Regenerative Agriculture and the Bay

Rob Schnabel

Maryland Restoration Scientist

Chesapeake Bay Foundation

Regenerative agriculture is farming in synchrony with nature to repair, rebuild, restore and revitalize ecosystem function, starting with all life in the soil and expanding to all life above the soil.

Understanding Ag LLC – Gabe Brown and Allen Williams

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Definition of Regenerative Agriculture

The 5 Soil health Principles *** Protect & Feed Soil Microbes ***

1) Armor the Soil / Cover at all times - Prevent erosion, keep moisture, maintain soil temperature

2) Plant Diversity - Different plants have different rooting depths, soil biology habitat, critical for nutrient cycling

3) Growing root as much as possible - Maintain photosynthesis, liquid carbon to soil biology, symbiotic relationship

4) Minimize Disturbance – Tilling of soil, herbicides, impact soil biology and soil structure

5) Add Livestock / Rotational Grazing – Good disturbance, manure a probiotic, cattle tromp half vegetation to groun
feed microbes carbon in a carbon starved environment

These principles are a continuum based on the type of agriculture.
Ex. Corn production at the most can do 3 of these

George Washington Carver - Agriculture Scientist & Researcher

Natural Systems to Restore Soil & Produce Food

- Legume Research – Peanuts restoring Cotton fields
- Organic amendments – swamp vegetation added to fields
- Crop rotation – enriched soils and reduced pests

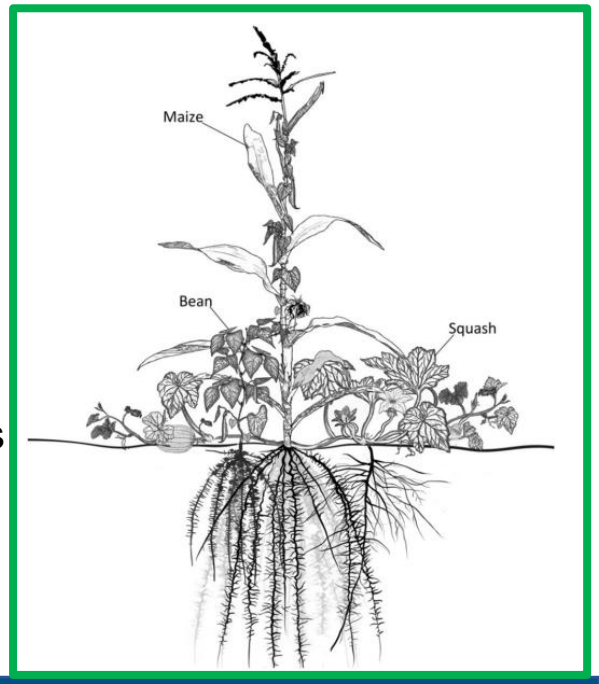
Indigenous Science

Iroquois and Cherokee – "The 3 Sisters"

Maize / Corn – provided the support

Beans – provided the nitrogen, microbes in roots

Squash – provided cover, suppress weeds, protect soil, soil moisture from sun



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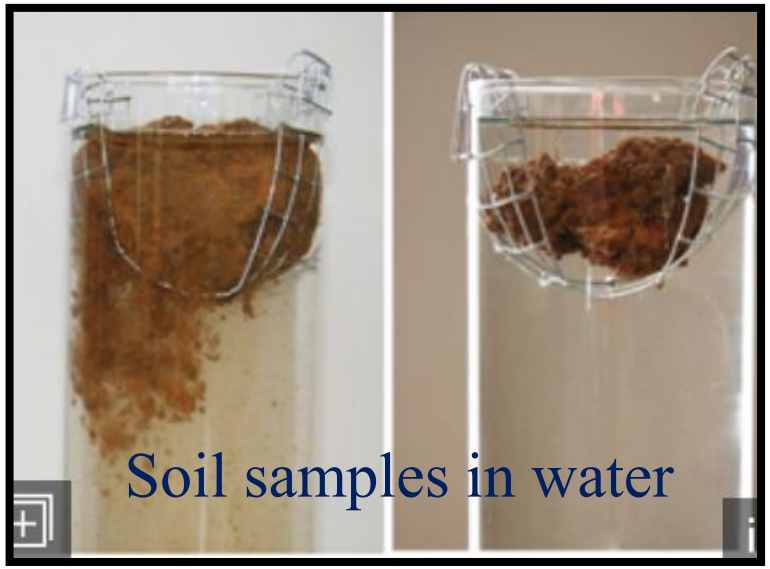
BIPOC Contributions Key

(BIPOC – Black, Indigenous, People of Color)

The 5 Soil health Principles

1) Minimize Disturbance – Tilling of soil, applying chemical fertilizers, herbicides, impact soil biology and soil structure

Unhealthy vs Healthy Soil



Slake test
Microbial glues the key

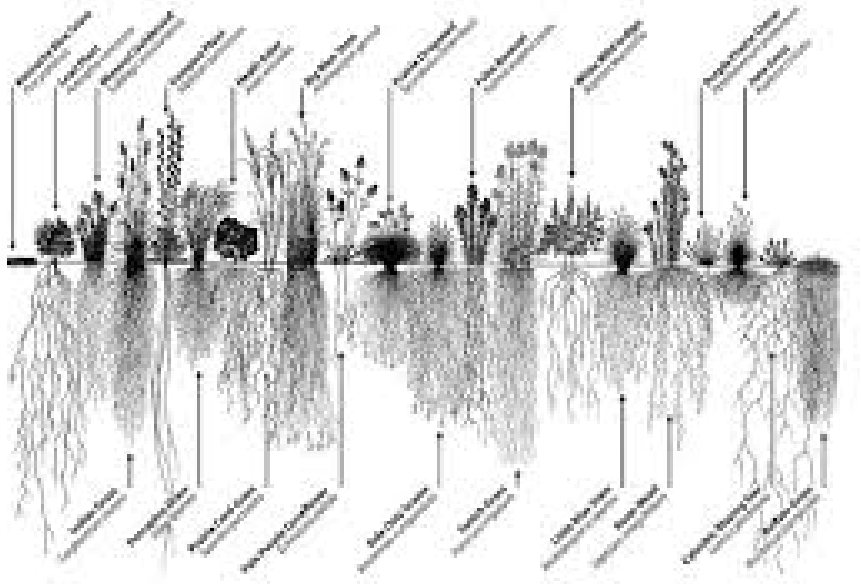
Soil Biology provides microbial glues to hold soil together.

Example – small marbles allowing for water infiltration and space for roots to grow.

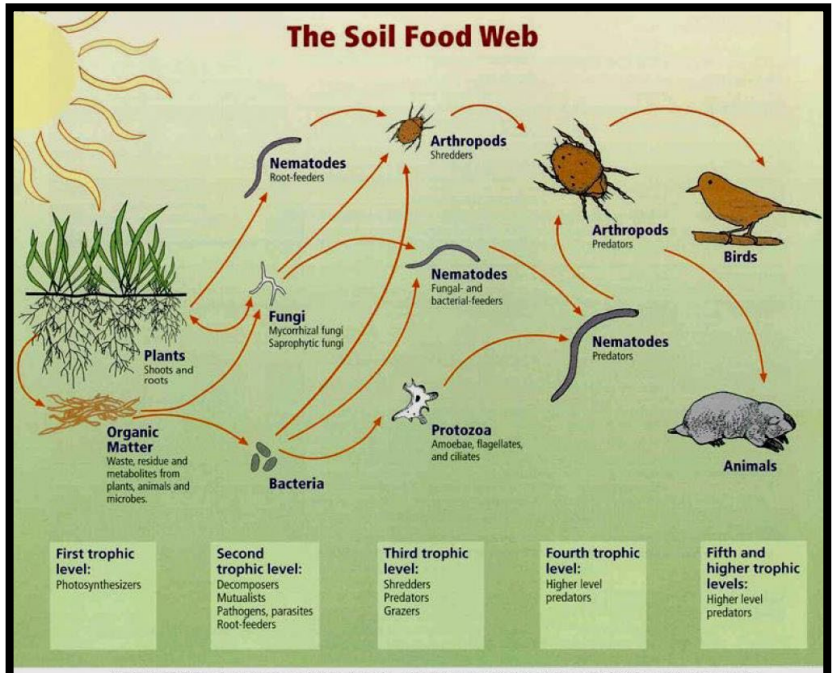
There is more life in one teaspoon of healthy soil then there are people on Earth.

The 5 Soil health Principles

3) Plant Diversity - Different plants have different rooting depths, greater soil biology habitat, this diverse soil biology results in nutrient cycling, providing the nutrient needs for the crop



Grasses, forbs, legumes, broadleafs, etc.



Relationships between soil food web, plants, organic matter, and birds and mammals
Image courtesy of USDA Natural Resources Conservation Service
http://soils.usda.gov/sqi/soil_quality/soil_biology/soil_food_web.html.

Without Diversity create a downward spiral- Costly Inputs

a) Less diversity limits nutrient cycling, resulting in fertilizer needs.

b) Chemical fertilizer kills soil biology and weeds are nitrogen hogs

c) The more weeds the need for herbicide if use chemical fertilizer

Plant & Animal Diversity – More above ground the more below ground

MARYLAND GRAZERS NETWORK

Started in 2008

Over 80 farms

1. Farmer Mentors
2. Pasture / Forage Specialists
3. Agriculture Economist
4. Marketing Specialist
5. Grazing Infrastructure Cost Share

Mountains to Bay Grazing Alliance

– Started in 2016

Partner on Research, Education and Implementation

Mountains-to-Bay Grazing Alliance Partnership

University of Maryland Extension – Solutions in your community

NRCS Natural Resources Conservation Service

Capital RC&D – Supporting Pennsylvania's Heartland

Maryland Grazers Network

VFGC

Maryland-Delaware Forage Council

red barn

Chesapeake Bay Foundation – Saving a National Treasure

Future Harvest – Chesapeake Alliance for Sustainable Agriculture

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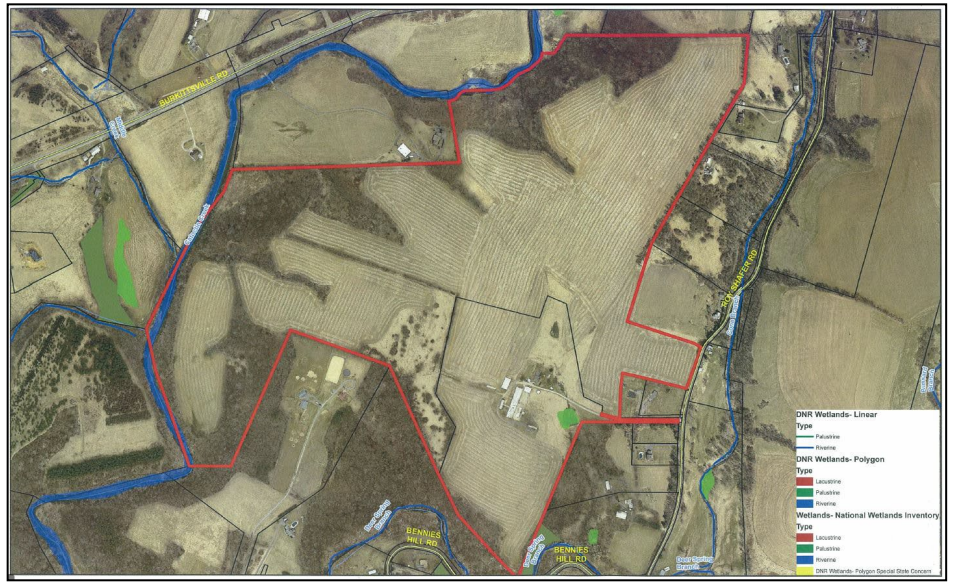
Partnership - Whole Farm Conservation

Regenerative Farm Example - Open Book Farm - Diversified Grazing and Vegetables

190-acre farm – Was all Monoculture Corn converted to Pasture - Direct Market Pastured Hogs, Chicken, Turkeys, Beef cattle and Veggies



Network provided Grazing mentor, funding to offset infrastructure costs

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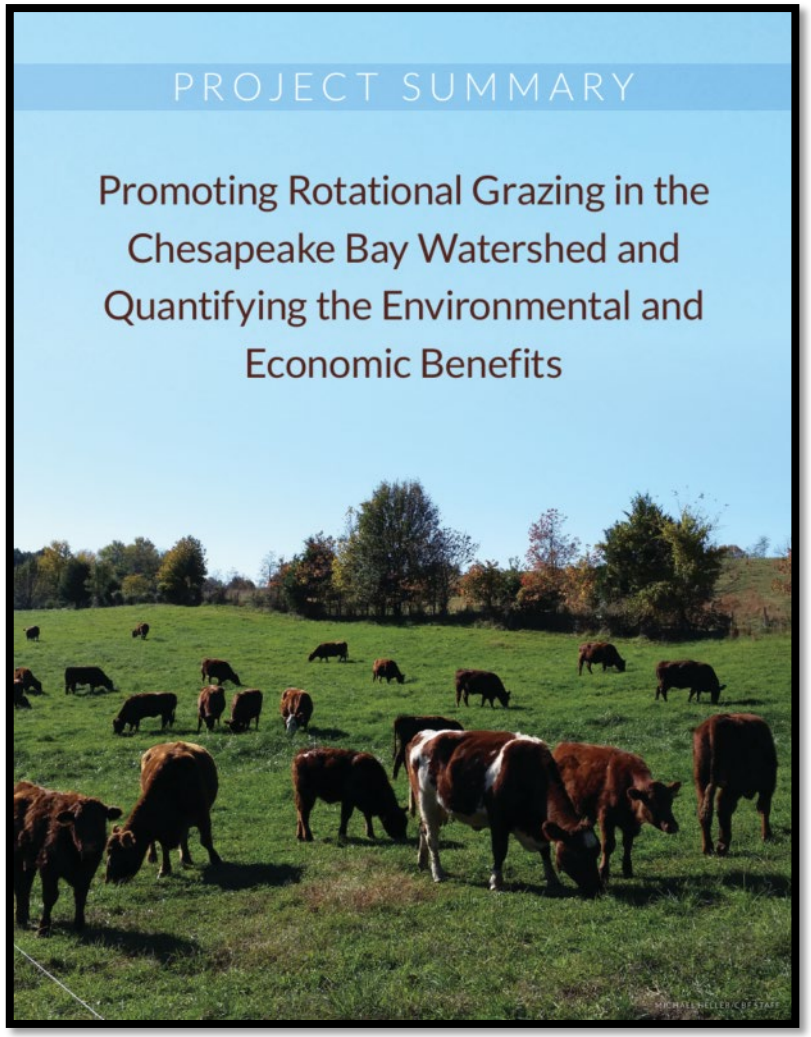
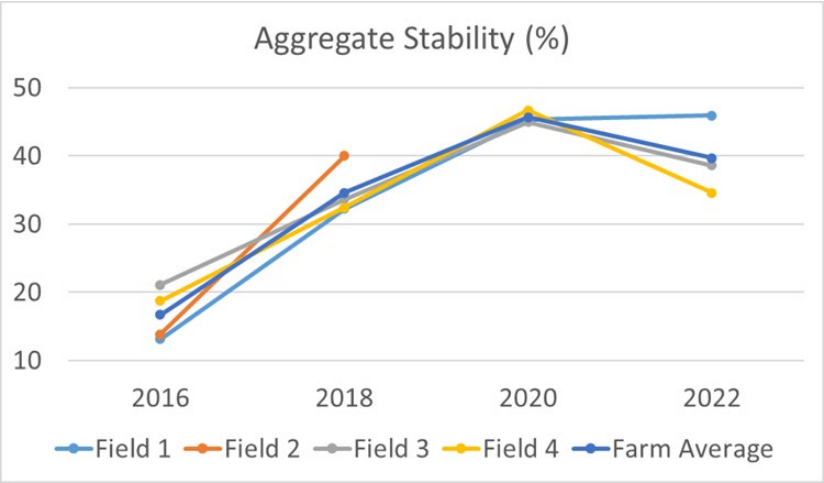
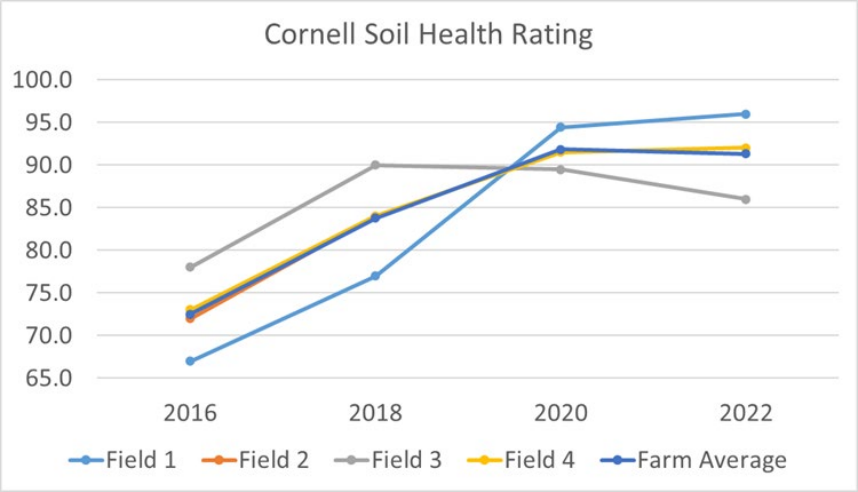
Whole Farm conversion to Regenerative

NRCS – Conservation Innovation Grant
7 Farms 2015 - 2019







Open Book Farm - Example
Cornfields to Regenerative Grazing

Variable – Aggregate Stability

Key for water infiltration

Farm is an overall Carbon "Sink",
Sequesters more GHG than it emits.

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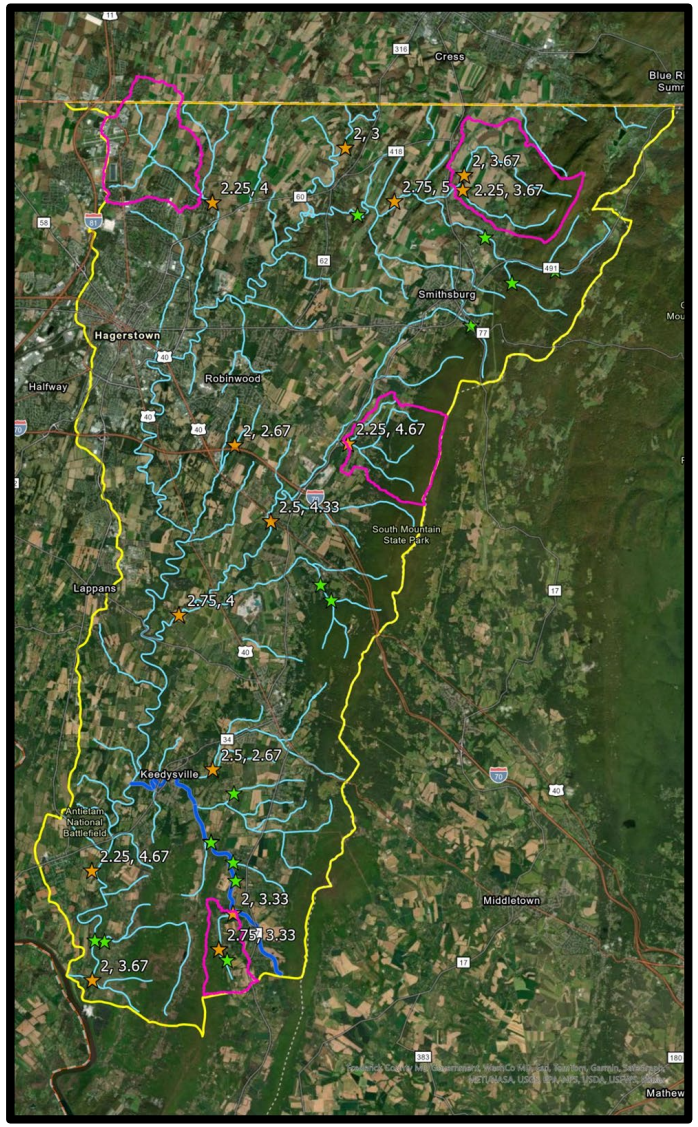
Regenerative Agriculture - Research



Antietam Whole Watershed Initiative
Goal to Delist Stream Segments from Dirty Waters List

- Map of Maryland portion of Antietam Creek, focus tributaries in pink
- Antietam **303D** "impairments" consist of nutrients, sediment, biology
- **Partnership** – Federal, State, Local agencies as well as numerous nonprofits
- **Regenerative Agriculture education & funding**
- One of two Agriculture watersheds selected
- Year 1 of 5-year Initiative - $2 million per year

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Maryland Whole Watershed Act
Antietam Creek Watershed Partnership

NRCS – Conservation Outreach – Racial Equity and Justice - 3 yr grant

Led Maryland & DC monthly meetings from 2022 – 2025
Field days with NRCS, Extension, PG SCD and Baltimore

Spring 2021 – 2 new Extension Urban Ag agents - Wrote legislation and passed bi

Land Access – DNR State lands 13,000 acres of farmland – to farm regeneratively

MDA – New Cover Crop Program - Small and Urban Farms – Lump sum payment

CBF Clagett Farm – Attendees for Cover Crop & Irrigation workshop

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Regenerative Agriculture – Education
Urban Ag and Equity

Maryland Soil Health Work Group

Sept 2019

Stakeholders

- MDA
- Farm Bureau
- NRCS
- Future Harvest
- Farmers

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CBF Clagett Farm Tours – Regenerative Ag Model

DNR Park Service and US Fish and Wildlife

2021

Maryland DNR State Lands

13,000 acres leased farmland

Park Service Education

Soil Health

Water quality and quantity

Biodiversity

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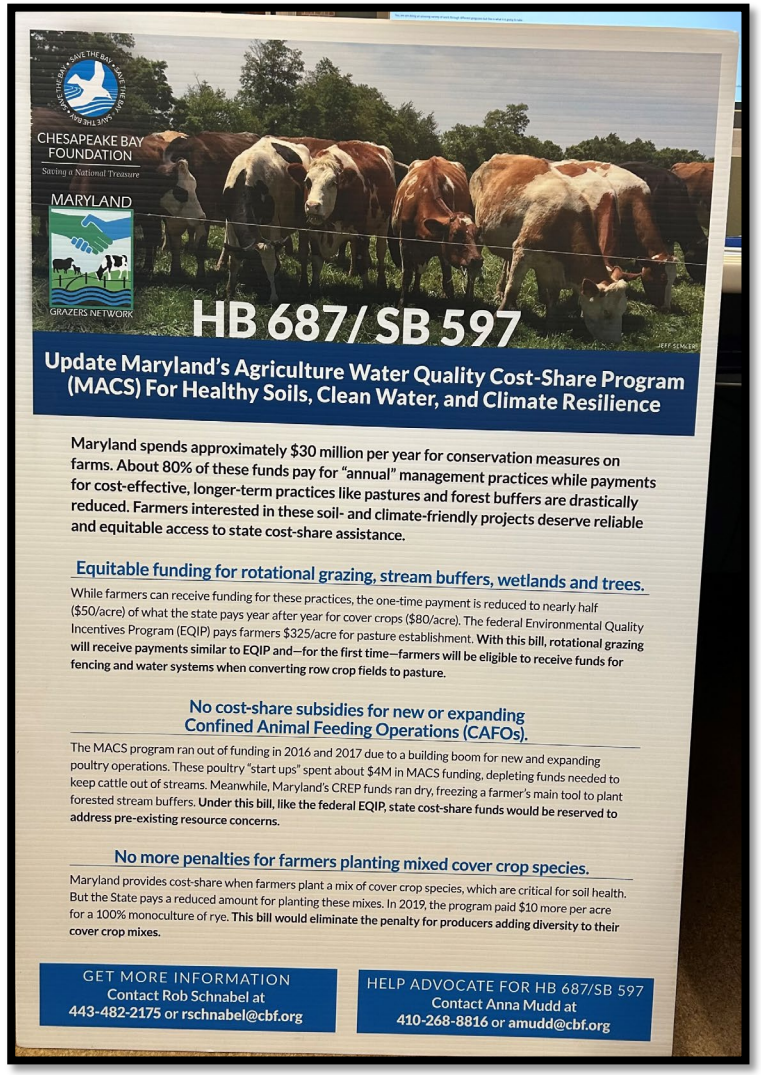
CBF Clagett Farm Tours – Regenerative Ag Model



Policy Poster

CBF with Farmers, Landowners and Extension at State Legislature in 2021.

10 NEW practices added to the State cost share program for farms in 2022.

- Grazing "systems"- fencing, water, pasture establishment
- Trees for silvopasture, hedgerows, wind breaks, field borders
- multi-species cover crops – end penalty for diversity
- Restricted funding for "start-up" CAFO's

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Regenerative Agriculture Advocacy & Policy

Beyond Sustainable Regenerative Agriculture Farm Tours

Rob Schnabel

Maryland Restoration Scientist

Chesapeake Bay Foundation

Beyond Sustainability – Regenerative Farm Tours
Economic and Ecosystem Benefits
(Water, Climate & Biodiversity)

Goal – To Educate Decision Makers, Farmers, and Consumers about Regenerative Agriculture

- Influence conservation funding
- Share Economically Successful Farms as over 50% farms are not profitable
- Influence Agriculture Preservation Programs

Partners / Presenters- Each have resources for farmers

MOBILIZE FREDERICK
EQUITABLE SUSTAINABLE SOLUTIONS

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SAVE THE BAY

OFFICE of AGRICULTURE
FREDERICK COUNTY

UNIVERSITY OF MARYLAND EXTENSION

MARYLAND FOREST SERVICE

FUTURE HARVEST
Chesapeake Alliance for Sustainable Agriculture

American Farmland Trust
SAVING THE LAND THAT SUSTAINS US

USDA United States Department of Agriculture
Natural Resources Conservation Service

On-Farm Education

Permanent diverse cover the best water infiltration and retention, less runoff.
More resilient given climate change - too much or too little rain.

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Regenerative Agriculture – Water Station

Rain Simulator – plants and soil biology

ECONOMICS OF HOLTERHOLM FARMS, LLC

	A	B	C	D	E	F	G	H	I	J	K	L	M
		Average 2021-2023											
1		Holter	32 New York	Holterholm Farm Income, Expenses, and Profit by Year 2014-2023									
2	Year	Farm	Conv. Farms	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
3	Average number of cows (1)	160	253	120	120	120	120	135	133	143	145	154	181
4	CWT milk sold per cow	35	250	47	47	44	38	33	37	39	37	37	32
5	Income in dollars per cow												
6	Milk sales	1,503	5,915	1,737	2,138	1,912	1,534	1,293	1,482	1,687	1,563	1,585	1,362
7	Cattle sales	415	359	459	491	625	168	359	518	395	499	292	453
8	Other income	68	405	52	67	27	36	48	43	138	19	99	85
9	Total income	1,986	6,679	2,248	2,696	2,564	1,737	1,699	2,043	2,220	2,081	1,976	1,901
10	Expenses in dollars per cow												
11	Feed purchased	155	1,979	252	562	526	214	38	336	176	89	73	303
12	Deprec. machine hire, repairs, fuel	341	1,261	269	209	183	150	240	345	423	390	374	258
13	Rent, interest, property tax	92	396	115	108	101	98	88	66	83	91	92	92
14	Seed, fertilizer, chemicals	0	411	2	4	0	3	0	16	0	0	0	0
15	Non-family labor	0	713	2	6	0	0	0	0	15	0	0	0
16	Vet, breedng, medicine	53	228	14	4	9	9	37	25	53	73	47	39
17	All other expenses	228	1,048	462	405	340	256	223	245	281	242	206	235
18	Total Expenses	868	6,036	1,115	1,297	1,160	730	626	1,033	1,030	884	791	928
19	Profit in dollars per cow (2)	1,118	643	1,133	1,398	1,405	1,007	1,074	1,011	1,189	1,197	1,185	973
20	Price of milk per CWT	42.50	23.63	36.75	45.49	43.00	40.10	39.23	40.54	42.90	42.44	42.58	42.49
21	Total income per CWT	56.29	26.68	47.56	57.36	57.68	45.43	51.56	55.91	56.46	56.52	53.08	59.27
22	Feed purchased per CWT	4.61	7.85	5.32	11.96	11.83	5.61	1.14	9.19	4.47	2.42	1.95	9.46
23	Total expense per CWT	24.73	24.11	23.59	27.60	26.08	19.09	18.99	28.26	26.21	24.01	21.26	28.93
24	Profit per CWT (2)	31.56	2.57	23.97	29.75	31.60	26.34	32.58	27.65	30.25	32.50	31.82	30.34
25	Total acres	375	614	284	284	284	284	284	284	310	350	375	400
26	Acres per cow	2.4	2.5	2.4	2.4	2.4	2.4	2.1	2.1	2.2	2.4	2.4	2.2
27	CWT of milk per acre	15	103	20	20	19	16	16	17	18	15	15	15
28	Profit per acre (2)	474	266	479	591	594	426	510	473	549	496	487	440

(1) Average number of cows includes nurse cows on Holter farm.

(2) Profit is the return to operators labor, management, & investment

Dale Johnson, Economist
Univ. of MD
Extension

REGENERATIVE MORE PROFITABLE

Dairy Farming

Rotational Grazing vs Confinement

Average over 2021 - 2023

Profit $ per cow $1,118 vs $643

Profit $ per acre $474 vs $266

Regenerative Grazing – Economics

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Million Acre Challenge
Partnerships
&
Resources

Goal to get half of Maryland's farmland to Regenerative Status

American Farmland Trust –
Amanda Cather

Future Harvest - Lisa Garfield

Chesapeake Bay Foundation

Regenerative Agriculture - Partnerships

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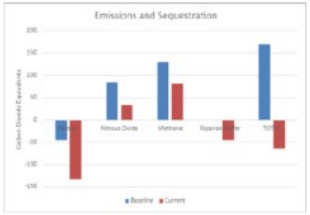
Greenhouse Gases

A farm-scale tool was used to estimate changes in greenhouse gas emissions at Open Book Farm. Overall, emissions from the farm decreased roughly 106 percent, transitioning the farm from a carbon emission source to a carbon sink.

CARBON DIOXIDE (CO_2) is the most abundant greenhouse gas, but the least potent in terms of its ability to trap heat in the atmosphere. CO_2 enters the atmosphere primarily through the burning of fossil fuels. It is removed from the atmosphere (or sequestered) when it is absorbed by plants and soils.	Converting from cropland to rotational grazing increases soil organic matter. Organic matter is directly related to soil organic carbon, so higher values indicate higher amounts of soil carbon sequestration. There is national and global interest in building healthy soils because of the huge capacity of soils to sequester carbon. Fossil fuel use can also be lower in grazing systems due to reduced use of farm equipment for planting and harvesting.
NITROUS OXIDE (N_2O) is 265 times[1] as potent as CO_2. N_2O is predominately produced in the soil by microbial processes and is heavily influenced by nitrogen fertilizer and manure application. The storage and handling of livestock manure is another source of on-farm emissions.	Converting fields from grain crops to pasture usually means less use of nitrogen fertilizer. As a result, on-farm emissions of N_2O can decrease substantially.
METHANE (CH_4) is 28 times as potent as CO_2 in terms of its ability to trap heat. Emissions of methane from livestock are a by-product of the fermentation process cows use to extract nutrition from the food they eat. Methane is also emitted from manure management systems. Manure releases methane when it decomposes in anerobic, oxygen free, systems found in manure storage lagoons.	Enteric emissions of methane typically increase when cows are converted to a grass-based diet. Fortunately, these increases are often offset by increases in carbon sequestration and decreases in N_2O emissions. On pasture-based farms, cows defecate on grass and decompose aerobically, with oxygen, therefore their manure releases significantly less methane.



In addition to cattle, Open Book Farm also has 2,000 broiler chickens and 200 laying hens.

CBF Fact Sheet – Greenhouse Gasses

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Regenerative Agriculture - Climate Station

Open Book Farm – Net "Sink", Sequesters more than Emits

Regenerative Agriculture

NRCS Staff are critical Partner!!

Hans Kefauver's leadership has been Paramount !!

Perhaps create a position ?

NRCS Maryland
Regenerative Agriculture Manager

Agriculture – Definition & System of Practices Station

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Roller Crimping and Planting Green

Field Day at Ernst Grain & Livestock

NRCS Led event
Need more of these on farm Events

- Roller crimping red clover and rye
- At least 40 lbs of N – reduced fertilizer needs
- One pass instead of two –
  reduced fossil fuel and time

Right: Penn State “Slug Hunter” – Cover crops & Slugs
Non-GMO seeds not treated with Neonics, Beetles eat slugs.
More biodiversity, predators eat pests

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Regenerative Agriculture – Monocultures /

Row Crops Practice - Planting Green – Roller crimping while planting corn

September 2024

Drone Seeding Cover Crop

Enables the planting of cover crop prior to row crop, soybeans harvest

Soil Health Principles

1. Maintain Cover / Amour Soil
2. Limits Disturbance physical & chemical
3. Diversity of cover
4. Maintain Growing Root

Soybeans typically harvested late Fall, often too late to seed diversity, given various seed germination temperatures. Late harvest makes it difficult to establish cover before winter.

Benefits -Economic and Other

Power of Diversity

Tillage Radish – breaks up compaction, for root growth, water infiltration, remedy past physical disturbance

Red Clover – legume “fixing” nitrogen, ~40 lbs. of nitrogen, save $ and reduce disturbance, impact of applying chemical fertilizer

Time & Money

No Fossil fuel, battery operated, less GHG’s

10 times faster versus tractor, tractor depreciation in value

No compaction of soils –no physical disturbance

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Early Overseed of Diverse Cover Crop

Volunteer Tree Plantings

Every Spring and Fall

Next volunteer planting March 19th in Clear Spring

Royer Farm – Frederick County
Friends Creek – Monocacy River – Potomac River

Silvopasture Plantings more Common

Shade for cattle given hotter summers

- Key for reproductive success

Speeds up Soil Health Regeneration

- Trees add fungi - exponential regeneration

New Practice in Bay Model

100 Acre project – Harford County – April 18th

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Silvopasture for Livestock

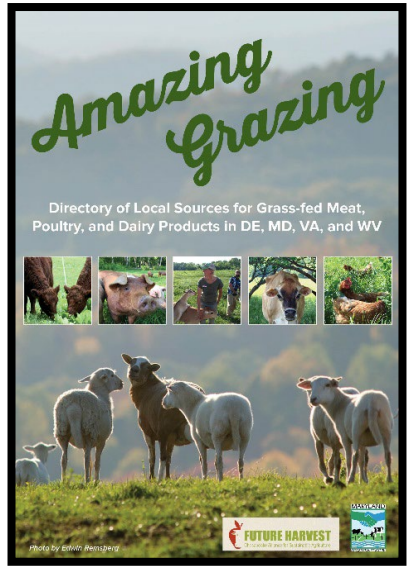
Implementation, Bay model, Farmer Education and Cost Share Rates

Food System makes up 1/3 Greenhouse Gas Emissions

Educate Consumers

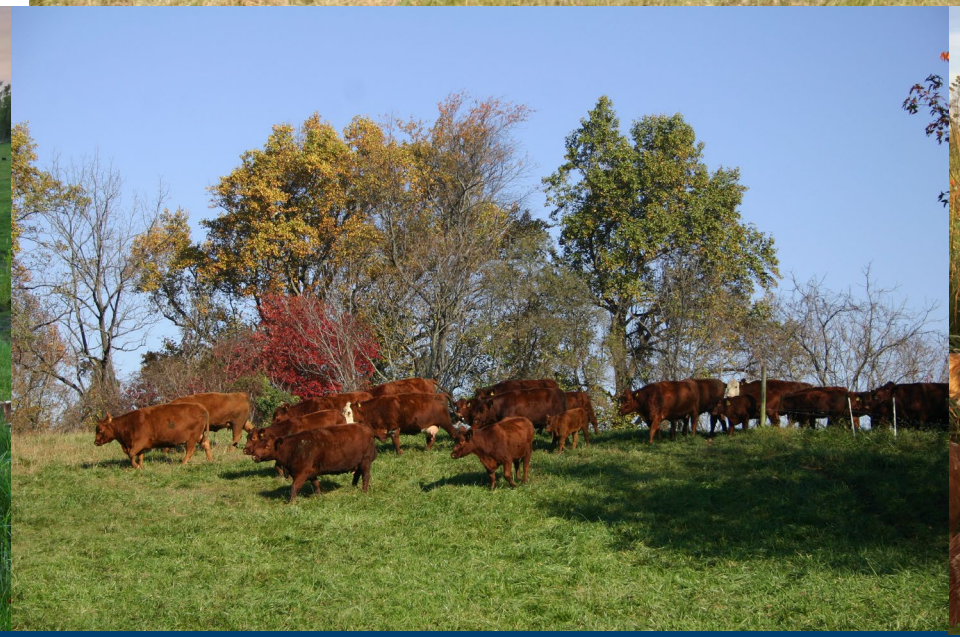
- Eater's Guide to Sustainably Produced Food
- Consumers Guide Calendar
- Amazing Grazing Directory – List of Farms

- Food Dollar and Local Economy



Thank you!

Questions?



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Regenerative Agriculture

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