Ecosystem Services: Making Benefits More Tangible





Photo by Will Parson, Chesapeake Bay Program.

Defining Ecosystem Services

Ecosystem services is a term used to describe human benefits derived from ecosystems. At Department of Defense (DoD) installations, best management practices (BMPs) are most often implemented to reduce peak storm runoff and improve water quality. Yet, when BMPs mimic natural ecosystems, they may also provide an additive effect through beneficial ecosystem services. In these cases, the BMP provides multiple benefits.

Several Goals and Outcomes recognized in the 2014 Chesapeake Bay Watershed Agreement (Bay Agreement), such as the Stream Health Outcome, also represent ecosystem services provided by BMPs. For example, a restored stream will reduce the flow rate in the stream, prevent erosion of the stream bed and bank, and create new or improved habitat for plants and wildlife, which may then lead to increased removal of pollutants. In turn, the restored stream provides ecosystem services, which deliver multiple benefits that are also aligned with the Bay Agreement, including Abundant Life and Clean Water. In other cases, benefits may also translate to financial gain like revenue collected from access to recreation or natural areas. Other economic benefits do not necessarily have a defined monetary value, such as long-term property protection and risk avoidance provided by shoreline management. Economic benefits can also be tied to human health issues. The figure below illustrates the translation from a BMP (change in urban tree cover) to the result of an ecosystem service (reduction in air temperature) to a benefit (reduced heat-related illness), which can then be assigned a monetary value. A similar approach can be applied for many bonus benefits of ecosystem services provided by BMPs. In some cases, benefits may be derived from non-uses, such as the satisfaction of protecting species and ecosystems that enhance social well-being.

In December 2017, the Science and Technology Advisory Committee (STAC) released the recommendations from a workshop to identify the ecosystem services of greatest value in the Chesapeake Bay and discuss existing methods and future efforts to quantify their benefits. For DoD installations, understanding the benefits from ecosystem services can initiate discussion on the integration of these services into decisionmaking processes to select BMPs that meet not only meet regulatory and policy objectives, but other mission readiness requirements.¹



Ecosystem services can lead to beneficial outcomes like reduction in air temperature and heat-related illnesses.

Quantifying and Valuing Benefits from Ecosystem Services

As described above, the benefits of environmental restoration initiatives can be measured by establishing clear between cause and effect. After the action, the outcome of the resulting ecosystem services can be identified. Then, the outcome can be measured in terms of a benefit indicator. From the example above, the change in ambient air temperature due to increased tree cover can be measured and combined with epidemiological literature to estimate the resulting health effects. Additionally, from this data, a value could be determined based on those health benefits (i.e. lower health care costs, long term care).



High-Priority Ecosystem Services in the Chesapeake Bay

The STAC workshop identified the highest-priority benefits in the Chesapeake Bay as being ecosystem sustainability, hazard mitigation, recreation, drinking water improvement, and human health. The following provides examples of types of projects and the possible mechanism to determine the benefit or value.

Ecosystem sustainability. Includes long term water quality improvements, preservation or creation of habitat, and enhanced species diversity. Biotic stream surveys can be used to quantify benefits to stream health.

Hazard mitigation. Includes reduction in the risk of flood, drought, and fire. Practices that allow infiltration and retention of water, such as afforestation, forest buffers, and urban stormwater BMPs reduce the risk of inland and coastal flooding, from sea level rise and storm surge. Practices like buffers, wetlands, and living shorelines that increase the distance between floods and developed areas are also effective in hazard mitigation. Inland flooding benefits can be quantified by estimating the storage volume of water, especially in urban areas. For coastal flooding, estimates of wave reduction and changes in the probability or degree of flooding in local areas can be used to quantify the benefits

Recreation and aesthetics. Includes hunting, fishing, swimming, boating, nature watching, outdoor education, canoeing, and kayaking. The value of recreation can be estimated by visitors' willingness to pay or using recreation demand models. Further work is needed to relate how additional recreation opportunities are gained through the implementation of BMPs.

Drinking water. Includes water supply and regulation improvements related to water quantity and quality through the implementation of practices such as afforestation, forest conservation, forest buffers, urban infiltration practices, and nutrient management. Existing models to quantify and valuate benefits estimate sediment removal or infiltration volume compared against costs to treat drinking water.

Human health. Includes improved air quality, reduced ambient temperatures, and cleaner waters. Although human health is undeniably important, the broad benefits require different various and complex methods.



Ecosystem services provide numerous benefits, including sustainability, hazard mitigation, recreation, drinking water improvement, and human health. Photo by Chesapeake Bay Program.

Future Action

DoD installations can accomplish multiple goals by understanding the full range of benefits gained by BMPs and being able to quantify and value these benefits. The benefits of ecosystem services provided by BMPs support multiple DoD objectives, such as maintenance of public access sites, protection and enhancement of wildlife habitat, and protection of facilities from flooding.

- Build on the existing understanding of benefits provided by BMPs
- Develop a common framework for the valuation of ecosystem services that is clear and considers the scaled impact of benefits and information needed by implementers.

¹ McGee, B., M. Bryer, J. Davis-Martin, L. Wainger, R. Batiuk, J. Greiner, S. Newbold, K. Saunders, S. Phillips, R. Dixon. 2017. Quantifying Ecosystem Services and Co-Benefits of Nutrient and Sediment Pollutant Reducing BMPs. STAC Publication Number 17-008, Edgewater, MD. 39 p.

About this Publication

For more information on the benefits of BMPs, a recent report from the Chesapeake Bay Trust evaluated the effects of BMP implementation and CBP management strategies. The Chesapeake Bay Trust report can be found online at: http://www.chesapeake.org/stac/presentations/274_TetraTech_BMPImpactScoringReport_20170428.pdf.

The CBP Quick Reference Guide to BMPs with summary narratives and graphical descriptions of CBP-approved BMPs will also be released later in 2018. The report this fact sheet is based on is available online at: http://www.chesapeake.org/pubs/381_McGee2017.pdf.