

# 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(SO<sub>2</sub>) Nitrogen Oxides (NO<sub>x</sub>) <-- 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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, CO<sub>2</sub>, Methane, Nitrous Oxide, Ozone).

Since Indus Revolution: CO<sub>2</sub> up by 30%, Methane doubled, Nitrous Oxide up by 15%.

**US emits 1/5 of total global greenhouse gases.**

**Future:** By 2100 CO<sub>2</sub> 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 O<sub>2</sub>, 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 CO<sub>2</sub>, 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 O<sub>2</sub> 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. CO<sub>2</sub> not released into air until fuel is mined or burned.

**Future:** Fossil fuels will run out. Hydrogen Gas (from H<sub>2</sub>O) 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: CO<sub>2</sub> (#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.

**CO<sub>2</sub>:** colorless,odorless,nonflam, From solid waste/fossil fuels (oil,nat gas,coal),wood products,photosynth. **82% of GH**

US emits the most CO<sub>2</sub> (25% of global emissions). Biggest increase is LDC (3x increase of MDC). 550m tons/yr

By Sector: CO<sub>2</sub> = 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(SF<sub>6</sub>)** <-- 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 CO<sub>2</sub>. Nitrous Oxide absorbs 270 more heat than CO<sub>2</sub>**

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,CO<sub>2</sub>,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** (O<sub>3</sub>), 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 CO<sub>2</sub> to O<sub>2</sub> and Sugar.

Aerobic Respiration: Living Organisms convert O<sub>2</sub> to CO<sub>2</sub>.

**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<sub>x</sub>, CO, SO<sub>x</sub>. **Fix:** Combust Control Techniq (cheaper than post-comb: catal reduction, NO<sub>x</sub> 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<sub>x</sub> 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.