- September 23, 2020 -

Scaling Up Pastured Livestock Production

- Presented by -

Franklin Egan

Pasa Sustainable Agriculture

- Hosted by -

FACT

Food Animal Concerns Trust

Introductions

Food Animal Concerns Trust (FACT) is a national nonprofit organization that advocates for the safe and humane production of meat, milk, and eggs.

Larissa McKenna
Humane Farming Program Director
Email: lmckenna@foodanimalconcerns.org
Website: foodanimalconcernstrust.org/farmer

FACT's services for livestock and poultry farmers include:

- **Fund-a-Farmer Grants**
- **Conference scholarships**
- **Free webinars**
- **Humane Farming Mentorship Program**

Our Presenter

Franklin Egan, PhD

Pasa Sustainable Agriculture

Scaling Up Pastured Livestock Production

FRANKLIN EGAN
23 SEPTEMBER, 2020
FRANKLIN@PASAFARMING.ORG

Pasa SUSTAINABLE AGRICULTURE

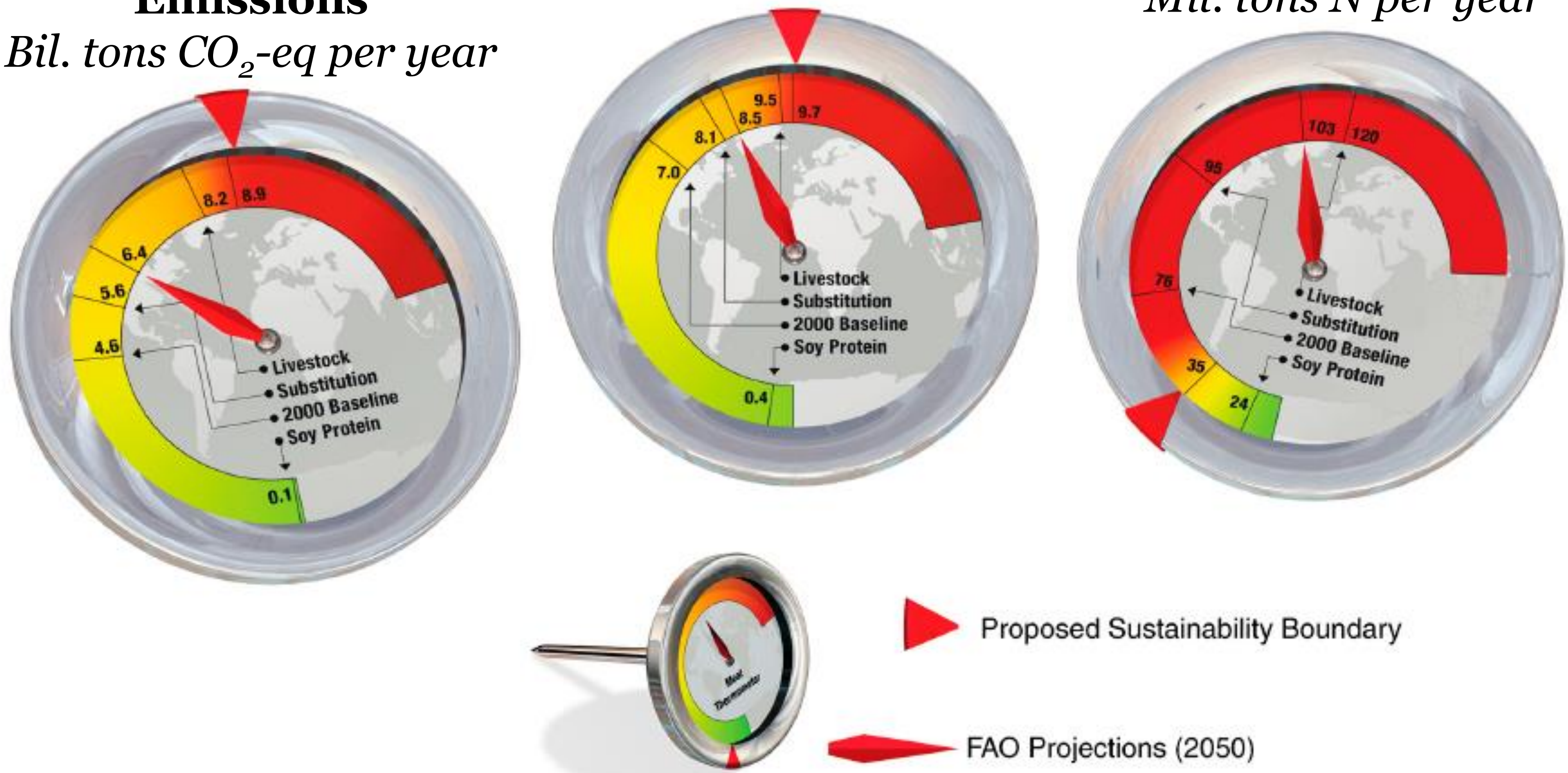
1. Farmer-to-Farmer Exchange
2. Registered Apprenticeships
3. Farmer-Driven Research

Globally, meat production has a HUGE environmental impact

Greenhouse Gas Emissions
Bil. tons CO_2-eq per year

Biomass Harvest
Bil. tons Carbon per year

Nitrogen Pollution
Mil. tons N per year



From Pelletier and Tydemers, 2010 *Proc. Nat'l Academy of Sciences*

1. Land and Feed Efficiency Benchmarks for Pastured Meats

NORTH
MOUNTAIN
PASTURES

Read the full report at www.pasafarming.org

Gross Meat Yield

= 13,000 LBS. HANGING WEIGHT * (65%) = 8,450 LBS.

Adj. Meat Yield

= [13,000 LBS. HANGING WEIGHT * (65%)] - [3 * 300 LBS LIVE WEIGHT * (55%) * (65%)] + [6 * 500 LBS. LIVE WEIGHT * (55%) * (65%)] = 9,139 LBS.

Example calculation for meat production on a beef farm with calves and stockers.

BEEF CATTLE

EFFICIENCY BENCHMARKS		
Farm	Adj. meat yield per ton hay	Adj. meat yield per total land acres
A	164	71
A	156	64
B	55	47
C	133	42
C	92	42
D	48	41
E	28	32
B	28	31

Benchmark your farm @ www.pasafarming.org!

PIGS

	EFFICIENCY BENCHMARKS	
Farm	Adj. meat yield per lb. Feed	Adj. meat yield per cropland acre.
F	0.12	1,186
B	0.08	733
G	0.16	591
H	0.14	540
H	0.14	532
D	0.10	469
E	0.12	468
I	0.09	372
J	0.10	313

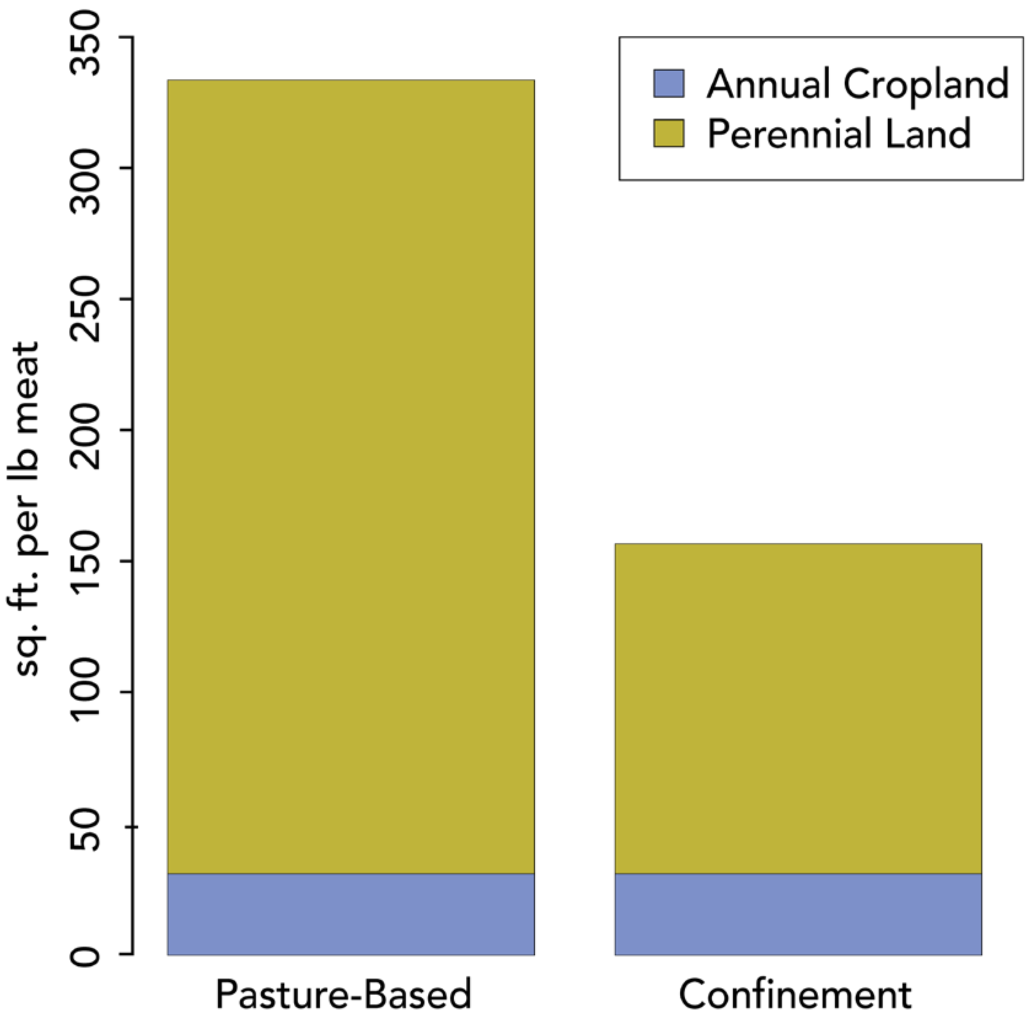
Benchmark your farm @ www.pasafarming.org!

BROILERS

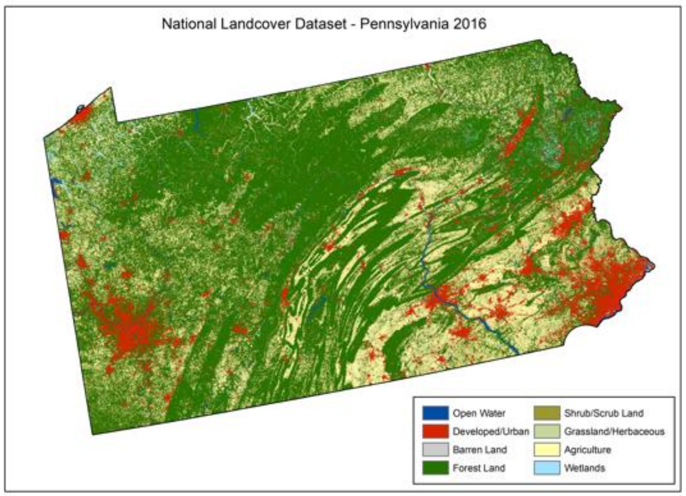
	EFFICIENCY BENCHMARKS	
Farm	Adj. meat yield per lb. feed	Adj. meat yield per cropland acre
H	0.87	4,958
H	0.88	4,781
F	0.27	2,351
J	0.37	1,697

Benchmark your farm @ www.pasafarming.org!

Land Use Efficiency:
Perennial, Annual, & Total

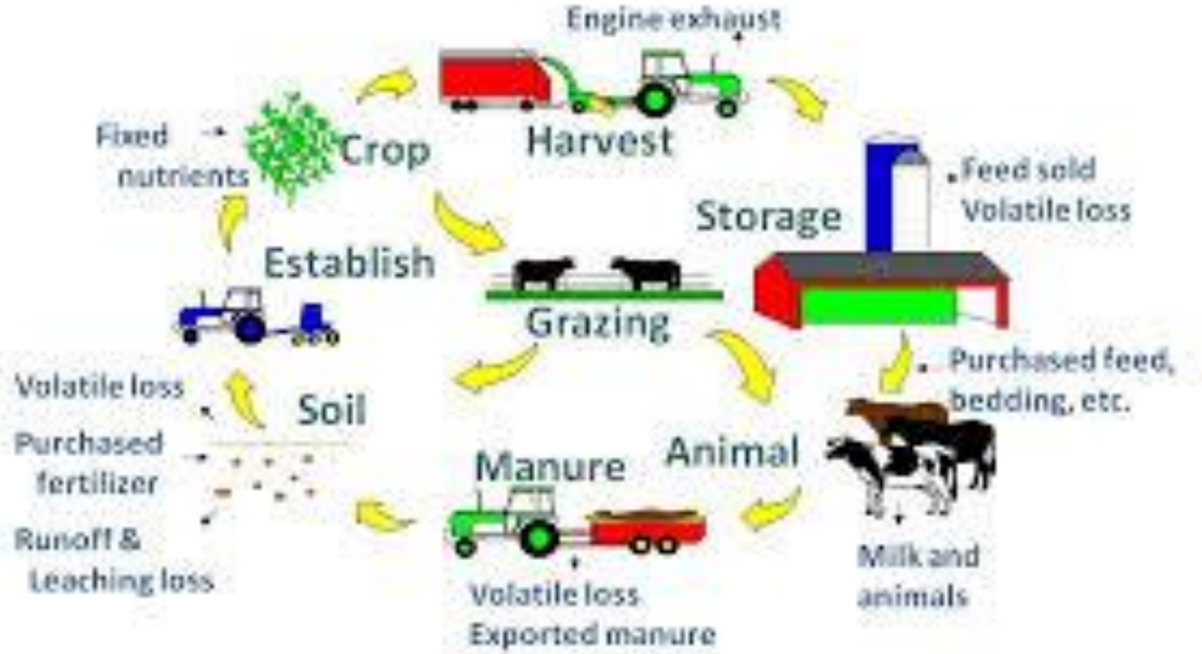


Feeding Pennsylvania with Pastured Livestock?



		Pasture-Based	Confinement
Current PA land base	Perennial Land	706,136	
	Annual Cropland	4,651,210	
Land needed to supply PA population	Perennial Land	12,536,694	4,922,975
	Annual Cropland	1,222,700	1,319,229

2. Environmental Footprints of Pasture-Based Dairies



Rotz et al. 2020. *Agricultural Systems*

Farm characteristic	All grass farms				Grass with grain farms			
	1	2	3	4	1	2	3	4
Total fam area, ha	85.0	179.3	146.9	121.4	60.7	250.9	106.8	40.5
Grass area, ha	85.0	149.7	132.3	121.4	40.5	202.4	106.8	40.5
Stand life, years	100	10	100	15	10	100	100	100
Legume portion in sward, %	25	30	20	25	30	30	10	40
Other crop area, ha	0.0	29.5	14.6	0.0	20.2	48.6	0.0	0.0
Number of cows	85	80	133	85	95	240	43	26
Number of heifers	45	29	44	60	45	200	31	18
Heifers/cow	0.53	0.36	0.33	0.71	0.47	0.83	0.72	0.69
Replacement rate, %	8	12	12	24	35	33	24	10
Annual milk production, kg FPCM/cow	3039	4396	4237	2931	6785	5988	5112	6312
Milk fat content, %	4.2	4.5	4.4	4.5	4.1	4.1	3.8	4.2
Land use, ha/animal	0.65	1.64	0.83	0.84	0.43	0.57	1.44	0.92
Land use, ha/cow	1.00	2.24	1.10	1.43	0.64	1.05	2.48	1.56
Milk price, $/kg	0.77	0.78	0.82	1.06	0.55	0.66	0.75	0.55

	Production system		
	All grass	Grass with grain	Confined fed TMR
Runoff P, kg/ha	0.67	0.56	1.47
Runoff P, mg P/FPCM	232	161	268
Blue water use, Mg/ha	46.5	58.9	86.9
Blue water use, kg/kg FPCM	16.0	13.0	13.3
Energy use, GJ/ha	5.81	11.8	16.9
Energy use, MJ/kg FPCM	2.00	2.60	2.58
Reactive N footprint, g N/ha	65.7	61.7	82.8
Reactive N footprint, g N/kg FPCM	2.54	1.53	1.42
Carbon footprint, Mg CO2e/ha	4.24	5.21	8.36
Carbon footprint, kg CO2e/kg FPCM	1.46	1.15	1.28

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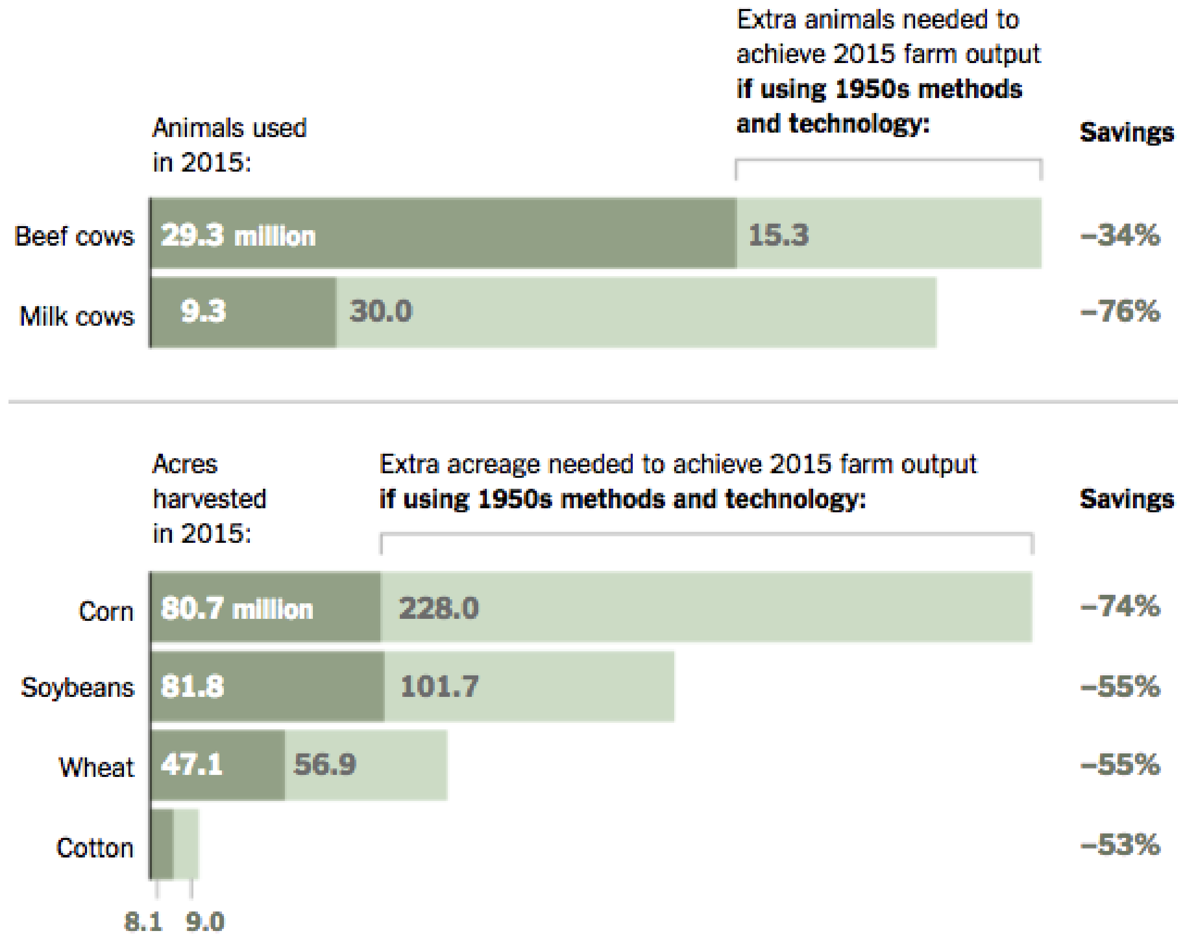
Carbon footprint, kg CO2e/kg FPCM	1.46	1.15	1.28
Annual Milk, kg FPCM/cow	3879	6056	8725

SundayReview | OP-ED CONTRIBUTOR

Why Industrial Farms Are Good for the Environment

By JAYSON LUSK SEPT. 23, 2016



Which Organism is more *Energy Efficient?*

House Mouse
(*Mus musculus*)

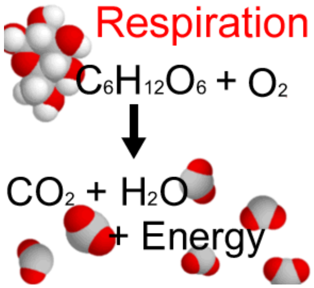
OR

Elephant
(*Loxodonta spp.*)

Expanded from Giampietro and Mayumi, 2010.

Cellular

Mouse: **3W*kg^{-1}**



Elep: **0.5W*kg^{-1}**

Cellular   **Individual**

Mouse: 3W*kg^{-1} $(0.02kg*Ind^{-1})*(3W*kg^{-1})$ = **$0.06W*Ind^{-1}$**

Respiration

$C_6H_{12}O_6 + O_2$

↓

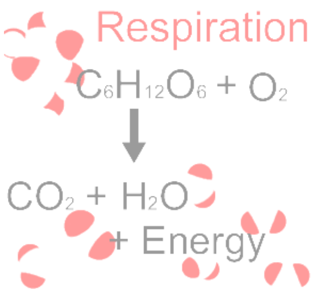
$CO_2 + H_2O$ + Energy

Elep: 0.5W*kg^{-1} $(4000kg*Ind^{-1})*(0.5W*kg^{-1})$ = **$2000W*Ind^{-1}$**

Expanded from Giampietro and Mayumi, 2010.

Cellular | Individual | **Population**

Mouse: **$3W*kg^{-1}$** | $(0.02kg*Ind^{-1})*(3W*kg^{-1})$ = **$0.06W*Ind^{-1}$** | $(10,000\ Ind*km^{-2})*(0.06W*Ind^{-1})$ = **$600W*km^{-2}$**



Elep: **$0.5W*kg^{-1}$** | $(4000kg*Ind^{-1})*(0.5W*kg^{-1})$ = **$2000W*Ind^{-1}$** | $(6\ Ind*km^{-2})*(2,000W*Ind^{-1})$ = **$12,000W*km^{-2}$**

Expanded from Giampietro and Mayumi, 2010.

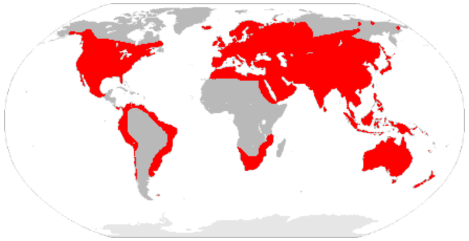
Cellular	Individual	Population	Species
Mouse: **3W*kg^{-1}**	(0.02kg*Ind^{-1})*(3W*kg^{-1}) = **0.06W*Ind^{-1}**	(10,000 Ind*km^{-2})*(0.06W*Ind^{-1}) = **600W*km^{-2}**	(40 mil. km2*Sp.$^{-1}$)*(600W*km^{-2}) = **24 GW*Sp.$^{-1}$**

Respiration

$C_6H_{12}O_6 + O_2$

↓

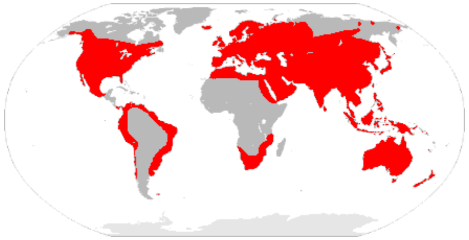
$CO_2 + H_2O$ + Energy

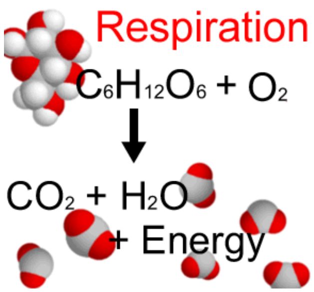


Cellular	Individual	Population	Species
Elep: **0.5W*kg^{-1}**	(4000kg*Ind^{-1})*(0.5W*kg^{-1}) = **2000W*Ind^{-1}**	(6 Ind*km^{-2})*(2,000W*Ind^{-1}) = **12,000W*km^{-2}**	(0.1 mil. km^2*Sp.$^{-1}$)*(12,000W*km^{-2}) = **1.2 GW*Sp.$^{-1}$**

Expanded from Giampietro and Mayumi, 2010.

Cellular	Individual	Population	Species
Mouse: **3W*kg^{-1}**	(0.02kg*Ind^{-1})*(3W*kg^{-1}) = **0.06W*Ind^{-1}**	(10,000 Ind*km^{-2})*(0.06W*Ind^{-1}) = **600W*km^{-2}**	(40 mil. km2*Sp.$^{-1}$)*(600W*km^{-2}) = **24 GW*Sp.$^{-1}$**





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Expanded from Giampietro and Mayumi, 2010.

Two Points:

1.) Resource Efficiency is a scale-dependent question.

2.) An increase in efficiency at one scale often leads to greater total resource use at a larger scale.

Are Confinement Dairies more *Land Efficient* than Pasture-Based Dairies?

- More efficient at the scale of individual farms.
- Remove a key constraint at the local scale (import grain and forages).
- Greater global land and resource use?

- Less efficient at the scale of individual farms.
- Retain a constraint at the local scale (available grazing land).
- Less global land and resource use?

Default Meat Consumption

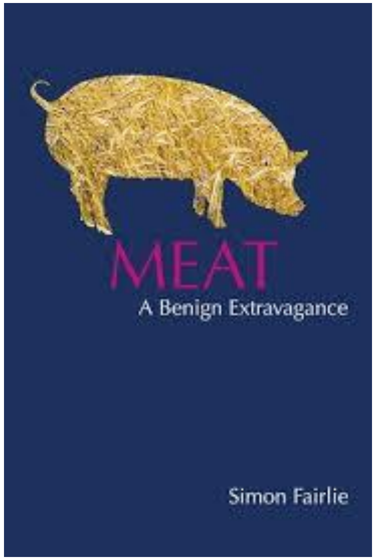
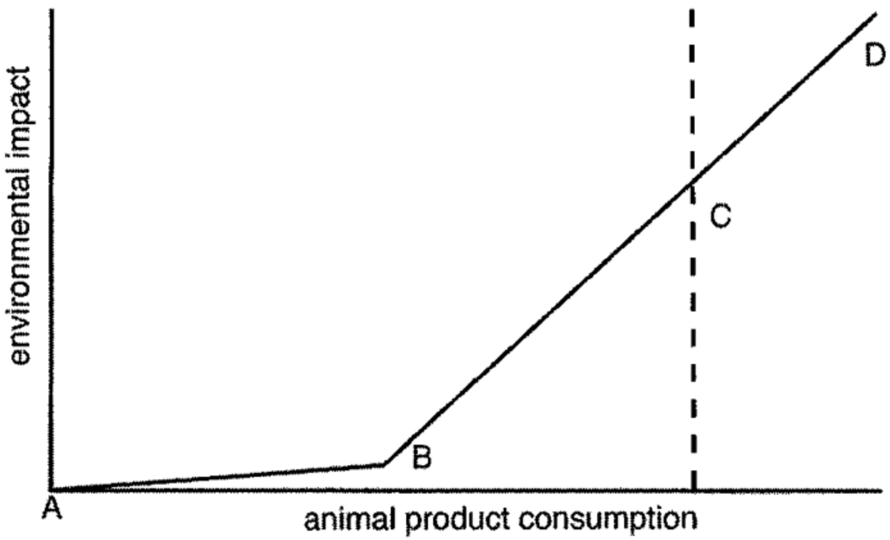


Figure 1. The Meat Consumption Curve



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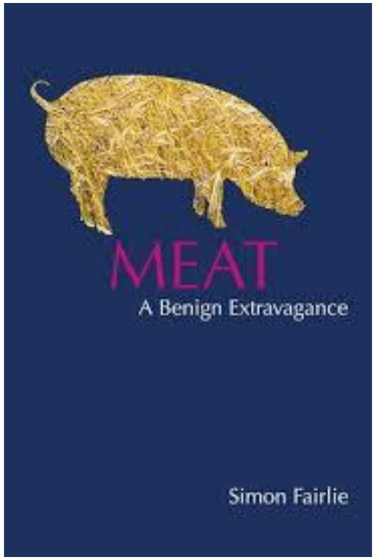
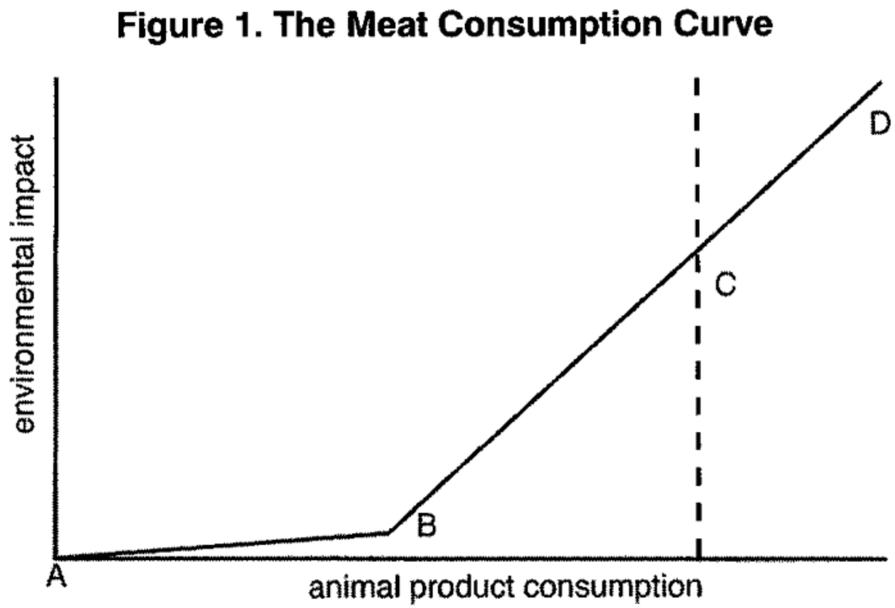
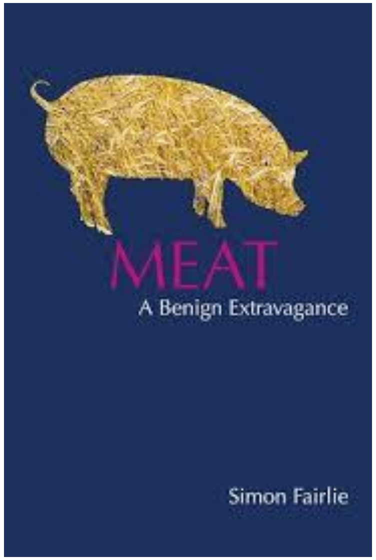




Constrain production/consumption by:

- Grazing on lands unsuitable for arable crops
- Forages needed for soil building rotations
- Wastes and biproducts

Default Meat Consumption



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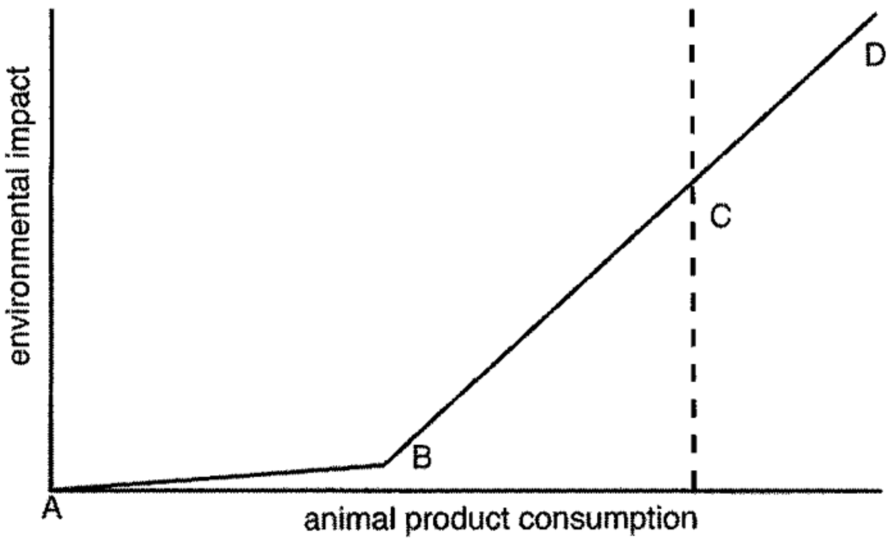

Constrain production/consumption by:

- Grazing on lands unsuitable for arable crops
- Forages needed for soil building rotations
- Wastes and biproducts

~ 7-36% of current U.S. animal protein consumption*

Van Zenten et al. 2018

Key Take-A-Ways:

1. Most pastured-livestock farmers can probably substantially improve their efficiency (and profitability).

2. For pastured-dairy, environmental impacts per acre are typically lower, but environmental impacts per unit milk may be higher.

3. ”Scaling up” pastured livestock means less meat overall but much lower environmental impacts.

THANKS!

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Connect with FACT

Food Animal Concerns Trust

Upcoming webinars

- **October 7:** Scaling Up Pastured Poultry Production
- **October 26:** Designing Silvopasture Plantings (Part 1)
- **November 2:** Why Trees Die in Silvopasture (Part 2)
- **November 9:** Silvopasture Decision Making (Part 3)

Grants, Scholarships, Mentorship & More!

- **Fund-a-Farmer Grants – application in early October**
- **Mentorship program – application in November**
- **Scholarships - ongoing**
- **Customized handouts on pastured-raised food available**
- Sign up for emails @ foodanimalconcernstrust.org/farmer/

Join us on social media