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Conserving the Greater Sage-Grouse: A Social-Ecological Systems Case Study from the California-Nevada Region

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ABSTRACT

The Endangered Species Act (ESA) continues to serve as one of the most powerful and contested federal legislative mandates for conservation. In the midst of heated debates, researchers, policy makers, and conservation practitioners champion the importance of cooperative conservation and social-ecological systems approaches, which forge partnerships at multiple levels and scales to address complex ecosystem challenges. However, few real-world examples exist to demonstrate how multifaceted collaborations among stakeholders who share a common goal of conserving at-risk species may be nested within a systems framework to achieve social and ecological goals. Here, we present a case study of Greater Sage-grouse *(Centrocercus urophasianus)* conservation efforts in the "Bi-State" region of California and Nevada, United States. Using key-informant interviews, we explored dimensions and drivers of this landscape-scale conservation effort. Three themes emerged from the interviews, including 1) ESA action was transformed into opportunity for system-wide conservation; 2) a diverse, locally based partnership anchored collaboration and engagement across multiple levels and scales; and 3) best-available science combined with local knowledge led to "certainty of effectiveness and implementation"—the criteria used by the US Fish and Wildlife Service to evaluate conservation efforts when making listing decisions. Ultimately, collaborative conservation through multistakeholder engagement at various levels and scales led to proactive planning and implementation of conservation measures and precluded the need for an ESA listing of the Bi-State population of Greater Sage-grouse. This article presents a potent example of how a systems approach integrating policy, management, and learning can be used to successfully overcome the conflict-laden and "wicked" challenges that surround at-risk species conservation.

Introduction

Preventing the extinction of at-risk species through diverse stakeholder engagement is an urgent societal priority (Wilson et al., 2011; Sawchuk et al., 2015). Escalating pressures related to species protection and biodiversity conservation are complicated by social and ecological change due to rapid human population growth (Cincotta et al., 2000), land use change (Vitousek et al., 1997; Haines-Young, 2009), increasing food demands (Phalan et al., 2011), and climate change (Young et al., 2006). Scholars and practitioners alike have long called for collaborative approaches to achieve balance or determine acceptable trade-offs between diverse human interests and ecosystem health (Berkes, 2004). More recent calls for social-ecological systems (SES) approaches to conservation have been criticized as too abstract for real-world application (Brand and Jax, 2007; Brunson, 2012). This case study provides a tangible example of how SES principles were implemented by diverse stakeholders to achieve system-wide conservation for an at-risk species.

Endangered Species Act of 1973

At the center of this discourse is the Endangered Species Act (ESA), which continues to serve as one of the most powerful federal statutes guarding against species loss in the United States (Eisner et al., 1995; Scott et al., 2005). The ESA was passed in 1973 in the United States Senate (92-0) and House of Representatives (355-4) with broad bipartisan support (Schwartz, 2008). Its purpose was to provide, "a program for the conservation … of endangered species and threatened species" and the, "ecosystems upon which (these) species depend" (16 U.S.C. sec. 1531[b]). However, 40 years later, tension and turbulence over its purpose and effectiveness have fragmented support (Cheever, 1996) despite quantitative findings that listing has enhanced species' recoveries (Taylor et al., 2005).

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Three key criticisms of the ESA have been posed: 1) It focuses on the survival of individual species, in lieu of the overall functionality of systems (Benson, 2012); 2) it is often used as an "emergency room" approach to biodiversity protection for species on the brink of extinction, focusing attention on the listing decision rather than preventative and/or holistic conservation (Salzman and Thompson, 2010:282); and 3) few species have been delisted with the list-protect-recover-delist approach necessary for long-term species recovery (Scott et al., 2005). As a result, the ESA is frequently targeted for legislative modification or repeal (Bean, 2006).

When species' existence are threatened or endangered in the United States, the ESA imposes federal protections if other approaches have not succeeded. Two important questions have emerged as paramount to the future of biodiversity conservation in this context. First, can focal or umbrella species conservation help define the spatial, compositional, and functional attributes of a landscape and associated threats, with system-wide conservation or restoration measures rather than one-species-at-a-time protection (Lambeck, 1997; Simberloff, 1998; Roberge and Angelstam, 2004)? Second, can systems approaches be employed to better meld regulatory (i.e., "top-down") with collaborative and voluntary (i.e., "bottom-up") tools to achieve conservation goals (Berkes et al., 2003; Ostrom, 2009)? In rangeland systems, these strategies would require engaging a broad set of stakeholders who are committed to working together over longer periods of time to bridge contested divides through multiscalar partnerships to adaptively address restoration and management challenges (Bestelmeyer and Briske, 2012).

Systems Theory to Guide Conservation

Theoretical frameworks to guide conservation have called for ecosystem-centric and collaborative or cooperative approaches to conservation. Ecosystem approaches seek best-available scientific understanding of biophysical system dynamics to inform management actions that might achieve desired conservation outcomes (Koontz and Bodine, 2008; Boyd et al., 2014). Cooperative conservation, which emerged as a new paradigm in the 1990s and 2000s, sought to engage diverse sets of public and private partners in collaborative approaches to natural resource management. Core to cooperative conservation is the belief that solutions to environmental problems must consider social, political, and economic dimensions along with ecosystem dynamics (Klinger et al., 2007). As such, its proponents advocate for widening the decision-making space to include an array of partners working together to sustain landscapes and communities. There is no single model of cooperative conservation; efforts vary in the range of focal issues and concerns, scale and complexity of geography, types of public and private partners engaged, and methods of collaboration (McKinney and Johnson, 2009). The conservation approach is partner-centric, wherein diverse individuals work hand-in-hand, representing various interests, values, and skillsets, and providing a range of technical and funding resources. Projects address biological and social dimensions and require a coproduced investment in the conservation outcome (Neudecker et al., 2011). National recognition of the need for cooperative conservation resulted in formal adoption of the approach in US federal policy in 2004 (CEQ, 2005).

Success in improving process and outcomes through implementation of cooperative conservation in the context of the ESA have led some to advocate for it as an alternative to regulatory species listing and recovery efforts (Schwartz, 2008). Others have pointed to cooperative conservation as a vehicle to motivate long-term and lasting species recovery. For example, Scott et al. (2010:95) suggest conservationists have experienced "only the tip of the iceberg" when considering the escalation in the number of species that face extinction due to anthropogenic threats and depend on conservation interventions for survival. To address these challenges, these authors propose a cooperative conservation approach: incorporate a broader level of participation among federal and state agencies, private landowners, and nongovernmental organizations to build new partnerships; expand the range of policy and management options; empower the private sector; and prioritize species and systems for management (Scott et al., 2010). Others have stressed the path forward must involve expanding the regulatory focus of the ESA to empower local, adaptive, and ecologically based management, and by so doing enlarging the discussion to a wider set of stakeholders necessary to solve complex ecosystem problems (Boyd et al., 2014).

More recently, there have been calls for SES approaches to conservation that fully consider the interrelationships among human and biophysical system dimensions while embracing cooperative conservation principles (Bestelmeyer and Briske, 2012; Brunson, 2012; Virapongse et al., 2016). SES approaches seek to enhance system resilience or the capacity to endure disturbance while retaining critical system structures, processes, and feedbacks (Adger et al., 2005). While promising, SES approaches have been criticized as too abstract or theoretical to adequately inform practical rangeland management (Anderies et al., 2004; Brand and Jax, 2007). Even SES proponents recognize the "grand challenges" for such resilience-based approaches to environmental management (Bestelmeyer and Briske, 2012:656). For example, multiscalar system relationships are complex; it can be difficult to construct robust models of social and ecological dynamics, let alone understand how they can be influenced (Cumming et al., 2005); stakeholders are numerous, holding diverse and often competing interests; engaging them in meaningful ways that reduce conflict takes thoughtful and consistent effort (Leach, 2006); data are not often available at the temporal or spatial scale necessary to inform decisions (Bestelmeyer and Briske, 2012; Virapongse et al., 2016); and institutional support is often limited or unwilling to support adaptive governance approaches (Lemieux et al., 2014).

To inform SES conservation efforts, examples of practical solutions to these complex challenges are needed. SES approaches to conservation are touted as a fruitful means for addressing the decline of species and the systems on which they depend, yet examples of successful SES applications are lacking (Brunson, 2012). Especially absent are tangible descriptions of how local actors have employed SES principles to achieve system-wide planning and adaptive management for at-risk species. A resilience perspective requires management to be adaptive with a shift from the focus on "optimization" of solving environmental problems toward a conservation planning process that incorporates learning back into conservation design (Benson, 2012:28). Is it possible that SES approaches can help address critiques of the ESA (e.g., reactive instead of proactive, single species focus instead of system wide, and little focus on meaningful recovery) while building the adaptive capacity of the system for a more preventative conservation strategy? Evaluations of real-world attempts to employ SES approaches are needed to advance conservation theory and management guidance for natural resources in general and for at-risk species in particular.

Case Study of SES Conservation

In this article, we present a case study of conservation of the Bi-State Distinct Population Segment of Greater Sage-grouse *(Centrocercus urophasianus)*, hereafter the "Bi-State sage-grouse," on the border of California and Nevada, United States. Bi-State sage-grouse are allopatrically isolated and genetically distinct (Oyler-McCance et al., 2005, 2014), occur along the southwestern edge of the species' range, and have been petitioned and reviewed for ESA protections on multiple occasions since 2002 (Table 1). A primary threat facing Bi-State sage-grouse has been identified as the encroachment of pinyon *(Pinus monophylla, Pinus edulis)* and juniper *(Juniperus osteosperma, Juniperus californica, Juniperus grandis)*, hereafter "pinyon-juniper," into sagebrush ecosystems. This area of California and Nevada encompasses a complex ownership mosaic (Fig. 1) representative of many other landscape-scale initiatives in the West where conservation is

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