FOOD AND AGRICULTURE

NUTRITION & FOOD SUPPLIES
~ although enough food is being produced to feed everyone, it is unevenly distributed
~undernourished: consuming less than enough calories needed for an active, healthy life
~over nutrition: too many calories, a problem in wealthy countries, greatest risk in the US
affects 20% of the world, increases blood pressure, heart attacks, strokes, diabetes
~sub-Saharan Africa: food is becoming scarce (war, poor governments, drought, etc)
~800 million undernourished ~obese:30 lbs over (morbidly- 100 lbs over (5 million Americans)
~60% of Americans are obese (we consume 3500 calories/day)

Chronic Hunger and Food Security
~Undernourishment as a child can lead to stunted growth, mental development, and other disorders. Infectious diseases like diarrhea that are usually to no concern can become lethal.
~Food Security: ability to obtain sufficient food on a day-today basis, threatened by poverty, women are usually more effected than men
Other Essential Nutrients
~It is possible to have plenty of calories but still suffer from malnutrition (having a nutritional imbalance, or by lacking a dietary component)
~Kwashiorkor: a protein deficiency in children, mainly in West Africa, victims have reddish hair, puffy, discolored skin, and a bloated stomach
~Marasmus: caused by a diet low in calories and protein, the child is thin and shriveled
~Both diseases can cause anemia, lower one's resistance to infections, or cause stunted growth and mental retardation
~Vitamin A deficiencies can cause blindness, while lack of folic acid causes neurological problems in babies, such as small heads or no brains
~Anemia: most common dietary deficiency in the world (not enough iron), is a lack of hemoglobin in the blood
~A deficiency of iodine can cause goiter (a swollen thyroid gland) or cause brain damage
Eating a Balanced Diet
~Eating a balanced diet full of grains, fruits, and vegetables, with moderate meat, dairy, and fats will give you all the nutrients you need
Famines
~Large-scale food shortages, massive starvation, social disruption, economic chaos
~Even if condition improve, it will be hard to recover (they have ruined their resources in order to survive)
~Causes: politics, government failure, adverse weather, insects, war, natural disasters, poverty, political boundaries, democracies seldom have famines

MAJOR FOOD SOURCES
~Our diet: a dozen grains, 3 root crops, 20 fruits/veggies, 6 mammals, two fowl,
Major Crops
~Mainly wheat, rice, and maize, wheat and rice make up 60% of calories consumed
~Fruits and veggies: have lots of vitamins, minerals, fiber, and complex carbs
Milk, Meat, & Seafood
~N. America, Japan, 7 Europe (20% world population) consume 80% of animal products
~Average American eats 260 lbs/meat/year (Bangladesh-6.5 lbs)
~90% of grain grown is used to feed animals (for slaughter)
~over harvesting, habitat destruction are endangering fisheries: 13/17 gone, with new technology,

we can exhaust entire populations, 70% of fish are declining
1/4 animals are unwanted "by-catch", includes birds and mammals (by lines, drift nets)
~trawl nets can destroy habitats, spawning areas, impossible to rebuild populations

SOIL: A RENEWABLE RESOURCE
~mixture of weathered minerals from rocks, decaying organic material, and living organisms
~with good husbandry, soil can be replenished and renewed
~1/2 of cropland is being destroyed quicker than replaced
Soil Composition
~1/2 mineral (from bedrock/sediments), plant & animal residue, air, water, organisms
~sandy soil: light soil, good drainage, dries quickly vs. clay (tiny particles), heavy, impermeable, holds water longer
~Humus: a sticky, brown residue from decaying plants & animals, gives structure to soil and helps drainage
Soil Organisms
~Topsoil contains millions of organisms, most microscopic (bacteria, algae), worms insects, animals, plant roots draw up minerals and release acids that decompose particles
~leaf litter creates new organic material
Soil Profiles
~soil horizons: layers of soil, reveal the history, classified by color, texture, composition,
~Horizons make up soil profiles. OAEBC
~Topsoil: A horizon, covered by O horizon (newly deposited material), minerals mixed w/ organic matter, where most plants spread their roots to absorb nutrients
~E horizon: leached nutrients from soil
~subsoil: B horizon, dense with clay and nutrients (soluble)
~C horizon: parent material, weathered rock, weathering allows soil to extend downward
Soil Types
~classified into soil orders by their structure and composition

WAYS WE USE AND ABUSE SOIL
~11% of Earth is used for agriculture
Land Resources
~the average land area available to each individual is decreasing
~ways to improve usage of land: variety, better fertilizers, irrigation, pesticides, labor, water- 95% of agricultural growth
~forests, plains being converted to farmland, will eventually have to increase output/acre
~some land shouldn't be farmed (more valuable in natural state)- nutrients in the plants, not soil, would result in loss of biodiversity

Land Degradation
~land destroyed by: 1) humans (buildings, etc) 2) desertification 3) erosion
~in some places, the degradation is so bad that no crops can be supported
~effects: less species, crops, biomass, diversity, vegetation, soil eroded, water runs off
~Causes: 1) water (55%) 2) wind (29%) 3) chemical (12%) 4) physical (4%)

Erosion: The Nature of the Problem
~Importance: redistributed sediments, part of soil formation and loss, sculpts landscapes, creates silt for farming
~However, erosion can destroy topsoil, (exposing the subsoil) reduce land fertility, load rivers with sediments, smother wetlands, clog water intakes, coat reservoirs with silt
~Erosion equals a 1% loss in cropland/year

Other Agricultural Resources:
water- 73% of all freshwater used for irrigation (15% crops are irrigated world wide)
-80% water irrigated never reach destination (because of evaporation and seepage)
water logging- water-saturated soil causing plants roots to die from lack of oxygen
salinization- when mineral salts accumulate in the soil (particularly occurs when soil in dry climates are irrigated with saline water)
-when water evaporates, leaves behind lethal salt accumulation for plants
-irrigation problems: 150 million acres worldwide crop land damaged by water logging and salinization.
Water Conservation: greatly reduced problems from excess water use
-makes water available for other uses
Fertilizer- inorganic nutrients
-plants need: nitrogen, potassium, phosphorus, calcium, magnesium and sulfur
-calcium and magnesium limited in areas w/ high rainfall: must be supplied in form of lime (fertilizer)
-lack of nitrogen, potassium and phosphorus also limits plants growth and these elements are added in fertilizers to enable plant growth
-crop production up since 1950: Nitrate levels in ground water have increased from fertilizers and young children are sensitive to this and it can be fatal
Alternatives for fertilizer:
-manure and green manure
-nitrogen-fixing bacteria in root nodules of legumes
-interplanting or rotating beans (or other leguminous crop) with other crops (corn, wheat)
Energy: Direct- Fossil fuels supply almost all energy for farming
Indirect-energy synthetic fertilizers, pesticides (agricultural chemicals)- increase in this energy
-food system in U.S.: 16% of total energy use
-more energy put to produce, process and transport than actual farming
-present energy usages unsustainable (need alternatives for future because going to run out)!
New Crops and Genetic Engineering:
-3,000 species of plants have been used for food
-most food only comes from 16 widely grown crops!
-new varieties of crops valuable for humans and good for areas that are limited by climate, soil, pests, etc (harsh environments)
-ex: winged beans, perennial plants (hot climates), tricale: drought resistant; grows in light, sandy, infertile soil
Green Revolution:
-50 years ago: agricultural research for tropical wheat and rice varieties (for developing countries)
-"miracle" variety- dwarf (Warmon Varlaug) in Mexico
-International Rice Institute in Philippines est. dwarf rice- dramatic increases with these varieties
-green rev. Breeds: "high responders": yield more than other varieties in optimal condition and produce less when under optimal conditions
Genetic Engineering-
-genetically modified organisms (GMO's) or Frankinsteinian foods!
-have DNA containing genes borrowed from unrelated species.
Ex: "golden rice": gene from daffodil- makes rice produce beta carotene (artificial nutrient in many poor countries).
-genetic engineering also creating new animals
-developed in 1980s.
-85% of soybeans and 76% cotton and 45% of corn in the U.S. are GM varieties. Roughly the percentage of GMO crops grown in the US are 75%.
-most of these crops are in the U.S. - Canada and Argentina hold most of these crops outside the

U.S.
Positives and Negatives: crops would require less chemicals, be nutrient rich and could withstand harsh conditions
-however, most are resistant to herbicides and can tolerate more chemical use
-some fear that traits will transfer to wild plants creating super, out-of-control weeds
-expensive
Pest Resistance:
-plants created with genes for insecticides
-Bacillus thuringiensis (Bt): bacterium makes toxins lethal to butterfly family and beetle family- when transformed to crops, protects against these pests
-reduces insecticide spraying
-most Bt crops in North America
-concerns: plants used to perfect conditions and not immune to pests (this natural pesticide is likely to be useless in the near future, so plants could be in danger in the future)
-effects on non-target species: can kill other species because susceptible and pesticides can travel long distances
-ex: can contaminate milkweeds that monarchs feed on
Weed Control- most popular transgenic crops: tolerates high doses of herbicides
-occupy 3/4 of all genetically engineered acreage
-2 main products: Monsanto's "Round up Ready" (resists glyphosate) and AgrEvo's "Liberty Link" crops (resists glufosinate).
-exterminates weeds but forces greater amounts of herbicides
-if widespread could create herbicide resistant "super weeds" (genes jump to wild relatives mostly in high biodiversity regions)
Public Opposition-
public shows concerns for safeness and making rich farmers richer and poor farmers bankrupt
-1999: protestors in India burnt crops suspected of genetic engineering
-objections strong in Europe (esp. Italy)
-2001 European Parliament passed rules requiring strict testing, monitoring and labeling of genetically engineered food products and seeds. Also banned genes for antibiotic resistance in plants: fear bacteria would become immune to it.
-potential risks to human health
-2000: StarLink corn only for livestock mixed into corn used in variety of human foods.
Sustainable Agriculture: (regenerative farming)
-aim to produce food and fiber on a sustainable basis and repair the damage caused by destructive practices.
Alternative Methods:
Soil conservation- soil is renewable resource
-most important elements in soil conservation: land management, ground cover, climate, soil type and tillage system
Managing Topography- water runoff downhill causes erosion: contour plowing- leave grass strips in waterways (plowing across hills, rather than up and down).
-like this is Strip Farming- planting of different kinds of crops in alternating strips along the land contours
-ridges created by cultivation make little dams that trap water to seep into the soil rather than runoff
terracing- shaping the land to create level shelves of earth to hold water and soil: edges of terraces planted with soil, anchoring plant species
-this is expensive and requires much hand labor (or expensive machines), but makes farming on steep hills possible
perennial species: plants that grow for more than two years- necessary for some crops to protect certain unstable soils on sloping gradients or watercourses (low areas w/ water runoff)

Ground Cover: protect soil
-cover crops (crop residues)
-interplanting of two different crops (or more) in same field (not only protects but produces double harvest) ex: beans or pumpkins planted in between corn rows- beans provide nitrogen for corn, pumpkin crowded out weeds and both crops provided balance of nutrients for corn
-Mulch: manure, wood chips, straw, seaweed, leaves, and other natural products
Reduced tillage: machines just cover seeds so do not disrupt ecosystem