

# Natural Capital: Valuing Nature in Policy and Finance

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## INTRODUCTION

Since the Industrial Revolution, growth in human numbers and economic activity has dramatically transformed our planet. While driving great improvements in human well-being, these forms of growth also deeply eroded **natural capital**, embodied in Earth's **ecosystems**: lands, waters, and their biodiversity. Rapid economic development has lifted hundreds of millions of people out of poverty and raised the standard of living and life expectancies of many more, yet the costs of this success cast a long shadow over future well-being (Mandle *et al.* 2019).

The world's ecosystems are capital assets. If properly managed, they yield a flow of vital **ecosystem services**, including the production of goods (such as seafood and timber), life-support processes (such as crop pollination and water purification), and life-fulfilling conditions (such as beauty and serenity). Moreover, ecosystems have value in terms of the preservation of options (such as genetic diversity for future use) and resilience (the capacity of people to live and develop with change, Folke 2006). Relative to the modern institutions supporting informed management of other forms of capital – built capital, human capital, social capital, and financial capital – the institutions supporting informed management of natural capital are in their infancy. Ecosystems have been poorly understood, scarcely monitored, and (in many cases) undergoing rapid degradation and depletion (Daily *et al.* 2000).

This is beginning to change. More and more people recognize that economic security hinges critically on the health of ecosystems and reliable flows of their services to society. Still, often the importance of ecosystems and their services is widely appreciated only upon their loss (Daily *et al.* 2000). Today, synergistic risks and shocks are emerging and propagating through degradation and destruction of primary forests, wetlands, coral reefs, grasslands, soils, and other ecosystems, along with their waters and wealth of life forms. Severe inland and coastal flooding, extreme heat, catastrophic wildfire, rivers running dry, sand and dust storms, and unhealthy air and water threaten security in food, water, climate, energy, health, and livelihoods. Taken together, these harms constitute a very sobering counterbalance to economic growth (Mandle *et al.* 2019; Dasgupta 2024).

Because services from natural capital are generally public goods and not reflected in market prices, their loss is often unrecognized – or at least unchecked – until the consequences become too large to ignore. A famous case is in China, where massive deforestation in the upper reaches of the Yangtze River led to devastating flooding in 1998. In 1999, China launched what is still the largest payment for ecosystem services program in the world – the Sloping Land Conversion Program, involving 120 million households (Liu *et al.*, 2018). Now, to realize the dual goals of

ecosystem benefits and poverty alleviation, China has one of the highest reforestation rates in the world.

Society's most vulnerable members often have the greatest immediate dependence on nature, and the lowest ability to cope with or substitute for loss of ecosystem service benefits (Gadgil & Guha 1992; MA 2005). In the face of natural disasters and extreme climate events, poor and marginalized individuals and communities are often most likely to end up in harm's way (Hamann et al. 2018). This makes considerations of inclusivity and equity imperative in the context of ecosystem services (Vira 2015).

Ultimately, however, all people depend on nature for their well-being. Although wealth provides a buffer, no one is secure from the escalating risks of continuing on our current path of depleting natural capital.

Framing ecosystems as natural capital assets is a way of incorporating human impacts and dependence on nature into mainstream economic decision-making. It is a way of making biodiversity – despite its mystery and complexity – tangible and actionable. Including the value of ecosystem services in the decisions of governments, corporations, traditional cultures, and individuals is designed to broaden our understanding of the roles nature plays in our lives and the reasons – including the moral imperative – for conserving it (e.g., Daily & Ellison, 2002; Ehrenfeld, 1988; Leopold, 1949; Norton, 1987; Rolston 2000).

## RECENT PROGRESS

As the consequences of natural capital losses have grown more pronounced, their impact has sparked innovations over the past two decades by visionary leaders around the world. In 2000, the terms “natural capital” and “ecosystem services” were scarcely known. There are now over 500 payment for ecosystem services programs around the globe with annual payments exceeding US\$36 billion (Salzman et al. 2018). Such programs have become a central component of China's nationwide human development, environmental protection, and national security strategy (Ouyang et al. 2016, Bryan et al. 2018). These innovations initially took the form of custom, one-off mechanisms. Over time, they are developing into more complete, tested tools and strategies on which policy-makers can draw with confidence.

Mainstreaming biodiversity and ecosystem services into everyday decisions requires systematic methods for characterizing their value in currencies relevant to policy and finance. Unlike the case for traditional economic goods, where market prices can be used as a proxy for value, other methods are needed to quantify most of nature's values (MA 2005; NRC 2005; Mäler et al. 2008). Mainstreaming also requires policy or institutional reforms so that decision-makers - policy leaders, managers, investors, and individuals - realize the full costs and benefits of their actions. Providing incentives for stewardship of natural capital, or dis-incentives for its depreciation, are needed to link short-term, individual interests with long-term societal wellbeing (Guerry et al. 2015).

Three major advances are propelling progress. First, the Millennium Ecosystem Assessment and then the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), visionary steps in global science and science-policy processes, have provided the first comprehensive assessments of the status and trends of the world's biodiversity and major ecosystem services. The MA's key finding - that two-thirds of our planet's ecosystem services were declining - captured the attention of world leaders (MA 2005). IPBES' modeling of future scenarios, harmonized with climate projections, provided a clear sense of what is at stake and options for shifting to livable futures (Chaplin-Kramer et al. 2019; IPBES 2019).

Second, the data and science linking ecosystem conditions and processes to human wellbeing are rapidly improving. Technological advances in remote sensing, computation, data science, and artificial intelligence are creating treasure troves of real-time data and enhanced ability to extract relevant information. Ecological science has become adept at mapping ecosystem services and the flow of benefits to people, from local to global scales (e.g., Guerry et al. 2015, Liu et al. 2015, Ouyang et al. 2016, Chaplin-Kramer et al., 2019). Economic valuation methods have been applied to estimate the monetary value of benefits and their distribution to different segments of society (e.g., NRC 2005, Bateman et al. 2013). In addition, methods from other fields are now being applied to gain better understanding of the psychological, social, and cultural importance of biodiversity and ecosystem services, and of shared values that people hold around nature (e.g., Pascual et al. 2017).

Third, experiments in payments for ecosystem services, in ecosystem-based management, investments in forest and other habitat restoration, and in regional- and national-level policy, planning, and finance are proliferating. They quantify tradeoffs among ecosystem values for different sectors and segments of society to better inform decisions, bring diverse actors together, and help stakeholders appreciate the perspectives of others in their choices (e.g., Pascual et al. 2017).

Together, these advances illuminate systematic natural capital approaches that offer enormous promise and proven success in a wide range of contexts (e.g., Arkema et al. 2015, Ouyang et al. 2016, Beatty et al. 2018, Mandley et al. 2019).

## NATURAL CAPITAL APPROACHES

**Natural capital approaches** have as their endpoint a change in policy and/or investment decisions that incorporate the values of biodiversity and ecosystems to people, aiming to improve human wellbeing by securing nature. They meld diverse disciplines, perspectives, and methodologies, and can include both

- 1) *assessments of natural capital stocks and ecosystem service flows*; and
- 2) *natural capital accounts*.

*Assessments* involve quantifying, mapping, and valuing stocks of natural capital and flows of ecosystem services to people. Assessments use a variety of metrics (qualitative and quantitative; biophysical, health, socioeconomic, and/or monetary). Natural capital assessments characterize

change and trade-offs of natural capital stocks and their flows through ecosystem services to benefit people, under present and future scenarios.

Many cases exist of natural capital assessments being used to guide policy, planning, investments, and management practices to meet integrated sustainable development aims (e.g. Arkema et al., 2015; Ouyang et al., 2016; Ozment et al., 2021; Ruckelshaus et al., 2015; Mandle et al., 2019). Best practice entails a close and iterative engagement process with scientists, communities, policy-makers, and other decision-makers, including key stakeholders (Guerry et al., 2015; Mandle et al., 2019; Rosenthal et al., 2014; Ruckelshaus et al. 2022).

**Natural capital accounts** track current stocks of natural capital and their change over time using a standardized, replicable approach for designing and evaluating policies and investments. In March 2020, the UN Statistical Division approved the SEEA Ecosystem Accounting Framework (SEEA EA), which allows quantification of ecosystems' (1) extent and (2) condition plus the (3) supply and use of ecosystem services in both physical and (4) monetary terms, and finally (5) asset accounts that quantify the net present value of stocks of ecosystem assets (United Nations, 2021a, 2021b).

The UN Statistical Division approval included **Gross Ecosystem Product (GEP)** (Ouyang et al., 2020) as a metric for the SEEA EA, laying out encouraging pathways to policy applications that are already being demonstrated in China.

National natural capital accounts can *in principle* identify, measure, and value natural capital from the public sector perspective, but these exercises take considerable time, and they have too rarely influenced decision making and policy instruments (GEF, 2021). Recent reviews of natural capital accounting indicate encouraging progress in systematically calculating accounts, but implementation of natural capital accounting information in decisions still greatly lags that of natural capital assessments (Bagstad et al., 2021; Ruijs et al., 2019). For this reason, in synthesizing evidence of natural capital approaches influencing policy and investment decisions, we focus here primarily on natural capital assessments, but include natural capital accounts where they have been used to inform decisions.

The most productive demonstrations of natural capital approaches use a co-development approach, whereby key actors and stakeholders are engaged with technical experts from the beginning of an engagement, helping to articulate a vision for the future that is based on local political, social, and cultural values and priorities (Burdon & Potts, 2020; Mandle et al., 2019; Posner et al., 2016; Ruckelshaus et al., 2015). The integrated science-policy team also co-produces knowledge and a mutual understanding of how their system works in both a biophysical and socio-political sense, through iterative improvement of input data and other information, modeling results, and interpretation for greatest local and policy/financial relevance. Ideally, local technical and policy experts are involved throughout the process, helping shape the approach and building local capacity for future iterations, communications, and an adaptive management cycle of learning and ongoing innovation.

If co-developed with decision makers and stakeholders, natural capital assessments and accounts can underpin decision-making for an inclusive and sustainable future, integrating people and life-support systems into economic development. Integrated, cross-sectoral engagement

encompassing multiple ecosystem services in natural capital approaches are the gold standard (e.g., *Belize case study and others herein*), as they can highlight ‘win-wins’ and key tradeoffs among locations, sectors, and societal goals. Multi-sectoral natural capital approaches provide the best opportunities to inform the design and implementation of integrated management as well as greater policy coherence and efficiency of investments in biodiversity and ecosystems (Farrell et al., 2021; Mandle et al., 2019). Nevertheless, incorporating natural capital information in single sector decision processes involving one or more sectors can be a promising way to grow understanding of nature’s value and affect specific sector outcomes. Single sector entry points can be a practical way to address a particular policy problem or problem, before taking on more systemic, structural reforms.

Natural capital approaches—as defined above to include both natural capital assessments and accounts—are being implemented in a number of geographies and decision contexts around the world. The innovations are inspiring, as governments, NGOs, civil society and other stakeholders realize how the benefits from biodiversity and ecosystems underpin many sectoral and sustainable development aims. Such approaches are useful in designing and evaluating policies and investments to improve biodiversity, food, water and hazard security, fisheries and forestry production systems, water quality, tourism and other nature-based livelihoods, and cultural and spiritual wellbeing. A recent review of nearly 20 years of implementing natural capital approaches articulates a diversity of enabling conditions, lessons learned, and best practices to secure durable outcomes (Ruckelshaus et al. 2022).

In the set of example demonstrations presented below, key elements of natural capital and the flows of its benefits to people are quantified and mapped, and policy or investment strategies are changing based on the information.

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**Box. Belize – Natural capital assessment underpins innovative coastal zone management planning and investment**

Belize’s natural capital assets provide a strong basis for its socio-economic prosperity, but not without intentional policies and finance. The country is home to extensive mangrove forests, seagrass meadows, and the second largest barrier coral reef system in the world (Arkema et al. 2015). These ecosystems in Belize and elsewhere are increasingly threatened by both development and climate change, putting provision of ecosystem benefits to people at risk.

Nature-based tourism plays a significant role in Belize's economy, drawing roughly 800,000 tourists annually, and employing 25% of the country's workforce (Arkema & Ruckelshaus, 2017). Thirty-five percent of the country's population lives in the coastal zone, relying upon the reefs and mangroves for protection from sea level rise and storms. As development and climate pressures in the coastal zone increase, demands on the government are growing to regularly assess and account for the values provided by their ecosystems, to ensure that they continue to support lives, livelihoods and the post-COVID recovery of the Belizean economy.

Three key processes underway in Belize are informed by a foundational natural capital assessment the country has been regularly updating and using to drive policy and investment for nearly 10 years. The assessment quantifies and spatially maps mangroves, coral reefs and seagrass meadows, and the flows of benefits from those habitats in biophysical and monetary terms. The assessment is spurring an explosion of policy and finance innovations aimed at securing the country's prosperity through protection and restoration of nature in ways that boost human development.

First, Belize's Coastal Zone Act of 2000 (the 'Act') recognizes the value of multi-sectoral, integrated spatial planning to guide policy and investment for more sustainable use of the coastal zone (Belize Coastal Zone Management Act, 2000). Such laws in and of themselves do not necessarily lead to transformation of ocean management. The Belizean government's coordinating authority for coastal use across all Ministries— the Coastal Zone Management Authority and Institute (CZMAI)—has played a key role in designing a co-development process with local communities, multiple government ministries (including Agriculture, Fisheries, Forestry, the Environment and Sustainable Development; Tourism; Blue Economy; and Natural Resources, Petroleum and Mining), local NGOs and technical experts, to create an Integrated Coastal Zone Management Plan that was formally approved by the government in 2016. The Plan creates zones of allowable human activities (e.g., shipping, fishing, tourist activities, oil and gas extraction, infrastructure development, etc.), and identifies areas for protection and restoration of coastal habitats to secure climate-resilient benefits to people. CZMAI and partners monitor human activities, policy and finance interventions, changes in habitats and intended biophysical and socio-economic outcomes. CZMAI is required by law to oversee ongoing implementation and adaptation of the Plan, which is currently being updated in response to monitoring and review.

Second, thanks to insights from their ongoing natural capital assessment and planning process, Belize included for the first time blue carbon targets in their more ambitious Nationally Determined Contributions (NDC) to reduce GHG emissions for the Glasgow summit. New priority mangrove targets in the NDC are based on the national natural capital assessment, using calculated values of co-benefits from tourism, lobster fisheries and avoided damages from sea-level rise and storms. The resulting NDC for blue carbon includes an additional 12,000 ha of mangrove protection and 4,000 ha of mangrove restoration for the country, respectively, by 2030, with specifics on which locations will provide the greatest returns (Arkema et al. 2023). The ongoing work by the government and civil society to monitor, report and verify the carbon, tourism, fishery and coastal protection benefits will continue to inform adaptation of the country's climate resilience strategy.

Third and finally, the government of Belize is a pioneer in attracting public and private sector investments in nature-positive development as a result of investor confidence in the country's integrated coastal plan. Belize's regular monitoring of policy and investment outcomes from nature protection and restoration has attracted loans from Inter-American Development Bank, a novel blue bond, and a more far-reaching 'project finance for permanence' effort to bring long-term investments for human prosperity through stewarding nature. Through its Blue Bond, Belize was able to reduce its national debt by 12% and obtain long-term financing for ocean conservation. The country currently is establishing a monitoring, reporting and verification (MRV)

process that will track key biophysical, monetary and social performance indicators (KPIs) related to these targeted policy and finance interventions.



### **Box. Uruguay – Pioneering a sovereign sustainability linked bond**

A novel sovereign sustainability linked bond (SLB) in Uruguay links its sovereign bond financing strategy to its climate and nature targets as established under the Paris Agreement. An SLB Framework describes Uruguay's sustainable strategic priorities and sets out goals with respect to two Key Performance Indicators (KPIs), related to the intensity of Greenhouse Gas (GHG) emissions and the area of native forests in the country. The targets are based on quantitative goals set for 2025 as established in the Nationally Determined Contribution (NDC) under the Paris Agreement.

Uruguay's Ministry of Economy and Finance issued the SLB in 2022 with a novel step-down mechanism that is activated if it reaches certain environmental targets. The bond issue attracted 188 investors from Europe, Asia, the United States, and Latin America, of whom 21% are new holders of Uruguayan debt. Total demand for the bond was \$3.96 billion, greatly exceeding the \$1.5 billion Uruguay targeted. The yield spread between this bond and the US Treasury bond used as a benchmark is 170 basis points. If the bond's goals are met, its spread will narrow by up to 30 basis points.

Interventions under the SLB include actions taken on private lands—notably for beef production—where public policies coupled with strong public and private investments in technological changes have reduced the intensity of methane emissions per product unit while increasing productivity (Uruguay 2022.) Other activities are focused on maintenance of native forests. In June 2024, the Uruguayan government published its second [Annual Report of the Sovereign Sustainability-Linked Bond](#). By 2022, the GHG-oriented KPI achieved a 46% reduction in the intensity of aggregate gross GHG emissions per real GDP unit, relative to 1990 levels. KPI-2 reached a 100% maintenance of native forest area by 2021, relative to the baseline, due primarily to natural regeneration and restoration.

Governance and the monitoring, reporting and verification (MRV) process for the SLB is an economy-wide effort, jointly undertaken by the Ministry of Economy and Finance, the Ministry of Environment, the Ministry of Industry, Energy and Mining, and the Ministry of Agriculture, Livestock and Fisheries, with the support of the Ministry of Foreign Relations. Strong inter-ministerial coordination and governance arrangements are critical to ensure the timely and reliable provision of data and for communicating clearly and regularly on progress in achieving sustainability targets.

All eyes are on Uruguay's innovative SLB as an example of how to tie international financing for nature to a country's climate and economic prosperity goals. The country is transparently

monitoring progress towards its KPIs, allowing learning to adapt its own interventions, and also providing much-needed confidence for investors curious about establishing similar bonds around the world.



### **Box. Chile – A New Natural Capital Committee**

Chile increasingly is recognizing the critical role of natural capital in securing its resources, enhancing resilience, and sustaining economic productivity. The water code was reformed to prioritize source watershed conservation and integrated management; a new forest protection and restoration law uses zoned areas and economic incentives to encourage regeneration and protection of native ecosystems; and a new National Biodiversity Strategy incorporates economic instruments for conservation.

In 2023, the President of Chile established the Chilean Natural Capital Committee (NCC). The cross-government NCC is comprised of the Chilean Central Bank and ministries of Finance, Economy and the Environment. The Committee advises on matters related to the valuation, protection, and restoration of Chile's natural capital, promoting the integration of nature and biodiversity into the country's sustainable development strategy and economic policies. The international community is closely watching Chile's innovative whole-of-government approach to securing its natural capital assets for its economic, cultural and social prosperity.

One of the NCC's earliest efforts is linking natural capital assessment and accounting information to policy and investment design and implementation. The NCC has commissioned a pilot to conduct integrated watershed management at the local scale—co-created with indigenous, ranching, and other sectoral stakeholders. This work will further the strategic integration of efforts across sectors, and be scaled to a national scale, with the aim to maximize the value and benefits of Chile's natural wealth in diverse public policies and investments.



### **Box. China's Mainstreaming of Natural Capital into Economic Decisions**

Decades of double-digit economic growth made China the fastest expanding major economy in history while saddling the country with likely the most severe environmental crisis faced by any civilization. China's ecosystems are quite fragile due to severe land degradation, erosion, desertification, water scarcity, and pollution. Ecological threats continue to grow in scale and severity across China because of rapid urbanization and increased destruction of natural capital. Political recognition of China's crisis started in 1998 when deforestation and erosion caused massive flooding along the Yangtze River. The floods killed thousands of people, made over 13.2 million people homeless, and cost US\$36 billion in property damage (Ouyang et al. 2019).



To address this crisis, the Chinese government has created a new pathway forward toward what's termed an Ecological Civilization. This is not simply a philosophical vision of social development. Policymakers are constructing a new governance strategy, with major reforms across all economic and social sectors to revitalize natural capital (Ouyang et al. 2019).

New policy mechanisms to improve environmental governance are being advanced on a strong scientific foundation. This is illustrated in the development of a first National Ecosystem Assessment, spanning a wide range of ecosystems, services, and spatial scales, over the past decade (2000-2010). This important effort showcases state-of-the-art technical approaches relevant to other nations undertaking such assessments (Ouyang et al., 2016). In evaluating ecosystem service provision over 2000-2010, a key finding was that all examined services improved – thanks to China's conservation policies – apart from habitat provision for biodiversity. This prompted the central government to launch creation of a new, greatly expanded and more comprehensive national park system.

Concurrently, China has established a new network of “national ecosystem function zones” spanning 51% of the country for regeneration of natural capital. NEFZs are a way of zoning land, so as to focus conservation and restoration in places with highest return-on-investment for public benefit, to halt and reverse degradation of vital ecosystems and their services. The zoning is also meant to focus high-impact human activities in places where they will do least damage (Ouyang et al. 2019). Finally, they are a way of focusing poverty alleviation efforts in places where the stakes are highest, both for local residents and for beneficiaries of ecosystem services living farther away. Implementing EFCAs involves compensation mechanisms, whereby regional beneficiaries – of, for example, water purification and sand storm control in Beijing – invest in the transformation to more sustainable livelihoods and durable improvements in well-being among the landholders producing the services (e.g., Zheng et al., 2013).

In March 2014, the State Council called for development of a new metric for tracking natural capital – gross ecosystem product (GEP), the total value of ecosystem goods and services. The aim of GEP accounting is to help reveal the contribution of ecosystems to the economy and human well-being; illuminate the ecological connections among regions (e.g., between suppliers and consumers of flood control and other ecosystem services); inform appropriate compensation from consumers to suppliers; serve as a performance metric for government officials; and otherwise inform government policy and investment (Ouyang et al. 2020; Zheng et al. 2023). GEP has now been approved by the UN Statistical Division for international use in line with SEAA-EA, and is being deployed in many contexts across China (Zheng et al. 2023) and tested by a suite of other countries.

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