

MAINSTREAMING THE VALUES OF NATURE FOR PEOPLE INTO DECISION-MAKING

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*There are three pathways to wisdom.
The first is through contemplation, and that is the noblest.
The second is through imitation, and that is the easiest.
The third is through experience, and that is the bitterest.*
(Confucius)

Summary

Promising efforts to harmonize people and Nature are being launched worldwide, in ways that reflect this ancient Confucian proverb. They are designed to help individuals and institutions see the values of Nature; to replicate models of success for integrating Nature's values into decision-making; and, thereby, to avoid devastating consequences of their loss.

Lights of innovation shine in many regions of the world. In terms of pace and scale of policy innovation, China and Latin America stand out especially. Key challenges remain, however, in fundamental understanding of the vital connections between people and Nature, and the institutions and governance systems through which these intimate, yet often hidden, connections can be made visible priorities for investment. Rapid advances are urgently needed to move from the initial awakening underway today to a deep and lasting societal transformation.

Introduction

The idea that ecosystems are vital assets, utterly essential to human well-being, has emerged over the past decade in many arenas that formerly seemed far from matters of ecology and conservation. Globally, "natural capital" now appears in society's thinking about agriculture, water, energy, health, fisheries, forestry, mining, cities, and the infrastructure supporting these and other vast sectors – and it is increasingly evident in the ways communities, corporations, governments and other institutions frame decisions (e.g., Ouyang, 2007; MEP and CAS 2008; Li *et al.* 2005; Rapidel *et al.* 2011; Goldstein *et al.* 2012; Levy *et al.* 2012; Kieseker *et al.* 2010). In particular, there is growing demand for rigorous approaches that integrate the values of natural capital into major development decisions, in order to reverse the degradation of Earth's life-support systems and enhance human well-being.

Now marks a key moment for the communities working on this grand challenge: to reflect on what has been learned in this creative, yet highly dispersed, phase of innovation. Our planet remains besieged by massive degradation and growing threats of catastrophic change. How can we help channel and magnify the energy of this movement into large-scale, durable, improved outcomes for Nature and people?

A wide range of strategies is needed. After a bit of background, I will focus my brief remarks on meeting and cultivating further demand from decision-makers now. This requires rapid advances on four science and policy frontiers: (i) *fundamental understanding* of ecosystem services, human well-being, and their inter-linkages, in biophysical, economic, social, institutional, and governance domains; (ii) *practical, science-based tools*, tailored initially for use in highest-leverage decision contexts; (iii) *pilot demonstrations* that implement new understanding and tools in such key decisions contexts, in diverse sites and sectors globally; and (iv) *engaging leaders* and building capacity to achieve transformative and lasting change. I will offer two real-world examples of how these advances are unfolding, in China and Latin America.

Background

Living Natural Capital

The world's ecosystems – Earth's lands, waters, and the myriad types of organisms embedded within them – are vital to human well-being. If properly managed, they yield a stream of “ecosystem services” that sustain and fulfill human life. These include the *production of goods*, such as seafood, crops, timber, and many industrial products, a familiar part of the economy. Second, the services also include less visible *life-support processes*, such as water purification, pest control, crop pollination, flood control, and climate stabilization. Third, they include *life-fulfilling conditions*, such as the beauty and uniqueness in Nature that spawn deep cultural attachments to place, and that improve aspects of cognitive function and mental well-being. Fourth, ecosystem services include the *preservation of options and resilience*, such as those embodied in biological diversity, from genetic to ecosystem levels.

Framing ecosystems as natural capital assets is a way of incorporating human impacts and dependence on Nature into mainstream decision-making. This framing shows starkly that – relative to other forms of capital (physical, financial, human, and social forms) – living natural capital is poorly understood, scarcely monitored, and in many important cases undergoing rapid degradation and depletion (Daily *et al.* 2000; Balmford *et al.* 2002; NRC 2005; Dasgupta 2010). Often its importance is widely appreciated only upon loss, such as in the wake of Hurricane Katrina or the Asian Tsunami.

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., Leopold 1949, Norton 1987, Ehrenfeld 1988, Rolston 2000, Daily and Ellison 2002).

The Opportunity Today

Mainstreaming ecosystem services into everyday decisions requires a systematic method for characterizing their value – and the change in value resulting from alternative choices. Unlike the tools we apply to measure the value of traditional economic goods and services, which are already well established and integrated into decisions, we have no existing accounting tools to measure the value of ecosystem services (MA 2005; NRC 2005; Mäler *et al.* 2008).

What makes it possible to change this today? Four big advances of the last decade offer promise that mainstreaming ecosystem service values into decisions is within reach. First, the Millennium Ecosystem Assessment represented a visionary step in global science – it was the first comprehensive assessment of the status and trends of the world’s major ecosystem services. The key finding of this assessment was that two-thirds of the world’s ecosystem services were declining, a finding that captured the attention of world leaders (MA 2005).

Second, the science of ecosystem functions and processes has made huge advances, so that we can now model (albeit with uncertainty) the impacts of management decisions and activities across landscapes and seascapes on a wide variety of ecosystem processes. Ecological science has also become adept at spatially explicit modeling, essential for mapping ecosystem services and their distribution to people (e.g., Chan *et al.* 2006, Rokityanskiy *et al.* 2007, Bennett *et al.* 2009, Nelson *et al.* 2009, Harrison *et al.* 2010, Goldstein *et al.* 2012, Guerry *et al.* 2012).

Third, economic valuation methods have been applied to the spatial provision of ecosystem services to estimate the monetary value of benefits and the distribution of those benefits to different segments of society (NRC 2005, Naidoo and Ricketts, 2006). In addition, qualitative and quantitative methods from other fields are now being applied to gain better understanding of the psychological, social, and cultural importance of ecosystem services, and of shared values that people hold together (e.g., MA 2005, US EPA 2009, Bratman *et al.* 2012, Daniel *et al.* 2012, Kenter *et al.* 2014).

Lastly, experiments in payments for ecosystem services, in ecosystem-based management, and in regional planning give us the empirical data to evaluate

approaches to valuing ecosystem services and incorporating values into decision-making (Barbier *et al.* 2008, Pagiola and Platais 2007, Zheng *et al.* 2013). There is a growing recognition that bundling together of ecosystem services and explicit attention to tradeoffs will both better inform decisions, and help diverse stakeholders to appreciate the perspectives of others (e.g., Bennett *et al.* 2009, Boody *et al.* 2005, Egoh *et al.* 2008, Goldstein *et al.* 2012).

Meeting the Challenge

A Strategy

Our urgent challenge today is to build on this foundation and move from ideas to action on a broad scale (Carpenter *et al.* 2006, Carpenter *et al.* 2009, Daily *et al.* 2009). Doing so requires understanding the production of services from landscapes and seascapes, together with their biodiversity and human activities; quantifying service flows, from producers to beneficiaries, across space, social class, economic sector, and time; understanding the decision-making processes of individuals, communities, governments and corporations; integrating research with institutional design and policy implementation; and crafting policy interventions with flexibility for learning and improvement. Each of these alone is a complex and difficult task; together they form a daunting but critically important agenda for collaboration.

The Natural Capital Project is an international partnership, founded in 2006 to help meet this challenge (www.naturalcapitalproject.org). The vision of the Natural Capital Project (NatCap) is a world in which people, governments, and corporations recognize the values of Nature in supporting human well-being, and routinely incorporate them into decision-making. NatCap is focused on making three major advances that together will help transform how businesses, governments, and individuals interact with nature:

(1) Co-developing interdisciplinary knowledge, packaged into practical tools and approaches, for incorporating natural capital values into planning and policy. This work is accelerating in institutions globally, and involves greatly increasing the interaction between researchers and real-world generators and users of knowledge.

In support of such work, NatCap has developed InVEST, a family of tools for Integrated Valuation of Ecosystem Services and Tradeoffs. InVEST helps decision makers visualize the impacts of potential policies – identifying tradeoffs and compatibilities between environmental, economic, and social benefits – by modeling and mapping the delivery, distribution and economic value of ecosystem services under alternative scenarios (Tallis *et al.* 2011). These models were co-devel-

oped with hundreds of researchers, practitioners, and managers. INVEST is free and designed for data available anywhere, globally.

(2) Implementing new knowledge, tools, and approaches in major resource decisions, in replicable and scalable models of success. Working with many partners around the world, NatCap is integrating the diverse values of natural capital into major resource policies and decisions.

These demonstrations range from: informing the infrastructure development strategies of major development banks and private investors, in transportation and other key sectors; to working with indigenous communities in strategic planning of land and ocean resource uses to balance conflicting values; to working with corporations to quantify the risks and opportunities of alternative resource development options. The approach has informed decisions relating to spatial planning, payment for ecosystem services, climate adaptation planning, impact assessments for permitting and mitigation, corporate risk mitigation, marine and coastal development, and habitat restoration (Ruckelshaus *et al.* 2013).

(3) Engaging leaders and practitioners in key institutions to magnify the impact of these successes, build capacity, and forge and accelerate lasting, transformative change. The focus is on developing tools for mainstreaming natural capital systemically, across high-leverage decision contexts, where there is strength and commitment among necessary leading partners to demonstrate real change. So far, these areas include: infrastructure investment; disaster risk reduction; national development planning; water security for cities; and agricultural supply chains.

Real-World Demonstrations

A great number and diversity of efforts to implement the ecosystem services framework have emerged worldwide over the past decade. Individually, most of these efforts are small and idiosyncratic. But collectively, they represent a powerful shift in the focus of conservation organizations and governments (primarily) toward a more inclusive, integrated and effective set of strategies. Taken together, these efforts span the globe and target a full suite of ecosystem services, including carbon sequestration, water supply, flood control, biodiversity conservation, and enhancement of scenic beauty (and associated recreation / tourism values).

Many local or regional efforts focus on a single service that stands out as sufficiently important, from economic and political perspectives, to protect

it. Under the institutional umbrella created for the focal service it is possible that other services may be at least partially protected. Beginning in the late 1990s, larger-scale investment in natural capital for water flow regulation in China – and for a broad suite of ecosystem services in Costa Rica – set pioneering examples that are now being adapted elsewhere and scaled up.

Next, I briefly describe two contrasting models, at different scales and in different kinds of social-ecological systems. In each case, there is an acute or looming crisis, innovative leadership, and an experiment underway in pursuit of dual goals: securing natural capital and human well-being.

Water for Cities in Latin America and Beyond

In the mid-1990s, New York City made one of the first and most famous investments in ecosystem service provision in recent history. The city invested about USD 1.5 billion in a variety of watershed protection activities to improve drinking water quality for 10 million users rather than spending the estimated USD 6–8 billion needed (excluding annual operating and maintenance costs) for building a new filtration plant. This seminal example is widely cited as evidence of the business case for investing in natural capital (Daily and Ellison 2002).

Now the New York City investment is one of many such experiments underway. With rapidly growing urban populations, expanding natural resource extraction in upstream watersheds, and climate change, water security for cities is a growing concern for governments, corporations, and other stakeholders globally. The source watersheds serving cities are now the target of a range of creative policy and finance mechanisms that link beneficiaries to suppliers through a payment system.

Water funds are a finance mechanism through which downstream water consumers and other parties (e.g., conservation and human development organizations, public entities) pay for upstream changes in land cover and use in order to achieve certain objectives. In biophysical terms, the objectives typically include maintenance or enhancement of: water quality; regular water flows (for dry-season supply and flood control); groundwater recharge; terrestrial and aquatic biodiversity; and well-being in upstream human communities. Other services are also anticipated, such as carbon storage and sequestration, crop pollination, and pest control (Goldman-Benner *et al.* 2012). Water fund objectives may also include sustainable improvements in human livelihoods and well-being.

There is now a major effort underway, supported by The Nature Conservancy, the World Bank, the Inter-American Development Bank, and FEMSA (a major bottling company) to replicate and standardize these funds

in terms of design, implementation, and monitoring, across more than 40 major cities throughout Latin America. Analysis is focused on predicting the relative feasibility and payoff of potential land-use / cover changes, such as conservation and restoration in headwaters, on steep slopes, and in riparian areas; and shifting to more sustainable pastoral and cropping practices. InVEST has been tailored for use in this decision context, to predict where and which potential activities would yield the greatest societal return-on-investment (the decision-support system is called Resource Investment Optimization System, RIOS).

Fondo Agua por la Vida y la Sostenibilidad, one of the recently established water funds, demonstrates the diversity of water users that are becoming engaged in these funds and the kinds of watershed management changes these funds motivate. Formally established in the Cauca Valley, Colombia in 2009, this water fund is supported by the region's sugar cane grower's association (PROCAÑA), the sugar producers' association (ASOCANA), 16 local watershed and river management groups, The Nature Conservancy and a Colombian peace and justice non-government organization. Many of these entities began working together as far back as 20 years ago, and the water fund is seen as building upon and strengthening these vital relationships.

Each member of the water fund voluntarily pays a self-determined amount into the fund that is then jointly managed by the members to improve landscape and river condition over 3,900 square kilometers. The aim is to strengthen the financing in the future. For now, members in this fund have committed to contributing USD 10 million over five years to be invested in five kinds of management changes: protection of native vegetation, restoration of denuded lands, enrichment of degraded forests, fencing of rangelands and implementation of best practices combining trees, pasture and livestock. The fund also invests in farmer training (agroforestry systems, cattle management), environmental education in schools, strengthening local community organizations, and setting up "food security modules" – essentially home gardens, with a diversity of crops, chickens, and other production. The investments target the dual goals of improving upstream livelihoods as well as downstream water security.

Investments will be targeted across landscapes to yield the highest return, using RIOS, subject to stakeholder preferences for security and equity. A great deal of stakeholder input feeds into the analysis of options. The fund is starting a monitoring program designed to ensure that these investments lead to measurable improvements in water quality for approximately 1 million water users downstream, as well as significant improvements in terrestrial and freshwater biodiversity.

Since the official establishment of the first water fund in Quito, Ecuador, in 2006, the model has spread rapidly (Figure 1). The Nature Conservancy is exploring establishing the first funds in Africa. The effort is focused on developing standards – in the biophysical modeling (through RIOS), financing, governance, and monitoring – that can be sensibly applied in contrasting conditions, but that guide the process and incorporate lessons as they are learned.



Figure 1. Water funds featured by stage of development (as of January 2014). Filled circles indicate that the water fund has been created, with a legal agreement among parties. Open circles designate water funds that are in the process of creation; four more (not depicted) are underway in Latin America since January 2014. Figure courtesy of the Latin American Water Funds Partnership Dashboard (Nov 2013) and The Nature Conservancy, Internal Survey of Water Funds (Dec 2013).

Water funds are an inspiring example of rapid advances in all areas of the three-part strategy laid out above. Today they are still at an early and vulnerable stage. With care, one could envision the emergence of flexible yet durable institutions that help guide growth of cities and management of the natural capital they depend on, more broadly.

China's Land-Use and Human Development Planning

The ecosystem service investments being made in China today are breathtaking in their goals, scale, duration and innovation. Following massive droughts and flooding in 1997-98, China implemented several national forestry and conservation initiatives, into which investments exceeded 700 billion yuan (about USD 100 billion) over 2000-2010 (Zhang *et al.* 2000; Liu *et al.* 2008). The larger and older of these initiatives, the Sloping Land Conversion Program (SLCP), involves 120 million farmers directly and is being rigorously evaluated to improve its design and efficacy.

These initiatives all have dual goals: to secure critical natural capital through targeted investments across landscapes and to alleviate poverty through targeted wealth transfers from coastal provinces to inland regions where many ecosystem services originate. The investments are focused on forests and grasslands, to help secure people from flooding, improve drinking and irrigation water supply, maintain efficient hydropower production, protect biodiversity, stabilize climate, reduce sand storms and soil loss, and foster more sustainable farming and other aspects of human well-being (Daily *et al.* 2013). In addition, the government aims to change the economic structure in rural areas to increase local household income while simultaneously making local households' patterns of land utilization and agricultural production more sustainable (Liu *et al.* 2008; Li *et al.* 2011).

Evaluation of the SLCP shows significant achievement of the biophysical goals, with remarkably rapid land conversion in the desired directions. For example, by the end of 2006, the SLCP had converted ca. 9 million ha of cropland into forest / grassland and had afforested ca. 12 million ha of barren land. Village level field measurements have shown not only that the payments for ecosystem services have altered land use patterns, but in turn soil erosion has been decreased in some areas by as much as 68% (Cao *et al.* 2009).

Overall social impacts of the programs are mixed, and depend on the details of the financial incentives and property rights (Cao *et al.* 2009, Liu *et al.* 2008). In some places, payment levels and types are leading to improvements in economic measures of well-being, whereas in others payments were not sufficient to compensate for loss of income from shifting livelihoods (Liu *et al.* 2008). In addition, in some places where participation in the SLCP has

significant positive impacts upon household income, it has not yet transferred labor towards non-farming activities as the government wished (Li *et al.* 2011). Payments are now being adjusted to improve success in achieving goals of poverty alleviation and growth of new economic sectors in rural areas.

China also stands out in strengthening the scientific foundation supporting these public policies. 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). The first step is to classify land cover for the whole of China, for 2000, 2005, and 2010, based on Landsat TM data at 30m x 30m resolution. The next stages of work involve characterizing the composition and structure of ecosystems and their changes over the assessment decade. The final stage will involve characterizing levels and types of ecosystem services, and changes therein across China and the assessment decade. This important effort will showcase state-of-the-art technical approaches relevant to other nations undertaking such assessments, and provide critical analysis to decision-makers (Perrings *et al.* 2011).

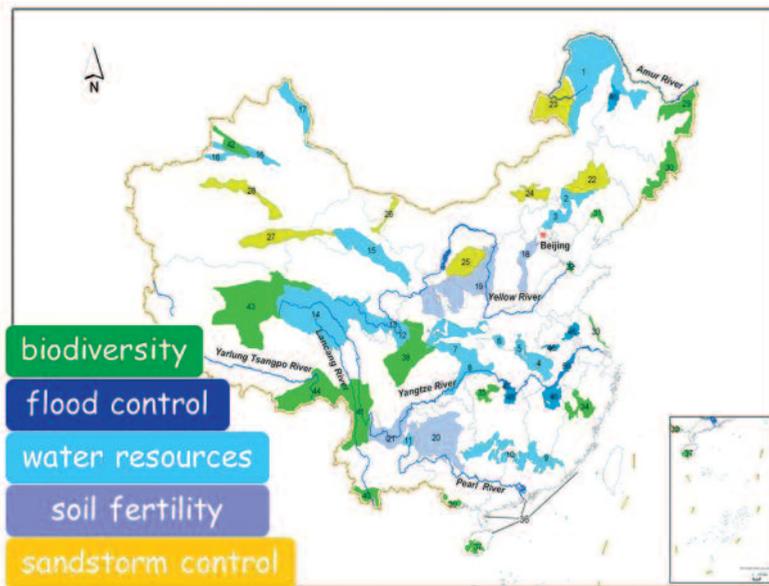


Figure 2. China's new system of Ecosystem Function Conservation Areas (EFCAs). As delineated by the Ministry of Environmental Protection and the Chinese Academy of Sciences, EFCAs span 28% of China's land area and 25% of its counties. EFCAs have dual goals of securing biodiversity and ecosystem services and alleviating poverty. Figure courtesy of Z. Ouyang, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences.

Perhaps most ambitiously, China is establishing a new network of “ecosystem function conservation areas” (EFCAs) (MEP and CAS 2008) (Figure 2). The network now spans 28% of the country and are expected to grow over time; their exact delineation and implementation is now being defined using InVEST together with a broad set of biophysical and social science tools and approaches.

EFCAs 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. The design and implementation of EFCAs involves assessments from local to national scales. At the national scale, the priority services are conservation of soil and water resources, flood protection, biodiversity, and sand storm protection (Ouyang, 2007; Ehrlich *et al.* 2012).

EFCAs are also 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).

While these initiatives represent a massive scientific and policy undertaking, they are very young and there is still little understanding of the local costs of implementation, or their effects on poor and vulnerable populations. The EFCA model represents a new paradigm for integrating conservation and human development, but for this policy innovation to have wide applicability and success, it will be important to assess and improve local livelihoods (e.g., Li *et al.* 2011; Li *et al.* 2012; Liang *et al.* 2012). This need points to the science and policy frontiers before us.

Pushing the frontier further, in March 2014, the central government approved development of a new metric – Gross Ecosystem Product – to be implemented highly visibly, alongside Gross Domestic Product, at all levels of government.

The current and potential future impacts of ecosystem service investments in China are enormous, both within the country and globally, perhaps most importantly in lessons on making the investments needed in natural capital and human well-being everywhere. This is seen as a vital matter of national security, and national leaders now speak of “China’s dream” as becoming “the ecological civilization of the 21st Century”.

Conclusion

Mainstreaming natural capital into decisions is a long-term proposition, requiring co-evolving advances in knowledge, social institutions, and culture. Certainly no single effort will be sufficient to achieve this. But each can contribute to the theory of change (Bradach *et al.* 2009) laid out here, with its three key elements: co-development of new tools and approaches; real-world demonstrations; and engaging leaders.

First, governments, businesses, and individuals must find it easy to inculcate ecosystem services and natural capital into their decisions, and the methods for doing so must be transparent, credible, and predictable. In many cases, sectors of society are open to the concepts of ecosystem services and natural capital, but simply do not know how to use them in a tangible way.

Second, there need to be examples of projects or enterprises that – as a result of properly valuing ecosystem services and natural capital – end up with improved decisions, institutions, and human well-being. These examples both test our knowledge against real-world problems, but also produce compelling stories of how an ecosystem services approach made a difference.

Lastly, these examples of success must have visibility and charisma, to draw political and thought leaders to them and thereby trigger much broader awareness. This is where the lessons of a set of examples can be mainstreamed into the myriad decisions – by businesses, governments, farmers, and banks – that are made every year and that impact our natural and social world. This is where the impact of scattered projects can be magnified into worldwide change.

None of these steps is complicated, and this theory of change does not require a brilliant and novel strategy. In fact, all three ingredients appear within striking distance. The environmental and human development movement has a much bigger and more diverse and powerful community behind it now than ever before. Co-development of knowledge with knowledge users is beginning to provide tools and methods that will reduce the transaction costs. There are enough policy experiments underway that compelling examples of natural capital stewardship enhancing human well-being are already forthcoming – the first step in an iterative process between basic science and application to real-world problems. Science by itself cannot change the world, but science plus the vision and action of leaders can.

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