Dairy’s Role in a Healthy, Sustainable Food System

April 20, 2023

Welcome

Housekeeping

Objectives

- Identify the ways dairy impacts sustainable food systems across health, environment and animal welfare
- Describe ways that the dairy community is advancing its sustainability commitments
- Apply your knowledge of sustainable food systems as it relates to both planetary and public health.

Audience Questions

- What percentage of US GHG emissions come from agriculture?
  a) 2%
  b) 11%
  c) 27%
  d) 35%

- One serving of milk provides an excellent or good source of how many nutrients:
  a) 5
  b) 9
  c) 13
  d) 15

Speakers

Joanne Slavin, PhD, RD

Frank Mitloehner, PhD

Joan Maxwell

How dairy nourishes people throughout life: with a focus on nutrition and health domain of sustainable food systems

Joanne L. Slavin, PhD, RDN, Professor, College of Food, Agricultural and Natural Resource Sciences, Department of Food Science and Nutrition, University of Minnesota – Twin Cities

April 20, 2023

University of Minnesota
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Joanne Slavin, PhD, RDN

Affiliations: Dr. Slavin is a Professor in the Department of Food Science and Nutrition at the University of Minnesota – Twin Cities, a Science Communicator for the Institute of Food Technologists (IFT), a member of the Academy of Nutrition & Dietetics (AND) and a member of the American Society for Nutrition (ASN) and a member of the 2010 Dietary Guidelines Advisory Committee (DGAC)

Competing Interests

- Dr. Slavin thanks the following organizations for research funds the past 2 years:
  - United States Department of Agriculture (USDA), National Institutes of Health (NIH), Taiyo, Barilla, Institute on the Environment (IonE), and the University of Minnesota Extension Southwest Regional Sustainable Development Partnership.

- These research projects are in the areas of dietary fiber, whole grains, legumes, digestive health including the microbiome, plant and animal protein needs, carbohydrate needs, snacking and sustainable agriculture.

- She serves on scientific advisory boards for Simply Good Foods, the Sustainable Nutrition Scientific Board, and the Quality Carbohydrate Coalition.

- She owns a 2/3 share and is the Managing Member of the Slavin Sisters Farm LLC, a 119 acre mixed use family farm in Walworth, WI

Development of Nutrition Recommendations

- People need to eat to survive by choosing diets that optimize health
- Nutrition guidelines tell us what types of nutrients and the amounts needed to maximize health
- Nutrient requirements vary greatly over the life cycle and are most critical during growth and development

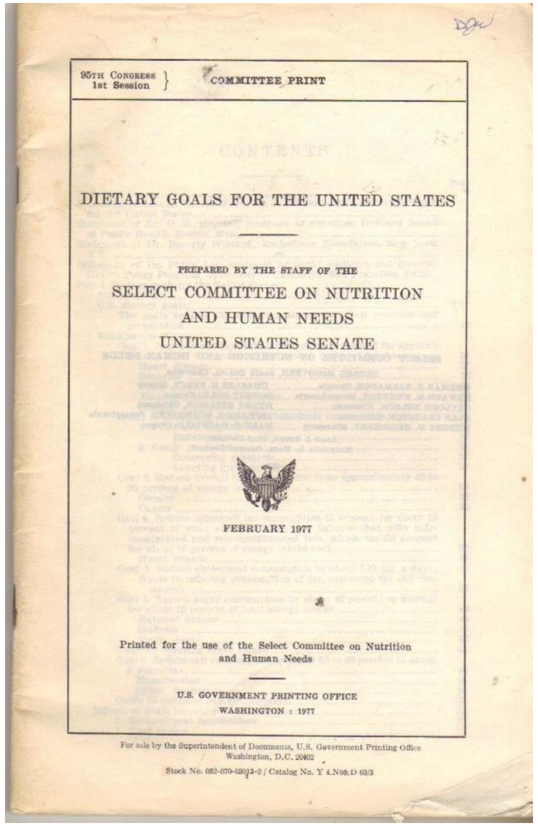
Nutritional science – nutrients to prevent deficiency diseases

- **1941 -** National Academy of Sciences began issuing Recommended Dietary Allowances (RDAs)
  - *"Quantity of nutrients a person needed to consume daily to ensure basic good health, proper growth and reproductive success, and to prevent nutrient deficiency diseases"*
  - Nutritional deficiency diseases have been virtually eliminated in the US thanks to enrichment of refined grains and other fortification strategies.

Beyond deficiency diseases:
Diet and chronic disease prevention

- The US Senate Select Committee on Nutrition and Human Needs led by Senator George McGovern issued the Dietary Goals for Americans (1977).

- The underlying premise for the work was that “too much fat, too much sugar or salt, can be and are linked directly to heart disease, cancer, obesity, and stroke, among other **killer** diseases.”


95TH CONGRESS
1st Session

COMMITTEE PRINT

DIETARY GOALS FOR THE UNITED STATES

PREPARED BY THE STAFF OF THE

SELECT COMMITTEE ON NUTRITION
AND HUMAN NEEDS
UNITED STATES SENATE

FEBRUARY 1977

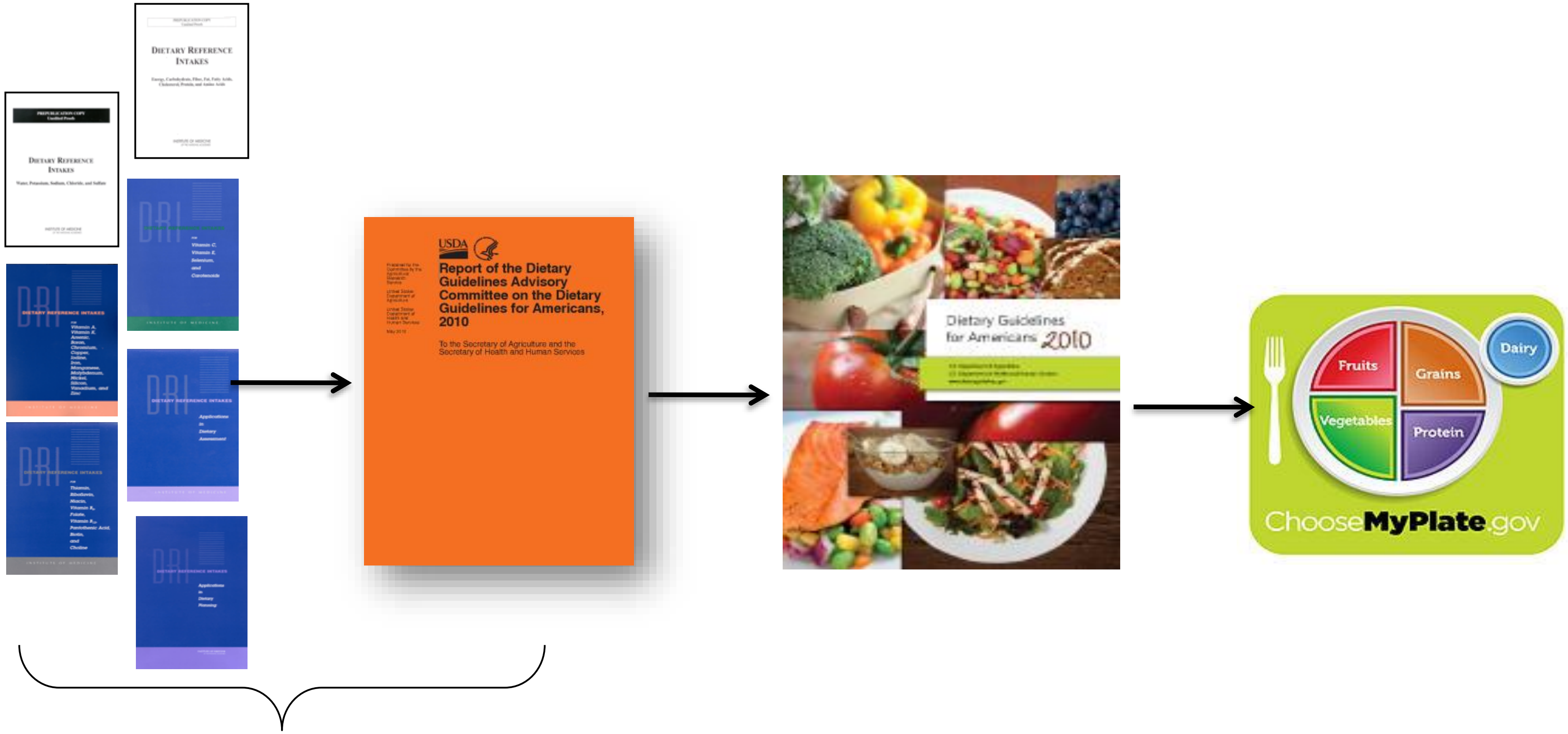
Printed for the use of the Select Committee on Nutrition and Human Needs

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1977

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

Stock No. 052-070-03913-2 / Catalog No. [illegible]

From the Science to Me – A Long Journey



The Science | Policy | Me

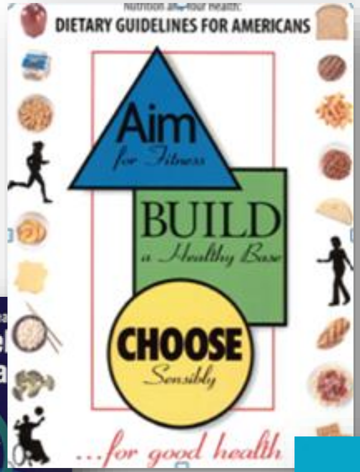
Dietary Guidelines for Americans 1980 - 2010

1980

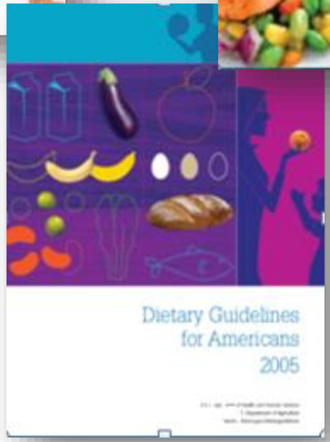
1985

1990

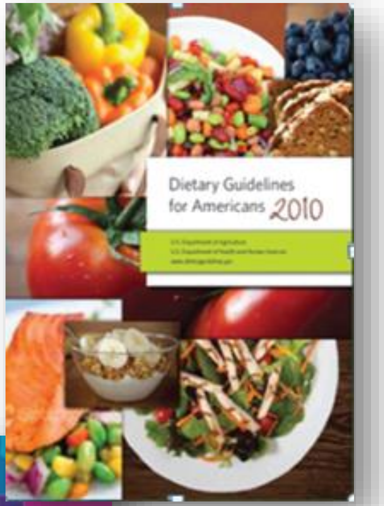
1995



2000



2005



2010

The Science Behind the Guidelines

Dietary Guidelines Advisory Committee considers:

- Original systematic scientific reviews
- Existing systematic reviews, meta-analyses and scientific reports
- Dietary data analyses
- Food pattern modeling analyses

Issues technical report with nutrition and health recommendations

DHHS/USDA uses technical report and comments to develop updated *Dietary Guidelines*

Scientific rationale based on <u>various research methods:</u>

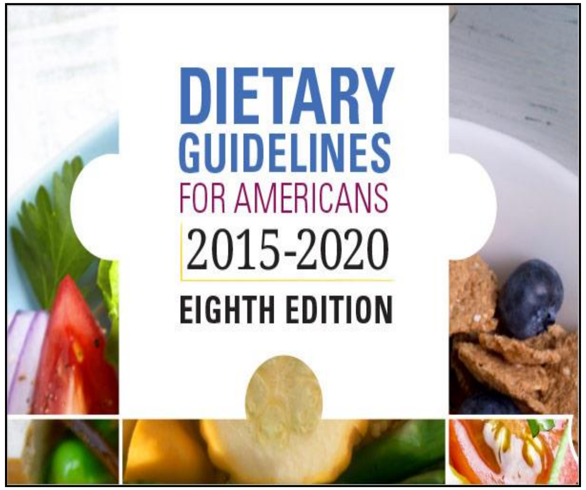
2015-2020 DGA – A Snapshot

Provides 5 Overarching Guidelines:

1. Follow a **healthy eating pattern** across the lifespan.
2. Focus on variety, nutrient density, and amount.
3. Limit calories from added sugars and saturated fats and reduce sodium intake.
4. Shift to healthier food and beverage choices.
5. Support healthy eating patterns for all.

A healthy pattern includes:

- A variety of vegetables
- Fruits, especially whole fruits
- Grains, at least half of which are Whole Grains
- Fat-free /low-fat dairy, including milk & yogurt
- A variety of protein foods
- Oils



Four nutrients of concern: Calcium, Vitamin D, potassium, dietary fiber

Shift from Individual Foods and Ingredients to Healthy Eating Patterns!

DGA Impacts Nutrition Policy and the Health and Wellness Marketplace

2020-2025 DGA Guidelines: A Customizable Framework

- DGA emphasizes four “Guidelines” to help **make every bite count**

2020-2025 DGA Highlights

Adopted a **life stage and dietary patterns approach**, like the 2015-2020 DGA

Provides recommendations for **pregnancy, lactation and birth to 23 months populations** for the first time in DGA history

Maintains current recommendations for **added sugar and saturated fat** (both at less than 10% of total daily energy)

Maintains current recommendations for **alcohol** (≤ 1/day for women, ≤2/day for men)

Supports tailoring dietary choices due to external factors, such as:

- **Personal preference**
- **Cultural foodways**
- **Budget**

NEW: Dairy Recommendations for 6 to 23 Mo.

- For the first time, the 2020-2025 DGA provided dairy recommendations for infants and toddlers:
  - **6-12 months:** Cheese and plain yogurt can be offered as complementary foods
  - **12-23 months:**
    - 1⅔-2 servings* of whole milk, reduced-fat cheese, reduced-fat plain yogurt per day advised for those who no longer consume human milk or formula
    - No flavored milk to avoid added sugar content

*Heathy U.S.-Style Dietary Pattern

The Case for Meeting Dairy Recommendations

- “Consumption of dairy foods provides numerous health benefits including lower risk of diabetes, metabolic syndrome, cardiovascular disease and obesity.”
- “When consumed in the amounts recommended by the Food Patterns, on average across the calorie levels, dairy foods contribute about 67 percent of calcium, 64 percent of vitamin D, and 17 percent of magnesium.”

- 2015 Dietary Guidelines Advisory Committee (p. 67)

https://health.gov/sites/default/files/2019-09/Scientific-Report-of-the-2015-Dietary-Guidelines-Advisory-Committee.pdf

Dietary Guidelines: Building Healthy Eating Patterns

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The DASH Eating Plan

Food group	Servings
Grains	6–8/day
Vegetables	4–5/day
Fruits	4–5/day
Fat-free or low-fat milk and milk products	2–3/day
Lean meats, poultry, and fish	6 or less/day
Nuts, seeds, and legumes	4–5/week
Fat and oils	2–3/day
Sweets and added sugars	5 or less/week

USDA Food Patterns

Food group	Amount/day
Vegetables	2.5 cups
Fruit and juices	2.0 cups
Grains	6.0 ounces
Dairy products	3.0 cups
Protein foods	5.5 ounces
Oils	27 grams
Solid fats	16 grams
Added sugars	32 grams

Mediterranean Eating Pattern

Foods	How often
Fruits, vegetables, grains (mostly whole), olive oil, nuts, legumes and seeds, herbs and spices	Every meal
Fish and seafood	At least twice a week
Cheese and yogurt	Moderate portions daily or weekly
Poultry and eggs	Moderate portions every 2 days or weekly
Meats and sweets	Less often

USDA Vegetarian Adaptations

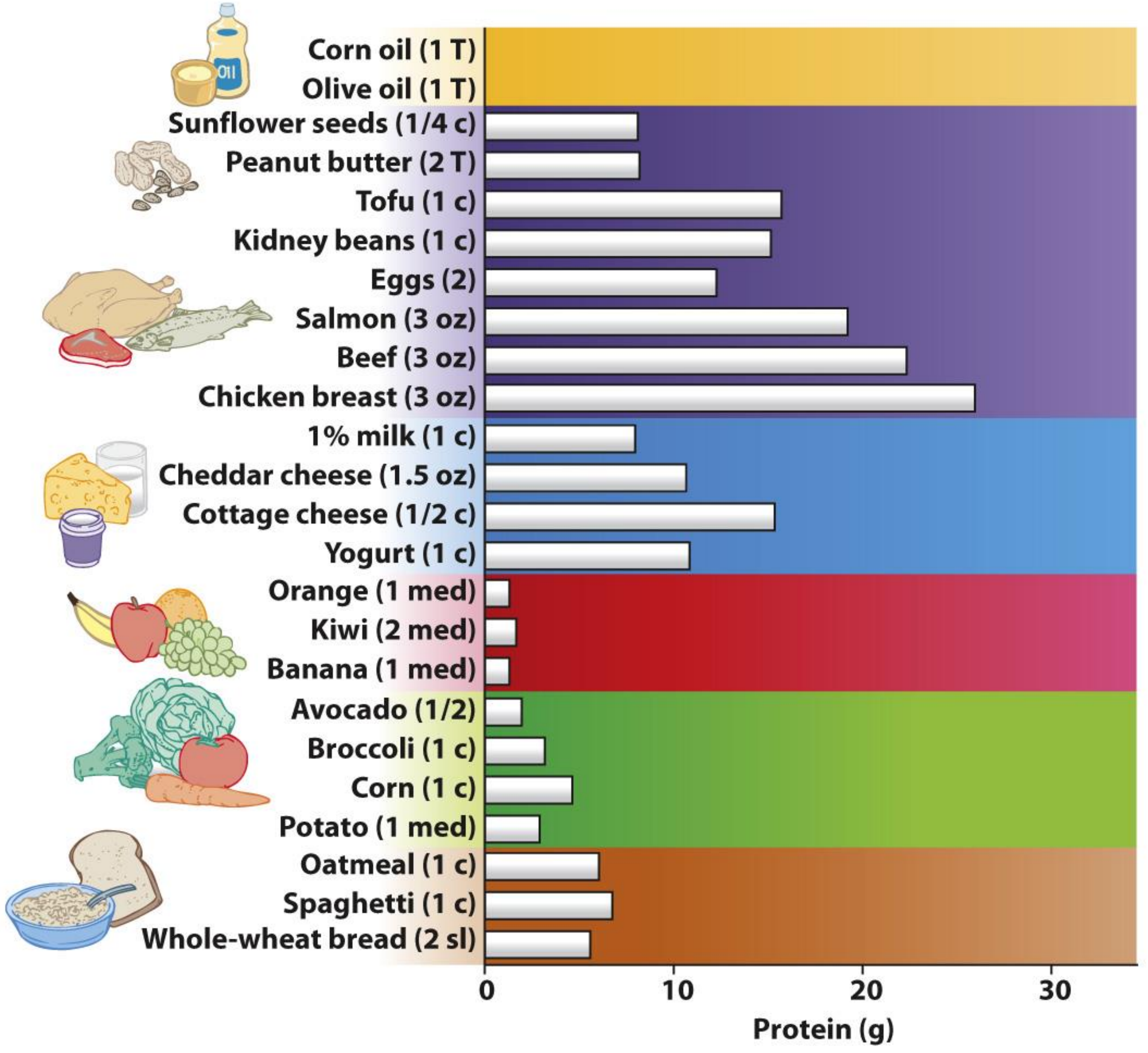
Food group and recommendation	Food choice examples	
	Lacto-Ovo	Vegan
Dairy products or dairy substitutes (3 cups/day)	Milk, calcium-fortified soymilk, yogurt, hard cheeses	Calcium-fortified soymilk, other fortified plant-based milks or yogurts
Protein foods (3.5 oz day)*		
Eggs	Eggs	
Beans and peas	Black, kidney, and pinto beans, chickpeas, hummus, peanut butter	Black, kidney, and pinto beans, chickpeas, hummus, peanut butter
Soy products	Tofu, tempeh, roasted soybeans	Tofu, tempeh, roasted soybeans
Nuts and seeds	Walnuts, almonds, pistachios, sunflower and pumpkin seeds	Walnuts, almonds, pistachios, sunflower and pumpkin seeds

*The amount recommended here is less than for non-vegetarian diets because some of the protein in a vegetarian diet comes from beans and peas included in the vegetables group.

Protein Requirements

- Adults require 0.8g protein/kg body weight per day
- Acceptable Macronutrient Distribution Range (AMDR) is 10–35% of energy for adults – when your calorie intake is low, you need to eat a higher percentage of your calories from protein and choose high quality proteins
- Protein needs increase during periods of growth, pregnancy and lactation
- Higher protein diets may also be recommended in the elderly because of "sarcopenia" – muscle loss

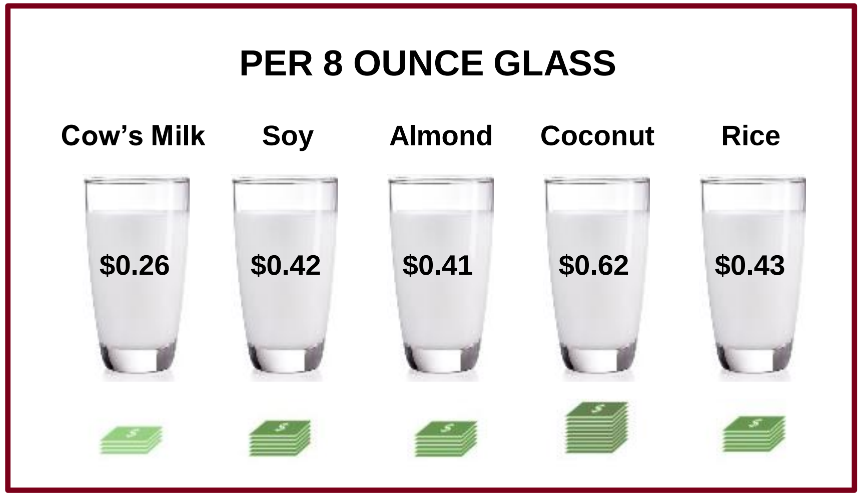
Sources of Protein in the Diet



Dairy more economical than plant-based beverages

= ~20¢

per serving*



*Based on U.S. average price of unflavored, private label milk, 1 gal.

Source: IRI Total US - Multi Outlet + Conv 2020, YTD ending 10-4-20

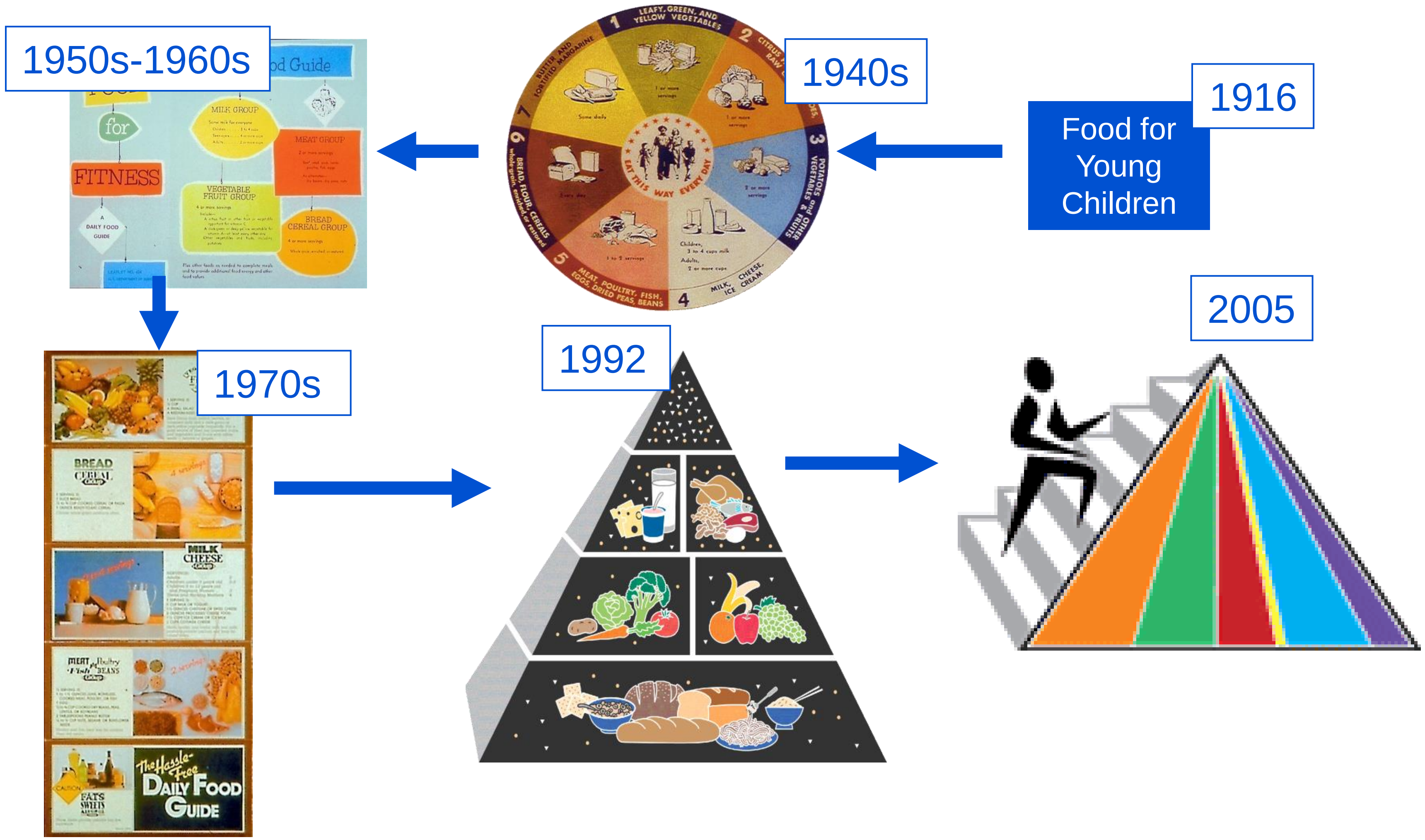
**FDA's Daily Value (DV) for potassium of 4700 mg is based on a 2005 DRI recommendation. In 2019, NASEM updated the DRI to 3400 mg. Based on the 2019 DRI, a serving of milk provides 10% of the DRI. FDA rule-making is needed to update this value for the purpose of food labeling.

USDA FoodData Central online at https://fdc.nal.usda.gov/. Mean values calculated from database entries across all fat levels of plain vitamin D-fortified fluid milk in Legacy, Foundation, and Survey (FNDDS) data sources.

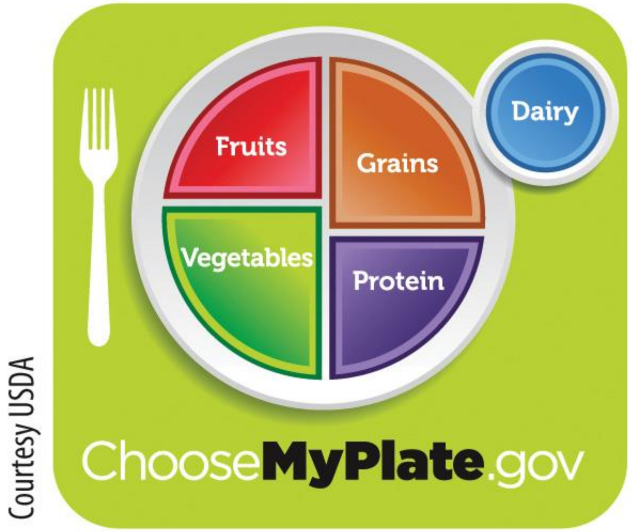
Dairy’s role in reducing hunger globally

- In rural low-income settings, household milk production increases household milk consumption, and increased milk consumption results in improved child growth and reduced stunting

Food advice: Evolution of USDA's Food Guidance – Moderation and Variety



Nutrition Guidelines Timeline



2011

MyPlate, shown here, was introduced in 2011 and is the most recent food guide. It shows how much of your plates should be filled with various food groups.

An Eating Patterns is More Than the Sum of Its Parts

Canada's Food Guide 2019

Conclusions

- All dietary guidelines must provide nutrients across different age groups from birth to death so nutrient dense foods like dairy, whole grains, fruits, vegetables, and protein foods will continue to be on the plate.
- The Dairy group is critical to Vitamin D and calcium intakes, but should also be part of the protein group of myplate.gov as each dairy serving provides 8 grams of high-quality protein.
- Cost, sustainability, supply, culture, and convenience all impact food intake and must be considered in dietary guidance.
- Food only provides nutrition when it is consumed, so we must be mindful of overzealous rules on sodium, added sugars, and solid fats that remove flavored milk, full fat milk, yogurt, and cheese from diets, especially for the food insecure in our country.

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Managing methane from livestock can be part of a climate solution

Frank Mitloehner, Professor & Air Quality Specialist, Director, CLEAR Center,
Department of Animal Science, University of California, Davis, fmmitloehner@ucdavis.edu

Last name pronounced: '*Mit*-ler-nah'

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CLEAR Center at UC Davis

The Center leverages its two cores – **research and science communication** – to help animal agriculture become more sustainable.

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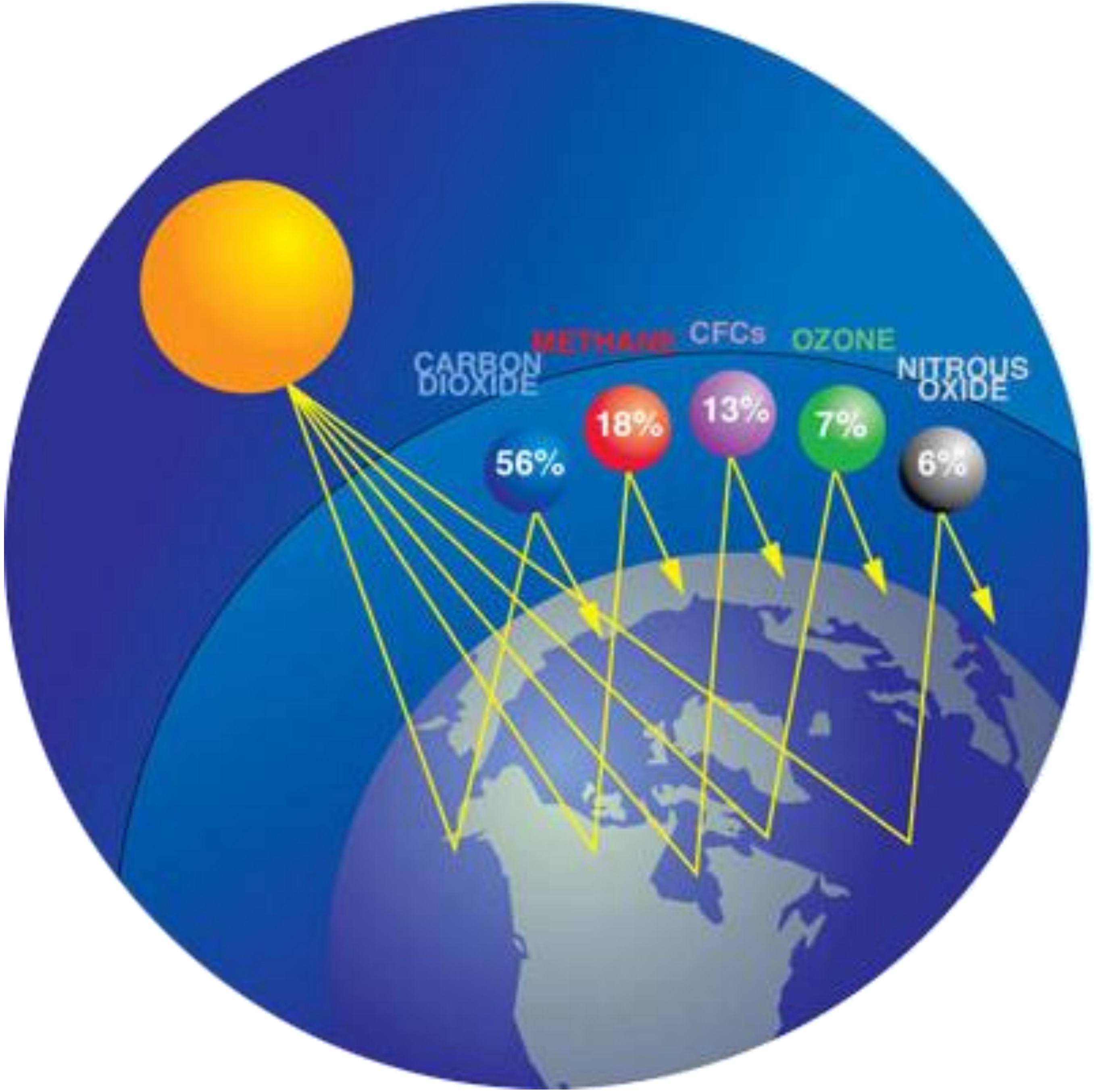

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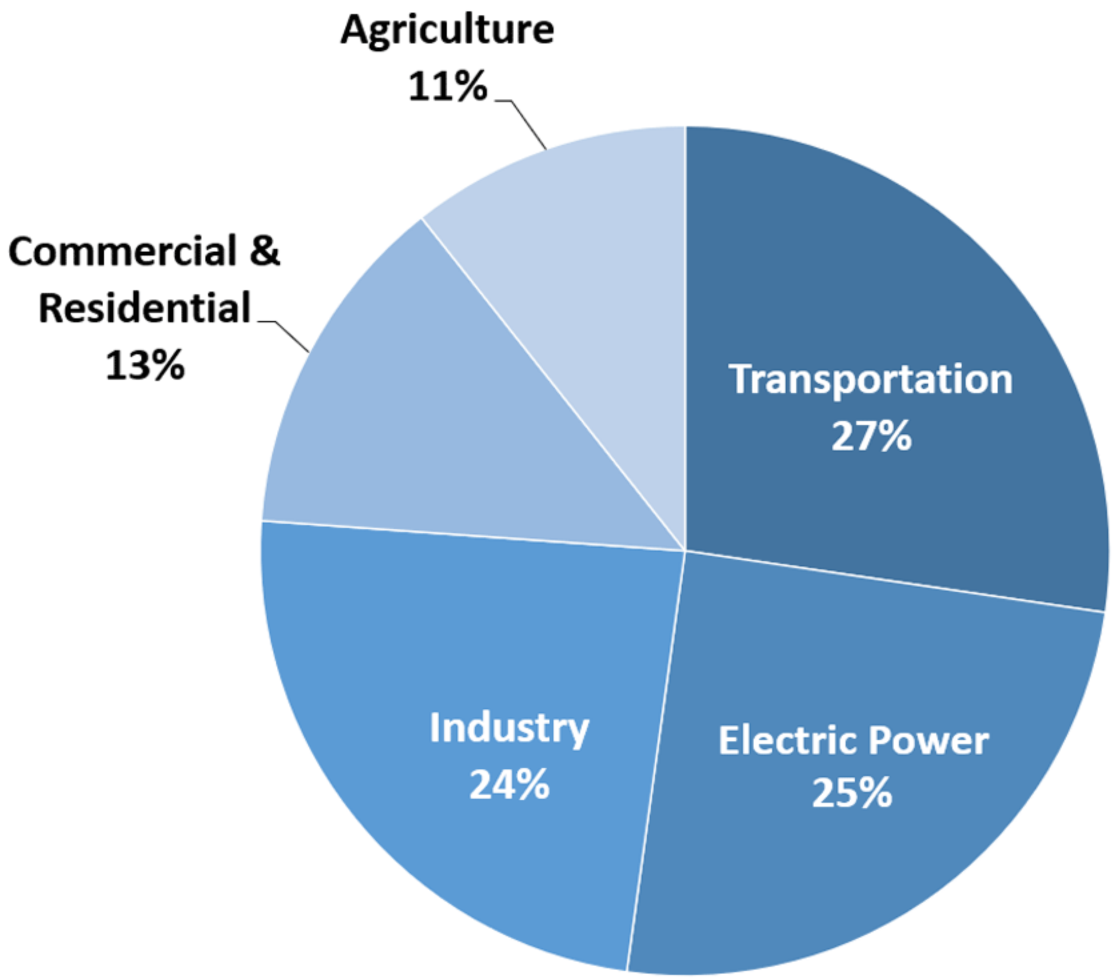
United States Greenhouse Gas 2020 Emissions by Sector



U.S. Environmental Protection Agency (2022). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020

Total U,S, Emissions in 2020 = 5,981 Million Metric Tons of CO_2 equivalent. Source: https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

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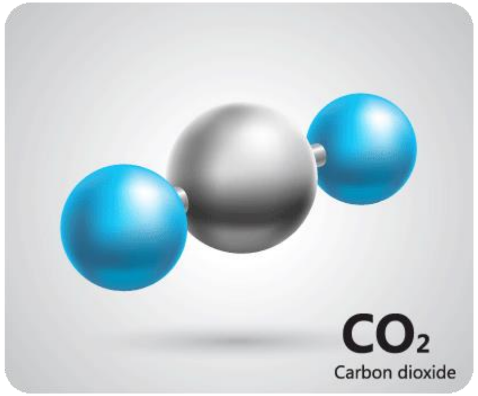
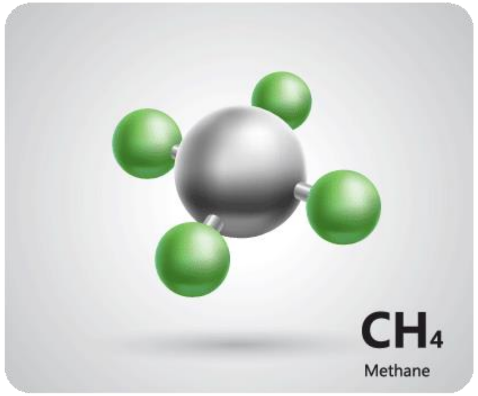
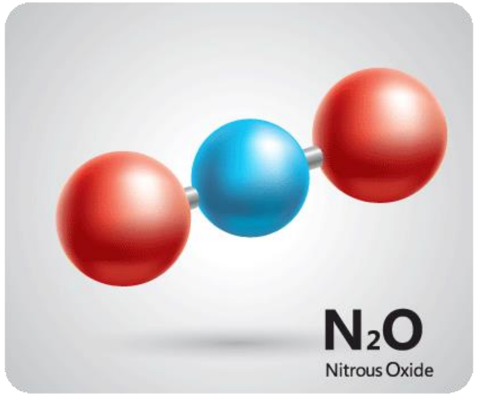


Global Warming Potential (GWP_{100}) of Main Greenhouse Gases



Carbon Dioxide (CO_2)	1
Methane (CH_4)	28
Nitrous Oxide (N_2O)	265



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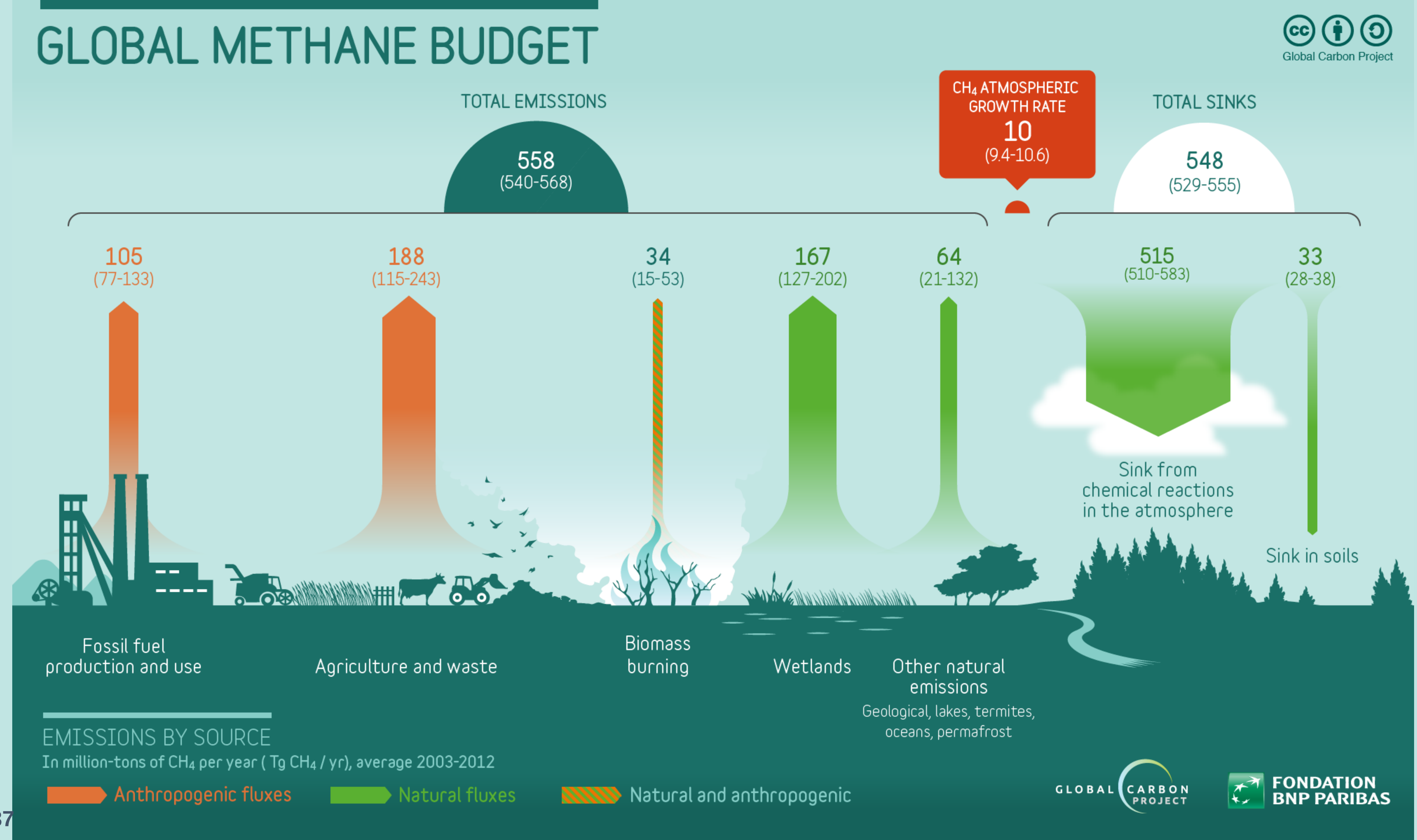
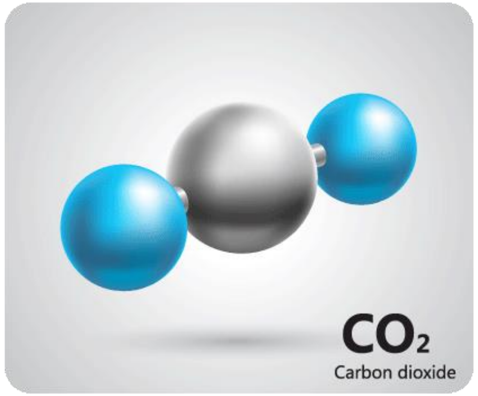
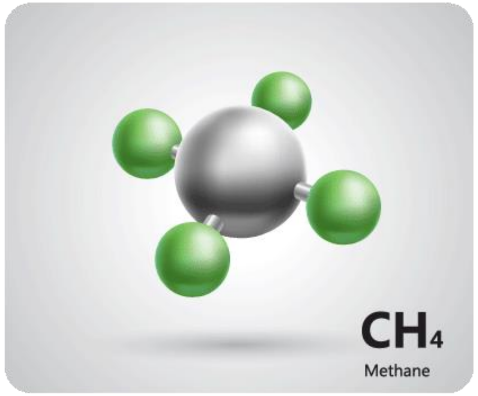
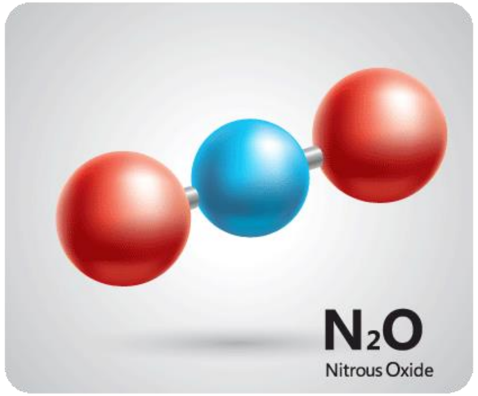

GLOBAL METHANE BUDGET
Global Carbon Project
TOTAL EMISSIONS
558
(540-568)
CH4 ATMOSPHERIC GROWTH RATE
10
(9.4-10.6)
TOTAL SINKS
548
(529-555)
105
(77-133)
188
(115-243)
34
(15-53)
167
(127-202)
64
(21-132)
515
(510-583)
33
(28-38)
Sink from chemical reactions in the atmosphere
Sink in soils
Fossil fuel production and use
Agriculture and waste
Biomass burning
Wetlands
Other natural emissions
Geological, lakes, termites, oceans, permafrost
EMISSIONS BY SOURCE
In million-tons of CH4 per year (Tg CH4 / yr), average 2003-2012
Anthropogenic fluxes
Natural fluxes
Natural and anthropogenic
GLOBAL CARBON PROJECT
FONDATION BNP PARIBAS

Half-Life of Main Greenhouse Gases in Years

Carbon Dioxide (CO_2)	1,000
Methane (CH_4)	12
Nitrous Oxide (N_2O)	110







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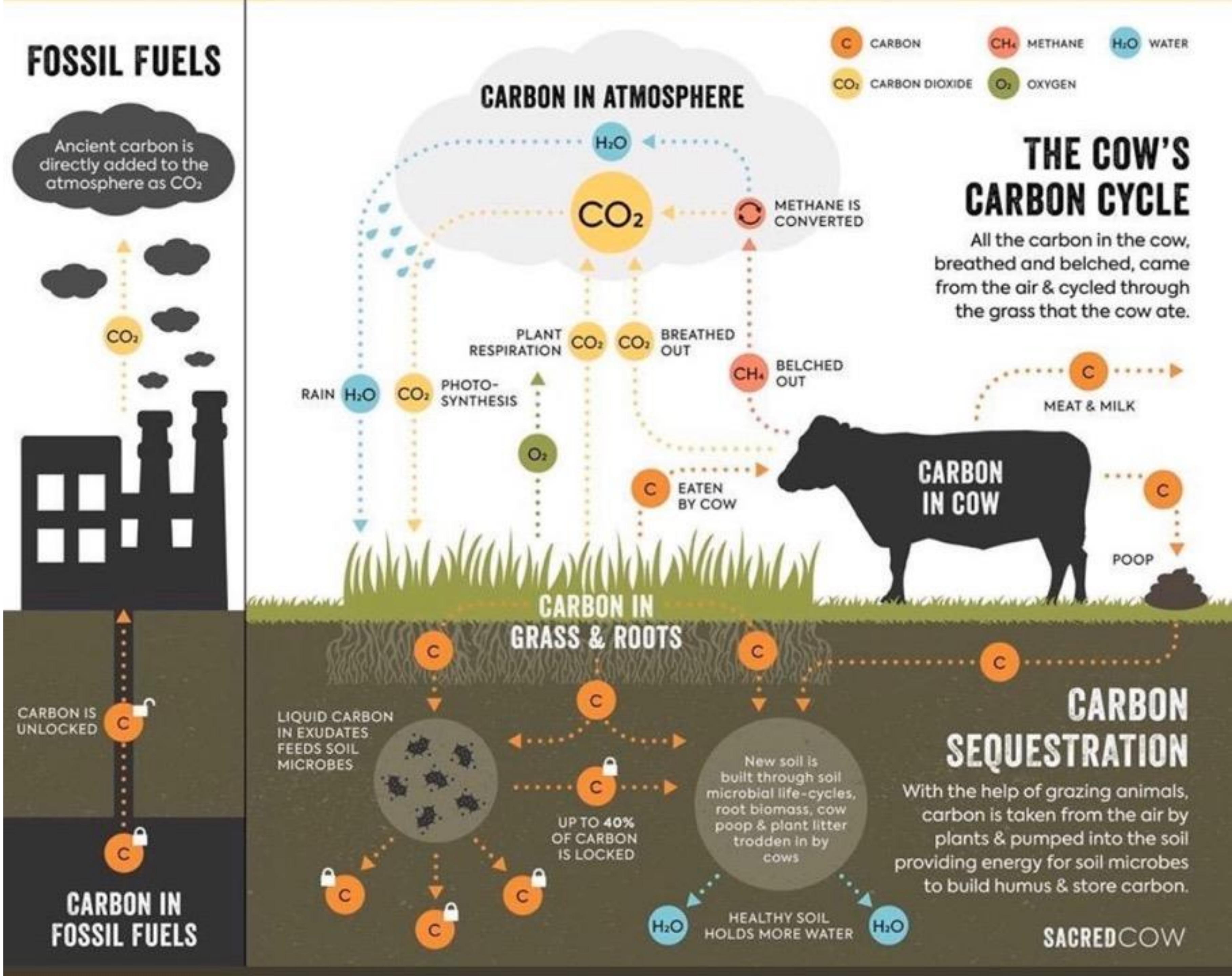
Fossil vs. Biogenic Carbon



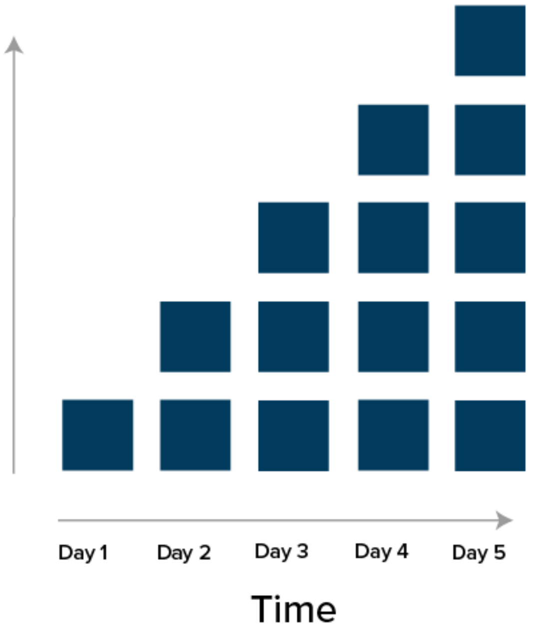
Via:
@sustainabledish
sacredcow.info

= Pulse of CO_2

Stock Gas

Carbon dioxide (CO_2)

Atmospheric Concentration



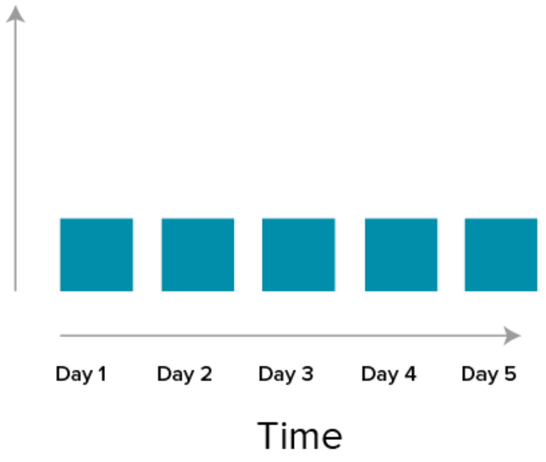
Stock gases will accumulate over time, because they stay in the environment.

= Pulse of CH_4

Flow Gas

Methane (CH_4)

Atmospheric Concentration



Flow gases will stay stagnent, as they are destroyed at the same rate of emission.

Based on research by Myles R. Allen, Keith P. Shine, Jan S. Fuglestvedt, Richard J. Millar, Michelle Cain, David J. Frame & Adrian H. Macey.
Read more here: https://rdcu.be/b1t7S

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GWP* - A new way to characterize short-lived greenhouse gases

- GWP100 overestimates methane's warming impact of constant herds by a factor of 4 and overlooks its ability to induce cooling when CH_4 emissions are reduced.

- GWP* is a new metric out of the University of Oxford that assesses how an emission of a short-lived greenhouse gas affects temperature.
- GWP* accounts for methane's short lifespan, including its atmospheric removal.

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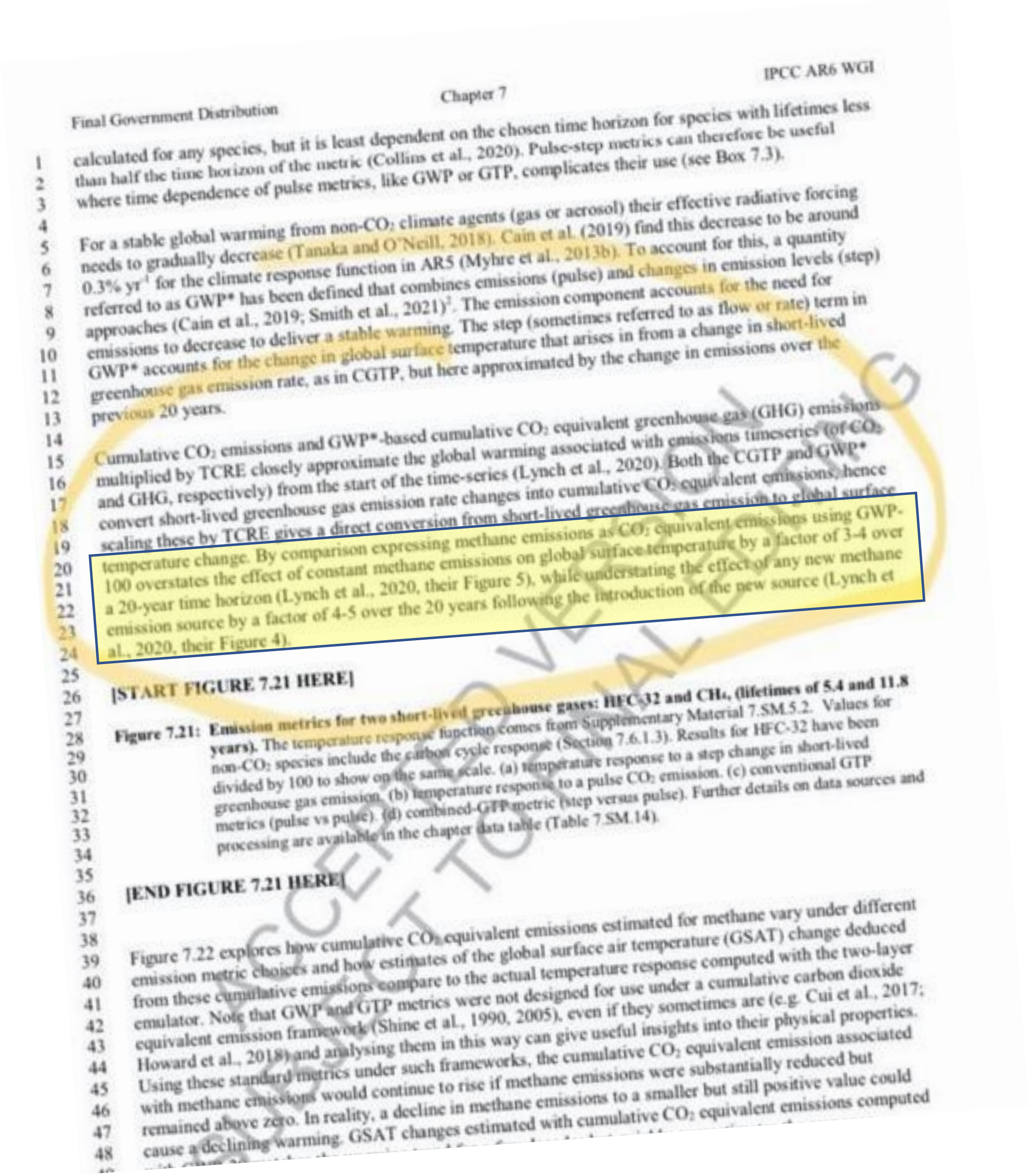


Final Government Distribution — Chapter 7 — IPCC AR6 WGI

calculated for any species, but it is least dependent on the chosen time horizon for species with lifetimes less than half the time horizon of the metric (Collins et al., 2020). Pulse-step metrics can therefore be useful where time dependence of pulse metrics, like GWP or GTP, complicates their use (see Box 7.3).

For a stable global warming from non-CO_2 climate agents (gas or aerosol) their effective radiative forcing needs to gradually decrease (Tanaka and O'Neill, 2018). Cain et al. (2019) find this decrease to be around 0.3% yr^{-1} for the climate response function in AR5 (Myhre et al., 2013b). To account for this, a quantity referred to as GWP* has been defined that combines emissions (pulse) and changes in emission levels (step) approaches (Cain et al., 2019; Smith et al., 2021)[2]. The emission component accounts for the need for emissions to decrease to deliver a stable warming. The step (sometimes referred to as flow or rate) term in GWP* accounts for the change in global surface temperature that arises in from a change in short-lived greenhouse gas emission rate, as in CGTP, but here approximated by the change in emissions over the previous 20 years.

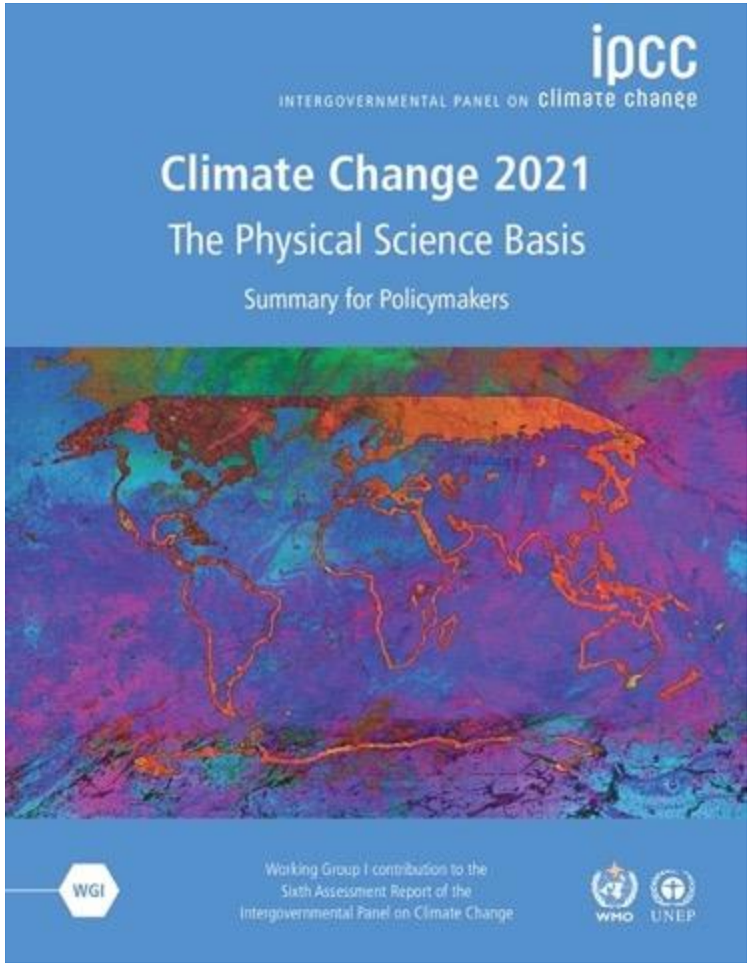
Cumulative CO_2 emissions and GWP*-based cumulative CO_2 equivalent greenhouse gas (GHG) emissions multiplied by TCRE closely approximate the global warming associated with emissions timeseries (of CO_2 and GHG, respectively) from the start of the time-series (Lynch et al., 2020). Both the CGTP and GWP* convert short-lived greenhouse gas emission rate changes into cumulative CO_2 equivalent emissions, hence scaling these by TCRE gives a direct conversion from short-lived greenhouse gas emission to global surface temperature change. By comparison expressing methane emissions as CO_2 equivalent emissions using GWP-100 overstates the effect of constant methane emissions on global surface temperature by a factor of 3-4 over a 20-year time horizon (Lynch et al., 2020, their Figure 5), while understating the effect of any new methane emission source by a factor of 4-5 over the 20 years following the introduction of the new source (Lynch et al., 2020, their Figure 4).

[START FIGURE 7.21 HERE]

Figure 7.21: Emission metrics for two short-lived greenhouse gases: HFC-32 and CH_4, (lifetimes of 5.4 and 11.8 years). The temperature response function comes from Supplementary Material 7.SM.5.2. Values for non-CO_2 species include the carbon cycle response (Section 7.6.1.3). Results for HFC-32 have been divided by 100 to show on the same scale. (a) temperature response to a step change in short-lived greenhouse gas emission. (b) temperature response to a pulse CO_2 emission. (c) conventional GTP metrics (pulse vs pulse). (d) combined-GTP metric (step versus pulse). Further details on data sources and processing are available in the chapter data table (Table 7.SM.14).

[END FIGURE 7.21 HERE]

Figure 7.22 explores how cumulative CO_2 equivalent emissions estimated for methane vary under different emission metric choices and how estimates of the global surface air temperature (GSAT) change deduced from these cumulative emissions compare to the actual temperature response computed with the two-layer emulator. Note that GWP and GTP metrics were not designed for use under a cumulative carbon dioxide equivalent emission framework (Shine et al., 1990, 2005), even if they sometimes are (e.g. Cui et al., 2017; Howard et al., 2018) and analysing them in this way can give useful insights into their physical properties. Using these standard metrics under such frameworks, the cumulative CO_2 equivalent emission associated with methane emissions would continue to rise if methane emissions were substantially reduced but remained above zero. In reality, a decline in methane emissions to a smaller but still positive value could cause a declining warming. GSAT changes estimated with cumulative CO_2 equivalent emissions computed



Read the page here: bit.ly/ipcc_ch7

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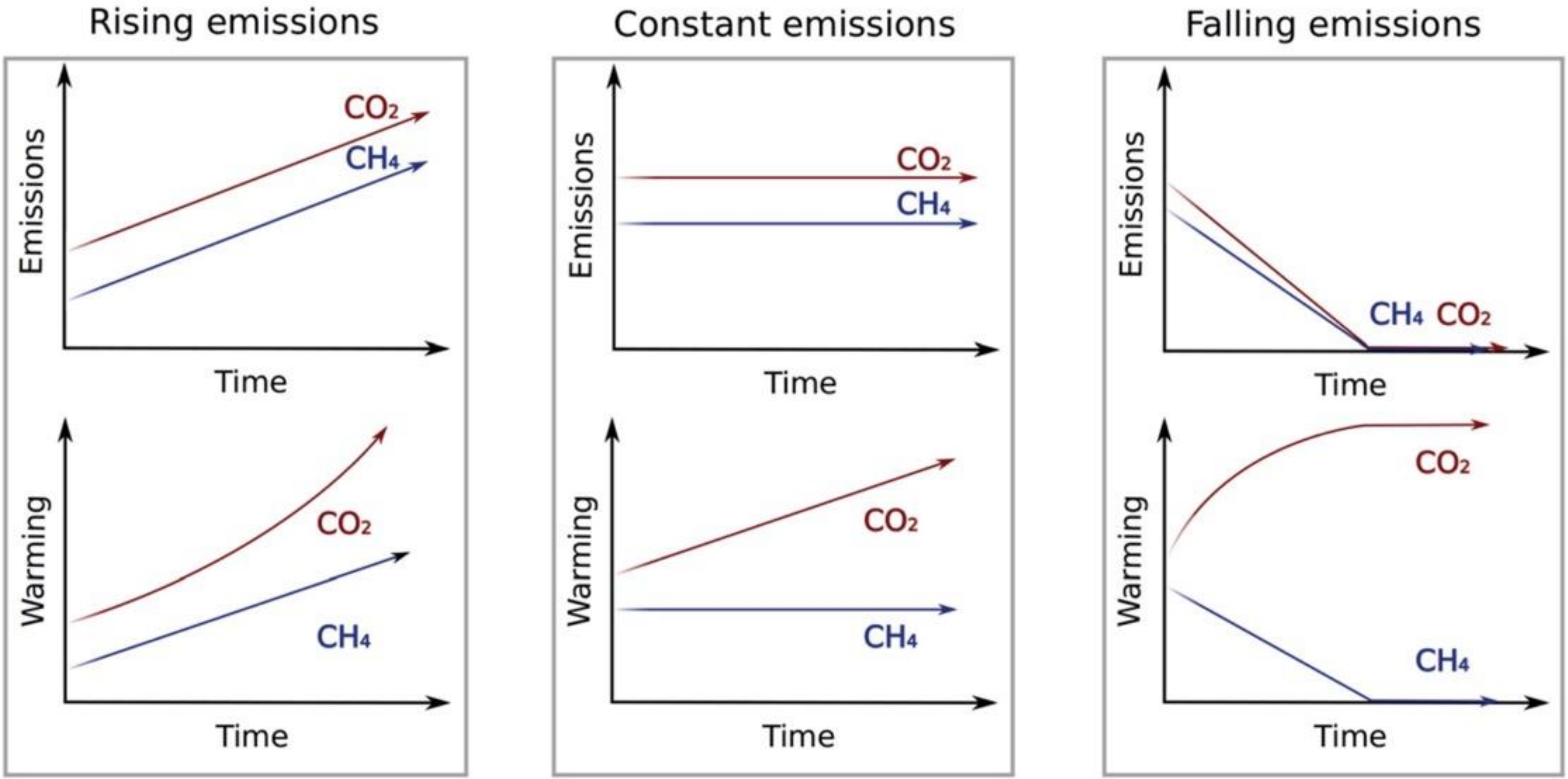

Oxford Martin, Climate Metrics for Ruminant Livestock, July 2018, [*https://www.oxfordmartin.ox.ac.uk/downloads/reports/Climate-metrics-for-ruminant-livestock.pdf%C2%A0*](https://www.oxfordmartin.ox.ac.uk/downloads/reports/Climate-metrics-for-ruminant-livestock.pdf%C2%A0)

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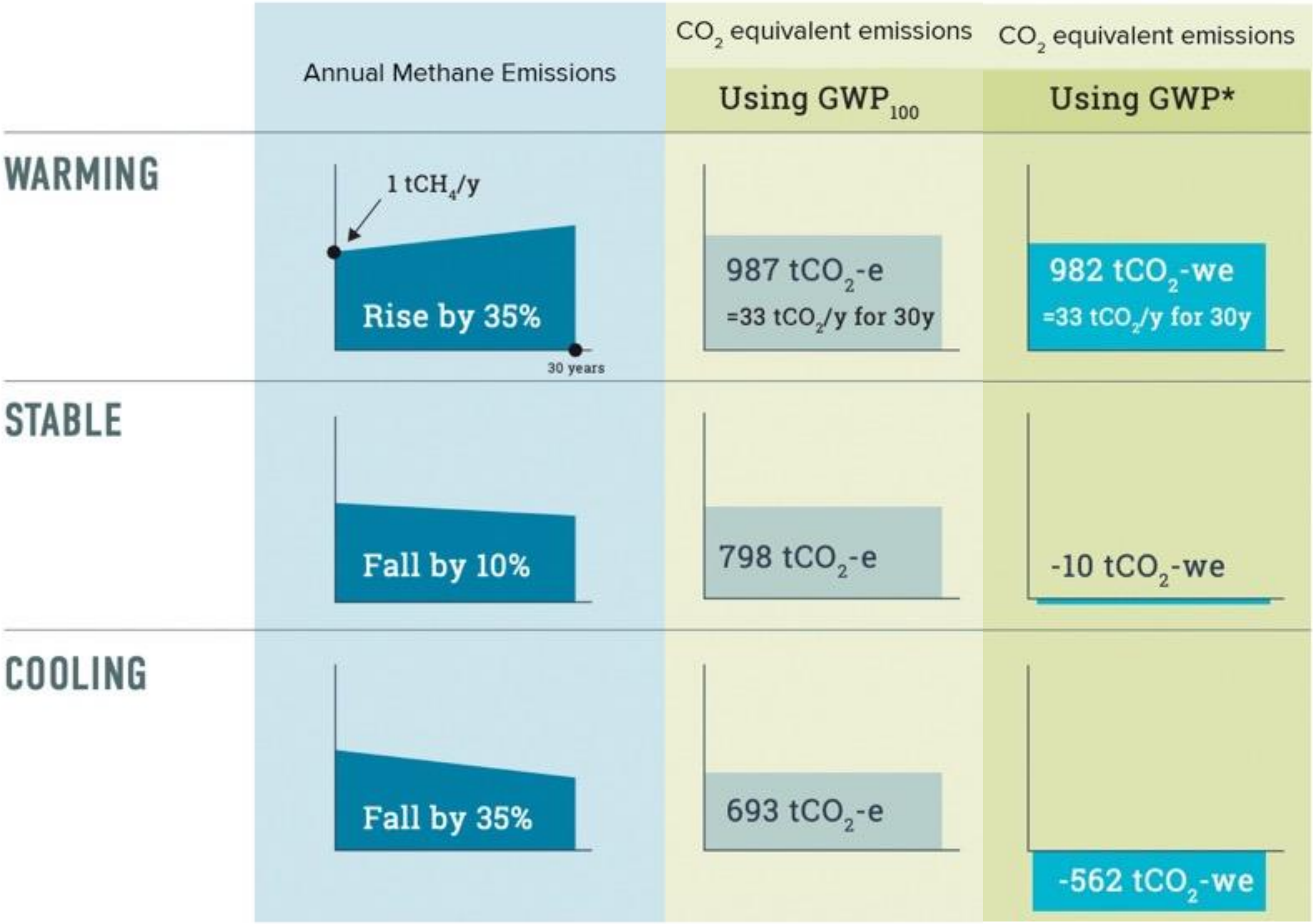

Cain, M., Allen, M. & Lynch, J. *Oxford Martin Programme on Climate Pollutants* (2019). Read more at: https://www.oxfordmartin.ox.ac.uk/downloads/academic/201908_ClimatePollutants.pdf.

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California dairies have reduced greenhouse gases by 2.3MMTCO2e – **30% of the sector's methane reduction goal**

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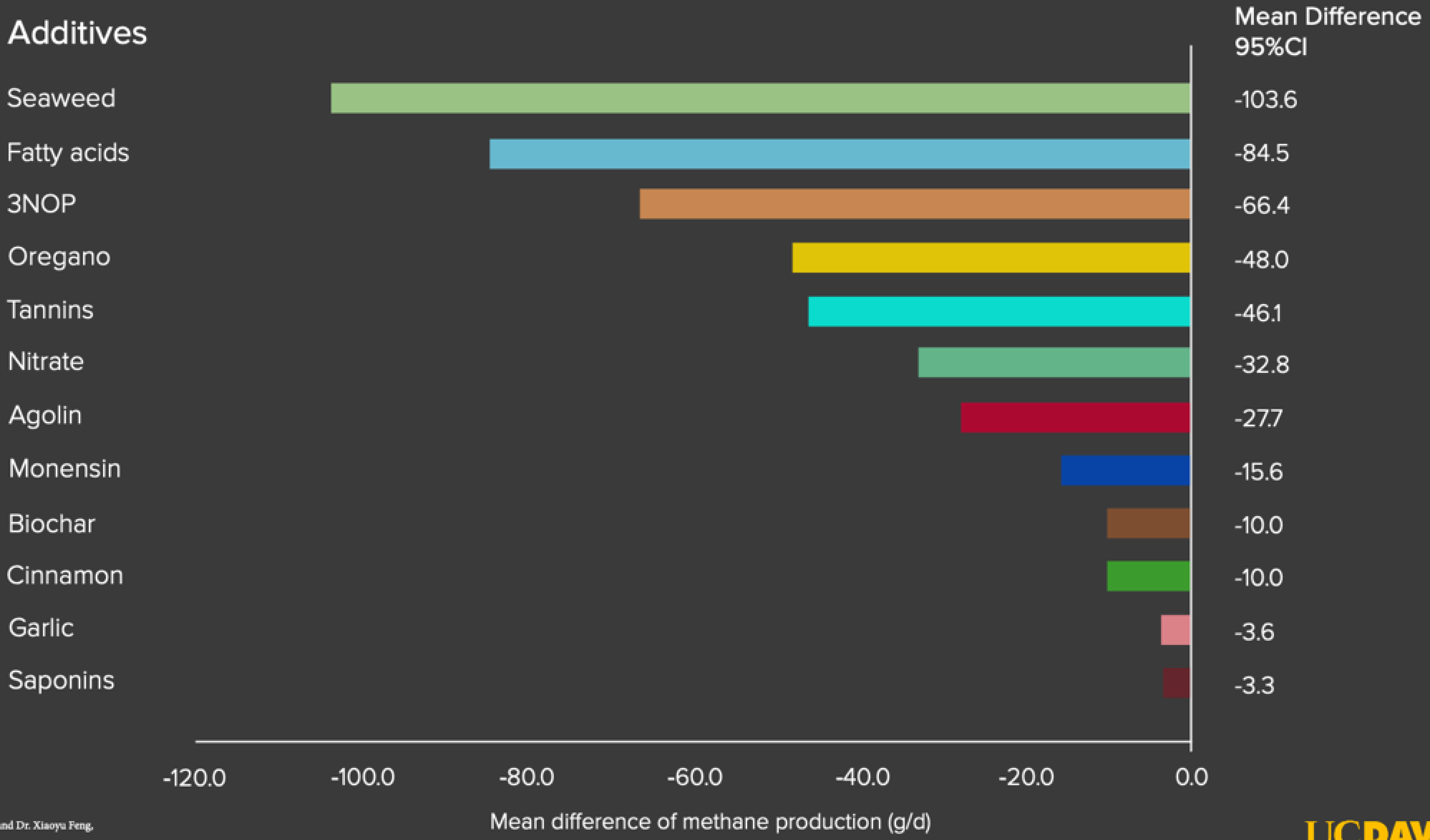
Methane Reductions from Feed Additives



Created based on the work of Dr. Ermias Kebreab and Dr. Xiaoyu Feng, University of California, Davis. https://ww2.arb.ca.gov/sites/default/files/2020-12/17RD018.pdf

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California Case Study

Whitepaper highlighting benefits of incentive-based policies in GHG reductions

Use your cellphone camera to scan the QR code and take you to the article.

https://bit.ly/pathwayclear

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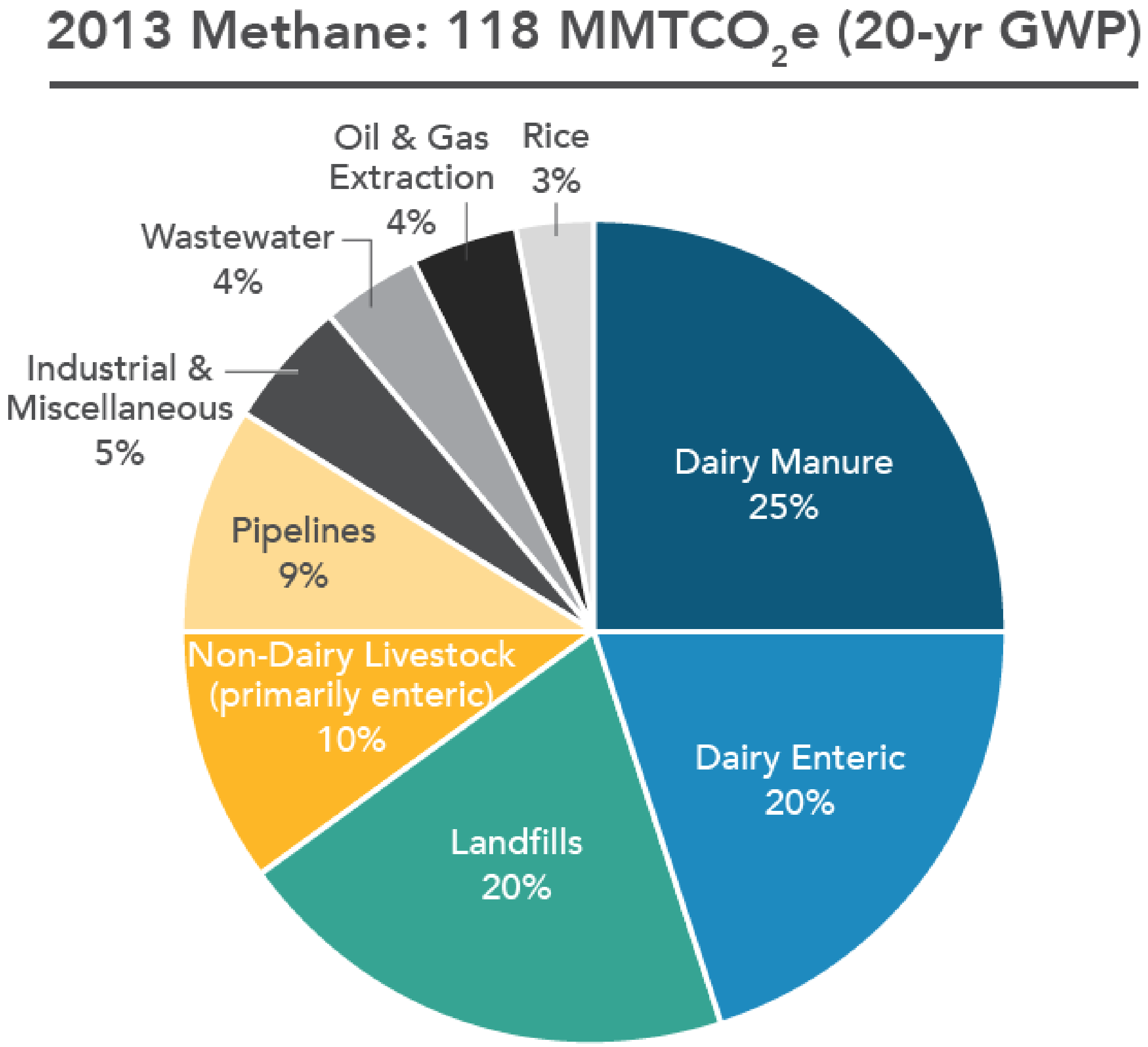
Ambitious Goals in California



- California had set aggressive targets for reducing methane 40% below 2013 levels by 2030
- Dairy to reduce 7.2 MMTCO2e
- 1.8 MMTCO2e reductions coming from mostly beef cattle.

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- Paper focuses on California's efforts to reduce dairy sector methane
- Our analysis shows that California's dairy sector is well on its way to achieving targets
- Our analysis suggests that continued aggressive GHG reduction strategies will also allow the California dairy industry to achieve "climate neutrality" by 2030
- Incentivizing reductions is working and offer a path further.

Figure 1. *California's dairy methane reduction efforts have employed a comprehensive and successful four-part strategy:*

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The methane reductions from programs and projects in place today, coupled with the implementation of a moderate feed additive strategy to reduce enteric emissions, is on track to reduce methane between 7.6 to 10.6 MMTCO2e by 2030, from the dairy sector alone.

Table 1. California Dairy Methane Reductions Projected to Exceed SB 1383 Requirements

Projected Dairy Sector Methane Reductions	
Reduction Type	**Expected Dairy Emission Reductions Through 2030 (MMTCO2e)**
Herd Reduction	2.61 – 3.3
Anaerobic Digestion	4.15
Alternative Manure Management Practices	0.6 - 1.1
Enteric Emission Reduction Strategies	0.25 – 2.04
Total	**7.61 – 10.59**

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Can we eat our way out of climate change?

- Omnivore to vegan (per yr) = 0.8 tons CO2e (Wynes & Nicholas, 2017)
- One trans-Atlantic flight (per passenger) = 1.6 tons CO2e (Wynes & Nicholas, 2017)
- Meatless Monday (US) = 0.3% GHG reduction (Hall & White, 2017)
- Vegan US = 2.6% (Hall & White, 2017)

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PHOTOGRAPH BY ROBERT CLARK, NATIONAL GEOGRAPHIC

Global Waste:

1 out of 3 calories

40% of food in the U.S. is wasted

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Thank you

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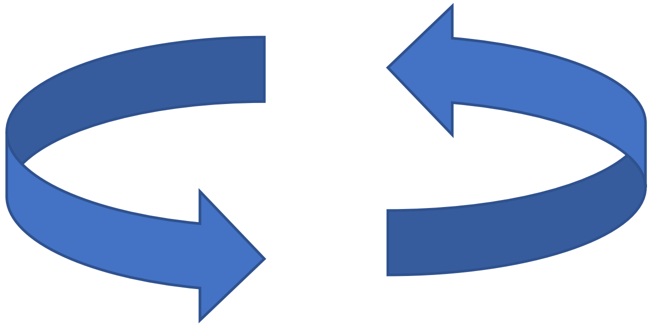
2019 US Sustainability Award Winner

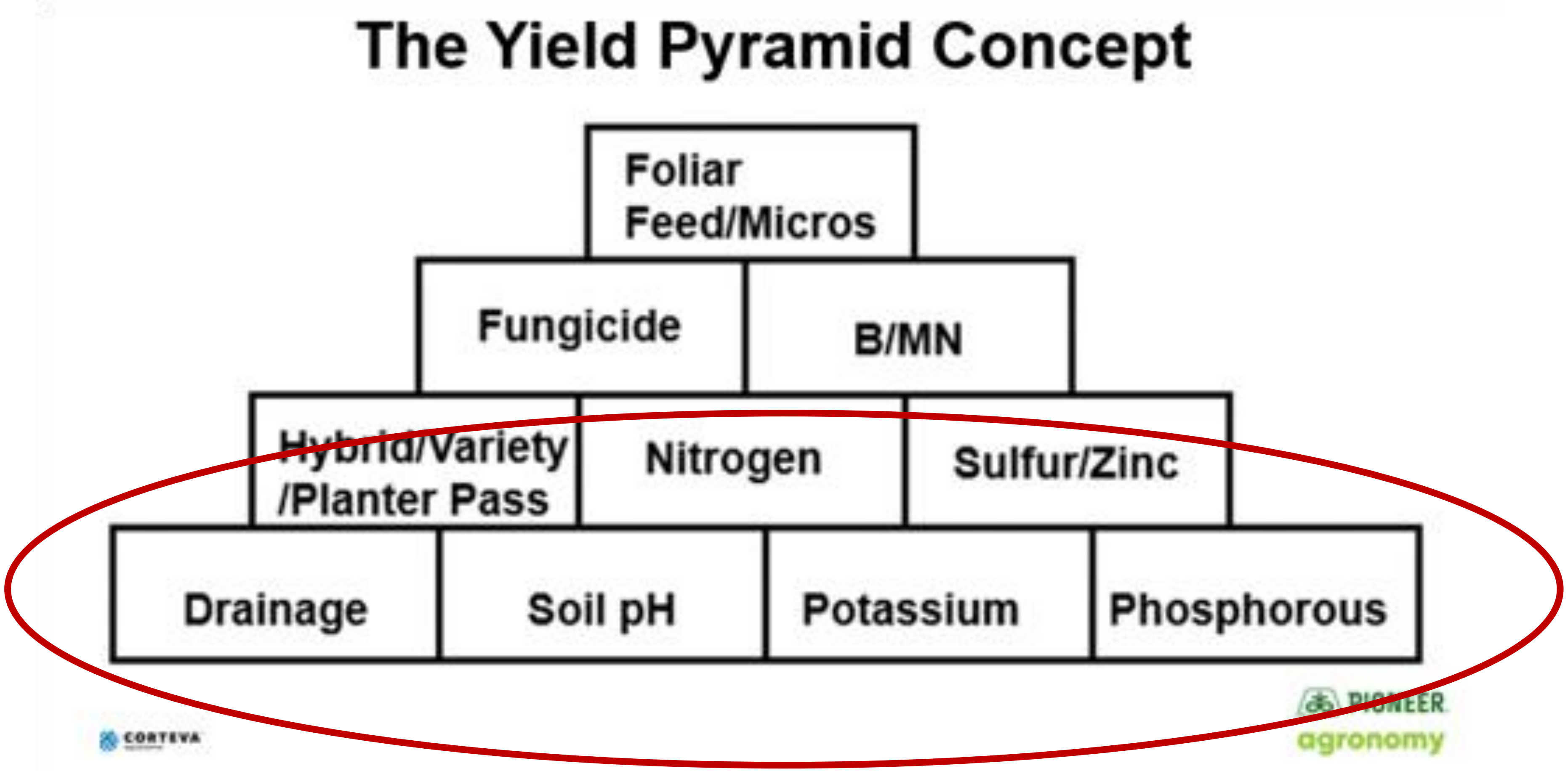
Cinnamon Ridge Dairy Farm

Dairy farming is a circular process

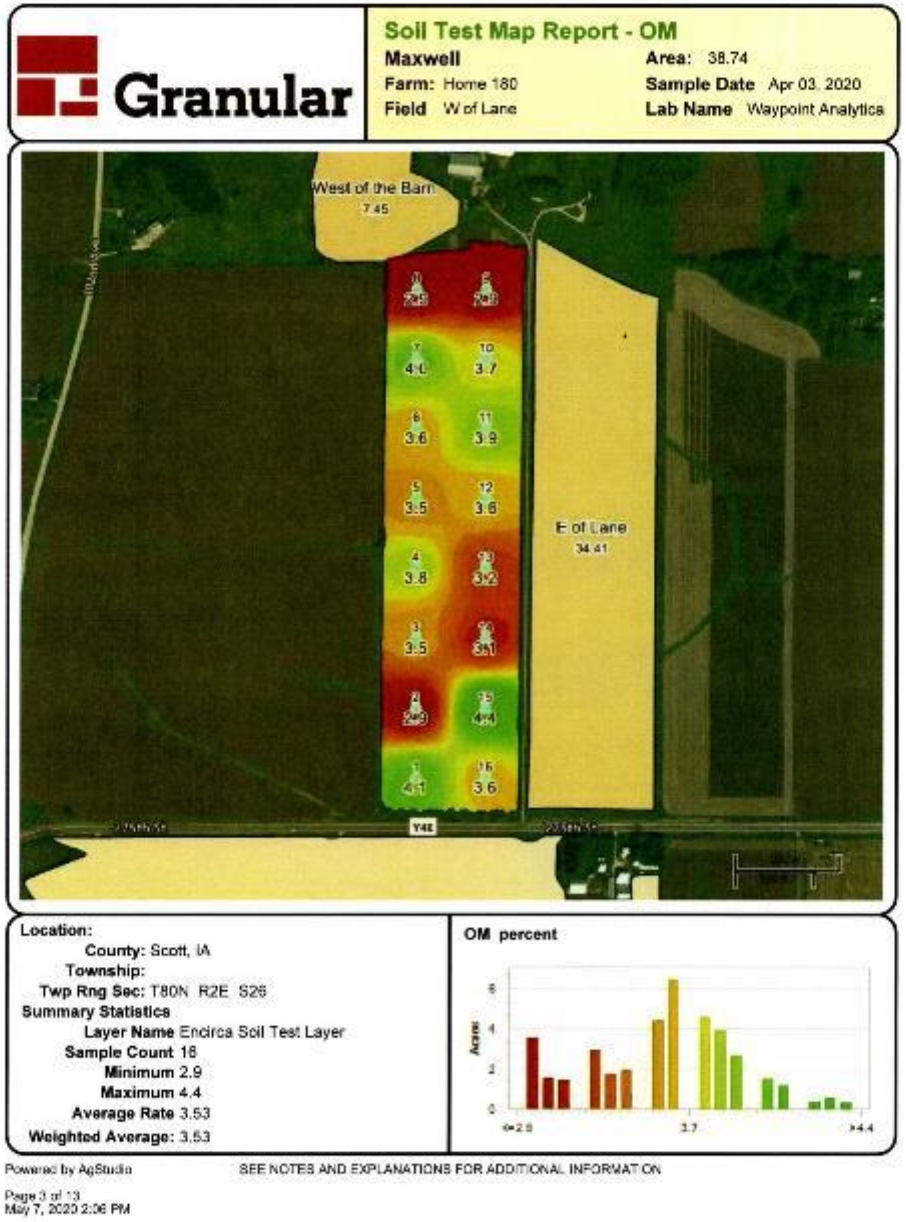
- We grow the crops for our cows
- Cows eat the crops and produce
  - Milk
  - Manure
- We apply manure to the land
- We grow the crops to feed the cows



It all starts with the soils



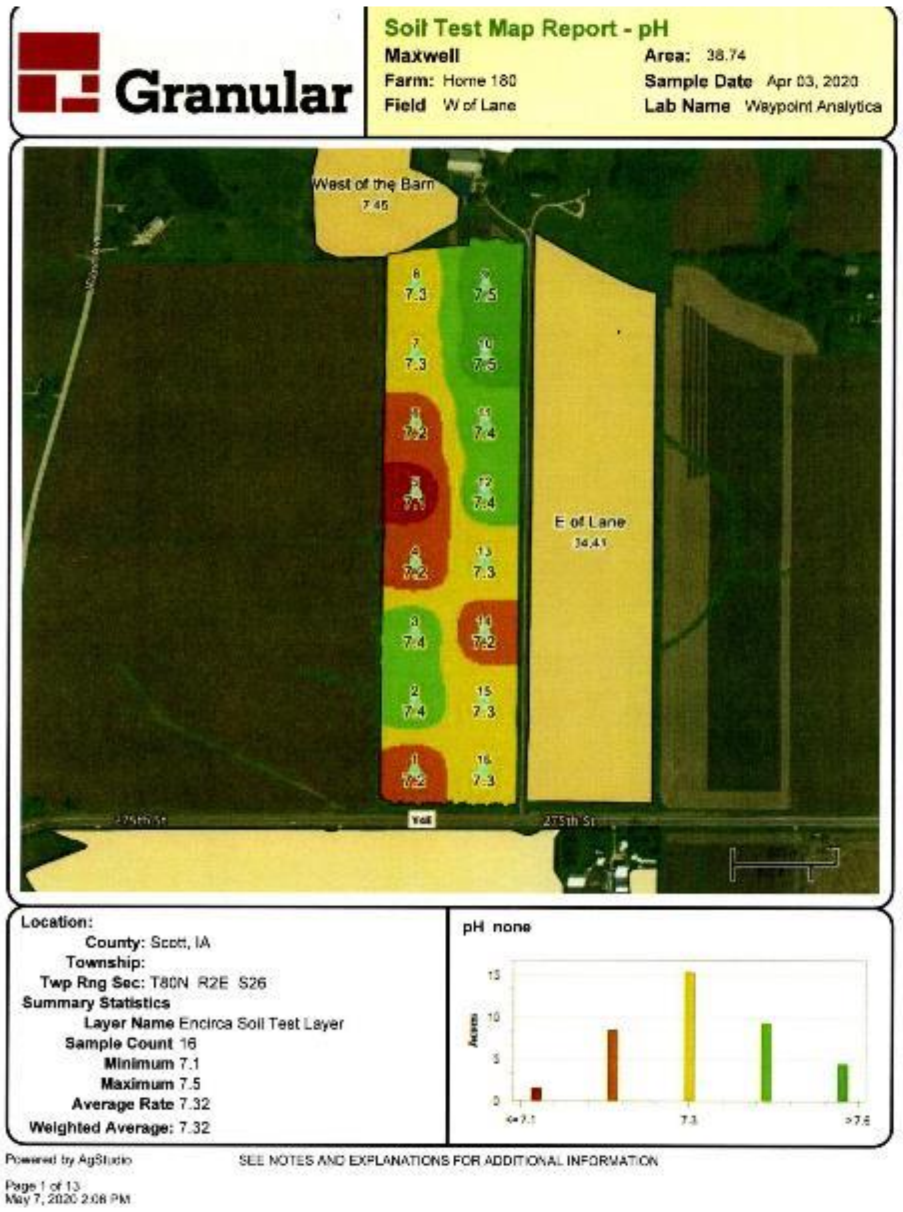
Soil Sampling



Soil Samples
On 2.5 acre grid

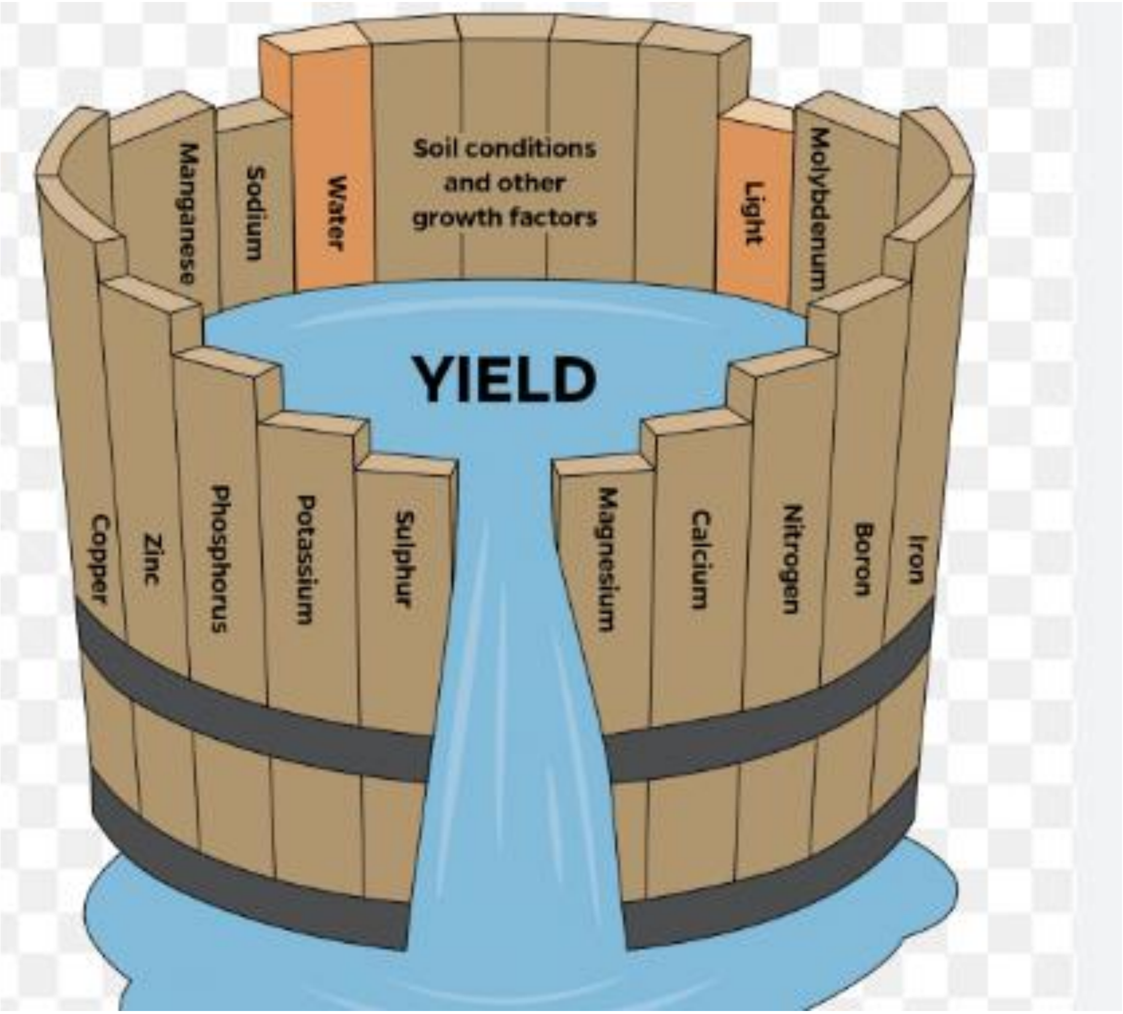
Sample for many macro and micro

Precision Ag



Goals

- Maximum Yield
- Minimal resources
- Clean Water



Cover crops

Planted in fall after silage is harvest

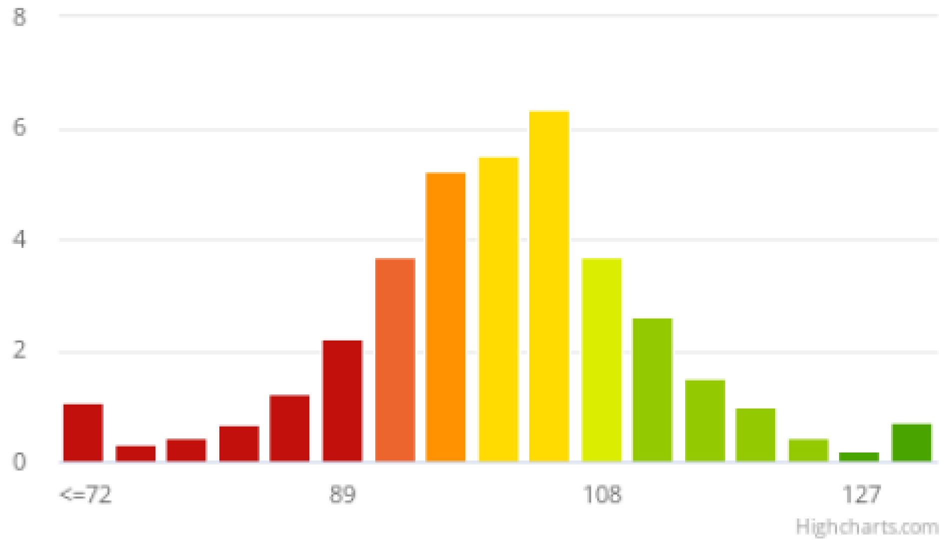
Resumes growing in the spring.

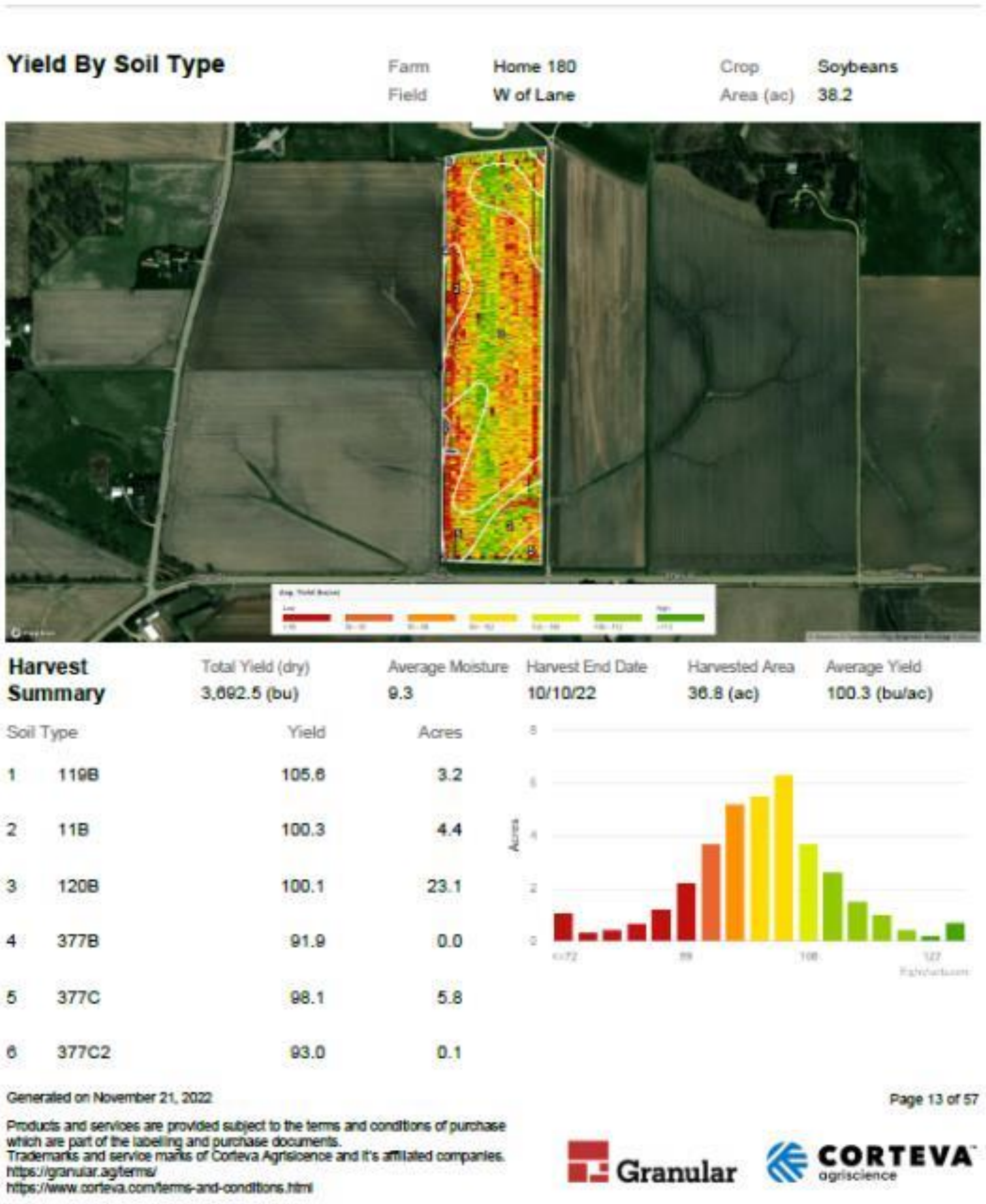
Harvested green for feed for heifers

No-till into the harvested cover crop

Yield maps

- Indicates soil types
- Yields
- Moisture





Yield By Soil Type

Farm: Home 180
Field: W of Lane
Crop: Soybeans
Area (ac): 38.2

Harvest Summary

Total Yield (dry)	Average Moisture	Harvest End Date	Harvested Area	Average Yield
3,692.5 (bu)	9.3	10/10/22	36.8 (ac)	100.3 (bu/ac)

Soil Type		Yield	Acres
1	119B	105.6	3.2
2	11B	100.3	4.4
3	120B	100.1	23.1
4	377B	91.9	0.0
5	377C	98.1	5.8
6	377C2	93.0	0.1

Generated on November 21, 2022

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Granular CORTEVA agriscience

Field Trials – Which corn is better?

Milk per acre

Digestibility

Location Summary Report

Experiment: West CR PKP South Set2
Tracking Name: OFGC22147810_0001
Crop: Corn Silage
Previous Crop:
Row Width (in): 30
 # Rows Harvested (count): 8
Planting Date: 04/28/2022
Harvest Date: 09/01/2022

Sales Agency: Madden Ag Services | **BP Name:** Maxwell; John | **BP ID:** 1010158619
Trial location: **Latitude:** 41.70475 | **Longitude:** -90.69328 | **State:** IA | **Postal Code:** 52746 | **County:** Scott

Trial Type: ☐ Agronomic ☑ Genetic
Irrigation: ☐ Full ☐ Limited ☑ Non-irrigated ☐ Unknown

Tillage: ☐ Conservation ☑ Conventional ☐ Mulch ☐ No-Till ☐ Ridge ☐ Strip ☐ Unknown
Weighing Device: ☐ Both ☑ Weighed ☐ Yield Monitor

Comments:

Additional Location Traits:

N Inhibitor (list):	None
Nitrogen Fert (lb/a):	160
Brittle Snap (y/n):	No

Brand	Product	Sub Product Code	Harvested			% DM (pct)	Tons/Acre (35%DM) (t/a)	% Starch (pct)	% Sugar (pct)	% NDF (pct)	% Fig Dig (24-hr) (pct)	% uNDF (240-hr) (pct)	% CP (pct)	Sample Dry Wt. (g)	Sample Wet Wt. (g)	Lbs Beef/Acre (lb/a)	Lbs Beef/Ton (lb/t)	Lbs Milk/Acre (lb/a)	Lbs Milk/Ton (lb/t)	Planting Rate (n/.001a)	# Rows Planted (count)	Harvest Stand (n/.001a)
			Silage Weight (lb)	Harvest Length (ft)	Harvest Width (in)																	
1-Pioneer	P0924Q	FHST	22340	702	240	36.1	35.78	43.4	8.9	31.32	53.22	8.1	9	206.4	558.6	5388.3	430.3	48852.7	3901.3	34	8	32
2-Pioneer	P1093Q	FHST	21040	701	240	36.3	33.86	44.5	9.48	29.34	50.85	8.01	9.4	209.7	565.9	5018.4	423.5	45952.4	3877.8	34	8	32
3-Pioneer	P1185Q	FIST	21260	700	240	36.3	34.27	40.7	9.47	32.81	55.38	8.06	9.1	245.7	665	5184.8	432.3	46651.1	3889.5	34	8	32
4-Pioneer	P1180XR	FIST	19500	699	240	33.3	28.9	37.6	10.43	33.52	53.04	8.35	9.1	219.7	645.7	4168.2	412	38057.6	3762.1	34	8	32
5-Pioneer	P1267Q	FHST	21580	698	240	33.8	32.55	43.1	8.92	31.62	53.48	8.04	8.2	239.8	694.9	4839.9	424.9	43955.6	3858.8	34	8	32
6-Pioneer	P1272Q	FHST	18700	697	240	35.8	29.86	40.9	10.14	30.46	50.85	8.5	9.5	252.7	693.8	4335.3	414.8	39840.7	3811.8	34	8	32
7-Pioneer	P1366Q	FHST	21920	696	240	35.1	34.35	46.7	8.69	27.43	48.09	7.92	8.7	268.1	751.6	4984.3	414.6	46122.7	3836.8	34	8	32

Market Price	Market Segment	Segment Price Adj.	Adjustment	Total Market Price
$6.00	Standard	$0.04	$0.00	$6.00
$6.00	High Oil	$0.04	$0.00	$6.00
$6.00	High Oil SX	$0.04	$0.00	$6.00

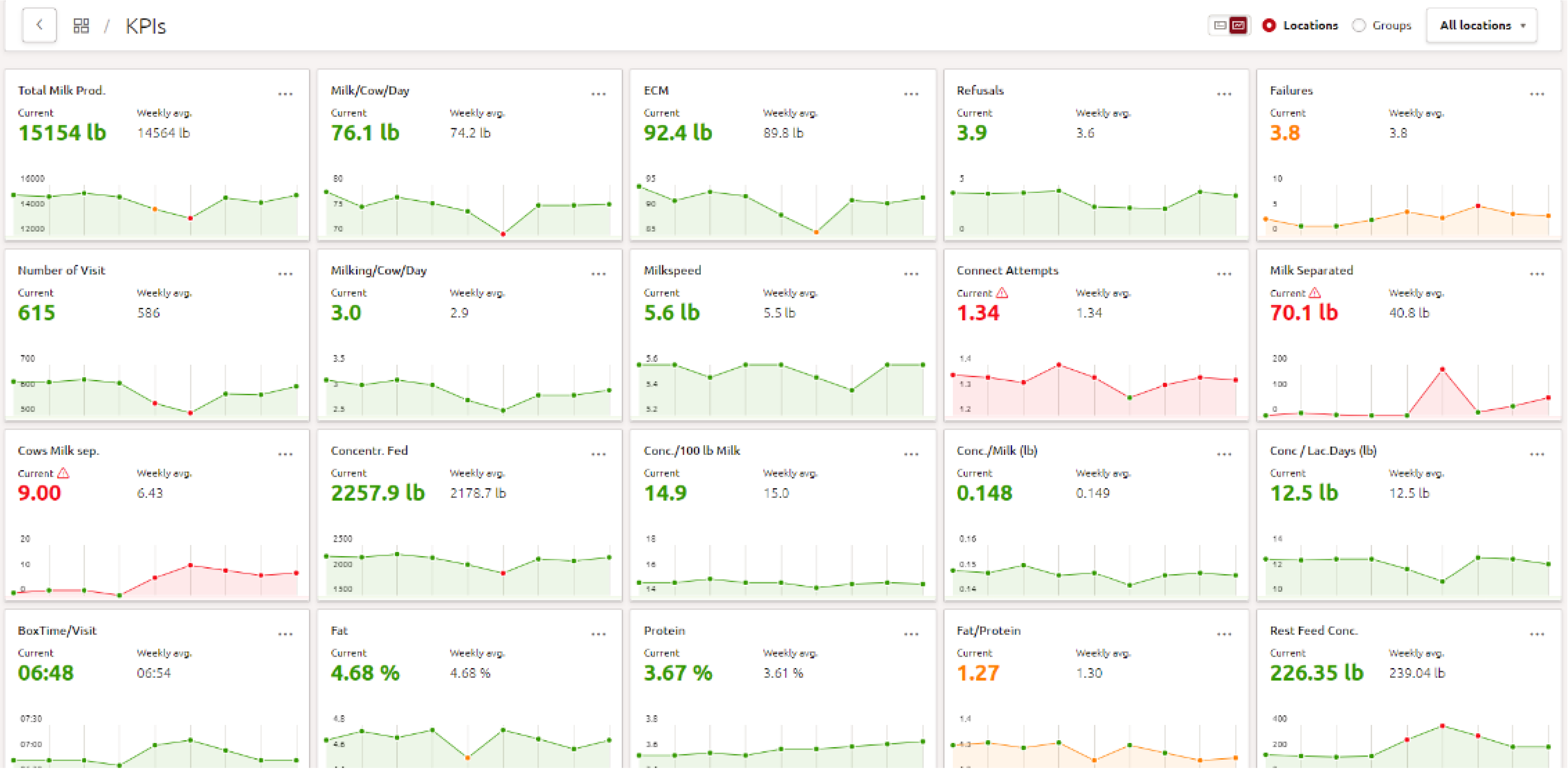
It is all about the cows – Cow Comfort

Cow Comfort

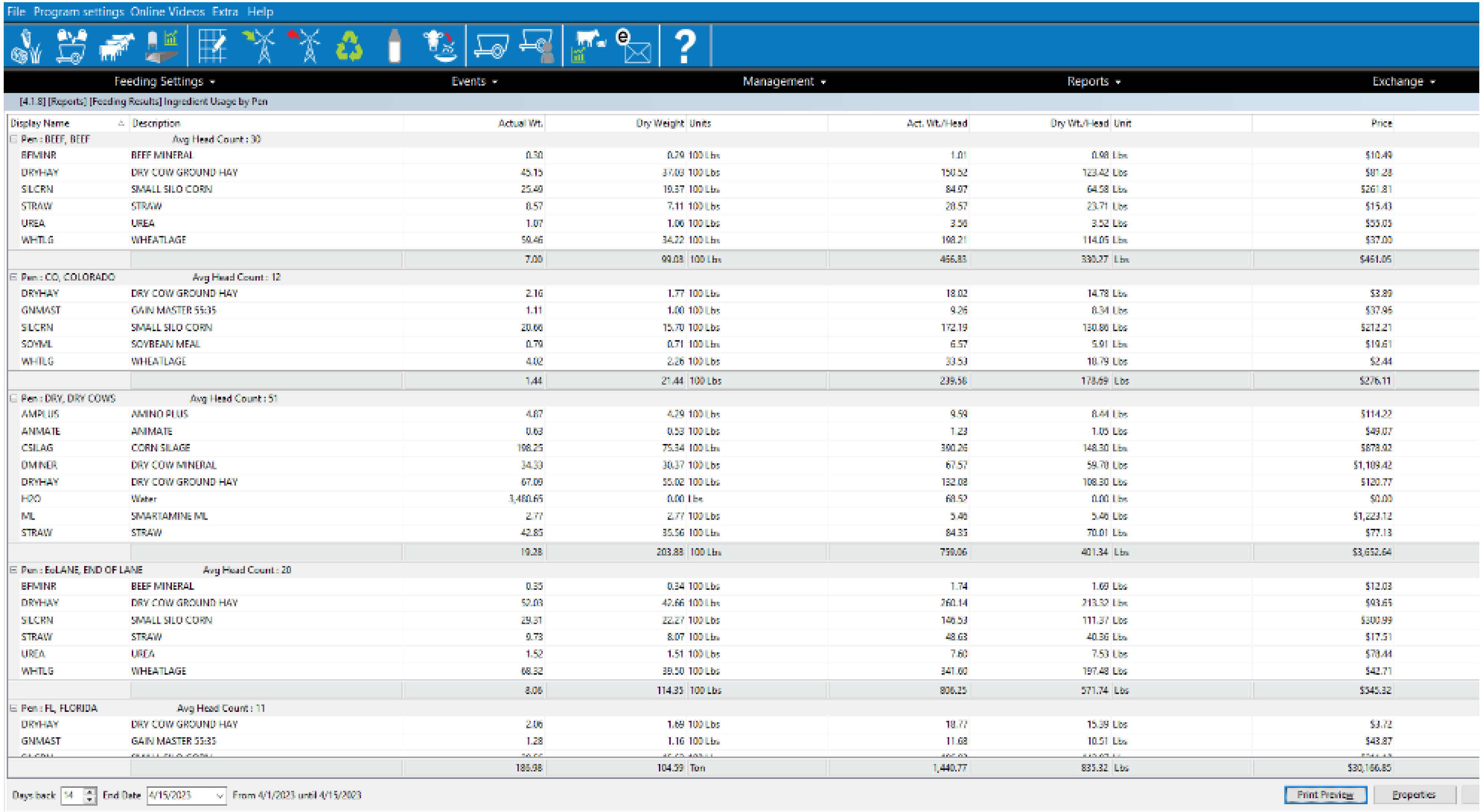
- Bedding with sand

Milk with robots

120+ data points every day on each cow



Tailor the feed/cow & know the cost



File Program settings Online Videos Extra Help

Feeding Settings ▾ Events ▾ Management ▾ Reports ▾ Exchange ▾

[4.1.8] [Reports] [Feeding Results] Ingredient Usage by Pen

Display Name	Description	Actual Wt.	Dry Weight	Units	Act. Wt./Head	Dry Wt./Head	Unit	Price
Pen : BEEF, BEEF	Avg Head Count : 30							
BFMINR	BEEF MINERAL	0.30	0.29	100 Lbs	1.01	0.98	Lbs	$10.49
DRYHAY	DRY COW GROUND HAY	45.15	37.03	100 Lbs	150.52	123.42	Lbs	$81.28
SILCRN	SMALL SILO CORN	25.49	19.37	100 Lbs	84.97	64.58	Lbs	$261.81
STRAW	STRAW	8.57	7.11	100 Lbs	28.57	23.71	Lbs	$15.43
UREA	UREA	1.07	1.06	100 Lbs	3.56	3.52	Lbs	$55.05
WHTLG	WHEATLAGE	59.46	34.22	100 Lbs	198.21	114.05	Lbs	$37.00
		7.00	99.08	100 Lbs	466.83	330.27	Lbs	$461.05
Pen : CO, COLORADO	Avg Head Count : 12							
DRYHAY	DRY COW GROUND HAY	2.16	1.77	100 Lbs	18.02	14.78	Lbs	$3.89
GNMAST	GAIN MASTER 55:35	1.11	1.00	100 Lbs	9.26	8.34	Lbs	$37.96
SILCRN	SMALL SILO CORN	20.66	15.70	100 Lbs	172.19	130.86	Lbs	$212.21
SOYML	SOYBEAN MEAL	0.79	0.71	100 Lbs	6.57	5.91	Lbs	$19.61
WHTLG	WHEATLAGE	4.02	2.26	100 Lbs	33.53	18.79	Lbs	$2.44
		1.44	21.44	100 Lbs	239.58	178.69	Lbs	$276.11
Pen : DRY, DRY COWS	Avg Head Count : 51							
AMPLUS	AMINO PLUS	4.87	4.29	100 Lbs	9.59	8.44	Lbs	$114.22
ANMATE	ANIMATE	0.63	0.53	100 Lbs	1.23	1.05	Lbs	$49.07
CSILAG	CORN SILAGE	198.25	75.34	100 Lbs	390.26	148.30	Lbs	$878.92
DMINER	DRY COW MINERAL	34.33	30.37	100 Lbs	67.57	59.78	Lbs	$1,109.42
DRYHAY	DRY COW GROUND HAY	67.09	55.02	100 Lbs	132.08	108.30	Lbs	$120.77
H2O	Water	3,480.65	0.00	Lbs	68.52	0.00	Lbs	$0.00
ML	SMARTAMINE ML	2.77	2.77	100 Lbs	5.46	5.46	Lbs	$1,223.12
STRAW	STRAW	42.85	35.56	100 Lbs	84.35	70.01	Lbs	$77.13
		19.28	203.88	100 Lbs	759.06	401.34	Lbs	$3,652.64
Pen : EoLANE, END OF LANE	Avg Head Count : 20							
BFMINR	BEEF MINERAL	0.35	0.34	100 Lbs	1.74	1.69	Lbs	$12.03
DRYHAY	DRY COW GROUND HAY	52.03	42.66	100 Lbs	260.14	213.32	Lbs	$93.65
SILCRN	SMALL SILO CORN	29.31	22.27	100 Lbs	146.53	111.37	Lbs	$300.99
STRAW	STRAW	9.73	8.07	100 Lbs	48.63	40.36	Lbs	$17.51
UREA	UREA	1.52	1.51	100 Lbs	7.60	7.53	Lbs	$78.44
WHTLG	WHEATLAGE	68.32	39.50	100 Lbs	341.60	197.48	Lbs	$42.71
		8.06	114.35	100 Lbs	806.25	571.74	Lbs	$545.32
Pen : FL, FLORIDA	Avg Head Count : 11							
DRYHAY	DRY COW GROUND HAY	2.06	1.69	100 Lbs	18.77	15.39	Lbs	$3.72
GNMAST	GAIN MASTER 55:35	1.28	1.16	100 Lbs	11.68	10.51	Lbs	$43.87
		186.98	104.59	Ton	1,440.77	833.32	Lbs	$30,166.85

Days back 14 End Date 4/15/2023 From 4/1/2023 until 4/15/2023

Print Preview Properties

Use of AI to tailor the milk schedule by cow

- Constant – the amt of time to hook up the milkers
- Longer time between visits – cow goes through few times in a day
- More milk yield per cow
    - Better for the cow
    - More milk per robot per day
    - Milking more cows

Cows are great up cyclers of bi-products

- Cover crops
- Whole corn plant
- Cotton Seed
- Soybean Meal
- Coffee creamer

Different regions have different bi-products

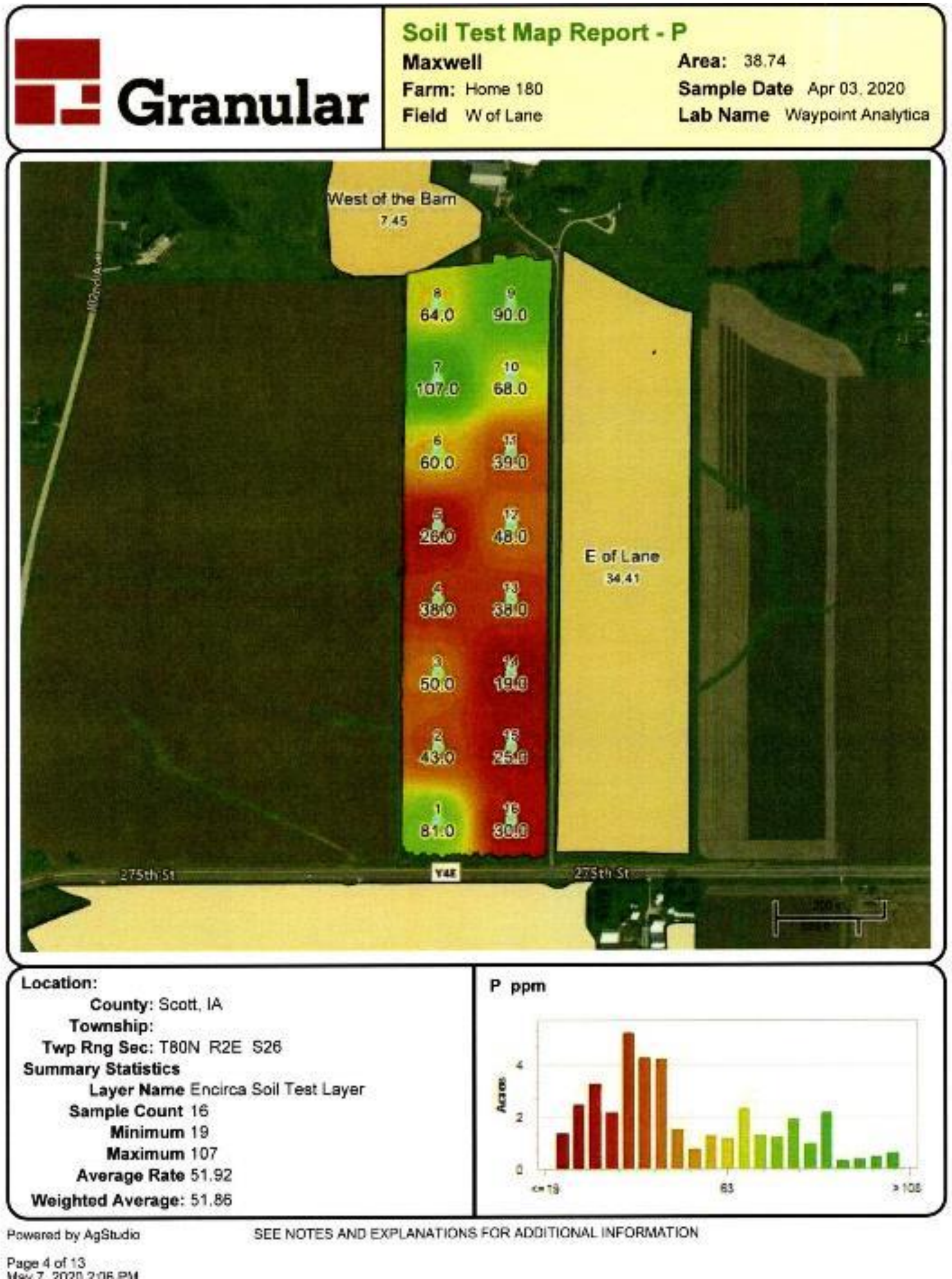
What the cows produce

- Milk
- Make into cheese

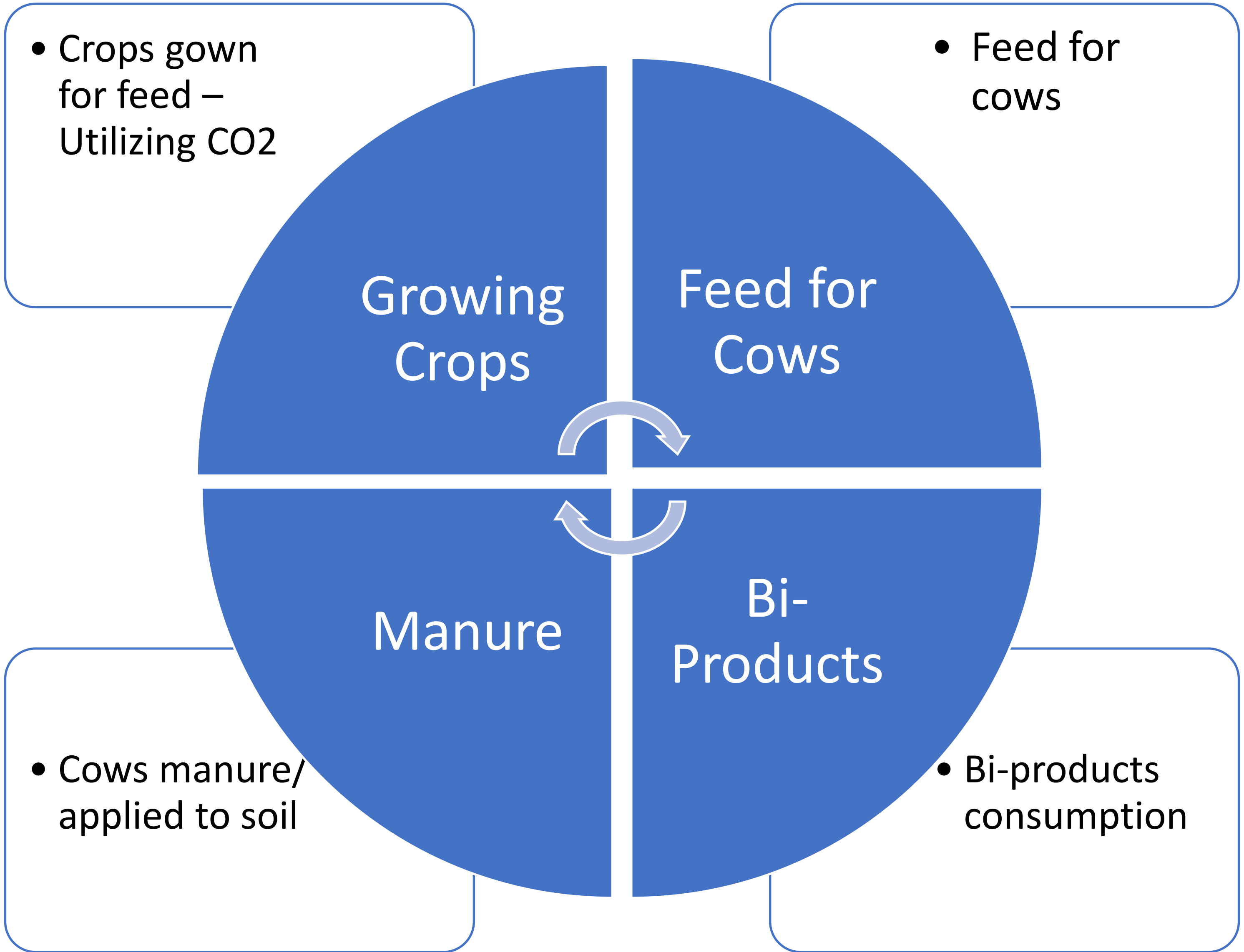
Manure is the best fertilizer

Manure – con't

- More organic matter
- Readily available
- Micro nutrients
- Bacteria



The Sustainability of Dairy



Q&A

THANK YOU!