

COMMENTARY:

Natural capital accounting and climate change

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Governments and businesses are beginning to account for natural capital, but must collaborate to promote sustainability, combat climate change and improve decision-making.

Globaly, government and corporate accounts are missing more than US\$40 trillion. It's a lot of money — nearly half the gross world product in 2012, 1.6 times the combined assets of the world's ten biggest banks and more than 300 times the cost of the Apollo Space Program. It's also a conservative estimate — a lower bound — of the value of natural capital in 2005¹. The UK Natural Capital Committee defines natural capital as the “elements of nature that directly or indirectly produce value to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions”². The World Bank's estimate includes only some of these elements from just 100 countries, and cannot be interpreted as the cost of losing all of Earth's ecosystems. However, it does demonstrate that the value of natural capital, largely excluded from both GDP and corporate accounting practices, is too large to leave off the balance sheet. Natural capital accounts (NCAs) contain vital information regarding our economic dependence and impact on the natural world. Economic valuation conveys this in an easily understood metric that can be readily integrated in real-world decision-making. As such, the public and private sectors should collaborate to develop NCAs to improve decision-making and economic resilience.

Governments and businesses face the common challenge of extracting the most from their scarce resources. Those resources must first be identified, accounted and valued — common practice for inputs with market prices. Businesses are adept at maximizing profit, refining supply chains and production processes to minimize costs; and governments calculate GDP, collect revenue and allocate funds accordingly. However, the services provided by natural capital often accrue outside the market: clean air promotes health and productivity;

clean water supports agriculture and recreation; insects pollinate crops and break down waste. All for free. Because both private companies and public well-being depend on these services, we should account for their degradation and incentivize investment in the natural capital that underpins them.

Concern for natural capital is what distinguishes green growth from regular growth. NCAs provide necessary metrics for governments to move beyond GDP and measure genuine progress, inclusive of environmental impact. But NCAs are equally relevant in the corporate world. In a recent shareholder resolution, ExxonMobil was asked to disclose the potential impact on natural capital asset (fossil fuel reserves) values if governments were to enforce emissions restrictions consistent with the 2 °C temperature rise target. The resolution demonstrated shareholder concern that stated policy objectives could render a significant proportion of proven reserves ‘stranded assets’ or ‘unburnable carbon’ that must be left in the ground. The report, which ExxonMobil published only after the US Securities and Exchange Commission ruled in favour of shareholders, demonstrates the company's confidence that “none of [ExxonMobil's] hydrocarbon reserves are now or will become stranded” on the grounds that they consider such an aggressive emissions reduction policy to be “highly unlikely”³. However, that other fossil fuel giants — including Chevron, BP, Royal Dutch Shell and Total — are facing similar shareholder requests suggests the issue is far from resolved⁴.

Interestingly, carbon accounts may be a useful starting place to build broader NCAs. Although carbon budgets have been a feature of governments' attempts to mitigate climate change for many years, the much wider accounting for natural capital is only now being recognized as essential both for

mitigation and adaptation. Accounting for the broader portfolio of natural capital will require joined-up thinking on a number of fundamental questions. Should governments and companies focus on the natural capital they own, or on the impact of their natural capital use on others? What about natural capital dependencies throughout supply chains? Ultimately, the perspective that is adopted may depend on who develops the accounts and why.

Linking climate change to natural capital

We identify three core links between climate change and natural capital accounting. The first is structural: carbon accounts are directly included in NCAs⁵⁻⁷. Efficient carbon prices reflect the liability, in terms of future economic damages, of emitting a unit of carbon. Because many of these damages relate to the environment, emissions are central to the much broader natural capital story. In fact, assumptions regarding CO₂ prices can mean that emissions dominate NCAs⁸. However, without proper context, a focus on carbon alone may lead to perverse incentives and unintended consequences, particularly if emissions reduction comes at the expense of other natural capital.

The second link is systemic, in that climate change, economies and natural capital impact on each other. Economic activity drives climate change, but both affect natural capital stocks and their ability to provide services. Rising nitrate and CO₂ concentrations from agriculture and fossil fuel combustion mean that mature unharvested forests, whose carbon flows were previously thought to be in equilibrium, may actually be significant sinks^{9,10}. Alternatively, if climate and land-use change exacerbate drought, then fires and reduced growth could turn tropical forests into carbon sources¹¹. Either case would affect the flow of sequestration services and the value of forests as

natural capital assets. Similarly, changes in water resources will affect agricultural production and impact on water intensive manufacturing processes and supply chains, driving changes in the wider economy.

The third link involves the complexity of overlapping and competing policy agendas and the possibility that what constitutes 'good' carbon policy may have dire consequences for other natural capital. For instance, hydropower in the Mekong River Basin (MRB) may serve a low carbon agenda, but the MRB is also a biodiversity hotspot, home to at least 877 fish species¹², the world's largest inland fishery and the 70 million people that depend on it for up to 70% of their protein intake. The more than 60 dams currently under consideration on the Mekong would interrupt nutrient deposition and fish migrations, compromising downstream agriculture and fisheries with estimated impacts ranging from +US\$33 billion to -US\$274 billion¹³. A focus purely on carbon would omit these broader natural capital impacts with severe consequences for public wellbeing, private sector revenues and social and political stability¹⁴. Crucially, the economic valuation of natural capital offers a common metric, allowing these competing goals and impacts to be compared on local and global levels.

Recent developments

A number of recent initiatives have begun turning discussion of natural capital into action. In 2010, GLOBE International — an organisation of parliamentarians seeking legislative solutions to climate change and sustainability — gathered a hundred senior legislators to pass the first Natural Capital Protocol at the UN Convention on Biological Diversity summit in Nagoya, Japan. In 2011, the UK produced a white paper¹⁵ that was greatly influenced by the UK National Ecosystem Assessment¹⁶, and, internationally, the World Bank moved to establish its WAVES (wealth accounting and valuation of ecosystem services) initiative. In 2012, the UN adopted a statistical standard for environmental-economic accounting⁶, the first inclusive wealth report⁷ was published and the UK's Natural Capital Committee was established. Table 1 lists countries with established (albeit incomplete) environmental accounting programmes. Several others are planning to establish natural capital legislation on similar lines.

The private sector is beginning to understand the importance of natural capital accounting. Companies are recognizing the vulnerability of their supply chains to natural capital risks and groups like Kering (which includes Puma and Gucci), have

Table 1 | Countries with established environmental accounting programmes¹⁷.

| | Assets* | Flow accounts for pollutants & materials | | Environmental protection and resource management expenditures |
|--------------|---------|--|----------|---|
| | | Physical | Monetary | |
| Australia | ✓ | ✓ | | ✓ |
| Canada | ✓ | ✓ | | ✓ |
| Colombia | | ✓ | ✓ | ✓ |
| EU-27† | ✓ | ✓ | | ✓ |
| Korea | ✓ | ✓ | ✓ | ✓ |
| Mexico | ✓ | ✓ | ✓ | ✓ |
| New Zealand | ✓ | ✓ | ✓ | |
| Norway | ✓ | ✓ | | |
| South Africa | ✓ | | | |

* Asset accounts in physical and monetary terms. † EU states are required to report greenhouse gas emissions, material flow accounts and environmental protection expenditures. Accounts for water and asset accounts for oil and gas, and forests are widely implemented.

now published environmental profit and loss accounts (<http://go.nature.com/x5jVo8>). Unilever and Kingfisher have become global leaders in sustainability and because of the Natural Capital Declaration, launched in 2012 at Rio+20 UN conference on sustainable development, Brazil, many of the world's largest financial institutions have committed to mainstream natural capital in their accounting and disclosure frameworks and integrate its value into loans, public and private equity, and fixed income and insurance products. In 2013, the inaugural World Forum on Natural Capital was held in Edinburgh, Scotland, where over 500 delegates from international businesses and governments called for collaboration on the development of NCAs.

The explosion of initiatives, compacts and consortiums dedicated to natural capital accounting is a good sign. That the value of natural capital should be considered in decision-making is an idea worth mainstreaming. However, there is a risk of 'natural capital' becoming a catch-all buzzword if these groups fail to work together. In particular, corporate natural capital accounting measures that are broadly applicable across business sectors and countries need to be developed. Although competition between accounting programmes and strategies can be useful, an effective mechanism for picking winners is required. At the national level, ascension to the status of a UN statistical standard serves this purpose. At the corporate level, the Natural Capital Coalition (formerly TEEB for Business Coalition) is a multi-stakeholder platform dedicated to developing methods for valuing natural and social capital in business, which may serve a similar function. Its Natural Capital Protocol, launched in November 2013, is

an ongoing project that seeks to develop and test a "harmonized framework for valuing natural capital in business decision-making" by the end of 2015 (<http://go.nature.com/rr1DZr>).

Next steps

Firms should examine natural capital impacts and dependencies throughout their supply chains to identify opportunities for efficiency gains and exposure to risks, including floods, droughts, resource scarcity and price volatility. Accounting and disclosure would be a major step forward, though equally important is that companies consider natural capital in senior-level decision-making across their business operations. However, the lack of market prices means that private markets will maintain too little natural capital: policy-makers must step forward.

Governments should encourage private sector investment in natural capital. This includes creating market incentives to invest in natural capital and setting accounting and reporting standards. Mandatory corporate disclosure would eliminate the potential disadvantages for first-movers and classifying investment in natural capital as capital, rather than operating-expenditure, would offer a strong incentive for firms to provide environmental public goods. Policies should take advantage of both the 'beneficiary pays' and 'polluter pays' principles, for instance through payments for ecosystem services (carrot) and emissions charges (stick).

Governments should identify key policy uses for NCAs. This would demonstrate the potential benefits of accounting for natural capital and guide data collection efforts. Integrating natural capital into national statistics would offer a deeper understanding

of green growth and provide early warning signs of emerging risks and vulnerabilities in the face of changing climate and land use. Robust economic valuation of natural capital and ecosystem services would help identify the trade-offs that deliver the greatest net benefits to society.

Natural capital is the foundation of all human wellbeing, yet its degradation is largely unreported and important public and private sector decisions are routinely made without regard for its value. Government and industry should join efforts to require companies to disclose their dependence on, and also their impact on, natural capital. This requires transparent qualitative and quantitative accounting and reporting. The story of ExxonMobil's stranded assets reflects both what is good and what is bad in natural capital accounting. Shareholders clearly recognize the importance of accounting for the value of natural assets in light of potential climate related risks. But fossil fuel companies remain confident that their reserves are safe from depreciation,

particularly given the impotence of global climate policies. Measuring the impact of climate change on natural capital in monetary terms can help improve public and private sector decision-making.

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COMMENTARY:

Five ways to enhance the impact of climate science

David Christian Rose

Embracing an 'evidence-informed' rather than 'evidence-based' attitude to policy-making should result in more effective action on climate change, recognizing that evidence must be used in such a way as to interact persuasively with other factors.

Policy-making is rarely driven by evidence alone. Thus, climate scientists who adopt an 'evidence-based' mindset, expecting more science to lead automatically to better policy, are likely to be disappointed. Consider, for example, the following statements:

"Anyone who needed convincing about the scale of the [climate change] problem need only have watched the recent [BBC] 'Panorama' programme on the floods." (Former UK government minister Chris Mullin, 2000)¹

"Colleagues across the House can argue about whether [flooding] is linked to climate change or not. I very much suspect that it is." (UK Prime Minister David Cameron, 2014)²

Both statements comprise responses to Parliamentary questions in which ministers

in the UK Government have been asked to explain recent extreme natural events. In both cases, flooding is clearly linked to climate change, and this reflects a wider tendency to make a connection between environmental change and the increasing frequency of extreme events. Yet, despite continuing high-profile claims about the urgency and gravity of the threat of climate change, policy seems to lag behind, and climate-based disasters gradually fade from media headlines. So why does meaningful policy not result, even when policymakers appear to accept that climate change is causing problems? Put simply, it is because policy-making is rarely 'evidence-based'.

Using the Fifth Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC) as inspiration, I argue

that climate scientists would do well to consider five ideas and ultimately embrace an evidence-informed approach to advising policymakers.

1. Reject an 'evidence-based' mindset

Growing confidence in climate science and observable impacts of climate change have led many policymakers to believe that climate change is a serious issue; however, considering the lack of meaningful action on climate change, this logic does not readily translate into policymakers believing that it is politically possible to act. Theorists of the policy process would not be surprised that evidence fails to influence policy in a direct fashion (rejecting Fig. 1)³, instead finding that scientific rationality must interact alongside other factors.