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Incorporating Sociocultural Phenomena into Ecosystem-Service Valuation: The Importance of Critical Pluralism

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Ecosystem-services scholarship has largely focused on monetary valuation and the material contributions of ecosystems to human well-being. Increasingly, research is calling for a deeper understanding of how less tangible, nonmaterial values shape management and stakeholder decisions. We propose a framework that characterizes a suite of sociocultural phenomena rooted in key social science disciplines that are currently underrepresented in the ecosystem-services literature. The results from three example studies are presented to demonstrate how the tenets of this conceptual model can be applied in practice. We consider the findings from these studies in light of three priorities for future research: (1) complexities in individual and social functioning, (2) the salience and specificity of the perceived benefits of nature, and (3) distinctions among value concepts. We also pose a series of questions to stimulate reflection on how ecosystem-services research can adopt more pluralistic viewpoints that accommodate different forms of knowledge and its acquisition.

Keywords: ecosystem services, nonmonetary valuation, conservation, interdisciplinary science

The ecosystem-services concept carries potential to promote broad appreciation of the contributions of ecosystems to human well-being. In recent years, numerous theoretical frameworks have been developed to illustrate how ecosystem structures and functions affect well-being, and integrate previously disparate approaches to conservation under a single banner (Daily 1997, MEA 2005, Carpenter et al. 2006, Díaz et al. 2015). This rapidly expanding literature has provided a foundation on which to guide management actions and evaluate trade-offs associated with environmental policies, regulations, development, and restoration (de Groot et al. 2002, Potschin and Haines-Young 2011, Sagoff 2011). Nonmonetary valuation focused on the less tangible values and benefits of nature is gaining attention in this arena, because it provides insight on intrinsic motivations that underpin the ownership, management, and conservation of natural resources (Chan et al. 2012a, 2016, Brown G and Fagerholm 2014, Plieninger et al. 2015). However, the process of valuing nonmaterial goods and services is shaped by numerous sociocultural phenomena, many of which are overlooked in the study of ecosystem services (Daniel et al. 2012) and are rarely the principal consideration

in decisionmaking (Milcu et al. 2013). Furthermore, many of these phenomena are discussed under the rubric of "cultural ecosystem services" but do not directly relate to culture or align with a service-provision philosophy (Winthrop 2014). To address these limitations, we characterize these phenomena as *internal processes* (e.g., emotions), *external factors* (e.g., institutions), and *perceived benefits* (e.g., aesthetics) and argue that each are crucial to understanding the relationships that emerge between people and their environments (Raudsepp-Hearne et al. 2010).

Ecosystem-services research has developed novel insights that bridge the disciplines of ecology and economics with a particular focus on understanding how attributes internal to the individual are rationally weighed and balanced against the costs and benefits of policy outcomes (Daly and Farley 2004). Relatively fewer studies have considered how external factors work in tandem and interact with internal processes that influence the perceived benefits of nature (Hoff-Elimari et al. 2014). This interaction creates multiple feedback loops and nonlinear dynamics in decisionmaking that are of increasing concern in the study of ecosystem services (Carpenter et al. 2006). However, despite broad

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recognition that complexity is imperative to understanding social–ecological change, the sociocultural phenomena that account for variation in perspectives remain underrepresented in research and practice (Waring et al. 2015, Manfredo et al. 2016). This is problematic, because these phenomena explain behaviors that affect the environment and contribute to well-being (Schultz 2011), which are outcomes that lie at the heart of the ecosystem-services framework (Santos-Martín et al. 2013). Moreover, accounting for diversity in public opinion is instrumental to sustaining livelihoods and cultural identity (Brown and Neil 2011), facilitating broad participation in decisionmaking (Chan et al. 2012a) and incorporating ecosystem services into resource-management plans (Sarukhán and Whyte 2003, Carpenter et al. 2006).

Scholarly positions that draw on different ontologies (i.e., forms of knowledge) and epistemologies (i.e., knowledge construction) are needed to better represent the dynamic complexities of valuing nature. Psychosocial models of human behavior (Stern 2000, Kumar and Kumar 2008), anthropological investigations of culture (Satterfield et al. 2013), and the study of politics and institutions (Ostrom 2005, Miller et al. 2015) are several areas of inquiry that can provide insight on how sociocultural phenomena shape ecosystem-service valuation. Explicit and greater consideration of social and behavioral science perspectives will enable managers, policymakers, and scientists to make decisions on the basis of more complete information about (in)tangible values, which complement the ecological–economic links currently informing conservation discourse (Mascia et al. 2003, Moon and Blackman 2014, Bennett and Roth 2015). A broader latitude of acceptance for a range of disciplines will result in deeper understanding of how and why people interact with ecosystems and come to value the services they provide (Chan et al. 2012a).

In this article, we present a conceptual model of the key relationships among sociocultural phenomena underpinning ecosystem-service valuation, as well as discuss the applicability of this model to seven areas of scholarly discourse rooted in different forms of knowledge and its acquisition. This model was developed during two interdisciplinary workshops held at Portland State University in conjunction with the National Science Foundation's Integrative Graduate Education and Research Traineeship (IGERT) program. Drawing on several prominent theoretical frameworks and the research programs of our working group members, we also identify three example studies that demonstrate how to operationalize our conceptual model and incorporate diverse knowledge in decisions about the provision of ecosystem services to enhance human well-being. Next, we pose a series of topical questions to stimulate thoughtful discussion about how researchers and practitioners can engage with the social and behavioral sciences to more effectively solve environmental management problems. Finally, we contend that research should prioritize pluralistic ideals to accommodate diverse forms of knowledge, reconcile differences in competing stakeholder viewpoints, and manage for the multiple values of nature.

Conceptual models of sociocultural phenomena that shape ecosystem-service valuation

The process by which individuals and groups value ecological structures, functions, and processes is iterative in nature and underpinned by a range of sociocultural phenomena that are embedded within a broader ecosystem (figure 1). These phenomena include a combination of internal psychological variables and external sociopolitical factors, each of which varies in salience and specificity, as is indicated by the dotted line in the conceptual model. *Salience* is defined as the prominence of a viewpoint and extent to which it routinely occurs in everyday life, whereas *specificity* is the degree of alignment between an internal or external factor and the decision being made (Manfredo 2008). We argue that *internal processes*, defined as variables specific to the individual, provide a fundamental basis for making decisions and operating within a social context (Stern 2000). Examples of internal processes include value orientations, beliefs, attitudes, emotions, and personality. Some internal processes remain relatively stable over the course of a person's life and are not easily changed by environmental managers or policies seeking to garner support for sustainability initiatives (Dietz et al. 2005, Manfredo et al. 2016). These processes govern individual decisions and are formed through acculturation at an early age, including childhood memories and parent–children relationships that serve as guiding principles for later in life (Markus and Kitayama 1991, Schwartz and Bardi 2001). Other internal processes such as emotions and norms are less stable and more subject to change given an individual's sensitivity to their environment (Mesquita and Frijada 1992).

Internal processes and external factors work in tandem to influence the decisions people make when valuing ecosystem services (Guagnano et al. 1995). *External factors* include variables such as the social structures of societies (e.g., race, gender, ethnicity, and class) (Black et al. 1985), history, culture, and the physical and scalar contexts surrounding individuals and groups (Ostrom 2005). Institutional arrangements that govern how people engage with and use their environments are also external, because these arrangements yield policies that do not necessarily align with individual interests. However, institutional arrangements can be created and modified by resource users, which blurs lines of distinction between internal and external forces. That is, individuals respond to their own interests but are influenced by factors operating on the outside that encourage and constrain decisions expressed in ecosystem-service valuation. This distinction between internal and external factors has been supported by research on factors that shape behavior performed with the intention of benefiting the environment (Stern 2000, Kollmus and Agyeman 2002).
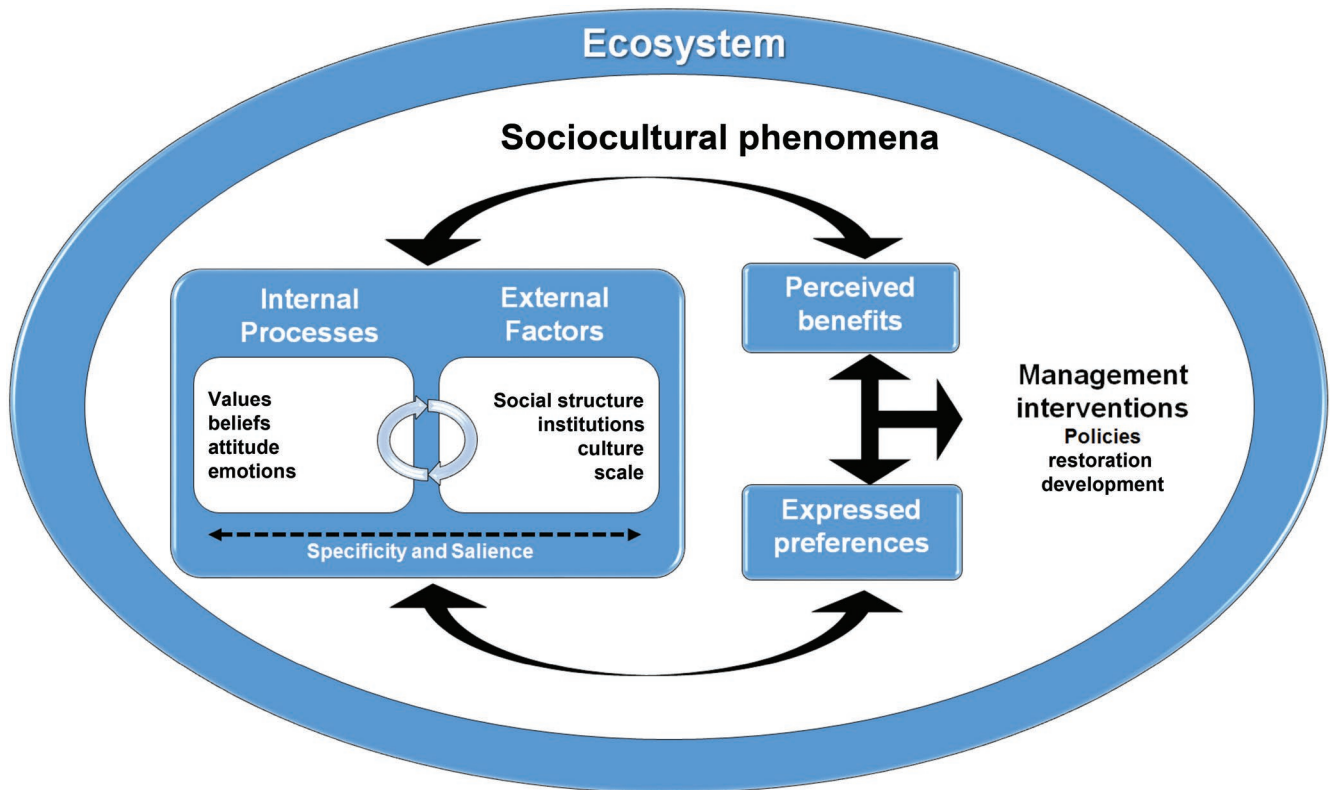
Figure 1. The role of sociocultural phenomena in the valuation of ecosystem services.

Internal and external factors—and the feedback loops among them—give rise to an individual's *perceived benefits of nature*, which are perceptions of positive and negative consequences of interacting with an environment. Zube's (1987) concept of perceived benefits suggests that continual transactions occur when people interact with landscapes by thinking, feeling, and acting in response to what is encountered. That is, an individual receives and processes information from a landscape and then reciprocates to impart their presence on that same environment (Gobster et al. 2007). For example, parks and protected areas that provide recreational experiences through different forms of human use (e.g., consumptive and nonconsumptive activities) can become degraded from anthropogenic change (van Riper et al. 2014a). These conditions influence human behavior and elicit different mental representations of what these protected areas provide to society. An individual's evaluation of a setting will consequently affect policies and, in turn, the dynamic characteristics of landscapes over time. Perceived benefits are a strong focus of study in environmental social science research that anchors individual experiences to physical, social and cultural contexts (Kyttä et al. 2013). This area of inquiry recognizes the importance of relational dynamics that emerge between humans and ecosystems rather than focusing merely on how people affect the environment.

Perceived benefits lead to an *expression of preferences* articulated and shared in real life events. We argue that expressed preferences parallel the valuation of goods and services. That is, individual and group level valuations are expressions of the worth or importance of ecosystems according to people's preferences for or against environmental features (Atkinson et al. 2012). These preferences can be assessed over space and time through the use of typologies that categorize different kinds of values assigned to places by individuals (e.g., aesthetics, recreational use, and therapeutic qualities) (Bengston and Xu 1995), as well as deliberated within groups and communities (Kenter et al. 2015). A number of classification schemes have been used to model social values for ecosystem services (Sherrouse et al. 2011) and complement assessments of the relative importance of competing attributes (de Groot et al. 2002, Martín-López et al. 2014).

Ecosystem-service valuation grounded in the perceived benefits of nature sets the stage for *management interventions* that help to sustain and/or improve the flow of goods and services to support human well-being. Interventions include policies, regulations, restoration, and developments that enforce the rules of governing authorities and affect human communities. Intervention programs can increase supply or demand (Daly and Farley 2004) and influence conditions that respond to and influence public preferences for use and management of natural resources. These interventions are more likely to succeed if sociocultural phenomena are considered by decisionmakers (Ban et al. 2013), because

people given an opportunity to engage in decisionmaking will be more likely to adjust their social situations and rationalize change (Brown 2009). Indeed, research that incorporates internal processes such as individual beliefs and external contextual factors can be applied to understand resource-use dilemmas and identify effective mechanisms (e.g., increasing social desirability) for influencing behavior change (Schultz 2011). Therefore, research and practice that consider the range of sociocultural phenomena influencing the perceived values of nature will be well poised to develop successful interventions that sustainably govern natural resources.

Diverse factors influence human decisionmaking related to valuation and management of ecosystem services. The relationships among sociocultural phenomena that shape these decisions about ecosystems are necessarily dynamic and fluid—that is, perceptions and preferences for nature's services change in accordance with decision contexts, feelings of moral obligation, and self-interest tied to the resources being evaluated (Heberlein 2012, Woodward et al. 2014). As such, we suggest an iterative view of human–environment interactions be adopted to accommodate multiple perceived values of nature and account for potential mismatches in scale that may occur between social and ecological systems over time (Wyborn and Bixler 2013). For example, stakeholder groups may not discern changing climatic conditions because global temperatures are shifting at rates that do not align with everyday experience. Impacts on plant and animal communities may go further unnoticed because of different degrees of sensitivity to climatic variability (e.g., farmers may notice year-to-year oscillations in crop yield, whereas urban residents may be less dependent on natural resources) and dissonant beliefs (e.g., resistance to accepting climate change despite scientific literacy; Manfredo et al. 2016). In other words, the process of valuing nature is highly complex because the meanings of ecosystems are not perceived equally among individuals and groups of stakeholders and because of misalignment between human perception and ecosystem processes.

Contributions from the social and behavioral sciences

We present a matrix to illustrate a range of disciplinary perspectives on the sociocultural phenomena that underpin ecosystem-service valuation (table 1). The matrix shows how seven social science disciplines (environmental anthropology, ecological economics, geography, landscape architecture, political science, conservation psychology, and environmental sociology) have interpreted internal processes, external factors, and the perceived benefits of nature. We selected these disciplines because of their ontological and epistemological breadth, and ability to add nuance to the process of valuation. We recognize that each discipline is predicated on a set of core beliefs concerning the nature of knowledge and methods for its production, and we acknowledge that the orientations of individuals in

these disciplines vary substantially. Moreover, numerous fields of study can enhance ecosystem-service valuation, but we believe the seven disciplines highlighted in this matrix should be prioritized in future research. In the section that follows, we explore the interactions between various disciplinary perspectives and the core tenets of the conceptual model described earlier. We also extend previous research that has emphasized the importance of epistemological pluralism and multiple theoretical paradigms to engage with diverse forms of knowledge (Miller et al. 2008, Raymond et al. 2010). We contend that explicit consideration of sociocultural phenomena is instrumental to reflect nature's values and enrich how ecosystem services are studied and characterized.

Internal processes. The disciplines in our matrix provide insight into a range of internal processes that influence valuation such as emotion, identity, perceptions, and attitudes. The similarities and differences in several of these variables are important to consider. For instance, sociologists often focus on identity associated with the role that an individual plays in society, and its effect on subsequent beliefs, attitudes, and behaviors (Stryker and Burke 2000). Conversely, psychological perspectives on identity emphasize individual beliefs concerning the self that exists largely independent of power dynamics and social structures (Clayton et al. 2013). Nuanced differences between these two disciplines are important to consider, because they offer unique perspectives on identity formation that explains, in part, why values are ascribed to an environment.

External factors. A variety of external factors such as institutions, culture, history, scale, and markets are highlighted in our matrix and drawn from a variety of academic traditions in the social and behavioral sciences. For example, conservation psychologists have studied the effects of external factors on internal processes that shape decisions to engage in behaviors that influence the environment (Guagnano et al. 1995). However, this research tradition has focused more attention on the individual than on their surroundings, which underlines the importance of considering interactions and feedback loops among various sociocultural phenomena. In a similar vein, environmental anthropologists and political scientists have investigated external factors such as institutions (Ostrom 2005) and scale (Wesche and Armitage 2010) to better understand land use planning and management. For example, previous research has incorporated measures of socioeconomic status in spatial models of urban biodiversity to predict land use and land cover change over time (Kinzig et al. 2005). In this study, the authors treated variables such as income as proxies for the capital available to local communities, which enhanced understanding of the production and consumption of ecosystem services. Thus, external forces alongside individual characteristics play crucial roles in explaining how people benefit from the ecosystems on which they rely (Heberlein 2012).

Table 1. Seven social and behavioral science disciplines that provide insight on the valuation of ecosystem services. Internal processes, external factors, the perceived benefits of nature, and examples of key literary sources are also presented for each discipline.

Example disciplines	Internal processes	External factors	Perceived benefits of nature	Examples of key literary sources
Environmental anthropology	emotion, identity	institutions, culture, history, scale, social structure	cultural preservation, community resilience, justice, traditional ecological knowledge, access and control of resources	(Brosius 1999, West et al. 2006, Satterfield et al. 2013)
Ecological economics	utility	markets, institutions, norms, equity	consumption of goods and services, value, human and natural capital, market stability, sustainability	(Costanza et al. 1997, Daly and Farley 2004)
Geography • **human** • **physical** • **GIScience**	place meanings, familiarity, identity	institutions, scale, culture, landscape function, disturbance	cultural and social protection (prevention of disturbance), access to resources, livelihoods, land use patterns and processes, spatial prioritization	(Tuan 1974, Turner 2002, Urquhart and Acott 2014, Steffen et al. 2004, Sherrouse et al. 2011)
Landscape architecture	various forms of perception	landscape design, scale, function of built and natural environments	aesthetics, cultural maintenance, infrastructure, recreational opportunities, sustainable development	(Helfand et al. 2006, Gobster et al. 2007, Daniel et al. 2012)
Political science	attitudes, utility	institutions, markets, history, power, social norms	formal and informal policy instruments, adherence to policies, conflict resolution, collective action, political engagement	(Ostrom 2000, 2005, Agrawal 2001)
Conservation psychology	attitudes, values, personal norms, identity, mental models	context, social norms	behavior change, sustainability, environmental communication, recreational opportunities	(Kumar and Kumar 2008, Schultz 2011, Clayton et al. 2013)
Environmental sociology	attitudes, beliefs, identity, self-efficacy	institution, social structure, culture, individual agency	social networks, community development, environmental justice, marketing, prevention of deviance	(Kinzig et al. 2005, Flint et al. 2008)

Perceived benefits. We expand on past research that has distinguished between the perceived benefits of nature and preferences expressed in economic valuation (Potschin and Haines-Young 2011, Chan et al. 2012b) to show that these processes result from and interact with internal and external forces. The manner in which the perceived benefits of nature are produced varies as a function of the ecosystem services in question. That is, benefits can be socially constructed, are specific to place-based concerns, and grounded in the social–ecological contexts that facilitate human interactions with nature (Zube 1987). Several examples of benefits that reach beyond the standardized views on monetary valuation include cultural preservation, community resilience, and environmental justice (Brosius 1999, West et al. 2006, Satterfield et al. 2013). The array of disciplinary lenses highlighted in our matrix can be adopted in the design of resource management plans to respond to the needs and interests of stakeholders who ultimately determine the success of conservation initiatives (Chan et al. 2012a). If the perceived benefits of nature are explicitly identified in environmental planning and management, policy outcomes will be less likely to create inequities and marginalize groups of stakeholders that do not serve in positions of power (Gould et al. 2014).

We argue that *expressed preferences* are influenced by external factors, internal processes, and the perceived benefits of nature. Ecosystem-services research and practice that

recognize and respond to the context surrounding a valuation exercise remains a challenging endeavor. The history of stakeholder engagement, sensitivity of researchers to the unique characteristics of places, and practical constraints related to the measurement or implementation of ideas are several examples of meaningful barriers that can impede the flow of ecosystem services to human communities (Stewart et al. 2013). Our matrix can provide a roadmap for scholars and practitioners interested in developing interdisciplinary teams to manage ecosystem services for human health and well-being (Bennett and Roth 2015). Rather than supplant existing perspectives or frameworks that have emerged in previous research, we aim to stimulate dialogue surrounding the representation of social science perspectives in ecosystem-service valuation and the diversity of epistemic and ontological beliefs that underpin its study.

Example studies of the sociocultural phenomena that shape ecosystem-service valuation

Three research examples were identified in our working group to demonstrate how the tenets of our conceptual model could be realized in practice by interdisciplinary teams of scientists. We present descriptions of research on the internal processes of people who visited Channel Islands National Park, California, United States; external factors that influenced policy change on the Anchicaya River, Colombia; and the perceived benefits of the Lower Hunter Region in

Australia. Our intention is to illustrate how diverse sociocultural phenomena surrounding ecosystem-service valuation can advance the management and protection of biological resources and the health and well-being of resource users.

Example study 1: Internal processes on Channel Islands National Park, California, United States. Channel Islands National Park is located off the coast of southern California and considered the "Galapagos of North America" owing to its biological diversity and abundance of endemic and endangered species that have evolved on the islands in geographic isolation. Most people who visit the park experience the two islands closest to the mainland, Anacapa and Santa Cruz. The agencies that manage these islands, the US National Park Service and the Nature Conservancy, support natural resource management activities, scientific research, and recreational opportunities for visitors. A number of management concerns have been prioritized by agencies to balance human use with the protection of park resources, especially (a) the eradication of invasive species; (b) ecological restoration; (c) impacts on cultural resources (e.g., archaeological artifacts); and (d) anthropogenic changes to the marine reserve network surrounding the islands. These four concerns were addressed in this example study using tools and theories from conservation psychology, human geography, and ecological economics.

Example study 1 evaluated the internal processes posited by the value–belief–norm theory (Stern 2000) to predict engagement in behaviors (e.g., volunteering, cleaning equipment, or reading scientific literature) that minimized impacts related to the park's four primary management concerns. To ensure salience of the resources being valued, the survey data were collected on site from visitors to Santa Cruz and Anacapa Islands in 2012. The results indicated biospheric and altruistic values that served as guiding principles in life, environmental worldviews, awareness of consequences incurred from inaction, and responsibility ascribed at the individual level positively influenced the activation of norms that anteceded behavior reported by the survey respondents (van Riper and Kyle 2014b). By identifying the internal processes at play within stakeholder groups, agencies became equipped with some of the necessary tools to invoke greater commitment to resource management activities and better understand how the perceived qualities of places related to on-ground conditions (van Riper et al. 2017). Moreover, respondents' internal processes explained why they perceived benefits such as biological diversity, recreation, and aesthetic qualities associated with the protected area (van Riper and Kyle 2014a). The interdisciplinary approach adopted in example study 1 provided additional insights into how the protected area could establish itself as a tourism destination and identify high and low priority places that embodied multiple social values for ecosystem services.

Example study 2: External factors on the Anchicaya River, Colombia. The region surrounding the Anchicaya River on the Pacific coast of Colombia is characterized by its high biological and cultural diversity. Inhabitants of the region are Afro-descendant communities whose livelihoods and culture are closely linked to the ecosystems in which they live. In 2001, a hydroelectric dam on the Anchicaya River released approximately 500,000 cubic meters of sediment that affected the terrestrial and aquatic ecosystems below the dam. Because of the area's remoteness, this issue lacked salience and the governmental institutions in Colombia failed to address the problem in a timely manner. Consequently, communities united to request compensation for loss of access to resources and filed a lawsuit against the company that released the sediment. In support of the lawsuit, an interdisciplinary group of researchers and nongovernmental-organization scientists studied the impact of the release along approximately 60 kilometers of the Anchicaya River in 2013 and provided a valuation of the impaired ecosystem services. This team drew from environmental anthropology, physical geography, and ecological economics to better understand the role of external factors and community members' expressed preferences for nature.

The valuations from example study 2 considered the market prices of products (e.g., fish and agriculture) within the regional context of the Anchicaya region. On the basis of the expressed preferences of residents, losses in marketable fishing and agricultural products from the time of the sediment release to the time of valuation were estimated to be approximately $102 million (Briceño et al. 2013). In addition to market prices, techniques from geography and ecological economics were used to provide transfer values for other ecosystem services, which amounted to approximately $57 million. The research team also evaluated the qualitative, nonmonetary values associated with impacts on various external factors, including the community's social structure, cultural maintenance and human health, as well as internal processes including loss of identity and feelings of safety. In 2015, the Constitutional Court of Colombia ruled in favor of the Afro-Colombian communities of the Anchicaya River that had sued the company responsible for the hydroelectric dam. A final number for compensation to the communities was still being developed in 2016 and is expected to include an amount for material losses and an amount for nonmaterial losses. This victory also sets legal precedent in Colombia for a community winning a battle against a large company over environmental damage and for use of the ecosystem-services concept in a legal case.

A key external factor in this example study was the institutional support provided by convention 169 of the International Labor Organization to ensure consideration of the rights of indigenous and tribal peoples. The affected communities organized themselves to take advantage of these rights and create informal arrangements to manage key environmental goods and services. Government and academic reports, interviews, focus groups, and informal information were adapted and used to reflect the local circumstances in which this valuation took place. To address

issues related to geographic scale, ecosystem properties in addition to the social structure and cultural ties between people and the river were considered to evaluate the river subsections. The results indicated that the Anchicaya River was used by the community for provisioning of water and fish, and for transportation to exchange products resulting in an important cultural exchange. People from upriver grew agricultural products, whereas downriver, residents relied on fish from mangroves and the sea to exchange for agricultural products. The loss and/or reduction of these resources threatened the exchanges on which these communities relied.

Example study 3: Perceived benefits and expressed preferences in the Lower Hunter Region, New South Wales, Australia. The Lower Hunter Region (LHR) in New South Wales, Australia, covers approximately 430,000 hectares, about 60% of which is covered in native vegetation. Although dominated by woody vegetation, the LHR hosts a diverse set of ecosystems, including grasslands and wetlands, as well as a suite of economically important industrial processes (e.g., coal mining), agricultural development, and residential growth. Development trajectories of this region have increasingly placed pressure on nationally listed rare and threatened native species in the region, which are protected under the Environment Protection and Biodiversity Conservation Act 1999. These species are formally referred to as Matters of National Environmental Significance (MNES). To better understand the impact of urban and regional development on MNES, the Australian Government initiated a regional sustainability planning process that involved identification of knowledge gaps and delivery of scientific research to inform sustainability planning for the LHR, as well as a strategic environmental assessment of proposed urban development and related infrastructure corridors in the region.

A series of research projects were conducted in the LHR, including a participatory study on local values for regional sustainability and an ecological assessment of the spatial distribution of MNES (Whitehead et al. 2014). The participatory study was designed to evaluate individual values and preferences for environmental amenities and potential changes to the LHR. Using public participation geographic information system methods, LHR residents were asked to map their perceived benefits (e.g., aesthetic and cultural significance) and expressed preferences for development locations (Brown and Raymond 2014). The respondents identified existing national parks, state forests, conservation reserves across the region, and the Lower Hunter coastal strip as areas with high conservation value. An analysis of internal processes (e.g., attitudes and beliefs) provided further insight on the future directions for perceived economic prosperity of the LHR. The respondents thought that that this area was too dependent on the coal mining industry and that coal–seam–gas mining was an unacceptable land use. According to spatial comparisons of the respondents' perceived benefits and expressed preferences with scientific values for biodiversity, areas identified by the respondents as highly acceptable for development were not typically associated with MNES. The results also indicated there were multiple locations for biodiversity conservation, irrespective of how perceived benefits and preferences were incorporated into the analysis. In summary, the case of the LHR showed multiple ways of valuing ecosystem services (i.e., spatial assessments of perceived benefits and expressed preferences, attitudes and beliefs about conservation issues, and a spatial comparison of social and scientific values for conservation). This project also provided support for the protection of MNES in the LHR, and used expressed preferences to provide place-based management approaches for nationally listed rare and threatened native species.

Discussion

We assert that a fuller, richer understanding of ecosystem services requires consideration of many sociocultural phenomena that shape valuation including internal processes, external factors, and the perceived benefits of nature. The model presented in this article was developed and related to seven disciplines in the social and behavioral sciences from the perspective of our working group, which is one of many that can be adopted to more broadly conceptualize ecosystem-service valuation. Indeed, expertise in the study of ecosystem services should be drawn from multiple scholarly positions. To demonstrate how the tenets of our conceptual model could be located in real-world examples, we presented the results from three example studies and underlined the importance of drawing from a range of disciplines to stimulate the production of different forms of knowledge and its acquisition. Greater and more explicit engagement with diverse disciplinary standpoints will enable ecosystem-services research to (a) account for complexity and variation in stakeholder perspectives, leaving space for new processes to emerge over time; (b) maintain salience for multiple actors and specificity in the valuation process; and (c) distinguish between value concepts that play distinct roles in guiding management interventions and explaining preference heterogeneity. In the sections that follow, we discuss our example study findings in light of these three priorities and pose a series of questions for future research.

Accounting for complexity in decisions to value ecosystem services. Complexities underlying ecosystem-service valuation are not always captured through ecological–economic frameworks that often focus on single, direct use values (Norgaard 2010, Winthrop 2014, Scholte et al. 2015). We argue that the feedback loops and nonlinear dynamics in decisionmaking can be better accounted for by research that engages with a range of disciplinary perspectives and provides insight on the multifaceted phenomena that shape valuation (Carpenter et al. 2006). Research approaches that embrace pluralistic ideals can build on different economic production metaphors, foster deliberative processes, and involve mutual learning to raise the visibility of human

values (monetary and otherwise) at play in a given resource use situation (Raymond et al. 2013, Klain et al. 2014). As is illustrated by the Anchicaya example, interdisciplinary teams can leverage resources to address distinct but complementary goals, resulting in outputs that recognize cultural exchange and remain defensible in litigation. The multiple philosophical orientations encompassed by disciplinary traditions have different understandings of sociocultural terms and methods (Adger et al. 2003), which can be brought to bear in contexts such as the Anchicaya to account for environmental degradation that influences well-being and quality of life.

Recognizing the salience and specificity of ecosystem services valued by stakeholders. Our example studies engaged with the idea of salience by drawing on multiple methods including survey and participatory techniques, as well as economic valuation. In many frameworks, such as IPBES (Díaz et al. 2015), that have been developed to better conceptualize ecosystem services and strategize for the future, salience could be more pronounced. That is, the prominence of beliefs held by individuals and groups performing a valuation have not been deemed a priority; rather, the focus is on broader direct and indirect anthropogenic drivers of ecosystem change. It is important to consider the salience of resources being valued, because one stakeholder may be forced into a valuation and have limited awareness and concern about project outcomes, whereas another may have vast knowledge and history with a resource that sustains their livelihood. In both of these circumstances, a better understanding of salience would help define problems and solutions for adapting to change and encourage consultation with the people most affected by decisions, particularly when issues are ethically charged. Future research should contextualize ecosystem-service valuation as a process embedded in a social–ecological system that recognizes the extent to which management and policies resonate with resource users (Chan et al. 2012a). Decisionmakers that carefully weigh costs and benefits in light of the salience of internal and external forces will be better equipped to draw from understandings (e.g., traditional ecological knowledge) that can advance sustainable resource use, signpost areas that are prone to conflict and anticipate noncompliance with regulations intended to protect the flow of ecosystem services to society.

The idea of specificity facilitates consideration of public opinion and can increase transparency and equity in management decisions (Bridge and Perreault 2009). In the case of the Channel Islands, the list of perceived benefits that survey respondents associated with places were developed before the study was conducted and tailored to the context through preliminary data collection and consultation with agencies and scientists. This step in the research process not only established rapport with decisionmakers, it enabled the research team to consider relevant management priorities and ensure the internal processes evaluated were at similar levels of specificity (Manfredo 2008). However, the salience

of this study could have been improved. Residents and consumptive users (e.g., fishers and commercial operators) outside of the protected area were not included in the sampling frame. Although the survey data were collected on site to ensure the salience of visitors to the protected area, to encourage consensus-based negotiations and maintain respect for the multiple values of places, future research should aim to reach beyond political borders and account for diverse stakeholder opinions (Chan et al. 2012a).

Distinguishing between value concepts to capture preference heterogeneity. Findings from our three example studies pointed to the importance of distinguishing between concepts such as human values that transcend specific contexts (i.e., internal processes) and the perceived benefits of nature, which were less stable place-based values that people formed in response to landscape conditions (Dietz et al. 2005). For example, in the Channel Islands, van Riper and Kyle (2014a) blended perspectives from conservation psychology and ecological economics to measure multiple values of nature, including "held" values and more specific "assigned" values that were mapped by the respondents segmented into subgroups to account for preference heterogeneity. In the LHR, Raymond and Curtis (2013) also mapped assigned values (e.g., aesthetics and cultural significance) and identified preferred locations for development (Brown and Raymond 2014), which were influenced by a variety of factors such as family upbringing, membership in environmental groups, number of years of residency, and occupation. "Relational" values associated with human–environment interactions that support virtuous pursuits add further nuance to understanding and framing the value concept (Chan et al. 2016). Without explicit recognition of the differences between these three kinds of values, a mismatch can occur between ecosystem-service provisioning and public evaluations of goods and services. That is, a lack of specificity between sociocultural phenomena—particularly value concepts—and the resources being valued can produce incomplete results that are less likely to account for variation in perspective.

Practical applications of sociocultural phenomena that embrace critical pluralism. Integrating an array of disciplinary positions and methods into decisionmaking is instrumental for implementing policy change, but current ecosystem-service frameworks offer limited conceptual guidance on how the research community can frame this process. The theoretical notion of critical pluralism (Williams and Patterson 2007) provides a useful roadmap for advancing the study of ecosystem services and supporting interdisciplinary collaboration (Bosque-Pérez et al. 2016). This philosophical stance suggests research should draw on a range of disciplines, including the multiple epistemologies and ontologies found within them, to more accurately define and articulate resource management problems and solutions. The use of this framework to guide future valuation research and practice will expand the capacity of actors to incorporate diverse opinions

Table 2. Questions posed to researchers and managers engaged with ecosystem-services research and practice.

	Research implications	Management implications
Regional scoping	1. How is the organizational context of research conceptualized?	1. Who are the different stakeholders relevant to the ES valuation?
	2. What knowledge relevant to ecosystem-service valuation has been identified, and to what extent is it drawn on at different stages of research?	2. How do managers working with local actors identify social and environmental conditions?
	3. How is the study context identified and defined?	3. What role do managers play in framing intervention strategies and the use of different policy instruments?
Integration and analysis	1. How are values and motives of stakeholders assessed?	1. Which tools (e.g., spatial analyses) are assumed or trusted to guide decisions at different levels of governance?
	2. What forms of evidence are perceived as valid and reliable by the research team?	2. How do knowledge brokers or boundary organizations help to overcome constraints to interpreting research outputs?
	3. Which elements of external events or internal processes are selected and analyzed?	3. How do the perceived benefits of local constituents interact with values identified through scientific analysis and government authorities?
Synthesis	1. How is the interface between the research outcomes (e.g., models and scenarios) and action plans negotiated?	1. How do environmental policies create space for stakeholder engagement and/or prohibit the incorporation of preferences into action plans?
	2. What processes are in place to build social capital (e.g., trust and reciprocity) between the individual scientist and decisionmakers?	2. Are managers monitoring conditions that reflect the interests of diverse groups?
	3. How do managers build capacity to create relationships that endure beyond funding cycles and political terms?	3. Is there sufficient flexibility in planning to respond to changes in the social or biophysical context including emergent forms of knowledge?

in decisionmaking and reconcile interpretive differences that likely affect valuation (Raymond et al. 2014). We suggest the ecosystem-services concept be used as a dialogic tool—a way of conceptualizing and speaking about knowledge, values, and ideas—to create bridges between different ways of knowing and therefore empowering more voices during policy development and implementation (Abson et al. 2014).

We extend previous research by providing a set of questions to guide the application of the ecosystem-services framework in a way that engages with the idea of critical pluralism (table 2; Raymond et al. 2010, Chan et al. 2012b, Álvarez-Romero et al. 2015). We suggest that diverse sociocultural phenomena be considered in three phases: (1) consideration of questions to further regional scoping wherein problems are defined and stakeholders identified; (2) integration and analysis to generate and interpret information through research and community engagement; and (3) synthesis to plan, mainstream, and monitor identified interventions. These phases are cyclical in nature and lay groundwork for researchers and decisionmakers grappling with natural resource management challenges to adopt critical pluralism. We raise these important questions to stimulate a constructive dialogue about how critical pluralism can be harnessed and applied throughout all phases of the research process.

We recognize that pluralistic ideals, although associated with innovation and knowledge generation, pose challenges to individual researchers and practitioners and their affiliate institutions (Scholte et al. 2015). Trade-offs and tensions are virtually inevitable to collaborative endeavors, particularly pluralistic ones. Individual scholars may lack the ability

to acquire the necessary resources and capacity to engage in negotiations involving multiple viewpoints. Legitimacy and the means for career development (e.g., promotion and review processes, funding, and publication outlets) may further impede engagement. Critical pluralism blurs the boundaries between different forms of evidence and standards for evaluating knowledge. Although disciplines have their own ethos, cultures, and norms that shape the process of generating knowledge (Kahan 2012), institutional structures do not necessarily reflect those of individual members. Future research should aim to better understand interactions between individuals and disciplines including competition and power dynamics. With greater open mindedness toward diverse ontologies and epistemologies, interdisciplinary pursuits and engagement with diverse sociocultural phenomena will be more likely to ensue.

Conclusions

We aim to enhance problem-focused research by encouraging the inclusion of multiple forms of knowledge and methods that advance the study of ecosystem-service valuation. In particular, we present a conceptual basis for scientists and decisionmakers to consider a range of sociocultural phenomena and diversity of viewpoints on how resources are managed, experienced by people, and tied to ecosystem-service valuation. The theoretical insights and results from three example studies in the United States, Australia, and Colombia are presented to demonstrate the tenets of this model. Drawing on these studies, we contend that research should embrace complexity, maintain salience and specificity, and distinguish between value concepts to garner

long-term support for effective and lasting policy change. Future research that accommodates multiple epistemological and ontological frames will provide a platform for a range of stakeholders to voice their opinions about the multiple values of nature. Adopting a pluralistic view of ecosystem services will require that critical questions be asked about regional scoping, integration, and the synthesis of ideas.

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