

Recreation as a transformative experience: Synthesizing the literature on outdoor recreation and recreation ecosystem services into a systems framework

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ARTICLE INFO

Keywords:

Recreation
Social ecological systems
Ecosystem services

ABSTRACT

Outdoor recreation is a type of recreation that occurs in, and depends on, the natural environment. Ecosystem services are the benefits people receive from ecosystems. The outdoor recreation research (ORR) field has developed a detailed understanding of the recreation experience but has not developed a full understanding of the contribution of the natural environment to those experiences. Recreation Ecosystem Services (RES) is a newer area of research that highlights the contribution of the natural environment for recreation. The integration of these lines of research can improve our understanding of how the natural environment contributes to outdoor recreation benefits and outcomes.

In this conceptual synthesis paper, we outline the evolution of outdoor recreation management to identify key theories and central concepts related to the biophysical setting in ORR. We then summarize contributions from RES, emphasizing the role of the natural environment in this research. Subsequently, we highlight key elements from systems theory and present the idea of transformation as a central element in outdoor recreation. We present a framework that captures central ideas from the ORR and RES fields and highlights the dynamic nature of transformative outdoor recreation experiences embedded in social-ecological complex adaptive systems. A more holistic systems view of outdoor recreation can help researchers and managers envision the bigger picture of how outdoor recreation land management contributes to recreation benefits and ecosystem services. If we understand the full complexity of the recreation system, we are better situated to address specific components in meaningful ways.

Management implications

- Provides an introduction to the research fields of outdoor recreation and recreation ecosystem services and how they conceptualize the environment.
- Develops a framework that will help researchers and managers better understand outdoor recreation as a social and ecological complex adaptive system.
- Develops a concept of the recreation transformation setting to better understand change as an inherent part of the recreation process.
- Understanding both positive and negative outcomes across scales and stakeholders will help to identify specific impacts and complementary ecosystem services to frame trade-offs.

- If we understand the full complexity of the recreation system, we are better situated to address specific components in meaningful ways.

1. Introduction

This article is a conceptual synthesis of outdoor recreation research (ORR) and research on recreation ecosystem services (RES). These two bodies of literature have largely remained separate and are in need of an integrated framework (Hermes, Van Erkel et al., 2018; Rice, Newman, Taff, Zipp, & Miller, 2020). We present a linked social-ecological systems model to form a comprehensive conceptual framework inclusive of both research perspectives. We believe this model can help facilitate understanding of the complexities of a dynamic recreation system,

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<https://doi.org/10.1016/j.jort.2022.100492>

Received 20 April 2021; Received in revised form 25 November 2021; Accepted 9 February 2022

Available online 24 February 2022

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highlight the interacting social and natural components, and outline relationships in a way that will help researchers and managers to better conceptualize the full recreation system (Morse, 2020). We agree with the premise that; “The more you can zoom out to embrace complexity, the better chance you have to zoom in on the details that matter most.” (Berlow, 2010).

Outdoor recreation can be defined as a type of recreation that occurs in and depends on the natural environment. Outdoor recreation is a process that includes a number of phases: anticipation and planning, travel-to, the on-site experience, travel-from, and recollection (Moore & Driver, 2005). As many outdoor recreation experience opportunities require at least a minimum of travel and support from industry or government (i.e. gear and parks), we are inclusive here of what can also be defined as nature-based tourism. Outdoor recreation involves a variety of associate providers that make up a tourism system including hospitality industries, public land agencies, outfitters and guides, local community restaurants and brewpubs, transportation, and other businesses and government affiliates (Driver, 2009). Benefits from outdoor recreation occur throughout multiple temporal phases and are distributed across space to other stakeholders. Interaction with the environment is central to the outdoor recreation experience and it can lead to transformations of the individual, within society, and to the environment. Our dynamic systems framework outlines the social and ecological inputs, interactions, outcomes, and feedbacks across systems and scales.

We begin with a summary of the field of ORR and present a key concept, the recreation experience model. We also highlight how the natural environment has been framed with the Recreation Opportunity Spectrum and by recreation ecology. We continue with a brief introduction to RES and highlight how the natural environment is considered. We next introduce some core principals from social-ecological systems theory to frame human and natural systems and how they operate and interact. Finally, we present how RES and ORR theory and concepts can be integrated into one systems model. We conclude with discussion of research areas to further integrate concepts from ORR and RES.

2. Outdoor recreation management and theory

It could be argued that a modern era of ORR research began with the 1962 Outdoor Recreation Resources Review Commission (ORRRC) report, a 27-vol tome examining the role of outdoor recreation in American life, present and future needs, and issues surrounding supply and demand of outdoor recreation (Moore & Driver, 2005). Since that period, approaches to outdoor recreation management have evolved to become increasingly complex, with each building on, but not

eliminating the need for, the previous approach (Moore & Driver, 2005). These approaches echoed the recreation demand hierarchy including demands for opportunities; to engage in activities, to realize desired experiences, and to attain additional benefits beyond experiences to multiple stakeholders (Driver, 2009; Driver & Brown, 1978). A brief overview of the evolution of major ORR approaches will highlight the role of the natural environment in this field of research.

Recreation management began with activity-based management (ABM) that targeted meeting customer demands for different activities by supplying commensurate facilities and resources. Attention was paid to participation numbers and activities, setting preferences, and how to design facilities to encourage and accommodate use (Driver, 2009). Beginning in the early 1980s, experience-based management (EBM) conceived recreation in experiential terms. The recreation experience model asserted that recreationists had motivations and preferences to conduct activities in settings and with companions to achieve desired recreation experiences (Fig. 1) (Moore & Driver, 2005). The focus shifted beyond activity participation to include the type of experience a customer desired from the activity. For example, managing a setting for a person to hike is different than managing a setting for a person to hike in solitude in a pristine natural setting.

The supply side application of the experience-based approach is the Recreation Opportunity Spectrum (ROS). Recreation lands that use the ROS are mapped into six zones or patches by criteria under three setting characteristics that include the physical setting (remoteness (distance from roads/development), size of area, and type of access), social setting (solitude versus crowding), and the managerial setting (management regulations and interactions, facilities, and degree of naturalness/evidence of humans) (Clark & Stankey, 1979; Driver, Brown, Stankey, & Gregoire, 1987). By offering a wide spectrum of setting types (six) from urban to wilderness, it was argued a diversity of experiences could be obtained. The experiential outcome of visitors was termed benefits.

There is a long history of research on the motivations for and benefits from recreation experiences (Driver, Brown, & Peterson, 1991; Manfredi & Driver, 1996; Manfredi, Driver, & Brown, 1983). By the early 1990s, benefits-based management (BBM) began to be integrated into management perspectives. BBM included all the benefits that individual visitors achieved, but also the on- and off-site benefits to households, communities and society (associate providers/tourism system), and the environment (Moore & Driver, 2005). Recognition that there are a number of negative impacts that can occur from outdoor recreation (environmental impacts, crowding, conflict, cultural impacts), BBM was reframed as outcomes-focused management to more accurately represent the full array of positive and negative recreation outcomes (Driver, 2009).

In ORR the benefits/outcomes of outdoor recreation have been

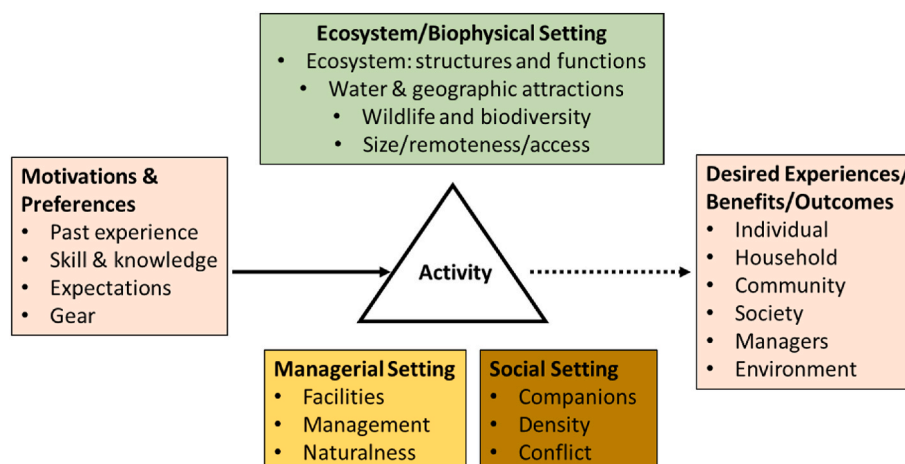


Fig. 1. Modified recreation experience model.

categorized into psychological (diminished anxiety, self-reliance, spiritual growth) and psychophysiological (fitness, cardiovascular health) outcomes for *individuals*; socio-cultural outcomes (family bonding, social relations, sense of place, community identity, economic impacts) for *households, communities, and society*; outcomes for setting *managers* (funding, support for mission, trust, image) and outcomes for the *environment* (conservation of protected area, improved stewardship, cultural/heritage preservation, reduced wildlife disturbance, provision of ecosystem services) (Driver, 2009; Moore & Driver, 2005). Maintaining focus on *who* or *what* is impacted by the benefits/outcomes (outcome stakeholders) instead of the categories helps to visualize the system of outdoor recreation stakeholders.

The ORR primarily addresses interaction with the natural environment in two ways: 1) as a component of the setting and, 2) as a natural resource that can be impacted by recreation use. The natural environment is a central component of the setting and is actualized spatially in the ROS experience settings (urban-wilderness). How the environment specifically contributes to a recreation experience or to different benefits has been a long standing question (Driver et al., 1987; Heywood, Christensen, & Stankey, 1991), but the subject of more limited assessments and providing mixed results (Baklund & Stewart, 2012; Fix, Carroll, & Harrington, 2013). For example, Pierskalla, Lee, Stein, Anderson, and Nickerson (2004) conducted a meta-analysis of nine benefits-based studies to explore relationships between activities and settings as recreation inputs to different types of benefits. Settings were characterized by both general (six ROS-type categories) and specific items (rivers, caves, cultural areas, etc.). The authors found that benefit opportunities were more closely associated with activity choice than setting characteristics, that other benefits resulted from a combination of setting and activity, while the connections to other benefits was less clear (Pierskalla et al., 2004).

The connection between natural environment settings, place attachment, and outcomes have also been assessed with Florida trail hikers. The authors found that groups with stronger place attachment preferred natural features and nature trails more than other groups (Kil, Holland, & Stein, 2015) and demonstrated that visitors to sites with different levels of naturalness had different benefit preferences, providing evidence for the ROS premise connecting setting types and experiential outcomes (Kil et al., 2012, 2015). Parry and Gollob (2018) used a photo manipulation study to examine activity, experience, and setting relationships. The authors used six setting classifications (primitive to urban), fifty-four benefit items, and perceived satisfaction conducting five different activity types in the different settings (Parry & Gollob, 2018). They found activities are more tied to specific setting type than benefits and recreationists are flexible and can realize benefits across the spectrum of setting types. However, they also found that the polar ends (wilderness and urban) were related to lower activity satisfaction and perceived benefits, while backcountry (the second most pristine environment) was optimal for benefits and satisfaction.

Recreation ecology is a sub-field within ORR that examines the impacts of outdoor recreation and nature-based tourism on the natural environment (Hammit, Cole, & Monz, 2015; Liddle, 1997). This field has a long history in studies focused on soil and vegetation compaction due to hiking and camping in wilderness areas (Cole, 1981; Cole & Monz, 2003; Marion, Arredondo, Wimpey, & Meadema, 2018) and has continued to advance and address a broader array of impacts and contemporary issues such as climate change (Monz et al., 2013, 2021). In addition to impacts on soils and vegetation, researchers regularly address the negative impacts of outdoor recreation on wildlife and water (Hammit et al., 2015). Authors have explored different ecosystem types, the durability of various settings, and the influence different activities, visitor behavior, and use intensity have on impacts. They also identify management strategies to reduce impacts (Hammit et al., 2015; Leung, Spenceley, Havenegaard, & Buckley, 2018). Scale issues and feedbacks have been addressed by some authors, but interdisciplinary and systems perspectives have not been frequently applied in recreation

ecology (Miller et al., This issue).

2.1. Recreation ecosystem services

Ecosystem services is a paradigm that links human welfare with functioning ecosystems (Costanza, 2020), they are the benefits that people receive from ecosystems (Millennium Ecosystem Assessment, 2005). The most common categorization of ecosystem services comes from the Millennium Ecosystem Assessment and includes supporting, provisioning, regulating, and cultural services (Millennium Ecosystem Assessment, 2005). Supporting services are the foundation for all other services including soil formation and primary production. Provisioning services include food, fiber and fresh water and directly fulfill our most basic needs. Regulating services are ecosystem processes such as water purification, pollination and climate regulation. Cultural services have been defined as “the non-material benefits that people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences” (p. 894) and include cultural identity, heritage, spirituality, inspiration, education, knowledge systems, aesthetics, sense of place, social relations, recreation and tourism, among others (Millennium Ecosystem Assessment, 2005).

Within the cultural services category, a body of literature has developed around recreation as an ecosystem service. In the introduction to a special issue on the topic, RES are defined as “the natural environment’s contribution to the range of leisure and recreational opportunities and experiences enjoyed by human societies” (p. 290) (Hermes, Van Berkel et al., 2018). The RES literature has an ecological perspective focused on the natural environment as its foundation, what types of systems, and what components of ecosystems contribute to the provision of recreation opportunities (Fisher, Turner, & Morling, 2009; Martin, Momtaz, Gaston, & Moltschaniwskyj, 2020). A heavy emphasis has been put on mapping the biophysical environment for areas with recreation potential as a measure of supply and linking them with tourist visitation information or proximity of local populations as measures of demand (Hermes, Van Berkel et al., 2018; Kulczyk, Wozniak, & Derek, 2018). The identification of the locations of specific landscape attributes and preferences for different landscape elements has been a focus of RES (Hermes, Van Erkel et al., 2018) and a few examples are given below.

Paracchini et al. (2014) developed a continental scale model of European Union to examine the availability of lands with outdoor recreation potential. The authors adapt portions of the ROS from ORR to map daily recreation potential (in contrast to the original spectrum of recreation experience types). The authors categorize the recreation potential as areas based on 1) degree of naturalness, 2) the location of protected areas with high natural value and associated services and facilities, and 3) the presence of water attractions including coastal swimming areas. They used an expert panel to determine a degree of access/remoteness with distance from urban areas and distance from roads as the qualifications (neighborhood, proximity, far, remote, very remote). The authors combined their recreation potential with the access/remoteness to determine their potential for recreation as their recreation ecosystem service assessment. Population density maps were used to identify potential demand for daily outdoor recreation.

Pena, Casado-Arzuaga, and Onaindia (2015) also examined recreation potential and accessibility. They focused on aesthetics as a descriptor of recreation potential and conducted a photo questionnaire to elicit preferences for different landscapes in Basque Country in northern Spain. Photos contained images of different territorial features; diverse or homogeneous landscapes, flat or mountainous landscapes, those with or without water, natural forest or forest plantations, etc. These attributes, the presence of protected areas and specific sites of geological interest, were combined to identify recreation supply. Accessibility was determined using road density and information on density of recreation destinations/infrastructure such as wine cellars, museums, biking centers, climbing sites, etc. (associate providers/tourism system). The authors conclude that aesthetic preferences are a

reasonable and efficient tool for mapping demand for different settings. In a different type of landscape, [Hahn, Heinrup, and Lindborg \(2018\)](#) also used a photo elicitation technique to score participants preferences for spatial heterogeneity in mixed agricultural landscapes for outdoor recreation and conservation. They found both recreation and conservation values are positively correlated with more heterogeneous landscapes ([Hahn et al., 2018](#)).

[Kulczyk et al. \(2018\)](#) examined how landscape potential, recreation facilities, and demand interact to provide recreation ecosystem services. They define the natural landscape as a combination of both the activity opportunity setting and landscape potential. The authors evaluate the potential for seven different water-based activities (swimming, fishing, canoeing, etc.) in a lakes region in northern Poland. They conducted a survey to determine willingness of visitors to conduct the different activities, their landscape preferences, and where they actually visited. The authors concluded it is not just landscape potential, but also the presence of recreation facilities that correlates with recreation use ([Kulczyk et al., 2018](#)).

RES researchers have identified a number of unique ecosystem features and setting components that are not articulated in the ORR models. There is a body of work being developed that has adapted portions of the ROS concept and applied it to mapping recreation potential but has not completely developed a new framework or integrated the original experiential understandings of ROS. There are many similarities with the ecosystem services benefits paradigm and ORR benefits based management that can help with integration

2.2. Social and ecological systems: embracing complexity

2.2.1. Recreation as complex adaptive systems

The recreation experience is where people come in contact with nature and where social and ecological systems come together. Recreation systems have been described as social-ecological complex adaptive systems ([Morse, 2020](#)). Complex adaptive systems (CAS) are dynamic multi-scale systems that display characteristics such as high levels of uncertainty, self-organization, cross-scale feedbacks, lack of central control, and emergent properties ([Berkes, Colding, & Folke, 2003](#); [Levin, 1999](#); [Norberg & Cumming, 2008](#)).

Recreation systems are dynamic, which means that they will change over time. If you have ever returned to a once less-known recreation site after not visiting for several years, you may notice an increase in the number of visitors, more retail and tour guides, and more trails with increased environmental impacts. Recreation systems are multi-scale; for example, your local park manager may work for the larger national park system and national administrators that set regulations for your local park. If you change one part of the recreation system, individuals within and other components of the system will adapt to those changes in a form of self organization. For instance, if the last bike rental shop in a community closed, there might be less biking on the trails allowing the vegetation to recover which could lessen trail erosion resulting in less sedimentation in streams. Furthermore, local hotels and shops that depended on bikers visiting town would adjust their business models in response to the closing. The adaptation within the system can lead to emergent properties, or those that you would not be able to predict. The bike shop closing might encourage local community members to organize a business development group to support the recreation industry that eventually networks with other regional recreation councils creating new emergent institutional structures supporting recreation commerce.

An example of cross scale and temporal feedbacks would be a recurrent conflict among recreationists reported to local managers at several different parks, who in-turn tell their administrators, that over time results in future management and administrative policy changes at the park system level. The recreation system is also a good example of a system with lack of central control. The hospitality industry, guides, retailers, recreationists, protected area managers, and the lands they

manage are all independent actors that no one individual or organization can control. Adaptive management and structuration theory have been used in the social sciences to frame how people adapt to and/or purposefully attempt to create changes in both social and ecological systems and are further detailed elsewhere ([Morse, 2020](#); [Morse, McLaughlin, Wulforth, & Harvey, 2013](#); [Ostrom, 2009](#); [Walker, Holling, Carpenter, & Kinzig, 2004](#)).

2.2.2. Recreation as ecological systems

If you have ever looked at an aerial photo or satellite image of a landscape, various patches of forest, meadows, water, pasture, crops, urban development, and linear features such as rivers and roads can be seen. All these items form a mosaic of landcover of ecological structures, a patch mosaic. If you were to zoom in on the image to a specific forest patch (or any patch type), you may see that patch actually has some openings with fallen trees, smaller patches of natural grasses, or that the forest is composed of different patches of different tree species. In that way, each patch also contains its own set of patches that are nested hierarchically (a nested patch mosaic). You will also notice that the edges of these boundaries are soft in that a bird or deer, or water and wind, or fire can more or less easily flow from one patch to the next. In this way, the patches interact, and the type of patch and their arrangement matters in terms of these flows.

We use hierarchical patch dynamics theory from ecology to address dynamic ecological systems where we recreate. Patches in this theory are spatial areas that are classified by size, shape, content, structure and spatial organization ([Pickett, Wu, & Cadenasso, 1999](#)) ([Turner et al., 2001](#)). Patch composition, structure, and the configuration of nested patches will contribute to the ecosystem functions and services that a particular patch and patch mosaic can provide ([Turner & Chapin, 2005](#)). Changes to patches and their composition will be driven by natural variation and disturbances (i.e. fire), human or otherwise, resulting in an adapting and evolving dynamic complex adaptive system ([Turner & Chapin, 2005](#)). The landcover (patch mosaic) and its structural and functional properties are the biophysical platform on which we recreate. How we chose where we want to go, the impacts we have on the landscape, and the complementary services that recreation land provides (biodiversity habitat, carbon sequestration, watershed services) can all be addressed with complex adaptive systems, hierarchical patch dynamics, and recreation ecology frameworks and theories.

2.3. Recreation as a social ecological complex adaptive system

2.3.1. Benefits or services

From the perspective of the field of ORR and the recreation experience model ([Fig. 1](#)), one of the first discrepancies with the RES literature is the position of recreation as a service or benefit, unto itself, alongside concepts like inspiration, heritage, aesthetics, and social relations. In ORR, these latter items have traditionally been considered the benefits/outcomes of outdoor recreation. We suggest that the ORR definition and theory developed around recreation as a process that is experiential in nature and leads to benefits/outcomes is more useful for a systems model. In this way, recreation is maintained as an action and an experiential transformation that enables benefits/outcomes in a social-ecological system.

2.3.2. The transformation setting

The center of our framework is the Recreation Transformation Setting (RTS) ([Fig. 2](#)). Recreation takes place in a biophysical, social, and managerial setting as defined in the recreation experience model and the ROS. At the center is the individual recreationist who has selected what activities they want to do, with companions they want to have, and in the managerial and biophysical setting they prefer. The on-site portion of the experience is not just a moment but may be hours or several days. This is important because during the experience encounters with other recreationists conducting similar or different activities

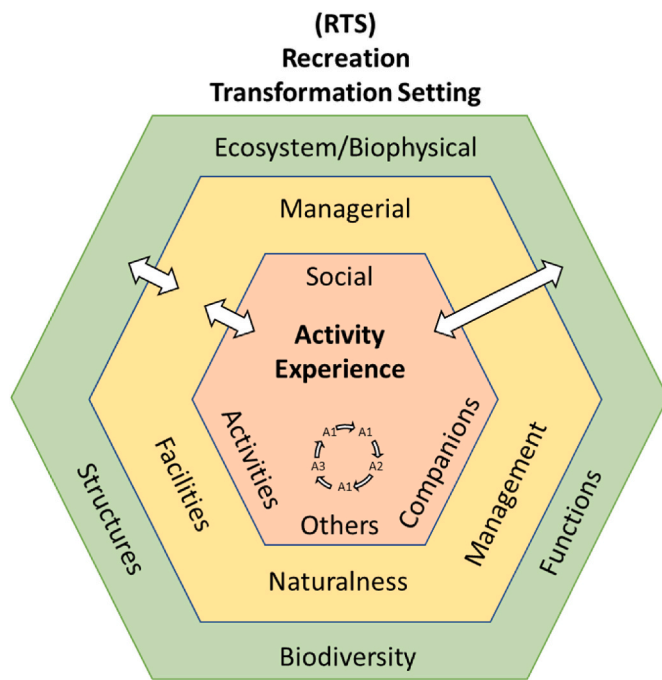


Fig. 2. The recreation transformation setting.

(Fig. 2: circle of A1, A2, A3) may enhance or conflict with an individual's desired outcome experiences (crowding or alternatively, positive social interactions). The arrows across the domains within the RTS indicate that recreationists interact with the biophysical environment, and directly or indirectly interact with management, and managers may take actions regarding the environment during an experience. A recreation experience is a dynamic, interactive, and transformative action.

By transformation we mean any change in form, nature, or character that can apply to any components of the system (individuals, households, communities, society, associate providers, wildlife, the environment) as outcomes of outdoor recreation. We use this term to describe the dynamic nature of complex adaptive system where all elements are subject to change, change across scales, and emergent properties. For example, if the number of visitors at a recreation site increases dramatically, some visitors may find it too crowded and have a less-positive experience, managers may adapt some of the behaviors allowed during crowded times, and wildlife may be more likely to avoid the crowds. Each component of the system may respond and adapt to any initial change in a form of self-organization. Some of the changes may be small, some may reinforce existing conditions (instead of changing them), and some may lead to a full transformation of the system. The adaptation and reciprocal responses are continual, and some changes will have short-term and small implications and others may have longer-term impacts and implications. Transformations can be complete or partial, isolated or system-wide, short or long-term.

Adaptation, resilience, structuration, and transformation are complementary attributes often used together when talking about change within complex adaptive systems (Morse et al., 2013; Walker & Salt, 2012) and with tourism specifically (Lew & Cheer, 2018; McCool & Bosak, 2019). Adaptation are changes that keep a system from crossing thresholds to become something else. Resilience is “the ability to absorb disturbance and reorganize so as to retain essentially the same function, structure, and feedbacks” (p. 3) (Walker & Salt, 2012). Structuration outlines how social systems are both the product of and medium or setting for action (Giddens, 1984; Stones, 2005). For example, our current community and tourism system and environmental conditions (social and ecological structures) provide the context for our current

recreation activities and actions, but those actions that we do will in-turn produce, transform, or otherwise reaffirm those social and ecological structures for the future in a constant recursive cycle (Morse, 2020; Morse et al., 2013). Transformation has also been defined as the capacity of a system to become a fundamentally different system (Walker & Salt, 2012). A recent related use of the concept of transformation is as a specifically directed form of tourism where it is the individual who transforms, “Transformative tourism focuses on pushing tourists out of their comfort zone, encouraging inclusive worldviews, promoting cross-cultural understanding and social empowerment” (p. 103141) (Soulaire, McGehee, Stern, & Lamoureux, 2021). Finally, Saarinen (2019) identifies that nature tourism can both positively and negatively transform entire or specific elements of communities by increasing employment, contributing to economic diversifications, leading to support for conservation, or alternatively leading to increased inequality, resource conflicts, negatively-impacted local culture or environment (Saarinen, 2019). Therefore, an individual may be transformed, or a component of the environment or economy transformed, without transforming the entire system. We chose to use the term transformation (over resilience and adaptation) to highlight the continuous interplay that all components of the recreation system undergo as co-evolving self-organizing systems (the dynamic complex adaptive systems or structuration process). We also use the term transformation to modify ‘setting’ because recreation is not static; transformation indicates action and process.

2.3.3. The full social ecological complex adaptive systems model (SECAS)

The full outdoor recreation model reflects Ostrom's general framework for social-ecological systems with users interacting with resources under social and ecological governance systems to achieve outcomes that feed back to each component to present a dynamic adaptive co-evolving system (Anderies, Janssen, & Ostrom, 2004; Ostrom, 2009). Similar social ecological systems models have been developed for managing protected areas (Cumming et al., 2015), nature tourism (Farrell & Twining-Ward, 2004; Moscardo, 2021; Strickland-Munro, Allison, & Moore, 2010), outdoor recreation (Ferguson, Mueller, Graefe, & Mowen, 2018; Morse, 2020), and ecosystem services (Morse et al., 2013).

The recreation transformation setting (RTS) is the center of our social ecological complex adaptive systems framework. The rest of the framework is composed of components identified within ORR and RES (Fig. 3). The general model layout is as follows. The top half of the model represents inputs into the recreation experience from the different stakeholders while the bottom half represents the outcomes to the different stakeholders and across scales. The left side of the model addresses social systems while the right side is focused on ecological systems with the interaction and transformation of both occurring due to visitation to the recreation transformation setting (RTS). The two sides are modeled separately due to the fact that social systems are modeled and designed with intent (and likely quite a bit of stochasticity), while our interaction with the environment may modify the environment through disturbance or conservation, ecosystems still operate based on ecological principles (Morse et al., 2013). Both sides have the feedbacks over time that spans the scales to represent the potential for cross-scale interactions. Given that this is a complex adaptive system, there is uncertainty throughout the framework (there is not perfect knowledge of all the interactions and outcomes may be unpredictable).

The different components are nested in our framework. Society level of tourism systems, governance, markets, etc. (can be many levels up to global) and all that happens there provides the context for the local community and the local tourism system (associate providers) at any point in time. Similarly, a national protected area system (though this could be any recreation area type or ownership) provides the context (regulations, policy) for any locally managed area. An individual may be nested within a local community (nearby recreation) or come through the community (nature tourism) on the way to their destination

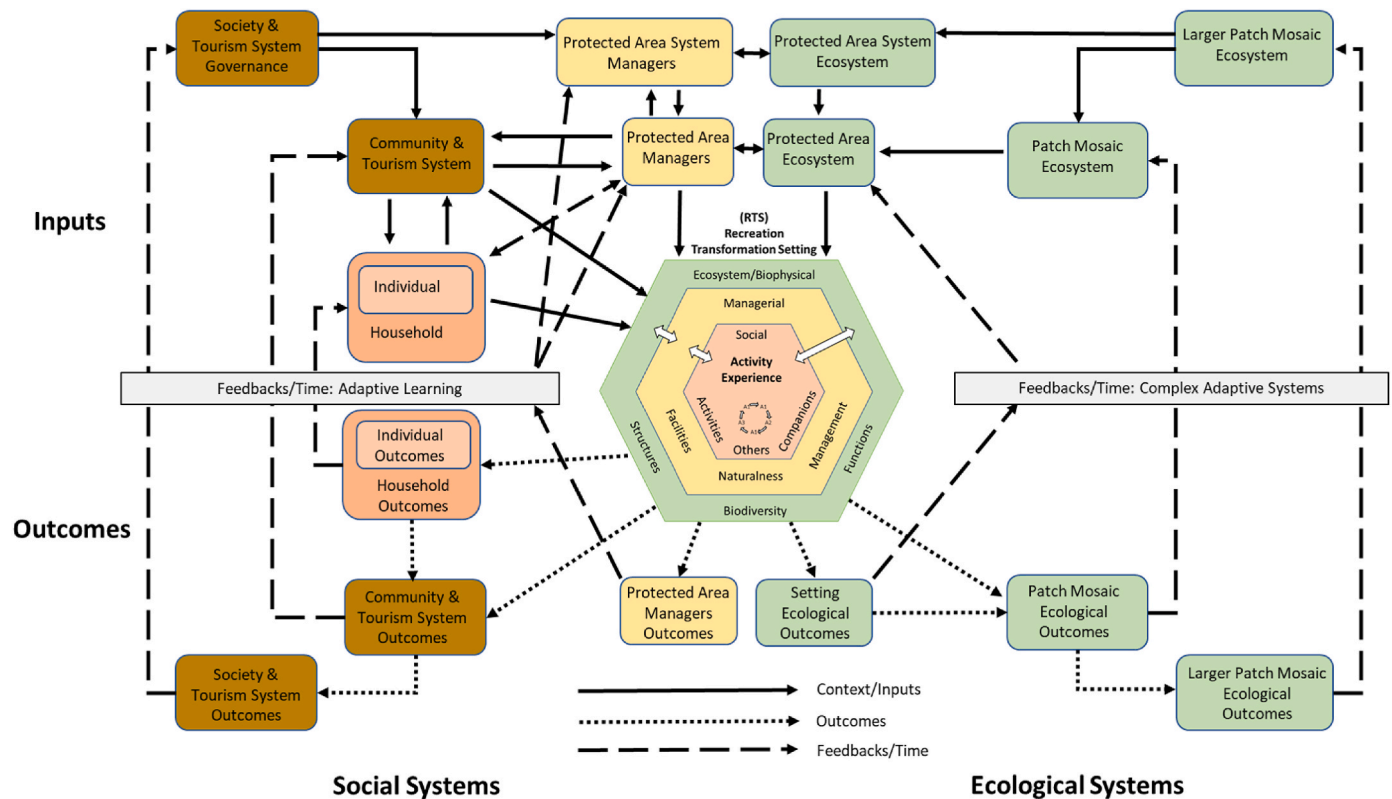


Fig. 3. The outdoor recreation ecosystem services SECAS framework.

(recreation transformation setting). Individuals may also interact directly or indirectly with park management (contacting the park or exploring websites) prior to visiting the setting. The community is modeled directly contributing to the recreation transformation setting as there are many other recreationists from the community who use a site and/or who may come through the community to use it. These are the other visitors doing their chosen activity (A1-A1-A2-A3) one may encounter during a visit.

Components on the ecological side are similarly nested with each higher level providing the context for the lower level. A specific recreation transformation setting (a trail or campground) is a patch within that Protected Area (PA). A specific protected area is a patch within a larger system of protected areas. The local park (and the whole protected area system) are nested within larger landscape ecosystems that are themselves patch mosaics made up of forests, grasslands, agriculture, urban areas and the like (the satellite image). The larger patch mosaics are made up of all the ecological structures and functions and their spatial arrangement that contribute to the provision of cultural (or any) ecosystem service (Fig. 3).

We won't attempt to describe every connection, instead, we will walk through the framework for an example recreational visit to describe the system identifying components and linkages from the framework.

I have my own preferences and motivations, skills and knowledge and desire to do a particular activity like mountain biking in a specific recreation transformation setting (RTS) (arrow from Individual to RTS) to achieve my desired outcomes. I am motivated by connecting to nature, beautiful aesthetic experiences, technical and physical challenge of riding, and to escape the rigors of daily life. I selected this RTS because it is a relatively short drive from my town (distance as a variable linking recreation and nature tourism), there is a great bike shop, and because of the mountainous sub-alpine and alpine terrain makes for good biking. It is a beautiful area with patches of forest, meadows, lakes, cliffs, and streams creating attractive views (PA Ecosystem arrow to RTS). The area

also has safe parking, clean restrooms near the trailheads, and several separate trail systems offering different levels of challenge (RTS facilities). The built facilities (trails, restrooms, roads & parking) also become part of the RTS ecosystem structures influencing ecosystem flows and functions (water runoff from parking lots, road as a firebreak) and also facilitate my recreation experience. There are birds and bears and other wildlife to view (arrow from PA Ecosystem to RTS). My past experiences in bear country (arrow from Individual Outcomes through Feedback/Time to Individual) and educational materials from the PA website (arrow from PA Managers to Individual) help form my expectations and enhance my opportunity to have a positive bear viewing experiential outcome (arrow from RTS to Individual Outcomes). Climate change has caused earlier snowmelts opening-up the alpine system earlier to biking (Larger Patch Mosaic Ecosystem arrow to PA System Ecosystem), but the weather remains cool. I pack warm gear as local mountain weather is always an uncertainty (PA Ecosystem arrow to RTS) and I remember a Scandinavian saying my parents repeated, "there is no bad weather, just poor clothing choices."

My preferences and skills were developed through past experiences (arrow from Individual Outcomes through Feedback/Time to Individual). I also remember a great bike shop in the community that hopefully won't be constrained for parts due to larger supply chain issues (Society & Tourism System arrow to Community & Tourism System), a simple hotel, and a little brewpub that I will visit after a day mountain biking on the trails (Individual to Community & Tourism System arrows). Before I travel (planning stage), I checked on the protected area website to make sure that the trails were open (Individual to PA Managers arrow), and that there were no planned burns, closures, or other ecosystem management activity (PA Manager to PA Ecosystem arrow) that might negatively impact my trip.

I travel to my RTS purchasing a little gas and food and paying for my hotel, my travel costs (Individual to Community & Tourism System arrow). I pay at the entrance to the park for my first direct management contact at the RTS (Individual to Managerial arrow within the RTS). At

the site, I ride and stay on the trails to minimize my ecological impact (Social to Biophysical arrow within RTS). I also come in contact with several large groups of other mountain bikers who aren't staying on the trails creating a negative interaction with other visitors (Social interaction within the RTS, A1-A1-A2-A3 circle). I also interact with the local manager at the site to point out the other bikers less-than-stellar conservation behavior and complain about the crowds (Social to Managerial arrow within the RTS). At this point, the manager reminds me of another area that is more challenging but has much less visitation resulting in a positive interaction (Managerial to Social arrow within RTS).

From my travel to the RTS through to my trip home and after, there are a number of outcomes generated (bottom half of Fig. 3). First, I had a positive experience riding in a different uncrowded area that the manager recommended. It was beautiful, I was able to escape daily rigors, and had a technically challenging time – my desired experiential outcomes (RTS arrow to Individual Outcomes). This has improved my abilities (slight personal transformation) and influenced my decision to return to the site next month (Individual Outcomes through Feedback/Time box to Individual).

I also had positive experiences with managers that influenced my support for them and my decision to donate cash to a 'friends of the park' group (Individual Outcomes through Feedback/Time box to PA Managers). My complaints to the on-site RTS manager may also have influenced their decision (Managers within RTS to PA Managers Outcomes) to give feedback to their bosses (PA Manager Outcomes through Feedback/Time box to PA Managers) that may initiate a change in policy at the local protected area. If the problem with off-trail use was significant or common enough, the PA Managers may report back to the PA System Managers for a system wide policy change (PA Manager Outcomes through Feedback/Time box to PA System Managers). Some outcomes like the manager directly interacting with wayward bikers in the RTS may be immediate, while others like a policy change may take more time to implement.

My travel to and stay in the local community contributed economic benefits for associate providers through the local bike store where I got some new gear, hotel and brewpub where I stayed and ate, and the gas station where I refueled (RTS Social arrow to Community & Tourism System Outcomes). My culturally appropriate behavior and positive interactions with locals provided positive social benefits to the community (RTS arrow to Community and Tourism System Outcomes) and a welcome back for my next visit (Community and Tourism System Outcomes through Feedback/Time box to Community and Tourism System).

My biking led to some trail compaction while the larger groups of ill-behaving mountain bikers led to additional erosion and new pattern user trails and wildlife disturbance by riding off trail (RTS arrow to Setting Ecological Outcomes). The new trails developed by these riders may be significant enough at the ecosystem level (Setting Ecological Outcome through Feedback/Time box to PA Ecosystem) that managers would develop new site-level management guidelines (PA Ecosystem arrow to PA Managers). The erosion or wildlife disturbance at the setting may also impact water quality and wildlife movement within the larger patch mosaic (Setting Ecological Outcome arrow to the Patch Mosaic Ecological Outcome). These ecological impacts from mountain biking may be significant or inconsequential when considered next to road development, forest harvesting, or car traffic that occur in a larger ecosystem (Patch Mosaic Ecological Outcomes to Larger Patch Mosaic Ecological Outcomes arrow). However, they may be significant locally and have impacts on future visitation with visitors deciding not to return to a site (Individual arrow to the RTS) because of lack of wildlife viewing, erosion, and reduced aesthetics of the RTS.

2.3.4. Maintaining diversity in the framework

The ORR literature informs us that recreation is not just one thing and that there is no average recreationist; we do different activities, have different motivations, different levels of expertise and specialization, desire different experiences and outcomes, and prefer and utilize

ecosystems to achieve those outcomes in different ways (Moore & Driver, 2005). This diversity is lost when we consider recreation as a universal outcome. ORR has developed scales and measures for specialization (Harshaw et al., 2021; Lessard, Morse, Lepczyk, & Seekamp, 2018; Scott & Shafer, 2001), sense of place (Boley et al., 2021; Stedman, 2003; Williams & Vaske, 2003), motivations (Driver et al., 1991; Manfredo & Driver, 1996; Moore & Driver, 2005), desired outcomes (Driver, 2009; Rice, Taff, et al., 2020), constraints and equity in access (Jerry Lee, Casper, & Floyd, 2020; Johnson, Bowker, & Cordell, 2001; Sanchez, Cerveny, Blahna, Valenzuela, & Schlafmann, 2020; Shinew, Floyd, & Parry, 2004), satisfaction (Birdsong & Arlinghaus, 2021; Graefe & Burns, 2013; Holland & Ditton, 1992), and ecological impacts (D'Antonio, Monz, Newman, Lawson, & Taff, 2013; Hammit et al., 2015) that help to identify these differences in recreationists, experiences, and outcomes. Our systems framework maintains the differentiated individuals and identifies the input and outcome stakeholders (individuals, households, communities & society (associate providers, tourism system), and environment) involved in the recreation process to account for this diversity: the 'to whom' and 'where' for the different outcomes/benefits occur.

2.3.5. Mapping the recreation transformation setting

The long-standing question of how the environment contributes to outdoor recreation experiences remains. However, a key integration point within the ORR and RES literature is mapping landscapes and the Recreation Opportunity Spectrum (ROS). In addition to testing the premise of ROS, studies have identified the close connection with activities and setting preferences and have considered other specific features (cultural areas, water, mountains, and other natural features) (Parry & Gollob, 2018; Pierskalla et al., 2004). Numerous ORR authors have suggested that the ROS could be developed further with additional setting variables and/or combined with other user characteristics to develop a more multi-dimensional understanding of site preferences and outcome relationships (Baklund & Stewart, 2012; Fix et al., 2013; Pierskalla et al., 2004). Others have been even more inclusive recognizing associate providers, communities, and the nature tourism system as recreation setting components (Boyd & Butler, 1996; Butler & Waldbrook, 2003).

The ROS has also been integrated with hierarchical patch dynamics to identify spatially-nested ecosystems/ROS patches as one attempt to bridge the ecological functional implications of patches with the experiential notions of the ROS (Morse, Hall, & Kruger, 2009). Mapped ecological structures and functions can be used to assess other ecosystems services such as watershed, biodiversity, and carbon sequestration recreation lands provide. These services are frequently compatible with outdoor recreation as highly natural areas with clean air, water, and forests are setting attributes frequently sought in outdoor recreation. Recreation ecology (Marion, Leung, Eagleston, & Burroughs, 2016) provides insights into how recreation can negatively impact those settings, but also how those interactions can lead to environmental stewardship and better land protection (Miller et al., This issue).

The RES literature has adopted the degree of naturalness and distance from roads from ROS as measures of recreation potential with formal park designation as a proxy for facilities (Hermes, Van Erkel et al., 2018; Kulczyk et al., 2018; Paracchini et al., 2014). RES has also tested preferences for many new biophysical attributes such as the presence of water, terrain, forests, landscape heterogeneity, and aesthetics (Hahn et al., 2018; Pena et al., 2015). Studies have also shown that facilities can be a major visitation and experiential driver in both fields of research (Donavan, Cerveny, & Gatzolis, 2016; Kulczyk et al., 2018). Both fields have applied the travel cost method to place a value on recreation outcomes from different settings (Ghermandi, 2018; Loomis, 2006). These studies recognize the inputs from and outcomes for associate providers and the importance of community destination features (complimenting the RTS) as part of the outdoor recreation experience (the tourism system). Both fields of research have applied

public participation geographic information systems to understand how stakeholders value the landscape and map where they find those values (Brown, Reed, & Raymond, 2020; Brown & Weber, 2011; Helmer et al., 2020). Research is using social media to identify specific attractants (views, waterfalls, etc.), aesthetic preferences, and patterns of use of recreationists (Sachdeva, 2021; Tenkanen et al., 2017). Munoz, Hausner, Runge, Brown, and Daigle (2020) applied both PPGIS and analysis of photos on Flickr to map recreation values and aesthetic destination features (Munoz et al., 2020). This body of research is moving beyond the original ROS to elaborate on how the biophysical, managerial, and social components of the RTS are related to the benefits/outcomes of outdoor recreation. Clearly, this is an area for future research and development and integration between ORR and RES.

3. Conclusions

We agree with Hermes, Van Berkel, et al. (2018) and Rice, Newman, et al. (2020) that it is important to integrate concepts from the literature on ORR and RES. Conceptualizing outdoor recreation as a transformative process within a nested hierarchy of complex social and ecological systems helps to identify the relevant inputs and outcomes across scales. Stakeholders in the system include individuals, households, communities and society (associate providers/tourism system), managers, and the environment. Understanding both positive and negative outcomes across scales and stakeholders will help to identify specific impacts and complimentary ecosystem services to frame trade offs. The dynamic systems perspective provides important illustrations about how social and ecological systems change through feedbacks over time as a recursive on-going process (Morse, 2020). We need to embrace this complexity to understand how the system works and to identify management opportunities.

Progress is being made on the critical question of how the natural environment contributes to outdoor recreation. How ecosystem structures, functions, wildlife, and specific features of the biophysical setting interact with facilities and the social and managerial setting to help produce outcomes is an essential integration point between ORR and RES. The ROS, ecosystem services and cultural services, along with the ecological theories of hierarchical patch dynamics and complex adaptive systems and applied work from recreation ecology can all contribute to this discussion. Our systems framework is inclusive of previous outdoor recreation models that account for individual preferences, activity diversity, experience differentiation, and positive and negative social and ecological outcomes. By zooming out to examine the larger recreation system, our goal was to help researchers and managers better identify those details that can be best used to transform the system or system components toward desired outcomes. We hope that our systems model, along with others working to integrate these lines of research (Rice, Newman, et al., 2020), will contribute to the ongoing discussion and integration of the complex social-ecological systems that provide opportunities for transformative recreation experiences.

Funding

Funding was provided by USFS Grant number PNW 09-JV-11261935-001.

CRedit authorship contribution statement

Wayde C. Morse: lead author, writing, Writing – original draft. **Marc Stern:** writing, edits, Writing – review & editing. **Dale Blahna:** Writing – review & editing, writing, edits. **Taylor Stein:** Writing – review & editing, writing, edits.

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