

Strategic Issues

Global Warming

Population Growth

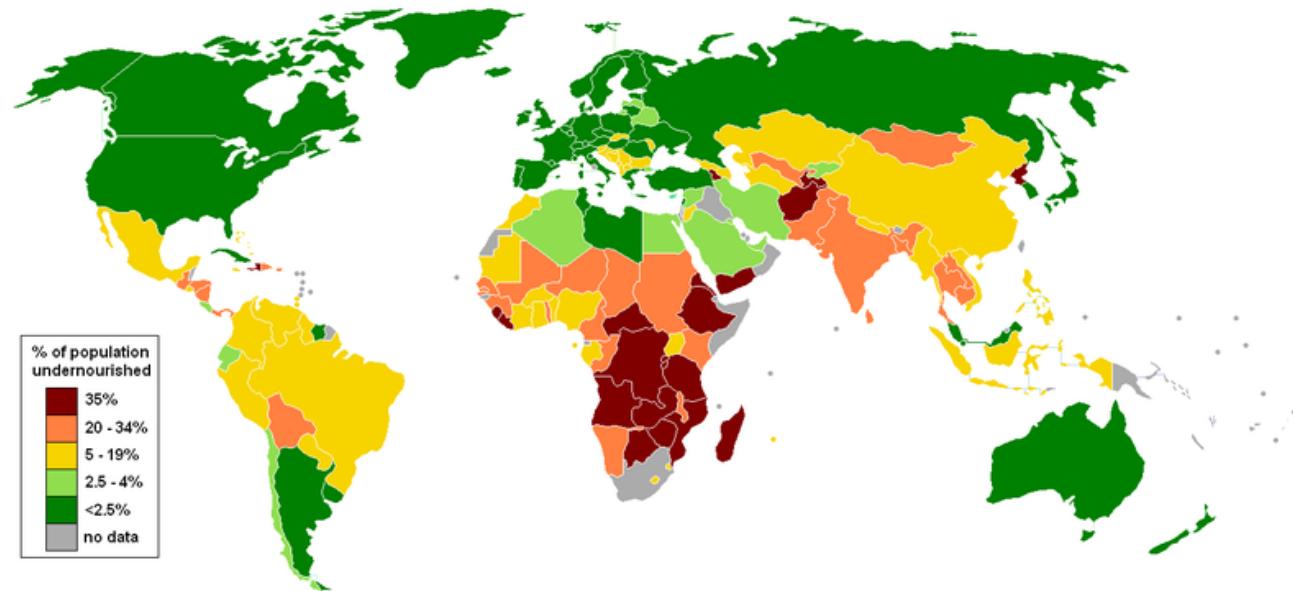
Year	World Population	Span in Years
1804	1 billion	
1927	2 billion	123
1960	3 billion	33
1974	4 billion	14
1987	5 billion	13
1999	6 billion	12
2019	7 billion	11
2026	8 billion	7

The Rise of The Middle Class

China, India, Russia, Malaysia, etc
1980-2000: 250 million new middle class

U.S. Food Problems

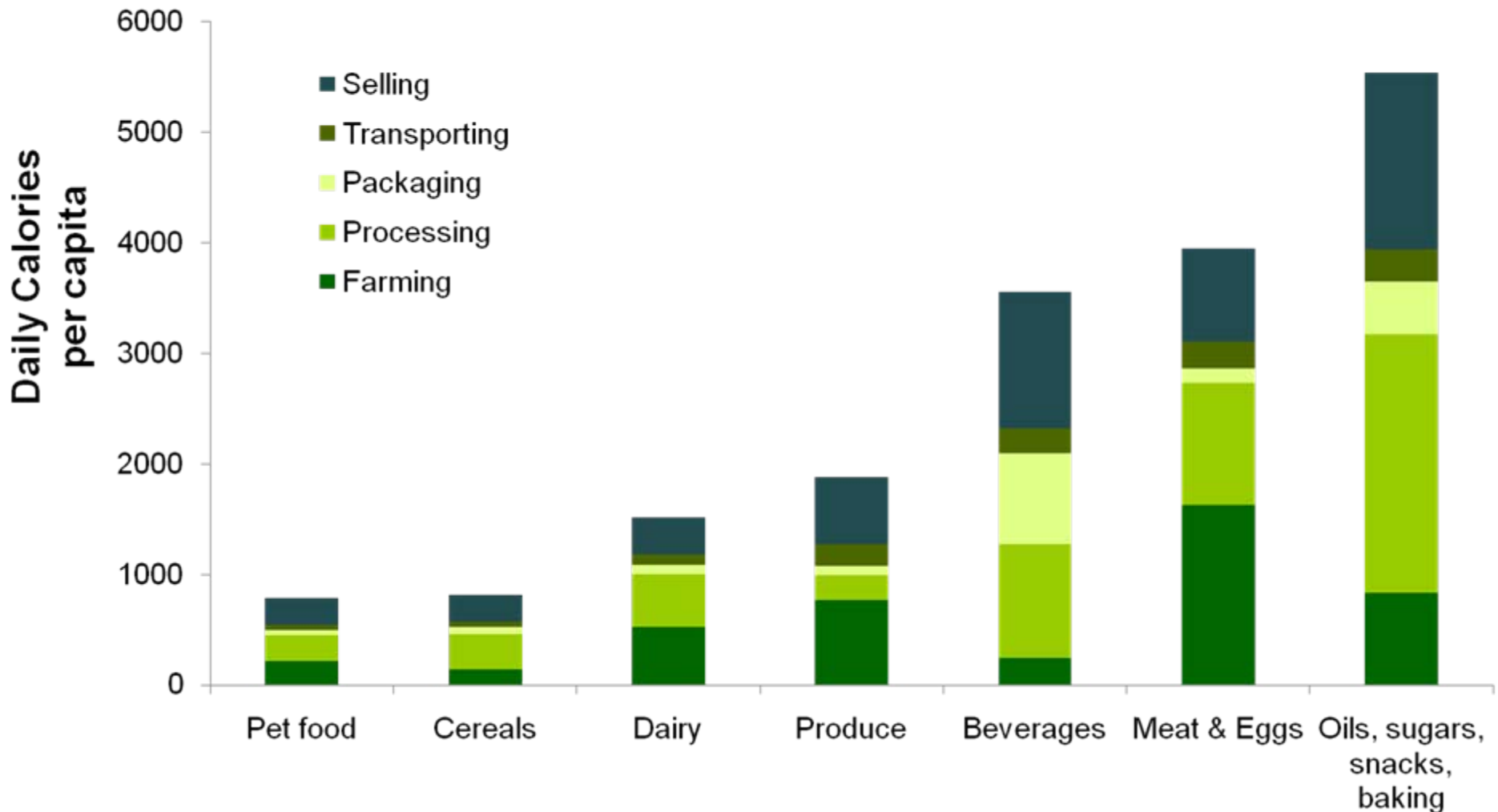
1. Food Consumption
2. Types of Food Produced
3. Production Methods



U.S. Food Consumption and Waste

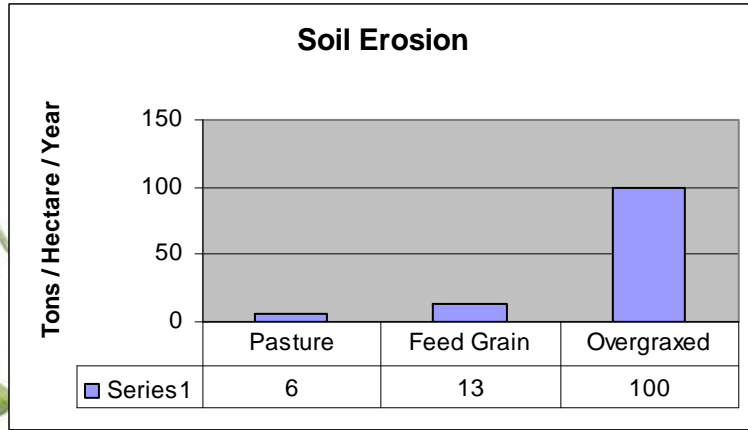
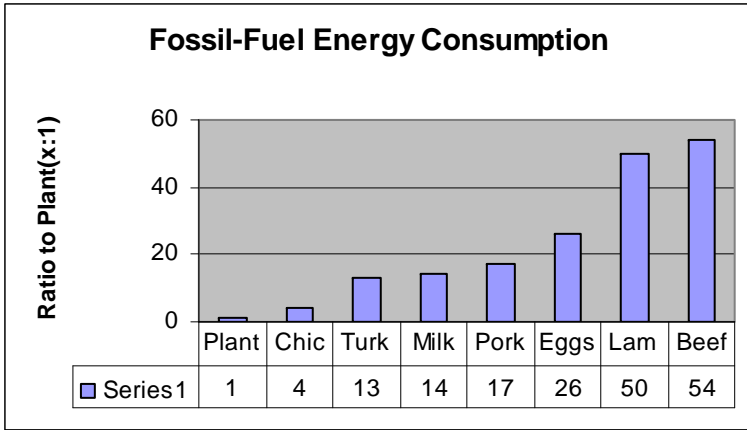
- **Americans eat 815 billion calories of food each day - that's roughly 200 billion more than needed - enough to feed 80 million people.**
- **Americans throw out 200,000 tons of edible food daily.**
- **The average American generates 52 tons of garbage by age 75.**
- **The average individual daily consumption of water is 159 gallons, while more than half the world's population lives on 25 gallons.**
- **Eighty percent of the corn grown and 95% of the oats are fed to livestock.**
- **Fifty-six percent of available farmland is used for beef production.**
- **Every day an estimated nine square miles of rural land are lost to development.**

Food Consumed in the U.S.

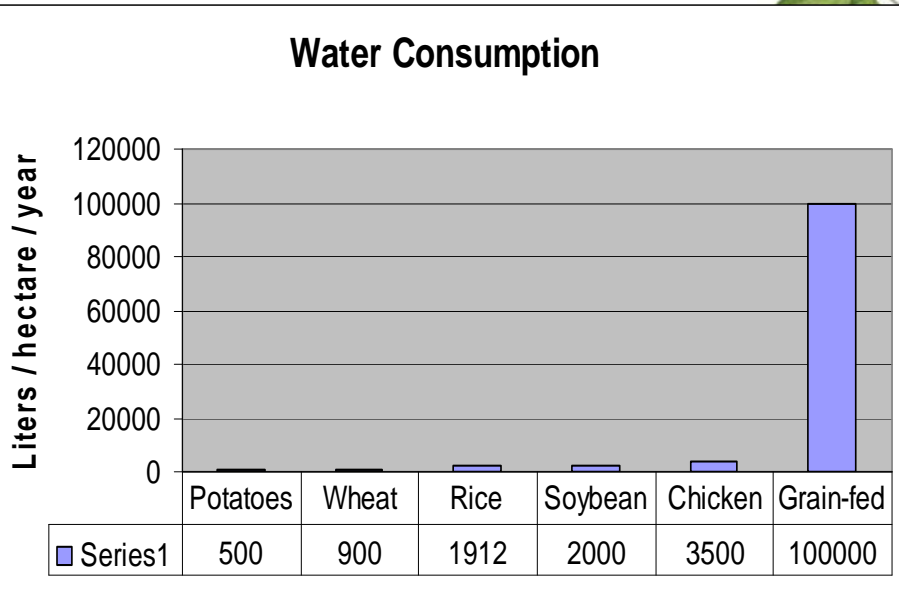


Source: Graph by Michael Bomford, based on data in [Canning et al, 2010](#), Table 6, pp. 22-23. ⁶

Impact of Food Type

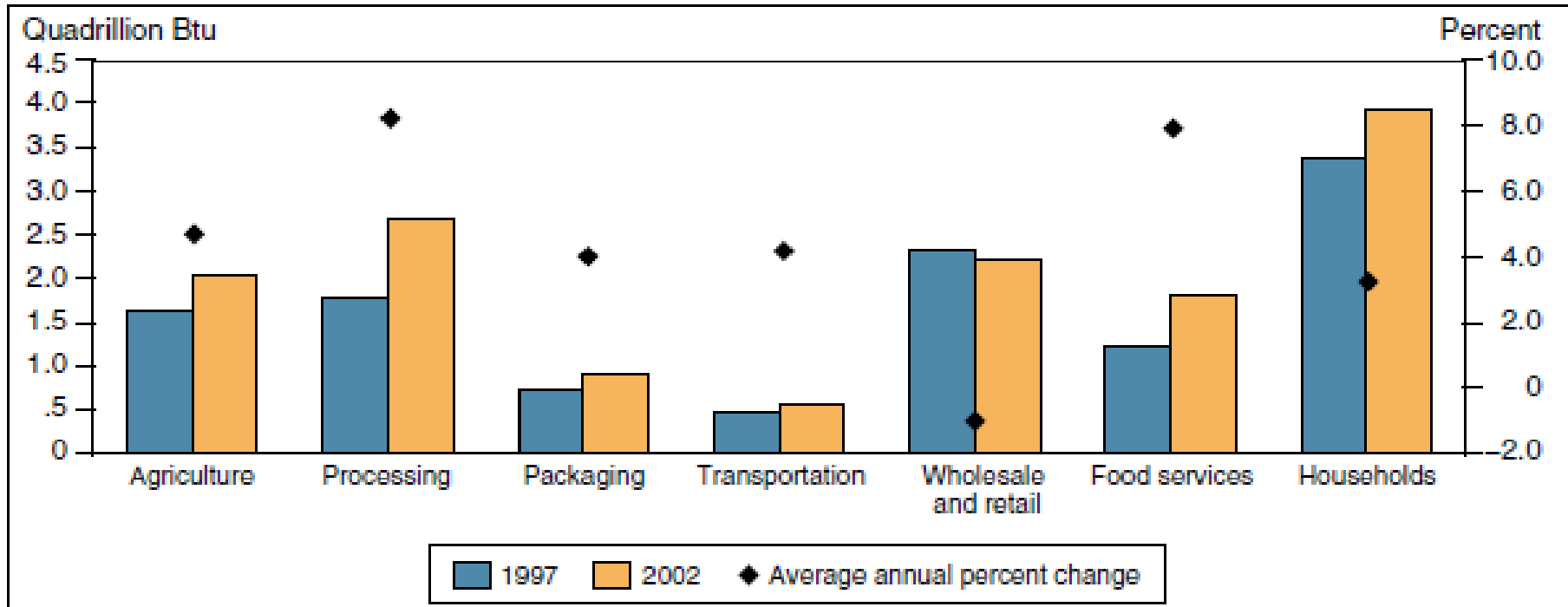


One-third of the world's fish catch and more than one-third of the world's total grain output is fed to livestock.



It takes an average of 25 gallons of water to produce a pound of wheat in modern Western farming systems. It takes 5,214 gallons of water to produce a pound of beef.

Food Energy Consumption

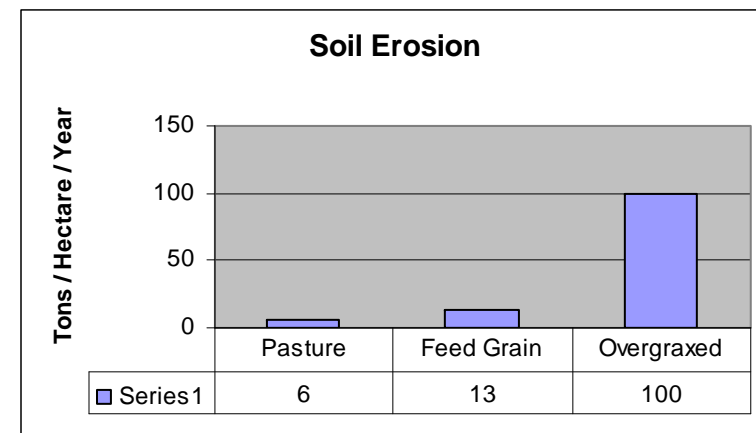


Source: USDA, Energy Use in the U.S. Food Production, Economic Research Report Number 94, March 2010

Food Production Methods

- Growing food requires three things:
 - Soil
 - Water
 - Fertilizer
- Modern Methods: huge, high output farming enterprises
- Organic Methods

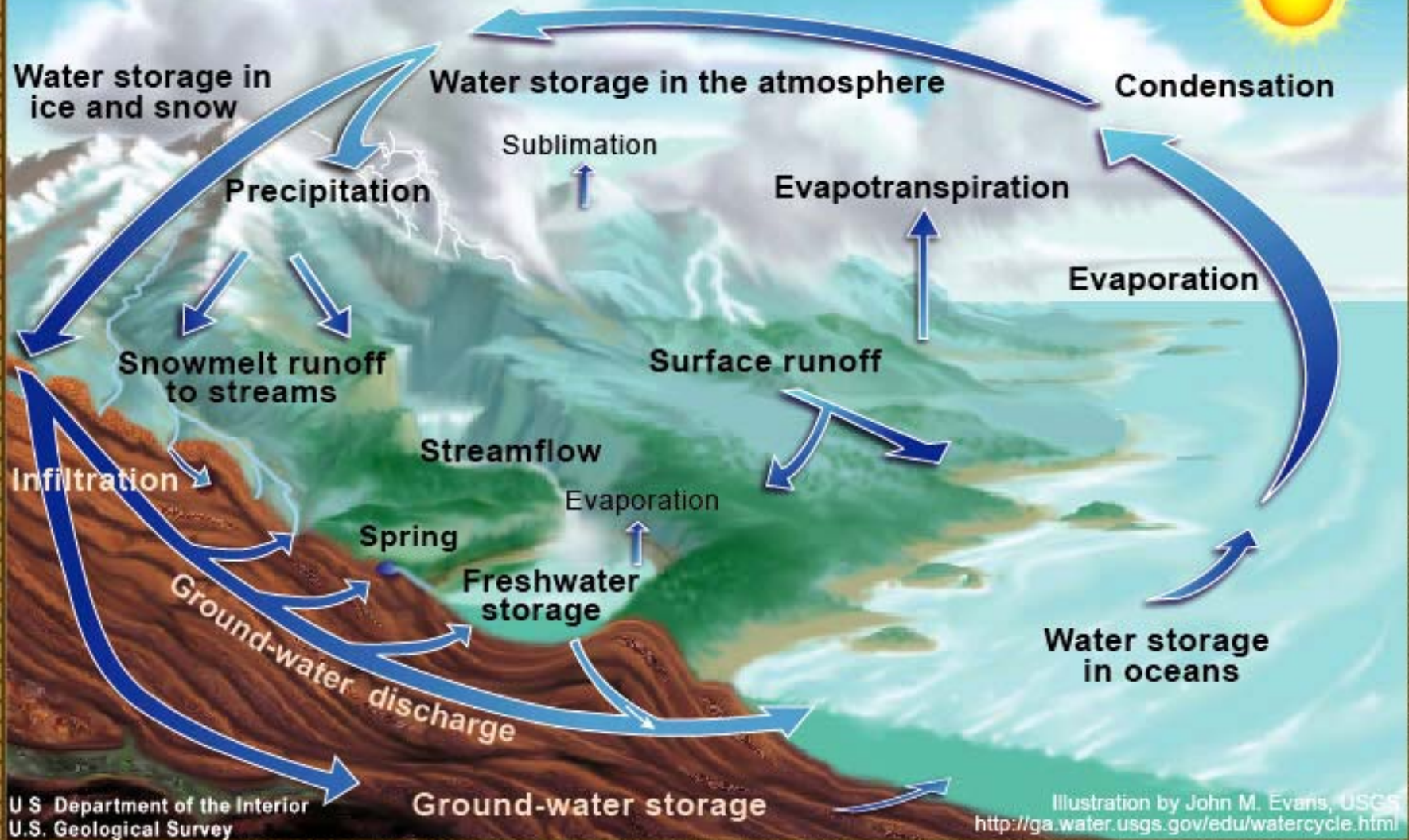
Soil



- Civilizations fall when they lose their soil, e.g.
 - Greece
 - Maya
 - Mesopotamia
 - China
- Erosion Accelerators
 - Removing natural cover
 - Tilling
 - Climate change

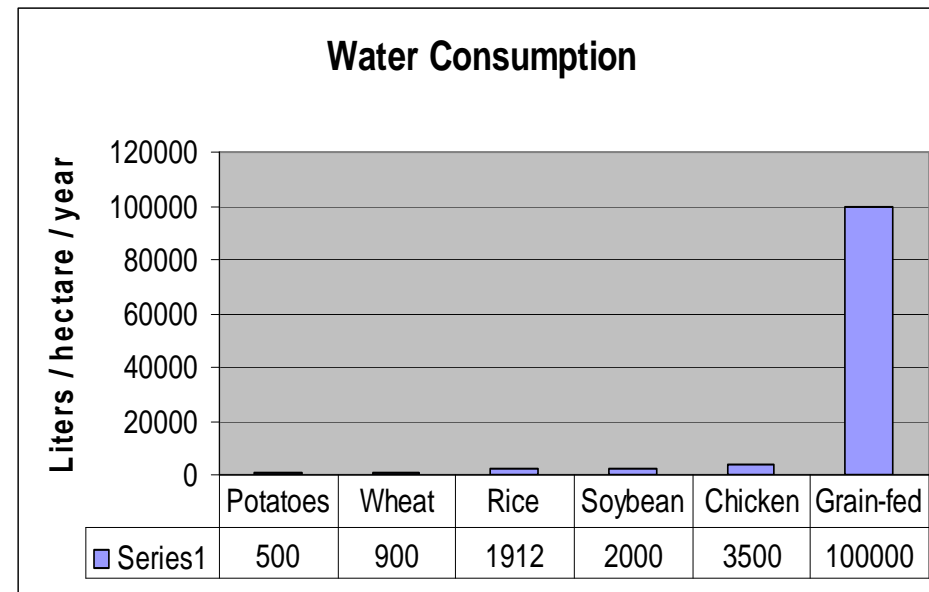
What we do to the land, we do to ourselves. *Wendell Berry*

The Water Cycle



The U.S. is overusing its water

- The U.S. has 3,069 km³ available per year
- It uses ~30% more than that
- The extra is pumped from aquifers
 - Source: Pacific Institute



Inorganic Fertilizer

- The minerals used in agriculture are diminishing rapidly
- The Big Three
 - Nitrogen
 - Phosphorus
 - Potassium

Nitrogen: King of Life and Death

- Abundant: Too much of a good thing
- Most commercial crops need a lot
 - Fast growth, shallow rooting, rapid soil turnover
 - Leads to large amount leaching (leaving) the soil as runoff due to rain, watering, snow melt, etc.
- In relatively still waters (oceans, lakes, Hood Canal) this spurs rapid growth of algae which absorbs oxygen and creates dead zones

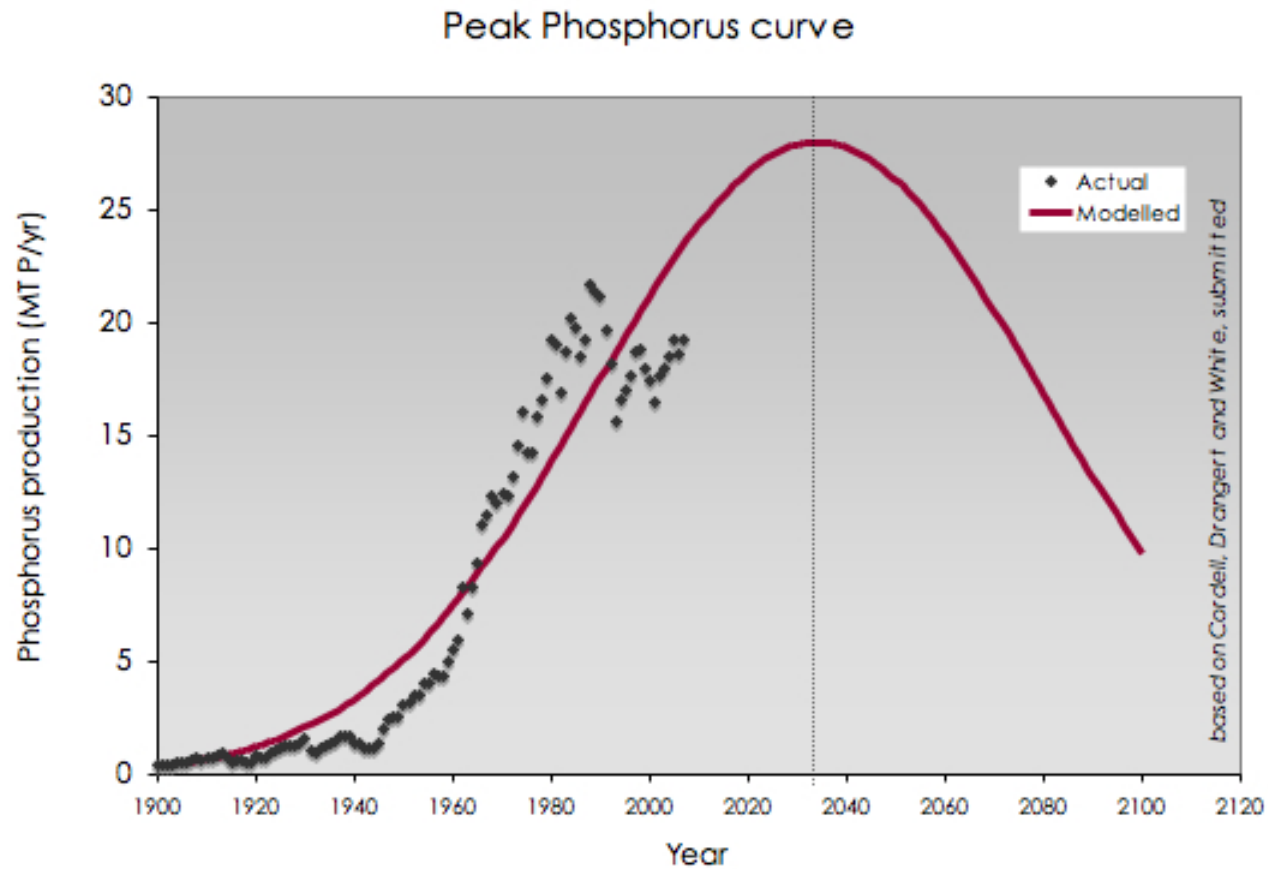
Potassium: The First To Go

- Obtained by mining
- Primary ingredient of cereal grains
 - Current yields of wheat are 8 tons/hectare
 - Without potassium yield drops to 2.5 tons/hectare
 - Organic farming yields 6 tons/hectare, independent of added potassium
- Potassium prices have soared
 - Once a commodity at \$200/ton, it is expected to reach \$1,500/ton by 2020. Its price in Vancouver in 2009 reached a record high at \$872.50/ton.

Phosphorus: Life's Bottleneck

- Concentration Factor = 5.8
 - Concentration in soil = 0.12%
 - Concentration in plants = 0.7%
 - Next closest are sulfur at 2.0 & chlorine at 1.5. All the rest are less than 1
- Phosphorus costs are also rising
 - Rose from \$50/ton to \$350/ton in 14 months(2008)
 - Peak production expected to be reached in 20 years

Peak Phosphorus



Goals to Protect Food Availability

- Increase local food production
 - Increase area for farming
 - Provide sufficient water for new farms
- Reduce Water Consumption
 - Decrease population growth
 - Decrease individual consumption
 - Decrease livestock raising
- Decrease soil loss
 - Decrease livestock raising
 - Increase no-till farming
- Decrease Fertilizer Use
 - Increase organic farming

