Debunking trickle-down ecosystem services: the fallacy of omnipotent, homogeneous beneficiaries

Abstract

Ecosystem services research broadly assumes that an increased supply of nature's goods and services will yield increased benefits. We challenge this 'trickle-down' assumption by explicitly investigating the factors that might impede ecosystem services yielding benefits to different stakeholder groups, based on a targeted literature review of First Nations' access to shellfish on Canada's Pacific Coast. Our review revealed four sets of barriers to realizing benefits from ecosystem services despite their abundance within many First Nation territories. The barriers highlight problems of access, particularly as driven by geographic location, technical capacity, markets and user conflicts, and management (of harvest and access), all of which limit First Nations' procuring of resources linked to key services. Our findings demonstrate that simply increasing ecosystem service supply does not necessarily increase benefits for individuals or groups. Realizing the promise that ecosystem services research will enhance human well-being through improved management depends on the explicit consideration of how access mediates the distribution of benefits.

Keywords: access; biophysical abundance; First Nations; food-social-ceremonial harvest; ecosystem-based management; provisioning

Introduction

The concept of ecosystem services (ES) has become a valuable, widely used framework for conceptualizing how people benefit from and depend on the diverse goods and services derived from the biosphere (Lele et al. 2013). Much work has gone into mapping, quantifying and monetizing ecosystem services and the benefits they yield. Such services have been categorized as provisioning (e.g., provision of food and clean water); regulating (e.g., flood and disease risk mitigation); cultural (e.g., contribution to spiritual, recreational, and cultural benefits); and supporting (e.g., nutrient cycling

and soil formation) (de Groot et al. 2002; Millennium Ecosystem Assessment 2005; Chan et al. 2012). In other words, ecosystem services are the conditions and processes through which natural ecosystems and their constituent species sustain and fulfill human life (Daily 1997).

A close reading of the ES literature reveals that the field as a whole effectively makes the implicit assumption that increasing the supply of an ecosystem service (e.g., available shellfish) will inevitably trickle down and lead to increased stakeholder benefits (e.g., via shellfish consumption). This tacit assumption is manifest in the lion's share of ES literature addressing metrics of ES supply rather than realized benefit (Tallis et al. 2012). Even those studies that assess the benefits or value of ES largely ignore how those benefits might actually be realized, let alone how evenly they may be realized across groups with diverse capabilities. While the importance of access to equitable ES benefit distribution was articulated by the Millennium Ecosystem Assessment (2003), and the United Kingdom's Ecosystem Services and Poverty Alleviation (ESPA) program provides a notable example where access is treated explicitly, such insights about the true realization of benefits by diverse groups have not yet percolated through the literature. An important component of how benefits are realized relates to the barriers that impede diverse groups, and not just those less-developed nations, from realizing the benefits of ES. Such barriers have yet to receive comprehensive treatment in the ES literature.

Despite this deficit, a broad diversity of research has provided a more nuanced perspective of ecosystem service benefits. For example, several authors have pointed to the need to disaggregate ES beneficiaries to articulate policy trade-offs, or identify winners and losers (Chan et al. 2007; Tallis et al. 2008; Daw et al. 2011; Ferraro & Hanauer 2011; Butler et al. 2013; Poppy et al. 2014). Others have demonstrated the importance of space and scale to ES management, as potential beneficiaries ascribe (cultural) value to and subsequently navigate space according to a particular social, economic, or historical contexts (Alessa et al. 2008; Aswani & Lauer 2006; Dalton et al. 2010; Sherrouse et al. 2011; Teh et al. 2012). ES benefits vary and are experienced differently depending on the scale of analysis

(Hein et al. 2006; Barbier et al. 2008; Carpenter et al. 2009; Martín-López et al. 2009; Plieninger et al. 2013), thus the need for ES trade-off and conflict analysis to be spatially and temporally explicit (Douvere & Ehler 2009; White et al. 2012). The linkages between ES and realized benefits, human well-being, and poverty alleviation have also been explored (Brown et al. 2008; Daw et al. 2011; Polishchuk & Rauschmayer 2012; Sikor 2013), with some pointing out that such benefits are inextricably linked to intangible benefits or cultural ecosystem services which may require separate characterization (Chan et al. 2011, 2012; Satterfield et al. 2013).

However, only a small number of papers drawing on the ES framework have explicitly accounted for how access to ES and the associated benefits varies across space, groups, or communities (e.g., Martín-López et al. 2009; Daw et al. 2011; Hicks & Cinner 2014). The paucity of studies investigating how benefits are realized by disadvantaged groups makes it clear that the field as a whole is still largely based on the assumption that increasing ecosystem service supply will generally increase benefits. We begin to address this gap in the literature using the case of Vancouver Island, British Columbia (BC), to demonstrate the unavoidable link between the availability of an ES (in this case, shellfish for commercial and subsistence harvesting), its distribution, and its promise of well-being, where well-being is linked in part to the cultural benefits accrued as part of harvesting culturally valued food species.

Erroneous Assumptions – the fallacy of 'more is better'

Shellfish harvesting continues to be important in maintaining cultural practices and livelihoods of many First Nations groups along BC's coast, and coastal Vancouver Island is no exception (Karpiak 2003; Ban et al. 2008; Menzies 2010). Culturally valued shellfish species on Vancouver Island include sea urchins, chitons, snails, mussels, barnacles, abalone, geoduck, and a variety of clams. Accordingly, the 1990 Sparrow decision set out that "aboriginal rights to fish for food, social, and ceremonial purposes have priority over all other uses of the fishery" (DFO 2008). A 2014 ruling by the Supreme Court upheld

this decision by asserting both the right to food fish and the right to fish for limited commercial activity (The Globe and Mail 2014).

If the implicit assumption that an increased abundance of goods and services correlates directly with increased benefits to communities holds true, then this court ruling could reasonably mean that First Nations communities' ability to benefit from shellfish should now be closely linked to the abundance of harvestable shellfish populations in the region. In other words, if benefits are not being realized, then abundance must be the primary issue we address.

Acknowledging that low abundance of harvestable shellfish remains a significant issue on northern Vancouver Island (Heaslip 2008), we nonetheless find that access is an equally large if not larger problem. Drawing on the work of Ribot and Peluso (2003) and Brown et al. (2008) to characterize *access,* we illustrate that many access barriers currently exist to limit the benefits First Nations communities derive from this marine resource, *even where* shellfish abundance is high. We begin by defining what we mean by access, and then define four sub-categories of barriers (geographical location, technical capacity, markets and user conflicts, and management), each of which captures a related set of circumstances that demonstrate the fallacy of trickle-down ecosystem services. This, in turn, establishes the need to seriously consider the link between ES availability, access, and realized benefits.

Defining access (to ecosystem services)

Access is listed by Schlager and Ostrom (1992) as one of five rights linked to resource control – access, withdrawal, management, exclusion, and alienation. These are understood as the right to enter a defined physical property and so the ability to withdrawal rights to obtain products or resources. For our purposes, we use “access” to refer to spatial, legal, policy, or economic considerations that may prevent individuals from realizing benefits from a supply of some good or service. Put simply, access is the “the

98 *ability* to derive benefits from things" (Ribot & Peluso 2003). In a coastal marine resource context,
99 Brown et al. (2008) further considered barriers to access that include permits and licenses, land
100 availability, gendered divisions of labour or gender-delimited access, geographical location, coastal
101 development, climate change, marine protected areas, technical capacity (fishing gear, boats, processing
102 facilities, storage equipment, skills), market isolation, user conflicts and pollution.
103
104 ***Geographic location: A resource does not benefit people if it is physically inaccessible.***
105 Two aspects of geographical location largely determine the degree of access and benefits
106 derived by coastal communities from marine resources. The first relates to physical and spatial barriers,
107 while the second relates to timing. Historically, restriction of physical proximity to coastal resources
108 began with the government instituted system of Indian Reserves along coastal BC that relocated and
109 restricted First Nations communities inland (Harris 2002; Heaslip 2008a; Joyce & Canessa 2009). This has
110 had numerous far-reaching effects, and its legacies continue to pose obstacles today.
111 There is much evidence that First Nations communities used to access marine resources by
112 locating villages nearby. Forced inland relocation means that many First Nations must now travel to
113 harvest resources that were once adjacent to their communities, or have completely lost access to areas
114 still considered part of their traditional territories. The problem is amplified by the fact that the
115 Department of Fisheries and Oceans Canada (DFO) will only allow communal commercial harvest for
116 "First Nations who have reserves fronting beaches with clam resources…" (DFO 2013). This problem
117 extends to many First Nations along BC's coast, not just those on Vancouver Island, in particular those
118 whose reserves do not directly front beaches that contain harvestable shellfish or that define those
119 beaches as public, not reserve, space (Heaslip 2008a).
120 Such harvesting has always been seasonal because of winter weather and tides, and
121 contemporarily, some First Nations still maintain seasonal harvest camps, especially on the east coast of

Vancouver Island. But the reserve system and its accompanying economy (e.g., wage labour where available) have made it increasingly difficult to accommodate temporal harvesting patterns based on weather and seasonal abundance (Heaslip 2008a). Climate effects producing changing timing of environmental conditions has only increased this post-colonial predicament (Turner & Clifton 2009).

Access on Vancouver Island is also undergoing ecological change as invertebrate populations, including shellfish decline in the face of predation from recovering sea otter populations (Watson & Estes 2011). Virtually no shellfish harvesting now occurs in some areas, although limited harvesting still occurs mainly on small remote beaches by hand along the lower intertidal zone. Such areas must now be accessed mainly by boat, except for the few clam beaches that are directly adjacent to reserves. Consequently, other factors such as fuel or moorage costs have emerged with a disproportionally large impact on the ability of people to harvest (Heaslip 2008a, Joyce & Canessa 2009).

Technical capacity: A resource does not benefit people if they lack the technical knowledge or capacity to harvest it.

There are two aspects of technical capacity to access: the first relates to the technical knowledge held by those who might benefit from a particular service, while the second considers technical ability. Historically, digging for shellfish was a coordinated community effort involving a system of hereditary chiefs, each head of a lineage or other kinship grouping with access rights to foreshore areas. Gathering was done by hand, or with a trap set at low tide and then retrieved by foot or small canoe at the next low tide (Menzies 2010). Many places along the BC coast were consistently used for harvesting (McKechnie 2005), so much so that K'wakwaka'wakw groups created over 350 culturally modified clam beaches and terraces (Harper et. al 1995). Indeed, recent research has shown that these ancient clam gardens, a marine management tool used by First Nations groups all along the northwest

Coast of North America, actually increased the productivity of clams within them (Groesbeck et al. 2014).

Historical forces of colonialism thus cannot be over-stated, particularly as concerns their impact on the food sovereignty and security of First Nations people throughout Canada and the world (Heaslip 2008a; Santha 2008; Parrish, Turner & Solberg 2007; Turner & Turner 2008). While, as noted above, the reserve system resulted in a loss of immediate physical access to harvesting locations, the associated residential school system removed many young people from their ancestral land and family (Turner & Turner 2008). This in turn led to a loss of cultural knowledge important for the production, harvesting, processing and use of food, as younger generations were unable to learn the specific technical knowledge about what species, where, when, and how much to harvest (Turner & Clifton 2006; Parrish, Turner & Solberg 2007). Where the transmission of such skills was broken, communities lost much of the capacity to harvest resources in an appropriate fashion (Turner & Turner 2008), and so too a critical cultural benefit of provisioning services. Additionally, current shellfish management boundaries drawn by DFO do not respect First Nations' traditional territorial boundaries leading to a lack of coordination and a break-down in resource governance protocols (Heaslip 2008a). One result is that where shellfish harvesting does occur on Vancouver Island, it has become more spatially clustered:

… many diggers describe a lack of communication and trust in the community. They argue that groups heading out to dig clams generally do not know where other groups are planning to go. The inexperienced end up heading to beaches where other groups' lights are visible. The result is increased pressure on a beach that is already under use, while leaving other beaches without cultivation. There is a need for coordination of the harvest, a role that, in the past, belonged to Chiefs (Heaslip 2008a).

The second technical barrier to shellfish harvesting is the cost of the necessary technology to reach harvesting areas and extract the resources efficiently. Harvesting now often requires a boat, fuel, and maintenance costs at the very least (Castleden 2007). Expense prohibits many First Nations from not only conducting subsistence harvesting but also from accessing many commercial fisheries. The communal nature of shellfish harvesting on Vancouver Island, where groups of community members

often travel to clam beaches in one boat and work together to harvest the resource (Pinkerton and John 2008), mean that some *individual* costs and barriers to accessing the resource are reduced; the costs for shellfish harvesting are therefore not as severe an access barrier as compared with some other types of coastal BC fisheries.

Markets and user conflicts: ***A service does not benefit people if their harvest or sale is pre-empted or outcompeted by others.***

The actions of other resource users can impede a group's successful harvest or the market sale of that harvest. Declines in coast-wide shellfish have been exacerbated by competition from commercial and recreational harvesting. Conflicts between recreational harvesters on both the east and west coasts of Vancouver Island have been identified (Joyce & Canessa 2009); as well as between First Nations groups (Heiltsuk Tribal Council/DFO 2010/2011, DFO 2013). Many bands also note that areas 'dug out' by commercial interests can no longer support subsistence harvest (Council of the Haida Nation/Fisheries and Oceans Canada 2013).

The frustration over user conflict is exacerbated because entrance into the commercial harvesting industry is expensive and complex, thus presenting a significant market barrier to First Nations participation (Schreiber 2002; Heiltsuk Tribal Council/DFO 2010/2011; Fisheries and Oceans Canada 2013). Many First Nations were and continue to be part of the commercial harvesting industry, but declining stocks and more centralized license ownership means many First Nations have lost access to commercial opportunities all along the BC coast (Schreiber 2002; Burke 2010). In BC, privatization of fishing rights in the form of Individual Transferable Quotas (ITQs) that can be bought, sold, or traded, now exist for most shellfish and many finfish fisheries (Ecotrust Canada 2004). These quotas are now prohibitively expensive for most First Nations communities and rural residents (Ecotrust Canada 2004). This ITQ system, with its high license and quota prices and government sponsored license retirement

196 and buyback programs, have caused many First Nations people to leave the fishery (Ecotrust Canada
197 2004). First Nations in this situation often face systemic disadvantages, where lower incomes and
198 property values and fewer economic opportunities overall leave them with less capital than many urban
199 residents. As of 2004, local residents on the west coast of Vancouver Island owned just two percent of
200 all ITQs in BC, while residents of Vancouver and Victoria owned 44 percent (Ecotrust Canada 2004).
201 Many First Nations communities on Vancouver Island have also identified commercial
202 aquaculture as a severe threat to wild harvesting (via spatial conflicts and diminished market
203 opportunities), though opinions vary considerably depending on community context (Joyce & Satterfield
204 2010). Shellfish and finfish aquaculture are rapidly growing industries in these regions. On the northwest
205 and northeast coasts of Vancouver Island, spatial analysis showed an increase of nearly 200% in beach
206 tenure area, representing a loss of 17% of total available harvestable area (Joyce & Canessa 2009). This
207 loss may well be exacerbated since such tenures are likely issued for some of the most highly
208 productivity areas.
209 Aquaculture often leads to the conversion of previously wild areas into privately leased tenures.
210 Processes of 'stealth privatization' have been identified as significant challenges facing shellfish
211 harvesters in the region and throughout Canada (Wiber et al. 2010). Private aquaculture leases typically
212 grant the lease-holder exclusive access to the land, water and foreshore (Deo 2002). This remains a
213 contentious issue on Vancouver Island, as treaties of lands and resources are still in negotiation.
214 Furthermore, private ownership and maintenance of lease space is expensive, limiting First Nations
215 access (Joyce & Canessa 2009).
216 User conflict can be considered a direct loss of access where these privately leased areas take
217 over wild clam and oyster bed areas. This occurs because leaseholders will generally choose to develop a
218 location that has proven biophysical capability (i.e., usually where FSC and wild clam harvest already
219 occurs) (Joyce & Canessa 2009). Indirect loss of access occurs where near-shore or deep-water shellfish

and finfish aquaculture infrastructure present hazards to navigation (Wiber et al. 2010). Finfish aquaculture, in limiting First Nations people's access to digging beaches on the east coast of Vancouver Island, for example, presents a direct barrier (Schreiber 2002; Joyce & Canessa 2009). Indirect loss of access results from the perception that fish farms and associated waste are negatively impacting surrounding clam beaches (Heaslip 2008b). The perception of contamination has been enough to influence harvesters to avoid previous digging locations for 'fear of contamination' (Schreiber 2002; Joyce & Canessa 2009).

Even after successful and legal capture of shellfish resources, benefits can be limited by the access to markets for sale. Such market access can be impeded by lack of capital (credit and equipment), geographic isolation (treated above), exclusionary practices, competition and conflict, state policy support, licensing requirements and access fees (Ribot & Peluso 2003; Brown et al. 2008).

Management: The benefits of a service can be dramatically reduced if management structures for harvest and access are ineffective and under-resourced.

Harvest rates, access, and catch limits are highly dependent on both the overarching structure of management by DFO and the extent of communities' ownership of licenses in their area (Heaslip 2008a). Wild clam harvest for subsistence purposes is managed as a common property resource, with limited licensing and seasonal openings and with the wild harvest licenses mostly owned by small-scale users in rural communities (DFO 2013). In general, official limits in the form of daily quotas are attached to communal licenses (although exact quantity restrictions vary between communities (DFO 2013)), while mandated summer closures limit harvesting to the winter season (Beach 2002).

As of 2004, over 16% of coastal areas were officially closed to shellfish harvest in BC (Beach 2002). While these closures have often been necessary to protect public health, more recently, an out-dated monitoring system (Beach 2002), and a lack of regional and local review of areas (Norman 2012)

have resulted in large areas (for instance Kyuquot Sound on the west coast of Vancouver Island) remaining officially closed to harvest without timely reconsideration. Where First Nations communities operate communal licences, communities must be able to afford continuous water quality assessments in order to safely gather shellfish without fear of toxin contamination (Beach 2002; Heaslip 2008b; Fisheries and Oceans Canada, 2013). If monitoring cannot be completed, areas remain closed until time and budget constraints allow for re-sampling by the DFO.

Discussion

Our case study of shellfish harvesting by First Nations communities on coastal Vancouver Island, Canada illustrates that increasing ecosystem service supply will not necessarily yield increased benefits to communities, as much of the ES literature implies. We identified four classes of access barriers – geographical location, technical capacity, markets and user conflicts, and management – that limit the benefits First Nations communities do or potentially could realize from shellfish harvesting. Given the shared colonial history and similar political and economic conditions today, these barriers are likely to be relevant to North American west coast First Nations more broadly. Further, while it is important to acknowledge that local context will influence the relevance of particular access barriers, the categories of access barriers are not unique to BC Coastal First Nations (Hicks & Cinner 2014). A growing number of studies are applying the categories identified by Ribot & Peluso (2003) to rural and resource-based communities globally. For example, work by Hicks and Cinner (2014) identified the importance of key access mechanisms ("rights-based, economic, knowledge, social, and institutional") in mediating how coral reef fishing communities in the Seychelles, Madagascar, Kenya and Tanzania are affected by the distribution of ecosystem services. Using a similar framework, Milgroom, Giller and Leeuwis (2014) call for critical work on the "dynamic relationships among quantity, quality and access" based on their analysis of access barriers to natural resources faced by communities in southern Mozambique. These

studies contribute to a growing recognition that understanding the access barriers facing rural and resource dependent communities is key to advancing our understanding of ecosystem service benefits (Hicks and Cinner 2014).

The case of the Vancouver Island shellfish fishery offers a stark reminder of how management decisions that fail to consider differences in beneficiaries' capacities to access resources can not only limit the benefits derived from ecosystems but also fundamentally undermine the livelihoods of coastal communities (Burke 2010). Crucially, it reminds us that ecosystem services yield not only quantitative (i.e., a measure of abundance) but also qualitative (i.e., cultural and social dimensions) benefits and that these interact to establish and maintain a sense of well-being. In general, we can point to five inter-related constituents of well-being: security, basic material for a good life, health, good social relations and freedoms and choice (Millennium Ecosystem Assessment 2005). A more nuanced perspective is brought forward by the “capability approach” which expands on the "freedoms and choice" component to argue that it is not just the end benefits that are important for well-being, but also the means by which these are obtained (Abunge et al. 2013).

Subsistence harvesting provides both material and cultural benefits. For example, the procurement of food provides an opportunity for the transmission of cultural knowledge, and other cultural benefits accrue with the ability to feast and potlatch. These linked services or benefits yield what are elsewhere referred to as tangible and intangible cultural ecosystem services, that is, contributions from the ecosystem to non-material benefits that arise from human-ecosystem relationships (Chan et al. 2012b). While difficult to value and highly subjective, they are crucial for the health of First Nations communities. The presence of shellfish has been and continues to be culturally important for First Nations communities; food and the processes of harvesting are intimately tied to cultural practices, regeneration, and health (Karpiak 2003; Ban et al. 2008; Menzies 2010). Further, the link between community sustainability and cultural practices (ceremony, storytelling, meaning-making,

identity, sense of place, relationship to nature, etc.) has been explored extensively (e.g., Barsh 1999; Garibaldi & Turner 2004; Parrish, Turner & Solberg 2007; Turner & Turner 2008; Alfred 2009). Cultural dislocation impacts First Nations at an individual and community level, limiting opportunities for self-sufficient, healthy and autonomous lives. The conceptualization of barriers to subsistence harvesting, as they pertain to benefits and more broadly, to well-being, must therefore include both the quantitative (access to food) and the qualitative (access to the conditions conducive to realizing and maintaining culture) aspects.

While the mechanisms by which the four factors pose barriers may be special to First Nations communities, and to the BC coast, we would argue that all pertain to many ES in many contexts. Geographic barriers—which are arguably the best recognized in the ES literature—can present themselves much more subtly than relocation of villages, for example, by the shifting distribution of ecological supply, or by a development (e.g., a road that separates a community from a site being developed into a freeway). In each case, the service formerly available is effectively further away. Technical and management barriers apply equally to regulating and supporting services: for example, one cannot benefit from the provision of tidal energy for electricity production without the needed know-how, financial capital, and appropriate infrastructure, or without the rights to install a tidal power facility (or perhaps, sell electricity back to the grid). And even then, as is the case for some First Nations considering this energy option, overcoming such technical barriers generally involves trading off significant current and future cultural benefits (Rodman 2013). In short, because cultural services are so frequently bundled with other ES (Klain & Chan 2012; Chan et al. 2012; Gould et al 2014), what applies to provisioning services also applies to many cultural services.

In light of prevalent and interacting barriers to access, it is paramount for researchers who frame their work in a context of human well-being to consider the cumulative impact the various barriers have on the realization of benefits. Barriers often interact in a variety of ways to impede the

316 realization of benefits, sometimes synergistically. For instance, a *geographic barrier* (often the result of
317 colonization and the reserve system) that separates communities from their traditional fishing grounds
318 is exacerbated by a lack of employment and capital - *a technical barrier* - needed to navigate between
319 home and resource area. This is linked to a loss of traditional ecological knowledge and a gradual decline
320 in cultural practices, which feeds back into a reliance on non-traditional forms of subsistence practice
321 within a competitive market environment, often controlled by unfavourable management regimes
322 replete with *management, market and user conflict barriers.* An increase in provisioning goods (i.e.,
323 more shellfish) cannot therefore be assumed to trickle down to benefit all resource users equally.
324 Rather, for any particular resource context, there will likely be a specific set of barriers whose
325 interactions determine the contexts in which a given group will gain—or even lose (e.g., due to 'elite
326 capture')—from an increase in ES supply.
327 The importance of understanding access and non-monetary services and benefits is critical to
328 allow quantitative ES evaluation tools to inform understanding of trade-offs resulting from ecosystem
329 change (e.g., Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) - Guerry et al. 2012).
330 InVEST uses ecological production functions to estimate how changes in inputs (e.g., labour, materials,
331 habitat) affect service supply (e.g., fish). Social and economic indicators are then used to value outputs
332 (material and nonmaterial) and consider trade-offs from alternative uses of marine resources, *assuming*
333 *access*. While such tools represent a tremendous step forward in ES science, they currently consider
334 only a subset of barriers to access and therefore likely provide overly optimistic accounts of benefits to
335 some groups. Such tools may lend tacit support to the assumption that increased biophysical supply
336 necessarily generates more benefit to communities, giving too little attention to crucial institutional
337 factors mediating the realization of benefits.
338 Ultimately, a richer understanding of the benefits of ES requires jettisoning the assumption of an
339 omnipotent, homogenous beneficiary. The reality of heterogeneity in preferences and, more

importantly, ability to access and make use of ecosystem supply is often overlooked. If ES research focuses on increasing supply without attending to the realities of realizing benefits, it may inadvertently further privilege those (empowered) actors who are poised to benefit most from changes in supply, potentially at the expense of disadvantaged parties. Explicitly considering the diversity and limitations of potential beneficiaries will be instrumental in enabling the accurate assessment and mapping ES to yield tangible and equitable improvements in ecological health and human well-being.

Conclusion

In the case of shellfish harvest by First Nations groups on the coast of Vancouver Island, significant barriers to access include geographic location, technical capacity, markets and user conflicts, and management. While increasing ecosystem service supply can be beneficial, our review shows that it is unlikely to be sufficient to yield increased benefits to human coastal communities. A service does not benefit people if they cannot physically access it; if they lack the technical knowledge or capacity to harvest it; if they are pre-empted or outcompeted by others; or if over-arching management structures are ineffective, under-resourced, or over-precautionary. For the ES literature to achieve its objectives of improving management decisions and resulting human well-being, it must abandon the fallacy of trickle down benefits, and begin to systematically address the diverse issues of access and how these differ across individuals and groups.

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