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Using institutional grammar to improve understanding of the form and function of payment for ecosystem services programs

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ABSTRACT

Payments for ecosystem services (PES) schemes are governed by complex institutional arrangements. Specific rules are needed to control who can participate in buying and selling of services, under what circumstances participation is allowed, how transactions are regulated, and many other actions. Decisions made by the developers of PES schemes about what rules to include and what form these rules take are likely to have an impact on the eventual success or failure of the scheme. This paper applies the Institutional Analysis and Develop Framework's rules typology and Institutional Grammar Tool to develop a new method of classifying and summarizing institutional arrangements of PES schemes. We use 21 water quality trading schemes and develop the institutional rules classification and summary system. The classification system enables comparative assessment of institutional diversity across PES schemes. We demonstrate the utility of the classification system for this purpose by showing that there is significant institutional diversity among water quality trading schemes, despite their common environmental objectives and market-based approaches to addressing environmental challenges. We conclude with suggestions for applying the classification system to comparative research to understand the effectiveness of PES schemes generally and how differences in institutional arrangements may contribute to success or failure.

1. Introduction

Payment for ecosystem services (PES) schemes are complex and varied. Differences between programs result from the large range of ecosystem services targeted by market-based approaches and variation in attributes of the buyers and sellers of services. At the same time, all PES schemes seek to use market-based approaches to conserve natural resources through transactions that incentivize management and maintenance of ecosystem service flows (Muradian et al., 2010; Wunder, 2007). Therefore, it is reasonable to expect substantial overlap in the structure and function of PES institutions. For example, as market-based approaches, PES schemes are expected to have clear rules about who is allowed to participate and what information is available to participants (Wunder, 2007). Whether PES schemes share similar underlying designs despite diversity in ecosystems services targeted and goals to be achieved, however, is an empirical question.

New tools are needed to understand institutional heterogeneity among PES schemes and the impacts of differences in institutional structure on program outcomes. Here, we introduce a new method for classification and summary of the institutional arrangements of PES schemes. Through the analysis of 21 water quality trading PES schemes, we develop a system for classification and summary of institutional arrangements and demonstrate its utility for identifying institutional diversity across PES schemes. This method, grounded in the rules typology of the Institutional Analysis and Development (IAD) Framework, provides a tool for both consistent in-depth case study and broadly comparative research of the institutional arrangements of PES schemes. We conclude with a discussion of the implications of our classification method for understanding the effectiveness of PES.

As PES approaches to conservation and environmental management become more common, so does the need for intensive study of PES approaches to understand if and when they are effective for achieving conservation goals (Ferraro and Pattanayak, 2006). As a result, there has been increasing interest in applying the methods and theory of institutional analysis to understanding PES programs. Recent special issues of the journals *Forest Policy and Economics* (2013) and *Ecosystem Services* (2013) have focused on the

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"institutional dimensions" of PES and sought to shed light on how institutional arrangements impact the structure and success of PES schemes. The articles in these special issues favor two different approaches to institutional analysis of PES programs: (1) a review of PES generally from a definitional and structural standpoint (Derissen and Latacz-Lohmann, 2013; Kroeger, 2013; Matzdorf et al., 2013; Sattler et al., 2013) or (2) specific, case study driven analyses of individual or a small group of PES programs (c.f. Mislimshoeva et al., 2013; Fauzi and Anna, 2013; Hrabanski et al., 2013; Legrand et al., 2013; Muñoz Escobar et al., 2013).

These approaches present two primary challenges for developing a broad understanding of PES institutions. First, articles that focus on definitions of PES programs help to provide a common understanding of what PES is to inform selection of programs for study, but do not increase our understanding of how programs function and what components of the institutional structures indicated by the definitions are most important for success. Second, while individual or small-n case studies are useful when researchers are seeking to conduct intensive studies to test hypotheses or theory, identify causal processes, or control for confounding variables (Poteete et al., 2010), generalizing results to new cases is difficult. In addition, the existing case study literature does not rely on a common set of theory, so difficulties in comparing results are compounded.

We take a different approach, building on efforts to analyze structural characteristics of PES programs (Bennett et al., 2014; Sattler et al., 2013) and more recent research to develop broadly comparative approaches to institutional analysis of PES programs (Huber-Stearns et al., 2015; Bennett and Gosnell, 2015). However, instead of focusing on commonalities and differences in program goals and design, we instead develop a classification system to summarize institutional arrangements of PES programs. This method is based on empirical analysis of the institutional statements – or rules – used to structure programs. To accomplish this goal, we use the Institutional Grammar Tool (IGT) and rules typology of the Institutional and Analysis and Development (IAD) Framework develop by Ostrom (2005). The IAD Framework provides a structure for analyzing institutional arrangements with a focus on action situations – a circumstance where "two or more individuals are faced with a set of potential actions that jointly produce outcomes" (Ostrom, 2005, p. 32). The IAD framework defines a set of variables present in all action situations.

The exchange of ecosystem services in any given PES program is the result of a series of connected action situations: the application process to participate in a program, the development of an ecosystem service credit, the exchange of an ecosystem service credit between actors, and many others. Each action situation is controlled by a set of rules that define who can participate, under what conditions, what actions they can take, and the costs and benefits of participation. These rules combine to form the PES institution, "... the prescriptions that humans use to organize all forms of repetitive and structured interactions..." (Ostrom, 2005, p. 3). Analysis of PES programs focused on institutional arrangements in the form of rules will improve understanding of how PES programs function and the relationship between institutional arrangements and program outcomes.

This paper presents a new method for classification and summary of PES scheme institutional arrangements based on the IAD Framework's rules typology. To develop the method, we focus on a specific type of PES program – water quality trading. Water quality trading is an approach to addressing water pollution from industrial and/or non-industrial sources, such as farms. Typically, trading programs will set an overall pollution reduction goal for a watershed and allow polluters to trade pollution credits in order to meet reduction goals. We selected water quality trading because it is a relatively common, providing a large group of examples to include in our study.

Our goal in creating this methodology for analyzing PES institutions is to provide an empirical basis for further analysis of the form, function, and outcomes of PES programs. Institutional arrangements in the form of rules, shared strategies, and norms define the set of possible actions available to actors participating in an institution. As a result, these arrangements have a significant impact on the ecological, economic, and equity outcomes of PES programs. The method presented here will improve our ability to evaluate PES programs, allowing for increased understanding of when PES is working, when it is not working, for whom, and why. In the rest of this paper, we explain the methods used to classify and summarize institutional rules, present the rules classification system resulting from application of our methods, illustrate the effectiveness of the method by showing its utility for identifying institutional diversity across water quality trading programs, and provide a preliminary discussion of what we can learn by classifying rules.

2. Methods

To develop a method for classifying and summarizing PES scheme institutional arrangements, we conducted a multi-stage analysis of institutional arrangements of 21 water quality trading programs using the IAD Framework's rules typology. This section begins by providing a brief overview of the rules typology and how the IGT are used to enable classification and summary of institutional arrangements. We then describe how we applied the rules typology and IGT to develop a method for classifying and summarizing PES institutional arrangements. Finally, we explain how the outcome of the method – a classification system for comparative analysis of water quality trading PES programs – can be used to test for the presence or absence of institutional diversity.

2.1. Institutional grammar tool

The IGT was developed by Crawford and Ostrom (Crawford and Ostrom, 1995; Ostrom, 2005) to enable empirical analysis of institutions at the level of individual institutional statements. Analysis at this level allows for a clear understanding of how rules guide and constrain the behavior of actors relative to one another. When applying the IGT, the unit of observation is an individual statement that permits, obliges, or forbids an actor from taking an action. The components of the IGT and an example of how an institutional statement is coded according to the grammar is shown in Fig. 1.

The IGT provides a replicable approach to coding and differentiating institutional statements (Basurto et al., 2010; Siddiki et al., 2011). It can be used to identify what statements are rules, norms or shared strategies. The components of the grammar are summarized by the acronym ADICO. Definitions of each component of the acronym are provided in Fig. 1. Rules contain all components of the ADICO grammar, while norms include only ADIC (no Or else) and shared strategies include only AIC (no Deontic or Or else) (Crawford and Ostrom, 1995; Ostrom, 2005). A sixth term, object, was added later to define the receiver of the action described in the institutional statement (Siddiki et al. 2011). The IGT also allows for consistent classification of institutional statements according to the IAD Framework's rules typology. Here, we are concerned with categorizing institutional statements according to the rules typology. Therefore, for convenience, we refer to all institutional statements as rules going forward.

2.2. Institutional analysis and development rules typology

The IAD rules typology contains seven types of rules: position, boundary, information, payoff, aggregation, choice and scope. Each