

**Bay Program Committee, Subcommittee, and Workgroup Activities for STAC
June 2006**

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Forestry Workgroup Meeting (April 12, 2006)

All presentations can be viewed at the following website:

<http://www.chesapeakebay.net/calendar.cfm?EventDetails=7163&DefaultView=2&R>

Amidea Daniel (Trout Unlimited) discussed the value of partnerships and Trout Unlimited Kettle Creek Home River initiative. The Kettle Creek, PA watershed is heavily forested and has 430 stream miles. Over 90% of the watershed is state park or forestland. The small local economy is supported by outdoor recreation.

The program objectives are:

- Conduct watershed assessments
- Improve fish habitat (restoration projects to stop erosion and provide trout habitat)
- Reclaim lower Kettle Creek through treatment of acid mine drainage
- Community environmental protection and education program

The Classroom Discovery Program was highlighted as a national program that allows teachers and students the opportunity to raise trout fingerlings to be released into cold-water streams. Students conduct daily water monitoring and learn about watersheds and riparian buffers. In the future, students may be able to track next year's adult trout.

Larry Martick (Adams County PA Conservation District Manager) discussed the county's tributary strategy implementation plan. In PA, all 38 conservation districts in the Bay watershed were tasked by the Dept. of Environmental Protection to submit by February 2005 county implementation plans. The plans are based on limited funding and dictate what can be done at the local level to solve nutrient and sediment problems.

Adams County is located in south central PA, roughly 334,000 acres in size, and over 1,300 miles of streams. The county is in both the lower Susquehanna west and Potomac watersheds. It contains over 1,200 farms and 54% of the land is agriculture-based. According to the 2000 census it is the fastest growing county in the Bay watershed. Almost 4,000 acres were proposed for development in 2003 alone. Since 1985, the Bay Program has spent over \$2million in Adams County for nutrient and sediment reductions.

As a strategy to achieve a cleaner Bay by 2010:

- Use of traditional agricultural BMP's such as: bin block stacking pad for manure storage, barnyard with a perforated curb and filter area, collection pit and manifold system, watering systems and spring developments, cattle crossings for heavy use areas, diversions and terraces, and roof spouting.
- Future of agriculture BMP's include: hoop structure manure storages, riparian buffers, traditional and enhanced nutrient management plans, cover crops, manure spreader calibrations, soil and manure testing, and promotion of no-till farming practices.

Tributary strategy for Adams County has a price tag of more than \$1.1 million and has received \$25,000 from PA Bay funding sources. There are concerns about the nutrient management plans being adequately accounted for due to lack of sufficient monitoring and farmer training. Also measuring benefits is complicated by the nature of the nitrogen cycle.

Gene Odatto (PA Bureau of Forestry) discussed how to better target current efforts in addressing forest resources impacts to nitrogen, phosphorus, and sediment loading, open space, habitat quality, wood supply, forestland protection, and water planning. Forest resource impacts include: timber harvesting operations, forest fragmentation, urbanization, fish and wildlife

habitat degradation, forest health and invasive species, wildfire and other catastrophes. Forest resource best management practices include: water quality improvement, invasive species control, reforestation, and forest stewardship plans. To improve forest resources first pick a forest resource impact then choose a best management practice. For each BMP, determine the number per year, cost for each, and total cost. Also factor in staffing needs, as this is costly. Change how BMP's are applied and get them on the ground. It is helpful to do this exercise for a full suite of BMP's and will help determine future workload, funding, and shape of forest resources.

Mike Foreman (VA Dept. of Forestry) announced the publication "The Woods in Your Backyard" is published and includes a manual and workbook which highlight implementing GIS and web-based tracking systems for forestry BMP's. The focus of the project is to communicate with the ten to twenty acre landowners to get them to do their own planning. The main message is to keep woods as woods. Training for field staff has already begun.

Member Updates and Announcements:

Pennsylvania: (Gene Odato)

- Rural and community forestry is taking a more regional approach to working with private forest lands, the state has been broken down into regions.
- The state forest resource plan is being revised to include stakeholder meetings every five years.
- The state is looking into green certifications.
- The Society of American Foresters 2006 National Convention will be held in Pittsburgh from October 25-29, 2006. Gene Odato submitted abstracts on Bay Program riparian forest buffers and forest fragmentation.
- Two publications due out this summer: Stream ReLeaf Implementation Plan and updated Buffer Toolkit.

Maryland: (Anne Hairston-Strang)

- Centennial celebration – 100 years from MD State Forests and Parks, planting being held in honor of, scout patch being developed, communications package for website and DNR magazine.
- Planning National Association of State Foresters meeting around Baltimore later this year, highlights most of the watershed and urban forestry work done in partnership with Forestry Service and CBP Forestry Workgroup.
- Landowner survey developed for Working Woodlot project, PSU developed survey to gauge acceptance and use of small scale harvesting systems, barriers to forest management by private landowners.
- Baltimore Urban Tree Canopy goal announced, expand canopy cover from 20% to 40% in thirty-year period.
- Tree expert bill passed to address issues from last year's new licensing bill for tree removal, grandfathers existing practitioners to get licensed without exam until May 2007. Exam now offered monthly, entirely in computer lab with rapid feedback for results.

Virginia: (Mike Foreman)

- In November, the VA Stream Alliance Workgroup will begin training on the stream restoration database developed in VA.

- VA Riparian Working Group has its own draft out and the tributary strategy should reference their implementation plan in the future.
- The state is requiring all state agencies that own land to have a nutrient management plan.

Alliance for the Chesapeake Bay: (Lou Etgen)

- There is a feeling among corporations not to do early plantings for carbon sequestration because if a trading program is instituted pre-existing plantings will not count.
- There is a small airline company promoting itself as a green airline because it plants trees to mitigate its carbon emissions.
- The Chesapeake Bay Watershed Forum will be held November 17-19, 2006 at the US Fish & Wildlife Service National Conservation Training Center in Shepherdstown, WV. 250 to 300 people from watershed organizations and local government planning offices are expected to attend.

Riparian Specialist: (Judy Okay)

- Working on identifying what watersheds need a boost in riparian buffers.
- Begun work on a photo contest to promote riparian forested buffers, one winner will be selected from each state each year.
- A decision maker workshop is scheduled on riparian buffers on September 19th at VIMS.

Nutrient Subcommittee Meeting (April 26, 2006)

All presentations and handouts can be viewed at the following website:

<http://www.chesapeakebay.net/calendar.cfm?EventDetails=7164&DefaultView=2&RequestDate=04/03/2006>

Robert Koroncai (EPA Region III Regulatory Protection Division) presented an update on the interstate trading in the Potomac Basin. There are 470 significant facilities in the Bay watershed and 102 in the Potomac River basin. Existing permits consistent with state tributary strategies and plans. The nutrient trading programs are under development in PA and VA with the focus on achieving loading reductions with point source to point source trading. MD just recently had a kick-off meeting to address these issues.

At the present time, only point to point sources are being discussed as an option for the Potomac basin since there are five different jurisdictions permitting in this watershed. It needs to be stressed that this is only conceptual at this time. Blue Plains facility in DC is responsible for 43% of the municipal design capacity in the Potomac basin. In order to be able to track trading, all trades would be with Blue Plains only. All facilities within the Potomac basin could trade with each other. There is more incentive when the phosphorus credits are worth at \$40 per pound.

Nutrient trading allows for innovations and technology to be developed. Tracking trades can be conducted through a web-based trading forum called Nutrient Net and was developed by World Resources Institute (PA has a contract with them). It will register credits and document trades and includes custom trading provisions such as delivery factors, retirement ratios, and custom trading rules. The trading cycle needs to be consistent, let's use VA as an example:

- Annual load limits (pounds/year)
- Compliance period of January 1 to December 31

- Reporting cycle that follows annual discharge monitoring report that is due January 31st from the previous year
- Register credits the day after report is completed (February 1st)
- Certify credits by allowing states to verify after two month period (April 1st)
- Trading session is from April 1st to June 30th

Any credits in bank could be used if in non-compliance mode. Non-compliance will usually happen at municipals in winter due to colder temperatures for biological activity resulting in NPDES enforcement with regulations and fines. Long Island TMDL trading is happening now and under 1:1 trading ratio are able to achieve water quality standards. The WWTP have difficult decisions to make on whether or not to upgrade facilities or count on year to year credits. The Chesapeake Bay permit at Blue Plains is for 430,000 lbs/day for phosphorus. The existing permit is for 200,000 lbs/day for phosphorus. Should the credits start to be earned below 430,000 or 200,000? Blue Plains permit expires in 2008.

Trading Updates by States

Washington, DC:

Over the past year EPA, DC government, and WASA have been discussing Bay allocations. Need to decrease their nitrogen load from 5.8 million lbs/year and need to 4.2 million lbs/year at a cost of \$300-400 million for compliance over lifespan of facility. The groups are discussing ways to structure the permit to deal with wet weather inflow problems.

Virginia:

The 2005 general permit draft open for comment until June 30th. To access the proposed nutrient program, please go to: <http://www.state.va.us/dcr/sw/nutmgt.htm>

The deadline to achieve point source tributary strategy loads is January 1, 2011. Permitted facilities by state law can trade credits from point to point allocations. A nutrient credit exchange group will be formed by late summer/early fall and the initial plan can save 10-15% capital costs by staggering the WWTP retrofits. Present allocations are based on design capacity and not flow. Only new state-of-the-art facilities will be allowed to trade non-point credits. Permit level is currently 0.18 mg/l total phosphorus and 4.0 mg/l total nitrogen. There is a dedicated cash flow similar to the MD state flush tax.

West Virginia:

The state tributary strategy can be found at the following website: <http://www.wvnet.org>
Existing facilities at re-issuance have new Bay requirements and must meet cap load allocations based on 5.0 mg/l total nitrogen and 0.5 mg/l total phosphorus. The state shall track monthly loadings and if one twelve annual limit is exceeded must submit explanations as to why not in compliance with regulations. All facilities must submit annual report each year. Facilities have five years to comply with annual cap loads and submit progress reports quarterly. New and expanded facilities must comply immediately on initiation of operation of plant. DEP has issued three permits with four more in draft form. Trading offset program not in existence but trading program of point to point in future.

Maryland:

Wastewater treatment plans enhanced nutrient removal (ENR) upgrade status:

- 1 ENR facility is in operation (Allegany County)

- 8 facilities are under construction for ENR
- 10 facilities are under design for ENR
- 29 facilities are in planning for ENR
- 18 facilities are in pre-planning phases for ENR

Point source tributary strategy update:

- MD's point source strategy has been incorporated into the draft "Maryland Chesapeake Bay Tributary Strategy Statewide Implementation Plan" available at: http://www.dnr.state.md.us/bay/tribstrat/implementation_plan.html
- The state's strategy is based on a two-part plan to:
 1. Upgrade MD's WWTP to Enhanced Nutrient Removal technology to meet concentrations of 3.0 mg/L or less total nitrogen and 0.3 mg/L or less total phosphorus.
 2. Maintain loading caps.
- Upgrades of WWTP to achieve ENR will be funded under the Bay Restoration Fund Act.
- Nutrient loading caps for significant municipal (>500,000 gallons per day), non-significant (<500,000 gallons per day), and significant industrial (minimum of total nitrogen discharge of 75 pounds per day and total phosphorus of 10 pounds per day) are as follows:
 - Significant municipal WWTPs annual nutrient cap loads based on an annual average concentration of 4.0 mg/l total nitrogen and 0.3 mg/l phosphorus and the approved design capacity of the plant.
 - Non-significant municipal WWTPs annual nutrient loads are based on design capacity or projected 2020 flow, whichever is less, and concentration of 18 mg/l total nitrogen and 3 mg/l total phosphorus.
 - Expanding non-significant facilities cannot exceed 6,100 lbs/year total nitrogen and 457 lbs/year total phosphorus.
 - Significant industrial WWTPs annual loads are based on a combination of (1) recent initial baselines established in 1985; and (2) identification and/or negotiation on a case by case basis of additional potential loading reductions.
 - Where applicable, more stringent load caps may be required to meet local water quality.

NPDES permits have begun to include annual average loading caps based on the point source strategy but must optimize operation to achieve 3 mg/l total nitrogen.

Trading Update:

- The Bay Restoration Fund in MD presents a unique situation, because it provides the funding to achieve the nutrient loading caps, therefore, MD is looking toward nutrient trading and offsets to maintain the caps.
- MD has put together an "incomplete preliminary discussion draft" approach to stimulate thought and discussion on this topic.
- A kick-off meeting to discuss trading/offsets/cap maintenance in MD was held on April 17th and was attended by approximately 50 non-MDE participants.
- Over the next several months, DNR will hold a series of "listening sessions" with various stakeholder groups to gather input, including meetings with the MD Municipal League, MD Association of Counties,

Tributary Team chairs, and MD Association for Municipal Wastewater Agencies.

- There is no specific timeline for completing a cap management strategy for MD. It is unknown at this time whether the strategy will be finalized as a policy or regulations.

New York:

A draft tributary strategy will be out in early this summer. 28 significant facility upgrades are underway using 4.0 mg/l total nitrogen.

Delaware:

There are 4 significant facilities including 2 using ENR technology, 1 spraying irrigation, and 1 redoing its permits using a 3.0 mg/l total nitrogen.

Pennsylvania:

There are 142 significant facilities in the state as of 2004 increasing to 190+ significant facilities as of 2006. The state is currently using 8.0 mg/l total nitrogen and 1.0 mg/l total phosphorus and their point source workgroup presently reviewing 2004 legislation. Their trading program is moving forward with non-binding moratoriums for WWTP facilities with 6.0 mg/l total nitrogen and 1.0 mg/l total phosphorus for new design facilities. Three “listening sessions” were held recently by DEP to discuss nutrient trading policy and details can be found at the following webpage: http://www.dep.state.pa.us/river/river_trading.htm

Tom Simpson (UMD) presented an outline of the BMP Project that was recently awarded to the CSREES Mid-Atlantic Regional Water Quality Program. The BMPs will be evaluated in the order requested by CBP Water Quality Steering Committee and Nutrient Subcommittee. The timeline for the projects work plan includes:

- Phase I – Revision of selected existing BMPs with efficiencies to be revised prior to use in the Phase 5 watershed model calibration. To be reviewed and approved by the Bay Program partners by April 30, 2007.
- Phase II – New tributary strategy BMPs credited in tributary strategies but not used in the Phase 5 watershed model calibration. To be modified and approved by the Bay Program partners by December 31, 2007.
- Phase III – New BMPs not currently in the jurisdictions’ tributary strategies and will not be used in the Phase 5 watershed model calibration. To be modified and approved by the Bay Program by April 30, 2008.
- Phase IV – Documentation, reporting, and dissemination of new and revised BMP definitions and efficiencies. The report will be completed and the forum held by April 30, 2008.

The project approach and methodology will include the following steps:

1. Scientific literature searches
2. Interviews and surveys
3. Selected demonstrations and field tours
4. Development of practice definitions and efficiencies
5. Documentation, reporting, and dissemination

For each BMP, the generated documentation should include the following:

- BMP name
- Photograph
- Description/Definition
- Efficiency
- Statement of conservatism
- Outstanding issues to resolve in the future
- References
- Review process

The final report will be distributed to the jurisdictions, Bay Program office, watershed planning managers and agricultural advisors at EPA Region III, USDA NRCS, STAC, and other interested parties. A one-day forum will be held to present the final definitions and efficiencies and discuss future direction and needs.

Tom Simpson (UMD) reviewed the highlights from the recent proposal presentation by R. Martinez of Scott's Fertilizer Company on reducing phosphorus application in lawn and fertilizer programs. The phosphorus reduction will take place in their Turf Builder product line beginning in 2007 and have targeted a 50% reduction in phosphorus applied by 2009 sales year. The fertilizer industry wants the Bay Program to sign a Memorandum of Understanding (MOU) at the Executive Council in 2006. The MOU would discuss the agreed upon phosphorus reductions, commit the industry and the Bay Program to addressing nitrogen reductions and implementing an educational campaign. The industry would work with the big box stores to set-up signs and tear-off sheet displays on healthy lawns and proper fertilizer application. There will be a website listed to direct the consumer for more environmentally friendly tips for lawn care. The big box stores will pay for the printing and the companies will maintain the displays.

Nutrient Subcommittee Meeting (May 24, 2006)

All presentations can be viewed at the following website:

<http://www.chesapeakebay.net/calendar.cfm?EventDetails=6848&DefaultView=2>

Scott Philips (USGS) made the introductory overview presentation for USGS activities in the Bay watershed focusing on land use and watershed data analysis, sediment, water clarity and biota, and nutrients and ground water delivery to the Bay. These factors can be used to prioritize implementation actions of watershed plans, tributary strategies, 2000 Bay Program commitments, TMDL's and other programs.

In 1999, the Chesapeake Bay was listed as an impaired water body with criteria and standards such as dissolved oxygen, chlorophyll a, and water clarity to be met in 2010 through the implementation of tributary strategies and cap allocations.

Factors affecting delivery and trends are river flow variability measured through a network of stream gages with water quality monitoring in the Bay watershed. There are 60 fully implemented and 20 partially implemented in the network. There are approximately 20 samples collected from each site over different water periods annually (12 monthly and 8 storm events). Long-term records are sites where there are annual measurements for 5+ years. The goal is to have 100 sites in many locations in the Bay basin with a total cost of \$3.5 million.

The annual nitrogen river loads to the Bay for 1990-2004 estimated from monitored (80%) and CBP model output (20%) to yield a load of 500 million pounds of nitrogen. The average river inputs for nitrogen are in the range of 1.0 to 1.5 mg L⁻¹, whereas the average river loads for

phosphorus are in the range of 0.1 to 1.5 mg L⁻¹. Larger peaks occurring after dry years are due to nutrient storage issues. The argument of flow versus loadings for related trends is valid for nitrogen and to some extent phosphorus due to storm-related events. In Virginia, flashing events occur which cause hardening of surfaces corresponding to changes in nutrient loadings. Averaging three-year conditions for mean river flow into the Bay has made attainment difficult and difficult to control runoff and transport of nutrients.

Jeff Raffensperger (USGS) presented changes in stream flow and water quality in selected non-tidal sites in the Bay basin for 1985-2004. Trends analysis is based upon data from 9 RIM and 23 non-tidal stations measuring TN, TP, NO₂, NO₃, PO₄, and sediments. These data can address the following questions:

1. What changes have occurred in concentrations and loads delivered to the Bay?
2. Keeping other factors constant, what changes have occurred in concentrations and loads delivered to the Bay?
3. What have been the effects of management actions on loads delivered to the Bay?

Trends estimation based on stream flow and water quality data using Spearman rho, non-flow adjusted trends, and flow-adjusted trends. The problem with trends estimation using raw (observed) concentration data; targeted sampling produces a biased data set. Possible solutions include; Spearman rho (non-flow adjusted) or regression analysis including flow as a variable (both flow-adjusted and non-flow adjusted trends). A flow-adjusted trend may be estimated using the model ESTIMATOR, a seven-parameter log-linear regression model that is independent of variation in stream flow.

Beginning in the late 1990's, USGS has reported flow-adjusted trends as a percent change relative to some starting date (1985). Flow-adjusted trends provide our best estimate of changes that have occurred due to a variety of actions, independent of variation in stream flow.

Development of a continuous flow-adjusted trend estimate includes both time and time-squared terms and allows for examination of changes in the system over time.

In summary, the 2004 trends update will introduce a complete suite of bias-corrected tools for water quality data analysis including: descriptive statistics for observed concentrations, estimation of continuous flow-adjusted trend, and non flow-adjusted trend in concentration and load. There are significant downward trends in TN, TP, and sediment throughout most of the Bay watershed with the notable exceptions of TP for the Potomac and TN, TP, and sediment for Pamunkey (point source is a pulp mill).

John Brakebill (USGS) presented an overview of the Spatially Referenced Regression Model on Watershed Attributes (SPARROW). It is a spatial statistical approach that empirically relates contaminant sources to measured stream loads as well as a spatial framework that provides targeting management practices and evaluating distribution of factors affecting loads.

Integrates watershed data over multiple spatial scales to predict origin and fate of contaminants:

1. Spatial design of network of connected and attributed stream and watersheds
2. Monitoring data (dependent variable)
3. Source data – water quality and stream flow
 - Nutrient sources include; atmospheric, septic, point sources, land cover, and agriculture
4. Land to water delivery (soils, slope, physiography, geology, meteorology)

The estimated equation includes:

Load = sources, land to water delivery factors, in-stream decay functions, and error

A reach-based network is defined as a spatial representation of a surface water pathway that data can be aggregated and referenced such as; headwater to tributary junction or tributary junction to tributary junction. When a stream flow monitoring station is associated to a reach allows for watershed development. Each reach and associated watershed is identified by a unique code. The GIS sources include nutrients and delivery which feeds into the network of stream reaches and watersheds which flows into SPARROW model to provide load estimates which give output yield by reach incremental and delivered.

Setting load allocations for the model include the following:

- Allocate loading caps to the 9 major Bay basins
- Further allocate cap load responsibilities to each state
- Further allocate major tributary basin load caps to 37 state defined sub-basins

Using this model for Chesapeake Bay restoration includes:

- Providing maps of SPARROW model estimates for targeted audiences such as Tributary Strategy Workgroups for watershed and jurisdictional purposes and revising nutrient management plans.
- Static images of individual tributary strategy basins to provide spatial detail within management areas.
- Provide local and delivered TN and TP for late 1990's.
- Provide GIS data sets.

In summary:

1. SPARROW provides a methodology to spatially relate contaminate load to sources
2. In terms of nutrient delivery to the Bay:
 - Less nutrient loss is likely to occur in large streams and close proximity to those large streams
 - Nitrogen loss is more likely to occur in headwaters of non-urban watersheds
3. Information delivery includes:
 - Tributary Strategy Workgroups to help revise nutrient management
 - Individual images, GIS data, and website (still under construction)

Scott Phillips (USGS) provided an overview on the impact of groundwater on nitrogen delivery to the Chesapeake Bay. Factors affecting delivery and trends are watershed properties that include groundwater, residence time and storage, and lag time. USGS ground water studies have focused on discharge, nitrate load, age, factors, and lag time.

Ground water discharge to streams contributes 50% of stream flow, which is in the 16-92% range with an influence of rock type (geology). Half of the nitrogen loading in stream delivery comes from ground water varying 17-80% with factors from land use (carbon content of soils), denitrification, and timing of delivery. Groundwater ages ranges from the uppermost aquifer layer to springs (wells) with 75% of springs being 10 years old and are affected by recharge area, properties of aquifer and gradient (relief). Ages of water to a stream include a large component of "modern" water (less than a year in age) which is runoff and soil water. Ground water ranges in age from 1-50 years in age with 10 years as the average age and 75% of all water less than 13 years old.

Implications of ground water delivery to the Bay:

- Meeting water quality criteria by 2010 will be difficult due to rate of source reduction and retention and influence of environmental factors.
- Need to increase rate of and better target nitrogen source reduction and retention; use denitrification to reduce nitrogen delivery to streams, priority on headwater streams, and reduce nitrogen in winter and spring.
- Groundwater will cause some delay in improvement of water quality of much less than a decade.
- Working to enhance watershed models and monitoring to better predict and explain improvements in streams.

Allen Gellis (USGS) addressed the studies that are ongoing in the Chesapeake Bay region:

1. Use existing data to characterize sediment concentrations, loads, and yields in the Bay watershed
2. Use of cosmogenic isotopes to estimate sediment yields
3. Sediment fingerprinting to determine upland versus channel corridor sources
4. Role of riparian wetlands in sediment storage

Sources for total suspended solids in the Bay watershed are: shoreline erosion, resuspension, biogenic, watershed, and Atlantic Ocean. The sediment budget for the upper Bay based on Biggs (1970) studies shows that for input 83% is from the Susquehanna River, 14% from shoreline erosion, and 4% plankton derived whereas the output is 78% deposited, with 18% due to oxidation and 4% transferred to mid-Bay. The sediment budget for the Choptank estuary based on the work of Yabro et al. (1983) shows 80% of the input from shoreline erosion, 12% from upland sources, and 8% down estuary whereas, 81% of the output is deposited with 19% transferred down the estuary.

Between 1952 and 2001, a total of 64 stations in the Bay watershed recorded sediment at different years. The most stations operating at one time were 29 in 1975. Of the 25 USGS stations being used for measuring sediment yield between the years 1985-2000, four of the six highest yields were in the Conestoga River basin in Lancaster County, PA. The physiographic origin for this region is a Piedmont province which has the highest potential yields in the Bay watershed. Storm-related events of less than five days in duration can contribute as much as 30-40% of the sediment transport to the Bay (i.e., Hurricane Ivan in September 2004).

The underlying principle for sediment fingerprinting is that it can be characterized using a number of diagnostic physical and chemical properties. Comparison of these fingerprints with equivalent information for suspended sediment samples permits the relative importance of the potential sources (Walling et al. 1999). Watershed sources versus suspended sediment can be teased apart using the cosmogenic isotopes such as ^{137}Cs , ^{210}Pb , ^{13}C , and ^{15}N to measure total nitrogen, phosphorus, and carbon.

Statistical methods to determine appropriate fingerprints (Lanwehr USGS):

1. Determine that fluvial samples are bracketed by sources (construction, bank, cropland, forest)
2. Kruskal-Wallis H-Test, Student T-Test, and Mann-Whitney
3. Multivariate un-mixing model

Two major sources of sediment are uplands and stream corridor (beds and banks) which can be human caused (roads, construction, mining, deforestation, agriculture, grazing) and natural (mass wasting, forest fires, natural stream processes). Since the 1700's the trend for sedimentation has

been increasing since the mid-to-late 1900's with urbanization. 86-90% of eroded sediment in the southern Piedmont is still in storage (Costa 1975; Thimble 1975).

Fingerprinting studies are being conducted in three regions of the Bay watershed:

- Little Conestoga Creek (Millersville, PA) which is an example of a more urbanized watershed where cropland and construction sources dominated.
- Pocomoke River (Willards, MD) which is an example of a more agriculturally dominated watershed where croplands are the major source of sediments.
- Mattawoman Creek (Pomonkey, MD) which is a good example of more forested watershed where the sediment sources are dominated by croplands and construction.

Conclusions:

1. In the Bay watershed, the Piedmont is the highest sediment yielding region.
2. In the Piedmont, the Conestoga River basin is a "hot spot" for sediment loading (legacy sediments).
3. On eastern shore, ditches and cropland are most important but remaining cropland is still important.
4. In the Piedmont, bank erosion is also important.

Common Sense Approach to Sediment Mitigation:

- Identify important sediment watersheds (target areas)
- Identify major sources of sedimentation in these watersheds (upland versus channel)
- Mitigate the problem (channel soil conservation versus erosion control)
- Monitor (suspended sediment, channel morphology)

Scott Philips (USGS) summarized the USGS presentations and asked the members of the NSC for input and suggestions for the future. The goals of the presentations to NSC were synthesis of science about water quality to help better inform implementation of management actions and better understand your information needs. Topics presented included factors and trends affecting water quality, sources of nitrogen, phosphorus, and watershed properties, influence of groundwater, sediment sources and loads, and implications, future directions and needs.

Lag times and water quality response:

- Management actions – one to five years to implement
- Watershed – TN, TP, and sediment (days to decades)
- Estuary – seasonal

Implications:

1. Difficult to meet 2010 goals due to:
 - Slow reduction of non-point sources and population growth
 - River flow variability
 - Lag time
2. Prioritize management actions:
 - Maximum efficiency
 - Most rapid improvement
3. Point source reductions:
 - Providing the most rapid improvements

4. Non-point sources:
 - 80% nitrogen and phosphorus
 - 100% sediment
 - Varied times for improvements
5. Use residence time and delivery factors to improve implementation

USGS integrated science for effective conservation and restoration:

- Improved understanding – better target current management actions
- Forecast potential impacts – help assess population growth and climate variability to protect critical habitat and lands
- Assess ecosystem change – evaluate effectiveness of actions
- Synthesize findings and provide implications – adapt improved approaches for ecosystem conservation, restoration, and sustainability
- Enhance joint studies with partners

Restoration Issues:

- Remove Bay from impaired waters list
- Watershed management to improve stream corridors
- Water quantity and ecological needs

Revised USGS theme will combine nutrients, sediments, and contaminants

Objectives are:

1. Improve monitoring and simulation of, further define factors affecting water quality and quantity
2. Water quality function of habitat
3. Delivery and impact of water quality in the estuary
4. Synthesis and forecasting for improved targeting and assessment

Better define information needs:

How can the information be improved for implementation of the tributary strategies?

- Environmental settings
- Tools/models/applications for targeting
- Synthesis and dissemination

How can the information be improved to the evaluation of the tributary strategies?

- Results from non-tidal monitoring network
- Monitoring at more local scales

Judy Okay (USFS) presented the 2006-2010 riparian forest buffer framework document from the CBP Forestry Workgroup.

2003 expanded and strengthened riparian forest buffer goals:

Goal I: Restore at least 10,000 miles of riparian forest buffers by 2010.

Goal II: Ensure that at least 70% of stream banks and shorelines in the Bay watershed are buffered.

Goal III: Advance efforts to conserve existing forest buffers.

Stakeholder meetings in 2002 identified barriers that are still not all resolved today but have made progress in the following ways:

- Training events to Smith Island for forester field trips
- Support of MD publication, “Riparian Forest Buffer Design and Maintenance Guide”
- Fish & Wildlife foundation grants
- Grants to assess VA and MD shoreline buffers
- Survey of PA landowners (CREP stewardship)
- MD and VA grants to assess former CREP sites (5-10 years old)
- Promoting CBP riparian forest buffer tracking website (www.chesapeakebay.net/rfb)

Other influences on past barriers, has been the 2007 Farm Bill, VA riparian tax cut, VA land conservation commitment, coordination with CBP partners, and riparian specialist at CBPO.

Identified barriers for the 2006-2010 riparian framework addresses:

- Technical assistance crisis
- Need for new incentives (new approaches for landowner interest)
- High cost of planting buffers
- Easements don't appeal to landowners
- Not enough resources (money and staff)
- Non-favorable tax policies
- Lack of monitoring existing projects
- Better education and outreach needed
- Need for assessing returns received from forest buffers
- Need to integrate forest buffers with other efforts
- Don't know rate of buffer loss
- Need more buffer conservation
- Total nutrient reduction benefits of forest buffers not known

Riparian forest buffer funding:

1. Promote funding for urban riparian restoration.
2. Compile list of innovative materials and time saving techniques to support riparian planting.
3. Partner with nurseries to supply suites of riparian species for citizen groups.
4. Act to return forest buffer ecosystem service costs to landowners with riparian forests.
5. Work with real estate agents to show property value increases for riparian forests on shorelines.

Riparian forest buffer technical service:

1. Include landscape contracting firms in riparian buffer trainings and technical exchanges.
2. Promote riparian certification for technical service providers.
3. Create on-line lists of sources for quality and dependable materials, and native plant nurseries.
4. Establish a forestry workgroup award for the most successful technical service provider in MD, PA, and VA annually.
5. Target master gardener groups as a source of technical service providers.

Riparian forest buffer outreach:

1. Review and expand buffer awards programs in MD, PA, and VA.
2. Enlist syndicated garden columnists to write a series of articles about shoreline forest buffers (radio opportunity as well).
3. Develop a stream forest buffer photo/poster contest similar to the Duck poster associated with waterfowl festivals.
4. Communicate with agricultural community through their established newsletters.

Riparian forest buffer conservation:

1. Facilitate the establishment of a riparian forest stewardship tax benefit that is not conjoined to an easement.
2. Investigate the possibilities of brokering land exchanges between riparian landowners and local, state, and federal agencies to exchange the use of land for the retention of a forested riparian buffer.
3. Promote the use of nutrient trading for riparian forest buffer ecological services, including carbon storage, as well as nitrogen, phosphorus, and sediment reductions.
4. Encourage targeting conservation of continuous lengths of forest buffers and extensive widths of forest buffers.

Riparian forest buffer accountability:

1. Track acres of private riparian forests conserved or protected in the Bay watershed annually.
2. Track stream restoration miles in the Bay watershed.
3. Build capacity and synergy with other CBP groups to best utilize funds, technology, and personnel.

Riparian forest buffer science:

1. Compile a list of critical research needs related to riparian forest buffers.
2. Reward the scientific community for outstanding findings in the study of riparian forest buffers.
3. Develop a topical, annotated portfolio of riparian research applicable to Bay goals.