



Improving habitat exchange planning through theory, application, and lessons from other fields



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ABSTRACT

New tools are being deployed to address the continued decline of species at risk of becoming threatened or endangered. One approach receiving increased attention is the habitat exchange, or the use of a market-based, landscape-scale approach to protect or restore habitat in one place to offset impacts elsewhere. Although considerable resources have been devoted to the establishment of habitat exchanges over the past several years, actual implementation of transactions through habitat exchanges have been limited. As we argue here, important lessons have been slow to translate to habitat exchanges from other planning arenas. We briefly outline how the decision sciences, particularly structured decision making, and other planning processes – such as those governing electricity infrastructure development – can provide examples to facilitate the use of habitat exchanges as a viable and scalable conservation tool. We emphasize the challenge of translating theory to application, and note the importance of cross-fertilization of knowledge and experience across traditional disciplinary bounds.

1. Introduction

Indicators point to declining biodiversity at multiple spatial scales (Yap et al., 2015; Butchart et al., 2010). In the U.S., efforts continue to reposition the nation's flagship conservation law — the Endangered Species Act (ESA) — to better address the host of threats facing at-risk species (USFWS, 2015c). In the wake of recently released pre-listing conservation policy by the U.S. Fish and Wildlife Service, legal challenges to the listing of the lesser prairie chicken (*Tympanuchus pallidicinctus*), and the controversial decision not to list the greater sage grouse (*Centrocercus urophasianus*) (Taylor, 2015a,b; USFWS, 2015b; USFWS, 2017), it is increasingly important to understand both the challenges to and the opportunities for the development of new conservation approaches. Quite simply, maximizing the effectiveness, efficiency, and transferability of emerging approaches is integral to achieving meaningful species conservation outcomes.

One voluntary conservation approach receiving particular attention in recent years is a type of habitat market known as a “habitat exchange.” Habitat exchanges are either under development or have been developed as a habitat conservation measure for at-risk species in several areas of the country (EDF, 2015a; Wolfe et al., 2012). In these

types of markets, willing participants generate habitat “credits” by creating and protecting a new unit of habitat or by protecting a unit of existing habitat that could otherwise be lost (Bull et al., 2013). Apart from facilitating species conservation efforts, they also function as a central credit clearinghouse and market manager, organizing diffuse credit production by many farmers, ranchers, conservation bankers, and forest landowners (EDF, 2015a). Attempts to standardize and facilitate use of habitat exchanges and similar mechanisms date back nearly a decade (USFWS, 2007), but habitat exchanges remain largely in the pilot stage of development.

In the analysis that follows, we explore the reasons why habitat exchanges have not achieved greater uptake in species conservation efforts. We then review similar environmental markets to assess the extent to which barriers to exchanges have been addressed elsewhere. Finding few relevant examples in existing environmental markets, we first turn our attention to the decision sciences, specifically an approach called structured decision making (SDM), as a source of process guidance. To further motivate our analysis, we then look further afield for applied examples for how to improve habitat exchange design and implementation, focusing on the integrated resource planning (IRP) process in electricity infrastructure development. Recognizing past

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difficulties in translating habitat exchange theory to practice, we conclude with a series of recommendations for how insights gleaned from these processes can be used to cross-fertilize implementation efforts in nascent habitat exchanges.

2. Habitat exchanges in planning and practice

The slow spread of habitat exchanges can be attributed to a variety of factors. First, single species exchanges risk being tightly specified and prone to low trade volumes, as each will be in some way unique to the species affected and the activities affecting them (Ruhl et al., 2005; Salzman and Ruhl, 2000). Second, the inherent link between each exchange and the unique conservation needs of the species it covers also requires that market development be rooted in robust conservation planning. Though recent developments with the monarch butterfly habitat exchange suggests some degree of maturation in the exchange planning process, the organizational complexity of habitat exchanges nonetheless requires both greater levels and new elements of organizational support than are commonly envisaged in existing conservation tools or processes (e.g., Pindilli and Casey, 2015). In Sections 2.1–2.3. below, we briefly discuss the challenges that inhibit the development and implementation of habitat exchanges and how formal planning processes and examples from other market contexts can help facilitate the use of habitat markets as a viable and scalable conservation tool.

2.1. Barriers to habitat exchange implementation

Despite their promise, habitat exchanges face a variety of barriers to implementation. These barriers can be loosely categorized into challenges of regulation, quantification, participation, and outcome evaluation. Each barrier is reviewed further below.

2.1.1. Regulatory barriers

One hurdle to the development of voluntary habitat credits has traditionally been a lack of clear assurances that purchase of credits through a voluntary conservation market will satisfy future regulatory obligations in the event that a species is listed. Though uncertainty has been addressed in part by the recent Director's Order regarding prelisting conservation actions (USFWS, 2017), additional uncertainty has been introduced elsewhere, such as through a recent decision to rescind a 2015 Presidential Memorandum on mitigation (U.S. Department of the Interior, 2017; The White House, 2015). Furthermore, a lack of robust conservation plans for most at-risk species means that it is still difficult, if not impossible, to determine the amount and distribution of conservation necessary to prevent a species from being listed. This uncertainty in turn presents a strong disincentive for potential credit producers, potentially limiting the volume of conservation supplied (e.g., Galik and McAdams, 2017). Finally, previous research has identified a link between regulatory stringency and demand for market-based species compliance approaches (Fox and Nino-Murcia, 2005). Though the concept of exchanges could be buoyed by the potential for an increased emphasis on voluntary approaches (See, e.g., American Farm Bureau Federation, 2016), any reduced emphasis on enforcement could also hamstring demand for habitat exchange credits.

2.1.2. Quantification

Habitat resources for many at risk species require a long time to develop, necessitating long-term planning and management (e.g., Connelly et al., 2000; Vesik et al., 2008). The complexity of this undertaking necessitates use of habitat modeling and scenario planning tools to help inform stakeholders what future needs will be. In addition to long-term availability, habitat resources also require short-term responsiveness of flow. For example, a certain amount of breeding habitat must be provided at a certain space and time, or a certain volume of forage provided in a particular place for a particular period.

Owing to the inherent complexity of habitat quantification, frameworks such as The Nature Conservancy's Conservation by Design approach (The Nature Conservancy, 2016) have emerged to guide the conservation planning process, while tools such as Marxan (The University of Queensland, 2012) have been developed to identify critical areas for priority conservation.

Further complicating the habitat quantification exercise is the need to also quantify the unit of trade in the resulting habitat market. As would be expected, creating a scientifically based tool for measuring credits is also time-consuming and expensive. The most appropriate measure of what constitutes a credit – defining the actual unit of trade – has also been a continual source of debate (BenDor and Woodruff, 2014; Doherty et al., 2010). As a result, formal, standardized approaches for evaluating the value of individual credits have lagged (Quétiér and Lavorel, 2011). As of this writing, draft habitat quantification tools have been developed for the lesser prairie-chicken, greater sage grouse, monarch butterfly, as well as several species in California. These tools were developed through a series of facilitated meetings with scientists with expertise of the target species, as well as metrics experts. But they remain complex and expensive endeavors, taking on average 18 months to develop.

2.1.3. Participation

Development of the overarching framework for habitat exchange implementation is complex, relying upon the participation of multiple parties from multiple sectors and at multiple levels of government. Personal experience indicates that the costs of and time required for this are currently quite high, presenting an impediment to the expansion of habitat exchanges. The interconnectedness and dynamics of impacts, species needs, and resource availability also requires integrated planning across multiple constituencies. In the cases of the prairie chicken and sage grouse exchanges, particular challenges arose from the need to address a large number of detailed design decisions by a stakeholder group with diverse interests and agendas. Notwithstanding examples of stakeholder processes that exist elsewhere under state or federal environmental law (e.g. California Environmental Quality Act, CA Pub. Res. Code, Sec. 21000-21178; National Environmental Policy Act, Pub. L. 91-190), a process that is efficient, yet responsive, has yet to emerge, presenting continued challenges to ongoing exchange development efforts. Engagement processes governing habitat exchanges continue to be developed and refined.

2.1.4. Outcome evaluation

At their heart, habitat exchanges are conservation and compliance tools. This implies that exchanges will be a feasible approach to addressing at-risk species needs only so long as they are seen as a viable approach to satisfy both species conservation and regulatory objectives. As noted in 2.1.1. above, exchanges may be challenged by a reduction in regulatory stringency, reducing the demand for any resulting credits. Reductions in regulatory stringency have an added effect of accelerating a push for low-cost, stripped down credits, pressuring credit producers to offer cheaper, lower quality credits. Combatting this so-called “race to the bottom” necessitates consistency and stringency in regulation and enforcement decisions, combined with transparency as to expectations and process for generating quality credits. A failure to do so effectively nullifies the utility of habitat exchanges in achieving conservation outcomes.

2.2. The habitat exchange planning paradox

Efforts to develop necessary organizational support and standardized processes for habitat exchange deployment are challenged by an inherent *Catch-22*: process standards are needed to guide habitat exchange development and implementation, but working examples and implementation experience are needed to inform the creation of standards themselves (Doherty et al., 2010). In the absence of such

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