



Synthesis

## Social-ecological enabling conditions for payments for ecosystem services

Heidi R. Huber-Stearns<sup>1</sup>, Drew E. Bennett<sup>2</sup>, Stephen Posner<sup>3,4</sup>, Ryan C. Richards<sup>5,6</sup>, Jenn Hoyle Fair<sup>7</sup>, Stella J. M. Cousins<sup>8</sup>  
and Chelsie L. Romulo<sup>5,6</sup>

**ABSTRACT.** The concept of “enabling conditions” centers on conditions that facilitate approaches to addressing social and ecological challenges. Although multiple fields have independently addressed the concept of enabling conditions, the literature lacks a shared understanding or integration of concepts. We propose a more synthesized understanding of enabling conditions beyond disciplinary boundaries by focusing on the enabling conditions that influence the implementation of a range of environmental policies termed payments for ecosystem services (PES). Through an analysis of key literature from different disciplinary perspectives, we examined how researchers and practitioners refer to and identify enabling conditions within the context of PES. Through our synthesis, we identified 24 distinct enabling conditions organized within 4 broad themes: biophysical, economic, governance, and social-cultural conditions. We found that the literature coalesces around certain enabling conditions, such as strong ecosystem science and existing institutions, regardless of disciplinary background or journal audience. We also observed key differences in how authors perceive the direction of influence for property type, program objectives, and number of actors. Additionally, we noted an emphasis on the importance of the contextual nature of many enabling conditions that may cause certain conditions to have a disproportionate impact on successful implementation in some circumstances. Unraveling the relative importance of specific enabling conditions in diverse contexts remains a research frontier. Ultimately, no single disciplinary perspective is likely to provide all necessary insights for PES creation, and given the intertwined nature of enabling conditions, practitioners need to consider insights from multiple dimensions. Our work suggests opportunities to better connect diverse conversations through integration of concepts, a common vocabulary, and a synthetic framework.

**Key Words:** *content analysis; enabling conditions; environmental governance; environmental synthesis; payments for ecosystem services; social-ecological systems*

### INTRODUCTION

In a time of increasing global environmental change, there is a pressing need to develop governance structures and associated management regimes to address social and ecological challenges (Anderies 2015). Despite interest in and experimentation with multiple approaches to environmental conservation, there are still major questions about what factors influence the viability of different strategies given a diversity of contexts. In particular, the concept of “enabling conditions” has emerged, highlighting the necessary conditions for establishing approaches to addressing social and ecological challenges. Multiple fields have addressed the concept of enabling conditions including economics (Coase 1960, Jack et al. 2008), political science (Sabatier 1986, Agrawal 2001, Ostrom 2009), and ecology (Rands et al. 2010). However, this dialogue often occurs within an academic field, with limited interaction across theoretical lenses. The true value of these contributions is in the collective understanding of enabling conditions, which is largely deficient, resulting in a lack of convergence on shared vocabulary or integration of concepts. Synthesizing these disconnected concepts to create common language and understanding is an important initial step toward building more robust theory on the concept of enabling conditions to inform policy and practice in the management of social-ecological systems.

We focus on the enabling conditions influencing the implementation of a range of environmental policies termed

payments for ecosystem services (PES). In concept, PES compensates those who protect, restore, or enhance benefits humans receive from nature (Engel et al. 2008, Tacconi 2012). We chose a discrete focal topic (PES) to understand the breadth of work related to enabling conditions in a specific policy arena and to connect these insights to the broader scholarship on the topic of enabling conditions. Through a review of key literature from different disciplinary perspectives, we seek to understand how researchers and practitioners refer to and identify enabling conditions within the context of PES.

Our purpose is to summarize the recent and expanding literature to: (1) identify how enabling conditions are described in the literature in relation to PES; (2) synthesize the findings from diverse fields to develop a more cohesive set of enabling conditions; and (3) develop theory on social-ecological enabling conditions by integrating insights from multiple disciplinary fields. In doing so, we bridge multiple disciplines and connect conversations that are occurring in various venues on the topic of enabling conditions for PES.

### The concept of enabling conditions

We define enabling conditions as factors that increase the likelihood of an intended change in the governance approach, strategy, or management regime. The presence of enabling conditions can facilitate the emergence of a particular environmental policy, whereas the absence of key enabling

<sup>1</sup>Institute for a Sustainable Environment, University of Oregon, <sup>2</sup>Department of Fish, Wildlife, and Conservation Biology, Warner College of Natural Resources, Colorado State University, <sup>3</sup>Gund Institute for Ecological Economics, Rubenstein School of Environment and Natural Resources, University of Vermont, <sup>4</sup>COMPASS, <sup>5</sup>Department of Environmental Science and Policy, George Mason University, <sup>6</sup>Center for Conservation and Sustainability, Smithsonian Conservation Biology Institute, <sup>7</sup>Yale School of Forestry and Environmental Studies, <sup>8</sup>Department of Environmental Science, Policy, and Management, University of California Berkeley

**Table 1.** Examples of terms and concepts equivalent to “enabling condition” used in a range of disciplines and focal areas of study.

Terminology	Focal Area(s)	Citation
Variables associated with self-organization for collective action	Collective action, new institutional economics	Ostrom 2009
Facilitating conditions for the successful governance of common-pool resources; Critical enabling conditions for sustainability on the commons	Collective action, common-pool resources	Agrawal 2001
Antecedent conditions associated with the successful adoption and operation of community-based collaborative governance arrangements	Collaborative governance	Weber 2009
Appropriate social arrangement for dealing with harmful effects	Transaction cost economics	Coase 1960
Enabling conditions for policy implementation	Ecology, biodiversity conservation	Rands et al. 2010
Preconditions for policy diffusion	Environmental policy, policy diffusion	Kern et al. 2001
Social dimension that enables adaptive ecosystem-based management	Resilience theory, adaptive governance	Folke et al. 2005

conditions can present a barrier to management or sustained policy action. The concept of enabling conditions has emerged in several disciplines, including political science, economics, and ecology, and has been applied to a variety of topics and in a range of contexts. Equally diverse is the terminology used to refer to the concept of enabling conditions (Table 1). We consider terms in Table 1 such as facilitating conditions, antecedent conditions, preconditions, and appropriate social arrangement to be equivalent to enabling conditions. Given the lack of a consistent and concrete definition for enabling conditions, we based our definition on insights gained from the literature synthesis and analysis we present.

Several scholars have identified specific enabling conditions in their research. An early example of this is Coase (1960:18) who addressed the “appropriate social arrangement for dealing with harmful effects [i.e., externalities].” Coase (1960) identified well-established property rights and low transaction costs as the appropriate or necessary social arrangement for efficiently addressing externalities through direct negotiation. Other early examples within public policy include Dawson and Robinson (1963), who found correlations between adoption of certain policies and political and socioeconomic contexts. This exploration of environmental and political factors in explaining policy adoption was expanded with Hofferbert’s (1966) model of factors having an impact on policy output (termed the “funnel of causality”), and other notable works that contributed to theories of the policy process (Dye 1965, Bauer and Gergen 1968, Sharkansky 1970, Weible 2014). This work has informed and manifested itself in forms, such as the Advocacy Coalition Framework (Sabatier 1986), which integrates both ecological and political factors explored by aforementioned authors.

This early scholarship primed inquiry in later works, including several significant studies that generated lists of enabling conditions for the sustainable management of common property systems. Reviewing these studies, Agrawal (2001) generated a list of 21 “facilitating conditions” in categories identified by Wade (1988), Ostrom (1990), and Baland and Platteau (1996). Example enabling conditions included small size of the resource system, shared norms among group members, and a high level of dependence by group members on the resource system. In summarizing insights, Ostrom (2009) identified 10 variables commonly associated with the ability of resource users or groups to self-organize to take collective action. These variables included several of those outlined by Agrawal (2001) but also include the predictability of the resource system, the mobility of the resources

being harvested, and shared knowledge or mental models of the social-ecological system.

Physical scientists have not engaged with the concept of enabling conditions to the same extent as social scientists, although there are some examples that inform the topic (Kremen 2005, Postel and Thompson 2005, Quintero et al. 2009, Rands et al. 2010, Keeler et al. 2012). Some ecologists concerned with conserving biodiversity have addressed key conditions that enable the implementation of conservation strategies. Rands et al. (2010:1302) emphasized the importance of “creating the enabling conditions for policy implementation.” Critical to establishing these enabling conditions is the foundational need for “knowledge about social and biological dimensions of biodiversity loss” (Rands et al. 2010:1302). Beyond this foundational knowledge, they argued that appropriate institutions and governance structures are required to enable specific instruments or strategies for conservation. Some of the specific institutional and governance conditions include clear property rights, the ability to enforce contracts, a lack of corruption, and a culture of patronage that controls the use of natural resources. Ultimately, Rands et al. (2010:1302) contended that “creating enabling conditions for conservation is an essential component of the solution, requiring conservationists to join with wider civil society groups pressing for governance reform and institutional change.” Similarly, other authors have advocated for an improved understanding of ecosystem services of interest to better link ecological function with the design of conservation programs (Kremen 2005, Asbjorsen et al. 2015).

Although much of the scholarship on enabling conditions is associated with specific disciplines, recently the concept has been addressed by interdisciplinary efforts such as those operating within a resilience framework (Berkes et al. 2003, Folke et al. 2005, Walker et al. 2006). In particular, scientists studying adaptive governance have identified that the critical role of leadership can help establish trust, a shared vision, and guide organizational transitions toward adaptability. Transboundary organizations that link social and ecological systems can play a key role in establishing stakeholder networks, communicating science in a policy relevant way to stakeholders, and lowering the costs of collaborating and mediating conflicts (Folke et al. 2005, Sternlieb et al. 2013, Posner et al. 2016). Government actors, institutions, and related policies can influence environmental management through the enforcement of laws, and by influencing local-scale actors (Koontz and Newig 2014). Additionally, social or ecological crises such as floods, changes in property rights

regimes, or the influence of external markets can create windows of opportunity that enable the establishment of new governance or management approaches (Folke et al. 2005).

As this condensed review illustrates, enabling conditions are discussed by a diversity of scholars and disciplines across a range of topics. This literature, however, is dispersed across publications in multiple fields and remains disaggregated. Although relatively new fields (e.g., resilience) have begun addressing these conditions in more integrative ways, we suggest there is still a need to actively synthesize understanding of enabling conditions beyond disciplinary boundaries.

#### **A focus on payments for ecosystem services**

We examined the literature on PES to understand how the concept of enabling conditions is being used in a particular policy arena, specifically the creation of PES. Ecosystem services (ES) are broadly defined as the benefits humans receive from nature (Daily 1997). Payments for ecosystem services is one approach to integrate ecosystem services into environmental policies by providing financial or other incentives to land managers (also known as ecosystem service providers) to promote the provision of beneficial ecosystem services or the land uses considered to provide these services (Ferraro and Kiss 2003, Wunder 2005, Muradian et al. 2010). This approach often involves identifying the people who directly benefit from the ES provided, ES beneficiaries, (Boyd and Banzhaf 2007, Nahlik et al. 2012), as well as engaging entities that connect ES providers and beneficiaries through transactions, e.g., public, private, or civil society organizations often called intermediaries (Pham et al. 2010, Huber-Stearns et al. 2013, Bennett et al. 2014). In practice, PES manifests in different policy and economic forms, depending on the social, economic, political, ecological, geographic, and other contexts in which it operates (Engel et al. 2008, Gomez-Baggethun et al. 2010, Muradian et al. 2010, Goldman-Benner et al. 2012).

We focused on PES as an illustrative subject for a synthesis of enabling conditions because it is an interdisciplinary topic that has received significant and growing research attention over the last decade and a half and has addressed several important dimensions common to environmental policy more broadly, e.g., program design, engaging multiple stakeholder groups, monitoring, and sustaining program longevity (Jack et al. 2008). Highlighting the relevant enabling conditions identified by scholars to date could enrich ongoing discussions assessing and reconciling PES in both theory and practice (see scholars on PES theory and practice, including: Engel et al. 2008, Gomez-Baggethun et al. 2010, Muradian et al. 2010, Goldman-Benner et al. 2012, Sattler and Matzdorf 2013). In many ways, debates surrounding PES embody many of the theoretical perspectives that have engaged with the concept of enabling conditions, such as the role of property rights and transaction costs (Engel et al. 2008, Kosoy and Corbera 2010), principles of common pool resource management (Fisher et al. 2010), linkages between biophysical ecosystem functions and the provision of services (Daily 1997, Kremen 2005, Ricketts et al. 2016), and the resilience of social-ecological systems to provide ecosystem services (Biggs et al. 2012, Paavola and Hubacek 2013). Additionally, PES researchers in different fields are not using the same terminology

for similar concepts. There is value in synthesizing these related topics to formally advance the dialogue on enabling conditions with a common language. More notably, many PES scholars have incorporated several influential theoretical perspectives into their analyses that shape how they understand and use ecosystem services in their work (Bennett and Gosnell 2015). By focusing on PES, our intent is to examine a specific tangible policy approach, the lessons from which can inform the concept of enabling conditions for environmental policies more broadly.

## **METHODS**

### **Literature selection**

First, we searched academic journal databases (including Web of Science and Academic Search Premier) in April 2015 to aggregate peer-reviewed academic journal literature on enabling conditions and ecosystem services, with a primary focus on payments for ecosystem services. We included both PES and ecosystem services literature because PES is one term for a broader set of literature on ecosystem services-based approaches. Because of the variety of terminology used to describe enabling conditions, searching databases with key words did not yield useful results. For example, searching for “enabl\* condition\*” and “pay\* for ecosystem service\*” yielded only five articles, three of which were relevant for inclusion in this literature review, but did not comprehensively represent available literature on the topic. Following this realization, we decided to use a purposive sample of the literature, to select information-rich cases aimed at insight about the phenomena (Creswell 2009). Our intent was to find key cases that provided rich information on the topic of enabling conditions in PES, not to attempt a comprehensive analysis of all potential articles.

The literature on these topics is widely dispersed and spans multiple disciplines, so an exhaustive search and coding of all potential documents was deemed impractical and beyond the scope of our research intent. We used our respective expertise in economic, institutional, and ecological components of PES to select articles known for their focus on enabling conditions (e.g., Kremen 2005, Wunder 2005, Jack et al. 2008, Muradian et al. 2010). We then used the reference lists of the selected articles and database searches for similar articles to find additional references to screen for potential inclusion. To be selected, each article must have met all of the following criteria:

1. Publication or *in press* in a peer-reviewed, academic journal.
2. Published in English between January 2000 and April 2015.
3. Used ecosystem services terminology, including variations of the following terms: payment for ecosystem services, environmental, ecological or ecosystem services, or market-based transactions.
4. Included terminology such as: enabling condition, antecedent condition, facilitating factor, influencing provision, or other similar language. We used the initial literature review presented in Table 1 to find relevant terminology to include in our search.

Our approach specifically identifies enabling conditions focused on factors that influence the creation of PES. This emphasis on

**Fig. 1.** Enabling conditions for payments for ecosystem services (PES) programs identified from the literature.

Biophysical conditions	Economic conditions	Governance conditions	Social-cultural conditions
<ul style="list-style-type: none"> <li>• Small resource area</li> <li>• Resource location &amp; arrangement</li> <li>• Well-defined boundaries of PES system</li> <li>• Existing fundamental ecosystem science and baseline data</li> <li>• Linkages between ES provision and management practices</li> <li>• Clear threat or risk to ES</li> </ul>	<ul style="list-style-type: none"> <li>• Significant value of ES</li> <li>• Low opportunity costs</li> <li>• Manageable transaction costs</li> <li>• Defining ES as an economic good or service</li> <li>• Economic growth</li> </ul>	<ul style="list-style-type: none"> <li>• Presence/absence of intermediaries</li> <li>• Strong capacity among actors</li> <li>• Influential champion</li> <li>• Strong existing institutions</li> <li>• Secure land tenure &amp; property type</li> <li>• Fit of governance structure with scale of PES</li> <li>• Multiple/single PES objectives</li> </ul>	<ul style="list-style-type: none"> <li>• Trust &amp; transparency among actors</li> <li>• Stakeholder communication &amp; engagement</li> <li>• Preexisting market-based culture</li> <li>• Participant willingness</li> <li>• Proximity of actors to each other</li> <li>• Large/small number of actors</li> </ul>

the creation of PES means we did not include factors that were explicitly noted to influence a PES program's longevity or success over time (e.g., types of monitoring and reporting conducted annually).

#### Coding and table creation

Using the approach outlined, we selected 27 publications that fit our criteria. We then conducted a multistage team coding process. First, we independently reviewed and coded five of the selected publications to identify the enabling conditions addressed in each. For intercoder reliability and agreement, we created common understandings of terminology, came to consensus about the meanings of our codebook and process, and used a team of five coders working in rotating teams for the remaining articles (Lombard 2002, Manheim 2007). We broadly structured coding by key social-ecological themes (e.g., biophysical, economic, governance, and sociocultural groupings) and included open coding to uncover other specific themes (Creswell 2009). Coders continually discussed findings to develop consensus on our literature review and a common understanding of our coding approach. Coders created a final combined list of enabling conditions from all 27 articles. This full list contained over 200 identified enabling conditions, which we organized by similarities in an iterative process to develop our broad themes and identify specific enabling conditions (Fig. 1). We then conducted a second review round to perform a saturation check and test whether new information (in this case, new identified enabling conditions) would be added to the analysis with the collection of additional data (Patton 2002). After selecting and coding an additional nine articles, we confirmed saturation because all enabling conditions in these new articles fit within existing categories.

#### RESULTS

Our literature review resulted in 36 articles from 20 different journals and over 34 different author sets, between the years of 2000-2015. The journals represented most frequently included: *Ecological Economics* (7 articles), *Ecosystem Services* (4 articles), and *PNAS* (3 articles). The represented disciplines included: ecological and environmental economics, ecology, political science, sociology, geography, hydrology, conservation biology, and anthropology. The articles included single case studies, comparative case studies, review articles, and theoretical cases. The data presented in this section are a synthesis of enabling conditions from all the selected literature.

#### Enabling conditions terminology from the payments for ecosystem services (PES) literature

Similar to the variety of terminology used to describe enabling conditions in the literature more broadly (Table 1), we also found variety in how individual articles described enabling conditions for PES. The articles included phrases such as: facilitating or key characteristics, subcriteria, conditions, preconditions, and key factors (Table 2). Descriptions of how these conditions had an impact on PES structures were also diverse and often reflected the authors' disciplinary backgrounds. For example, Postel and Thompson (2005:98) focused on the "institutional mechanisms for safeguarding watershed services" in their institutional and hydrology oriented article, whereas Wunder (2013:231) provided a more direct explanation of "what necessary conditions are needed to allow PES to emerge and function." Ruckelshaus et al. (2015:12) explained that when specific enabling conditions are in place the "chances of early success and replication are high." Similarly, authors used a variety of resource contexts to explain enabling conditions, including biodiversity (Kremen 2005,

**Table 2.** Selected terminology examples for enabling conditions for the development of payment for ecosystem services (PES).

Terminology	Citation
Conditions determining origin and function of mechanisms of compensation and reward for environmental services (CRES)	Swallow et al. 2010
Context lessons based on previous experience with incentive-based mechanisms	Jack et al. 2008
Facilitating characteristics for sustainably managing common property regimes (CPRs), or key considerations for using PES as a management tool	Fisher et al. 2010
Conditions or preconditions needed to allow PES to emerge and function	Wunder 2013
Subcriteria for effective, efficient, sustainable, as well as equitable compensation and reward mechanisms for environmental services	van Noordwijk et al. 2007

Balvanera et al. 2006), watershed services (Postel and Thompson 2005), coastal settings (Waite et al. 2015), agricultural lands (Kroeger and Casey 2007), and land-use change (Foley et al. 2005, Jack et al. 2008, Ruckelshaus et al. 2015).

### Synthesis of enabling conditions in payments for ecosystem services (PES)

Our literature review, coding, and synthesis of the selected articles resulted in 24 distinct enabling conditions. Figure 1 provides an overview of the four broad themes and the associated enabling conditions grouped within each theme, and Appendix 1 provides a detailed summary of each enabling condition and the supporting citations. We used the broad themes (biophysical, economic, governance, and social-cultural conditions) to organize the presentation and structure of the resulting enabling conditions list. Although these themes provided more structure for the presentation of conditions, it is important to note that the conditions in each theme were identified from a variety of disciplinary perspectives and fields, journal types, and author considerations, so no one theme was solely represented by one discipline.

### Biophysical, economic, governance, and social-cultural enabling conditions for payments for ecosystem services (PES)

The literature widely coalesced around certain enabling conditions, regardless of disciplinary backgrounds or journal audience. In particular, the majority of literature routinely cited the need for both strong ecosystem science and strong existing institutions. Strong ecosystem science was identified as necessary for improved scientific understanding of ecological processes and interactions that occur in a region in which specific ecosystem services are targeted by a PES program. This understanding of the ecosystem in question can have a direct link to the ability to develop PES in a particular biophysical context. In addition to understanding the ecosystem, this understanding must also be translated to the stakeholders involved in the PES policy to promote buy-in of the project or policy. Experts across disciplines pointed out that successfully linking the ecological and social values and benefits of ecosystem service(s) to human populations could improve the likelihood of PES development. Furthermore, authors stated that clearly explained relationships between management practices and ecosystem service provision also contribute to PES development, particularly if the practices and provision are readily quantifiable, i.e., the impact of increased hectares in cover crop on water quality (e.g., Diaz et al. 2005, Kremen 2005, Balvanera et al. 2006, Quintero et al. 2009, Rands et al. 2010, Ponette-González et al. 2013, Asbjornsen et al. 2015).

The provision of ES and development of PES are tightly linked, so underlying ecosystem functions such as productivity, biodiversity, and landscape arrangement are also important conditions for PES. In some cases, authors highlighted the importance of the science-policy process, linking both ecological and policy science to decision making around PES (Rosenthal et al. 2015, Ruckelshaus et al. 2015).

Authors also emphasized the need for strong existing institutions to help facilitate the development of rules and management structures for PES. The literature described these strong existing institutions as legal frameworks, regulatory underpinnings, policy support networks, government support and public attitudes, policy windows, political will, and interplay of political forces (e.g., Postel and Thompson 2005, Kroeger and Casey 2007, Engel et al. 2008, Corbera et al. 2009, Rands et al. 2010, Lockie 2013, Muñoz Escobar et al. 2013, Rosenthal et al. 2015). The fit of the existing governance structure with the PES structure (e.g., hierarchical) and scale (e.g., local to global) can also have an impact on PES. The capacity of actor groups and the presence of specific actors, such as intermediaries, to help facilitate transactions and program operations were also mentioned (e.g., Engel et al. 2008, Kemkes et al. 2010, van Noordwijk and Leimona 2010, Sattler and Matzdorf 2013). Similar to these considerations of institutional structure, several authors noted manageable transaction costs as an important enabling condition for PES (e.g., Kroeger and Casey 2007, Sommerville et al. 2009, Wunder 2013). These authors identified how the number of actors, program organization, secure buyer funding, and creation of provider cooperatives can all influence transaction costs. Selected literature also described legal preconditions, such as secure tenure and clearly defined property rights as influencing PES development (e.g., Postel and Thompson 2005, Huang et al. 2009, van Noordwijk and Leimona 2010, Sattler and Matzdorf 2013, Lambin et al. 2014).

Multiple authors described how the size of the preexisting biophysical and institutional system could have an impact on PES: more clearly defined and confined geographic regions and institutional contexts, both with clearly defined actors, can facilitate PES (e.g., Armsworth and Roughgarden 2003, Huang et al. 2009, Asbjornsen et al. 2015). To a lesser degree, some literature also highlighted social and cultural conditions, primarily interactor communications, use of ecosystem knowledge to inform decision making, engagement and trust, existing structure of markets and government, and awareness and promotion of the PES concept (e.g., Corbera et al. 2009, Huang et al. 2009, Lockie 2013, McKenzie et al. 2014, Rosenthal et al. 2015, Ruckelshaus et al. 2015, Waite et al. 2015, Posner et al. 2016).

However, several authors identified the same enabling condition but provided opposite interpretations of the condition's influence on PES. In these cases, the literature was inconsistent about whether certain factors were enabling conditions or barriers for PES. For instance, several authors argued that intermediaries enable the design and implementation of PES programs (Engel et al. 2008, Kemkes et al. 2010, van Noordwijk and Leimona 2010, Sattler and Matzdorf 2013) whereas Sommerville et al. (2009) stated that intermediaries may inhibit PES by preventing direct interaction and negotiation among ES beneficiaries and providers. We noted key differences in the directionality of the enabling condition for property type, program objectives, and number of actors, but we did not detect a clear pattern from these differences (e.g., Postel and Thompson 2005, Huang et al. 2009, Sommerville et al. 2009, Muradian et al. 2010, van Noordwijk and Leimona 2010, Kinzig et al. 2011, Lockie 2013). We noted the differences in directionality in Appendix 1 and attributed these inconsistencies to the different contexts of individual studies (e.g., developed and developing countries, different interested actor groups, and ES needs).

## DISCUSSION

Our synthesis provides a way to organize recent inquiry into the factors that influence the creation of an environmental policy, focused specifically on the enabling conditions that influence the implementation of PES. This research contains implications for enabling conditions in practice as well as theory. Our synthesis provides important insights from diverse perspectives on enabling conditions and highlights several challenges and areas for future consideration.

### The importance of enabling conditions to practice

Given the complexity of the social-ecological systems in which PES programs are implemented, we see a need to provide natural resource managers with the knowledge to understand the contexts in which PES is likely to be a viable and effective policy solution. Through our synthesis, we identified 24 conditions, organized within 4 themes (biophysical, economic, governance, and social-cultural), as a first step toward providing practitioners with the spectrum of conditions to consider in the development of new PES efforts or adapting existing ones.

No single disciplinary perspective is likely to provide all necessary insights for PES creation and there were many instances of enabling conditions broadly divided along disciplinary lines (e.g., economists listing only conditions that fell into the economic conditions category, natural scientists emphasizing biophysical conditions). However, we found numerous conditions with broad agreement, regardless of the author's discipline. In particular, the need for adequate scientific understanding of ecological processes and ecosystem services interactions was echoed across fields because of the need to quantify how ecosystem services are having an impact on or being impacted by human communities; a finding not surprising given the underlying premise of PES. Similarly, articles from multiple disciplines noted strong existing institutions as an enabling condition, which is reflected in current research in PES (Corbera et al. 2009, Muradian et al. 2010, Vatn 2010, Ruckelshaus et al. 2015). Given the intertwined nature of enabling conditions, practitioners need to consider insights from multiple dimensions. Emerging gray literature on lessons learned in enabling PES (e.g., Kushner et al. 2012), tools and guides, such as success

factor case studies (e.g., Ozment et al. 2016), and diagnostic and economic approaches (e.g., Mermet et al. 2014, Hansen et al. 2015, respectively) are increasingly considering multiple dimensions of enabling conditions. The use of PES given different places and PES options (or other policy or economic instruments), as well as the policy or decision maker's concept of PES, all shape the type of PES developed. The issues we raise in this discussion reflect current conversation in practitioner settings, which further highlights the need to continue developing and linking enabling conditions from science and practice.

Over the long-term, we envision building upon this synthesis to develop a road map to guide practitioners in fostering the range of factors needed for PES development. We recognize that the synthesis presented in this article is not sufficient for achieving this long-term objective and is rather a starting point in guiding this endeavor. Considerable empirical research is still needed to understand a variety of important questions to better inform practice. One such investigation is understanding the relative importance of different enabling conditions and how they influence program design and implementation. The 24 conditions we identified might all be relevant, but only a few may have a disproportionate impact on successful implementation.

Some of the conditions may also only be relevant to certain stages of the policy process. For instance, considering the proximity of actors to each other and the size of the resource area may only be relevant at the scoping stage to understand the overall viability of PES in a specific situation. Maintaining stakeholder communication and engagement and strong capacity among actors, however, is likely to be important throughout the duration of the PES program. Additionally, practitioners have varying levels of control over the 24 enabling conditions. Although practitioners have the ability to influence stakeholder engagement and build capacity among actors, they have very little ability to control the size of the resource area and the proximity of actors. We used our best judgment to identify the relevance of each enabling condition to the scoping, implementing, and sustaining stages of the policy process and the levels of influence practitioners have over the enabling conditions in Appendix 1.

Additional questions also remain about the potential for critical thresholds among the enabling conditions. As an example, strong governance institutions seem to be a key factor enabling the enforcement of PES agreements. However, PES might be viable within a wide range of governance arrangements but only become unviable at a certain point when legal institutions are ineffective, i.e., a threshold is crossed. Similarly, a range of transaction costs may be acceptable, but a PES scheme may become economical only when a tipping point is reached. Increased understanding of these questions will help guide practitioners in developing and implementing PES programs.

### The contextual challenge of enabling conditions

A reoccurring theme was also the importance of biophysical, economic, governance, and social-cultural context. The emphasis on the contextual nature of many enabling conditions is not unexpected, but understanding how the relative importance of enabling conditions changes from one context to another is not fully clear. Similarly, the contextual nature of enabling conditions may also explain why we noted cases of inconsistency in the literature, particularly cases in which the directionality of the

enabling condition conflicted between different authors. For example, some literature noted that a small number of actors would make organizing groups of PES users easier and therefore facilitate PES (Corbera et al. 2009, Fisher et al. 2010), whereas Lockie (2013) suggested that larger groups were needed to facilitate PES by creating a critical mass necessary to overcome transactions costs and spur competition. Interactions and linkages among the conditions we have identified could explain why the same condition could be an enabler in one context, but a barrier in another context. In the example above regarding the influence of the number of actors in enabling PES, differences in interpretations are likely highly influenced by the institutional environments and the capacity among state agencies and NGOs in which these authors work. In contexts with strong existing institutions and strong actor capacity, the challenge of dealing with a large number of actors can be overcome, and the actions of many actors can be coordinated through auctions and other systems that facilitate collective action among many participants (Lockie 2013). By coordinating a large numbers of actors, PES practitioners can achieve efficiencies in scale and reduce overall transaction costs. In contexts with less developed institutions and lower actor capacity, a large number of actors can be overwhelming to coordinate and prevent reductions in transaction costs and increase barriers to meaningful stakeholder communication and engagement. There is a need to better understand the interconnections among enabling conditions and explicitly consider their linkages in future research efforts.

Context is also important in considering insights on enabling conditions from PES examples in the Global North and the Global South. Contexts in the Global North can typically be characterized by strong existing institutions, strong capacity among actors, and secure land tenure. Poverty reduction is also less relevant as a PES objective in the Global North because the strong institutional environment in these countries typically means that there are other programs and policies in place to address poverty concerns. Institutional settings, actor capacity, and property rights regimes vary significantly across the Global South and can even vary significantly within a country as one moves from areas with a strong state presence to more remote areas with less influence from formal state actors and institutions. Although meaningful comparisons can be made across these contexts, explicitly acknowledging the relative differences in economic and governance conditions is critical to understanding how these varying contexts influence PES.

Many of the insights about the contextual nature of enabling conditions came from case studies of individual or a small number of PES examples. To more fully understand the importance of context, scholars will need to move to larger and richer datasets that allow for comparisons across many cases. The ability to answer these practical questions, which will give natural resources managers a much stronger link between theory and practice, remains elusive and should provide the template for an actionable research agenda.

#### **Enabling what kind of payments for ecosystem services (PES)?**

Our analysis also revealed a blending of concepts related to enabling conditions for PES. Much of the literature discussed the importance of various conditions that need to be in place to make PES a viable policy approach. However, it was often unclear

whether this referred to the conditions necessary to simply set up a PES program or the required conditions for effective PES. For instance, the emphasis on the linkage between ecosystem service provision and incentivized management practices was one of the most commonly identified enabling conditions, yet numerous studies have critiqued PES programs for their lack of such quantifiable linkages (e.g., Huber-Stearns et al. 2015, Naeem et al. 2015). Therefore, this condition is better interpreted as enabling effective PES because there are many PES programs in place around the world without this clear linkage. Similarly, conditions for equitable PES were also intermixed within a larger discussion of enabling conditions and were often not clearly distinguished. Based on our analysis, we see a need to distinguish between the aspirational ideals of PES (i.e., what is desired in an ideal scenario) versus the essential elements for a viable PES program (i.e., what are the bare essentials needed for PES to function), a need that is challenging to distinguish in the literature.

The differences in the interpretation of the type of PES being enabled are likely a reflection of the larger, ongoing debates on the definitional, theoretical framing, and practical dimensions of PES (e.g., Muradian et al. 2010, 2013, Sattler and Matzdorf 2013, Wunder 2013). A focus on enabling conditions can provide insight into the underlying positions of scholars engaged in these debates and their interpretations of how various enabling conditions diverge in the creation of effective, efficient, and/or equitable PES. For instance, in considering multiple versus single objectives of PES, Kinzig et al. (2011) argued that the focus should be entirely on achieving ecological goals to ensure effectiveness and efficiency. Conversely, Muradian et al. (2010) emphasized that efficiency and equity issues need to be considered together because they are inherently linked through PES, but that PES objectives cannot be determined outside of preexisting relationships among actors. Further examination of enabling conditions can enrich the ongoing debates among PES scholars and help to understand and breakdown their respective theoretical and practical underpinnings.

In addition, we note that the enabling conditions of interest to a decision maker, policy maker, or researcher studying a particular PES (or potential PES) will vary depending on their disciplinary and individual conceptions of PES (Laurans et al. 2012, Mermet et al. 2014). For example, a biophysical scientist may focus on different enabling conditions than a sociologist, and a decision or policy maker could be influenced by their backgrounds as well as economic and political agendas. Many of the articles we studied included authors from multiple backgrounds in terms of varying disciplinary homes, as well as both applied and theoretical directions. This increasing use of multidisciplinary teams for multifaceted social and natural issues is necessary to more holistically advance human and environmental well-being.

#### **Linking payments for ecosystem services (PES) enabling conditions to theoretical perspectives**

We observed clear connections between the broader theoretical perspectives on enabling conditions (e.g., those presented in Table 1) with the literature on PES. Notably, nearly all of the broader theoretical perspectives were reflected in one or more of the articles we reviewed. In fact, many of the articles we analyzed were strongly influenced by these theoretical perspectives and several directly linked their analyses to one or more of the

aforementioned scholars. For instance, several articles were strongly influenced by Coase (1960) and thus emphasized the importance of low transaction costs and clear and secure property rights (e.g., Engel et al. 2008, Sattler and Matzdorf 2013, Wunder 2013). This is perhaps not surprising given that some scholars attribute the ideas of Coase (1960) and transaction cost economics as foundational to the origin of PES (Engel et al. 2008). Other articles, however, linked to the broader literature on common property regimes (CPRs) or “the commons” and were strongly informed by scholars such as Ostrom (1990) and Agrawal (2001), among others (e.g., Corbera et al. 2009, Fisher et al. 2010, Muñoz Escobar et al. 2013). Swallow et al. (2010) integrated multiple theoretical perspectives in their analysis including examining the conditions necessary for policy diffusion provided by Kern et al. (2001). Despite the strong connections of several articles to the broader theoretical literature, over half the articles we reviewed were not clearly linked to a theoretical perspective and were largely theory neutral. This suggests that this applied research could be better connected to theory to structure analyses and further develop the theoretical basis underlying the concept of enabling conditions.

Our analysis suggests several key findings related to the theory on enabling conditions. For one, we observed significant overlap and broad agreement on many of the individual enabling conditions for PES and those outlined by the theoretical perspectives on enabling conditions, even though the specific terminology diverged. For instance, the enabling conditions we identified had many similarities with the list of conditions Agrawal (2001) synthesized regarding the sustainable management of common property. This is especially notable given our particular policy focus on PES and Agrawal’s focus on common property resource regimes. Our synthesis builds on Agrawal’s analysis by integrating insights from other fields such as transaction cost economics (e.g., Coase 1960) and biophysical sciences, which are more prevalent in ecosystem services studies. Because there was significant overlap across the theoretical perspectives, these orientations are not as “siloeed” as they appear and their points of divergence are likely because of differences in contexts examined and authors’ emphasis on efficiency, effectiveness, or equity issues. This suggests that there is an opportunity to better connect these diverse conversations through an integration of language and a synthetic theoretical framework, such as the social-ecological systems (SES) framework developed by Ostrom and colleagues (Ostrom 2007, 2009, Bennett and Gosnell 2014, McGinnis and Ostrom 2014). There were, however, key differences between the PES-focused literature and the theoretical literature on enabling conditions. Notably, the PES literature gives much stronger emphasis to the biophysical characteristics of social-ecological systems. This clear emphasis in the literature illustrates the influence of preexisting biophysical context on the range of possible policy approaches. Given that much of the research on enabling conditions has emerged from the social sciences, we share a similar view as Vogt et al. (2015) with regard to Ostrom’s SES framework and argue for an increased integration of biophysical perspectives to advance the theoretical foundations of enabling conditions. Focusing on a topic that has significant participation from physical scientists, such as PES or ecosystem services policies more generally, could provide valuable insights into the range of possible policy scenarios in a given ecological system.

## CONCLUSION

Through a review of key literature from different disciplinary perspectives, we sought to understand how researchers and practitioners refer to and identify enabling conditions within the context of PES. We summarized the recent and expanding literature to identify the diverse ways in which enabling conditions are described in the literature in relation to PES. We then synthesized the findings from these diverse fields to develop a more cohesive set of enabling conditions resulting in biophysical, economic, governance, and sociocultural conditions. We used this analysis of literature to develop a theory on social-ecological enabling conditions by integrating insights from multiple disciplinary fields, bridge multiple disciplines, and connect conversations occurring in various venues on the topic of enabling conditions for PES.

We found that in many cases, enabling conditions research related to PES was disaggregated into different theoretical perspectives. Our work aligns with a recent focus on studying social-ecological systems, and highlights social and ecological considerations that need to be taken into account in developing environmental policies such as payments for ecosystem services. Globally, as we face intensifying natural resource concerns, issues of environmental policy will be increasingly important for areas of further research. Developing robust theory around the conditions necessary for implementing novel policy approaches will help guide those working in programs on the ground and enhance their ability to address increasingly complex ecological and social issues.

*Responses to this article can be read online at:*

<http://www.ecologyandsociety.org/issues/responses.php/8979>

---

## Acknowledgments:

*This work was supported by the National Socio-Environmental Synthesis Center (SESYNC) under funding received from the National Science Foundation DBI-1052875. The authors are all part of the "Enabling payments for watershed services" 2015-2016 SESYNC team, and thank SESYNC for their support of this work (<https://www.sesync.org/project/graduate-student-pursuit-rfp/enabling-payments-for-watershed-services>). The authors also extend appreciation to those who helped shaped this research: Beth Tellman, Brendan Fisher, Genevieve Bennett, and Leah Bremer for their review of an earlier version of this manuscript, and Rob McDonald, Joshua Goldstein, Todd Gartner, and Nathaniel Carroll for guiding conversations early in this research. Please note that H. R. Huber-Stearns and D. E. Bennett, the first two authors, contributed equally to this paper.*

---

## LITERATURE CITED

- Agrawal, A. 2001. Common property institutions and sustainable governance of resources. *World Development* 29(10):1649-1672. [http://dx.doi.org/10.1016/s0305-750x\(01\)00063-8](http://dx.doi.org/10.1016/s0305-750x(01)00063-8)
- Anderies, J. M. 2015. Managing variance: key policy challenges for the Anthropocene. *Proceedings of the National Academy of Sciences* 112(47):14402-14403. <http://dx.doi.org/10.1073/pnas.1519071112>

- Armsworth, P. R., and J. E. Roughgarden. 2003. The economic value of ecological stability. *Proceedings of the National Academy of Sciences* 100(12):7147-7151. <http://dx.doi.org/10.1073/pnas.0832226100>
- Asbjornsen, H., A. S. Mayer, K. W. Jones, T. Selfa, L. Saenz, R. K. Kolka, and K. E. Halvorsen. 2015. Assessing impacts of payments for watershed services on sustainability in coupled human and natural systems. *BioScience* 65(6):579-591. <http://dx.doi.org/10.1093/biosci/biv051>
- Baland, J.-M., and J.-P. Platteau. 1996. *Halting degradation of natural resources. Is there a role for rural communities?* Food and Agriculture Organizations of the United Nations, Rome, Italy. [online] URL: <http://www.fao.org/docrep/x5316e/x5316e00.htm> <http://dx.doi.org/10.1093/0198290616.001.0001>
- Balvanera, P., A. B. Pfisterer, N. Buchmann, J.-S. He, T. Nakashizuka, D. Raffaelli, and B. Schmid. 2006. Quantifying the evidence for biodiversity effects on ecosystem functioning and services. *Ecology Letters* 9:1146-1156. <http://dx.doi.org/10.1111/j.1461-0248.2006.00963.x>
- Bauer, R. A., and K. J. Gergen. 1968. *The study of policy formation*. Free Press, New York, New York, USA.
- Bennett, D. E., and H. Gosnell. 2015. Integrating multiple perspectives on payments for ecosystem services through a social-ecological systems framework. *Ecological Economics* 116:172-181. <http://dx.doi.org/10.1016/j.ecolecon.2015.04.019>
- Bennett, D. E., H. Gosnell, S. Lurie, and S. Duncan. 2014. Utility engagement with payments for watershed services in the United States. *Ecosystem Services* 8:56-64. <http://dx.doi.org/10.1016/j.ecoser.2014.02.001>
- Berkes, F., J. Colding, and C. Folke. 2003. *Navigating social-ecological systems: building resilience for complexity and change*. Cambridge University Press, Cambridge, UK. <http://dx.doi.org/10.1017/cbo9780511541957>
- Biggs, R., M. Schlüter, D. Biggs, E. L. Bohensky, S. BurnSilver, G. Cundill, V. Dakos, T. M. Daw, L. S. Evans, K. Kotschy, A. M. Leitch, C. Meek, A. Quinlan, C. Raudsepp-Hearne, M. D. Robards, M. L. Schoon, L. Schultz, and P. C. West. 2012. Toward principles for enhancing the resilience of ecosystem services. *Annual Review of Environment and Resources* 37:421-448. <http://dx.doi.org/10.1146/annurev-environ-051211-123836>
- Boyd, J., and S. Banzhaf. 2007. What are ecosystem services? The need for standardized environmental accounting units. *Ecological Economics* 63:616-626. <http://dx.doi.org/10.1016/j.ecolecon.2007.01.002>
- Coase, R. H. 1960. The problem of social cost. *Journal of Law and Economics* 3:1-44. <http://dx.doi.org/10.1086/466560>
- Corbera, E., C. G. Soberanis, and K. Brown. 2009. Institutional dimensions of payments for ecosystem services: an analysis of Mexico's carbon forestry programme. *Ecological Economics* 68(3):743-761. <http://dx.doi.org/10.1016/j.ecolecon.2008.06.008>
- Creswell, J. W. 2009. *Research design: qualitative, quantitative, and mixed methods approaches*. Third edition. Sage, Thousand Oaks, California, USA.
- Daily, G. 1997. *Nature's services: societal dependence on natural ecosystems*. Island, Washington, D.C., USA.
- Dawson, R. E., and J. A. Robinson. 1963. Inter-party competition, economic variables and welfare policies in the American states. *Journal of Politics* 25(2):265-289. <http://dx.doi.org/10.2307/2127465>
- Díaz, S., D. Tilman, J. Fargione, F. S. Chapin, III, R. Dirzo, T. Kitzberger, B. Gemmill, M. Zobel, M. Vilá, C. Mitchell, A. Wilby, G. C. Daily, M. Galetti, W. F. Laurance, J. Pretty, R. L. Naylor, A. Power, and D. Harvell. 2005. Biodiversity regulation of ecosystem services. Pages 279-329 in *Ecosystems and human well-being: current state and trends*. Island, Washington, D.C., USA.
- Dye, T. R. 1965. Malapportionment and public policy in the United States. *Journal of Politics* 27(3):586-601. <http://dx.doi.org/10.2307/2127741>
- Engel, S., S. Pagiola, and S. Wunder. 2008. Designing payments for environmental services in theory and practice: an overview of the issues. *Ecological Economics* 65(4):663-674. <http://dx.doi.org/10.1016/j.ecolecon.2008.03.011>
- Ferraro, P. J., and A. Kiss. 2003. Direct payments to conserve biodiversity. *Himalayan Journal of Sciences* 1(2):81-83. <http://dx.doi.org/10.3126/hjs.v1i2.200>
- Fisher, B., K. Kulindwa, I. Mwanyoka, R. K. Turner, and N. D. Burgess. 2010. Common pool resource management and PES: lessons and constraints for water PES in Tanzania. *Ecological Economics* 69(6):1253-1261. <http://dx.doi.org/10.1016/j.ecolecon.2009.11.008>
- Foley, J. A., R. DeFries, G. P. Asner, C. Barford, G. Bonan, S. R. Carpenter, F. S. Chapin, M. T. Coe, G. C. Daily, H. K. Gibbs, J. H. Helkowski, T. Holloway, E. A. Howard, C. J. Kucharik, C. Monfreda, J. A. Patz, I. C. Prentice, N. Ramankutty, and P. K. Snyder. 2005. Global consequences of land use. *Science* 309(5734): 570-574. <http://dx.doi.org/10.1126/science.1111772>
- Folke, C., T. Hahn, P. Olsson, and J. Norberg. 2005. Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources* 30:441-473. <http://dx.doi.org/10.1146/annurev.energy.30.050504.144511>
- Goldman-Benner, R. L., S. Benitez, T. Boucher, A. Calvache, G. Daily, P. Kareiva, T. Kroeger, and A. Ramos. 2012. Water funds and payments for ecosystem services: practice learns from theory and theory can learn from practice. *Oryx* 46(01):55-63. <https://doi.org/10.1017/S0030605311001050>
- Gómez-Baggethun, E., R. de Groot, P. L. Lomas, and C. Montes. 2010. The history of ecosystem services in economic theory and practice: from early notions to markets and payment schemes. *Ecological Economics* 69:1209-1218. <http://dx.doi.org/10.1016/j.ecolecon.2009.11.007>
- Hansen, C., K. Buckingham, S. Dewitt, and L. Laestadius. 2015. *The restoration diagnostic: a method for developing forest landscape restoration strategies by rapidly assessing the status of key success factors*. World Resources Institute Report. World Resources Institute, Washington, D.C., USA. [online] URL: [https://www.wri.org/sites/default/files/WRI\\_Restoration\\_Diagnostic\\_0.pdf](https://www.wri.org/sites/default/files/WRI_Restoration_Diagnostic_0.pdf)
- Hofferbert, R. I. 1966. The relation between public policy and some structural and environmental variables in the American states. *American Political Science Review* 60(1):73-82. <http://dx.doi.org/10.2307/1953808>

- Huang, M., S. K. Upadhyaya, R. Jindal, and J. Kerr. 2009. Payments for watershed services in Asia: a review of current initiatives. *Journal of Sustainable Forestry* 28(3-5):551-575. <http://dx.doi.org/10.1080/10549810902794287>
- Huber-Stearns, H. R., J. H. Goldstein, A. S. Cheng, and T. P. Toombs. 2015. Institutional analysis of payments for watershed services in the western United States. *Ecosystem Services* 16:83-93. <http://dx.doi.org/10.1016/j.ecoser.2015.10.009>
- Huber-Stearns, H. R., J. H. Goldstein, and E. A. Duke. 2013. Intermediary roles and payments for ecosystem services: a typology and program feasibility application in Panama. *Ecosystem Services* 6:104-116. <http://dx.doi.org/10.1016/j.ecoser.2013.09.006>
- Jack, B. K., C. Kousky, and K. R. E. Sims. 2008. Designing payments for ecosystem services: lessons from previous experience with incentive-based mechanisms. *Proceedings of the National Academy of Sciences* 105(28):9465-9470. <http://dx.doi.org/10.1073/pnas.0705503104>
- Keeler, B. L., S. Polasky, K. A. Brauman, K. A. Johnson, J. C. Finlay, A. O'Neill, K. Kovacs, and B. Dalzell. 2012. Linking water quality and well-being for improved assessment and valuation of ecosystem services. *Proceedings of the National Academy of Sciences* 109(45):18619-18624. <http://dx.doi.org/10.1073/pnas.1215991109>
- Kemkes, R. J., J. Farley, and C. J. Koliba. 2010. Determining when payments are an effective policy approach to ecosystem service provision. *Ecological Economics* 69(11):2069-2074. <http://dx.doi.org/10.1016/j.ecolecon.2009.11.032>
- Kern, K., H. Jörgens, and M. Jänicke. 2001. *The diffusion of environmental policy innovations: a contribution to the globalisation of environmental policy*. WZB, Berlin, Germany.
- Kinzig, A. P., C. Perrings, F. S. Chapin, III, S. Polasky, V. K. Smith, D. Tilman, and B. L. Turner, II. 2011. Paying for ecosystem services - promise and peril. *Science* 334(6056):603-604. <http://dx.doi.org/10.1126/science.1210297>
- Koontz, T., and J. Newig. 2014. From planning to implementation: top-down and bottom-up approaches for collaborative watershed management. *Policy Studies Journal* 42(3):416-442. <http://dx.doi.org/10.1111/psj.12067>
- Kosoy, N., and E. Corbera. 2010. Payments for ecosystem services as commodity fetishism. *Ecological Economics* 69(6):1228-1236. <http://dx.doi.org/10.1016/j.ecolecon.2009.11.002>
- Kremen, C. 2005. Managing ecosystem services: what do we need to know about their ecology? *Ecology Letters* 8(5):468-479. <http://dx.doi.org/10.1111/j.1461-0248.2005.00751.x>
- Kroeger, T., and F. Casey. 2007. An assessment of market-based approaches to providing ecosystem services on agricultural lands. *Ecological Economics* 64(2):321-332. <http://dx.doi.org/10.1016/j.ecolecon.2007.07.021>
- Kushner, B., R. Waite, M. Jungwiwattanaporn, and L. Burke. 2012. *Influence of coastal economic valuations in the Caribbean: enabling conditions and lessons learned*. World Resources Institute, Washington, D.C., USA. [online] URL: <http://www.wri.org/publication/influence-coastal-economic-valuations-caribbean>
- Lambin, E. F., P. Meyfroidt, X. Rueda, A. Blackman, J. Börner, P. O. Cerutti, T. Dietsch, L. Jungmann, P. Lamarque, J. Lister, N. F. Walker, and S. Wunder. 2014. Effectiveness and synergies of policy instruments for land use governance in tropical regions. *Global Environmental Change* 28:129-140. <http://dx.doi.org/10.1016/j.gloenvcha.2014.06.007>
- Laurans, Y., T. Leménager, and S. Aoubid. 2012. *Payments for ecosystem services: from theory to practice: what are the prospects for developing countries*. Agence Française de Développement, Paris, France. [online] URL: <http://bibliothèque.afd.fr/en/payments-for-ecosystem-services-from-theory-to-practice-what-are-the-prospects-for-developing-countries/>
- Lockie, S. 2013. Market instruments, ecosystem services, and property rights: assumptions and conditions for sustained social and ecological benefits. *Land Use Policy* 31:90-98. <http://dx.doi.org/10.1016/j.landusepol.2011.08.010>
- Lombard, M., J. Snyder-Duch, and C. Campanella Bracken. 2002. Content analysis in mass communication. Assessment and reporting of intercoder reliability. *Human Communications Research* (284):587-604. <http://dx.doi.org/10.1111/j.1468-2958.2002.tb00826.x>
- Manheim, J. B., C. R. Rich, L. Willnat, and C. L. Brians. 2007. *Empirical political analysis: qualitative and quantitative research methods*. Seventh edition. Pearson, New York, New York, USA.
- McGinnis, M. D., and E. Ostrom. 2014. Social-ecological systems framework: initial changes and continuing challenges. *Ecology and Society* 19(2):30. <http://dx.doi.org/10.5751/es-06387-190230>
- McKenzie, E., S. Posner, P. Tillmann, J. R. Bernhardt, K. Howard, and A. Rosenthal. 2014. Understanding the use of ecosystem service knowledge in decision making: lessons from international experiences of spatial planning. *Environment and Planning C: Politics and Space* 32(2):320. <http://dx.doi.org/10.1068/c12292j>
- Mermet, L., Y. Laurans, and T. Leménager. 2014. *Tools for what trade? Analysing the utilisation of economic instruments and valuations in biodiversity management*. Agence Française de Développement, Paris, France. [online] URL: <http://www.iddri.org/Publications/Tools-for-what-trade-Analysing-the-Utilisation-of-Economic-Instruments-and-Valuations-in-Biodiversity-Management>
- Mitchell, M. G. E., E. M. Bennett, and A. Gonzalez. 2013. Linking landscape connectivity and ecosystem service provision: current knowledge and research gaps. *Ecosystems* 16(5):894-908. <http://dx.doi.org/10.1007/s10021-013-9647-2>
- Muñoz Escobar, M., R. Hollaender, and C. Pineda Weffer. 2013. Institutional durability of payments for watershed ecosystem services: lessons from two case studies from Columbia and Germany. *Ecosystem Services* 6:46-53. <http://dx.doi.org/10.1016/j.ecoser.2013.04.004>
- Muradian, R., M. Arsel, L. Pellegrini, F. Adaman, B. Aguilar, B. Agarwal, E. Corbera, D. Ezzine de Blas, J. Farley, G. Froger, E. E. Garcia-Frapolli, E. Gómez-Baggethun, J. Gowdy, N. Kosoy, J. F. Le Coq, P. Leroy, P. May, P. Méral, P. Mibielli, R. Norgaard, B. Ozkaynak, U. Pascual, W. Pengue, M. Perez, D. Pesche, R. Pirard, J. Ramos-Martin, L. Rival, F. Saenz1, G. Van Hecken, A. Vatn, B. Vira, and K. Urama. 2013. Payments for ecosystem

- services and the fatal attraction of win-win solutions. *Conservation Letters* 6(4):274-279. <http://dx.doi.org/10.1111/j.1755-263X.2012.00309.x>
- Muradian, R., E. Corbera, U. Pascual, N. Kosoy, and P. H. May. 2010. Reconciling theory and practice: an alternative conceptual framework for understanding payments for environmental services. *Ecological Economics* 69(6):1202-1208. <http://dx.doi.org/10.1016/j.ecolecon.2009.11.006>
- Naeem, S., J. C. Ingram, A. Varga, T. Agardy, P. Barten, G. Bennett, E. Bloomgarden, L. L. Bremer, P. Burkill, M. Cattau, C. Ching, M. Colby, D. C. Cook, R. Costanza, F. DeClerck, C. Freund, T. Gartner, R. Goldman-Benner, J. Gunderson, D. Jarrett, A. P. Kinzig, A. Kiss, A. Koontz, P. Kumar, J. R. Lasky, M. Masozera, D. Meyers, F. Milano, L. Naughton-Treves, E. Nichols, L. Olander, P. Olmsted, E. Perge, C. Perrings, S. Polasky, J. Potent, C. Prager, F. Quétier, K. Redford, K. Saterson, G. Thoumi, M. T. Vargas, S. Vickerman, W. Weisser, D. Wilkie, and S. Wunder. 2015. Get the science right when paying for nature's services. *Science* 347(6227):1206-1207. <http://dx.doi.org/10.1126/science.aaa1403>
- Nahlik, A. M., M. E. Kentula, M. S. Fennessy, and D. H. Landers. 2012. Where is the consensus? A proposed foundation for moving ecosystem service concepts into practice. *Ecological Economics* 77:27-35. <http://dx.doi.org/10.1016/j.ecolecon.2012.01.001>
- Ostrom, E. 1990. *Governing the commons: the evolution of institutions for collective action*. Cambridge University Press, Cambridge, UK.
- Ostrom, E. 2007. A diagnostic approach for going beyond panaceas. *Proceedings of the National Academy of Sciences* 104(39):15181-15187. <http://dx.doi.org/10.1073/pnas.0702288104>
- Ostrom, E. 2009. A general framework for analyzing sustainability of social-ecological systems. *Science* 325:419-422. <http://dx.doi.org/10.1126/science.1172133>
- Ozment, S., T. Gartner, H. Huber-Stearns, K. DiFrancesco, N. Lichten, and S. Tognetti. 2016. *Protecting drinking water at the source: lessons from watershed investment programs in the United States*. World Resources Institute Report. World Resources Institute, Washington, D.C., USA. [online] URL: <http://www.wri.org/publication/protecting-drinking-water-source>
- Paavola, J., and K. Hubacek. 2013. Ecosystem services, governance, and stakeholder participation: an introduction. *Ecology and Society* 18(4):42. <http://dx.doi.org/10.5751/es-06019-180442>
- Patton, M. Q. 2002. *Qualitative research and evaluation methods*. Third edition. Sage, Thousand Oaks, California, USA.
- Pham, T. T., B. M. Campbell, S. Garnett, H. Aslin, and M. H. Hoang. 2010. Importance and impacts of intermediary boundary organizations in facilitating payment for environmental services in Vietnam. *Environmental Conservation* 37:64-72. <http://dx.doi.org/10.1017/S037689291000024X>
- Pirard, R. 2012. Payments for environmental services in the public policy landscape: "mandatory" spices in the Indonesian recipe. *Forest Policy and Economics* 18:23-29. <http://dx.doi.org/10.1016/j.forpol.2011.09.002>
- Ponette-González, A. G., E. Marín-Spiotta, K. A. Brauman, K. A. Farley, K. C. Weathers, and K. R. Young. 2013. Hydrologic connectivity in the high-elevation tropics: heterogeneous responses to land change. *BioScience* 64(2):92-104. <http://dx.doi.org/10.1093/biosci/bit013>
- Posner, S. M., E. McKenzie, and T. H. Ricketts. 2016. Policy impacts of ecosystem services knowledge. *Proceedings of the National Academy of Sciences* 113(7):1760-1765. <http://dx.doi.org/10.1073/pnas.1502452113>
- Postel, S. L., and B. H. Thompson, Jr. 2005. Watershed protection: capturing the benefits of nature's water supply services. *Natural Resources Forum* 29(2):98-108. <http://dx.doi.org/10.1111/j.1477-8947.2005.00119.x>
- Quintero, M., S. Wunder, and R. D. Estrada. 2009. For services rendered? Modeling hydrology and livelihoods in Andean payments for environmental services schemes. *Forest Ecology and Management* 258(9):1871-1880. <http://dx.doi.org/10.1016/j.foreco.2009.04.032>
- Rands, M. R. W., W. M. Adams, L. Bennun, S. H. M. Buchart, A. Clements, D. Coomes, A. Entwistle, I. Hodge, V. Kapos, J. P. W. Scharlemann, W. J. Sutherland, and B. Vira. 2010. Biodiversity conservation: challenges beyond 2010. *Science* 329:1298-1303. <http://dx.doi.org/10.1126/science.1189138>
- Ricketts, T. H., K. B. Watson, I. Koh, A. M. Ellis, C. C. Nicholson, S. Posner, L. L. Richardson, and L. J. Sontner. 2016. Disaggregating the evidence linking biodiversity and ecosystem services. *Nature Communications* 7:13106. <http://dx.doi.org/10.1038/ncomms13106>
- Rosenthal, A., G. Verutes, E. McKenzie, K. K. Arkema, N. Bhagabati, L. L. Bremer, N. Olwero, and A. L. Vogl. 2015. Process matters: a framework for conducting decision-relevant assessments of ecosystem services. *International Journal of Biodiversity Science, Ecosystem Services, and Management* 11(3):190-204. <http://dx.doi.org/10.1080/21513732.2014.966149>
- Ruckelshaus, M., E. McKenzie, H. Tallis, A. Guerry, G. Daily, P. Kareiva, S. Polasky, T. Ricketts, N. Bhagabati, S. A. Wood, and J. Bernhardt. 2015. Notes from the field: lessons learned from using ecosystem service approaches to inform real-world decisions. *Ecological Economics* 115:11-21. <http://dx.doi.org/10.1016/j.ecolecon.2013.07.009>
- Sabatier, P. A. 1986. Top-down and bottom-up models of policy implementation: a critical analysis and suggested synthesis. *Journal of Public Policy* 6:21-48. <http://dx.doi.org/10.1017/S0143814X00003846>
- Sattler, C., and B. Matzdorf. 2013. PES in a nutshell: from definitions and origins to PES in practice - approaches, design process and innovative aspects. *Ecosystem Services* 6:2-11. <http://dx.doi.org/10.1016/j.ecoser.2013.09.009>
- Sharkansky, I. 1970. *Policy analysis in political science*. Markham, Chicago, Illinois, USA.
- Sommerville, M. M., J. P. G. Jones, and E. J. Milner-Gulland. 2009. A revised conceptual framework for payments for environmental services. *Ecology and Society* 14(2):34. [online] URL: <http://www.ecologyandsociety.org/vol14/iss2/art34/> <http://dx.doi.org/10.5751/es-03064-140234>

- Sternlieb, F., R. P. Bixler, H. Huber-Stearns, and C. Huayhuaca. 2013. A question of fit: reflections on boundaries, organizations and social-ecological systems. *Journal of Environmental Management* 130:117-125. <http://dx.doi.org/10.1016/j.jenvman.2013.08.053>
- Swallow, B. M., B. Leimona, T. Yatich, and S. J. Velarde. 2010. The conditions for functional mechanisms of compensation and reward for environmental services. *Ecology and Society* 15(4):6. [online] URL: <http://www.ecologyandsociety.org/vol15/iss4/art6/>
- Tacconi, L. 2012. Redefining payments for environmental services. *Ecological Economics* 73:29-36. <http://dx.doi.org/10.1016/j.ecolecon.2011.09.028>
- Turner, M. G., D. C. Donato, and W. H. Romme. 2013. Consequences of spatial heterogeneity for ecosystem services in changing forest landscapes: priorities for future research. *Landscape Ecology* 28:1081-1097. <http://dx.doi.org/10.1007/s10980-012-9741-4>
- van Noordwijk, M., and B. Leimona. 2010. Principles for fairness and efficiency in enhancing environmental services in Asia: payments, compensation, or co-investment? *Ecology and Society* 15(4):17. [online] URL: <http://www.ecologyandsociety.org/vol15/iss4/art17/>
- van Noordwijk, M., B. Leimona, L. Emerton, T. P. Tomich, S. J. Velarde, M. Kallesoe, M. Sekher, and B. Swallow, 2007. *Criteria and indicators for environmental service compensation and reward mechanisms: realistic, voluntary, conditional and pro-poor*. CES Scoping Study Issue Paper No. 2., ICRAF Working Paper No. 37. World Agroforestry Centre, Nairobi, Kenya. [online] URL: <http://www.worldagroforestry.org/downloads/Publications/PDFS/WP14964.pdf>
- Vatn, A. 2010. An institutional analysis of payments for environmental services. *Ecological Economics* 69(6):1245-1252. <http://dx.doi.org/10.1016/j.ecolecon.2009.11.018>
- Vogt, J. M., G. B. Epstein, S. K. Mincey, B. C. Fischer, and P. McCord. 2015. Putting the “E” in SES: unpacking the ecology in the Ostrom social-ecological system framework. *Ecology and Society* 20(1):55. <http://dx.doi.org/10.5751/es-07239-200155>
- Wade, R. 1988. *Village republics: economic conditions for collective action in South India*. ICS, San Francisco, California, USA.
- Waite, R., B. Kushner, M. Jungwiwattanaporn, E. Gray, and L. Burke. 2015. Use of coastal economic valuation in decision making in the Caribbean: enabling conditions and lessons learned. *Ecosystem Services* 11:45-55. <http://dx.doi.org/10.1016/j.ecoser.2014.07.010>
- Walker, B. H., L. H. Gunderson, A. P. Kinzig, C. Folke, S. R. Carpenter, and L. Schultz. 2006. A handful of heuristics and some propositions for understanding resilience in social-ecological systems. *Ecology and Society* 11(1):13. [online] URL: <http://www.ecologyandsociety.org/vol11/iss1/art13/> <http://dx.doi.org/10.5751/es-01530-110113>
- Weible, C. M. 2014. Introducing the scope and focus of policy process research and theory. Pages 3-21 in P. A. Sabatier and C. M. Weible, editors. *Theories of the policy process*. Westview, Boulder, Colorado, USA.
- Wunder, S. 2005. *Payments for environmental services: some nuts and bolts*. CIFOR Occasional Paper, No. 42. Center for International Forestry Research, Jakarta, Indonesia. [online] URL: [http://www.cifor.org/publications/pdf\\_files/OccPapers/OP-42.pdf](http://www.cifor.org/publications/pdf_files/OccPapers/OP-42.pdf)
- Wunder, S. 2013. When payments for environmental services will work for conservation. *Conservation Letters* 6(4):230-237. <http://dx.doi.org/10.1111/conl.12034>

## Appendix A. Enabling conditions for PES programs identified from the literature with citations

	Enabling Condition	Summary of Enabling Condition	Citations
<b>Biophysical Conditions</b>	Small resource area <sup>a; 1</sup>	Smaller areas providing ES (as opposed to larger) facilitates the development of PES.	Fisher et al. 2010
	Resource location and arrangement <sup>a; 1</sup>	Proximity of beneficiaries to the location of ES provision facilitates the development of PES. Greater connectivity of intact ecosystems enhances provision of ES. Type and arrangement of land use impacts provision of ES.	Foley et al. 2005; Kremen 2005; Sommerville et al. 2009; Fisher et al. 2010; Mitchell et al. 2013; Muñoz Escobar et al. 2013; Turner et al. 2013 Wunder 2013;
	Well-defined boundaries of PES system <sup>a, b; 2</sup>	A confined resource system with clearly identified ES providers and beneficiaries and knowledge of resource system boundaries both spatial and functional facilitates development of PES.	Armsworth & Roughgarden 2003 Huang et al. 2009; Fisher et al. 2010; Kemkes et al. 2010; Asbjornsen et al. 2015
	Existing fundamental ecosystem science and baseline data <sup>a; 2</sup>	Basic scientific understanding of the ecological processes and interactions among ES in the specific ecosystem targeted by a program facilitates PES.	Postel & Thompson 2005 Kroeger & Casey 2007; Engel et al. 2008; Jack et al. 2008; Corbera et al. 2009; Huang et al. 2009; Sommerville et al. 2009; Rands et al. 2010; Swallow et al. 2010; van Noordwijk & Leimona 2010; Keeler et al. 2012; Lockie 2013; Ponette-Gonzalez et al. 2014; Asbjornsen et al. 2015; Rosenthal et al. 2015; Ruckelshaus et al. 2015
	Linkages between ES provision and management practices <sup>a, b, c; 2</sup>	The presence of a clear link between quantifiable management practices or readily monitored ecosystem functions and the provision of ES enables PES.	Kremen 2005; Balvanera et al. 2006; Quintero et al. 2009; Rands et al. 2010; Ponette-Gonzalez et al 2014; Asbjornsen et al. 2015; Rosenthal et al. 2015; Ruckelshaus et al. 2015
	Clear threat or risk to ES provision <sup>a, c; 1</sup>	Clear threats or risks to ES provision can facilitate development of PES by increasing demand for ES or stimulating increased awareness of ES benefits and their need for conservation among beneficiaries.	Kemkes et al. 2010; Rands et al. 2010; Swallow et al. 2010 Waite et al. 2015
<b>Economic Conditions</b>	Significant value of ES <sup>a, c; 2</sup>	When ES have clear value and benefits to human communities, efforts to protect these ES are more likely to occur since beneficiaries have incentive to compensate ES providers for provision.	Kroeger & Casey 2007; Engel et al. 2008; Keeler et al. 2012; Ruckelshaus et al. 2015; Waite et al. 2015
	Low opportunity costs <sup>a, b, c; 2</sup>	Where the value of the payments exceed the value of alternative land uses to the ES provider and the alternative ways of receiving the same benefit exceed the cost of the ES payment for the buyer PES are more likely to occur.	Engel et al. 2008; Jack et al. 2008; Sommerville et al. 2009; Muradian et al. 2010; van Noordwijk & Leimona 2010; Muradian et al. 2013; Sattler & Matzdorf 2013; Wunder 2013
	Manageable transaction costs <sup>a, b, c; 2</sup>	Manageable transaction costs increases the viability of PES. Low number of actors or organizational structures such as ES provider groups and ES that are easier to monitor help to reduce transaction costs.	Kroeger & Casey 2007; Engel et al. 2008; Corbera et al. 2009; Huang et al. 2009; Sommerville et al. 2009; Kemkes et al. 2010; Swallow et al. 2010; Sattler & Matzdorf 2013; Lockie 2013; Wunder 2013

<b>Economic</b>	Defining ES as an economic good or service <sup>a; 2</sup>	Rival and excludable goods make it easier to design PES than non-rival and non-excludable goods, however, monopsony can help overcome these challenges. Agreed upon methods for measuring and valuing ES can also help in defining an ES as economic good or service and facilitate PES development	Postel & Thompson 2005; Kroeger & Casey 2007; Engel et al. 2008; Jack et al. 2008; Kemkes et al. 2010; Sattler & Matzdorf 2013
	Economic growth <sup>a; 1</sup>	Rapid economic growth at local or national scales may increase the interest in and resources available for PES.	Huang et al. 2009
<b>Governance Conditions</b>	Presence/absence of Intermediaries <sup>a, b, c; 3</sup>	The presence or absence of intermediaries such as “boundary organizations” may influence PES development and implementation. [+] Some suggest intermediaries facilitate PES by providing technical resources and bridging trust gaps among buyers and sellers. [-] Others suggest intermediaries may inhibit PES by preventing direct interactions and negotiation.	[+] Engel et al. 2008; Kemkes et al. 2010; van Noordwijk & Leimona 2010; Sattler and Matzdorf 2013; [-] Sommerville et al. 2009
	Strong capacity among actors <sup>a, b, c; 3</sup>	Knowledge, technical expertise, financial resources, and stability of NGOs, agencies, and ES sellers facilitate PES. Strong capacity of non-state actors may compensate for weak state institutions.	Engel et al. 2008; Jack et al. 2008; Corbera et al. 2009; Huang et al. 2009; Sommerville et al. 2009; Swallow et al. 2010; Lockie 2013; Huber-Stearns et al. 2013; Lambin et al. 2014; Rosenthal et al. 2015; Ruckelshaus et al. 2015; Waite et al. 2015
	Influential champion <sup>a, b; 2</sup>	Presence of an influential supporter of PES such as politician or prominent NGO can help overcome inertia.	Swallow et al. 2010; Rosenthal et al. 2015; Ruckelshaus et al. 2015; Waite et al. 2015
	Strong existing institutions <sup>a, b; 1</sup>	Strong institutions (e.g., laws, policies, norms) can help the enforcement and adjudication of PES rules to ensure conditionality and provide clear and accepted mechanisms for revising rules. Pre-existing institutions that support conservation efforts can also provide the background in which PES can be designed to fill specific gaps.	Postel & Thompson 2005; Kroeger & Casey 2007; Engel et al. 2008; Corbera et al. 2009; Huang et al. 2009; Sommerville et al. 2009; Fisher et al. 2010; Rands et al. 2010; Swallow et al. 2010; Pirard 2012; Huber-Stearns et al. 2013; Lockie 2013; Muñoz Escobar et al. 2013; Muradian et al. 2013; Sattler and Matzdorf 2013; Ruckelshaus et al. 2015; Waite et al. 2015
	Secure land tenure and property type <sup>a, b, c; 2</sup>	Secure tenure and clearly defined property rights facilitate PES. Property type (e.g., private [+], public [+ or -], communal [-]) may also influence PES development.	Postel and Thompson 2005; Engel et al. 2008; Jack et al. 2008; Huang et al. 2009; Sommerville et al. 2009; Rands et al. 2010; Swallow et al. 2010; van Noordwijk & Leimona 2010; Sattler & Matzdorf 2013; Wunder 2013; Lambin et al. 2014
	Fit of governance structure with scale of PES <sup>b; 3</sup>	The governance structure ideally fits the scale of the PES. Local governance typically facilitates PES development more than top-down/hierarchical structures	Postel & Thompson 2005; Corbera et al. 2009; Huang et al. 2009; Sommerville et al. 2009; Ruckelshaus et al. 2015; Waite et al. 2015
	Multiple/single PES objectives <sup>a, b; 3</sup>	[+] Some scholars suggest multiple goals including social or economic development objectives facilitate PES development. [-] Others argue multiple objectives hinder PES.	Sommerville et al. 2009; Muradian et al. 2010; Kinzig et al. 2011

<b>Social-Cultural Conditions</b>	Trust and transparency among actors <sup>a, b, c; 2</sup>	High levels of trust and transparency among actors creates an environment of perceived fairness conducive to PES	Wunder 2013; Corbera et al. 2009; Fisher et al. 2010; Muradian et al. 2010; Rands et al. 2010; Swallow et al. 2010; van Noordwijk & Leimona 2010; Lambin et al. 2015; Rosenthal et al. 2015; Ruckelshaus et al. 2015
	Stakeholder communication and engagement <sup>a, b, c; 3</sup>	Stakeholder involvement and communication in design and implementation can increase the buy-in and perceived legitimacy of PES among actors	Engel et al. 2008; van Noordwijk & Leimona 2010; Sattler & Matzdorf 2013; Rosenthal et al. 2015; Ruckelshaus et al. 2015; Waite et al. 2015
	Pre-existing market-based culture <sup>a; 1</sup>	A preexisting culture in which compensation is common or expected can facilitate PES	Huang et al. 2009; Lockie 2013; Wunder 2013
	Participant willingness <sup>a, b, c; 2</sup>	PES is facilitated when participation by providers is voluntary and there is strong support from ES buyers even if buyer participation is compulsory (e.g., government supported programs)	Postel & Thompson 2005; Jack et al. 2008; Sommerville et al. 2009; Pirard 2012; Sattler & Matzdorf 2013
	Proximity of actors to each other <sup>a; 1</sup>	Spatial proximity of actors, especially buyers and sellers, to each other facilitates PES	Engel et al. 2008; Fisher et al. 2010; Muradian et al. 2010; Kinzig et al. 2011
	Large/small number of actors <sup>a; 2</sup>	[+] Some authors suggest smaller groups are easier to organize. [-] Others suggest smaller groups may not have a critical mass to overcome transaction costs or spur competition among ES providers.	Corbera et al. 2009; Huang et al. 2009; Fisher et al. 2010; [-] Lockie 2013

*\*The literature differs in directionality for some conditions. In these cases we specify summaries and citations indicating the condition as supporting PES with [+]* and those indicating the condition as inhibiting PES with [-].

*<sup>a, b, c</sup> Superscripts denote the stage(s) of the policy process that the conditions should be considered (a = scoping; b = Implementing; c = Sustaining). These groupings represent our interpretations as the reviewed literature did not directly address the relevant stages of the PES policy process.*

*<sup>1, 2, 3</sup> Superscripts denote the level of influence practitioners likely have over each condition (1 = low; 2 = moderate; 3 = high). These groupings represent our interpretations as the reviewed literature did not directly address the levels of influence that practitioners have over the identified enabling conditions.*