PROJECT SUMMARY

Promoting Rotational Grazing in the Chesapeake Bay Watershed and Quantifying the Environmental and Economic Benefits

MICHAEL HELLER/CBF STAFF

Project overview

Between 2015 and 2019, the Chesapeake Bay Foundation worked with several partners to promote the adoption of rotational grazing in the Chesapeake Bay watershed portions of Maryland, Virginia, and Pennsylvania and quantified some of the environmental (water quality, greenhouse gas, and soil health) and economic benefits. This project was funded through a Natural Resources Conservation Service (NRCS) Conservation Innovation Grant (CIG).

Partners

CHESAPEAKE BAY FOUNDATION
Saving a National Treasure

UNIVERSITY OF MARYLAND EXTENSION
Solutions in your community

MARYLAND GRAZERS NETWORK

Capital RC&D
Supporting Pennsylvania's Heartland!

red barn CONSULTING

VFGC

WORLD RESOURCES INSTITUTE

FUTURE HARVEST
Chesapeake Alliance for Sustainable Agriculture

Why adopt rotational grazing?

MICHAEL HELLER/CBF STAFF

There are many reasons why farmers convert to grazing. Graziers can save money on labor, feed costs, and vet bills. Often, they get higher prices for their products. Many producers also say it improves their quality of life. There are even more ways that the rest of us benefit from this decision. Planting grass instead of corn for feed or moving from continuous grazing to rotational grazing can substantially reduce farm nutrient and sediment runoff. Because of these water quality benefits, Chesapeake Bay jurisdictions have committed to implement rotational grazing on over 1.2 million acres within the Bay watershed. Since 2009, the jurisdictions are only 19 percent of the way toward accomplishing that goal by 2025.

This transition also helps reduce greenhouse gases by sequestering carbon in soil through increases in soil organic matter. In addition, fertilizer use is often reduced or eliminated, leading to lower emissions of nitrous oxide, a very potent greenhouse gas. Rotational grazing improves soil health and fertility. It makes farms more resilient to weather extremes, like drought and heavy rainfall, because healthy soils have higher water holding capacity. Yet despite these benefits, adoption of this practice is relatively low among producers.

Greenhouse gases and agriculture

Gases that trap heat in the atmosphere are called greenhouse gases. We list the most common ones and some agricultural sources and sinks.

"CO_2 equivalents" is a standard unit for measuring carbon footprints. It allows us to account for the different potencies of greenhouse gases and express them in common units. For example, 1 ton of methane would be 28 tonnes of CO_2 equivalents, since methane is 28 times as potent as carbon dioxide.

CARBON DIOXIDE (CO_2) is the most abundant greenhouse gas, but the least potent in terms of its ability to trap heat. 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 to rotational grazing increases soil organic matter and functioning. 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 as potent as carbon dioxide. 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.[1] "Enteric" 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.	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.

1 ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values %28Feb 16 2016%29_1.pdf

JEFF VANUGA/NRCS

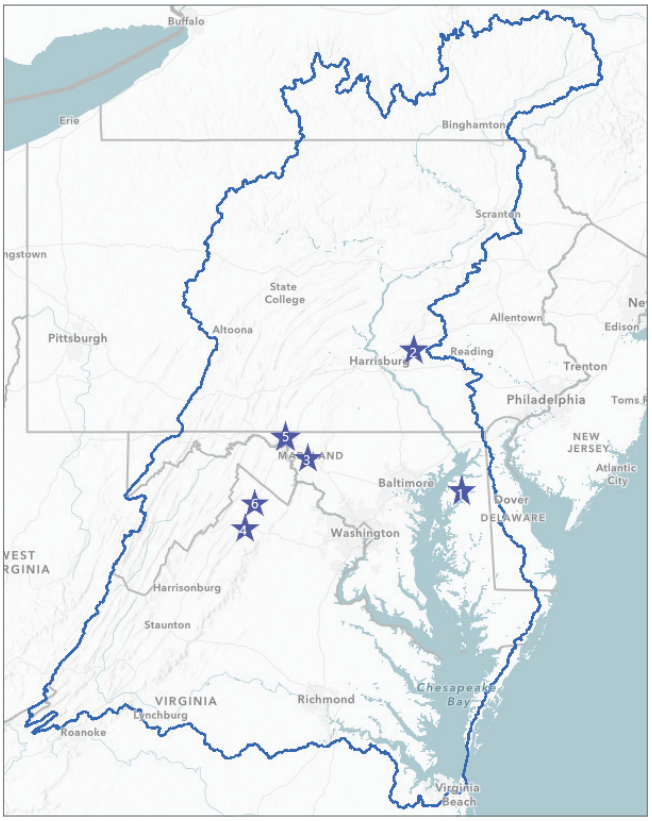
Impact

Building the case

One objective of our project was to estimate the environmental benefits of converting to rotational grazing on actual farms in the Chesapeake Bay region. To that end, we used farm scale models, *COMET-Farm* for greenhouse gas emissions and the *Chesapeake Bay Nutrient Trading Tool* (CBNTT) for nutrient and sediment loads, to quantify benefits for six "case study" farms (see map).

Both models are available online (cometfarm.nrel.colostate.edu and cbntt.org) and are free to use, but users need to establish an account and password to protect the confidentiality of the data.

For each farm, Chesapeake Bay Foundation (CBF) staff worked with the producers to obtain the necessary information to run two scenarios: the "baseline scenario" that reflected on-farm conditions and practices before the conversion to rotational grazing, and the "current scenario" that reflects conditions after the conversion. We also collected "before and after" samples to assess changes in soil health and worked with an agricultural economist to conduct a financial analysis on two farms—both dairies. Results of the financial analysis are available upon request.



Case Study Farm Results Highlights

GREENHOUSE GASES

- Five of six farms showed decreases in whole farm emissions of greenhouse gases when transitioning to rotational grazing due to a combination of increased carbon sequestration in the soil and lower emissions of nitrous oxide from reductions in fertilizer/manure use. The average reduction across all farms was 42 percent.
- We expressed greenhouse gas emissions per hundred weight (cwt) of milk for two dairy farms in our pilot since graziers typically experience a reduction in annual milk production. Results indicate that even accounting for this reduction there was a 50 percent and 43 percent reduction in greenhouse gas emissions when expressed on a cwt production basis.

NUTRIENT AND SEDIMENT LOADS

- Modeling results indicate substantial reductions in annual loads of nitrogen, phosphorus, and sediment from all six farms. Average reductions were 63 percent, 67 percent, and 47 percent for nitrogen, phosphorus, and sediment, respectively.

SOIL HEALTH

- Three of four farms where we collected "before and after" soil samples experienced statistically significant increases in key soil health indicators—aggregate stability and organic matter—after converting to rotational grazing. We cannot rule out, however, the influence of climatic conditions on these results.

For more details, read our Rotational Grazing Pilot Farm Study Report (m2balliance.org/benefits.html#case-study). The report includes farm details and results, a comparison of the results of COMET-FARM with another greenhouse gas tool, A-Microscale, and recommendations and conclusions.

BOB NICHOLS/NRCS

Leveraging resources for implementation

Collectively, we converted more than 1300 acres to rotational grazing over the life of the project.

One innovative funding source was the use of the CBF-managed Carbon Reduction Fund (CRF) to pay costs for grazing infrastructure not covered by federal or state programs. The CRF was established via a CBF partnership with WGL Energy and Sterling Planet. CBF receives donations related to the sale of voluntary carbon offsets to WGL Energy natural gas customers and uses them to fund projects that benefit water quality and reduce greenhouse gases (wges.com/cmp/cleanstepsoffsets/partners.php).

CBF also leveraged this grant to secure a three-year, $1 million 2017 Regional Conservation Partnership Program award focused on providing

financial and technical assistance to graziers in Maryland. These dollars were expended within two years.

Building awareness

Project partners decided to create an umbrella name for the multi-state grazing partnership—the Mountains-to-Bay Grazing Alliance (M2B). M2B partners hosted a variety of outreach events in Maryland, Virginia, and Pennsylvania. These included intensive two-day Grazing Schools that reached more than 100 producers and over a dozen pasture walks and field days attended by more than 300 producers. We also hosted two successful regional grazing conferences that featured a farmer panel and nationally and internationally known experts on soil health and grazing. The conferences averaged over 100 attendees.

MOUNTAINS-TO-BAY GRAZING ALLIANCE

Direct distribution of our quarterly electronic Mountains-to-Bay Grazing Alliance newsletter has increased to over 250 and is forwarded to members of our partner organizations. Want to be on our emailing list? Please email our newsletter editor at eronston@cbf.org. Access all newsletter issues at m2balliance.org/resources.html#newsletters.

Tools for producers

An annual planning calendar for graziers in Pennsylvania, Virginia, and Maryland is another key way to disseminate important grazing information and keep the network engaged and informed.

Direct marketing to consumers

As part of this project, the *Amazing Grazing Directory* was updated to include grass-based producers in Virginia, West Virginia, Delaware, and Maryland. This directory is a tool for graziers to market their "value-added" products—such as grass-fed beef, lamb, and pastured poultry—directly to consumers, making these farming systems more profitable and making it easier for consumers to locate and support local sustainable farms. The online version is regularly updated (futureharvestcasa.org/resources/amazing-grazing-directory-0).

Assessing obstacles to adoption

CBF held three workshops (one each in Maryland, Virginia, and Pennsylvania) to run ADOPT (Adoption and Diffusion Outcome Prediction Tool). ADOPT is a tool developed by social scientists in Australia to provide insights about the importance of various factors influencing the adoption of a particular practice—in our case, rotational grazing.[1] Workshop participants were local experts, e.g. staff from local soil conservation districts, extension, and/or NRCS that work with producers on grazing.

Application of ADOPT provided the forum for an informed and engaged discussion about potential barriers to adoption of rotational grazing. More importantly, the workshops led to tangible recommendations that, if implemented, could lead to greater adoption. These include:

- Continue to provide opportunities for farmer-to-farmer sharing and technical assistance via field days and pasture walks.

1 Kuehne, G, Llewellyn, R, Pannell, DJ , Wilkinson, R, Dolling, P, Ouzmana, J, Ewing, M. 2017. Predicting farmer uptake of new agricultural practices: A tool for research, extension and policy. *Agricultural Systems* 156: 115-125.

- Organize local grazing groups or roundtables that provide informal opportunities for new and established graziers to connect.
- Allow flexibility to "try out" the practice before committing to full-farm adoption.
- Continue and expand efforts to connect producers with markets and generate consumer demand for grass-fed products.
- Leverage the finding that many farmers have a desire to invest in the future of their farm by developing outreach materials that highlight the long-term benefits of grazing to soil health, increased resiliency to climatic extremes, and long-term farm productivity.

For more details on these workshops, visit m2balliance.org/resources.html.

TIM MCCABE/NRCS

What's next?

Building on the partnerships and lessons learned from this grant, CBF recently received a three-year, $750,000 grant from the National Fish and Wildlife Foundation (NFWF) entitled: *Mountains-to-Bay Grazing Alliance: A Collaborative to Increase Rotational Grazing.*

The grant objectives are:

- To build on and strengthen the structure and information-sharing of the Mountains-to-Bay (M2B) partnership and to create a strong core of collaborating partners.
- To expand and enhance outreach efforts focused on promoting rotational grazing and soil health. A key component of outreach efforts will continue to be on-farm demonstrations, field days, and peer-to-peer dialogue, including lessons learned from the ADOPT workshops.
- To work with roughly 30 producers to convert 1,700 acres to rotational grazing, as well as implement related practices such as livestock stream exclusion and forested buffers, by leveraging private, state, and federal funds.

For more information go to m2balliance.org.

In addition, one of our grant partners, Future Harvest–Chesapeake Alliance for Sustainable Agriculture, recently received a U.S. Department of Agriculture (USDA) grant from the Farmers Market and Local Food Promotion Program, entitled *Amazing Grazing: Stepping up supply and demand for grass-fed meat, dairy, and other local, pasture-based products in the Chesapeake region.* This grant also builds upon the partnerships formed during this project and is complementary to the NFWF grant.

The project has three objectives:

- To increase the number of graziers trained in direct-to-consumer marketing.
- To increase the number of consumers informed about how and where to buy local grass-fed products and why it's important.
- To increase pasture-based product sales for area graziers.

Acknowledgments

The project partners are excited about building upon the CIG via these new initiatives and are very grateful for the support of the USDA Natural Resources Conservation Service under agreement number 69-3A75-16-038.

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the U.S. Department of Agriculture.