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Biofuels and the Bay: An Analysis of Crop Production Trends and their Potential Water Quality Impacts within the Chesapeake Bay Watershed

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The Chesapeake Bay Program Partnership

- Established in 1983 under the first Chesapeake Bay Agreement
- Subsequent Agreements Signed
- Goals Established to Improve Water Quality and Aquatic Habitat by Reducing Pollutant Loading and Protecting Natural Resources

Chesapeake Bay Statistics

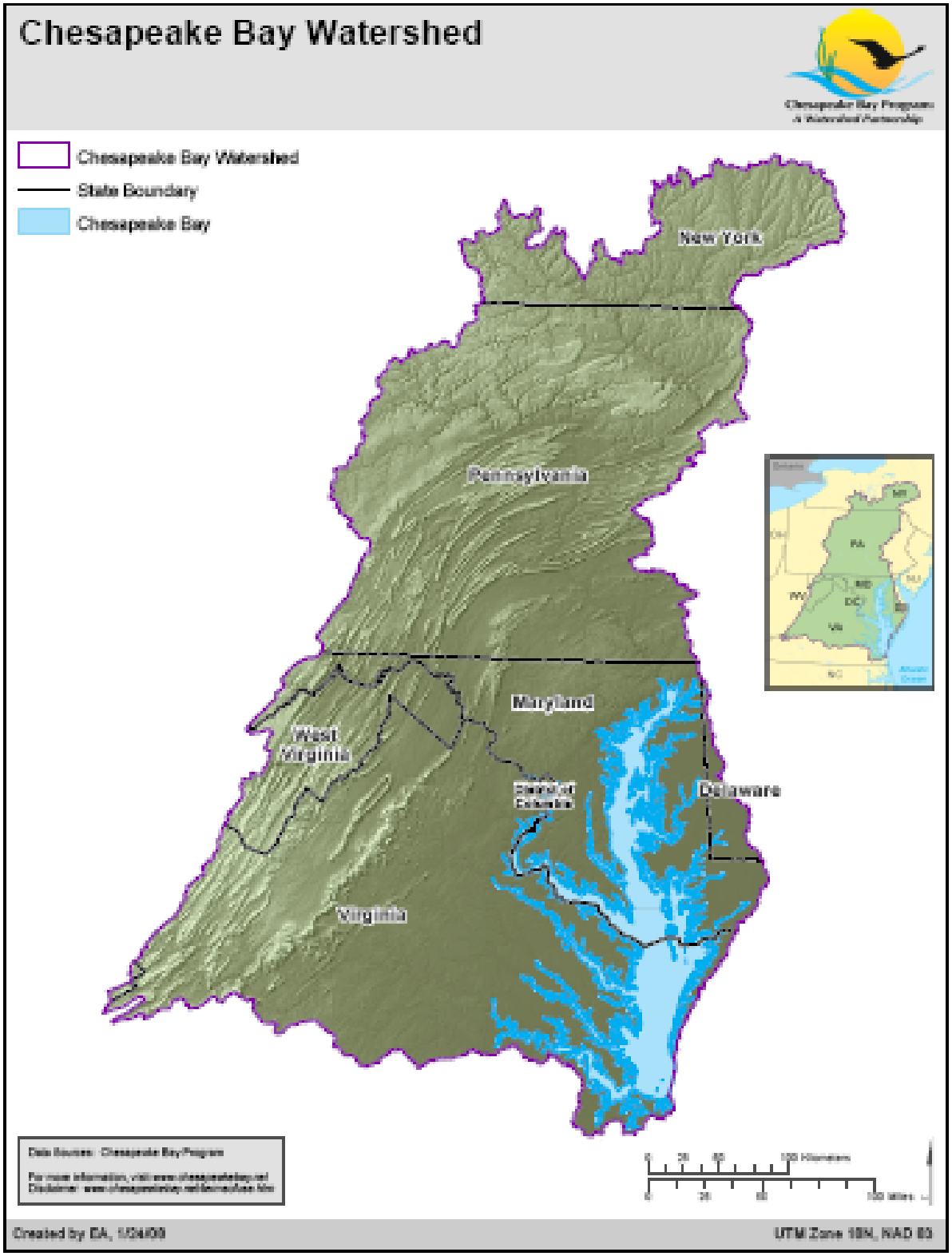
• Encompasses parts of Six States and the Entire District of Columbia

•Largest Estuary in the U.S. at over 64,000 Square Miles

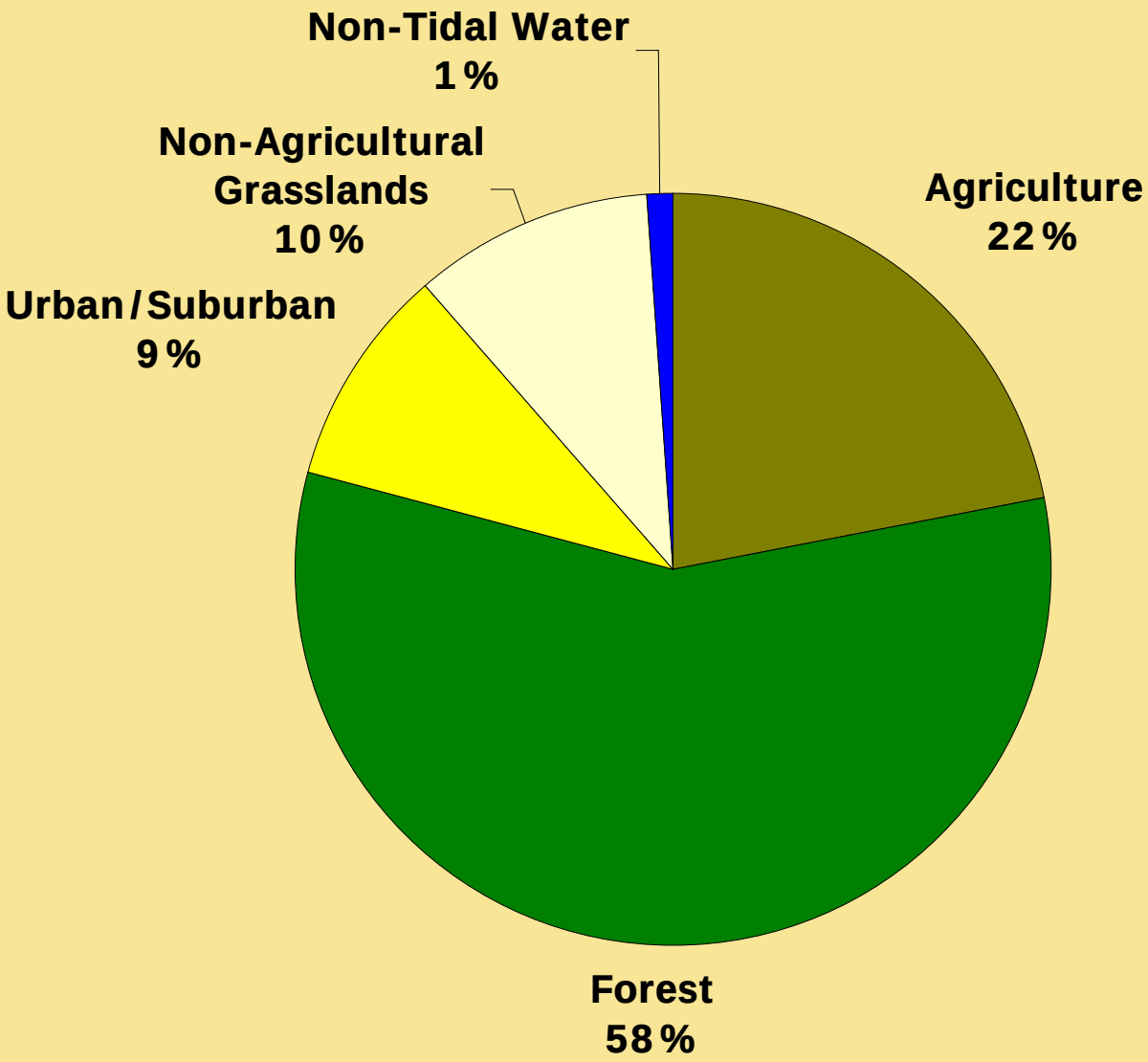
• Approximately 200 Miles in Length with 11,684 Miles of Shoreline- More than the Entire West Coast of the U.S.

• The Average Depth of the Bay is 21 Feet and the Deepest Trench is 174 Feet

• 16.6 Million People Call the Watershed Home Increasing by Approximately 170,000 Each Year

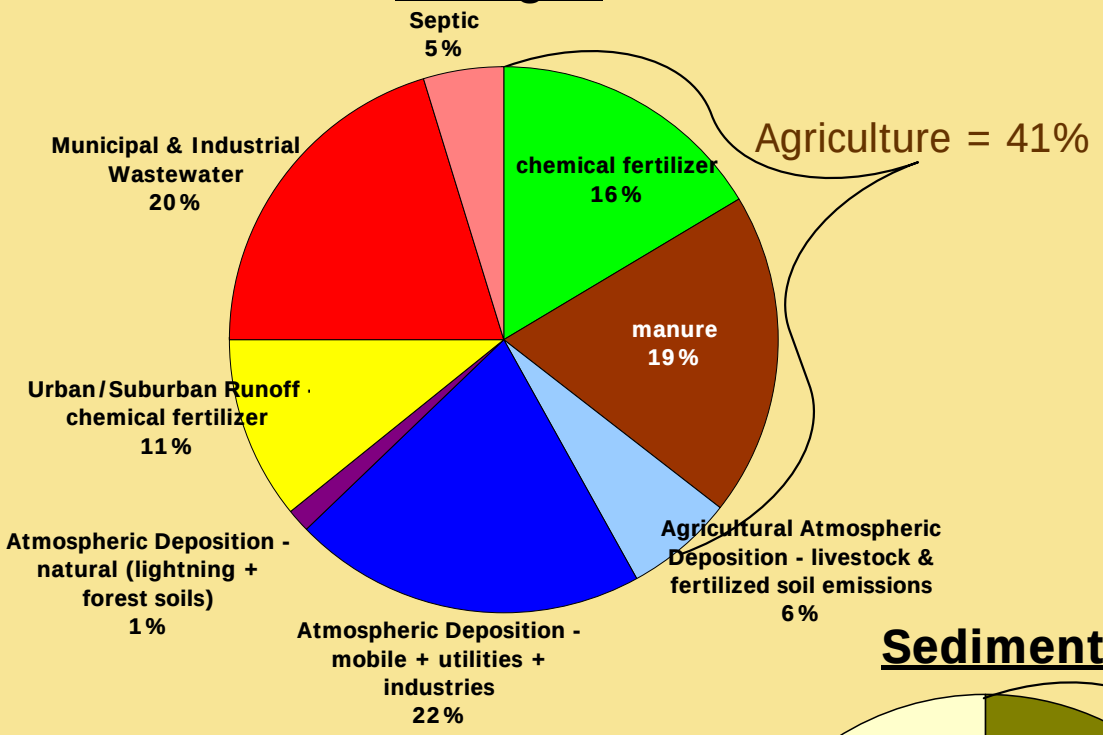


Agricultural Lands in the Watershed

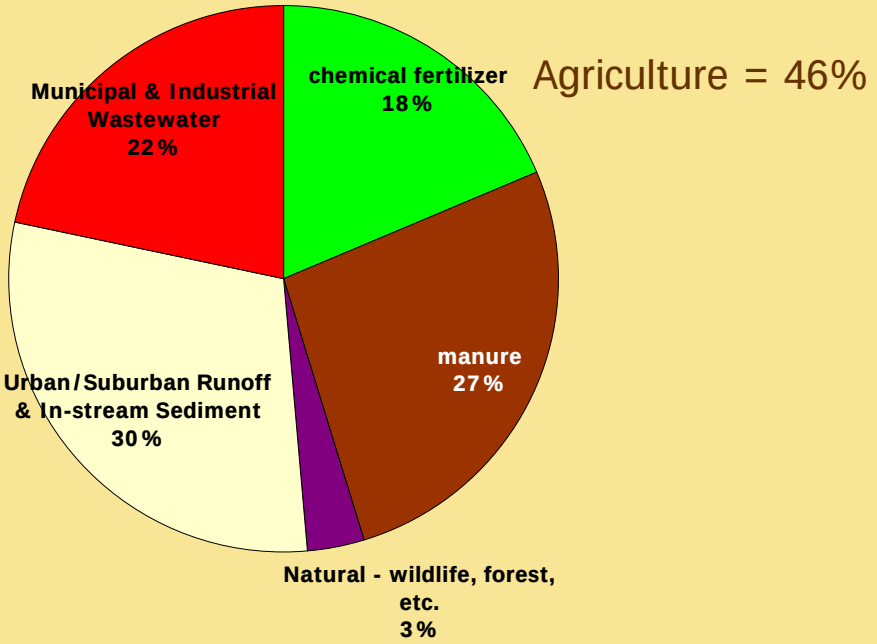


Agricultural Nutrient and Sediment Loads to the Chesapeake Bay

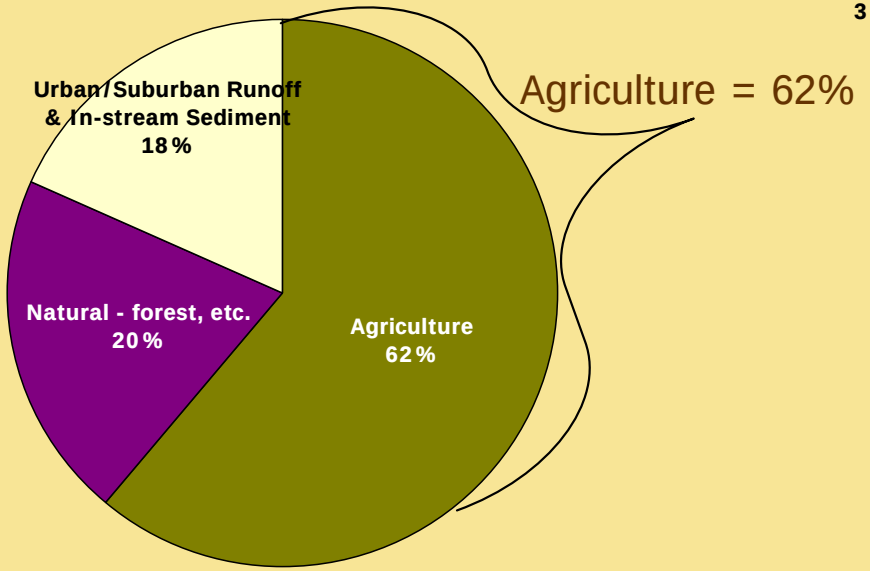
Nitrogen



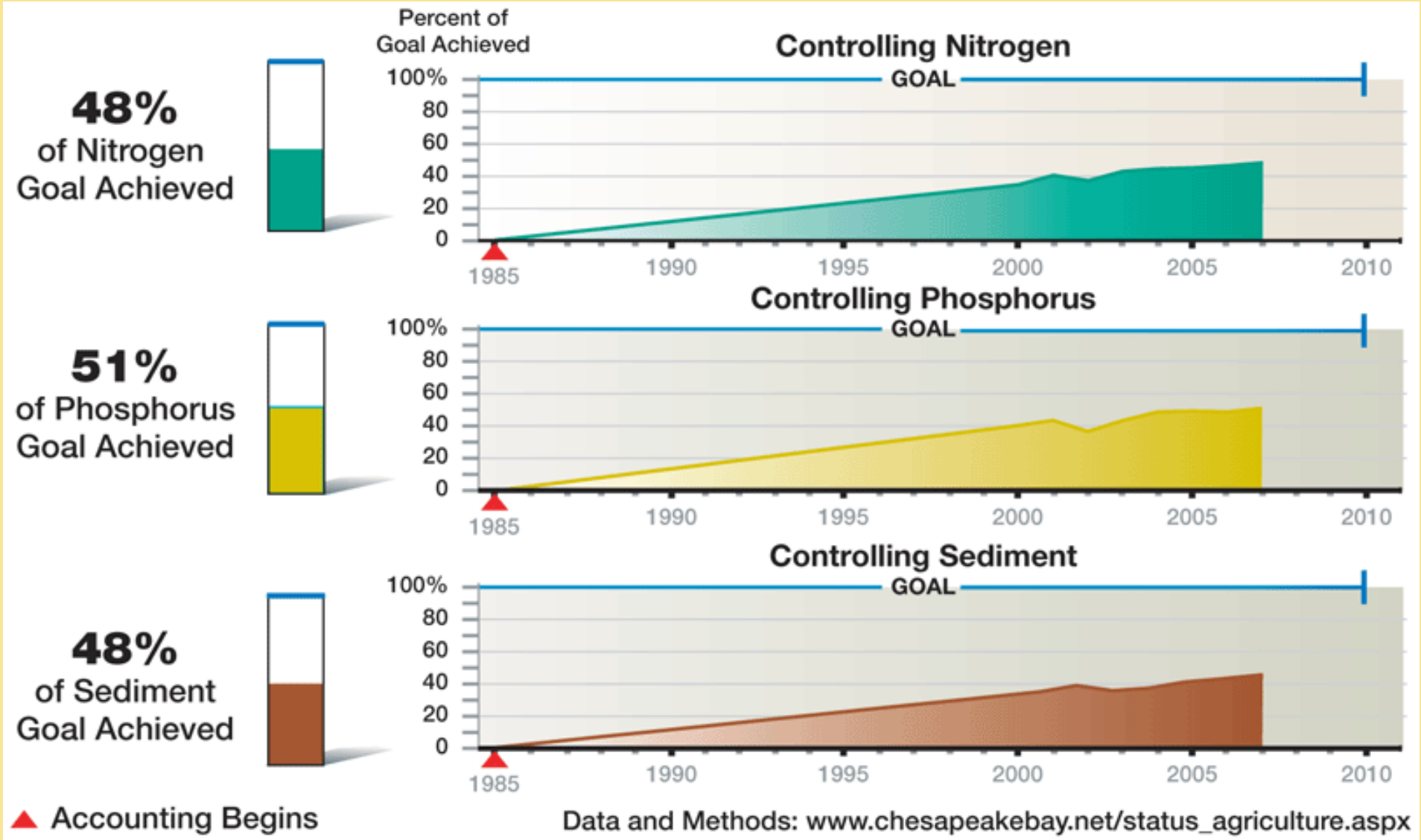
Phosphorus



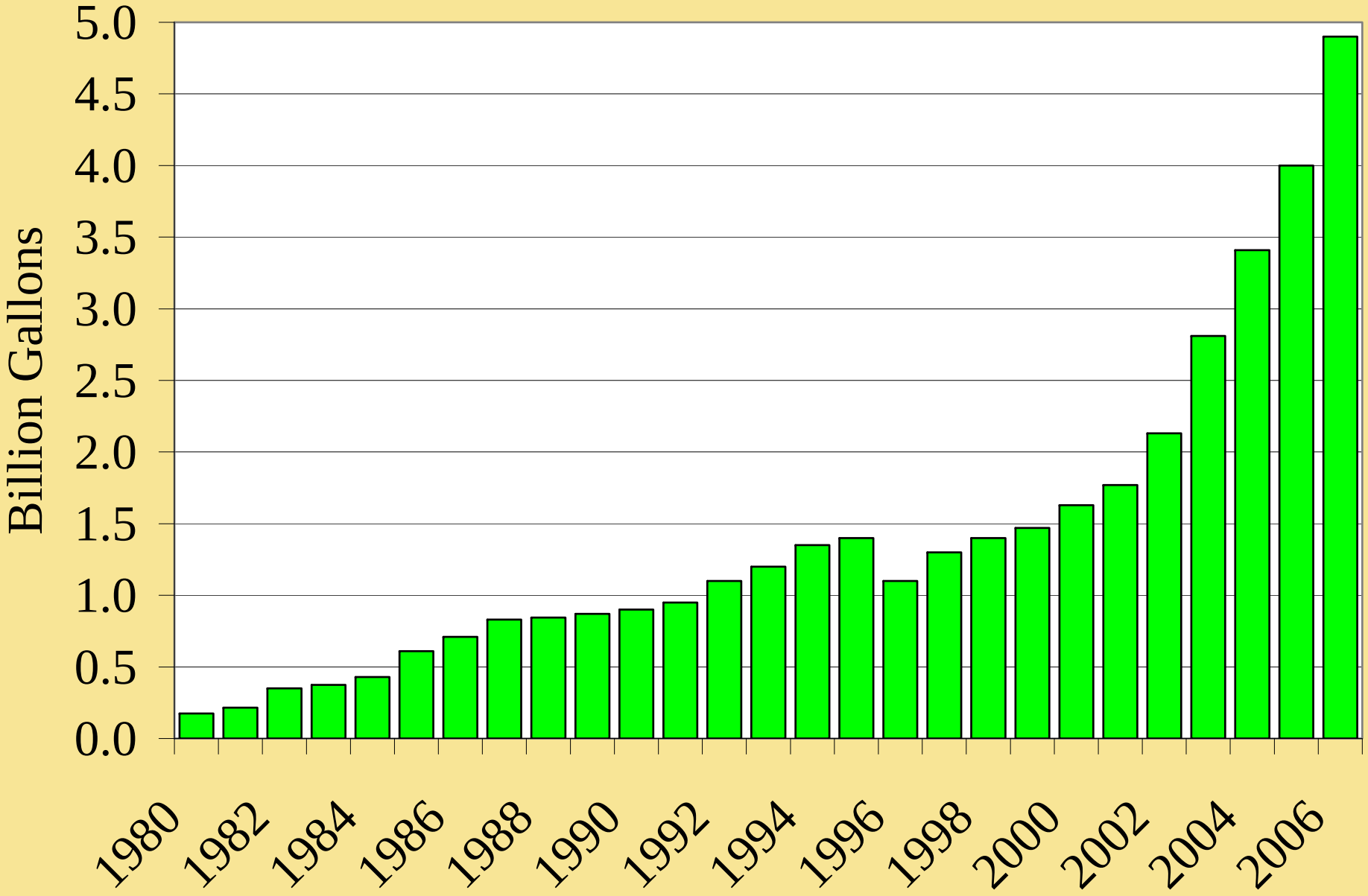
Sediment



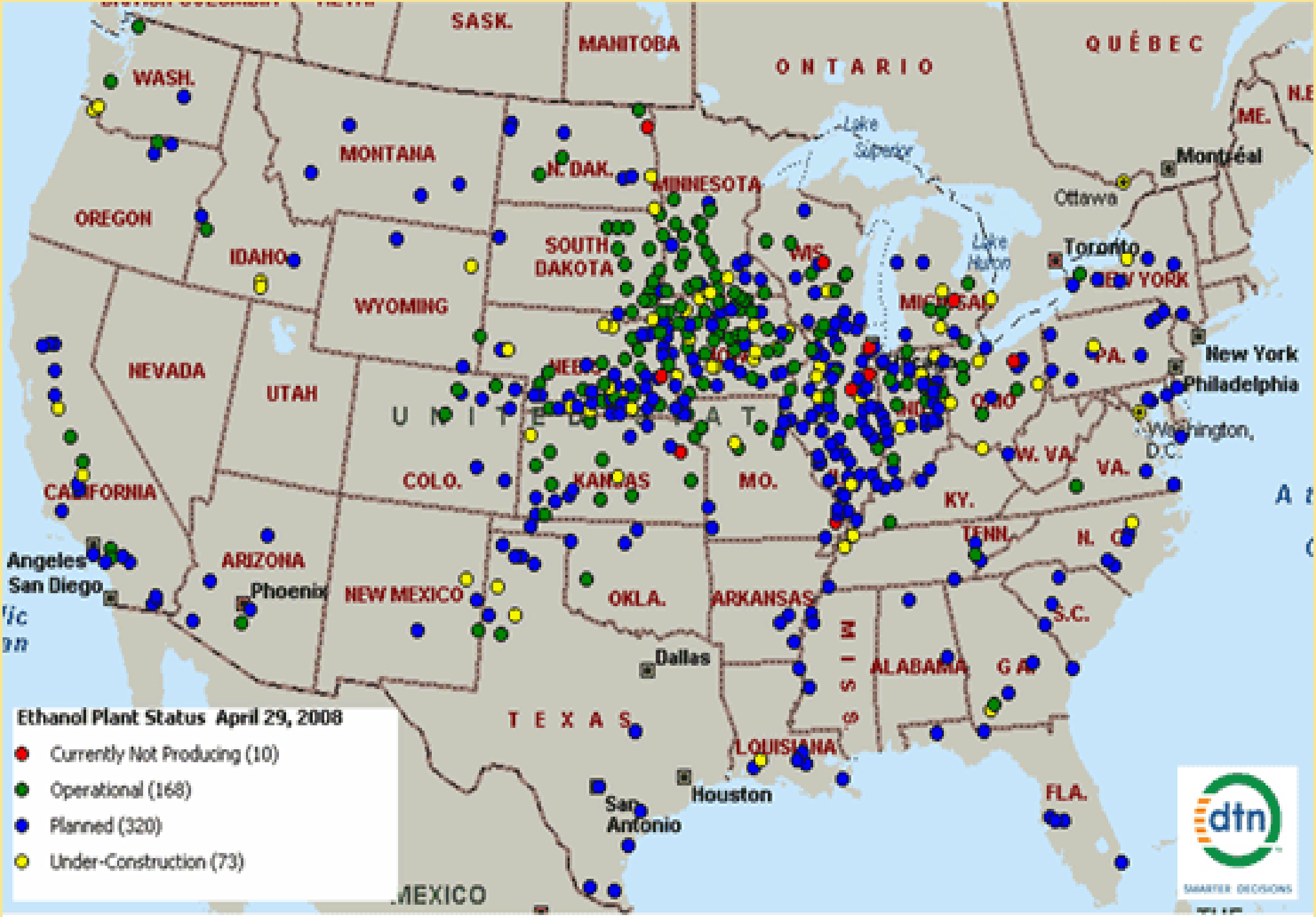
Agricultural Nutrient and Sediment Loads to the Chesapeake Bay



Ethanol Explosion



Source: Renewable Fuels Association



*Alaska has one ethanol plant in the planning stage
*Hawaii has two ethanol plants in the planning stage

Chesapeake Bay Watershed Biofuel Analyses

- **Past and Planned Analyses:**
  - Chesapeake Bay Commission (2007-2008)
  - Chesapeake Bay Program Office (2008)
  - U.S. Environmental Protection Agency (2009)
  - U.S. Government Accounting Office (2009)
  - 2010?

Chesapeake Bay Commission Biofuel Reports

- **Who is the CBC?**
  - Created in 1980 to coordinate Bay policy across state boundaries
  - A tri-state legislative assembly representing Maryland, Virginia and Pennsylvania
  - Identifies critical state and federal actions to sustain the Bay restoration efforts
  - A member of the Chesapeake Bay Program's Executive Council

Chesapeake Bay Commission Biofuel Reports

- **Analysis Tools:**
  - Chesapeake Bay Program Watershed Model Phase 4.3
  - Chesapeake Bay Program Vortex Model
  - USDA-NASS Prospective Plantings Report (March 2005-2007)

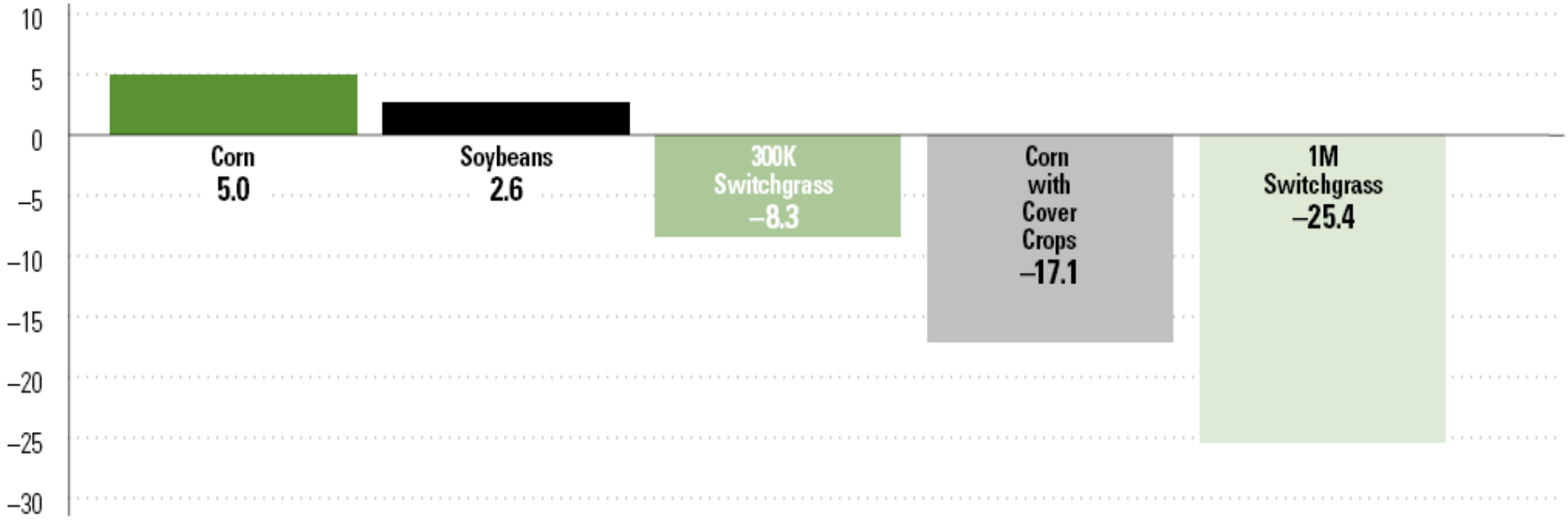
Chesapeake Bay Commission Biofuel Reports

- **Analysis assumptions:**
  - USDA-NASS Prospective Plantings Report data reflect actual planted acreages
  - Ratio of total state area to watershed area is equal to ratio of total agricultural acreage to watershed acreage
  - Corn w/ cover crops scenario includes cover crops on total corn acreage+
  - Switchgrass acreage primarily from hay and pasture land uses
  - Typical nutrient management

Chesapeake Bay Commission Biofuel Reports

Comparing Nitrogen Loads from Various Biofuel Feedstocks

Millions of pounds per year of nitrogen delivered from the Chesapeake Bay watershed to the Bay under five modeling scenarios.



Assumptions for Alternative Scenarios (Next 3–5 Years):

- **Corn:** 300,000 additional acres of corn with typical levels of management practices
- **Soybeans:** 300,000 additional acres of soybeans with typical levels of management practices
- **300K Switchgrass:** 300,000 acres of switchgrass, converted primarily from hay and pastureland, with no fertilization
- **Corn with Cover Crops:** Cover crops on all existing and new (additional 300,000) corn acres and one quarter of all other row crops, watershed-wide.
- **1M Switchgrass:** 1 million acres of switchgrass, converted primarily from hay and pastureland, with no fertilization

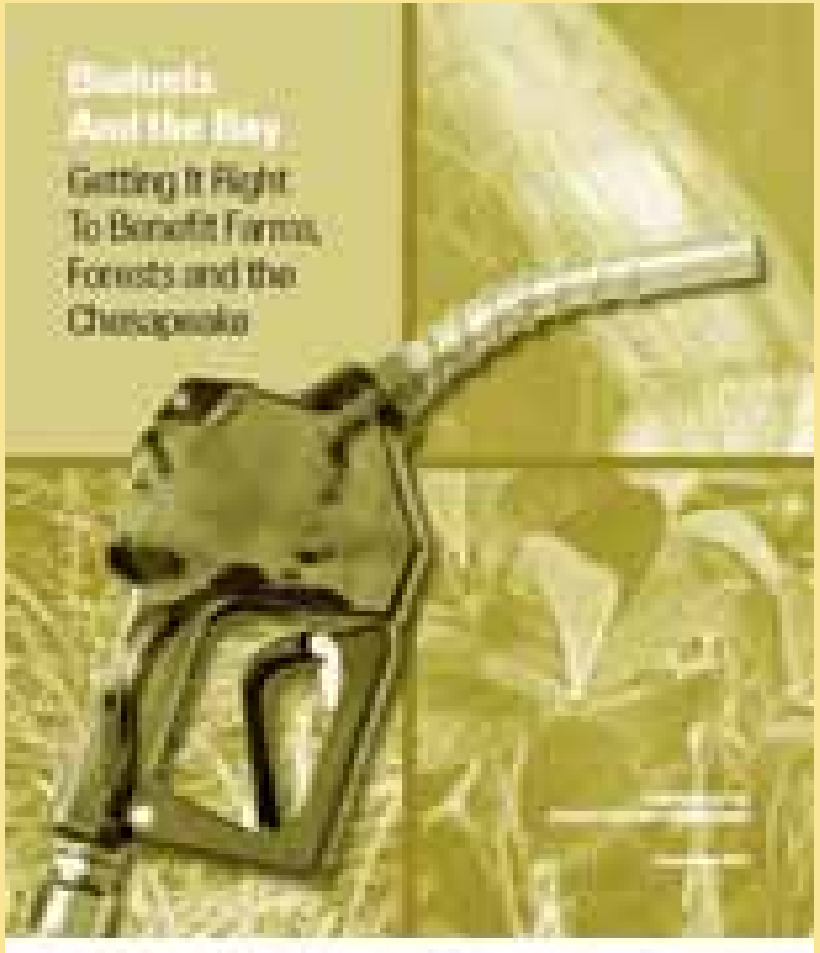
SOURCE: U.S. EPA CHESAPEAKE BAY PROGRAM OFFICE, 2007

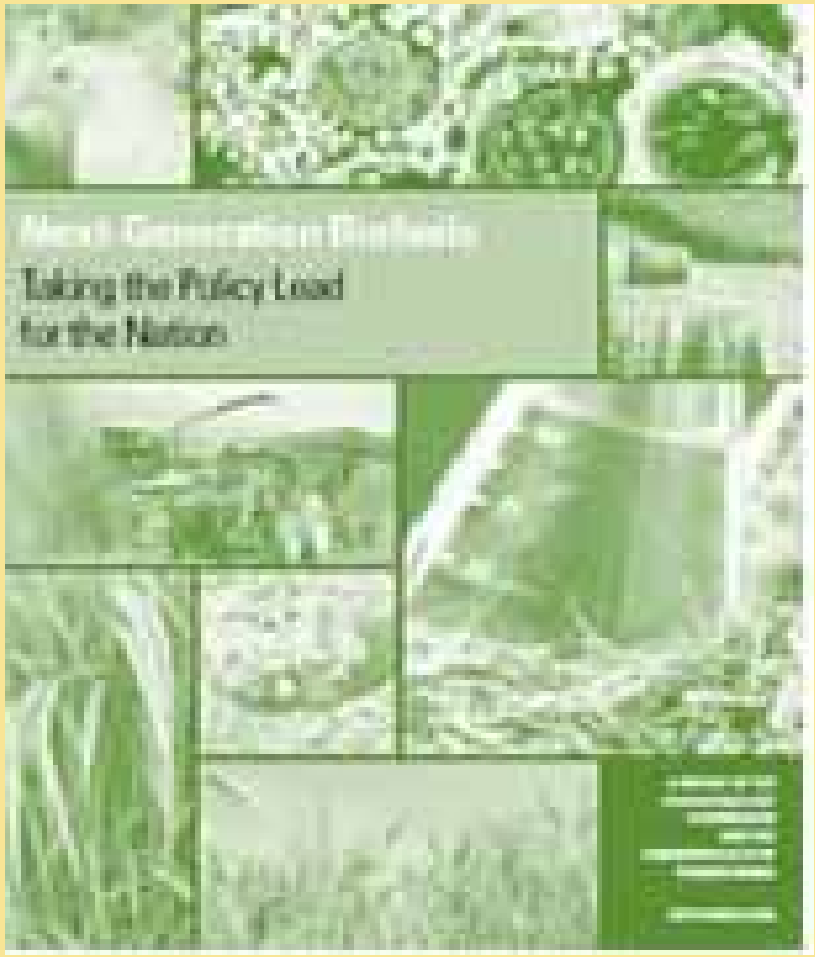
Chesapeake Bay Commission Biofuel Reports

- **Analysis conclusions:**
  - An additional 300K acres of grain corn could result in an increase of 5.0 Million pounds per year
  - An additional 300K acres of soybeans could result in an increase of 2.6 Million pounds per year
  - An additional 300K acres of switchgrass could result in a decrease of 8.3 Million pounds per year
  - Influential commodity markets and/or government policies can strongly influence crop management decisions of agricultural producers, and consequently potential attainment of water quality goals

Chesapeake Bay Commission Biofuel Reports

- September 2007





- September 2008

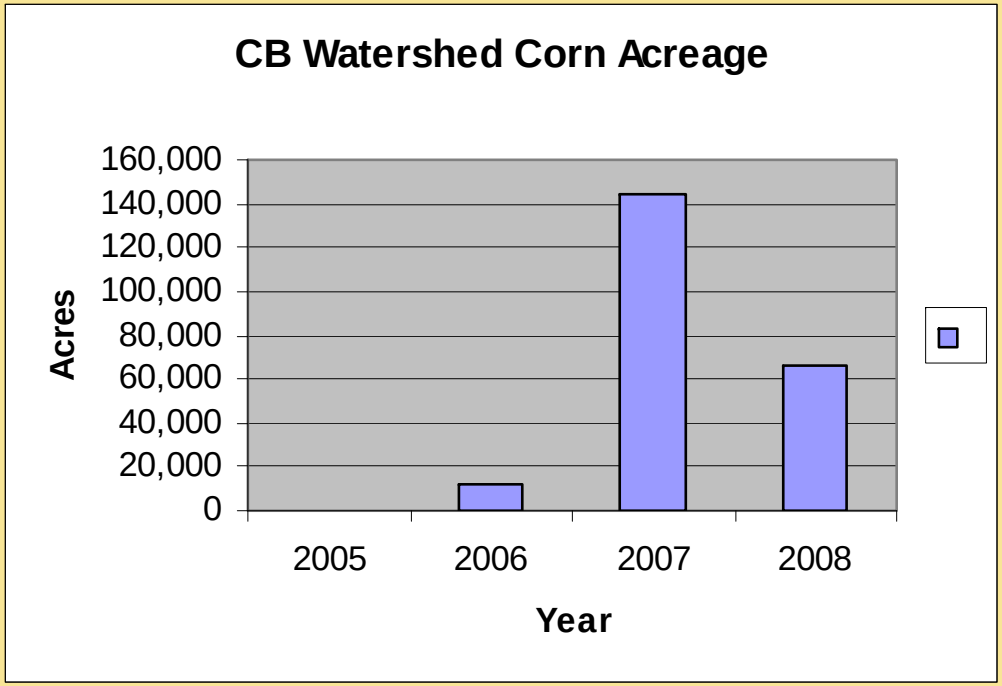
Crop Production Analysis for the Chesapeake Bay Program

- **Analysis tools:**
  - Chesapeake Bay Program Watershed Model Phase 4.3
  - Chesapeake Bay Program Vortex Model
  - USDA-NASS Prospective Plantings Report (March 2005-2008)

Crop Production Analysis for the Chesapeake Bay Program

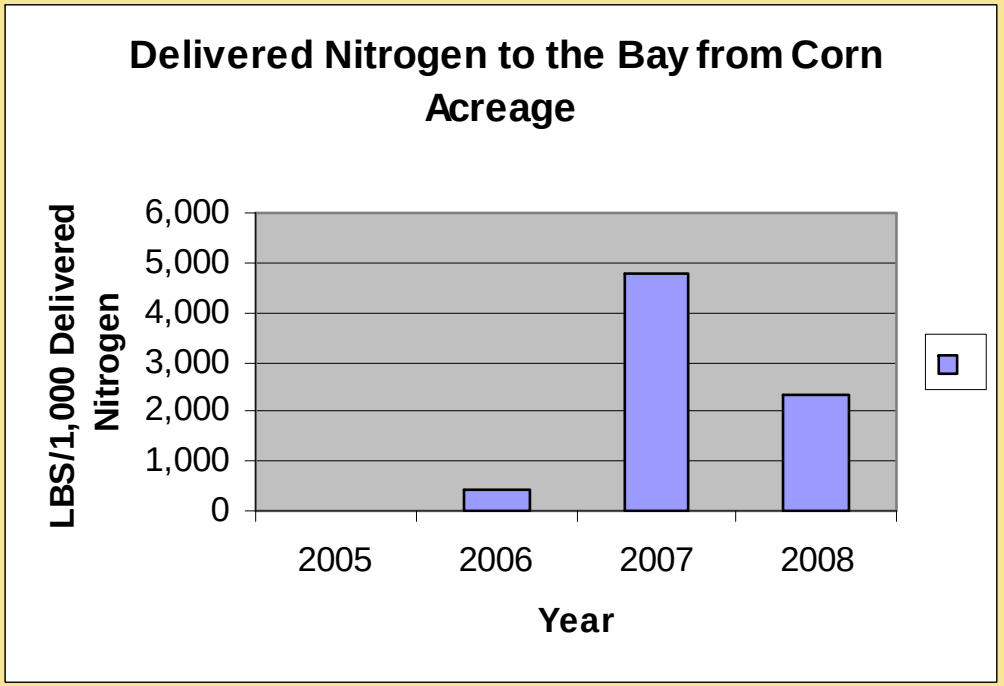
- **Analysis assumptions:**
  - USDA-NASS Prospective Plantings Report data reflect actual planted acreages
  - Row-crop production acreage represents total of USDA-NASS reported acreages for all row crops (double cropping opportunities excluded)
  - Ratio of total state area to watershed area is equal to ratio of total agricultural acreage to watershed acreage
  - Typical nutrient management

Crop Production Analysis for the Chesapeake Bay Program

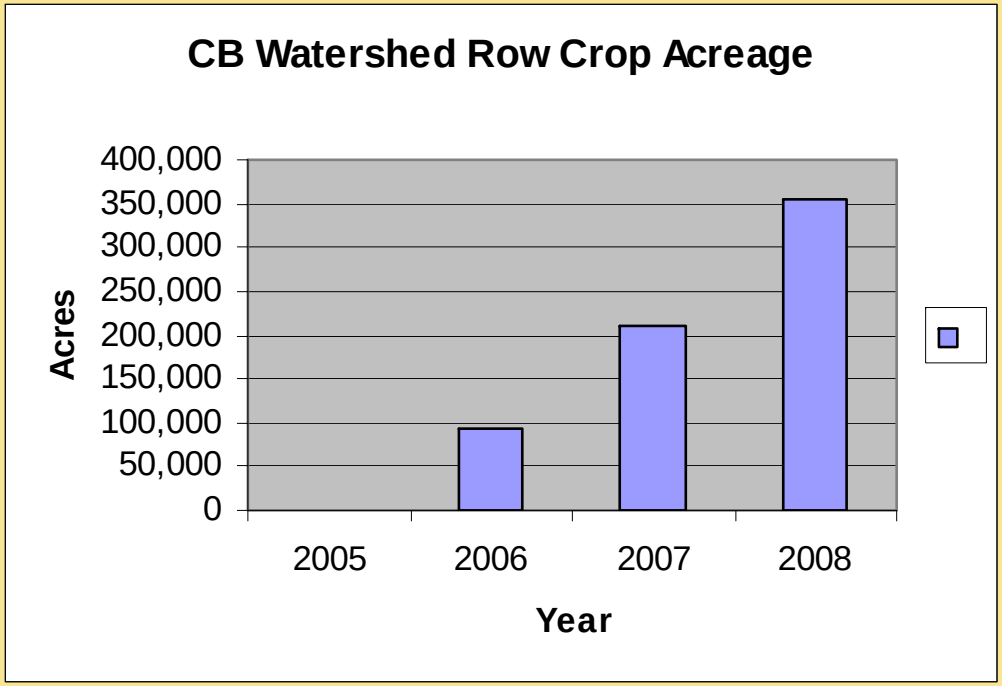


Relative Change in Corn Production Acreages from 2005 Baseline

Estimated Change in Nitrogen Loads Based on Typical Nutrient Management

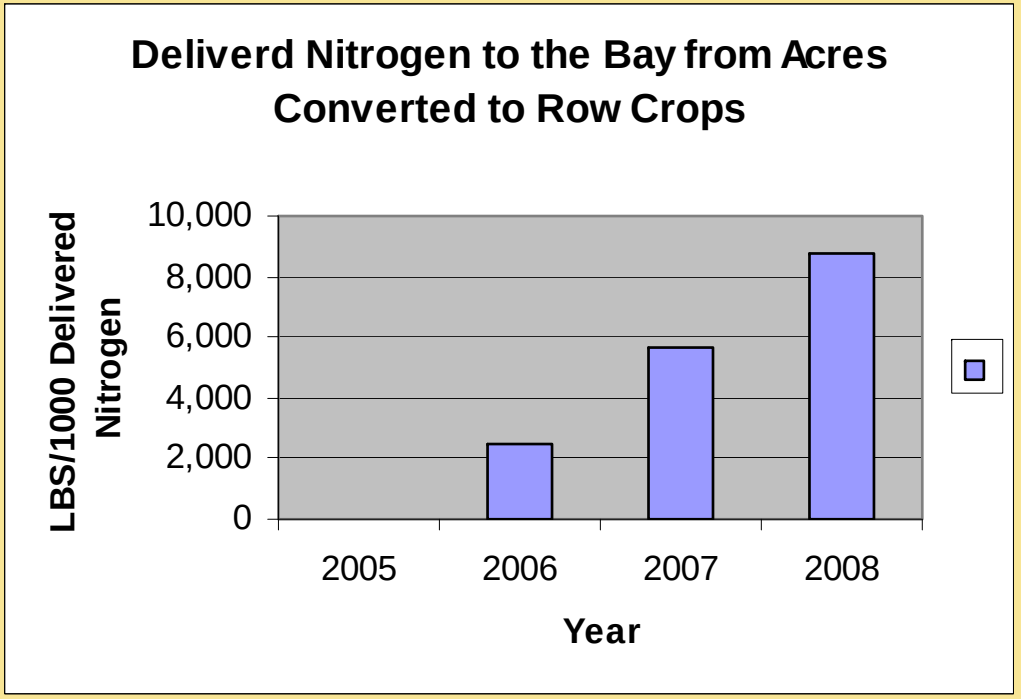


Crop Production Analysis for the Chesapeake Bay Program



Relative Change in Row Crop Production Acreages from 2005 Baseline

Estimated Change in Nitrogen Loads Based on Conversion of Non-Row Crop Acreage



Crop Production Analysis for the Chesapeake Bay Program

- **Analysis conclusions:**
  - Substantial shifts in the annual crop management decisions of agricultural producers could generate significantly modified nutrient loads delivered to the Bay
    - Crop characteristic differences such as growth cycle, time to maturity, nutrient efficiency and the ability to fix nitrogen
    - Conversion of agricultural lands from non-row crop production to row crop systems
  - Influential commodity markets and/or government policies can strongly influence crop management decisions of agricultural producers, and consequently potential attainment of water quality goals

U.S. Renewable Fuels Standard (RFS)

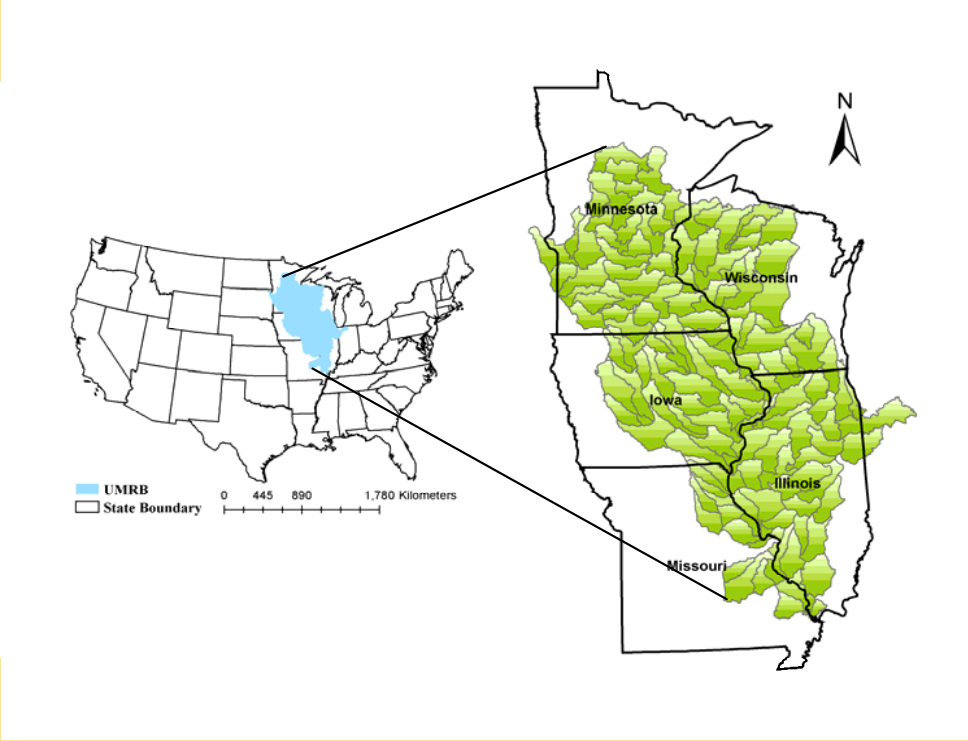
- **What is the RFS?**
  - Established by Congress in the Energy Independence and Security Act of 2007 (EISA)
  - Mandated annual increases of U.S. biofuel production (renewable and advanced)
  - Ethanol target of 10.5 Billion gallons in 2009
  - Ethanol target of 15 Billion gallons by 2015
  - Total Biofuel target of 36 Billion gallons by 2022

U.S. Renewable Fuels Standard Reauthorization (RFS2)

- **What is the RFS2?**
  - The Energy Independence and Security Act of 2008 (EISA) revised the previous RFS
  - Increased requirements for production of renewable fuels with required volumes for 2016 and 2022 under RFS2
  - RFS2 rulemaking scheduled for summer of 2009
  - EPA analysis of the potential water quality impacts and water consumption of new biofuel policies
  - GAO review of the energy, environmental and agricultural impacts of new biofuel policies

U.S. Renewable Fuels Standard Reauthorization (RFS2)

- **RFS2 Water Impact Analysis Watersheds**
  - Gulf of Mexico
  - Upper Mississippi River Basin
  - Chesapeake Bay Watershed



U.S. Renewable Fuels Standard Reauthorization (RFS2)

- **Analysis Tools:**
  - Chesapeake Bay Watershed Model Phase 5.2 (CBWM)
  - Nutrient and Sediment Scenario Builder (NSSB)
  - Chesapeake Bay Estuarine Water Quality Sediment Transport Model (CBEWQSTM)
  - Chesapeake Bay Land Change Model (CBLCM)
  - Forest and Agricultural Sector Optimization Model (FASOM)

U.S. Renewable Fuels Standard Reauthorization (RFS2)

- **RFS2 Analysis:**
  - Scheduled for the spring 2009
  - Scope
    - Analysis from 2000 to 2030
    - Estimates of incremental and delivered nitrogen, phosphorous, and sediment loads to the Bay
    - Water quality impacts of nutrient and sediment load changes due to modified agricultural management
    - Potential effect of nutrient and sediment loads on attainment of water quality standards
    - Estimated changes in land use

U.S. Renewable Fuels Standard Reauthorization (RFS2)

- **Chesapeake Bay Watershed RFS2 Analysis Team**
  - Mark Dubin, UMD/MAWP/CBPO
  - Jeff Sweeney, UMD/CBPO
  - Olivia Devereux, UMD/CBPO
  - Gary Shenk, EPA/CBPO
  - Lewis Linker, EPA/CBPO
  - Peter Claggett, USGS/CBPO

Chesapeake Bay Program
A Watershed Partnership