ADDRESSING CLIMATE CHANGE WITH AGRICULTURE IN YOUR OPEN SPACE

GUY STEUCEK FARMER/ DRACUT LAND TRUST

JOYCE MEADER THE LIVESTOCK INSTITUTE OF SOUTHERN NEW ENGLAND / RETIRED UCONN EXTENSION EDUCATOR U.S. Greenhouse Gas Emissions in 2017 Fluorinated Nitrous Oxide 6% Gases 3% Methane 10% Carbon Dioxide 82%

ENVIRONMENTAL

PROTECTION

AGENCY



UNITED STATES AGRICULTURE =

9% OF TOTAL U.S. GHG:

4.5% FERTILIZERS/ IRRIGATION (N2O)

3% BELCHING (METHANE)

1.5% MANURE STORAGE (N20/ METHANE)

EPA 2017

Total U.S. Greenhouse Gas Emissions by Economic Sector in 2017



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A10 Author, 3/7/2020



Follow the IPCC

The Intergovernmental Panel on Climate Change (IPCC) is active socially – choose your network:



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A6 Author, 3/4/2020

EPA 2015

Global Greenhouse Gas Emissions by Economic Sector





Fires

Forestry (CO₂)



AGRICULTURE EMISSIONS

- Crop Residues and Savannah Burning (N₂O,CH₂)
- Cultivated Organic Soils (N₂O)
- Crop Residues (N,O)
- Manure Applied to Soils (N₂O)
- Manure on Pasture (N₂O)
- Synthetic Fertilizers (N₂O)

- Manure Management (CH, and N,O)
- Rice Cultivation (CH4)
- Enteric Fermentation (CH,)
- Drained Peat and Peat Fires (CO₂, N₂O, CH₄)
- Land Use Change and Forestry (CO₂)

Global Agriculture Emissions 2009

AR5 Climate Change 2014: Mitigation of Climate Change



THE

CARBON

CYCLE



HEALTHY SOILS TO COOL THE PLANET / A Philanthropic Action Guide

<u>SOIL</u> ORGANIC MATTER

"SOM"



A well structured soil

OPTIMIZING PLANT COVER/ ROOT HEALTH

SOIL TEXTURE (SILT/SAND/CLAY%)

(SOIL SURVEY)

SOIL ORGANIC MATTER

(SOIL O.M. TESTS)

NUTRIENTS/ LIME APPLIED

IMPROVED CROP VARIETIES

HARVESTING DECISIONS

(SOIL TESTS)

(COMMERCIAL TRIALS)

(ANNUALS, PERENNIAL S)

ROLE OF ORGANIC MATTER IN SOILS

- WATER / NUTRIENT HOLDING CAPACITY
- SOIL STRUCTURE (AIR/ WATER/ ROOT GROWTH
- FEEDS MICROBES
- SLOW NUTRIENT RELEASE
- INCREASED PLANT YIELDS

SOIL ORGANIC MATTER

50% BREAKS DOWN OVER

100 - 1000 YEARS

Unless.....

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A4 Author, 3/1/2020

TILLAGE BARE LAND EROSION

Exposes organic matter

Speeds up decomposition

CO2 EMISSION



NO TILL SEEDING

- COULTERS OPEN SLIT
- SEED TUBE DEPOSITS SEED
- PACKER WHEELS CLOSE SLIT
- SEED 1/4" DEEP



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A2 Author, 2/22/2020

ORGANIC MATTER SATURATION POINT

- MAXIMUM OF 15% IN ROOT ZONE (3-5% NORMAL)
- MAX REACHED UP TO 25 YEARS AFTER
 - TILLAGE STOPS
 - ROOT GROWTH STARTS

PERENNIALS grasses, legumes, fruits:

- Less planting activity, less soil disturbance
- Quality variable (weather, maturity, insects)
- Infrequent reseeding, unless poor management





ANNUALS CORN, SOYBEANS, VEGETABLES



Level, well drained, rock-free soils best
Harvesting: weather/ soil dependent
Higher yield of nutrients per acre
Cover crops for erosion/ nutrient mgt

U.S. Greenhouse Gas Emissions in 2017



Where Does N₂O Come From?

Agriculture, particularly fertilized soil and animal waste, accounts for about three quarters of U.S. nitrous oxide emissions.

U.S. NITROUS OXIDE EMISSIONS

By source, 2017



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A7 Author, 3/6/2020



Manure Manager, September, 2016, Maximizing the

N CYCLE

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NUTRIENT MANAGEMENT TO REDUCE N20

BALANCE RATIONS FOR TO MATCH NEEDS OF RUMEN BACTERIA/ LIVESTOCK

FERTILIZER TIMING / QUANTITY TO MATCH CROP N NEEDS

COVER CROPS TO REMOVE EXCESS SOIL N

MANURE / 'GREEN MANURE' (LEGUMES) SLOW RELEASE NITROGEN

MICROBES FIX N IN LEGUME NODULES

SCHOOL OF PERMACULTURE





2017 U.S. Methane Emissions, By Source



In A. Devices encoded the standard Agency (2010). Intercoding all Adv. Incontrasted Concentrations and Residue (2000) 2017.

U.S. Greenhouse Gas Emissions in 2017



METHANE

-BELCHING



METHANE

-BELCHING

-EXCRETION

-MANURE STORAGE AND APPLICATION



(<1% OF U.S. GREENHOUSE GASES) DIGESTERS (ANAEROBIC) SURFACE COVERS (ANAEROBIC) COMPOSTING (OXYGEN ADDED)

MANURE STORAGE MANAGEMENT



Although CO₂ is a GHG, aerobic processes that produce CO₂ are usually desired over anaerobic processes because CH₄ has 25 times the GHG effect.

HIGHER PRODUCTION EFFICIENCY REDUCES GHG/ UNIT

Crop nutrient yield per acre

Animal health and genetics

Nutrition of Livestock
 Improved forage quality

- Healthy supplementation

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A8 Author, 3/7/2020

Improved Forage Quality:

Grass / legumes (clovers, alfalfa)

-High <u>energy</u> forage (immature or corn silage)
-Rotationally grazed pastures (12 - 4" height)
-Baleage or haylage or dry hay





breeding mothers forage based

A12

nursing babies forage based

weaned - yearlings forage based Slide 32

A12 in Author, 3/8/2020

Finishing of ruminants:

grain or no grain supplementation? Depends on forage quality

<u>marbling of beef requires over 2 lbs gain/day</u> during finishing phase

<u>Lambs/ kids</u> need 0.25 lbs gain/day to reach desired 100 pounds yearling weight

Forage Supplementation

Market Demand, Income over Feedcosts??

 Forage tested then supplemented for desired rate of gain/ product quality

- <u>Supplements:</u> Corn, small grains, Brewers' grains, legume meal (SBM)



More Milk Produced per Cow = Less Methane and Waste



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A5	Author, 3/3/2020
A11	Author, 3/7/2020

FINISHING PHASE

GRAIN VS **GRASS**

Average Daily Gain, Ibs	4.0
Days of finishing	172
Carcass weight, lbs	900
Feed / gain	5.7
Acres per animal	0.6

MICHIGAN STATE U., 2018 STUDY

2.0

200

600

13.0

1.0

Greenhouse Gas (lbs CO2e	e/lb carcass)	ONLY
FINISHING PHASE	<u>GRAIN</u> VS	FORAGE
Fuel emissions	+ 0.1	+ 0.2
Feed emissions	+ 2	+ 2
Manure emissions	+ 2	+2.5
Belching emissions	+ 2	+ 5_
	+6.1	+9.7
Soil carbon sequestered	<u> 0 </u>	<u>-16.0</u>
Net, Ibs CO2 e/ Ibs carcase	s +6.1	- 6.3
		*C sink
*Until Soil Organic Matter rea	ches saturation poi	int

MICHIGAN STATE U., 2018

Alternative choices to reduce Greenhouse Gases	Action	Per year GHG savings CO2 e, lbs
Diet vegetables reduced Diet cheese reduced Diet white meat reduced Diet beef reduced Clothesline for drying	180 days X 0.1/ per half C. 180 days X 1.5/ per 4 oz 180 days X 1.5/ per 4 oz 180 days X 6.6 / per 4 oz	- 18 - 270 - 270 - 1200 - 1200
Improve car efficiency,+5 mpg	10,000 mi	- 1200
Upgrade to Energy Star	Bulbs, boiler, fridge, windows replaced	- 5500



Climate Change Impacts in the United States 2014

Projected Precipitation Change by Season

Higher Emissions (A2)





Future change (higher emissions)



PREDICTED <u>CHANGE</u> IN <u>EXTREME PRECIPITATION</u> <u>EVENTS</u>

2070 – 2100 COMPARED TO PAST 30 YEARS

OVER 40% MORE EXTREME EVENTS

NOAA 2017

HOW WILL FARMERS ADAPT TO CLIMATE CHANGE? Summer Droughts

1. Drought resistant species/varieties -

2. Soil moisture protected (conservation tillage, plastic)

3. Cover crops/ perennials to increase OM

Continued:

4. Water sources upgraded (irrigation, waterers)

5. Emergency feed (barn feeding to rest pastures)

6. High tunnels / barns (protection from hot sun)

HOW WILL FARMERS ADAPT TO CLIMATE CHANGE? Heavy Precipitation Events

1. Disease resistant species/ varieties

2. Select crops resistant to lodging

3. Slopes planted to perennial crops

4. Annual crops in flood prone areas

5. Drainage tiles on cropland

6. Drainage of livestock heavy use areas

7. High tunnels (for high value crops)

8. Surface protected with residue or cover crops



PLANTS THAT KEEP THE GROUND COVERED WHEN A CASH CROP IS NOT GROWING

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CAN BE INTER SEEDED INTO GROWING CROPS OR SEEDED AFTER THE HARVEST

CONTRIBUTE TO FORAGE FOR LIVESTOCK

A13 Author, 3/8/2020

THEIR LIVING ROOTS:

- A LIVING BIOLOGICAL COMMUNITY IN THE SOIL

- PROTECT THE SOIL FROM WIND / WATER EROSION

- BUILD ORGANIC MATTER TO HOLD MOISTURE

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CONSERVATION LEASES

DEVELOPING A WIN-WIN ARRANGEMENT WITH

OR

A STEWARDSHIP VALUES CHECKLIST

healthy, biologically active soil keep living roots all year diversified vegetative cover little to no soil disturbance clean water rotationally grazed livestock

LAND LEASE

2020, This lease made the day of between_____, owner, of _____ and _____, lessee, of .MA 4. Operation and Maintenance of Land: "The land shall be continuously covered with growing perennial or annual crops, ensuring adequate soil organic matter (SOM). Winter cover crops will be seeded as the cash crop is harvested, with a deadline of to protect land from erosion until spring seeding. Failure to do this will result in having to pay to have this done"

FARMERS SPEAK ABOUT CLIMATE ADAPTATION

FARMING AND CLIMATE CHANGE (9.5 MIN) VERMONT CENTER FOR SUSTAINABLE AGRICULTURE <u>HTTPS://WWW.YOUTUBE.COM/WATCH?V=JIU1MPDTIKK&LIST=PL7TYEW-AB6CNQBAETUOHTYQZV0ZVUCUTB</u>

Illinois video 2.50-6.00 and 17:36-26 minutes (12min) https://www.youtube.com/watch?v=itgoc3YtNQs

Iowa video (corn/soybeans/ cover/ grazing) (15 min): https://www.youtube.com/watch?v=VNWFafXCyAw0



MEADERJOYCE@YAHOO.COM GUY GUYSTEUCEK@COMCAST.NET

⁶0 520 56