



Strengthening conceptual foundations: Analysing frameworks for ecosystem services and poverty alleviation research



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ABSTRACT

A research agenda is currently developing around the linkages between ecosystem services and poverty alleviation. It is therefore timely to consider which conceptual frameworks can best support research at this nexus. Our review of frameworks synthesises existing research on poverty/environment linkages that should not be overlooked with the adoption of the topical language of ecosystem services. A total of nine conceptual frameworks were selected on the basis of relevance. These were reviewed and compared to assess their ability to illuminate the provision of ecosystem services, the condition, determinants and dynamics of poverty, and political economy factors that mediate the relationship between poverty and ecosystem services. The paper synthesises the key contributions of each of these frameworks, and the gaps they expose in one another, drawing out lessons that can inform emerging research. Research on poverty alleviation must recognize social differentiation, and be able to distinguish between constraints of access and constraints of aggregate availability of ecosystem services. Different frameworks also highlight important differences between categories of services, their pathways of production, and their contribution to poverty alleviation. Furthermore, we highlight that it is important to acknowledge the limits of ecosystem services for poverty alleviation, given evidence that ecosystem services tend to be more associated with poverty prevention than reduction. We conclude by reflecting on the relative merits of dynamic Social–Ecological Systems frameworks versus more static checklists, and suggest that research on ecosystem services and poverty alleviation would be well served by a new framework distilling insights from the frameworks we review.

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1. Introduction

Various research agendas have emerged from the Millennium Ecosystem Assessment (MEA), including one concerned with understanding more fully the links the MEA makes between ecosystem services and human wellbeing and poverty (Carpenter et al., 2009; Daw et al., 2011; Raudsepp-Hearne et al., 2010). Whilst ecosystem services concepts have become popular relatively recently, it is our contention that the ecosystem services and

poverty alleviation research agenda can draw much from existing scholarship. At this stage in the nascent research agenda, there is a particular need to review existing conceptual approaches. Conceptual frameworks are popular in natural resource aspects of international development, with Sustainable Livelihoods approaches adopted influentially in the 1990s, for instance. Frameworks are popular perhaps because they assist with multidisciplinary analysis to make sense of complexity in dynamic situations. The reliance on conceptual frameworks in this field means they are influential; at its simplest, a framework provides a checklist for what issues are considered, and by extension, what does not reach the agenda. The objective of this paper is to critically evaluate the contribution of various conceptual frameworks to understanding the relationship between ecosystem services and rural poverty alleviation. We start by reviewing the relationship between poverty and the environment.

Links have been made between poverty and environment because poor rural people in developing countries often have higher dependence on livelihood resources directly from nature. This relationship may also run in the other direction: poverty can

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be a driver of degradation of ecosystem services, for instance through the intensification of agriculture (for further discussion of the poverty/environment relationship, see [Duraiappah, 1998](#); [Gray and Moseley, 2005](#); [Reardon and Vosti, 1995](#)). Regardless of the direction of drivers, poor people are often disproportionately vulnerable to environmental change and stressors ([MEA, 2005b](#); [Poverty Environment Initiative, 2009](#)). In addition, the importance of the relationship between environment and poverty is heightened because poor people are commonly constrained in their ability to substitute natural capital for other forms of capital ([MEA, 2005a](#)). In contrast, wealthier people in industrial nations often reduce apparent dependence on the environment by substituting natural for manufactured capital and petrochemical energy.

Attempts to define poverty are confounded as it is multidimensional, context-dependent and subjectively experienced. Yet, the ‘voices of the poor’ research, spanning 23 countries ([Narayan et al., 1999, 2000](#)) highlighted components that poor people commonly invoke as constituting wellbeing. This work reflected a broader shift to the conceptualization of poverty as the profound deprivation of wellbeing, making a departure from monodimensional income or material asset-based notion of poverty. We adopt this conceptualization when referring to poverty and derivatives including ‘poor’. Narayan et al. identify five components of wellbeing:

- ‘the necessary material for a good life (including secure and adequate livelihoods, income and assets, enough food at all times, shelter, furniture, clothing, and access to goods);
- health (including being strong, feeling well, and having a healthy physical environment);
- good social relations (including social cohesion, mutual respect, good gender and family relations, and the ability to help others and provide for children);
- security (including secure access to natural and other resources, safety of person and possessions, and living in a predictable and controllable environment with security from natural and human-made disasters);
- freedom of choice and action (including having control over what happens and being able to achieve what a person values doing or being)’ ([Narayan et al., 1999; 2000](#), as represented in [MEA, 2003](#); 74).

The MEA’s ‘micro-level’ conceptual framework presents these aspects of wellbeing, linked to categories of ecosystem service (see [Fig. 1](#)).

This framework highlights links between ecosystem services and the basic material for a good life, security and health. Empirical work endorses the importance of these links, showing that the poor particularly prioritize provisioning services and also recognize regulating services ([Brown et al., 2008](#)). The MEA also links good social relations to ecosystem services, through the relationship between ecosystems and the expression of cultural and spiritual values ([2005a](#)). Clearly this link is not exclusive: non-environmental factors are also important in fostering good social relations. The framework links ecosystem services to ‘freedom of choice and action’ via other elements of wellbeing, suggesting that the ability to make choices over components of wellbeing actually constitutes wellbeing, with echoes of [Sen \(2001\)](#). Yet, ‘freedom of choice and action’ also links more directly with ecosystem services because the mechanisms by which rural people engage with the state are often in the context of the management of natural resources. Hence, [Ribot \(2006\)](#) urges environmentalists to work through democratic channels, [Brown et al. \(2002\)](#) argue that the forest sector can be the ‘crucible’ of wider governance reform, with lessons for other sectors, and [Mayers \(2007; 1\)](#) argues that forests can be associated with poverty reduction, through the extension of related ‘civil and political rights, voice and the rule of law’.

Hence, poverty and the environment are closely linked. Yet, it is worth questioning what scope there is for poverty to be alleviated by ecosystem services. [Angelsen and Wunder \(2003\)](#) consider that poverty alleviation incorporates poverty reduction and poverty prevention. Through poverty reduction, people move above a poverty line, whereas, in contrast, poverty prevention means that people maintain a minimum standard of living – surviving – although they may be below the poverty line ([Angelsen and Wunder, 2003](#)). The literature is better furnished with examples in which ecosystem services are associated with poverty prevention than reduction ([Angelsen and Wunder, 2003](#); [Béné et al., 2010](#); [Fisher, 2004](#); [Mayers, 2007](#)). Ecosystem services tend to provide ‘safety nets’ to depend on for subsistence in lean times or when crops fail, or they provide income ‘gap fillers’, by which a few products managed or cultivated make a small cash income ([Mayers, 2007](#)). The absence of these critical ‘safety-nets’ or ‘gap-fillers’ may lead to extreme poverty and ill being. Hence, it is perhaps useful to think about ecosystem services as preventing absolute poverty.

The paper proceeds as follows. The following methods section identifies a more precise definition of what type of conceptual framework we focus on, outlines the means by which we selected frameworks, and the process of appraisal. The review then proceeds to critically appraise each framework for research on ecosystem services and poverty alleviation. We conclude by discussing the commonalities between frameworks and how they inform a research agenda.

2. Methods: the selection of frameworks for review

Before outlining the process by which we selected frameworks to review, broader questions require attention as regards the purpose served by conceptual frameworks. Distinct traditions within environment-society research embody nuanced differences in how frameworks are used, with variable emphases on concepts and data. These differences are important to disentangle in the positioning of this review. We trace a broad, and not necessarily mutually exclusive, distinction between frameworks providing conceptual insight and frameworks designed to support data collection. This dichotomy is associated with, but does not strictly adhere to, familiar dichotomies of natural versus social sciences, or qualitative versus quantitative and modelling traditions.

In empirically-oriented traditions, frameworks tend to be operationalized through the collection of data. Frameworks therefore serve as data classification templates, to aid synthesis, particularly meta-analysis. Such an example is presented in [Ostrom \(2009\)](#). A second tradition of framework usage is as a presentation of key concepts and relationships, either as a ‘thinking-tool’, or as the preliminary stage of a model. Examples are identifiable within social science and policy-applied research where frameworks act as representations of key concepts and relationships between concepts. In a distinct tradition, modellers often use frameworks as systems diagrams, linking entities and processes. Such diagrams may have conceptual merit, for instance through the novelty of what is featured, and in the characterization of the relationships. What unites these modelling and social science applications of frameworks is that they are primarily conceptual, and loosely inform, rather than being a template for, data collection. We therefore highlight this distinction between empirical frameworks, and frameworks with conceptual insight.

For this review paper, we made a comprehensive selection of frameworks and bodies of conceptual literature focused on the environment-society interface. The list was compiled by the multidisciplinary team of authors and augmented with suggestions from peers in the Ecosystem Services for Poverty Alleviation research community with whom we consulted at a general meeting of this community in May 2011. There was considerable

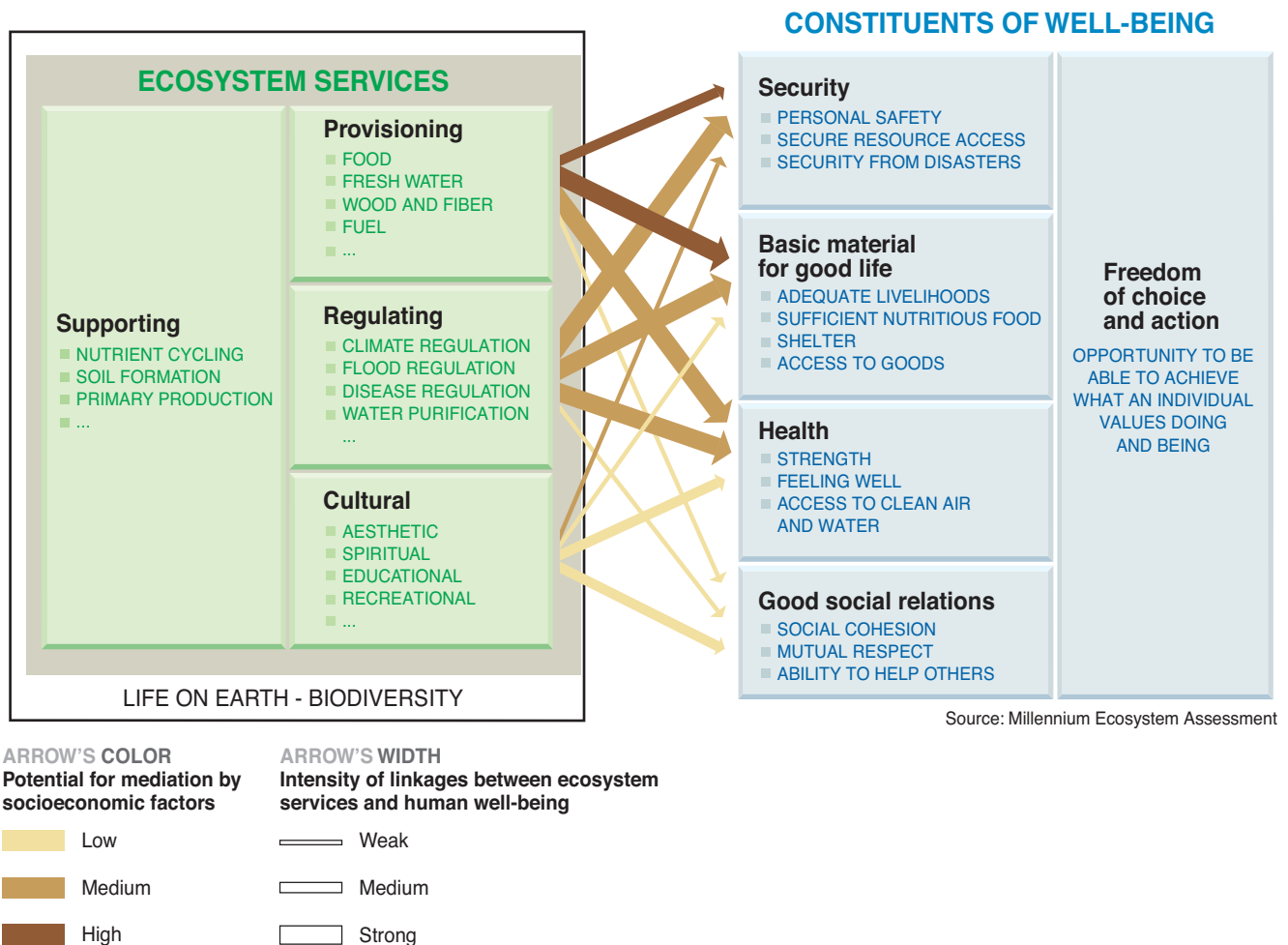


Fig. 1. The 'micro' Millennium Ecosystem Assessment framework (reproduced with permission from MEA, 2005b; vi).

homogeneity in suggestions of relevant frameworks and therefore, all frameworks suggested could be included and none were excluded. However, with reference to the distinction highlighted above between conceptual and empirical frameworks, this paper is focused solely on frameworks with conceptual insight. Therefore, empirically-oriented frameworks such as Ostrom (2009) (suggested later by an anonymous reviewer of this paper) are excluded. A further criterion for inclusion relates to whether frameworks are represented diagrammatically. We include both diagrammatic and non-diagrammatically represented frameworks because excluding non-diagrammatic frameworks would have narrowed the range of conceptual influences, meaning we could not incorporate insights from, for instance, political ecology or resilience.

This process of framework selection resulted in the following list (in alphabetical order, which extends to Section 3, and with key texts noted):

- Environmental Entitlements (Leach et al., 1999).
- Framework for Ecosystem Services Provision (Rounsevell et al., 2010).
- Millennium Ecosystem Assessment (MEA, 2005b).
- Political Ecology (Blaikie and Brookfield, 1987).
- Resilience (Folke, 2006; Holling, 1973).
- Sustainable Livelihoods (Chambers and Conway, 1992; Scoones, 1998).
- The Social Assessment of Protected Areas (linked to Sustainable Livelihoods) (Schreckenberg et al., 2010).

- The Economics of Ecosystems and Biodiversity (TEEB, 2010a).
- Vulnerability (Adger, 2006; Fussler, 2007).

In what follows, we appraise the heuristic value of frameworks, to structure information and analysis, ultimately to improve our understanding of the relationships between ecosystem services and poverty alleviation. These identified frameworks have a variety of purposes and applications: some are the basis of scientific assessments (e.g. MEA, 2005b; TEEB, 2010b), others have been proposed within published literature (e.g. Leach et al., 1999; Rounsevell et al., 2010). Despite this variety, the frameworks all contain conceptual insight. However, because of this variety, it would be artificial to appraise them by scoring against prescriptive criteria. Instead, we take a relatively inductive approach to identify the contribution of each to this research agenda. For each framework, key elements and emphases are noted, followed by discussion within three areas: the ability of the framework to illuminate (1) aspects of ecosystem service delivery; (2) the condition, determinants and dynamics of poverty, and; (3) political economy factors that influence how ecosystem services contribute to poverty alleviation. We use the term 'political economy' here to describe the political and power dynamics affecting the distribution of ecosystem services and other resources. The balance of discussion will depend on the emphases of each; for instance, some frameworks make no contribution to our understanding of ecology. We support the analysis of frameworks with the literature that introduced the frameworks, and further literature employing

and appraising these frameworks. This gives the basis for a comparative analysis of frameworks. The focus we defined above on the conceptual insights of frameworks means that we do not appraise their operational value, for empirical or other applications. The novelty of this paper comes not only from the application of different disciplinary perspectives to understanding ecosystem services and poverty, but also because to the best of our knowledge, no other paper reviews this range of frameworks across disciplines.

3. The contribution of different conceptual frameworks to understanding the relationship between poverty and ecosystem services

3.1. The Environmental Entitlements and property rights frameworks

Leach et al. (1999) have extended Amartya Sen's work on entitlements to focus specifically on environmental goods and services. Sen (1981) argues that in famines, aggregate food availability is less important than the ability of people to access food. This distinction between aggregate availability and access is also crucially important for understanding how people benefit from ecosystem services and Leach et al. (1999) highlight the importance of endowments and entitlements. Endowments refer to the rights and resources actors have (Leach et al., 1999; 233). These can be natural endowments (for instance proximity to a forest), or in the case of rights, institutionalized in law. Yet, the work of Sen and others shows endowments are not enough: beyond the existence of a resource, or the right to exploit that resource, actors require entitlements to benefit from the resource. Entitlements are the means to use a resource: 'legitimate effective command over alternative commodity bundles' (Leach et al., 1999; 233; despite this reference to commodities, we consider both commodified and un-commodified ecosystem services in their relationship with poverty alleviation). Sikor and Nguyen (2007) provide a forest-related illustration: through greater entitlements, wealthier households have more extensive means to exploit forests and derive higher benefits from forest resources, both through markets and in agricultural production. This demonstrates the centrality of the notion of social differentiation in entitlements analysis. The idea that entitlements and endowments are held at the household or individual level means that social differentiation can be analyzed through this lens. Leach et al.'s (1999) analysis is supported by a diagrammatic framework (Fig. 2), showing how entitlements and endowments mediate access to ecosystem goods and services for actors with differentiated capabilities. This diagram also refers to 'capabilities'. Another notion closely associated with Sen (1985), capabilities refer to what people can do or be, and as such are closely linked to entitlements.

Because many ecosystem services derive from land, endowments relate closely to property rights, defined as the authority to undertake specific actions in relation to a particular domain (Commons, 1968, in Schlager and Ostrom, 1992). Property rights frameworks also facilitate consideration of collectives, whereas entitlements and endowments are typically considered in relation to individuals or households. Schlager and Ostrom (1992) distinguish between different categories of property rights

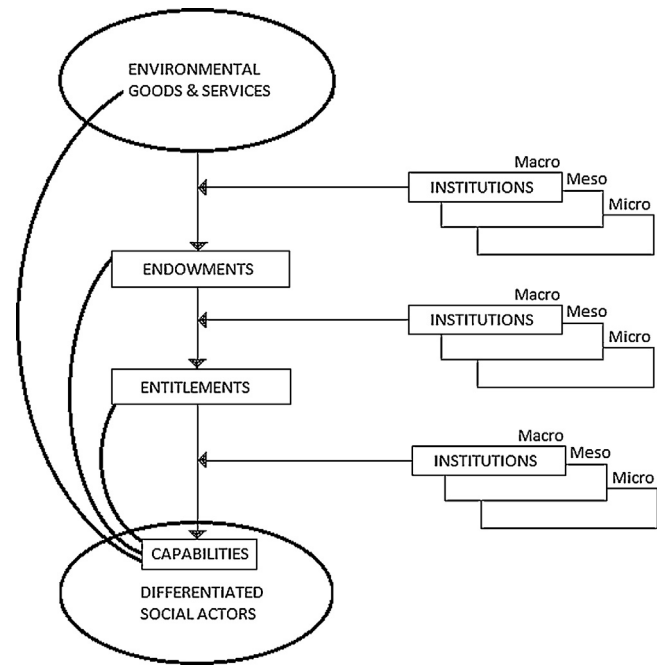


Fig. 2. The Environmental Entitlements framework (redrawn with permission from Leach et al., 1999; 234).

including operational level aspects, of access and withdrawal, and higher level collective-choice rights, of management, exclusion and alienation (Schlager and Ostrom, 1992). Collective-choice rights govern operational rights. Different groups of actors (e.g. owner; proprietor; claimant; authorized user) are distinguished according to their property rights, from the constrained rights of authorized user, to the extensive rights of owner (represented in Fig. 3). As such, Schlager and Ostrom's work gives a vocabulary for analyzing the endowments of poor groups to ecosystem services. Poverty is more likely to be associated with access, withdrawal, and possibly management rights, whereas collective-choice rights often remain the preserve of wealthier elites.

Entitlements and property rights frameworks make two crucial contributions beyond the MEA framework. They facilitate analysis of firstly, access to ecosystem services and secondly, social differentiation. With the ability to illuminate social differentiation at a micro scale, the Entitlements framework tends to be used at the local level. However, it can also serve cross-scale analysis, to understand the political economy context of entitlements. Leach et al. (1999) conceptualize entitlements as the outcome of social negotiations, meaning that *de facto*, as well as *de jure* aspects are incorporated. It is for this reason that Leach et al. (1999) emphasize 'legitimate' and 'effective' in their definition. There is also a realistic appreciation of the importance of power, hence it is acknowledged that failures of entitlement are less commonly associated with a lack of 'institutionally grounded claims' (p. 241), and more often with limited power to enforce those claims against more powerful actors (Leach et al., 1999).

	Owner	Proprietor	Claimant	Authorized User
Access and Withdrawal	X	X	X	X
Management	X	X	X	
Exclusion	X	X		
Alienation	X			

Fig. 3. Bundles of rights associated with positions (reproduced with permission from Schlager and Ostrom, 1992; 252).

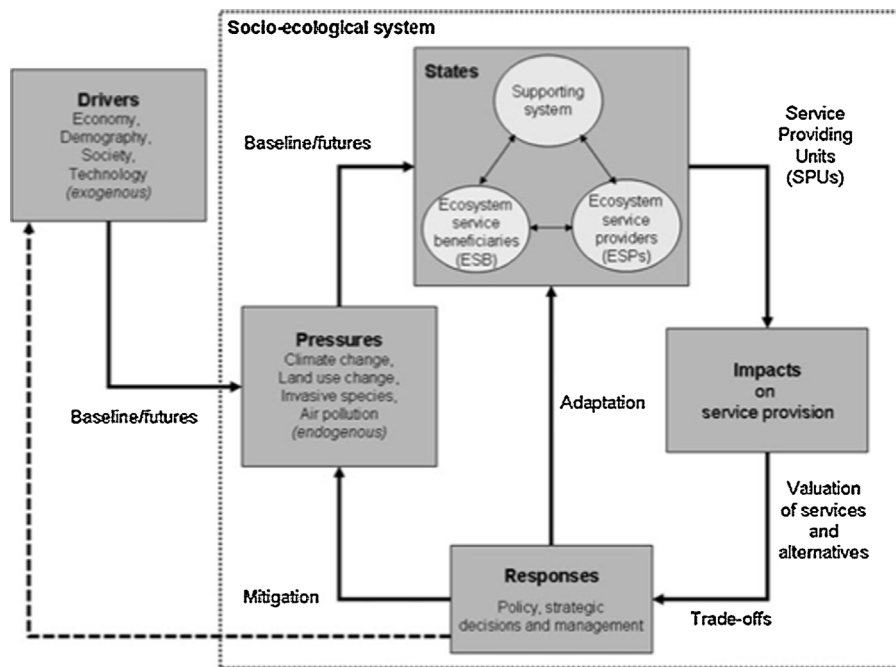


Fig. 4. The framework for ecosystem service provision (reproduced with permission from Rounsevell et al., 2010; 2827).

3.2. The framework for Ecosystem Services Provision

The Framework for Ecosystem Services Provision forms an adaptation of the Drivers, Pressures, State, Impact, Response framework, which is commonly used in industrialized-world applications. The framework describes a Social–Ecological System, in which pressures, states, impacts and responses are internal to the system and drivers are external. Pressures act upon states, which are composed of the supporting system (biophysical), Ecosystem Service Providers (defined as biological in Rounsevell et al. (2010; 2828), although arguably, Social–Ecological Systems produce ecosystem services) and Ecosystem Service Beneficiaries. These entities within the ‘states’ sector lead to impacts on service provision, which in turn initiate responses. Importantly, responses are separated into adaptation, which leads to change in the properties of the states, and mitigation, through which pressures change. The terminology of the Framework for Ecosystem Services Provision relates closely to other frameworks: for instance, ‘drivers’ within this framework are equivalent to the ‘indirect drivers’ of the MEA and ‘pressures’ are equivalent to the ‘direct drivers’ of the MEA (Fig. 4).

The Framework for Ecosystem Services Provision has three key contributions relating to the ecosystem services and poverty alleviation research agenda. Firstly, the framework contains an innovation that analytically extends the anthropocentric focus of ecosystem services: Ecosystem Services Beneficiaries have attributes that influence their interaction with services. As with the Entitlements framework, this gives the potential for recognizing differentiation between social actors. Hence these frameworks can be used to support questions about the contribution of ecosystem services to ‘whose wellbeing’, at a time in which Daw et al. (2011) critique the MEA framework as it does not illuminate social differentiation. However, Rounsevell et al. (2010) do not offer potential axes for examining social differentiation, and do not specifically consider poverty or access to ecosystem services. A second key innovation is to support the distinction between adaptation and mitigation responses, providing useful conceptual clarity in a field with extensive policy considerations. Finally, the

Framework for Ecosystem Services Provision represents a dynamic system with directional relationships between entities, in contrast to other frameworks that comprise a checklist of factors.

3.3. The Millennium Ecosystem Assessment frameworks

The Millennium Assessment is a global assessment of the state and trends of ecosystems, particularly focused on the implications for human wellbeing (MEA, 2005b). The MEA developed two conceptual frameworks. The first concentrates on a ‘micro’ scale (see Fig. 1) whereas the ‘macro’ framework situates ecosystem services and wellbeing within a context of direct and indirect drivers, and within spatial and temporal dimensions (Fig. 5).

The introductory section has already described the ‘micro’ MEA conceptual framework. Whilst the Assessment has a seminal position, a number of weaknesses common to both the ‘micro’ and ‘macro’ frameworks are pertinent for future research. Recent critique results from the framework’s lack of representation of social differentiation (Daw et al., 2011). Research across sectors has shown that benefits to the poor or poorest are not necessarily well represented in aggregate human wellbeing, and that social tradeoffs exist in most environmental management strategies.

In the ‘macro’ MEA framework, drivers are highly generic (for instance, climate change), and whilst economic and socio-political indirect drivers are noted, these translate to few direct drivers that take any account of political economy. The framework resembles others in that the top rightmost box is analogous to the leftmost column of Sustainable Livelihoods, which in turn relates to the TEEB representation of governance. The MEA frameworks have also strongly influenced the UK National Ecosystem Assessment framework (NEA, 2011).

3.4. The political ecology literature

From its origin, political ecology has been used as a framework for understanding political economy factors in human–ecosystem interactions, involving the recognition that economic and political factors strongly influence the relationship of people and natural

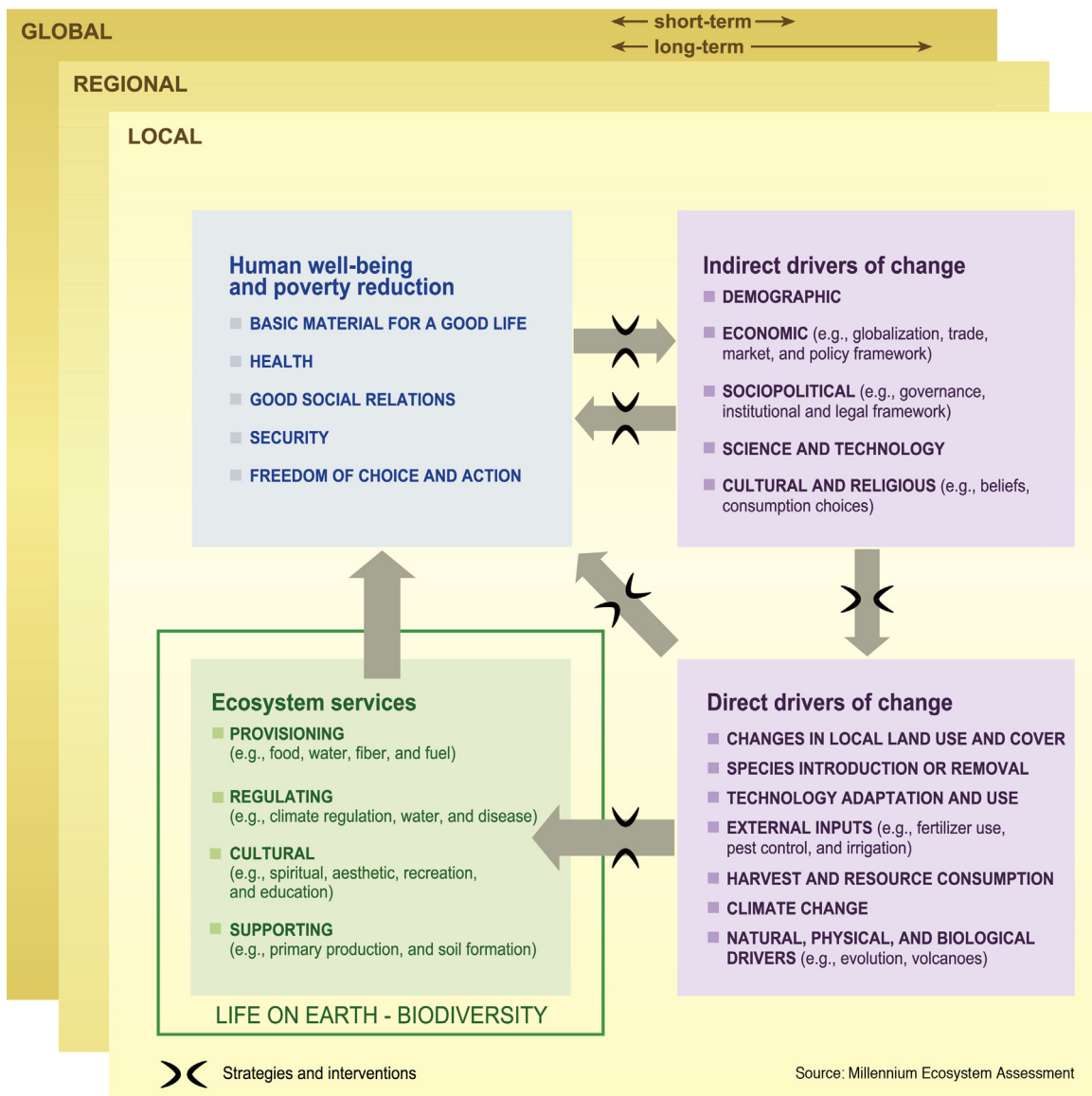


Fig. 5. The macro Millennium Ecosystem Assessment framework (reproduced with permission from MEA, 2005b; vii).

resources. Whereas forerunning ecological anthropology and cultural ecology had tended to portray societies in harmony with nature (Brown, 1997), early work in political ecology brought a more structuralist analysis, pointing to the imprints of markets, social inequality, conflict and the dislocations of both postcolonial situations and rapid globalization (Watts, 2000). The field has also developed as a reaction to apolitical environmental science which tends to offer apolitical answers to political questions (Robbins, 2004), such as those surrounding global consumption disparities. In this way, political ecology has focused on the influence of ultimate rather than proximate factors in environmental change (Blaikie and Brookfield, 1987; Turner and Robbins, 2008). More recently, post-structural forms of political ecology focus on the importance of discourse and power in the construction of environmental narratives (Forsyth, 2003; Hoben, 1995; Stott and Sullivan, 2000). This is the ‘politics of how environmental explanations are made’ (Forsyth, 2008; 756), with notable examples including theories of Himalayan environmental crisis (Blaikie and Muldavin, 2004), and desertification narratives in dryland Africa (Behnke et al., 1993; Stott and Sullivan, 2000).

Because political ecology forms a disparate field (Watts, 2000), it is important to draw out the particular elements useful for ecosystem services and poverty alleviation research. Most obviously, structural political ecology concepts can be used to engage with political economy processes that produce poverty and impact upon ecosystem services. Because of the commitment to understanding ultimate, rather than solely proximate factors, political ecology is useful for cross-scale analyses: understanding how global discourses and material phenomena are manifest in local situations (Adger et al., 2001; Rocheleau, 2008). In this way, transnational linkages of the production and consumption of ecosystem services can be traced, alongside the political dynamics arising from these. Beyond these cross-scale analyses, political ecology can also aid our understanding of local level, intra-community dynamics. Through an explicit commitment to social justice (Forsyth, 2003), locally grounded political ecology analyses use concepts of power and politics to highlight the socially differentiated implications of environmental change and environmental interventions (Brown, 1997; Bryant, 1992). Hence, analytical tools associated with political ecology link to work on

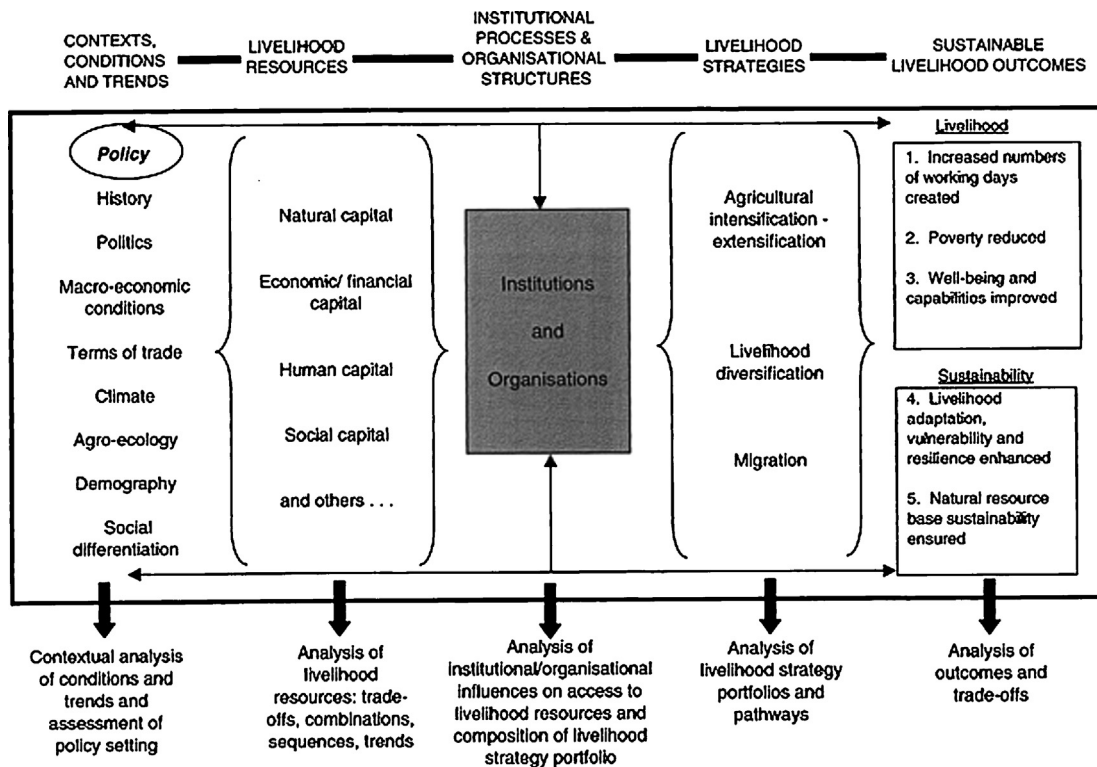


Fig. 6. The Sustainable Livelihoods framework (reproduced with permission from Scoones, 1998; 4).

entitlements, vulnerability and Sustainable Livelihoods by allowing an analysis of social differentiation, the importance of a relative conceptualization of poverty and differentiated access, control and distribution of environmental resources.

3.5. Resilience

The concept of resilience is foundational to ecology, defined succinctly by Folke (2006) as the capacity of a system to absorb shocks and still maintain function. Resilience thought traces back to Holling (1973) and is closely associated with mathematical modelling and concepts including the adaptive cycle, which characterizes distinct phases in systems, of growth/exploitation; conservation; release, and reorganization/renewal. Inherent is the idea that ecological systems have multiple stable states, and resilience thought is therefore closely associated with ideas of non-linearity, uncertainty and thresholds (Janssen and Ostrom, 2006). Resilience ideas have therefore influenced important revisions in ecological thought, away from stability, climax communities and the balance of nature.

Since the 1990s, resilience concepts have increasingly been applied to Social–Ecological Systems. These are defined as an ‘ecological system intricately linked with and affected by one or more social systems’ (Anderies et al., 2004; 3) Resilience in Social–Ecological Systems is defined by Gunderson (2000) as the ability to absorb disturbance without flipping into another state or phase. Folke also highlights the important capacities of resilient systems to self-organize and adapt to emerging circumstances (2006).

Resilience is important to ecosystem services and poverty alleviation research in a number of ways. Within ecological science, links exist between the resilience of ecosystems and their ability to provide services (e.g. MEA, 2005b; Paquette and Messier, 2011), hence their ability to support human wellbeing. Ecological resilience is therefore important for service production. Thinking

beyond ecology to Social–Ecological Systems, resilience gives a conceptual basis for considering change, and allows the integration of interdisciplinary work on vulnerability and adaptation. While resilience, vulnerability and adaptation have tended to be discrete in terminology and scholarly communities (for a citation analysis, see Janssen et al., 2006), Adger (2006) notes the numerous and fundamental commonalities and anticipates fruitful convergence between these fields. Finally, there are important implications of the application of resilience concepts in policy, through which the ability of the system to adjust and respond is highlighted (Eakin et al., 2009). As such, resilience-based policy is aligned with adaptive management approaches, which recognize dynamism and attempt to incorporate learning. This is important for interventions focused on ecosystem services and poverty, given these will take place in an era of rapid environmental and social change.

The various possibilities that resilience approaches present have been highlighted. However, scholars caution at the uncritical transfer of concepts such as resilience from the natural to the social sciences (Adger, 2000; Cote and Nightingale, 2011) insofar as this implies there are no essential differences in behaviour and structure between natural and social systems (Gallopini, 2006). This is pertinent because resilience and systems concepts are not well suited to understanding political economic factors and power, or the agency of people (Brown and Westaway, 2011). More broadly, systems approaches can mask contextual complexity, which social science research commonly attempts to understand (Flyvbjerg, 2002). Context is likely to be important in situations where ecosystem services contribute to poverty alleviation. Furthermore, resilience itself is a neutral concept, rather than a normative one. For instance, poverty traps can be very resilient, and yet undesirable. Social–Ecological Systems and resilience approaches are currently not well suited for addressing more normative and hence political questions at the root of many

ecosystem services and poverty alleviation issues (Cote and Nightingale, 2011).

3.6. The Sustainable Livelihoods framework and adaptations

Ideas of Sustainable Livelihoods were first articulated through a discussion paper, which defined a livelihood as ‘compris[ing] people, their capabilities and their means of living, including food, income and assets’ (Chambers and Conway, 1992; 1). Chambers and Conway draw on notions of capabilities and equity, with an overarching concern for sustainability. These ideas were later represented in a diagrammatic conceptual framework (Scoones, 1998) (Fig. 6).

Much of the energy surrounding Sustainable Livelihoods results from its extensive adoption within the UK Department for International Development (DfID) (Solesbury, 2003). Whilst DfID no longer promotes it, the framework remains influential globally. The framework’s flexibility makes it widely applicable, although some note that this engenders a lowest common denominator approach (Clark and Carney, 2008). The framework assists with the analysis of what makes a livelihood sustainable, with livelihood outcomes in the rightmost column. Outcomes result from livelihood strategies (4th column), related to institutional processes and organizational structures (3rd column). The accompanying notes highlight the importance of access to resources, with parallels to entitlements and property rights frameworks. The ‘resources’ (2nd) column notes capitals of various kinds, including natural capital, which could include ecosystem services. The first column is the least specific of all: contexts, conditions and trends.

Clark and Carney (2008) consider this framework to be relatively weak for analyzing the influence of policies and political economy processes, partly because it tends towards a micro household, rather than cross-scale focus. They consider the approach relatively apolitical, inadequately focused on the underlying causes of poverty, including power, exclusion and entitlement (Clark and Carney, 2008). This may be associated with implementation rather than inherent to the framework. Scoones

(2009) argues that the use of the framework has tended to focus disproportionately on quantifiable aspects, such as the ‘asset pentagon’ (DfID’s version presented column 2 pentagonally), when the innovation of the approach involves a more holistic combination of quantitative and qualitative analysis. In sum, the framework presents various entry points for thinking holistically about the contribution of ecosystem services to livelihoods. Furthermore, the flexibility of the framework means it is highly compatible with other frameworks. For instance, ideas associated with political ecology or Environmental Entitlements could be used to extend the political analysis of Sustainable Livelihoods.

The importance of the Sustainable Livelihoods framework is reflected in its influence on others, including the Social Assessment of Protected Areas framework (Schreckenberg et al., 2010). Small extensions on Sustainable Livelihoods include that ‘natural’ assets are presented in the ecosystem services categories of the MEA, with cultural services included amongst ‘social/cultural’ assets. A sixth asset incorporates ‘political/legal’ factors, reflecting recent interest in rights-based approaches and the opportunities and empowerment focus of the World Development Report (2000). This could serve to address Clark and Carney’s (2008) critique that Sustainable Livelihoods does not support analysis of political economy factors. Authors note that the diagram (Fig. 7) does not represent causal relationships, instead being a checklist of factors.

3.7. The Economics of Ecosystems and Biodiversity (TEEB) framework

The TEEB report, the mandate of which is to develop economic valuation of ecosystems and biodiversity, developed a conceptual framework most closely related to the MEA (Fig. 5). There are also similarities to the Framework for Ecosystem Services Provision, particularly through the language of drivers. However, the entries under ‘ecosystems and biodiversity’ and ‘human wellbeing’ are subtly different from the MEA.

Firstly, ecosystem services are diagrammatically placed more explicitly as the products of ecological function. TEEB therefore employs a distinction argued for by Boyd and Banzhaf (2007) and

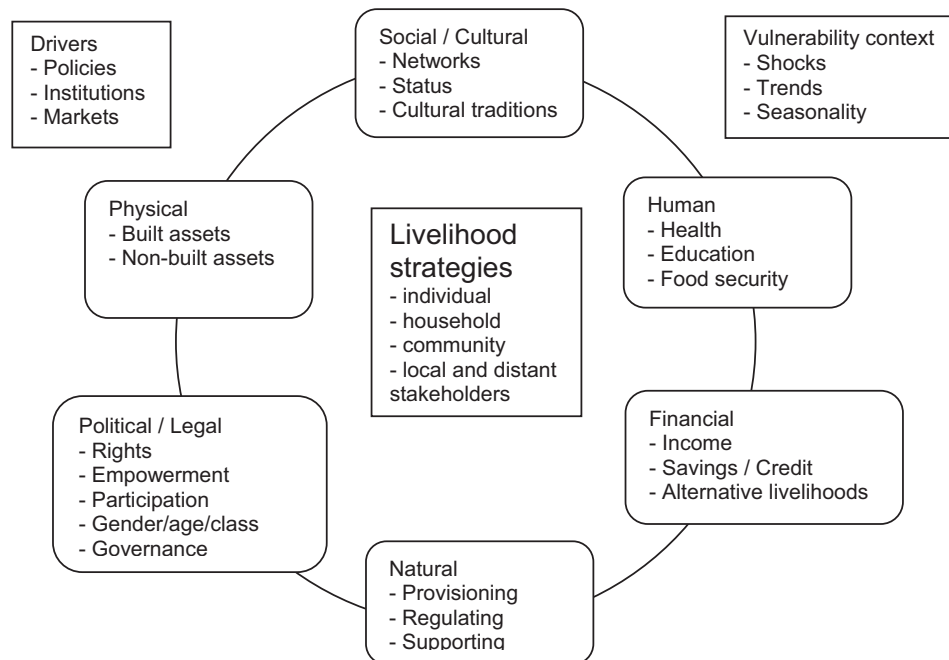


Fig. 7. The Social Assessment of Protected Areas framework (reproduced with permission from Schreckenberg et al., 2010; 28).

Fisher et al. (2009) between ecological function, services, and the benefits they generate for human wellbeing. This distinction, and the use of a terminology of ‘goods’ and ‘final ecosystem services’, is reflected in the NEA framework (NEA, 2011) and associated work (e.g. Mace et al., 2012). These distinctions are particularly pertinent for economic valuation and avoiding double-counting.

A second factor distinguishing the TEEB framework from the MEA is that the human wellbeing box is structured differently, framed as economic, social and ecological ‘benefits and values’, with related indicators. Finally, there is a ‘governance and decision-making’ entry, yet this is specific to TEEB’s work programme, rather than more generally applicable. The placement of this entry and the arrangement of the arrows make the framework unrealistically linear, suggesting it actually represents more of a checklist than a system. In sum therefore, TEEB’s conceptual framework supports valuation, a particular subset of work on ecosystem services and human wellbeing, and not a strong focus of this review (Fig. 8).

3.8. Vulnerability

Vulnerability refers to ‘the degree to which a system... is likely to experience harm due to exposure to a hazard’ (Turner et al., 2003; 8074). Adger (2006; 269) summarizes the key parameters of vulnerability to include ‘stress to which a system is exposed, its sensitivity, and its adaptive capacity’. This definition is similar to that of the IPCC Third Assessment report (2001), important to note because much contemporary work on vulnerability stems from concern about climate change (Adger, 2006; Fussel, 2007).

Vulnerability is both a condition and determinant of poverty (Consortium for Ecosystem Services and Poverty Alleviation, 2008): poor people tend to be vulnerable in some way, because poverty may undermine adaptive capacity. Vulnerability could impinge on any of the five aspects of wellbeing presented in the MEA (Section 1), and perhaps most evidently on health, security and the necessary materials for a good life. As noted above, the rural poor tend to depend directly on services, and are thus

immediately vulnerable to natural or anthropogenic changes, affecting livelihood resources or regulating services, which govern the habitability of an environment. The importance of vulnerability is evident in its inclusion in many existing frameworks: explicitly in Sustainable Livelihoods and closely linked to resilience and political ecology.

However, the word vulnerability is commonly used either fairly loosely or in nuanced ways by different academic traditions. It is therefore worth determining a particular approach to vulnerability from a concern with poverty and ecosystem services. Fussel argues that a vulnerable situation can only be described with reference to the system; attribute of concern; hazard, and temporal reference (2007; 157). Research traditions in vulnerability have variously highlighted biophysical (hazard and risk), or political economic factors. An important contribution has been the idea of social vulnerability: defined by Brooks (2003; 5) as the factors which determine the outcomes of a ‘hazard event of a given nature and severity’. Research shows that household and individual vulnerability are strongly mediated by social position; objective hazards or risks are experienced differently according to social factors. This stems from a political economy analysis, focusing not on ‘nature, technology or agency’ (Fussel, 2007; 159), but *structure* in creating vulnerability, including poverty, inequality, marginalization, access to insurance, and housing quality (Adger and Kelly, 1999; Blaikie et al., 1994; Brooks, 2003). Many of these factors explaining social vulnerability relate to entitlements (Adger and Kelly, 1999), demonstrating a clear connection between frameworks.

Fussel (2007) makes a useful distinction between internal and external vulnerability. External factors are the stressors that a system is exposed to and internal factors determine the impacts to the system. This places both internal and external components in the socioeconomic domain, whereas the implication of Brooks’ (2003) definition of social vulnerability (above) is that social dimensions are always internal. Fussel’s work enables the examination of structural factors such as ‘national policies, international aid and economic globalization’ (Fussel, 2007; 158). Thus, whereas much vulnerability research is concerned

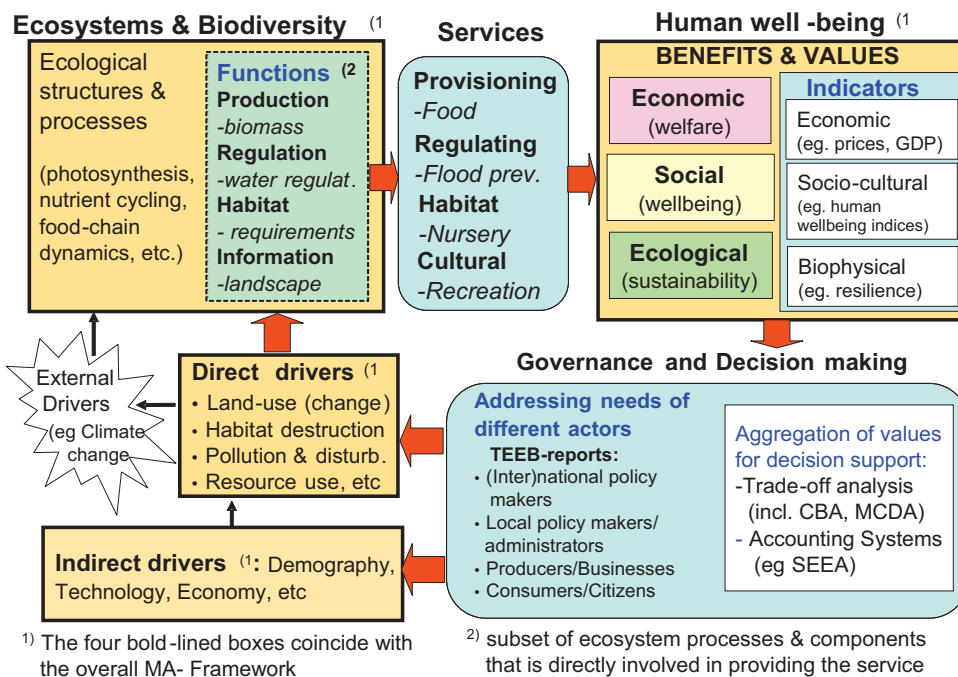


Fig. 8. The Economics of Ecosystems and Biodiversity (TEEB) framework (reproduced with permission from TEEB, 2010a; 17).

with biophysical hazards, Fussler's work demonstrates the influence of macro social, political or economic factors. These are critical in determining vulnerability; they may constitute external shocks themselves in certain circumstances. It is important to highlight this because the concern surrounding the relationship between poverty and ecosystem services stems not only from expected changes in aggregate ecosystem service availability, but also the possibility of entitlement failure resulting from political, economic or social dynamics. O'Brien and Leichenko (2000) introduce the concept of 'double-exposure': that some regions, sectors and communities are susceptible to combined negative impacts of globalization and environmental change.

Differences between services in their contribution to reducing vulnerability also require discussion. Most obviously, poor people can be vulnerable to changes in aggregate supply or access to provisioning and supporting services that contribute to livelihoods. Yet, other services are also important in poverty alleviation. Work on vulnerability and resilience highlights the role of regulating services in maintaining environments in which people are secure and healthy, for instance through the filtration of clean water, and disease-, flood- and climate-regulation. However, the pathways by which people benefit from these regulating services differ from the pathways by which people benefit from provisioning services. Because unlike provisioning, regulating services are not a physical entity but a physical process, entitlements are not so important, as long as the function of the regulating service is maintained such that the benefits accrue to the poor. Moreover, it is clear that the maintenance of regulating services is influenced by a more diverse set of actors, often over larger spatial scales and in highly complex interactions dependent on the nature of the service. This complexity potentially makes effective governance of regulating services harder, but the broader point is that significant differences exist between vulnerability resulting from lack of access to provisioning services, and vulnerability as a result of disruption to regulating services.

Table 1 summarizes the reviewed frameworks and identifies the contribution of each to understanding ecosystem services and poverty alleviation.

4. Conclusion: towards new conceptual approaches in ecosystem services and poverty alleviation research

Interest is growing in the potential for ecosystem services to be managed to contribute to poverty alleviation. To support this developing research agenda, we present findings from a review of nine frameworks and bodies of literature, highlighting the contribution of each for new research. Despite the novelty associated with the language of ecosystem services, we find in existing work a range of important insights. This concluding section reviews these insights, and where appropriate, groups frameworks with similar strengths, in order to highlight overarching lessons and gaps that conceptual and empirical research might seek to address.

The frameworks strongest for analyzing the ecological provision of ecosystem services are Framework for Ecosystem Services Provision, MEA, TEEB and Resilience. The MEA reports document much information about the linkages between ecology and services provision, but these relationships do not feature in the diagrammatic frameworks (2005b). In contrast, the TEEB (2010a) framework gives higher prominence to ecological function, but is mainly concerned with economic valuation. The Framework for Ecosystem Services Provision makes some steps forward in its more dynamic presentation, with the ability to incorporate feedbacks between the supporting system and ecosystem service providers and beneficiaries (Rounsevell et al., 2010). This forms a basis for thinking about thresholds and non-linearities in dynamic

systems, a priority for Carpenter et al. (2009). The ecology of services provision is itself a research frontier, encompassing live debates about the roles of diversity and resilience, for instance, in the production of services (Balvanera et al., 2006; Isbell et al., 2011; Norgaard, 2010; Paquette and Messier, 2011). Addressing these ecological questions is a central part of understanding the 'biodiversity–ecosystem functioning–ecosystem services–human wellbeing' progression discussed by Naeem et al. (2009). Yet, as Naeem et al. (2009) argue, ecological understanding needs to develop in unison with understanding other parts of the progression. Overall, beyond small steps forward in characterizing the ecology, it is remarkable how few frameworks give any more granularity than the MEA in how different categories of services actually support different aspects of wellbeing.

An area that remains underdeveloped in many of these frameworks is what the MEA terms 'cultural services'. There may be a number of reasons for this. Cultural dimensions have tended to be studied in ecological anthropology or cultural geography, which tend to rely less upon the use of diagrammatic conceptual frameworks and more upon written representations. Furthermore, the impetus to convert knowledge in these fields to the (contested) (McCauley, 2006; Robertson, 2006) terminology of 'services' is unlikely to have been strong. Additionally, cultural services do not have such an evident link with policy intervention compared to other aspects of rural development, and this may explain why they appear underrepresented in frameworks associated with policy-applied fields. Notwithstanding the above, there is scope within Sustainable Livelihoods, political ecology and the Framework for Ecosystem Services Provision to incorporate aspects such as these. For instance, the conceptual space the Framework for Ecosystem Services Provision opens up for characterizing ecosystem service beneficiaries could promote the representation of cultural aspects, albeit within a potentially reductionist paradigm. Thus, understanding the contribution of what are termed 'cultural services' to wellbeing, and indeed, how wellbeing is itself culturally constructed (Coulthard et al., 2011), form further areas ripe for research. This requires the ability to think across epistemological boundaries, as well as those of discipline and terminology.

Humanity increasingly faces problems stemming from limited aggregate availability of ecosystem services (MEA, 2005b; Rockstrom et al., 2009), but a key contribution of frameworks more closely focused on poverty or political economy (e.g. Entitlements, political ecology, social vulnerability), is to highlight that the poor may suffer from lack of access, as much as they do from constrained aggregate availability. Hence, the review established early on that social and political, as well as ecological factors govern the availability of ecosystem services for the poor. Typically, frameworks maintain a focus in line with their disciplinary basis, for instance either on access, or aggregate availability. Sustainable Livelihoods takes a broader and more interdisciplinary approach, but it is only Environmental Entitlements that makes this explicit distinction between access and availability. The MEA ('macro' framework) and TEEB tend to frame political economy factors as drivers, leading once more to a focus on aggregate availability of services, rather than the social processes governing access, and governing social differentiation. Whether it is aggregate availability or access that constrains wellbeing is highly contextual and dependent on geography, seasonality and governance, amongst other things. However, it is critical to be able to distinguish between these two fundamentally different types of constraint, in order to understand the mechanisms by which ecosystem services contribute to wellbeing.

This point about access leads to questions as to how access to different types of services differs. Access to provisioning services depends on the aggregate availability of these, and on entitlements. However, direct access to certain categories of ecosystem

Table 1
Summary of contributions of conceptual frameworks to understanding ecosystem services and poverty alleviation.

Conceptual frameworks and bodies of literature	Key elements and emphases including links with other frameworks	Strengths/contributions for research on ecosystem services and poverty	Summary of contribution
Environmental Entitlements (conceptual framework) (Leach et al., 1999)	<ul style="list-style-type: none"> Highlights the role of institutions mediating environment/society relationships. Disaggregates 'community' to understand differentiated: <ol style="list-style-type: none"> Endowments (rights and resources) Entitlements (legitimate effective command over alternative commodity bundles) Analytical overlap with Sustainable Livelihoods, vulnerability and political ecology. 	<p>Entitlements work allows analysis of differentiated social actors with varied entitlements and endowments, which facilitate their access to services. This supports research about whose wellbeing ecosystem services contribute to, and the potential for trade-offs (cf. Daw et al., 2011).</p> <p>Allows analysis of <i>de jure</i> and <i>de facto</i>, and highlights that failures of entitlement are often linked to constrained ability to enforce claims against powerful actors.</p>	<p>Entitlements and endowments are central to understanding access to services. The framework highlights social differentiation, making it useful for analyzing relative poverty. It also highlights the relationship between institutions and entitlements, aiding analysis of political economy.</p>
Framework for Ecosystem Service Provision (conceptual framework) (Rounsevell et al., 2010)	<p>Based on DPSIR framework, including:</p> <ul style="list-style-type: none"> Driving forces of environmental change Pressures on the environment State of the environment Impacts on population, economy, ecosystems Response of society <p>Uses familiar terminology for analyzing environmental change, i.e. 'drivers' terminology is compatible with MEA/TEEB.</p> <p>Represents a Social–Ecological System, with directional social and environmental dynamism and feedbacks, making this a more dynamic framework than many others.</p>	<p>Key innovation in recognizing attributes of ecosystem service beneficiaries, not just service providers. The analytical attention given to beneficiaries provides an important recognition of social differentiation.</p> <p>Framework makes useful distinction between adaptation/mitigation responses.</p>	<p>The DPSIR basis is stronger for analyzing the aggregate availability of ecosystem services, than access to them. However, the attention given to ecosystem service beneficiaries provides the basis for thinking about, e.g. differentiation in poverty status or preferences for cultural services; or access to provisioning services.</p>
Millennium Ecosystem Assessment (2 conceptual frameworks) (MEA, 2005b)	<p>MEA provides an influential classification of ecosystem services.</p> <p>Micro framework links categories of ecosystem service with 5 components of human wellbeing (MEA, 2005b, v).</p> <p>Macro framework aggregates aspects of wellbeing, and places them in a context of direct and indirect drivers (some terminology common with Framework for Ecosystem Services Provision, TEEB and Sustainable Livelihoods).</p>	<p>Foundational to work on ecosystem services and wellbeing, particularly through categorization of components of wellbeing and services.</p> <p>Focuses on wellbeing in aggregate, thus not useful for understanding social differentiation or differential access to services.</p> <p>Little insight in to political economy or analytical issues beyond 'drivers'.</p>	<p>Useful presentation of categories of services and components of wellbeing, although the framework gives little potential for analysing the mechanisms of these links and gives no attention to social differentiation.</p>
Political Ecology (body of literature) (Blaikie and Brookfield, 1987) (Bryant and Bailey, 1997) (Forsyth, 2003)	<p>Forsyth (2003) makes useful distinction between:</p> <ol style="list-style-type: none"> Structural political ecology. Concerned with understanding ultimate (political economy) drivers, rather than proximate factors in analysis of environmental issues. Post-structural political ecology. Concerned with the role of power/knowledge/discourse in the construction and analysis of environmental issues. 	<p>Useful for analyzing the factors that mediate access to, and control and distribution of environmental resources.</p> <p>Useful for analyzing cross-scale (local–global) dynamics: ultimate rather than proximate factors in social/environmental change.</p> <p>Political ecology encompasses an explicit commitment to social justice: a useful analytical lens for highlighting disparities of resource consumption.</p>	<p>Strongest for analyzing how people gain access to ecosystem services and the distribution of services and other resources in society.</p>
Resilience (body of literature) (Holling, 1973) (Folke, 2006)	<p>Resilience is defined in different ways:</p> <ul style="list-style-type: none"> the capacity to absorb shocks and still maintain function. the capacity for renewal, re-organization and development. (Folke, 2006) <p>Key concepts:</p> <ul style="list-style-type: none"> Adaptive cycle Multiple stable states Adaptive management (managing in the face of complexity and fostering learning) Social–Ecological Systems Concepts derive from ecology, but Social–Ecological System resilience has important links to adaptation and vulnerability. 	<p>Concepts for thinking about dynamic Social–Ecological Systems. As with much of the systems–science paradigm, thus far the study of Social–Ecological Systems tends to be associated with relatively apolitical analyses (Cote and Nightingale, 2011), which tend not to prioritize human agency (Brown and Westaway, 2011).</p>	<p>Resilience provides a framework for thinking about change. There is fruitful convergence between resilience, adaptation and vulnerability in how we consider the links between ecosystem services and poverty.</p>

Table 1 (Continued)

Conceptual frameworks and bodies of literature	Key elements and emphases including links with other frameworks	Strengths/contributions for research on ecosystem services and poverty	Summary of contribution
Sustainable Livelihoods (conceptual framework) (Chambers and Conway, 1992) Diagrammatic framework developed by Scoones (1998)	Influential and holistic paradigm for analyzing rural development. 5-part framework focusing on factors associated with Sustainable Livelihoods: <ul style="list-style-type: none"> • Contexts, conditions trends (also named vulnerability context) • Livelihood resources (capitals) • Institutions, processes and structures • Livelihood strategies • Livelihood outcomes Because this framework has elements common to many others, it can be used to unite various approaches. For instance, there are parallels to the Entitlements framework, with a focus on access in the middle column.	Wide and holistic in scope, overarching different sectors. This breadth serves to highlight that ecosystem services are only one component of Sustainable Livelihoods. The framework can also be used at a micro (household) or wider scale. While Clark and Carney (2008) comment that the framework is inadequately focused on the underlying causes of poverty (power/exclusion/entitlement), Sustainable Livelihoods gives more insight to these than many frameworks.	Strongest for the holistic analysis of poverty and acting as a means to link insights from various frameworks.
Social Assessment of Protected Areas (conceptual framework) (Schreckenberg et al., 2010)	Closely related to Sustainable Livelihoods, but with: <ul style="list-style-type: none"> • Natural capital framed in terms of ecosystem services • Addition of a sixth 'asset' in form of 'political/legal' aspects reflecting rights-based approaches and importance of opportunities/empowerment (World Development Report, 2000). 	Most comprehensive framework, incorporating material from Sustainable Livelihoods, MEA and World Development Report (2000).	Builds on the holistic approach of Sustainable Livelihoods. Limited by the checklist, rather than dynamic format, without meaningful relationships between entities.
TEEB (conceptual framework) (TEEB, 2010a)	Components: <ul style="list-style-type: none"> • Ecosystems and biodiversity • Services • Human wellbeing • Governance and decision making • Direct driver/indirect drivers • External drivers Very similar terminology to MEA, and elements in common with the Framework for Ecosystem Services Provision.	TEEB framework primarily oriented towards extending economic valuation, and clarifies distinctions between ecosystem functions and services, and benefits and values.	Beyond that content which overlaps with MEA or the Framework for Ecosystem Services Provision, there is little directly relevant in this framework for analyzing ecosystem services and poverty alleviation.
Vulnerability (conceptual framework and body of literature) (Blaikie et al., 1994) (Turner et al., 2003) (Brooks, 2003) (Adger and Kelly, 1999) (Fussel, 2007)	Vulnerability is defined as a combination of risk exposure (hazard) and social vulnerability. The concept of social vulnerability highlights political economy factors that influence the outcomes of a hazard. Social factors, including entitlements, make people differentially vulnerable. Because of the centrality of vulnerability in poverty, the concept provides linkages between frameworks, including political ecology, Sustainable Livelihoods, Environmental Entitlements and resilience.	Vulnerability is a condition and determinant of poverty (Consortium for Ecosystem Services and Poverty Alleviation, 2008), hence vulnerability is central to understanding poverty, particularly poverty linked to environmental degradation. In the relationship between vulnerability, wellbeing and ecosystem services there are evident differences between types of service. Vulnerability can result from constrained access to provisioning services and vulnerability (in the sense of insecurity) can result from sub-optimal situations regarding regulating services (flood prevention, etc.).	Central for understanding the relationship between ecosystem services and poverty, particularly through concept of social vulnerability. Useful in combination with other concepts, including those associated with resilience and political ecology.

service is not always required, because people benefit from different types of ecosystem service through different mechanisms. For instance, regulating services have an important role in reducing environmental vulnerability, but the mechanism by which people benefit from them does not necessarily require direct access (as it would for provisioning services), and potentially depends on a more complex set of biophysical processes and human actors, sometimes over large spatial scales. There is scope for empirical work to understand more fully the production of regulating services, and their contribution to human wellbeing.

It is critical that all research on ecosystem services and poverty can recognize social differentiation and relative levels of poverty.

Differentiation mediates access and therefore the same frameworks illuminating access help us consider social differentiation. Thus Entitlements, property rights frameworks and political ecology offer insight to the mechanisms by which people establish and defend claims around services, and how these processes in turn may lead to increased social differentiation. Entitlements analysis also gives important insights to social vulnerability, giving explanatory power, for instance, to why impacts of environmental hazards are distributed differentially within society (Adger and Kelly, 1999).

This paper established early on that ecosystem services are more likely to be associated with poverty prevention than reduction. Indeed, evidence suggests that communities lacking

basic amenities and constrained to ecosystem services alone are stuck in a poverty trap (Angelsen and Wunder, 2003; Fisher, 2004). As such, this review highlights an imperative to maintain the holism associated with Sustainable Livelihoods approaches, in recognition of the complexity of rural development. Because of the limits of ecosystem services for poverty reduction, growing interest in this area must not detract from the importance of health, education and governance for rural development. These policy areas may contain interventions with more credible claims to actually reduce poverty, than the claims surrounding ecosystem services. Moreover, we question whether the concept of ecosystem services might actually be more fruitfully applied to illuminate the footprint of the world's wealthy, than it is useful to understand poverty reduction. This would involve restoring to the concept of ecosystem services, an ecological economics critique of continued consumption (Norgaard, 2010), made increasingly pertinent as evidence accumulates regarding planetary boundaries (Rockstrom et al., 2009).

All of these conceptual approaches therefore contribute something to our understanding of the linkages between ecosystem services and poverty alleviation. This review serves as a guide to which conceptual approaches, or combination of approaches, could be applied to address particular research questions as this research agenda develops. In addition, a number of substantive messages and research agendas emerge from this concluding section. These include the importance of recognizing social differentiation, and whose wellbeing is a priority (Daw et al., 2011), given that trade-offs can be expected. There are also evident differences between ecosystem services themselves in their contribution to wellbeing, an illustrative example being differences in the production of, and mechanism of benefit from provisioning and regulating services. We also highlight large gaps of understanding of the role of cultural services in human wellbeing. Finally, the review probes the limits of ecosystem services for poverty reduction and highlights the potential, in certain circumstances, for dependence on ecosystem services to represent a poverty trap.

Reflecting on the qualities of the frameworks themselves, beyond their content, it is clear that any framework is a simplification and the review shows that poverty-environment issues are complex, cross-sectoral and dynamic and therefore inherently challenging to represent in diagrammatic form. However, there may be greater value in dynamic frameworks, which attempt to represent meaningful relationships between entities, compared to checklist frameworks, which present important factors with no relationships. In addition, the use of dynamic frameworks is more aligned with Social–Ecological Systems thinking. The systems of concern here are characterized by factors including direct dependence on ecosystem services and monetary poverty. The application of this research paradigm to ecosystem services and poverty alleviation is embryonic, but promising. Indeed, there is scope for a new framework representing ecosystem services and poverty alleviation in Social–Ecological Systems form that distills key insights highlighted by this review.

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References

- Adger, W.N., 2000. Social and ecological resilience: are they related? *Progress in Human Geography* 24, 347–364.
- Adger, W.N., 2006. Vulnerability. *Global Environmental Change* 16, 268–281.
- Adger, W.N., Benjaminsen, T.A., Brown, K., Svarstad, H., 2001. Advancing a Political Ecology of Global Environmental Discourses. *Development & Change* 32, 681–715.
- Adger, W.N., Kelly, P.M., 1999. Social Vulnerability to Climate Change and the Architecture of Entitlements. *Mitigation and Adaptation Strategies for Global Change* 4, 253–266.
- Anderies, J.M., Janssen, M.A., Ostrom, E., 2004. A framework to analyze the robustness of social–ecological systems from an institutional perspective. *Ecology and Society* 9, 18.
- Angelsen, A., Wunder, S., 2003. Exploring the forest–poverty link: key concepts, issues and research implications, key concepts, issues and research implications. CIFOR, Bogor, Indonesia viii, 58p.
- Balvanera, P., Pfisterer, A.B., Buchmann, N., He, J.-S., Nakashizuka, T., Raffaelli, D., Schmid, B., 2006. Quantifying the evidence for biodiversity effects on ecosystem functioning and services. *Ecology Letters* 9, 1146–1156.
- Behnke, R., Scoones, I., Kerven, C., 1993. Range Ecology at Disequilibrium: New Models of Natural Variability and Pastoral Adaptation in African Savannas. Institute of Development Studies, Brighton.
- 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.
- Blaikie, P., Cannon, T., Davis, I., Wisner, B., 1994. At Risk: Natural Hazards, People's Vulnerability and Disasters. Routledge, London.
- Blaikie, P.M., Brookfield, H.C., 1987. *Land Degradation and Society*. Routledge, London.
- Blaikie, P.M., Muldavin, J.S.S., 2004. Upstream, Downstream, China, India: The Politics of Environment in the Himalayan Region. *Annals of the Association of American Geographers* 94, 520–548.
- Boyd, J., Banzhaf, S., 2007. What are ecosystem services? The need for standardized environmental accounting units. *Ecological Economics* 63, 616–626.
- Brooks, N., 2003. Vulnerability, risk and adaptation: a conceptual framework. Working Paper 38. Tyndall Centre for Climate Change, Norwich, UK., <http://www.tyndall.ac.uk>.
- Brown, D., Schreckenberg, K., Shepherd, G., Wells, A., 2002. Forestry as an entry point for governance reform. ODI Forestry Briefing, vol. 1. Overseas Development Institute, London.
- Brown, K., 1997. The political ecology of biodiversity, conservation and development in Nepal's Terai: Confused meanings, means and ends. *Ecological Economics* 24, 73–87.
- Brown, K., Daw, T., Rosendo, S., Bunce, M., Cherrett, N., 2008. Ecosystem Services for Poverty Alleviation: Marine & Coastal Situational Analysis. ESPA, In: <http://www.ESPA.ac.uk>.
- Brown, K., Westaway, E., 2011. Agency, capacity, and resilience to environmental change: lessons from human development, well-being, and disasters. *Annual Review of Environment and Resources* 36, 321–342.
- Bryant, R.L., 1992. Political ecology: an emerging research agenda in Third-World studies. *Political Geography* 11, 12–36.
- Bryant, R.L., Bailey, S., 1997. *Third World Political Ecology*. Routledge, London.
- Carpenter, S.R., Mooney, H.A., Agard, J., Capistrano, D., DeFries, R., Diaz, S., Dietz, T., Duraiaappah, A., Oteng-Yeboah, A., Miguel Pereira, H., Perrings, C., Reid, W., Sarukhan, J., Scholes, R., Whyte, A., 2009. Science for managing ecosystem services: beyond the millennium ecosystem assessment. *Proceedings of the National Academy of Sciences* 106, 1305–1312.
- Chambers, R., Conway, G., 1992. Sustainable rural livelihoods: practical concepts for the 21st century. *IDS Discussion Paper* 296.
- Clark, J., Carney, D., 2008. ESRC research seminar report. In: Sustainable livelihoods approaches—what have we learnt? Eldis. Institute for Development Studies, Brighton, Sussex. In: <http://www.livelihoods.org>.
- Consortium for Ecosystem Services and Poverty Alleviation, 2008. Situation analysis of ecosystem services and poverty alleviation in arid and semi-arid Africa. In: Ecosystem Services for Poverty Alleviation. In: <http://www.espa.ac.uk>.
- Cote, M., Nightingale, A.J., 2011. Resilience thinking meets social theory: situating change in socio-ecological systems (SES) research. *Progress in Human Geography*, <http://dx.doi.org/10.1177/0309132511425708>.
- Coulthard, S., Johnson, D., McGregor, J.A., 2011. Poverty, sustainability and human wellbeing: a social wellbeing approach to the global fisheries crisis. *Global Environmental Change* 21, 453–463.
- Daw, T., Brown, K., Rosendo, S., Pomeroy, R., 2011. Applying the ecosystem services concept to poverty alleviation: the need to disaggregate human well-being. *Environmental Conservation* 38, 370–379.
- Duraiaappah, A.K., 1998. Poverty and environmental degradation: a review and analysis of the nexus. *World Development* 26, 2169–2179.
- Eakin, H., Tompkins, E., Nelson, D.R., Anderies, J.M., 2009. Hidden costs and disparate uncertainties: trade-offs in approaches to climate policy. In: Adger, W.N., Lorenzoni, I., O'Brien, K. (Eds.), *Adapting to Climate Change: Thresholds, Values, Governance*. Cambridge University Press, Cambridge.
- Fisher, B., Turner, R.K., Morling, P., 2009. Defining and classifying ecosystem services for decision making. *Ecological Economics* 68, 643–653.
- Fisher, M., 2004. Household welfare and forest dependence in Southern Malawi. *Environment and Development Economics* 9, 135–154.

- Flyvbjerg, B., 2002. *Making Social Science Matter: Why Social Inquiry Fails and How It Can Succeed Again*. Cambridge University Press, Cambridge.
- Folke, C., 2006. Resilience: the emergence of a perspective for social–ecological systems analyses. *Global Environmental Change* 16, 253–267.
- Forsyth, T., 2003. *Critical Political Ecology: The Politics of Environmental Science*. Routledge, London.
- Forsyth, T., 2008. Political ecology and the epistemology of social justice. *Geoforum* 39, 756–764.
- Fussler, H.-M., 2007. Vulnerability: a generally applicable conceptual framework for climate change research. *Global Environmental Change* 17, 155–167.
- Gallopín, G.C., 2006. Linkages between vulnerability, resilience, and adaptive capacity. *Global Environmental Change* 16, 293–303.
- Gray, L.C., Moseley, W.G., 2005. A geographical perspective on poverty–environment interactions. *The Geographical Journal* 171, 9–23.
- Gunderson, L.H., 2000. Ecological resilience—in theory and application. *Annual Review of Ecology and Systematics* 31, 425–439.
- Hoben, A., 1995. Paradigms and politics: the cultural construction of environmental policy in Ethiopia. *World Development* 23, 1007–1021.
- Holling, C.S., 1973. Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics* 4, 1–23.
- IPCC, 2001. *Climate change 2001: impacts, adaptation, and vulnerability*. In: *Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, UK.
- Isbell, F., Calcagno, V., Hector, A., Connolly, J., Harpole, W.S., Reich, P.B., Scherer-Lorenzen, M., Schmid, B., Tilman, D., van Ruijven, J., Weigelt, A., Wilsey, B.J., Zavaleta, E.S., Loreau, M., 2011. High plant diversity is needed to maintain ecosystem services. *Nature* 477, 199–202.
- Janssen, M.A., Ostrom, E., 2006. Resilience, vulnerability, and adaptation: a cross-cutting theme of the International Human Dimensions Programme on Global Environmental Change. *Global Environmental Change* 16, 237–239.
- Janssen, M.A., Schoon, M.L., Ke, W., Borner, K., 2006. Scholarly networks on resilience, vulnerability and adaptation within the human dimensions of global environmental change. *Global Environmental Change* 16, 240–252.
- Leach, M., Mearns, R., Scoones, I., 1999. Environmental entitlements: dynamics and institutions in community-based natural resource management. *World Development* 27, 225–247.
- Mace, G.M., Norris, K., Fitter, A.H., 2012. Biodiversity and ecosystem services: a multilayered relationship. *Trends in Ecology & Evolution* 27, 19–26.
- Mayers, J., 2007. *Forests and the Millennium Development Goals: Could do Better!* Editorial in *ETFRN News* 47–48, p7–14 European Tropical Forest Research Network, Wageningen.
- McCauley, D.J., 2006. Selling out on nature. *Nature* 443, 27–28.
- MEA, 2003. *Millennium Ecosystem Assessment, Ecosystems and Human Well-being: A Framework for Assessment*. Island Press.
- MEA, 2005a. *Framework Reports: Ecosystems and Human Wellbeing*, Millennium Ecosystem Assessment., In: <http://www.maweb.org/en/index.aspx>.
- MEA, 2005b. *Millennium Ecosystem Assessment: Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC.
- Naeem, S., Bunker, D.E., Hector, A., Loreau, M., Perrings, C., 2009. *Biodiversity, Ecosystem Functioning, and Human Wellbeing: An Ecological and Economic Perspective*. Oxford Univ. Press, Oxford.
- Narayan, D., Chambers, R., Shah, M.K., Petesch, P., 1999. *Global Synthesis: Confrontations with the Poor*. World Bank, Washington, D.C.
- Narayan, D., Chambers, R., Shah, M.K., Petesch, P., 2000. *Voices of the Poor: Crying Out for Change*. Oxford University Press, Oxford.
- NEA, 2011. *Conceptual Framework and Methodology*. National Ecosystem Assessment. Chapter 2., In: <http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx>.
- Norgaard, R.B., 2010. Ecosystem services: from eye-opening metaphor to complexity blinder. *Ecological Economics* 69, 1219–1227.
- O'Brien, K., Leichenko, R., 2000. Double exposure: assessing the impacts of climate change within the context of economic globalization. *Global Environmental Change* 10, 221–232.
- Ostrom, E., 2009. A general framework for analyzing sustainability of social–ecological systems. *Science* 325, 419–422.
- Paquette, A., Messier, C., 2011. The effect of biodiversity on tree productivity: from temperate to boreal forests. *Global Ecology and Biogeography* 20, 170–180.
- Poverty Environment Initiative, 2009. *Guidance Note: Mainstreaming Poverty–Environment Linkages into National Development Planning*. United Nations Poverty Environment Initiative, In: <http://www.unpei.org>.
- Raudsepp-Hearne, C., Peterson, G.D., Tengö, M., Bennett, E.M., Holland, T., Benešsaiha, 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.
- Reardon, T., Vosti, S.A., 1995. Links between rural poverty and the environment in developing countries: asset categories and investment poverty. *World Development* 23, 1495–1506.
- Ribot, J.C., 2006. Choose democracy: environmentalists' socio-political responsibility. *Global Environmental Change* 16, 115–119.
- Robbins, P., 2004. *Political Ecology*. Blackwell, Oxford.
- Robertson, M., 2006. The nature that capital can see: science, state, and market in the commodification of ecosystem services. *Environment and Planning D: Society and Space* 24, 367–387.
- Rocheleau, D.E., 2008. Political ecology in the key of policy: from chains of explanation to webs of relation. *Geoforum* 39, 716–727.
- Rockstrom, J., Steffen, W., Noone, K., Persson, A., Chapin, F.S., Lambin, E.F., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H.J., Nykvist, B., de Wit, C.A., Hughes, T., van der Leeuw, S., Rodhe, H., Sorlin, S., Snyder, P.K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R.W., Fabry, V.J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P., Foley, J.A., 2009. A safe operating space for humanity. *Nature* 461, 472–475.
- Rounsevell, M., Dawson, T., Harrison, P., 2010. A conceptual framework to assess the effects of environmental change on ecosystem services. *Biodiversity and Conservation* 19, 2823–2842.
- Schlager, Ostrom, E., 1992. Property rights regimes and natural resources: a conceptual analysis. *Land Economics* 68, 249–262.
- Schreckenberg, K., Camargo, I., Withnall, K., Corrigan, C., Franks, P., Roe, D., Scherl, L.M., Richardson, V., 2010. *Social Assessment of Conservation Initiatives: A Review of Rapid Methodologies*. International Institute for Environment and Development (IIED), London.
- Scoones, I., 1998. Sustainable rural livelihoods: a framework for analysis. *IDS Working Paper* 72, 1–22.
- Scoones, I., 2009. Livelihoods perspectives and rural development. *Journal of Peasant Studies* 36, 171–196.
- Sen, A., 1981. *Poverty and Famines: An Essay on Entitlement and Deprivation*. Clarendon, Oxford.
- Sen, A., 1985. *Commodities and Capabilities*. Oxford University Press, Oxford.
- Sen, A., 2001. *Development as Freedom*. Oxford University Press, Oxford.
- Sikor, T., Nguyen, T.Q., 2007. Why may forest devolution not benefit the rural poor? Forest entitlements in Vietnam's Central Highlands. *World Development* 35, 2010–2025.
- Solesbury, W., 2003. *Sustainable livelihoods: A case study of the evolution of DFID policy*. Overseas Development Institute Working Paper 217.
- Stott, P.A., Sullivan, S., 2000. *Political Ecology: Science, Myth and Power*. Oxford University Press, Oxford.
- TEEB, 2010a. *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations*. Earthscan, London.
- TEEB, 2010b. *The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A Synthesis of the Approach, Conclusions and Recommendations of TEEB*, In: <http://www.teebweb.org>.
- Turner, B.L., Kasperson, R.E., Matson, P.A., McCarthy, J.J., Corell, R.W., Christensen, L., Eckley, N., Kasperson, J.X., Luers, A., Martello, M.L., Polsky, C., Pulsipher, A., Schiller, A., 2003. A framework for vulnerability analysis in sustainability science. *Proceedings of the National Academy of Sciences of the United States of America* 100, 8074–8079.
- Turner, B.L., Robbins, P., 2008. Land-change science and political ecology: similarities, differences, and implications for sustainability science. *Annual Review of Environment and Resources* 33, 295–316.
- Watts, M., 2000. *Political ecology*. In: Sheppard, E., Barnes, T.J. (Eds.), *A Companion to Economic Geography*. Blackwell, Oxford.
- World Development Report, 2000. *Attacking Poverty*. World Bank, Washington, D.C..