Quantifying Ecosystem Services and Co-Benefits of Nutrient and Sediment Pollution Reducing BMPs

(BMPs & Bonus Benefits)

Recap from March 29, 2017

“Ecosystem Services”

Whatever the person using the term at the time wants it to mean

Foundational Principles/Assumptions

- Water quality is a critical target due to the Chesapeake Bay TMDL
- The Chesapeake Bay Agreement includes many other goals as well
- Other benefits may also come from trying to meet water quality goals
  - What is the service and BMPs we are talking about (identification)?
  - How can we count them (quantification)?
  - What is their value (valuation)?
  - Where are the practices, and where are the benefits (location specific? Local, regional, global? Headwaters vs. downstream?)
- Jobs/economic development are important
- Resources are limited (money, time, people, bandwith)

Critical factors to consider

- Benefits, values, costs are different things
- Timeframes are important (ecological vs. political, for example)
- Individual vs. local vs. societal vs. natural benefits can differ
- Valuation: dollars, risk avoidance, impacts/benefits, other?
- Economic value is different than marketing
- Scaleability is critical
- Tradeoffs may occur
- Location matters
- Certainty needs to be understood (transparency key)
- Direct vs. indirect benefits are critical
- We have a lot of different audiences
  - Communication and messaging is key (accessible language to community members to motivate, inspire for implementation). Tailor outputs to audience
- Avoided costs or risks may be helpful to convey

Potential questions for different audiences

- If I am a local decision maker having to implement BMPs, how can I get more benefits from implementing any given BMP, what are those benefits, what's the "value", and is it specific to a location? What are my "drivers" for making a decision?

- If I am a state responsible for meeting the Chesapeake Bay requirements, how can I help incentivize BMPs that will get me credit for the TMDL, and be interesting to local implementers to implement?

- If I am from the Chesapeake Bay Program, what can I give credit for, how do we incentivize more of these practices to get implemented (and faster), and how can we show the co-benefits in CAST/BayFAST/etc.?

- If I am a funder, how can I help implement projects that get the biggest bang for the buck, not only in terms of water quality, but whatever other attributes I find important?

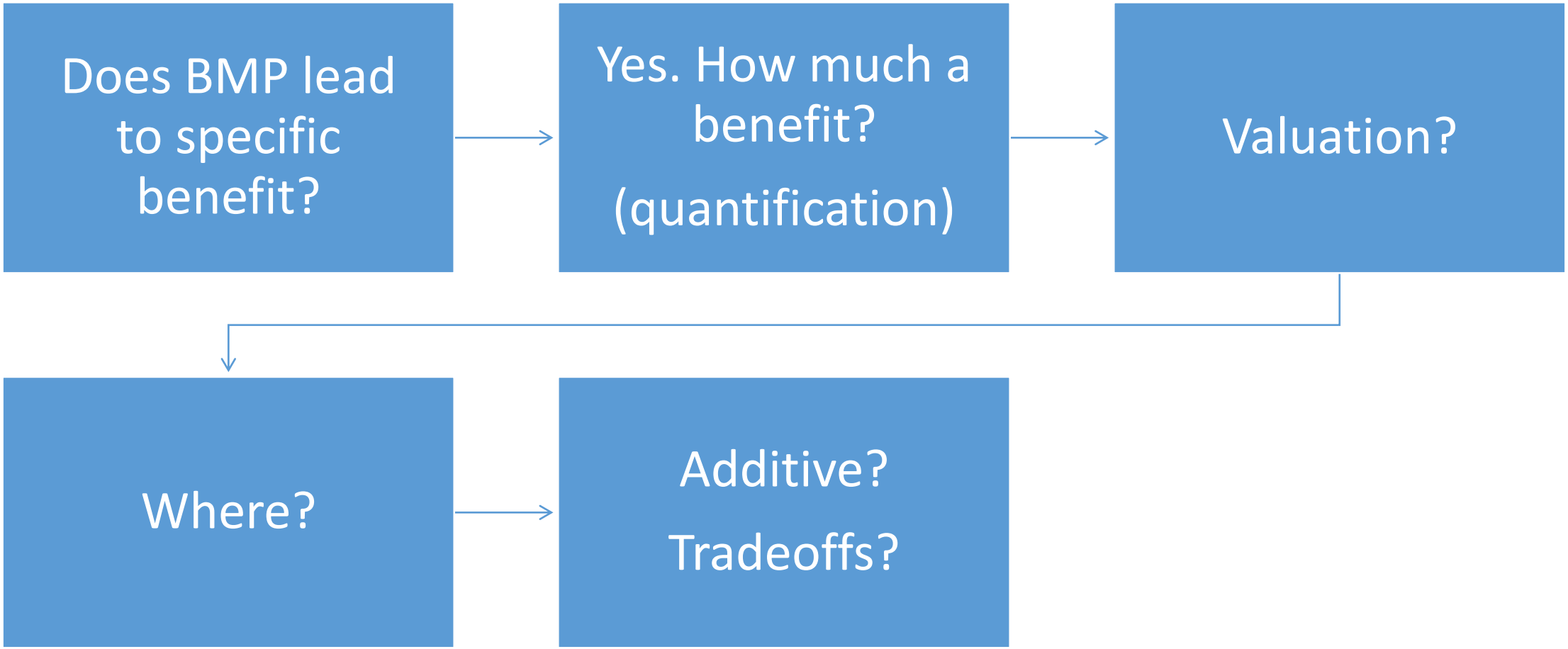
Potential entry points

- I want to implement a BMP. What are the other benefits from doing so?
  - (BMP + bonus benefits)

- I want to reduce flooding in my community. What practices might help reduce my problem, how can I leverage funding or meet another obligation, and what do I need to think about?
  - (Service→ BMP or suite of BMPs to meet need)
  - Are there benefits that practices that have multiple outputs and tradeoffs?

- Questions:
  - Does BMP reach a desired outcome?
  - How much does it help?
  - How do we monetize or value (what's the benefit/cost analysis, how can we capture quant/qual info, and how is the info reliable, transparent, credible, even if not high degree of certainty)

Working schematic
(who benefits, who pays, how much)



Service 1: Drinking water (water supply/regulation) (inflows)

- What is it?
  - Adequate quantity (not too much, not too little) (surface water, groundwater) (water supply/regulation)
  - Good quality (limited to no treatment)
  - Avoidance of issues: bacteria, sediment, nitrates, toxics
  - Human health

- BMPs that help provide this service?
  - Intact floodplains, forest conservation, decrease development
  - GW recharge & infiltration

- Can we quantify it? (What info do we have about it?)
  - NEXUS model
  - Easy to measure sediments, bacteria (cost to treat, cost avoidance)
  - Harder to quantify impact of toxics

- How do we value it?
  - Cost to treat or purify, cost avoidance due to loss of high value water (e.g., NYC watershed)
  - Impact to human health

- Location (practice, benefit)
  - Water may be taken from a location not controlled by the jurisdiction– mismatch between location of practice and benefit?

Service 2: wastewater/bacteria/water purification (outflows)

- What is it?
  - Treatment of sewage, combined sewage overflows (CSOs)
  - Local TMDLs→ bacteria listed (recreation impairments)
  - Impact of bacteria loads from non-point sources, including ag

- BMPs that help provide this service?
  - Created wetlands/sprayfields; buffers; urban BMPs to reduce runoff
  - Ag. BMPs to keep bacteria out of water

- Can we quantify it? (What info do we have about it?)
  - Quantity of treated wastewater
  - Cost of managing CSO issues in larger urban areas
  - Impact of bacteriological issues

- How do we value it?
  - Cost of water treatment (primary, secondary, tertiary, etc.)
  - Lot of info about this (easier to value, high knowledge of this area)
  - Water purification and treatment to protect human health
  - Water quality APEX or Bay Modeling as an indicator of water purity and waste water treatment

- Location (practice, benefit)
  - Mismatch between water reuse source and opportunities?

Service 3: Hazard mitigation (flooding)

- What is it?
  - Flooding, drought, storm (wind?)
  - Fire (increasing issue in CB region?)

- BMPs that help provide this service?
  - Wetlands, buffers, forests for rural areas
  - Urban stormwater BMPs (infiltration, etc)

- Can we quantify it?
  - # of storms, impact of damage, recurrence of flooding

- How do we value it, and what do we know?
  - Loss avoidance (what would be lost or damaged if benefits not protected? E.g., mangrove study)
  - Benefit from rural to urban, or urban to rural (opportunity for benefit trading)?
  - Flood insurance/ community rating system= lower insurance premiums
  - FEMA (and other) flood modeling to evaluate hazards such as flooding and erosion
  - Know more about coastal flooding and impacts, and less about riverine

- Location (practice, benefit)
  - Urban vs. rural
  - Coastal vs. riverine

Service 4: Recreation

- What is it?
  - Hunting, fishing, duck hunting
  - Kayaking, canoeing, swimming
  - Hiking, bird watching, viewing (linked to aesthetics)

- BMPs that help provide this service?
  - Intact forests
  - Living shoreline→ habitat→ birds → bird watchers (example causal chain?)

- Can we quantify it?
  - # of people doing any given activity
  - Avoidance of people getting sick due to contact illnesses (bacteria in water)

- How do we value it?
  - Some studies of recreational benefits for hunting, fishing, duck hunting, swimming, but geographically based and perhaps not detailed enough?
  - Risk avoidance (e.g., impact of endocrine disruptors on trout, avoid loss of resource)
  - Need more study in urban environments beyond “greenspace”.
  - Valuation around recreation
  - Literature that is available re: water quality and recreational fishing

- Location (practice, benefit)
  - Forests (rural), parks (urban)

Service 5: Spiritual, cultural, education

- What is it?
  - Spiritual, cultural, education, heritage, sense of place
  - Education→ economic development/jobs (different audiences, including youth)

- BMPs that help provide this service?
  - Intact forests, buffers, shorelines

- Can we quantify it?
  - # of people benefited by this? Educational programs/standards met (e.g., VA educational standards require understanding of CB)

- How do we value it?
  - Intrinsic non-use values (important, but hard to monetize)

- Location (practice, benefit)
  - Various

Service 6: Aesthetics

- What is it?
  - View (green infrastructure vs. grey), intact streams, clean water (sight, smell)
  - Impact of grey infrastructure (e.g., flood walls in Johnstown, PA seen as blight)
  - Connection to recreation

- BMPs that help provide this service?
  - Intact forests, buffers, shorelines

- Can we quantify it?
  - Property values higher b/c of parks, trees
  - Rural areas w/ pastoral views more valuable?

- How do we value it?
  - Impact on property values (e.g., study @ property w/in 300 m.: WQ/clarity/SAV)
  - Home values as an indication of improved ecological health, green space, tree canopies, and water quality
  - Benefit transfer values

- Location (practice, benefit)
  - Various

Service 7: Food production

- What is it?
  - Commercial harvest (e.g., commercial fishery, crab in Bay)
  - Pollinator habitat
  - Avoidance of impacts to food (e.g., toxic shellfish)
  - Healthy livestock (herd health)
  - Soil health → increase productivity

- BMPs that help provide this service?
  - Mix of cover crops
  - Pasture BMPs, fencing

- Can we quantify it?
  - Impact of avoided toxic algae
  - Cost of treatment to livestock
  - Increased productivity due to soil health

- How do we value it?
  - Studies about commercial fisheries in the Bay
  - Dairy herd health (CBC report on water quality/herd health)
  - Headwaters WQ benefit to fish (USDA study @ Lake Erie)

- Location (practice, benefit)
  - Various

Service 8: local air quality

- What is it?
  - Absorption of carbon, pollutants → climate regulation & sequestration
  - Impacts from ammonium
  - Human health support
- BMPs that help provide this service?
  - Vegetative BMPs
- Can we quantify it?
  - Human health impacts
  - i-Tree
- How do we value it?
  - Human health impacts
- Location (practice, benefit)
  - Regional impact, local benefit?

Service 9: Climate/carbon sequestration/global air quality

- What is it?
  - Absorption of carbon, pollutants
  - Management of storms, impacts
  - Trees to manage heat impacts, air quality
- BMPs that help provide this service?
  - Vegetative BMPs
  - Stormwater runoff BMPs
- Can we quantify it?
  - Quantity of trees, carbon uptake
  - Human health impacts
- How do we value it?
  - Social cost of carbon
  - Carbon modeling to evaluate climate regulation and carbon sequestration
- Location (practice, benefit)
  - Local practice, global benefit (mismatch?)

Service 10: Energy production and efficiency

- What is it?
  - Climate regulation and sequestration
  - Heat island effect

- BMPs that help provide this service?
  - Vegetative BMPs to provide shading
  - Biodigesters (address water quality while providing energy?)

- Can we quantify it?
  - Quantity of trees, decrease of energy bills
  - Human health impacts

- How do we value it?
  - Social cost of carbon

- Location (practice, benefit)
  - Local practice, local benefit if done correctly

Service 11: Health

- What is it?
  - Air quality: asthma, etc.
  - Heat:
  - Human health: strokes, etc.
  - animal health (management of animal facilities like dairy barns)
  - Avoidance of toxic algae blooms, toxics in fish, bacteria
  - Soil health→ productivity/food

- BMPs that help provide this service?
  - Vegetative (trees) (but unintended consequence of increasing allergies)
  - Urban BMPs

- Can we quantify it?
  - National level studies about air quality
  - Bay study about impact of CAFOs, ammonium

- How do we value it?
  - Avoided costs of health impacts

- Location (practice, benefit)
  - Local practice, regional benefit (mismatch?)

Service 12: Ecosystem sustainability (biodiversity, habitat)

- What is it?
  - Not sure
  - Biodiversity & habitat
  - Intrinsic habitat maintenance (e.g., shift in tidal wetlands)
  - Local waterways and stream applicability
  - Direct benefits to nature
  - [need a better way to communicate this]

- BMPs that help provide this service?
  - All of them?

- Can we quantify it?
  - Biodiversity indicators?
  - Fish habitat/surveys

- How do we value it?
  - Intrinsic value
  -

- Location (practice, benefit)
  - Local benefits of providing local habitat
  - Landscape level

What are we missing?

- BMPs
  - Cover crops→ soil health
  - No till/ conservation tillage (demonstration value, visibility, replication)
  - Oysters: filtering oyster reef (wild, aquaculture)
  - Future manure storage & nutrient management
  - Managed grazing, conversation to pasture
  - Land use & management BMPs (preserve good forest, land)
  - Reforestation (tree planting)

- Ecosystem services
  - Elimination of WQ drivers (legal requirements allow elimination)

<u>Additional needs:</u>

- Communicability
  - (community understanding, support, motivation to inspire drivers)
  - Clear language needed about natural benefits (values drive BMPs)
- Jobs/economic development

Implementation considerations?

- Need to figure out likely entities to study and/or implement
- Need to figure out how to include in CB toolbox (CAST, BayFast)
  - Can we create valuations that can be edited to run scenarios?
  - Website: will a specific BMP allow you to reach a particular benefit (yes/no)
- Assumptions about valuations, benefits transfer → challenging policy decisions (e.g., may address sediments, but not nutrients)
- Ease, time for implementation critical
  - Phasing, incremental approaches possible?
- Criteria for BMPs?
  - Ease of implementation?
  - Cost effectiveness?
  - Number of people impacted?

- Providing a number gives an implied sense of precision, but fails to convey the error, range, set of assumptions
  - (provide range when possible?)
  - Need to provide confidence in # (good enough?)
  - Something like environmental benefits index helpful even if not precise
- Figure out some scale to be able to add benefits together?