

- Humans: NOx emissions from fossil fuel combustion + N fixation through fertilized production
- Phosphorous
  - Organisms use phosphorus as phosphate (PO<sub>4</sub>)
  - Must be weathered out of rock (mainly sedimentary)
  - Limiting factor in marine production
  - Humans: mining
- Human impacts
  - Haber–Bosch process (non-biological N fixation)
  - Apatite mining
  - Increased N and P production advanced agricultural production, but...
    - Fossil fuel costs of production
    - Excess N and P often act as pollutants

## How Does Modern Agriculture Impact The Environment?

- Agrobiodiversity: Variety + variability of genetic material in lifeforms used by humans for food and other agricultural applications
  - Green Revolution selected crop varieties for production over others → reduced agrobiodiversity
- Loss of crop varieties leads to genetic erosion
  - Resultant crop or livestock monoculture temporarily have higher yields but are more vulnerable to pests and diseases
- In 1940s, synthetic fertilizers + monocultures = agricultural pest infestations
  - Use of pesticides caused toxic bioaccumulation in species above insects in the food chain
- Overuse of pesticides creates chemical resistance and poses risks for humans
- "Roundup-ready" crops: GMOs that allow broadfield spraying to control weeds without affecting crops
- European regulations: new products show they are safe prior to use. United States: new products are safe until shown not to be
- GMOs are creating resistant weeds and insects through natural selection
- When land is intensely cultivated, large areas of bare soil are vulnerable to erosion, where water and wind redistribute soil particles across landscape
- Irrigation systems speed up erosion when application rates exceed abilities of cultivated soil to absorb water
- Intensive irrigation speeds up leaching and salinization
- Agriculture draws on most water resources and uses two-thirds of all freshwater
- Due to drilling and pumping, groundwater supplies 40% of irrigation water
- As an aquifer dries up, subsidence may occur where formerly water-filled places collapse under weight of overlying rock and soil

## How Is Meat Production Changing What We Consume?

- Farmers = more specialized and industrialized, crop/animal agriculture decoupled
- Farms use synthetic fertilizers and predominantly raise livestock in Concentrated Animal Feeding Operations (CAFOs)