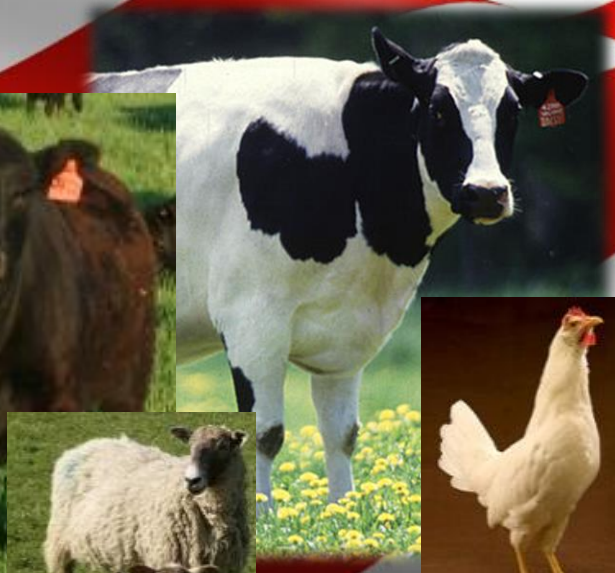


Thank You.

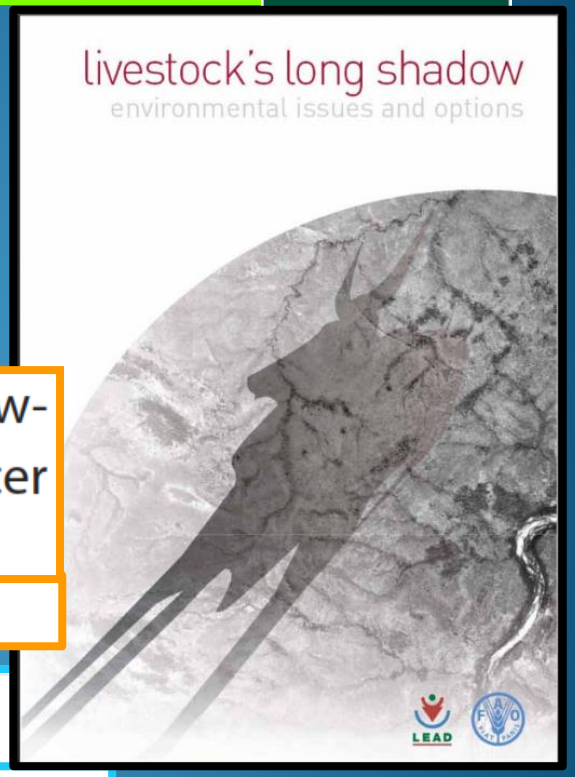
Livestock In The U.S.

- Employs 1.6 million people
- $31.8 billion in exports
- Recycle 43.2 billion kg of human-inedible by-products of food, fiber, & biofuel
- Adhesives, ceramics, cosmetics, fertilizer, germicides, textiles, ointments, heart valves, etc.
- Convert resources that people cannot use into things we can.

Livestock In The News

Is the Livestock Industry Destroying the Planet?

SMITHSONIAN.COM



Our results suggest that vegetarians have a significantly lower ischemic heart disease mortality (29%) and overall cancer incidence (18%) than nonvegetarians.

Huang et al. (2012) Annals Nutr. & Metab. 60:233-240

≡ EcoWatch

Researchers Say Only Way to Guarantee Enough Food in 2050 Is if the World Turns Vegan

Livestock pollute water & air, erode land, cause deforestation, are inefficient, compete with people for food & water….

Our Food Web

Human Society

By-Product Feeds

Animal Agriculture

Feed

Food, Fiber Biofuel, Other

Fertilizer/Biosolids

Plant Agriculture

Van Horn and Hall, 1997

What would U.S. food supply, meeting U.S. nutrient requirements, and green house gas production look like if we removed farmed animals?

Modelled with freely available data, No outside funding.

White and Hall, 2017

U.S. Population

- 316 million people
- 36 nutrients
- Requirements 1 year

69.9 dogs
74.1 cats
8.3 birds
89.4 other
10.2 horses

Rendered products
Protein 727.5 K tons
Fats 143.3 K tons

10/3/18

Nutrition Facts

Serving Size 1 cup (28g)
Children Under 4 - ¾ cup (21g)
Servings Per Container about 18
Children Under 4 - about 24

Amount Per Serving	Cheerios	with ½ cup skim milk	Cereal for Children Under 4
Calories	100	150	80
Calories from Fat	15	20	10
	% Daily Value**		
Total Fat 2g*	3%	3%	1.5g
Saturated Fat 0.5g	3%	3%	0g
Trans Fat 0g			0g
Polyunsaturated Fat 0.5g			0.5g
Monounsaturated Fat 0.5g			0.5g
Cholesterol 0mg	0%	1%	0mg
Sodium 140mg	6%	8%	105mg
Potassium 180mg	5%	11%	135mg
Total Carbohydrate 20g	7%	9%	15g
Dietary Fiber 3g	11%	11%	2g
Soluble Fiber 1g			0g
Sugars 1g			1g
Other Carbohydrate 16g			12g
Protein 3g			2g
			% Daily Value**
Protein	-	-	9%
Vitamin A	10%	15%	10%
Vitamin C	10%	10%	10%
Calcium	10%	25%	8%
Iron	45%	45%	50%
Vitamin D	10%	25%	6%
Thiamin	25%	30%	35%
Riboflavin	2%	10%	2%
Niacin	25%	25%	35%
Vitamin B_6	25%	25%	45%
Folic Acid	50%	50%	60%
Vitamin B_{12}	25%	30%	30%
Phosphorus	10%	20%	8%
Magnesium	8%	10%	10%
Zinc	25%	30%	30%

*Amount in cereal. A serving of [illegible]

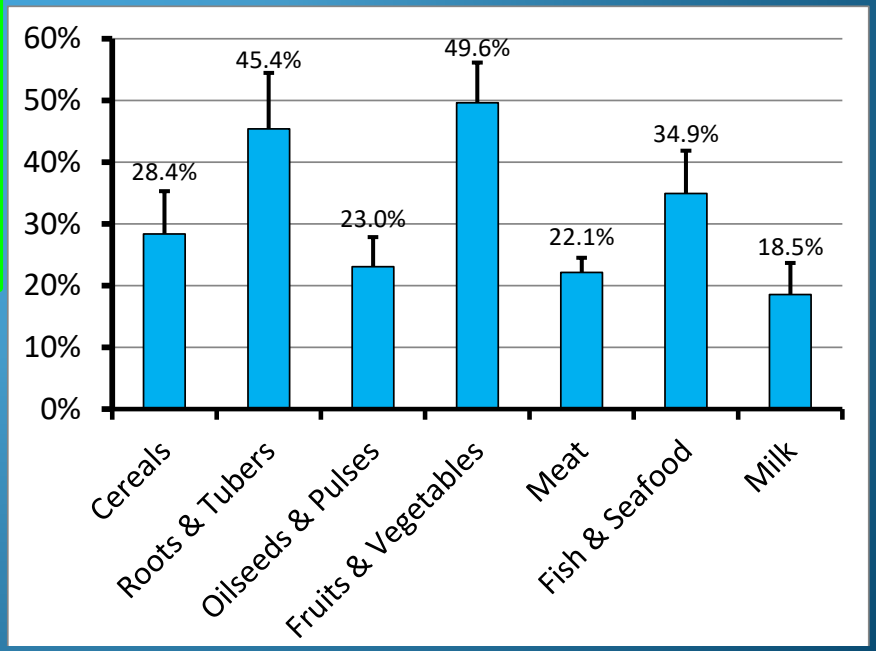
Food

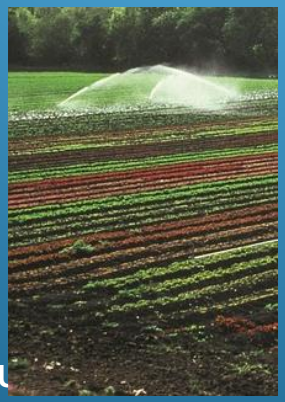
- 26 animal, 89 plant
- All crops except seeds, industrial use, & aflatoxin corn
- Max edible portion
- Nutrients only from foods
- Least cost diets to meet needs

Why Not More Fruits & Vegetables?

- US imports 51% of fruits, 39% of vegetables.
- Weather/Climate/Temp
- Soil quality/Elevation/Slope
- Water availability
- Food waste
- Profitability / Risk

% of Food Wasted



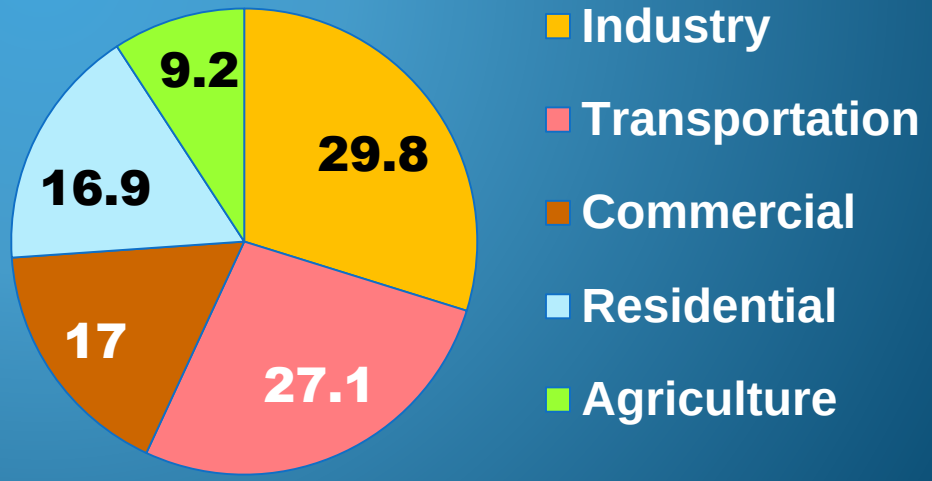


FAO. 2011. Global food losses and food waste – Extent, causes and prevention.

Greenhouse Gas (GHG)

- 9% U.S. greenhouse gas is from agriculture
- ~50% from animal agriculture
- Removal of animals, new crops.
- Synthesis of fertilizer to replace manure.
- Incineration of human-inedible byproducts; P & K recycled to fertilizer.

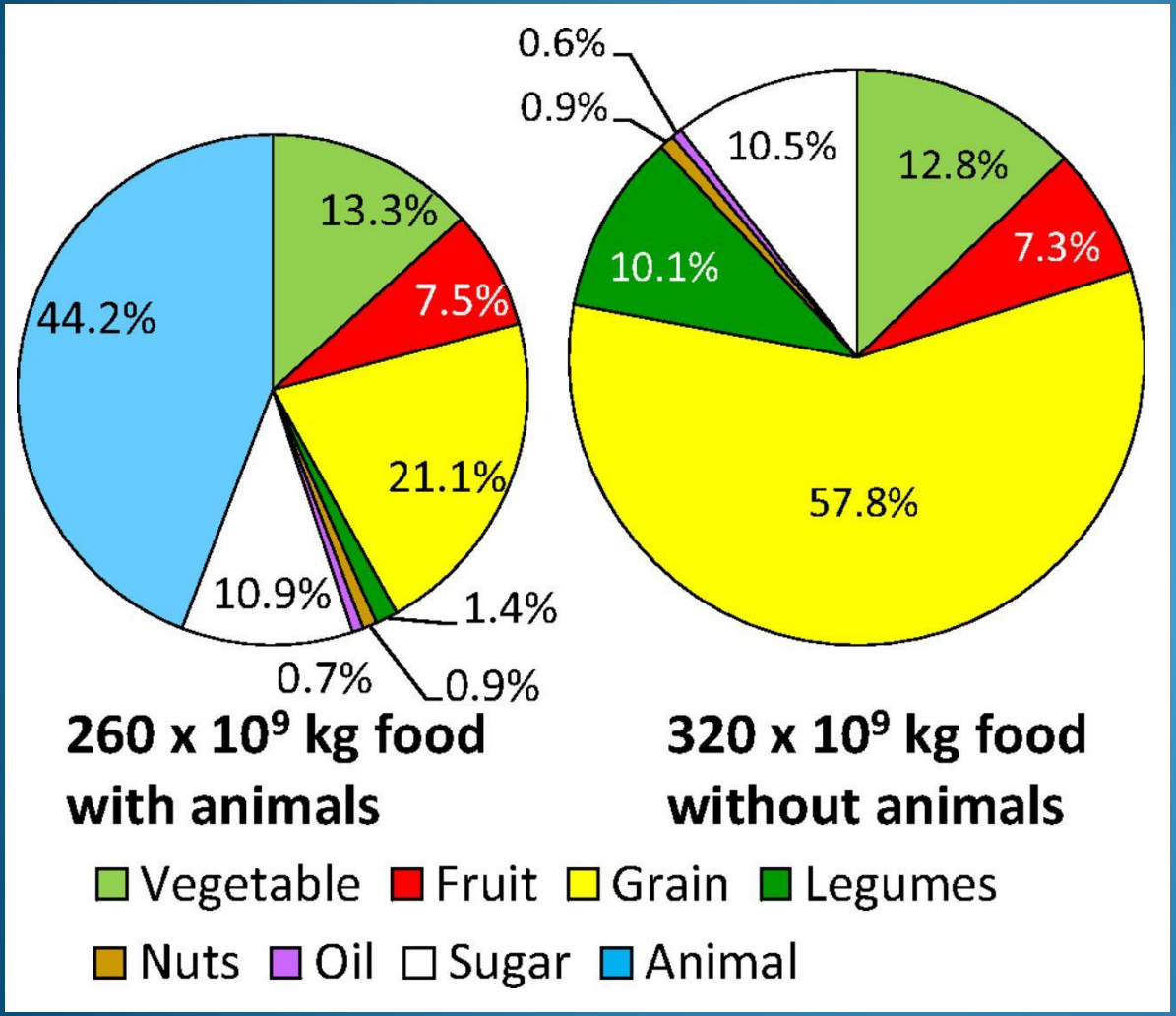
From Manure, kg:
N 4.01×10^9
P 1.69×10^9
K 1.88×10^9
S 2.84×10^8



2013 CO_2 equivalents, EPA, 2017

White and Hall, 2017

Results: Food Production



Plants-only system:

- Increased 23%, primarily as grain.
- Grain: 77% corn.
- Legumes: 92% soy and soy flour.

White and Hall, 2017

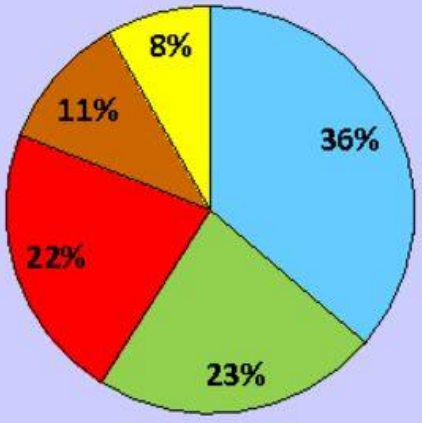
Nutrient Adequacy: Available Food

Available food:

Current
To current use of U.S. production + imports

Diet composition, % of food type:

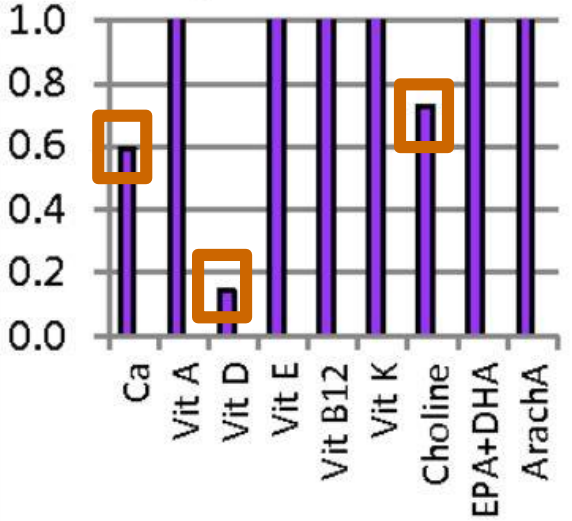
Animal Vegetable Fruit Other Grain



CO_2e, kg	3.29
Diet cost, US$	$4.00
Total food, g	1,492
Food solids, g	448

Adequacy of diets

<1.0 = requirement not met



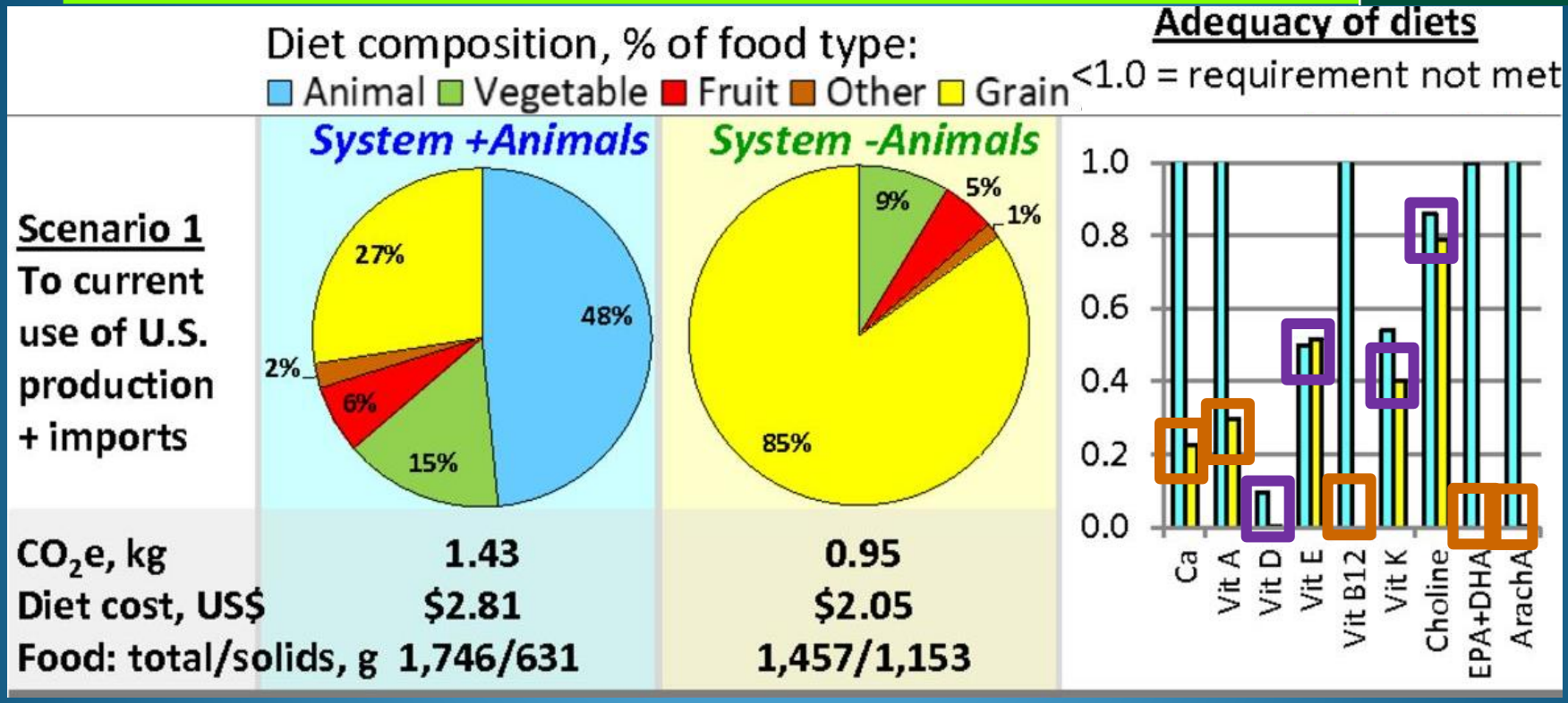
Current average diet:

- Deficient in calcium, vitamin D, and choline.

USDA-ERS, US Food Commodity Available by Food Source, accessed 2014

White and Hall, 2017

Results: Diets From Available Food



Plants-only system:

- Lower diet cost & greenhouse gas equivalents per person.
- Deficient in more nutrients. Cifelli et al. 2016, NAHNES A, D, Ca, protein
- Greater food & calorie (145 to 230%) intakes; **density**.

White and Hall, 2017

Plants-Only:Nutrient Deficiency

- Plants do not have, or have low concentrations of some nutrients.

Long Chain Fatty Acids

Omega-3: EPA & DHA
Infants: Cognitive & visual development
Adults: Cardiovascular health

Omega-6: Arachidonic
Infants: Visual acuity

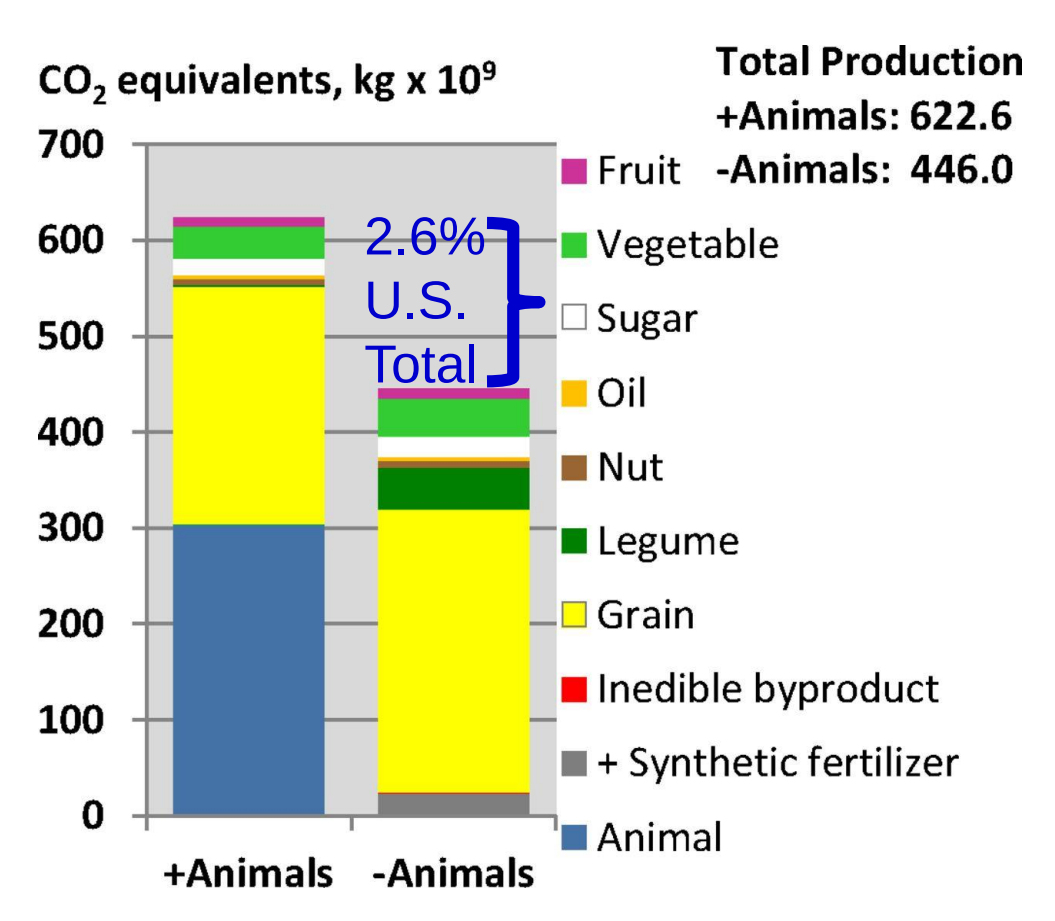
Calcium
Bone, electrolyte, milk
Many physiological functions

Vitamin B12
Brain & nervous system
Red blood cell formation

Ca --Weaver et al., 1999

Results: Greenhouse Gas

Agricultural GHG



Plants-only system:

- US National GHG ↓2.6%.
- Agricultural GHG ↓ 28%, but not the ~50% associated with animals.
- Counterbalanced by fertilizer synthesis & all land now allocated to food production.

White and Hall, 2017

A Change Creates Other Changes

Agriculture Without Animals:

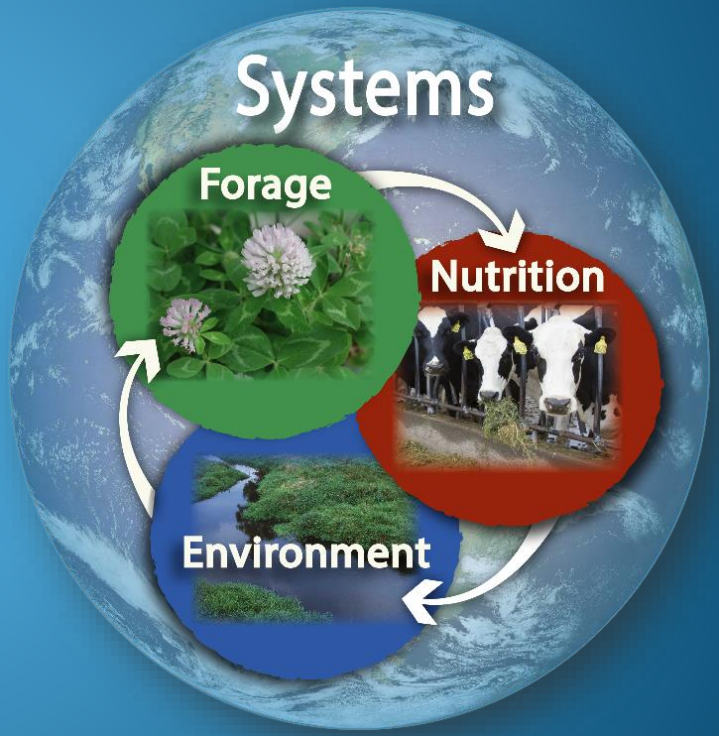
- More total food.
- Small U.S. GHG decline.
- The food produced would not support U.S. nutrient needs.
- Agriculture is a system. Need to look at many, many more factors and how they fit together to have an accurate picture.

White and Hall, 2017

USDA

United States Department of Agriculture

Questions?



U. S. Dairy Forage Research Center

www.ars.usda.gov/mwa/madison/dfrc