Antibiotics, Hormones, & other issues: Beef Production

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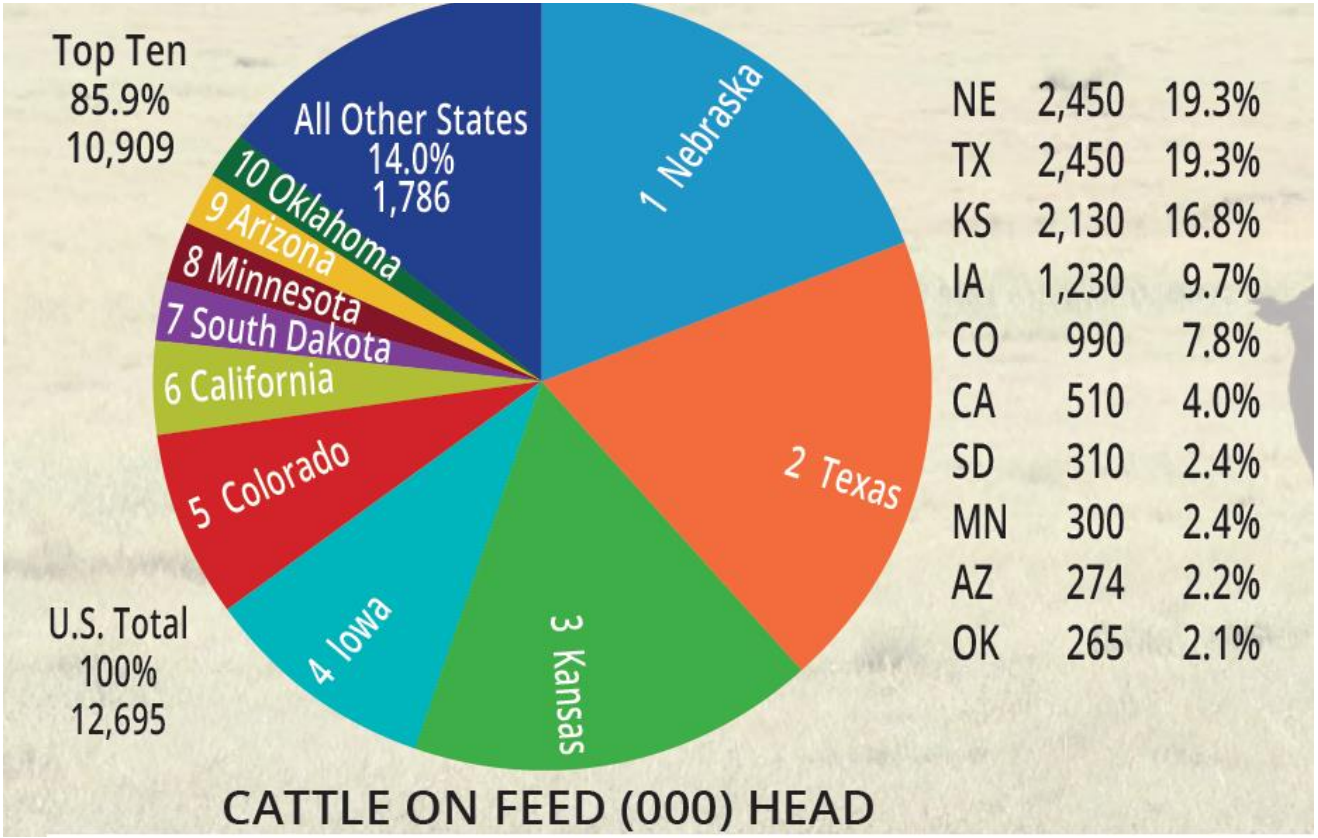
Objectives

- Beef Production
- Antibiotics
  - Feed grade
  - VFD meaning and reasoning
  - AMR
- Hormone Implants
  - Common use and reasoning
  - Implications and safety
  - Common food ingredients and relative contribution of beef
- Other Environmental Issues Being Addressed

U.S. Beef Industry

Top 10 States - Feedlots



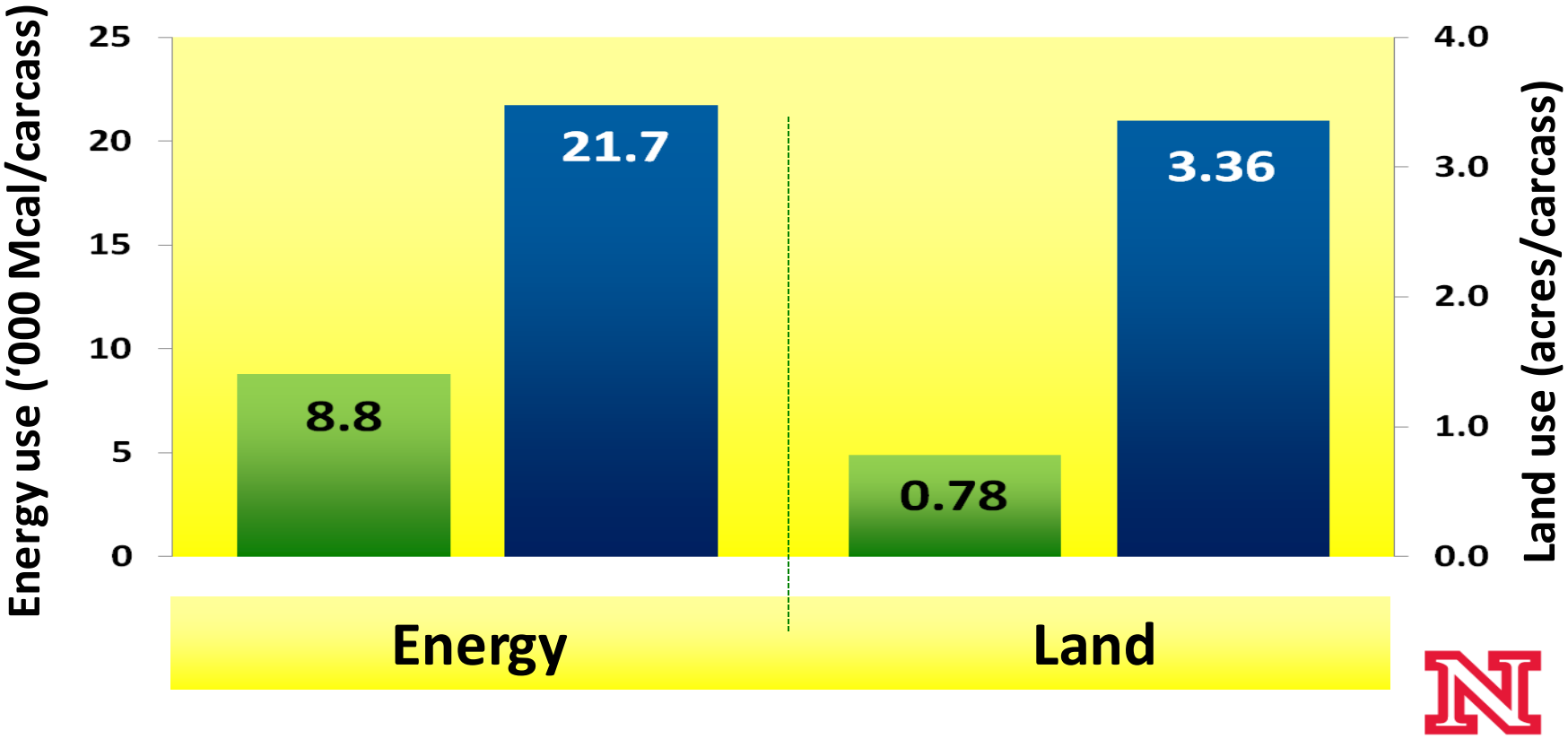
Just how much grass vs grain is used?

- Almost all are grain fed at the end (98.6%) unless cow beef (lean) is included
- If cow slaughter is included, then approximately 81% of beef is grain fed
- Even so, average time in feedlot: 173 d,
  - but average age is 500-550 d
- So, calf life fed grain 173/525 = 33%
- If the cow is around for 1 year to raise a calf (7 mos to wean; 5 mos dry)
- Add in the cow's year (plus she eats 2X the calf)
  - In the U.S., forage is: >82.3% of feed needs
  - Doesn't account for byproducts, all cattle (< 10%

Just how efficient is grain use (in beef)?

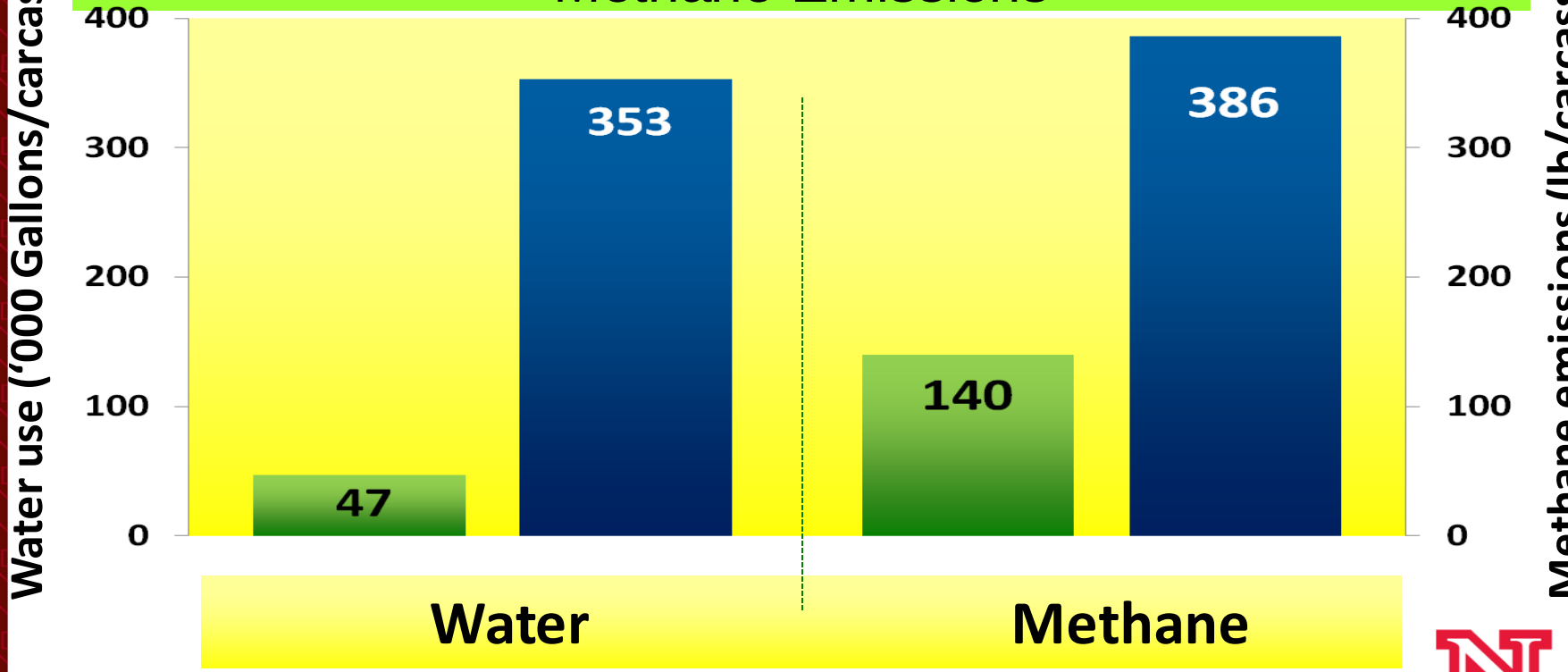
- 1400 steer
- 50 bu (old rule of thumb) = 2400 lb of DM as corn
- 2400/1400 = 1.71 lb corn/lb of weight sold
- Cattle use forage (not used by non-ruminants)
- So, why any grain?
  - Taste, marbling, quicker growth rate, and bigger
- 95 million hd (U.S.) > 215 million hd (Brazil) as example

Corn-Finished Beef Production Reduces Energy and Land Use



Source: Adapted from Capper et al. (2009) "Demystifying the environmental sustainability of food production" *Cornell Nutrition Conference*

Corn-Finished Beef Production Reduces Water Use and Methane Emissions



Source: Adapted from Capper et al. (2009) "Demystifying the environmental sustainability of food production" *Cornell Nutrition Conference*. Irrigation water use from USDA (2008) and irrigation use for pasture estimated at 20%

Fat in Beef

- 30% Stearic Acid
- 40% Oleic Acid
- Both **decrease vLDL's & triglycerides,** plus……
- **Increase HDL**
- Remaining 30% neutral
- **Fat in beef is heart healthy**

Tim Carr, Ph.D., human nutrition

Grass fed vs Grain fed (meat)

- Lehesta et al., 2008; J. Anim. Sci.;

Table 4. Means and SEM for percentages of moisture, fat, protein, and ash, and cholesterol content of raw strip steaks and ground beef from grain-fed (control) and grass-fed treatments

	Strip steaks					Ground beef				
	Control (n = 9)		Grass-fed[1] (n = 41)			Control (n = 9)		Grass-fed[2] (n = 42)		
Constituent	Mean	SE	Mean	SE	*P*-value	Mean	SE	Mean	SE	*P*-value
Moisture, %	71.6	0.25	73.5	0.19	0.001	65.9	0.64	67.1	0.47	0.772
Fat, %	4.4	0.41	2.8	0.17	0.001	14.7	0.80	12.8	0.58	0.800
Protein, %	23.2	0.15	23.1	0.12	0.613	19.2	0.17	19.4	0.15	0.511
Ash, %	0.8	0.09	0.7	0.06	0.655	0.4	0.13	0.8	0.09	0.093
Cholesterol,[3] mg/100 g	54.6	1.25	54.7	0.90	0.987	62.0	1.08	62.3	0.83	0.851

Grass fed vs Grain fed (meat)

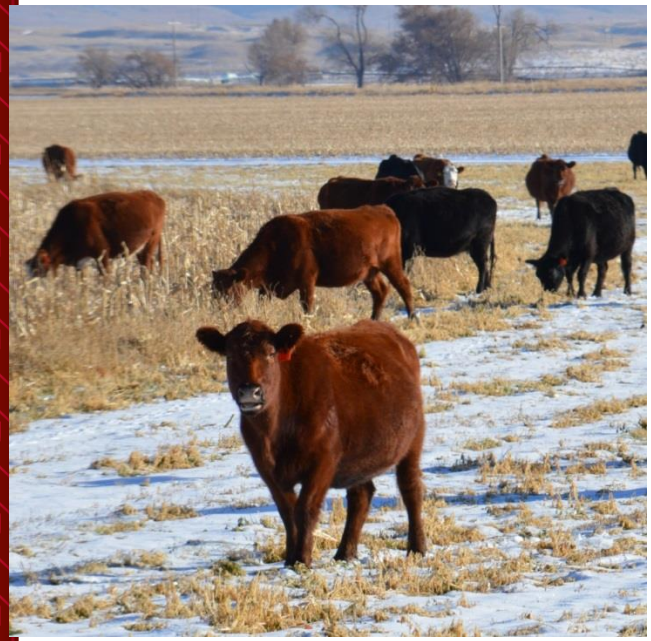
- Lehesta et al., 2008; J. Anim. Sci.; Read Daley et al., 2010 Nutrition

Table 5. Mean concentration of saturated, unsaturated, *trans*, n-3, and n-6 fatty acids in grass-fed and control raw ground beef as percentage of total fatty acids (g/100 g fat)

	Control		Grass-fed		
Fatty acid	Mean	SE	Mean	SE	*P*-value
SFA[1]	44.5	0.75	50.9	0.60	0.001
MUFA[2]	47.0	1.09	39.2	0.74	0.001
PUFA[3]	2.7	0.10	2.44	0.20	0.276
n-3	0.24	0.04	0.88	0.06	0.002
n-6	2.20	0.17	1.85	0.10	0.195
Total *trans*[4]	6.00	1.02	7.15	0.32	0.194
*c*9, *t*11 CLA	0.50	0.04	0.94	0.04	0.001
Total CLA	0.60	0.04	1.03	0.04	0.001
PUFA:SFA	0.059	0.004	0.050	0.004	0.904
n-6:n-3	9.60	1.44	2.45	0.39	0.001

Antibiotics

Animal Health Judicious Use



- **Judicious use of antimicrobials**
- **Veterinary medicine approach to maximize therapeutic efficacy and minimize selection of resistant microorganisms.**
- **Guideline: (Dr. Jeff Fox, NC 2015)**
- **Timely – Early Diagnosis**
- **Needed – Is the Animal Sick? (Temp 104+)**
- **Effective – Use Product Labeled for Diagnosis**
- **Legal – Follow Label**

- Nebraska BQA

EXTENSION

Veterinary Feed Directive Timeline

- VFD is a written order (paper or electronic) by a licensed ve terinarian in the course of their practice approving the use of a VFD product.

-June 3, 2015
- -New Labels Submitted
- -No Performance Claims

-January 1, 2016
- -Begin approving new labels
- -New Labels begin to be available

-January 1, 2017
- -All Feed Grade Antibiotics Require VFD
- -Water Delivered Require Prescriptions

EXTENSION

Veterinarian Client Patient Relationship

- Working Relationship
- Understanding of Operation
- Development of Animal Health Plan/Protocols
- Assist in Diagnosis
- Develop Treatment Regime
- Oversight & Follow up

EXTENSION

VFD Treatment Protocol

Therapeutic Uses (Labeled Use)

• **"Prevention of Disease"** with a VFD can be approved when a known disease risk is present and the VFD antibiotic can be administered to prevent animal infections. None of the animals in the group are exhibiting clinical signs of disease but where the disease is likely to occur if the drug is not administered.

• **"Treatment of Disease"** with a VFD antibiotic can be approved when animals are exhibiting disease signs.

• **"Control of Disease"** with a VFD antibiotic can be approved to decrease the spread of disease when a percentage of the animals in the group have exhibited disease signs and the clinically sick are being individually treated.

EXTENSION

Veterinary Feed Directive

GFI 152 (Table 7 Interpreted by DG)

Antibiotic Importance To Humans	Length Of Time Bacteria Are Exposed To The Antibiotic		
	Less Than 7 Days	7 to 21 Days	Greater Than 21 Days
Critically Important Antibiotics (Classes)	Would allow in livestock if a veterinarian was involved ONLY for disease prevention, treatment or control		Would not allow in livestock
Aminoglycosides: ex Neomycin			
Amphenicols: ex Nuflor			
b-Lactams: ex PenG, Excede			
Macrolides: ex Tylan, Pulmotil			
Quinolones: ex Baytril			
Highly Important Antibiotics (Classes)	Would allow in livestock if a veterinarian was involved ONLY for disease prevention, treatment or control		
Lincosamides: ex Pirlimycin			
Streptogramins: ex Virginiamycin			
Sulfas: ex Sulfadimethoxine (Albon)			
Tetracyclines: ex Chlortetracycline (CTC)			
Antibiotics Not Important To Humans (Classes)	Allowed in livestock		
Glycolipids: ex Bambermycin			
Ionophores: ex Monensin			
Pleuromutilins: ex Tiamulin			
Polypeptides: ex Bacitracin			
Quinoxalines: ex Carbdox			

http://www.fda.gov/downloads/AnimalVeterinary/GuidanceComplianceEnforcement/GuidanceforIndustry/ucm052519.pdf

Only affects antibiotics used in feed!

Does NOT affect Ionophores!

Water Delivered Antibiotics Require Prescription

Feed Additives

Ionophores- Rumensin, Bovatec, Cattlyst, Gainpro, Vmax

Coccidiostats- Deccox, Amprolium, Rumensin, Bovatec

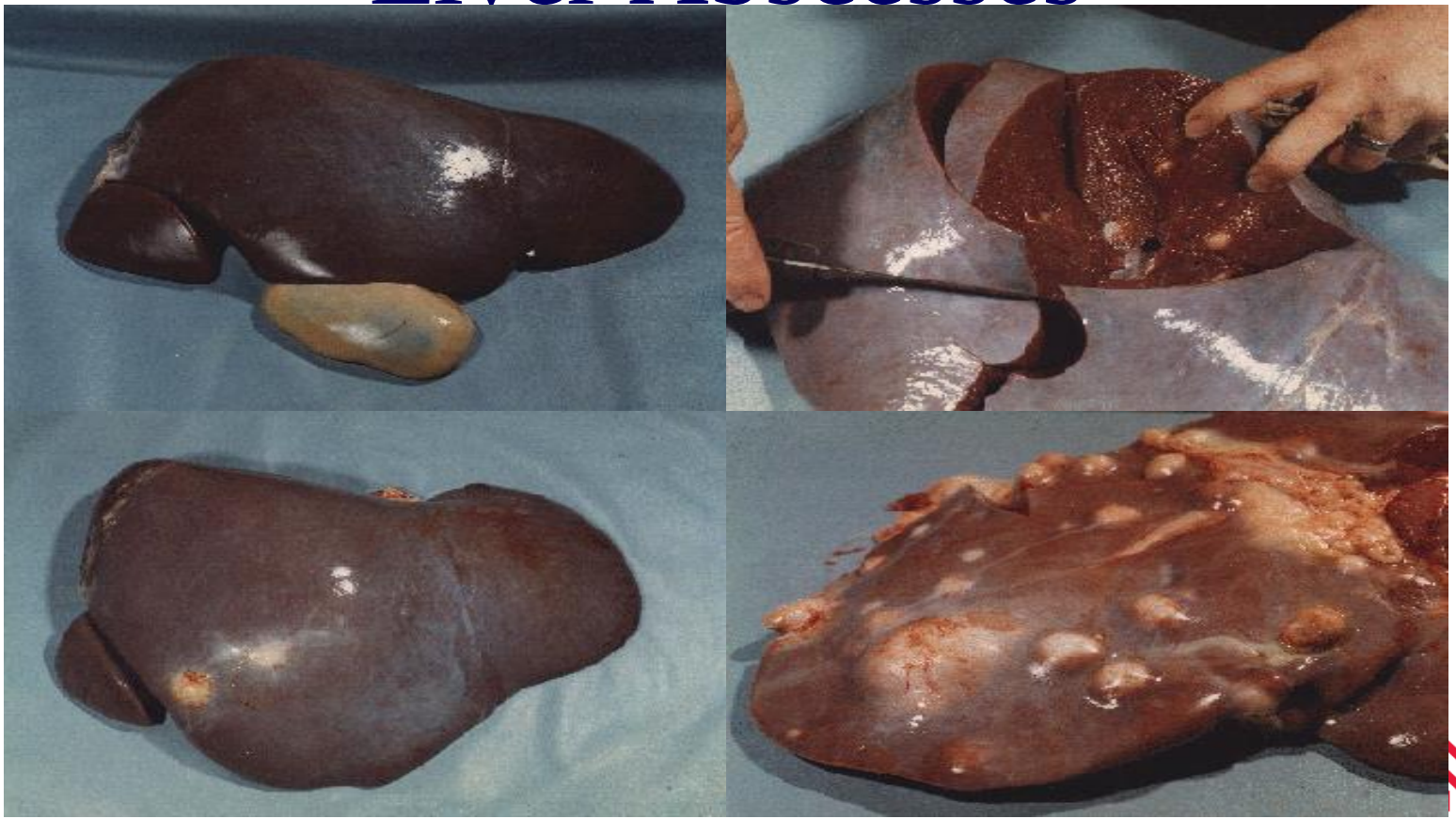
Antibiotics- Tylan, CTC, OTC

Hormone- MGA (melengesterol acetate)

B-agonists- Optaflexx

- Antibiotic resistance is “normal”
  - Question: does antibiotic use in animals increase rate of resistance of bacteria that could be pathogenic to humans?
  - Certainly being studied

Liver Abscesses



Tylan

	none	Tylan	%change
Trials	40	40	
DOF	134	134	
ADG	2.84	2.90	2.1
F:G	6.72	6.90	-2.6
Liver abscesses	27.9	7.5	

Elanco Animal Health Technical Bulletin; Laudert and Vogel

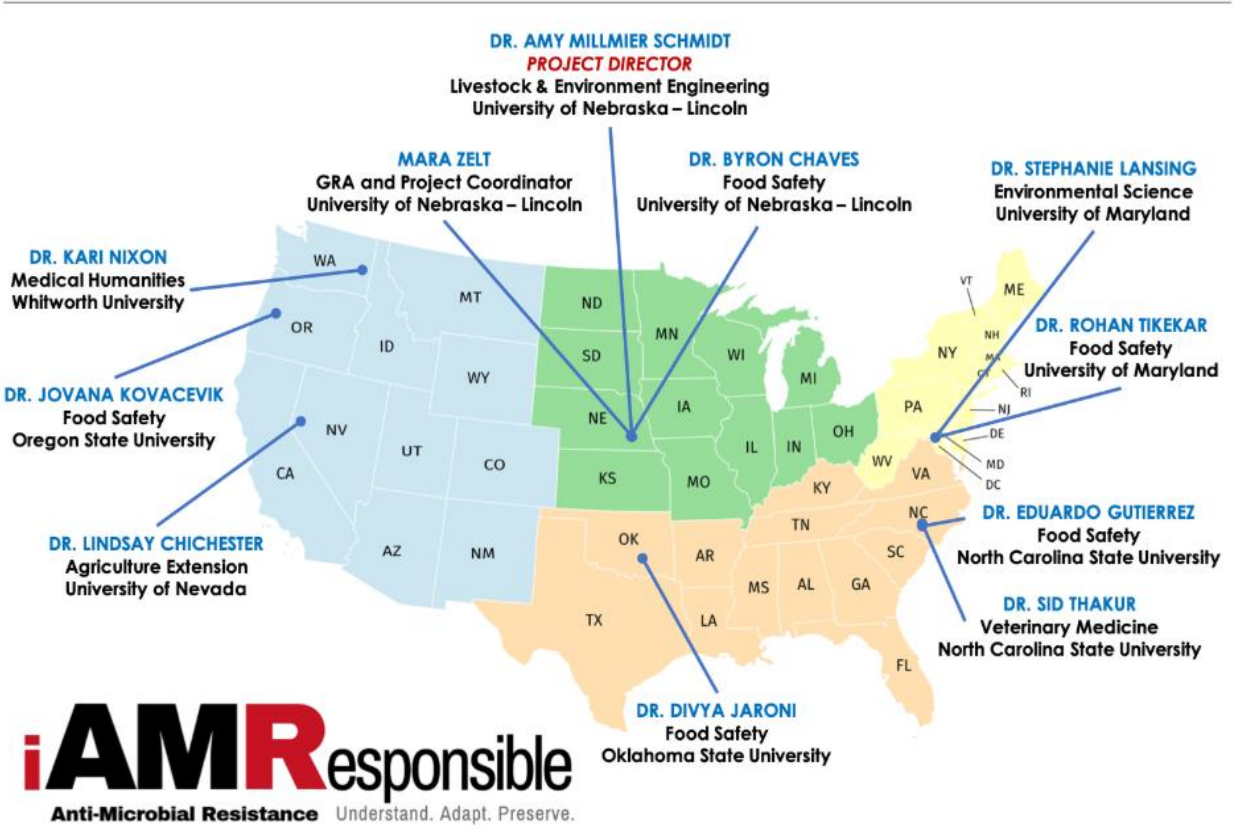
3 recent UNL studies: (25-42%) to (8-19%)

AMR

- Does feeding antibiotics increase AMR?
- UNL and US MARC research suggests no, as soon as pressure is removed. And, AMR gene activity and microbes possessing it are in soil (naturally)

AMR

- Down 43%
- tetracycline



Residues

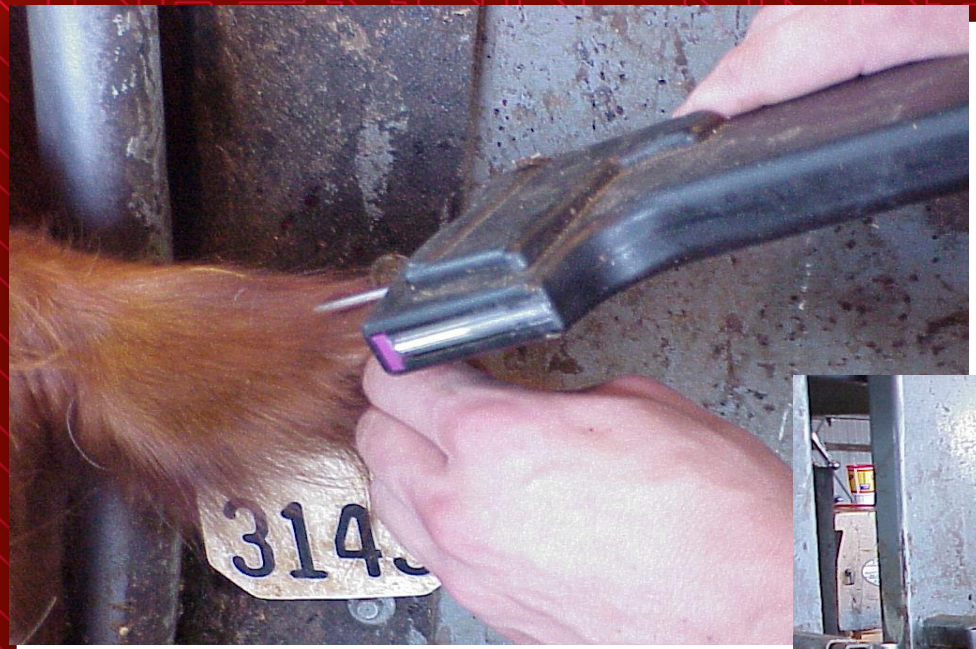
- FSIS National Residue Program
- Select any visually sick
- Random sampling
- Prior violations

- < 0.5% of 120,000 samplings, mostly in dairy cows (about 0.2% in 2017)
- Kidney test (most sensitive storage, and last to clear)
- Includes pesticides, minerals, and antibiotics/hormones
- Tylosin is approved to be fed up to slaughter (no residues). Most injectibles have a 21 to 28 d clearance required
- 0% on tylosin (macrolide)

Hormones

- Three types
  - Protein: Insulin, Growth Hormone (bST)
  - Steroid (sex): Estrogen, Testosterone, Progesterone (many compounds "like" steroids such as phytoestrogens, trenbolone acetate, melengesterol acetate)
  - Amine: Epinephrine, Norepinephrine, Beta-Agonists ("inhalers")

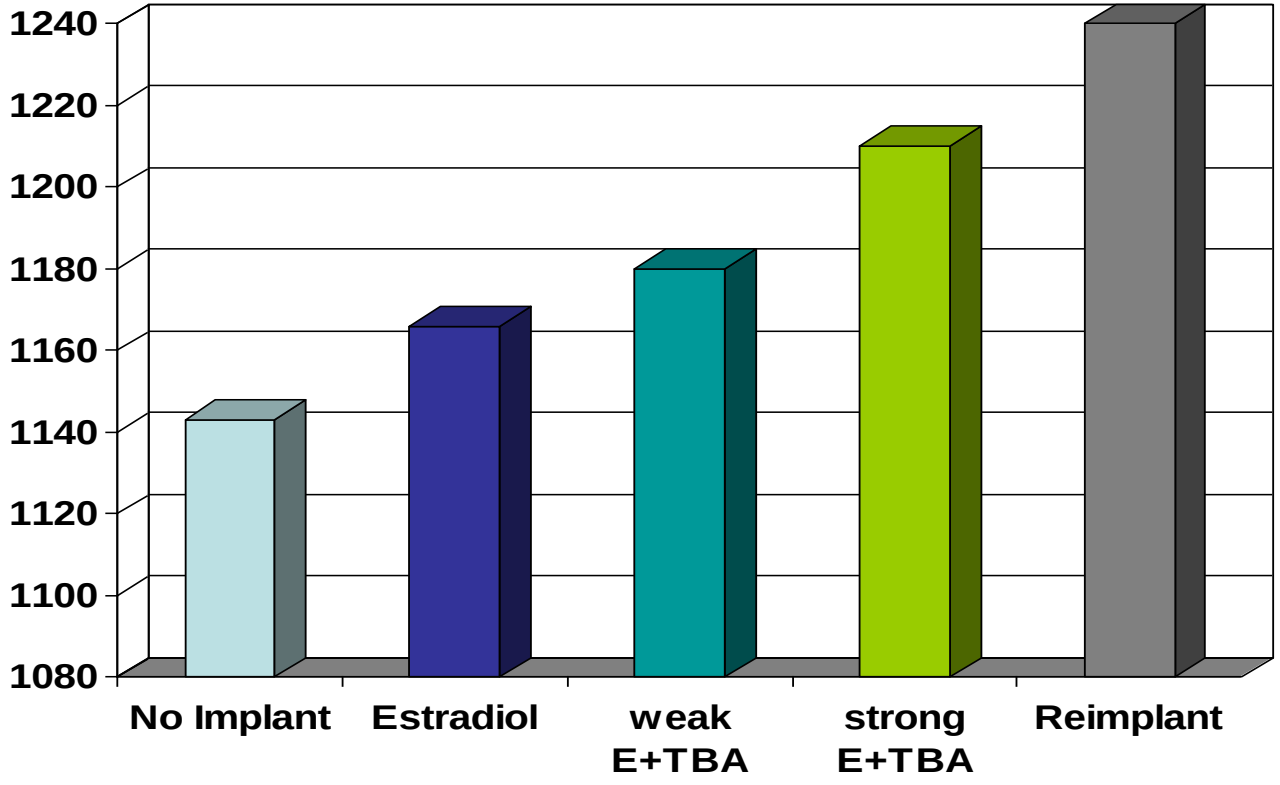
- Oral activity from Steroids and Amines only
- In cattle: implants are steroid like or steroid and given in the ear
- In cattle: two feed additives approved as beta-agonists



FDA approved
Middle 1/3 of the ear
No withdrawal

Implants

Implants and Finished Body Weight



13 trials, 9,052 steers

Guiroy et al., 2002

Types of Implants

- Most commercial implants are combinations of both
- Estrogenic
  - Estradiol 17ß (E_2)
  - Estradiol benzoate (E_2B)
    - about 73% estradiol 17ß
  - Zeranol
- Androgenic
  - Testosterone proprionate
  - Trenbolone acetate (TBA)

Source	Total Estrogen Activity
Soy Flour	775,000 ng/500 gm
Infant formula (soy)	125,000 ng/500 gm
Tofu	113,000 ng/500 gm
White bread	300 ng/500 gm
Peanuts	100 ng/500 gm
Milk	80 ng/500 gm
Bulls (H. Free)	110 ng/500 gm
Steer (H. Treated	**11 ng/500 gm**
Heifer (H. Free)	9 ng/500 gm
Steer (H. Free)	8 ng/500 gm
Children	40,000 ng/day
Males	180,000 ng/day
Females	5,000,000 ng/day
Preg. Females	90,000,000 ngday

Androgen Content Meat

Food	Androgen (ng/portion)
Bull	1,560
Steer implanted w/TBA	135
Heifer implanted w/TBA	150

Human Estradiol Production

"A man's body produces 15,000 times the estradiol in a day than he would get from a pound of meat from treated cattle, while a woman produces several million times that. Similar situations apply to testosterone and progesterone". FDA

Human Estradiol Production

	Estradiol Produced /day
Boys	41,000 nanograms
Girls	43,000 – 54,000 nanograms
Adult Male	168,000 nanograms
Non-Pregnant Female	20,000,000 nanograms
Pregnant Female	4,000,000 – 64,300,000 nanograms

One Birth Control Pill contains the same amount of estrogen as 125,000 lbs of beef from implanted steers.

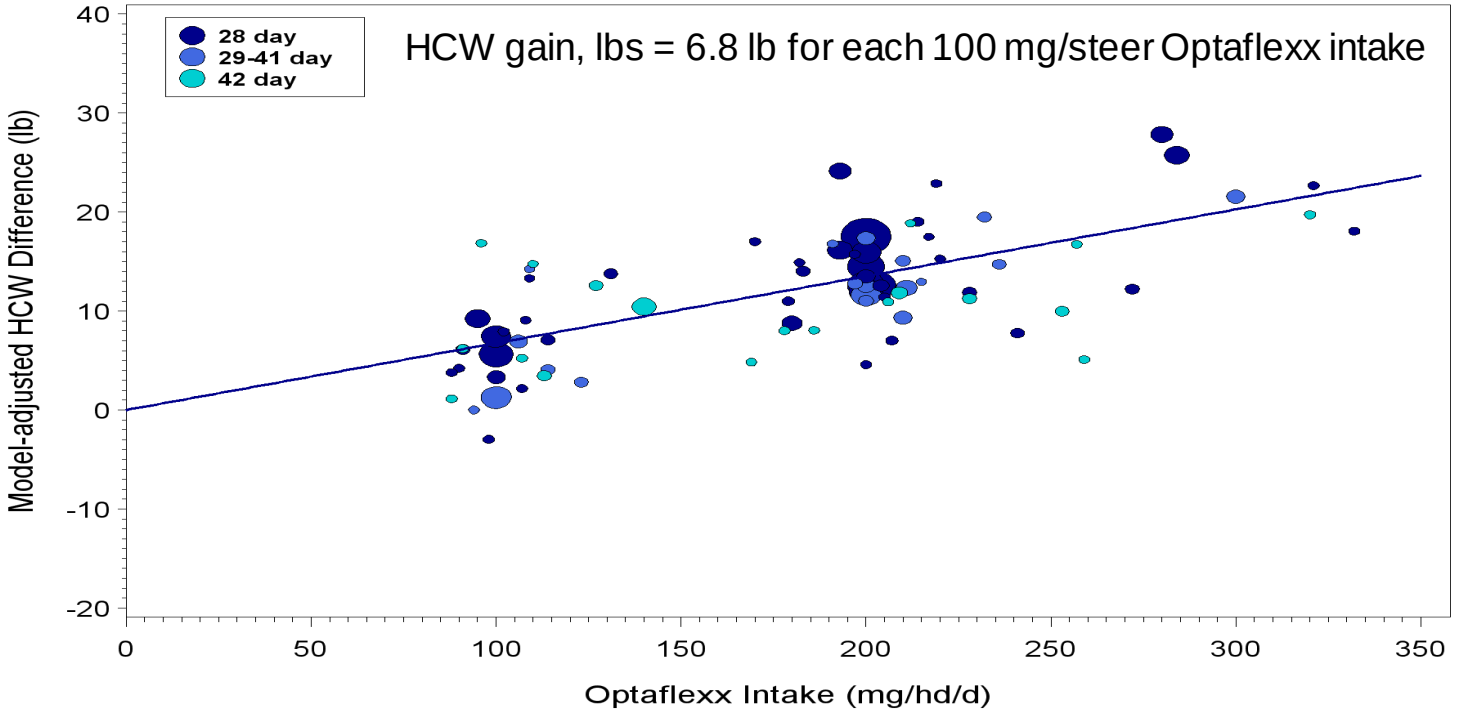
Marketing Programs Exist

- Alternative production systems
  - Organic
  - Grass-fed
  - NHTC
  - Branded programs: Natural, etc
- Produce more Beef with less inputs
  - Safe
  - Affordable: competing protein
- What will be new breakthroughs?

Hormone implants

- No other technology is more beneficial for increasing beef production
  - Increases beef supply with less total cattle (positive)
  - Costs are <$10, Returns are >$80
  - No negative impact on beef quality or safety
  - Been used for over 60 years
  - Can participate in NHTC or branded programs that restrict use
    - Increases cost, so need a large premium
    - Costs more to consumer

Effects of Optaflexx on Steer Carcass Weight Gain[a]



[a]Hot carcass weight expected outcomes for 100, 200 and 300 mg/hd/d are 6.8, 13.5 and 20.3 lbs greater (respectively) relative to control.

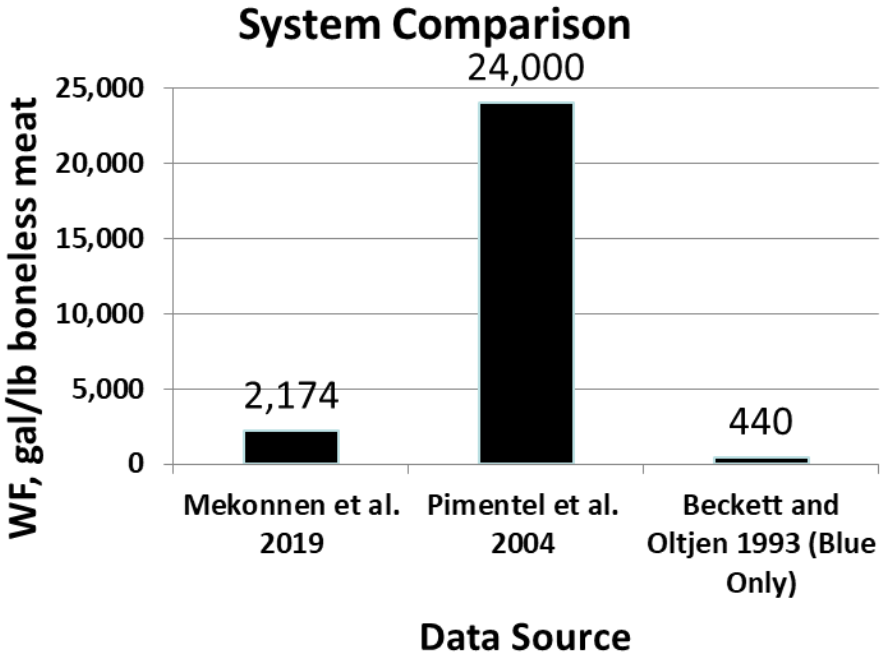
“From cows not treated with rBST”

“No significant differences has been shown between milk derived from rBST-treated cows and non-rBST-treated cows.”

Other Issues Being Addressed

- Water Use
- Methane
- AMR
- Sustainability measures
- Rural socioeconomic issues

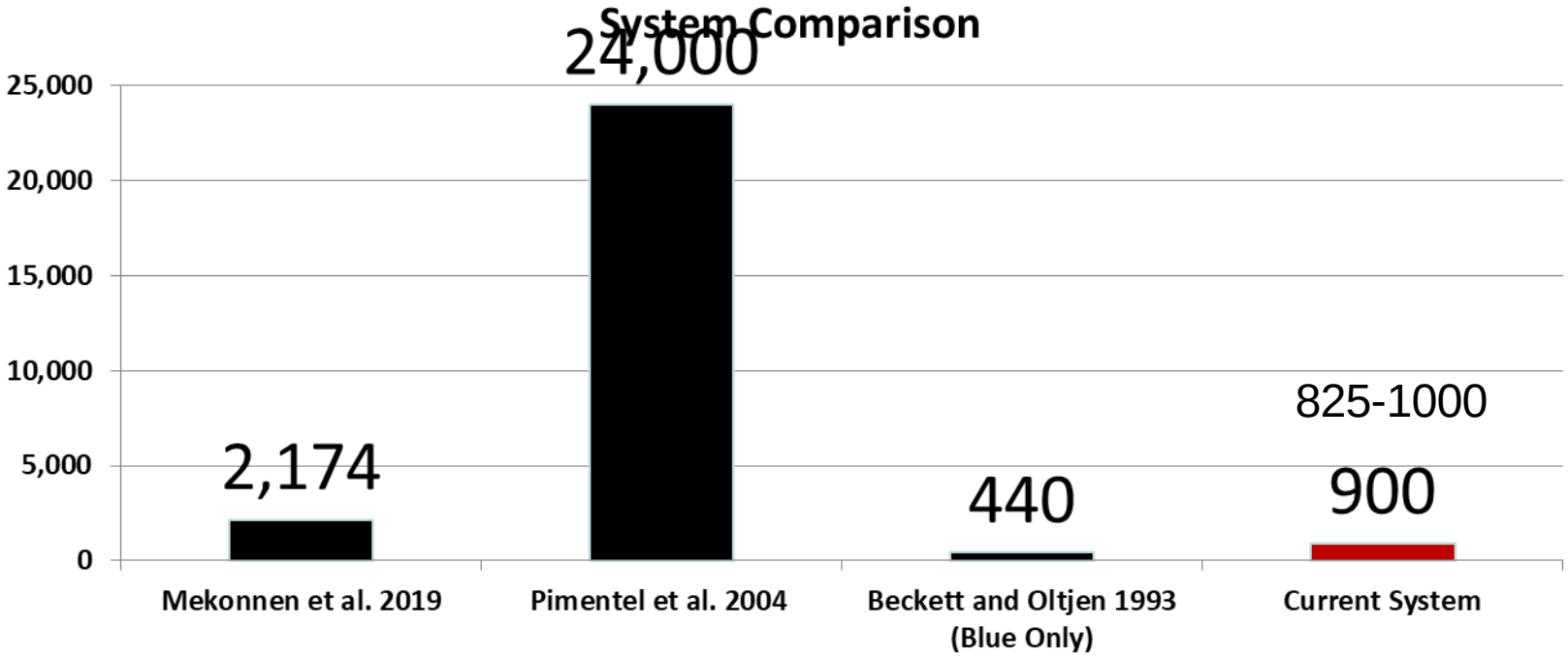
CURRENT SCIENTIFIC ESTIMATES

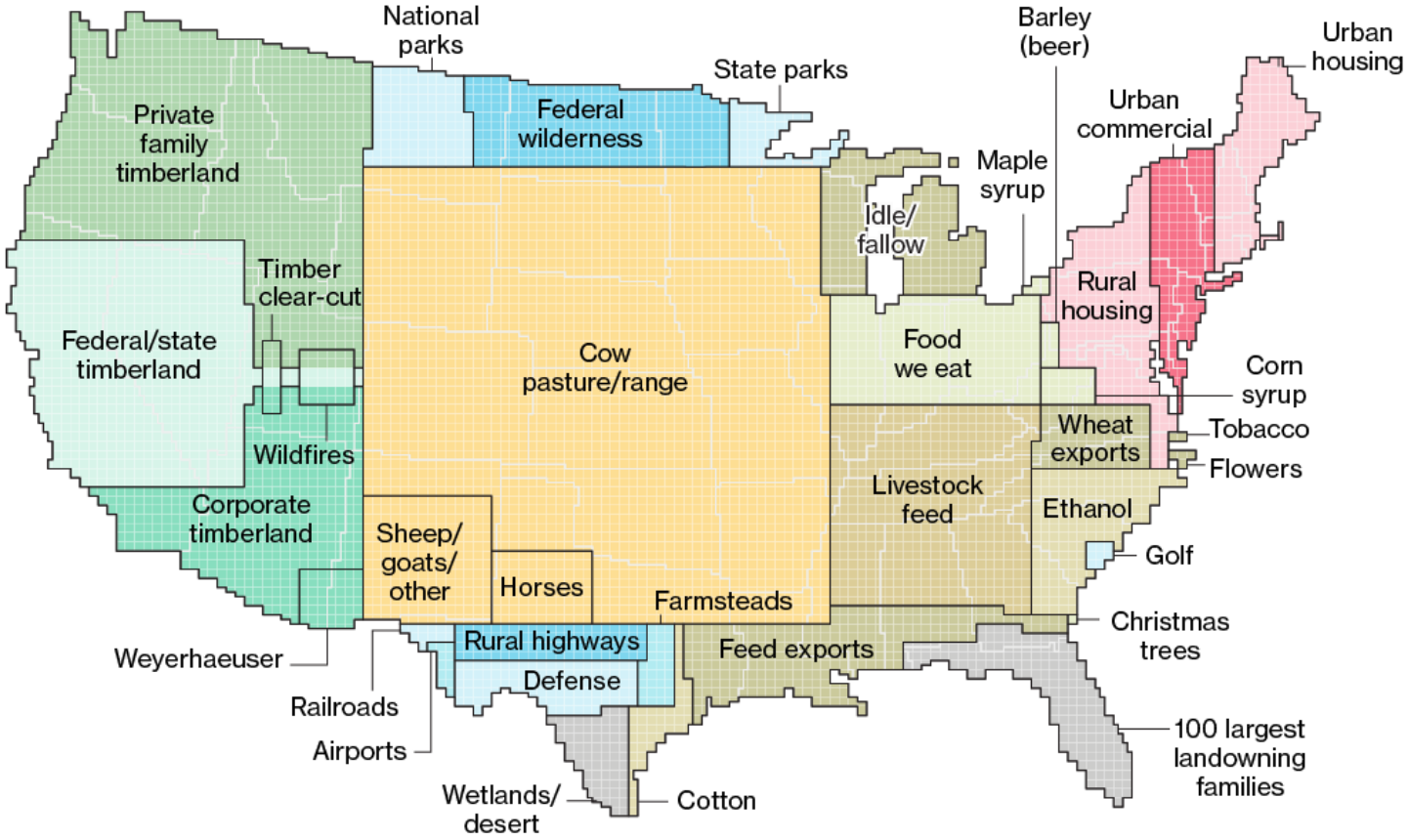


Why the variation?

Which value is most accurate?

CURRENT ESTIMATES




National parks
Barley (beer)
Urban housing
State parks
Private family timberland
Federal wilderness
Urban commercial
Maple syrup
Idle/ fallow
Timber clear-cut
Rural housing
Federal/state timberland
Cow pasture/range
Food we eat
Corn syrup
Wheat exports
Tobacco
Wildfires
Flowers
Livestock feed
Corporate timberland
Sheep/ goats/ other
Ethanol
Golf
Horses
Farmsteads
Christmas trees
Rural highways
Feed exports
Weyerhaeuser
Defense
Railroads
Airports
100 largest landowning families
Wetlands/ desert
Cotton

EXTENSION

Questions?

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