Co-Benefits and Adaptability of Agricultural BMPs in the Chesapeake Bay Watershed

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Objectives of the presentation

- Review range of agricultural BMPs approved and credited by the Chesapeake Bay Partnership
- Identify ag BMPs that have climate change mitigation or adaptation benefits or liabilities, in addition to water quality benefits
- Discuss flexibility of ag BMPs to address changes associated with climate change
- Provide brief overview of the USDA's Climate Hubs

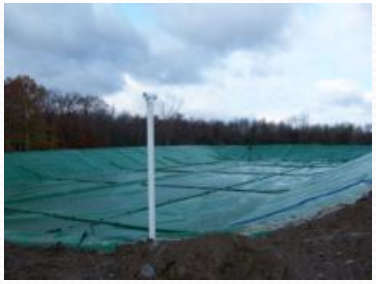
Ag BMPs in general

- Largest category of BMP receiving credit from the Bay Program
- Multiple classes:
  - Structural
  - Vegetative buffers
  - Land use changes
  - Annual management (largest group)
  - Management plans

Structural BMPs

BMP	Climate Co-benefit[1]	Climate liability
Animal Waste Management Systems	Potential reduction of some GHG emissions	Potential increase in some GHG emissions
Barnyard Runoff Control	Save water for irrigation?	None apparent
Biofilters	None apparent	Increase in N_2O emission?
Irrigation Water Capture Reuse	Drought response	None apparent
Lagoon Covers	Methane capture/burn off	None apparent
Mortality Composters	Reduce GHG emissions?	Increase GHG emissions?
Water Control Structures	Drought response	Increase in N_2O emission?

[1] In addition to water quality benefit, practice has potential for climate change mitigation or has climate change adaptation benefits



Vegetative Buffers

BMP	Climate Co-benefit	Climate liability
Forest Buffers (4 practices)	C sequestration	Increased N_2O when denitrification is promoted to remove nitrates?
Grass Buffers (4 practices)	C sequestration	Increased N_2O when denitrification is promoted to remove nitrates?
Tree Planting	C sequestration	None apparent

Annual BMPs- cropping

BMP	Climate Co-benefit	Climate liability
Alternative Crops	Selection of crop with greater climate resilience	None apparent, if new crops are less intensively managed
Cover Crops (103 practices)	C seq., nitrate immobilization can potentially reduce N_2O production	None apparent
Cropland Irrigation Management	Drought response	None apparent
Manure Incorporation/Injection (5 practices)	Increasing N use efficiency can reduce N_2O emission	N_2O increased with injection
Nutrient Management (8 practices)	Increasing N use efficiency can reduce N_2O emission	None apparent
Tillage Management (3 practices)	C sequestration and improved soil health	Potential N_2O increase with no-till

Annual BMPs- livestock

BMP	Climate Co-benefit	Climate liability
Dairy Precision Feeding	Reduced enteric methane, lower manure N content can reduce N_2O	None apparent
Horse Pasture Management	C sequestration	None apparent
Loafing Lot Management	None apparent	None apparent
Off Stream Watering	None	None apparent
Precision Intensive Grazing	C sequestration	None apparent

Annual BMPs- Manure Management

BMP	Climate Co-benefit	Climate liability
Manure Composting (8 practices)	Potential reduction of some GHG emissions	Potential increase in some GHG emissions
Manure Transport	Wider usage of manure has soil health benefit	Fuel usage increases C footprint
Manure Treatment (12 practices)	Potential reduction of some GHG emissions	Potential increase in some GHG emissions
Poultry Litter Amendments	Potential reduction of some GHG emissions	Potential increase in some GHG emissions

Annual BMPs- Planning

BMP	Climate Co-benefit	Climate liability
Nutrient Management (8 practices)[1]	Facilitates adaptive management of nutrient inputs, reducing potential for GHG emission	None apparent
Soil Conservation and Water Quality Plans	Improved soil health increase resilience to climate change impacts	None apparent

[1] Intentionally repeated, because nutrient management employee both management of annual practice and long-term, whole farm planning.

Link Between Soil Health and Adaptation to Climate Change

- Healthy soil is rich in organic matter and biological activity
- Organic matter is the primary manageable property of soil
- Practices that reduce tillage, increase plant residue, and/or apply manures or other organic amendments (at appropriate rates) promote soil health
- Healthy soils have better structure (improving aeration, drainage, root growth and other properties) and have greater water holding capacity, improving the ability of the system to withstand extreme weather

Ag BMPs and adaptation

- Structural BMPs and vegetative buffers not easily modified over time, but add climate resiliency to the landscape
  - Design BMPs and select buffer plant species with changing climate in mind
- Annual practices have most flexibility
  - Nutrient management and cover crop BMPs incorporate adaptive management principles
  - Modifying practices to address changing climate probably less critical than expanding use of current annual practice to help with adaptation to changing climate and extreme weather
- Long-term, whole farm conservation needed
  - Employing more of the right conservation practices in the right place
  - Selecting more resilient cropping systems
  - Increasing efficiency in livestock and manure management
  - Examine nutrient balances to improve efficiency

Nutrient Management and Adaptation

- Nutrient management is important for adapting to changing climate and greater variability in the weather
- BMP provides credit for basic core practices and additional credit for further adaptive management
  - Optimizing application rates, timing, and placement
  - Utilize advanced technology and more intensive management to better coordinate nutrient application with plant utilization
- Goal is to utilize higher rate of nutrients where plants will utilize the nutrients and reduce applications in areas where crop growth is limited by other factors

Cover Crops and Adaptation

- Cover protect again damage from weather events when primary crop is not growing
- Current Bay Program Cover Crop BMP provides flexibility in cover crop management
  - Broad range of plant species considered
  - New options for planting method and timing
  - Allows cover only crops vs commodity winter crops
  - Addresses nutrient application to cover crops

USDA Climate Hubs

Mission: Develop and deliver science-based information to agricultural and natural resource managers that enable climate-informed decision-making.

<u>What do the Hubs do</u>:

- Technical support: Synthesize findings and guidance from multiple USDA agencies and partners to help farmers and foresters adapt to climate variability

•Assessments and Forecasts: Periodic updates on risk and vulnerabilities of production sectors and rural economies

•Outreach and Education: Provide newsletters, fact sheets, video series, and webinars

NE Hub

- Director: David Hollinger, US Forest Service Northern Research Station, Durham, NH
- Web page: https://www.climatehubs.oce.usda.gov/northeast