Watershed Model Phase 4.3:

Data, Calibration, and Scenario Method

- 64,000 square miles
- Nine land uses
- 94 segments
Types of Input Data

• Point sources
• Land use
• Nutrient loads to land
• Management Actions

• Rainfall, PET, physical watershed characteristics
Point Sources

- Facility by facility list
- Monthly data where available
- Years 1984 - 1999
- Estimates for future scenarios
Point Source Info

- Point Source Workgroup
  - representation from CBP states + DC
- Documented on the modeling subcommittee web site

CHESAPEAKE BAY WATERSHED MODEL
APPLICATION AND CALCULATION OF NUTRIENT AND SEDIMENT LOADINGS
Appendix F: Point Source Loadings

A Report of the Chesapeake Bay Program
Nutrient Subcommittee
Annapolis, MD
August 1998

Printed by the U.S. Environmental Protection Agency for the Chesapeake Bay Program
Land Use

EMAP GIRAS

Forest
Impervious Urban
Pervious Urban
Herbaceous (1990)

Population Estimations, Projections

Forest
Impervious Urban
Pervious Urban
Herbaceous (any year)

Agricultural Census

Forest
Impervious Urban
Pervious Urban
Crop
Hay
Pasture
Mixed Open
Land Use

- Tributary Strategy Workgroup
  - representation from CBP states + DC
- Documented on the modeling subcommittee web site
Nutrient Loads to Land

- Atmospheric Deposition
- Fertilizer
- Manure
Atmospheric Deposition

- Use national data source (NADP)
- Use Airshed model to determine wet deposition vs dry deposition
- Use Airshed model to estimate change due to management actions
Atmospheric Deposition

Nitrogen Atmospheric Deposition
- 11.042 - 13.139
- 10.288 - 11.042
- 9.966 - 10.288
- 9.662 - 9.966
- 9.351 - 9.662
- 9.17 - 9.351
Manure

- Use Agriculture Census to get animal numbers by type
- Use assumptions about manure production and applications
- Get monthly applications by crop type
- Overseen by Tributary Strategy Work Group
Fertilizer

• Data From State Agriculture Agencies

• Modified for nutrient management

• Overseen by Modeling Subcommittee and Tributary Strategy Workgroup
Find Nutrient Management

- Fertilizer
- Manure
- AtDep
- Mineral

35% Crop Need

Chesapeake Bay Program Modeling
Find Nutrient Management

<table>
<thead>
<tr>
<th>Fertilizer</th>
<th>35% Crop Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manure</td>
<td>Crop Need</td>
</tr>
<tr>
<td>AtDep</td>
<td></td>
</tr>
<tr>
<td>Mineral</td>
<td></td>
</tr>
</tbody>
</table>
Manure and Fertilizer

- Trib Strategy Workgroup
  - representation from CBP states + DC
- Documented on the modeling subcommittee web site

CHESAPEAKE BAY WATERSHED MODEL
APPLICATION AND CALCULATION OF NUTRIENT AND SEDIMENT LOADINGS

Appendix C: Agricultural Nutrient Loads

A Report of the Chesapeake Bay Program
Nutrient Subcommittee
Annapolis, MD
August 1998

Printed by the U.S. Environmental Protection Agency for the Chesapeake Bay Program
Scenario Method

• Always use 1985 - 1994 hydrology

• Hold land use, land management, and point sources constant for simulation period
Types of Scenario Data

- Atmospheric deposition
- Point sources
- Septic
- BMPs
  - Nutrient application
  - Land use
  - Structural BMPs
Chesapeake Bay Program Modeling

BMPs

Nutrient Management

Atmosphere

Fertilizer

Manure

Runoff
BMPs

Atmosphere

Fertilizer

Manure

Land Use Change

Runoff

Chesapeake Bay Program Modeling
Chesapeake Bay Program Modeling

BMPs

Structural BMPs

Atmosphere  Fertilizer  Manure  Runoff

Chesapeake Bay Program Modeling
Chesapeake Bay Program Modeling

BMPs

Atmosphere

Fertilizer

Manure

Structural BMPs

Runoff

Chesapeake Bay Program Modeling
How do we calibrate?

Rain

Land Surface

River Reach

Chesapeake Bay Program Modeling
Calibration

- Exports from land
  - Literature values
  - Analysis of input
- River input to tidal waters
  - Data at all major inputs
  - Upstream points
Figure 12. Crop Nitrogen

Ib/ac/year

Beulac & Reckhow  Sparrow  Sweeney & Chang  CBP Model

Chemung
Figure 13. Crop Phosphorus

Beaulac & Reckhow
Sweeney & Chang
model

Chemung
Figure 28. Pasture TN Export vs TN applications

\[ y = 0.0791x + 3.5782 \]

\[ R^2 = 0.9221 \]
Second point of calibration

Rain

Land Surface

River Reach

Chesapeake Bay Program Modeling
Calibration in the Upper Susquehanna

Flow 80% NY

WQ 56% NY
East Branch Susquehanna River at Segment 40 - Calib June 2000
Observed and Simulated versus Time
Flow-cfs

(*)=Observed, --=Simulated
East Branch Susquehanna River at Segment 40 - Calib June 2000
Flow-cfs
Frequency Distribution - PAIRED Simulated and Observed Data
East Branch Susquehanna River at Segment 40 - Calib June 2000
Observed and Simulated versus Time
Temperature-C
(∗=Observed, - = Simulated)
East Branch Susquehanna River at Segment 40 - Calib June 2000
Observed and Simulated versus Time
Total Suspended Sediment

(*=Observed, -=Simulated)
East Branch Susquehanna River at Segment 40 - Calib June 2006

Observed and Simulated versus Time

Total Nitrogen

(=*Observed, -=Simulated)
Calibration Reviews

- Modeling Subcommittee
- Tributary Strategy Work Group
- Model Evaluation Group