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From ash pond to Riverside Wetlands: Making the business case for engineered natural technologies

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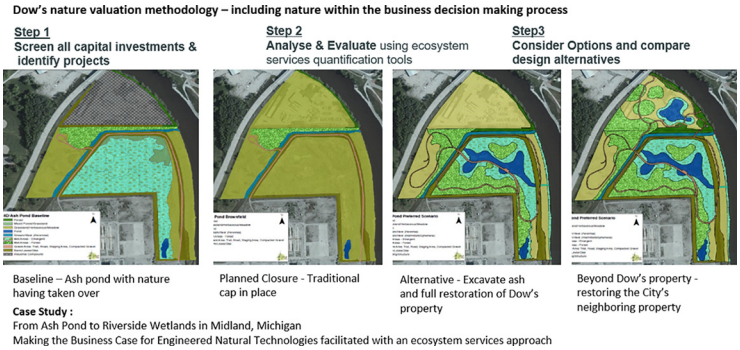
HIGHLIGHTS

- Presents a framework developed by The Dow Chemical Company (Dow) and The Nature Conservancy (TNC) for assessing ecosystem services and cost-benefit analyses.
- Dow used a specialized modeling tool, called the Ecosystem Services Identification and Inventory (ESII) tool, developed in conjunction with TNC and Ecometrix Solutions Group.
- Reviews the successful application of the framework to a restoration project, a 23-acre conservation wetland adjacent to Dow's Michigan Operations plant site along the Tittabawassee River.
- Ecosystem quantification facilitated the multi stakeholder engagement process (Dow, Michigan Department of Environmental Quality, and the City of Midland) in defining the optimal restoration plan.

GRAPHICAL ABSTRACT



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ABSTRACT

The 2015 announcement of The Dow Chemical Company's (Dow) Valuing Nature Goal, which aims to identify $1 billion in business value from projects that are better for nature, gives nature a spot at the project design table. To support this goal, Dow and The Nature Conservancy have extended their long-standing collaboration and are now working to develop a defensible methodology to support the implementation of the goal. This paper reviews the nature valuation methodology framework developed by the Collaboration in support of the goal. The nature valuation methodology is a three-step process that engages Dow project managers at multiple stages in the project design and capital allocation processes. The three-step process identifies projects that may have a large impact on nature and then promotes the use of ecosystem service tools, such as the Ecosystem Services Identification and Inventory Tool, to enhance the project design so that it better supports ecosystem health. After reviewing the nature valuation methodology, we describe the results from a case study of redevelopment plans for a 23-acre site adjacent to Dow's Michigan Operations plant along the Tittabawassee River.

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1. Introduction

As part of The Dow Chemical Company's ("Dow's") 2025 sustainability goals, nature now has a spot at the design table and a critical role in business decisions. Dow's Valuing Nature Goal aims to identify $1 billion in long-term value from projects necessary for its businesses that are also better for nature than traditional alternatives. The foundation for this goal was based on a study that investigated the use of the replacement cost methodology (RCM) for financial analysis and life cycle assessment (LCA) for environmental assessment comparing grey and green infrastructure solutions for wastewater treatment in Seadrift, Texas (DiMuro et al., 2014).

Green infrastructure is a concept originating in the US in the mid-1990s that highlights the importance of the natural environment in decisions about land-use planning. The President's Council on Sustainable Development initiated efforts to apply the concept of sustainable development in the US and identified green infrastructure as one of several key strategies for achieving sustainability in its May 1999 report. The report, titled "Towards a Sustainable America – Advancing Prosperity, Opportunity and a Healthy Environment for the 21st Century" defined green infrastructure as: "the network of open space, airsheds, woodlands, wildlife habitat, parks and other natural areas that provide many vital services that sustain life and enrich the quality of life" (The President's Council on Sustainable Development, 1999, p. 64).

However, the term does not have a widely recognized definition, and mostly refers to a network of protected sites, nature reserves, green spaces, and greenway linkages. The Nature Team decided this term did not fit its intentions, i.e., the creation of a network between Dow manufacturing sites and the local ecosystem may be totally absent and even undesirable in some cases from our objectives. Dow extended the concept of green infrastructure to include solutions that were applicable to manufacturing site challenges. The term Dow uses is "engineered natural technologies," referred to as ENT, and defined as "engineered systems that use or mimic natural processes and are able to deliver the same design functionality as a man-made solution while affording benefits to the triple bottom line." ENT may also involve protection and restoration of natural systems, but it is more expansive and includes much more than just protection and restoration of nature. The term "natural infrastructure" more accurately refers to projects that solely aim to protect and restore nature.

This paper reviews the framework and methodology developed by the Nature Team to engage Dow employees in defining, at the initial stages of projects and product design, opportunities for driving business value associated with the benefits obtained from nature's functions, commonly referred to as ecosystem services. We refer to this methodology as the nature valuation methodology. We then present results from applying this methodology to a specific case study of redevelopment plans for a 23-acre site adjacent to Dow's Michigan Operations plant along the Tittabawassee River, now dubbed the "Dow Riverside Wetlands".

2. Methods

The nature valuation methodology developed to support Dow's Valuing Nature Goal is a tiered process that incorporates the following three steps: i) an initial screen to identify potential opportunities at a very early stage of a project; ii) a subsequent analysis to identify and evaluate potential natural enhancement and engineered natural technology alternatives. This analysis may use a specialized modeling tool owned by The Nature Conservancy (the Conservancy), called the Ecosystem Services Identification and Inventory Tool (ESII Tool) developed in conjunction with Dow and EcoMetrix Solutions Group (ESG) and iii) a final step that considers and compares the financial and natural capital returns associated with the various alternatives. Fig. 1 depicts the nature valuation methodology.

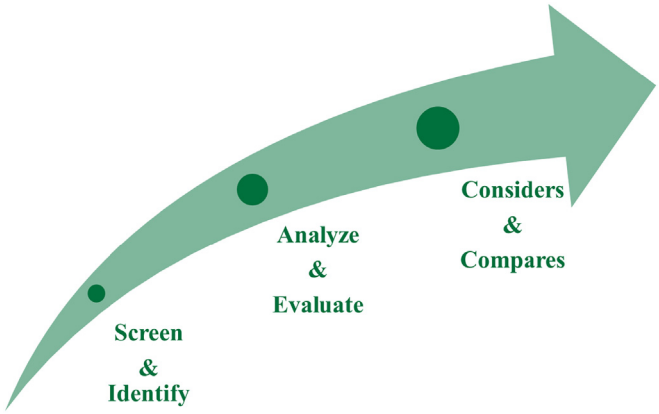

Fig. 1. Three steps of the nature valuation methodology.

The nature valuation methodology is administered and supported by the Nature Team, which consists of employees from both Dow and the Conservancy. The Nature Team reports to Dow's Valuing Nature Goal leaders and executive sponsors and supports the advancement of the Valuing Nature Goal across the company. Within Dow, the Nature Team consists of a project manager and engineers within the Global Environmental Technology Center and Engineering Solutions Group. Within the Conservancy, the Nature Team consists of members from the Corporate Engagement team as well as The Center for Sustainability Science.

The aim of the nature valuation methodology is to provide a framework through which Dow employees, who are typically not well versed in ecology and conservation science, can obtain additional information about the environmental impacts of their proposed processes, strategies, and decisions. By incorporating this information into project design, Dow employees will be able to make better decisions about project design related to environmental impacts. It will also build awareness of the value and benefits of nature across Dow sites and beyond.

The entire nature valuation methodology is structured around a definition of nature that highlights the provisioning of ecosystem services that directly address the large environmental challenges most directly connected to Dow's business operations. Ecosystem services refer to the tangible benefits that humans (and businesses) obtain from ecosystems, which the Millenium Ecosystem Assessment defines as "a dynamic complex of plant, animal, and microorganism communities and the nonliving environment interacting as a functional unit" (Millenium Ecosystem Assessment, 2005, p. v). The nature valuation methodology focuses on the provisioning of three specific ecosystem services: (i) clean water; (ii) clean air; and (iii) healthy soil.

While these three ecosystem services are important, the overall functioning of the local ecosystem is a product of a complex system that includes "inputs, outputs, cycling of materials and energy, and the interactions of organisms" (Christensen et al., 1996, p. 666). To account for the overall functioning of the local environment, the nature valuation methodology also incorporates easy to collect metrics around biodiversity.

In what follows, we detail each of the three nature valuation steps shown in Fig. 1.

2.1. Screen and identify

First, a project goes through an initial five-question screen to identify the potential avenues for environmental impact (e.g., through consumption, emissions, or built footprint) as well as potential opportunities for improving the performance of ecosystem services (e.g., through incorporating natural infrastructure into the project design). Project managers at Dow complete this initial screen during

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