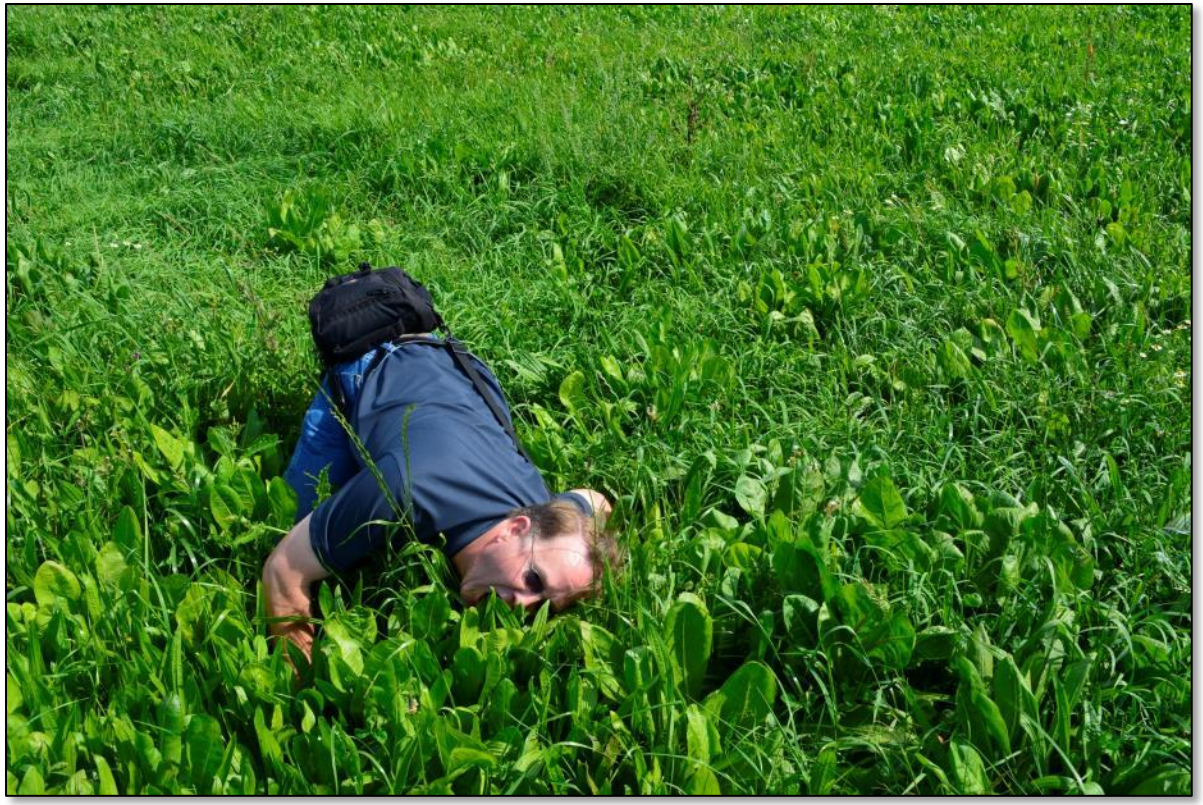
“Ruminant Reality: Diet, Human Health and the Environment”

Low Carb Breckenridge 2017
February 26th
Peter Ballerstedt, PhD

We eat plants

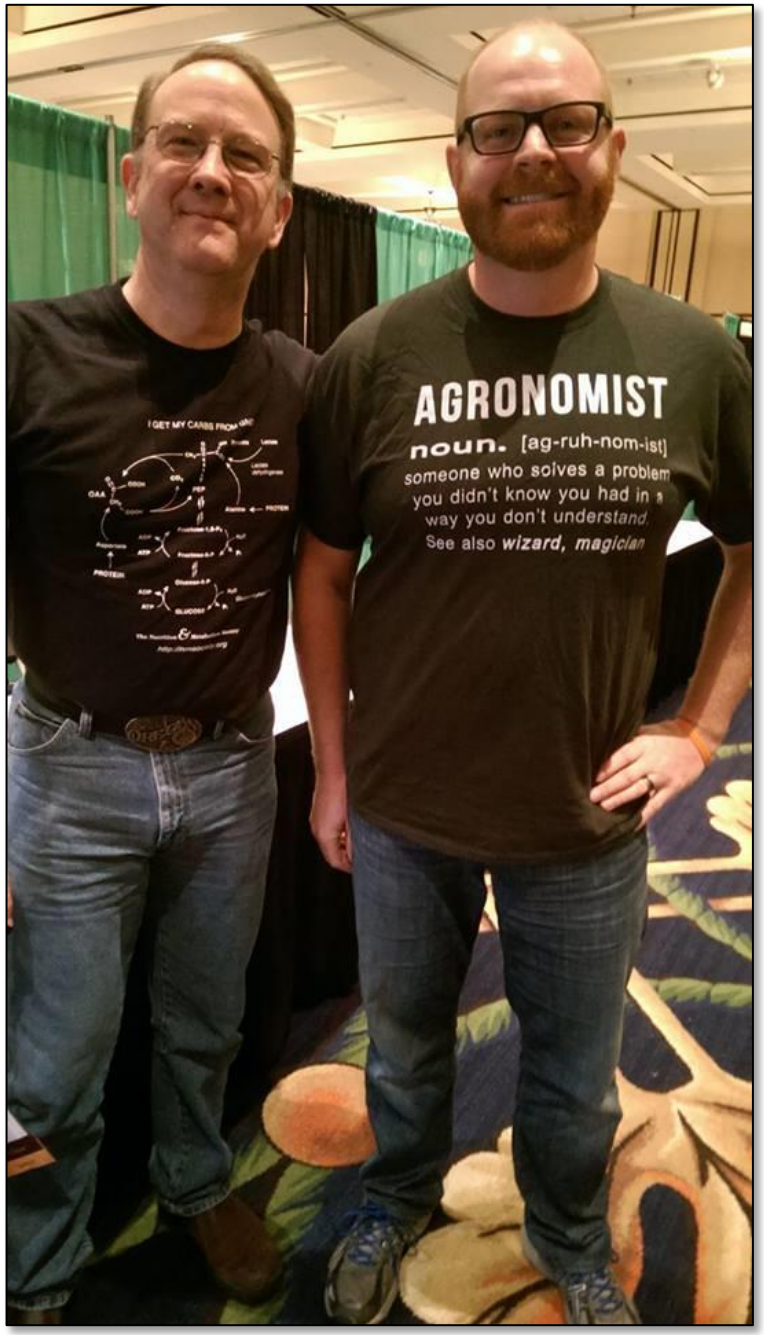


so you don’t HAVE to!

Disclosure

- None

- I’m an advocate for LCHF and ruminant animal agriculture
- I’ve worked in forage agriculture
- I work for a forage seed company



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And wouldn't it be *really* amazing if…

…there were a way to convert inedible (by humans) materials into high-quality food for humans...

... utilizing that portion of the Earth's surface that cannot produce human-utilizable feedstuffs...

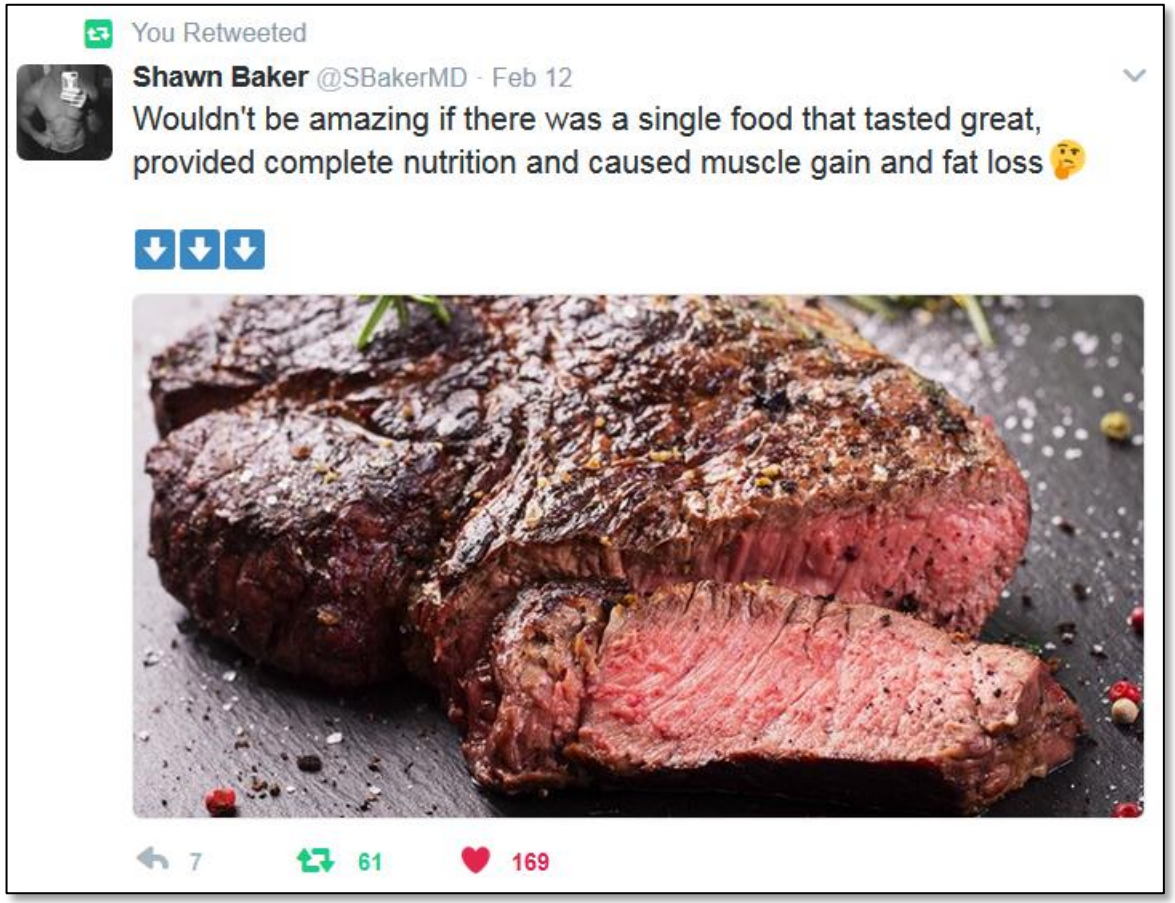
...while improving the environment,...

... improving human health,…

…and increasing human flourishing?

Oh, wait…

Ruminants RULE!



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The Products of Forage Agriculture: True Health Food!

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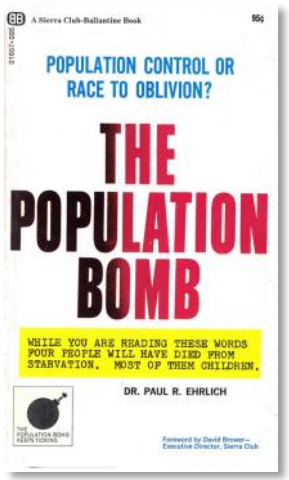
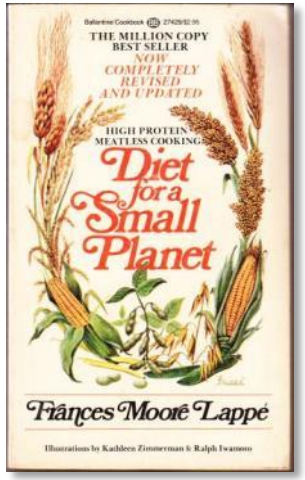
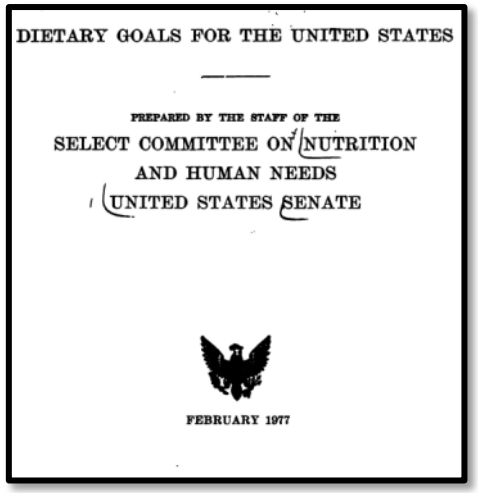
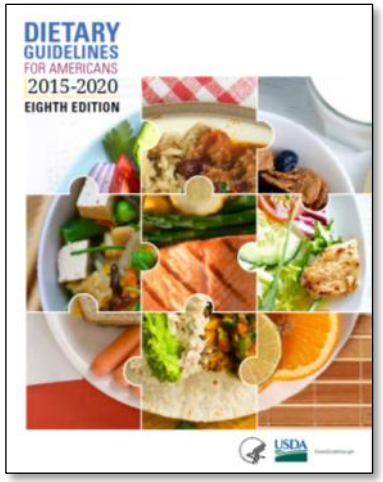
“The great enemy of truth is very often not the lie--deliberate, contrived and dishonest--but the myth--persistent, persuasive and unrealistic. Too often we hold fast to the clichés of our forebears. We subject all facts to a prefabricated set of interpretations. We enjoy the comfort of opinion without the discomfort of thought.”

— John F. Kennedy Commencement Address at Yale University, June 11, 1962









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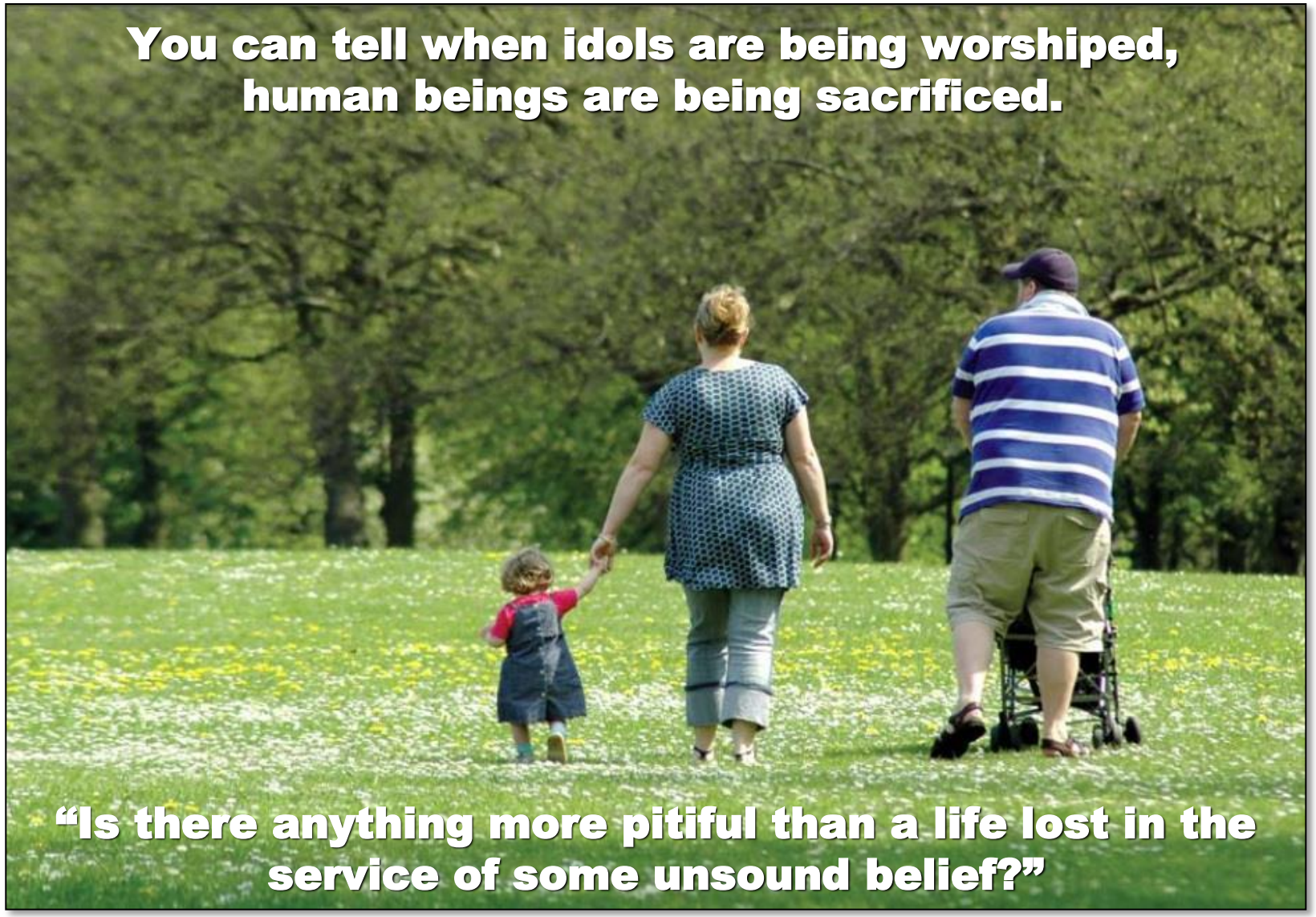

Thomas Gilovich, 1991. *How We Know What Isn't So: The Fallibility of Human Reason in Everyday Life*. Free Press. New York, NY

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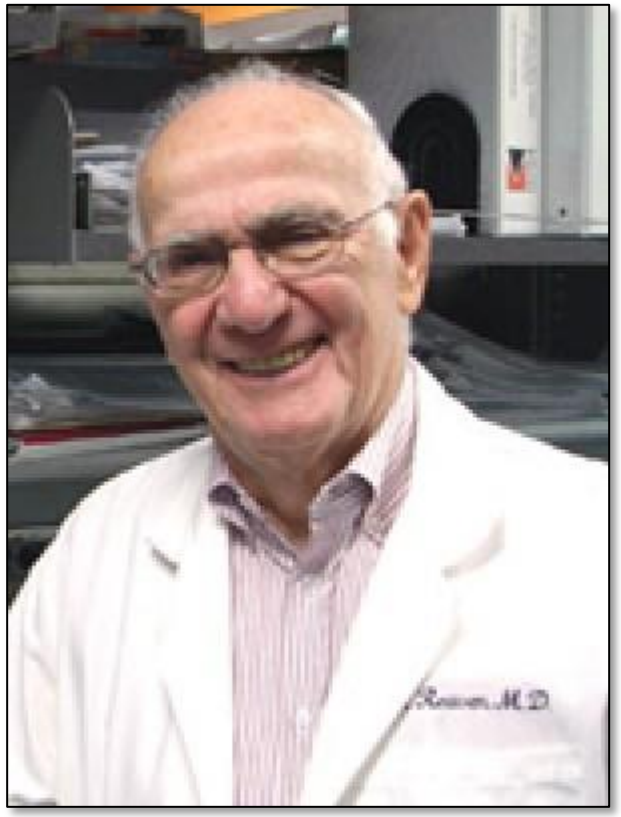
“What is required is less advice and more information.”

- Gerald M. Reaven, 1986



Reaven GM. Effect of dietary carbohydrate on the metabolism of patients with non-insulin dependent diabetes mellitus. Nutr Rev 1986;44:65-73. https://goo.gl/cd9unf

So let's review…

1. "nutrition research does not support that vegetarian diets are healthier than animal based diets"

2. The hypothesis that natural saturated fats from animal products causes vascular diseases has been refuted.

3. The hypothesis that dietary cholesterol lead to vascular diseases was never supported by research. It was primarily a marketing campaign promoting plant product replacements for animal products.

4. Animal protein is superior to plant protein for human nutrition.

5. Polyunsaturated fatty acids from plants have been shown to produce harm in humans.

6. Diets high in animal products and restricted in carbohydrates (high in natural fats) have been shown to produce greater weight loss, better blood glucose control, and reduced CVD risks than low fat (high carbohydrate) diets.

“For a modern disease to be related to an old-fashioned food [e.g. red meat] is one of the most ludicrous things I have ever heard in my life”

T.L. “Peter” Cleave, 1973

Mounted auroch skeleton in National Museum of Denmark in Copenhagen
https://goo.gl/otXTaE

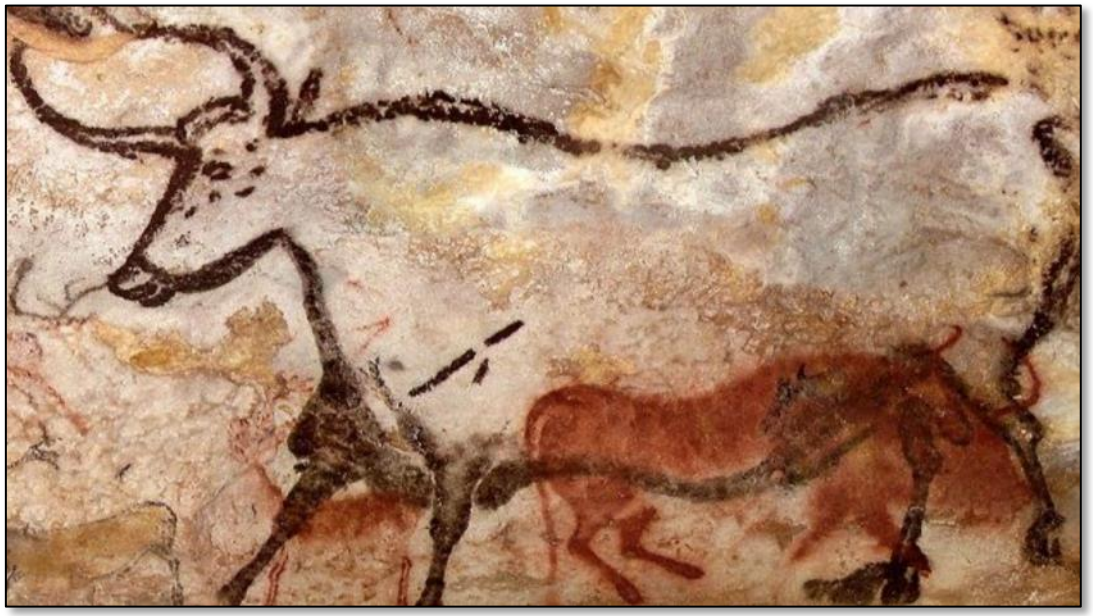
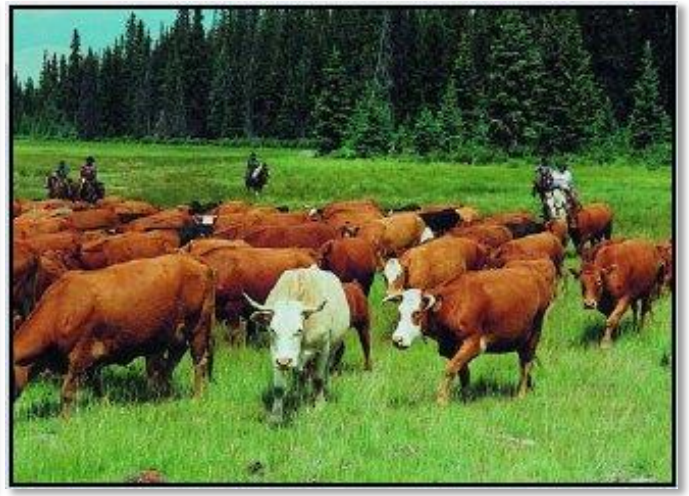


Image from Lascaux Cave, a section of the "Hall of the Bulls“
http://goo.gl/dfbD7

Select Committee on Nutrition and Human Needs of the United States Senate. 1973a. Sugar in Diet, Diabetes, and Heart Disease. Hearing Before the Select Committee on Nutrition and Human Needs of the United States Senate, Ninety-Third Congress, pt. 2, April 30, May 1 and 2, 1973. Washington, D.C.: U.S. Government Printing Office.

Which mammals are designed to digest a low fat diet?



From “Homo carnivorous” by Barry Groves, PhD

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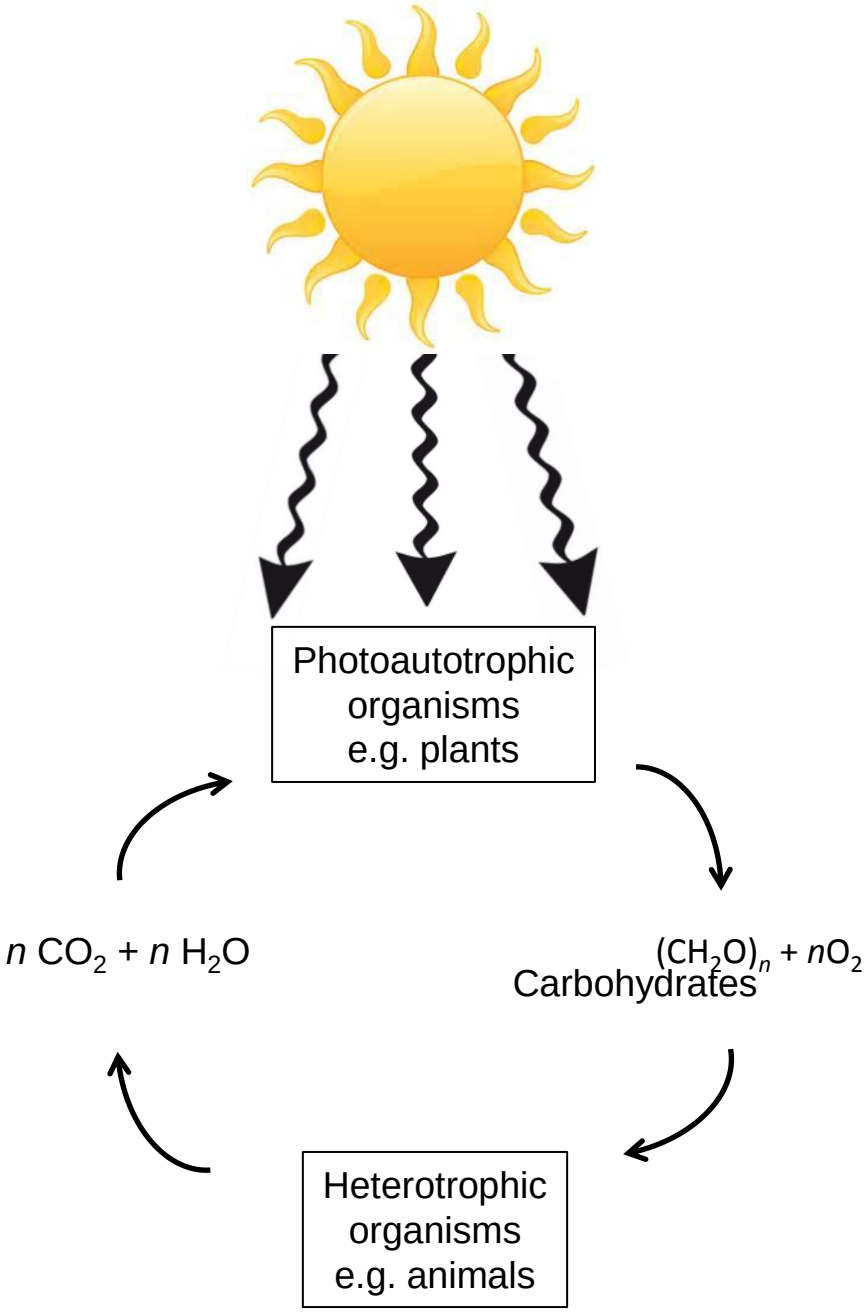
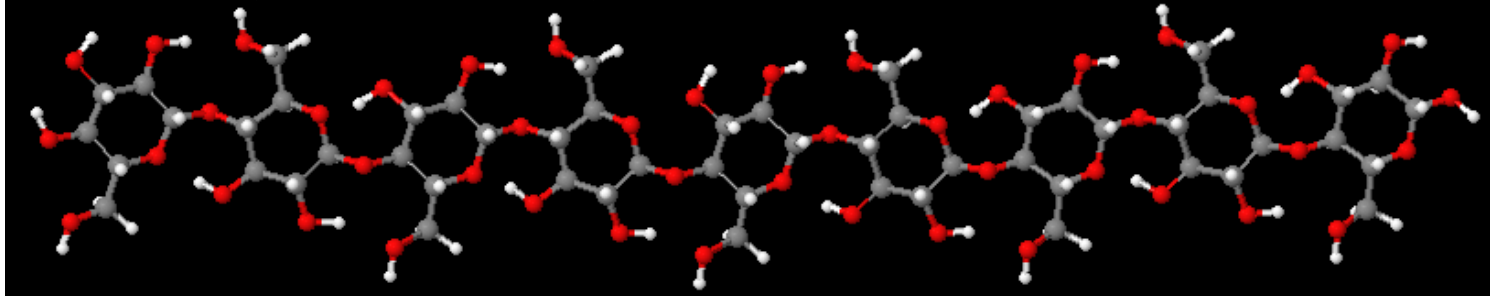
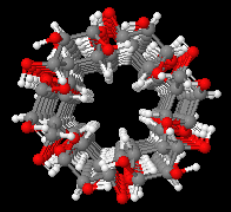
Life on Earth:
A cycling of CO_2

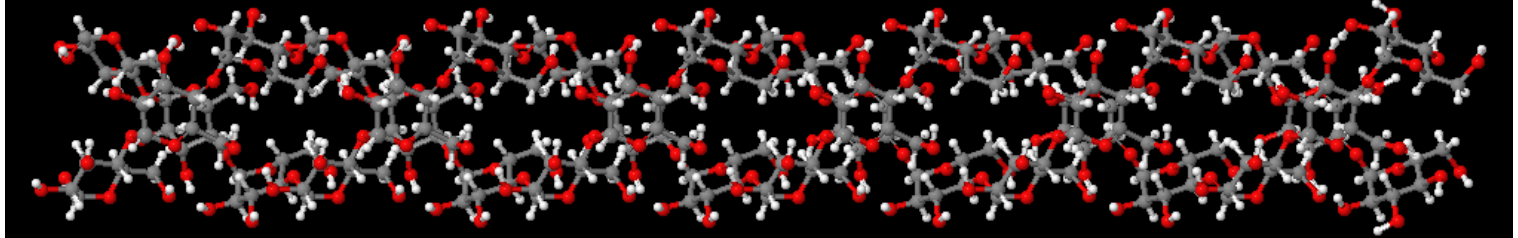


Cellulose, β(1→4) linked D-glucose units.





Starch, α (1→4) linked D-glucose units.



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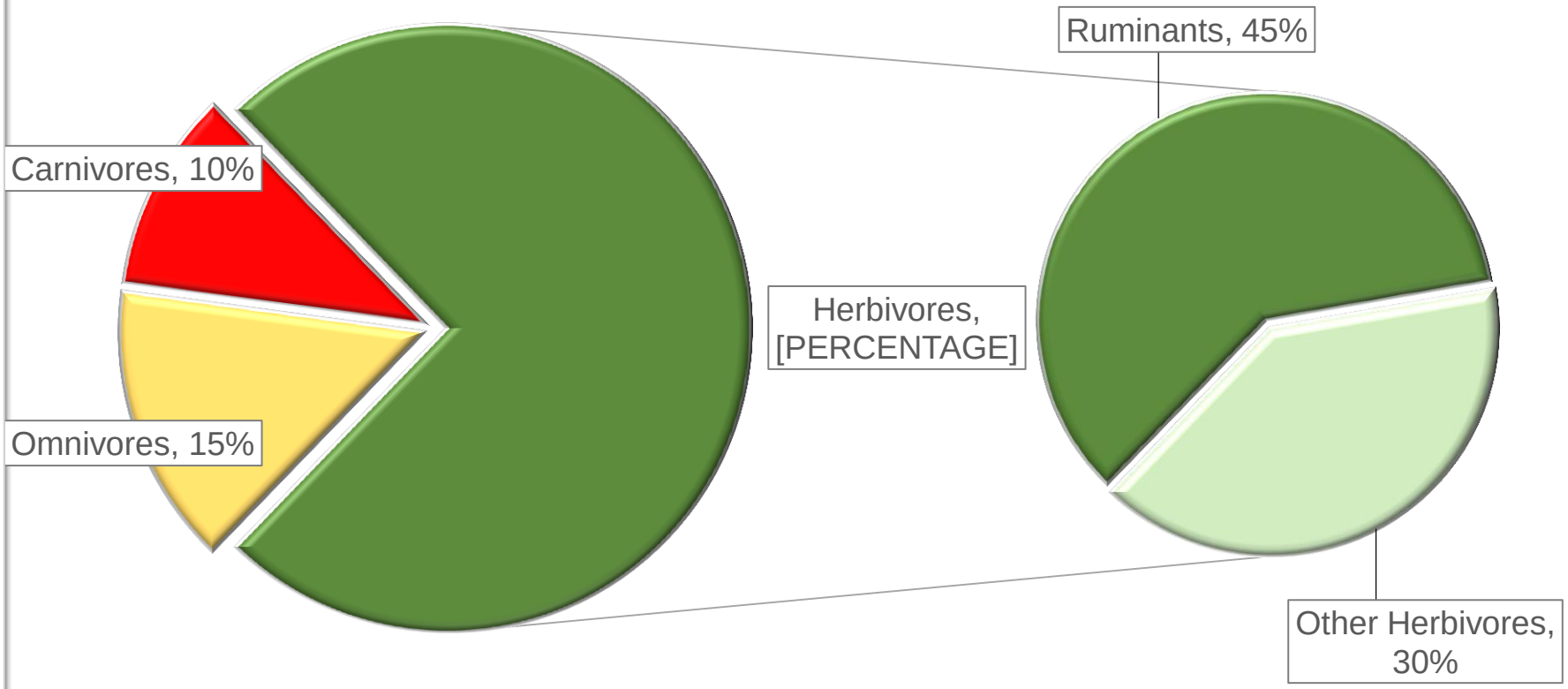
Domesticated Species
47 Total
21 Ruminants







Ruminants (134 species in total, 21 domestic species)

- Are not competitive to humans
- Convert plant “protein” and low nutrient density organic materials into food for humans via anaerobic microbial fermentation of fibrous plants and plant residues in the rumen
- Provide services and assist in recycling soil nutrients





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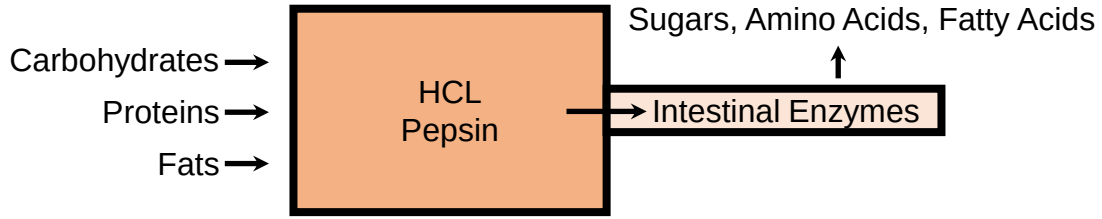
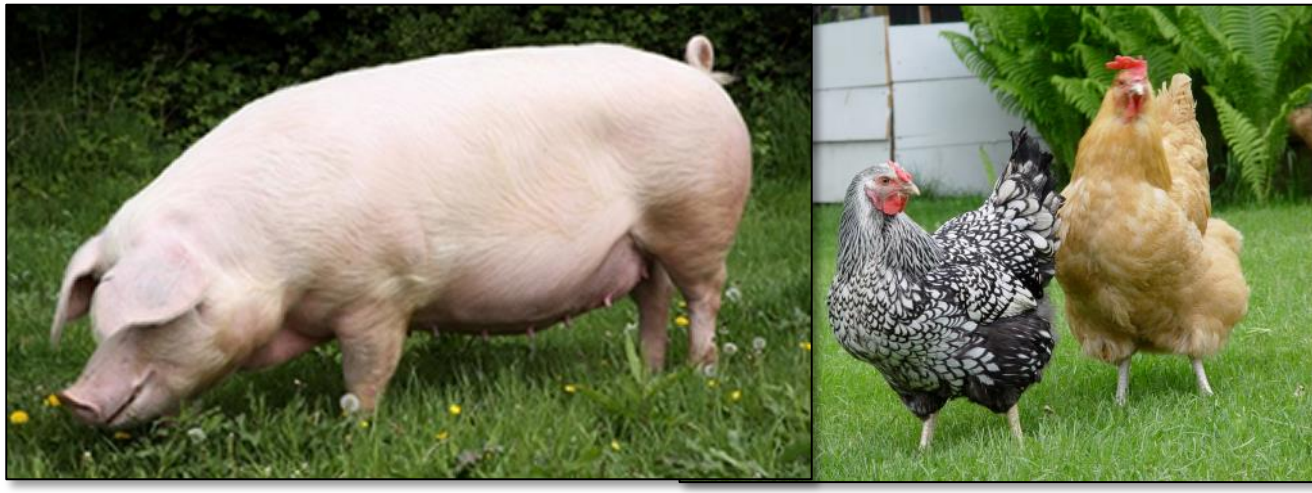
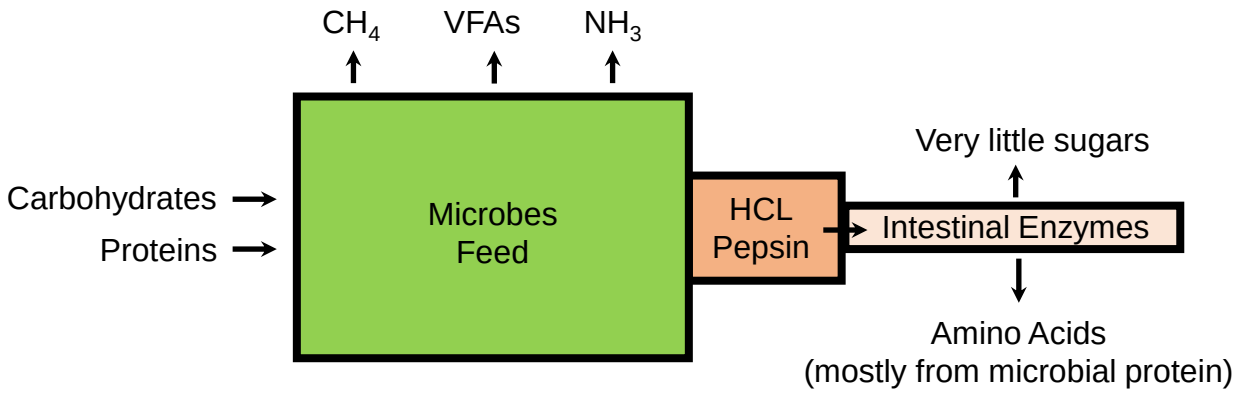
Simple stomached
(pigs, chickens, rats, man, etc)





Ruminants
(cows, sheet, goats, deer, etc)



After graphic by Ariya Shookh - Rumen Microbiology and its role in ruminant nutrition by James B. Russell, CC BY-SA 3.0, https://en.wikipedia.org/w/index.php?curid=26606317

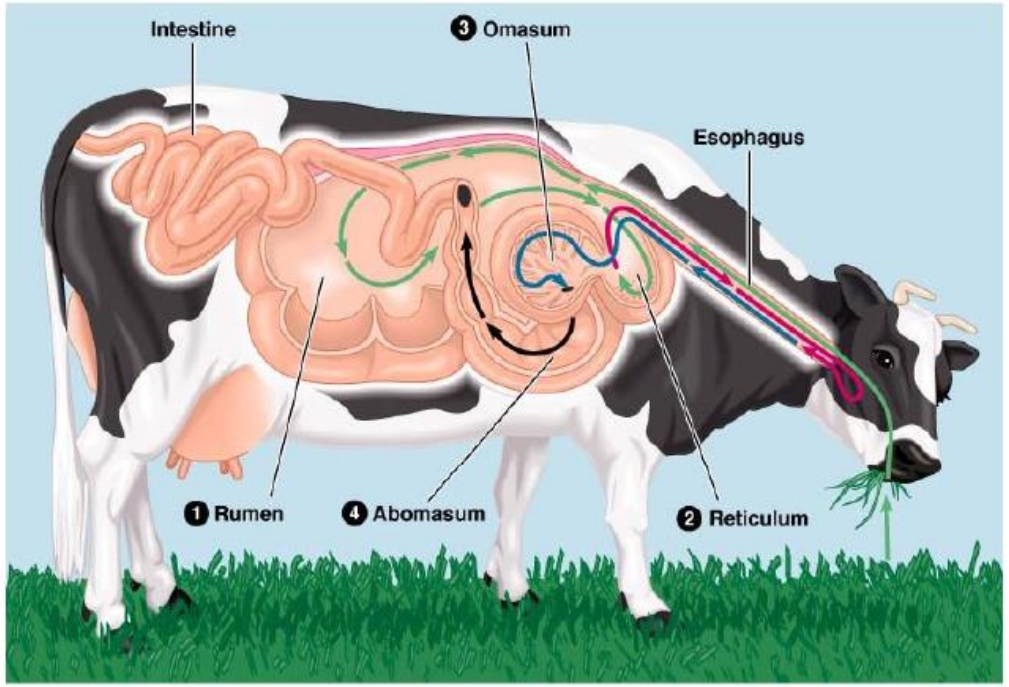
“Four Stomachs”

Rumen - “Fermentation Vat”

Reticulum - Additional fermentation

Omasum - Water and salts absorption; return of large feed particles to reticulorumen

Abomasum - Acid digestion of proteins to amino acids and of carbohydrates



Rumen

Reticulum

Omasum

Abomasum

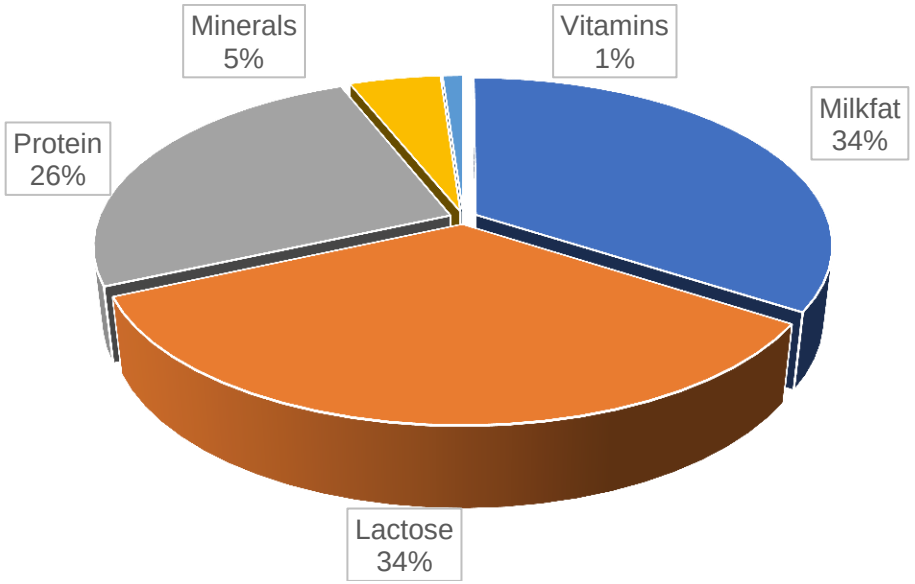
courses.washington.edu

Cows producing 2.4 kg Milk Solids/cow/day from pasture alone
Need 19-20 kg Dry Matter/cow/day
@ 15% DM, fresh weight of pasture consumed = 130 kg/day

The Metabolizable Energy of pasture = 12.5 MJ ME/kg DM
Therefore, 245 MegaJoules ME/day from pasture
(confirmed from back calculations; Cows were weighed every day & weight-stable; MS production must have been eating 240-250 MJ)

NOTE: This pile of grass isn't actually the pasture being consumed. It's the right amount of pasture, but it's too stalky to be 12.5 ME. Not dairy pasture!

Average Components of Milk Solids, New Zealand



2.4 kg (5.3 lb) of milk solids per day from grass!
(That's a LOT of tongue work!!)

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Rank	Crop	Value 1,000 USD (2012)	Production metric tons (2012)	Top Producing Country & Value (2011)
2	Cow's milk, whole, fresh	$183,583,111	614,578,723	$27.6 billion (United States)
3	Cattle, meat	$170,272,001	63,031,582	$30.6 billion (United States)
15	Water Buffalo milk	$37,673,032	95,888,113	$26.0 billion (India)
21	Sheep, meat	$22,406,097	8,229,068	$5.6 billion (Mainland China)
38	Goat, meat	$9,970,000		$4.5 billion (Mainland China)
42	Buffalo, meat	$9,410,000		$4.0 billion (India)
		$433,314,241		


Data from http://www.fao.org/faostat/en/#data

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World meat supply

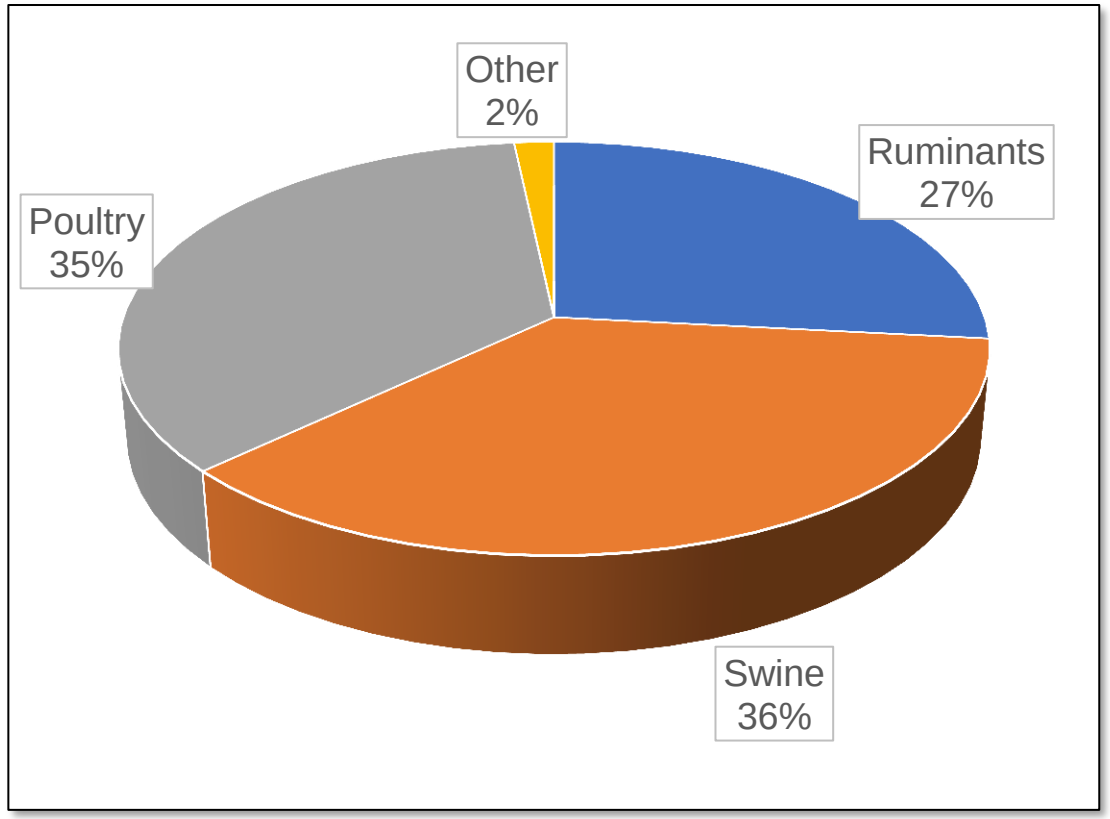
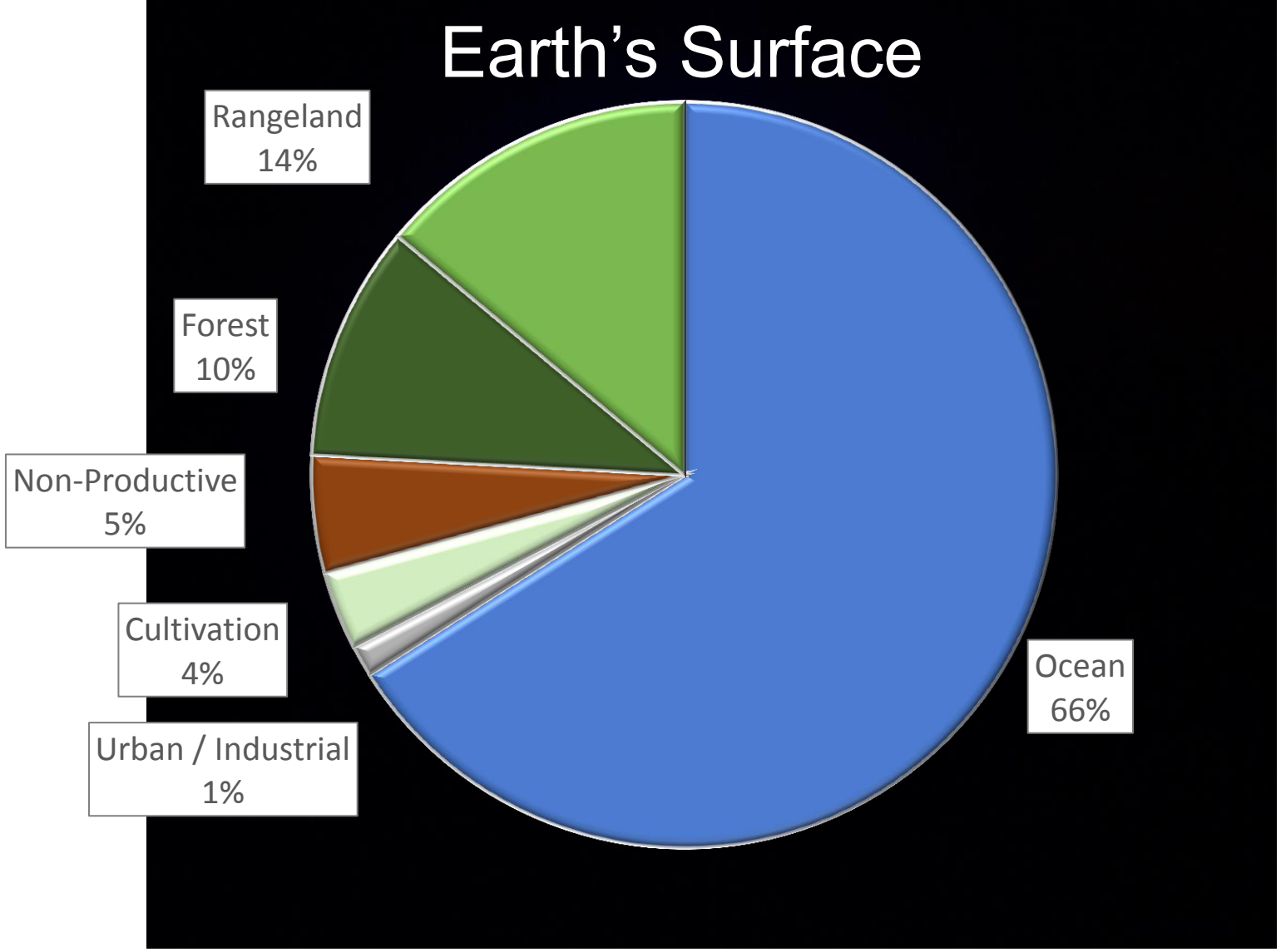


Image source: http://www.beefmagazine.com/sites/beefmagazine.com/files/uploads/2015/buying-beef-99673810-thinkstock.jpg

The challenge ahead

- UN projects world population will reach 9+ billion by mid-century
- UN has called for a 100 percent increase in world food production by 2050
- FAO predicts a 60% increase in demand for meat, milk and eggs by 2050
- Must come from virtually the same land area as today.



All figures are % of total
From *The Ruminant Animal: Digestive Physiology and Nutrition*. D.C. Church, ed. 1993. Waveland Press, Long Grove, IL

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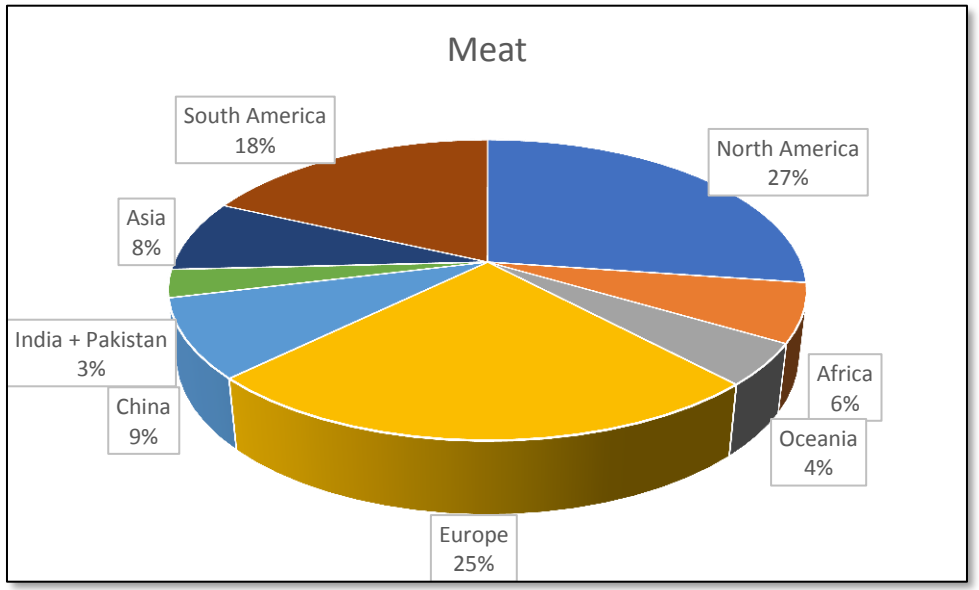
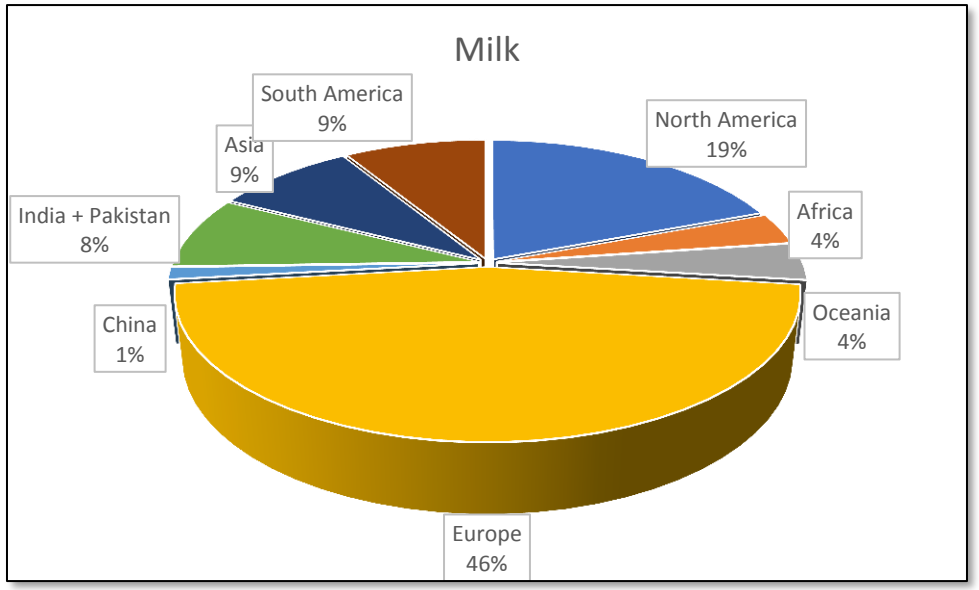
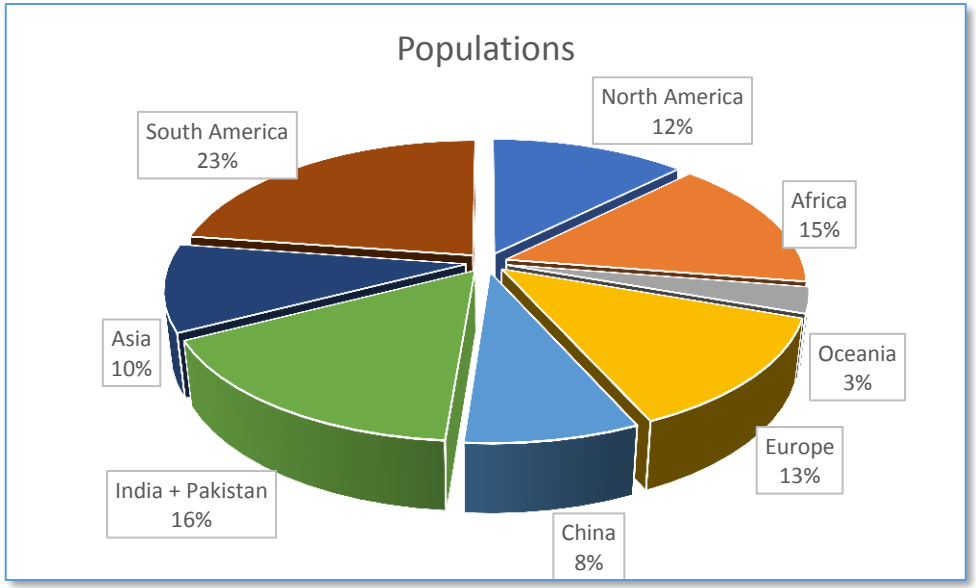
The Production Gap
Room for improvement







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I can turn grass into heavy whipping cream.

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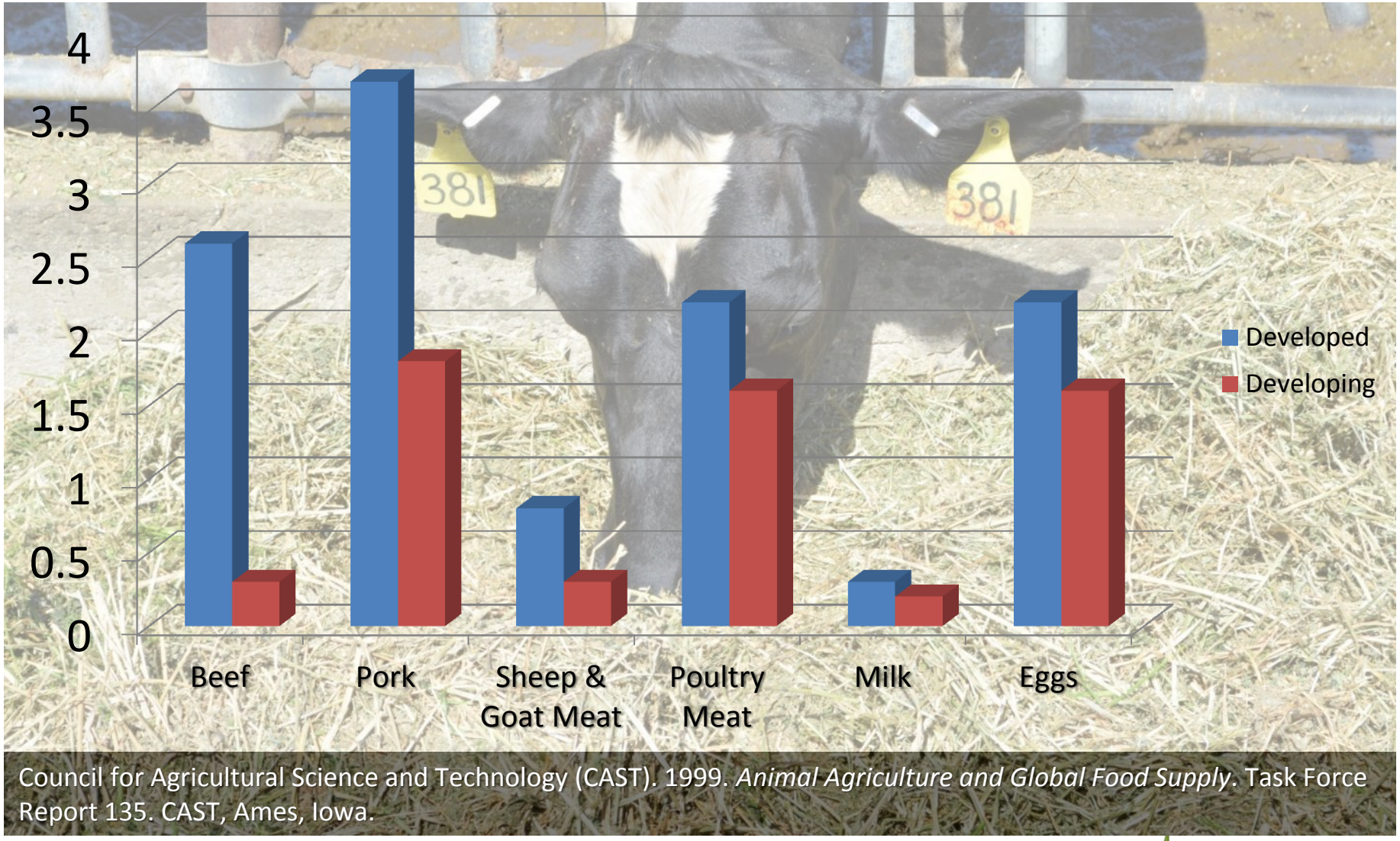
Ruminants RULE!

Increasing the human-utilizable food supply!

	Proportion of ration (%)		Proportion of total concentrate (%)	Proportion of total feed (%)
	Concentrate	Forages		
All livestock and poultry	36	63	100.0	100.0
All dairy cattle	39	61	16.6	16.0
All beef cattle	17	83	25.8	56.9
Beef cattle on feed	72	28	20.7	10.7
Other beef cattle	4	96	5.1	46.2
Sheep and goats	9	91	0.4	1.9
Hens and pullets	100	0	12.4	4.6
Turkeys	100	0	3.3	1.3
Broilers	100	0	9.3	3.5
Swine	85	15	30.0	13.2
Horses and mules	28	72	2.9	2.9

Ruminants RULE!!

Conversion rates of feed grain to human food, developed and developing world
(lb grain/lb product)



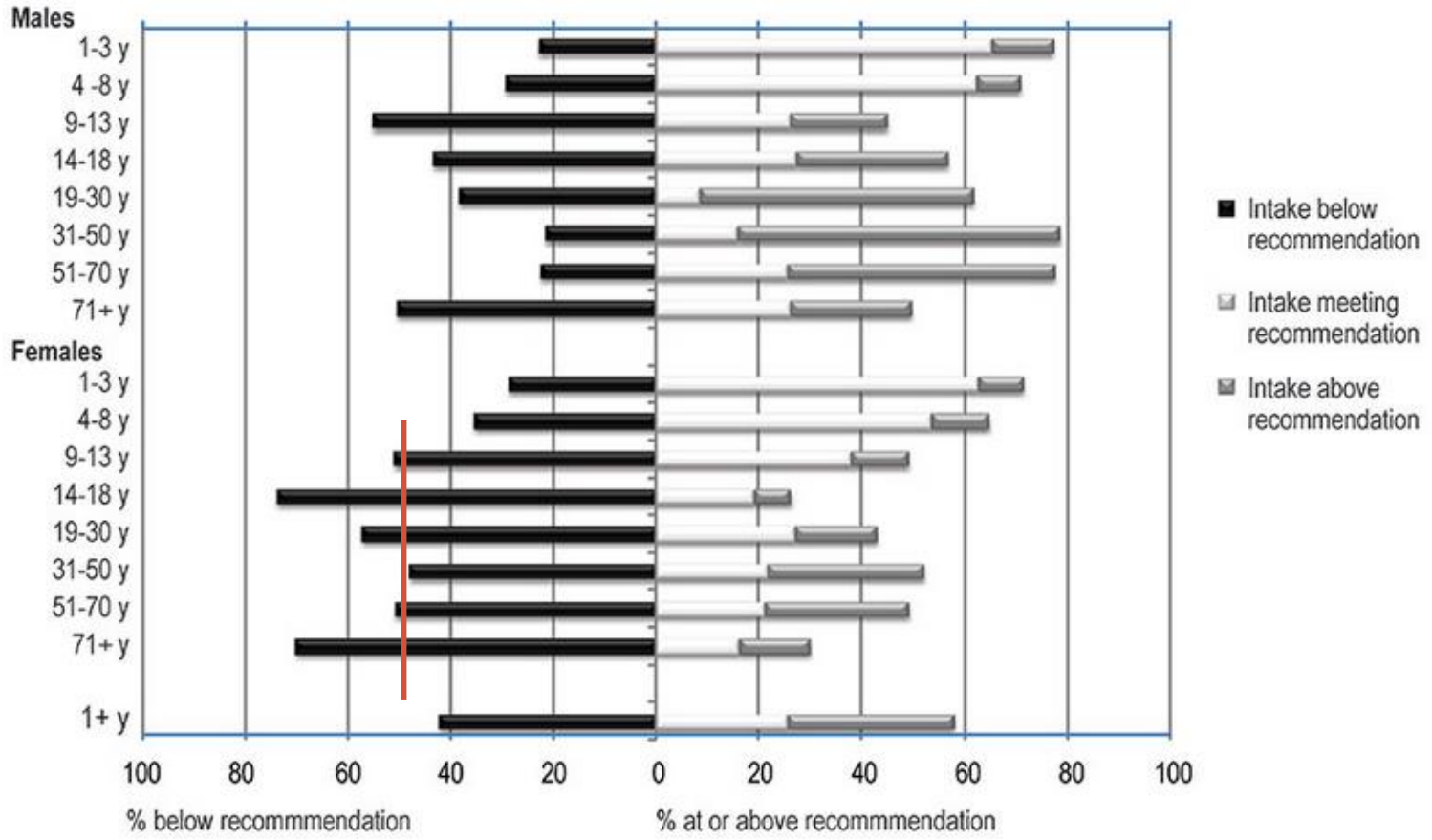
Council for Agricultural Science and Technology (CAST). 1999. *Animal Agriculture and Global Food Supply*. Task Force Report 135. CAST, Ames, Iowa.

Ruminants RULE!!

The ratio of human-edible protein input to the human-edible protein output for US systems: 0.48, 0.84, 3.4, and 1.6 (for milk, beef, pigs, and poultry systems, respectively).

Council for Agricultural Science and Technology (CAST). 1999. *Animal Agriculture and Global Food Supply*. Task Force Report 135. CAST, Ames, Iowa.

Over 40% of Americans don't get enough protein



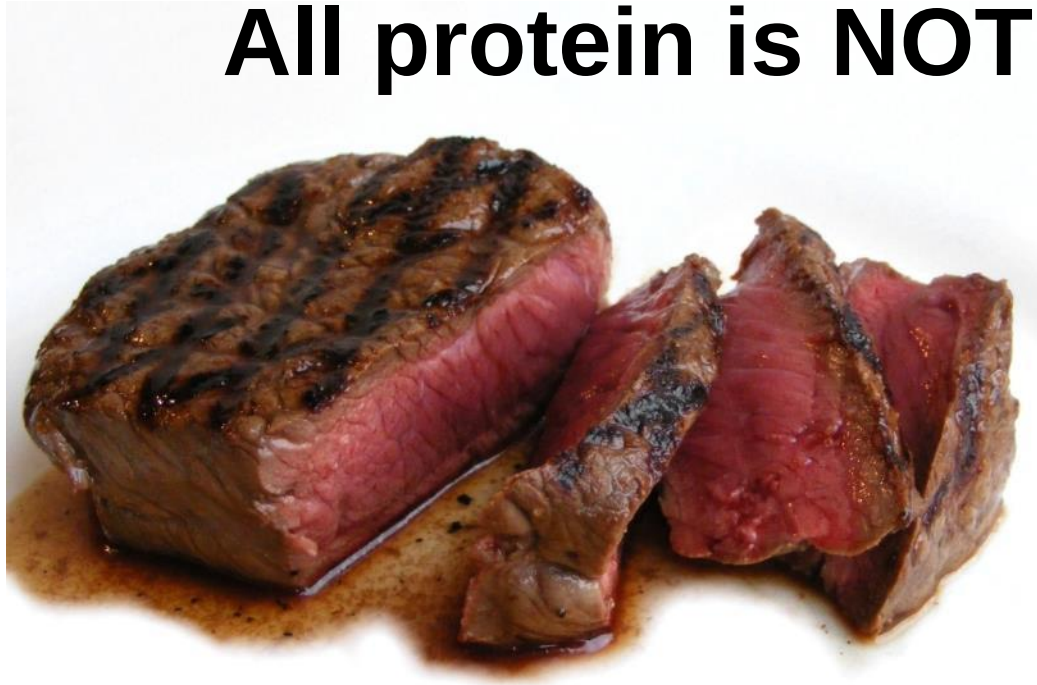
Most females over age 8 don't get enough protein

What We Eat in America, NHANES 2007-2010

“The concept that all proteins are of comparable nutritional value is flawed and should be rejected by anyone interested in planning healthful diets.”

Ottoboni, A., F. Ottoboni. 2013. *The Modern Nutritional Diseases and How to Prevent Them*, 2nd Edition. Vincente Books, Fernley, NV.

All protein is NOT created equal!



Protein profile from 100 grams of beef vs beans

	Protein (g)
Beef Muscle, cooked	21.3
Navy Beans, cooked	22.5

Best C.H., N.B. Taylor. 1950. *The Physiological Basis of Medical Practice*, 5th Ed. The William & Wilkins Company, Baltimore, MD.
Cited in
Ottoboni, A., F. Ottoboni. 2013. *The Modern Nutritional Diseases and How to Prevent Them*, 2nd Edition. Vincente Books, Fernley, NV.

Detoxing

"Most of the naturally occurring chemicals [i.e. alkaloids, hydrazines, isothiocyanates, aromatic carboxylic acids, alkyl phenols, various glycosides, and catechols] in foods that are foreign for humans are of plant origin."

"The digestive and metabolic systems of animals used as food selectively eliminate from their digestive systems many of the foreign chemicals in their plant feed with the result that their flesh is free of these nonnutrients."

Ottoboni, A., F. Ottoboni. 2012.*The Modern Nutritional Diseases and How to Prevent Them*, 2nd Ed. Vincente Books, Fernley, NV




"Cows *[and all other ruminants]* are nature's carbon capture technology as well as a cheap source of protein *[and fat!]* for the world."

Geoff Maynard Australian cattleman & Director of MLA (Meat and Livestock Australia).

See: "Carbon Cows" on Youtube https://youtu.be/q_BD5FApHKc

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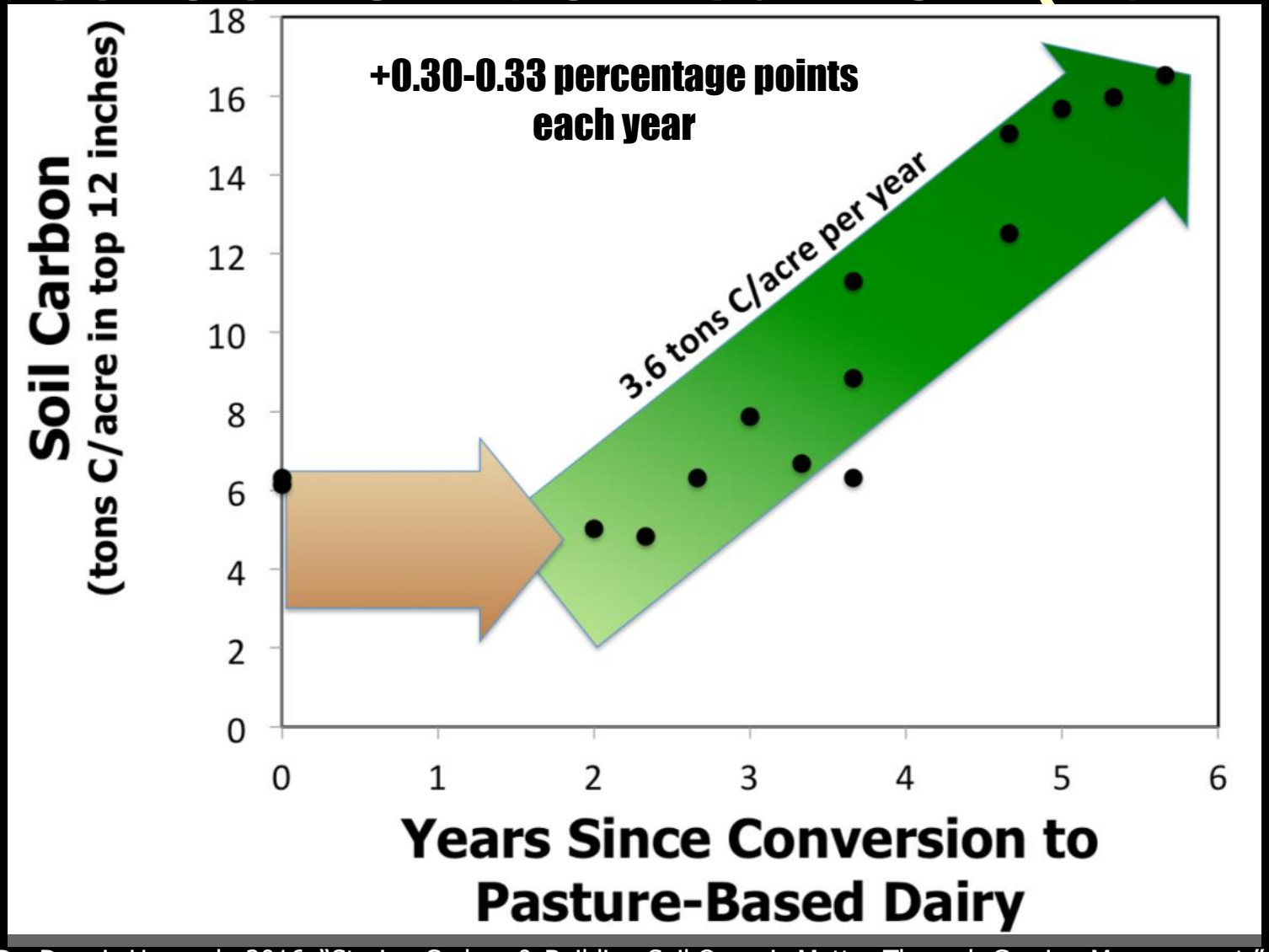
Impact of Pasture-Based Livestock on Soil Carbon (Soil OM)



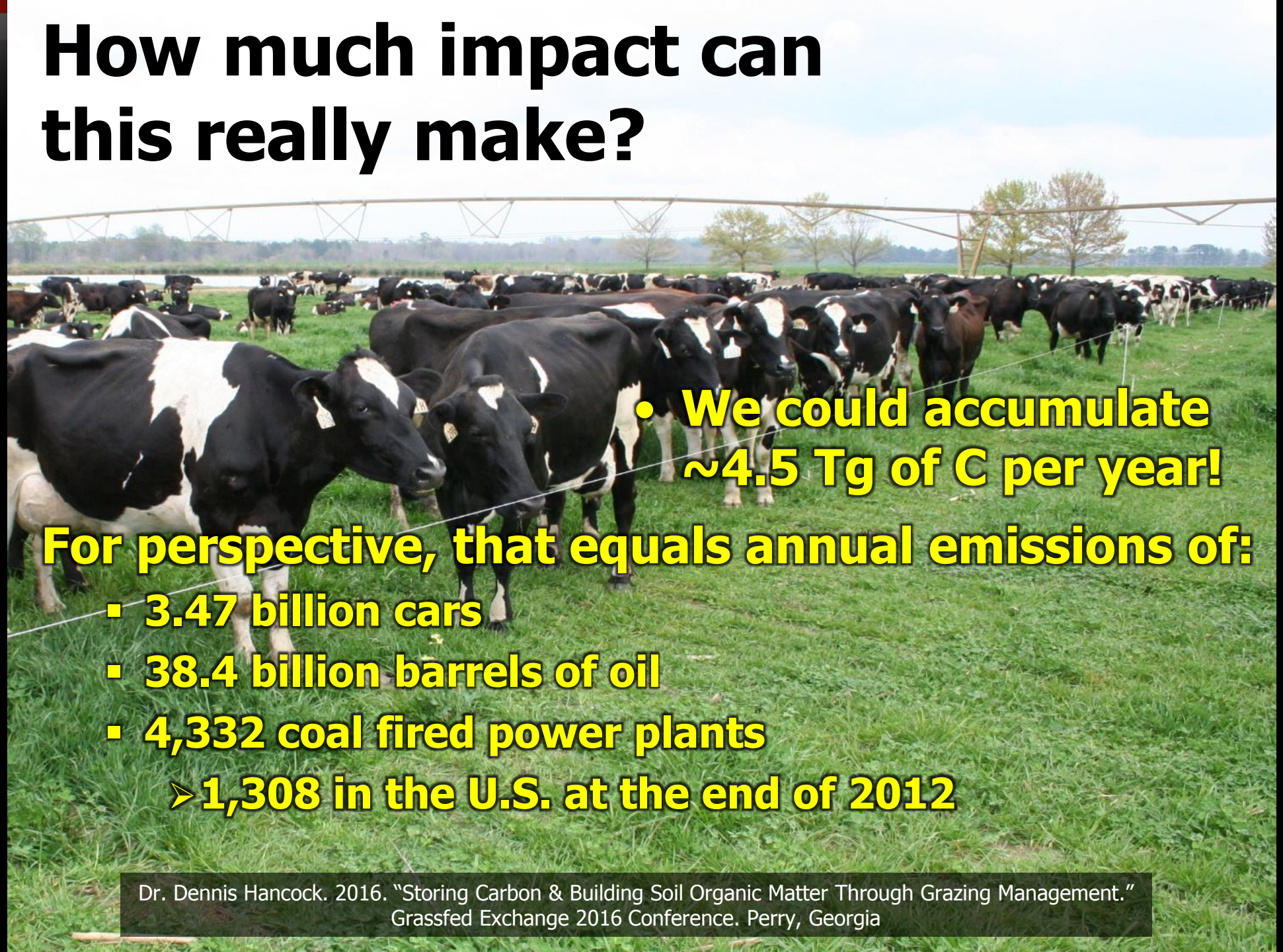
Dr. Dennis Hancock. 2016. "Storing Carbon & Building Soil Organic Matter Through Grazing Management." Grassfed Exchange 2016 Conference. Perry, Georgia

How much impact can this really make?

- **There are ~ 9 million ha (or 22.2 million acres) of degraded (i.e., low OM) row crop ground in the Southeastern U.S.**
  - **What if just 10% of this land was converted to pasture-based MIG systems?**

Dr. Dennis Hancock. 2016. "Storing Carbon & Building Soil Organic Matter Through Grazing Management." Grassfed Exchange 2016 Conference. Perry, Georgia

How much impact can this really make?



- We could accumulate ~4.5 Tg of C per year!

For perspective, that equals annual emissions of:

- 3.47 billion cars
- 38.4 billion barrels of oil
- 4,332 coal fired power plants
  - 1,308 in the U.S. at the end of 2012

Dr. Dennis Hancock. 2016. "Storing Carbon & Building Soil Organic Matter Through Grazing Management." Grassfed Exchange 2016 Conference. Perry, Georgia

Focus on the water cycle instead of the carbon cycle

Slake Test: Peds from long-term grassland (left) and conventional tillage fields (right) suspended in water column.

Slake Test: After 25 minutes. Water-stable structure on left. No structure on right. Consider impact on water infiltration, runoff, erosion, and surface water quality.

Improved Grazing, Improved Soils, Better Water Quality

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Variation in Ratios

Study, type of cattle	*n-6*:*n-3* ratio	
	Grass	Grain
Realini, et al., 2004, Hereford steers	1.44 : 1 *	3.00 : 1 *
Ponnampalam, et al., 2006, Angus steers	1.96 : 1 *	3.57 :1 *
Duckett, et al., 2009, Angus-cross	1.65 : 1 *	4.84 : 1 *
Descalzo, et al., 2005, Crossbred steers	3.72 : 1 *	5.73 : 1 *
Nuernberg, et al., 2005, Simmental bulls	2.04 : 1 *	8.34 : 1 *
Alfaia, et al., 2009, Crossbred steers	1.77 : 1 *	8.99 : 1 *
Garcia, et al., 2008, Angus steers	1.72 : 1 *	10.38 : 1 *
Leheska, et al., 2008, Mixed cattle	2.78 : 1 *	13.60 : 1 *

* Indicates a significant difference (at least $p<0.05$) between feeding regimens within each respective study

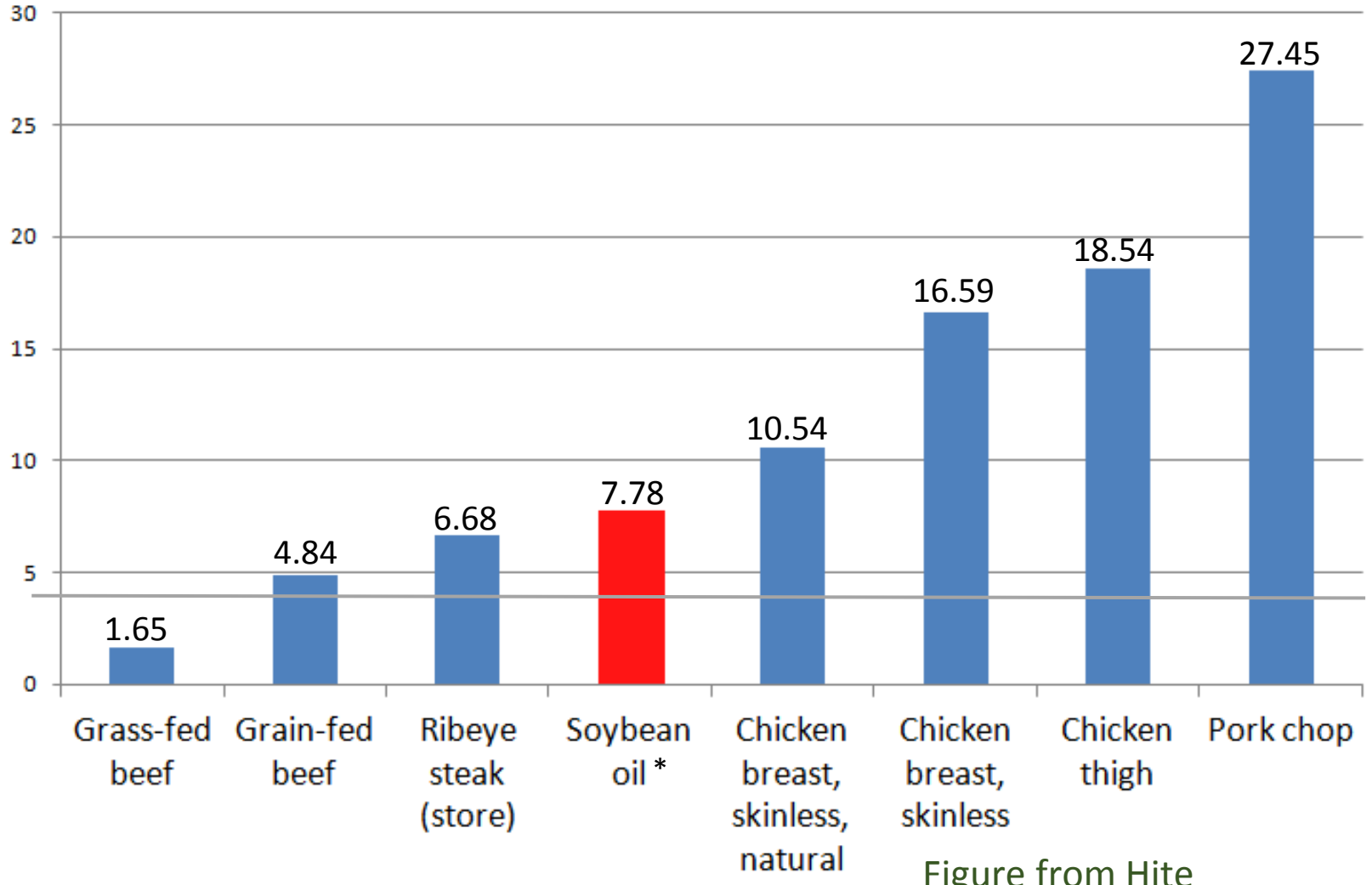
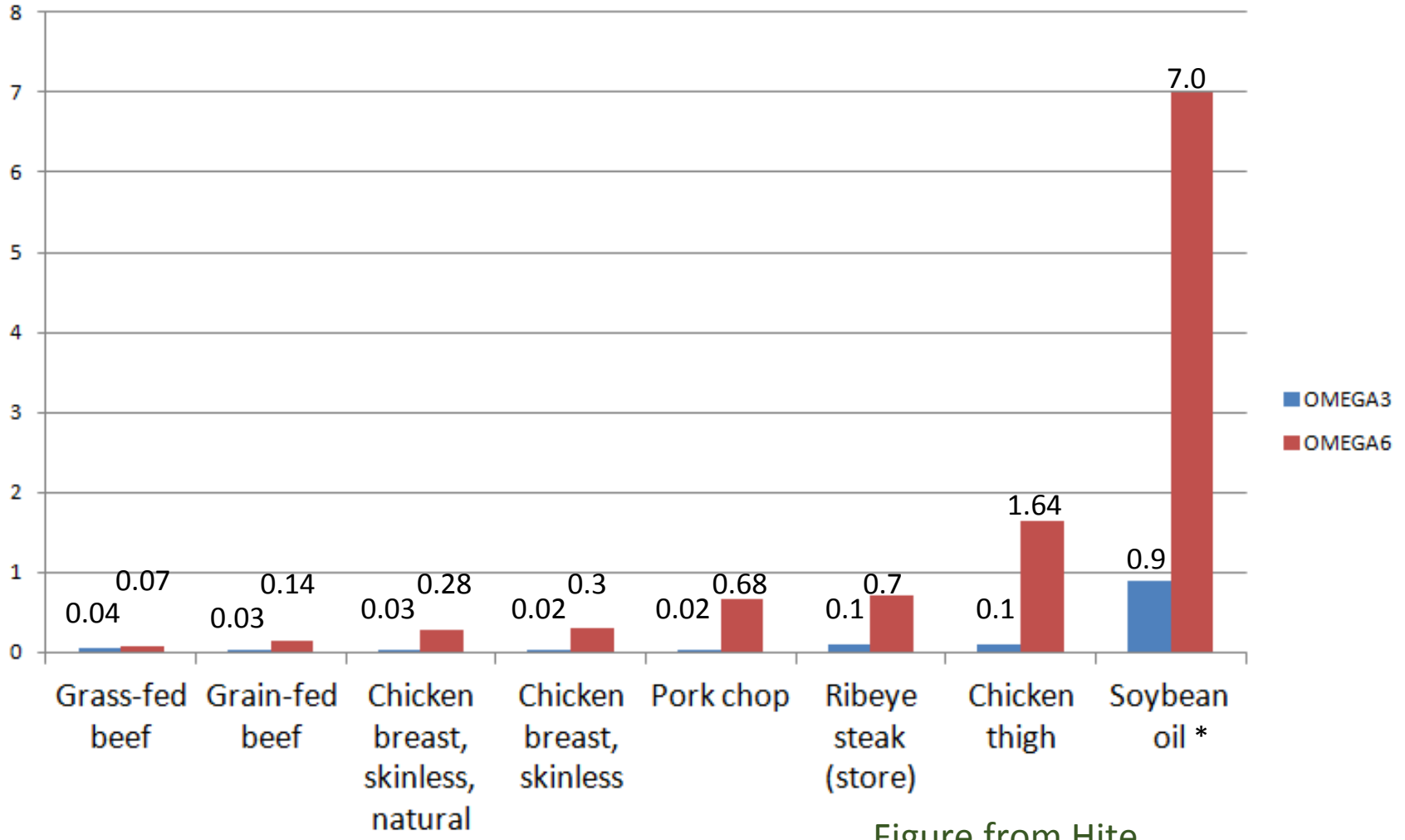


Figure from Hite

Data from Duckett, Clemson Univ, and Hite (*)



Serving size:
85.5 g (3 oz), cooked, for all except Soybean oil
Soybean oil = 1 Tablespoon (15 grams)

Figure from Hite
Data from Duckett, Clemson Univ, and Hite (*)

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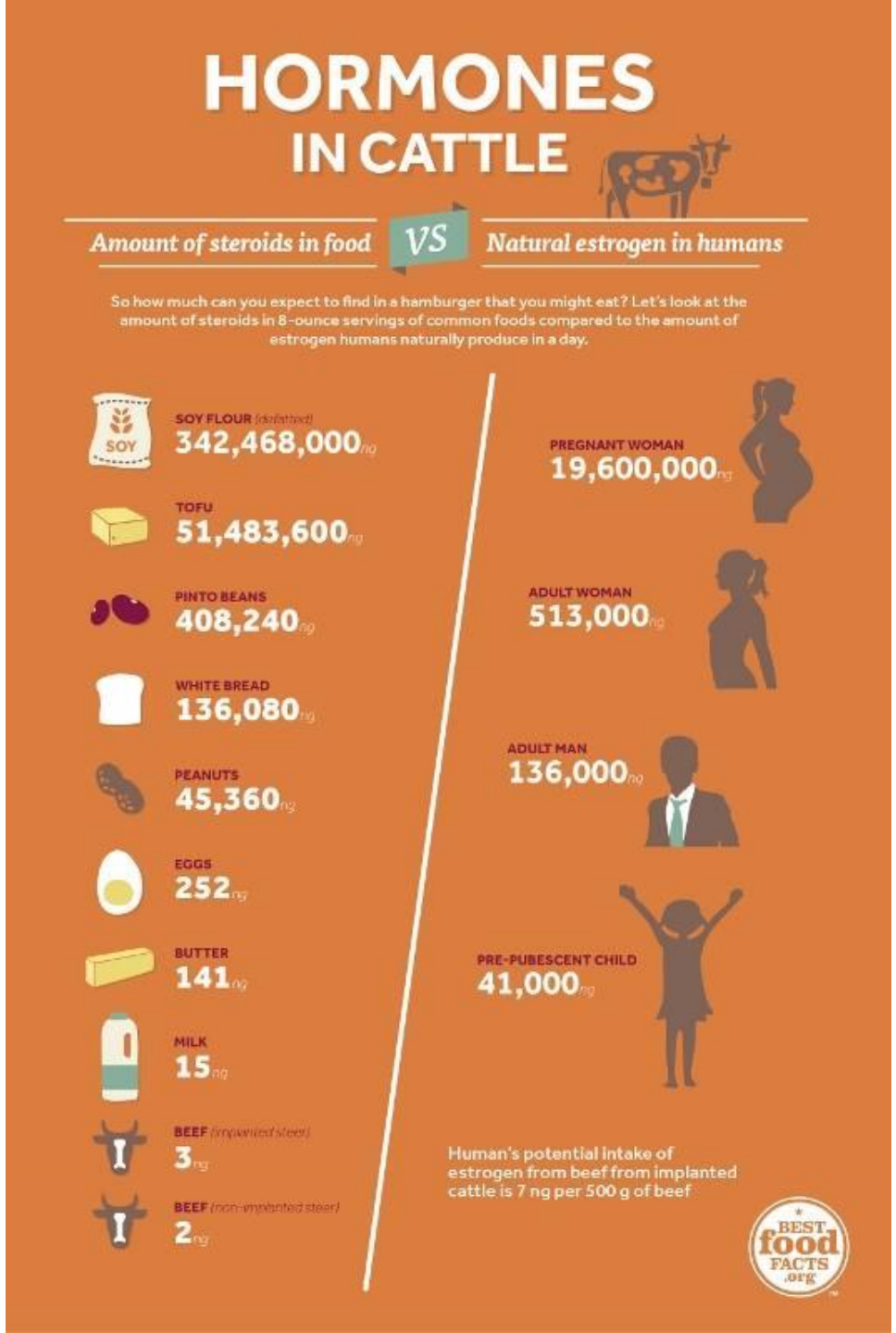
What about hormones?



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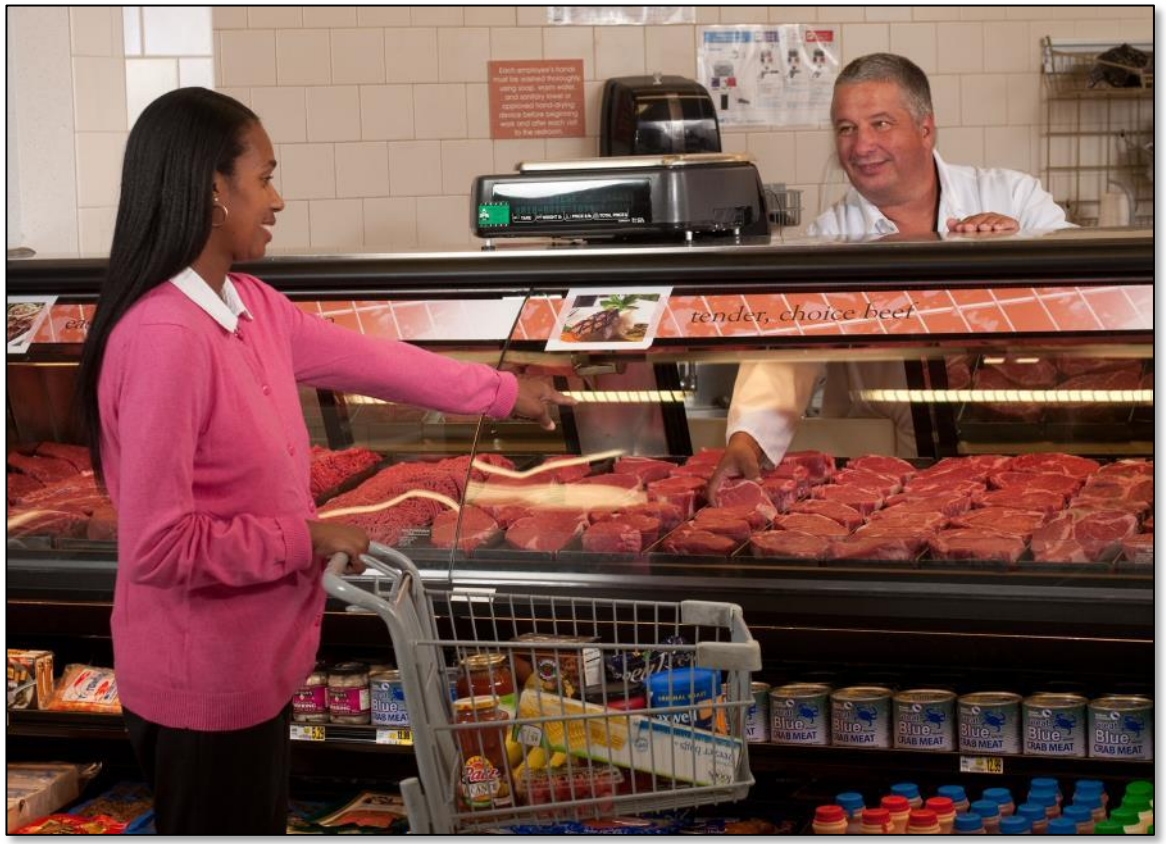
Healthy Soils ↔ Healthy Plants ↔ Healthy Animals ↔ Healthy People

Other Concerns

- Nitrates
- Pesticide and antibiotic residues
- Antibiotic resistance
- Animal welfare
- Others?



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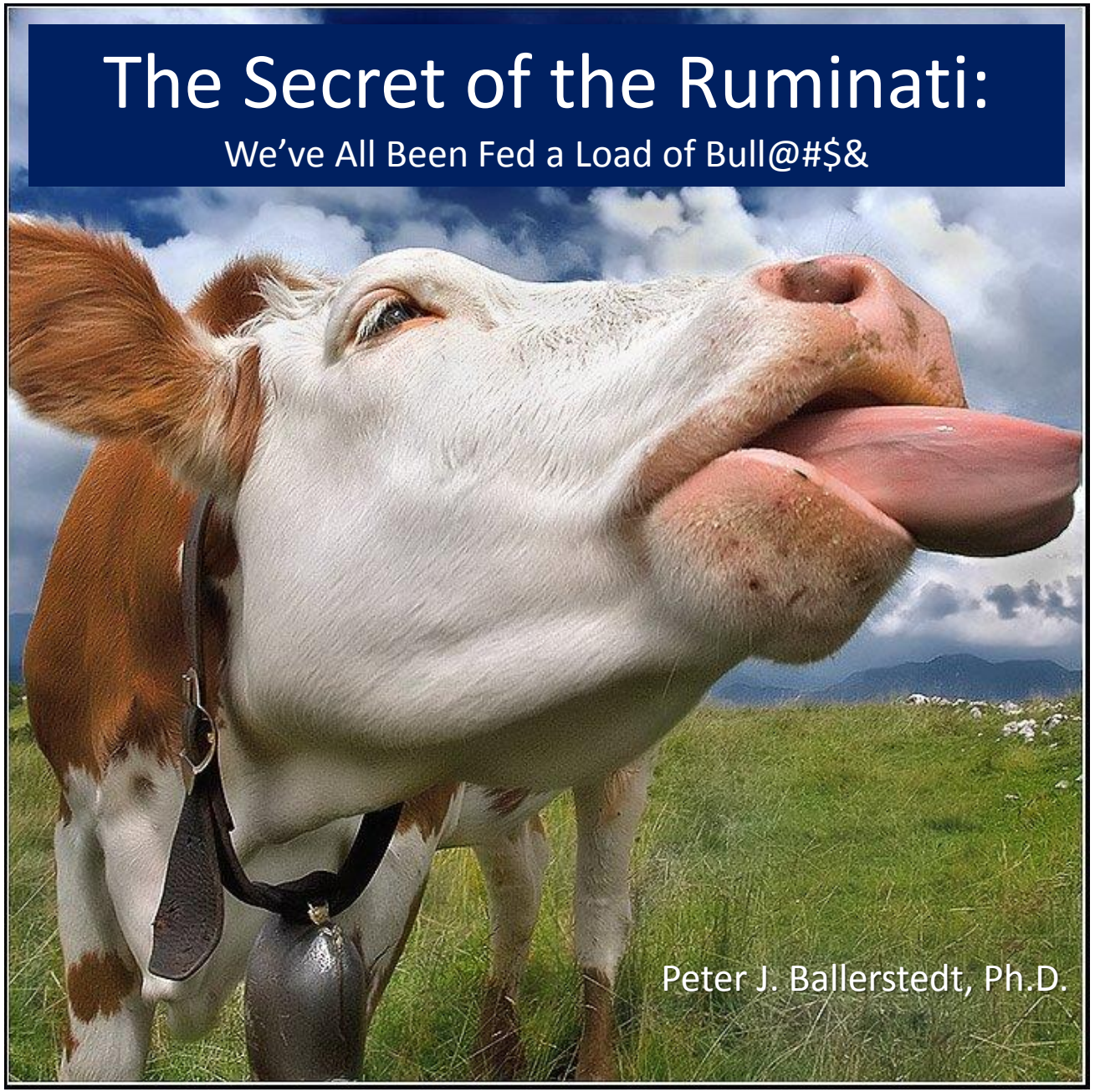
The Secret of the Ruminati:
We've All Been Fed a Load of Bull@#$&
Peter J. Ballerstedt, Ph.D.

Coming soon?

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