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Comparing polycentric configuration for adaptive governance within community forests: case studies in Eastern North America

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Abstract: Looking at two cases of community forests (CF) in Eastern North America, this article examines their institutional features in order to assess whether they are conducive to adaptive governance. To do so, this article presents CFs as manifestations of polycentric governance, which allow identifying the complex networks of relations existing between different actors involved in governance at many scales. Polycentric governance is assumed to have a higher adaptability to changing factors. To better capture the variables conducive to adaptive governance in CFs, we draw on the socio-ecological system (SES) framework. The study shows that variables from the SES framework are useful in identifying features of polycentricity in CFs. Moreover, these variables highlight mechanisms

of adaptability in CF governance, namely: interaction between organizations and actors, multiplicity of complementary rules from different organizations and structures of governance. Moreover, ongoing communication with the forest users and learning among actors appear key for CF governance's adaptability.

Keywords: Adaptive governance, community forest, North America, polycentricity, socio-ecological system

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1. Introduction

Over the last three decades, the devolution of forest resource governance to local communities has gained momentum as its legitimacy grew in global policy, starting with the 1992 Rio Summit and Agenda 21 (Khan 1995; Berkes 2010). Worldwide, policies have encouraged the devolution of forest governance to local communities to move away from government or corporate centralized forest management models (Shackleton et al. 2002; Edmunds and Wollenberg 2013). In the literature, numerous terms refer to the devolution of forest resource management to local communities – such as community-based forest management, collaborative forest management or community forests – which designate a range of institutional arrangements (Bowler et al. 2012; Bullock and Lawler 2015). Community forests (CFs) are but one manifestation of different forms of forest management designed to improve management of local forest resource. For this study, a CF is defined as an entity with an explicit mandate and legal authority to manage a forest territory for the benefit of a local community (Krogman and Beckley 2002).

Despite some attention, the characteristics of community forest institutions in the Global North have been less systematically analyzed than for the Global South (Teitelbaum 2014). Moreover, most research on the topic is based on a single jurisdiction (McIlveen and Bradshaw 2009; Teitelbaum and Bullock 2012). Recent research has sought to improve the evaluation of performance and outcomes of community forestry initiatives in Canada, notably through case studies (Teitelbaum 2014; Bullock and Lawler 2015). However, little effort has been invested to systematically describe and analyze institutional arrangements that take place within CF governance in a comparative perspective. Some studies have addressed questions of adaptive governance in the context of CFs, which emphasize how institutions adapt positively to changes in socio-ecological systems (SES), so as to increase their resilience (Duinker et al. 1994; Baker and

Kusel 2003). This article contributes to this body of scholarship on CFs by looking at polycentric governance through the SES framework. As such, variables from the SES framework allow apprehending dynamic institutions that evolve through ongoing interactions, which refers to what we call polycentric governance configurations. This perspective is a full recognition of the iterative construction of a governance system, according to the interplay between different institutions as the idea of polycentricity allows to capture cross-scale dynamics (Bixler 2014). We highlight how existing institutions are altered to explain how they are being reshaped to adapt to constantly changing social and ecological context (de Koning 2014).

This article provides a comparative perspective of two case studies in North America, by drawing on a constructivist perspective of institutional arrangements (Cleaver 2012, 2017). This paper attends specifically to CFs in North-America as manifestations of polycentric governance dynamics. In this case, polycentricity points to a form of governance characterized by institutional diversity manifested through numerous dynamic rule-making structures operating at different scales, which can partially overlap and compete with each another (Boettke et al. 2015). As stated by Pahl-Wostl (2009, 357), as a result, “polycentric systems are assumed to have a higher ability to adapt to a changing environment and to be less affected in their integrity by sudden changes or failure in parts of the system.” We draw on this assumption to investigate formal institutions in specific CF cases, and ask how polycentric governance can influence adaptive governance in CF initiatives. To better identify the institutional arrangements of CF cases presented, we use variables provided by Ostrom’s Socio-ecological system (SES) framework as it offers the opportunity to diagnose the state of a SES at one given time in its history (Ostrom 2007; McGinnis and Ostrom 2014). Moreover, the SES framework has proven useful to develop classification systems (Basurto et al. 2013) which in this study supports the systematic analysis of polycentricity. We hypothesize that high level of information sharing between different governance structures in polycentric CF governance yields tighter networks that allow for dynamic adjustments. Therefore, polycentric institutional arrangements would be conducive to governance outcomes that are adaptive to change in socioecological systems.

In this research, we identify institutional features in governance models of CFs that have been in place for at least 10 years and display polycentric governance configurations. Ten years is considered a minimum baseline as it allows for more than a cycle of forest management to be completed. For comparative purposes, we chose two CFs, one established in New Hampshire, USA, and one in Ontario, Canada, to compare the institutional settings and how they can be related to the implementation and consolidation of an adaptive governance framework. The CFs selected for this study fit the basic definition provided by Duinker et al. (1994, 713), as they provide benefits to the local community and involve the “deliberate development of a relationship between a community and its immediate forests, such as all community members have a means of direct involvement in

the management of the forests, with a goal of benefitting the whole community”. Yet these CFs have contrasted characteristics, which allow us to analyse how polycentric institutional arrangements take shape in different policy and socio-historical contexts. The paper is organized as follows: (1) we present the conceptual framework and choice of variables, (2) the methodology, (3) case studies and (4) discussion/conclusion.

2. Conceptual framework: CFs as socio-ecological systems

2.1. Adaptive governance

CF governance, or systems of rules, have been under intense scrutiny over the past decades (Bullock and Lawler 2015). The notion of forest land and resource governance “takes into account the different actors and networks that help formulate and implement [...] policy instruments. Governance embraces the full complexity of regulatory processes and their interaction” (Pahl-Wostl 2009, 355). Authors have been concerned with CF governance performance, some insisting particularly on the adaptability of institutions through which governance takes place (Arts and Babili 2012). Adaptive governance is usually correlated with resilience, or capacity to cope with stresses or disturbances (Young 2010). As such, resilience is “a function of innovation and creative socio-cultural adaptation, and alternative systems of rules vary in their ability to be conducive to innovation and adaptation” (Aligica and Tarko 2012, 54). Therefore, the characteristics of institutional arrangements in governance systems are indicative of their potential for innovation and ultimately adaptation.

To analyse adaptive governance outcomes for common resources, many recent studies have dwelled on the insights from Ostrom (2007) insisting on the complex and multi-level nature of socio-ecological systems, along with the feedbacks between the system’s levels (Agrawal 2014; Araral 2014). As such, we conceptualize CFs as socio-ecological systems produced through institutional arrangements over a territorially bound resource system governed largely by local actors (Ostrom 2005a). In this regard, institutions are defined broadly as “the prescriptions that humans use to organize all forms of repetitive and structured interactions...” or as “enduring regularities of human action in situations structured by rules, norms and shared strategies” (Crawford and Ostrom 1995, 582; Ostrom 2005b, 3). Yet, we only address institutions narrowly focused on CF initiatives.

On a more applied level, a CF governance involves a decision-making body which disposes of a long-term right of use, control and management over a specific forest territory and its resources for collective goals (Glasmeier and Farrigan 2005). In this regard, a CF generally relies on tenure rights that allow for the formation of endogenous institutions enabling long-term or perpetual control over the forest land by local forest users and the broader community. Moreover, it often involves extensive forms of collaboration with exogenous political and economic actors. When endogenous institutions are able to co-evolve with exogenous ones, adaptive capacity is maximized (Low et al. 2003). In general, in case studies

reported from countries of the Global North, CF involves the decision-making body which can achieve CF's objectives by engaging in social and policy learning with a broad range of stakeholders (Cheng et al. 2011). In sum, for the study of institutional arrangements in CF initiatives, adaptive governance refers to the capacity of institutions that constitute a governance system to adapt positively to changes in the SES (Koontz et al. 2015).

2.2. Polycentricity

Beyond devolution, polycentricity better captures the types of formal and informal institutional arrangements, along with the legal systems that shape CF governance and allow adaptation to changing contexts (Andersson and Ostrom 2008; Bixler 2014). Community forest initiatives may derive from the self-organization of local citizens, yet they interact with government and non-government institutional frameworks at different scales (Andersson and Ostrom 2008). These interactions have major significance on the outcome of local forest management institutions. Polycentricity appears as both a process and outcome of self-organization "that mix scales (such as local/national...), mechanisms (such as subsidies, and mandates), actors (such as government regulators, business stakeholders...) and can foster equity, inclusivity, information, accountability, organizational multiplicity, and adaptability..." to solve resource-based management problems (Sovacool 2011, 3832). However, there can be no set definition of polycentric institutional arrangements, or any predefined outcome, as polycentric rule-making are always processual and contextual (Aligica and Tarko 2012).

As polycentricity largely refers to self-organization and absence of top-down governance, institutional arrangements may lead to some level of overlap between institutional structures. The notion of polycentricity emphasises a situation in which heterogeneous institutional arrangements conducive to information sharing improve the potential for self-organization and prompt adaptive response to changing economic or ecological signals (Aligica and Tarko 2012). As such institutional structures may be simultaneously entering competitive and collaborative relationship, which can provide a context for co-evolution and mutually beneficial information exchange (Boettke et al. 2015). In fact, adaptive capacity decreases with increasing institutional rigidity and entrenched institutional arrangements that seek to achieve permanent assignation of roles and exclusive fields of intervention to rule-making organizations, while directing the flow of information (Young 2010). However, in order to achieve long-term adaptive capacity in polycentric configuration, the formal roles of rule-making organizations should be well defined (Aligica and Tarko 2012).

Nagendra and Ostrom (2012, 115) insist that a polycentric order is characterised by a system where many elements can mutually adjust to one another within a general system of rules, according to information received. In fact, the complexity of multifunctional forestry resources and the socio-ecological systems in which they are embedded require complex polycentric governance systems

(Nagendra and Ostrom 2012). Forests, as other natural resource systems, are complex ecosystems which are entwined in heterogeneous relationship with different groups of actors managing and exploiting specific resources. We acknowledge that CFs are governed by forest users “involved over time in making and adapting rules within collective-choice arenas regarding the inclusion or exclusion of participants, appropriation strategies, obligation of participants, monitoring and sanctioning, and conflict resolution” (Ostrom 2005a, 132). Important factors such as the number of actors involved, the type of interactions that take place, and the forms of participation in decision-making and monitoring, are usually influenced by institutional dynamics (Ostrom 2007).

Polycentric governance would be conducive to adaptation especially when it provides for opportunities for social learning. In fact, the governance structure has a significant influence on the nature of multi-party cooperation and social learning processes. When governance provides opportunities for social learning, it sustains the capacity of different authorities and stakeholders, along with the public, to get involved in forest resources management effectively. As such, different actors are able to negotiate about goals, how they can be achieved and translated into action (Pahl-Wostl 2009, 358). However, polycentric governance can raise coordination issues and may involve fragmentation of authority which can also hinder adaptive strategies (Ross et al. 2014).

In the context of citizen-led CF governance in North America, the system’s capacity to adapt is mediated by a number of actors that interact and exchange information according to a polycentric pattern. The forest is usually owned and managed by municipalities or local organizations, yet the rules of ownership and management are often based on forest easement and land trusts, which lead to the establishment of a hybrid property system both public and private. While the land legally belongs to a defined community/municipality or organism, the easement and its constraints are enforced by the state or an organization to maximize conservation and public benefits (Cole 2002; Merenlender et al. 2004; Rissman et al. 2007; Cole and Ostrom 2012).

2.3. SES variables to study adaptive governance in polycentricity

The socio-ecological system’s (SES) framework (Ostrom 2007; McGinnis and Ostrom 2014) is useful to characterize the variables and processes that drive the dynamics of a common-pool resource such as a CF, and systematically identify its characteristics (GS1–GS10) (Table 1). These variables are useful to attend to the polycentric configuration of governance, and to its potential for adaptation. Following Ostrom’s formalism (Ostrom 2007), we focus on the relation between governance systems (GS) with interactions and outcomes (I, O) (See Table 1). In order to describe the institutions composing the governance system of CFs under study we look at second-tier variables (GS1–GS10) (Table 1). Given the primary role of institutions in governance systems (GS) (Pahl-Wostl 2009), we use variables of second-tier properties proposed by McGinnis and Ostrom (2014)

Table 1: First, second and third-tier variables from the SES framework retained for the purpose of this study.

First-tier variables	Second-tier variables	Third-tier variables	
Governance systems (GS)	GS1 – Policy area		
	GS2 – Geographic scale of gov. system		
	GS3 – Population		
	GS4 – Regime type		
	GS5 – Rule making organization	Public sector organizations Private sector organizations Nongovernmental, non-profit org. Community-based organizations Hybrid organizations	
		GS6 – Rules-in-use	Operational-choice rules Collective-choice rules Constitutional-choice rules
		GS7 – Property rights systems	
		GS8 – Repertoire of norms and strategies	
		GS9 – Network structure	
		GS10 – Historical continuity	
Actions-situations: interactions (I) → outcomes (O)	I1 – Harvesting		
	I2 – Information sharing*		
	I3 – Deliberation processes*		
	I4 – Conflicts		
	I5 – Investment activities		
	I6 – Lobbying activities		
	I7 – Self-organizing activities*		
	I8 – Networking activities*		
	I9 – Monitoring activities		
	I10 – Evaluative activities*		

*Main variables related to adaptive governance. Source: McGinnis and Ostrom (2014).

(Table 2). This alternative list identifies second-tier analytical variables to decompose the properties of governance systems (GS). Polycentricity is best expressed by third-tier variables of rulemaking organizations (GS5) which allow to capture the full range of interacting organizations defining the rules in use (GS6). We do not seek an exhaustive treatment of all variables, but use them as a way to systematize description and facilitate comparison with other cases.

For analytical purposes, we focus on interaction (I) variables. These specific variables (Table 1) allow to look at two key components of adaptive governance in a polycentric configuration: interactions between actors and learning. Interactions allow the formation of linkages across users, groups and agencies, which in turn can foster social learning. Social learning is important for socio-ecological systems, as it allows actors to exchange knowledge and question norms and practices, and adapt to changing factors (Koontz et al. 2015). The SES framework variables allow to map out some of the interaction between institutional structures, which point to the ongoing construction of institutions (Clever 2017).

Table 2. Second- and third-tier variables of community forests' Governance system (GS) according to the social-ecological system's framework.

	Working definition	Randolph CF (N.-H)	Larose CF (Ontario)
GS1 – Policy area	Area of expertise	Multiple uses collective forestland management 4047 ha	Multiple uses collective forestland management 11,000 ha
GS2 – Geographic scale of governance	CF area		
GS3 – Population	Total population of CF	610 (2010) (2 municipalities)	85,381 (2011) (8 municipalities)
GS5.1 – State government	State or provincial government role. (legislative/monitoring)	<p><i>Significant role:</i></p> <ul style="list-style-type: none"> – Oversight of the forest conservation easement – Annual allowable cut forest management guidelines 	<p><i>Moderate role:</i></p> <ul style="list-style-type: none"> – Forest management guidelines
GS5.2 – Municipal government	Regional and local government role	<p><i>Significant role:</i></p> <ul style="list-style-type: none"> – Land owner – Forest Commission: Orientations and long-term financial management – Planning Board: management 	<p><i>Very significant role:</i></p> <ul style="list-style-type: none"> – Land owner, financing – Dpt. of Planning and Forestry: Advisory Committee – Management, Planning – Water protection
GS5.3 – Nongovernmental, non-profit organizations	Nongovernmental organization role	<p><i>Significant role:</i></p> <ul style="list-style-type: none"> – Technical and organizational support – Tree Farm System Certification 	<p><i>Moderate role:</i></p> <ul style="list-style-type: none"> – Technical support – FSC certification – Aboriginal groups – Forest association – Tourism organisation
GS5.4 – Community-based organizations	Community-based organization and users groups role	<p><i>Moderate role:</i></p> <ul style="list-style-type: none"> – Trails and land management 	<p><i>Moderate role:</i></p> <ul style="list-style-type: none"> – Trails and land management
GS5.5 – Private sector organizations	Private organism and company role	<p><i>Significant role:</i></p> <ul style="list-style-type: none"> – Forestry consulting – Wood harvest – Sugar bush 	<p><i>Significant role:</i></p> <ul style="list-style-type: none"> – Wood harvest – Forestry consulting – Sugar bush
GS6.1 Operational choice rules	Operational decision-making	Forest Commission (municipal) and forest easement (state)	Municipal land planning and forest service

Table 2 (continued)

	<i>Working definition</i>	Randolph CF (N.-H)	Larose CF (Ontario)
GS6.2 Collective-choice rules	<i>Tactical and strategic decision-making</i>	Forest Commission (5 members – Monthly meetings) (Users groups are consulted once a year) Planning Board Town council, State government	Advisory Committee (12 members – Monthly meetings) (5-year revision of operational plan) Counties council, Provincial government Municipal property
GS6.3 Constitutional-choice rules	<i>Legal framework</i>		
GS7 – Property-rights systems	<i>Property of the CF</i>	Municipal property with State conservation easement	Municipal property
GS8 – Repertoire of norms and strategies	<i>Norms, planning and management tools</i>	Forest ordinance Forest management plan (20 years) Forest operational plan (5 years) Bidding and contractual process for logging operations (when necessary)	Land development and protection plan (20 years) Forest management plan (20 years) Forest operational plan (5 years) Bidding and contractual process for logging operations (each year) Multiple horizontal and vertical networks
GS9 – Network structure	<i>Vertical and horizontal partners in management</i>	Multiple horizontal and vertical networks	Multiple horizontal and vertical networks
GS10 – Historical continuity	<i>CF evolution</i>	Maintenance of historical free access, progressive expansion, and diversification of uses	Maintenance of historical free access, progressive expansion, and diversification of uses

3. Methodology

Two studies have been conducted on CFs located in New Hampshire and Ontario. Each case was chosen according to its characteristics as presented in the literature in order to perform the comparative study. The method chosen is best characterized as qualitative case studies, broadly defined as a comprehensive description of a small number of individual cases (Yin 1994). This method is often used to identify variables, structures, to assess the performance or progress of a phenomenon (Starman 2013, 31). Therefore, case studies are generally aimed at the study of a single instance, generally through an epistemology that focuses on its uniqueness and context (Gerring 2004).

More practically, our case study documentation efforts were based on two methods including in-depth literature review and open ended interviews with key informants met in person on the CF sites. These two complementary methods allowed for data validation, given the confirmatory research strategy adopted (Gerring 2004). Literature research focused on primary sources including documents produced by CF themselves, charters, forest management plans, governance guidelines, websites, along with secondary sources such as research articles, government and non-government organization reports. Key informants interviewed for the study were chosen among the main forest managers or based on their past experience regarding governance issues (Patton 2005). The purpose was not to represent the perspectives of all groups of users, but rather to identify the formal institutional structures and mechanisms that allow for adaptive governance. For this purpose, only key informants with in-depth experience in the process of setting up the CF initiatives were interviewed. We recognize the limitation of this approach, as it strictly allows to focus on formal rules, and leaves out a large part of actual everyday rules-in-use, but insist on its validity to attend to the dynamic process of the emergence of formalized institutions, based on the narratives of key informants.

Semi-structured in-depth interviews were considered the most relevant method to document specific cases and improve knowledge and understanding of issues of governance according to place-based experience (Creswell 2013). Interviews took place in the municipality offices of the CF under study, on an individual basis or as a group. Informants were met on an individual basis at first, and group discussions often took place later on with all key informants met in the interview site. In total, 10 key informants were met, four in Larose CF and six related to Randolph CF and New England initiatives, which were met individually or as groups and 501 minutes of interview were recorded, for an average of 50 minutes per interview. Interview content has been transcribed according to open coding realized with a sample of the most relevant interviews. This first stage of coding allowed to identify novel and unexpected elements that we included in the research. Then we performed selective coding on all interviews (Corbin and Strauss 1990) according to the core variables identified in Ostrom's framework (2009, 2014) and complementary documentary sources. The result of the open

coding was integrated according to their correspondence with the description of the SES framework variables. Variables identified in Table 1 have been used for this purpose.

4. Case studies

4.1. Randolph Community Forest, New Hampshire, USA

4.1.1. GS1 – Policy area

All formal levels of governance – federal, state and municipal – are central actors of CFs in New England. Forest management tradition in New Hampshire, and more generally in New England as a whole, derives from a specific history of settlement which was conducive to the establishment of CFs (Bullock and Hanna, 2012). In 1915, the state of New Hampshire enacted bills to confirm the authority of municipalities to establish municipal forests (Lyman et al. 2013). This recognition proceeded with the implementation of a CF program by the US Forest Service in 1938. However, the termination of the Federal program in 1950 put an end to the development of CFs which was followed in subsequent decades by an important transfer of forest land to large institutional actors such as investment funds and private companies (McCullough 1995; Lyman 2007; Bullock and Hanna 2012). In the late 1990s, town dwellers' desire to increase local benefits of forests led to a renewed interest of local communities and municipalities in forest acquisition. This was paralleled by a development of government programs for the establishment of CFs. In 2013, 188 municipalities in New Hampshire owned 41,532 ha of forests (Lyman et al. 2013).

4.1.2. GS2 – Geographic scale of governance system; GS3 – population size

The Randolph CF was created in 2001 and covers an area of 4000 ha (Table 2). It is one of the largest CF in Eastern United States. The Randolph CF, which is located in a recreational sector that provides access and scenic views to the White Mountains, was initiated by the municipality with the purchase of forest land to a paper company. The Randolph municipality sought to purchase the land mainly to gain better control over management, prevent speculation, housing development, and maintain the hiking tradition of the site. The core mission of the CF is public access, education, recreation, wildlife habitat conservation, and timber harvest (Interview # 3).

4.1.3. GS4 – Regime type

Thanks to the technical support provided by regional organizations such as the Trust for Public Land (a public sector organization), a federal grant, and legislative tools in place at the state level, forest acquisition was completed in 2001. The federal grant was attached with the obligation to maintain the site accessible to existing recreation activities. A precondition for the local citizens consulted in municipal assemblies involved in the CF project was that it shall not involve costs

for the citizens of Randolph (Willcox 2005). Through fundraising, including 200 private and public donors, and through a partnership with the U.S. Forest Service (USFS), which provided grants for the protection of two important watersheds on the forest land, forest commission members succeeded in purchasing a large part of the forest land, while the remainder was purchased directly by USFS. This initial mobilization can be compared to self-organization, as basic rules were set to maintain recreational functions and framed the financial involvement of participants to prevent disengagement.

4.1.4. GS5 – Rule-making organizations; GS6 – rules in use

The governance structure of the Randolph CF has evolved through ongoing feedback with the state government, which has enacted a special provision for the creation of a distinct CF entity. In this regard, both the Randolph CF and the State government have mutually adjusted to the specificities of local forest governance framework, in a process that goes beyond mere devolution, and that can be related to polycentricity. Randolph shows features of adaptive governance which has allowed to establish a unique governance system according to considerations and objectives of community stakeholders involved in the purchase process. More specifically, the governance system within the broader state legal framework allows the creation of a sub-system of governance that can be activated when windows of opportunity arise. “The Randolph negotiating team designed an alternative management structure it felt would be more appropriate for the town of Randolph. In order to adopt the system, it was necessary to have a special act passed by the state legislature...” (Willcox 2005, 62–63). This element also clearly speak to the open communication channels that were maintained between the representatives of a local initiative and the state legislature, along with the capacity of state legislature to adapt the legal framework to the management objectives of a specific CF project.

The governance and management structure for the Randolph Community Forest is stipulated in the Randolph Town Forest Ordinance. This governance and management structure includes a Forest Commission, the town Planning Board and the Municipal Council of elected officials (Wintturi 2003). The Forest Commission is the main governance body of the CF and is composed of four members, three being appointed by the municipality elected officials including a member from the Conservation Commission, and one being automatically selected from the municipal Planning Board. The Forest Commission meets once a month to discuss ongoing forest management. To avoid short-term political interests, the Municipal council does not interfere with long-term orientations of the CF, which is also an innovative feature of the governance system, deriving from a process of self-organization, leading to long-term forest planning objective realization decided and approved collectively by municipal citizens, independently the Municipal Council.

The Randolph CF and the U.S. Forest Service (USFS) maintain communication by meeting once a year to coordinate forest management. The conservation

easement was purchased through a program called the Federal Legacy funds and is being held by the Division of Forest and Lands of New Hampshire, which determines the activities allowed in the forest. The conservation easement is enforced by the state of New Hampshire, which monitors it and sees that owners comply with the rules laid down in the easement. The easement is approved locally in a process of ordinance, which is audited annually by the State of New Hampshire for evaluation purposes.¹ The State's Division of Forest and lands is also co-signer of the three-way memorandum of agreement between the State, the Town and the USFS which is invited for the sharing of information, discussion of proposed activities and frequent meetings between the parties. The meetings taking place between the USFS, the Randolph CF commission and the State's Division of Forests, which also include managers from the adjacent White Mountain National Forest (USDA) provide opportunities to discuss management objectives and the maintenance of recreational infrastructures. These meetings take place twice a year in a formal committee established for this purpose and display adaptive governance rendered possible by polycentricity. For example, the USFS owns watershed areas for water supply and has to co-manage these territories with the Randolph CF. As such, stricter conservation rules have been enforced on these plots which has led the CF Commission to change its land planning (Interview # 3). The interplay and at times competition between recreational, conservation and forest exploitation activities proposed by these actors is a matter of constant adjustments. In these deliberations, informants expressed that on top of participating, the USFS provides guidelines and support, which appears to be largely consensual among CF management actors according to interview data (Interviews # 2, 3, 4). Ongoing interactions and information sharing between these actors provide the basis of polycentricity (Figure 1).

4.1.5. I2 – Information sharing; I3 – deliberation process; I10 – evaluation activities

According to the Town Forest Ordinance, interactions between actors involved in the governance are regulated by a legal framework. The Forest Commission is accountable to the town's elected Planning Board. The Planning Board is elected yet it remains independent from the municipal council while including one member from the municipal council. The Planning Board reports to town meeting about the CF matters, and is required by law to organize public assemblies for important decision-making regarding the CF. The budget for the CF is prepared by the Forest Commission and approved by the Planning Board. The Municipal Council is advised of the CF budget approval by the planning board. As a result, money generated in the forest remains distinct from municipal funds and is reinvested in the forest management to maintain roads, wildlife habitats, etc. In case

¹ The Federal government gives conservation money to the states: In New Hampshire the department of Resources and Economic Development manages this fund and holds the easement under the Federal legacy program.

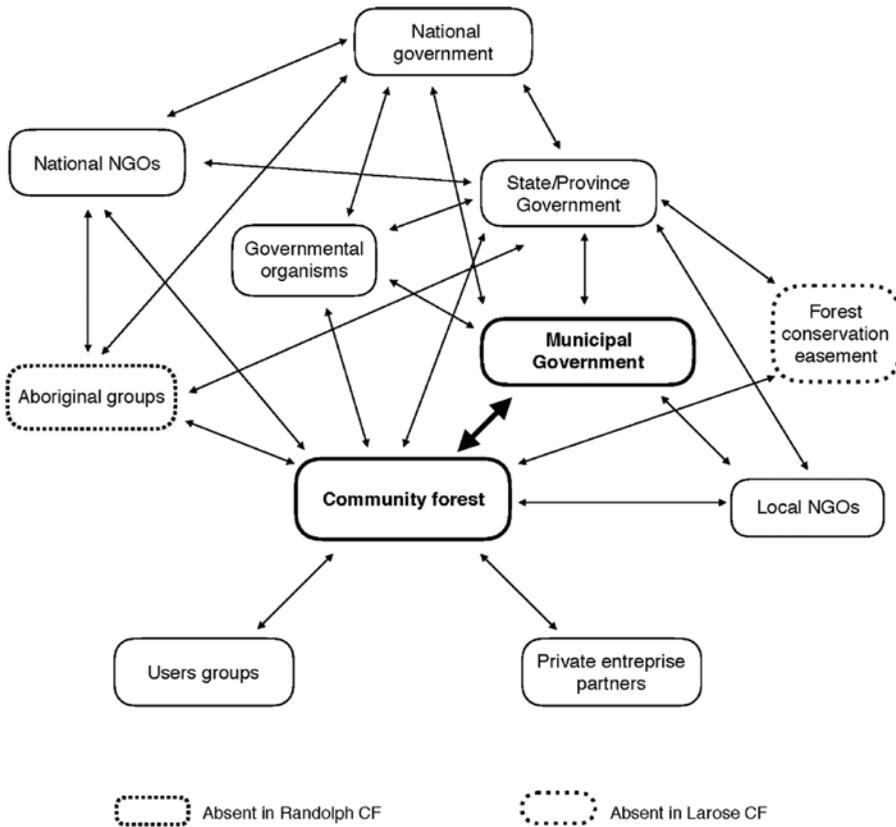


Figure 1: Schematic representation of the polycentric configuration of relations in the governance system of community forest (CF) initiatives. Comparison between Randolph CF, New Hampshire and Larose CF, Ontario.

of surplus funds, the Planning Board may accept a transfer to the municipality. Formal rules are clear and formalize the division between the Municipal Council and the Planning Board. However since a member of the Municipal Council sits on the Planning Board, there is a degree of permeability between these two structures. Although no major conflicts have been reported between the Municipal Council and the Planning Board about the CF, financial resources remain an issue in deliberations for some members of the Municipal Council who would already like to see a part of the funds generated by forest exploitation to be administered by the Municipal Council. However, the small size of the governing bodies and the personal relationship between members, along with the clarity of formal rules which are being enforced by multiple bodies has prevented any major conflicts, and the autonomy of CF fund management has been upheld, while allowing ongoing discussion and information exchange.

At the state level, forestry is governed by best management practices for the state of New Hampshire. The main management tool for the CF is the stewardship plan of 2002, realized after the inventory and revised every 10 years. This plan is prepared by an external private organization for the Forest Commission. The main objectives of the stewardship plan are: respect of the forest easement requirements, inventory of forest resources and the development of a forestry action plan, including road development, wildlife habitat management and recreation (Wintturi 2003). The stewardship plan contributes to the stability of overall management, while the timber harvest allows standing trees' improvement and generates revenues. The second stewardship plan emphasizes improvement of the forest's ecological value, while it presents new opportunities of revenues and educational activities (Wintturi 2013). Forestry activities are certified by the American Tree farm System which insured compliance with 10 standards. As mentioned earlier, the overseeing capacity of the Division of Forest and Lands of New Hampshire in forest management, as part of its responsibilities as holder of the easement, insures a high degree of fit between forest management actions and long-term multifunctional forest activities. Interactions between on the one hand American Tree farm System and the Randolph CF Commission, and on the other the Division of Forest and Lands and the Randolph CF Commission insures the SES' management adaptation to the vision of stakeholders. As such, the easement has been able to adjust its rules to allow for snowmobile activities in certain areas, which are an important component of regional economic activities and to intensify forest management for creating wildlife habitat (Interview # 1).

At the CF level, deliberation between forest users, managers and organization is maintained through annual town meetings where CF issues are brought up. Forestry work is communicated directly to town inhabitants by the mail and email (Interview # 4). As stated in the Randolph Town Forest Ordinance, independent organizations act as activity managers for different recreation activities through private donations and state grants, such as the Randolph Mountain Club which manages hiking trails. Members of the two towns on which the CF is located are able to participate in management at town meetings, but are also invited to take part in a yearly CF day where they can be informed on ongoing activities including management operations (Berlin Daily Sun 2013). Also, the annual forest day allows the general public to be informed about ongoing activities and different aspects of management, and to visit the CF with its managers. This mechanism has allowed CF managers to become more responsive to concerns from the population, such as the location of logging operations, hiking paths development, or access control to a former mining site which has patrimonial value (Interview # 3). On these specific issues, local citizens have the capacity to deliberate on best practices and preferences. The CF website actively advertises the Forest Commission meetings and the matters that are discussed. Individuals or organizations which seek to submit a proposition are allowed at the Forest Commission meetings, if they presented their request prior to the meeting. From the data gathered in this research, the general level of participation from the public remains

limited to information sharing about the management decisions and the capacity to voice concerns. As in other small rural communities of North America, the largely consensual values have prevented major conflicts from happening.

4.2. Larose Community Forest, Ontario, Canada

4.2.1. GS1 – Policy area

Community forests take a variety of forms in Ontario, but those that have existed for the longest time are municipal forests known as Agreement Forests (Harvey and Hillier 1994). In Ontario, at the beginning of the 20th century, rapid land degradation of croplands in some areas led to reforestation programs for land rehabilitation. From 1911 onward, numerous acts provided counties with the capacity to purchase degraded lands to be managed for reforestation purposes while devolving land management and reforestation to the provincial government for 20–50 years (Bullock and Hanna 2012; Leclerc 2014; Bowley 2015). For many decades, these local forests were managed by the Ontario Government (Conservation de la Nation Sud 2007). In 1994, the Ontario Government started negotiating the termination of “agreement forests” and gradually transferred the management of these reforested lands to the municipalities (Eastern Ontario Model Forest 2012; Teitelbaum and Bullock 2012). In 2012, 15 years after the withdrawal of the government program, 24 CFs were managed by counties and municipalities with an average area of 2000 ha per forest entity (Bullock and Hanna 2012).

4.2.2. GS2 – Geographic scale of governance system; GS3 – population size

Larose Forest was established on a site designated as the “desert of Bourget” which resulted from large-scale clear cutting of pine forests and ensuing land degradation in the region of the United Counties of Prescott and Russell. Under the leadership of a local agronomist, M. Ferdinand Larose, long-term reforestation activities were carried out to ensure soil rehabilitation (United Counties of Prescott and Russell 2000, 2008, 2016a). To this end, an agreement was signed between the Counties’ authorities and the Province in 1928 to allow the Counties to acquire lands which would be managed through a provincial program. In 2000, the forest planning at the Larose forest was devolved to the United Counties of Prescott and Russell (United Counties of Prescott and Russell 2008, 2016b). Since its creation, over 18 million trees have been planted on a territory of 11,000 ha (United Counties of Prescott and Russell 2016b). The Larose forest has the status of municipal forest owned by a municipality and supported by the residents of the Counties to whom it provides a free access for recreation and education purposes.

4.2.3. GS4 – Regime type; GS5 – rule-making organizations

The Larose Forest governance is assumed by the Counties’ Council on which each mayor of the 8 municipalities of the United Counties of Prescott and Russell sits (United Counties of Prescott and Russell 2016a). The Council’s president

sits on the Advisory Committee of the Larose Forest, with another mayor of the Counties. Along with these two elected officials, the Advisory Committee includes provincial civil servants, volunteers, members of indigenous communities and contact persons of different groups of experts (Interview # 8). The mandate of the Advisory Committee is to provide notifications to the Council regarding forest management orientations, and realization of projects.

The Advisory Committee explicitly excludes people with vested interests in forest management such as hunters or local forestry companies' owners. Yet, the Council is also assisted by the Forest Users' Committee, composed of one representative for each group of users, which purpose is to ensure cohabitation of uses and trail management. Whether some groups with vested interests can be represented on the Forest Users' Committee has been expressed as matter of debate (Interview # 7,8). The interests that can be put forward in deliberations appear as an aspect of competition between actors within the governing structures. The interactions between the Council, the Advisory Committee and the Forest Users' Committee are conducive to information sharing, although the clear separation between the two latter committees was designed as a mechanism to maintain the independence of decision-making from any vested interests. Yet, interactions that take place with the Council are able to lead to adjustments in the ongoing rule-making about recreational and logging activities. The responsibility for ongoing management of the Larose Forest falls on the Department of Planning and Forestry of the Counties.

The Counties' Department of Planning and Forestry manages a large share of the revenues from logging operations which are reinvested in the improvement of recreation infrastructures and public engagement activities. In this regard, its structure is somewhat close to the one of New England CFs. Although, as a property of the Counties, the Larose Forest is not financially autonomous and benefits from direct fund allocation for the ongoing management, its financial resource management capacities are increasing along with its revenues from forest exploitation. The capacity of the Counties' Department of Planning and Forestry in financial management is important, but yet under the authority of the County's administration. The Counties have been able to expand forest lands owned, while also swapping properties to ensure contiguous land area for the Larose Forest. The Larose Forest status is secured by municipal/county zoning by-laws enforced under provincial regulation (Interview # 9). These organizations and the regime in which they take place form the basis of a polycentric governance structure. This governance allows information sharing and mutual adjustments, with some level of competition, but is still limited by the fact that the CF ultimately belongs to the County which delegates its management to the Advisory Committee. Although, the formal rules related to this arrangement limit the scope of polycentricity, the actual rules in use in governance show significant exchanges, competition and mutual adjustments between the different governing bodies and organizations involved (Table 2).

4.2.4. GS6 – Rules in use

From the 1990s onward, the stakeholders in charge of Larose Forest revised their original mandate according to changing contexts and objectives, and notably forest users' needs and projects (Leclerc 2014). Over the years, for former "agreement forests", initial goals of land rehabilitation through reforestation evolved into multi-use management associated to CF models, such as forest management, wildlife habitat management, water catchment protection, flood control, scientific research, and recreational development (Bullock and Hanna 2012). Following the full takeover of the Larose Forest by the Counties of Prescott and Russell from the provincial government, a protection and development plan was elaborated to realize a full inventory and analysis of the natural environment, along with social and economic context of the forest. This mandate was elaborated jointly between the Advisory Committee and South Nation Conservation, which belongs to a provincial network of conservation organizations specialized in watershed management and consultation with forest users. The South Nation Conservation organization was able to provide guidelines to the Advisory Committee, while both bodies interacted and competed over rules in use and their related priorities. Moreover, a private consulting firm was hired to set up public consultations and determine the formal rules of forest management. The main objective of the inventory was to facilitate decision-making regarding the conservation and development of the forest. Moreover, the Larose Forest is certified by the Forest Stewardship Council (FSC) in order to improve its forest management practices and to demonstrate its commitment to best practices to forest users (Interview # 7). However, the FSC introduced new rules regarding the free prior and informed consent that should be obtained from indigenous communities and local forest users before forest operations. This overlaps with the authority of the Advisory Committee and triggers processes of change in governance (Interview # 7). This has been taking place as part of measures to improve harvesting practices and efforts to be more transparent to local forest users concerned about wood harvesting.

Following the adoption of the protection and development plan, a forest management plan was also adopted by the Council according to the recommendation of the Counties' Forest Management Committee, working with the Advisory Committee. This was established through a consultation process. The forest management plan (stewardship plan) seeks to formulate clear long-term orientations for a 20-year period, in collaboration with the South Nation Conservation for watershed management (Horizon Multiressource 2008). The forest management plan is composed of three parts: a forest policy, a 20-year management plan, and a 5-year operational plan. Every 5 years, according to the terms of reference of the County Forest Lands Advisory Committee, consultations are carried out with forest users to allow information sharing and documentation of potential issues in order to implement the operational plan. This exercise is an opportunity for sharing learnings which has proven conducive to adaptation of forestry practices to improved norms, as it has contributed in the past to implement improved harvesting practices and better

communication with the public over time. In this case again, communication processes appear largely consensual and are based on open communication channels, especially with citizens whose properties are adjacent to the CF.

4.2.5. I2 – Information sharing; I3 – deliberation process; I10 – evaluation activities

Larose CF has always been considered by local population as a collective asset, with a strong sense of collective ownership, which played a role in local identity formation ever since F. Larose became involved and mobilized local people in plantation work (Leclerc 2014). As a result, the forest management plan involved consultations with forest users and the general public. The consultation process is ongoing in the Larose CF, including information sharing through Internet and local newspapers, public workshops, field visits, public consultations during the revision of management plans, notices to the forest users and neighbors before forestry operations (Teitelbaum and Bullock 2012). The Larose Forest has been promoting recreational activities such as hiking, biking and skiing, along with multi-use trails for all-terrain vehicles. Many educational and interpretative activities are also organized for schools of the region. Every year, the main forest managers organize a forest tour for the Counties' elected officials, while keeping open communication channels with the users and local populations. There is also a Larose Forest Day for the general public when interpretative activities are organized. Moreover, the Counties have been maintaining good relations with different First Nation communities over the integration of traditional knowledge in Larose CF management. Larose CF managers have been accommodating requests of First Nation communities to harvest timber and non-timber forest products for traditional uses (Interview # 6). The forest uses have adjusted by taking into account the cultural needs of the First Nation communities, leaving certain tree species to the use of members of these communities.

5. Discussion

The study shows the value of polycentricity to interpret the particular governance system configuration for institutions pertaining to CFs according to their specific characteristics as highlighted by the SES framework (Table 2). These characteristics provide an overview of the formal rules in use, while the polycentric nature of governance processes entail institution diversity, mutual adjustments and overlapping jurisdictions. It is the mechanisms described in the previous section that provide room for institutional adaptation to considerations of society and ecological processes in an ongoing transformation process. As such, the notion of polycentricity has allowed to pay attention to formal structures and their rules in use, to attend to the dynamics that emerge between governing bodies. However, according to the picture of polycentricity, space for adaptation in governance is somewhat limited to the interplay between formalized structures of governance and the informational input they receive from groups and citizens.

5.1. Similarities

Community forests have derived largely from bottom-up initiatives and have often emerged in collaboration with different governing bodies, whether from government and non-government organizations. Moreover, CFs also derive from processes of deliberation and in many instances competition between the governing bodies, organizations and groups interacting over specific issues. Therefore, the notion of polycentricity allows to shed light on dynamic modes of forest governance that rest on intense information sharing, through formal governing structures that depend on sustained communication mechanisms. Although CFs derive from a unique history of interplay between institutions nested at different scales, the jurisdiction in which they are found define some of their features (GS1). For Randolph and Larose CFs, the state/provincial governments have played an important role, with access to Federal programs in the case of Randolph (Figure 1). These two cases exemplify regime types (GS4) involving multiple authorities with overlapping jurisdictions, yet rules in use (GS6) largely pertain to the Forest Commission and the Planning Board in the case of Randolph CF; and to the Department of Planning and Forestry and the Advisory Committee in the case of Larose CF. These main organizations are able to shape rules and practices to adapt to changing contexts, and community values, while other organizations seek to introduce new rules that may change formal rules in use. This is the case with tensions over conservation and recreation in Randolph CF and with the approach to First Nation communities in Larose CF.

Both community forests are owned (GS7) by municipalities which ensure high level of control over its management and accountability of local forest managers toward residents. Many mechanisms of public participation are in place in all CFs to allow for sustained communication and transparency on forest operations and finance. There is a repertoire of norms and actions (GS8) insuring that 20-year forest stewardship plan is monitored and reviewed every 5 or 10 years. Logging operations in all CFs are monitored by the certification and easement holders in the case of New England CF. Timber harvest is contracted to local companies using a bidding process. Formal democratic procedures and measures of public participation insure that an important level of interaction between actors is maintained which is beneficial to information sharing and learning among actors (I2, I3, I7, I8, I10). Moreover, all CFs provide some level of historical continuity, the CF have had long histories of free access for recreational activities (hiking and hunting). Therefore, the CF institutional structures of Randolph and Larose, in large part due to the polycentric manifestation of governance, have proven adaptive and even proactive to maintaining free access while pursuing forestry activities in a sustainable framework that tends to increase the autonomy of the CF as a distinct entity that is mutually constituted with formal organizations (NGOs, foundations, users' groups).

5.2. Differences

The comparative analysis also shows many differences between both cases. As shown by Table 2, the number of rule-making organizations (GS5) with a significant

role in governance appear more numerous in the case of Randolph CF than for the Larose forest, where the formal state institutions, namely the County's administration play a more influential role. In fact, for Randolph CF, institutional and policy guidelines have been stemming from federal, state, and nongovernmental organizations, as the Ontario CF mainly relies on provincial and municipal regulations, along with the province-funded South Nation Conservation Authority. Yet, also in the Larose CF, a large number of non-state rule-making organizations are also involved in the governance process, such as a certification body and citizen committees.

However, a major distinction pertains to the use of forest easement, a legal tool that is a prerequisite to the creation of New England CFs. For Randolph CF, the easement, held by New Hampshire to ensure forest use in perpetuity, enables CFs to obtain donations and program funding. Forest easements set clear guidelines on allowed forest activities (GS7). As for Ontario CFs, municipal land planning in accordance with Ontario regulations is the sole tool in use, along with forest planning. In the case of Ontario, the long-term existence of the CF is ensured by provincial by-laws regarding municipal zoning, which so far reflect the strong attachment of the residents to the CF, but does not provide the same level of legal protection.

Due in large part to the forest easement and the ongoing information exchange between state, federal and CF governing bodies, the Randolph CF governance appears to be sustained by a more complex polycentric configuration than Larose CF. Moreover, the number of overlapping institutional structures (Federal, state, municipal, Non-governmental, citizen groups) in the case of Randolph CF suggests more dynamic and sustained information exchange than Larose CF (Provincial, municipal and citizen groups) (GS9). In this regard, the Randolph CF governing body displays a large level of autonomy framed through the polycentric arrangements with other institutional bodies. Yet, the scope of this study does not allow to conclude that Randolph CF governance is more adaptive than the Larose CF. In fact, the larger size of the Larose CF and the number of stakeholders involved in governance translate into complex issues that led to adjustment and adaptation to specific concerns, such as First Nation participation. The data suggests that Larose CF's adaptive mechanisms are more sector-based (forestry, recreation, education), which does not prevent inter-sector information exchange, but does limit the involvement of higher level (provincial and federal) governing bodies. Yet, for both CF initiatives, the forest management and stewardship plans used seem to provide sufficient guidelines for forest stakeholders, while increasing the level of accountability to local resident.

6. Conclusion

The formal institutions of CF governing bodies display polycentric features in their mode of functioning that can be considered conducive to adaptive governance. Although a more extensive survey on CF would be required to validate our hypothesis, both case studies suggest that it is valid. Information sharing between

different institutional structures in a polycentric arrangement has in fact yielded tighter network able to sustain dynamic adjustments conducive to adaptive governance. In fact, the study highlights interactions often at the same time competitive and collaborative, the multiplicity of complementary rules from different organizations and structures of governance and overlapping jurisdictions. Most important is how the notion of polycentricity allows to see how information exchange takes place differently, according to interactions between governing bodies in Randolph and Larose CFs. The comparison between Randolph and Larose CFs shows that polycentric configurations are to some extent shaped by legal frameworks in which CF initiatives develop. These frameworks determine in part the adjustments and forms of adaptation that take place in the interplay between multiple governing bodies. Overall, for both cases, the mechanisms that maintain ongoing interaction and information exchange appear conducive to the adaptability of CFs governance, especially to respond to new social claims and changing management objectives in this case. However, the relatively short temporal horizon of the study and lack of major socioeconomic or environmental disturbances does not allow to clearly identify more in-depth forms of adaptation. Nevertheless, this perspective along with Frances Cleaver's (2012) shows that community forest initiatives are not necessarily amenable to design from the outset, but are being shaped by complex polycentric multi-scalar interactions (Bixler 2014). We attempted to capture these interactions through the notion polycentricity and the variables provided by the SES framework in the study of adaptive governance.

Moreover, the SES framework has been instrumental in the systematic analysis of two CFs' institutional features, while polycentric features have been analysed through an inductive approach. The study shows that the SES framework is efficient in identifying features of polycentricity and how they differ in specific CFs. Therefore, the study provides a contribution to empirical research on CF in the North by a detailed investigation of the potential and actual adaptive governance, according to an understanding of their polycentricity, as described by an exhaustive number of SES variables. This research also has normative value insofar as it is indicative of practices that demonstrated some degree of effectiveness for adaptive governance. As such, this analysis of particular institutional configurations partly answered the call of Koontz et al. (2015, 147) who "recommend research that develops typologies to aid analysis of particular configurations, to understand how adaptive institutions are most readily attained in different types of settings." Yet, we contend that more research is needed on the particular informal rules-in-use that favour adaptive governance in CF, and how it comes about in contextual interactions between institutionalized structures and people.

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