

Places to Stand, Places to Grow:
Measuring Membership Characteristics and Land Use/Land Cover Change in Ontario's
Conservation Authorities

by

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ABSTRACT

Conservation authorities are infrequently studied intergovernmental public bodies in Ontario which are responsible for delivering a variety of resource management programs and services. One aspect that is particularly poorly understood is the role that their governing boards' differential memberships may play in the authorities' decision-making, especially surrounding development priorities. My research explores this issue by conducting a statistical analysis of the relationship between two membership demographic variables—gender and ethnicity—and indicators of land use/land cover change that proxy urban development. My results demonstrate that a significant relationship exists between the ratio of visible minority members of conservation authority boards and land use/land cover change in roads and forestry.

CHAPTER 1: INTRODUCTION

Conservation authorities are public bodies in Ontario with responsibility for the delivery of programs and services relating to resource conservation and management in the province's watersheds (Conservation Authorities Act, 1990). Unlike most other public bodies, conservation authorities are not bound by political boundaries but rather organized on a watershed basis (Conservation Ontario, n.d.), making them a unique form of government that does not neatly respect regional and district lines. These public bodies are administered through boards appointed by constituent municipalities but subject to provincial oversight, making them intergovernmental agencies.

Conservation authorities have a long history in Ontario, which was one of the first jurisdictions in North America to turn to specialized government bodies for natural resource management. However, despite their longevity and the scrutiny accorded to some of their functions (e.g., water management), comparatively little attention has been paid to their composition and the role of individual authority members in collective decision-making. Although authors such as Lyons (2015)—who analyzed the impact of different appointment procedures on authority decisions—have begun to shine the light in this direction, there remains a dearth of literature on what role, if any, the membership of conservation authorities' governing boards plays in their administration of watersheds.

This lack of study on the inner workings of conservation authorities comes even during a period where these public bodies face growing attention from provincial and local decisionmakers, especially in light of the 2000 Walkerton tragedy where poor water management led to lethal *E. coli* aquifer contamination (Watson et al. 2019). Moreover, as development, urban sprawl, and climate change strategy become increasingly important issues of public debate, the natural resource management and watershed protection functions of conservation authorities have grown in importance, highlighting the need for efficient, responsive, and ecologically responsible management bodies for Ontario's natural wealth.

As such, my project serves as exploratory research into this poorly studied aspect of the operations of conservation authorities in Ontario. In this thesis, I theorize that, due to the importance of adequate public representation for democratic service delivery, a relationship exists between the demographic makeup of conservation authority boards and their land-use

development decisions. I then proceed to analyze the link between the composition of the governing boards of conservation authorities and land use/land cover (LULC) change in Ontario between 1990 and 2010, in the aim of identifying the existence of any relationship between the membership of these boards and differential patterns of development between jurisdictions. By tracking land use/land cover change between 1990 and 2010—the most recent years for which regular and high-quality remote sensing data are found—and performing statistical analysis on demographic characteristics of board members, this project will aim to answer that question and open new avenues for research into the behaviour and composition of these poorly understood public bodies.

In Chapter 2, I first review the literature on specialized government, regulatory capture, and participatory governance to build a theoretical understanding of the role and function conservation authorities. Then, in Chapter 3, I situate this research within the historical and political context of resource management and urban development in Ontario. Afterwards, in Chapter 4, I explain my methodology, including the use of geographic information systems and statistical analysis. In Chapters 5 and 6, I show and discuss the results of my simple and multiple linear regressions, which show that a statistically significant link exists between the visible minority ratio on conservation authority boards and two proxies of urban development. Finally, in Chapter 7, I conclude that there exists a plausible link between conservation authorities' membership and decision-making and identify avenues for future research.

CHAPTER 2: CONCEPTUALIZING CONSERVATION AUTHORITY DECISION-MAKING

This section presents a conceptual framework that first situates Ontario's conservation authorities within global governance trends and then raises important questions about how the makeup and democratic accountability of governance structures can impact their decision-making. In order to understand the prospective relationship between conservation authorities and developmental decision-making in Ontario, my conceptual framework is based upon three concepts drawn from the political geography and urban studies scholarships: specialized government, regulatory capture, and participatory governance.

Conservation authorities in Ontario, as a non-municipal form of devolved governance with a narrow, subject-based mandate, are an example of specialized government. Examining the existing scholarship on specialized governments thus allows me to situate Ontario's conservation authorities within a broader North American context of growing atomization of local governance and brings into focus many of the issues and critiques of this government model in the literature.

I then turn towards the regulatory capture literature to theorize a mechanism by which the membership of governance bodies can affect their decision-making. By distinguishing the parochial private interests of individual regulators from the public interest served by the regulation, this body of literature highlights that the interests and priorities of individual members of regulatory organizations are not fungible, and further brings attention to the need for examining the backgrounds of an organization's members to develop a better understanding of the organization's behaviour. Applying this principle to conservation authorities, I conclude that different members of conservation authorities may have different interests that they proceed apply to the authorities' decision-making—a theorized link that invites scrutiny of the members' backgrounds to understand how conservation authorities approve development.

Finally, I look at the participatory governance literature to establish an idealized model for governance and to understand the centrality of public participation and stakeholder representation to democratic service delivery. This literature, which emphasizes representation and consultation, leads me to look at two important identity markers in Canadian communities—gender and ethnicity—to interrogate the extent to which diverse cross-sections of local communities are being represented within the conservation authorities whose goals are to deliver

resource management and conservation services to their communities.

RESEARCH AIM: To understand how the membership of conservation authorities in Ontario, Canada can impact the decision-making of these public bodies on issues of development.



| SPECIALIZED GOVERNMENT LITERATURE (2.1) | REGULATORY CAPTURE LITERATURE (2.2) | PARTICIPATORY GOVERNANCE LITERATURE (2.3) |
|---|--|---|
| <ul style="list-style-type: none"> • Contrasted with general government (i.e., cities) • Theoretically promotes efficiency by clearly delineating powers and promoting competition • Democratic deficit • Diverse forms of specialized governance exist | <ul style="list-style-type: none"> • Citizen confusion on governance structures enables special interests to dictate policy priorities. • Regulatory capture is positioned in opposition to the amorphous concept of the “public interest”. • An individual-action theory that is accused of ignoring structural forces | <ul style="list-style-type: none"> • Importance of public participation and stakeholder consultation • Service delivery • Anti-hierarchical and radical subversion of traditional democratic participation |

Fig. 2.1. Conceptual framework model

2.1. Specialized Government

Specialized governments, also variously called ‘special districts’, ‘public authorities’, and ‘special-purpose governments’, are a form of local government with independence from municipalities, jurisdiction that transcends existing local boundaries, and a limited scope of authority (Mullin, 2009), standing in contrast to the traditional system of home rule where “all policies are under the control of one general-purpose government” (Berry, 2009, p. 55). While the latter category encompasses traditional local governments, such as towns, cities and counties, the former can include a wide and disparate array of administrative entities with jurisdictions bounded by political boundaries, service area, subject-matter, watershed or any other number of criteria. As a result, it is difficult to make many universal observations about specialized governance.

Accordingly, this section aims to provide a brief discussion of the origins, professed justifications, critiques, and gaps in the literature pertaining to specialized governance as a concept in the North American context, along with their relevance to the local context of conservation authorities in Ontario.

2.1.1. Comparative local contexts

Specialized governments have a long history in the North American context, with the first special district tracing back to the early 19th century, although these early authorities had very limited jurisdictions (Advisory Commission on Intergovernmental Relations, 1964). Special districts did not begin to proliferate until the early 20th century, when the first modern general-purpose special district was established in New York in the form of the Triborough Bridge and Tunnel Authority (Caro, 1978; Henderson, 2012). This form of government rapidly proliferated in the Great Depression and Second World War eras: by 1957, they would come to be known as the “new dark continent of American politics” on account of their prevalence, compounded by the dearth of serious academic research on their subject (ACIR, 1964; Bollens, 1957, p. 1). As of 1992, natural resource districts—a broad category of environmental management bodies that includes organizations like Ontario’s conservation authorities—accounted for nearly a fifth of all special districts in the United States (Foster, 1997). Today, scholars such as Foster (1996) and Zimmerman (1993) have observed that special districts have become nearly ubiquitous as a

result of the expansion of local government functions, the complexity of metropolitan administration, and the growing public mistrust in traditional government institutions.

In the Canadian context, special districts find their origin in the 1912 creation of the Toronto Harbour Commission, which was used to borrow large sums for the creation of a deepwater port without adding municipal debt (Valverde, 2016). Although these government bodies are hardly uncommon in Canada—counting amongst their members school boards, transit commissions, and the aforementioned port authorities—they are also far less ubiquitous than in the United States. Indeed, the defining difference in U.S. and Canadian public discourse is the lack of support for exploring administrative fragmentation as a local governance option in the latter (Sancton, 1994). Rather, Imbroscio (1996) observes that Canadian municipalities have taken the opposite approach and centralized authority in powerful general-purpose governments due to provincial “pressures from above for political-administrative control” (p. 601), contrasting with strong demands for decentralization in the United States. Due to the difference in governance structures and political culture, Canadian special district governance, especially in *sui generis* forms such as Ontario’s conservation authorities, is accordingly subject of little systematic study in the literature.

2.1.2. Supportive rationales

Other factors have also animated the proliferation of special districts as a form of local government which is normatively viewed as “purely responsive to constituent demands, efficiently translating those demands into policy outcomes” (Mullin, 2009, p. 8). Valverde (2016) connects the discourse of efficiency surrounding this form of public administration to the public-private integration and ad hoc hybrid government typical of neoliberal governance practices, whose rise is coterminous with the explosion of special districts in the postwar era. Other arguments in favour of special districts identified by Berry (2009) include increased spending on public welfare programs relevant to minority groups that would be drowned out in general elections and an increase in government efficiency created by the competition between public and special governance models.

One of the main advantages of special districts for their creators lies in their territorial flexibility, as they are not bound to any municipality and can overlap with multiple local government areas (Bollens, 1957). Another key appeal of special districts lies in their

combination of quasi-governmental powers and quasi-private flexibility and discretion (Foster, 1997; Henderson, 2012). More controversially, Burns (1994) also found that special districts have grown thanks to the support of developer interests in order to increase the power of wealthy constituents and exclude ‘undesirable’ demographics, although Bauroth (2007) argues that these special interests are only present at the creation of the district and gradually recede over time. Finally, special districts also allow for the selective limitation of representation through a great variation in appointment and elective processes for the composition of district board membership and the restriction of the franchise to certain groups who have a direct stake in the services provided, such as landowners or service users (Bollens, 1957).

2.1.3. Critiques of specialized governance

In spite of this looming presence, research on the governance of special districts remains sparse and this form of government continues to lack systematic study (Berry, 2009; Foster, 1997). However, what research exists unambiguously highlights several prevailing critiques, including the potential for inefficiency through the duplication of services (Mullin, 2009) and the increased role of special interest groups in public administration (Berry, 2009). The democratic deficit of special districts becomes especially acute when their membership is appointed rather than elected: Valverde (2016) found that such bodies regularly circumvent democratic accountability mechanisms and that their activities are hidden from public record. Compounding this lack of transparency, the dedicated revenue streams typical of special districts insulates them from typical democratic pressures surrounding budgeting faced by local governments (Berry, 2009).

Moreover, Oates (2006) summarized the findings of a growing body of literature that questioned the normative neoliberal assumptions behind specialized governance, finding that public-service performance is not necessarily improved by the atomization of government services. As Wolman (2019) summarizes, the literature suggests that “concern with fragmentation is increasing” across the world (p. 324), with European states also beginning to recognize the flaws of fragmented local administration. These critiques, though recently amplified by a growing body of research, are not new: as early as the 1960s, the U.S. Advisory Commission on Intergovernmental Relations (1964) condemned the tendency for special districts

to increase the cost of public services, hamper intergovernmental coordination and reduce citizen participation.

2.2. Regulatory Capture

Regulatory capture refers to the process by which “regulation is acquired by the industry and is designed and operated primarily for its benefit” (Novak, 2013, p. 26). According to Dal Bó (2006), this concept can be defined in either a broad or narrow fashion, with the former approach understanding it as “the process through which special interests affect state intervention in any of its forms” (p. 203), and the latter approach instead construing it as “specifically the process through which regulated monopolies end up manipulating the state agencies that are supposed to control them” (p. 203). In either construction, the emphasis in regulatory capture analysis is on the identification of an anomalous degree of influence by a tendentious subset of the population which was not envisioned to exercise control over a public institution.

Because control of public services by private interests is difficult to reconcile with the democratic principles underlying liberal government, regulatory capture is normatively regarded as an undesirable social illness with connotations of private corruption (Novak, 2013). It is moreover typically framed as a deeply embedded problem, with Dal Bó (2006) observing that even institutions set up to combat regulatory capture have been captured by special interests. As Carpenter and Moss (2013) conclude, “observers often point to regulatory capture as a culprit” for market failures and perceived failures in government action (p. 1). Examples related by the authors of this tendency in action include the attribution to regulatory capture of everything from the Great Recession to the *Deepwater Horizon* oil spill. Thus, regulatory capture is a highly politically charged accusation whose misidentification and inability to systematically define may hinder the effectiveness of efforts to combat its persistence in public institutions (Carpenter and Moss, 2013).

2.2.1. Municipal and Canadian contexts

Though all forms of institutions are capable of being captured, municipal governments, especially special districts, are particularly prone to undue influence from special interest groups, as discussed in the previous section. This is an insidious and alarmingly common form of

regulatory capture whose possibly inherent nature to the structural design of special districts has been the focus of an emerging body of literature.

The most common application of regulatory capture in the municipal context occurs in terms of land use. Fischel (2001) argues that homeowners are able to control the development of their neighbourhood using public institutions, thereby protecting their real estate investments and property values. Accordingly, regulatory capture takes the form of undue private-sector influence on public-sector decision-making pertaining to debates over private residential development versus the public interest in environmental conservation (Mullin, 2009). However, other municipal functions are also prone to capture by special interests. For instance, municipal powers over housing and transportation have been subject of intense lobbying efforts by sharing economy firms like Airbnb and Uber, who seek beneficial rewrites of existing regulatory regimes (Johal and Crawford Urban, 2017).

In Canada, research on regulatory capture has primarily focused on national-level institutions, including the Canadian Radio-television and Telecommunications Commission (Mahar, 2015) and the Investment Dealers Association (Lokanan, 2017). Environmental policy in particular is subject to high incidence of regulatory capture in Canada, as summarized by Bernauer (2020), with widespread media and civil society criticism of industry influence on environmental regulators in public discourse. Unlike in the United States, the prevalence of regulatory capture at the municipal level in Canada does not appear to be the subject of significant academic study, although this may be on account of the aforementioned relative paucity of special districts in the Canadian local context.

2.2.2. Revolving door

Returning to Dal Bó's (2006) discussion of the differing definitions of regulatory capture, the two definitions overlap in identifying a key element: the existence of the so-called 'revolving door' in politics, which Blanes i Vidal et al. (2012) defines as the movement of public-sector personnel into private lobbying groups that in turn attempt to influence public sector policy. However, Ninua (2010) observes that the 'revolving door' can also operate in the opposite direction, with captured individuals entering government from private-sector interest groups. In those circumstances, corporate executives and lobbyists are often hired as public officials or

special advisors in fields where they have a vested interest, allowing for undue external influence on the decision-making processes of the state.

This phenomenon is intractably tied to regulatory capture because it results in the distorted allocation of government resources towards the interests of the lobby groups who make effective use of the revolving door (Hong and Lim, 2016). Although there are many policies in place to mitigate the strength of this cycle, including mandatory disclosure, cooling-off periods, and transparency rules, these barriers appear ineffective in preventing system-wide intermingling of public and private interests in government, resulting in the distortion of interests represented in official decision-making (LaPira and Thomas, 2014).

However, some authors have questioned the normative view of ‘revolving door’ politics as intractably negative by pointing to evidence of its benign effects or unsuitability as an analytical framework. For instance, Makkai and Braithwaite (1992) note that regulatory capture is a poor macro-level explanation for micro-level issues and that attributing many of the regulatory failings of public agencies to the ‘revolving door’ without situational analysis rooted in an “overdrawn structural determinism” (p. 1). Meanwhile, LaPira and Thomas (2017) controversially argue that the ‘revolving door’ can also have positive effects, asserting that “the typical lobbyist is a political professional with useful policy expertise and institutional knowledge” (p. 3) and that the impact of lobbyists on the government is relatively benign because they simply observe the government or encourage it to take decisions that it had already planned to take.

2.2.3. Potential inadequacies

Indeed, there is a growing body of revisionist literature questioning the entire foundation of the theory of regulatory capture. A variety of authors have taken aim at the very notion from vastly different perspectives, some arguing for a more structural view of public-private interaction and others attacking the explanatory power of the conventional literature.

One of the prevailing critiques of existing work on regulatory capture is the difficulty of diagnosing the phenomenon in actual government practice. Carpenter and Moss (2013) argue that the nebulous definitions and difficulty in divining intent result in both under- and over-diagnosis of the phenomenon in the literature, with the latter being far more common. They

attribute the fundamental flaw to the need to establish the presence of regulatory capture, as “the fact that an industry is well served by regulation is deeply insufficient for a judgment of capture” (p. 14). They explain that studies fail to properly eliminate the possibility of confounding variables, pointing to the possibility of bureaucratic drift, coincidence, or special and public interests simply aligning on certain issues.

An alternative view questions the very basis of regulatory capture and argues that it is rooted in normative and recursive reasoning, since the role of so-called ‘special interests’ in the government “must have some notion of the public interest in mind as a counterfactual” (Carpenter, 2013, p. 55) and stands in opposition to the general interest of the body politic. In turn, this “simple binary” has been criticized by a minority of the scholarship as ignorant of structural forces (Novak, 2013, p. 45): Novak (2013) argues that even state-directed activities without any undue external influence can be subject to intense corruption, and that regulatory capture theory is fundamentally mistaken because it attributes the phenomenon to economic, rather than political, causes. He instead suggests that regulatory capture is fundamentally a political failure rather than a market failure and merits a political solution—i.e., the introduction of greater democracy rather than regulation in public decision-making.

2.2.4. Conclusion

While regulatory capture may not provide a complete explanation of structural forces underlying state policy, it offers an important critical lens through which the insidious role of private development interests on public policymaking may be interrogated. However, in light of the compelling critiques of this analytical framework, discussions of regulatory capture should be framed in political terms rather than economic rationality, and confounding variables must be both accounted for and eliminated prior to a conclusive determination of its presence.

A regulatory capture paradigm brings into focus the fact that certain groups with outsized influence or representation in a regulatory government body can shape its decision-making in a way that diverges from the public interest. As such, it confirms that examining the membership of governance bodies can yield crucial insights into their internal organizational logic and how this logic translates into decision-making.

2.3. Participatory Governance

Having previously discussed the state of the literature on specialized governments and the potential pitfalls associated with this form of governance, I will now discuss a method of assessing if conservation authorities in Ontario successfully achieve their statutory goal of increasing public participation in the environmental conservation process.

Participatory governance is an emerging field of governance theory that questions many of the normative assumptions behind traditional democratic citizen engagement in order to create mass “reason-based action-oriented decision-making” (Fisher, 2012, p. 464). Part of this anti-hierarchical redistribution of power is the facilitation of “supportive collaborative-based discursive relationships among public and private sectors” (p. 458) in the context of institutional governance and service delivery. In the case of environmental management, public participation (Shrubsole, 1996) and stakeholder involvement (Roberts and Garima, 2014) are consistently held as main priorities for formal state institutions; top-down technocratic control, which is understood to have the potential to delegitimize state projects in the eyes of the people (Trowsdale et al., 2020), is firmly rejected under this democratic approach.

In Ontario, participatory governance is a principle that is enshrined within the statutory mission of conservation authorities (Watson et al., 2019). The participatory governance literature thus highlights the salience of examining the membership of conservation authority boards as a means of understanding their ability to engage in democratic service delivery. Specifically, the participatory governance literature would strongly suggest that the fair representation and engagement of stakeholders and the general public are essential for effective service delivery, which in the Ontario case consists of the variety of services and programs that conservation authorities are responsible for providing.

Since conservation authorities are responsible to the local communities within their jurisdictions and deliver services that affect all people within the watershed catchment area, it should thus follow that authorities devoted to democratic service delivery and participatory governance would accordingly reflect a cross-section of their communities in their leadership. One useful proxy for representation of the diverse backgrounds and interests of the general public is demographics. In turn, two particularly common and salient demographic indicators—gender and ethnicity—also happen to be matters of public record for individual members of

conservation authorities, making them uniquely accessible data points for the assessment of how Ontario conservation authorities reflect the public interest in their developmental decisions.

Accordingly, because greater diversity of interests and backgrounds represented in governance should result in more democratic service delivery, I theorize that gender and ethnicity—as indicators of adequate representation of a fair cross-section of the general population—should be related to conservation authorities’ decision-making on land use development.

CHAPTER 3: CONSERVATION AUTHORITIES AND URBAN DEVELOPMENT IN ONTARIO—A PRIMER

3.1. Conservation Authorities

3.1.1. Conservation authorities generally

Conservation authorities are local government bodies in the province of Ontario with overall responsibility for a variety of conservation and management functions in watersheds. According to the enabling statute for their establishment, the main purpose of a conservation authority is to deliver “programs and services that further the conservation, restoration, development and management of natural resources in watersheds in Ontario” (Conservation Authorities Act, 1990). This expansive purpose is in turn only circumscribed in the broadest of terms by the agencies’ objectives, which are statutorily defined as the establishment within their jurisdiction of “a program designed to further the conservation, restoration, development and management of natural resources other than gas, oil, coal and minerals” (Conservation Authorities Act, 1990). Their influence is particularly strong with regards to development, since they can recommend approval or rejection of planning applications based on the impact on watershed health (Lyons, 2015).

To pursue these objectives, conservation authorities are formed on the application of Ontario’s municipalities to the provincial Minister of Natural Resources and organized as intergovernmental bodies in partnership between member municipalities and the province (Mitchell et al., 2013). Consequently, their organization reflects an uneasy balance between the two tiers of government in various fields, such as budgeting, appointments, and oversight. Although their budget historically derives from equal cost-sharing between the local and provincial levels, provincial budget reductions since the 1990s have increasingly required conservation authorities to rely on a variety of revenue resources, including federal grants, fees for authority-run services, and dues paid by member municipalities (Lyons, 2015). Although part V of the Conservation Authorities Act grants the Minister of Natural Resources broad oversight of conservation authorities and the power to take over local operations (Conservation Authorities Act, 1990), the boards are appointed by municipal councils and “predominantly” constituted with municipal politicians (Lyons, 2015).

3.1.2. A brief history

Conservation authorities were first organized in 1946, making them some of the earliest watershed-based natural resource agencies in the world (Watson et al., 2019).

The powers and scope of conservation authorities have ebbed and flowed since their establishment. Following the destruction wrought by Hurricane Hazel in 1954, they gained the authority to acquire and manage lands for conservation purposes (Conservation Ontario, n.d.). The 1990s saw a sharp reduction in provincial financial assistance, although the downsizing of provincial control of resource management has seen greater delegation of duties to these authorities—aggravating the financial situation (Shrubsole, 1996). Despite its retrenchment, the provincial government also began during this period to issue land-use policy papers that condone a catchment area-based approach to resource management (Lyons, 2015).

The 21st century has seen renewed provincial interest in the activities of conservation authorities, especially as a result of the Walkerton tragedy. In the aftermath of that *E. coli* groundwater contamination scandal, conservation authorities were made responsible for developing water protection plans, with additional provincial aid accorded for water research (Watson et al., 2019). Around the same time, the provincial enabling statute was amended to require that planning approval be compliant with provincial watershed management policies, highlighting the newfound provincial attention accorded to responsible exploitation of watershed resources (Lyons, 2015).

3.1.3. Locations of conservation authorities

There are 36 conservation authorities spanning the province of Ontario; as seen in Figure 3.1, they are largely concentrated in the populous south of the province, with 31 located in southern Ontario and five in northern Ontario. Together, their jurisdictions cover 95 percent of Ontario's population (Conservation Ontario, n.d.). Conservation authorities take a variety of forms and sizes, with significant diversity in both authority budgeting and membership (Mitchell et al., 2013). As Lyons (2015) explores, a particularly stark diversity exists in the number of member municipalities, with some dragooned by a single large municipality and others highly atomized amongst dozens of municipalities.

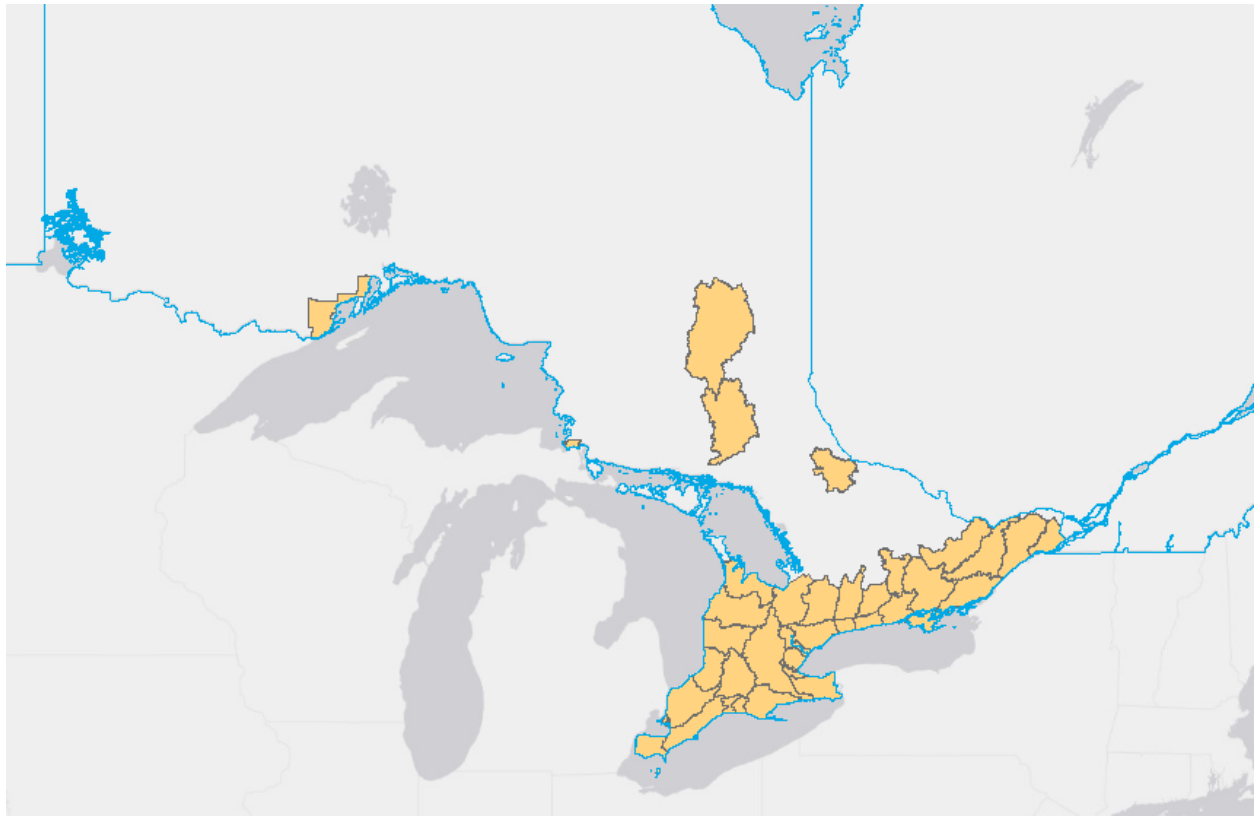


Fig. 3.1. Map of all conservation authorities (orange) in the province of Ontario

3.2. Development Patterns in Ontario

Urban sprawl continues to be a dominant pattern of land use change in Ontario, eliciting significant public debate and public policy proposals that attempt to change the trend in development. This process is neither confined to a single time period nor a single region, being seen in several Ontario municipalities throughout the recent decades. Regions facing urban sprawl and public debates about the rate of development include Ottawa (Paterson and Mueller, 2018), Hamilton (Maoh et al., 2017), and Toronto (Epp and Caldwell, 2018).

As part of the efforts to ensure responsible development practices, the provincial government established a greenbelt in 2006 of 1.8 million hectares in an effort to help contain the spatial expansion of cities (Eidelman, 2010). Nevertheless, studies such as Epp and Caldwell (2018) have continued to find loss of agricultural land to urban sprawl both before and after the introduction of the greenbelt, although loss rates lowered in certain areas.

The relationship between new development and conservation authorities is underscored by the significant impact of such developments on watershed management. This is due to the

significant association between urban sprawl and forms of environmental degradation such as regional coastal erosion, as detailed by Vaz and Bowman (2013) within the Golden Horseshoe region of Southwestern Ontario. Due to the strong regulatory ties between land use conversion and conservation authorities, as discussed in Section 3.1, examining these authorities may yield important insights into the approval of developments that contribute to urban sprawl in multiple regions of Ontario.

CHAPTER 4: METHODOLOGY

As my research goal is to understand how the membership of conservation authorities in Ontario can impact the decision-making of these public bodies on issues of development, I operationalize this goal by comparing certain demographic data of conservation authority members with measures of development within the authorities' boundaries.

Employing the participatory governance framework in Chapter 2, I determined that gender and ethnicity would allow for an understanding of public participation in conservation authority governance. Moreover, by tracing the salience of the urban sprawl and development debate in modern Ontario politics in Chapter 3, I am led to conclude that studying the impact of conservation authorities' decisions on land use change for urban development in particular would simultaneously serve my original research goal and also contribute evidence to this important issue of public concern in Ontario. Thus, my methodology concerns itself with the existence of a relationship between the demographics of conservation authority board members—namely, the variables of gender and visible minority status—and measures of urban land use change.

In order to identify any such relationship, my research uses quantitative methods to calculate the statistical significance between the selected membership characteristics and land use/land cover change.

4.1. Data Sources

Data on land use and land cover change are sourced from a decennial land use map published by Agriculture and Agri-Food Canada between 1990 and 2010. Accordingly, the dataset includes three high-definition GeoTIFFs, respectively containing land use and land cover data for the years 1990, 2000, and 2010. The dataset covers all land in Canada south of the 60th parallel north and has a spatial resolution of 30 metres, with settlement and hydrological data deriving from other Natural Resources Canada data. Each pixel of the dataset is coded in accordance with the land use and land cover classification system of the Intergovernmental Panel on Climate Change, namely forest, water, cropland, grassland, settlement, and other (Agriculture and Agri-Food Canada 2015). In turn, some of these categories are further broken down into subcategories (e.g., forest is broken down into “forest”, “forest wetland”, “trees”, and “treed wetland”).

The boundaries of the conservation authorities originate with a vector shapefile produced by Land Information Ontario based on the boundaries of participating municipalities and the text-based boundaries set in the Orders-in-Council that established individual authorities pursuant to the Conservation Authorities Act (Land Information Ontario, 2014). Relevant attributes included in the dataset are the legal and common (i.e., business) names of each conservation authority (e.g., “Halton Region Conservation Authority” and “Conservation Halton”, respectively).

Data on the political composition of Ontario’s conservation authorities originates in a dataset that Prof. Benjamin Forest provided based on the membership of the authorities’ boards in November of 2019. The data, which codes the occupation, gender, and visible minority status of every appointee, was in turn aggregated at the authority level to produce ratios for each board that reflect the representation of women and visible minorities on that board.

4.2. Data Transformations

In order to generate data on the land use in each conservation authority, the same procedure was followed for all three GeoTIFF files of land use and land cover in Canada.

The raw number of pixels of each type of land use in each conservation authority was first obtained in ArcMap. After being reprojected to WGS 84 to match the projection used by the conservation authority boundaries file, the land use data was clipped using the boundaries file to remove all pixels not within the boundaries of an authority. Subsequently, the attribute table for the clipped land use raster was generated and it was then split using the boundaries file to generate 36 tables, each containing the number of pixels matching each land use/land cover classification within a conservation authority. These tables were in turn exported as comma-separated value (CSV) files.

A Python script was then used to combine the 36 tables for each given year into a single table. A second script was then used to combine the three tables together into one large dataset that contains 36 rows, each representing one conservation authority, and a column for the number of pixels for each land use in each authority in 1990, 2000, and 2010. Finally, the land use/land cover change dataset was combined with the political dataset in R to add the gender and visible minority ratios to each of the 36 conservation authorities.

Visible minority representation in Ontario conservation authorities

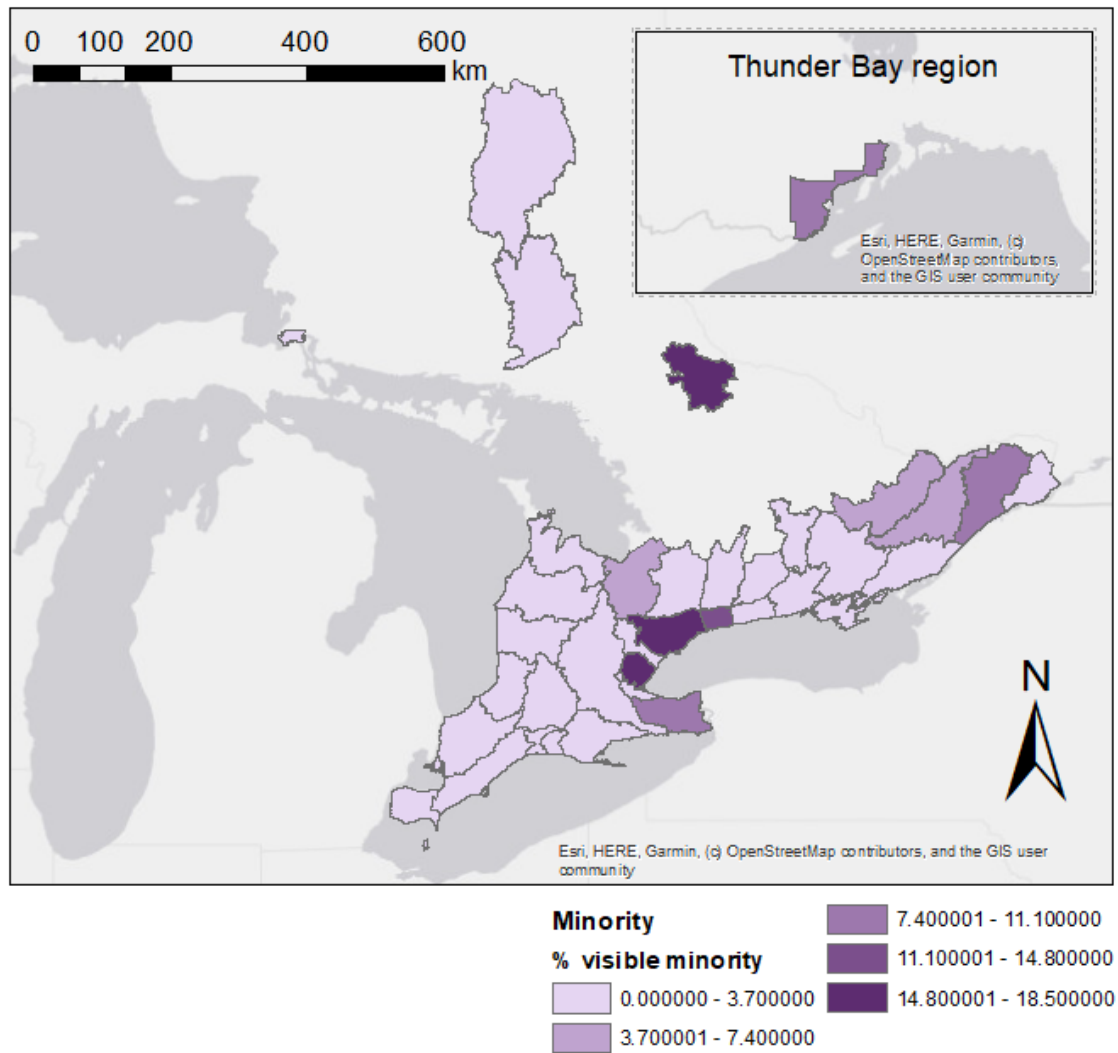


Fig. 4.1. Map depicting the percentage of visible minority representation in the membership of each conservation authority in Ontario

Female representation in Ontario conservation authorities

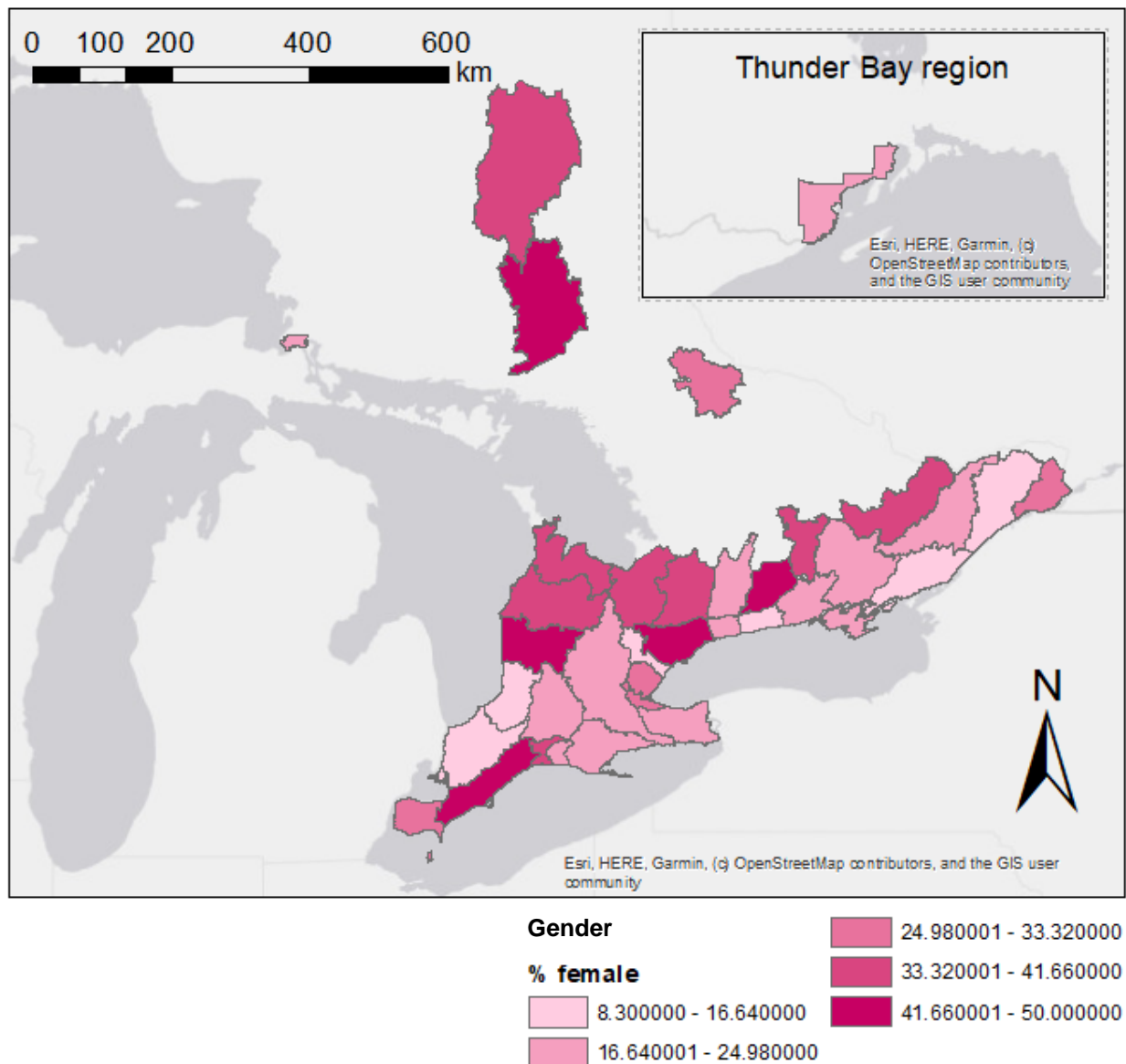


Fig. 4.2. Map depicting the percentage of female representation in the membership of each conservation authority in Ontario

4.3. Statistical Analysis

In order to determine the link between demographic composition and land use change in Ontario's conservation authorities, simple and multiple linear regression analyses were conducted to show the strength of the relationship between these three variables. To confirm the validity of the findings and eliminate potentially extraneous variables, a backward elimination

was conducted to determine whether a univariate or bivariate regression identified a stronger relationship. Four types of land use/land cover change were selected for examination for their relevance to the debate over development and land use in Ontario:

- (1) *Settlements* (accounting for approximately 4.67% of all pixels in the research area in 1990), as it represents a close proxy of urban development growth and sprawl;
- (2) *Roads* (accounting for approximately 3.15% of all pixels in the research area in 1990), as it represents a similar proxy of urban development growth and sprawl, but may also reflect earlier stages of development where new roads have been laid out but housing has not yet been built;
- (3) *Cropland* (accounting for approximately 40.89% of all pixels in the research area in 1990), because the loss of agricultural land is a major motivating factor for urban sprawl limitation measures in the public discourse in Ontario; and
- (4) *Forest* (accounting for approximately 40.04% of all pixels in the research area in 1990), which serves as a proxy for undeveloped wilderness as the dominant land use in virtually every Ontario conservation authority.

To determine the statistical significance of the generated regression equations, a standard 95% confidential interval was used, while the predictive power of the equation was assessed using the R-squared value.

CHAPTER 5: RESULTS

Four sets of three linear regressions (two simple regressions and one multiple regression in each set) were used to predict the change in one of the four land use/land cover characteristic based on the ratio of women in board membership, the ratio of visible minorities in board membership, and both. A summary of important results is presented in Table 5.1, while the full results of the multiple regression models are presented in Appendix 1.

Table 5.1. Relevant statistical output for linear regressions conducted

| Dependent variable | Independent variables | p-value of regression equation | Adjusted R ² value of regression equation |
|---|---|--------------------------------|--|
| Percent change in settlements land use between 1990 and 2010 | Ratio of women on authority boards | 0.603 | -0.0212 |
| | Ratio of visible minorities on authority boards | 0.775 | -0.0269 |
| | Both ratios (multiple regression) | 0.827 | -0.0485 |
| Percent change in agricultural land use between 1990 and 2010 | Ratio of women on authority boards | 0.333 | -0.0010 |
| | Ratio of visible minorities on authority boards | 0.451 | -0.0121 |
| | Both ratios (multiple regression) | 0.435 | -0.0084 |

| | | | |
|---|---|--------|---------|
| Percent change in forest land use between 1990 and 2010 | Ratio of women on authority boards | 0.891 | -0.0288 |
| | Ratio of visible minorities on authority boards | 0.024 | 0.1159 |
| | Both ratios (multiple regression) | 0.076 | 0.0930 |
| Percent change in roads land use between 1990 and 2010 | Ratio of women on authority boards | 0.679 | -0.0242 |
| | Ratio of visible minorities on authority boards | <0.001 | 0.3394 |
| | Both ratios (multiple regression) | 0.001 | 0.3195 |

For settlements, no statistically significant relationship was identified. First, a simple linear regression was used to predict the percent change in settlements land use between 1990 and 2010 based on the ratio of women on conservation authorities. The regression equation was not statistically significant, with a p-value of 0.603 (> 0.05) and an adjusted R-squared value of -0.0212. A second linear regression with the same dependent variable was conducted based on the ratio of visible minorities on authorities. Likewise, the regression equation was not statistically significant, with a p-value of 0.775 (> 0.05) and an adjusted R-squared value of -0.0269. Finally, a multiple regression was used to predict the percent change in settlements land use between 1990 and 2010 based on the ratio of women and the ratio of minorities on conservation authorities. The regression equation was not statistically significant, with a p-value of 0.827 (> 0.05) and an adjusted R-squared value of -0.0484.

Likewise, no statistically significant relationship was found for agricultural land use change. First, a simple linear regression was used to predict the percent change in agricultural land use between 1990 and 2010 based on the ratio of women on conservation authorities. The regression equation was not statistically significant, with a p-value of 0.333 (> 0.05) and an

adjusted R-squared value of -0.0010. A second linear regression with the same dependent variable was conducted based on the ratio of visible minorities on authorities. Likewise, the regression equation was not statistically significant, with a p-value of 0.451 (> 0.05) and an adjusted R-squared value of -0.0121. Finally, a multiple regression was used to predict the percent change in agricultural land use between 1990 and 2010 based on the ratio of women and the ratio of minorities on conservation authorities. The regression equation was not statistically significant, with a p-value of 0.435 and an adjusted R-squared value of -0.0084.

However, statistically significant relationships were found for the two other dependent variables.

First, a simple linear regression was used to predict the percent change in forest land cover between 1990 and 2010 based on the ratio of women on conservation authorities. The regression equation was not statistically significant, with a p-value of 0.891 (> 0.05) and an adjusted R-squared value of -0.0288. However, the second linear regression, with the same dependent variable based on the ratio of visible minorities on authorities, was statistically significant, with a p-value of 0.024, below the 0.05 threshold for significance, and an adjusted R-squared value of 0.1159. The t-value for the equation is -2.364, showing a negative correlation. Combining the two variables into a multiple regression yielded a statistically insignificant equation, with a p-value of 0.076 and an adjusted R-squared value of 0.0930.

Finally, a simple linear regression was used to predict the percent change in road land use between 1990 and 2010 based on the ratio of women on conservation authorities. The regression equation was not statistically significant, with a p-value of 0.679 (> 0.05) and an adjusted R-squared value of -0.0242. However, the second linear regression, with the same dependent variable based on the ratio of visible minorities on authorities, was statistically significant, with a p-value smaller than 0.001, far below the 0.05 threshold for significance, and an adjusted R-squared value of 0.3394. The t-value for the equation is 4.357. Combining the two variables into a multiple regression also yielded a statistically significant equation, with a p-value of 0.001, below the significance threshold, and an adjusted R-squared value of 0.3195. The t-value is 4.263.

Ultimately, three relationships were significant in the dataset: the visible minority ratio as a predictor of forest cover change, the visible minority ratio as a predictor of road land use

change, and the visible minority *and* gender ratios as predictors of road land use change. It was unnecessary to run a stepwise regression for the road multiple regression because one of the two variables was not statistically significant, clearly indicating its nature as a confounding factor.

CHAPTER 6: DISCUSSION

The results of the statistical analysis indicate no relationship between the gender composition of Ontario conservation authorities and key indicators of land use/land cover change; however, they suggest the possibility that there exists a weak positive relationship between ethnic diversity, as measured through visible minority representation, and the rate of urban development in Ontario.

6.1. Settlements

The very high p-values for all three regression equations conducted with settlement percent change as the dependent variable suggest the absence of any statistical relationship between board member composition and development within authority jurisdictions. This is consistent with a descriptive examination of the dataset, which shows a highly scattered dataset with no clear direction or association.

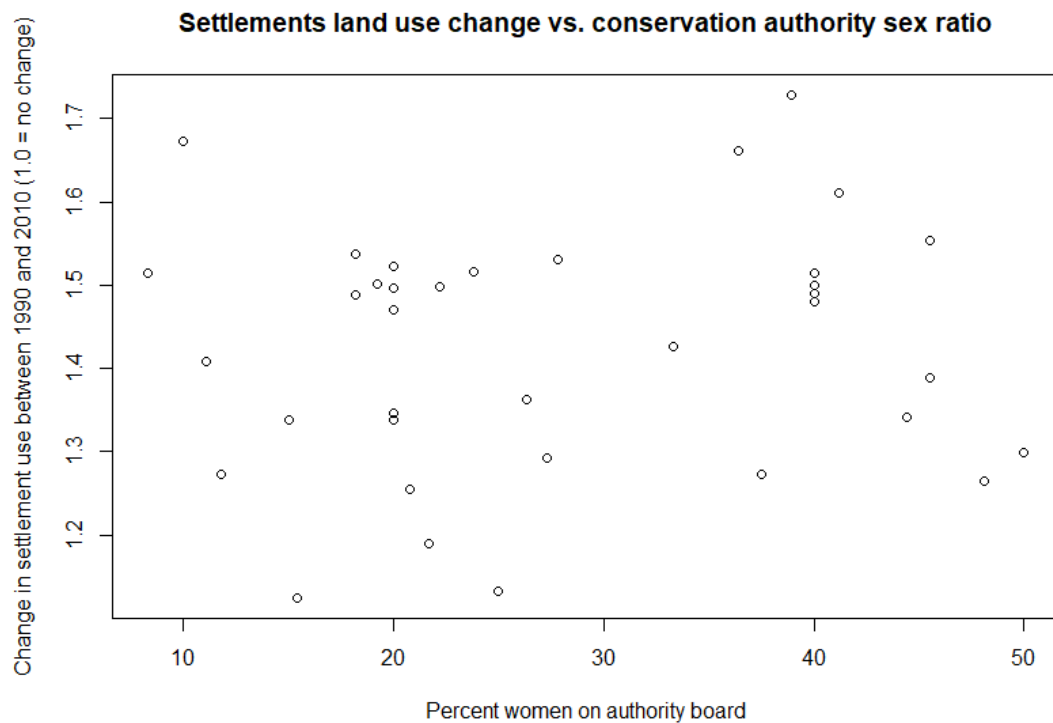


Fig. 6.1. Scatterplot graph showing settlements land use change plotted against the gender ratio in conservation authorities

In turn, this finding suggests that the demographic composition of conservation authority boards does not significantly influence the growth in settlements in Ontario. However, because settlements include all built-up areas and built structures, this is an expansive category of land uses that do not neatly correspond to urban sprawl (Agriculture and Agri-Food Canada, 2015). Nonetheless, the analyses conducted with this variable do not lend support to the existence of a correlation between these factors.

6.2. Cropland/Agriculture

Likewise, the analysis of cropland land use between 1990 and 2010 does not suggest the presence of an association between agricultural land use/land cover change and the membership composition of conservation authorities. Although the p-values are lower than for settlements, which suggests that there may be a slightly stronger pattern in relationships in the dataset, they are still far above the 95 percent confidence interval threshold, making any correlation between these variables statistically insignificant.

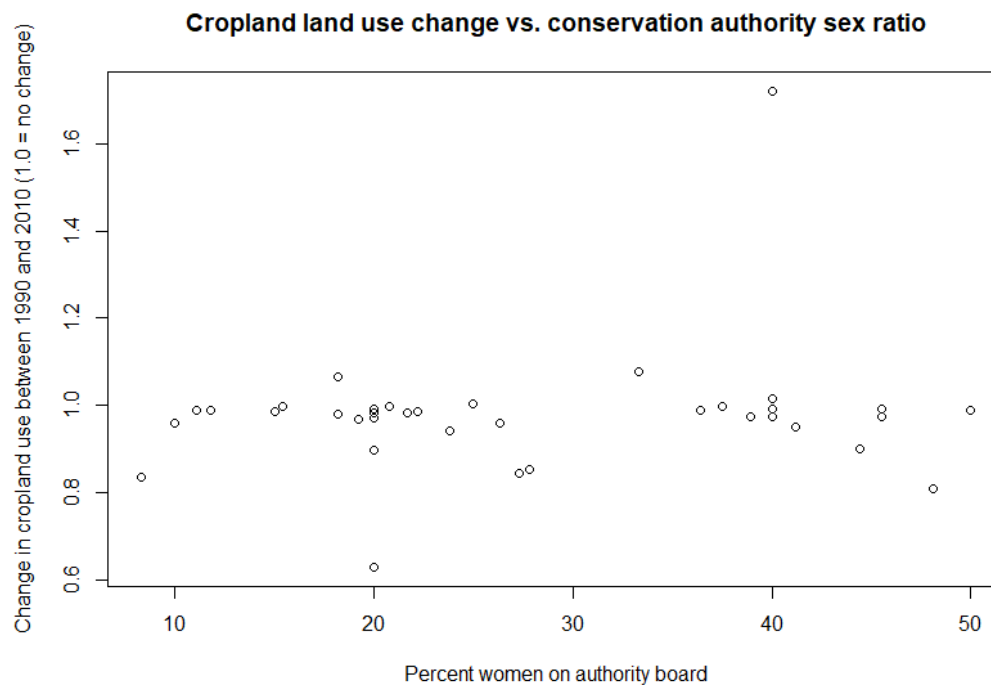


Fig. 6.2. Scatterplot graph showing cropland land use change plotted against the gender ratio in conservation authorities

As seen in Figure 6.2, although the scatterplot shows significant grouping—with the exception of one extreme outlier (the Mattagami Region Conservation Authority, which saw explosive agricultural use growth between 1990 and 2000 but none since that year, perhaps as a result of greenbelt policies)—the association still appears weak, with little difference across different jurisdictions. Specifically, a slight to significant decrease in farmland, ranging from a reduction of 0 to over 45 percent, occurred in almost all Ontario conservation authorities. This statistical analysis is consistent with the existing literature and an examination of the public discourse in Ontario, which have raised alarms about the rapid loss of farmland to development in communities across the province.

Thus, the consistent pattern of agricultural land use loss in nearly every conservation authority in the province may mask any underlying factors driving such losses, with the ubiquity of this development practice—particularly before the 2005 implementation of the provincial greenbelt (Epp and Caldwell, 2018)—possibly drowning out any other factors at play. With the implementation of the 2005 greenbelt, the reduction and regularization of farmland loss since may yield different results with data from later dates than the years at issue in this project.

6.3. Forest

Unlike the previous two variables, forest cover change shows at least one statistically significant correlation with conservation authority membership. Although the multiple regression with both gender and ethnicity and gender alone failed to show a statistically significant relationship, with the latter registering a high p-value of 0.891 that suggests a serious lack of predictive power, the same is not true for ethnicity: a statistically significant p-value is identified for the weak negative correlation between visible minority representation on boards and forest cover change between 1990 and 2010. This finding suggests that a greater number of visible minority persons on a conservation authority results in greater loss of forest cover within a jurisdiction.

However, the low adjusted R-squared value of 0.1159 highlights the inherent limited predictive power of this regression equation. Combined with the marginal 0.024 p-value, only 2.6% below the 95% confidence interval, this suggests that the relationship for this variable is relatively weak. As seen in Figure 6.3, the grouping of observations is also highly irregular, with a large number of conservation authorities featuring neither noticeable forest cover change nor

visible minority representation. However, of the conservation authorities that do have visible minority membership, they generally show reduced forest cover as ethnic diversity increases.

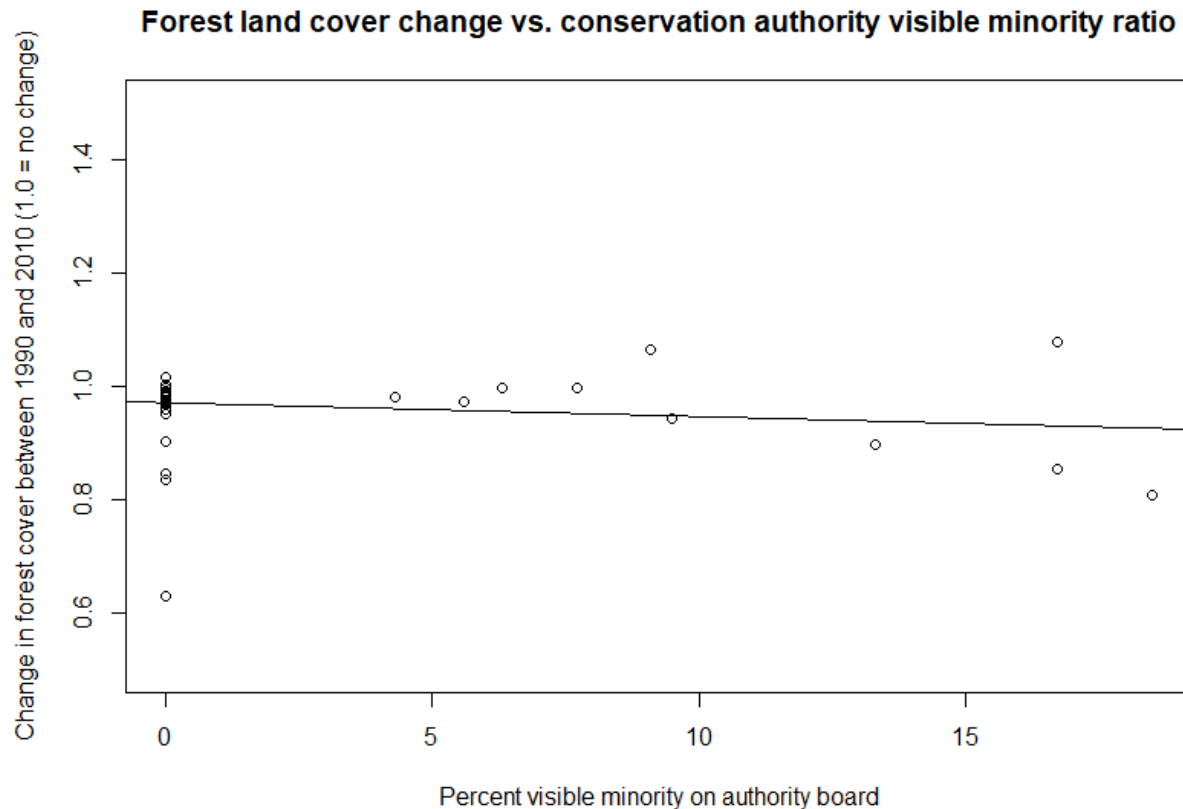


Fig. 6.3. Scatterplot graph showing forest land cover change plotted against the visible minority ratio in conservation authorities; the line shows the statistically significant linear regression equation.

However, while this finding suggests a relationship between the two factors, it does not guarantee it: since visible minorities are significantly underrepresented compared to their percentage of the Canadian general on all conservation boards, with no more having more than 20% visible minority membership, the presence or absence of a single member can cause the relative position of a board in the dataset to change drastically.

6.4. Roads

The road land use change variable shows the strongest statistical relationship with the demographic composition of conservation authorities, with the exceedingly low p-values for the

simple linear regression with visible minority membership and the multiple regression with both female and visible minority membership indicating strong statistical significance for the moderately positive correlation. In the former case, the p-value below 0.001 indicates a very strong correlation between greater diversity and increased road-building activity over the twenty-year period between 1990 and 2010. The latter, despite including the uncorrelated variable of gender ratio, still manages to have a low p-value of 0.001, maintaining the strength of the correlation. Moreover, the adjusted R-squared value of both equations—0.34 and 0.32, respectively—show that the predictive power of these equations is relatively high for an uncontrolled dataset that is acted upon by a variety of forces not analyzed by this research project.

This relationship suggests an important relationship between conservation authorities' membership and the impact on road network expansion. Because expansion of the road network often precedes construction, with car-friendly urban policies such as road expansion and expansion of transportation infrastructure associated with greater sprawl (Burchfield et al., 2006), this finding might then suggest that conservation authorities' ethnic diversity does affect the rate of development and urban sprawl. However, these results also come with significant limitations.

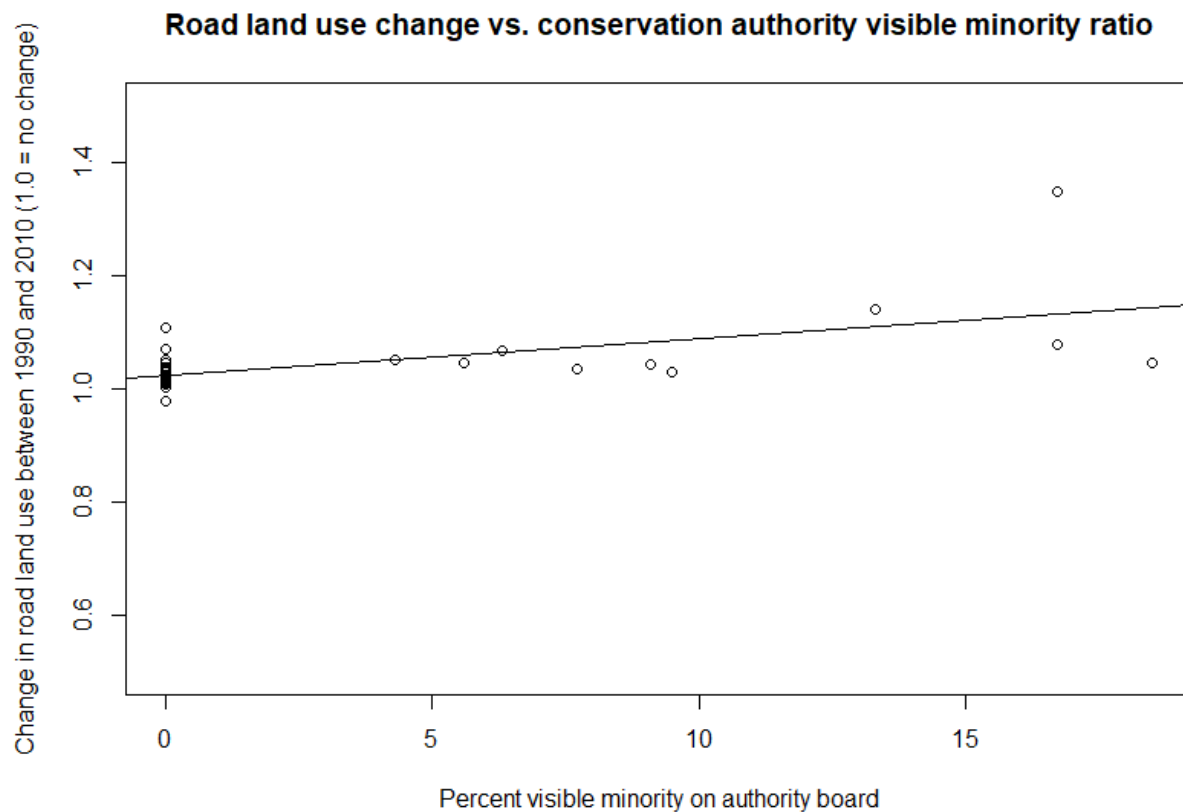


Fig. 6.4. Scatterplot graph showing road land use change plotted against the visible minority ratio in conservation authorities; the line shows the statistically significant linear regression equation.

Ultimately, what the regression analysis shows for road land use is that there may be a relationship between land use/land cover change and the ethnic diversity of boards. However, this finding cannot exclude the possibility of a confounding variable, i.e., greater visible minority populations within the jurisdictions of conservation authorities where rapid urban growth and development is occurring. Indeed, it is reasonable to theorize that the actual relationship is between urban development and general population ethnic diversity, and that conservation authority ethnic diversity is simply spurious. The use of a control variable in further research on this topic may disentangle the possible collinearity between board diversity and general-population diversity in the local communities in question.

Two other limitations must also be noted. First, because the demographic data for board members is from 2019, while the LULC data is from 1990 and 2010, the study assumes that the

present-day composition of conservation authority boards reflects the demographics of those boards over this thirty-year period. Second, because of the small number of visible minority members on all conservation authority boards, even modest variance between boards can potentially result in statistically significant relationships.

CHAPTER 7: CONCLUSION

Because the two variables chosen as proxies for urban development, settlements and roads, showed different outcomes, this finding does not conclusively establish the existence of a correlation between the individual background characteristics of conservation authority members in Ontario and changes in land use and land cover patterns between 1990 and 2010. However, the identification of several statistically significant outcomes would support Lyons' (2015) contention that the membership characteristics of these boards—in that case, the identity of the appointing municipality; but in this project, gender and ethnicity—can result in differential decision-making and may influence public participation, community engagement, and ultimately development outcomes.

The fact that there may be a relationship between the composition of the boards and their decision-making on development issues highlights the significance of public participation principles and greater accountability on the composition of special district governments, as it would suggest that boards composed of a membership which is more representative of the local community may hold different priorities to boards that come from a single background. Further research on this question building off this explanatory research project may elucidate the pathways by which special district governance is influenced by its membership, or establish a causal link rather than the simple correlations identified in this research.

One avenue of inquiry that was intended to be part of this project but prevented by circumstances related to scheduling during the COVID-19 pandemic involved a quantitative analysis of conservation authority members' professional backgrounds, which would have shed greater light on the possible implication of developer interests by assessing the correlation between urban sprawl and the presence of board members with development and real estate backgrounds. While this would have tied more directly into the existing literature on special interests and regulatory capture, the fact that this project has identified potential relationships between membership composition of these conservation authorities and development outcomes invites avenues for further research into identifying a prospective causal mechanism by which these local government bodies' influence on planning decisions can be shaped by the backgrounds of individual members.

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APPENDIX A: EQUATION RESULTS

Table A.1. Regression Results for Settlements Land Use Change (1990-2010)

| | |
|------------------------|-------------------|
| Constant | 21.914*** (0.064) |
| Ratio of women | 0.548 (0.002) |
| Ratio of minorities | 0.005 (0.005) |
| Adjusted R-squared | -0.048 |
| Number of observations | 36 |

Standard deviations from the mean in (parentheses)

*, **, and *** respectively indicate significance at the 90%, 95%, and 99% confidence intervals.

Table A.2. Regression Results for Roads Land Use Change (1990-2010)

| | |
|------------------------|--------------------|
| Constant | 48.189*** (<0.001) |
| Ratio of women | 0.087 (<0.001) |
| Ratio of minorities | 4.263*** (<0.001) |
| Adjusted R-squared | 0.320 |
| Number of observations | 36 |

Standard deviations from the mean in (parentheses)

*, **, and *** respectively indicate significance at the 90%, 95%, and 99% confidence intervals.

Table A.3. Regression Results for Croplands Land Use Change (1990-2010)

| | |
|------------------------|-------------------|
| Constant | 14.424*** (0.064) |
| Ratio of women | 1.060 (0.002) |
| Ratio of minorities | -0.866 (0.005) |
| Adjusted R-squared | -0.008 |
| Number of observations | 36 |

Standard deviations from the mean in (parentheses)

*, **, and *** respectively indicate significance at the 90%, 95%, and 99% confidence intervals.

Table A.4. Regression Results for Forest Land Cover Change (1990-2010)

| | |
|----------|-------------------|
| Constant | 66.150*** (0.015) |
|----------|-------------------|

| | |
|------------------------|-----------------|
| Ratio of women | 0.380 (<0.001) |
| Ratio of minorities | -2.360* (0.001) |
| Adjusted R-squared | 0.093 |
| Number of observations | 36 |

Standard deviations from the mean in (parentheses)

***, **, and * respectively indicate $p < 0.001$, $p < 0.01$ and $p < 0.05$.