

Entangling conservation schemes and its effects on farmers' participation: the case of two agri-environmental incentives in Quebec

Alejandra Zaga-Mendez¹, Vijay Kolinjivadi¹, Jean-François Bissonnette² and Jérôme Dupras¹.

¹Université du Québec en Outaouais, ² Université Laval.

Paper presented at the XVII Biennial IASC Conference "In Defense of the Commons: Challenges, Innovation, and Action." Lima, Peru. July 1-5 2019.

Abstract

Incentive-based mechanisms, such as payments for ecosystem services (PES) are increasingly being employed to encourage adoption of biodiversity conservation practices for the provision of multiple ecosystem services and the preservation of agricultural commons. PES are not created in an institutional vacuum, and their success in encouraging participation might depend on their interactions with previous programs and schemes. This paper analyzes how the institutional characteristics and interactions of incentive-based mechanisms influence farmers' participation and therefore the achievement of desired socio-ecological outcomes. This research pays close attention to the institutional framework of two programs in the province of Québec, Canada: the Prime-Vert Program (a 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 (IAD) framework, suggested by Ostrom (2005). Moreover, this work discusses the impact of the functional characteristics described by the IAD framework on farmers' participation by analyzing the level of farmers' engagement in the implementation and management of agri-environmental schemes (Prager and Freese 2009). The institutional comparison of these two incentives 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 integration of both programs could help diversify sources of funding for farmers, the multiplicity of rules which govern the integration of these two programs tend to treat farmers as passive beneficiaries to a network of centralized subsidies.

1. Introduction

Over the last decades, market-based mechanisms and monetary incentives 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. The voluntary character of these schemes is presented as more attractive, decentralized, less

bureaucratic and encouraging more engagement from producers, than traditional command and control policies (Gomez-Baggethun and Muradian 2015). In such way, payment for ecosystem services (PES) and agri-environmental schemes (AESs) have been the shiny carrot, an attractive option to encourage farmer behaviour. However these two incentives based mechanisms differ from their conception point.

AESs are defined as public economic instruments that provide payments, technical transfer or extension support to farmers for environmental commitments related to preserving or enhancing agri-environmental practices (Uthes and Matzdorf 2013, Schleyer and Plieninger 2011). These schemes are characterized as a state-bureaucratic program that relies on administrative rules and organization control to coordinate environmental action (Potter and Wolf 2014). On the contrary, PES are though as exchanges between providers and users of ecosystem services to enhance ecological conservation. PES are judged to find their origins in neoliberal policy agendas, and are promoted to challenge state-centred incentives for the provision of ES from the agricultural landscaper (Potter and Wolf 2014). The voluntary character of these mechanisms is directed towards efforts for greater decentralization, less bureaucracy, and therefore greater efficiency than traditional command and control environmental regulation. However, PES are not created in an institutional vacuum (Vatn 2010), and their success in encouraging participation might depend on their interactions with previous programs and schemes.

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 (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 (Grima et al. 2016, Uthes and Matzdorf 2013). However, it has been shown that various institutional factors affect the adherence to these incentive mechanisms, including the roles of rules and social norms (Chan et al. 2017, Kuhfuss et al. 2016, Van Hecken et al. 2015, Muradian et al. 2010; Vatn, 2010), the type of governance structure (Primmer et al. 2015, Westerink et al. 2015), as well as the level of participation of actors (Beckman 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).

Therefore, the operationalization and success of incentive mechanisms rely on the role of institutions that are responsible for determining socio-ecological interactions, shaping human behaviour and influencing the use of natural resources. Institutions are defined as “the conventions, norms and formally sanctioned rules of society. They provide expectations, stability and meaning essential to human existence and coordination” (Vatn 2005). In this sense, the behaviour of actors as well as the nature of existing rules and norms regarding environmental action are the result of past processes and socially-embedded structures of habit as outcomes of historical and evolutionary transformations (Vatn 2009).

From this perspective, economic incentives behave more like social arrangements than market-based exchanges resulting from negotiation between two parties (Vatn 2015). There remain gaps in the institutional analysis of the application of economic incentives for ecosystem service provision in agricultural environments. Froger et al. (2016) propose to further analyze the optimal institutional conditions that influence the sustainability of programs, as well as the interaction of programs with other regulations and policies. Moreover, Muradian and Rival (2012) insist on the need to study the hybrid character of these programs, by analyzing the components and interactions of such frameworks.

The main objective of this article is to analyze how the institutional characteristics and interactions of incentive-based mechanisms influence farmers' participation and therefore the achievement of desired socio-ecological outcomes. This research pays close attention to the institutional framework 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 in Canada (Lavallée and Dupras 2016). We focus attention on the Monteregion region of southern Quebec, as it remains one of the most intensively produced agricultural landscapes in Canada (Ruiz and Domon 2009).

The institutional prescriptions of these two programs were examined and compared through the lenses of the Institutional analysis and development (IAD) framework, suggested by Ostrom (2005). This framework permits the identification of functional characteristics of policy instruments and offers a systematic institutional codification and typology. To date, there is little use of the IAD framework for the analysis of programs such as PES or other 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 this institutional typology sheds light on the institutional diversity across PES schemes and its application can help further understand the potential effectiveness of schemes in providing ecosystem services by identifying key design features, possible hybridization with other institutional arrangements. These conclusions are also shared by Barton et al (2017), who suggest that the IAD framework illustrates the potential of policy-mixing and hybridization on conservation policy frameworks.

Our work is based on the methodology and analyses of Lien et al. (2018) and Barton et al. (2017), but goes a step further as it discusses the impact of the functional characteristics described by the IAD framework on farmers' participation by analyzing the level of farmers' engagement in the implementation and management of agri-environmental schemes (Pretty et al. 1995, Prager and Freese 2009). To do so, the institutional content analysis was combined with data on the adoption rate of schemes as well as exploratory interviews to contextualize the results. The following sections will present briefly the institutional background of Quebec's agri-environmental incentives, the framework for institutional analysis, the results of the content analysis and a discussion on their implications for participation.

2. Agri-environmental incentives in Quebec

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 mainly destined for animal feed (Morisset and Couture 2010). Agricultural production shifted from an "inefficient" scenario towards one focused on economic growth and encouraging farmers to become "specialists" in the production of specific agricultural goods such as dairy, hog, corn and soybean (Morisset and Couture 2010). The specialized and intensive agricultural model resulted in the decline in the number of farms and an increasing pressure to enhance yields per hectare of production. However, despite the push towards economic efficiency, Parcerisas and Dupras (2018) have recently illustrated that agriculture in Quebec has been increasingly inefficient in terms of energy use in recent decades.

This landscape 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, agri-environmental practices have been put in place through regulation in Quebec since 2002. This included the introduction of the Agriculture Operation Regulation that requires farmers to produce agro-environmental plans, protect shorelines and to manage livestock waste (Zaga-Mendez 2016).

Moreover, voluntary programs aiming to encourage environmental conservation beyond regulatory requirements were introduced. The main goal of such schemes is to encourage agro-environmental practices such as the protection of riverbanks, the adoption of hedgerows, and the creation of multifunctional infrastructure. The main direct payment scheme to agricultural producers for the adoption of agri-environmental practices is the Prime-Vert program, implemented by the Ministry of Agriculture, Fisheries and Food (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 last version of the program (2013–2018), Prime-Vert aims to: (1) promote and disseminate good agricultural practices; (2) support farms to adopt environmentally friendly production methods; and (3) promote collective initiatives to address issues on 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 practises; and (3) biodiversity conservation. Prime-Vert has received significant funding from various strategic frameworks and action plans of Quebec and Canadian governments. In the first period of the program, CA\$162.1 million of financial assistance was disbursed (1997–2001), of which nearly one quarter (CA\$41.6 million) was allocated to agri-environmental advisory club funding (MEDDLCC 2003, Larbi-Youcef 2012).

Furthermore, 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 Montérégie region, as the first-ever PES program in Quebec. ALUS is 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 on agricultural landscapes. The implementation of ALUS in Quebec was established through a partnership between ALUS Canada and the Federation of Agricultural Producers of the Montérégie. The objective of the program is to provide an avenue for farmers to enhance biodiverse and multifunctional landscapes that improve air and water quality without the financial “burden” that this might entail in an otherwise intensive and productive landscape.

3. Analytical Framework

As stated, we analyze incentives 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 implementation and design of agri-environmental programs (Bennett and Gosnell 2015, McDermott et al. 2010, Muradian et al. 2010), a few offers a systematic description of the functional characteristics of a program and how they influence participation (Barton et al. 2017, Lien et al. 2018, Ring and Barton 2015).

We take this void as a start point and apply a framework to identify these functional characteristics, and the type of interactions encouraged by agri-environmental programs. Specifically, we use the taxonomy of the Institutional Analysis and Development framework (Ostrom 2005) that has thus far been primarily developed for research on the management of common-pool resources, and could be applied to characterize the interactions encouraged by conservation policy instruments such as PES and AESs (Barton et al. 2017, Lien et al., 2018, Ring and Barton 2015). For instance, Barton et al. 2017 show how the characteristics of PES suggested by Wunder (2015) correspond with the “rules of use” of the IAD framework. Thus, the framework provides an adequate terminology to define the institutional context, and to study the socio-ecological interactions encouraged. We build on to the work of Barton et al. (2017) and Lien et al. (2018) in suggesting that the rule terminology can provide a common language for comparing the institutional structure of an agri-environmental initiative while avoiding arguments based on the ideal type of instrument.

3.1. Codification of rules with the institutional grammar

To apply the IAD typology, we first use the Institutional Grammar Tool (IGT) proposed by Crawford and Ostrom (1995) to code and deconstruct relevant policy documents and other institutional declarations identifying the actor, actions affected and conditions of the two programs mentioned. The institutional grammar tool permits the identification of

individual elements of a policy 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* that refers to the animated actor responsible for performing an action; (2) the one who receives the action (*object*); (3) the operator who indicates whether the action is required, authorized or prohibited (*deontic*); (4) the action itself (*aim*); (5) the spatial, temporal and procedural circumstances under which the action is performed (*conditions*); and (6) the punishment for non-compliance (*or else*) (Siddiki et al. 2012, Basurto et al. 2009).

The application of this codification process presents certain challenges, primarily the choice of vocabulary and structure of sentences chosen by the authors of the policy (Carter et al. 2016). Reinterpretation and changes to vocabulary and sentence structure can sometimes facilitate the coding of written rules. However, such changes to institutional declarations introduce elements of subjectivity into the codification process, and are likely to diminish the reliability of the exercise. In light of these methodological risks, we followed Carter et al. (2016) suggesting stricter coding rules, based on guidelines offered by Sidikki et al. (2012) and a minimum of text modifications. Table 1 illustrates the first codification process applied to identify institutional statements and their content.

Table 1: Components of the institutional statements of the Institutional grammar tool (Carter et al. 2016, Sidikki et al. 2012)

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

3.2. Content analysis of rules

The second step was to analyze the content of the institutional statements based by applying the IAD rule typology. This typology facilitates the analysis of the operationalization of rules by classifying them into seven categories (Ostrom 1986, 2005). The main indicator to categorize rules is the content of the “Aim” of coded institutional statements (Ostrom, 2005).

The interactions between rules shape what Ostrom calls the “action situations” (Ostrom 2005, Carter et al. 2016). As detailed in Table 2, in an action situation, the position of actors are defined by “position rules.” Actors assume a position (i.e. a role) according to “boundary rules” that define who has the right to enter the action situation. The actions expected are defined by the “choice rules” and joint actions or collaborative situations are affected by the 'aggregation rules.' The information available to participants are 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 and Ostrom 1982, Ostrom 1986, 2005, Barton et al. 2017).

Table 2: Description of the rule typology 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 determined 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 more individuals, and set the conditions for collaboration	<ul style="list-style-type: none"> - Are the actions requiring collaboration? - What are the conditions for this collaboration?
Information rules	They indicate what are 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?

In this work, the content of the institutional statements was codified using the features of the rules typology of the IAD framework to qualitatively describe resulting action situations. Table 2 presents as well the content analysis questions that were adapted to the study of incentive mechanisms and used to classify the institutional content. The content analysis was combined with governmental data on the participation rate and the impact of the programs over the past years in Quebec to discuss the implications of the incentive. We conducted ten (10) exploratory interviews with farmers, managers and agronomists as well as field visits (5) to understand the context in which these schemes operate and further our understanding of how these agri-environmental institutions unfold in practice.

3.3. Impact on participation

In order to discuss the impact of the functional characteristics described by IAD framework on farmers' participation, we need to understand what participation to an incentive mechanism means. There are several conceptual frameworks that evaluate the role of participation in a given policy initiative or governance strategy (Carr 2015). This work draws on the levels of participation suggested by Pretty et al. (1995) and Prager and Freese (2009) in relation to the implementation of participatory processes in agri-environmental schemes. Participation in decision-making can reach different levels: actors can be consulted, be present in the decision-making process, have the possibility of influencing or even controlling all the results (Prager and Freese 2009). Therefore, the type of participation depends on the role of actors and their control over the results.

In relation to market-based mechanisms, *incentive-based participation* occurs when stakeholders participate by providing resources such as conservation labour, in exchange for food, money or other material incentives (Prager and Fraser 2009). It is very common to call this type of engagement "participation," but actors often have no decision-making power over the process and may terminate conservation efforts when the incentives end (Prager and Fraser 2009). On the contrary, *interactive participation* occurs when actors take part in the joint analysis of the project, influencing action plans, moulding the formation of new local institutions or strengthening of 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 reached when actors reshape or create new independent initiatives from institutions initially proposed by an agri-environment scheme (Shapiro-Garza, 2013; Prager and Fraser, 2009).

4. Results

This section presents a comparison of the Prime-Vert and ALUS programs based on 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. We first codified the administrative guidelines of the Prime-Vert program, the description of the ALUS program as well as the contract between the federation of farmers and producers. Table 3 illustrates the number of

statements identified in each type of documentation. These 291 statements served as the basis of the content analysis using the rule typology.

Table 3: Number of institutional statements resulting from the ADICO codification

Policy Document	Number of Statements
ALUS Contract	55
ALUS Description	15
Prime-Vert measure 4201: Guidelines to extend riparian buffer strips	73
Prime-Vert measure 4200: Guidelines for hedgerows	73
Prime-Vert measure 4203: Guidelines for biodiversity conservation	75

4.2. Rules

4.2.1. Position of Actors

Prime-Vert. The program targets all agriculture producers in Quebec, inviting them to voluntarily submit a request 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, who advises them on the types of practices to adopt and on the preparation of documents. There is no limit to the number of participants that can subscribe to the program, but the number of participants follows a “first come first serve” basis, depending on funding available at the federal and provincial level. The government is in charge of the design and conception of the program.

ALUS. This program applies only to farmers residing in the Montérégie region. The producer is required to apply for funding through the *Union des Producteurs Agricoles—Montérégie* (Quebec farmers’ union, henceforth UPA-Montérégie) which coordinates the management and promotion of the program. The funding comes mainly from private sources such as ALUS Canada and, Soleno (a local drainage company). The city of Saint-Jean-sur-Richelieu and the regional county governments also contributes to the program, but less than private investments. 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, the president of the UPA-Montérégie, agricultural stakeholders, watershed organizations and agri-environmental extension services (i.e. *clubs de conseil*). Two ALUS coordinators are in charge of their 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. The design of the program is the result of a negotiation between ALUS-Canada, in determining overall program goals, and the UPA-Montérégie who manages ALUS in Quebec.

4.2.2. 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 management plan and a phosphorous balance sheet. The program only supports farms engaged in an integrated management approach, and this commitment must be reflected in the development of an accompanying agri-environmental plan (AAP). The AAP is a tool for recognizing the agri-environmental risks present on a farm and for describing the agri-environmental 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 agri-environmental projects. 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-Montérégie before its implementation. Similarly to Prime-Vert, producers must obtain all authorizations (e.g. municipal or governmental) for the realization of the project. The area of the project must be beyond the regulated buffer requirements according to the existing policy protecting shores and shorelines. Producers are required to carry out the implementation of projects themselves, though, they might ask for support from the UPA-Montérégie 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 if required by the municipality. Once the project is accepted, producers sign a contract with the UPA-Montérégie detailing all the condition of payments and expected participation. A chosen participant may terminate this contract at any time within 30 days-notice. In the case of receiving financial assistance from the UPA-Montérégie in implementing projects, participants will reimburse a portion of the costs of implementation to the UPA. .

4.2.3. 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 compensation. In addition to these conditions, projects must comply with regional standards as stipulated in specifications and data sheets suggested by the regional department. For instance, some counties demand a winder buffer between the cultivation zone and a waterbody. 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 to the program. 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 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-Montérégie and protect the project against any grazing by livestock. Moreover, the producer must not alter, displace or destroy the project throughout the duration of the contract, without the written authorization of the UPA-Montérégie. Finally, participants must agree to transfer to the UPA-Montérégie, any present or future carbon offset or ecological credits potential of funded projects.

Prime-Vert and ALUS each fund 9 different types of biodiversity conservation practices. Table 4 details each type of project according to the language used by the respective programs' guidelines.

Table 4: Practices encouraged by the Prime-Vert and ALUS program

Prime-Vert		ALUS	
Hedgerows	Trees	High ecosystem value	Pond surrounded by a vegetative strip (trees and shrubs)
	Shrubs		Reforestation of a wetland with trees and shrubs
Extended riparian strips	Mixed (trees, shrubs and/or grass)		Multifunctional hedge (trees and shrubs) with strip for pollinators
	Arborescent (trees and shrubs)		Multifunctional hedge (trees and shrubs)
Infrastructure favouring Biodiversity	Riparian bands for biodiversity	Medium ecological value	Windbreak hedge (trees)
	Flower strip or island		Shrubs hedge
	Wooded hedge rows or island	Flower meadow with shrubs and herbaceous plants	
	Buffer zone for zones of ecological interest	Low ecological value	Hedge for pollinators (herbaceous and grasses)
	Ponds or swamps		Meadow with herbaceous

4.2.5. Aggregated Actions

Prime-Vert. The main action that requires collaboration is in the application process itself. Farmers need to be followed 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 in order to facilitate the process and to manage the bureaucratic burden of subscriptions to the program. Producers can also choose to collaborate by subscribing to a second stream of the program, based upon a collective action approach. This approach involves three or more farmers in the watershed collectively implementing joint agri-environmental structures within the Prime-Vert program. This collective 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.

ALUS. A strong degree of collaboration is evident between the ALUS coordinators at the UPA-Montérégie and farmers. The UPA-Montérégie coordinators are tasked with promoting the program and guiding potential participants through the application process. They also support farmers in seeking other funding sources to cover the cost of

implementation and are in charge of supervising the implementation and sustainability of the projects. Collaboration between actors is also evident in the ALUS committee in relation to reviewing and approving potential projects. Additionally, producers can be supported by an agronomist throughout the design of the project and in the application process.

4.2.6. 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 regional division 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 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 in the sense that 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-Montérégie (e.g. assemblies, meetings, newsletters). Coordinators are also in constant contact with farmers who participate. The UPA-Montérégie also 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.

4.2.7. The Payoff

Prime-Vert. The main incentive serves to cover the cost of implementation of well-defined projects. The reimbursement initially covers 70 % of the implementation cost and is a one-time 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 as opposed to financially compensating for the loss of revenue from production. In addition, the program does not provide funding for the maintenance of practices, which must be fully borne by the producer. 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 compensation 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-Montérégie). 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. However, the longer-term intention is to more closely link beneficiaries of ecosystem services with service providers (agricultural producers). The current payment is calculated based on the price of land in the Montérégie region. The UPA-Montérégie may adjust the annual payments based on the actual area of the project if different from the estimated area at the time of design.

4.2.8. Scope of the programs

Prime-Vert. Since there is no legal contract between the producer and the Ministry, it is difficult to analyze the type of commitment that producers make in providing ecosystem services in the long term. However, in the application form, producers sign a declaration committing to “maintain the integrity of the facilities, works or equipment that are the subject of this application and to maintain them for a period of five years”. It should be noted that 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” completed and signed by a professional consultant. The payment is conditional on the presentation of this certificate. This attestation must indicate whether the improvements are in conformity with the project approved by the Ministry, including all supporting documents as well as photographs of the project's implementation. In sum, it is only the realization of the infrastructure that is verified and not the permanence of the installations over time.

ALUS. Payments are made during the five years of the contract, 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-Montérégie. The UPA-Montérégie may terminate the contract if participants do not respect all terms of the contract or if the mutual agreement is not achieved according to the deadlines and satisfaction of the UPA-Montérégie. In case the UPA-Montérégie 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.

4.3 Participation

A major strength of the Prime-Vert program is the funding of various agri-environmental practices that go beyond regulation. As shown in Table 5, the latest version of the program (2013–2018) established approximately 2,900 projects across Quebec, involving roughly 2,100 agricultural producers. This funding is concentrated in regions of intensive agriculture such as Montérégie. However, the program remains unpopular among producers in the province, despite significant investment. In considering the total number of farms in Quebec in 2016, only 7% of farmers benefited from Prime-Vert between 2013 and 2018 across Quebec, with the rate limited to 10 % for the Montérégie region.

Tableau 5: 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 (%)
Montréal	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.

Although the program encourages a wide variety of practices, these are not equally popular among farmers. Table 6 shows the distribution of the number 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 significant funding. These measures represent nearly 60% of subsidized projects and have received nearly 38% of the amounts disbursed for Quebec. 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. These data show that 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 in delivering.

Table 6: Breakdown of funded projects and financial assistance disbursed by the type of agri-environmental practices between 2013–2018 in Quebec

Practice	Number of projects	Funding (CA\$)	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.

The ALUS program has only been operating for two years, its impact on agri-environmental outcomes remains unclear, as the program remains in a development phase. Between 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 covered with a total of 4,500\$ offered in financial contributions to farmers. The second year the program was extended to all watersheds of the Montérégie region, and the program covered 14.6 ha for a total of 10 900\$ in financial contribution to farmers.

It is important to note that to be admitted as an ALUS project, farmers need to be able to financially absorb the costs of implementation and to seek additional financing for the maintenance of installed structures. 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.

Also, as there is only one program financing the implementation of the ALUS covered practices, farmers will logically apply to Prime-Vert to be admitted to the ALUS payment. During the interviews, farmers involved in the pilot phase were already involved in agri-environmental initiatives funded by UPA and Prime-Vert. This interaction between the two schemes reveals an organic integration between public and private schemes in the adoption of agri-environmental practices. Figure 1 illustrates the interactions between both programs.

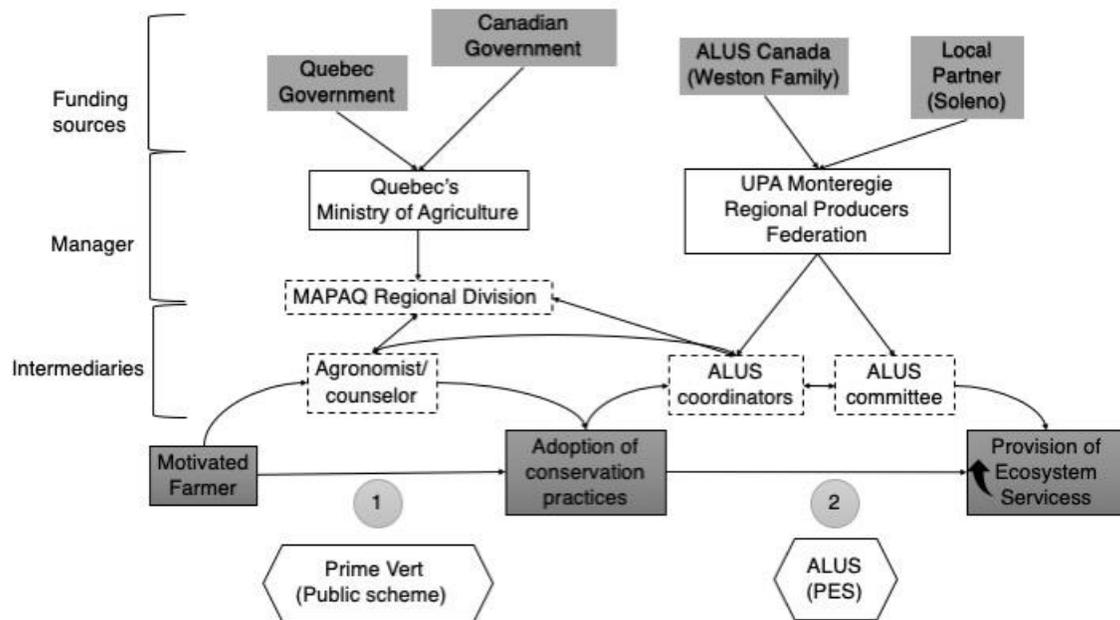


Figure 1: Interactions between the governance structure of the public scheme and the private PES as detailed by the rules in use. In order to increase the participation of farmers and the provision of ecosystem services, ALUS (PES) relies first on the institutions of the public scheme.

In this manner, ALUS behaves as a financial complement to the Prime-Vert program and indirectly depends on this source of public funding to operate as a “private” PES-like program in Quebec. As observed during the interviews, farmers depend on the same pool of funding for the implementation of practices and the bureaucratic requirements for ALUS and Prime-Vert are complementary. This might suggest a consolidation of control and influence by state or state like actors (in this case MAPAQ and UPA) while implementing voluntary measures as market-based mechanisms.

5. Discussion

The rule typology offered by the institutional analysis and development framework (IAD) helped us to structure the institutional content of both programs and analyze how the different institutional functions encompass the action situation on the uptake of conservation practices. Each program presents different roles of actors, eligible criteria, flows of information, coordination of actions, pay offs, diversifying options for farmers. However, these analyses raised several concerns regarding farmers’ participation to incentive programs in intensive agricultural areas of southern Quebec.

There is a low adoption of the main public program (e.g. Prime-Vert) in relation to conservation practices that increase the provision of bundle ecosystem services. This low adoption is also observed by Larbi-Youcef (2017) who argues that few farmers take advantage of Prime-Vert because the applications process is administratively complex and stakeholders do not feel sufficiently supported in this procedure by the Ministry. As

detailed in our analysis, farmers need to comply with numerous conditions, and require proper support from an agronomist in order to present a request to join the program. This indicates that farmers need to be sufficiently motivated to go through this process, suggesting that passing through bureaucratic hoops might require a greater commitment to ecological conscience or financial incentive in order to participate. This rigidity also suggests that adherence does not only depend on the intrinsic motivation of farmers, or on the extrinsic motivation offered by the incentive, but rather on the *capacity* of farmers to comply with the multiple criteria of the program and to their ability to absorb the administrative burden.

In the case of ALUS, a similar trend can be seen. To be admitted, farmers require being accompanied by either an agronomist or by an agro-environmental coordinator of the UPA-Montérégie. The role of the ALUS coordinators in the facilitation of participation is not insignificant. It is these individuals who facilitate farmers in obtaining initial funding for implementing a new project in order to be admitted to the annual ALUS payment. These individuals also contribute to approving projects as they are submitted to the UPA-Montérégie. Given the influence of these coordinators and the UPA-Montérégie, their influence plays an increasingly pivotal role in shaping the implementation of the program as it evolves and expands.

Furthermore, both programs mainly encourage farmers' participation based only on the transaction of agri-environmental practice for financial payment. In the 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 agriculture production. This limits the implication of farmers to Prime-Vert as passive recipients and might compromise their interest in continuing the adoption of agri-environmental activities in the long-term. In the case of ALUS, though a committee exists that manages the program, not all farmers are able to be part of this decision table, as places for farmer representation are limited within the committee.

The interaction between the programs raises the question of additionality of the new PES, as ALUS risks being a novel source of financing for projects and practices that have already received insufficient financial support from Prime-Vert to cover their long-term installation and maintenance. 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 state of the green infrastructure and the long-term effect of such practices in the provision of ecosystem services (i.e. biodiversity, soil health, water quality, among others), which ultimately serves as the primary objective of their implementation.

Moreover, the interdependence between the Prime-Vert and ALUS implies that farmers are already constrained to ensure the solvency of agri-environmental measures installed through the more centralized Prime-Vert program. This might reduce their bargaining potential within the ALUS committee in terms of projects to be financed and in establishing payment rates, as they might consider the constraints of the Prime-Vert program. The integration between the programs in terms of financial and bureaucratic commitments limit

options in the design of projects and reduce the autonomy of farmers' actions within the rigid framing of rules provided by these programs.

Therefore, the low adoption of agri-environmental practices masks a larger concern, in terms of farmer autonomy. This refers to farmers' capacities to adopt cultivation practices independently from external institutions such as incentives and under market pressures. An institutional characteristic of voluntary agri-environmental programs often focus on the adoption or maintenance of practices by adhering to strict rules for compliance, while crucially paying less attention to the implications of such practices and their broader objectives within an intensive agricultural system (Burton et al. 2008). As stated by Burton and Upanada (2011), AESs may have limited influence on the farmers' attitudes towards conservation as the actions they encourage are not embedded within conventional farming cultures as they relate to global market pressures for food production. Thus, incentives may need to shift from compensation for economic capital foregone towards the support of social and cultural relations within farming communities that will increase the autonomy of farmers to change cultivation practices in more socially and ecologically beneficial ways.

Exploring a more decentralized management approach to implementing principles of adaptive governance could increase levels of participation and also farmers autonomy (Cook et al. 2016, Mills et al. 2011). Examples of local collective action committees and agri-environmental cooperatives in Europe offer useful examples (Beckmann et al. 2009, Mills 2010). As shown in the case of Pontbren, sources of funding allows farmers to decide on the rules and guidelines when implementing tree hedges on farm land increasing their autonomy (Mills et al. 2011). Adaptive management of a scheme helps to increase the sustainability of practices by empowering local agri-environmental organizations and actors. The regionalization of agri-environmental schemes helps build a more cooperative model that bridges social ties among farmers and stakeholders (Krom 2017). Such participation could lead to longer-term environmental behaviour while reinforcing social and ecological links (Krom 2017, Prager and Fraser 2009).

Finally, we acknowledge that the IAD framework does not allow unveiling the institutional complexity in which market-based mechanisms and incentives operate. As stated by Van Hecken et al. (2015), researchers need to pay closer attention to the power asymmetries between actors and their influence on the institutional characteristics of programs. Power dynamics are not detailed by the IAD even if they influence how rules are designed and operationalized. Moreover, even if the grammar and typology of the IAD help to categorize the design and functional features of schemes, one needs to contextualize the rules within the overall institutional setting, for instance, by including interviews and field visit to determine how actors interpret and manage the rules in use, as it has been done in this study.

6. Conclusion

Through a systematic analysis of the functional characteristics of a public and private incentive-based mechanism for agri-environmental enhancements in Quebec, we have

revealed numerous ways in which institutions of private PES and public agri-environmental scheme shape participation of farmers to these interventions. Our study reveals low farmers' participation in both programs and 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 the participation in the Prime-Vert public program, the limited conservation practices proposed, and the centralized manner by which participation is constrained, compromising the autonomy of farmers to engage in agri-environmental behaviour.

Moreover, the comparison of these two schemes highlighted the strong integration between them, effectively rendering both programs largely managed by the remit of the provincial government. While, the integration could help diversify the sources of funding for farmers; the deployment of a PES approach may be slow in achieving additionality by increasing the adoption of new practices and therefore the provision of ecosystem services or at a minimum, desired land-use change behaviour. Finally, the multiplicity of rules which govern the integration of these two programs tend to treat farmers as passive beneficiaries to a network of centralized subsidies. In other words, farmers have little autonomy to influence the outcome or development of the program as they relate to a broader market pressures, which can act as counter incentives.

References

- 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.
- 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*. <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.
- 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.
- Burton, R., Kuczera, C., Schwarz, G., & others. (2008). Exploring farmers' cultural resistance to voluntary agri-environmental schemes. *Sociologia ruralis*, 48 (1), 16–37.

- Carr, G. (2015). Stakeholder and public participation in river basin management—an introduction. *Wiley Interdisciplinary Reviews: Water*. Retrieved from <http://onlinelibrary.wiley.com/doi/10.1002/wat2.1086/full>
- 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. <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.
- Cook, D. C., Kristensen, N. P., & Liu, S. (2016). Coordinated service provision in payment for ecosystem service schemes through adaptive governance. *Ecosystem Services*, 19, 103–108. <https://doi.org/10.1016/j.ecoser.2016.01.008>
- Coordination Services-Conseils (CSC). 2016. Rapport annuel 2015-2016 sur les services conseils offerts aux entreprises agricoles, administrés par les réseaux Agriconseils. [http://www.agricconseils.qc.ca/wpcontent/uploads/2014/02/Rapport-annuel_s-c_2015-2016_Final.pdf]
- Crawford, S. E. S., & Ostrom, E. (1995). A Grammar of Institutions. *American Political Science Review*, 89 (3), 582–600. <https://doi.org/10.2307/2082975>
- 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>
- Ghorbani, A., Bots, P., Dignum, V., & Dijkema, G. (2012). MAIA: a Framework for Developing Agent-Based Social Simulations. *Journal of Artificial Societies and Social Simulation*, 16 (2), 9.
- 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.
- Government of Canada, S. C. (2018, juin 8). Alternative format - Portable Document Format (PDF). Consulté 8 juin 2018, à l’adresse <https://www150.statcan.gc.ca/n1/pub/16-002-x/2015002/article/14133-eng.pdf>

- 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.
- Groulx-Tellier, E. 2012. Facteurs influençant l'adoption de bonnes pratiques agro-environnementales par les producteurs de grandes cultures dans le bassin versant de la rivière Chateauguay. Mémoire de maîtrise. Université Sherbrooke. Centre Universitaire de formation en environnement [https://www.usherbrooke.ca/environnement/fileadmin/sites/environnement/documents/Essais2012/Groulx-Tellier_E__31-10-2012_.pdf]
- Jeswiet, S., & Hermsen, L. (2015). *Agriculture et faune: une relation d'interdépendance*. Statistique Canada.
- 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.
- 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>
- Larbi-Youcef, Y. 2017. Les politiques agroenvironnementales au Québec: Enjeux, perspectives et recommandations. Mémoire de maîtrise. 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]
- 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.
- 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.
- Mills, J., Gibbon, D., Ingram, J., Reed, M., Short, C., & Dwyer, J. (2011). Organising collective action for effective environmental management and social learning in Wales. *Journal of Agricultural Education and Extension*, 17 (1), 69–83.

- 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.
- Muradian, R., & Rival, L. (2012). Between markets and hierarchies: The challenge of governing ecosystem services. *Ecosystem Services*, 1 (1), 93–100. <https://doi.org/10.1016/j.ecoser.2012.07.009>
- Ostrom, E. (2005). *Understanding Institutional Diversity*. Princeton: Princeton University Press.
- Parcerisas, L., & Dupras, J. (2018). From mixed farming to intensive agriculture: energy profiles of agriculture in Quebec, Canada, 1871–2011. *Regional environmental change*, 1–11.
- 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.
- 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.
- 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. Pretty, J. N. (1995). *A trainer's guide for participatory learning and action*. Iied.

- 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.
- Ring, I., & Barton, D. N. (2015). Economic instruments in policy mixes for biodiversity conservation and ecosystem governance. *Handbook of Ecological Economics*, 413–449.
- Ruiz, J., & Domon, G. (2009). Analysis of landscape pattern change trajectories within areas of intensive agricultural use: case study in a watershed of southern Québec, Canada. *Landscape Ecology*, *24* (3), 419–432.
- Sandbrook, C. G., Fisher, J. A., & Vira, B. (2013). What do conservationists think about markets? *Geoforum*, *50*, 232–240.
- 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.
- Schlüter, A., & Theesfeld, I. (2010). The grammar of institutions: The challenge of distinguishing between strategies, norms, and rules. *Rationality and Society*, *22* (4), 445–475. <https://doi.org/10.1177/1043463110377299>
- Scott, W. R. (2008). *Institutions and organizations: ideas and interests*. Los Angeles: Sage Publications.
- 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.
- 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. <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.
- Uthes, S., & Matzdorf, B. (2013). Studies on agri-environmental measures: a survey of the literature. *Environmental Management*, *51* (1), 251–266.
- 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. <https://doi.org/10.1016/j.ecolecon.2015.10.012>

- Vatn, A. (2005). *Institutions and the Environment*. Edward Elgar.
- Vatn, A. (2009). Combining Post Keynesian, ecological and institutional economics perspectives. In *Post Keynesian and Ecological Economics, Cheltenham*, (Edward Elgar, Vols. 1– Edward Elgar, pp. 114–138). Retrieved from <https://books.google.ca/books?hl=en&lr=&id=cSTmZLXH7GoC&oi=fnd&pg=PA114&dq=Vatn+post+keynesian&ots=3g7aaFNSmY&sig=xokPEPuyUz8RA8DpclWf0RVOW1Q>
- Vatn, A. (2010). An institutional analysis of payments for environmental services. *Ecological Economics*, 69 (6), 1245–1252.
- Vatn, A. (2015a). *Environmental Governance: Institutions, Policies and Actions*. Edward Elgar Publishing. Vatn, A. (2015b). Markets in environmental governance. From theory to practice. *Ecological Economics*, 117, 225–233. <https://doi.org/10.1016/j.ecolecon.2014.07.017>
- 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.
- Wunder, S. (2015). Revisiting the concept of payments for environmental services. *Ecological Economics*, 117, 234–243.
- 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>