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Editorial

Against mono-consequentialism: Multiple outcomes and their drivers in social–ecological systems

One of the most exciting areas of research in the social sciences concerns the analysis of the interactions between social and ecological/biophysical processes. The goal of many of these analyses is to improve the understanding of how and under what conditions human–nature interactions lead to positive and sustainable outcomes. Scholarship in this vast domain of human activities and interactions with the natural world has been variously referenced as sustainability science (Clark and Dickson, 2003; Kates et al., 2001), and as research on social–ecological systems (Berkes et al., 2003; Folke et al., 2005), coupled natural and human systems (Liu et al., 2007), and ecosystem services (Costanza et al., 1997). Studies in the fields of common property (Ostrom, 1990), political ecology (Robbins, 2004), and community-based conservation (Agrawal and Gibson, 1999) also fall within this same broad category.

More generally, to mention climate change, biodiversity conservation, human-wildlife interactions, urbanization, the triple bottom line, and sustainable development is also to bring to mind the real-world relevance and the enormous vitality of these related bodies of work (Adger et al., 2010). To evoke these terms is also to name just a few of the expanding domains of inquiry in which a deeper understanding of the interactions between social and natural processes requires new theories and conceptual frameworks, methodological innovations, and more encompassing data sets. The urgency, importance, and ambitiousness of the need for cooperation between social and natural sciences to improve the analysis of multiple outcomes and the advancement of positive synergies across such outcomes is visible both in the growing interest in it across disciplines and in the increasing opportunities for work on coupled systems.

The growing importance of work on social–ecological systems can be substantially enhanced by attending more systematically, carefully, and insistently to the multiple outcomes that characterize all social–ecological systems. Such attention would require choosing, characterizing, and measuring the outcomes of interest, and analyzing causal relationships to attend to the patterns as well as drivers of multiple outcomes. The task is necessary because the intersection of all the different domains of human–environmental interactions is characterized by outcomes that unfold in the multiple dimensions of the human and the environmental. It is urgent because of precipitous declines in the status and functioning of many ecosystems the world over.

Multiple outcomes are ubiquitously the result of the social and ecological/biophysical processes related to sustainability. National economic growth is about increases in output and changes in the distribution of that output; it also impacts ecosystems. Deforestation affects terrestrial carbon and biodiversity, but also levels of economic output across scales. Agricultural innovation affects productivity, food security, and investments, but also soil carbon and nutrients. Recessions are about economic output; and they also influence employment and resource consumption. Higher levels of consumption have an impact on life expectancy as well as health status... examples of how social and social–ecological systems generate outcomes in multiple dimensions can be increased many more times.

Despite their ubiquity and importance, the study and analysis of multiple outcomes is uncommon (but see Chhatre and Agrawal, 2009; Liu et al., 2003; Steffan-Dewenter et al., 2007). Decades ago, the social sciences dismissed mono-causalism as an inadequate principle to guide social-scientific investigations (van den Braembussche, 1989). Mono-consequentialism, however, reigns across the social sciences, with relatively few challenges to its hegemony. Scholarship in the social sciences only infrequently focuses on more than one outcome as a commitment or as a guiding principle for analysis. The same focus on singular dimensions and consequences of social and social–ecological processes tends to be characteristic of the substantial literatures that examine how human and natural processes connect and with what consequences: resource condition, biodiversity, livelihoods, or carbon sequestration are some of the prominent examples of the single focus that many studies of social–ecological systems have, even when the studied systems (such as forests) function to produce all these outcomes simultaneously.

An analytical focus beyond the examination of single to multiple outcomes constitutes fertile grounds for substantial conceptual harvests and rich practical dividends. If social processes related to sustainability, and to social–ecological interactions more generally, invariably generate multiple outcomes then a focus on any single one of them – however important for a particular group of scholars and/or decision makers – leaves us uninformed about important outcomes in other dimensions. The simultaneous examination of multiple outcomes of interest on the other hand can enable the analysis of synergies and tradeoffs among outcomes; as importantly, it can allow more informed choices about which social goals to advance, how, and at what costs.

In this context, it is useful to note that although the simultaneous consideration of the multiple outcomes of social and social–ecological processes is rare in the social sciences – in part because of disciplinary divisions – the gap is often the result of epistemological commitments rather than a lack of potentially useful methods and modeling strategies. Qualitative, statistical,

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mathematical, and computational approaches can all be used to describe, represent, analyze, and model multiple outcomes in social and social–ecological systems. It is a different matter that in many cases, analysts and investigators using these representations and modeling strategies end up focusing on only one of the outcomes from among the many on which their models can cast light.

Similarly, a number of specific literatures referenced by terms such as unintended outcomes (Lal, 1999), tradeoffs and synergies (Steffan-Dewenter et al., 2007; Turner, 2010), Kuznets Curve (Stern, 2004), integrated assessment (Rotmans, 1998), and sustainable development (Lele, 1991) implicitly invoke multiple outcomes. But despite the invocation, the analysis often does not attend systematically to the different outcomes, their measures, and relationships, let alone their drivers (Agrawal and Redford, 2006). As we begin to consider the investigation and analysis of multiple outcomes more seriously, the effort to connect and understand the multi-faceted relationships between the social and the natural will certainly require, as a first step, deeper exploration of the commonalities and resonances among the literatures, analytical methods, and approaches that at least implicitly are about multiple outcomes. But to really say goodbye to mono-consequentialism will also require the development of analytical frameworks and methodological innovations that can accommodate data and analytical perspectives emphasizing multiple outcomes.

Therefore, important as it is to note the presence of literatures and analytical models for understanding and thinking about multiple outcomes, it is at least as necessary to emphasize that an adequate understanding of such outcomes would move beyond contemporary efforts that do so by minimizing or eliminating the distinction between different dimensions of outcomes (Hirsch et al., 2010). Two such strategies in wide use are (a) when outcomes in different dimensions are fungibly converted to a single dimension by using a common measure (such as money) and (b) when a (weighted) index is used to convert multiple, often incommensurable dimensions into a single encompassing dimension. Both these strategies for thinking about multiple outcomes are fundamentally attempts to project a multi-consequentialist world into a mono-consequential analytical framework.

Consider as an example a common approach to the valuation of ecosystem services. Many, indeed all, ecosystems generate multiple ecosystem services, typically classified into provisioning, regulating, supporting, and aesthetic/cultural services (Millennium Ecosystem Assessment, 2005). The conversion of each of the component ecosystem services in these categories into a monetary value for a given ecosystem, and the aggregation of these different monetary values yields a single amount as the value of the ecosystem. Using such aggregated values of different services resulting from potential uses of a given ecosystem to argue for or against the superiority of a proposed use may appear elegant, but it essentially obscures nearly all the interesting questions about the relationships among multiple ecosystem services, ignores the drivers of different ecosystem outcomes, and brushes away the tough political, social, and cultural issues integral to choosing between different, incommensurable dimensions.

The development and use of vulnerability indices in the context of climate change is an analogous attempt to convert a multi-dimensional world into a single dimension. Vulnerability, in much work on climate change is viewed as the result of the levels of exposure, sensitivity, and adaptive capacity of a given organism, system, or community (IPCC, 2001). To develop measures of vulnerability that amalgamate different levels and distinct dimensions of exposure, sensitivity, and adaptive capacity and mash them into a single number indicating vulnerability – either as a conceptual enterprise or as a policy guidance strategy – may provide a summary measure of vulnerability and sometimes be useful as a starting point. But to construct vulnerability indices as the goal of analysis is to ignore the critical need to understand the reasons *why* an individual or a group is vulnerable. Without such an understanding of the different ways in which people are vulnerable and the processes that make them vulnerable is thus to lose the opportunity to assess the policy-relevant question of how vulnerability can effectively be reduced. Use of a single-indexed measure to treat as similar things that are clearly different is to behave as if the world is full of nails because the tool one has in hand is a hammer. Commensuration is useful, but not when the dimensions being combined are in fact incommensurable.

The study of multiple outcomes as a new research program is likely to encompass at least five tasks: (a) the selection and characterization of outcomes to be examined; (b) the choice, development, and construction of measures of different simultaneously occurring outcomes that the intersection of social and social–ecological processes generates; (c) the identification of patterns in the relationships among selected multiple outcomes; (d) the specification of the drivers of multiple outcomes, including whether these drivers relate to individual or multiple outcomes of interest; and (e) the estimation of the strength of relationships among identified drivers and the relevant outcomes, including feedback, non-linearity and hierarchy in such relationships. Accomplishing these tasks will require the development of novel analytical frameworks to think about joint outcomes, methods to understand their interactions and drivers, and integrated datasets on multiple outcomes and their causes. Such a focus on multiple outcomes has the potential to marry spatial and network approaches and data with more conventional social science approaches so as to improve the understanding and knowledge of relationships among different factors and processes. Doing so will require as well a move away from easy assumptions that tradeoffs or synergies are the universal pattern of relationship among selected outcomes of interest. Whether tradeoffs or synergies characterize the patterns of relationships among observed outcomes of interest depends on the number of outcomes deemed to be of interest, and the contextual conditions under which social–ecological systems produce these outcomes.

The tasks outlined above are not just scholarly exercises in objectivity and analytical autonomy. For example, deciding which outcomes to focus upon is essentially a socially and politically freighted activity (Weber, 1946), and there is no getting away from the cultural politics that makes some outcomes appear more important (indeed even makes some outcomes visible), and some measures of selected outcomes more "reasonable" (Hirsch et al., 2010). Acknowledging and analyzing the weight of the social and the political (Hulme, 2010) in the choice of outcomes to be examined and research questions to be answered is also thus an inevitable part of scholarly research into multiple outcomes, and their measures, patterns, and drivers. The payoff to such acknowledgment and analysis is to open an unexplored continent of research and investigation relevant to understanding and changing the world.

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