ISSN 1756-7904

DEV INTERNATIONAL DEVELOPMENT University of East Anglia

Working Paper Series

Applying the ecosystem services concept to poverty alleviation: The need to disaggregate human wellbeing

Tim Daw, Katrina Brown,
Sérgio Rosendo and Robert Pomeroy

2011

University of East Anglia

Working Paper 30

The School of International Development, University of East Anglia
Norwich, NR4 7TJ, United Kingdom

DEV Working Paper 30

Applying the ecosystem services concept to poverty alleviation: The need to disaggregate human wellbeing

Tim Daw, Katrina Brown, Sérgio Rosendo and Robert Pomeroy

First published by the School of International Development in April 2011.

This publication may be cited as:
Daw, T., Brown, K., Rosendo, S. & Pomeroy, R., 2011, Applying the ecosystem services concept to poverty alleviation: The need to disaggregate human wellbeing, Working Paper 30, DEV Working Paper Series, The School of International Development, University of East Anglia, UK.

About the Authors

Tim Daw is a Senior Lecturer in Natural Resources in the School of International Development at the University of East Anglia, Norwich, UK and a Researcher at the Stockholm Resilience Centre at Stockholm University, Sweden.

Katrina Brown is Professor of Development Studies in the School of International Development at the University of East Anglia, Norwich, UK.

Sérgio Rosendo is a Senior Research Fellow at e-GEO, Geography and Regional Planning Research Centre, Universidade Nova de Lisboa, Lisbon, Portugal.

Robert Pomeroy is Professor of Agricultural and Resource Economics in the Department of Agricultural and Resource Economics/Connecticut Sea Grant, University of Connecticut, Connecticut, USA.

Contact:
Email t.daw@uea.ac.uk
School of International Development
University of East Anglia
Norwich, NR4 7TJ
United Kingdom
Tel: +44(0)1603 592325
Fax: +44(0)1603 451999

ISSN 1756-7904

About the DEV Working Paper Series

The Working Paper Series profiles research and policy work conducted by the School of International Development and International Development UEA (see below). Launched in 2007, it provides an opportunity for staff, associated researchers and fellows to disseminate original research and policy advice on a wide range of subjects. All papers are peer reviewed within the School.

About the School of International Development

The School of International Development (DEV) applies economic, social and natural science disciplines to the study of international development, with special emphasis on social and environmental change and poverty alleviation. DEV has a strong commitment to an interdisciplinary research and teaching approach to Development Studies and the study of poverty.

International Development UEA (formerly Overseas Development Group)

Founded in 1967, International Development UEA is a charitable company wholly owned by the University of East Anglia, which handles the consultancy, research, and training undertaken by the faculty members in DEV and approximately 200 external consultants. Since its foundation it has provided training for professionals from more than 70 countries and completed over 1,000 consultancy and research assignments. International Development UEA provides DEV staff with opportunities to participate in on-going development work, practical and policy related engagement which add a unique and valuable element to the School's teaching programmes.

For further information on DEV and the International Development UEA, please contact:

School of International Development
University of East Anglia, Norwich NR4 7TJ, United Kingdom
Tel: +44 (0)1603 592329
Fax: +44 (0)1603 451999
Email: dev.general@uea.ac.uk
Webpage: www.uea.ac.uk/dev

Abstract

The Millennium Assessment promoted the concept of ecosystem services (ES), which is increasingly applied to questions of conservation, human wellbeing and poverty alleviation. Commonly applied ES frameworks, tend to adopt an aggregated view of humanity, which limits their applicability to poverty alleviation for a number of reasons. Firstly, there is no direct link between ES and the poor's wellbeing due to variable and dynamic mechanisms of access to ES. Secondly, the ES contribution to wellbeing depends on individual circumstances and need. Thirdly, and as a result of these two points, trade-offs between different ES imply winners and losers and must be analysed according to who derives wellbeing benefits from which ES. Fourthly, view of humanity in aggregate tends to overlook ES-based cash and employment, which are crucial to the wellbeing of the poor. Finally, we highlight the inadequacy of the Millennium Assessment categorisation of ES for understanding poverty alleviation and illustrate how it affects ES valuation. We need to distinguish between different beneficiaries of different ES, and consider how the wellbeing of each is enhanced before we can understand the significance of ES to poverty alleviation. We illustrate these points with examples from coastal and marine ES.

Introduction

Current interest in Payments for Ecosystem Services (PES) corresponds to an "explosion of interest" (Perrings 2006) in ecosystem services (ES), which stems in part from the Millennium Ecosystem Assessment (MA 2005). The MA developed and promoted a widely applied conceptual framework (MA 2003) based on a definition of ES as "…the benefits people obtain from ecosystems" (MA 2005: v). The ES concept originated as a metaphor to illustrate the reliance of humans and society on the biosphere (Daily 1997; Norgaard 2010) and is finding new applications in understanding how choices and scenarios around ecosystem conservation, use and modification ultimately affect human wellbeing in specific cases through cost-benefit analysis, landscape planning, multi-criteria analysis and public policy (Fisher *et al.* 2009).

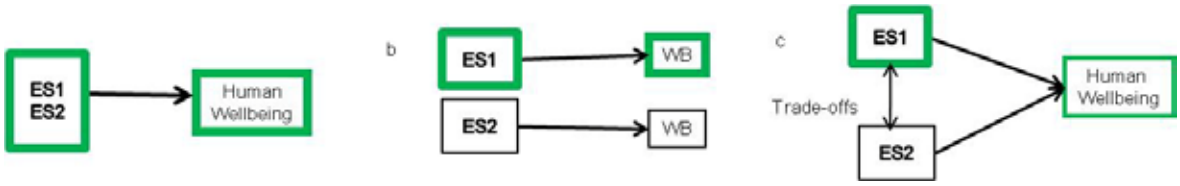
The MA, with an explicit focus on 'human well-being and poverty alleviation', highlighted the importance of ES for the wellbeing of poorer members of global society, and the relevance of the ES concept to contentious challenges of conservation, development and poverty alleviation (Adams *et al.* 2004). Recent scientific and policy initiatives have directly applied ES to poverty alleviation (e.g. www.espa.ac.uk, Kumar *et al* 2010, WRI *et al* 2007), and emphasised their potential for alleviating poverty (FAO 2007; WRI 2008).

In this paper we critically examine the ES concept, as outlined by the MA, for its ability to address poverty alleviation. Poverty alleviation includes both 'poverty reduction', in which people are lifted out of poverty, and 'poverty prevention' in which ES contribute to maintaining people's wellbeing by meeting their immediate needs (Béné *et al.* 2010). We define poverty as lack of wellbeing, and focus on the relationship between ES and wellbeing, specifically for those in society who have the lowest levels of wellbeing (hereafter 'the poor'). Our commentary is informed by a collaborative and multi-scale 'situation assessment' of marine and coastal ecosystem services (Brown *et al.* 2008) and we draw on coastal examples from developing countries.

The relationship between ES and human wellbeing can be conceptualised in various ways. The simplest and most linear conceptualisation (Fig 1a) assumes that changes in ES will have direct impacts on wellbeing, such that increasing ES would lead to poverty reduction, and maintaining ES would lead to poverty prevention. The MA extended this simplistic view, emphasising that different ES contribute to different aspects of human wellbeing (e.g. material, health, security, Fig 1b, MA 2005: vi). Several authors have also emphasised the existence of trade-offs between different ES (Fig 1c, Carpenter *et al.* 2009; Rodriguez *et al.* 2006) and some progress has been made in identifying and quantifying these (e.g. Raudsepp-Hearne *et al.* 2010; Cheung *et al.* 2008). Most approaches however, tend to aggregate the humans who are

represented within 'human wellbeing', which limits the applicability of these approaches to questions of poverty alleviation. By 'aggregation' we mean the consideration of all 'humanity' when considering benefits of ES (e.g. Fig1a) without explicit recognition of distributional patterns of benefits. This implicitly occurs when 'the benefits to human-well being' is considered, measured or valued without explicit reference to different groups of humans who unevenly share the benefits or costs of ES. These sub-groups could for example be defined by geographical area, socioeconomic status, gender, ethnicity or (in terms of current and future generations) time. We propose that any attempt to consider ES contributions to wellbeing without consideration of subgroups either explicitly or implicitly results in this aggregation. In this paper we identify five issues related to aggregation: 1) the link between ES and the poor's wellbeing is affected by complex and dynamic mechanisms of access to ES; 2) the ES contribution to wellbeing depends on individual circumstances and need; 3) As a result, trade-offs between different ES imply winners and losers and must be analysed according to who derives wellbeing benefits from which ES; 4) aggregation tends to overlook ES-based cash and employment, which are crucial to the wellbeing of the poor; 5) Aggregation suggests categories of ES that are inadequate for understanding poverty alleviation and can affect the way we evaluate ES. We conclude by suggesting critical elements for an ES framework that can be applied to understand and support poverty alleviation.

Figure 1. Conceptualisation of ES and human wellbeing that do not disaggregate human beneficiaries.



a) simplistic aggregated view of WB and ES which leads to assumptions that increases in ES will lead to increases in WB. b) elements of human WB are disaggregated recognising that different ES may contribute to different elements of WB. c) ES are disaggregated to explore trade-offs between them without recognising different elements of WB.

Access to the benefits from ecosystems

Conceptualisations of of ES and human wellbeing which aggregate humanity (Fig 1) lead to an assumption that improving or safeguarding the flow of ES will necessarily contribute to wellbeing and poverty alleviation. This is clearly an oversimplification (Butler and Oluoch-Kosura 2006) and has been shown not to hold even at the global level (Raudsepp-Hearne *et al.* 2010; Dietz *et al.* 2009). The degree to which any

human individual benefits from ecosystems depends on a complex range of mechanisms of access including social relationships, institutions, capabilities and rights and various capitals, both in terms of traditional resource use (Ribot and Peluso 2003) and evolving mechanisms of PES (Pagiola *et al.* 2005). Increasing flows of an ES thus may have little effect on the wellbeing of the poor if they do not have access mechanisms to benefit from it (Fig 2a). Conversely, the ES-contribution to the poor's wellbeing may change as a result of changes in access, even if ecosystem functions remain unchanged. The MA framework text refers to such opportunities: "For poor people, the greatest gains in well-being will occur through more equitable and secure access to ecosystem services" (MA 2003:72). However, the aggregation of human wellbeing misses the possibility of trade-offs between the wellbeing of different groups purely as a result of the complex access mechanisms highlighted by Ribot and Peluso (2003).

Figure 2

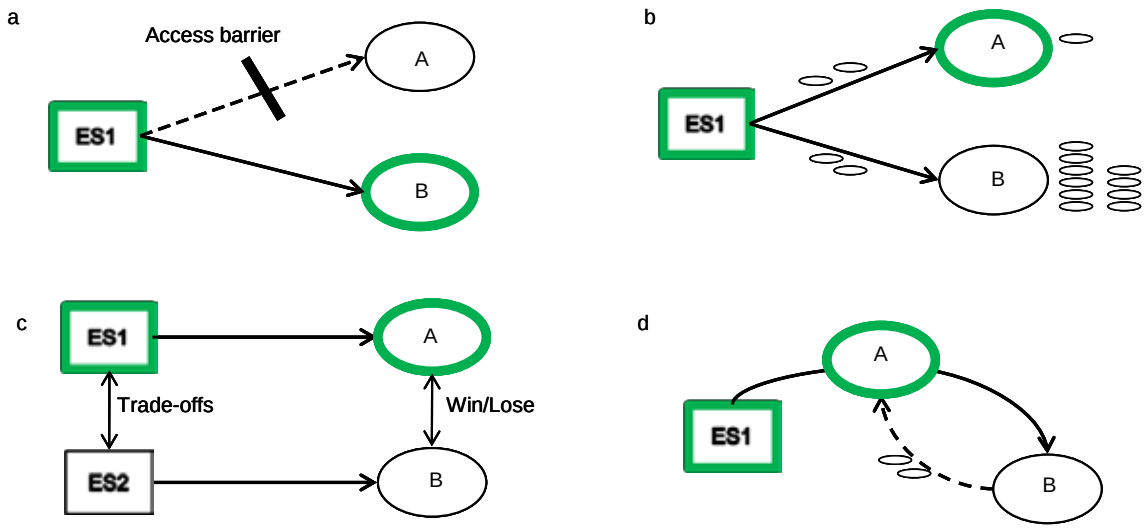


Figure 2 – Aspects of ES and human wellbeing relevant to poverty alleviation that are highlighted by disaggregating beneficiaries of ES. Highlighted boxes show increases in ES flows and wellbeing of beneficiaries.
a – Influence of access mechanisms determine the wellbeing impacts of changes in ES. Increases in ES1 are captured by beneficiary B but not available to 'A' looses more than 'B', in this case?
b – Contribution of ES to wellbeing depends on the 'wellbeing-context' (in this case wealth) and needs of each beneficiary. Increasing ES1 contributes more to the wellbeing of A than B due to the relative importance of benefits relative to existing or other wealth or livelihood opportunities.

c – Trade-offs between different ES lead to winners and losers depending on who is placed to benefit from which ES.
d – Wellbeing contributions of ES to A is indirect, resulting not from direct 'consumption' of ES1 but, from the consumption of the ES by B.

For example, in Tanzania, connecting the octopus fishery to international markets increased the price available to fishers (so increased aggregate total benefits of the service) but this led to women, who traditionally caught octopus, being displaced from the activity by men, and losing their livelihood (Porter *et al.* 2008). Thus a change in the institutions around this ES led to a direct trade-off between the wellbeing of two groups. The net value of the ES benefits and the well-being of male fishers was enhanced by new economic opportunities at the expense of already-marginalised poor women.

Thus, although progress has been made in identifying and quantifying flows and trade-offs of ES, these cannot be used to make draw conclusions about poverty alleviation unless they are complimented by assessments of access to such benefits by target poor groups.

The context-dependent relationship between ES and wellbeing

An aggregated evaluation of ES is particularly inadequate for understanding ES impacts on the multidimensional and dynamic aspects of wellbeing and poverty (Alkire 2002). The MA conceptual framework emphasises: *"How well-being and ill-being, or poverty, are expressed and experienced is context- and situation-dependent, reflecting local social and personal factors" (MA 2003:71).* The implication of this is that the contribution of ES to wellbeing can only be understood by taking account of the perspectives and context of ES beneficiaries themselves. This 'wellbeing context' is likely to vary considerably between different individuals and groups. As a result, the same ES can have different effects on the wellbeing of different beneficiaries (Fig 2b). For example, the service provided by fisheries has, in some contexts, been shown to contribute to a sense of identity and job satisfaction (Pollnac *et al.* 2001), which itself is dependent on the personality of the individual (Pollnac and Poggie 2008). Meanwhile, the contribution of regulating services to maintaining wellbeing (i.e. poverty prevention) depends on the exposure and sensitivity of individuals to environmental extremes, and their existing adaptive capacities (Adger *et al.* 2005).

In general, poor people have been shown to be more reliant on ES (TEEB 2008). For example women fishmongers on the Kenyan coast tend to have low socioeconomic status, limited education, capital or opportunities (Matsue 2009), while fishers from poorer households show less readiness to exit a declining fishery and conduct other

occupations than those from wealthier households (Cinner *et al.* 2009). The access of these groups to even small quantities of low-value fish can therefore be expected to make a disproportionately significant contribution to their wellbeing compared to wealthier groups with more alternatives.

ES benefits in terms of cash earned through sale of goods can be valued easily, but the wellbeing contribution of cash income depends on the beneficiary's situation. Any given level of financial benefit will have a greater wellbeing impact on a poor individual than a wealthier individual (Fig 2d). Utilitarian economics has long recognised that the marginal utility of income decreases as total income increases (Dasgupta 2001). Disaggregated ES assessments could use equity weights to account for this and express the greater wellbeing impact of ES that accrue to the poor. Even when calculated at an aggregate national level, equity weights make a considerable difference to the understanding of welfare impacts of environmental changes (Srinivasan *et al.* 2008), and they are likely to have further impacts when applied at sub-national levels (Baer 2009). Equity weightings are not frequently used, have not been widely applied in ES valuation studies and remain controversial amongst many economists. An argument against the use of equity weights is that cost-benefit studies should focus on measuring aggregate rents from a resource, which can be maximised and subsequently contribute to poverty alleviation through redistributive taxes, or trickle-down effects in the economy (Johansson-Stenman 2005). However, this perspective is not appropriate for considering ES contributions to the wellbeing of the poor considering the persistent exclusion of the poor from broader wealth generation (Landell-Mills and Porras 2002), the non-use (and untaxable) value of many ES, the lack of structured, taxable markets for others, and the ineffectiveness of institutions redistributing wealth in many developing countries. The use of equity weightings or similar techniques to disaggregate assessments of ES benefits are highly relevant for considering the contribution of ES to poverty alleviation.

Winners and losers from ES trade-offs

Various authors have drawn attention to trade-offs in ES (Rodriguez *et al.* 2006), and some progress has been made in documenting them through ES assessments (Cheung and Sumaila 2008; Nelson *et al.* 2009; Raudsepp-Hearne *et al.* 2010). However, many cutting edge attempts to model and quantify ES do not disaggregate the beneficiaries of those ES, thus ignoring distribution of benefits between groups and individuals in society. Others disaggregate between very broad groups of beneficiaries such as 'private interests' and 'net social benefits' (Polasky *et al.* 2010) or broadly between stakeholders at different scales (Hein *et al.* 2006).

As discussed in the previous sections, various access mechanisms and individual wellbeing contexts mean that different individuals and groups benefit from different ES to different extents. As a result, each change in the 'bundle' of ES flows from an ecosystem (Raudsepp-Hearne *et al.* 2010) creates winners and losers. Thus trade-offs between different ES, highlighted by Rodriguez *et al.* (2006), also lead to tradeoffs between the wellbeing of different people (either between or within communities) due to their reliance on, or access to different ES (Fig 2c).

Many cases illustrate such trade-offs. For example, the establishment of a Marine Protected Area in coastal Kenya reduced the overall number of fishers in the area who benefitted from fisheries (McClanahan *et al.* 1996), while likely improving opportunities for tourism revenue. Some fishers lost out while those who had skills and opportunities to benefit from tourism increased their benefits from the ecosystem.

In order to improve the wellbeing of the poorest members of society, the beneficiaries of current and alternative future bundles of ES must be more explicitly considered. Recent advances in documenting trade-offs in ES e.g. Cheung and Sumaila 2008; Polasky *et al.* 2010) could be made relevant to poverty alleviation by linking them to stakeholder analysis of those groups with access to each ES, and by identifying how each ES contributes to the wellbeing of the poor. Hein *et al* (2006) explicitly disaggregated stakeholders on the basis of spatial and institutional scales and clearly illustrated that different ES have beneficiaries at different scales. We would suggest that to have relevance for poverty alleviation this type of approach to disaggregating benefits to different stakeholder groups needs to be more widely applied, but based also on socioeconomic groupings *within* scales, for example by ethnic, gender or livelihood groupings.

Cash and employment are hidden by aggregation

Rural communities may directly utilise local ES, for example provisioning services such as mangrove for building materials, marine animals used for food etc. However, increasing penetration of markets into rural areas (Pendleton and Howe 2002; Godoy *et al.* 2005), particularly in the coastal zone (e.g. Berkes *et al.* 2006; Crona *et al.* 2010) and commoditisation of ES (as exemplified by PES) have created opportunities for earning cash from ES. The development of markets in rural communities has also increased the importance of cash and employment as a means to improve wellbeing through the purchase of imported goods, travel and education opportunities for children. This trend is reflected in the strategy of aid agencies aiming to alleviate poverty and prevent famine through their increasing use of cash transfers rather than direct provision of food (Ellis *et al.* 2008).

A case from the remote Lau islands of Fiji illustrates the marketisation of previously remote communities, and how this has affected their relationship with ES. Communities began to trade their cultural artefacts and services (in terms of producing ceremonial kava bowls for export) and earned cash to buy imported fish. This displaced consumption of local reef-caught fish to such an extent that they were unaware of extreme changes in their local coral-reef ecosystem caused by climate and other environmental events (Turner *et al.* 2007).

One of the impacts of market penetration is that many ES from local ecosystems make a wider contribution to wellbeing by generating cash that can impact on multiple dimensions of wellbeing than simply via direct consumption. This perspective was strongly articulated by focus groups conducted by Brown *et al.* (2008) with poor coastal stakeholders from five East African and SE Asian countries who were asked "Is the sea/coastal area (and the animals and plants there) important to you and/or your community? In what way?" and then asked to score the identified services in a PRA ranking exercise (Brown *et al.* 2008). All focus groups identified cash and employment, or processes generating earning possibilities (e.g. tourism attraction, fisheries) as the most important benefits from coastal ecosystems. If one of the most important benefits of ecosystems for the poor are to generate cash and employment, and given the definition of ES as "…the benefits people obtain from ecosystems" (MA 2005: v) should cash and employment be considered ES? In fact, both employment and cash are poorly represented in the MA synthesis document. 'Earnings', 'employment' and 'cash' are mentioned as benefits from ecosystems 12, 11 and 0 times respectively in contrast to more frequent mentions of 'food', 'recreation', 'spiritual' and 'wood' (138, 41, 38 and 29 mentions). One explanation is simply the view that ES are 'ecological in nature' (Boyd and Banzhaf 2007) in line with earlier definitions of ES (Daily 1997), rather than human institutions. Fisher and Turner (2008) distinguish ecologically-natured ES from 'benefits', which also derive from non-ecological inputs such as built capital. However, even when discussing benefits, "…like more food, better hiking, less flooding" Fisher and Turner (2008) place little emphasis on cash or employment.

This limited emphasis on cash and employment in ES literature could be understood as another result of aggregation of 'human wellbeing' (compare Figs 1a and 2d). Cash and employment are human-created institutions which exchange and distribute resources between humans (i.e. all within the 'human wellbeing' box of Fig 1). Thus aggregation of humanity leads to tendency to overlook cash, trade and employment.

This omission implies an implicit and incorrect assumption that people are mostly direct beneficiaries of ES (e.g. through subsistence activities) and that this has greatest impact on wellbeing or poverty alleviation. Subsistence use of ES is often important in terms of poverty *prevention* to avoid further impoverishment, for

example through the provision of food, shelter and natural disaster mitigation. However, market mechanisms play a crucial role in the potential for ES to contribute to poverty *reduction*, because it is arguably cash-earning opportunities from nature-based enterprises which offer the best opportunity for reduction of rural poverty (WRI *et al* 2008). This may become particularly relevant where payment for ecosystem services (PES) schemes have been created. Market and exchange mechanisms therefore must be explicitly accounted for in any ES framework aimed at poverty alleviation and are likely to emerge from appropriately disaggregated analysis of the benefits the poor derive from ecosystems.

ES categories, beneficiaries and appropriate valuation

The MA categories of provisioning, regulating, cultural and supporting ES have been adapted for different purposes (Turner and Fisher 2010), and are also called into question by applying a disaggregated, pro-poor focus. This is illustrated by marine ES from coastal East Africa. Marine resources are harvested for both for consumption within local communities, and for national and, in the case of sea cucumbers global markets for consumption by wealthy consumers in Asia (Marshall *et al.* 2001). Aggregation of human wellbeing leads to a categorisation of all these resources as provisioning services (food production), whereas each provides different contributions to the wellbeing of poor coastal people, either through nutrition, or by generating income (Fig 3 a, b).

Figure 3

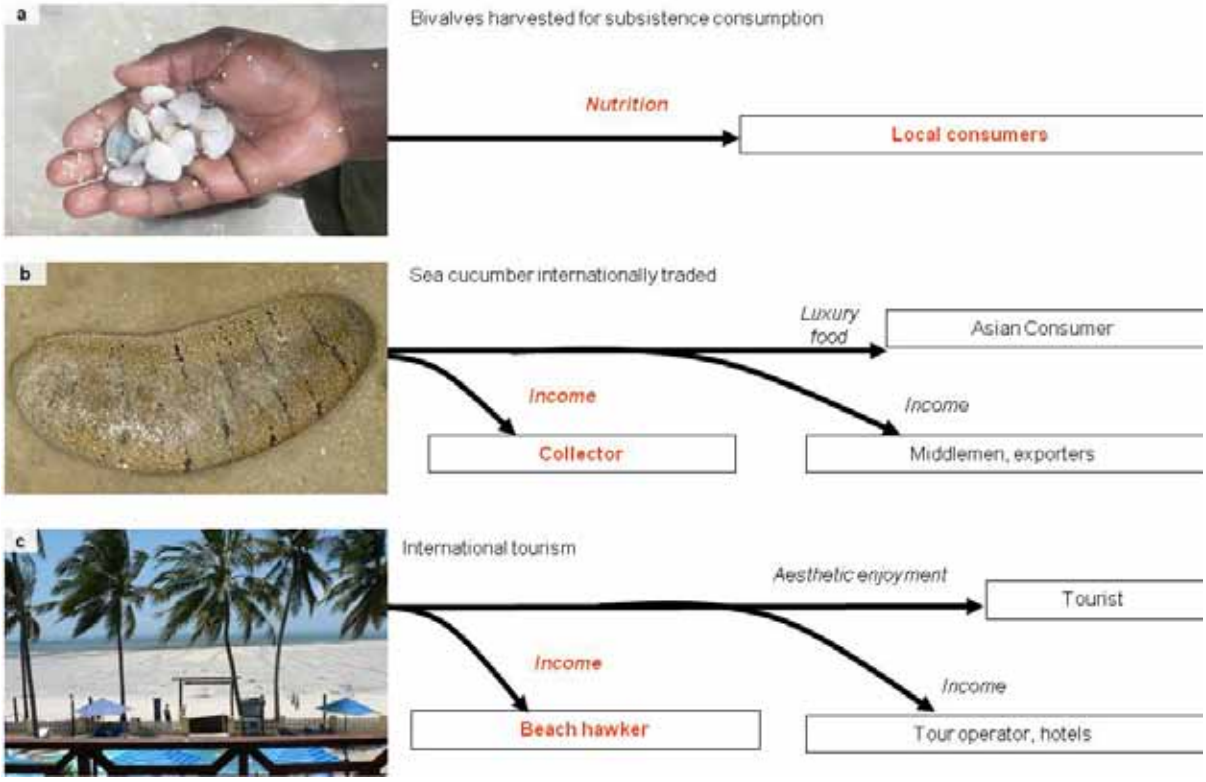


Figure 3. Benefits from three different coastal ES in East Africa which contribute to the wellbeing of local poor stakeholders (in bold text). a and b contribute in entirely different ways but are both categorised as provisioning services (food). c is categorised as a cultural service although it provides income in the same way as b.

Similarly, the MA (focussing on the final consumption of ES and the contribution to 'human wellbeing') conceptualises tourism as a cultural ES. But for poor local communities, tourism is effectively a provisioning service, providing income and employment, which allow material needs to be met (Fig 3c). Confusion arises because of the lack of disaggregation between beneficiaries, the different roles of those who capture, trade or finally consume each ES are obscured, as is how these processes contribute to the wellbeing of each. In trying to distinguish between 'services' and 'benefits', Fisher and Turner (2008) point out that, "[s]ervices are often a function of beneficiary's perspective". A poverty alleviation approach to ES must therefore categorise ES from the perspective of what benefits they provide to the poor.

The categorisation of ES has implications for how ES concepts are applied in practice. This can be illustrated by a simple example of valuation methods as they are applied to coastal ES, and how they reflect contributions to the wellbeing of the poor. The aggregate value of marketed ecosystem goods are often valued by the total market value of the product. The contribution of this ES to poverty alleviation,

however, can only be appreciated by knowing who the different beneficiaries are (e.g. final consumer, people who derive an income through trade or exchange) and how the ES contributes to each individual's overall wellbeing in its multiple dimensions.

If ES are directly consumed by the poor (e.g. Fig 3a), then market prices, reflecting the willingness to pay of the poor consumers would give an indication of the importance of that service to the poor, if corrected for relative purchasing power by equity weights. In contrast, some resource economists are increasingly calling for the calculation of producer surplus (or economic rent) for fisheries and management of fisheries towards rent-maximisation, based on concepts of 'maximum economic yield'. This may undermine the contribution of small-scale fisheries to wellbeing in developing countries (Béné *et al.* 2010). On the other hand, poor groups benefit from coastal tourism, by 'selling' experiences to wealthy consumers (Fig 3c) calling for calculation of the producer surplus at the relevant stage of the marketing chain to reflect cash-earning opportunities for local people (also interpreted through equity weights to reflect the significance of these values relative to other earnings). However, consumer willingness-to-pay is often used to value tourism (e.g. through travel-cost and contingent valuation methods). The relative wealth of tourists and high costs paid to 'consume' this cultural ES can inflate tourism values so that they overshadow other, locally held values (Hicks *et al.* 2009). It is clear from these two examples that aggregate valuation tools, unless carefully selected, and without correction of inherent biases can lead to gross misrepresentations of the wellbeing contribution of different ES, particularly for the poorest. Inappropriate ES classifications, and an aggregate view of 'human wellbeing' increase the risk of such problematic valuations by de-emphasising the distinction between those who capture, those who trade and finally those who consume each ES.

Conclusions

We have discussed the relevance of the ES approach to poverty alleviation and highlighted some of the issues that we perceive in the current thinking around ES and human wellbeing, particularly related to the aggregation of human wellbeing. We do not reject the concept of ES as having no relevance for poverty alleviation. On the contrary, the focus of ES as defined by the MA, with an emphasis on 'the *benefits* people derive from ecosystems' offers a powerful conceptual lens to understand and propose solutions to environment-development conflicts *if* benefits are sufficiently disaggregated, so that benefits to the poor are not subsumed within aggregate 'human wellbeing' and subsequently ignored. Although trade-offs in ES have been widely discussed, not enough attention has been paid to the fact that changes in flows of, or access to, ES will not have uniform impacts on the wellbeing of different individual humans implying winners and losers. To address poverty alleviation, the

wellbeing of poor people needs to be explicitly recognised as distinct from the aggregate wellbeing of humanity. In order to be relevant to the wellbeing of poor people, an ES-based framework, and assessments of ES should:

1. Explicitly disaggregate ES beneficiaries into poor and other vulnerable groups (e.g. by gender, class, ethnicity, geography, livelihoods and socioeconomic status)

2. Emphasise institutions, technologies and capabilities that determine the poor's *access to* the benefits of ES.

3. Recognise the different wellbeing contribution of ES to the poor compared to other stakeholders by accounting for the marginal utility of material wealth and the context of the poor.

4. Explicitly recognise distributional mechanisms within society, (e.g. markets, employment, cash) their interaction with ES and contribution to wellbeing

For the ES concept to address the MA's stated scope of wellbeing and poverty alleviation, ES frameworks need to be broadened, disaggregating humans to better understand how ES contribute to poverty alleviation, and also to incorporate existing exchange mechanisms such as income and employment as well as new mechanisms such as PES.

Acknowledgments

This work was supported by ESRC/NERC ESPA (Ecosystem Services and Poverty Alleviation) situation assessment and we are grateful for stimulating discussions with partners. Tim McClanahan, Beatrice Crona and Bruce Lankford provided comments on the manuscript. Rozi Goodbody assisted with literature and manuscript preparation.

References

Adams, W.M., Aveling, R., Brockington, D., Dickson, B., Elliott, J., Hutton, J., Roe, D., Vira, B., Wolmer, W. (2004) Biodiversity Conservation and the Eradication of Poverty. *Science*, **306:** 1146-1149.

Adger, W.N., Hughes, T.P., Folke, C., Carpenter, S.R., Rockstrom, J. (2005) Social-ecological resilience to coastal disasters. *Science*, **309:** 1036. Alkire, S., (2002) Dimensions of human development. *World Development*, **30** (2): 181–205.

Baer, P. (2009). Equity in climate–economy scenarios: the importance of subnational income distribution. *Environmental Research Letters*, **4:** 015007

Béné, C., Hersoug, B., Allison, E.H. (2010) Not by Rent Alone: Analysing the Pro-Poor Functions of Small-Scale Fisheries in Developing Countries. *Development Policy Review*, **28**: 325–358.

Berkes, F., Hughes, T.P., Steneck, R.S., Wilson, J.A., Bellwood, D.R., Crona, B., Folke, C. et al. (2006) Ecology - Globalization, roving bandits, and marine resources. *Science* **311** (5767): 1557-1558.

Brown, K., Daw, T., Rosendo,S., Bunce,M., Cherrett, N. (2008) *Ecosystem Services for Poverty Alleviation: Marine & Coastal Situational Analysis. Synthesis Report*. Report for NERC/DFID. November 2008

Boyd, J., Banzhaf, S., (2007) What are ecosystem services? *Ecological Economics* **63** (2–3): 616–626

Butler, C., Oluoch-Kosura, W. (2006) Linking future ecosystem services and future human well-being. *Ecology and Society*, **11** (1): 30. [WWW document] URL: http://www.ecologyandsociety.org/vol11/iss1/art30/

Carpenter, S.R., Mooney, H.A., Agard, J., Capistrano, D., DeFries, R.S., Díaz, S., Dietz, T., Duraiappah, A.K., Oteng-Yeboah, A., Pereira, H.M., Perrings,C. Reid, W.V., Sarukhan, J., Scholes, R.J., Whyte, A. (2009) Science for managing ecosystem services: Beyond the Millennium Ecosystem Assessment. *PNAS*, **106** (5): 1305-1312.

Cheung, W.W.L., Sumaila, U.R. (2008) Trade-offs between conservation and socio-economic objectives in managing a tropical marine ecosystem. *Ecological Economics*, **66** (1): 193-210.

Cinner, J.E., Daw, T., McClanahan, T.R. (2009) Socioeconomic Factors that Affect Artisanal Fishers' Readiness to Exit a Declining Fishery. *Conservation Biology*, **23** (1): 124-130.

Costanza, R., dArge, R., deGroot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., Oneill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., vandenBelt, M. (1997) The value of the world's ecosystem services and natural capital. *Nature*, **387:** 253-260.

Crona, B., Nyström, M., Folke, C., Jiddawi, N. (2010) Middlemen, a critical social-ecological link in coastal communities of Kenya and Zanzibar. *Marine Policy*, **34**, 761-771.

Cunningham, S., Neiland, A. (2005) Investigating the linkages between fisheries, poverty and growth: policy brief. A report prepared for the Department for International Development (DFID) Project: 'The role of fisheries in poverty alleviation and growth: past, present and future'. DFID/PASS Contract: AG0213

Daily, G.C. (1997) *Nature's services: societal dependence on natural ecosystems*. Island Press.

Dasgupta, P. (2001) *Human well-being and the natural environment*. Oxford, Oxford University Press.

Dietz, T., Rosa, E., York, R. (2009) Environmentally efficient wellbeing: Rethinking sustainability as the relationship between human wellbeing and environmental impacts. *Human Ecology Review,* **16** (1): 114-123.

Ellis, F., White, P., Lloyd-Sherlock, P., Chhotray, V., Seeley, J. (2008) *Social Protection Research Scoping Study*, Report prepared for the Department for International Development.

FAO, 2007. *The State of Food and Agriculture 2007*. FAO Rome

Fisher, B., Turner, R.K., (2008) Ecosystem services: Classification for valuation. *Biological Conservation* **141**, (5): 1167-1169.

Fisher, B., Turner, R.K., Morling, P. (2009) Defining and classifying ecosystem services for decision making. *Ecological Economics,* **68** (3): 643-653

Godoy, R., Reyes-Garcia, V., Byron, E., Leonard, W.R., Vadez, V. (2005) The Effect of Market Economies on the Well-Being of Indigenous Peoples and on Their Use of Renewable Natural Resources, *Annual Review of Anthropology,* **34:** 121-138

Hein, L., van Koppen,K., de Groot, R.S. , van Ierland, E.C. (2006) Spatial scales, stakeholders and the valuation of ecosystem services. *Ecological Economics* **57** (2): 209-228.

Hicks, C. C., McClanahan, T. R., Cinner, J. E., Hills,J. M. (2009) Trade-Offs in Values Assigned to Ecological Goods and Services Associated with Different Coral Reef Management Strategies. *Ecology and Society* **14**(1).

Johansson-Stenman, O. (2005) Distributional weights in cost-benefit analysis - Should we forget about them? *Land Economics* **81** (3): 337-352.

Kumar, P. (ed) The Economics of Ecosystems and Biodiversity: *Ecological and Economic Foundations*, London, Earthscan**.**

Landell-Mills N., Porras, I.T. (2002) *Silver bullet or fools' gold? A global review of markets for forest environmental services and their impact on the poor,* IIED, London.

MA (Millennium Ecosystem Assessment) (2003) *Ecosystems and Human Well-being: A Framework for Assessment.* Washington DC., Island Press.

MA (Millennium Ecosystem Assessment) (2005) *Ecosystems and Human Well-being: Synthesis.* Washington, DC., Island Press.

Marshall, N., Milledge, S.A.H., Afonso, P.S. (2001) *Stormy seas for marine invertebrates; Trade in sea cucumbers, seashells and lobsters in Kenya, Tanzania and Mozambique,* TRAFFIC East/Southern Africa, Harare.

Matsue, N. (2009) *Gender, Trade and Development in Kenya's Marine Fishery*. MSc Thesis, University of East Anglia, School of International Development, Norwich

McClanahan, T. R. (2010) Effects of Fisheries Closures and Gear Restrictions on Fishing Income in a Kenyan Coral Reef. *Conservation Biology,* **24** (6): 1519-1528

McClanahan, T.R., Kaunda-Arara, B. (1996) Fishery recovery in a coral-reef marine park and its effect on the adjacent fishery. *Conservation Biology*, **10** (4): 1187-1199.

Nelson, E., Mendoza, G., Regetz, J., Polasky, S., Tallis, H., Cameron, D., Chan, K.M., Daily, G.C., Goldstein, J., Kareiva, P.M., Lonsdorf, E., Naidoo, R., Ricketts, T.H., Shaw, M. (2009) Modeling multiple ecosystem services, biodiversity conservation, commodity production, and tradeoffs at landscape scales. *Frontiers in Ecology and the Environment*, **7** (1): 4-11.

Norgaard, R.B. (2010) Ecosystem services: From eye-opening metaphor to complexity blinder. *Ecological Economics*, **69**(6) 1219-1227.

Pagiola, S., Arcenas, A., Platais, G. (2005) Can Payments for Environmental Services Help Reduce Poverty? An Exploration of the Issues and the Evidence to Date from Latin America. *World Development* **33** (2) : 237-253.

Pendleton, L.H., Howe, E.L. (2002) Market Integration, Development, and Smallholder Forest Clearance, *Land Economics,* **78** (1): 1-19.

Perrings, C. (2006) Ecological economics after the Millennium Assessment. *International Journal of Ecological Economics & Statistics (IJEES),* **6:** 8-22.

Polasky, S., Nelson, E., Pennington, D., Johnson, K.A. (2010) The Impact of Land-Use Change on Ecosystem Services, Biodiversity and Returns to Landowners: A Case Study in the State of Minnesota. *Environmental and Resource Economics* (11). doi:10.1007/s10640-010-9407-0.

Pollnac, R.B., Pomeroy, R.S., Harkes, I.H.T. (2001) Fishery policy and job satisfaction in three southeast Asian fisheries. *Ocean & Coastal Management*, **44** (7-8): 531-544.

Pollnac, R.B., Poggie,J.J. (2008) Hapiness, well-being and psychocultural adaptation to the stresses associated with marine fishing. *Human Ecology Review* **15** (2): 194-200.

Porter, M., Mwaipopo, R., Faustine, R., Mzuma, M. (2008) Globalization and Women in Coastal Communities in Tanzania. *Development* **51**(2): 193-198.

Raudsepp-Hearne, C., Peterson, G. D., Bennett, E. M. (In Press) Ecosystem service bundles for analyzing tradeoffs in diverse landscapes. *PNAS*

Raudsepp-Hearne, C., Peterson, G.D., Tengö, M., Bennett, E.M., Holland, T., Benessaiah, K., MacDonald, G.K., Pfeifer, L. (2010) Untangling the Environmentalist's Paradox: Why Is Human Well-being Increasing as Ecosystem Services Degrade? *BioScience*, **60:** 576-589.

Ribot, J.C., Peluso, N.L. (2009) A Theory of Access. *Rural Sociology*, **68:** 153-181.

Rodriguez, J.P., Beard Jr, T.D., Bennett, E.M., Cumming, G.S., Cork, S., Agard, J., Dobson, A.P., Peterson, G.D. (2006) Trade-offs across space, time, and ecosystem services. *Ecology and Society*, **11:** 28.

Srinivasan, U.T., Carey, S.P., Hallstein, E., Higgins, P.A.T., Kerr, A.C., Koteen, L.E., Smith, A.B., Watson, W., Harte, J., Norgaard, R.B. (2008) The debt of nations and the distribution of ecological impacts from human activities. *Proceedings of the National Academy of Sciences of the United States of America*, **105:** 1768-1773.

TEEB (2008) *The economics of ecosystems and biodiversity (TEEB). An Interim report*. European Communities, Cambridge.

Turner, R.A., Cakacaka, A., Graham, N.A.J., Polunin, N.V.C., Pratchett, M.S., Stead, S.M., Wilson, S.K. (2007) Declining reliance on marine resources in remote South Pacific societies: ecological versus socio-economic drivers. *Coral Reefs*, **26**, 997-1008.

Turner, R.K., Morse-Jones,S., Fisher,B. (2010) Ecosystem valuation. *Annals of the New York Academy of Sciences* 1185, no. 1: 79-101.

WRI, (World Resource Institute) (2007) *Nature's benefits in Kenya: An atlas of ecosystem services and human wellbeing*. Department of Resource Surveys and Remote Sensing, MENR, Kenya, Central Bureau of Statistics and International Livestock Research Institute, 2007. WRI, Washington DC and Nairobi.

WRI, UNDP, UNEP, World Bank. (2008) *A Guide to World Resources 2008: Roots of Resilience-Growing the Wealth of the Poor*. World Resources Institute, Washington DC.