Does ecosystem services valuation reflect local cultural valuations? Comparative analysis of resident perspectives in four major urban river ecosystems

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Anthropologists have long considered how people create and perceive the value of goods and services. While valuation of nature as a commodity is one means of conservation, locally resonant values of nature may not follow market logic. We apply the ecosystem services valuation (ESV) framework to four major urban river ecosystems (Australia, New Zealand, United States, and United Kingdom) to compare and contrast value (the alienable goods that are readily commodified and monetized) and values (the inalienable goods and rights that defy easy comparability and recognition). In interviews, respondents (N = 283) living near the rivers described the local river-associated ecosystem services (ES) they experienced. Thematic content analysis of coded interview data showed that respondents in all four sites recognize ES in their local areas related to rivers, and these resonate with the value-oriented ESV frameworks. While the ESV framework offers a way for scholars and policymakers to easily compare the monetary value of ES, our results indicate that rivers have locally ascribed value that defies easy commodification. In particular, our work highlights the local importance of priceless, inalienable values perceived to be conferred across ES and not just restricted to cultural services.

Keywords Ecosystem Services; Rivers; Culture; Values; Environmental Valuation; Market-Based Conservation

Anthropologists have much to say about value—the ways that humans create and perceive meanings for goods and services (Graeber 2001, 2013; Werner and Bell 2004). Debates over what constitutes value have roiled anthropology for decades, and while anthropologists have not settled on a single or cohesive theory of value, anthropologists do generally agree that all humans organize their lives around the pursuit or furtherance of value (Graeber 2013). Anthropologists also agree that there is an important distinction between "value"—how much someone is willing to give up to obtain something (Appadurai 1988; Simmel 1978)—and "values"—moral understandings of what is right and good (Kluckhohn 1961). Research shows that moral values can, and often do, play a role in determining price or exchange value (Dalsgaard 2013), but higher moral importance is not commensurable with price (Ferguson 1992; Polanyi, Arensberg, and Pearson 1957). In fact, goods and services considered to have extreme moral importance are seen as "priceless." These goods to be kept (e.g., heirlooms and sacred objects) or services to be given freely (e.g., care work, sexual relations) are considered "inalienable" in that they cannot be readily removed from their moral, symbolic, and/or social contexts. "Alienable" goods (and services), on the other hand—those that are easily ascribed economic value—are those that are readily commodified and exchanged (Godelier 1999; Weiner 1992; Zelizer 1985). They are, as Graeber (2001) explains, easily compared and publicly recognized.

Despite this rich anthropological view of value, economic anthropologists have had relatively little to say about the value of ecosystem services (ES) (cf. Cattelino 2015; Satterfield et al. 2013), including the formal process of

ecosystem services valuation (ESV). ES refer to the benefits that humans extract from natural and productive ecosystems (such as grasslands, forests, and riverine environments). Created by scientists and policymakers, the formal ecosystems valuation framework (ESV) is designed to help people operationalize and juxtapose the services and benefits of natural environments by ascribing specific "services" of nature with economic value. The basic idea behind this framework is that price tags on environmental services will encourage people, first, to recognize their importance and desirability and, second, to engage in cost–benefit analysis to measure the environmental impact of human-led projects using market logic (Balvanera et al. 2017; Grimm et al. 2016; Ma et al. 2017; Peterson 2015; Tallis et al. 2008; Tallis et al. 2015). Practical examples of market-based conservation initiatives include carbon trading and ecotourism. From an anthropological perspective, such initiatives are (economic) valuation projects per Graeber (2001): they make the value of nature public, recognizable, and comparable.

In operationalizing this framework for the "value" of nature, ESV initially did not place a strong emphasis on "values." While early ES scholarship (MEA 2003) discussed cultural services—defined as the nonmaterial benefits humans derive from human–ecological relations—efforts to integrate cultural services into valuation assessments and the resulting decision-making processes are more recent and largely lack an anthropological perspective. In this study, we attempt to build upon efforts to improve this integration (Chan, Satterfield, and Goldstein 2012; Klain, Satterfield, and Chan 2014) using the case of urban riverine ecosystems, asking, (how) does the ESV framework (e.g., as deployed by policymakers) map onto—or not—the (alienable) values and (inalienable) values that local community members ascribe to riverine ecosystems?

Saving the environment via the market

The ES paradigm is one of the most recognizable conservation frameworks designed to ascribe economic value to nature. Beyond this, ES is part of a much broader scientific and policy movement to reframe the reasoning behind "saving the environment" into market logic and neoliberalism (i.e., the political-economic ideology that prioritizes marketization, commodification, privatization, financialization, and decentralization) (Arsel and Büscher 2012; Holmes and Cavanagh 2016; McElwee 2017). Policy makers behind various "neoliberal conservation" projects (e.g., REDD and carbon trading, ecotourism, biodiversity derivatives, and payments for ES) argue that these are "common sense" and "win-win-win," as they protect the environment, grow the economy, and benefit local communities (Holmes and Cavanagh 2016; Igoe and Brockington 2007). These ideas have been implemented at all scales of governance, from local government to international accords (e.g., Kyoto Protocol).

In response to the increasing prominence of these paradigms, a vast academic critique has emerged (Arsel and Büscher 2012; Castree 2003; Igoe and Brockington 2007; McElwee 2017). This critique highlights three major recurring trends: the implementation of new forms of power, especially Foucauldian forms of governmentality that reshape local subjectivities and ideas about conservation; the promotion of new Eurocentric representations of what nature *should* be; and the interaction with existing structures of social inequality (see Holmes and Cavanagh 2016). While such studies make valuable contributions by outlining the dangers and the possible benefits of these market-based conservation approaches, they rarely recognize or promote other possible paradigms for recognizing value in nature (McElwee 2017).

Anthropologists have much to contribute to these debates via investigations of how local people create and understand the values imbued in their own ecosystems and how these perceived benefits may vary across different communities (i.e., of value and valuation). Anthropological accounts of neoliberal conservation efforts have demonstrated the ways that market logic is produced and perpetuated by these initiatives (Benadusi 2018; Faas 2018; Larsen 2017; Machaqueiro 2017; O'Connell et al. 2017; Özden-Schilling 2016; Sager 2016; Zhang 2017). Yet, anthropological literature on value demonstrates that capitalist and market-based value is not the only way that humans recognize and conceptualize importance and desirability (Graeber 2001; Otto and Willerslev 2013). Human

value systems are diverse, are locally embedded, and need not follow market logic. For example, recent research indicates that place is a significant component of how individuals and communities value ecosystems; particularly as these ecosystems are often the site of cultural practices, the physical space itself is exceptionally important as a source of inalienable value (Bryce et al. 2016; Fish et al. 2016; Irvine et al. 2016; Spash and Vatn 2006). Additionally, the values ascribed to natural environments are often highly contested (Drew 2012; Strang 1997).

While local, place-based research is important to understand unique ES (Anderson 2017; Quyen et al. 2017; Sanna and Eja 2017), comparative research is necessary for place-based investigations of the convergence and deviation of the ESV framework compared to local valuations. Thus it is worth asking how market-based conservation frameworks (such as ESV), which rely on the logic of economic value, map onto different local understandings of "value" for and "values" of nature. To advance this agenda, we present a study of urban riverine communities in four countries.

Ecosystem services valuation: Some background

ES emerged as a paradigm in the mid-1990s to address conservation goals and help people better understand and measure the value of nature (Costanza et al. 1997). Designed to draw attention to the benefits that humans gain from natural environments (e.g., carbon sequestration, drinking water, nutrient cycling, wildlife habitat, etc.), ES outlines four different types of services that natural environments provide: provisioning, regulating, supporting, and cultural services (Daily 1997; MEA 2003). As the ESV framework is adopted to promote conservation goals and responsible environmental management, scholars have largely focused on how people assign monetary value to individual services, how important these services are to individuals within a community (Kumar and Kumar 2008; Robertson 2004), or the ways ES may simultaneously achieve development and conservation goals (Tallis et al. 2008).

Scientists, policymakers, and the public had discussed the benefits that natural environments provide for decades, but the 2003 Millennium Ecosystem Assessment (MEA) formalized a framework for citizens and policymakers to officially recognize the services provided by the world's ecosystems. The framework outlined by the MEA divided ES into four discrete categories. Provisioning services provide tangible material resources, including food, water, power, and other raw materials (MEA 2003). Regulating services include ecosystem processes that aid in the health of the environment, including heat regulation, flood control, and pest prevention (Costanza et al. 1997; Hale et al. 2014; Jenerette et al. 2011; MEA 2003; Palta, Ehrenfeld, and Groffman 2014; TEEB 2010). Supporting services include processes that support other ecosystem processes and life, including nutrient cycling and providing a habitat for plants and animals (MEA 2003). Finally, cultural services refer to the less-than-tangible benefits that people glean from the ecosystem, including recreation opportunities, appreciating spiritual or heritage values in a place, and identifying with a place (Bieling and Plieninger 2013; Daniel et al. 2012; de Groot et al. 2005; Palta et al. 2016). In formalizing this framework, the authors of the MEA aimed to foreground the products and services that humans freely gain from nature and draw attention to the fact that these products and services are not actually "free" but come at a cost to human populations if they are disrupted or destroyed.

The first three categories outlined in the ESV framework — provisioning, regulating, and supporting — are straightforward in that they provide a format to compare elements of an ecosystem with other commodities and services in the marketplace. As such, the ES literature has historically focused on these services. For example, in looking at carbon sequestration, which is a particularly "value"-laden service, scholars conclude that focusing on one form of regulating services often leads to the conservation of other regulating services (improved water quality, soil conservation, etc.), but only when landowners receive payment for making decisions that preserve and enhance ES (Nelson et al. 2009). The outcomes of monetizing provisioning, regulating, and supporting services at local and state levels compared across cases, for example, showed the value ascribed to provisioning services, such as the availability of clean water for domestic use (Wunder, Engel, and Pagiola 2008). One suggestion is that regulating,

provisioning, and supporting categories are more easily monetized and commoditized because these are comparable with other services already in the marketplace (Farley and Costanza 2010; Gómez-Baggethun et al. 2010; Kosoy and Corbera 2010; Ma et al. 2017). They are "alienable," easily valued and exchanged.

ESV does not need to equate to commodification of ES, but the monetization of ES has dominated the literature, and cultural ecosystem services were often difficult to accommodate in such work (Chan et al. 2012; Costanza et al. 2014; Kelemen et al. 2014; Satz et al. 2013; Tallis et al. 2008). Scientists and policymakers, at times, struggled in operationalizing, quantifying, and/or articulating a monetary value for these benefits (Chan et al. 2012; Larsen, Turner, and Brooks 2012). As a result, theorization of cultural ecosystem services was slower to develop than in other areas of ES (Daniel et al. 2012).

Scholarship in the last decade has focused on cultural services as the "nonmaterial benefits" that individuals and communities gain through interaction with ecosystems, including cultural identity, inspiration, recreation, tourism, knowledge systems, and social relations, among other benefits (Bieling and Plieninger 2013; Chan, Satterfield, and Goldstein 2012; Tengberg et al. 2012). As recognized in the ESV literature (Adams et al. 2016; Bieling et al. 2014), these types of "services" are not easily comparable, not always publicly recognized, and thus not readily commodified or monetized. While progress has been made in quantifying cultural ES (e.g., Kumar and Kumar 2008; Plieninger et al. 2013; Robertson 2004; Van Berkel and Verburg 2014; Winthrop 2014), more research is needed to determine if some cultural ES are considered to be inalienable human "values" — what people consider right and good about their natural ecosystems.

Across both the alienable services (provisioning, regulating, and supporting) and the possibly inalienable services (cultural), there is an assumption that laypeople conceptualize ES in the same way that scientists do, that is, in discrete categories of services. But ES studies rarely engage laypeople (Seppelt 2011), and studies that have engaged laypeople often use the ESV framework to frame and elicit responses (Satterfield et al. 2013). This makes it impossible to determine if laypeople define ES entirely differently or if laypeople have perceptions of ES that affect their willingness to support development and conservation programs in their local communities (Klain, Satterfield, and Chan 2014). Building on the work of Klain, Satterfield, and Chan, our work addresses the assumptions that there is broad consensus about (a) what ES are and (b) the relationship between the discrete ES and the conferred benefits (MEA 2003).

Methods

Site selection and data collection

We selected four major central-city riverine ecosystems for comparison (a) to enrich understandings of ESV in urban environments and (b) because residents are situated close to and hence are familiar with the ecosystems we are asking them about (seeing, crossing, and having direct access to them daily). All interviews took place within a mile of the main river in four major Anglophone cities (Brisbane River in Brisbane, Australia; Waikato River in Hamilton, New Zealand; River Thames in London, England; Salt River in Phoenix, Arizona, United States). Our reason for selecting a range of cross-cultural Anglophone sites is that these are the local cultural contexts most likely to conform to ESV thinking; we would expect wider deviations from ESV thinking in non-Western, non-Anglophone, and majority-indigenous sites (Satterfield et al. 2013). All four sites have undergone major restoration projects and thus have been a focus of local government policy and investment. The degree to which each river provides tangible services to its city residents ranges across the sites (Table 1). For example, city transportation in the Australia site leans heavily on river-based passenger ferry systems but does not at the others.

The interview protocol examined how local citizens in each city understood the dominant categories in the ES framework. It used a paired structure of questions, asking respondents to describe types of services they received from the river and if some people in their community were more affected by the services they described. Following

Table 1 Population, Demographics, and River Features of Each City in Which Interviews Were Conducted, Along With the Sample Demographics

	City Population	City Demographics	Sample Demographics	River Features
Thames River, London, England	6.7 million	79.8% white/European; 10.3% Asian; 8.1% black	74% white/European; 12% Asian; 7.6% black	Longest river in UK; tidal; used for sports; minimal transportation; widely used for river walk recreation; swimming discouraged
Brisbane River, Brisbane, Australia	2.4 million	79.2% white/European; 14.6% Asian; 2.4% Aboriginal/Torres Straits peoples	70% white/European; 8.3% African; 5% Asian	Long, tidal regional river; used as key component of within-city transport; major issues with flooding; some private boat use; sometimes safe for swimming in some locations
Salt River, Phoenix, AZ, United States	1.3 million	69.5% white; 40.8% Hispanic/Latino; 2.2% Native American	57.4% white; 14.8% Hispanic/Latino; 11.5% Asian; 8% Native American	A tributary of the Gila River; bed mostly dry due to upriver damming; minimal use within the city outside of a single reservoir allowing boating with an attached park; swimming prohibited
Waikato River, Hamilton, New Zealand	165,500	69.5% Pakeha/European; 21.3% Maori (indigenous); 13.8% Asian; 5.1% Pacific peoples	70.3% Pakeha/European; 14.9% Maori (indigenous); 2.7% Asian	Longest river in New Zealand; strong spiritual connection to Maori, especially Tainui tribe; used for recreation (shooting, boating, cruises); generally safe for swimming

the work of Klain, Satterfield, and Chan (2014), each set of questions used conversational language to obliquely target the academic categories of the ESV framework. For example, the question regarding provisioning services asked, what natural resources (such as water, food, medicine, fuel, or other raw materials) does the river provide to people who live in this city? Cognitive pretesting (DeMaio and Rothgeb 1996) in Phoenix, Arizona, was used to ensure that the questions were appropriately framed to address the relevant ES that local residents might experience as a result of proximity to a river. Using a nonprobabilistic, purposive sample, a total of 283 adults across four sites were interviewed (sixty-eight in Brisbane, seventy-four in Hamilton, seventy-four in London, and sixty-seven in Phoenix). Trained field assistants recruited participants in river-proximate public spaces. This purposive/convenience approach is appropriate when the aim is to capture data that reflect *shared* cultural and environmental knowledge (Handwerker and Wozniak 1997).

Data analysis

We analyzed interview data using thematic content analysis, with both deductive (Balvanera et al. 2017; Bieling and Plieninger 2013; Chan et al. 2011; Costanza et al. 1997; de Groot et al. 2005; MEA 2003; TEEB 2010; von Döhren and Haase 2015) and inductive, place-specific codes. The codebook identified forty-one themes organized into six meta-themes: (a) provisioning services, (b) regulating services, (c) supporting services, (d) cultural services, (e) cross-cutting services (e.g., human well-being), and (f) inductively and place-derived codes reflecting site-specific value. These inductively derived codes included "inequity in services," which captured factors like proximity to the

river, socioeconomic status, the role of race/ethnic identity, how industry might benefit more, and how tourism affects services. Additional place-specific codes were derived through multiple readings and memoing of the data (Charmaz 2014). We iteratively revised the codebook working with 10% samples of the interviews until all codes reached high levels of intercoder reliability as measured by Cohen's kappa (i.e., κ > .70) (McHugh 2012). We then coded each interview at the sentence level. The themes/patterns that composed our analysis form the basis of the results and discussion presented herein.

Results

Our results are sorted into four thematic categories that address how respondents in urban riverine environments understand ES and the way that their responses match or deviate from the ESV framework. This demonstrates both convergence between local community valuations and the ESV framework and deviations from it. Deviations include (a) substantial overlap between the discrete categories outlined in the ESV framework; (b) beliefs that the river does not currently provide services, although perhaps it should; and (c) locally derived valuations of the river that defy discrete categorization. While the ESV framework has created a way for scholars and policymakers to easily compare the monetary value of ES, our results indicate that rivers have locally ascribed values that are closer to inalienable and priceless value.

Local valuations and convergence with the ecosystem services valuation framework

Across the four sites, respondents identified examples of ES that align with scholarly definitions (Table 2). For example, respondents consistently said that their river environments created provisioning services, such as "transport via water. Fishing as a food source. Geology research on the plants and the effect of the environment" (interview, May 17, 2016, Brisbane, Australia). Along the Brisbane River, ferries provide an important means of transportation for many residents; while this is not a commonly identified provisioning resource in the literature, it is identified as a "freshwater" provisioning service (MEA 2003). A respondent along the Waikato River in New Zealand identified similar provisioning services and added that the Waikato provides additional resources: "The water, power, they take a lot out to clean up for drinking water. [It's a] huge renewable resource for power. This river is the main production site for power in the North Island. Historically, it provided food and fishing" (interview, May 31, 2016, Hamilton, New Zealand). Here the respondent identifies multiple types of provisioning services, including the provision of drinking water, as well as hydropower. While the respondent noted that the river doesn't provide hydropower in their area, they nevertheless recognized this function as a valuable and important service.

Respondents in London were less likely to identify provisioning services from the Thames. However, they mentioned services like "the Thames provides drinking water to London. And there's fish in there, too, so some sort of food. The water is filtered out so it is drinkable. We need water to survive" (interview, June 25, 2016, London, England). Many indicated that the Thames had historically provided more services than it currently does; several respondents said that the Thames had been a source of transportation and food in the past. Many respondents indicated that the water from the Thames was undrinkable or that it wasn't available to all as a service.

Local valuations deviate from the ecosystem services valuation framework

While respondents regularly identified examples of ES within the question designed to elicit each service, respondents also regularly "bundled" services together. This bundling is recognized in the ES literature; however, the focus has primarily been on the covariation of regulating and provisioning services across heterogeneous landscapes and the difficulty of assigning value to interdependent services (see Klain, Satterfield, and Chan 2014). Similarly to Klain, Satterfield, and Chan, we found respondents rarely discussed just one benefit, instead frequently naming multiple benefits and often bundling benefits across ES categories.

Table 2 Ecosystem Service Definitions (MEA 2003), Along With Representative Quotes

Services	Definition	Representative Quote
Cultural	Nonmaterial benefits obtained from ecosystems: • recreation • heritage/spiritual/identity values • education • aesthetic/inspiration	"The river is beautiful. [It's a] natural environment, a contrast between the city and nature. Lots of photography, photo classes by professionals. It's a symbol of the city." (interview, May 17, 2016, Brisbane, Australia)
Provisioning	Products obtained from ecosystems: • food • freshwater • fuel/wood • other raw materials	"[The river provides] minerals, water supply, energy; higher authorities provide [these] to the public." (interview, May 31, 2016, Hamilton, New Zealand)
Regulating	Benefits obtained from regulation of ecosystem processes: • pest regulation • water purification • prevention of natural disasters	"Since Tempe has dammed it, I think they have some control of the flooding because it used to flood every once and a while." (interview, November 4, 2016, Tempe, Arizona)
Supporting	Services necessary for the production of all other ecosystem services: • nutrient cycling • soil formation • habitat for plants and animals	"If there are fish, it helps provide food source, helps transport nutrients from one place to another." (interview, June 25, 2016, London, England)

The most common bundling across categories involved both provisioning and cultural services within the same response. This occurred with 29% of respondents overall, most frequently in Australia and New Zealand. While transportation is typically considered a provisioning service (MEA 2003; TEEB 2010), in Australia, it was often named as a benefit in response to our cultural services prompt. When asked about cultural services, one respondent said, "The [Brisbane] River is mostly there for [the] nice feel it gives our city. Other than for transportation, it lines the parks and centers to make it enjoyable to look at" (interview, May 17, 2016, Brisbane, Australia). Respondents in Brisbane recognized the value of the ferry system along the river and included the ferries as both cultural and provisioning services. In New Zealand, the co-occurrence of provisioning and cultural services is often related to Maori harvesting practices and rights: "Natural resources, obviously water. Spiritual sense for Maori, water is how they identify themselves. They do a lot of eeling from the river" (interview, May 31, 2016, Hamilton, New Zealand). Both Pakeha (European descendent) and Maori respondents agreed that Maori worldviews do not silo ES into provisioning, regulating, supporting, and cultural. Instead, because the river is central to local Maori history, spiritual values, and identity (all historically considered part of cultural ecosystem services in ESV), these cultural values are fully entangled with the other ES that the river provides. Across all four sites, the co-occurrence of provisioning and cultural codes can also be attributed to the organization of the protocol, which started with questions about provisioning services. However, several respondents named cultural services when answering this first question, indicating the salience of cultural services.

The least common bundling of service categories comprised regulating and provisioning services. As discussed earlier, this is the most common type of bundling discussed in the ES literature. This finding emphasizes the importance of engaging stakeholders in ES assessments.

Historical services and dead rivers

In addition to identifying overlap in ecosystem service categories, respondents also deviated from the ESV framework, indicating that their riverine ecosystems no longer provided services due to human intervention. For example, many respondents said that their river was "dead," "black," and "polluted." While respondents indicated that it used to provide drinking water, or that it *could* provide drinking water, they would not drink it. It is clear that respondents are aware that the ecosystem should provide services but believe the services are no longer healthy or beneficial. Particularly along the River Thames, respondents indicated that the river had provided a range of services in the past but no longer did. Respondents said that the Thames "does not help" with provisioning and supporting services, indicating that they would not drink the water and that the river was not a good habitat for fish. These sentiments were often accompanied by a sense of disgust with the current state of the river; as this respondent said, "it used to provide food. The water is gross" (interview, June 25, 2016, London, England), indicating that while the river historically had moral and monetary value, this is not necessarily the case now.

Respondents in the other three sites also indicated that their rivers did not provide services. Those at Brisbane River said that it "doesn't provide any resources at all" (interview, May 17, 2016, Brisbane, Australia) and that "it doesn't help the air because it is polluted" (interview, May 17, 2016, Brisbane, Australia). While respondents clearly understood the questions regarding provisioning and regulating services, many indicated that people do not perceive the river as providing these services. Along the Waikato River, respondents offered two notable arguments. For some, the river is polluted and therefore does not provide services: "It doesn't [provide services] because it's so polluted. It's been polluted since the Pakeha came here" (interview, May 31, 2016, Hamilton, New Zealand). For others, the river *could* provide services, but people do not avail themselves of them: "Nobody is benefiting here, [they're] not using it. The resources are underutilized, most are not using those available, therefore nobody is benefiting" (interview, May 31, 2016, Hamilton, New Zealand).

Local perceptions and values

Respondents in each of the four sites also identified ways the river was providing services beyond typical scholarly notions. Respondents along the Waikato River identified sustainability as value associated with the river and indicated that New Zealand has tried to cultivate a "green" image. While some scholars might identify sustainability as a value associated with provisioning and regulating services, and one that could easily be monetized or capitalized upon, the respondents who identified sustainability associated it more with the moral values of their community and country, saying, "New Zealand tries to hold a green image, so anything green or natural helps in keeping this image; it's also part of our culture" (interview, May 31, 2016, Hamilton, New Zealand). While sustainability as a value does contribute to provisioning and regulating services, for these respondents, sustainability became associated with cultural values.

For respondents along the Brisbane River, the river serves as a cultural divide between the north and south sides of the river; this likely reflects the complex colonial history of the river as a social divider (from 1855, specific street boundary lines on the south side of the river marked the legal exclusion of Aboriginal peoples from the city after 4:00 p.m. and all day on Sunday).[1] The discussion of this service does not align with any examples of cultural services, but this cultural divide is clearly imbued with complex moral values.

Along the River Thames, respondents did not identify unique cultural ES but an unusual regulating service: sewage removal and sanitation. This is not a commonly accepted example for a regulating service. Respondents provided vague responses with regard to whether the sewage was directly in the water, but they nevertheless said that the Thames was invaluable in managing the sanitation of the city.

Finally, respondents along the Salt River indicated a unique service in saying that the river was salty, which prevented it from being used, particularly by plants and animals. The Salt River was not so named because it is saline but from salt banks more than one hundred miles upriver. The perception of saltiness may indicate a misperception

Table 3 Quotes From Interviews That Show the Overlap Between Cultural Services and Other Ecosystem Services

	Quote
Cultural/provisioning	"The Salt River is trapped for hydro-electric generation. Native peoples have used it for hunting and fishing because the water attracts them." (interview, November 11, 2016, Tempe, Arizona)
Cultural/regulating	"Adds more emotional aspect. When seeing the river, it's very uplifting seeing the river next to the city. Provides cleaner air, but I'm not quite sure how." (interview, June 25, 2016, London, England)
Cultural/supporting	"Making a usable place for parks and rec for everyone to access. This is the last remaining wetland in the area. Everyone plants trees by the river. Growing vegetation leads to other growth." (interview, May 31, 2016, Hamilton, New Zealand)

based on the name (which still has implications for perceived value) or may actually be a reference to the notoriously "hard water" of the US site, which is actually a result of high levels of calcium and magnesium.

Discussion

Our analysis offers insight into local understandings of value for local ecosystems. First, for respondents who felt that their local riverine ecosystem provided ES, the examples and definitions they gave largely fit within the accepted scholarly definitions of ES (Table 3), with some noted exceptions. Second, despite clear evidence that local riverine ecosystems do provide services, many respondents felt that the rivers *do not* provide services, either because they have not thought about it in the context of services before or because they see the river as a "dead" river. Finally, while the scholarly definitions of ES are largely applicable in many different communities, there are specific, local definitions and values that defy the ESV framework.

The contrast of the four sites indicates, overall, that local understandings of ES do align with the formal definitions outlined in the ESV framework. However, while previous studies of ES have siloed services into categories of easily commodified or alienable provisioning, regulating, and supporting services that are considered separate from the more priceless and inalienable cultural services, our respondents did not conceptualize services in such structured ways (following Klain, Satterfield, and Chan 2014); rather, there is significant and consistent overlap in how respondents understand and experience ES, particularly in the overlap between cultural and other services. This indicates a disconnect between local understandings of ES and the scholarly definitions but also that people do not think of inalienable, or priceless, services provided by ecosystems and alienable and more easily commodified services as discrete and separate. This does not necessarily indicate that ES definitions need to change — at least in Anglophone sites, such as ours — but it does suggest that the ways scientists and practitioners have been mobilizing the ES framework to enable and encourage people to easily compare ES and engage in cost–benefit analysis may not align with local understandings of value. Rather, local communities may think more holistically about the value they ascribe to their local ecosystems, with alienable and inalienable values entangling with one another. That this finding remains consistent across all four sites demonstrates that this may not be only a locally relevant dissonance but could reflect a larger dissonance between grounded and local ideas of value and the neoliberal, market-driven frameworks of value that are often proposed by scientists and policymakers in market-based conservation paradigms.

Our analysis also provides a curious and notable insight into community perspectives on the valuation of services. Our findings suggest that unique, possibly negative, value and values are assigned to local riverine ecosystems. While this was most common along the River Thames, respondents in all four sites expressed disgust for their river, noting that it no longer provided benefits and suggesting erosion of their valuation of the river and its services. Importantly, there was no lack of knowledge about ES; rather, the river ecosystem historically provided services diminished by human intervention. This sheds light on a possible relationship between *negative* "value" and "values" with regard to ES. While anthropologists consistently demonstrate that high moral worth is

not commensurable with economic value (Graeber 2001), little work has been done in the inverse, that is, exploring the relationship of *low* moral worth with economic value. In this case, even though polluted rivers indeed still provide services (Grimm et al. 2016; Hale et al. 2014; Palta, Ehrenfeld, and Groffman 2014; Robertson 2004), our respondents clearly did not perceive any value from their river environment, possibly because their values of clean and pristine ecosystems precluded them from perceiving other forms of value.

Finally, we conclude that there are unique values not included in the formal ESV framework evident at the local level. For example, cultural divides related to racist histories (Brisbane River) defy typical moral valuations of ES. While this might not necessarily be considered an ecosystem service (MEA 2003; TEEB 2010), it indicates deep ecosystem values (D'Andrade 1992).

Conclusion

Our comparison of four urban river locales demonstrates several important things with regard to the ways that people value their local environments. While the ESV framework has long lent itself to ascribing economic value to natural resources, there is tremendous difficulty in easily ascribing commodity value to natural resources. And while monetization of ES frequently ignores the very important and often recognized (inalienable and priceless) cultural services that community members derive from local ecosystems, we identify significant overlap in lay thinking about ecosystem service categories. For example, when there is great overlap in the way people understand provisioning and cultural ES, it challenges the ideas of monetizing provisioning services. Particularly, responses in New Zealand highlight the local importance of priceless, inalienable values. Our New Zealand sample had the highest rate (see Table 1) of indigenous community member responses (mainly Maori), and respondents most frequently mentioned cultural ES across the categories, indicating the centrality of inalienable values affiliated with the river environment that is characteristic of Maori culture. Further research in a wider range of cultural sites and contexts, especially non-Anglophone sites, may reveal even more diverse conceptions of value for nature.

The divergence in the understanding of value between the ES framework and local community members has implications for other research and policy on market-based and "neoliberal" conservation efforts. As market-based conservation efforts continue to be implemented to encourage changes in human behavior toward the environment, it is important to consider that such paradigms do not wholly reflect local understandings of value. For ES and other market-based conservation frameworks to be successful policy tools, community responsiveness is of the utmost necessity. Thus, for practitioners involved in conservation and restoration projects using market-based conservation frameworks, harnessing local knowledge regarding the value and values that are imbued in local environments is key. Communities who see existing value in their local environment will likely have ideas about how to successfully implement projects to ensure environmental health, and these values—which may not be monetary—are important to create and support such projects.

Finally, for anthropological studies of values, we find tension between the monetary value of ES and the values that local community members ascribe to their local environments. While the ESV framework attempts to account for priceless, inalienable values by including the cultural services category, our results show that local community members may be more likely to ascribe inalienable and priceless value to all four categories outlined in the ESV framework (thus not thinking of "priceless" cultural services as separate from other forms of value provided by their local ecosystems). Our respondents recognized and compared the value of services provided by their local ecosystems, as Graeber (2001) suggests, but the consistent entanglement of inalienable, cultural services with categories of services that are alienable and more easily commoditized demonstrates the ways that even in thinking about nature, it is difficult for people to fully separate moral and economic understandings of value.

Acknowledgments

Note

1   Our ethnographic expert indicates that this is common knowledge among locals in the area and in the historical record (see http://members.optusnet .com.au/~dbelling/boundary.html;   https://www.brisbanetimes.com.au/national/queensland/brisbane-could-rename-historically-racist-boundary-streets-20160129-gmhgi3.html; http://www.westendmagazine.com/the-stories-of-our-streets/; http://westender.com.au/boundary-street-mural-story-tell/).

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