THE ESII (ECOSYSTEM SERVICES IDENTIFICATION & INVENTORY) TOOL

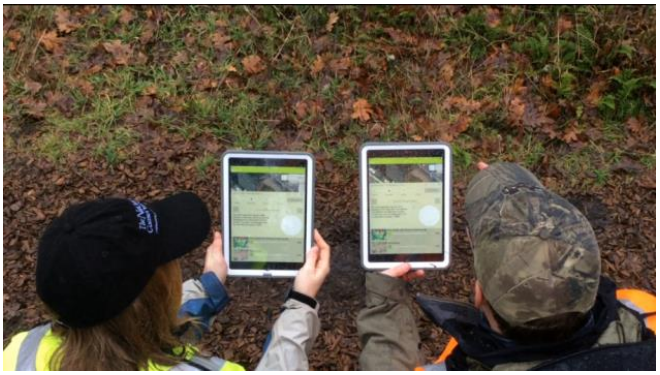
THE BUSINESS OPPORTUNITY

A growing number of organizations and institutions around the world recognize that the natural systems on which we depend are at risk. Fortunately, these ecosystems can be made more resilient—investment in their protection and restoration can produce well-documented positive social, ecological and economic outcomes.

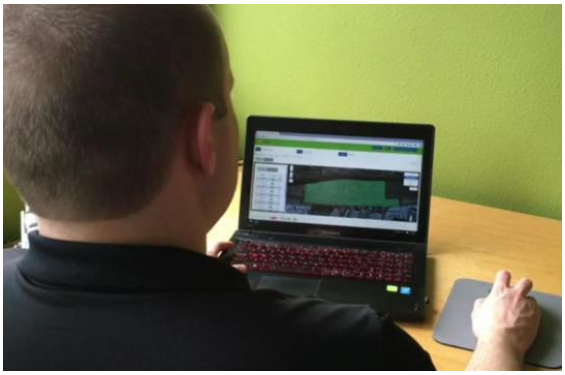
Businesses also benefit from resilient natural systems. From mitigating physical and regulatory risks to discovering new markets and investment opportunities, building resilience in natural capital through nature-based solutions can yield significant upside for corporate decision makers who recognize that their operations and supply chains depend on robust, healthy ecosystems. There is an opportunity today for the private sector to provide solutions to help make our planet and society more sustainable.

THE ESII TOOL

The ESII Tool (pronounced "easy"), was developed in collaboration by The Dow Chemical Company, The Nature Conservancy, and EcoMetrix Solutions Group, and is owned by the Conservancy. ESII is a free assessment tool that provides information that can lead to better business decisions and better conservation outcomes. It fills an important gap between simple tools built upon limited scientific information and complex tools that require expert users. Designed for business managers, engineers, and ecologists alike, the tool can be used in the early stages of decision making to identify benefits provided by natural assets so that their value can be incorporated into operational and planning decisions. The ESII Tool can be used in site planning, impact assessments, cost/benefit analyses, or to compare alternatives. Outputs from the tool can be used directly in financial analyses or engineering models.



ESII Field App



ESII Project Workspace

The tool consists of the iOS-based Field App, used to collect ecological information on site, and the web-based Project Workspace, where projects are set up, data is reviewed, and outputs are generated.

HOW THE ESII TOOL WORKS

(1) A project is identified and (2) set up in the Project Workspace; (3) ecological information is collected at the site using the Field App; (4) this information is synced with the Project Workspace, where ecological models process the results; and (5) outputs can be downloaded and used for different purposes.

1 2 3 4 5

MODELING APPROACH AND STRUCTURE

The ESII Tool models and estimates the performance of eight ecosystem services (shown with additional sub-services):

- Aesthetics (visual screening and sound reduction)
- Air quality control (nitrogen and particulates)
- Climate regulation (carbon uptake and air temperature regulation)
- Erosion control (and mass wasting)
- Flood mitigation
- Water provisioning
- Water quality control (nitrogen, temperature, and sediment removal)
- Water quantity control

These models are built in Bayesian Belief Networks (BBNs), which provide an effective modeling mechanism for ecological systems and natural resource management, situations in which uncertainty and incomplete information are common (Fig. 1). The BBN structure in which the models are housed tracks the uncertainty associated with the ecological models within the ESII Tool, as well as the uncertainty associated with the relative level of expertise of the data collector. The outputs are reported with a standard deviation value, which enables the user to make an informed decision about the reliability of the outputs.

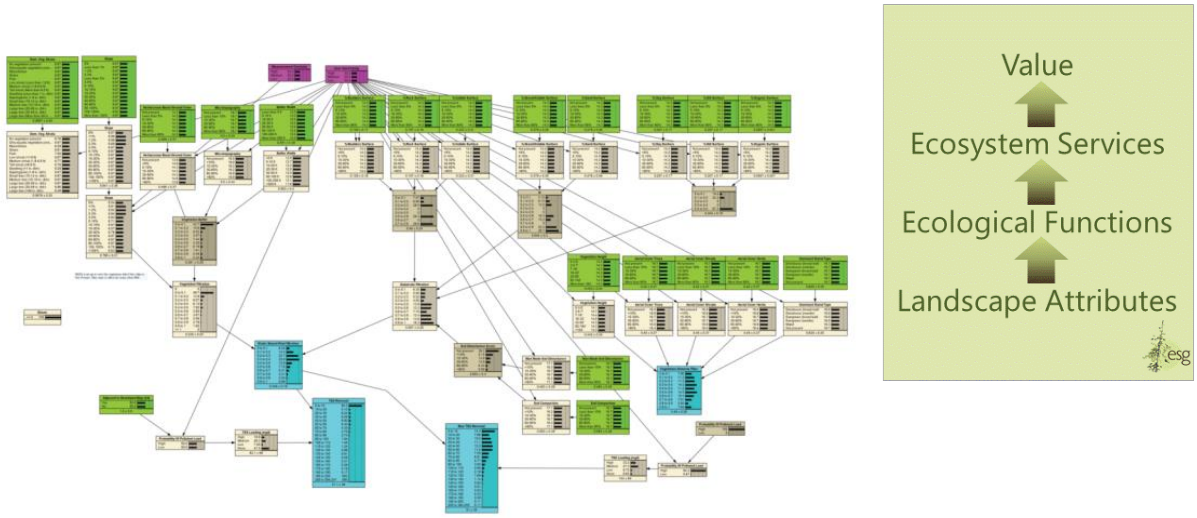


Figure 1. Bayesian Belief Networks (BBNs) are used to model ecological functions and services. The structure on the left shows a BBN that is organized according to the standard ecosystem services cascade model on the right. Landscape attributes collected for a given area determine the likely level of ecological functions, which in turn produce ecosystem services.

Ecological information collected at the site is processed by 22 ecological function models (such as the model shown in figure 1) that provide the first tier of analysis. The results of this analysis are combined with corresponding regional information, such as the rainfall level for a 25-year storm event and the average growing season, to drive the second tier analysis using the ecosystem service models listed above.

OUTPUTS FROM THE TOOL

The analyses described above provide planning-level estimates of the ecosystem services produced on the site. The results are provided in two metrics: a common metric of percent performance, which is a measure of the performance of an area, ecosystem service, or function relative to its maximum potential; and a service-specific metric of absolute performance in biophysical units such as gallons per minute or pounds per year. These so-called “engineering units” include:

- Air NOx removal (lbs/year)
- Air PM removal (lbs/year)
- BTU reduction shade (BTU/sf/hr)
- BTU reduction shade (BTU/hr)
- Max water quality TSS removal (mg/l)
- Water quality TSS removal (mg/l)
- Max water quality NOx removal (mg/l)
- Water quality NOx removal (mg/l)
- Water provisioning (gallons/sf)
- Water provisioning (gallons)
- Water quantity runoff (inches of runoff across site)
- Water quantity runoff (gallons/min)

THE ESII TOOL IN ACTION: ENHANCING ECOSYSTEM SERVICES & REDUCING BUSINESS COSTS FOR A GREENBELT RESTORATION

The Challenge

Dow wanted to explore restoration options for a portion of greenbelt at its Midland, MI, facility that contains legacy site issues. The 37-acre parcel is located on the Tittabawassee River, adjacent to a park and brownfield site both owned by the City (Fig. 2). Dow's standard restoration practice would be to cap the site and plant grasses. However, Dow wanted to consider whether alternative ecological restoration options that restore habitats could reduce operating and maintenance costs and enhance benefits such as water quality and noise reduction for Dow and the surrounding community.

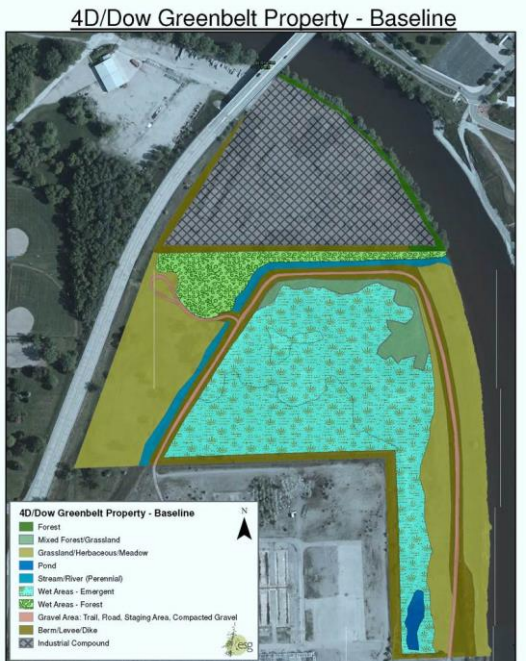


Figure 2. Baseline conditions at the Dow site and adjacent City-owned property (hatched area).

Using the ESII Tool

A team from Dow, The Nature Conservancy and EcoMetrix Solutions Group used the ESII Tool to evaluate three options for restoration of Dow's greenbelt site together with the City's brownfield site:

1. Standard brownfield restoration (SBR) on the greenbelt and brownfield site;
2. Ecological restoration (ER) on the greenbelt, and standard restoration on the brownfield site;
3. Ecological restoration of both the greenbelt and brownfield site (ER+).

Ecological data was collected for both sites and the ESII Tool was used to assess to each alternative design. Project managers, engineers, and experts in ecology and restoration used the ESII Tool outputs to further refine the designs to enhance specific ecosystem services: noise reduction, visual aesthetics, water filtration (removal of sediments), water nitrogen removal, and water quantity control.

Key Findings

The ESII Tool outputs showed:

- Standard brownfield restoration would result in lower performance for a majority of ecosystem services than under baseline or ecological restoration.
- Ecological restoration of both the greenbelt and brownfield site (ER+) would result in higher performance for all priority ecosystem services, except for water filtration, than under baseline or standard brownfield restoration (Table 1).

Ecosystem Services (engineering units of measure)	Baseline	Standard Brownfield	Ecological Restoration (ER) on Dow land only	Ecological Restoration on Dow and City land (ER+)
Water Quality NOx Removal (mg/l) (Area Weighted Average)	0.20	0.13	0.15	0.15
Max Water Quality NOx Removal (mg/l) (Area Weighted Average)	0.80	0.52	0.75	0.83
Water Quality TSS Removal (mg/l) (Area Weighted Average)	17	13	11	11
Max Water Quality TSS Removal (mg/l) (Area Weighted Average)	63	78	69	68
Water Quantity Runoff (Inches of runoff across site)	1.44	1.84	0.94	0.79
Water Quantity Runoff (gal)	1,900,000	2,400,000	1,240,000	1,000,000

Table 1. Ecosystem services in engineering units of measure for the priority ecosystem services under baseline conditions and each alternative restoration design.

In addition, the ER+ alternative would save Dow an estimated $2 million in operating & maintenance costs (mowing, fencing, etc.) over a ten-year time frame and provide numerous ecosystem services to the surrounding community (e.g., open space, improved aesthetics and storm water management) through the restoration of pre-settlement beech-maple forest, prairie, and wetlands. Dow plans to implement the ecological restoration design for its parcel and will share the results of this analysis with the city of Midland to support the city's planning efforts.

For more information visit www.esiitool.com or send an email to info@esiitool.com.