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

What do ecosystem services mean to you?

- Respond at PollEv.com/racheldixon602
- Text 318495 and your message to 37607
- Answers to this poll are anonymous
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, bandwidth)
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)

Does BMP lead to specific benefit?

Yes. How much a benefit? (quantification)

Valuation?

Where?

Additive? Tradeoffs?
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)

Additional needs:
• 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?