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Intermediary roles and payments for ecosystem services: A typology and program feasibility application in Panama

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ABSTRACT

Intermediaries in payments for ecosystem services (PES) play diverse roles in facilitating transactions between buyers and sellers. From the literature, we identified major roles including information exchange; program design; networking, representation, and mediation; and administration and project coordination; and we evaluated these roles alongside crosscutting institutional factors of influence, process, and context. We applied this typology to a Western Panama case study informing PES feasibility using semi-structured interviews with 34 intermediary organizations to understand current and potential future PES roles, capacity, and connections. We found broad capacity to perform intermediary roles and ways in which the limitations of one organization (or sector) could be compensated for by another organization (sector) through partnerships. The strongest organization-to-organization connections were found between the civil and public sectors working at the local and regional scales, and between intermediaries overall and "supply-side" landowners. While beneficial, these connections highlight the need to ensure that the interests of weakly connected actors, particularly potential buyers, are adequately represented; furthermore, uncertain central government support may affect program development at the regional scale. Our study advances a more synthetic understanding of the intermediary actor landscape in relation to PES institutional analysis, which can inform future project-specific and theoretical analyses.

1. Introduction

Payments for ecosystem services (PES) are an incentive-based conservation policy tool through which ecosystem service buyers compensate sellers who protect, enhance, or restore ecosystem services (Engel et al., 2008; Tacconi, 2012). PES is generally considered first and foremost a tool targeting conservation objectives, but many programs, particularly in the developing world, also incorporate livelihood, equity, and rural economic development objectives (Engel et al., 2008; Pascual et al., 2010).

Alongside the rapid expansion of PES globally, there has been a growing body of literature evaluating its strengths and limitations as a policy tool (e.g., Engel et al., 2008; Brouwer et al., 2011; Redford and Adams, 2009; Swallow et al., 2009; Vatn, 2010). A key need is to ensure that feasibility assessments and new program development are informed by the experience of current (and failed) programs to ensure that PES is an appropriate tool for the new context and that resources will be used effectively to achieve program goals. Recent reports have emphasized that low levels of institutional or legal capacity can cause PES failure, and careful consideration of the broader institutional context is fundamental to PES effectiveness and understanding organizational capacity to address conservation concerns in a region (e.g., Brouwer et al., 2011; Carius, 2012; Pascual et al., 2010; Vatn, 2010).

Actors participating in a PES scheme are one key component to consider, as their interests, capacities, and constraints play an important role in determining how a program is structured, how economic and institutional benefits and costs are distributed, what conflicts may arise, and related factors (Corbera et al., 2009; Pascual et al., 2010; Vatn, 2010). Furthermore, actors may take on different roles at different stages of PES development from initial feasibility assessment to program design, implementation, and adaptation (Carius, 2012). These actor-related considerations, along with broader ecological, economic, political, sociocultural, and institutional contexts, are integral in understanding ecosystem services decision-making, and determining if a PES scheme achieves its intended outcomes (Balvanera et al., 2012; Muradian et al., 2013).

At a minimum, PES schemes require two actor groups: buyers (beneficiaries) of ecosystem services, and sellers (providers) who affect ecosystem services supply. Oftentimes, a third group called

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intermediaries is needed. For the purpose of this study, we define *PES intermediaries* as those actors who take on roles that connect and facilitate transactions between buyers and sellers. Intermediaries are also connected to each other, in order to strengthen connections between buyers and sellers. This definition does not limit the type of actors involved, but rather defines intermediaries by the work they perform instead of their organizational characteristics (Moss et al., 2009). Intermediaries can be a variety of actors, from individuals to organizations to collaborative groups that are connected in some way to different PES stakeholders (Swallow et al., 2009; van Noordwijk and Leimona, 2010). These intermediaries span scales including local, regional, national, and international, and can include organizations from the public, private, civil, and academic sectors (Kemkes et al., 2010; Pham et al., 2010; Swallow et al., 2009).

1.1. Research focus: intermediary roles in PES

An understanding of the potential roles and limitations of PES intermediaries is key to informing PES feasibility assessment, program design, and implementation. While intermediary roles have been discussed in the literature, a systematic review has not yet been conducted that synthesizes current knowledge about the diverse ways in which intermediaries participate in PES. This information would be valuable to advance our understanding of how intermediaries support or impede PES operation, as well as to guide site-specific research that informs PES practitioners about the potential capacities and roles of intermediaries in the project region, strategies for effectively engaging intermediaries, and conflicts that may arise between intermediaries and in their interactions with other actors.

In this context, our research objectives were twofold: (1) to fill an existing gap in the literature by characterizing and evaluating the general types of roles undertaken by PES intermediaries; and (2) to use this categorization to inform analysis of an empirical case study of the potential roles, capacities, and conflicts of intermediary organizations in a region at the initial stage of PES feasibility assessment.

For the first objective, we conducted a literature review to answer the following research questions: (1) what are the general types of roles that intermediaries perform in PES programs? and (2) what broader institutional factors affect intermediary roles, such as influence, process, and context?

For the second objective, we investigated the roles and capacity of organizations currently performing intermediary functions in the Chiriquí province in Western Panama, where stakeholders are exploring the feasibility of developing a regional PES program (Duke, 2010). Through semi-structured interviews, we addressed the following research questions: (1) What roles are intermediary organizations currently performing that contribute to conservation efforts in the study region? (2) What perceived roles could organizations potentially play to contribute to the future design and implementation of a regional PES program? (3) What are the perceived organizational challenges and opportunities for individual organizations and across the study region? (4) How are intermediary organizations in the study system connected, and what are the potential implications of these connections for PES development? Drawing upon the information provided by these questions, we then evaluated intermediary roles in the larger setting of process, influence, and context to understand how the broader actor landscape can affect PES.

Given the early stage of PES assessment being undertaken by local stakeholders (as described below in Section 2), our intention was to provide actionable research findings about the intermediary actor landscape and how this might shape the institutional design of a future PES scheme in the region. This case study also provided a concrete context in which to evaluate the utility of the PES intermediaries typology that we developed in terms of its ability to guide place-based PES feasibility assessment.

2. Methods

2.1. Literature review and typology development

For the first stage of our research, we developed a typology of PES intermediary roles based upon a review of existing PES literature on intermediaries, and additional key references on intermediaries in other bodies of literature, including the following references: Bracer et al. (2007), Carius (2012), Corbera et al. (2007a), Howells (2006), Leimona and Lee (2008), Locatelli et al. (2008), Milder et al. (2010), Mike and Simon (2008), Moss (2009), Moss et al. (2009), Pagiola et al. (2005), Peskett et al. (2011), Pham et al. (2010), Sternlieb et al. (2013), Swallow et al. (2009), van Noordwijk et al. (2007), and Vatn (2010). The body of literature on PES intermediaries is relatively small but growing; information has been focused more on theoretical considerations, but is shifting towards practical examples (Carius, 2012; Bracer et al., 2007; Pham et al., 2010). This review enabled us to identify the types of roles PES intermediaries perform and issues that can arise that affect, positively or negatively, the ability of intermediaries to perform their roles in relation to the PES program's goals. This review also provided an opportunity to consider these roles in light of the broader institutional context, relating specifically to the crosscutting factors of influence, process and context. In addition to providing a novel, synthesized perspective on PES intermediaries and a typology of their roles, this information provided the starting point for our understanding of PES intermediary roles, which we applied to our Western Panama case study.

2.2. Study region

The second stage of our research involved conducting an empirical case study of potential PES intermediaries in the Chiriquí province of Western Panama, where stakeholders were at the initial stage of PES feasibility assessment (Fig. 1). We focused on intermediary organizations in the districts of Boquete, Renacimiento, and Bugaba, where active PES interest exists and to align our study with previous PES feasibility research in this region.

From a conservation perspective, the region is globally important, as it contains portions of UNESCO Biosphere Reserve and World Heritage Site La Amistad International Park (PILA), which is estimated to contain 4% of Earth's species (Clark et al., 2006). It is also a major agricultural region in Panama, known particularly for its coffee and vegetable production that contributes to regional and national markets. As agriculture continues to expand in this region, and more intensive management practices are employed, concerns are rising about negative impacts to watershed health, biodiversity, and other conservation values (The Nature Conservancy, 2007). Conservation efforts in the region are threatened by funding limitations and agricultural encroachment in PILA, intensified agricultural practices in the park buffer zone, and landslides on surrounding steeply-sloped farms (Oestreicher et al., 2009; The Nature Conservancy, 2007).

Organizations from multiple sectors are collaborating to determine how best to address the environmental, economic, and social concerns of the area, primarily through building local capacity and engagement of neighboring communities. In this context, stakeholders are exploring PES as a tool for addressing these concerns. This PES feasibility project has been led by two non-profit organizations focused on conservation and sustainable development in the study region. These organizations, along with researchers from Colorado State University facilitated a collaborative workshop in May 2009 to learn about and explore interest in PES with regional stakeholders from Panama, as well as partners from Costa Rica knowledgeable about PES and who work in PILA. This workshop was followed by an exploratory study to identify potential landowner interest in PES and factors that could enhance or decrease expected participation (Duke, 2010). In reporting back to local stakeholders on the results of this landowner study, a

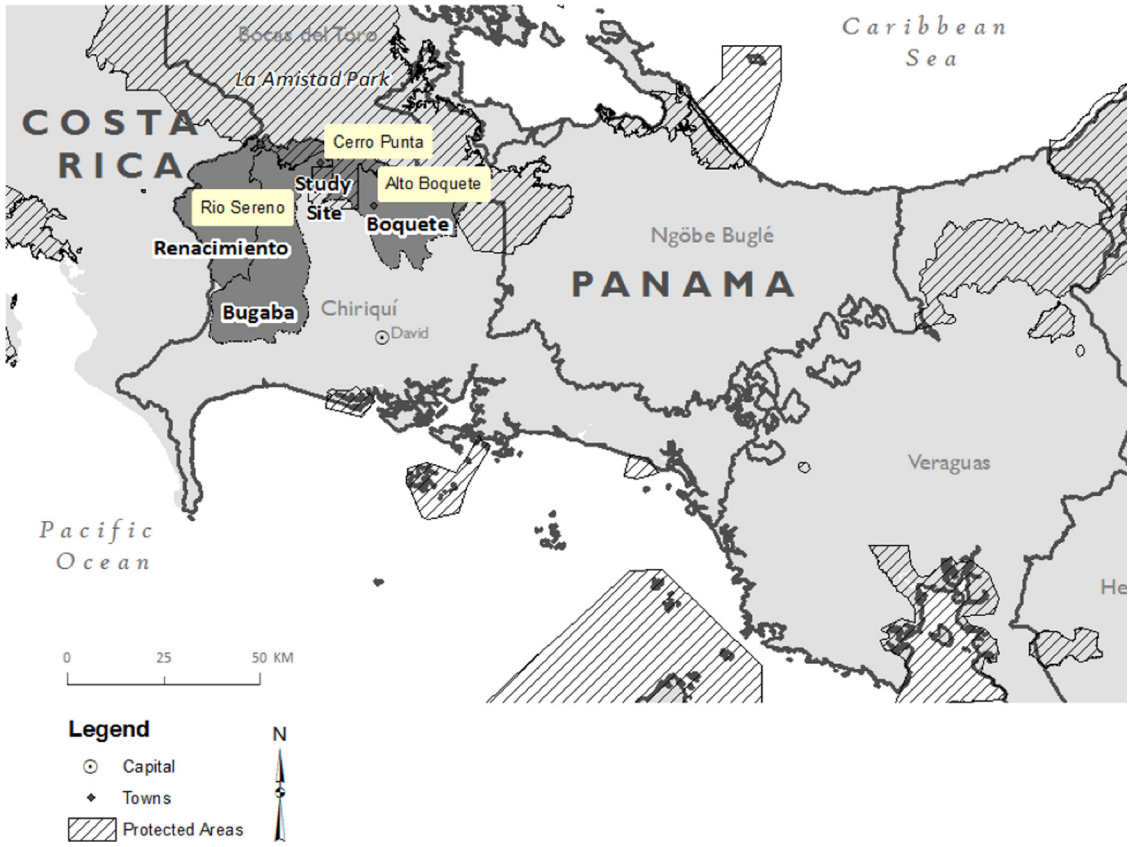

Fig. 1. Map of Western Panama study site. Areas in dark grey represent the area included in the study site.

priority was next expressed to investigate the intermediary actor landscape, to which our study responded. Because our research was conducted at an early stage of PES feasibility analysis, we note that the specific type of PES program (e.g., ecosystem service target; payment structure; identified buyers or sellers) was not pre-defined; rather, stakeholders sought to use information from this study and related analyses to assist in identifying the type of program that would be most appropriate for the region.

Our study site exists within the larger socio-political context of Panama. In Panama, no legal mechanisms currently exist to approve direct payments for ES, and only two PES programs are operating in the country, though neither in our study region (Balvanera et al., 2012). The prominent regional-scale program is politically and economically driven, focusing on compensation to landowners for land management practices aimed at generating improved ecosystem services for the Panama Canal watersheds (Balvanera et al., 2012). The other program is more local in scale, focused on biodiversity and funded by international conservation donors (Balvanera et al., 2012).

2.3. Study design and population

We used a purposeful design strategy to select interviewees, which involves selecting cases for study because they are rich in information, and provide illumination to the topics in question (Patton, 2002). We targeted interviewees based on their organization's current roles and involvement in the region's network of conservation, agricultural, and sustainable development activities. This involved first conducting interviews with representatives of key organizations recommended by our two partner conservation NGOs who are well-established entities in the region but whose names we do not report for confidentiality reasons. These partners facilitated our project and helped us connect with initial interviewees. We then followed the network of organizational ties that emerged from each interview until we began consistently receiving similar results from interviewees, and no new relevant organizations were found or suggested to contact (Patton, 2002). This design was intended to identify as many possible organizations in the population to interview, until we reached the point of information saturation (Glesne, 2011).

We interviewed a broad spectrum of organizations because the skills and expert knowledge for PES design and implementation can span many organizational types. We designed this study from the outset not to predict or assume how many or what intermediary actors would be most suited for a PES program, but instead to more broadly characterize the intermediary actor landscape and its implications for PES feasibility. Furthermore, recent research has found that collaboration between various sectors in Latin America, including government, research and academic institutions, and non-governmental organizations (including international conservation organizations) can be crucial to PES development and operation, and ecosystem services policy formation (Balvanera et al., 2012).

Following our sampling design, we conducted interviews with individuals representing 34 organizations and four sectors: 15 civil sector organizations, including 10 NGOs, four community groups, and one civic club; 10 public sector organizations, including seven provincial governments and three municipal governments; five private sector organizations, including three businesses and two agricultural cooperatives; and four academic organizations from province-level universities (Table 1). These organizations spanned geographic scales in terms of where they operate, including 14 local, 16 regional, and four national–international scale organizations. For the purpose of our study, the local scale includes organizations operating at or within the district level, which includes district-level or small watershed organizations, and government agencies such as municipalities. The regional scale includes organizations working on a scale larger than one district and equal to or less

Table 1
Organization interviewees by scale and sector.

Organization sector	Organization scale			
	All	Local	Regional	National–international
	34	14	16	4
Civil	**15**	**8**	**4**	**3**
Non-governmental organizations	10	4	3	3
Community organizations	5	4	1	–
Public	**10**	**3**	**7**	–
Government agencies and ministries	8	1	7	–
Municipal government	3	3	–	–
Private	**5**	**3**	**2**	–
Businesses	3	1	2	–
Cooperatives	2	2	–	–
Academic (all Public Universities)	**4**	–	**3**	**1**

than the entire Chiriquí province. The national–international scale includes organizations operating across the entire nation of Panama or across multiple countries. The number of organizations sampled in our study differed across sector type and geographic scale due to pre-existing variation in the region, relevance to the study, and sampling methodology. Our total number of people interviewed ($n=42$) exceeded the number of organizations sampled ($n=34$), because for five organizations, we interviewed multiple individuals who represented distinctly different regions, geographic scales, or project foci within the same organization.

We conducted topic driven, semi-structured interviews designed to investigate (1) current organizational roles, (2) perceived roles to contribute to a possible future regional PES program, (3) perceived organizational challenges and opportunities, and (4) connections between organizations. The full list of interview questions is in Appendix A. We utilized the potential roles of PES intermediaries from the literature review (Table 2) to analyze the current roles of organizations in the study region, as well as their potential roles in a future PES program. Near the outset of each interview, we asked interviewees to self-report their knowledge and understanding of PES as low, medium or high. While we recognize that self-reporting knowledge levels has its limitations, it provided us an opportunity to gauge general level of understanding, and we ensured that all interviewees had a minimum level of PES knowledge by providing a verbal description. This process also provided an opportunity for the interviewee to ask questions, which facilitated building of rapport (Glesne, 2011).

We transcribed and analyzed data from each interview using the qualitative data analysis software NVivo 9 (QSR International, 2010). We have included interviewee quotes (translated from Spanish to English) in Section 3 in order to support and elucidate various findings. In reporting our results, we identify the interviewee only by his or her organizational sector (public, private, civil, academic) and geographic scale (local, regional, national–international) to preserve confidentiality.

3. Results

3.1. PES intermediary roles and cross-cutting themes

Intermediaries perform a variety of tasks, depending on their strengths or abilities, the local context in which they are working, and regulatory measures (Pham et al., 2010; Pagiola et al., 2005; Mike and Simon, 2008). Through our literature review, we identified and describe below the following four overarching roles that intermediaries perform: information exchange; program design; networking, representation and mediation; and administration and project coordination (Table 2). We then discuss issues that arise in the literature regarding how the cross-cutting factors of influence, process, and context affect PES intermediary roles.

Table 2
Potential roles for PES intermediaries synthesized from PES and other relevant intermediaries literature.

Information exchange	Providing accessible information about the concept of PES to stakeholders and the public. Providing information to potential participants about how the program works. Assisting with information sharing between buyers, sellers, and other groups involved in the PES program.
Program design	Convening stakeholders to obtain input into program design (e.g., target ecosystem services, landowner eligibility, payment structure, geographic boundaries). Ensuring that region-specific and stakeholder-specific concerns are incorporated into program design considerations. Developing program standards and guidelines, including a protocol for program monitoring and evaluation.
Networking, representation and mediation	Representing interests and concerns related to buyers, sellers, and other program participants. Where appropriate, acting as a neutral third party. Representing buyers and/or sellers in the contract negotiation process. Serving as honest brokers of information and resources across program participants. Helping to establish trust between program participants. Facilitating connections among organizations.
Administration and project coordination	Promoting and publicizing information about the PES program. Project administration, such as managing contracts, and administering program funds. Monitoring and evaluation. Providing assistance and support with paperwork and program eligibility requirements.

3.1.1. Information exchange

PES buyers and sellers are interested in understanding how they will be affected by program participation but are cautious of their information sources. Particularly in developing countries, PES may neither be well understood initially by potential buyers and sellers, nor by other decision makers or the general public (Pham et al., 2010). Intermediaries can help address these situations by providing comprehensive and stakeholder-oriented information that bridges information gaps between actors and facilitates PES design and implementation. Often, intermediaries serve as a trusted or authoritative information source (Swallow et al., 2009). PES intermediaries have also been shown to work across the divides between policy makers, organizations, and others with differing expectations and terminology to present information appropriate for the target audience (Pham et al., 2010). Intermediaries' ability to simplify technical jargon and present information at a level easily understandable to all involved actors can help keep communication channels open (Cash et al., 2003). Intermediaries provide information through research

projects and technical assistance to program actors (Peskett et al., 2011; Rosa et al., 2004). Finally, intermediaries can bring nonmonetary benefits to involved stakeholders through information exchange such as training courses (Rosa et al., 2004; Wunder, 2006).

3.1.2. Program design

Intermediaries assist with PES design, such as conducting feasibility analyses, supporting collaborative stakeholder processes, developing program standards and protocols, and conducting investigations, such as elucidating potential actor roles and perspectives (Pham et al., 2010; van Noordwijk et al., 2007). They can aid in defining ecosystem services and prices, and in forming groups, such as buyers and sellers (Vatn, 2010). Intermediaries sometimes serve in an advisory role, such as providing input on PES regulations, structures, and stakeholder actions and roles (van Noordwijk et al., 2007).

3.1.3. Networking, representation, and mediation

Intermediaries are often seen as a go-between, functioning as trustworthy agents who assist with brokering information, conducting negotiations, and representing the interests for all involved actors (Howells, 2006; Moss et al., 2009; Pham et al., 2010). Intermediaries are frequently required to balance the interests of PES actors to build trust, mediate between actors, and facilitate contract and price negotiations (Corbera et al., 2007a; van Noordwijk et al., 2007; Peskett et al., 2011). They often act as agents for underrepresented populations, and assert influence and power in order to provide greater weight to the needs and concerns of economically and socially disadvantaged populations. Furthermore, they can promote more legitimate decision-making processes by helping acknowledge competing viewpoints from diverse actors involved in resource decisions (Corbera et al., 2007b).

PES intermediaries also perform networking functions such as facilitating connections among organizations, identifying potential project participants, and bridging the relationship between buyers and sellers (van Noordwijk et al., 2007). PES intermediaries' involvement in networking to identify program investment and funding prospects was key in practice for initial project steps in Mesoamerica (Corbera et al., 2007a).

3.1.4. Administration and project coordination

Intermediaries perform a range of administrative tasks, including: promotion of programs; administration of paperwork, support, and funds; and supervision (Pagiola et al., 2005). Intermediaries have been found to encourage the development of local organizations and their internal structure (Pham et al., 2010). They influence or support other program actors, such as local NGOs and government groups administering ecosystem services production and transactions (Milder et al., 2010). Identifying and supervising appropriate conservation tasks to be conducted by ecosystem service sellers are another function of PES intermediaries (Corbera et al., 2007a). They assist with transactions, including transferring monetary and non-monetary resources (e.g., support and training) between PES actors (Rosa et al., 2004). Intermediaries can negotiate, implement, and guarantee contracts or other binding agreements (van Noordwijk et al., 2007). Another project coordination function is monitoring, including the supervision of agreements, verification, and measurement of ecosystem services (Pagiola et al., 2005; van Noordwijk et al., 2007). Finally, they often work with multiple PES actors to obtain political support for a program and to increase participation (Pham et al., 2010; Rosa et al., 2004).

3.1.5. Intermediaries and influence

Intermediaries can shape interactions within PES, and can legitimize or delegitimize the process (Pascual et al., 2010). Complexity and diverging interests among intermediaries and their associated relationships can result in negative impacts of intermediary involvement, particularly on the poorest populations (Rosa et al., 2004; Pham et al., 2010; van Noordwijk et al., 2007). Intermediaries can reduce the amount of benefits that producers and communities receive, contribute to a power imbalance, be influenced by the potential to increase their profit margin with each transaction, or negatively impact local culture or customs (Peskett et al., 2011; Pham et al., 2010; Corbera et al., 2009).

Intermediaries from the private, public, and civil sectors have been found to be the “dominant agent” in some PES schemes, primarily due to their role in defining ecosystem services, informing transaction prices, and engaging buyer and seller groups (Vatn, 2010). This dominant role of an intermediary demonstrates the influence they can exert over a process, which can be a positive contribution to program success, or adversely and inequitably affect program participants if the intermediary insufficiently represents participants' interests.

Intermediaries can influence actor behavior (Swallow et al., 2009). This influence can be environmentally and socially beneficial, or it can be driven by an intermediary's agenda more focused on, for example, program success than equity. Similar to other policy instruments, PES is embedded within larger power structures, which has the potential to affect payment design, and program outcomes and effectiveness (Muradian et al., 2013). The influence of certain interest groups can shape programs, and result in lower degrees of environmental additionality (Muradian et al., 2013). This type of conflict of interest is often driven by where and how the intermediary is paid, which is a key issue in the institutional design of PES.

In a recent case study of Costa Rica's PES program, Daniels et al. (2010) discuss the challenge of having intermediaries' compensation come from a portion of the payment made to ecosystem services sellers. This can be problematic because there is a disincentive to report non-compliance since the intermediary would not get paid. Additionally, the intermediary may preferentially target information to landowners deemed most likely to successfully enroll and to do so at scale, as this would lower the transaction costs incurred per unit of revenue captured by the intermediary (Daniels et al., 2010). More recently, Costa Rica and other PES programs have addressed some of these challenges through changes in institutional design. This example still underscores a critical point in understanding the conflict of interest intermediaries can have in a program, and their potential to reinforce existing conflicts (Corbera et al., 2007b).

The influential relationships between buyers and sellers of services can also affect the institutional context of PES arrangements (Pascual et al., 2010). Most intermediaries do not operate in a perfectly neutral middle space; they often are more closely aligned with buyer or seller groups. This influence could be used for positive purposes, such as increasing program participation and advocating for underserved populations; alternatively, it could shift program power dimensions in favor of buyers or sellers.

Program power and influence bring up considerations of equity within PES, which Pascual et al. (2010) define as including the distribution of benefits from ecosystem services provision, who participates, conditions of participation, and underlying empowerment of those involved and left out. Pre-existing institutions and power relationships can shape the program, often predetermining considerations of equity (Pascual et al., 2010). Equity is a key issue of concern for policy makers and practitioners engaged in PES development (Pascual et al., 2010; Muradian et al., 2013).

Existing organizations have been found to play an important role in forming PES, particularly for involving intermediaries to address uncertainties surrounding PES development (Corbera et al., 2007b; Vatn, 2010). When introducing PES to a region,

program developers must be cognizant of pre-existing relationships between potential program actors related to social, political, economic, or environmental factors, as well as the broader institutional context (Brouwer et al., 2011; Vatn, 2010). Knowledge of overall institutional design is key to minimizing and pre-emptively mitigating potential perverse incentives that can arise from inappropriate program design. Focusing on building trust and encouraging participation has been shown to successfully address adverse intermediary influence in programs (Corbera et al., 2007b). Understanding the roles organizations in a region are currently conducting, how they are connected to other actors in the region, and their capacity to be involved in a PES scheme are all important considerations to selecting the appropriate group of actors for program design and administration.

3.1.6. Intermediaries and process

Intermediary roles in PES are dynamic, and an organization may perform a variety of roles over time as projects develop (Carius, 2012; Moss, 2009; Sternlieb et al., 2013). For example, in program design they might first facilitate and coordinate cooperation between actors, negotiate contracts, and provide information about the program, eventually transitioning into other roles, such as administering payments or facilitating program monitoring and verification (Carius, 2012). As intermediaries transition roles over time and take on new or additional responsibilities, it is critical to consider how these transitions can reinforce existing conflicts of interest, or potentially create new conflicts if intermediaries are moving into roles that might not be an appropriate fit.

In some PES implementation contexts, local ecosystem service sellers and non-local buyers from differing socio-economic and cultural contexts are placed together to co-create a PES program, which includes mutual agreement on monitoring, adjudication, and payment procedures (Carius, 2012). The success of this process often depends on intermediaries establishing trust with both actor groups in order to facilitate this process (Carius, 2012). Considerations mentioned previously, such as intermediary influence and potential conflict of interest would be important to take into account when designing sets of rules for resource management, in order to ensure intermediaries are playing appropriate roles. As a program develops, the expertise, skills and competence of intermediary actors in a region are critical to accomplish program design and administration tasks.

3.1.7. Intermediaries and context

Through our literature review, we also found considerations of intermediaries in relation to context that might affect PES feasibility more generally. The need for and role of intermediaries is directly dependent on the larger resource and governance context in which PES is being developed. Consideration of enabling conditions within a given context is key for practitioners and researchers alike to understand if a situation is promising for PES development. Critical enabling factors influencing sustainable governance of resources have been well researched in common property literature (e.g., Agrawal, 2001; Ostrom 1999) and recently applied within PES-specific literature (Muñoz Escobar et al., 2013; Muradian et al., 2013). These key enabling conditions of "group characteristics" (e.g., prior organizational experiences, leadership, trust; Muñoz Escobar et al., 2013) have been discussed in the previous sections. Other enabling conditions that are relevant to intermediaries and PES feasibility and design include the "resource system" and "external environment" (Agrawal, 2001; Muñoz Escobar et al., 2013).

The resource system characteristics include the feasibility of measuring changes in an ecosystem service (e.g. to determine scarcity), and the scale and size of the program, which determines potential to define boundaries and monitoring plans (Muñoz Escobar et al., 2013). For example, in watershed PES, programs are typically local or regional scale, in order to better track the supply of ecosystem services at manageable scales (Muñoz Escobar et al., 2013). These resources conditions directly impact assessment of PES feasibility overall, as well as help to define the scales and types of potential intermediary actors.

The external environment enabling conditions most relevant to our consideration of intermediaries focus on PES financing mechanisms, and the role and support of the central government. Determining program rules and structure without government authorities overruling or undermining the process (Ostrom, 1999) is a critical external environment consideration. The broader institutional framework of the government also affects PES program design and operation (Muñoz Escobar et al., 2013). These external environment considerations, particularly government influence, can significantly affect which actors are able to participate in PES. Most notably, which and how intermediaries are able to engage in a program can be directly influenced by existing government policies, procedures, and influence.

Having described the information gathered from the literature review, we now turn to examine how intermediary roles, influence, process, and context function in assessing the intermediary actor landscape in our PES feasibility case study.

3.2. Interviewee PES knowledge

Our interviewees varied in their pre-interview understanding of PES, with 26% self-reporting low knowledge, 31% medium knowledge, and 43% high knowledge. Academic organizations reported the highest level of understanding, followed by the public, civil, and private sectors (high understanding = 75%, 44%, 41%, and 20% respectively). In terms of geographic scale, we found that 100% of national–international scale organizations reported high PES knowledge compared to 55% of regional and 17% of local scale organizations.

Some interviewees expressed their perception of a general lack of understanding about PES in the region. For example, one public sector interviewee believed the majority of PES knowledge resided within the government when he stated,

> This is a problem. In Panama, the people don't know the concept [of PES]. First, we need to sensitize the authorities that there is a mechanism that could resolve many necessities and weaknesses in environmental [issues], hydrological aspects, forestry, and biodiversity of the protected areas. But those who understand this the best are from [public sector organization] but it is necessary to tie this [concept] to the municipalities, representatives, coordinators, civil society, schools and the normal person.

3.3. Organization-identified intermediary roles

When asked about which intermediary roles organizations currently perform, interviewees across the four sectors collectively identified all main intermediary roles listed in Table 2, though not each organization performed all roles. Across all 34 organizations, 97% identified information exchange, 91% identified administration and project coordination, 73% identified networking, representation and mediation, and 44% identified program design roles occurring in their organization (Fig. 2).

When asked about the feasibility of their organization playing a role in a possible future PES scheme, all public, private, and academic and 87% of civil organizations identified specific intermediary roles their organizations could best perform to support PES design and implementation (Fig. 2). For the two civil

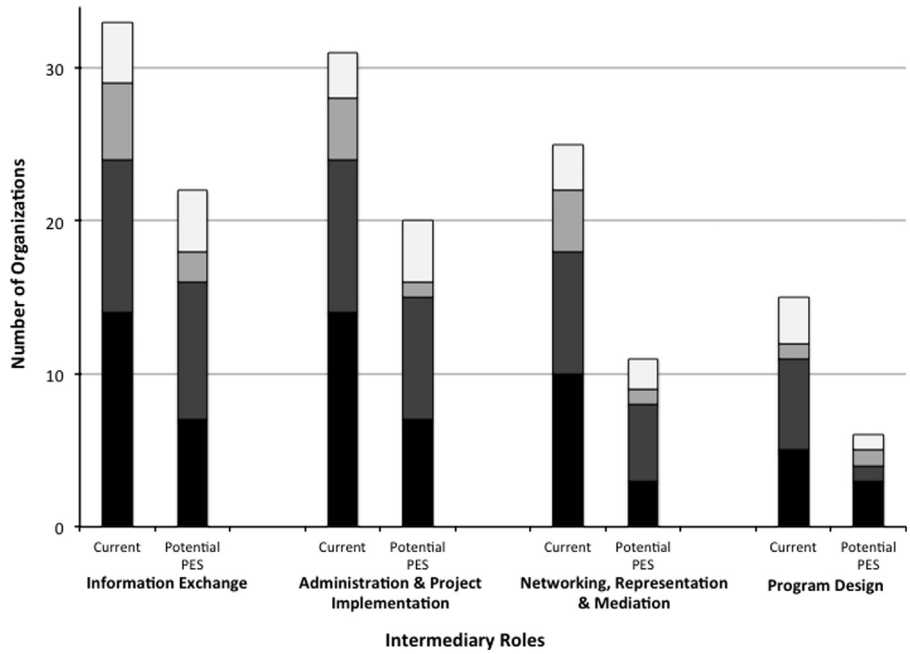

Fig. 2. Organization-identified current intermediary roles and potential future PES roles. Roles are divided by organizational sector: civil (black, $n=15$), public (dark gray, $n=10$), private (light gray, $n=5$), and academic (white, $n=4$).

organizations that did not specify PES intermediary roles, they chose not to because they were unsure, at this feasibility stage, if there would be a clear role for their organization in a future program.

3.3.1. Information exchange

We found that all public, private, and academic organizations and 93% of civil organizations currently perform information exchange roles. The most common role involved providing seminars, trainings, informational meetings, and hands-on field days to target audiences (e.g., agricultural producers rather than the public at large). A regional-scale public sector interviewee explained outreach to producers as,

> Many farms don't have the capacity to complete or formulate projects on their own. [They] need specialists, and we can listen to what they want, then help them design a project for their land… This helps the farmer plan better for the future.

The second most common type of information exchange identified by interviewees was described as environmental educational programming at grade schools and universities.

The most common potential PES intermediary role identified by 65% of organizations was information exchange, which included the dissemination of information, outreach to the community, and communicating program information. Organizations also identified the role of investigation and technical assistance, which was described as sharing existing research, as well as conducting investigations to inform PES program design and providing technical assistance to actors involved in the program.

3.3.2. Administration and project coordination

One-hundred percent of public, 93% of civil, 80% of private, and 75% of academic organizations identified administrative and project coordination roles. The most common role performed by 68% of organizations was facilitation and administrative support. Organizations described this role as including coordination and facilitation of meetings, events, and collaborative processes. Public and civil organizations also described this role as support of other organizations by providing meeting space, sharing of human, information, and financial resources, and training in administrative roles. One regional-scale civil organization explained her organization's support of other organizations as,

> What is certain is that all this mobilization of [organizational] management needs resources, and these small groups do not have that capacity. So there is more weight and responsibility on our organization, because we have the vehicles, fuel, and other resources. [Smaller organizations] are not prepared to function on their own… Our organization is working to strengthen the people so they will get to that ability of standing on their own.

The second most common type of administration and project coordination role involved fund administration and management, between actors and for projects. Organizations also identified themes of coordination, implementation, and supervision of projects or programs, and particularly for public organizations, this involved project monitoring and evaluation.

Fifty-nine percent of organizations identified administration and project coordination as a potential role their organization could play in a future PES scheme. Mainly public organizations identified their administrative role to be project facilitation and support, such as supervising programs, transferring resources, managing program paperwork and contracts, supporting organizations with resources and administrative training, and assisting participants with program enrollment. Additionally, organizations identified the administrative role of coordination and logistical support, which includes functions such as the coordination of meetings.

3.3.3. Networking, representation and mediation

We found that networking, representation and mediation roles were being performed by 80% of private and public, 75% of academic, and 67% of civil organizations. The most common role was networking, which interviewees described as being a main contact for people in their region to connect with other actors, as a conduit between actors, and as an entity that was well known and could easily connect with a variety of actors. The second most common role performed mainly by civil organizations was working as credible, honest, and trusted sources of information and support.

Mediation-specific roles were also performed by organizations, particularly mediating conflicts between different user groups (e.g., water allocation). For some public and academic organizations, conducting mediation when approached by the public is part of fulfilling their organization's mission. Another theme identified by organizations involved representing the interests of their organizational members or participants in their programs.

Thirty-two percent of organizations identified networking, representation and mediation as being roles they could perform in a future PES scheme. Many of these organizations identified their potential role as networking, such as being a main contact, providing information about and connection to potential PES opportunities for buyers, sellers, and other actors, and being able to do so for individuals and organizations across sectors, communities, and producer groups. Organizations also identified the potential PES role of representing the interests of, and providing mediation between, program participants.

3.3.4. Program design

We found that 75% of academic, 60% of public, 33% of civil, and 20% of private organizations are currently performing program design roles (Fig. 2). The most common role performed by 41% of organizations was overseeing the design of entire programs or contributing to the design of specific program components, such as the design of agricultural producer outreach activities, as part of larger collaborative projects. Another program design theme performed by organizations was the use of research and management plans to inform program design. This role was also the most cited one in terms of organizations' reported potential future PES program design role.

3.4. Organizational challenges to performing intermediary roles

Ninety-three percent of organizations identified organizational challenges and limitations that affected their ability to perform organizational functions and processes. These challenges included self-reported challenges specific to the interviewee's organization, region-wide challenges, and challenges related to particular organizational sectors.

3.4.1. Process challenges

The most common self-reported challenge to organizational processes identified by 68% of organizations involved funding limiting the work organizations could conduct. A local-scale public sector interviewee explained her organization's funding limitations by stating,

> …there is not government support for things. There is a lack of [financial] resources to do what we are supposed to do as representatives of the local government. There is interest; we just cannot do very much for lack of resources.

Another commonly reported challenge was lack of human and equipment resources to complete projects. Organizations identified constraints on the number of reliable volunteers available to help civil organizations, insufficient public employees to cover the entire assigned region for outreach and technical support, and an inability to retain employees due to low wages or funding instability. Organizations also highlighted limitations of equipment, materials, and transportation availability.

More broadly, 91% of organizations identified challenges pertinent to organizational processes across the study region. The most common limitation theme was a need for additional support and capacity building, described as organizations' inability to sufficiently access resources and maintain project continuity; a need by resource-constrained organizations for assistance with capacity building and self-sufficiency; and weakness in coordinating collaborations and larger projects. Other study region limitation themes involved a lack of technical support and training, and public access to information.

3.4.2. Context challenges

Seventy-three percent of organizations identified limitations pertinent to the broader external context of the region. Government limitations were most commonly identified, and mainly related to overarching political factors (primarily at the federal level) including instability from political change, restructuring of public agencies, and unreliable allocation of and access to resources from the centralized federal government in Panama City. A regional-scale public sector interviewee explained these challenges as government influence affecting access to and the structure of agencies. He described this as,

> The people have a belief in [our organization] from the previous [government agency] structure when [we] welcomed participation, input, proposals, and worked with projects. Now [under the new political administration], we have restructured and people have a former concept of how we worked. It is not the same anymore. It is not like when it used to work so well with open participation.

Other identified public sector themes included the centralized government's adverse effect on the time needed for decision-making (e.g., to approve or disapprove a project), and responsiveness to requests from regional public agencies, both of which influence project completion. A regional-scale civil sector interviewee described these challenges as,

> The government received funds to channel to community projects, but this was done in a political and bureaucratic manner. Some groups were told they would be receiving funds but they have yet to see a contract or funds. A local NGO signed a contract with [government agency] a year ago and is still waiting to be able to use funds. I don't know what the government is doing that those funds are not accessible. At the national level there is REDD with large funds. And what is happening with this fund? The government has not gone to the communities to explain that the fund exists or what they are doing with it… The information [we have] said that the first year of REDD [funds] was to strengthen [government agency]… What is the significance of 'strengthen'? To buy more vehicles, hire more people, buy equipment and keep it all in the [central] office of the government? These funds are not useful when the government manipulates it and none of it goes to the communities… Sometimes the resources exist but they are just not being distributed or shared.

Other challenges to the broader external context included civil sector limitations, identified by interviewees as insufficient collaboration capacities due to the independent nature or limited resources of civil organizations, and limited organizational ability to expand scope of work or partnerships. Organizations also referenced the civil and private sectors' diminished organizational effectiveness due to a lack of political support and influence, and the perceived disengagement of the academic sector from other sectors for collaboration opportunities.

3.5. Intermediary connections, process and influence

We collected information from organizations related to organizational networking, collaboration, and communication, recognizing the important role intermediaries play in facilitating organization-to-organization interactions in PES design and implementation. These connections illuminate existing processes and influence of organizations, by sector and scale. Ninety percent of all organizations identified other organizations within our study sample with whom they were

communicating or connected to in some way. We used this information to depict the connections between interviewed organizations in our study region (Fig. 3). We defined a connection as occurring when an interviewee identified linkages with another organization in our study, such as collaborating on projects or sharing information and resources. We used this information to quantify the total number of connections between organizations, and then look at these connections in aggregated groups by sector, scale, and a combination of both sector and scale. We defined four levels of connection strength by dividing connection percentages into quartiles.

When examining organizational connections by scale, we found the strongest connections between local and regional scales. These connections were reciprocal, meaning that the local and regional scales were both strongly connected to each other in their sharing of information, resources, and/or projects. Notably, all 16 regional-scale organizations identified linkages to other organizations at their same scale. The weakest connections existed between organizations at the local and national–international scales.

When examining organizational connections by sector type, we found the strongest connections in reciprocal relationships between the public and civil sectors. The civil and public sectors also reported strong connections *within* their respective sectors. The private and academic sectors were connected, but in weaker ways to the public and civil sectors, and to each other.

Interviewees explained their organizations' communication and collaboration across sectors as intending to improve project success and expand project scope. A regional-scale public sector interviewee described this connection as NGOs working on projects that the government had limited ability or resources to complete on its own. A regional-scale civil sector interviewee explained his organization's collaboration with public organizations as,

> There are political mandates for the agencies and sometimes they don't have the resources. So they have to put some of this [environmental education] responsibility onto our organization instead… The agencies are supposed to have stable personnel to help with projects but that is not always the case… Environmental education should not be handled solely by environmentalists or [nongovernmental] organizations; the government presence is very important.

When examining organizational connections by sector type and geographic scale, public sector organizations at the regional scale were mentioned most often by other organizations in terms of to whom they reach out. The strongest reciprocal relationships were between civil and public sector organizations working at the regional and local scales. The most weakly connected actors in the overall network were private and academic organizations across all scales, and civil organizations at the national–international scale.

4. Discussion

Our typology synthesizes a broad variety of intermediary and PES-specific intermediary literature into manageable considerations for contextualizing PES intermediary roles and capacity, and cross-cutting factors of influence, process, and context. Our PES feasibility case study results demonstrate that literature-identified intermediary roles are being performed by organizations in the study region. What is clear throughout our literature review and case study is the importance of interpreting these results within the broader institutional context (Muradian et al., 2013; Vatn, 2010). As Vatn (2010, p. 1248) said, "PES systems are not created in an institutional vacuum". Accordingly,

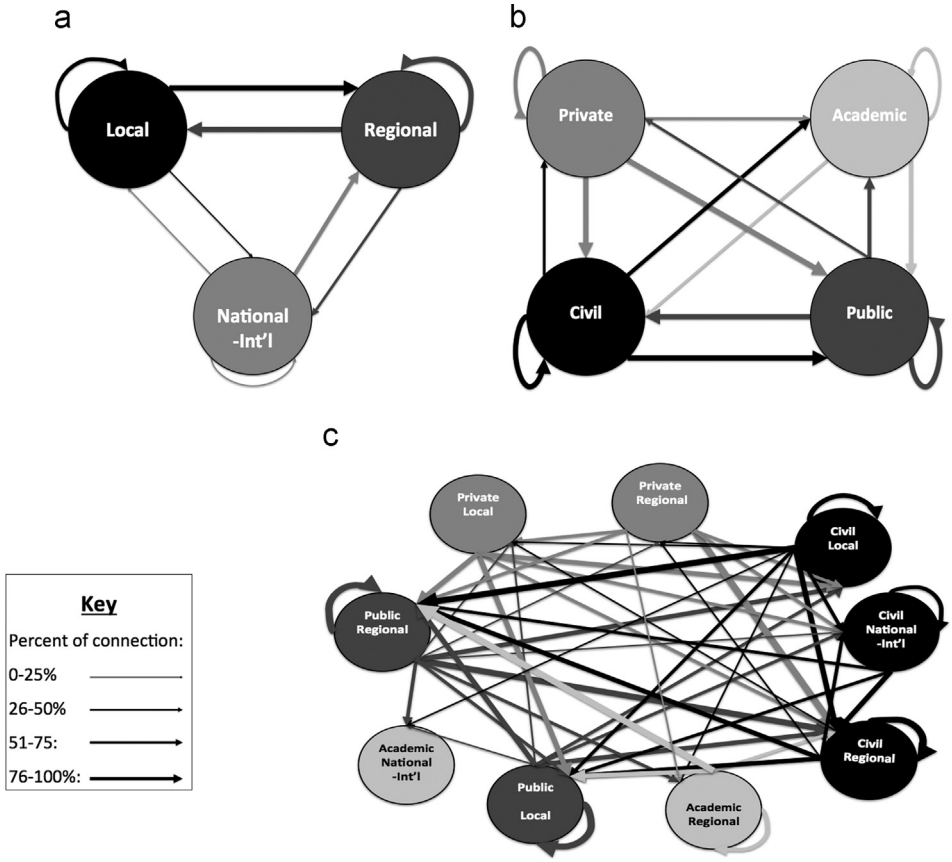

Fig. 3. Diagram of network connections between interviewed organizations by (a) scale, (b) sector, and (c) sector and scale. Circles represent different organizational scales, sectors, or sector-scale combinations. The strength of connection between organizations was determined by the percentage of organizations identifying connections with other interviewed organizations.

intermediary roles should be evaluated in consideration of broader factors including influence, process, context, and other formal and informal rules within existing institutions. In light of this, we provide a discussion of what the broader institutional landscape implies for intermediary and organizational potential in the study region, as well as implications for PES more broadly.

4.1. Organization-identified intermediary roles

Our results demonstrate that the key roles of information exchange; administration and project coordination; networking, representation, and mediation; and program design identified from our literature review are currently being performed to varying degrees by existing organizations in our study site. Interviewees did not identify any additional intermediary roles not covered in our typology, thus supporting our categorization of roles based upon PES experience to date, though recognizing that new or modified roles may arise as PES continues to evolve and adapt to new institutional contexts over time.

Our case study results show a systematic lower reporting of organizational capacity to be involved in future PES roles than reporting of current intermediary roles. Interviewees explained that this is mainly due to future organizational uncertainties of funding, staff and resource capacities, and the undefined nature of potential program roles since no program has been designed yet. This is a limitation of our study, yet information collection at the initial program design, or feasibility stage as we have undertaken here, is valuable to understand what organizational enabling conditions (or conflicts) exist in an area that lend themselves to potential PES success (or potential failure). Sufficient capacity building is needed in order to foster long-term program sustainability (Carius, 2012), which can only be conducted once a (capacity) baseline is established. Intermediary expertise is a critical success factor for PES, for building upon existing institutions, establishing sellers, negotiating and managing contracts, and other related functions (Carius, 2012).

4.2. Organizational influence

Overall, the organizations that we interviewed reported stronger engagement with actors that would be on the “supply side” of PES (e.g., agricultural producers) than the “demand side” (e.g., those utilizing ecosystem services). This situation poses the potential risk that PES sellers may have a disproportionate ability, through closely-connected intermediaries, to influence the design and operation of a PES program. For PES to be successful, intermediaries need to bridge supply- and demand-side actors, so work may be warranted in our study region to build stronger demand-side connections amongst existing organizations. This imbalance of organizational position could adversely impact engagement of PES buyers, which remains a limiting factor for PES expansion and financial sustainability (Wunder, 2009). Intermediaries can act as and at times are viewed as neutral third parties, yet this needs careful examination on a case-by-case basis. For example, closer alignment with sellers or buyers can support increased actor participation, but in these cases, programs might seek to create structural safeguards so that intermediaries do not unduly influence the process.

Successful PES design hinges not only on engaging and meeting buyers' needs, but also on explicit consideration of the often politicized and dominant influence of intermediary actors. While an influential intermediary can be helpful in engaging stakeholders, and promoting program acceptability and success, this influence must be monitored closely to understand the full implications for a program (Pascual et al., 2010).

One particularly important aspect related to organizational influence is leadership. Our organizational connection results suggest that engaging only one organization sector or scale in a program could result in a lack of connection to other sectors or scales, thus decreasing PES intermediaries' effectiveness at working on the appropriate geographic scale and with all suitable actors. This corroborates previous PES research suggesting that depending on one sector or select organization(s) to act as intermediaries in PES is not always feasible (Balvanera et al., 2012; Carius, 2012; Engel et al., 2008).

However, a recent meta-analysis of PES characteristics found a negative correlation between the number of intermediaries involved in a payment for watershed services scheme and the effectiveness of the scheme in meeting its environmental goals (Brouwer et al., 2011). This is an interesting result in light of the fact that we did not find an organization in the study region able to conduct all intermediary roles and connect to all appropriate sectors and scales. This suggests perhaps that multiple intermediaries would be needed in the region to better connect across the web of organizational connections and roles in the region.

Drawing upon Muñoz Escobar et al. (2013), effective and appropriate leadership in PES intermediaries includes communicating well, establishing trust, ensuring equity within a program, and engaging program actors, all of which are linked to program success. Having appropriate leadership to build trust can reduce transaction costs and facilitate the engagement of marginalized populations in PES. These will be important factors for advancing PES design in the region, particularly since these considerations of leadership are not comprehensively met by existing organizations.

4.3. Organizational process

Organizations demonstrated how they deal with sector limitations and enhance their capacity by partnering with actors from other sectors who are able to perform tasks where their own organization might be limited, less effective, or even possibly viewed by certain groups as less legitimate. This critical junction of organizational limitations is where intermediaries can constructively step in to fill gaps that other organizations cannot perform, and act as the conduit and trust builder between potential PES participants and program implementers. Understanding which actors are engaged in a proposed program region is key to identifying which organizations could represent and mediate between multiple buyers, sellers, or other program actors, which can reduce costs and streamline the process (Jack et al., 2008). PES is about strengthening existing cooperative will and organizational connections, not necessarily fundamentally changing it (Carius, 2012; Vatn, 2010).

In some cases, organizations, particularly smaller-scale organizations were found to be working with limited resources independently on similar issues. Connecting these smaller-scale organizations to larger collaborative approaches can aid in maximizing the impact of shared resources across the region. These considerations should be recognized prior to implementation of a program, to avoid fragmenting organizations further, or creating unnecessary work due to organizational disconnects.

4.4. Context

In many cases, PES schemes are found to be dependent on the assistance of external donors instead of self-sustaining internal funds, such as regionally linked and consistent ecosystem services buyers (Wunder, 2009). Connections to these external donors may require the engagement of intermediaries across scales (Sternlieb et al., 2013). This is particularly relevant in contexts such as our case study, where results demonstrate relatively weak connections to actors at the national and international scales, yet these may be scales that offer sources of funding (e.g., REDD+, which is relevant to Panama) if more local sources are not available or insufficient in size.

Region-wide limitations are realities faced by interviewed organizations, such as challenges of a centralized government, political restructuring and change, and waning economic conditions reducing the influx of foreign money into civil sector organizations. These national and international issues are not necessarily specific to Panama; rather, they are occurring in countries around the world, and are becoming increasingly important to recognize in PES design.

Several of the most notable findings of our case study are the challenges pertaining to public sector actors. Although many enabling conditions exist for local and regional scale PES capacity, central government support is often still a key factor in program success (Muñoz Escobar et al., 2013). Based on current organizational connections (strongest at the local and regional levels; Fig. 3) and challenges (mainly government-related, as illustrated in interviewee quotes in Section 3), it might not be feasible to enact a PES program in the region without a change in the external environment. Even a neutral external environment might not be enough; due to the need for a clearer delineation of buyers, a regional program would likely need *active* government support (e.g. policies, program infrastructure).

5. Conclusions

At the PES feasibility stage pertinent to our case study, we sought to characterize the intermediary actor landscape and how it could support or impede PES development, as actionable information to support local stakeholders' exploration of PES. We based our analysis upon a typology of PES intermediary roles and contextual factors obtained from a literature review. Ultimately, linking actor characteristics and other institutional factors to program performance is necessary information to guide PES design and adaptation. We see this as an important area of future PES research through program-specific case studies and meta-analyses.

While our primary research objective was focused on understanding intermediaries, our analysis of roles, influence, process, and context resulted in broader implications for PES. Our results support the contention that PES does not operate within an institutional vacuum, and illustrate how PES is shaped by the existing actor landscape and its relation to broader social, ecological, and institutional contexts. Intermediaries have critical roles to play in PES, roles which must be understood prior to developing a program, in order to align with and build off of existing organizational capacities, and to understand how the broader actor landscape and context influence program development.

As Muradian et al. (2013) emphasize in their recent cautionary tale of the fatal attraction of seemingly "win–win" solutions such as PES, policymakers and practitioners need to expand their view to encompass a wider set of fundamental issues facing PES, specifically, assessing the validity and effectiveness of rule-making, assumptions used to guide decisions, and determining trade-offs. Our literature review and case study results prompt us to advocate for more explicit consideration of the enabling conditions and assumptions for appropriate PES interventions. In light of new conservation tools and the magnitude of organizational efforts to address conservation concerns, we find the need to work across organizational sectors and scales to better understand enabling conditions for PES.

Acknowledgments

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Appendix A. Semi-structured interview (conducted in Spanish)

(1) Overview for interviewee of research project, PES, and intermediaries

(2) Organization background

Information about the types of work, roles, and functions of the organization

- What type of organization?
- What type of work does your organization do?
- What main projects are you currently working on?
- Do you currently have projects that you are working on with other organizations?
  - What organizations (names, types of projects)?
  - Describe the project(s)?
  - How do you work together? Do you normally work together?
  - What are the major challenges to working with other groups on projects?
  - Does your organization work across topics (as previously described), like an intermediary? How?

(3) Current PES knowledge

Explanation and discussion of PES, self-assessment of PES knowledge

- How knowledgeable are you and your organization with the concept of payments for ecosystem services? [Scale: no knowledge, some knowledge, moderate working knowledge, high knowledge]
  - How have you/your organization heard about PES?
- Do you know of people or organizations working on PES-related issues in or beyond this region?
  - [If yes]: Who is working on these issues, and what are they doing?
  - Where are they working?
  - How do you know about their work?

(3) Current organizational intermediary role(s)

Explanation of intermediaries in PES and intermediary roles (using intermediary table)

- Now that we have talked about some of the roles an intermediary group can fill, we would like to ask:
  - Do you see these characteristics in your own organization?
    - What roles and how?
  - Do you see these characteristics in other organizations?
    - What organizations and what roles?
  - Based on your organization's experiences, do you think this table describes the correct tasks for organizations performing intermediary roles in this area?
    - [If yes] How does it describe role correctly? Do you see these characteristics in organizations in this area?
      - Do you think these characteristics are important for intermediaries?
    - [If no] What would you change about this list? What does not fit well?
      - Can you provide any examples of how these roles do not fit well?

(4) Potential intermediary role(s) in a PES program

Understanding of which roles organizations thought they could perform in a potential future PES program

- Are there certain roles listed in the table that you think your organization might be able to provide in a potential future PES program?
  - Why that/those role(s)?
- What types of skills or resources does your organization have that would make conducting that task possible?
  - How does your organization currently use these skills in other projects?
- Does your organization have certain strengths that might be helpful for this type of (PES) project?
- Does your organization have areas of limitation that might make PES participation challenging?
- What other organizations working in this area do you think might be interested in participating in a project like this? What tasks might be of interest to them?
- Do you think your organization sees value in this type of approach to conservation issues?
- What risks or opportunities could be involved in your organization becoming involved in a PES project?
- Do you think that in order to be an intermediary, an organization should be well connected?
  - Why or why not?
- What do you think an intermediary, such as a group like yours, would need out of a PES program to make it possible to be involved?

(5) Interest in possible PES program

Discussion of region and organization's interest in new conservation approaches such as PES; additional challenges to such a program

- Would your organization be interested in participating in this type of program and/or what resources/skills could your organization offer?
- What challenges would you expect to face your organization or other organizations with regards to participating in a future PES program?

(6) Additional comments

Opportunity for interviewee to ask follow-up questions or make additional comments

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