

RESEARCH ARTICLE

Mixing Public and Private Agri-Environment Schemes: Effects on Farmers Participation in Quebec, Canada

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Incentive-based mechanisms, such as payments for ecosystem services (PES) are increasingly being employed to encourage adoption of biodiversity conservation practices in agriculture. Farmers' participation in a PES depends – amongst other factors – on their interactions with previous programs and schemes. This research analyses how the institutional characteristics and interactions of incentive-based mechanisms shape the type of farmers' participation and the achievement of desired socio-ecological outcomes. This research focusses on the institutional frameworks of two programs in the Province of Quebec, Canada: the 'Prime-Vert' Program (public agri-environment scheme) and the 'Alternative Land Use Services' (ALUS) initiative (a privately-funded "PES" scheme). The institutional prescriptions of these two programs were examined and compared through the lenses of the Institutional Analysis and Development framework. We reveal the impact of the institutional framework on farmers' participation by assessing the degree of farmers' engagement in the implementation and management of schemes. Our results showed a strong dependence of the private PES on the public scheme, rendering both programs ultimately managed under the remit of the provincial government. While the complementarity of both programs diversifies sources of funding for farmers, the presence of rigid rules governing these incentives tend to treat farmers as passive beneficiaries of a network of centralized subsidies which they have little control over. This compromises farmers' autonomy as the rigidity of rules impedes any attempt to achieve active participation in the design and implementation of agri-environmental practices.

Keywords: Agri-environmental schemes; institutional analysis; payments for ecosystem services; Institutional analysis and development (IAD) framework

Introduction

Over the last decades, market-based mechanisms have gained popularity in agri-environmental policy as a means to reduce nuisances coming from intensive agriculture and encourage the provision of ecosystem services such as water quality, biodiversity conservation, carbon sequestration, and nutrient cycling among others. The voluntary character of these schemes is presented as more attractive, decentralized, and less bureaucratic encouraging more engagement from producers than traditional command and control policies (Gomez-Baggethun and Muradian 2015). In particular, payments for ecosystem services (PES) and agri-environmental schemes (AES) have been portrayed as an attractive option to encourage farmer behaviour towards environmental stewardship on their lands.

These two incentives-based mechanisms differ in the ways they are conceptualized (Potter and Wolf 2014). AESs are public economic instruments that provide payments, technical transfer or extension support to farmers for environmental commitments related to preserving or enhancing agri-environmental practices (Schleyer and Plieninger 2011, Uthes and Matzdorf 2013). These schemes are characterized as a state-bureaucratic program relying on administrative rules and organization control to coordinate ecological action (Potter and Wolf 2014). In contrast, PES are conceived as financial transactions between providers and users of ecosystem services to enhance ecological conservation. PES are promoted to complement

state-centred incentives for the provision of ES from the agricultural landscape through getting prices right according to opportunity cost of potential ecosystem service providers (Wunder 2013, Potter and Wolf 2014).

In this work, we consider incentives such as AESs and PES as transfers of resources between social actors to align individuals and/or collective decisions on land use, while having a social interest in the management of natural resources, following the definition of PES by Muradian et al., 2010. The analyses of the success of these incentives are often focused on the economic performance of the payments and the effectiveness of outcomes (Uthes and Matzdorf 2013, Grima et al. 2016). However, PES are not created in an institutional vacuum (Vatn 2010). Their operationalization and success rely on the role of institutions that are responsible for guiding socio-ecological interactions, shaping human behaviour and influencing the use of natural resources (Vatn 2005).

Various institutional factors will therefore affect commitment to these incentive mechanisms, including the influence of formal and informal rules, social norms, and power relations (Muradian et al. 2010, Vatn 2010, Van Hecken et al. 2015, Kuhfuss et al. 2016, Chan et al. 2017), the type of governance structure (Primmer et al. 2015, Westerink et al. 2015), as well as the degree of participation of actors (Beckmann et al. 2009, Mettepenningen et al. 2013). Moreover, there remain major institutional challenges in incentivizing active farmers' participation in these schemes, including the incorporation of collective action rules that allow for more adaptive management of ecosystem services (Prager et al. 2012, Barnaud et al. 2018). Finally, an institutional analysis of the application of economic incentives for ecosystem service provision in agricultural environments remains undertheorized. Froger et al. (2016) propose further analysing the optimal institutional conditions that influence the sustainability of programs, as well as the interaction of programs with other regulations and policies. Elsewhere, Muradian and Rival (2012) insist on the need to study the hybrid character of these programs, by analysing the components of the institutional frameworks that shape how incentive-based programs for agri-environmental protection take form in practice.

The objective of this paper is to analyse how the institutional characteristics and interactions of incentive-based mechanisms influence farmers' participation and therefore the achievement of desired socio-ecological outcomes. This research investigates the institutional frameworks of two programs in the Province of Quebec, Canada: the 'Prime-Vert' Program (a public AES) and the "Alternative Land Use Services" (ALUS) initiative (a privately-funded PES scheme). To date, few articles have explored the socio-political and institutional aspects of designing and implementing incentive-based programs for agri-environmental conservation in Canada (Lavallée and Dupras 2016).

We analyse these two schemes by paying attention to the functional characteristics of the schemes themselves (i.e. the way the institutional arrangements work and operate). While previous studies have offered analytical insight on how the institutional and socio-ecological context influence the design and implementation of agri-environmental programs (e.g. McDermott et al. 2013, Muradian et al. 2010, Bennett and Gosnell 2015), only a few recent studies have provided a systematic description of the functional characteristics of a program and how they influence land users' participation (Ring and Barton 2015, Barton et al. 2017; Lien et al., 2018). This paper offers new insights from previous institutional analyses of PES in Canada (Lavallée and Dupras 2016; Kolinjivadi et al. 2019) in adopting the Institutional Analysis and Development (IAD) framework, suggested by Ostrom (2005), to examine and compare the institutional prescriptions of two incentive programs. We also link policy analysis with 'on the ground' effects of the incentives, by looking at the type of participation and engagement encouraged by incentives.

The following sections will present briefly the analytical framework for institutional analysis, the study site, the methodology, the results as well as a discussion of their implications on farmer's participation in the region.

Analytical Framework

To respond to our research question on how the institutional characteristics of the 'Prime-Vert' and ALUS program, and their interactions influence farmers' participation, we based our analysis on the Institutional Analysis and Development (IAD) framework from Ostrom (2005). The IAD is used to describe the different types of rules in-use that form the institutional setting in which action situations take place. Here, institutions are understood as "human constructed constraints or opportunities within which individual choices take place and which shape the consequences of their choices" (McGinnis 2011, p 170). In order to analyse material effects of these programs, one must identify the rules-in-use, a main component of the institutional context to understand how they shape outcomes by determining the action situation, the place where policy related choices are made (McGinnis 2011).

The IAD offers different levels of analysis: operational, collective and constitutional (Carter et al. 2016). We limit the scope of the analysis to the operational choice level where we pay closer attention to the

everyday decisions taken on the ground by individuals affected by the policy setting (McGinnis 2011, Ostrom 2005). At this level, we adopt the Institutional Grammar Tool (IGT) and the typology of rules from the IAD framework to study the effects of the characteristics of the programs on the uptake of practices and the degree of induced participation from farmers. The IAD framework was chosen as it clearly identifies the functional characteristics of policy instruments, offers a systematic institutional codification and typology, and provides a rigorous mechanism for conducting an institutional analysis of the impact of a particular policy.

Although the IAD framework (Ostrom 2005) has been primarily developed for research on the management of common-pool resources, it could be applied to characterize the interactions encouraged by conservation policy instruments (Ring and Barton 2015). To date, there is little use of the IAD framework for the analysis of conservation schemes. One exception is the work of Lien et al. (2018) who applied this framework to the analysis of 21 PES program for water quality trading. Lien et al. (2018) claim that the IAD sheds light on the institutional diversity across PES schemes and helps to understand the potential effectiveness of schemes by identifying key design features and possible hybridization with other institutional arrangements.

These conclusions are shared by Barton et al. (2017), who suggest that the IAD framework illustrates the potential of policy-mixing and hybridization in conservation policy frameworks by showing how the characteristics of PES suggested by Wunder (2015) correspond with the “rules-in-use” of the IAD framework. These refer to the formalized or structured institutions that guide how PES takes form in practice. We build on the work of Barton et al. (2017) and Lien et al. (2018) in suggesting that the IAD can provide a common language for comparing the institutional structure of an agri-environmental initiative while avoiding arguments based on the so-called “ideal type” (e.g. Wunder, 2015) of policy instruments such as PES.

We acknowledge that various alternative analytical frameworks for the study of rules implied in agri-environmental management exist. The Agrarian Socio Ecological Systems framework (ASES) has been used to analyse ecological systems through their linkage with components of social systems (Anderies 2014). This framework delimits the interactions between inter-connected sub-components including the resource system (e.g. the agrarian ecosystem), resource units (e.g. crops, nutrients), users (e.g. farmers, society), and governance systems (e.g. organisations and rules). However, this framework mainly explores the institutional spaces of co-management and co-production of environmental commons rather than the characteristics of policies.

Another framework is the Institutional Resource Regime (IRR) that analyses the transformation of regulatory measures and other resource management practices by combining property rights theory and policy analysis. This framework describes the configuration of land-use regimes and changes in order to predict their ability to assure the sustainable use of a given resource (Gerber et al., 2008). The IRR analyses institutions from a political economy perspective at a macro-level, but pays less attention to the operationalisation of rules and the way they influence land-user choices. Compared to these frameworks, and in light of our research question, the IAD framework offers a structured way to explore how rules affect outcomes in a given action situation and relevant to a policy intervention such as PES (Lien et al., 2018).

Analysing participation

In this paper, we need to understand ‘participation’ to go beyond mere enrolment of land users in any type of program but involve role-sharing between governments, communities and individuals. Drawing on the levels of participation applied by Prager and Freese (2009) as well as on the typology of Ross et al. (2002) we define participation as a process of power and role-sharing between parties with differences in agency (which parties carry out which part of a measure), tenure (parties’ control over resources), type of participants and the specificities of measures implemented, such as task and duration.

Moreover, the role and power of land users’ in the design, implementation of a policy can take different forms: actors can be simply consulted; be present in the decision-making process; or have the possibility of influencing or even controlling the overall results (Prager and Freese 2009). The type of participation will therefore depend on the distribution of power in the agency of actors to directly influence outcomes (Cooke and Kothari, 2001), in our case to influence the adoption of land-use management for the provision of ecosystem services. The type of participation will also delimit strategies within a coordination (top-down approach) or cooperation (bottom-up approach) (Davies et al. 2004).

In relation to market-based mechanisms, we consider that *incentive-based participation* occurs when stakeholders participate by providing resources such as management activities for conservation, in exchange for a payment (Prager and Fraser 2009). It is very common to call this type of engagement “participation,” but actors often have little agency in influencing decision-making over the process and may terminate conservation efforts when the incentives end (Prager and Fraser 2009). On the contrary, *interactive*

participation occurs when land managers take part in the joint analysis of the project, influencing action plans, directly shaping the formation of new local institutions or in strengthening existing institutions. In this situation, farmers take control of local decisions, and have an interest in maintaining structures or practices. This more engaged degree of participation is attained when actors reshape or create new independent initiatives that go beyond initially proposed by an agri-environment scheme (Shapiro-Garza 2013, Prager and Fraser, 2009).

In that way, we will distinguish between enrolment in an incentive-based program and the agency of actors to influence the process and outcomes of their involvement as active participants. The duration of the engagement of land users and their agency over decisions are crucial in the long-term sustainability and maintenance of land uses (Schauppenlehner-Kloyber and Penker 2016, Riley 2016).

Study Site

Quebec's agriculture has undergone a trend of intensification and specialization, especially in southern Quebec, where most agricultural land is situated (Lehner et al. 2014). This trend is the result of technological and production changes during the 20th century, characterized by the replacement of pasture and traditional cereals by industrial-scale production of corn and soybean destined primarily for animal feed (Morisset and Couture 2010). Agricultural production shifted from what was perceived as an "inefficient" scenario towards one premised on the modern tenets of economic growth and in encouraging farmers to become "specialists" in the production of specific agricultural goods such as dairy, hog, corn and soybean (Morisset and Couture 2010).

This production change led to important environmental issues such as biodiversity and habitat loss, soil erosion, and an increase in nutrient runoff affecting water quality in rural areas (Jeswiet and Hermsen 2015, Terrado et al. 2015). To reduce the impact of nutrient pollution, regulations that prescribe agri-environmental practices have been put in place in Quebec since 2002. These have included the introduction of the Agriculture Operation Regulation requiring farmers to produce agro-environmental plans, protect shorelines and to manage livestock waste (Zaga-Mendez 2016).

In recent years, voluntary programs to encourage environmental conservation beyond regulatory requirements have been introduced. The main goal of such schemes is to encourage agri-environmental practices such as the protection of riverbanks, the establishment of hedgerows, and the creation of multifunctional infrastructure such as hedges mixings trees and shrubs or the reconstruction of wetlands. The main direct payment scheme for agricultural producers to encourage the adoption of best management practices is the 'Prime-Vert' program ("Green-Award" program), implemented by the Ministry of Agriculture, Fisheries and Food of Quebec (MAPAQ) since the early 2000s. Initially, the main objective of the program was to support farms in regulatory compliance, notably by subsidizing the construction of manure and slurry storage structures. Currently and as stated in the latest available version of the program (2013–2018), 'Prime-Vert' aims to promote and disseminate good agricultural practices, support farms to adopt environmentally friendly production methods, promote collective initiatives to address concerns regarding air quality, soil health, biodiversity and human health, as well as issues related to climate change (MAPAQ 2013).

In line with these objectives, the MAPAQ prioritizes three areas of intervention: (1) reducing the risks associated with the use of pesticides; (2) the adoption of effective soil conservation practices; and (3) biodiversity conservation. 'Prime-Vert' has received significant funding from various strategic frameworks and action plans of the Quebec and Canadian governments. In the first period of the program, CAD\$162.1 million of financial assistance was disbursed (1997–2001), of which nearly one quarter (CAD\$41.6 million) was allocated to fund agri-environmental advisory organizations or extension services (Larbi-Youcef 2017).

Since 2016, a private program, known as the "Alternative Land Use Services" (ALUS) initiative was introduced in Quebec to increase the provision of ecosystem services by farmers. This program was launched in the Monteregie region, an intensive agricultural landscape, as the first-ever PES program in Quebec. ALUS is also an NGO that receives financial support from the W. Garfield Weston Foundation, a private Canadian family foundation which directs a significant proportion of its philanthropic mandate to fund projects in nature conservation. ALUS currently operates in six Canadian provinces and offers annual payments to farmers and ranchers for the ecosystem services they provide in agricultural landscapes. The implementation of ALUS in Quebec was established through a partnership between ALUS Canada and the Federation of Agricultural Producers of the Monteregie region (henceforth UPA-Monteregie). The objective of ALUS is to provide an avenue for farmers to enhance biodiversity and multifunctional landscapes that improve air and water quality without the financial "burden" that this might entail in an otherwise intensive and productive landscape.

Table 1 shows an overview of the practices for enhancing the provision of ecosystem services in agro-ecosystems encouraged in the respective program.

Table 1: Practices encouraged by the 'Prime-Vert' and ALUS program.

'Prime-Vert'		ALUS	
Hedgerows	<ul style="list-style-type: none"> · Trees · Shrubs 	High ecological value	<ul style="list-style-type: none"> · Pond surrounded by a vegetative strip (trees and shrubs) · Reforestation of a wetland with trees and shrubs · Multifunctional hedge (trees and shrubs) with strip for pollinators · Multifunctional hedge (trees and shrubs) · Windbreak hedge (trees)
Extended riparian strips	<ul style="list-style-type: none"> · Mixed (trees, shrubs and/or grass) · Arborescent (trees and shrubs) 	Medium ecological value	<ul style="list-style-type: none"> · Shrubs hedge · Flower meadow with shrubs and herbaceous plants
Infrastructure favouring Biodiversity	<ul style="list-style-type: none"> · Riparian bands for biodiversity · Flower strip or island · Wooded hedge rows or island · Buffer zone for zones of ecological interest · Ponds or swamps 	Low ecological value	<ul style="list-style-type: none"> · Hedge for pollinators (herbaceous and grasses) · Meadow with herbaceous plants

Table 2: Components of the institutional statements of the Institutional grammar tool (Sidikki et al. 2012 Carter et al. 2016).

Institutional statement component	Description
A Attribute	Organization or actors who can/should/must conduct an action
B Object	Organization or actor who receives the action
D Deontic	Verbal mode indicating if an action is permitted, obliged or forbidden.
I Aim	The action, the goal of the action and how it should be conducted
C Conditions	Restrictions and conditions of action, such as the "when", "where", "if", and "unless".
O Or else	Sanctions or consequences for non-compliance

Methods

The methodology applied in this study followed three analytical steps: The codification of policy documents using the institutional grammar tool; a content analysis based on the rule typology of the IAD, and data collection from governmental sources and informant interviews to contextualize the incentive programs.

Codification of rules with the institutional grammar

We first use the Institutional Grammar Tool (IGT) proposed by Crawford and Ostrom (1995) to code and deconstruct relevant policy documents identifying the actor, actions affected and conditions of the two programs mentioned. The IGT is part of the IAD and it is the first analytical step to identify the rules governing the action situation by isolating policy-embedded directives that determine agents and outcomes (Carter et al. 2016). The unit of observation is the *institutional statement*, defined as a statement that allows, authorizes or prohibits a particular action. An institutional statement can include up to six components: (1) the *attribute*, the actor responsible for performing an action; (2) the one who receives the action (*object*); (3) the *deontic* or operator that indicates whether the action is required, authorized or prohibited (4) the action itself (*aim*); (5) the circumstances under which the action is performed (*conditions*); and (6) the punishment for non-compliance (*or else*) (Table 2; Siddiki et al. 2012, Basurto et al. 2009).

Based on these IGT components, we codified five (5) policy documents: (1) the ALUS contract and (2) the ALUS description for the private PES, (3) the guidelines for extending riparian buffer strips (MAPAQ 2017a), (4) Guidelines for hedgerows and (5) Guidelines for biodiversity conservation from the 'Prime Vert' MAPAQ 2017b.

Content analysis of rules

Secondly, we analysed the content of the institutional statements based on the rule typology of the IAD. This typology facilitates the analysis of the operationalization of rules by classifying them into seven categories (Ostrom 2005). The main indicator for categorizing rules is the content of the "Aim" from the coded institutional statements (Ostrom, 2005).

Table 3: Description of the rule typology of the IAD and the content analysis questions adapted from Barton et al. 2017.

Rule Type	Description	Analytical questions
Position rules	They define the role played by each actor. They determine the minimum or maximum number of actors for a given position (participants, administrators, etc.)	<ul style="list-style-type: none"> · Who are the actors targeted by the program? · Who manages or promotes the program?
Boundary rules	They identify the prerequisites (e.g. characteristics, skills, possessions) for individuals to be eligible to hold a particular position.	<ul style="list-style-type: none"> · What are the eligibility requirements to participate in the program?
Choice rules	They specify the actions an actor should or should not take. Often, such rules also indicate the conditions that affect what an actor must or must not do.	<ul style="list-style-type: none"> · What are the practices funded by the program? · What are the actions that are not funded by the program? · What are the responsibilities of the actors participating, administrating or promoting the program?
Aggregation rules	They determine the actions that involve two or more individuals, and set the conditions for collaboration and decision making	<ul style="list-style-type: none"> · Are the actions requiring collaboration/ coordination? · What are the conditions for this collaboration/ coordination? · How are decisions made between actors?
Information rules	They indicate the permitted channels of communication between actors, the manner by which information flows, and what form of information is allowed.	<ul style="list-style-type: none"> · Is there any exchange of information/ knowledge among participants, and/or with other actors (e.g. consultants, managers)? · How does this exchange occur? · What type of information is exchanged?
Pay off rules	They assign rewards and sanctions to specific actors.	<ul style="list-style-type: none"> · What is the payment/incentive offered by the program? · Are there sanctions or consequences for not complying with the program?
Scope	They identify the outcomes, goals or results of the actions. They may include the parameters, the range or the variables to measure the desired outcome.	<ul style="list-style-type: none"> · What is the main outcomes of the program? · How are these outcomes measured? · Is there a monitoring system to account for the provision of ecosystem services or the impact of the program?

As detailed in **Table 3**, in an action situation, the position of actors is defined by “position rules.” Actors assume a position (i.e. a role) also according to “boundary rules” that define who has the right to enter the action situation. The actions expected are defined by “choice rules” and collaborative situations are affected by “aggregation rules.” The information available to participants is influenced by “information rules.” The benefits and costs attributed to the results of an action (in our case the incentives or punishments), are defined by “payoff rules.” Finally, the potential outcomes are affected by “scope rules” (Kiser et al., 1982, Ostrom 2005, Barton et al. 2017). **Table 3** presents the content analysis questions that were adapted in this study to determine the rule typology of incentive-based approaches for agri-environmental policy.

Data on program operationalization

In the third phase, the content analysis was combined with data on the enrolment rate and the impact of the programs in recent years in Quebec to discuss the implications of these incentive-based programs (Refer to **Table 4**). These data were requested from both managing agencies, the Quebec provincial government and the UPA Monteregie.

To understand the context in which these schemes operate and how institutions promoting agri-environmental activities unfold in practice, the results from the rule typology were triangulated with data collected during semi-directed interviews with key stakeholders (11) involved in the management and implementation of both programs: farmers (4), Producer union coordinators and representatives (3), agronomists (3), and a member of watershed organisations (1). We also reached out to representatives of

the provincial government (MAPAQ) that responded to our questions through email. The recruitment of participants was done through targeted calls and a snowball sampling technique. We also participated in open meetings with farmers (3) organized by the UPA-Monteregie, as well as field visits (2). The themes of the interviews followed the analytical questions of the rule typology (e.g. **Table 3**) on what types of rules and norms were applied in the governance of these programs. We also added questions regarding participation of beneficiaries in the management, design and development of the programs.

Results

This section presents a descriptive comparison of the 'Prime-Vert' and ALUS programs based on the functional characteristics, including the position of actors, the boundaries of the program, the choices encouraged, the aggregation of actions, the exchange of information, the type of pay off and the scope of the programs. The first codification using the IGT of the five policy documents from both programs resulted in 291 statements that served as the basis of the content analysis using the rule typology described earlier.

Rules

Position of Actors

'Prime-Vert'

The government is tasked with the design and conception of the program. The program targets all agriculture producers in Quebec, inviting them to voluntarily submit an application to their Ministry of Agriculture (MAPAQ) regional office. It is the Ministry's regional representatives who judge the eligibility of projects and administer the funds. In order to submit an application, producers work with an agronomist, often associated with an agri-environmental extension service, who advises them on the types of practices to adopt and on the preparation of documents. The number of participants follows a "first come first serve" basis, depending on funding availability at the federal and provincial level.

ALUS

The design of the program is the result of a negotiation between ALUS-Canada, in determining overall program goal, and the UPA-Monteregie. This program applies only to farmers residing in the Monteregie region. The producer is required to apply for funding through the UPA-Monteregie which coordinates the management and promotion of the program. The funding derives primarily from private sources such as ALUS Canada and, Soleno (a local drainage company). An ALUS committee is held which oversees the functioning of the program and judges the eligibility of proposed projects. The committee is composed of representatives of agricultural producers, ALUS coordinators, and the president of the UPA-Monteregie, agricultural stakeholders, watershed organizations and agri-environmental extension services. Two ALUS coordinators are in charge of operations on a day-to-day basis. Producers are encouraged to work with an agronomist to present and develop an infrastructure plan for the installation of specified agri-environmental measures.

Boundaries of the Program

'Prime-Vert'

To be admitted, producers must respect current regulations, such as the Agricultural Operation Regulations and the Pesticide Act. Producers need to declare that they produced an agri-environmental fertilization plan and a phosphorous balance sheet. The program only supports farms engaged in an integrated management approach, and this must be reflected in the development of an accompanying agri-environmental plan (AAP). The AAP is a tool for recognizing the environmental risks present on a farm and for describing the practices that must be implemented by the farmer in order to reduce those risks. Producers must present a complete request to the Ministry and await approval before implementing any project. The producer must also obtain all authorizations (e.g. municipal or governmental) necessary for the realization of the project. No formal contract is established between the producers and the Ministry.

ALUS

The program offers payments for new agri-environmental infrastructure, thus producers must show that the project has not already been carried out and wait for the acceptance of the project by the UPA-Monteregie before its implementation. Similar in vein to 'Prime-Vert', producers must obtain all authorizations for the realization of the project. The area of the project must be beyond the regulated buffer requirements according to the existing policy for protecting shores and shorelines. Producers are required to carry out the implementation of projects themselves, though, they might ask for support from the UPA-Monteregie

or other public or private funding sources. Producers must submit a complete project request including a description of the project, expected cost structure, aerial or visual maps of planned new infrastructure, consent of the landowner where necessary, and any permits and certificates required by the municipality. Producers sign a contract with the UPA-Monteregie detailing the condition of payments and expected outcomes. A chosen participant may terminate this contract at any time within 30 days-notice. In the case of receiving financial assistance from the UPA-Monteregie in implementing projects, participants will reimburse a portion of the costs of implementation to the UPA.

Choice of Practices

'Prime-Vert'

All green infrastructure must follow the design criteria approved by the Ministry, including the minimum and maximum width of the project, as well as adhering to recommendations on the composition and vegetative density (percentage of herbaceous species, trees or shrubs) of planted species. The producer must meet these standards in order to be admitted to the program and to receive their entitled financial compensation. Projects must also comply with regional standards as stipulated in specifications suggested by the regional municipalities. For instance, some counties demand a wider buffer between the cultivation zone and a waterbody than that regulated by the provincial shoreline protection regulation. Producers must also declare that they aim to maintain the practice for a minimum of 5 years.

ALUS

Producers do not have to follow any specific technical prescriptions on the composition of the agri-environmental infrastructure installed to be admitted. It is up to the producers to decide the site, length and composition of the project. However, the annual payment is adjusted according to the ecological value of the project and land-price values of the area covered, following retribution charts designed by the ALUS coordinators. Producers must maintain the soil in accordance with the recommendations suggested by the UPA-Monteregie and protect the project against any grazing by livestock. The producer must not alter, displace or destroy the project throughout the duration of the contract, without the written authorization of the UPA-Monteregie. Finally, participants must agree to transfer any present or future carbon offset or ecological credits potential of funded projects to the UPA-Monteregie.

Coordinated actions and collaboration

'Prime-Vert'

The main action that requires coordination is in the application process itself. Farmers are required to be accompanied by an agronomist to complete the forms and in preparing and submitting an agri-environmental plan. The agronomist completes the required paper work and designs the project to facilitate the process and to manage the bureaucratic burden of subscriptions to the program. Producers can select a joint management of activities by subscribing to a second stream of the program, based upon a collective action approach. This approach, within the 'Prime-Vert' program, involves farmer-to-farmer collaboration in the watershed implementing jointly or individually a land-use practice that encourages biodiversity, protects riparian zones, or prevents soil erosion. One example of a joint initiative could involve collaborating across parcels of land to implement revegetated buffer zones across the length of a watershed basin. This collaborative approach incentivizes farmers to receive an additional 20% in compensation once admitted to the program. To be admitted, farmers must collectively present a request to the regional division to be approved as a collective agri-environmental initiative. Farmers are only beneficiaries of the agri-environmental measures implemented without ongoing procedural follow-up or participatory engagement in the process.

ALUS

A strong degree of coordination is evident between the ALUS coordinators at the UPA-Monteregie and farmers subscribed to the program. The UPA-Monteregie coordinators are tasked with promoting the program and guiding potential participants through the application process. They also support farmers in seeking additional funding sources to cover the full costs of implementation; are in charge of supervising project implementation, and in assuring the permanence of the projects. Like 'Prime-Vert', subscribed farmers are encouraged to be accompanied by an agronomist throughout the design of the project and in the application process. An interactive and more bottom-up participation of farmers is evident in the ALUS committee in reviewing and approving potential projects, with farmers and UPA representatives given a space to discuss the aims and type of practices encouraged.

Information Exchange

'Prime-Vert'

The Ministry provides agronomists and producers with detailed guidelines and fact sheets to facilitate the completion of the request and the determination of practices eligible for funding. The Ministry also produces promotional material and organizes presentations of the program. These are the main information channels that formally exist between the manager of the program and participants. It was noted that communication often took place between farmers, the agronomist, and the regional division in the completion of the request. Additionally, the Ministry frequently organizes consultations and exchanges with agri-environmental groups in the management and updating of the program. These channels of communication are not formally detailed in written documents. Rather, consultations often take place informally and are often unidirectional as the Ministry informs about updates to the program, but does not permit the active participation of farmers in the design and management of the program.

ALUS

Information is transmitted by the coordinators to potential participants through the existing channels of the UPA-Monteregie (e.g. assemblies, meetings, newsletters). Coordinators are also in constant contact with farmers who participate in the program. The UPA-Monteregie organizes field visits to showcase agri-environmental practices and entice ALUS to regional stakeholders, including neighbouring farmers not yet subscribed to the program. No details have been provided on the nature of information exchange between stakeholders in the ALUS committee, during the design phase of the program.

Payment

'Prime-Vert'

The primary incentive covers the cost of implementation of well-defined projects. The reimbursement initially covers 70% of the implementation cost and is a one-off payment. The coverage can reach up to 90% if the project is part of a collective approach as recognized and approved by the Ministry. Payments cover the costs of the development of new infrastructure and does not compensate for the loss of revenue from production. In addition, the program does not provide funding for the maintenance of practices. In the event that a producer does not realize any type of project according to the approved plans, the Ministry reserves the right to demand repayment of the payment granted or to block access to other financial assistance within the framework of the project.

ALUS

Implementation is financed by either the producer or in partnership with other agencies (MAPAQ or the UPA-Monteregie). Participants receive annual payments for a period of five years to maintain the project according to contract conditions. Payments are calculated according to the rate per hectare of ALUS activity installed and the area of the project, rather than on opportunity costs for farmers or market values of ecosystem services. The current payment is calculated based on the price of land in the Monteregie region. The UPA-Monteregie may adjust the annual payments based on the actual area of the project if different from the estimated area at the time of design.

Scope of the programs

'Prime-Vert'

Since there is no legal contract between the producer and the Ministry, it is difficult to analyse the type of commitment that producers make in the long term other than the declaration to maintain the integrity of the project for five years on the application form. The program only stipulates rules on the control and monitoring measures to verify the completion of projects. Admitted farms have a maximum of 15 days following the completion of the project to submit a "certificate of conformity" signed by a professional consultant. The payment is conditional on the presentation of this certificate. This attestation must include all supporting documents as well as photographs of the project's implementation. In sum, it is only the implemented "green" infrastructure that is verified and not the permanence of the agri-environmental measures over time.

ALUS

Payments are made following an annual inspection of the funded projects. If the attainability or long-term maintenance of the project is compromised, a mutual agreement with regard to the actions necessary

to rectify non-compliance might be established between the farmer and the UPA-Monteregie. The UPA-Monteregie may terminate the payment if participants do not respect the contract or if the mutual agreement is not achieved according to the deadlines and satisfaction of the UPA-Monteregie. In the situation where the UPA-Monteregie has paid the implementation costs, a reimbursement of implementation costs will be requested from farmers, with failure to do so resorting to potential legal recourse.

In terms of monitoring, both programs appear to have a well-established process to ensure compliance with scheme rules. However, neither program proposes adequate ecological monitoring to evaluate the ecological impacts of agri-environmental measures put in place and the long-term effects of such practices in the provision of ecosystem services (i.e. biodiversity, soil health, water quality, among others), as primary objectives of these programs.

Operationalization of 'Prime-Vert' and ALUS Quebec

A major strength of the 'Prime-Vert' program is the funding of various agri-environmental practices that go beyond regulation. As shown in **Table 4**, the previous version of the program (2013–2018) funded approximately 2,900 projects across Quebec, involving roughly 2,100 agricultural producers. This funding is concentrated in intensive agricultural regions such as the Monteregie. However, the program reaches few producers in the province, despite significant investment: only 7% of farms benefited from 'Prime-Vert' between 2013 and 2018 across Quebec, with the rate limited to 10% for the Monteregie region.

Moreover, practices are not equally distributed in terms of uptake by farmers. **Table 5** shows the breakdown of projects funded by the program, between 2013 and 2018. It can be seen that measures to acquire and improve equipment for the reduction of risks related to the pesticide application has received

Table 4: Number of beneficiaries, number of projects and amounts disbursed by the 'Prime-Vert' program (2013–2018).

Region	Number of farmers	Number of projects	Total funding	Number of farms in the region ¹	Percentage of Adoption ² (%)
Monteregie	695	887	3,947,243	6,748	10.30
Quebec total	2,132	2,903	17,089,070	28,919	7.37

Source: MAPAQ, 2017. Data obtained from an access to information request.

¹ Number of farms according to the Agricultural Census 2016. Source: Statistiques Canada.

² This percentage represents the ratio between the number of beneficiaries and of the Volet 1 of the program in the region and the total number of farms.

Table 5: Breakdown of funded projects and financial assistance disbursed by the type of agri-environmental practices from 2013–2018 in Quebec.

Practice	Number of projects	Funding (CAS)	Percentage of total projects	Percentage of total funding
Acquisition and improvement of equipment to reduce pesticide risk	1,738	6 589 795,00 \$	59.87%	38.56%
Soil conservation	449	2 470 708,00 \$	15.47%	14.46%
Hedgerows	343	1 070 956,00 \$	11.82%	6.27%
Biodiversity conservation projects	48	220 959,00 \$	1.65%	1.29%
Expanded riparian strips	52	191 948,00 \$	1.79%	1.12%
Alternatives installations	178	3 376 700,00 \$	6,13%	19,76%
Aeration of irrigation ponds	24	43 760,00 \$	0.83%	0.26%
Management of residual organic matter and liquid effluents from plant production	46	2 134 107,00 \$	1.58%	12,49%
Alternative installations in Beef Cattle Production	10	108 137,00 \$	0.34%	0.63%
Manure storage structures for biogas treatment	15	882 000,00 \$	0.52%	5.16%
Total	2,903	17 089 070,00 \$	100	100

Source: MAPAQ, 2017. Data obtained from an access to information request.

significant funding (60% of subsidized projects and 38% of the total amounts disbursed). However, the expanded riparian buffer strips, hedgerows and biodiversity-enhancing development represented a mere 1.79%, 11.82% and 1.65% respectively of total projects financed. Therefore, the number of projects funded for the development of biodiversity conservation measures remains marginal compared to other practices offered by 'Prime-Vert'. It is important to note that these data do not consider projects financed prior to 2013. Nevertheless, they provide a portrait of current program priorities and impacts in the adoption of agri-environmental practices and encouraging the delivery of ecosystem services.

The ALUS program has only been operating since 2016 and as such, its impact on agri-environmental outcomes remains unclear. From 2016–2017, there have been 7 producers participating in the first phase and from 2017–2018, 15 additional producers joined the program. In its first year of implementation, the projects were conducted in two watershed basins; a total of 6 ha of land were converted into hedge rows, riparian bands, flower strips, covering a total of 4,500\$ CA offered in financial contributions to farmers. The second year the program was extended to all watersheds of the Monteregie region, and the program covered 14.6 ha for a total of 10 900\$ CA in financial contribution to farmers.

According to the boundary and payoff rules, farmers need to be able to financially absorb the costs of implementation and to seek additional financing for the maintenance of installed structures to be admitted to ALUS. Even if the program offers more flexibility compared to 'Prime-Vert' in terms of conditions of entry while offering more informational support to farmers, the adoption of ALUS activities relies on the financial conditions of each farmer or on their capacity to comply with the requirements imposed by the program or entity financing the implementation.

Furthermore, the informative interviews showed that all farmers involved in the ALUS pilot phase were either involved in agri-environmental initiatives funded by UPA, and were encouraged to apply to 'Prime-Vert' for initial funding. As discussed by the managers of ALUS Monteregie, 'Prime-Vert' is the only program in the province financing the implementation of ALUS supported land-use practices. For this reason, agronomists and ALUS coordinators accompany farmers to apply to 'Prime-Vert' in order to comply with the main requirements of the ALUS payment, covering the financial cost of agri-environmental measures implemented. As this shows, both programs are more than just complementary, they are institutionally integrated.

Figure 1 illustrates the interactions between both programs in terms of organisations involved, how they are interrelated, and the networked relationships that farmers will already be familiar with if they are (or were already) motivated to implement agri-environmental practices. These interactions are the results of the

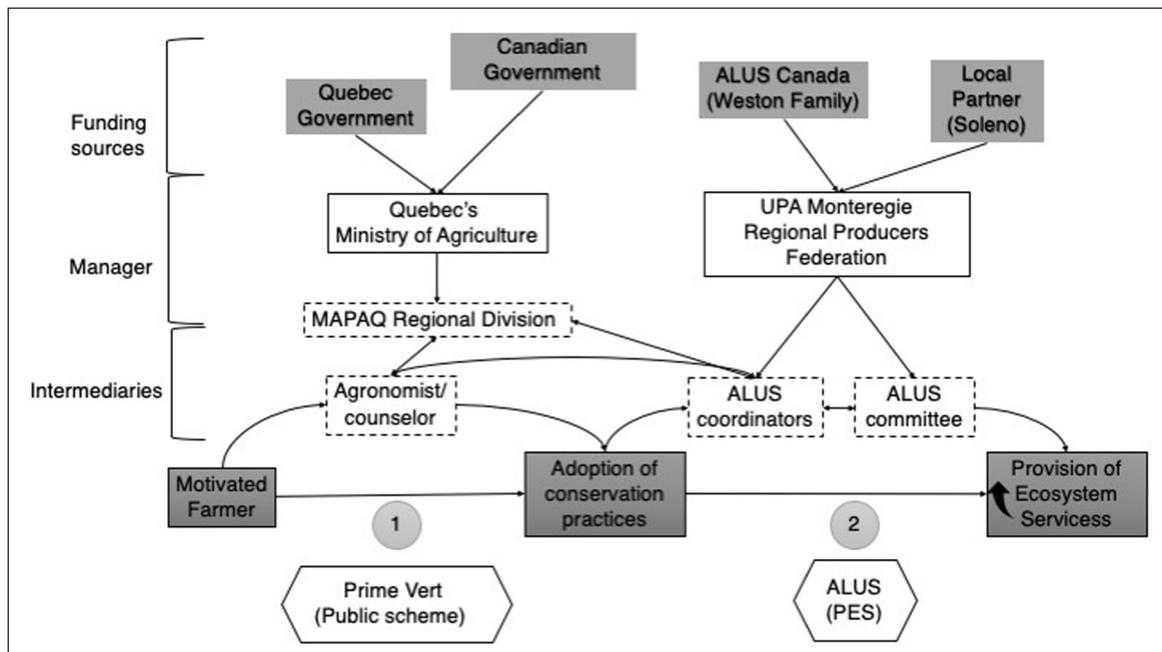


Figure 1: Interactions between the governance structure of the public 'Prime-Vert' scheme and the private PES (ALUS) as detailed by the rules in use of the IAD framework. In order to increase the participation of farmers for the provision of ecosystem services, ALUS (PES) relies first on the institutions and governance structure of the public scheme (e.g. 'Prime-Vert').

position rules – roles that the actors play in the implementation of the programs – and the payoffs rules – the type of incentive payment that farmers interviewed received from both programs.

As observed, there is a multiplicity of actors involved in each scheme. These include governments and private foundations or companies, or managers such as provincial government agents and farmers' associations. Intermediaries (i.e. agronomist and ALUS coordinators) play an important role in the process by (1) facilitating the uptake of agri-environmental practices ('Prime-Vert') and (2) ensuring the permanence of continued ecosystem service provisioning (ALUS) through continuous management of the program. The ensemble of these actions aim to complement and in the long-term increase the provision of ecosystem services. The arrows in the figure between actors signify the type of collaboration or exchange (e.g. unilateral or bilateral).

Therefore, ALUS behaves as a financial complement to the 'Prime-Vert' program and thus indirectly depends on public funding to operate as a "private" PES-like program. Moreover, the bureaucratic requirements to enter both programs are complementary. This might suggest a consolidation of control and influence by the state or state-like actors (in this case MAPAQ and UPA) while seemingly implementing PES-like programs, such as ALUS, as voluntary measures or, increasingly, as market-based mechanisms.

These interactions between the rules of both programs limit farmers to only an *incentive-based participation* where farmers are taken by the hand by the promoters of the program, and are given a pay-off only in exchange for compliance, where they have no influence in the development, design or implementation of the incentives rules and process. The following farmers' statements illustrate this dynamic:

"To install the hedgerow, it was her [UPA coordinator] that took care of it, she will plan everything: the type of tree species and all those details. We did not have to take care of that" – Farmer 1.

"All the forms were done together, ALUS and 'Prime-Vert', each time it was him [agri-environmental advisor] who would lead the project. He knew about ALUS, so he will do it, not me" – Farmer 3.

Discussion

The aim of this study was to look at how the institutional characteristics and interactions between incentive mechanisms influence the degree of farmers' participation in the adoption of management practices for the delivery and conservation of ecosystem services. Our results show that both programs differed in terms of rules-in-use. Boundaries and choice rules of 'Prime-Vert' were more rigid having more admission conditions compared to ALUS. However, as shown by the institutional interactions, rigid rules might extend to ALUS. This strictness might explain the low enrolment to the public program in relation to conservation practices that increase the provision of bundled ecosystem services such as hedge rows, biodiversity conservation measures and buffer strips (**Table 5**). This is also observed by Larbi-Youcef (2017) who argues that few farmers take advantage of 'Prime-Vert' because the application process is administratively complex and often farmers do not feel sufficiently supported in this procedure by the Ministry.

Moreover, budget limitations might influence the uptake of practices as the funds are distributed based on a first come, first serve basis. However, in the case of Prime-Vert, budget limitations have not been a concern in recent years. Between 2013–2017, the amount distributed to farmers for individual projects was about C\$17 million (**Table 5**). Other sub-programs of Prime-Vert offered funding to organisations for watershed management projects (C\$ 2 383 318), interregional agri-environmental projects (C\$ 12 326 231), and knowledge mobilisation activities (C\$8 586 402), for a total of C\$ 40.4 million in expenditures¹. This total represents about 33.5% of the total budget for Prime-Vert 2013–2017 allocated by the Ministry (C\$ 120 700 000), leaving sufficient funds for individual and collective management projects².

Overall, in the case of 'Prime Vert', farmers need to be sufficiently motivated to go through this process, suggesting that passing through bureaucratic hoops might require a greater commitment to ecological consciousness. This rigidity also suggests that inscription to the 'Prime-Vert' program not only depends on the intrinsic motivation of farmers and the extrinsic motivation offered by the incentive, but also on the *capacity* of farmers to comply with the multiple rules of the program and to their capacity to absorb the costs of the administrative burden.

¹ Data obtained from an access to information request to the Ministry of Agriculture of Québec in 2017.

² Idem.

Moreover, programs' aggregation rules – that set the way actors interact, collaborate and reach decisions – illustrate that the admission process for both programs requires collaboration among various actors. Of the two programs, ALUS is closer to engendering more direct interactions between the administrative body and farmers. To be admitted, farmers require being accompanied by either an agronomist or by an agri-environmental coordinator of the UPA-Monteregie (position and aggregation rules). The role of the ALUS coordinators in facilitating enrolment to the program does not adopt a “hands off” approach. Rather, these actors are directly involved in the functioning of the program, for instance, helping farmers to obtain initial funding for implementing a new project. Given the influence of these coordinators and the UPA-Monteregie, intermediaries play an increasingly pivotal role in shaping the implementation of the program as it evolves and expands.

It is subsequently necessary to frame the role of actors in both programs within the IAD rule typology. The alignment of actor participation to the IAD rule typology, especially between the positions rules (roles of the actors) and the pay offs (rewards from both incentives), highlights dependency interactions whereby the private PES relies on the structure of the public scheme to operate. This interaction raises a concern over additionality in terms of what the ALUS program would contribute to ecosystem services compared to if it had not been introduced. ALUS risks being viewed as a novel source of financing for measures that are already in practice but have received insufficient financial support to cover their long-term implementation and maintenance costs. While the complementarity of financing is not a problem in itself, it once again illustrates the heavy bureaucratic burden that the combination of these programs entails for the farmers. Moreover, the lack of ecological monitoring in either program to evaluate the state of agri-environmental measures implemented compromises the long-term effects of these land-use changes in the provision of ecosystem services.

Furthermore, the analysis of the aggregation rules delimiting decision making process for each program showed that farmer's participation for collective decision making arenas is inexistent in the case of 'Prime-Vert' and limited in the case of ALUS. In the case of 'Prime –Vert', farmers have little to no decision-making power over the type of practices to be adopted, the process of admission, governance of the program, or the challenges and obstacles they must face to adhere to program rules within an environment of intensive agricultural production. The absence of decision-making agency for farmers to decide the rules and process of program implementation limits the involvement of farmers in 'Prime-Vert' as passive recipients and risks compromising their interest in continuing the adoption of agri-environmental activities in the long-term.

In this sense, incentive-based programs continue to operate more closely to government intervention measures, even though they are promoted as decentralized policy options as is the case of payments for ecosystem services. In the case of ALUS, though a committee exists that manages the program, not all farmers are able to be part of this decision-making process, as availabilities for farmer representation are limited within the committee, and individuals chosen for the committee are themselves selected by the ALUS coordinators who manage the program.

Accordingly, the attempt of ALUS to increase farmers' involvement in decision making is compromised by its interactions with 'Prime-Vert'. The integration between the programs, in terms of financial and bureaucratic commitments, limits options in the design of projects and reduces the autonomy of farmers' actions within the rigid framing of rules provided by the public program. For instance, the bureaucratic burden associated with program integration might reduce farmers' bargaining potential within the ALUS committee in terms of projects to be financed as they are influenced by the constraints of the 'Prime-Vert' program to which they are already subscribed to and to which they had minimal input in influencing. Consequentially, the interaction of these incentives results in bringing farmers together simply in relation to the transaction costs of implementing and financing *a priori* determined agri-environmental land-use practices. Farmers have very little input in framing and putting this policy into practice. Instead, the complementarity of these two programs has tended to treat farmers as passive beneficiaries of a network of centrally managed subsidies.

Connecting how the IAD framework analyses the way institutions are crafted with how to achieve greater levels of participation in PES requires attention to the aggregation rules delimiting the way decision-making is carried out and operationalized. Aggregation rules are key to understand the extent to which farmers engaged in these schemes have the autonomy to shape the process and influence outcomes or, conversely, whether interaction by farmers are shaped in more passive ways. As we have illustrated, the potential of aggregation rules to foster participation can be influenced by policy-mixing, whereby an overarching set of rules associated with one policy fundamentally alters the agency of participation of farmers in engaging with a second policy. In our case, the adherence obligations established by the public 'Prime-Vert' program in Quebec fundamentally alters the emancipatory potential of the private PES (e.g. ALUS) initiative to foster truly bottom-up interactive participation.

Finally, we acknowledge that the IAD framework does not reveal all the institutional complexity in which market-based mechanisms operate. Researchers need to pay closer attention to the power asymmetries between actors and their influence in the institutional characteristics of program design and implementation (Van Hecken et al. 2015; Pascual et al. 2017). Power dynamics are not evident or remain poorly acknowledged through the IAD, even as they crucially influence how rules are designed and operationalized (Cleaver and Whaley 2018). Future investigation of these policies as they continue to evolve, would benefit from the adoption of a more “politicized” institutional analysis as proposed by Clement (2010). Finally, even if the IAD helps to categorize the design and functional features of agri-environment schemes, one needs to contextualize the rules within an overall historical, political, and cultural setting, for instance, by including oral histories from interviews and field visits to determine how actors interpret and manage ‘rules in use’ according to their lived realities.

Conclusion

In this analysis, we reveal numerous ways in which the rules of a private PES and a public agri-environmental scheme shape participation of farmers in influencing the design and attainment of program objectives. Our study shows that low participation rates in both programs reflect major challenges in encouraging the provision of ecosystem services in intensive agricultural areas in Quebec. The low uptake can be partly explained by the rigid rules governing enrolment in the ‘Prime Vert’ public program (boundary rules), the limited conservation practices proposed within the overall ambit of the program (choice rules), and the constraints on coordinated and collaborative actions (aggregation rules). The consequence of our assessment illustrates that together these aspects limit the effects of the schemes on farmers’ enrolment and further participation to agri-environmental incentives.

The comparison of these two schemes highlights the institutional integration between them despite being conceptualized differently and through different sources of support. This dependency of the private PES on the public scheme effectively renders both largely managed under the remit of the provincial government. While this could help diversify the sources of funding for farmers, the deployment of a private PES approach (in the presented case) may indicate minimal additionality in terms of the delivery of ecosystem services or, perhaps more importantly, in ensuring desired land-use changes towards land stewardship in the protection of soils and biodiversity. As noted, the multiplicity of rules which govern the interactions of these two programs tend to treat farmers as passive beneficiaries of a network of centralized subsidies, thus neutralizing the attempt of the PES program to increase participation. This linkage risks turning incentives for agri-environmental land-use change into a bureaucratic engagement with little control for farmers. Farmers require greater autonomy to influence outcomes in the development of both programs, and more broadly in the face of mounting market pressures for production which otherwise act to intensify protection on already depleted and fragile soils.

Competing Interests

The authors have no competing interests to declare.

References

- Anderies, J. M.** (2014). Embedding built environments in social–ecological systems: resilience-based design principles. *Building Research & Information*, 42(2), 130–142. DOI: <https://doi.org/10.1080/09613218.2013.857455>
- Barnaud, C., Corbera, E., Muradian, R., Salliou, N., Sirami, C., Vialatte, A., & Reyes-García, V.** (2018). Ecosystem services, social interdependencies, and collective action: a conceptual framework. *Ecology and Society*, 23(1), 1–14. DOI: <https://doi.org/10.5751/ES-09848-230115>
- Barton, D. N., Benavides, K., Chacon-Cascante, A., Le Coq, J.-F., Quiros, M. M., Porras, I., ... Ring, I.** (2017). Payments for Ecosystem Services as a Policy Mix: Demonstrating the institutional analysis and development framework on conservation policy instruments. *Environmental Policy and Governance*, 27(5), 404–421. DOI: <https://doi.org/10.1002/eet.1769>
- Basurto, X., Kingsley, G., McQueen, K., Smith, M., & Weible, C. M.** (2009). A Systematic Approach to Institutional Analysis: Applying Crawford and Ostrom’s Grammar. *Political Research Quarterly*. DOI: <https://doi.org/10.1177/1065912909334430>
- Beckmann, V., Eggers, J., & Mettepenningen, E.** (2009). Deciding how to decide on agri-environmental schemes: the political economy of subsidiarity, decentralisation and participation in the European

- Union. *Journal of Environmental Planning and Management*, 52(5), 689–716. DOI: <https://doi.org/10.1080/09640560902958289>
- Bennett, D. E., & Gosnell, H.** (2015). Integrating multiple perspectives on payments for ecosystem services through a social–ecological systems framework. *Ecological Economics*, 116, 172–181. DOI: <https://doi.org/10.1016/j.ecolecon.2015.04.019>
- Carter, D. P., Weible, C. M., Siddiki, S. N., & Basurto, X.** (2016). Integrating core concepts from the institutional analysis and development framework for the systematic analysis of policy designs: An illustration from the US National Organic Program regulation. *Journal of Theoretical Politics*, 28(1), 159–185. DOI: <https://doi.org/10.1177/0951629815603494>
- Chan, K. M., Anderson, E., Chapman, M., Jespersen, K., & Olmsted, P.** (2017). Payments for ecosystem services: Rife with problems and potential—for transformation towards sustainability. *Ecological Economics*, 140, 110–122. DOI: <https://doi.org/10.1016/j.ecolecon.2017.04.029>
- Cleaver, F., & Whaley, L.** (2018). Understanding process, power, and meaning in adaptive governance: a critical institutional reading. *Ecology and Society*, 23(2). DOI: <https://doi.org/10.5751/ES-10212-230249>
- Cooke, B., & Kothari, U.** (2001). *Participation. The New Tyranny?* London: Zed Books Ltd.
- Crawford, S. E. S., & Ostrom, E.** (1995). A Grammar of Institutions. *American Political Science Review*, 89(3), 582–600. DOI: <https://doi.org/10.2307/2082975>
- Davies, B., Blackstock, K., Brown, K., & Shannon, P.** (2004). Challenges in creating local agri-environmental cooperation action amongst farmers and other stakeholders. Aberdeen: The Macaulay Institute.
- Froger, G., Méral, P., & Muradian, R.** (2016). Vers une prise en compte de la diversité des arrangements institutionnels et des pratiques dans l'analyse des paiements pour services environnementaux. *Développement Durable et Territoires. Économie, Géographie, Politique, Droit, Sociologie*, 7(1). Retrieved from <https://developpementdurable.revues.org/11163?lang=en>
- Gerber, J. D., Nahrath, S., Reynard, E., & Thomi, L.** (2008). The role of common pool resource institutions in the implementation of Swiss natural resource management policy. *International Journal of the Commons*, 2(2), 222–247. DOI: <https://doi.org/10.18352/ijc.44>
- Gómez-Baggethun, E., & Muradian, R.** (2015). In markets we trust? Setting the boundaries of market-based instruments in ecosystem services governance. *Ecological Economics*, 117, 217–224. DOI: <https://doi.org/10.1016/j.ecolecon.2015.03.016>
- Grima, N., Singh, S. J., Smetschka, B., & Ringhofer, L.** (2016). Payment for Ecosystem Services (PES) in Latin America: Analysing the performance of 40 case studies. *Ecosystem Services*, 17, 24–32. DOI: <https://doi.org/10.1016/j.ecoser.2015.11.010>
- Jeswiet, S., & Hermsen, L.** (2015). *Agriculture et faune: une relation d'interdépendance*. Statistique Canada.
- Kiser, L., Ostrom, E., & Ostrom, E.** (1982). *Strategies of political inquiry* (pp. 179–222). Beverley Hills, CA, and London: Sage Publications.
- Kolinjivadi, V., Zaga-Mendez, A & Dupras, J.** (2019). Putting nature 'to work' through Payments for Ecosystem Services (PES): Tensions between autonomy, voluntary action and the political economy of agri-environmental practice. *Land use policy*, 81, 324–336. DOI: <https://doi.org/10.1016/j.landusepol.2018.11.012>
- Kuhfuss, L., Préget, R., Thoyer, S., Hanley, N., Coent, P. L., & Désolé, M.** (2016). Nudges, Social Norms, and Permanence in Agri-environmental Schemes. *Land Economics*, 92(4), 641–655. DOI: <https://doi.org/10.3368/le.92.4.641>
- Larbi-Youcef, Y.** (2017). Les politiques agroenvironnementales au Québec: Enjeux, perspectives et recommandations. Master thesis. Université de Sherbrooke. Centre Universitaire de formation en environnement. https://savoirs.usherbrooke.ca/bitstream/handle/11143/10467/Larbi_Youcef_Yasmina_MEnv_2017.pdf?sequence=1&isAllowed=y
- Lavallée, S., & Dupras, J.** (2016). Regards sur les systèmes de paiements pour services écosystémiques en milieu agricole au Québec. *Développement Durable et Territoires. Économie, Géographie, Politique, Droit, Sociologie*, 7(1). Retrieved from <http://developpementdurable.revues.org/11210>
- Lehner, B., Gombault, C., Mehdi, B., Michaud, A., Beaudin, I., Sottile, M.-F., ... others.** (2014). *Increasing agricultural watershed resilience to climate change and land use change using a water master plan: A case study for the Missisquoi Bay*. Retrieved from http://www.ouranos.ca/media/publication/379_RapportLehner2013.pdf

- Lien, A. M., Schlager, E., & Lona, A.** (2018). Using institutional grammar to improve understanding of the form and function of payment for ecosystem services programs. *Ecosystem Services*, 31, 21–31. DOI: <https://doi.org/10.1016/j.ecoser.2018.03.011>
- McDermott, M., Mahanty, S., & Schreckenber, K.** (2013). Examining equity: a multidimensional framework for assessing equity in payments for ecosystem services. *Environmental Science & Policy*, 33, 416–427. DOI: <https://doi.org/10.1016/j.envsci.2012.10.006>
- Mettepenningen, E., Vandermeulen, V., Delaet, K., Van Huylenbroeck, G., & Wailes, E. J.** (2013). Investigating the influence of the institutional organisation of agri-environmental schemes on scheme adoption. *Land Use Policy*, 33, 20–30. DOI: <https://doi.org/10.1016/j.landusepol.2012.12.004>
- Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ).** (2013). Prime-vert.
- Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ).** (2017a). Guide administratif 2017–2018 – Mesure 4201 – Aménagement de bandes riveraines élargies. Volet 1–Prime-Vert 2013–2018. https://www.agrireseau.net/agroenvironnement/documents/Volet1_Guide_4201_Bande_riveraine_elargie_version_14juillet_2014_logos.pdf
- Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ).** (2017b). Guide administratif 2017–2018 – Mesure 4203: Aménagements favorisant la biodiversité. Volet 1–Prime-Vert 2013–2018. https://www.agrireseau.net/references/6/2017-2018_Volet1_Guide_4203_Amenagements_favorisant_Biodiversite_vs12jui_.pdf
- Morisset, M., & Couture, J.-M.** (2010). *Politique et Syndicalisme Agricoles Au Québec*. Les Presses de l'Université Laval.
- Muradian, R., Corbera, E., Pascual, U., Kosoy, N., & May, P. H.** (2010). Reconciling theory and practice: An alternative conceptual framework for understanding payments for environmental services. *Ecological Economics*, 69(6), 1202–1208. DOI: <https://doi.org/10.1016/j.ecolecon.2009.11.006>
- Muradian, R., & Rival, L.** (2012). Between markets and hierarchies: The challenge of governing ecosystem services. *Ecosystem Services*, 1(1), 93–100. DOI: <https://doi.org/10.1016/j.ecoser.2012.07.009>
- Ostrom, E.** (2005). *Understanding Institutional Diversity*. Princeton: Princeton University Press. DOI: <https://doi.org/10.1515/9781400831739>
- Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., ... & Maris, V.** (2017). Valuing nature's contributions to people: the IPBES approach. *Current Opinion in Environmental Sustainability*, 26, 7–16. DOI: <https://doi.org/10.1016/j.cosust.2016.12.006>
- Potter, C. A., & Wolf, S. A.** (2014). Payments for ecosystem services in relation to US and UK agri-environmental policy: disruptive neoliberal innovation or hybrid policy adaptation? *Agriculture and human values*, 31(3), 397–408. DOI: <https://doi.org/10.1007/s10460-014-9518-2>
- Prager, K., & Freese, J.** (2009). Stakeholder involvement in agri-environmental policy making—learning from a local-and a state-level approach in Germany. *Journal of Environmental Management*, 90(2), 1154–1167. DOI: <https://doi.org/10.1016/j.jenvman.2008.05.005>
- Prager, K., Reed, M., & Scott, A.** (2012). Encouraging collaboration for the provision of ecosystem services at a landscape scale—rethinking agri-environmental payments. *Land Use Policy*, 29(1), 244–249. DOI: <https://doi.org/10.1016/j.landusepol.2011.06.012>
- Primmer, E., Jokinen, P., Blicharska, M., Barton, D. N., Bugter, R., & Potschin, M.** (2015). Governance of ecosystem services: a framework for empirical analysis. *Ecosystem Services*, 16, 158–166. DOI: <https://doi.org/10.1016/j.ecoser.2015.05.002>
- Riley, M.** (2016). How does longer term participation in agri-environment schemes [re]shape farmers' environmental dispositions and identities? *Land Use Policy*, 52, 62–75. DOI: <https://doi.org/10.1016/j.landusepol.2015.12.010>
- Ring, I., & Barton, D. N.** (2015). Economic instruments in policy mixes for biodiversity conservation and ecosystem governance. *Handbook of Ecological Economics*, 413–449. DOI: <https://doi.org/10.4337/9781783471416.00021>
- Ross, H., Buchy, M., & Proctor, W.** (2002). Laying down the ladder: a typology of public participation in Australian natural resource management. *Australian journal of environmental management*, 9(4), 205–217. DOI: <https://doi.org/10.1080/14486563.2002.10648561>
- Schauppenlehner-Kloyber, E., & Penker, M.** (2016). Between participation and collective action—from occasional liaisons towards long-term co-management for urban resilience. *Sustainability*, 8(7), 664. DOI: <https://doi.org/10.3390/su8070664>
- Schleyer, C., & Plieninger, T.** (2011). Obstacles and options for the design and implementation of payment schemes for ecosystem services provided through farm trees in Saxony, Germany. *Environmental Conservation*, 38(4), 454–463. DOI: <https://doi.org/10.1017/S0376892911000361>

- Shapiro-Garza, E.** (2013). Contesting the market-based nature of Mexico's national payments for ecosystem services programs: Four sites of articulation and hybridization. *Geoforum*, 46, 5–15. DOI: <https://doi.org/10.1016/j.geoforum.2012.11.018>
- Siddiki, S., Basurto, X., & Weible, C. M.** (2012). Using the institutional grammar tool to understand regulatory compliance: The case of Colorado aquaculture. *Regulation & Governance*, 6(2), 167–188. DOI: <https://doi.org/10.1111/j.1748-5991.2012.01132.x>
- Terrado, M., Tauler, R., & Bennett, E. M.** (2015). Landscape and local factors influence water purification in the Monteregian agroecosystem in Québec, Canada. *Regional Environmental Change*, 15(8), 1743–1755. DOI: <https://doi.org/10.1007/s10113-014-0733-6>
- Uthas, S., & Matzdorf, B.** (2013). Studies on agri-environmental measures: a survey of the literature. *Environmental Management*, 51(1), 251–266. DOI: <https://doi.org/10.1007/s00267-012-9959-6>
- Van Hecken, G., Bastiaensen, J., & Windey, C.** (2015). Towards a power-sensitive and socially-informed analysis of payments for ecosystem services (PES): Addressing the gaps in the current debate. *Ecological Economics*, 120, 117–125. DOI: <https://doi.org/10.1016/j.ecolecon.2015.10.012>
- Vatn, A.** (2005). *Institutions and the Environment*. Edward Elgar.
- Vatn, A.** (2010). An institutional analysis of payments for environmental services. *Ecological Economics*, 69(6), 1245–1252. DOI: <https://doi.org/10.1016/j.ecolecon.2009.11.018>
- Westerink, J., Melman, D. C., & Schrijver, R. A.** (2015). Scale and self-governance in agri-environment schemes: experiences with two alternative approaches in the Netherlands. *Journal of Environmental Planning and Management*, 58(8), 1490–1508. DOI: <https://doi.org/10.1080/09640568.2014.932762>
- Wunder, S.** (2013). When payments for environmental services will work for conservation. *Conservation Letters*, 6(4), 230–237. DOI: <https://doi.org/10.1111/conl.12034>
- Wunder, S.** (2015). Revisiting the concept of payments for environmental services. *Ecological Economics*, 117, 234–243. DOI: <https://doi.org/10.1016/j.ecolecon.2014.08.016>
- Zaga Mendez, A.** (2016). *Hog farmers' compliance and the role of agro-environmental institutions in the Missisquoi Bay* (McGill University). Retrieved from <http://oatd.org/oatd/record?record=oai%5C%3Adigitool.library.mcgill.ca%5C%3A139022>

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