leached water collected and treated.

US = 4.6% of Earth's pop. but produces 33% of Solid Waste. Ecologists call for US to refuse, **reduce, re-use, recycle**, redesign.

Stack Pollution: Chimney. NO_x, CO, SO_x. **Fix:** Combust Control Techniq (cheaper than post-comb: catal reduction, NO_x red agents).

Low Excess Air Firing: 10% reduction. Extra air to ensure complete burning.

Low Nitrogen Fuel Oil: 60-70% reduction. 15-20x less nitrogen...so less NO_x when burned.

Flue Gas Recirculation: 75% reduction. Most effective except for Selective Catalytic Reduction (90% a post-combust control, too expensive)

Succession(Biotic Change): Primary=New organism takes over an area.

Secondary=Old organism leaves area(deforest,no plants/animals).

Land: lichen/moss>Tall grass/Weeds(3yrs)>Pine Trees etc.(3-10yrs)>Forest(10-30yrs)>Hardwood trees(30-70yrs)>Nat Dis>Restart.

Aqua/Pond: Birds bring seeds,Waterplants/weeds,Plants emerge edges,Sed/debris build up,Pond=shallow,Plants/debris fill,Marsh,Dry,Trees.

3 Factors: Facilitation, Inhibition, Tolerance.

Stability: Inertia/Persist(withstand disturbance), Constancy/Maintain pop, Resilience/Regenerate Trop Rainforest=High Intertia, low resilience.

Sun: 4.6b yrs old (10^9). 98% of solar system's mass (332k x earth).

Surface=photosphere (11,000°f) **91% hydrogen, 9% helium.** Core=27m°f.

Luminosity: 400billion-billion megawatts. 93m miles from earth (energy takes 8 minutes). 30% reflected back by clouds, desert, snow.

Nuclear Fusion. 5 billion years of energy left.

Pros: Infrared & Visible Light. Fresh Air, warmth, tides, seasons, solar energy, plant growth. **Cons:** UV/skin cancer/cataracts/Aging. El Nino.

Only 1 part in 2 billion of solar energy/radiation reaches earth!

Sustainability (Ecosystem): 1. Recycle waste/nutrients. 2. Solar Energy. 3. Maintain pop. 4. Maintain biodiversity.

Sustainable Development: "Our Common Future" (1987 UN Report/Brundtland Report). World Commission on Env & Development.

Temperature Inversions: Cool air is trapped under layer of warm air (traps pollutants)
= Smog

Subsidence Inversion: Warm air floats over cooler, prevents vertical mixing.

Radiation Inversion: Night! Ground air cools fast than warm above.

Tolerance Level: Existence, number, spread of a species in an ecosystem.

Limiting Factor: Too much/Too little abiotic can stunt or stop pop growth. Eg, too much water can kill a plant.

Toxic Waste: discarded solid or liquid that contains 1 or more of the 39 carcin,mutagen,teratogenic compounds, flammable, reactive, unstable.

Clean up: Phytoremediation, Bioremediation(enzymes to clean), Plasma Arc Torch (10,000°C), Incineration(expensive,pollutes air)

In US, tox/haz waste injected into rock deep underground (below our water supplies), or landfills, above ground storage units.

Usage: Petroleum: Transport > Industry > Residential > Commercial > Electric Power Plants. By State Usage: TX > CA > FL > NY.

East coast uses more oil than other regions. Per Capita: Gulf Coast > Rockies > Midwest > East Coast > West Coast

Water: 80% in US used for agriculture(crops/livestock).

Weather: Temp, pressure, humidity,sunshine, cloud cover, wind speed, wind direction, precipitation.

Warm Front (approaching warm over retreating cold) Cold Front (approaching cold over retreating warm).

Cold Front: Fast moving, large clouds (Thunderheads).

High Pressure = good weather (cool air gradually warms as it descends), Low Pressure=bad weather (warm air spirals down)

Tornado=land, Cyclone=ocean. Atlantic=hurricane, Pacific=Typhoon.

Six Global Convection Cells (wind patterns): NE & SE Trade Winds, NW(SH) & SWerlies(NH), 2 Polar Easterlies (from East)

El Nino Southern Oscillation (affects 66% of planet). Every 3-7 years. Trade Winds slowing down b/c of Glob Warming.

El Nino: Warming of equatorial Pacific Ocean. Westerly winds slow down or stop, ocean heats, inhibits nutrient-rich water

La Nina: Cooling. When hurricanes, cold Canada/NE US winters, wildfires in Florida meet.

Lawsuits: Relating to environmental issues are based on Statutory Laws and Common Laws. (mostly Nuisance and Negligence)

Clean Air Act (1963, 70, 77, 90): Acceptable levels of Air Pollution.

1990 CAA: "Emissions Trading Policy" Power plants = pollution credits (sulfur dioxide). Can sell, save, trade credits.

Disasters: Love Canal(1977-Superfund)3-Mile Island (1979)Chernobyl (1986)**Exxon Valdez** (1989)11m gallons Prince William, Alaska.

Endangered Species Act (1973): Protects ecosystems, resources, and species from harm. Endangered and threatened species.

Environmental Protection Agency (EPA): 1970. President Nixon. Silent Spring(1962)>NEPA(1969)>1st Earth Day(1970)>EPA (1970).

Kyoto Protocol (1998): 67 countries. Created a framework for reducing emission of GH Gases into the atmosphere.

Montreal Protocol (1987 Amend: 90, 92, 95, 97, 99): 46 nations (later 189). Freeze production of CFCs at 1986 levels (stratos ozone).

National Environmental Policy Act (1969): Federal Agencies must research effect of all proposed activities before implementing.

Non-government Organizations (NGO): 30,000 mainstream NGOs worldwide. Lobby politicians to make/improve environ laws.

Greenpeace, Worldwide Fund for Nature, Sierra Club, Audubon Society, National Wildlife Federation, Wilderness Society, Defenders of WL

Policy Life Cycle: Recognition, Formulation, Implementation, Control.

Safe Drinking Water Act/SDWA (1974): EPA sets standards.

Silent Spring (1962): Rachel Carson. Serial publication in New Yorker, then became a best selling book. Use of Phosphate Pesticides.

Superfund Law (1980): Compreh Env Response, Compensation & Liability Act (CEFCCLA) Response to Love Canal(tax on petrochem to clean)

Toxic Substances Control Act (1976): Compulsory checks on substances before permitting widespread use.

UN Conference on the Human Environment (1972): Stockholm. Created UN Environment Programme (UNEP): negot, impl, monit treaties.

300 international agreements since that meeting. 500 total. UNEP is seriously underfunded: \$100m (world military is \$750b)

UN Conf on the Hum Env (1992): "Rio Earth Summit". Protect biodiversity, reduce emmissions, GH Gases, sustainable development

UN Conf on Population & Development (1994): Aim for target pop of 7.8b by 2050 instead of estimated 9.3b.

Better Family Planning, improve healthcare for babies/women, raise status of women, reduce poverty, better education, national pop policies.

Vienna Convention (1985): 20 countries negotiate regulations on ozone-depleting substances.

Viewpoints: Earth-centered (Eco-centric), individual-centered.

Exploitation: Planetary Management. Humans in charge, exploit earth. All economic growth is good.

Utilitarian: Environmental Wisdom. Resources limited, symbiotic relationship with nature. Manage resources so don't exhaust.

Preservation: Preserve, set aside, protect. 1880s. John Muir (Sierra Club).

Social Ecology: Murray Bookchin. Fairer laws; sustainable production; compact, energy efficient technology. "Trag of the Commons"(Hardin)

Water Pollution Control Act (1948): Acceptable levels of Water Pollution. (last amended in 1987)

Wilderness Act (1964): Protect lands, preservation areas, national parks, restricts uses.

World Trade Organization (1995): WTO. 120 nations agreed to regulate world trade. Monitors env, health, worker safety laws.

WTO headed by US, EU, Japan, Canada. Mostly trade/legal officials (not env). Small countries underrepresented.