FOOD PRODUCTION
Food Supplies

• 14 plants provide 90% of world’s calories
  – 47% of all calories consumed come from wheat, rice, and corn
  – Meat only consumed as income grows.
• There is enough food on Earth for everyone if evenly distributed
• 3 Most Deficient Nutrients in Diets Worldwide
  – Vitamin A – prevents blindness
  – Iron – low iron levels (anemia) causes fatigue, bleeding, and increases infection chances
  – Iodine – helps thyroid gland function – helps proper hormone function – deficiency causes a goiter
How was food grown traditionally?

• Traditional agriculture techniques have these characteristics:
  – Polyculture (many crops on the same piece of land)
  – Low fertilizer & pesticide use
  – Lots of manual labor
  – Use of animals of burden
  – Little to no machinery or ag technology used
  – Low GMO use
Examples of Traditional Ag

- Subsistence Farming – families grow small plots of food, primarily for feeding themselves

- Slash and Burn Agriculture – families cut vegetation to farm land and burn it to clear it and add nutrients in the ash to the soil
  - Can lead to biodiversity loss and deforestation problems if many users do this
  - Only works for a few years – nutrients in vegetation will be depleted after farming; with no remaining vegetation, nutrients cannot be sustained
Industrial Agriculture - How Did We Grow More Food?

• Answer: The “Green Revolution”
  – This is a significant increase in worldwide food production (starting in 1950s and 1960s)

• What is done in the “Green Revolution” or industrialized agriculture to increase food?
  – Development of high-yield crops (those that produce more food per plant)
  – Shift to monocultures (growing only 1 crop at a time) from polycultures
  – Increased use of artificial fertilizers
  – Increased use of pesticides
  – Increased use of irrigation technologies
  – Increased use of farming machinery
  – Grow multiple rounds of crops on the same field in the same growing season
  – Use of GMOs
The Results of the Green Revolution

• Did The Green Revolution Work?
  – YES! There is MUCH more food!
    • Grain production has grown (most is used to feed animals now)

• Can We Keep This Up?
  – Farming has a HEAVY toll on resources. Such impacts are:
    • Reduced fertilizer raw materials
    • Reduced freshwater for irrigation
    • Increased fertilizer pollution
    • Increased pesticide pollution
    • Increased farming costs with decreasing profit margins
    • Decreasing amounts of arable land – the word for land suitable for farming
    • Habitat loss to create farmland (particularly bad for native grasslands)
    • Increased soil erosion, desertification, and salinization


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Sources: International Food Policy Research Institute, October 1999, US Bureau of the Census, and CIA.
Types of Industrialized Agricultural Systems

• Concentrated Animal Feeding Operations (CAFOs) or Feedlots – large scale animal monoculture
  – Pros:
    • Efficient – more animals can be grown and faster with more profit
  – Cons:
    • High animal density spreads disease easily
    • High antibiotic use leading to resistance
    • High concentrations of animal waste – pollution concerns
    • Concerns over animal welfare
Aquaculture – raising seafood in controlled environments

Pros:
- Efficient – can raise many individuals in small spaces
- Can be done in the wild or in artificially constructed tanks
- Can raise species that have low populations in the wild

Cons:
- Species can escape and become invasive
- Farmed species often spread disease and parasites to natives
- High concentrations of animal waste in the water
- Some operations use lots of antibiotics
- Concerns over animal welfare
Types of Industrialized Agricultural Systems

• Plantation Agriculture – industrial farming for tropical cash crops for import to other geographic regions
  – Pros:
    • Cheap production – usually done in a developing nation
    • Provides novelty goods to other nations (like coffee, tea, pineapple, tropical fruits, sugar)
    • Efficient – usually a monoculture
  – Cons:
    • Usually pays low wages to workers, making prices artificially low
    • Monoculture impacts, like overuse of fertilizer & pesticide
    • Promotes loss of habitats like tropical rain forest
Recent Agricultural Trends - Organic Farming

- There are 5 things not allowed in organic farming – refer to prior notes for these
- Benefits of Organic Farming
  - Less pesticide and fertilizer manufacturing and pollution
  - For those who it concerns, no GMO and hormone use
  - More biodiverse than other farming
- Issues Surrounding Organics
  - More expensive to produce
    - More laborious, more loss of product to pest, more inputs needed
  - No indication organic food is more nutrient rich
  - More land may be required for organic farming
Recent Agricultural Trends – Urban & Vertical Farming

• Growing food in urban areas either on roofs, hydroponically, or vertically in larger buildings/skyscrapers

• Benefits
  – More local food produced (less transport needed)
  – Can be grown over less land
  – Can be grown more efficiently than traditional crops

• Potential Issues
  – High energy use (for greenhouse lights or water use)
  – Increased costs for running and setup
  – Increased CO₂ emissions depending on electricity use
Recent Agricultural Trends - GMOs

- **GMO** = Genetically Modified Organism

- **Example – Bt Corn**
  - Corn is enhanced with bacterial DNA to help corn to produce certain proteins
  - Proteins kill certain corn pests, including the European Corn Borer

- **Example – Golden Rice**
  - This is a strain of GMO rice that has enhanced levels of vitamin A.
  - Vitamin A was enhanced by embedding bacterial DNA to help in the creation of vitamin A
  - Used around the world to enhance the nutrition of people who regularly face malnutrition
Recent Agricultural Trends - GMOs

• Pros of GMOs
  – Higher yields of crops mean less land use
  – Many GMOs survive well in no-till and conservation tilling, meaning less soil impact
  – Can provide large amounts of food to feed a growing population
  – Can provide cheap sources of food to poorer nations
  – Crops can grow earlier and later in the growing season
  – There is no to low evidence that GMO crops that cross pollinate with non-GMO plants cause any harm
  – Some GMO crops may have:
    • Lower fertilizer requirements
    • Insect resistance (reduction in pesticide use)
    • Drought resistance
    • Salt resistance
Recent Agricultural Trends - GMOs

• Disadvantages of GMOs
  – Insect resistance can affect non-pest insects
  – Resistance to various conditions could accidentally get transferred to other plants if there is cross-pollination of GMOs with non-GMOs (this could be bad if the resistance is transferred to weeds)
  – Salt and drought resistant crops force farming on lands that are sensitive to development
  – Development of genetic monocultures
  – Public fear/concern over GMOs
  – GMOs could hinder the normal cultural means in which people gain access to food
  – Higher crop yields per acre can lead to more soil erosion on that land
  – Concern that GMOs could affect health and body systems
  – Potential exposure of non-GMO organisms to genetically engineered items, such as drugs, vaccines, enzymes, etc