Valuing Nature's Capital

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GLOBAL HUMAN WELL-BEING has continuously been increasing since the age of industrialization—at least if economic growth is taken as an indicator. The only problem is that we seem to be running out of planets. Human impacts on natural systems causes them to be degraded more rapidly than they are able to recover, resulting in a depletion of natural capital assets that are vital not only for the economy but also for the existence of humankind[1].

The fact that global economic growth—as measured by the Gross Domestic Product (GDP)—beyond the biophysical limits of our planet cannot be sustained has been advocated by many scientists and politicians over the last four decades[2]. However, the past and current development model, the so-called 'Washington Consensus', remains in place—with growth of the market economy being the primary policy goal[3]. This systematically neglects the major part of contributions to world economy that originate from natural systems. The concept of 'ecosystem services'—as proposed by the end of the 20th century—tries to determine the importance of these contributions and account for environmental externalities by making benefits from natural capital comparable to economic services[4]. Although a global assessment of their monetary value is difficult to obtain, estimates result in ecosystems providing services that exceed GDP several times. It is not difficult to imagine that composition and functioning of the world economy would be very different if ecosystem services were to be paid for.

Therefore, expectations towards the concept of ecosystem services are extraordinarily high: they are advocated as a tool to stop further degradation of earth's ecosystems, facilitate the establishment of a 'green economy', provide incentives to foster more sustainable development and contribute to alleviating poverty. Are these expectations justified—or will major challenges prevent successful application of the concept of ecosystem services? What implications does this have for shaping the economy of the future? In order to provide answers to these questions, first a proper definition of what ecosystem services are – and what they are not—is needed.

Benefitting from nature

Ecosystems are complex adaptive systems[5] which are determined by the material parts of the system (stock and flow), and the interactions and interrelations between these parts, i.e. the configuration of the system. A stock generates a physical flow that is either directly consumed or serves as input for a production process. An example are fish populations that constantly reproduce and thereby provide a flow of new individuals that can be captured. Stock-flow resources can be regarded as ecosystem goods.

An ecosystem service is a fund-service[6]—a flux that is the result of a particular configuration of stock-flow resources. An ecosystem is not physically transformed into its services (i.e. it is not used up by providing them).[7] In the above example, the relevant ecosystem service is not a physical entity (like caught fish), but the capacity of the system to reproduce itself—and this capacity depends on the state of the fish population, food availability, predator abundance, habitat quality and several other factors.

Ecosystem services and goods contribute to the economy in the form of natural capital. Together with other types of capital—social capital, human capital and built capital—they are used to produce more capital, e.g. in the form of commodities[8].

Now, in order to maintain any ecosystem service, the necessary material components must be kept in a configuration that allows for its provision—and this must present an economically favorable option. For example, certain land use types that provide a desired service—like carbon sequestration—should then be more favorable than other types of land use. The most straightforward approach is to assign a monetary value to the service and direct payments to managers that ensure for the service to be provided. A possible valuation method[9] could be to determine the additional costs beneficiaries would face if they were to substitute an ecosystem service with available technology—e.g. substituting natural watershed protection with a filtration plant. Like this, payments for ecosystem services can become market transactions. Natural capital could then be incorporated into GDP—thereby reducing economic incentives for degradation of ecosystems because of additional costs being created.

Unfortunately, it is not at all that easy. The pictured scenario works with many underlying assumptions concerning market situation, participating actors, institutional arrangements and the characteristics of ecosystem services themselves. However, these assumptions very often do not reflect reality properly—which confronts the concept of ecosystem services with numerous challenges that have to be taken into account if the high expectations set in the concept are to be met.

The effect of uncertainty on ecosystems and markets

Major assumptions inherent to a market-based approach on ecosystem services are that services can be explicitly linked to ecosystem structures and management interventions; that services can be clearly separated from each other (itemization); that they exhibit a stable behavior on markets; and that effective provision of ecosystem services is secured by their efficient allocation on the market.

The major problem of these assumptions is that complexity of ecosystems makes their assessment difficult. In many cases there are no clear causal relationships between ecosystem structure and ecosystem services, while the services themselves usually depend on each other and act on different spatial and temporal scales. These complex relations have to be obscured in order to create tradable units from ecosystem services. When these units are marketed, their relations are not apparent and can be harmed—resulting in a changed configuration of the system that, eventually, may impair provision of ecosystem services. If standing forests are converted to monoclonal plantations in order to maximize carbon sequestration, other services like water provision and biodiversity can be negatively affected[10]. Furthermore, the market prices of single ecosystem services may have little to do with the ecosystem itself and can strongly be influenced by consumptions levels, political interventions and access to information[11], leading to price fluc-

tuations similar to existing markets of natural resources[12]. This results in an unreliable price development that does not provide incentives for long-term sustainable use and conservation of ecosystems.

Altogether, these uncertainties call for an approach that is based on resilience. Rather then trying to break ecosystems down to ever smaller pieces, one should embrace uncertainty and admit that knowledge of how ecosystem services interact—and how management interventions influence these interactions—is indeed very limited. In most cases, it makes more sense to consider ecosystem services as bundles and define recommended management actions to secure provision of these bundles only up to scientifically feasible level (e.g. a certain land use type). Focussing on a number of ecosystem services, rather than only one or two, increases resilience of the system—which may act as a buffer for unintended negative effects due to management and secure service provision in the context of climate change.

However, accepting a higher degree of uncertainty compromises economic efficiency, which is a primary concern of in our current development model. However, in terms of ecosystem services, a focus on economic efficiency might not necessarily yield more sustainable outcomes. This becomes apparent if equity considerations are examined.

Environmental conservation and equity

Payment schemes that put the concept of ecosystem services into practice are advocated as a tool for both ecosystem conservation and poverty alleviation—bringing about the challenge of how these goals can be prioritized, or integrated. It is argued that solving environmental problems and poverty at the same time is too ambitious; payments for ecosystem services should focus on environmental goals and treat other objectives as desirable side effects.

Nevertheless, if equity considerations are neglected in the design of payment schemes, existing imbalances of power may be aggravated, jeopardizing effective and sustainable provision of ecosystem services. This is exemplified by services that provide tradable ecosystem goods and therefore are already being reflected in markets (as 'natural resources'). Poor countries rich in natural resources often fail to benefit from resource revenues and ensure sustainable development[13]. Power imbalances, information asymmetries and corruption can cause severe economic and social distortions that do not allow for a 'trickle down' effect as expected by by our current development model—on the contrary, these distortions allow further concentration of wealth in the hands of more powerful actors. Moreover, if payments schemes are perceived as being unfair in terms of the distribution of costs and benefits, they may be rejected by stakeholders[14]. Similarly, (non-economic) intrinsic and social incentives are frequently overlooked[15].

Thus, for the design of payment schemes for ecosystem services equity considerations have to be taken into account from the beginning on, or the schemes will not be feasible. This implies framing payment schemes as multi-goal tools that have to deal with tradeoffs between equity and efficiency. Whether they are weighed equally is then dependent on the particular conditions, mainly on the degree of social and economic distortions.

So far, it has been made clear, that most problems in applying the concept of ecosystem services arise if payments are only seen as a market-based instrument. Therefore, payments for ecosystem services (as monetary or non-monetary resource transfers) should take place not only through markets but also

through other mechanisms that take into account social factors and non-economic incentives of service providers. The ultimate goal is then to provide incentives to favor land use types that ensure sustainable provision of ecosystem services[16]. This allows for resilience and equity being key parts of the concept. However, institutions play a crucial role for payment schemes to work properly.

Characteristics of ecosystem services and fitting institutional arrangements

The so-called 'Washington consensus' advocates minimizing the role of government and favors its replacement with private and market institutions[17]. These institutions are, however, ill-suited if payments for ecosystem services do not take place through markets. To determine, whether payment schemes for ecosystem services can be implemented, facilitated or monitored by existing institutions or whether new institutions have to be created, is a tough challenge—and strongly depends on the inherent characteristics of the services themselves[18].

Ecosystem services and goods can be categorized according to the degree in which their use is rivalrous and whether others can be excluded from usage. For services and good to be marketable, all those that do not 'buy' them must be excluded from their use, and providers must hold exclusive rights to sell them. This may be accomplished in the case of ecosystem goods (e.g. food and timber) but results much more difficult for the majority of ecosystems services. And even if it is theoretically possible to market a given service, it might still be undesirable in case of the service being essential and non-substitutable. In order to provide an alternative to markets, novel institutions must act as intermediaries between beneficiaries and service providers. In order to deal with trade-offs and to design payment schemes that are fair and adaptive, these institutions should be based on cooperation rather than competition. Moreover, they have to match the scales at which provision and benefits accrue in order not to further increase transaction costs. If property rights are absent, they must be created by collective institutions to establish a relationship between ecosystem service providers and beneficiaries. In most cases, common property regimes that favor adaptive collaborative management are then better suited in the context of ecosystem service provision than single private owners.

In total, the diverse institutions needed for successful implementation of schemes for payments of ecosystems services may differ substantially from conventional market institutions and tend to give more importance to governance. This shift is required by the the physical characteristics of ecosystem services, the uncertainties involved with ecosystem functioning, questions of equity, and, finally, a management paradigm that focuses on resilience.

The value of natural capital

After examining the numerous challenges that lie within practical applications of the concept, the limits of ecosystem services have become apparent. Ecosystem services can hardly be integrated into the market-economy and a one-dimensional, market-based approach severely neglects resilience, equity concerns, and more appropriate institutional arrangements. However, rather than to neglect the entire concept[19] one should focus on the opportunities that payments for ecosystem services provide if they are framed as

a multi-goal tool, taking into account natural and social capital. Only in this form, expectations of reducing environmental degradation and alleviation of poverty can be met.

However, ecosystem services might become a short-lived concept that fails to be adapted at a broader scale. The implications for successful application of ecosystem services that have been discussed do not comply with our current development model. Within the our current development mdoel, distribution concerns are neglected, private property is emphasized and the role of government is to be reduced—whereas schemes that transfer payments for ecosystem services require strong non-market institutions, emphasize the importance of common property regimes and integrate equity concerns[20]. This reveals the underlying policies of our development model as a major cause for present-day environmental problems.

Therefore, one should not rely entirely on the concept of ecosystem services to solve these problems. Instead, valuation of ecosystem services is of most use if it leads us towards a different understanding of well-being and how it is related to natural and social capital—and this will require us to redefine progress. We will only truly be able to value natural capital if we recognize that 'more' is not necessarily 'better'.

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Notes

[1] Millennium Ecosystem Assessment (2005)

[2] e.g. Meadows et al. (1972)

[3] cf. Costanza (2008) for a summary of the principles of the Washington Consensus

[4] Costanza et al. (1997)

[5] in the sense of Holland (2006)

[6] For the original definition of fund services cf. Georgescu-Roegen (1971)

[7] Definition of ecosystem goods and services as in Farley and Costanza (2010)—there, the following example for ecosystem services is related: 'Malghan gives the example of a car, which is a particular configuration of glass, metal, plastic and rubber that provides the service of transportation. A car wreck is a different configuration of exactly the same components that no longer provides the desired service.'

[8] Capital is defined here as an economic factor that can take part in a production process. Different types of capital can be distinguished and they can take on tangible and intangible forms. For this essay, four categories of capital are referred to (in line with Costanza and Daly 1992, Costanza 1997): (i) natural capital, in the form of the physical components of nature as well as the interrelations of these components; (ii) human capital, that comprises education, experience, skills and labor of individual human beings; (iii) social capital, such as culture and social networks; and (iv) built capital, meaning physical entities that are the result of a production process, including financial assets. Please note that these are only roughly equivalent to the production factors described by Marx, which are: land (natural capital), labor (human and social capital) and capital (built capital).

[9] An overview of valuation methods is provided by Farber et al. (2002)

[10] Corbera et al. (2007)

[11] Kosoy and Corbera (2010)

[12] Kronenberg and Hubacek (2013)

[13] Kronenberg and Hubacek (2013)

[14] Pascual et al. (2010)

[15] Clements et al. (2010)

[16] This is the definition of payment for ecosystem services as proposed by Muradian et al. (2010)

[17] Costanza (2008)

[18] Farley and Costanza (2010)

[19] cf. McCauley (2006)

[20] Costanza (2008)