Measuring Corporate Impact on Ecosystems:
A Comprehensive Review of New Tools

Executive Summary

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To date, corporate environmental management has focused primarily on measuring and managing easily quantifiable things such as effluent, emissions or toxins. For many years, occupying the "cutting edge" of environmental best practice meant designing more and more refined metrics for increasingly narrower environmental media (e.g. air pollutants, water pollutants, etc.).

Within the past couple of years, however, key stakeholders and opinion leaders have expanded their focus to include consideration of new, often harder to measure issues, such as ecosystem services. The reason is simple. It is increasingly clear that many corporate environmental performance measures fail to capture impacts on broader ecological dynamics.

For companies, this emerging expansion of corporate environmental performance expectations could be significant.[1] Companies may face accountability not only for pollution prevention but also for impacts (positive or negative) to ecological structure and function in the areas where they operate or source. Such an evolving mandate could either be advanced via regulation or, more opaquely, become expected practice by investors, insurers, activists, employees or neighboring communities. Such an expanded focus would translate into a company needing to understand its dependencies and impacts (both positive and negative) on the flow of ecosystem services.

Although the exact timing remains unclear, there appears to be a paradigm shift afoot that moves us toward an ecosystem-level measurement, management and accountability. In the short term, this could lead to a tension for corporate leaders between the historical process-based risk mitigation strategies and emerging performance-based ecological approaches. The new management paradigm will require rigorous, standardized methodologies for identifying, measuring and potentially valuing ecosystem services. At present, such methodologies do not exist in a standardized, widely agreed-upon form.

However, building upon the strong scientific foundation of the 2005 Millennium Ecosystem Assessment, a new set of efforts is underway to create ecosystem services assessment and measurement tools. Several prominent academics, NGOs and public sector research entities have been focusing on both methodological and data gaps to enable the integration of ecosystem service concepts into planning and daily decision making. As these tools are developed, the questions for corporate decision makers become if and when to add new parameters to existing protocols, and how to integrate new components:

"If":

- Are market or operating conditions making ecosystem-level assessments critical to my company?
- How comfortable is senior management with piloting assessment tools when no clear standardized guidelines exist?
- What investments would my company make in data collection versus collaborating with NGO or academic partners on the ground?

"When":

- What are the trends projected for the market or operating conditions mentioned above?
- Can the case be made to management that positioning our company now will benefit it once the field crystallizes?

"How":

- **Gap Analysis for Processes:** A logical first step is to conduct a gap analysis of existing internal processes and reporting tools (e.g. Environmental Impact Assessment, Biodiversity Action Plan, etc.) to gauge their effectiveness in identifying ecosystem service-related issues. In some cases, existing

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1 For an introduction to ecosystem services as the concepts apply to business management, please see BSR's "The New Markets for Environmental Services: A Corporate Manager's Resource Guide to Trading in Air, Climate, Water and Biodiversity Assets."

reporting protocols, some driven by voluntary or regulatory government programs, may act as barriers to a shift toward ecosystem services-level management.

- **Gap Analysis for Expertise:** As with any cutting-edge domain, the necessary skills may not exist in-house, and early conversations with academic, NGO or consultant advisors will benefit eventual decision making.

- **Cultural Litmus Test:** It will be useful to gauge past success in measuring historically intangible values. If the company culture is not conducive, it may be worth prioritizing tools that place a value on ecosystem services, rather than those that are more qualitative or relative in their results.

- **Wish List of Tool Attributes:** Based upon findings from above, one can assemble a "wish list" of tool design attributes that would be most helpful to a company's decision-making circumstances.

- **Match Selected Tools to Existing Decision-Making Points:** Prospective users will need to clarify the "interface points" between tools and relevant business decision-making points.

- **Decide on Balance of In-House Versus Outsourced Work:** Corporate practitioners have pointed to the fact that major companies tend to trust models built in-house or at least with their own datasets. As such, prospective tool users will need to strike a balance between drawing on the deep expertise of external tool developers while maximizing in-house modeling capacity and know-how.

- **Use Tool as Shared Analytical Platform for Cross-Enterprise Dialogue:** One of the more intangible benefits of tool adoption will be the opportunity to discuss ecosystem services issues across the company. Through the data collection process, tool users will gain a better understanding of the day-to-day challenges in each business unit, and build relationships that can lead to better environmental decision making in the future.

For a newcomer, it is becoming difficult to sort through and select what tools to consider in more detail, particularly when considered in relation to other tools related to single environmental issues, such as water, greenhouse gases, persistent chemicals, etc. To address this, our report offers readers an overview of the emerging field of ecosystem services tools based upon our interviews, workshops and early experiences with leading tools. We cover the tools on the following page.

Description	Intended Users	Salient Features
Multi–Ecosystem Service Assessment Tools		
ARIES A computer model and decision-support infrastructure to assist decision makers and researchers by estimating and forecasting ecosystem services provision and their correspondent range of economic values in a specific area	■ Policymakers ■ NGOs ■ Consultants ■ Companies	■ Probabilistic, nondeterministic model designed for continual updating ■ Transparent, so users know information sources ■ User-friendly interface despite complexity of model ■ Builds on University of Vermont's Ecosystem Services Database, which contains spatially-explicit, peer-reviewed valuation data as well as methods of analysis, publications and project models ■ Will be pilot tested via Conservation International and Earth Economics
ESR A sequence of questions that helps managers develop strategies to manage risks and opportunities arising from a company's dependence on ecosystems	■ Corporate managers	■ Offers a methodical, logical sequence of guiding questions ■ Most advanced in terms of "road-testing" with companies ■ Plans to provide guidance on integration into existing Environmental Management Systems as well as valuation techniques
InVEST A decision-making aid to assess how distinct scenarios may lead to different ecosystem services and human-well-being-related outcomes in particular geographic areas	■ Government agencies ■ Farmers and individual landowners	■ Enables users to input their own site-specific data ■ Allows for expert opinion as data to address data gaps ■ Enables consideration of present and future tradeoffs from alternative resource management ■ User-friendly with few data requirements ■ Identifies where ecosystem service benefits originate
MIMES A multi-scale, integrated suite of models that assess the true value of ecosystem services, their linkages to human welfare, and how their function and value may change under various management scenarios	■ Scientists ■ Policymakers ■ Natural resource managers	■ Value can be denominated in monetary terms, land area or other parameters ■ Is already populated with reliable, publicly available data ■ Can be scaled for additional data input ■ Model is open source and has been successfully implemented
NVI An evaluation benchmark methodology for assessing biodiversity and ecosystem services-related risks and opportunities in the food, beverage and tobacco sectors	■ Corporate managers ■ Financial analysts	■ Promotes greater awareness within the finance sector of the links between biodiversity, ecosystem services and investment value, including the risks associated with mismanagement ■ Creates a company risk profile and offers case studies based on both publicly available information and direct corporate engagement
Biodiversity–Focused Tools Linked to Ecosystem Services		
BBOP A toolkit that assesses whether biodiversity offsets are appropriate and provides guidance on offset design	■ Corporate managers	■ Offers biological and socioeconomic indicators to show net gain or loss of biodiversity ■ Designed to eventually sync with Environmental Impact Assessments (EIAs) ■ Codesigned by corporate, government and conservation organizations
IBAT A screening tool to help companies incorporate biodiversity into their risk analysis, decision-making and planning processes	■ Corporate managers	■ Builds on locally collected scientific knowledge and data ■ Delivers a cost-effective product in a timely manner ■ Limited to biodiversity "hot spots" and protected areas ■ Designed to eventually inform Biodiversity Action Plans and EIAs

A. Similarities

A range of crosscutting characteristics emerged in this tool review, including:

1. Intent – All of the tools profiled on the preceding pages seek to enable improved decision making through inclusion of ecosystem services considerations.

2. Common Target Audience – All of the tools are intended to influence policymakers, with ARIES, InVEST and MIMES explicitly focused on this target audience. ESR, NVI, IBAT and BBOP have cast a wider net with an emphasis on corporate decision makers.

3. Nomenclature – Most of the tools use the Millennium Ecosystem Assessment set of ecosystem services and definitions. InVEST has narrowed the list to those services it deems as "proxies" for others in an effort to make the set of services more manageable.

4. Terrestrial Focus – None of the tools have fully developed marine/ocean models and few have marine ecosystems as a primary focus area. Marine systems are, however, on the list of future activities.

5. Scalable Data and Resource and Time Demands – ARIES, MIMES, InVEST and IBAT provide pre-loaded databases while ESR, BBOP and NVI require users to input their own data.

6. User Friendly – The tools are focused on ease of use, either through computer models (in beta versions of MIMES and IBAT, and in yet-to-be-developed software for ARIES and InVEST), or a series of tasks within an overall analytical approach (ESR, BBOP and NVI).

7. Credibility – The involvement of well-respected players in development of these tools is likely to result in higher levels of attention paid by policymakers and other target audiences.

8. Unclear Delivery Mechanisms – While ESR, IBAT, NVI and BBOP are (or will be) available in basic form via the Web, the model-based tools (InVEST, ARIES and MIMES) will require more sophisticated technological delivery. InVEST is working to insert the tool as a feature on ArcGIS.

9. Evolving Business and Training Models – All tool development teams intend to have free public access to at least a basic version of the tool, while MIMES, IBAT and InVEST are considering a paid subscription service for advanced users. All developers are considering ways to provide training to prospective users, rather than become involved in each application of a tool. Such training is also seen as a way to ensure continued quality of results.

10. Minimal Stakeholder Engagement Thus Far – While InVEST and ESR are designed to incorporate stakeholder input as a key source of data during tool use, only minimal stakeholder engagement has been undertaken in tool development across all seven tools. This is due to a combination of the scarce resources and budgets as well as preexisting silos in academic departments, NGOs and other sectors.

B. Distinctions

Despite some areas of resonance across tools, there are a number of key distinctions:

1. User Interfaces – which span from computer models through "workbook-like" Excel spreadsheets.

2. Types of Results – ranging from a list of priority ecosystems to consider through spatially-explicit maps showing changes under different land management scenarios

3. Data Demands – from high to low, spanning from do-it-yourself to detailed preloaded databases.

4. Ecological Detail – from high-level, coarse-grain assessments to fine-grain, map-based assessments

5. Valuation Emphasis – which can be further parsed in terms of value within an existing environmental market (such as within the European Union Emissions Trading Scheme) or value within a broader societal context that draws upon ecological economics theory/concepts.

There remains a considerable amount of work to advance both the business case for, and business adoption of, ecosystem services tools. In order to avoid duplication of effort — or proliferation and dilution of impact — we suggest that tool developers launch a coordinating initiative to stay informed of each other's learnings and design a detailed navigational device to help match user needs to tool offerings.

Corporate Users' Needs	Tool Developers' Needs	Public Sector Needs
a. A detailed navigational device to help users find the most suitable tool, or complementary set of tools, for a given decision-making context, including product design and manufacturing	a. A detailed list of corporate decision-making junctures in which an ecosystem services assessment tool could be applied	a. An R&D agenda within regulatory agencies that advances ecosystem services-based management
b. Clarifications on the geographical gaps or data-related biases within the tools	b. A comprehensive list of corporate reporting requirements (internal and external) that could be integrated with ecosystem service assessment tools	b. A prospectus to share with legislators for funding of trans-disciplinary, public-private centers of excellence in regions of high ecosystem service importance
c. Research on the best way to factor ecosystem services issues into capital decision making	c. Input on how to structure and deliver a navigational device to tools	c. An indication from industry and tool developer groups as to how government can constructively engage with their efforts
d. Pilot testing of tools in a public-private partnership within a data-rich region to "kick the tires" for senior management	d. A candid assessment of how seriously, and in what way, industry wants to help advance ecosystem services-based management	

It is our hope that this synthesis paper will be a first step in moving toward greater clarity on the details related to each of the emerging ecosystem services-related tools, as well as how to most effectively use the tools within the business setting.