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Perception, acquisition and use of ecosystem services: Human behavior, and ecosystem management and policy implications

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ABSTRACT

Ecosystem services, fundamental to livelihoods and well-being, are reshaping environmental management and policy. However, the behavioral dimensions of ecosystem services and the responses of ordinary people to the management of those services, is less well understood. The ecosystem services framework lends itself to understanding the relationship between ecosystems and human behavior. Ecosystem services, according to the psychological theory of motivational functionalism, are motivations—the personal and social processes that initiate, direct and sustain human action. Thus, how people perceive, acquire and use ecosystem services influences the initiation, direction, and intensity of their behaviors. Profound understanding of how people perceive, acquire and use ecosystem services can help influence behavioral compliance with management and policy prescriptions. We use focus group interviewing to illustrate how ecosystem services relate to human behavior. Results show that people perceive, acquire and use indirect benefits while acquiring direct ecosystem services. Understanding indirect benefits has implications for the constitution and regulation of human behavior through ecosystem management and policy. Perceived ecosystem benefits, expressed in people's own words and from their own frames of reference, can facilitate better valuation of ecosystem services and setting of prices, compliance with ecosystem management and policy directives, recruitment and retention of ecosystem stewards, development of use policies, enhancement of user experiences, and encouragement of pro-environmental attitudes and behaviors.

1. Introduction

Since the Millennium Ecosystem Assessment (MEA, 2005), increased recognition that ecosystem services—the benefits people gain from ecosystems—are fundamental to the global economy and human well-being has begun to reshape contemporary environmental management and policy. Ecosystem services are the building blocks of human societies and include–among many other benefits–the provision of food, fiber, medicines, and clean water; protection from flooding, storms, and pests; and cultural and spiritual well-being. A growing field of research has sprung up to address how to value and account for these services in regional and global economies and decision-making.

However, the social and behavioral dimensions of ecosystem services and the responses of ordinary people to the management of those services, are poorly understood (Kline et al., 2013). Although economic and ecological valuations of ES have received much attention (e.g., Balmford et al., 2002; Farber et al., 2002), they are not the only ways of valuing ecosystem services (Ruckelshaus et al., 2013). Some have pointed to the failure of the economic valuation of ecosystem services to capture the true range and value of the benefits people obtain from ecosystems (e.g., Kumar and Kumar, 2008). In this article, we illustrate the link between ecosystem services and human behavior. We explain the important role of understanding how human motivations to acquire and use ecosystem services may mediate people's responses to ecosystem management and policy. We present some existing work in the area, and then use an approach that allows beneficiaries to express the benefits they receive from ecosystems, and how they acquire and use those benefits, in their own words and from their own frames of reference. We chose this approach to facilitate the expression of perceived benefits such that it captures the

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contextual essence of the range and variety of benefits that people may ascribe to ecosystem services. We use a case study of interviewees from the Warm Springs Confederated Tribes in Oregon State, USA to illustrate the implications of interviewees' perceived benefits as well as mechanisms of acquisition and use for behavioral compliance with ecosystem management and policy efforts.

1.1. Human motivations, behavior, and ecosystem services

Ecosystem management is largely about managing how people claim and use ecosystem services (Gerlach and Bengston, 1994). That is, ecosystem management and policy often include the constitution and regulation of human action (Cortner and Moote, 1999). Thus, management and policy decisions prescribe what kind of persons or entities can engage in particular behaviors and to what extent. For example, fern-gathering permits on public lands often have a cost per unit harvest. Thus, the structure of fern gathering permit management and policy constitutes behavior by implying that only people who have paid a certain amount and are in possession of a valid permit can harvest ferns in a particular area. Permits also regulate behavior by stipulating that permit holders can only harvest so much and only during a certain period. Several factors motivate permit management and policy decisions. For example, harvest limits are likely based on the prospect that those limits ensure the sustainable production of ferns at acceptable levels without compromising ecosystem integrity. Behavioral compliance with permit restrictions—harvesting only if you have a permit, only so much and, sometimes, only in certain areas—is therefore a vital piece of the sustainable management of ecosystems.

The framework of ecosystem services is important for natural resource management, in part, because it lends itself to understanding the relationship between ecosystems and human behavior. Because ecosystem services are benefits, according to the psychological theory of motivational functionalism (Smith et al., 1956; Katz, 1960), they are, therefore, motivations—the personal and social processes that initiate, direct and sustain human actions toward ecosystems (Snyder, 1993). That is, the perceived benefits that people get from ecosystems are the reasons why they might likely engage (or not) in behaviors that ensure the continuous supply of desired ecosystem services. Thus, as illustrated in our previous example of fern gathering, how people perceive, acquire and use ecosystem services influences their behaviors (Clary et al., 1998).

The existence and delivery of ecosystem services motivates human behavior with important ramifications for ecosystem sustainability because deteriorating ecosystems and biodiversity loss are primarily caused by human behavior (Vitousek et al., 1997). For example, people who harvest berries, a direct provisioning service, from ecosystems are likely to engage in invasive species removal if they believe invasive species interfere with the production of berries. Conversely, berry harvesters may engage in the suppression of other social-ecologically important species if they believe that those species suppress berry production and harvest. Thus, the capacity of the ecosystem to provide a wide range of benefits beyond berries also depends on the behaviors of those who value and act toward securing the provision of berries. Hence, the desire to acquire perceived direct benefits from ecosystems may initiate, sustain, and direct behaviors that can enhance or compromise ecological integrity and ecosystem's ability to provide either a single benefit or a range of benefits in the long term. For example, intense agriculture can represent the production of food—an inarguably important service—at the expense of a number of other services that might have been provided by that land without intensification. Consequently, we need to scrutinize and understand individual and collective human behavior in order to successfully address ecosystem deterioration and biodiversity loss (Ehrlich and Kennedy, 2005). Thus, it is critical to understand how people perceive, acquire, and use ecosystem services given the motivational functions of ecosystem services on human behavior.

The psychological theory of motivational functionalism has the potential to facilitate our understanding of, and hence enhance, behavioral compliance with ecosystem management and policy decisions. The theory proposes that the success of efforts to change attitudes [and behaviors] depends on the extent to which such efforts address the functions those attitudes and behaviors serve (Smith et al., 1956; Katz, 1960). That is, if managers want to effectively constitute and regulate certain behaviors, to effectively manage ecosystem services, they must first understand what and how people gain or lose (direct and indirect ecosystem benefits) by engaging in those behaviors. Thus, a good understanding of how people perceive the benefits derived from ecosystems is essential for the effective management of ecosystems and for the setting of effective policies that promote sustainable livelihoods and enhanced well-being. For example, if managers and policy makers aim to regulate the abundance of a particular game species, they must understand why people hunt that species. If hunting is motivated by the need for food, manipulating the cost of hunting permits to make harvesting that species economically more or less competitive than other foods may be a good management strategy to meet the goal of achieving a desired population size. However, if hunting is motivated by a desire to spend time with family and friends, and/or to maintain tradition, hunting serves more as a gateway to the acquisition of culturally relevant ecosystem services—a very different function. In this case, the manipulation of hunting permit cost may have different effects on harvesting rates and consequently on population sizes, because it may have undesirable effects on the extent to which people perceive access to the indirect cultural benefits of spending time with family and friends while hunting.

Despite the direct reliance of the effectiveness of management and policy on behavioral compliance and the strong link between ecosystem services and human actions, we know little about how people perceive, acquire and use the benefits they get from ecosystems. Consequently, we have incomplete understanding of how perception, acquisition, and use of ecosystem services might inform individual and collective behaviors. Thus, management and policy strategies for influencing such behaviors might be inadequate.

In this article, we seek to accomplish three objectives. First, we review the small body of work on people's perception of the benefits they get from ecosystems as expressed in their own words and from their own frames of reference. Second, based on field observations from interviews with Native American tribal members in Central Oregon, USA, we provide additional empirical evidence of people's self-expressed benefits of ecosystems and how they acquire and use those benefits. Then, we discuss the implications of these findings for the sustainable management of ecosystem services and the setting of effective policies that facilitate sustainable ecosystem management and enhance livelihoods and human well-being.

1.2. Perception, acquisition and use of ecosystem services

Although some ecosystem services provide a single or a limited set of benefits, many services provide multiple benefits and not all people perceive the same benefits of a given service. For example, Driver (1977) showed that people obtain several cultural benefits from nature-based recreation. Since Driver's work, several others have provided evidence supporting the notion that people are motivated to recreate in natural areas by the desire to acquire several cultural benefits. These motivations include the desires to

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rest mentally and physically, enjoy the aesthetic and sentimental qualities of nature, spend time with family and friends, experience tranquility, enhance cognitive functioning, be introspective and adventurous, and acquire and enhance cultural heritage, identity and well-being (e.g., Kuo, 2001; Taylor et al., 2002; Mayer et al., 2009; Asah et al., 2012a; Tengberg et al., 2012; Russell et al., 2013).

However, despite widespread work on cultural ecosystem services and mostly in the context of nature-based recreation, we know little about people's self-expressions, from their own frames of reference, of the entire range of benefits they get from ecosystems in general. As an exception, Asah et al. (2012b) conducted a study of how people identify and construct forest ecosystem services and compared that to the MEA classification of ecosystem services. Asah et al. (2012b) used, open-ended questions and non-directive interview moderation techniques to enable ecosystem service beneficiaries to collectively express how they benefit from forest ecosystems. They found that, to some extent, people of Deschutes County in central Oregon, USA, identify and construct forest ecosystem services in the same ways and categories as in the MEA. The core categories of ecosystem services in the MEA include, provisioning, cultural, regulating, and supporting services (MEA, 2005).

Asah et al. (2012b) also showed that people identify and construct how they obtain ecosystem benefits by merging or expanding existing MEA categories in ways that are somewhat different from the original categorization. For example, the MEA classifies mushrooms and Christmas trees as provisioning services. But, people see mushroom picking and Christmas tree harvesting not only as provisioning services, but most importantly as opportunities for the attainment of key cultural benefits such as spending time with family and interacting with people of different micro-cultures. People enjoyed the social setting and interactions during mushroom picking and Christmas tree harvesting more than the quantity and quality of the items harvested.

Anderson and colleagues reported similar results when examining fern gathering in the San Bernardino National Forest by people with Korean and Japanese ancestry (Anderson et al., 2000). They also showed that managers were acting on the basis of economic valuation of provisioning ecosystem services while the fern gatherers were focusing on the cultural values of those services. They concluded that assumptions based on economics and commerce may be inappropriate for managing special forest product gathering activities for some groups of people. These findings suggest, according to the psychological theory of motivational functionalism, that managers may not fully understand what motivates people's behaviors pertinent to the obtainment and use of ecosystem services and thus are likely missing opportunities to facilitate the acquisition of desired ecosystem services by their constituents. Perhaps more importantly, because management is largely about constituting and regulating human behavior and demands a profound understanding of human motivations, decision makers who do not adequately understand what motivates people's behaviors risk ineffective management. Thus, the classification of ecosystem services themselves may be less interesting to management and policy than understanding how people perceive, acquire, and use ecosystem services.

Managers and their constituents may not perceive the same set of benefits resulting from a given service. For example, in a study of forest managers and volunteers, Asah et al. (2012b) showed that managers assumed that volunteers were participating out of a desire to assist in forest management and provide for a healthier forest ecosystem. By contrast, the volunteers felt that they were benefiting in multiple, more nuanced ways. Some of the benefits from volunteering that volunteer interviewees identified included the feeling of giving back something to nature, fulfilling a sense of duty, opportunities to be more closely connected to nature, and the opportunity to act on ones' own beliefs. These benefits undoubtedly enhance the psychological well-being of volunteers. Had mangers better understood the perceived benefits of volunteering, they could have better designed volunteer recruitment efforts and perhaps provided a better experience for, and increased the performance and retention of, the volunteers.

People's understanding of perceived ecosystem benefits is insightful in novel ways that are relevant to management and policy. For example, in Oregon, stakeholders reported that they saw the forest as serving as affordable housing to the homeless and as a regulator of urban sprawl (Asah et al., 2012b). These are not the most-cited ecosystem services derived from forest systems (e.g., timber, carbon storage, non-timber forest products). However, studies exploring ordinary people's perception of the full range of benefits they get from ecosystems as perceived by the people themselves and in their own frames of references are rare. Furthermore, studies that have examined the general ecosystem services that ordinary people identified and constructed have generally overlooked, the indigenous American Tribes. Exploring indigenous people's perception of ecosystem services is critical. For example, the Convention on Biological Diversity (CBD) 2020 biodiversity targets recognize the dependence of livelihoods and well-being on ecosystem services, and emphasize the importance of meeting the needs of indigenous and local communities (CBD, 2010).

In the following sections, we explore, how focus group interviewees from the Confederated Tribes of the Warm Springs Reservation (Native American tribes) of Oregon perceive the benefits they get from the Deschutes National Forest. We discuss our findings in the context of selected literature on human–environment interactions and human behavior, and discuss the implications for ecosystem management and policy.

1.3. *Warm Springs Tribes and ecosystem services*

The Confederated Tribes of the Warm Springs (Native American Tribes) extend from the summit of the Cascade Mountains to the cliffs of the Deschutes River in Central Oregon, encompassing the Deschutes National Forest. Salmon from the Columbia River, deer and other large game from the high planes, and assorted roots, fruits, and other plant-life are staple foods in these tribes (Kalama, 2013). As food gathering and preparation was a significant part of the daily lives of the Confederated Tribes, the methods used to gather and prepare food became as much a part of the tribal culture as the foods themselves (Kalama, 2013). After extensive periods of trial and error, the methods for acquiring and preparing assorted roots, fruits and plants, as well as game and fish were perfected; and are a significant part of many festivals and rituals (Kalama, 2013). Every year, the Confederated Tribes of the Warm Springs observe three religious feasts of thanksgiving based on important native foods. Clearly, in this case, the provisioning ecosystem services are inseparable from the much broader cultural enrichment of these tribes.

2. Methods

To understand how indigenous people of the Confederated Tribes of the Warm Springs communities perceive and construct the benefits they obtain from the Deschutes National Forest, we conducted a focus group interview (Krueger and Casey, 2000) with tribal members. Our intent was to qualitatively explore, in-depth, what and how indigenous people perceive, acquire and use ecosystem services provided by the Deschutes National Forest. Thus, a random sample of interviewees was unnecessary (Weiss, 1995). Potential interviewees, from a list of key tribal members involved in natural resources

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management within the confederation, were each sent emails and follow-up phone calls, as necessary, explaining the study and requesting participation. Using the snowball technique in which interviewees suggest others they think would contribute to the study, we contacted additional prospective interviewees.

The data for this article were collected as part of a broader effort examining perceived benefits, management opportunities, and constraints to the provision of ecosystem services of the Deschutes National Forest. Here, we analyze two questions from the interviews: (i) what benefits do you receive from the Deschutes National Forest and how do you receive them, and (ii) what do you think other people benefit from the Deschutes National Forest and how do they receive them? We moderated the focus group interview such that the "what" prompted the collective identification of perceived benefits, and the "how" elicited the co-construction of the contextual essence of acquiring identified ecosystem services. Our goal was to enable interviewees' self-expressions of how they benefit from the forest—not to suggest to them how they might benefit. Thus, nondirective techniques were used to moderate the focus group interview (Krueger and Casey, 2000). Consequently, interview questions were open ended, enabling interviewees to articulate how they perceive the benefits they get from the forest without restrictions or hints to potential responses.

Open-ended questions provide deeper and more nuanced understandings of people's perceptions of ecosystem services (Esses and Maio, 2002) because interviewees express their perceptions, acquisition and use of benefits in their own words and from their own frames of reference (Bengston et al., 2011). Thus, this approach of using open-ended questions might help address some shortfalls of economic valuation of ecosystem services. Kumar and Kumar (2008) used a psychoanalytic approach to show that contingent valuation methods, and their bold assumptions such as market centrality, substitutability, and resource fungibility, may not fully capture the nuances and intricacies of ecosystem services.

The open-ended interview questions and nondirective interviewing technique provided interviewees with many opportunities to note and respond to others, explain, re-visit and re-explain, thereby co-identifying and co-constructing what and how they benefit from the Deschutes National Forest. The desire to acquire an understanding of ecosystem services that is grounded in the perceptions and collective constructions of interviewees made the focus group approach and the nondirective moderation technique most appropriate (Glasser and Straus, 1967; Krueger and Casey, 2000). The interview protocol was reviewed and approved by the Institutional Review Board of the University of Washington. Each interviewee's consent was sought prior to the commencement of interviews.

There are additional benefits to using focus group interviews to explore how people perceive and construct the benefits they obtain from ecosystems. First, focus group interviews can create comfortable and permissive environments that nurture self-disclosure among interviewees, which facilitates a more in-depth exploration of ecosystem services (Krueger and Casey, 2000). Second, quantitative approaches to social inquiry are subject to priming effects—the information provided to respondents affects their responses (Schuman and Presser, 1981). Thus, quantitative approaches may paint a partial picture of people's perceptions, acquisition and use of ecosystem services and consequent management and policy efforts.

2.1. Data analysis

Focus group conversations were recorded and later transcribed before analyses. We read and re-read the transcripts and used first cycle coding methods, primarily In Vivo and Values coding, for initial data analysis (Saldaña, 2010). First cycle coding enabled us to familiarize ourselves with interviewees' use of descriptive words and language to articulate perceived benefits from the Deschutes National Forest. For second cycle coding and subsequent data analysis, we used both deductive and inductive approaches. Deductively, we used the MEA classification categories of ecosystem services, namely, provisioning, regulating, cultural, and supporting services, as a coding and analytic guide. Using this guide to generate codes, we iteratively searched the text for benefits expressed by interviewees that conveyed the ecosystem categories outlined in the MEA. This process of pattern coding (Saldaña, 2010) involved identifying, and segregating, grouping, regrouping, and relinking texts and codes to the categories specified in the MEA classification.

For further coding, we followed the grounded theory approach to coding and analysis (Glasser and Straus, 1967). The primary purpose of using the grounded theory approach was to facilitate inductive coding—to allow important concepts to emerge during data analysis rather than from predefined conceptual categories of ecosystem services as presented in the MEA classification. Hence, as an analytical approach, inductive coding minimizes the influence of the researcher's presumptions about the results (Saldaña, 2010). Using the grounded theory approach, the remaining texts that did not convey benefits that fit directly into any of the MEA categories were grouped into emergent themes and categories that reflected interviewees' perceptions of the ecosystem benefits of the Deschutes National Forest. Thus the coding process was primarily substantive (Holton, 2010). That is, we used open inductive coding for emergent core categories. Then, we used constant comparison of incidents (indicators) in the data to elicit the attributes of each core category, including the mechanisms through which each category of ecosystem services is acquired. We continued the process of constant comparison until conceptual saturation was reached—until no new conceptual categories and attributes of core categories of ecosystem services emerged with continued coding and comparison of indicators. Once conceptual saturation was reached, we shifted our attention to the latent patterns of behavior that may underlie interviewees' conceptualization of ecosystem services and articulations of how such benefits are acquired, and their implications for management and policy.

3. Results and discussion

Interviewees revealed rich information about the depth and breadth of perceived ecosystem benefits. Similar to findings from previous work (e.g., Asah et al., 2012b), interviewees focused on provisioning and cultural services and rarely mentioned regulating or supporting services. Provisioning services such as fish, game, and assorted plants were most commonly mentioned. Interviewees also reported the acquisition of several cultural services including spiritual benefits, aesthetics, place attraction, and tranquility. We focus here on new information about perceptions, acquisition and use of ecosystem services that interviewees revealed.

Interviewees expressed nuanced and elaborate mechanisms through which ecosystem services are obtained, and perceived indirect connections between provisioning and cultural services. Specifically, interviewees revealed that the presence of the Deschutes National Forest and the acquisition of some provisioning services facilitate attainment of a broad range of cultural services. In the next sections, we present these unique benefits as direct quotes from interviewees. When presenting and discussing these findings, we focus on illustrating the relationship between ecosystem benefits and human attitudes and behavior. We also illustrate the critical distinction between direct and indirect ecosystem services that emerged from the data. Direct

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ecosystem services are the benefits that people perceive they obtain directly from the forest. Examples of direct services include fish, game, and the calmness people felt when visiting the forest. Indirect ecosystem services are the benefits that people perceive they obtain through direct ecosystem services. Examples of indirect benefits include developing stronger connections with others while hunting or harvesting non-timber forest products such as mushroom and berries. In the following section, we explore three indirect benefits that emerged from our interviews.

3.1. Unique sense of place

Interviewees often mentioned that the Deschutes National Forest instills in them a unique sense of place. Interviewees expressed appreciation for living near the forest, as illustrated by the following quote:

> *"So we are fortunate to live close to a national forest, for Warm Springs a couple of national forests. You go to other places and they don't have that unless it is hours and hours of driving. You know, we're really fortunate where we live."*

This unique sense of place extends to include the stronger connection to place instilled by the acquisition of provisioning and cultural services. The following quote illustrates how interviewees acquire a strong sense of place attachment through the obtainment of provisioning and cultural ecosystem services:

> *"For Warm Springs, the tribes are very connected to their resources, going out there and utilizing those. Whether those are medicinal plants, or huckleberries, or black lichens, the mushrooms, the deer and elk and the fisheries, you know it is just a wonderful place from that aspect. But it is also an area that, from a cultural side, we also have archaeological sites, burial sites in areas that some we know, some we don't know of and run across those, so we really have a real deep connection to the area."*

It is likely that interviewees' perceived connectedness to nature contributes to their wellbeing and influences their behaviors towards ecosystems. Connectedness to nature has been shown to enhance psychological well-being (Kamitsis and Francis, 2013) and pro-environmental behavior (Davis et al., 2009). Most importantly, perceived benefits of vegetation management, a proxy to provisioning (timber) and cultural (aesthetics) services, mediate the influence of connectedness to nature on management behaviors (Gosling and Williams, 2010). Place attachment also has a significant influence on human behavior toward ecosystems (Stedman, 2002). It has also been shown to predict pro-environmental behaviors, place-related pro-environmental intentions, and pro-environmental behavioral intensions in everyday life (Kelly and Hosking, 2008; Halpenny, 2010). People who believe that management and policy actions interfere with their place attachment have been shown to manifest negative attitudes and oppositional behavior toward those management actions and policies (Devine-Wright and Howes, 2010).

Thus, sense of place, an indirect ecosystem service obtained while acquiring provisioning and cultural ecosystem services has important effects on the extent to which management and policy effectively constitutes and regulates human action in efforts to attain management objectives. Therefore, management and policy decisions that alter obtainment of direct provisioning and cultural services must pay attention to how such alterations may affect the indirect benefits of a unique sense of place, to avoid compromising behavioral compliance.

3.2. Community, civic behavior and identity

Another perceived indirect service that interviewees identified was the acquisition and maintenance of a stronger sense of community. Interviewees mentioned that:

> *"I think using the national forest, that's our tie in natural resources. The use of land, the preservation of things does connect us a little more than just 'we're neighbors'. It's relaxing; people here are a little more laid back. It is easier to have a discussion with the people that live in central Oregon near the forests, because we are all well connected. Even though you think how large, Bend, Prineville and Warm Springs, our geographic area is, it's smaller than you think, because everyone really does know each other."*

This sense of community as a benefit of the ecosystem is especially important because most people now live in urban areas where social relationships and networks are less dense and traditional forms of community vitality are declining (Putnam, 2000). Protected forests, such as National Forests in the US, can regulate urbanization by limiting the available land base for sprawl (Asah et al., 2012b), and urbanization can pose a significant threat to informal social networks (Putnam, 2000). Thus, the Deschutes National Forest supports community in two ways: by regulating urban sprawl and thus protecting existing social capital, and by re-enforcing community ties. The importance of community vitality to the social-psychological well-being of people cannot be overemphasized.

A strong sense of community also enhances broader positive civic behavior and a sense of collective place identity among community members. Interviewees stated that:

> *"What's funny* [*because we all know each other*] *is you will come into a 4-way stop sign*; *folks around here are all very polite drivers and so you will see each other trying to go like this* [*laughter*], *or wave at each other, but if you see someone that cuts you off or just goes for it*, *the joke is*, *they must be from California."*

Additionally, increased sense of community builds and re-enforces social capital (Putnam, 2000), which has been shown to play a significant role in biodiversity conservation and management (Pretty and Smith, 2004). Social connectedness (community) has also been shown to be associated with higher levels of civic engagement (Lenzi et al., 2013). By knowing who they are based on behaviors (driving in this case) interviewees express a sense of unique place identity. Place identity has been shown to influence antecedents of pro-environmental behavior as well as pro-environmental and sustainability behaviors (Stedman, 2002; Uzzell et al., 2002; Hernandez et al., 2010). Accordingly, management decisions made purely on the basis of direct ecosystem services may interfere with indirect benefits of sense of community, civic behavior, and identity. By so doing, such decisions are likely to have undesirable effects on ecosystem beneficiaries which may in turn hamper their willingness to comply with management and policy prescriptions.

3.3. Exercising rights and building political relationships

Interviewees revealed several other perceived cultural benefits derived from the existence and management of the Deschutes National Forest including the opportunity to exercise tribal rights, to negotiate cultural differences, and to build political relationships.

> *"I think helping to manage is also managing ourselves and exercising our rights, utilizing our right because it is within our treaty to exercise our rights, to utilize this forest."*

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"One thing that is really important about the forest is it is a big hunk of the watershed of the Deschutes, a tremendous resource for the tribe, because the tribe has exclusive right to the fish of the Deschutes as mentioned in the treaty, and so, the tribe's water right is a very important water right, the tribe has a firm pride in its water settlement agreement that basically is water that comes off, or mainly off the Deschutes National Forest, so the whole issue of watershed management is a big hunk of the relationship of both the Warm Springs people and it's government perpetuating the relationship with the United States and the state of Oregon. It's all tied up in that big ribbon of water that flows down the east side of the reservation and it's such a defining thing."

"For the Warm Springs, we put extra effort into having better relationships and doing things to help the forest service and other federal agencies understand who we are and what's important to us and why the forest that they are managing is important because of our treaty rights. And we see ourselves and a co-manager of those resources that have been reserved for us. The forest service won't call that co-management but they call it collaboration. So it's uh, over the years it's improved substantially, we have a really good working relationship with Deschutes National Forest."

The perceived ability to exercise rights, garner pride, and nurture political relationships all have the potential to influence how people make and respond to management and policy decisions (Innes and Booher, 2003). Thus, the very existence of the National Forest lands, and the processes of managing and obtaining direct benefits from them facilitate the attainment of other benefits that may not be directly obvious to managers and policy makers. Understanding how people perceive and describe the diverse ways in which they benefit from ecosystems reveals important and more nuanced insights that are useful for management and policy as well as other efforts to facilitate the provision of ecosystem services for human wellbeing and livelihoods.

4. Management and policy implications

To be effective and efficient, management and policy decisions that constitute and regulate the acquisition of provisioning services must consider the indirect cultural services that people perceive to be equally, if not more, beneficial. Taking into account the full range of perceived benefits can allow managers to: (1) better value services and set prices, (2) ensure compliance with regulations and policies, (3) recruit and retain ecosystem stewards, (4) develop use policies, (5) enhance user experiences, and (6) encourage pro-environmental attitudes and behaviors. For example, although managers may be selling hunting and berry-picking permits to people, the people are also paying for stronger connections to nature, sense of place, sense of community, and perceived civic engagement. If managers and policy makers only think that they are providing provisioning services while people are seeking to acquire cultural benefits as well, managers may not tap into people's salient motivations and consequently may incorrectly price the services, fail to obtain behavioral compliance, and/or do a poor job of marketing the services. For example, in the study of fern gathering in the San Bernardino National Forest, people with Korean and Japanese ancestry perceived the cost of the harvest permit to be unfair because they rarely harvest and do not need to harvest as much fern as specified by the permit cost (Anderson et al., 2000). However, they expressed much satisfaction with the indirect cultural benefits of socializing with others and maintaining their cultural heritage through fern gathering. But, the price of the fern gathering permit does not explicitly attribute cost to these more desirable indirect cultural benefits.

It has been shown (Anderson et al.. 2000; Asah et al., 2012b) that interviewees value the quality of some provisioning services less than the quality of the social experience (cultural benefit) of spending time and bonding with family and friends. Thus, management decisions regarding the aesthetic qualities of provisioning services without facilitating social interactions during harvest may lead to fewer people choosing to buy provisioning services and therefore less access to the indirect cultural benefits of connecting more with nature and building community, etc. These indirect benefits have profound influences on human actions including compliance with management and policy prescriptions (Stedman, 2002; Davis et al., 2009). It is conceivable that interviewees may value the unique sense of place, stronger community, civic behavior and identity, and the perceived discretion to exercise tribal rights and build political relationships just as much as, if not more than, they value the direct benefits they get from the Deschutes National Forest. Thus, management and policy should equally consider the broader socio-cultural arrangements and contexts within which provisioning services are obtained. Management and policy decisions made without explicit attention to how such decisions may affect the obtainment of indirect services, and may be less effective in facilitating human well-being, livelihoods, and behavioral compliance.

In general, assessments and management decisions that are based on economic valuation of ecosystem services, and scientific and management classifications of ecosystem services, alone may not capture the breath and nuance inherent in how people perceive, acquire, and use ecosystem services. Failure to understand and consider the interactions between cultural and other forms of ecosystem services is likely to undermine the effectiveness of ecosystem services management and policy prescriptions. Ecosystem services management and policy practitioners need to incorporate local social-psychological and cultural conditions; streams of direct and indirect services need to be developed using local contextual knowledge of how people perceive, acquire, and use ecosystem services.

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References

Anderson, J.A., Blahna, D.J., Chavez, D.J., 2000. Fern gathering on the San Bernardino National Forest: cultural versus commercial values among Korean and Japanese participants. Soc. Nat. Resour. 13, 747–762.

Asah, S.T., Bengston, D.N., Wettphal, L.M., 2012a. The influence of childhood: operational pathways to adulthood participation in nature-based activities. Environ. Behav. 44 (4), 545–569.

Asah, S.T., Blahna, D.J., Ryan, C., 2012b. Involving forest communities in identifying and constructing ecosystem services: millenium assessment and place specificity. J. For. 110, 149–156.

Balmford, A., Bruner, A., Cooper, P., Costanza, R., Farber, S., Green, R.S., Jenkins, M., Jefferiss, P., Jessamy, V., Madden, J., Munro, K., Myers, N., Naeem, S., Paavola, J., Rayment, M., Rosendo, S., Roughgarden, J., Trumper, K., Turner, R.K., 2002. Economic reasons for conserving wild nature. Science 297, 950–953.

Bengston, D.N., Asah, S.T., Butler, B.J., 2011. The diverse values and motivations of family forest owners in the United States: an analysis of an open-ended question in the National Woodland Owner Survey. Small-Scale For. 10, 339–355.

CBD, 2010. Conference of Parties 10 Decision X/2: Strategic Plan for Biodiversity 2011–2020. Online: ⟨http://www.cbd.int/decision/cop/?id=12268⟩.

Clary, E.G., Snyder, M., Ridge, R.D., Copeland, J., Stukas, A.A., Haugen, J., Miene, P., 1998. Understanding and assessing the motivations of volunteers: a functional approach. J. Personal. Soc. Psychol. 74, 1516–1530.

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Cortner, H.J., Moote, M.A., 1999. The Politics of Ecosystem Management. Island Press, Washington, DC.
Davis, J.L., Green, J.D., Reed, A., 2009. Interdependence with the environment: commitment, interconnectedness, and environmental behavior. J. Environ. Psychol. 29, 173–180.
Devine-Wright, P., Howes, Y., 2010. Disruption to place attachment and the protection of restorative environments: a wind energy case study. J. Environ. Psychol. 30, 271–280.
Driver, B.L., 1997. Item pools for scales designed to quantify the psychological outcomes desired and expected from recreation participation . Rocky Mountain Forest and Range Experiment Station, USDA Forest Service, Fort Collins, CO.
Ehrlich, P.R., Kennedy, D., 2005. Millennium assessment of human behavior. Science 309, 562–563.
Esses, V.M., Maio, G.R., 2002. Expanding the assessment of attitude components and structure: the benefits of open-ended measures. Eur. Rev. Soc. Psychol. 12, 71–101.
Farber, S.C., Costanza, R., Wilson, M.A., 2002. Economic and ecological concepts for valuing ecosystem services. Ecol. Econ. 41 (3), 375–392.
Gerlach, L., Bengston, D., 1994. If ecosystem management is the problem, what's the solution? Eleven challenges for ecosystem management. J. For. 92, 18–21.
Glasser, G.G., Strauss, A.S., 1967. The Discovery of Grounded Theory: Strategies for Qualitative Research. Aldine Transaction, New Brunswick.
Gosling, E., Williams, K.J.H., 2010. Connectedness to nature, place attachment and conservation behaviour: testing connectedness theory among farmers. J. Environ. Psychol. 30, 298–304.
Halpenny, E.A., 2010. Pro-environmental behaviours and park visitors: the effect of place attachment. J. Environ. Psychol. 30, 409–421.
Hernandez, B., Martina, A.M., Ruiz, C., Hildago, M.C., 2010. The role of place identity and place attachment in breaking environmental protection laws. J. Environ. Psychol. 30, 281–288.
Holton, J.A., 2010. The coding process and its challenges. In: Bryant, A., Charmaz, K. (Eds.), The sage handbook of grounded theory. Sage Publications, LA, USA, pp. 265–289.
Innes, J.E., Booher, D.E., 2003. Collaborative policy making: governance through dialogue. In: Hajer, M.A., Wagenaar, H. (Eds.), Deliberative Policy Analysis: Understanding Governance in the Network Society. Cambridge University Press, Cambridge, UK, pp. 33–59.
Kalama, F.K., 2013. History of the Tribes of Warm Springs. ⟨http://discoveringourstory.wisdomoftheelders.org/history-of-the-tribes-of-warm-springs⟩.
Kamitsis, I., Francis, A.J.P., 2013. Spirituality mediates the relationship between engagement with nature and psychological wellbeing. J. Environ. Psychol. 36, 136–143.
Katz, D., 1960. A functional approach to the study of attitudes. Public Opin. Q. 24, 163–204.
Kelly, G., Hosking, K., 2008. Nonpermanent residents, place attachment, and "sea change" communities. Environ. Behav. 40 (4), 575–594.
Kline, J.D., Mazzotta, M.J., Spies, T.A., Harmon, M.E., 2013. Applying the ecosystem services concept to public land management. Agric. Resour. Econ. Rev. 42 (1), 139–158.
Krueger, R.A., Casey, M.A., 2000. Focus Groups: A Practical Guide for Applied Research. Sage Publications, London.
Kumar, M., Kumar, P., 2008. Valuation of ecosystem services: a psycho-cultural perspective. Ecol. Econ. 64, 808–819.
Kuo, F.E., 2001. Coping with poverty: impacts of environment and attention in the inner city. Environ. Behav. 33, 5–34.
Lenzi, M., Vieno, A., Pastore, M., Santinello, M., 2013. Neighborhood social connectedness and adolescent civic engagement: an integrative model. J. Environ. Psychol. 34, 45–54.
Mayer, F.S., Frantz, C.M., Bruehlman-Senecal, E., Dolliver, K., 2009. Why is nature beneficial? The role of connectedness to nature. Environ. Behav. 41, 607–643.
MEA (Millennium Ecosystem Assessment), 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC, p. 137.
Pretty, J., Smith, D., 2004. Social capital in biodiversity conservation and management. Conserv. Biol. 18 (3), 631–638.
Putnam, R.D., 2000. Bowling Alone: The Collapse and Renewal of American Community. Simon and Schuster, New York.
Ruckelshaus, M., McKenzie, M., Tallis, T., Guerry, A., Daily, G., Kareiva, P., Polasky, S., Ricketts, T., Bhagabati, N., Wood, S.A., Bernhardt, J., 2013. Notes from the field: lessons learned from using ecosystem service approaches to inform real-world decisions. Ecol. Econ.
Russell, R., Guerry, A.D., Balvanera, P., Gould, R.K., Basurto, X., Chan, K.M.A., Klain, S., Levine, J., Tam, J., 2013. Humans and nature: how knowing and experiencing nature affect well-being. Annu. Rev. Environ. Resour. 38, 473–502.
Saldaña, J., 2010. The coding Manual for Qualitative Researchers. Sage Publications, Los Angeles.
Schuman, H., Presser, S., 1981. Questions and Answers in Attitude Surveys: Experiments on Question Form, Wording, and Context. Academic Press, New York.
Smith, M., Bruner, J., White, R., 1956. Opinions and Personality. Wiley, New York, USA.
Snyder, M., 1993. Basic research and practical problems: the promise of a "functional" personality and social psychology. Person. Soc. Psychol. Bull. 19, 251–264.
Stedman, R., 2002. Toward a social psychology of place: predicting behavior from place-based cognitions, attitude, and identity. Environ. Behav. 34 (5), 561–581.
Taylor, A.F., Kuo, F.E., Sulivan, W.C., 2002. Views of nature and self-discipline: evidence from inner city children. J. Environ. Psychol. 22, 49–63.
Tengberg, A., Fredholm, S., Eliason, I., Knez, I., Saltzman, K., Wetterberg, O., 2012. Cultural ecosystem services by landscapes: assessment of heritage values and identity. Ecosyst. Serv. 2, 14–26.
Uzzell, D., Pol, E., Badenas, D., 2002. Place identification, social cohesion, and environmental sustainability. Environ. Behav. 34 (1), 26–53.
Vitousek, P.M., Mooney, H.A., Lubchenco, J., Melillo, J.M., 1997. Human domination of Earth's ecosystems. Science 277 (5325), 494–499.
Weiss, R.S., 1995. Learning from Strangers: The Art and Method of Qualitative Interview Studies. Free Press, New York.

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