






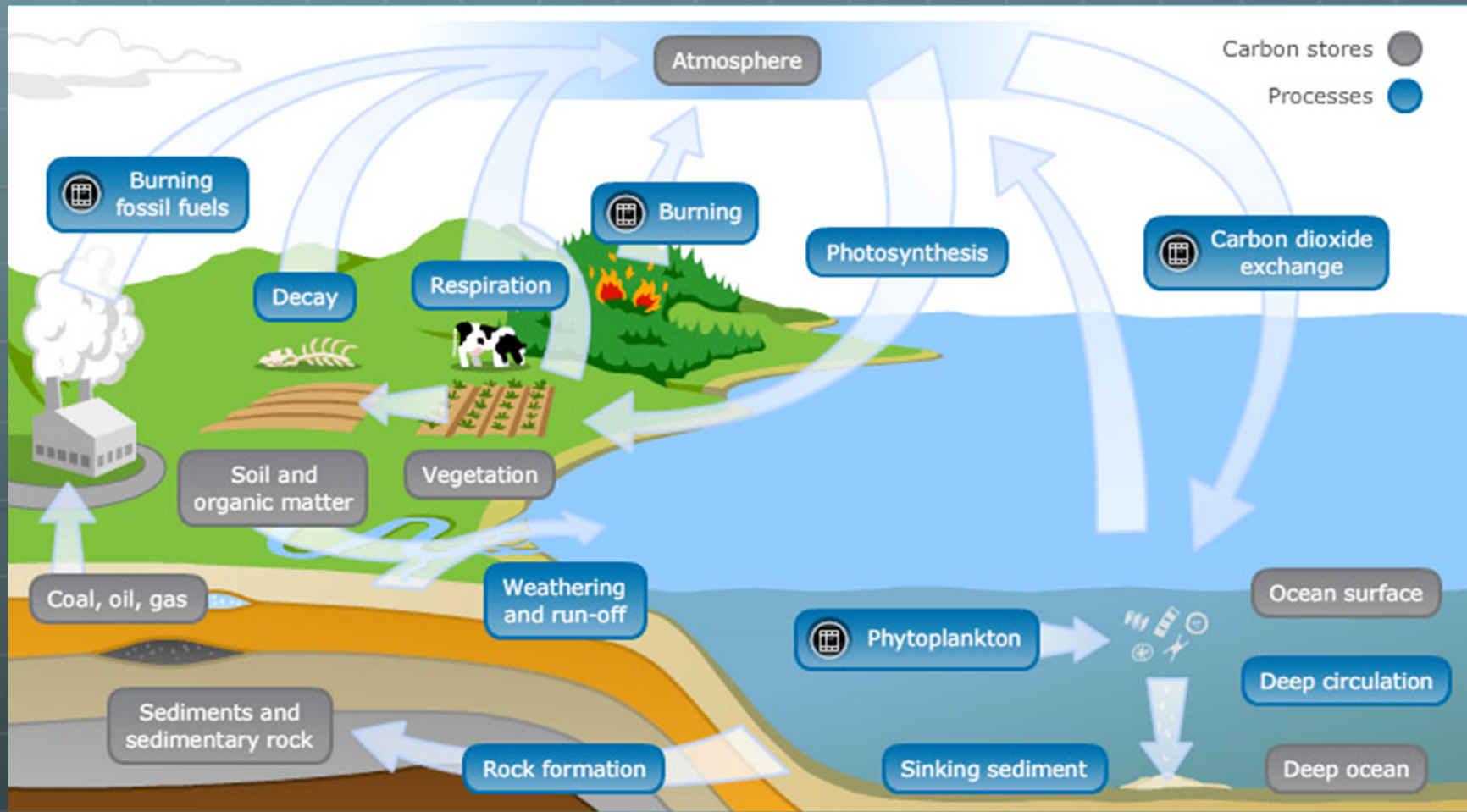
# **Circular Economy: Business in Nature's Image**

Janet E. Hawkes, Ph.D.

# Natural Cycles

-  Carbon Cycle
-  Water cycle
-  N Cycle
-  Earth Cycles
-  Agriculture – Energy – Nutrient – Water Cycle
-  Stellar cycles

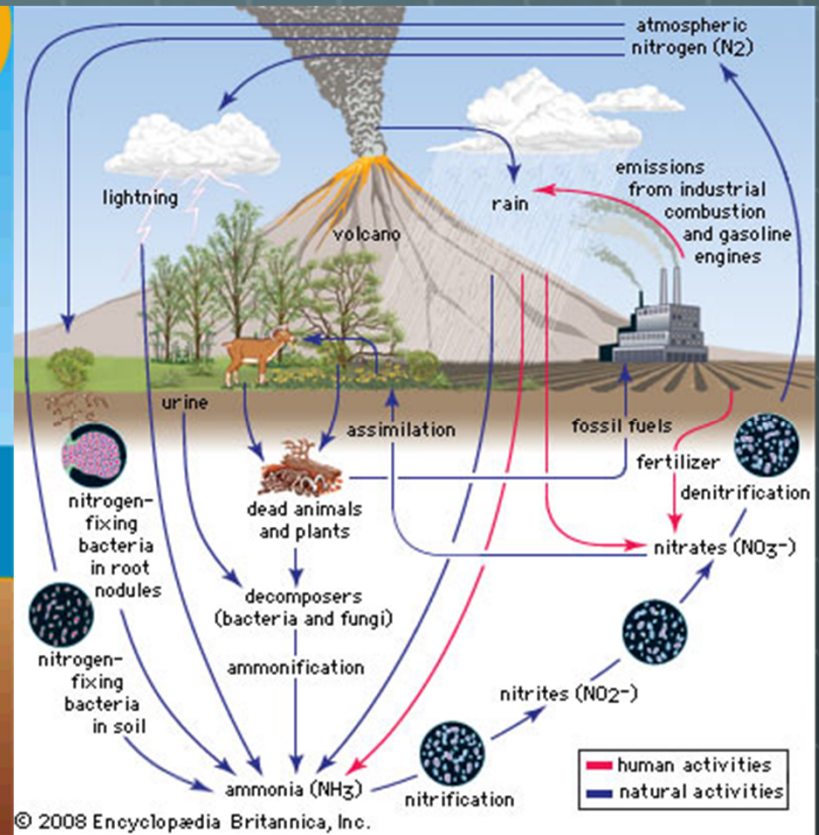
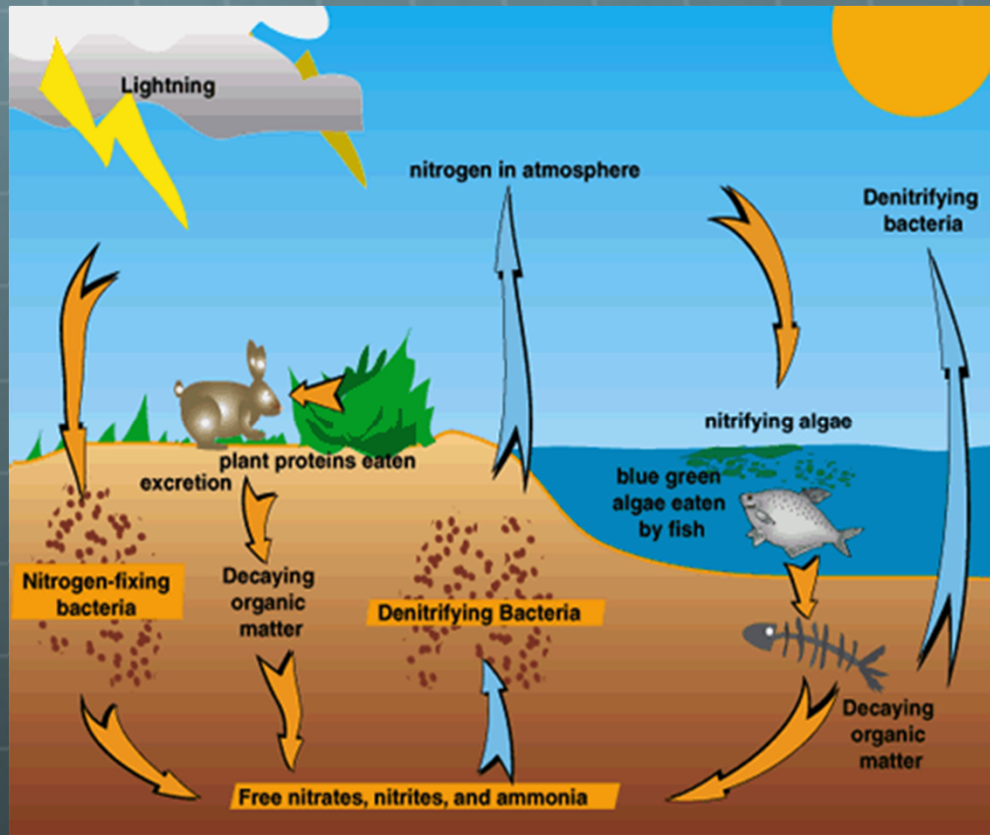
# The Carbon Cycle



From University of Waikato, NZ



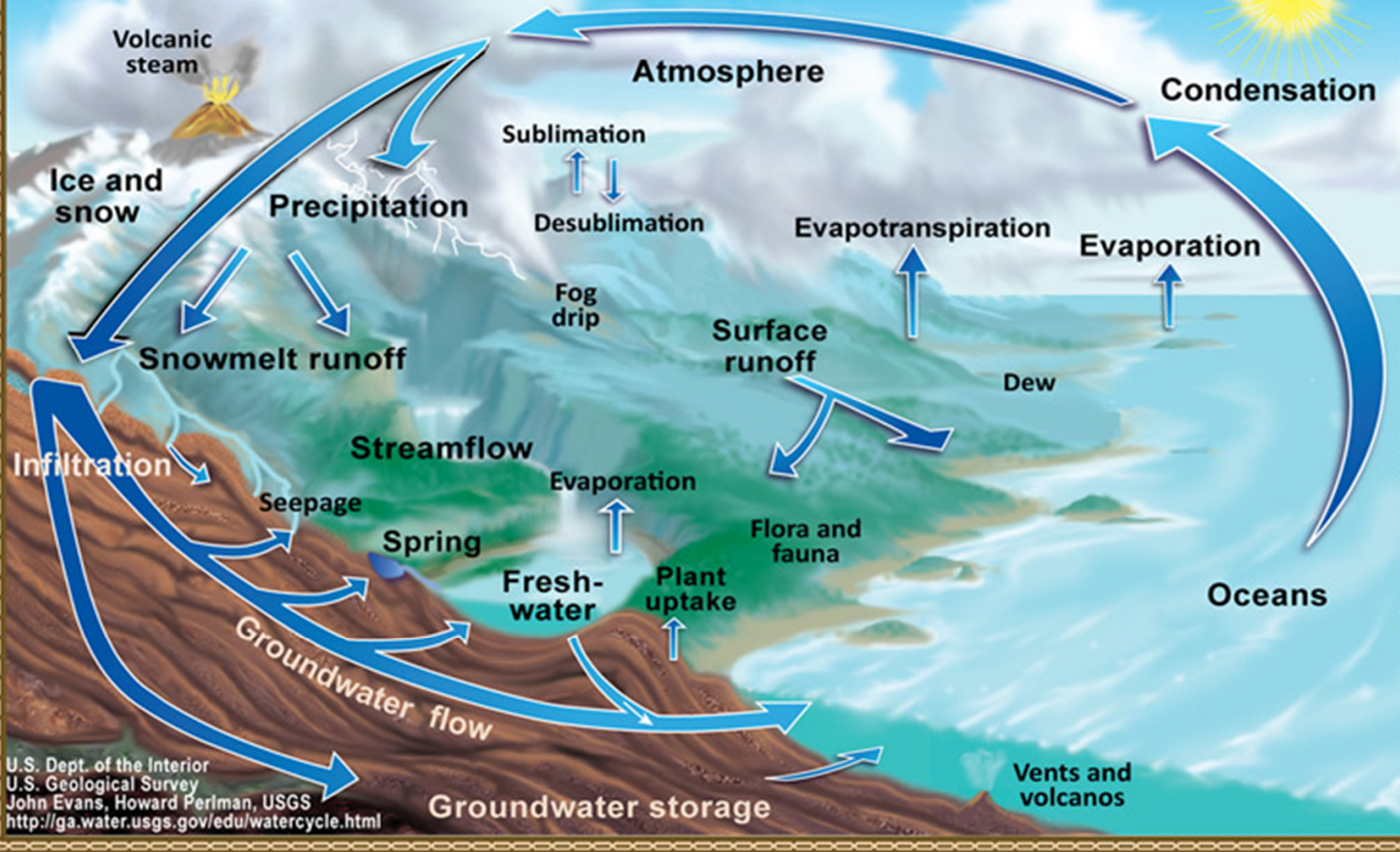
# The Nitrogen Cycle



© 2008 Encyclopædia Britannica, Inc.

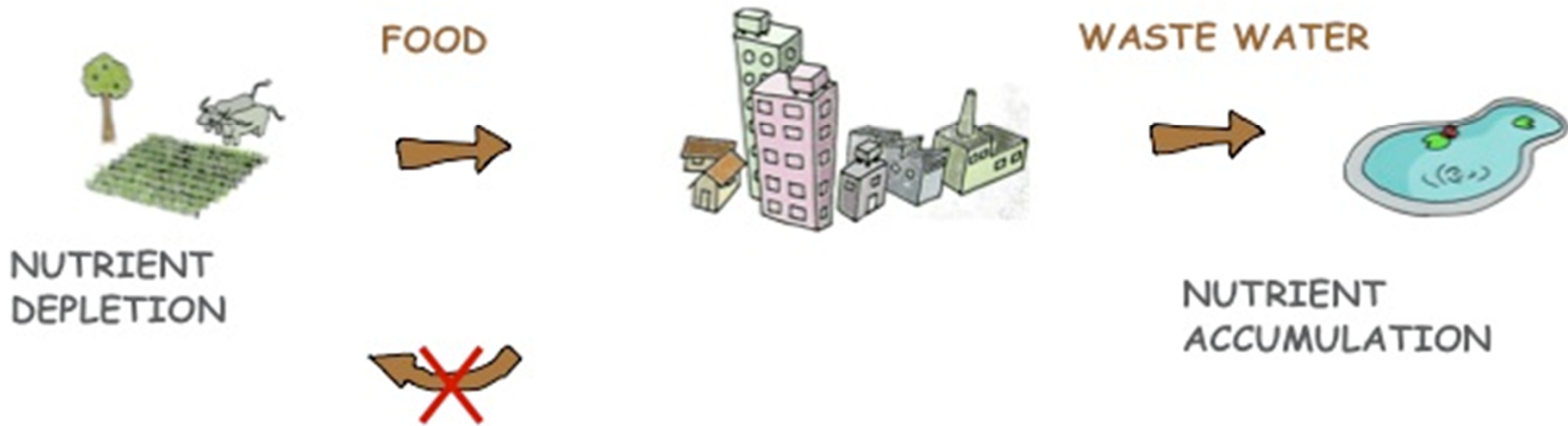


# The Water Cycle

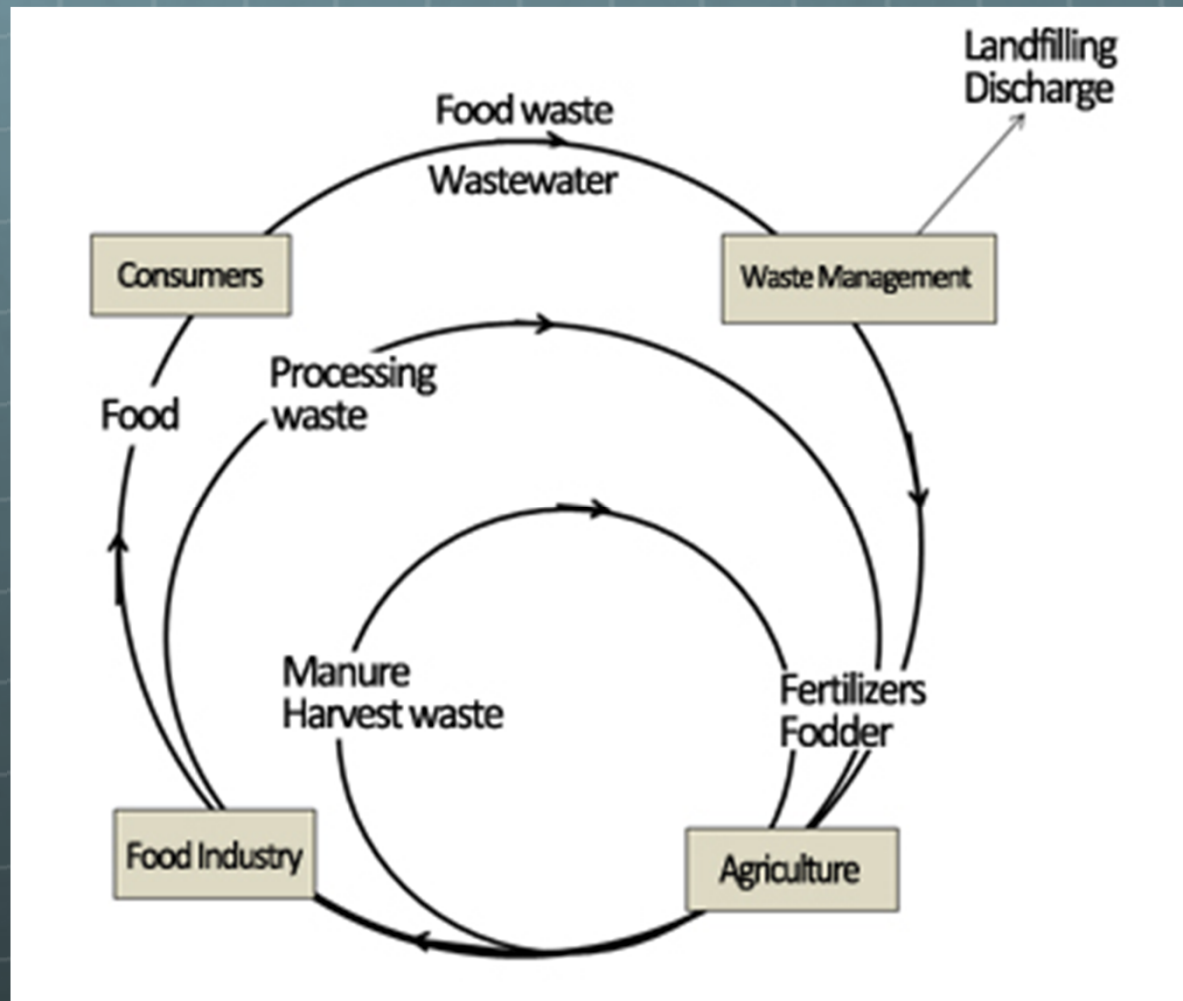


# One-way vs Circular

→ NUTRIENT FLOW →



# Food Loops










# Agriculture and Bioenergy

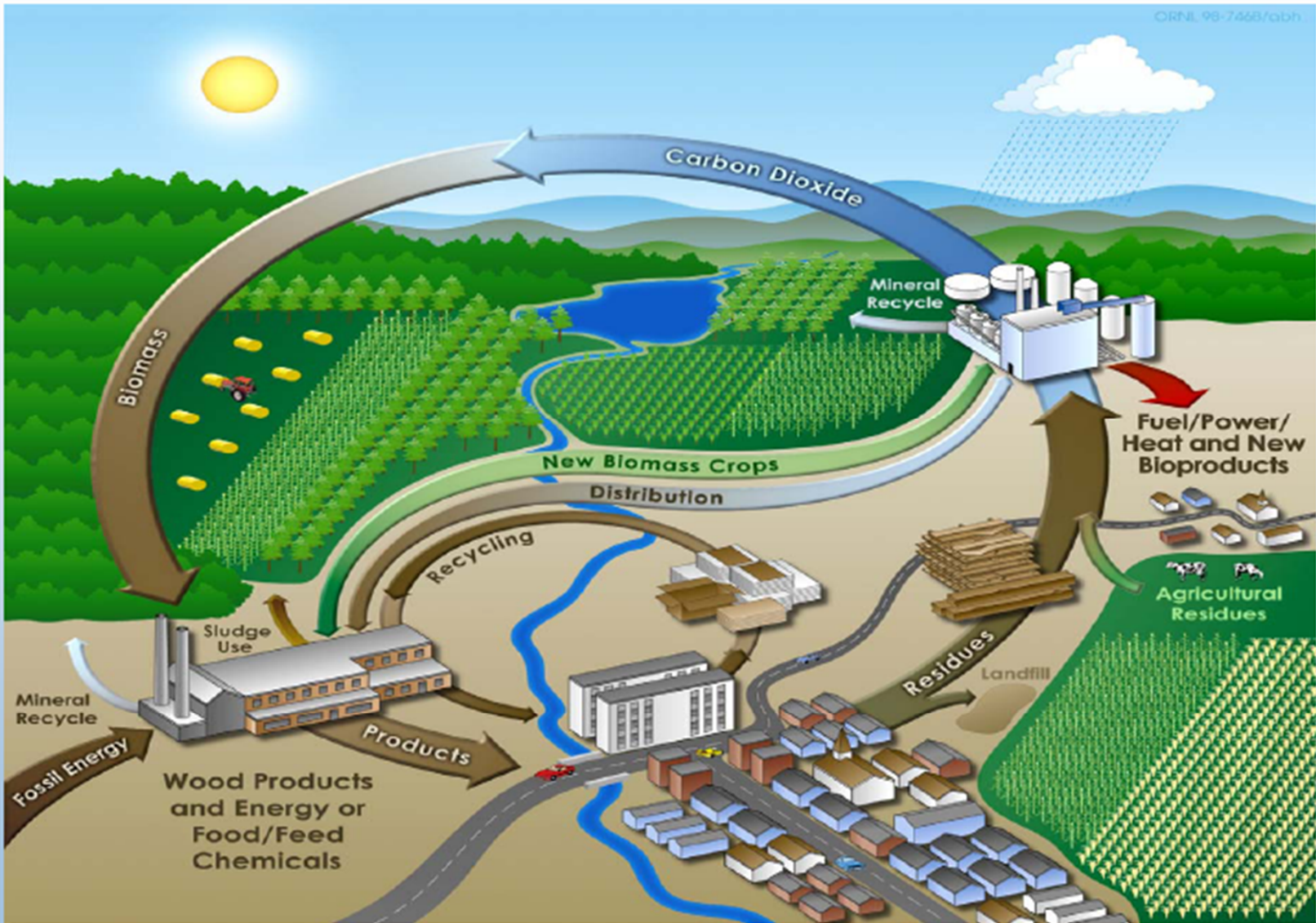
## 100% Invested

- 🌐 100% Eaters!!!!!!
- 🌐 Health and Safety
- 🌐 Economics
- 🌐 Policy Framework
- 🌐 All Energy converters
- 🌐 Waste = unrealized asset!!!

# Examples:

-  **Food Waste**
-  **Waste 2 Energy**
-  **Waste to Water**
-  **Waster to Fertility**
-  **Other Systems & Co-Products**

# Biomass Carbon Cycle





# Food “Waste”

- 🌍 1/3 of all food produced worldwide, approx. \$1 trillion USD, gets lost or wasted in food production and consumption systems
- 🌍 converted to calories - about 1 in 4 calories are never actually eaten
- 🌍 Every year, consumers in industrialized countries waste almost as much food as the entire net food production of sub-Saharan Africa (222 million vs. 230 million tons)

# Food Waste Examples

AMERICANS EAT APPROXIMATELY  
**3.2 BILLION POUNDS**  
OF BANANAS A YEAR

**THAT'S 304 BANANAS  
EVERY SECOND!**





**12%**

**OF A BANANA'S  
WEIGHT IS THE PEEL**

**THAT'S 780 MILLION POUNDS OF  
PEELS HEADED FOR LANDFILLS!**

# More than 3Rs

-  reduction
-  reusing
-  recycling
-  recovering
-  rethinking
-  renovation
-  regulation







From: The Gaia Legacy; and Cradle to Cradle









# Importance of Food

- 🌍 **“Food is everyone’s issue, whether you work on healthcare, the environment, labor issues, immigration, social justice, education, biotechnology, law, or numerous other fields.”**
- 🌍 **“Complexity of the food system and the interconnectedness between the food system and other fields, including domestic policy, international policy, the economy and capitalism, and the environment.”**

# Strategic and Critical Commodities or Services

-  Food
-  Energy
-  **Water**
-  Waste Management
-  Nutrients
-  Supply Logistics

# Regulation

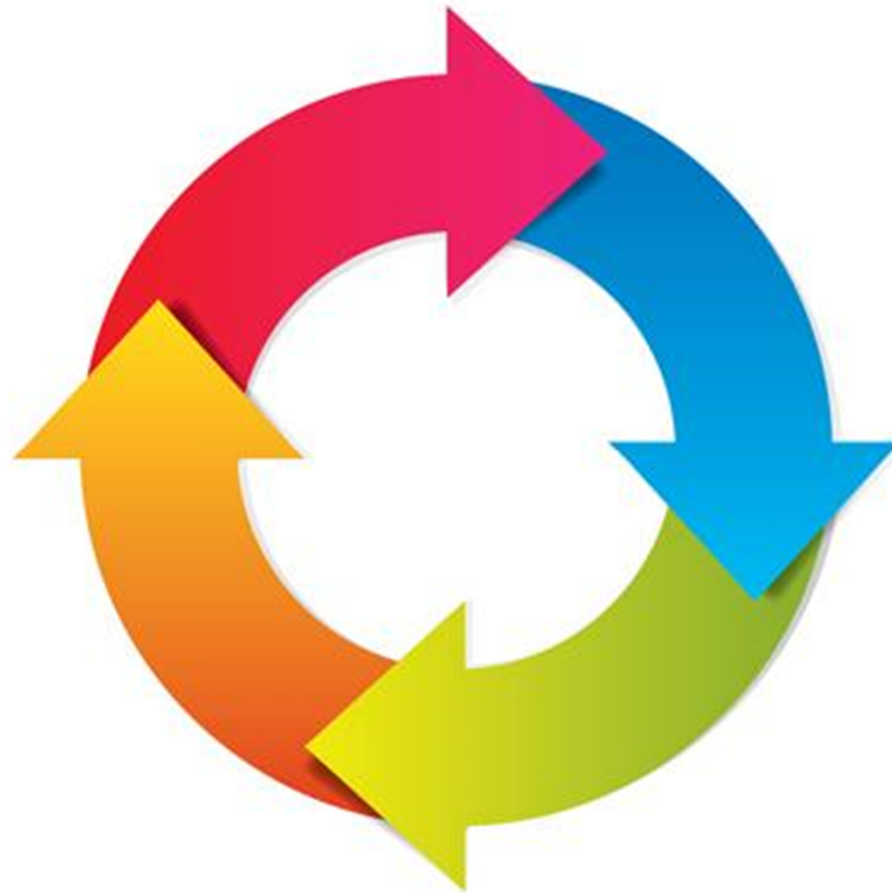
-  **Water Rights**
-  **Public Health**
-  **FSMA**
-  **Utilities**
-  **Transportation**
-  **Other regulations**



# Commercial Dimensions

- 🌐 Not Core Business
- 🌐 Lack of Capacity
- 🌐 Too many markets
- 🌐 Variety and complexity of regulations
- 🌐 Scale and returns
- 🌐 Risk Management

# Thank you



Janet E. Hawkes, Ph.D.  
janethawket@gmail.com