

SUSTAINABLE FARMING

INCORPORATING AWA NEWSLETTER

VOLUME 4 | ISSUE 2 | SPRING 2019 | \$5

FAKE MOOS!

DON'T BELIEVE THE LIES
WHY CATTLE **ARE** GOOD
FOR THE ENVIRONMENT

PLUS
EAT-LANCET EXPOSED
BIODIVERSITY SURVEY
MIND, BODY & WELFARE



STEADY AS SHE GOES



It’s a tough time to be a livestock farmer. As if the vagaries of the market and weather aren’t challenging enough, we have recently witnessed increased public scrutiny and criticism of our very way of life.

All too often, this has been fueled by those with an underlying ‘anti-meat’ or anti-farming agenda. I’ve lost track of the number of times I have spoken to leading food advocates and journalists, many who really should know better, countering their anti-meat positions. Sadly, when it comes to selling more newspapers and driving ‘click through’ rates, polarizing OpEds and poorly researched ‘click bait’ continue to trump science-based facts or efforts to achieve common ground.

So we’re using this issue to highlight and challenge some of the mainstream myths or ‘fake news’ currently in circulation about livestock production—particularly beef—in the hope you can share this with your neighbors and customers alike. Simon Fairlie reveals that most climate scientists have wrongly employed a formula for equating the climate impact of methane emissions with that of carbon dioxide. As a result, he argues, “nearly all the mainstream media and the public remain unaware of what is in effect a calumny against ruminant livestock farmers.” Professor Frédéric Leroy and Martin Cohen expose the powerful forces driving the

EAT Foundation, the influential global food campaigning network behind the EAT-Lancet Commission; while Dr. Zoe Harcombe raises concerns about potential nutritional deficiencies of the EAT-Lancet Commission’s highly publicized ‘planetary health diet’. Finally, Patricia Thomas challenges the vested interests driving this ‘great food transition’ to alternative diets, and asks if the proliferation of new high tech (and high investment) solutions, such as cultured meat or synthetic biology (synbio), really are as benevolent as some might assume.

But we also need to keep things in perspective. While anti-meat campaigners continue to garner media attention, vegetarians and vegans make up less than 5% of the U.S. population and research shows negative campaigning isn’t winning over meat eaters. While it may seem counterintuitive, I believe the current spotlight on food animal production could actually help our cause. By raising public awareness of the impacts of industrial food animal production on our health and the environment—and the scientifically proven benefits of high-welfare, sustainable livestock systems—mainstream farmers and consumers will look for alternatives closer to their current values and tastes. And when they do, AGW’s farmers will be ready to assist with proven sustainable farming practices and high-quality food food. Steady as she goes.

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BIODIVERSITY BOOM

Survey shows AGW-certified farms support biodiversity and protect endangered species

A Greener World’s certified farms and ranches are implementing sustainable farming practices that protect and enhance ecosystems, according to a new survey.

Working in partnership with a student of Dr. Jamie Bunting at the Biological Sciences Department, California Polytechnic State University, AGW surveyed its certified farms and ranches over a two-month period in fall 2018 to assess both sustainable farming practices and farm biodiversity.

“The results were astounding. Not only are our farms committed to raising animals sustainably, but their practices are having a measurably positive impact on biodiversity,” says Emily Moose, AGW’s Director of Communications and Outreach.

Every AGW farm surveyed reported using biodiversity-friendly practices. Some practices directly support wildlife, such as creating hedge-rows (59%), using non-lethal predator management like guardian animals (48%), scheduling pasture use around predation (30%), and using bat, bee or bird boxes (59%). Others promote general biodiversity, like cover crops (57%), conservation tillage (62%), rotational grazing (87%), avoidance of conventional pesticides (57%), as well as permaculture practices, planting native flowering plants to support pollinators and designating restoration and wildlife sanctuary areas.

The survey reveals that AGW farms and ranches are home to an incredibly diverse range of species,

including birds like finches, nuthatches, swallows, buntings, magpies, pigeons, owls, woodpeckers, orioles, waxwings, tanagers, doves, phoebes; mammals like bats, raccoons, bears, foxes, mountain lions, gophers, field mice, badgers, armadillos, prairie dogs, voles, groundhogs, rabbits, deer, elk, beavers, weasels; reptiles like snakes, toads, frogs, turtles, lizards, salamanders; along with fish, bees, wasps, spiders, butterflies, beetles, worms, flies; and a huge diversity of trees, shrubs, grasses, herbs, flowers, cacti, mosses and fungi.

Keystone predators such as the endangered gray wolf and the threatened grizzly bear were also identified. These are important because their presence is integral to maintaining the biodiversity of the ecosystem to which it belongs.

“We found that the more wildlife-friendly management practices there were in place, the more species called the farm home—in other words, these practices are working,” Moose says.

“AGW’s farms are living proof of the synergy between productive agriculture and biodiversity conservation, and the ecosystem benefits of well-managed, pasture-based systems on the natural world. The agroecological systems supported by AGW’s farming standards offer an alternative agriculture that supports the environment and outlasts the short-term promises of industrial monoculture.”

For more information visit **agreenerworld.org**



IN THE NEWS...

PESTICIDE RESIDUES

Around 70% of fresh produce sold in the U.S. has pesticide residues on it even after washing, according to a health advocacy group.

Strawberries, spinach and kale are among the most pesticide-heavy produce, while avocados, sweetcorn and pineapples had the lowest level of residues, according to the Environmental Working Group’s annual analysis of USDA data. More than 90% of kale tested contained two or more pesticide residues, while up to 18 different pesticides were found on a single kale sample.

CHEESE FOR LIFE

A new study published in *The Lancet* claims that eating cheese reduces your risk of stroke and cardiovascular disease.

Researchers from McMaster University in Canada looked at the dietary habits of over 130,000 people between the ages of 35 and 70 from 21 different countries. The study concluded that a moderate intake (2-3 servings) of dairy products per day resulted in a lower risk of a stroke and a decreased risk of cardiovascular disease compared with a dairy-free diet.

AUTISM LINK

Scientists have found a link between pesticide exposure and a higher risk of autism. Published in the *British Medical Journal*, researchers at the University of California analyzed records of diagnosis of autistic spectrum disorder (ASD) along with data on pesticide spraying in the Pesticide Use Reporting program.

Findings suggest the risk of ASD increases with prenatal and infant exposure to several common ambient pesticides that have been shown to affect neurodevelopment in experimental studies.

CERTIFIED EN FRANÇAIS

Certified AWA by AGW stickers for French-speaking customers are now available.

Designed for use in French-speaking regions, the full color 1” x 1” high-quality stickers include “Certifié Bien-Être Animal” text with the eye-catching Certified Animal Welfare Approved by AGW logo.

The 1,000-sticker rolls are available from AGW’s online merchandise store at \$5.70/roll plus shipping. Visit **agreenerworld.org/shop-agw**





NORTH CAROLINA SCHOOL MENU SUCCESS

And the result? The local *News & Observer* reports that the pork bowl was a success among the students: "I think it tastes good because it has all this stuff in it, and it tastes really sweet," said kindergartener, Demani Dargan-Juarez.



A total of 38 'Fund-A-Farmer' grants were awarded in 19 states, ranging from \$600 to \$5,000.

COMPARE GRASSFED LABELS

Label	"Unrated"					
	Star Certified	Certified Green Mark Program (current Program) by Singapore Green Mark Council	Recognized Certified Program (2015 Certified)	American GreenMark Association Certified (Starred)	Head Office Certified (GreenMark)	Certified (GreenMark & GreenMark World)
Publicly Available Standards	No	No	Yes	Yes	Yes	Yes
Requires 3rd Party Register Audit, Issuing Body	No	No	No	No	Yes	Yes
All Items in Production System are Certified	No	Yes	Yes	No	Yes	Yes
Issuing Chain Transparency on Material Acquisition Required	No	Yes	Yes	No	No	Yes
Independently Recognized External Certification	No	No	?	No	No	Yes
Recognizable Auditable One-Click/One-stop Whole-Building Register One	?	No	No	No	No	Yes
Accredited under ISO9001 Accredited	No	No	No	No	No	Yes
Independent Review	?	?	?	?	?	Yes
Certified Program	?	Yes	Yes	?	?	?
Statutory Requirement	No	No	No	No	No	Yes

Yes indicates a detail in adding standards and documents in improvement records in 2016/2017. 2017

G A Greener World 2019

GRASSFED CHART

Download the chart at agreenerworld.org/agreener-world/grassfed-label-comparison-chart/

The agency announced in March it will drop an import alert banning GM salmon and salmon eggs from entering the U.S. since 2016, on the basis that new USDA guidelines on labeling GM ingredients also apply to GM salmon. The AquAdvantage GM salmon was approved for human consumption in 2015. The first GM salmon could enter the market as early as 2020.



The findings highlight that currently proposed types of lab-grown meat cannot provide a cure-all for the detrimental climate impacts of meat production without a large-scale transition to a decarbonized energy system.

EUROPEAN CHEESE FIRST

Based in Somerset in the heart of the West Country, the Alvis family has produced handmade cheeses at Lye Cross Farm for over 65 years. The company sources milk from Certified Animal Welfare Approved by AGW and Certified Grassfed by AGW cows raised on pasture, not treated with routine antibiotics or hormones, and fed a non-

Visit lyecrossfarm.co.uk

GOOD FOOD AWARDED

In the cheese category, 'Kenne' from Toluma Farms and Tomales Farmstead Creamery in Petaluma, CA, 'Danziger' from Chapel Hill Creamery in Chapel Hill, NC, and 'Dirt Lover' from Green Dirt Farm in Weston, MO, all took home top awards. Lady Edison Pork Loin Pastrami and Lady

A total of 220 winners were chosen from 324 finalists, selected in blind tastings from over 2,035 initial entries. Visit goodfoodawards.com



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Opinion

A DANGEROUS DIET?

The EAT diet is nutritionally deficient, claims Zoë Harcombe

On January 17, 2019, a report was published in prestigious journal *The Lancet* claiming to address “the need to feed a growing global population a healthy diet while also defining sustainable food systems that will minimize damage to our planet.”

The EAT Lancet Commission report was written by 37 people from 16 different countries, and was three years in the making. The researchers detailed a “healthy reference diet,” presented as the ideal diet for population and planetary health.

Dangerous to recommend

Referred to as “The EAT diet” in extensive media coverage, the major sources of energy came from: grains (811 calories), legumes (426 calories) and vegetable oils (411 calories)—including palm oil. Red meat was to provide just 30 calories a day (14g). Sugar provided almost as many calories (120/day) as the meat, fish and eggs element combined.

As a nutritionist, I replicated the diet as closely as possible using the notes and calorie intakes. The diet was based on 2,500 calories per day, presumably for an adult male. Notwithstanding that an adult female would consume four fifths of the diet (and nutrients), the diet was already nutritionally deficient.

Key deficiencies

The most serious deficiencies were:

Vitamin D: just 5% of the Recommended Dietary Allowance (RDA) of 15mcg was provided, and some of that came from plants—and thus was not D3, which is the body's preferred form.

Retinol: 17% of the RDA of 900mcg. Retinol is the form in which the body needs vitamin A; carotene conversion cannot be relied upon.

Calcium: 55–65% of 1,000–1,200mg recommended.

Iron: the paltry amounts of beef, pork, chicken

and fish provided a maximum of 1.1mg of heme iron, the most absorbable form. The RDAs for vegetarians are 1.8 times higher than for people who eat meat. Barely half the iron intake for females would thus be provided.

Essential fatty acids: 28g of fish cannot provide the EPA and DHA required, while the nutritionally poor 350 calories of highly unsaturated fats would create an unhealthy omega-6 to omega-3 ratio.

Vitamin B12: Vitamin B12 requirements were almost met, but allowed for animal foods to be replaced with plants—and these would not provide B12. There was also a significant error on page 16 of the report: “The only exception is vitamin B12 that is low in animal-based diets.” That should read “low in plant-based diets.”

Wider concerns

There were also issues with vitamin K, which was mostly K1 from plants—and not the more easily-absorbed K2 from fermented foods and some foods of animal origin. The diet also provided just 67% of the potassium RDA and 22% of the sodium RDA. Potassium and sodium intakes are easily rectifiable, but the other deficiencies are not.

The focus of my examination was to highlight that the EAT diet is nutritionally deficient. Yet there are numerous wider issues with this plant-biased advice; not least, what will all these plants be grown in when there is no top soil left because we have replaced soil-rejuvenating ruminants with exploitative cropping and continued reliance on artificial fertilizers? The EAT diet will cause malnutrition and is dangerous to recommend.



Dr Zoë Harcombe is an author and nutritionist, with a PhD in public health nutrition. Visit zoeharcombe.com

A CONVENIENT UNTRUTH

Cattle are often blamed for more global warming than they cause because of a faulty methodology for equating methane emissions with carbon dioxide emissions, says Simon Fairlie



BERND BRUEGGEMANN

Ruminants, and particularly cattle, are habitually cast as climate villains, responsible for large amount of greenhouse gas emissions. According to a much quoted United Nations Food and Agriculture Organization (FAO) figure, livestock are responsible for 14.5 percent of human greenhouse gas emissions.¹ Eighty percent of these emissions come from ruminants, half being methane, and a quarter nitrous oxide.

As a result, there are innumerable scientific papers comparing the environmental impact of dairy and beef unfavorably with pork and poultry, with vegetarian diets, with milk substitutes, with test-tube meat and so on. Virtually all of these papers and the FAO's figure of 14.5 percent are flawed because they employ a formula for equating the climate impact of methane emissions with that of carbon dioxide—through the unit known as “CO₂ equivalent”—which is highly misleading.

Nearly all the mainstream media and the public remain unaware of what is in effect a calumny against ruminant livestock farmers. Myles Allen and colleagues at the Oxford Martin School at Oxford University, UK, have published useful material designed to explain this dubious accounting to non-scientific readers.

Comparing apples and pears

Methane (CH₄) and carbon dioxide (CO₂) act upon the global temperature in very different ways. For the first few years after it has been released into the atmosphere, a given quantity of methane will have a much stronger global warming impact than the same amount of CO₂. The standard metric for equating the two gases, Global Warming Potential (GWP100), currently estimates that over 100 years a kilo of methane has 28 times as much global warming effect as a kilo of CO₂, or 34 times as much if you take into account certain feedback mechanisms. The FAO's calculation that livestock cause 14.5 percent of all anthropogenic greenhouse gas emissions is based on the 34 figure.

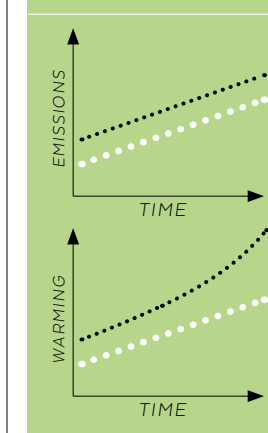
However, methane degrades in the atmosphere relatively quickly — it has a half-life of about 10 years — whereas CO₂ is cumulative; that is to say a single emission of CO₂ will remain in the atmosphere for many hundreds of years, and a series of them will accumulate, continually increasing the amount of global warming.

The difference in behavior between the two gases can be seen in the graphs (right). If emissions of the two gases are rising, then the global warming effect also rises, but more steeply in the case of CO₂. If emissions of the two gases are constant, then the warming effect of methane is relatively constant, whereas the warming effect of CO₂ increases as it accumulates in the atmosphere. Finally, if emissions of both gases are falling, then the net warming effect of methane begins to drop

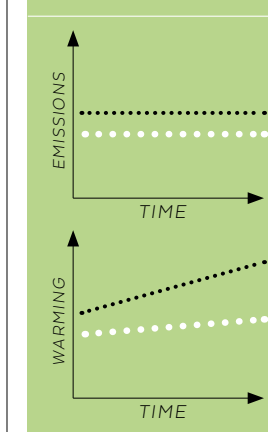
Emissions impossible?

CO₂
CH₄

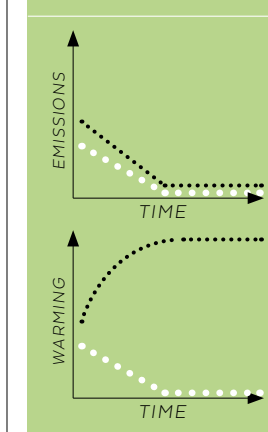
RISING EMISSIONS



CONSTANT EMISSIONS



FALLING EMISSIONS



CO₂ CH₄ graphs. Oxford Martin, 'Climate Metrics for Ruminant Livestock', July 2018 (<https://www.oxfordmartin.ox.ac.uk/downloads/reports/Climate-metrics-for-ruminant-livestock.pdf>).

(in other words the drop in emissions has a cooling effect), whereas the warming effect of CO₂ continues to increase, albeit at a slower rate, and only becomes constant when emissions cease altogether.

This means that a single pulse of CO₂ can be equated to a sustained increase in the emissions rate. A farmer who has been keeping the same number of cattle on their land for several decades will not be increasing global warming significantly because the methane will be disappearing from the atmosphere almost as fast as it is being added. The same applies to a nation, or indeed the world, if its total cattle population remains stable over a number of decades.

But a single emission of CO₂, say from using a tractor to spread artificial fertilizer, will remain in the atmosphere and continue to have a warming effect more or less indefinitely. And repeated emissions of CO₂ from annual use of diesel and applications of fertilizer will accumulate in the atmosphere, causing the global temperatures to increase. GWP100 fails to account for this crucial difference, resulting in perverse assessments of the relative performance of the two gases and frequent exaggeration of the role played by methane.

There are none so blind ...

None of this is really news. There have been plenty of scientific papers analyzing the problem.² Myles Allen comments:³

“Researchers have debated for decades about the adequacy of this approach ... The point was made in the first major climate report produced by the Intergovernmental Panel on Climate Change (IPCC) way back in 1990. Those early discussions were loaded with caveats: Global Warming Potentials, which underpin the traditional practice of CO₂ equivalence, were introduced as “a simple approach ... to illustrate the difficulties inherent in the concept.

“The problem with developing a concept is that people might use it. Worse they might use it and ignore all the caveats that attended its development. This is more or less what happened with GWPs as used to create CO₂ equivalence.

“The science caveats were there, and suggestions for alternatives or improvements have continued to appear in the literature. But policy makers needed something (or thought they did) and the international climate negotiations community grasped the first option that became available, although this has not been without challenges from some countries.”⁴

This doesn't entirely explain why the FAO, who ostensibly exist to support farmers, should adopt a metric that is so unfavorable to ruminant husbandry. There is a suspicion that FAO

economists feel comfortable with GWP100 methodology (at its higher exchange rate of 34:1) because of its bias in favor of intensive fossil-fuel dependent sectors, such as pig and poultry factory farms, and against ruminant livestock herders reliant on biomass. In their original assessment in 2006, the FAO stated that “by far the largest share of emissions come from more extensive systems where poor livestock holders often extract marginal livelihoods from dwindling resources,”—a jaundiced, inaccurate view of peasant farming.⁵

Allen and his colleagues note that the GWP100 methodology particularly impacts upon countries with a relatively high share of methane in their emissions portfolios, “which tend to be either middle income countries with large agricultural sectors ... or less developed countries where agricultural emissions dominate because their energy sector is small.”

An alternative metric

They propose an alternative metric which they call “GWP*.” Instead of measuring a pulse emission of CO₂ against a methane pulse of the same mass, GWP* compares a pulse emission of CO₂ with an increase in the emission rate of methane. The methane emissions resulting from adding an extra cow to a herd for an indefinite period would be directly comparable to a one-off single emission of fossil fuel CO₂.

The discrepancy between the two metrics can be large, especially if emissions are declining. Under the conventional GWP₁₀₀ methodology, if a source of methane undergoes a reduction of 25 percent in methane emissions over 30 years it will over that period cause global warming equivalent to 810 tons of CO₂ for every ton of methane emitted in year one. Under the more accurate GWP* methodology it results in global cooling equivalent to 462 tons of CO₂.⁶

According to USDA data, the U.S. cattle herd declined by around 20 percent from 114 million head in 1984 to 93.6 million head in 2017, a period of 33 years.⁷ Assuming that methane emissions per cow are broadly the same over the whole period, this means that methane emissions from the U.S. herd currently have no net global warming impact, and are probably having a global cooling effect.

The cart before the horse

The adoption of GWP* would be a great improvement over the current employment of GWP100. It provides a much fairer assessment of the climate impacts of ruminant husbandry as compared with those of intensively farmed pigs and poultry, or vegan substitutes. Many of the scientific papers comparing the impact of meat and plant-based diets would have to be reconsidered.

However, if policy-makers and politicians were doing their job and reducing CO₂ emissions in line with the pathways mapped out by the IPCC to limit global warming to a rise of 1.5 degrees above pre-industrial levels, then it is questionable whether we would need any metric at all, because substantial reductions in methane emissions would be a consequence of reductions in CO₂.

The increase in methane levels in the atmosphere since 2000 is in the order of 4 percent (much less than the increase in CO₂ in the atmosphere over the same time). Since a constant flow of methane over time does not cause any substantial increase in global warming, it would take a relatively modest decline in methane emissions to stabilize methane levels in the atmosphere at a level that causes no increase. IPCC estimates of what is necessary to achieve stability range between a 6.1 percent drop and a “less than 30 percent” drop in methane emissions.⁸ Most recently, in the pathways which it proposes to limit global warming to 1.50, the IPCC

advocate a drop in methane emissions of “35 percent or more relative to 2010 levels”.

Net emissions of CO₂, on the other hand, because they are cumulative, have to be reduced to zero by 2050.⁹

The IPCC also points out that “non-CO₂ emissions can be reduced as a result of broad mitigation measures in the energy sector.”¹⁰ In other words, as we progressively reduce fossil fuel use and CO₂ emissions to zero, reductions in methane emissions are likely to follow:

- About one third of anthropogenic methane emissions result directly from the extraction of fossil fuels, particularly gas, which is partially composed of methane. If and when the use of fossil fuels declines to zero, we can expect the associated methane emissions to decline correspondingly.

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3. M. Allen, D. Frame and A.H. Macey, 'Why Methane Should be Treated Differently Compared to Long-Lived Greenhouse Gases', *The Conversation*, June 2018.
4. Notably from Brazil, whose targets for mitigating climate change are expressed using a different metric, GTP₁₀₀, which allocates a much lower value to methane emissions over 100 years (Federative Republic of Brazil, 'Intended Nationally Determined Contribution Towards Achieving the Objective of the United Nations Framework Convention on Climate Change', <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Brazil/1/BRAZIL%20INDC%20english%20FINAL.pdf>).
5. H. Steinfeld et al (2006), *Livestock's Long Shadow*, FAO. The bias in this document against peasant farming is discussed in S Fairlie (2010), *Meat: A Benign Extravagance*, Permanent Publications.
6. Under GWP* a drop in methane emissions of 10 percent over 30 years is equivalent to zero tonnes CO₂ emissions. Under GWP₁₀₀ the same rate of reduction in methane emissions is regarded as equivalent to 800 tonnes of CO₂eq over the 30 years, for every tonne of methane emitted in year one. Oxford Martin, *Climate Metrics for Ruminant Livestock*, July 2018 (<https://www.oxfordmartin.ox.ac.uk/downloads/reports/ClimateMetrics-for-ruminant-livestock.pdf>).
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9. IPPC, 'Global Warming of 1.50: Summary for Policy Makers', IPCC, SRI 5, para C1.2, October 2018. Myles Allen is one of the many authors of this report.
10. Ibid.

- Another one-sixth of methane emissions come from landfill. As we transition from fossil fuels to a circular bioeconomy, and abandon throwaway plastics, landfill will become increasingly rare and associated methane emissions will also diminish.
- Another third of anthropogenic methane emissions are derived from livestock. But we can reasonably expect these to decline as well, as a result of reduced fossil fuel availability. Artificial fertilizers will become more expensive, leading to reduced animal feed production; and livestock will be competing for grazing and forage land with the demand for biomass energy.

Some methane will no doubt rebound in other forms—for example, from leaky biogas plants, compost heaps and so on. But the point here is that methane emissions are not the driver of global warming; they are better understood as a symptom or function of a system currently driven by fossil fuel extraction.

There is a danger that the increasing clamor for a reduction in livestock emissions will upstage the effort to reduce the use of fossil fuels—that would be a case of putting the cart before the horse. It doesn't matter how many people go vegan, or how little meat we eat, it will not stop global warming. Only one thing will do that—reducing net carbon emissions from fossil fuel extraction to zero.

The caveat

Nonetheless, there are strong reasons for immediately reducing meat consumption in rich countries, since the wealthy of the world eat more than their fair share. It is vital that livestock numbers do not increase around the world because that would generate more methane in the atmosphere and cause global warming. It is also vital that wide expanses of tropical forests are not cleared to support livestock—that would increase CO₂ emissions. We must stop felling forests in South America to provide soy to feed to livestock in factory farms. To ensure that these scenarios do not happen, the limited amount of meat and dairy that can be sustainably produced must be distributed more equitably. The strongest argument for reducing meat consumption in industrialized countries is one of environmental justice.

Simon Fairlie is the author of *Meat: A Benign Extravagance*. A version of this article first appeared in *The Land* magazine. To subscribe, visit thelandmagazine.org.uk



Michelle Cain explains why a herd of cows is like a closed power station

If all greenhouse gases are taxed then using GWP100 would unfairly penalize short-lived emissions, assuming the aim was to penalize global warming.

Consider a power station and a herd of cows. A power station emits CO₂ by burning fossil fuels. This is CO₂ taxed. When it shuts down permanently, it emits no more CO₂, so is no longer taxed. However the CO₂ already emitted continues to affect the climate for hundreds or potentially thousands of years. So even after closing down, that power station still contributes to holding up global temperatures because of the CO₂ that remains in the atmosphere.

Now to the cows. A herd of cows emits methane, so the farmer is taxed for those emissions. If the herd remains the same size with the same methane emissions every year, it will maintain the same amount of additional methane in the atmosphere year on year. In terms of its contribution to global warming, this is equivalent to the closed power station.

The power station pushed up global temperatures when it was running in the past, just as the farmer's great-grandparents pushed up global temperatures when they were building up the herd. But neither a steady herd of cattle, nor a defunct power station is pushing up global temperatures any more.

However under almost all proposed systems for taxing emissions that attempt to include methane, the farmer would get taxed for their herd's methane emissions every year while the owner of the closed power station would not.

One way to make this fairer would be employ a methodology (such as GWP) that equates changes in methane emission rates with tons of CO₂. Thus a stable emission of methane equates to a zero-rate of CO₂ emissions, as it does not change the level of warming into the future, and therefore would not be taxed.

The flip side of this is that any sustained increases in methane emissions would be heavily taxed, as they would contribute very substantially to future warming. Conversely any sustained cuts would be rewarded for contributing to future cooling.

Drawn from GWP Masks True Effects of Short-Lived Gases, Carbon Brief 2018, www.carbonbrief.org



CLIMATE POLITICS AND VEGAN WARS

Frédéric Leroy and Martin Cohen examine the recent rise of the ‘planetary health diet’—and those behind it

Have you noticed how arguments to ditch dairy and cut back on meat are springing up everywhere, from Twitter to the *New York Times*?

It’s estimated there are one and a half million vegans in the U.S. Yet they are still outnumbered by livestock farmers and ranchers, who provide the nation with important nutrition and economic value. Until recently, if you’d had to say which group had the most political clout, it would have been a no-brainer. However, behind the scenes, there have been some tectonic shifts in power bases. And that’s why now, cheered on by the big newspapers, at the Departments of Agriculture and international organizations like the United Nations, advocates of “plant-based” eating are making ‘planetary food policy’.

Old enemies

How did this come about? You may well ask. “Veganism is a capitalist industrial dream”, tweets Shelby Parker; not a food expert, but just an independent thinker. “Your reality is boxed products, ultra-processed fake foods that are completely disconnected from nature,” she says. And in the upcoming battle for the future of farming, the real power belongs not to the often naive vegan militants, but to that old enemy of farmers: the industrial food processing giants.

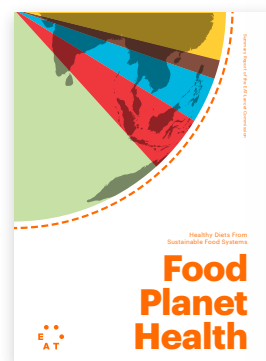
The *Routledge Handbook of Food as a Commons* earnestly notes that small-scale farmers, peasants, fishermen, sensitized urban

consumers, food security activists, legal and political academics and human rights advocates (among others) across the world are trying to reconstruct a different food paradigm. However, in the corridors of power, farmers are being relentlessly pressured to become providers of cheap raw materials to the food manufacturing industry as never before.

Add to this the influence of powerful individuals like Christiana Figueres, the United Nations official responsible for the 2015 Paris climate agreement (about driving down carbon emissions). She has a startling vision for restaurants of the future, which is that anyone who wants a steak should be banished: “How about restaurants in 10–15 years start treating carnivores the same way that smokers are treated?” Figures even suggested during a recent conference that, “If they want to eat meat, they can do it outside the restaurant.” And so, in this new political battle, cattle and livestock grazing will be on the front line.

Behind the EAT Foundation

There is now a broad front in politics determined



Download the EAT-Lancet Commission's report, *Food in the Anthropocene*, at eatforum.org

to do nothing less than drastically change the way the world eats. Take the highly influential food campaigning network called the EAT Foundation. Its campaign is big on things that we all know are bad, such as rainforest being cleared to raise beef cattle, yet almost silent on things like the conservation-friendly role of cattle, sheep and goats in areas such as sub-Saharan Africa (and indeed in traditional landscapes worldwide) or the various nutritional benefits of animal products, particularly for the young and elderly.

But then EAT has not been created by dispassionate scientists. In fact, it was founded by the Stordalens, a billionaire couple consisting of an animal right activist and a hotel tycoon known for driving around in a red Tesla Roadster with a pet pig called Pia Parma in the passenger seat. Other wealthy allies of the network include the Saudi Prince, Khaled bin Alwaleed, who has identified dairy as “the root of all environmental evil” and is, according to PETA, on “a mission to vegan-ize the Middle East”. His portfolio of investments includes companies developing new biotechnologies to replace ... meat and dairy.

Transforming the world food system

January 2019 was the official start of the EAT-Lancet campaign to transform the world’s food system—and our lives and landscapes along with it. Tactically, it aims to follow in the footsteps of earlier global initiatives for energy and produce a kind of new Kyoto agreement for food.

First, though, public opinion must be molded; and right now the case is being made by an alliance of eccentric yet well-connected billionaires and academic ideologists. People like Harvard’s Professor Walter Willett, who says

that a third of early deaths could be saved if everyone gave up meat; and University of Oxford researcher, Dr. Marco Springmann (a vegan), who calculates that meat taxes could prevent “more than 220,000 deaths and save over US\$40 billion globally in healthcare costs”. Alongside are key figures from ever opportunistic global agribusiness, having discovered that vegan product lines are able to generate vast profit margins, adding value through the ultraprocessing of cheap materials, such as protein extracts, starch and oil.

Catastrophic consequences

The danger here is that the political arguments being advanced right now—meat and dairy bad, new scientific foods good—are dangerously simplistic and could have catastrophic consequences for human health and the environment. It is high time that we start spending more of our energy on improving the food system using truly evidence-based interventions—which are indeed urgently needed—instead of losing ourselves in ‘one-size-fits-all’ planetary solutions that overlook most of the ecological, physiological and cultural diversity.

And blaming livestock farmers (who have been of tremendous value throughout history for various reasons), opting for the high-tech and quick-fix option of ersatz foods, and referring to sloganized statements for the mere fact that they are easier to persuade the policy makers and public, is certainly not helping.

Frédéric Leroy is Professor of Food Science and Biotechnology at Vrije Universiteit, Brussels, writing in own capacity. @fleroy1974

Martin Cohen is a social scientist whose latest book, I Think Therefore I Eat, takes a philosophical look at food science. @docmartincohen





GREAT FOOD TRANSITION OR GREAT MISTAKE?

The EAT Lancet Commission report proclaims itself as a blueprint for a “great food transition.” But it has sown only confusion and controversy, says Pat Thomas

The authors of the EAT Lancet Commission report, *Food in the Anthropocene*, may not have intended their work to be a polemic, but polemic it has become.

Its notion of a “great food transition” has especially outraged regenerative farmers who are working to raise healthy animals in sustainable systems. It has divided green groups into either conceding the broad brush strokes of its conclusions or picking apart its shocking lack of detail. The mainstream media’s acquiescence—as if the report’s findings had been delivered from on high

—has also been a cause of significant frustration.

As the philosophical and financial interests of the groups behind the report have been uncovered, it has also raised the spectre of bias, corporate agendas and science for sale.

There are multiple unsettling aspects to the report, beginning with its dismissal of the dietary value of animal foods. Its ‘healthy’ reference diet excludes all but a daily forkful of red meat and only marginally more poultry and fish, one quarter of an egg and no dairy products at all.

Instead it suggests we seek protein from

WHAT IS CULTURED MEAT?

Cultured (or lab) meat is an emerging technology where animal muscle cells are produced through tissue culture in a factory or laboratory.

legumes—a legitimate, healthful and sustainable option as part of a balanced and diverse diet, but no substitute for animal foods.

Among its recommendations are alternative sources of protein such as lab-grown meat, insects and algae. It’s these proposed ‘solutions’, which mostly require factories rather than farms to produce, that hint at the dark corporate heart of the report.

Facsimile meat

Whether you call it cultured, in vitro or clean, the process of growing ‘meat’ in a lab remains the same: you take a cell biopsy from a living animal, extract the stem cells and grow these in a bioreactor full of growth medium—a feedstock of sugars, amino acid, salts, minerals and growth factors currently made from fetal bovine serum.

As they grow, these living cells clump together to form a ground beef-like substance. They also produce waste, mostly lactic acid and ammonia, for which no one seems to have a plan for the disposal. In addition to a feedstock derived from conventional crops, the process also consumes large amounts of energy (because the growing cells need to be kept warm) and large amounts of water (because they need to be rinsed frequently to remove waste).

This process can only make facsimile meat with none of the nutritional co-factors, including fat, found in real meat. Those co-factors have to be added – or engineered—into the final product to provide nutritional value.

The deficits of the in vitro model are so great it can only ever be an expensive and short-term distraction. Indeed, a recent analysis by British researchers at the University of Oxford (see page 5) underlines the short-termism of this approach. Scale it up and look far enough into the future, they warn, and cultured meat and cattle farms will have similar global warming potential because the methane (CH₄) emissions from ruminants do not accumulate in the way that the carbon dioxide (CO₂) emissions from lab meat do. This is something that should trouble the Commission, but apparently does not.

Let them eat bugs

The EAT Lancet Commission also seems untroubled by the irony—but also the moral implications—of using intensively-farmed insects for food and feed while our natural world is teetering on the brink of what has been called “Insect Armageddon.”

The UN Food and Agriculture Organization suggests there are some 1,900 edible insect species and that insects form a part of the diets of around 2 billion people globally. Most of these insects are wild foraged. No human culture relies

exclusively on insects for its protein requirements and for many there is a significant ‘yuck’ factor.

But the real issue, again, is that scaling up production has significant downsides. This type of “mini-livestock” may require less land, but intensively-farmed insects are also fed on conventional grains. Energy requirements are high: mealworm production systems can use as much energy as meat and milk; houseflies and black soldier flies as much as fish and soybean meals.

Since most people would not eat raw insects, a great deal of energy-hungry processing, including grinding and freeze-drying, is also required.

Bacteria to the future

It is true that blue green algae (cyanobacteria), which has an amino acid profile comparable to eggs, is eaten as a natural food by some cultures. It’s also a popular food supplement for the ‘worried well.’ The corporate vision for algae in the human diet, however, is not as a wholefood, but as the poster child for synthetic biology (synbio), a form of genetic engineering. Scientists are experimenting with re-engineering algae and other microorganisms to become living bioreactors that produce substances they would not produce naturally. Synbio algae and other microorganisms remove farmers from the equation and take the notion of ultra-processing to a whole new level.

Research is ongoing into how algae can be used to synthesize multiple food ingredients. Most of these are high-end ingredients such as saffron, cocoa, vanilla and stevia, as well as supplements like anthocyanins, beta-carotene and resveratrol.

Embracing complexity

Sustainability is complex. Regenerative farmers are leaning in to this complexity, looking at whole systems, recognizing that it’s not just about energy, resources, waste and pollution, but health, well-being, tradition and culture, too. They are working with technology, logistics, social and political cohesion and the reality that genuine sustainability requires boundaries—and therefore trade-offs.

The task is made much harder by the fact that many of us are trying to reclaim sustainability in the framework of a society where the rules, structures and economic imperatives have become embedded through decades of unsustainable thinking and behavior.

Food in the Anthropocene does little to address this complexity and, in the end, many of its technological solutions simply add more unnecessary knots to a problem that is already of Gordian proportions.

Pat Thomas is a journalist, author and campaigner specializing in the intersection of food, health and environment. Visit howlatthemoon.org.uk

MULTI-FUNCTIONING AGRICULTURE

Food in the Anthropocene provides no real impetus for food system change; it simply shuffles crowd-pleasing concepts around while ignoring the bigger picture of sustainable farming.

Contrast this with the recent IDDRi report, *An Agroecological Europe in 2050: Multifunctioning Agriculture for Healthy Eating*, which suggests the whole of Europe can feed itself using agro-ecological farming and recognizes the role that extensive grasslands—and the ruminants that graze them—play in soil fertility, carbon storage and nitrogen production, as well as the beneficial fatty acid profiles of grazed animals over those fed on maize.

If it can be done in Europe, it can be done elsewhere as well.





These sheep are being allowed to investigate the dog on their own terms. If livestock can sense they are “in control” of fear, stress or discomfort, health management may be more effective

MIND OVER MATTER

Jennifer L. Burton explores the confluence of placebo, mind and modern medicine

Throughout history—and around the world—the mind has been considered integral to health. As logic and science gained traction in the 14th century, however, Western philosophers began to believe mind and body might be separate. For the next 400 years or so, this view largely overshadowed other ideas about health.

But a good scientist must acknowledge that there is much we do not know—and that some of what we “know” is incorrect.

The placebo effect

Today, scientific discoveries about mind-mediated pain control and health effects of stress continue to change the face of medical science. Modern researchers must deal with a particular phenomenon so undeniably effective that it is included in every drug trial—even though science cannot explain how it works.

To publish their work in a reputable journal, researchers must *pretend* to treat some patients. Why? Because science has proven that pretending works. Today’s rigorous medical studies must be “placebo-controlled.” In other words, they must be designed to sort out the real effects of a new treatment from the real effects of fake medicine.

Can a plain saline injection make a dog vomit, salivate or defecate? Raise or lower a rat’s blood sugar, or induce convulsions? Might a little scratching of the skin increase white blood cell counts in

a guinea pig? Could a taste of sweetened water suppress antibody production in rats? It was once presumed the placebo effect—the physical effects of *pretending* to treat—could not occur in animals. However, double-blind studies (in which neither the vet nor owner knows which animals are receiving drug versus placebo) have shown that placebo can induce all of the above effects in animals, through a variety of causes.

Mind and body

Saline injections and flavored water do not create any of the physical responses listed above, but all of these responses can be “classically conditioned.” Here’s how it works: animals are routinely dosed with real drugs for several days and become accustomed to the routine. Then the routine is continued without the drug; the animal is placed in the treatment room, handled by the practitioner, injected with drug-free saline solution or given the same flavored water. If classical conditioning has occurred, the body responds to the placebo situation as though the drug was administered.

In addition to reflex-like classical conditioning, animals can develop mental “expectations” about what will happen next. For example, they might anticipate feeling better after a visit to the recovery stall, vomiting after a pill is administered, or feeling pain when the handler arrives. Placebo effects also arise from positive interactions with humans, gentle handling or specific “feel-good” substances released by nerves. Science cannot yet explain how these physical reactions are activated by placebo, but it is safe to say they involve a relationship between mental state and physical process—a real connection between mind and body.

Want better health? Offer choices

Mental states of helplessness and hopelessness can adversely affect physical health. The ability to obtain relief from pain or avoid frightening situations are critical factors in how body systems work to maintain health. Inability to escape these stressors can, for example, decrease the immune system’s efforts to fight cancer, or increase the likelihood of mortality from an ulcer. Control and predictability, on the other hand, have the opposite effect.

Can your animals choose to avoid stressful situations? Do they have adequate space to separate themselves from tense social interactions? Is there time to inspect a gate, handling chute or milking stanchion before proceeding, or are they rushed into these areas? When they become uncomfortable, can your animals escape heat or cold by accessing shelter? If your livestock can sense they are “in control” of fear, stress or discomfort, your health management may be more effective than expected.

COMMON SENSE
Even if we do not know how they work, mind-body interactions affect animal health
Maintain routines that are associated with good health and productivity
Avoid repeating situations associated with undesirable outcomes
Offer opportunities for animals to predict and avoid frightening, painful or stressful situations
CAREGIVER PLACEBO
Do not fall victim to “caregiver placebo”, where caretakers who believe a treatment is working sometimes fail to detect animal disease or discomfort
Always include objective assessments, and keep records to ensure accurate monitoring when evaluating whether a treatment is effective

Non-western medical systems

Each medical system below recognizes an influence of mind, spirit or energy not currently recognized by science. It is impossible to articulate the rich culture and deep philosophy of these time-honored practices in a few sentences. Consider this a starting point for further exploration, and for conversations with your vet.

Grounded in interconnectedness, life energy (qi) and harmony, Chinese medicine seeks to treat patterns of imbalance. Therapies include specific exercises for mind and body, carefully selected foods, natural products, massage, acupuncture and more. Many traditional Chinese medical concepts have no counterpart in Western medicine, so English translations are often misunderstood by individuals who lack training in Chinese medicine.

A complete medical system also originated thousands of years ago in India. Ayurveda, or “life science”, seeks to understand a patient’s functional energies (doshas). Ayurveda includes many of the same specialties as western health-care: pediatrics, surgery, geriatric care and more. Ayurvedic practices considered alternative in the West include the use of herbs, massage, specialized diets, significant emphasis on cleansing or detoxification and attention to spiritual wellness.

Other treatments such as homeopathy, craniosacral therapy, Reiki and other forms of energy medicine are based on physiological mechanisms that science has not been able to verify. A practitioner of shamanism enters altered states of consciousness, seeking to interact with spirits to mediate healing or obtain solutions to problems.

An open mind

Are these mechanisms, energies and spiritual connections fictional, or is today’s science simply not able to observe them? If some beliefs about how they work are incorrect, could the therapies be useful nonetheless? Should farmers wait for answers from science, or should we consider all the possibilities available to us?

We will never have all the answers. How you proceed will depend on your preferences and on local availability of trained practitioners. With any therapy, ask your veterinarian to help you assess the risks of treatment, including the risks associated with delaying other treatment options. Inquire about environmental or other impacts of unfamiliar medicines. Monitor patient progress, and be prepared to switch treatments as appropriate.

Jennifer L. Burton, DVM, is a veterinarian and educator with a special interest in the intersection of food animal medicine and public health

PECKING ORDER

Understanding key natural behaviors is essential for the high-welfare management of pasture-raised poultry

The provision of an environment that enables birds to conduct their natural behavior is key to delivering high welfare. An understanding of the birds’ behavioral needs is integral to the success of all pasture-based production systems.

Groups and flocking

The main affiliative behavior shown by poultry is flocking. Birds in large outdoor areas normally stay together in a group, an activity thought to have evolved primarily as protection against predators.

Domestic fowl naturally live in small groups, with a dominance hierarchy or pecking order based on establishment fights, followed by remembered assessment of status involving individual recognition. Individual recognition is limited to groups of up to 80 birds; hens in small groups have been shown to discriminate between familiar and unfamiliar subjects by showing more aggression towards unfamiliar hens. In larger groups, this system is thought to breakdown, and hens may adapt by becoming less aggressive or by restricting their movements to defined ‘territories’ and sub-flocks may emerge.

Within flocks, birds of high rank peck or displace others, while those of low rank will be displaced by others. In small, stable flocks, this hierarchy should not result in excessive aggression unless other factors, such as lack of feeding space, encourage it.

Rest and sleep

The main pattern of rest and sleep in poultry is set by the light-dark cycle. Chickens are generally inactive at night and the strength of the natural diurnal rhythm is enhanced if houses are completely dark at night. Birds also rest during day-time and this is normally synchronized within a group; hence the importance of allowing social grouping in promoting “natural” behavior.

Perching

Perching, particularly at dusk, is another strongly motivated behavior pattern and birds become unsettled if there is no perch site available. However, poorly designed perches can also result in pain and injury. Birds should have access to low perches at a young age so they learn to safely negotiate them. Perches should be arranged

to allow birds to easily move between them and other equipment. To minimize risk of injury and aid movement, the angle between perches at different heights should be no more than 45 degrees.

Dustbathing

Dustbathing shows a clear diurnal rhythm and, under unrestricted conditions, hens dust bathe about every two days. Birds deprived of litter show a rebound in dustbathing behavior when litter is again made available, which suggests increased motivation after deprivation. A suitable substrate is an important stimulus for eliciting dustbathing. Hens seem to prefer substrates with a fine structure, such as sand.

Nesting

Within the flock hierarchical structure, subordinate hens are often bullied, particularly when seeking nest boxes. Researchers found that social factors—and the restriction of these—have an impact on the period of time a hen spends nesting. In high-welfare systems, laying hens must have access to at least one individual nest box for every five birds, or at least 20 sq. inches per laying hen where communal nests are used.

Article adapted from Farm Health Online. For more information about practical, science-based advice on high-welfare livestock management, visit farmhealthonline.com

FREE RANGE

Wide open fields are not ideal habitats. Chickens prefer areas with trees or natural or man-made cover, in order to hide from predators. Semi-wild jungle fowl spend up to 60% of their time actively pecking the ground, even when not hungry, and domesticated free-range birds will spend time pecking for food even when poultry feeds are provided.

MIKE SUAREZ



Certification news

COMPLIANCE SUPPORT

AGW is unique in offering a range of technical support, says Tim Holmes

One of the standout differences between AGW and other farm certifiers is that we offer numerous tools to help you achieve and maintain compliance with our program’s standards.

Our website is full of helpful information, with a specific ‘For Farmers’ tab with links to a range of technical support and other useful content.

Technical support

Our Technical Advice Fact Sheets (TAFS) are one of the best resources the program offers, providing practical information and advice for farmers and ranchers on the most commonly asked questions about our standards and on-farm situations. We have 23 different fact sheets, covering a range of topics—from castration, tail docking and weaning age to Farm Health Plans, record keeping and how to do feed calculations for ruminants. In many cases, they also explain the scientific assessment and reasoning behind many of the program’s key standards. For example, if you (or your customers) want to understand why the program places such importance on pre-slaughter stunning, TAFS 18 and 20 should provide everything you need to know. We are always open to new suggestions for TAFS—let us know what you’d like to see!

We also offer a range of Farm Templates and Plans to help you meet the standards, covering farm and health plans, emergency and transport plans, as well as various farm record templates, and instructions on how to use the templates. If you fill in the various plans available you will meet the planning requirements of the program. You’ll find these templates and plans under the ‘Certifications’ tab; just choose the relevant certification and check the right side menu. Here, you’ll also find our farm standards, as well as information about parasite treatment options, grassfed supplements and even guidelines for working dogs.

Thinking of hosting an open day on your farm? Our free ‘Guidelines for Farms that Host Open Days’ information sheet will help ensure you have all necessary health and safety measures in place.

Farm Health Online

In recognition that little practical support or advice currently exists on alternative approaches to live-stock health management, AGW helped launch Farm Health Online (see farmhealthonline.com), a free website for farmers, ranchers, advisors and veterinarians offering practical advice to support high welfare management of food animals in pasture-based systems.

Run in partnership with the UK’s Duchy College Rural Business School, it covers cattle, sheep, goats, poultry and pigs, with information on over 100 livestock diseases, advice on nutrition, housing, breeding and husbandry, and bio-security, as well as public health and legislation. The site cannot replace direct support from a qualified vet, but it can help bridge the knowledge gap.

Further resources

Alongside the magazine you are now reading, our monthly ‘Focus on Farming’ e-newsletters include technical information on compliance with our standards. Both the magazine and email cover a wide range of topics—from preventing heat stress in pigs to how to correctly body condition score animals. You’ll find back issue of the magazine on the AGW website under ‘Resources’ and they are well worth reviewing for past technical content.

The bottom line: If you haven’t browsed the website, set aside 10 minutes to explore some of the links above. I am sure you will find it very informative and helpful. And remember: we’re always happy to answer any questions. You can email us at info@agreenerworld.org or call 800-373-8806.

A GREENER WORLD

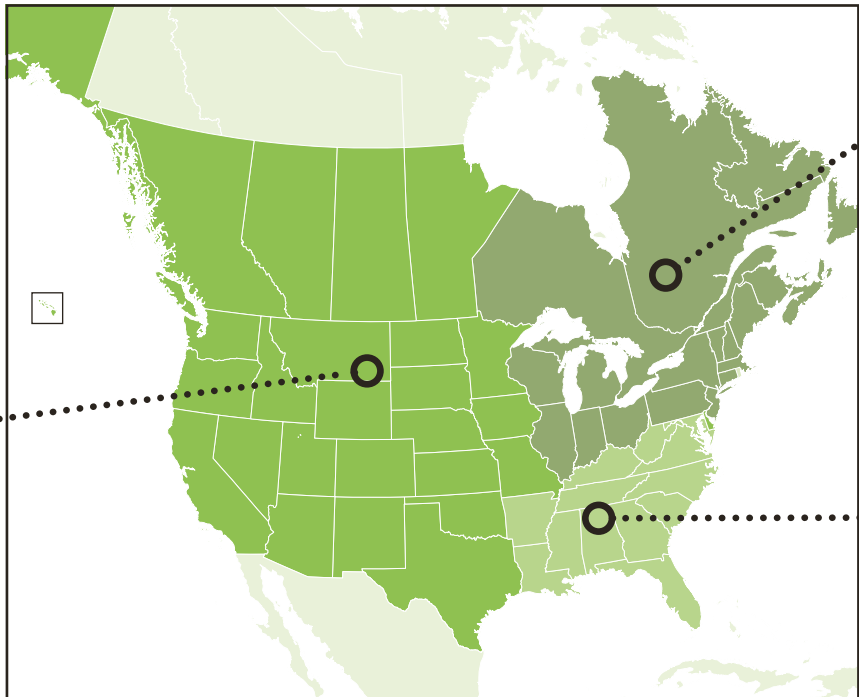
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THE CALL TO FARM

Rhonda Gothberg produces award-winning goat's milk cheese from her Certified Animal Welfare Approved by AGW LaMancha dairy goats at her 40-acre farm, set in the heart of the Skagit Valley, WA. After achieving Grade A Goat Dairy status in 2004, Gothberg Farms became the first dairy in the state to become Certified Animal Welfare Approved by AGW in 2010.

How did you get into farming?

We purchased our first goats to provide milk for the family and I fell in love. I started making cheese, sharing it with friends and family; they said it was the best they'd ever had and encouraged me to sell it locally. I began investigating—and never looked back! Working 30 years as a registered nurse prepared me well: my love of caring for others, mixed generously with art and science, was a good base to start the business. I gave the goats my utmost best from the beginning and, when I learned of AGW, I applied right away. Third-party certification has been a big bonus to business.

Describe a typical day

Early waking is key. Goats to feed and milk. Cheese to make, pack and sell. Marketing duties abound. Ever present goat health checks, farm chores and product development. We have a few amazing employees who share the same goals and commitments.

Who are your customers?

We have a diverse customer base, including members of the public, chefs, shops and stores. The common thread is love of high-quality, responsibly produced local food.

What are your business plans for the future?

To pretty much continue as we are. We're happy with our small size and commitment to quality at every step. Our product lines grow and morph as time goes on, but amazing milk is our key to it all.

Sustainable farming principles: why do they matter?

We get only so much farmland and it needs to be protected and utilized in a responsible manner. The animals we tend deserve the best we can give them. Everything starts with the soil.

What is the biggest threat to the sustainable farming movement?

Big business and 'Big Ag' aggregation. It is very difficult for the smaller, more sustainable operations to remain profitable.

What do you love most about what you do?

The satisfaction of a job well done. Producing high-quality, wholesome, responsibly produced food for our eating community.

What do you find most frustrating about what you do?

Probably the most challenging aspect is finding and keeping good employees.

What keeps you awake at night?

Thinking of what still needs to be done! And always thinking of new and improved ways to do things.

What is your greatest achievement?

Starting this dairy at age 50 with no prior experience—and seeing it succeed!



GOYBERG FARMS (x2)

AT A GLANCE

Farm: Gothberg Farms LLC, Bow, WA
Certification date: April 2010
Size: 40 acres
Soil type: Sandy loam and clay
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gothbergfarms.com



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TIMOTHY HAWS, Autumn's Harvest Farm, New York

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