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The Natural Capital Accounting Opportunity: Let's Really Do the Numbers

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The nation's economic accounts provide objective, regular, and standardized information routinely relied on by public and private decision-makers. But they are incomplete. The United States and many other nations currently do not account for the natural capital—such as the wildlife, forests, grasslands, soils, and water bodies—on which all other economic activity rests. By creating formal natural capital accounts (NCA) and ecosystem goods and service (EGSA) accounts, governments and businesses could better understand the past, peer into the future, innovate, conserve, and plan for environmental shocks. They would standardize, regularly repeat, and aggregate diverse natural resource, environmental, and social and economic data and could thereby play a significant role in advancing the science of coupled biophysical and social systems.

One morning each quarter, thousands of business people, journalists, and financial analysts sit at their computers waiting to devour the US government's latest gross domestic product (GDP) estimates. On the basis of what they see, markets move, politicians react, and businesses change their plans. Why all the rapt attention? Because our national accounts—which also include data on employment, trade, and other widely used tallies—serve as a trusted truth-telling machine. They give decision-makers crucial insight into what is happening nationally but also provide coherent information on developments in specific regions, industries, and supply chains. Accounts generate consistent time series data across decades. Those data allow us to document what has happened in the past and evaluate the effect of policies, shocks, and demographic change on our economy.

But the existing system provides an incomplete accounting of economic activity and the factors that generate wealth and well-being. One example, and our concern, is that the United States and many other nations currently do not account for the natural capital—such as the forests, grasslands, animals, soils, and water bodies—on which all economic activity rests (Jorgenson et al. 2006; Helm 2015). So, although car manufacturers can routinely track the steel, glass, rubber, and electronics they use to build cars, it is much harder for them to track their dependence on natural capital such as clean, available water or mineral resources. Farmers have access to agricultural production and trade data but no routine access to data on the supply of irrigation water or pollinator populations they need to grow their crops. The tourism and recreation sectors cannot track the state of natural resources—such as forests, beaches, parks, or water quantity and quality—that are essential to their financial survival. And voters have no accounting yardstick to use when evaluating whether politicians are following through on promises to protect the nation's natural resource wealth in the way we hold them accountable for jobs and trade numbers.

Creating formal natural capital (NCA) and ecosystem goods and service (EGSA) accounts for the United States would allow diverse environmental, social, and economic data to be transformed into standardized, regularly repeated, and useful reports—much like the eagerly awaited GDP and jobs reports (United Nations et al. 2014). Robust NCAs would help better guide hundreds of billions of investment dollars every year in a way that makes our country more innovative, richer, and healthier. They would enable managers to evaluate their investments and policies. And they would make it easier to identify trends that help businesses and governments understand the past, peer into the future, innovate, and plan for shocks (IBRD 2017).

Accounts can take a wide variety of forms. For example, economists have developed a prototype account that links industrial sources of air pollution to health and environmental damages generated by those industries (Muller et al. 2011).

The goal of our community is to extend this kind of prototype to more broadly capture natural systems' relationships to economic activity. For example, we are not only interested in how economic activity damages environmental and health conditions but also in how natural resources positively contribute—as valuable inputs—to economic activity. We also aspire to extend accounting to capture relationships between a broader array of natural resource types (e.g., water availability and quality, species and land cover features), ecological relationships that affect the production of valuable

ecological outputs (e.g., how the extent and condition of ecosystems affect the benefits they provide), and sectors dependent on them (e.g., recreation, housing, public infrastructure, agriculture).

To clarify the path forward, it is useful to distinguish between the two types of environmental accounts. NCAs are designed to track broad classes of natural assets at national or regional scales. For example, natural capital land accounts distinguish between undisturbed wilderness areas, natural but potentially disturbed or harvested lands, such as national forests, agricultural lands, semideveloped lands, and urban areas. Natural capital water accounts track river, stream, lake, estuary, and groundwater resources. Natural capital species accounts track populations within broad avian, aquatic, and terrestrial taxonomic classes.

Ecosystem goods and services are derived from those natural capital stocks. Goods and services are the ecological resources and qualities actually used, consumed, or enjoyed by specific households, communities, and businesses. Examples of ecosystem goods and services are harvestable timber stands, water quantities suitable for navigation and recreation, water of suitable quality for irrigation and recreation, storm surge risk reductions provided by wetlands, and the presence of recreationally desirable species populations. Both types of account—and their integration—are necessary to a full accounting of ecological production and value.

For decades, many economists and national accountants have viewed the desirability of such accounts as beyond debate (NRC 1999). To economists, natural capital, goods, and services are significant and self-evident factors of production—just like steel, energy, and crops—and therefore worthy of their own analysis and tracking.

Is such accounting realistic for the United States? We think it is. However, a range of issues require more concerted effort on the part of natural scientists, economists, and accountants to achieve this goal. One barrier to the creation of NCAs and EGSAs has been the need for extensive collaboration among a trio of disciplines—natural science, economics, and accounting—that see the world in different ways. Another long-standing hurdle has been a lack of strong coordination between the government and the private sector, which must collaborate on data collection and setting accounting standards, both complicated tasks.

We see reasons for optimism regarding these issues. First, collaboration on environmental matters between the public and private sectors has generally improved. One example is the Natural Capital Coalition, a consortium of 250 businesses, financial firms, nongovernmental organizations, and universities, which generates, shares, and evaluates information on natural capital (Natural Capital Coalition 2016). Second, natural and social scientists have already coalesced around the concepts of natural capital and ecosystem services as areas for collaboration. Finally, the UN's *System of Environmental-Economic Accounting* has produced internationally agreed-on environmental accounting definitions, rules, and classifications aligned with economic standards for national accounts (United Nations et al. 2014). Accountants have been drawn in via specific international NCA initiatives—for example, in Australia, Canada, and the United Kingdom (Sustainable Prosperity 2014, Australian Bureau of Statistics 2017, United Kingdom Office for National Statistics 2017).

What about data requirements, since NCAs and EGSAs require repeated, standardized, and integrated natural resource measures at a national scale? Fortunately, much of the needed data already exist. The practical challenge is coordination among the numerous federal and state agencies that collect the data. Here, we already observe (and are ourselves an example of) accounting collaborations among the Department of Commerce (the Bureau of Economic Analysis and NOAA), the Department of the Interior (US Geological Survey, the Bureau of Land Management, and the National Park Service), the Department of Agriculture (the Forest Service), the State Department, the Environmental Protection Agency (EPA), and NASA.

Another positive development is the explosion in new types of biophysical Earth observations data. Satellite, various *in situ*, and mobile sensor technologies are producing more accurate, regular, detailed, standardized, and affordable information on natural capital conditions.

The development of EGSAs will be more difficult than the development of NCAs. The goal of EGSAs is to track the production of biophysical features and conditions that are used, consumed, or otherwise benefit specific kinds of social beneficiary (e.g., farmers, industrial facilities, homeowners, aquatic recreators, commercial fishermen). Again, the analogy is to conventional product accounts, which track inputs produced and outputs consumed by various sectors of the economy. One challenge is that many, if not most, ecosystem goods and services are *nonmarket* commodities, which lack the prices (or exchange values) used to weight goods and services in economic accounts.

While environmental economists have developed a range of methods to derive the value of nonmarket commodities several features of that literature complicate its application to accounting. First, valuation studies are typically not standardized in terms of the environmental commodity that is valued, which makes it difficult to derive generalizable values based on meta-analytic techniques. Second, the literature demonstrates an often-significant dependence of values on the commodity's geographic location. This means that values measured in one location should not be assumed to hold in other locations. Third, many studies do not derive or report the exchange values of nonmarket goods but, rather, are focused on welfare measures of value, which are not the same.

EGSAs also will require broader analysis and quantification of ecological

production relationships by natural scientists. For conventional market goods, standardized types of inputs (raw materials, labor, energy) are tracked and related to outputs produced. Because inputs are purchased, paper trails allow their amounts and prices to be tracked and reported relatively easily. For nonmarket ecological goods and services, standardized input categories and prices do not yet exist.

Another challenge for EGSAs relates to the spatial nature of ecological production, a challenge unique to environmental accounting. In effect, natural science will be required to depict supply chains and environmental damage functions that are spatially idiosyncratic. Ecosystem services research is well aware of and has been able to quantify some of these spatial production relationships (Semmens et al. 2011).

Beyond these research needs, several concrete steps would help support the faster development of trusted, high-quality information for use in NCAs and EGSAs. We suggest that national statistical agencies, such as the US Bureau of Economic Analysis (BEA) and the Census Bureau, expand data-sharing collaborations with other federal agencies, particularly with those responsible for natural resource and environmental data, such as the Department of the Interior and the EPA. Federal agencies should identify existing federal data applicable to NCAs and EGSAs and should coordinate environmental data collection with the BEA, the Department of Labor, the Office of Management and Budget, and other statistical agencies. We also recommend that a state government lead the way to act as a test bed for state, regional, and national data coordination. Finally, the business community—including the finance and investor community—should collaborate and support this effort by identifying the natural resource and environmental accounting information most important to informed business planning. This information could include, for example, data on water flows and data pertinent to analysis of exposures to environmental risk.

These are all steps on the path to a systematic, coordinated information system that delivers regular information on the status, economic uses, and financial implications of our nation's natural and environmental resources. With these requests fulfilled, we can imagine a different kind of morning in the year 2025. This time, thousands of business people, journalists, and financial analysts wait to devour numbers that more fully reflect the status of our linked economic and environmental performance. And the decisions they make on the basis of those numbers will create an even more prosperous, healthy, and innovative nation.

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