Finding Common Ground for Biodiversity and Ecosystem Services

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Recently, some members of the conservation community have used ecosystem services as a strategy to conserve biodiversity. Others in the community have criticized this strategy as a distraction from the mission of biodiversity conservation. The debate continues, and it remains unclear whether the concerns expressed are significant enough to merit the opposition. Through an exploration of the science of biodiversity and ecosystem services, we find that narrow interpretations of metrics, values, and management drive much of the tension and make the common ground appear small. The size of this common ground depends on the relationship between biodiversity and ecosystem services and how they respond to management interventions. We demonstrate how understanding this response can be used to delimit common ground but highlight the importance of differentiating between objectives and approaches to meeting those objectives in conservation projects.

Keywords: conservation, trade-offs, economic value, intrinsic value

Despite appeals about the intrinsic value of nature and important gains in some areas, the dominant flow of human activity has continued moving in directions detrimental to biodiversity conservation (Butchart et al. 2010). In response, some within the conservation community have attempted to broaden the base of support for biodiversity conservation by adopting the concept of ecosystem services and by arguing that the conservation of biodiversity matters not only because of its intrinsic value but because it is essential for human well-being. Examples include the Convention on Biological Diversity's ecosystem-services approach and the targets adopted in their Strategic Plan for Biodiversity 2011–2020 (*www.cbd.int/sp*) and the new mission statement of Conservation International (CI), which states that "CI empowers societies to responsibly and sustainably care for nature, our global biodiversity, for the well-being of humanity" (*www.conservation.org/about/mission_strategy/pages/mission.aspx*). The move to embrace ecosystem services has raised concerns among some in the conservation community who argue that putting ecosystem services at the heart of biodiversity-conservation strategies is at best a distraction and at worst a dangerous diversion from the true mission of conservation (e.g., McCauley 2006, Ghazoul 2007, Redford and Adams 2009). Others, however, argue that we can better conserve biodiversity under the big tent of ecosystem services (e.g., Skroch and López-Hoffman 2009).

The debate about the role that ecosystem services should play in biodiversity conservation has gone back and forth without resolution. This debate, if it divides the conservation community, would hamper efforts to stem the tide that is sweeping away biodiversity and the very foundations of our life-support systems. However, it is not clear whether the concerns around ecosystem services are large enough to merit the opposition expressed or whether they are perhaps linked to confusion and narrow interpretations of the complex concepts involved (Norgaard 2010). This article is an attempt to explore the science and values that underlie biodiversity and ecosystem services, in an effort to better understand these concerns and to work toward a common understanding and appreciation of ecosystem services and their place within the conservation community.

Clarifying the concepts and values of biodiversity and ecosystem services

Although they are relatively simple to define in theory, *biodiversity* and *ecosystem services* are both complex concepts. The complexity makes it difficult to provide concise operational definitions and to measure the success of conservation strategies in attaining their stated goals. *Biodiversity*, which literally means the variety of life, includes not only the variety of structures at the genetic, species, and ecosystem levels but also the variety in their composition and function. There is no single measure or approach that can represent the full spectrum of biodiversity. *Ecosystem services* are broadly defined as being the benefits that people obtain from ecosystems and include a wide array of benefits,

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including products such as food, fuel, and fiber, regulating services such as flood protection and pollination, and the myriad of cultural benefits and values that people enjoy from nature. Similar to biodiversity, there is no generally accepted approach to measure the complete bundle of ecosystem services provided by an area.

The complexity of the two concepts, the challenges of understanding and communicating them, and the limited accuracy and difficulty of complete measurement have practical implications. Narrower interpretations of the concepts are often used as proxies for the more complete and complex concept. For example, *biodiversity* is often interpreted and measured in terms of higher-taxon species richness, and the focus of ecosystem-services analyses is often on provisioning services that lend themselves to economic valuation, such as timber and food. Use of these narrow definitions and measurements can make it appear that there is less connection and greater divergence between strategies to conserve biodiversity and strategies to promote ecosystem services than may in fact be the case.

At a deeper level, the underlying motivations for biodiversity conservation and the provision of ecosystem services are often associated with what appear to be fundamentally different value systems (Colyvan et al. 2009). Biodiversity conservation is often associated with a biocentric perspective that assigns an intrinsic value to all life on Earth (Norton 1986, Rolston 1988). Something has *intrinsic value* when it is an end in itself. Ecosystem services, however, are associated with an anthropocentric perspective in which biodiversity has instrumental value because it contributes services that improve human well-being. Something that has *instrumental value* is a means to a valuable end. Instrumental values from ecosystem services include a broad range of values, from direct use of food and timber species to the nonuse of cultural and spiritual values associated with species or habitats.

The different underlying philosophies behind intrinsic and instrumental values make it appear that there is little common ground between approaches targeting biodiversity conservation for its own sake and approaches for promoting the provision of ecosystem services. But this need not be the case. Although we will not address the ethical and philosophical debates surrounding intrinsic value covered elsewhere (Justus et al. 2008, Colyvan et al. 2009), it appears that it is often the complexity of intrinsic and instrumental values—and the narrow interpretations of the latter—that makes the common ground they share appear smaller than it actually is. For example, although the concept of *biodiversity* emerges from an intrinsic context, the conservation of biodiversity is usually motivated by a wide variety of human values and choices, including *existence value*, which is the benefit that people receive from knowing a species, habitat, or landscape—or, in fact, all of biodiversity—exists. The Millennium Ecosystem Assessment defines *existence value* as a cultural ecosystem service because it is linked to the "deeply held historical, national, ethical, religious, and spiritual values people ascribe to ecosystems" (MA 2005, p. 34), highlighting that instrumental values include a wider variety of values than one would expect from the usual focus on use values only. Therefore, although existence values come quite close to what many people think of as intrinsic values, they are in fact a form of instrumental value and serve to illustrate a broader view of ecosystem services that goes beyond the market value of commodities, and even beyond human-use values, to include nonuse and existence values.

Therefore, the outcomes of biodiversity-conservation strategies motivated by intrinsic and existence values, or by an ecosystem-services approach based on the instrumental (including existence) values of ecosystem services, may not be as different as is feared. In recognizing this broader view of the common ground, Maquire and Justus (2008) suggested that we will not only capture what many in the conservation community ascribe to the intrinsic value of biodiversity but we will also capture it in a way "that can be evaluated comparatively [against other instrumental values] and used in decisionmaking" (p. 911). This view and a clearer understanding of *existence value* brings the values associated with biodiversity conservation and ecosystem services closer together, and the common ground between biodiversity conservation and ecosystem services becomes more apparent.

There are also real and perceived differences in policy and management approaches for biodiversity conservation compared with approaches designed to enhance the provision of ecosystem services. Biodiversity-conservation strategies are often perceived to be focused on protected areas and other strategies that minimize human disturbances of ecosystems. Ecosystem-services strategies, however, require connections between people and ecosystems and are often focused on interventions in human-dominated landscapes, with the perception that these strategies rely on payments and markets. Again, this narrow interpretation of biodiversity conservation and ecosystem-services management may not reflect the wide diversity of management approaches currently being used in the conservation of biodiversity and the management of ecosystem services. Although much biodiversity conservation does target largely uninhabited protected areas, this is certainly not true of all biodiversity conservation, which is increasingly conducted in human-dominated systems (Redford et al. 2003); similarly, the management of ecosystem services can range from protected-area management to global markets for carbon, water, and other services. Within this wide diversity of possible management interventions, Goldman and Tallis (2009) found that in ecosystem-services projects employed by the world's two largest conservation organizations, the protection of intact systems and associated management approaches were used just as often as in projects in which only biodiversity was targeted. Although this will certainly not be the case in all projects, narrow interpretations of what management is used for biodiversity and for ecosystem services are not helpful in finding common ground.

One such narrow interpretation around ecosystem-services management comes from particular strategies that are focused on markets and incentives for the provision of services, such as payments for ecosystem services (PES). In PES, services are transformed into commodities and the logic of markets and monetary payments guides actions, which strikes some in the conservation community as moving in the wrong direction (e.g., McCauley 2006). PES schemes, however, cover a wide array of payments, and once again a narrow focus on a limited set of these schemes is problematic. Furthermore, there are ways other than PES to promote the sustainable supply of ecosystem services, including planning, regulatory approaches, and community self-regulation (Ostrom 1990). Again, a narrow focus on concerns around markets, payment schemes, and the economic paradigm ignores the large diversity of ecosystem-services strategies and aesthetic, spiritual, educational, scientific, and existence values associated with ecosystem services (e.g., Farber et al. 2002, MA 2005, USEPA 2009).

In reviewing the concepts, values, and management options of biodiversity and ecosystem services, it appears that it is often differences in interpretation and a narrow understanding of the full complexity of biodiversity and ecosystem services, as well their values and management approaches, that have caused the current tension in the conservation community. Although this does not do away with all the concerns around ecosystem-services approaches to conservation, it does mean that the conservation community needs a greater appreciation of how narrow interpretations, unsupported assumptions, different value systems, and different policy approaches factor into this debate. How important these differences are in practice depends in large part on the relationship between biodiversity and ecosystem services.

Relationships

Because both biodiversity and ecosystem services are complex concepts, it can be difficult to untangle all of the links between them. In attempting to understand the relationship between biodiversity and ecosystem services and the role of ecosystem services in biodiversity conservation, it is perhaps useful to differentiate between the innate relationship between biodiversity and ecosystem services on one hand (i.e., the exact mechanisms by which biodiversity supports or provides ecosystem services; e.g., Mace et al. 2011) and, on the other hand, their responses to a particular management action (e.g., Bennett et al. 2009). In exploring the innate relationship between the two, we know that all ecosystem services require some level of biodiversity to function, but the exact nature of the relationship is not well understood for most services, and the current evidence base remains weak (Díaz et al. 2006). In understanding how biodiversity and ecosystem services respond to a particular management action, our knowledge and the evidence base, although they are far from complete, are better and can be readily supplemented through systematic review or meta-analysis (e.g., Naeem et al. 2009). Although neither a review nor a meta-analysis is the purpose here, we explore a selected set of case studies and existing reviews below, using a trade-offs typology of win–win, win–lose, and win–neutral, to illustrate the utility of such an evidence base in finding common ground.

Win–win. Mutually beneficial relationships exist between biodiversity and many regulating, supporting, and cultural services for which the aggregate stock of natural capital is more valuable than the extraction of a flow of materials or energy (Vira and Adams 2009). Management actions to conserve ecosystem processes that promote regulating, supporting, and cultural ecosystem services are often also good for biodiversity conservation—a *win–win* scenario. For example, conserving forests to sequester carbon, prevent erosion, and filter water will also conserve forest-dependent species. Nelson and colleagues (2009) compared the consequences of alternative land-use change scenarios and showed that the scenario that conserved the greatest amount of natural habitat was best for a suite of regulating ecosystem services (carbon sequestration, water quality, flood control) and for the conservation of a set of habitat-sensitive vertebrate species. Similarly, Reyers and colleagues (2009) illustrated how actions to restore biodiversity in overgrazed areas in the Little Karoo of South Africa were also beneficial for the ecosystem services of water regulation, carbon storage, erosion prevention, and tourism. These and similar studies generate results from specific regions and are limited in the range of ecosystem services and biodiversity that they include and are therefore not proof that win–win situations always exist. However, these studies do illustrate that actions that maintain ecosystems and their processes (e.g., habitat conservation or restoration) can be good for biodiversity (Cowling et al. 1999) and for the ecosystem services reliant on those processes (Díaz et al. 2006). Clearly, more effort is needed in building the evidence base of the impacts of management interventions on biodiversity and ecosystem services across a broad range of contexts before large-scale extrapolations become possible. In such mutualistic situations, biodiversity proponents and groups who wish to promote ecosystem services will be ready allies, and the common ground will be clear (Goldman and Tallis 2009).

Win–lose. Many authors have highlighted the potential for trade-offs between biodiversity and ecosystem services (e.g., Chan et al. 2007, Redford and Adams 2009). In *win–lose* situations, a management intervention promoting ecosystem services will be bad for biodiversity, and conserving biodiversity will be bad for the provision of ecosystem services. Most examples of win–lose interventions involve conflicts between provisioning services and biodiversity. Examples include damming a river to improve the consistency of a water supply, plowing up natural vegetation to plant food crops, or using pesticides to increase food production. The Millennium Ecosystem Assessment found that trade-offs

between provisioning services and biodiversity have been the largest driver of biodiversity loss over the last 50 years (MA 2005). Actions to conserve biodiversity can also have negative effects on ecosystem services and may conflict with human interests and well-being (e.g., fencing off of protected areas that limits access to hunting, the gathering of medicinal plants, the grazing of land, and other benefits). In these win–lose cases, biodiversity proponents will face an even harder task, because biodiversity-conservation actions will run counter to promoting ecosystem services and human well-being, and the common ground between the two will be very limited. In the same way, people managing for ecosystem services in these conditions will not have the support of biodiversity proponents.

Win–neutral. Although win–win and win–lose situations are apparent, there may be some cases in which an action to conserve biodiversity will not change the net benefits from ecosystem services or, conversely, in which an action that promotes an ecosystem service will have no net impact on biodiversity. Examples of such relationships that are positive for biodiversity and neutral for ecosystem services could exist where there is no apparent human benefit from biodiversity conservation. Examples could include biodiversity conservation that affects pollination functions where there are no pollination-dependent food crops or wetland regulation of water flows in uninhabited catchments. Such cases may prove hard to find in the real world, since there are few places where protected areas provide absolutely no benefits to people, especially when one considers existence values or globally distributed benefits, such as climate regulation. Examples of unidirectional benefits that are positive for ecosystem services and neutral for biodiversity may be easier to find where the flow of the service is decoupled from the natural stocks through a technological intervention (e.g., increased agricultural yields from improved management) or where cultural appreciation for a landscape or ecosystem is independent of the biodiversity within it. In these *win–neutral* situations, biodiversity proponents will not be able to use the ecosystem-services argument and framework and must continue to rely on using traditional approaches to conservation. Alternatively, there could be the possibility of finding the common ground in these situations (e.g., by promoting the existence value of protected areas or untangling and demonstrating the links between biodiversity and ecosystem services in production landscapes), which could change these into win–win cases.

Conservation means and ends

Although it is by no means a meta-analysis of the evidence base, this exploration demonstrates the value of such an evidence base and trade-offs typology in helping to identify the borders of the common ground where ecosystem-services approaches may be a useful means to achieving a biodiversity-conservation objective and where they will not.

Even where ecosystem services can be a useful means for achieving conservation objectives, biodiversity conservationists—whose primary objective is to conserve biodiversity—should be clear about their goals. Where mutually beneficial relationships between biodiversity and ecosystem services exist (win–win), there will be much larger and more powerful sets of potential partners in conservation when ecosystem-services arguments are promoted than can be found just within the conservation community. For example, conservation organizations can partner with other groups to provide clean, reliable sources of water. Good examples of this approach are water-fund projects in South America, where the partners include hydropower companies, beverage-bottling companies (including beer breweries and Coca-Cola), water municipalities, and large agribusinesses (including sugarcane growers and processors). However, this does not mean that ecosystem services should replace biodiversity conservation as the objective of biodiversity-conservation organizations. Not all cases will be win–win, and there is still a vital role for conservation organizations to play in conserving biodiversity. Biodiversity conservation is still the end, but ecosystem services can be a useful means to further this end in some cases.

In addition to sometimes being a useful means to meet biodiversity-conservation objectives, ecosystem services can be helpful in reconciling many sustainability goals, including poverty alleviation and the improvement of human well-being through biodiversity conservation. This is relevant to individuals or projects in the conservation community whose objectives go beyond biodiversity conservation. Multiple goals, however, do not always align perfectly. In tough cases in which they do not (win–lose), careful judgment and a clear-eyed evaluation of trade-offs is needed in order to decide how much to push each goal. These hard choices abound, as they do in the trade-offs between increased food provision to alleviate hunger and poverty and increased habitat protection for biodiversity conservation.

Conclusions

The current debate between proponents and detractors of ecosystem-services approaches in biodiversity conservation has helped raise a number of crucial issues about the concepts of biodiversity and ecosystem services, their relationships, the proper goals of biodiversity conservation, and the means to attain these goals. However, if this debate leads to polarization of the conservation community, it may prevent the emergence of common understanding of how best to push forward with conservation, which in our experience, is what all sides of the current debate desire. In our view, there is an urgent need for the community to move beyond the *either biodiversity or ecosystem services* debate to one that acknowledges that both biodiversity and ecosystem services—both intrinsic and instrumental values—are important arguments in stemming the tide of biodiversity loss. Being clear about ends and means in each unique case will allow the conservation community to usefully engage

with other sectors for the achievement of societal goals (Ludwig et al. 2001). However, in pursuing multiple goals, it is critical that the intrinsic value of biodiversity and the goals of biodiversity conservation are not dismissed in the conservation community's search for relevance and buy in through an ecosystem-services alignment. We will always need people and agencies dedicated to the cause of biodiversity if we are to achieve the goals set forth in policies such as the Convention on Biological Diversity. The common ground that exists between biodiversity and ecosystem services has the potential to play a powerful role in evolving our ability to address the sustainability challenges that we face—if we use these concepts correctly and carefully.

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