

Urban, Suburban, Regional and Wet Growth in Alberta

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EXECUTIVE SUMMARY

Sub(urban) growth, or “sprawl” as it is often described, elicits various emotions among elected officials, policy-makers, planners, land developers, and residents. The phenomenon is either well supported or categorically rejected, although for some people a comfortable middle ground emerges. Despite the fast pace of growth in Alberta, however, misconceptions, questions, and assumptions remain regarding the impact of sprawl on the urban form.

This research had several goals:

- to systematically explore the concerns about suburban development within the existing literature
- to examine them within an Alberta context—specifically the sub(urban) forms in the major cities of Calgary and Edmonton
- to identify factors responsible for various settlement forms, through empirical analyses; and
- to make policy recommendations

This report will help inform policy decisions at the local and provincial levels in Alberta. We also hope the findings will contribute more broadly to the current national, province-wide, and local debate on urban form. The report makes the following broad assertions:

1. The provincial government should consider using water as a tool to manage regional growth across the province and integrate it with the “efficient use of land” strategy in the Land Use Framework.
2. Strategy 5 (efficient use of land) in the Land Use Framework should be made a legally binding regulatory component of the regional plans.
3. Alberta cities will have to design their model of development charges and/or any other form of levies to ensure that the cost of new developments can be fully covered. The Municipal Government Act should allow municipalities to charge developers for other forms of infrastructure such as community facilities for recreation, library, police stations and others.
4. For metropolitan areas such as Calgary, Red Deer, Lethbridge, and Medicine Hat, the provincial government should consider creating mandatory growth management boards, like Edmonton’s Capital Region Board.
5. The provincial government should establish regional governance structures to manage each region as identified in the Province’s Land Use Framework.
6. The provincial government should allow these regional bodies to not only devise policy framework with respect to land use, transportation, and housing, but also provide services such as transit, police, fire, water, and others as per individual municipal needs, along the lines of British Columbia’s regional districts.

7. The provincial government should work with the municipal governments—both urban and rural—to encourage and facilitate various components of the Transfer of Development Credits (such as sending area, receiving area, and the credit transfer system), enabled by the Alberta Land Stewardship Act.

1. INTRODUCTION

Urban growth in Alberta has taken various forms—downtown, inner city, suburban, and exurban development—but most growth has been suburban. A substantial literature exists on urban growth and its forms. Much of it falls under the rubric of “urban sprawl,” and focuses on its costs, causes, and remedies, although more recently, it has turned towards opportunities for “smart growth.” Despite this wealth of knowledge, however, we still lack a systematic understanding of the growth of cities and towns in Alberta, as well as the reasons, contexts, and regulatory framework in which it has occurred. With this as a starting point, this report will explore the state of urban-suburban growth in Alberta.

The study identifies criteria by which sustainable urban or suburban growth can be evaluated, clarifies mechanisms to foster sustainable growth, and describes the key research gaps in understanding the benefits and costs of various urban forms. This study does not claim to be comprehensive in nature as the topic of urban and suburban forms is broad and encompasses multiple intertwined factors. Instead, it is purposive and selective. The research methodology involves a review of scholarly and grey literature, key informant interviews, and an advisory panel comprising leading urban scholars and professionals from across the country.

No one, universally accepted definition of sprawl exists. However, an area may be said to be sprawling if it combines any of the following factors:

- low density (households and population)
- inefficiencies in infrastructure
- automobile dependence compared with other multimodal transportation systems
- the absorption of greenfield or natural areas for predominantly single detached homes or business parks
- new developments locating increasingly far from the inner core
- a dis-contiguous growth pattern, extending away from existing built-up areas.

REPORT ORGANIZATION

The report is organized in six sections beginning with this introduction, which introduces the purpose, significance, and intellectual context of the study. The second section tackles the many factors that shape urban form and can contribute to sprawl, both broadly, and more specifically in Alberta. Because there is much to consider here and it is sometimes hard to parse out the causal relationships and influences this section has several components: It begins by examining the broad historical factors, the role of transportation, legislative frameworks, and the history of regional planning in the province. The latter portion takes on the financial factors, and the public and private participants in urban sprawl. Given how imbricated these various elements are this is a somewhat arbitrary progression, but it effective to unpack how the pieces fit together. Often two or more of these factors combine to create various urban forms, and where possible these

complex relationships will be explored. This is thus the lengthiest section of this report.

The third section follows logically by delving into the impacts of sprawl, as suburban forms influence the environment, agricultural land, and human health. They also have socio-cultural implications. It is useful to remember that these multiple aspects are reciprocal and iterative—how developers, planners, and other vested parties inform and navigate them changes future outcomes that may both ameliorate some issues and renew or instigate others.

After sketching out this picture of the causes and impacts, the fourth section turns to management—it will review various strategies that have or can be used to manage the issues of sprawl and urban

Between 2006 and 2011, Calgary and Edmonton had the fastest growing populations in Canada, primarily due to inter-provincial migration.

development. This encompasses city

planning and particular metropolitan contexts, the very important and untapped role of water in this story, and the effect that development policies and regulations have on urban form.

The fifth section presents the empirical analysis on the state of sub(urban) growth on the Calgary and Edmonton regions using GIS data. These datasets are from Statistics Canada, the Participatory Geographic Information System (PGIS) from the Capital Region Board, the Alberta Biodiversity Monitoring Institute (ABMI), and other government sources. This section also includes a full suite of maps for visual reference. The sixth and final section summarizes findings, draws conclusions for policy- and decision-makers, and points to future research.

PURPOSE AND METHODOLOGY

Alberta has experienced the effects of rapid urbanization more than any other region of the country. Just five decades ago, over 50% of the people in this province lived in rural settings. Today it is now as urbanized as the provinces of British Columbia and Ontario, with 83% of the population living in urban centres. Almost all of this urbanization has been concentrated around the cities of Edmonton, Calgary, and Red Deer, at the expense of the rest of the province. This significant adjustment from rural to urban has instigated a paradigm shift as our urban footprint expands outwards. This comes with the loss of agricultural and natural areas, giving rise to questions regarding the appropriateness of urban growth and expansion, and the sustainability of our current growth patterns.

This report employed a four-tiered approach to measuring urban growth in the context of Alberta.

- 1. We reviewed peer-reviewed scholarly and grey literature** on planning, public policy, and health. This included scholarly research, government research, reports from private think-tanks, newspaper articles, position papers by professional organizations, and research by

university-based centres. When combined, these sources helped to identify best practices, case studies, and patterns across Canada and beyond. From this review, we highlighted areas requiring further exploration.

2. **We convened an expert panel** consisting of leading academic and industry professionals. Over two days, round-table discussions with panel members provided direction to the research team and insight into key issues of urban and suburban form. A panel discussion open to the public and the planning community supplemented the specialists' panel by helping to facilitate conversations about development practices in Alberta.
3. **We conducted key informant interviews** between May and August 2015. Interviewees included municipal planners, provincial staff, and developers. These interviews provided valuable information that pertained specifically to issues surrounding development practices in Alberta.
4. **We conducted a detailed regional analysis** for Calgary and Edmonton using PGIS and ABMI datasets. Additionally, by using the major municipalities along Highway 2 we included the Calgary-Edmonton corridor connecting these two major Alberta cities. This analysis used various timeframes so as to understand past and present land use patterns and trends. These results are reported in Section 5 of this report.

APPROACHES TO URBAN AND SUBURBAN FORMS

The debate on urban/suburban growth can be divided into two schools—one group views suburban growth as undesirable and unsustainable; the second sees it as acceptable and benign. Both have distinct views on how urban sprawl developed and is maintained.

Adherents of the first school of thought, known as “smart growth,” attribute current North American

Key Terms

Densification: Increasing population, dwelling units, and/or number of jobs on a unit of land.

Exurban: An area that lies outside of municipal limits, beyond its suburbs.

Greenfield land: Area that has not previously been developed, and may have formerly been agricultural land or simply undeveloped municipal land.

Acronyms

ABMI	Alberta Biodiversity Monitoring Institute
ALSA	Alberta Land Stewardship Act
CRB	Capital Region Board
CRL	Community Revitalization Levy
CRP	Calgary Regional Partnership
DFISF	Developer Funded Infrastructure Stabilization Fund
DPC	District Planning Commissions
EA	Expansion Assessment
FBC	Form-based Coding
IIMP	Integrated Infrastructure Management Planning
LUF	Land Use Framework
MCA:	Metropolitan Census Area
MDP	Municipal Development Plan
MGA	Municipal Government Act
PAC	Permanent Area Contributions
PGA	Priority Growth Areas
PGIS	Participatory Geographic Information System
RPC	Regional Planning Commissions
SDA	Standard Development Agreement
TDC	Transfer Development Credits
UDI	Urban Development Institute
UGA	Urban Growth Areas
UGB	Urban Growth Boundaries

suburban growth patterns to government subsidies (such as the US federal housing programs for returning veterans), the advent of the automobile, massive investment in highways, and outdated planning regulations and engineering standards. Distortionary development charges and service pricing mechanisms, along with flawed land use policies, also contribute to ongoing patterns of suburban development. The contention is that sprawl comes with social, economic, and environmental costs, among which are:

- *Direct cost* – the loss of farmland and natural areas, as well as automobile costs, traffic congestion, air pollution, and greenhouse gas emissions.
- *Social costs* – non-drivers or those who cannot afford a vehicle (the elderly, the young, women, and low-income families) are excluded.
- *Health costs* – increasing rates of asthma, obesity, and diabetes, and traffic fatalities.
- *Economic costs* – capital, operating, and maintenance costs of public infrastructure such as roads, transit, water distribution, and sewage collection and treatment.

This anti-sprawl group advocates more integrated, mixed-use, dense, and walkable neighbourhoods to avoid the costs associated with sprawl, which is the approach from which the name “smart growth” comes. They usually support alternative forms of regulation and regional governance to coordinate region-wide issues, and have been endorsed by Sierra Club Canada.

The second group, identified as “laissez-faire,” holds a minority view founded on the assertion that sprawl existed well before the Second World War. Economic and technological trends, rising incomes and standards of living, and falling transportation costs led to consumer demand for suburban developments. In fact, suburbanization has been instrumental in producing low-cost housing and business premises, and promoting homeownership and business competitiveness. Thus, this group recommends a *laissez-faire* approach that is guided by market forces; it suggests that government should engage in road building and public works. Moreover, land use policy should be limited because the market will ensure the efficient use of land and minimize incompatible uses.

2. CAUSES OF SUB(URBAN) FORM: HISTORICAL TRENDS, TRANSPORTATION, LAWS, & ECONOMICS

THE HISTORY OF SUB(URBAN) GROWTH IN ALBERTA

Several historical factors have influenced Alberta's growth:

- the fur trade, administered by the *Hudson's Bay Company*
- growth in the agricultural sector, particularly wheat/grain farming
- natural resource extraction (coal, oil and gas, and lumber)
- the development of the national transportation and railway networks, which opened up small and mid-sized communities to economic growth and development (Wetherel, 2005)

Today, approximately 83% of Albertans live in urban areas, while the remaining 17% live in rural areas (Statistics Canada, 2011a). The Calgary and Edmonton regions, along with the corridor that connects the two metropolitan centres, have received the majority of this urbanized population, making it the most urbanized area in the province.

Between 2006 and 2011, Calgary and Edmonton had the fastest growing populations in Canada (Statistics Canada, 2011b), primarily attributed to inter-provincial migration from the Eastern provinces of Ontario and Quebec. Some of the growth is also due to migration from other provinces or from other countries. The third-fastest growing region in the province is in the north, in the Regional Municipality of Wood Buffalo. It is one of five specialized municipalities in Alberta where both urban and rural communities exist as one local government. Development pressures to accommodate this growth include providing housing, industrial land, water and wastewater infrastructure, roads, recreation, and social community provisions.

During the 1950s, Edmonton's suburbs expanded significantly, reflecting the post-WWII trend in many North American cities. In Edmonton, this was largely due to the discovery of oil in Leduc in 1947 and a favourable economic climate. The baby-boom generation compounded this suburban shift, introducing single-family dwellings, affordable mortgages, and a pervasive "country" lifestyle that marked modern life (Nugent, 2011). Over time, this rapid outward expansion and concomitant lack of investment in public transit meant the downtown core declined, since it did not economically benefit from the suburban populations. The slow growth of Edmonton's downtown until recently attests to this impact. These largely auto-oriented developments continue to characterize the typical suburban form in Alberta's capital.

In Calgary, more aggressive local policies have slowed outward growth—through intensification policies and by investments in public transit. Compared to previous decades, Calgary's new developments consume less land: about 2 hectares per 100 new residents in 2001 to 2011 compared with 6.5 hectares in 1991 to 2001 (Kramer et al., 2014). Even without intensification policies, Edmonton has experienced similar trends: from 2001 to 2011, Edmonton's rural land

was consumed at about 3 hectares per 100 new residents as opposed to 7 hectares in the preceding decade (Kramer et al., 2014).

The Neptis Foundation (2014) similarly found that Canadian cities, including Edmonton and Calgary, sprawl less than they used to. In Calgary, the rate of urban expansion from 2001 to 2011 was only 12% compared with 41% in the preceding decade. These figures are noteworthy

Sprawl is not a natural phenomenon: it is shaped by government policies and regulations and so can be mitigated by them.

because it was only in 2009 that planning policies shifted towards greater densification and intensification, although population rise was stable across both periods. Comparably, Edmonton's population increased by 24% and the urban area by

18% between 2001 and 2011, compared with the 1991 to 2001 period when the population rose by only 12% but the urban area increased by 26%.

TRANSPORTATION

The history of sprawl cannot be separated from the history of transportation as cities have always been shaped by transportation technologies. Gurin (2003) argues that after the removal of streetcar lines, and the popularization of private vehicles, transportation planning became about efficient movement and storage of automobiles. He suggests that "urban transportation ought to be the means of getting around cities, but instead it has come to be more like an end unto itself: it dominates much of the landscape of the world's cities, mostly in the form of accumulated private automobiles" (p. 7). Unlike earlier transportation innovations, the car has radically reshaped cities because it eliminates walking almost entirely (Glaeser & Kahn, 2004)

Nonetheless, debate continues about the relationship between automobile dependence and sprawl—very like the colloquial chicken and egg analogy of which came first. Meredith (2003) argues that sprawl has made us more dependent on automobiles, while Glaeser and Kahn (2004) point to the automobile as the *root cause* of sprawl. Gurin (2003) believes that transportation planners have directly affected how sprawl has unfolded, and Emerson (2008) suggests that transportation policy has encouraged sprawl, through road building and gasoline tax regulation. According to Miron (2003), the size of the city and the relative cost of transportation determine density.

Complicating this story further is that automobile dependence and sprawl are expensive for both municipalities and their residents (Gurin, 2003). For the last few decades, governments have prioritized the automobile over public transit, even if this what was intended. The unfortunate outcome of this, however, is this: the public has come to mistakenly perceive infrastructure supporting automobile use as a public good, while the infrastructure necessary for public transit supports only a private good. (Meredith, 2003).

Private vehicles are not without problems. They are certainly expensive to own. They also demand more room, as these facts demonstrate: cars use five times the amount of land needed for public transit, and the capacity of a 12-lane highway can be met by only a two-track subway line. In contrast, when people choose instead to use public transit one consequence of this is that no cars need to park at the destination, which similarly means a smaller space requirement (Gurin, 2003). Wilson (1995) considered this parking issue in particular, finding that in 10 office buildings in southern California, peak parking utilization averaged only 56%. Thus, the remaining 44% of land is wasted since it cannot be used for development, which would increase density and minimize sprawl (Lewyn, 2006). The reality here is that free parking in suburban areas encourages more driving, increases solo driving, and undermines the economic and societal value of parking (Lewyn, 2006)

Burchell et al. (1998) and Glaeser and Kahn (2004) both found a correlation between sprawl, and the joint factors of transportation technology and wealth. Specifically, Glaeser and Kahn found that in the monocentric model¹, as transportation costs fall, the city gets larger and less dense; in the polycentric model, automobile use reduced the fixed costs of opening new employment centres, thereby encouraging suburban development. Nechyba and Walsh (2004) agree with this view, noting that the monocentric model relies on both incomes and transportation costs to explain sprawl. They also make an important distinction between mobility and accessibility, pointing out that when congestion is seen as an evil (as it often is when people talk about work commutes), then ease of mobility emerges as a society goal. Unfortunately, the goal of mobility has negative consequences when it leads to an obsession with transportation efficiency, and does not necessarily address accessibility. This manifests itself through the constant expansion of highways and arterial roads.

LEGISLATIVE FRAMEWORKS AND REGIONAL PLANNING

¹ Alonso (1964) and others used monocentric urban model as an economic model to describe resource allocation within a city with the central business district (CBD) as the hub of employment. However, with changing technology and cheaper and faster transportation options, cities have gradually shifted towards a polycentric pattern of development, creating economic regions rather than central cores and decentralized employment.

To understand how and why urban forms vary, we must understand how relevant decision making is shaped by legislative structures. For instance, Alberta’s legislative framework has contributed to the existing patterns of development, in that land use and subdivision approval are

largely driven by local government councils under the authority of the Municipal Government Act (MGA) of 1995. Before 1995 however, regional planning commissions and the provincial government were more directly involved in subdivision development and approval.

Alberta’s efforts to address urbanization through regional planning have been ongoing since the mid-1900s, but it has been a tumultuous history, with mixed success.

While this local autonomy gives municipalities oversight for how and where to grow, other provincial government initiatives offer guidance for land use. Examples include documents such as Efficient Use of Land Implementation Tools Compendium, principles for building healthy communities in the Land Use Framework Regional Plans, Integrated Land Management Tools Compendium, and provincial interests such as transportation, historical resources, water bodies, and so on in various legislation and policies. However, a majority of these government plans, policies and documents take a permissive approach that respects the principle of municipal autonomy for land use development.

As sprawl is generally considered to be, at least in part, an issue of land use, it makes sense that land use regulations and policies affect development. Bart (2010) found that sprawl is *not* a natural phenomenon—it is shaped by government policies and regulations and so can be mitigated by them. We elaborate on these in the following sub-sections.

Regional Planning

At its best, regional planning presents local governments with a collaborative climate in which economic development, growth management, and regional objectives are pursued to the benefit of residents, governing bodies, and the private sector. Some of the key issues addressed in regional planning include suburban sprawl, as in Montréal’s city-region, encroachment of prime agricultural lands in Vancouver, and natural resource management in Alberta’s Land Use Framework Regional Plans (Alberta Municipal Affairs, 2012; Hodge & Robinson, 2001).

Alberta’s efforts to address urbanization through regional planning have been ongoing since the mid-1900s, but it has been a tumultuous history that has seen governments tinker with various strategies for regional authority over land use planning, with mixed success. Up to 1995, the Province was more directly involved in subdivision development and approval, but with the MGA of that year, municipalities became responsible for all land use and development decisions. This local autonomy was a major change from the pre-1995 period when regional planning commissions were in force.

For a better understanding of the multi-faceted planning and management context that now exists in this province, it is worthwhile to look at the highlights of how and why suburban growth has been a planning concern for many decades.

Roots of Regional Planning in Alberta

Regional planning in Alberta did not get proper attention until 1950. Wartime prosperity and the discovery of oil in Leduc in 1947, along with rising agricultural prices, led to a boom which then brought regional planning to the forefront. It was the 1950 Town and Rural Planning Act that introduced the concept of District Planning Commissions (DPC). The major cities in Alberta, such as Calgary, Edmonton, and others formed these DPCs, although they were advisory in nature and did not force municipalities to comply with their policies—a weakness that led, for example, to the residential development in Sherwood Park, east of Edmonton (Masson & LeSage, 1994). The DPCs received statutory authority for subdivision and development for all municipalities in their district in 1953.

A revision of the Planning Act in 1957 made preparing general plans mandatory for communities with over 50,000 people and gave all final subdivision and approval authority to regional bodies and select municipalities (Masson & LeSage, 1994). It was also in the 1950s that the McNally Commission issued its report to address orderly development in Calgary and Edmonton, particularly around the fringes. Reports indicate that Sherwood Park pulled out of the District Edmonton Planning Commission for two years, during which time it created the bedroom community, against the wishes of Edmonton's DPC (Climenhanga, 1997).

Regional Planning Commissions: 1950-1994

Between 1950 and 1994, land use and growth management were conducted by several bodies including the following:

1. Regional Planning Commissions (RPCs)
2. Calgary, Edmonton, Lethbridge, and St. Albert, which had all established their own development and subdivision authority and DPC.
3. The Provincial Department of Municipal Affairs, which provided planning and advisory services to areas not covered by the RPCs

The 1977 Planning Act called for the creation of regional plans by the RPCs by the end of 1982. These commissions were considered

the primary institutions below the Provincial Government level for resolving land development and growth management issues in Alberta.... [Regional Planning Commissions] were originally established because of a recognition of the fact that not even the two major cities of Edmonton and Calgary, let alone the intermediate urban areas such as Red Deer, Medicine Hat and Lethbridge, could manage, independently, the spatial problems of their urban growth. (Burton, 1981, pp. 6, 3)

The Metropolitan RPCs for Edmonton and Calgary, maintaining an urban-centric view, promoted the idea of acreage and suburban developments in peri-urban areas, which set the pace for outward growth that still

Economic factors play a key role in development patterns and urban growth, as a complex mix of public and private sector investments make suburban developments financially significant.

persists today (Masuda & Garvin, 2008). The Metropolitan Commission did this to provide a “rural refuge that allowed migrants to remain connected to urban-oriented lifestyles,” which was what the city of Edmonton offered them (Masuda & Garvin, 2008, p. 118). The *country residential* lifestyle associated with these outlying areas thus began to take root as more retirees and wealthy elites moved into these scenic, “un-urbanized” areas.

By 1984, eight RPCs were active throughout the province. They were responsible for a wide range of activities, such as:

- preparing and adopting a regional plan to regulate land development within their district boundaries
- preparing statutory plans, such as General Municipal Plans, at the request of member municipalities
- providing planning advice to member municipalities
- reviewing and approving subdivision applications, except where such authority was already given, as in the cities of Edmonton, Calgary, Lethbridge and St. Albert.

Provincial Land Use Policies and Municipal Autonomy: 1995-2008

RPCs existed until 1995, when the new MGA of that year eliminated them. Major changes in the new Act included:

- repealing the old 1977 *Planning Act*
- dissolving provincial funding of RPCs
- instituting the “natural person” powers to municipalities
- delegated to the municipalities all land use planning authority

The final point above is the most important as, in essence, this made rural and urban municipalities equal.

Devolving subdivision and development authority in this way led to intense inter-municipal disputes in the region, particularly in peri-urban areas surrounding the big cities (Almujhairi, 2014; Masuda & Garvin, 2008). However, perhaps recognizing this tension, Hyndman’s (2000) provincial report entitled *An Agenda for Action* called for mandatory regional cooperation to address disputes between urban and rural municipalities. In 2007, Mr. Radke, a civil servant in

Alberta Municipal Affairs whose report led to creation of the Capital Region Board, also echoed this sentiment in regard to the growth management plan in the capital region (Radke, 2007).

The political ideology of the Progressive Conservative government in Alberta in the mid-1990s did not embrace regional commissions, but other practical reasons also account for why these RPCs' time was over. Among them are:

1. Commissions spent a lot of time providing assistance to member municipalities and to serving as the authority within subdivisions to approve various development-related decisions. These responsibilities perhaps do not belong at this level.
2. The painfully slow process, often entailing disagreements, resulted in ineffective and unworkable regional plans.
3. The Commissions were thought to be a financial drain on the government, offering little return for the value.

The passing of the 1995 MGA, however, created a policy vacuum. With this Act and with no immediate replacement for the eliminated regional commissions, the Province had no formal means to express interest in

land use planning matters.

Comparably, many local rural governments had no planning capacity. Fortunately, by 1996, the Provincial Land Use Policies were drafted to give the Province some planning

Development charges often increase for high-density developments, incentivizing developers to construct inefficient, lower-density developments that have lower development charges.

oversight of municipalities. These policies were influenced by the emerging sustainable development paradigm and needed to take a broad and flexible approach.

Some of the repealed RPCs were subsequently re-structured as nonprofit entities, with subdivision and development authority for the member municipalities. About five of these descendants of the RPCs exist today in Alberta as regional planning agencies. The Act also allowed the private sector to step in and act on behalf of a municipality as subdivision and development authorities, once such powers have been delegated by the municipal council. A positive outcome of the 1995 MGA is that it encouraged inter-municipal cooperation through the adoption of inter-municipal development plans.

The period from 2009 onward brings us into the present regional planning period, and so will be covered in Section 4 on current growth management strategies.

ECONOMICS: THE COST OF DEVELOPMENT

Economic factors play a key role in development patterns and urban growth, as a complex mix of public and private sector investments make suburban developments financially significant. For

developers and builders, development charges set by municipalities cover the costs of infrastructure emplacement for new residential developments. For the municipalities, the costs of suburban developments arise from the maintenance of infrastructure, policing, emergency services, recreation, schools and so on.

Many of the key economic arguments frame certain financial practices or policies as subsidies, particularly as they relate to development and transportation—in essence then, these encourage the growth of sprawling cities. In Alberta, the development charges fall into two camps—fees and charges *before* the development begins and *after* the development is complete. Charges imposed *before* development begins include development charges and levies, Permanent Area Contributions (PAC), and Standard Development Agreements (SDA). There are also fees associated with assessments, such as the Integrated Infrastructure Management Planning Framework (IIMP) and Priority Growth Areas (PGA). Charges imposed *after* development is complete are to recover the costs associated with developing an area. Property taxes, charges for water sewage, solid waste and other services, license permits, and fees are examples of such charges.

Pre-Development Fees

Before development starts, several mechanisms can help municipalities to finance infrastructure and development costs, as well as their aid their capacity to sustain or manage these costs in the future. However, with the exception of development charges, municipalities use pre-development fees in different ways to fund infrastructure and assessments. The result is that the effects of pre-development fees on growth patterns, rates, and the intensity of developments can vary widely between municipalities.

Development Charges

As per the MGA, development charges in Alberta can be implemented mainly through two methods:

- ***A redevelopment levy.*** This levy is for a development permit in respect of development in a redevelopment area.
- ***An off-site levy.*** This levy is for services such as water, sewage, storm water management facilities, and roads for the new development.

Off-site levy works under the assumption that “growth should pay for itself and not be a burden on existing taxpayers.” (Slack, 2002, p. 15). However, we will see later that both Calgary and Edmonton do not live up to this expectation of their levies.

As a planning tool, development charges—if they reflect the true cost—can steer development away from inefficient locations and create more efficient densities (Slack, 2002). This requires that fees take into consideration the added costs associated with constructing and extending services further into greenfield lands. Blais (2010) points out that these costs can not only

fluctuate between established and new neighbourhoods, but also between different greenfield sites. As Slack (2002) notes, charging *uniform* development charges over-develops low-density housing and under-develops high-density, therefore making it more likely development will occur in an inefficient manner in greenfields. This failure to account for locational differences effectively results in market failures and excessive growth, particularly at the urban boundaries.

Development charges often increase for high-density developments, incentivizing developers to construct inefficient, lower-density developments since they then have lower development charges. Structuring development charges in this manner essentially rewards lower-density developments that require more infrastructure, consume more land, and are a less efficient form of development.

In Alberta, development charges have been used since 1979. They were traditionally only used in larger urban centres until recently; now, growth pressures in smaller and rural municipalities means they are being adopted there as well (Baumeister, 2012). Today, these communities administer development charges based on the size and type of development taking place, but the charges are uniform, failing to factor in the location.

The MGA gives municipalities broad powers on how development charges should be administered and calculated, with the exception of Regulation 48/2004, which outlines the principles and criteria for off-site levies. This Act accounts for why fees differ from municipality to municipality, and from development to development. Unfortunately, when municipalities rely on development charges just as a source of revenue this “may affect staff’s ability to see how these charges could also be used as a planning tool” (Baumeister, 2012, p. 26). Skaburskis and Tomalty (2000) hold a similar view, observing in their study that:

Municipalities were focused on the role of development charges in generating revenue to help cover their capital needs: they had little interest in land use or planning implications. It was not unusual to encounter officials ... who denied that development charges had any implications for development activity or urban form. (p. 50)

Standard Development Agreements (SDA) [Calgary – Infrastructure Fee]

In order to provide and finance infrastructure, each year the City of Calgary enters into negotiations with Urban Development Institute (UDI)-Calgary to create an SDA. The agreement documents that developers agree to provide public infrastructure and financial contributions (fees and levies) that will finance new development.

Unlike the city of Edmonton, in Calgary it is the City, not the developers, that build core infrastructure for new neighbourhoods. Developers then pay the City fees and levies associated with the costs of providing such infrastructure (sewer, water, roads and so on). Calgary Mayor Naheed Nenshi said soon after being elected that “growth must be paid for by those who are the primary beneficiaries of that growth. We can no longer subsidize growth on the backs of citizens in existing neighbourhoods” (Cuthbertson, 2010). In keeping with his promise and with a better

understanding of the cross-subsidization between greenfield and established neighbourhoods, the City of Calgary recently passed a new off-site levy bylaw (Bylaw 2M2016) with support from the development industry and home builders. Under this new bylaw, charges will reflect the cost of new development since new growth will be assessed fees that represent 100% of its proportionate cost (City of Calgary, 2016b). This will apply particularly to water, sanitary and storm sewers, and road infrastructure.

The new bylaw also includes charges to provide community services such as libraries, buses, recreation facilities, and police stations. The MGA does not allow the capital cost of these types of services in the list of eligible infrastructure for which off-site levies can be imposed. However, the development industry in Calgary has agreed to this levy as they concur with the City that

Failing to account for locational differences in development charges effectively results in market failures and excessive growth, particularly at urban boundaries.

these services are important to build complete communities.

Although SDAs give the City control over where and when development will occur, this system carries some inherent flaws, the biggest of which is the

liability undertaken by the municipality. Namely, if the City builds a subdivision's infrastructure when the development industry has no intentions of developing the area for several years, the City may have to carry that construction cost alone, since property taxes that would go to cover this cost cannot be collected from an undeveloped area. A corollary here is that developers greatly benefit as they assume no risks in financing the infrastructure. One may argue that this approach will reduce the development costs and subsequently the cost of housing for homebuyers, but eventually such costs get passed on to homeowners in the form of property taxes. Still, some developers on our expert panel held the view that the City's involvement in building the infrastructure results in higher costs, which in turn results in higher development charges and hence higher housing costs.

Permanent Area Contributions (PAC) [Edmonton – Infrastructure Fee]

This fee is a method of financing and sharing the costs of infrastructure for new developments. In Edmonton, the PAC system includes payments for storm and sanitary sewer trunks, storm water management facilities, and other drainage improvements. The drainage improvements apply to a predefined drainage basin based on the area being developed or subdivided.

The PAC system has two different types of cost sharing:

- **On-site cost sharing** refers to the cost sharing of trunk sewers installed within the drainage basin as per the City of Edmonton (n.d.-a). The pace of development dictates the construction of the sewer system, with each developer responsible for their portion of the system. PAC charges will be larger for the first developer(s) in an area; subsequent developers will pay

less as initial costs are higher, although if costs run higher than expected these are recovered from subsequent developers.

- **Off-site cost sharing** refers to the cost sharing of intercepting sewers built outside the boundaries of on-site cost sharing basins. Using calculations similar to those of on-site cost sharing, these systems are usually installed by one or more developer(s), that front end the cost of construction until the project is completed.

Priority Growth Areas (PGA) [Calgary – Assessment Fee]

In the *Corporate Growth Management Report* (City of Calgary, 2013), the City of Calgary has explicitly outlined areas within its municipal boundaries where growth should be focused. Areas are ranked on several criteria: access to transit, capacity of infrastructure, readiness to proceed, and so forth and assessed as to whether they align with the municipal development plan (MDP). The document recommends that areas at the top of the priority sequence receive the appropriate capital funds to ensure they are fully built before new development occurs.

In an interview with representatives from the City of Calgary, this method of controlling growth was described as contentious within the development community. The City, however, believes the process is fair since it is transparent and developers know exactly which communities will be developed next. The City of Calgary is also able to control this growth because of the SDAs described above that give it control over where and when infrastructure will be built. This ensures that development is completed in existing developments before new projects begins. Therefore, development does not leapfrog and is carried out in an organized and efficient manner.

According to a City of Calgary *Financing Municipal Infrastructure Report* (2010), local industry in Calgary does not supported the PAC system. Their position is that it jeopardizes the viability of the development by introducing a large capital investment at the start of the development.

Integrated Infrastructure Management Planning Framework (IIMP)

[Edmonton –Assessment Fee]

IIMP is a process that deals with the “gathering, synthesis, presentation, and use of data related to the provision of infrastructure to the three remaining Urban Growth Areas [UGA].” In Edmonton, these are in the northeast, southeast, and southwest corners of the city. The IIMP determines both the initial and ongoing viability of a neighbourhood, including whether it will generate enough revenue to cover the costs of providing infrastructure such as sewer and roads. This understanding gives planners and decision-makers greater insight into “the infrastructure required for the development, its costs and efficiencies, how it relates to other infrastructure (present and planned) in the city, implications to the City’s operations, and a greater understanding of the effects of the timing of the development” (City of Edmonton, n.d-b).

Having this information at hand allows decision-makers to make informed decisions about the efficiency and sustainability of future developments. The IIMP’s effect on development can be

seen in the Decoteau Area Structure Plan (ASP): the plan was rejected because densities were at the lower end of the Capital Region Board's² requirements and the City of Edmonton feared financial losses. However, unlike Calgary's PGA system the IIMP does not allow the City to control when or where development occurs. This thus lets development leapfrog and continue before previously started developments are completed.

A 2016 staff report to Edmonton City Council explained how the IIMP is affecting development. It notes that within the three remaining UGAs in Edmonton, a total of \$3.8 billion investment will be required from developers for infrastructure, with an additional \$1.4 billion needed for capital investments—fire stations, parks, roads, interchanges, and so on. Likely sources for funds are the City and/or Province. As residential tax revenue is not intended to pay for an area's programs and services, over a 50-year period, the report anticipated that these UGAs will run a \$1.4-billion-dollar shortfall.

The staff report also indicates that although recent UGAs have had better cost-to-revenue ratios due to greater than expected populations, unless the City is able to increase its non-residential tax base, residential taxes may increase (even though non-residential taxes already generate almost three times more revenue than residential taxes) (City of Edmonton, 2016). However, the report notes that a levy similar to that of Calgary, which would capture 100% of the proportionate share of infrastructure in UGAs, is an alternative to increased taxes that would see new development paid for by its users.

Edmonton has other forms of assessment fees such as Arterial Road Assessments Fee (ARA) and Expansion Assessment Fee (EAF). ARA charges are additional to Edmonton's PAC assessment costs and are collected as a condition of a subdivision permit. An ARA assessment requires developers to construct or pay for four to five lanes of an arterial road depending on the width and of course the need. The EAF applies to properties located in areas where the intention is that they will be serviced by existing or future major sanitary trunks.

Post-development Charges

Financing of infrastructure and services is done through a variety of means; however, no method brings in more revenue than post-development charges. Property taxes are the most well-known and highest revenue-generating option in this category, which municipalities use to offset these costs. (Slack, 2002). Additionally, user fees may generate a much smaller portion of a municipality's revenue, but when properly employed, they can be an effective method of collecting revenues that reflect the true cost of a service.

² The Capital Region Board was established in 2008 to promote coordination and cooperation between municipalities within the Edmonton Metropolitan Region. The board is covered in detail in the management section (Section 4).

The MGA gives municipalities the power to tax properties in order to fund municipal expenditures, one of few options municipalities have to generate revenue. In Alberta, property taxes are determined through property assessments based on market value and the municipal revenue required to provide services. Albertans have some of the lowest personal taxes in Canada, in part because of low property taxes (Government of Alberta, n.d.). In Edmonton, average property taxes are \$ 2,947, while property taxes in Calgary are slightly lower at an average of \$2,830 (Huffington Post, 2014).

While property taxes account for over half of Canadian municipalities revenue (Blais, 2010), scholars deem them a negative force on the built form, suggesting they lead to excessive growth (Blais, 2010; Burchell et al., 2005; Slack, 2002). Slack (2002) explains that this is because the marginal cost of property taxes does not equal the marginal benefit received from services. Blais (2010) adds that there is a fundamental disconnect when correlating development charges that are based on average costing with property taxes that are based on market values tied to various urban forms. Both do not reflect the actual municipal service costs, leading to an inefficient allocation of resources and services.

Property taxes also contribute to sprawl as they act as a disincentive to intensify—investments that increase property values result in greater taxes being imposed upon property owners (Blais, 2010, Slack, 2002). Therefore, true costs are distorted as higher density developments are taxed at a higher rate than single-family homes, even though the cost to service them (such as laterals) is often lower in high-density developments (Burchell et al, 2005; Slack, 2003;). Moreover, property taxes fail to take into consideration location: homes closer to the central core, which are often smaller in size and do not require the extension of services, typically have a greater market value compared to those in the suburbs (Blais, 2010). This effectively results in higher property taxes in the core and the cross-subsidization of the suburbs.

PARTICIPANTS IN SPRAWL: CONSUMERS, DEVELOPERS, AND THE PUBLIC SECTOR

Homeowners make decisions about where to live based on house prices and location, availability of community services, and accessibility via private and public transportation (Thompson, 2013). Like all consumer goods in a market economy such as Canada's, the supply of housing, and the style and location of this housing is, at least in part, influenced by consumer preference. Bunting et al. (1999) commented that the post-war suburb inverted the importance of accessibility and place (the features of the home and neighbourhood) for consumers. Their study reported that most people preferred homogeneity, low density, and living close to or within the country. It also reported that high income households and households with children (two markets that developers are often trying to attract) prefer new neighbourhoods because of their place qualities. Interestingly, the group that generally did not share the preferences of the majority were those who had already lived in functional and successful high-density mixed-use neighbourhoods elsewhere in the country and the world.

Suburban developments are attractive also because they are often cheaper than homes in the inner-city core. As demand for relatively cheaper suburbanized homes increase, this encourages more investment in new developments, which further contributes to sprawl (Thompson, 2013). This is consistent with the view that sprawl is often attributed to the private sector—developers and builders in particular. The literature is rife with how developers aiming for profits look to cheap greenfield areas and attempt to politically and financially influence local governments to approve such developments. Further, when property owners in the central core who are looking for high prices “holdout,” waiting of the right moment to sell, this can certainly contribute to high land consolidation costs and financial losses to municipalities in the form of delays.

For homeowners, it is thought that they do not consider the hidden costs of living in non-centralized locations, which are not often reflected in the purchase price: indirect and direct cost of increased automobile use, emissions, noise, traffic congestion, increased commute time, injuries from collisions, rise in obesity, rise in mental illness, and the like (which will be discussed in Section 3).

Another perspective currently gaining traction focuses on sprawl caused by the public sector. Many private sector developers who participated in our expert panels pointed out this issue. They said that at the neighbourhood level, public spaces and institutions like roads, storm water management, parks, and schools take up about 40-50% of a neighbourhood’s land. These factors thus may also account for some of the current sprawl.

The Province of Ontario (2008) acknowledges that traditionally planned institutional uses by the public sector can result in sprawl. It points to the large, land-intensive hospital, university, or school developments on the urban fringes of communities. The current legislation, building codes, separation distances, and road engineering required for such facilities may [also] contribute to sprawl to the same degree that residential, commercial, or industrial net areas do. For example, in Alberta, the provincial Municipal Government Act and the School Act require schools to be built on school reserve land. This inhibits any opportunities for mixed land use, such as building schools in tandem with seniors housing, offices, or other building or use types compatible with schools. The question here is how we develop public institutions and spaces meant for multiple uses in ways that physically integrate them with the remaining neighbourhood fabric.

SUMMARY

The phenomenon of urban sprawl has been covered extensively in scholarly literature with a variety of methods and measurements employed to try defining this ambiguous term. We note that the public’s addiction to cars and developers’ desires to provide cheap housing while making good profit have largely contributed to the current forms of development. However, the recent literature has begun to challenge this long-standing assumption. It calls into question the role of

the municipality and the Province as well, what has been referred to as “public sector sprawl” by both our study informants and the literature.

Unlike most other provinces, Alberta has had an interesting journey over the last several decades in its endeavour to tackle regional growth. Since 1950, the province incrementally built up the regional institutions and structures only to see it dismantled in 1995 and regional planning or the remnants of it downloaded to the individual municipality. The new approach relies heavily on voluntary cooperation with the assumption that everyone will “play nicely in the sand box.” However, we see that it has not quite worked out that way. As of 2008, we see a resurgence of regional planning through provincial efforts—the Province’s has created a regional board in the Edmonton area, developed the Land Use Framework, and created multiple regional plans across the province.

Many scholars take issue with the subsidies inherently built into development charges and fees, since they do not account for all the real cost. This leads, in turn, to further suburbanization and sprawl. Both the Edmonton and Calgary approaches to charging for development have largely failed. Calgary’s approach seems to have slightly more potential. If nothing else, it puts the City in the driver’s seat, which can potentially reduce the leapfrogging of development and introduce more predictability in the overall development process.

3. IMPACTS OF SUBURBAN FORM

The collateral consequences of urban sprawl appear to be many, and researchers have investigated a broad range, from those arising from traffic congestion and the loss of open space, to the low development costs and holdouts. When examining the effects of sprawl on economics, Soule (2006) affirms that “many of the costs continue to be difficult to quantify” (p. 267). Nonetheless, this report will review some of the more salient impacts of sprawl, in this order: environmental costs, impacts on agricultural land, human health issues, and socio-cultural associations.

BROAD ENVIRONMENTAL CONCERNS

Emissions

The diversity of opinions about sprawl—its causes and consequences—extends to its impacts on the environment, which are generally thought to be negative. While it is difficult to directly link climate change to sprawl, Gurin (2003) posits that 70% of greenhouse gas emissions from transportation are from cars and trucks alone, and two-thirds of this figure is generated in urban areas. In Alberta, this proportion is about 20%, partly because oil and gas, and power generation through coal-burning, take up the majority (over 60%) of GHG emissions (Climate Leadership report, 2015). While transportation is a contributor to sprawl, it is also a player in the impacts of sprawl, although the relationship with emission is not entirely clear (Nechyba & Walsh, 2004). Bart (2010) found a strong relationship between the growth of urban areas and the increase in carbon dioxide emissions.

Water

Water quality is also affected, as it decreases when Vehicle Miles Travelled increase. This is due to insufficient porous surfaces in suburban areas, which reduce natural drainage and filtration. This means that runoff travels large distances on non-porous surfaces, picking up urban pollutants along the way (Gurin, 2003). Furlong, Mahler & Van Metre (2000) looked at concentrations of Polycyclic Aromatic Hydrocarbons in 10 sediment cores from reservoirs and lakes within US metropolitan areas. This suspected carcinogen and threat to aquatic health is found in exhaust, engine oil, and asphalt and tire, and has spiked in developing watersheds over the past three decades. Trends suggest these increased concentrations are closely correlated with increased automobile usage, linked in turn to increased urbanization.

Energy Inefficiency

Dwelling unit type also plays a significant role in the amount of energy occupants consume.

Single-family homes, which are common in suburbanized areas, are the least energy efficient of all residential built forms (Meredith,

2003), in part because they have more exposed surface area and thus require more energy than similar-sized attached houses (Ewing & Rong, 2008). Statistics Canada (2011c) data back this up, recording that apartments consumed less energy (40 GJ per dwelling) when compared to multi-unit³ (84 GJ per dwelling) and single-family dwellings (134 GJ per dwelling).

Urbanization and agricultural production have a complex relationship: Agricultural operations are often displaced by the development that created the need for them in the first place.

Natural Habitat

The loss of natural areas due to sprawl compounds the problems of air and water quality, as these areas produce oxygen, help to reduce climate change, naturally filter the water, and support biodiversity (Gurin, 2003). Robinson, Newell and Marzluff (2005) analyzed geo-referenced black and white orthophotos for 1974 and 1998 to develop a digital record of land cover and land use in Kings County, Washington. The study area encompassed cities that have designed urban growth boundaries as well as unincorporated land. The analysis showed a dramatic increase in suburban and exurban single-family homes, while interior forest habitat decreased by 41%. This fragmentation of natural habitats has the potential to affect many species.

AGRICULTURAL LAND AND URBAN EXPANSION

When an agricultural field is transformed through development into a new urban subdivision, the changed appearance is striking. Urban expansion can lead to a loss of local food production, the disruption of the agricultural economy, and damage to both the environment and the communities that are organized around the rural farm culture (Bentley et al., 2014; Daniels & Bowers, 1997; Furuseth, 1987; Mariola, 2005). As also acknowledged in the Edmonton Capital Region Board's Land Use Plan (2009a):

Agricultural land has significant value, both at the local and regional levels, beyond its pure economic capacity, including green space, aesthetics, community character, lifestyle, air quality, wildlife habitat, as well as [being] a risk management measure in the event of future food shortages. (p. 11)

Worldwide, urban land cover is expected to triple between 2000 and 2030, which researchers expect to have drastic impacts on world biodiversity and carbon pools (Seto et al., 2012). According to Foley et al. (2005), we now “face the challenge of managing trade-offs between immediate human needs and maintaining the capacity of the biosphere to provide goods and

³ Includes duplexes, row houses, and terrace dwelling units

services in the long term” (p. 570). This suggests that finding a way to balance the relationship between urbanization and agricultural production is and will be complex. With increases in urbanization comes a need for increased food production, but this production needs to be sufficiently close to an urban centre to easily supply fresh food to those who need it. The result is that urban centres are located on or near agriculturally capable land. However, this also creates pressures as urban centres expand outward (Loss and Fragmentation of Farmland, 2002, p. i).

Agricultural operations are often displaced by the development that created the need for their produce in the first place. According to Martellozzo et al. (2014), the competition between urbanization and agricultural production is extremely challenging to manage because of two interconnected reasons. First, “urban settlements are highly path dependent with high inertia and are therefore essentially irreversible....Second, urban settlements [are] frequently located near the best agricultural soils, so any expansion would inevitably encroach on prime agricultural lands” (p. 891).

Hofmann (2001) of Statistics Canada partly attributes the loss of farmland to population growth, but also to urban households consuming more land per dwelling than in the past. While large cities are always expanding, between 1971 and 1996, the majority of urban expansion in Canada occurred around smaller cities with fewer than 100,000 residents. In this same time period, the density of Canadian cities decreased by 33%, and the amount of land in Alberta classified as urban increased by over 130% (Hofmann, 2001).

Loss of Productive Farmland

Many researchers are concerned about how sprawl contributes to the loss of agricultural land. Bentley et. al (2014) report that the loss of agricultural land can cause issues with land conservation and local food production, leading to loss of high quality soil and generating economic inefficiencies. 33% of Alberta’s land area is used for agricultural production (Bentley, et. al, 2014), which is significantly more than the national percentage—only 7% of Canada’s land mass was used for farming in 2013 (The World Bank, 2016).

Between 2000 and 2012, 123,900 hectares of land (0.8% of Alberta’s land area) and 4.3% of land within the Edmonton region alone were converted from agricultural uses to developed uses, primarily along the Edmonton-Calgary corridor (Bentley, et. al, 2014) where 75% of Alberta’s population resides (Statistics Canada, 2011a). Between 1996 and 2011, a period of only 15 years, the population of the corridor increased 42%, from 1.9 million to 2.7 million (Statistics Canada 2002, 2012). In this period from 2000 to 2012, of the 0.8% of Alberta’s farmland that was converted to urban development, 68.4% of it was classified as either Class 1 or 2 soils under the Canada Land Inventory (Bentley et al., 2014).

According to Martellozzo et al. (2014), the expansion of farmland in the Calgary-Edmonton corridor between 1988 and 2010 is taking place on soils of poorer quality than where urban expansion is taking place. 60% of peri-urban and urban expansion in the Calgary-Edmonton

corridor during this same 22-year period took place on agricultural land. In fact, more than two-thirds of the urban expansion in the area took place on very good, good, or moderate soils and the growth on these classifications was accelerating, while there was much slower growth taking place on fair and extremely poor soils⁴ (Loss and Fragmentation of Farmland, 2002; Martellozzo et al., 2014). If this trend continues, coupled with the projected increase in urban area, the outcome is a potential loss of 1,000 to 2,000 square kilometres of capable agricultural land (Martellozzo et al., 2014). (Some of these issues are further explored empirically in the section on density.)

Martellozzo et al. (2014) also noted that in this period (1988–2010) the developed area of Edmonton and Calgary expanded by 137% and 64% respectively, and many smaller communities grew at even faster rates. These researchers projected that by 2036 these cities will increase in area by 39-75% relative to their size in 2010. Considering growth up to the present, they observed that in over the years they surveyed, both Spruce Grove (including Stony Plain) and the Leduc/Beaumont/Devon area expanded four-fold. This study showed that the smaller the settlement, the faster it grew in area; the rate of expansion appeared to have an inverse relationship with the area of the existing urban core

While land is being converted from agricultural to urban uses, forested and other natural lands are simultaneously being converted to land for agricultural purposes. Further, according to Alberta Agriculture and Forestry (2016), between 2011 and 2015, there was a net increase in the agricultural land throughout the province, with a concomitant, substantial decrease in non-agricultural land. Between 2001 and 2006 the number of farms in Alberta decreased by 7.9%, but the total land area being farmed actually increased by 0.1% (Federal Agricultural Census, 2006). Land put towards rural residential increased three-fold during the same time.

Perhaps the worst implication of the loss of farmland is that once land has been developed for urban purposes, it is near impossible to reclaim it for agricultural use (Bentley et al, 2014). The loss of fertile land threatens food production as well as basic but important ecosystem services performed by farmland such as “providing clean water, reducing soil erosion, mitigating impacts on severe weather, preserving biodiversity and maintaining open space for recreation” (Francis et. al, 2012, p. 8). Unfortunately, urban development increases greenhouse gas emissions, while the loss of farmland to this development reduces the capacity for the system to absorb these gases (Francis et. al, 2012).

⁴ The federal government developed the Canadian Land Inventory tool to classify agricultural land capability across the country. Classifications are based on climate, land formation, and soil parameters such as texture, pH, and stoniness. There are seven classes, ranging from one (most capable) to seven (least capable) (Canada Land Inventory).

Farm Fragmentation and Responses to Farmland Loss

While the loss of farmland is itself a problem, its fragmentation is equally problematic because it can decrease farm production. Fragmentation of farmland encompasses five dimensions:

- quantity of farmland
- size of individual plots
- shape of the plots
- distance between plots owned by the same operation
- distance between the plots and the residence of the farmers (Latruffe & Piet, 2013)

Fragmentation affects efficiency because when things are spread farther apart they will require more time and energy to manage, creating work for the farmer and increasing greenhouse gas emissions (Latruffe & Piet, 2013). Bentley et al. (2014) found that between 2000 and 2012 the fragmentation of land within Alberta decreased, possibly because of the agglomeration of land by large agricultural operations. However, practices such as “first parcel out” subdivisions still contribute to fragmentation and can make farming on the surrounding properties difficult because of increased property values, increased traffic, and the incompatibility of agricultural and residential land uses (Loss and Fragmentation of Farmland, 2002).

Regulatory Measures to Prevent Loss of Farmland

Across North America, particularly in Canada, various land use tools have been employed to limit urban pressures on farmland, such as the BC Agricultural Land Commission, Ontario’s Greenbelt Act and farmland trusts or Quebec’s Act to preserve agricultural land. In 1996, Alberta legislated conservation easements but only to preserve scenery or biological diversity. The Alberta Land Stewardship Act (ALSA) (2009) added agricultural land and land used for agricultural purposes as possible conservation easement justifications.

The relationship between urban growth and agricultural land is complex, but it is, of course, fundamental to local food provision. We still do not have a full picture of how the expansion of urban settlements onto agriculturally capable soils, and the resulting relocation of farmlands to less capable soils, will affect food production. What is clear is that this process is unsustainable and includes negative effects on erosion, water quality, community character and identity, and economic capacity. Even if green revolution technologies can continue to produce greater yields with less natural services, their energy consumption is remarkably inefficient.

The general consensus seems to be that more concise policy is needed that considers local, regional and provincial contexts. There is a potential for regional entities such as the Capital Region Board to contribute a collaborative land use management system on a regional scale such as the Calgary-Edmonton corridor, where the majority of Alberta’s growth is taking place. Below is a brief description of some tools and strategies that have or are being used to this end.

Conservation Easement

Conservation easement is a contract between a qualified private land conservation organization (or government agency) and a private landowner, in which the landowner gives up certain rights so as to protect the identified conservation values—or, agriculture use in the case of an agriculture conservation easement. These restrictions are registered on title and stay with the land regardless of the owner. Conservation easement does not provide much financial incentive or compensation to the land owner. Tax receipts are the most common form of compensation. According to Greenaway and Good (2008), because both land trusts and government agencies can issue tax receipts, donations of conservation easements could be eligible for a federal and provincial tax receipt.

Transfer Development Credits

Another conservation tool—Transfer Development Credits (TDCs)—has been enabled by the ALSA. TDCs are common in the US and at places exist alongside the Agricultural Land Reserve (ALR, described below); they have been responsible for saving several thousand hectares of agricultural land. Montgomery County in Maryland in the US has the oldest TDC program in the country, which is arguably most successful. This tool, once fully developed as a market-based transfer of development rights, has several benefits for Alberta. It will allow for the transfer of development potential from areas less suited to development (based on a community's wish to preserve it as agricultural land), to areas more suited to increased development (based on their capacity to accept greater development activity).

To date, TDCs have not been well-used in Alberta. This may be because the various components that constitute a TDC—sending area, usual conservation area, receiving area, usual development area, and the system of credit— have not been put in place. Even though the provincial government has enabled this tool, it will have to take the leadership in developing broad parameters and in encouraging and facilitating municipalities to partake in the program by creating awareness programs and relevant land use bylaws. The bonus development could provide a financial incentive to developers to build in the receiving areas, while the payment for credits provides a financial incentive to landowners in the sending areas.

Agricultural Master Plans

Some Alberta rural counties like Strathcona, Rocky View, and others have adopted Agriculture Master Plans. These plans are meant to identify a long-term vision that supports existing agricultural operations and provides new opportunities for the agriculture sector. In addition, they inform future planning decisions and policy development related to the agriculture industry. Unfortunately, these documents contain motherhood statements but little regulatory power to put them into action.

Agricultural Land Reserve (ALR)

The ALR is a zone of agricultural land in which agriculture is recognized as the priority use, usually by legislation. To combat the dwindling supply of agricultural lands, in 1973, BC created the ALR and the Agricultural Land Commission to protect the ALR. In 1999, BC strengthened the Commission's power by declaring the preservation of farmland a "provincial interest." The Commission works in conjunction with regional districts and municipalities, but has both defenders and critics. The provincial government itself is sometimes one of these critics, claiming that the ALR is too rigid and frequently impedes economic development. Some hold it responsible for the astronomical rise in land prices, especially in the Lower Mainland region. Other critics claim the ALR does not sufficiently compensate owners for their property, which they consider unreasonable interference in private property rights. Nonetheless, the ALR remains popular with BC voters (Mickleburgh, 2012).

HUMAN HEALTH

Much of the research into the human health implications of suburbanizing cities has looked at American cities, although some Canadian cities are now being examined. Health issues of interest include obesity and hypertension (Ewing et al., 2003), and "reduced air quality, increased motor vehicle collisions because of widespread automobile travel, and mental health" (Alberta Health Services, 2009). Some of these impacts may be tougher to measure than others.

Obesity

This concern is the most agreed upon health issue associated with urban sprawl. Ewing et al. (2003) used Smart Growth America's metropolitan sprawl index to measure several health factors in American cities, showing small but significant relationships between suburbanizing counties and the amount of time people walked, obesity, BMI, and hypertension. Frank, Andersen and Schmid (2004) also connected sprawl and obesity, finding "the odds of obesity declined by 12.2% for each quartile increase in mixed use and by 4.8% for each additional kilometre walked, but conversely increased by 6% for each hour spent in a car per day" (pp. 93–94). While Alberta Health Services (2009) and Vandegrift and Yoked (2004) both note that increased time spent commuting in vehicles and less time performing active transport make it harder for individuals to reach daily-recommended activity levels.

Other Canadian research on sprawl and obesity has provided similar, yet mixed results among age groups. Pouliou and Elliott (2010) have stated that the built environment, socio-economic status, and individual choices influence BMI and obesity levels in adults. Seliske, Pickett and Janssen (2012) note that adolescents benefit from urban sprawl, and those living in less dense areas are more likely to engage in active transport, likely because of traffic safety concerns in dense areas.

Vehicle Use

When people drive more because of sprawl they are exposed to more vehicle emissions, such as “nitrogen oxides, carbon monoxide, volatile organic compounds, fine particulates” (Alberta Health Services, 2009, p. 2). Poor quality air can lead to “respiratory symptoms, poor lung function, increased hospital visits and medication as well as absenteeism from work and school” (Frumkin, 2002, p. 202). When people drive more and farther, they likely increase their risks of injury or death associated with car accidents (Alberta Health Services, 2009; Frumkin, 2002).

Mental Health

Identifying a causal link between sprawl and mental health issues is difficult to make. This is because “[many] complex factors contribute to mental health” (Alberta Health Services, 2009, p. 2). However, as Frumkin (2002) notes, sprawl may contribute positively to mental health as individuals are generally closer to nature. On the other hand, he is quick to note that long, congested commutes may result in stress, stress-related ailments, road rage, social isolation, and loss of social capital.

Brueckner and Largey (2008) are more cautious, suggesting that little empirical evidence is available to support that sprawl contributes to mental health concerns. Indeed, they show that density and social interaction have negative relationships and that we cannot conclude sprawl reduces social capital—an argument supported by Sturm and Cohen (2004), who also found sprawl had no adverse effects on mental health. However, Soule (2006) reminds us that it is difficult to quantify the social costs of sprawl and suburban living—such things as seclusion, social capital, and alienation. However, the famous Jane Jacobs’s (1961) emphasis on “eyes on the street,” which increases social interactions for residents, reaffirms that these concerns matter.

SOCIO-CULTURAL ASPECTS

In the last decades, North American suburbs have dramatically shifted from the homogenous environment prevalent in post-WWII, to more diverse, heterogeneous, mixed-income residential homes (Drummond & Labbe, 2013). Certainly, Canada’s contemporary suburbs vary in terms of their demographic, economic, and social mix. They show unprecedented diversity, complexity, and opportunities for residential and business interests.

American researchers have emerging evidence of increasing poverty or blight in suburban areas, when they link poverty with race (Rusk, 2006). The issue is more complex in Canada (Badger,

Transfer Development Credits appear to have more potential, but need to be developed and operationalized in concert with urban and rural municipalities.

2013; Kneebone & Berube, 2013). For example, the traditional settlement of new immigrants into cheaper, inner-core housing has shifted outwards; they now settle in middle-upper, residential enclaves that are increasingly diverse—hence the term “ethnoburbs” (Wang & Zhong, 2013).

In the Toronto area, Qadeer et al (2010) and Qadeer and Kumar (2006) observe just this phenomenon, noting that new immigrants to that region now settle directly in suburban metropolitan areas, bypassing the historical inner-city neighbourhoods. In his recent research on Calgary and Edmonton, Agrawal (2016) noticed similar trends in Alberta cities as well. The scholars show that many of these ethnic settlements are affluent and are adding vibrancy and life to an otherwise sterile environment. There are pockets of poverty, but certainly it is not rampant, as one sees in American cities such as New York and Los Angeles. Still, 29% of Toronto’s homeless people live in the suburbs (Gee, 2015).

Preston et al.’s (2009) study on homelessness in Canadian suburbs finds that a high proportion of newcomers in the York Region in Ontario are at-risk of homelessness during the first 10 years of residence in Canada. Although renters are more vulnerable than homeowners, a substantial percentage of newcomers who are homeowners pay more than 30% of their total income on housing costs. The shortage of affordable rental housing in the outer suburbs exacerbates the impacts of low incomes, immigration status, household size, and ethnoracial identities on immigrants’ housing.

Hulchanski’s study (2006) on Toronto reports the increasing income disparities within the city. He notes that over the last few decades, poverty has moved from the centre of the city to the inner suburbs at the edge of the city, areas that are largely inhabited by recent immigrants to the country.

SUMMARY

Sprawl-related concerns extensively studied by researchers have included environmental impacts, such as the loss of natural areas and farmland resulting from fringe development. Academics have also found links between sprawl and human health and socio-economic conditions.

There are a few mechanisms available to preserve agricultural land. Conservation Easement is a tool that the Alberta Land Stewardship Act allows. The issue here is that it does not compensate land owners adequately for voluntarily putting restrictions on their land. Agriculture Master

Plans have been used by local municipalities but they have limited enforcement power. More powerful mechanisms used in other provinces, like the Agricultural Land Reserve of BC and Quebec's Act of Preservation of agricultural land are also worth exploring. They, however, may not be palatable in the Alberta context as they may be viewed as violating landowners' property rights. Transfer Development Credits, available under Alberta Land Stewardship Act, appear to have a lot more potential. This tool, however, also needs to be developed fully and operationalized in concert with urban and rural municipalities, with the provincial government taking the lead.

4. *MANAGING URBAN SPRAWL*

Many tools and strategies have been invoked to manage sprawling urban development. Some of these are unique to particular contexts, as metropolitan centres seek to devise approaches that work within their particular set of constraints. Planning growth management tools are one means to work towards a city's vision for itself, and may take the form of bylaws or other regulatory measures intended to direct how growth occurs. The earlier review of regional planning policy and strategies in Section 2 of this report touched on some of these, acknowledging that they can be less than successful. This section looks at a few of these tools and turns again briefly to regional planning, bringing the Albertan story up to the moment by looking at the most recent planning policies and efforts to manage sprawl.

Access to water and water licensing is another major, largely unexplored avenue to contain urban development, and the latter half of this section is devoted to this issue. We begin, however, but considering how the particular metropolitan context can shape needs and patterns of development in a given region.

METROPOLITAN CONTEXTS

City planners consider both a city's present and its past when making planning decisions, including about its density patterns. Each metropolitan area's unique "contextual factors" inform residential densities, shaping how they are standardized or differentiated from other cities. Bunting et al. (2010) compared Toronto, Montréal, Vancouver, and Ottawa-Hull to show that all these cities had developed outer suburbs, and declining inner suburbs and city cores. They attributed this convergence largely to automobile dependence. In contrast, how the four cities differed reflects the unique context of each place—factors such as topography, inherited built environment, urban culture, demographic and market trends, political institutions, land use policies and patterns, and transportation.

Toronto was more stable and decentralized, Montréal was also decentralized, and Vancouver was the densest of all the cities. Bunting et al. (2010) conclude that the densities across Canadian cities align with a hybrid model: suburban areas converge and have similar characteristics, but central areas diverge and develop based on qualities unique to each area.

A 2016 Statistics Canada report on the changing landscape of Canadian metropolitan areas showed that from 1971 to 2011:

- The total built area of Census Metropolitan Areas (CMAs) increased from 565,100 hectares to 1,454,600 hectares (almost tripling over 40 years)
- Toronto (118,900 ha), Montréal (81,600) and Edmonton (75,200 ha) experienced the largest increase in built areas
- Edmonton's growth rate was the highest of all CMAs, at 220%.

As of 2011:

- The Edmonton CMA ranks third in total built area (109,400 ha), behind only Toronto and Montréal, despite having only the sixth largest population among CMAs and half the population of Vancouver's CMA.
- Toronto (3,368 persons/km²), Montréal (3,356 persons/km²), Vancouver (3,100 persons/km²) and Calgary (2,685 persons/km²) had the greatest population densities, indicating more compact development.
- Dwelling unit density was highest in Montréal (1,490 dwellings/km²), Vancouver (1,273 dwellings/km²) and Toronto (1,255 dwellings/km²).

Between 2001 and 2011, the report found that densities increased most in the CMAs of Barrie (19% population density increase and 23% dwelling unit density increase), as well as Edmonton (16% population density increase and 21% dwelling unit density increase).

Calgary and Edmonton

Local opinions differ on how to handle the needs of a growing city like Calgary or Edmonton. For example, Tomalty and Haider's (2008) report to the City of Calgary on housing affordability found that the City's growth management policies were not escalating housing prices. However, they suggest that efforts to densify be balanced with greenfield development so that housing remains affordable. In contrast, a survey of Calgarians conducted by the Manning Foundation (Brunnen, 2013), a local conservative think tank, blames planning policies and municipal planners for thwarting the wishes of Calgary residents, whose primary concerns are traffic, roads, and congestion, and not intensification.

The literature does not explain whether Edmonton's current outward expansion as well as downtown intensification efforts indicate a shift towards sustainable development. Indeed, scholars question whether proposed new developments underway in Edmonton will fully recover costs (City of Edmonton, 2011; Thompson, 2013). We need further research to understand how Edmonton's growth rates, development charges, and downtown investments compare with other Canadian CMAs, and more importantly, whether they are sustainable urban developments (Nugent, 2011).

In another study, Gordon and Shirokoff (2014) observed that from 2006 to 2011, Calgary was the fastest growing metropolitan area, with Edmonton the second fastest. In both cities, this was predominately in automobile suburbs and exurban areas (Calgary – 97%; Edmonton – 93%). When compared to other major Canadian cities, Calgary had the least growth in its central core and near transit stations, whereas Edmonton had more transit suburbs near Light Rail Transit stations.

GROWTH MANAGEMENT TOOLS

Growth management tools are “the deliberate and integrated use of the planning, regulatory, and fiscal authority of state and local governments to influence the pattern of growth and development in order to meet projected needs” (Nelson et al., 2002, p.2). Thus, they are intended to create predictable outcomes. These tools range in scope from taxes and fees to zoning regulations; however, over the past years, tools such as zoning, form-based codes, and urban growth boundaries have become prominent tools for managing urban growth.

Zoning Bylaws

Zoning bylaws regulate and control growth, although Talen (2013) argues that zoning inherently produces sprawl due to how they inform patterns, dimensions, homogeneity, separation, and enclosure. She suggests that zoning:

- limits the logical organization of space
- over-consumes the amount of land needed, by imposing minimum lot sizes
- creates single-use neighbourhoods
- diminishes or eliminates connectivity and enclosure, which are essential to walkable streets

Lewyn (2012) agrees with this zoning concern, noting that although Canadian cities’ downtowns are growing when compared to American cities’, zones with minimum lot widths and height restrictions generate excessive sprawl. Lewyn also blames minimum parking requirements for suburbanizing cities, as they restrict developers from developing lots to their maximum potential. However, the City of Houston offers a contrary example, since it does not subscribe to traditional zoning but still faces same issues of suburbanization (Glaeser & Kahn, 2003). Thus, zoning alone is insufficient to explain the processes of suburbanization and sprawl.

Form-based Coding (FBC)

An alternative zoning approach that considers forms of buildings rather than their uses offers a different way to predictably create meaningful, diverse, connected, and enclosed spaces (Talen, 2013). However, Talen (2013) makes the point that the success of FBCs is difficult to gauge, as many cities, such as New York City, use a combination of traditional zoning and FBCs. In Alberta, the City of Calgary, the City of Airdrie and the Town of Sylvan Lake have adopted some form of FBCs.

In the last two decades, urban growth boundaries have become popular to limit sprawl—but while the boundaries can limit the footprint of cities they also drive up housing costs and thus impose a large burden on lower income households.

Urban Growth Boundaries (UGBs)

These boundaries arbitrarily divide areas of high and low density, so can be used by municipalities to decide where to encourage or mandate density. Sierra Club Canada champions UGBs, pointing out Portland as an exemplar (Bonser, Neil & Pelley, 2003). However, while places like Oregon may have successfully used UGBs to control growth, Nechyba and Walsh (2004) note that urban growth boundaries have become a popular proposal to limit sprawl over the past two decades. They observe that while the boundaries can limit the footprint of cities they also simultaneously drive up housing costs and thus impose the largest burdens on lower income households. Furthermore, they can worsen the problems associated with sprawl if designed in a way that pushes sprawl beyond the growth boundaries around the city.

Macdonald and Keil (2012) also consider the role of greenbelts to “mitigate the negative impacts of sprawling suburban development such as those regarding climate change, water security, rising oil prices and concerns regarding food security” (pp.141–142). However, leapfrog development is also a potential consequence that exacerbates environmental and health issues because of the associated increased commute times and emission levels (Keil & Shields, 2013; Macdonald & Keil, 2012). We can observe this in the Greater Toronto Area where the *Greenbelt Act* of 2005 squeezed land supply, driving up housing costs and leapfrog development (Curtis, 2014; Tuckey, 2014).

The three above-noted growth management tools may be supplemented by others that use monetary measures to control growth. These include development, user, and impact fees, which may even be more effective at managing growth. When used correctly, these additional tools transfer the full cost of development to developers, thus making it costlier to build at the fringes (Miceli & Sirmans, 2007). As Slack (2002) describes, “A combination of user fees based on marginal cost pricing and development charges levied on a development-by-development basis could encourage efficient land and infrastructure use and result in developments located closer to existing services” (p.22).

REGIONAL PLANNING CHANGES

Regional Planning and Collaboration: 2009 to 2017

Returning again to regional planning and policy, it is clear that the public approaches have a role to play in managing growth. Planning can address a variety of concerns, but some regions are better positioned to address problems than others: some may have provisions for such things as growth management, natural resource management, transportation or utility corridors, and economic development, while others may not (Almujhairy, 2014; Hodge & Robinson, 2001). Currently, Alberta’s regional planning is governed under several pieces of legislation, such as the Municipal Government Act (MGA), the 2009 Alberta Land Stewardship Act (ALSA) and its Land Use Framework Regional Plans, the Efficient Use of Land Strategy, the metropolitan plans for Edmonton and Calgary, and several inter-municipal development plans adopted by municipalities.

The Alberta Land Stewardship Act (ALSA)

In 2009, the ALSA was enacted, which essentially reintroduced and legislated regional planning back in the province. This piece of legislation called for the creation of seven regional plans, a Stewardship Minister, Commissioner, and the Land Use Secretariat to oversee the making of the plans and Conservation and Stewardship tools. All municipal statutory instruments must be reviewed, and all municipal decisions must comply with any regional plan.

The Old Regional Planning Commissions (RPCs) Vs. the Land Use Framework (LUF) Regional Plans

The nature of regional planning under ALSA is different from the former RPCs in several ways:

1. ALSA does not provide funding, nor does it mandate a planning board that has statutory authority to create plans or authorize subdivisions.
2. LUF regional plans include policies on both private and public lands, with an emphasis on public lands.
3. While the LUF regional plans do not have strict directions for private land, they do incorporate the 1996 Provincial Land Use Policies in each subsequent plans. In the Cabinet-approved regional plans for the Lower Athabasca and South Saskatchewan region plans, for example, the provincial interest in land use planning matters is stated broadly, while municipalities still retain the authority for land use development.

The New 2017 MGA and Mandatory Growth Management Boards

The proposed Bill 21 *Modernized Municipal Government Act*, when proclaimed in 2017, could mark a shift towards inter-municipal cooperation with respect to growth management. Specifically, Bill 20 calls for clearly identified principles and processes regarding annexation requirements, clarity about the hierarchy and relationship of statutory plans, and mandatory training for subdivision and development appeal board members and staff through a standardized curriculum (Alberta Government, 2015).

During the MGA review, and in light of the concerns about annexations, growth boundary adjustments, agricultural land conversion, and urban/rural tensions, one of the proposed options is to mandate “Minimum densities...in urban areas prior to allowing annexations to proceed” (KPMG, 2015, p. 8). It will be interesting to follow how Alberta’s new MGA will handle growth management across municipalities, and the form, structure, and role of the growth management boards in Alberta’s major urban centres.

In September 2015, the Province decided to mandate growth management boards for the cities of Calgary and Edmonton. This decision is a major policy shift, as the Calgary Regional Partnership (CRP) has been a

In Alberta, we must bring back some form of regional coordinating or governance structure, perhaps similar to BC’s regional districts.

voluntary organization since its inception. However, the CRP has been in a state of disarray since all rural municipalities left the partnership because of disagreements on density figures, direction of growth, and its overall governance. There are ongoing issues between urban and rural municipalities in the Calgary area. Notable among them are these recent conflicts:

- Between Rocky View County, the City of Chestermere, and the City of Calgary over the proposed industrial/commercial area by the County, just north of Chestermere and at the western edge of Calgary
- Between Municipal District of Foothills and the Town of Okotoks regarding the Town's intent to annex a few quarter sections of Municipal District's land

Clearly, attempts at extending urban municipal boundaries and discontinuous growth are unsustainable and lead to tensions and mistrust among the municipalities.

REGIONAL PLANNING ALTERNATIVES FROM OTHER PROVINCES

Other provinces offer potentially viable regional planning models:

- *Ontario* –
 - Metrolinx in the Greater Toronto and Hamilton area, to coordinate and integrate transportation across these regions
 - Upper-tier local governments at the regional level. They are responsible for providing many essential services at the regional level, which could include maintenance and construction of regional roads, transit, policing, sewer and water systems, waste disposal, health and social services and region-wide land-use planning and development.
- *Quebec* – regional county municipalities
- *British Columbia* – regional districts

BC's regional districts were created about 60 years ago to manage issues beyond municipal jurisdictions—that is, urban fringes—and to gain economies of scale regarding service provisions. Regional districts provide regional governance and services for the region as a whole. They also provide a political and administrative framework for inter-municipal or sub-regional service partnerships. Regional districts perform differently in different parts of the province. For example, a regional district such as Thompson-Nicola emphasizes the rural government role.

In contrast, the Greater Vancouver Regional District (also known as Metro Vancouver) primarily focuses on delivery of regional services. Metro Vancouver includes 21 municipalities and one First Nation community. It provides house, transit, water and sewer, garbage disposal, and a regional growth strategy. It requires local official plans to follow Metro Vancouver's regional plan. Municipalities can opt out of the regional service, or if they are near the outer boundary, they can opt in to the services provided by a neighbouring district.

Among the various models on the above list, regional districts seem the most effective and have been the longest-serving regional governance model, although their forms have evolved over the years. Regional districts are a mixture of two governance systems. In rural areas, citizens vote for directors and receive their services directly from the regional district. In municipal areas, citizens do not vote directly for regional board members and the services are not received directly from the region but from the municipality. Cashaback (2001) argues that this form of regional governance is effective and has mostly served the province of British Columbia quite well. He and others, such as the BC Government (2006), point out how remarkably flexible this model is, by allowing regions to choose which services they wish to provide and at what scale.

Regional districts may be revolutionary in the Albertan context but they are certainly worth exploring in an effort to develop a model that fits the situation in Alberta—in other words, one that considers the legislative framework, diversity of settlements, the economy, and local autonomy. Alberta has now witnessed both situations—a province with regional planning and one without. The current regional situation is much worse than it was before, especially in the wake of expanding urbanization. The voluntary nature of regional planning has not worked. In fact, it is leading to multiple disputes and competitions among municipalities over where growth should take place, creating a sense of gridlock. With the creation of the Capital Region Board and the development of regional plans, it is time now to fill the remaining gap. This means we must bring back some form of regional coordination or governance structure. Using BC's regional districts as a model could be a way to move forward.

WATER

At first glance, water and patterns of urban growth may seem disconnected. However, since the beginning of human civilization, settlements have been locating within reasonable distance of a body of water to meet drinking, domestic, and trade needs. Since that time, technologies and policies, such as underground water infrastructure and water licensing programs, have created densely interwoven systems.

Even though a clear relationship exists between water and urban development, little actual research has been done on how the supply of water as a utility can shape urban development, or how water can be intentionally used as a growth management tool. The following sections will trace how this seems to be unfolding in Alberta by looking at Calgary and Edmonton practices.

Water in Alberta

All of the water in Alberta is owned by the Crown and managed by the Province. Under its Water Act, the Province requires an individual, municipality, or business to obtain a water license to use any ground or surface water.

Among the exceptions are statutory household use and traditional agriculture use.

Cities may start to take proactive and reactive measures to manage which areas they supply, as over-exploited water supplies diminish—and through this process, shape growth.

There are seven major river basins in Alberta. Calgary is located in the South Saskatchewan River Basin, which consists of four river sub-basins: Bow River, Red Deer River, Old Man River, and South Saskatchewan River. Edmonton is within the North Saskatchewan River Basin. The supply and demand for water in Alberta is mismatched as 80% of Alberta's water is located in the northern part of the province, while 80% of the demand is in the south. Water diversions, 97% of which are for surface water, are managed by Alberta Environment and Parks under the *Water Act*.

The city of Edmonton has the largest regional water supply system in the province, providing water to places over 100 kilometres from Edmonton's border. Since 2006, water license applications for portions of the South Saskatchewan River Basin have not been accepted by the Province because of the low water levels in the rivers. This moratorium on the issuing of new water licenses created Canada's first market-based system to transfer or trade water licenses.

Much like agricultural land consumption, both population growth and increases in low-density development increase water consumption. The difference between population growth and decreases in density is that low-density living often increases water consumption per capita (Smart Water, 2003). Correlations have been found between lot size and water consumption (Smart Water, 2003; Apartment Living is Green, n.d). However, according to Shepel et al. (2010), although absolute water consumption in Edmonton has increased over time, EPCOR notes that consumption per capita has gone down, which could be due to increases in overall density or to residents trying to consume less.

Water Supply to Municipalities

Growth of or in new communities is the main factor shaping the circumstances under which a water supply is established. Both Calgary and Edmonton have expanded their underground water infrastructure to great distances to service their own suburbs as well as smaller surrounding municipalities. In 2008, the residential and multi-residential uses within Edmonton accounted for only 49% of the water consumption in Edmonton, while supply to regional municipalities accounted for 26% (Shepel et al., 2010). It appears that Edmonton attaches no conditions to its supply of water to these regional areas; it also appears that it has no say in the growth of surrounding municipalities.

However, the relationship between water availability and growth of satellite communities may be getting more complicated. As water supply becomes more restricted in response to being over-exploited—that is, cities start to take proactive and reactive measures to manage what areas they supply—growth may become dependent on the supply of water. For example, a provincial cap on the number of available water licenses on the Bow River Basin has already begun to limit or change the pattern of growth within certain municipalities.

Southern Alberta Water License

As noted, all water in Alberta is regulated through licenses. However, in 2006, the South Saskatchewan River Basin became the first watershed to be closed to new water license applications (Alberta Water Portal, n.d.). The implications here are that municipalities and counties that reach the limit of their existing licenses because of population growth will have to cap growth. Or, they will have to trade or exchange licenses at market price. It is still unclear at this point if this will effectively manage growth so that it is contiguous and sustainable to service, or whether growth will simply be pushed elsewhere.

According to experts like Pernitsky and Guy (2010), and my own calculations, the City of Calgary holds the largest municipal water allocation (about 93.5%) in the South Saskatchewan River Basin, apart from the licenses held by three irrigation districts. This large allocation of water allows for significant growth within its municipal jurisdiction, but at the expense of growth elsewhere in the region. Some exceptions have occurred however, such as the Cross Iron Mills Mall in Rocky View County, which was made possible by the transfer of water licenses from the Western Irrigation District. Another example is the Town of Okotoks' recent agreement with Calgary for water supply and sewage treatment in order to help expand the town's growth from its current population of 28,000. It is just not Okotoks, Chestermere, a city of about 19,000 people also receives its water from the City of Calgary and sends its waste water back to the City's treatment system to be treated.

Wet Growth

A credible source indicated to us that future growth in the Calgary region would take place only if and when the growth can afford the cost of the water; this would lead to more efficient development patterns to manage service costs. Arnold (2005) refers to this as a "wet growth," which connects water quality and availability of supply to the density, form, pattern, and location of development. In his opinion, wet growth could be a more sustainable strategy to regional growth. He cites several American examples, such as Senate Bill 221 in the State of California, which prohibits cities and counties from approving subdivisions of 500 or more residential units, unless the local water agency verifies in writing that it has enough water to serve the new development for 20 years.

According to Arnold (2005), growth moratoria based on water concerns have been upheld in the US courts, giving it a legal legitimacy. He cites the recently upheld US Supreme Court moratorium enacted by the Tahoe Regional Planning Authority on new development surrounding Lake Tahoe. The moratorium is in place to stem declining water quality because of development-related runoff.

Beveridge and Droitsch (2010) support the implementation of Arnold's concept of wet growth in the Alberta context. In their opinion, the value of watersheds and their role in providing a clean

supply of water are often not integrated into land use planning processes in Alberta. They characterize wet growth as the new smart growth. They say,

Understanding the carrying capacity of a landscape or watershed and identifying the “critical threshold” at which point the amount or intensity of the land use becomes too much for ecological processes to function properly are critical for sustainable land use planning. (p. 44)

Calgary

Water and wastewater services in the city of Calgary are managed by Water Services in the Utilities and Environmental Protection Department (City of Calgary, n.d). Under the *Water Utility Bylaw*, all homes in Calgary were required to switch to water meters by the end of 2014 (City of Calgary, n.d). Until recently, Calgary could only supply water for two million residents; however, through water management and education they have been able to adjust their consumption to allow for three million residents. The interesting aspect to Calgary’s reduction in water is that they are not curbing growth. Rather, they are simply reducing per capita water increase, perhaps to allow for even greater growth in the future.

Edmonton

The sole source of water for the city of Edmonton and the other municipalities that rely on Edmonton’s water, is the North Saskatchewan River watershed (Shepel et al., 2010). Edmonton’s water and wastewater infrastructure and services are provided by EPCOR Inc., which began as an Edmonton utility 120 years ago and is now a commercial entity of which Edmonton is the sole shareholder (EPCOR). At present, all water use in the city is metered (Shepel et al. 2010).

Although water is not presently an issue in the Edmonton region, the rapidly shrinking Columbian and other icefields that feed the North Saskatchewan River could lead to a future water crisis. Shepel et al.’s (2010) study shows that the water flow has been decreasing for 50 years. Even if anticipated climate changes are unlikely to significantly affect the total volume of water in the river basin, there is potential for significantly lower summer flows. In such a scenario, Neufeld (2010) raises concerns about higher contaminant levels in the water, making it harder to drink. Should this occur, water licenses in the North Saskatchewan River Basin could well follow the southern Alberta precedent.

Members of our expert panel members weighed on this issue as well. They opined that it is the access to water that resulted in different urban forms in Calgary and Edmonton, partly because of how water is controlled by the two municipalities. Water is municipally owned in Calgary, where the municipality can use it to control growth. In Edmonton, on the other hand, it is not municipally owned but rather, is run as a corporation wholly owned by the City—that is, EPCOR Inc. Therefore, it might not be used to control growth because if the City can justify making a profit out of it, it will allow the growth to move further out. As per City of Edmonton (2016), EPCOR dividends contribute 5.6% of the City of Edmonton’s revenue (\$141 million) for each of the next three years.

Regulating water could emerge as an important tool in the near future to manage growth, decrease waste and consumption, and encourage municipalities to coordinate their growth.

Other Regions in Alberta

While smaller municipalities in Alberta represent less of the overall population than the two large cities, some of them, like Grande Prairie (a 24% increase in population since 2011), are growing at much faster rates than Calgary and Edmonton (Martellozzo et al., 2014). About 12% of Albertans and 90% of rural Albertans rely on groundwater as their private source of water (Alberta Agriculture and Forestry, 2008). These users do not pay for their water consumption, but this privatized water supply may contribute to inefficiencies and over use.

Water as a Growth Management Tool

As noted before, most of the water licenses in the Bow River are held by the City of Calgary. Because Calgary supplies water to a number of municipalities in the area, at first glance this would appear to give them the ability to control the consumption of these municipalities it services. However, according to the Calgary Metropolitan Plan (2014), the City of Calgary will only service those member municipalities that achieve minimum density targets as outlined in the Plan. Based on this, one could argue that in the Calgary region water is already being used as a growth management tool, especially as the City of Calgary administration sees this potential. Water is something that all municipalities need, but do not have. As such, this resource can be used to positively influence urban development patterns; but, under this model, one municipality here calls the shot.

Some municipalities in the region have found a work-around through the licensing system. For example, Rocky View County, which borders Calgary on the north, east, and west, has been able to purchase additional water licenses from irrigation districts such as the Western Irrigation District. This will allow future growth in the Conrich region (Rocky View County, 2011). This means that if Calgary tries to limit growth on their periphery the result will likely be a leapfrog

over into the County, contributing to the problems associated with non-contiguous development far from the city centre.

The Town of Okotoks demonstrates how the free market trade of water licenses may encourage or at least allow for continuous outward growth. Between 1998 and 2012, Okotoks capped its growth at 30,000 residents based on the water supply available to them. Given the water license market, the town has negotiated the transfer of water licenses from the City of Calgary to expand above this 30,000 limit, lifting its long-held population cap. Recently, the Town also bought a new water license from an irrigation district to allow further growth. This is a vicious cycle. Unfortunately, a municipality like Okotoks must pursue growth now, in order to pay for its future water and sewage infrastructure and to increase its tax base (Querengesser, 2014).

SUMMARY

The section of the report discussed a number of growth management tools like zoning, urban growth boundaries, regional planning legislation, and water as the new potential ways of managing growth. There is little systematic evidence of how water works to shape urban development, in Alberta or elsewhere. Still, Edmonton and Calgary, and their surrounding municipalities, seem to be using their water resources to further their agendas, albeit in different ways. Edmonton has not had to grapple with water shortages in the way that Calgary has and has shown little resistance to servicing new greenfield development on their fringes or any of its 61 satellite municipalities.

While water is a strong tool in principle, the City of Calgary and the Calgary Region are only able to apply these standards to those regional municipalities that require their services and only on the terms imposed by the City. We have noticed some Calgary regional developments that have leapfrogged because they could purchase or transfer licenses, for a price, on the free market. Some could argue that Calgary is not holding to its own density standards—it has its own water source and thus could continue to grow as it is now. Others could argue that the current disarray among municipalities in the Calgary region is partially because of the water licensing system.

Although we do not yet have a full grasp on water in relation to growth, the current situation suggests that regulating water could emerge as an important tool in the near future to manage growth, decrease waste and consumption, and perhaps encourage municipalities to cooperatively coordinate their growth. With a proper regulatory framework from the Province, water will thus not only be considered a public good, but also a resource that can be commodified to effectively shape efficient growth. One place to begin is the Land Use Framework: surface water supply and quality could to be integrated with efficient land use strategies, so that the two work in tandem rather than in isolation.

5. DENSITY: DATA ANALYSIS AND RESULTS

While the efficiency of urban and suburban form has been measured in many ways, academics and practitioners most commonly use dwelling unit density to measure this form. Taking a broader approach, we also analyze population density. This is meaningful to include as a single-family home with four occupants may in fact be denser than a duplex with lone occupants in each dwelling. Analyzing data from The Participatory GIS (PGIS) database from the Capital Region Board provides insight into the Edmonton region's urban footprint, and helps to build a clearer picture of its development patterns prior to and following the creation of the board.

To compare the urban footprint of Edmonton's CRB region with that of the Calgary Regional Partnership (CRP), the satellite imagery data from the Alberta Biodiversity Monitoring Institute (ABMI) was used since the PGIS data was unavailable for both regions. This allowed us to compare across regions. We also used population census data from Alberta Municipal Affairs to determine the population densities of each of the regions. The empirical evidence paints a clearer picture of the development patterns of Alberta's largest urban centres, each of which is described in further detail below.

EDMONTON AND REGION

The Edmonton Metropolitan Region is composed of 24 municipalities comprising 19 cities, towns and villages, and five counties, totaling 1,238,447 hectares of land and 1,244,428 residents. With the exception of Lamont County and the Town of Lamont the remaining 22 CRB members belong to the Edmonton Census Metropolitan Area (CMA), which is the fifth largest CMA in the country and the second fastest growing over the past decade, behind only Calgary. The result of this development has been an expanding urban footprint within the region as observed through the PGIS data, which analyzes parcel-level data to calculate the total urban footprint.⁵

The Capital Region Board (CRB)

The CRB was established in 2008 to promote coordination and cooperation between municipalities within the Edmonton Metropolitan Region. The board has authority over land use planning and inter-municipal transit and, unlike the Alberta Capital Region Alliance which preceded it, had power through the MGA to ensure municipalities follow regional goals and visions.

With regards to decision making at CRB, each member municipality has one vote. The MGA requires that any decisions made by a vote must have support from at least 17 representatives

⁵ Using parcel data does not account for services such as roads, but does include urban-related land uses such as parks and natural areas. Further, this method of calculating an urban footprint assumes that all planned subdivided land areas have been built upon and put to "urban" use.

from participating municipalities, which collectively have at least 75% of the population in the capital region. Since Edmonton has about 70% of the region's people, it has an effective veto at the CRB. This has been a point of contention among the members of the board.

The CRB's principles include protecting the environment and resources, minimizing the regional footprint, and supporting regional economic development, all of which have implications for agriculture. Obviously then, preserving agricultural lands is an important aspect of environmental protection and the board is required to identify agricultural lands and buffer areas. They must work with municipalities to identify agricultural land that should be protected from fragmentation or conversion.

Successfully managing agricultural land clearly requires working on multiple geographic scales, with policy that addresses both geographic and ecological concerns (Foley et al., 2005) Martellozzo et al. (2015) suggest that regional plans within areas such as the Calgary-Edmonton corridor are in need of "effective policies and regulations" so that future land use changes in response to growth do not result in the continued loss of capable agricultural land. The CRB is one piece of a necessary, multi-pronged approach.

Comparing the amount of urbanization in the five years before and after the CRB was formed, our analysis shows that the urban footprint has decreased substantially—from 26% in 2003 to 2008, to 18% in 2009 to 2014. It would be imprudent, however, to ignore the impact of Alberta's boom and bust economy on development patterns; for example, the 2008 financial crisis that led to three years of reduced development (Canada Mortgage and Housing Corporation [CMHC] Summary in the City of Edmonton's 2015 Growth Report) could reflect the prevailing economic climate at the time.

Densities in the Capital Region Growth Plan

The Capital Region Growth Plan calls for a net residential density target for Priority Growth Areas (PGAs) and a gross residential density of 2 units/gross hectare in Cluster Country Residential Areas in an effort to conserve open space. These developments are areas that "accommodate a mixture of agricultural and rural residential lifestyles" and have traditionally been associated with large parcels, areas greater than 2 acres in many counties.

CRB's Land Use Growth Plan identifies PGAs through sustainable development criteria that call for intensification, multimodal transportation, contiguous growth, adjacency to core employment areas, utilization of existing infrastructure, and so forth. (Capital Region Board, 2009b). The PGAs use regional rather than municipal boundaries to promote regional cooperation on matters such as transit and transportation. The CRB also specifies the density targets for the PGA, non-PGA areas, and Cluster Country Residential Areas. However, the new draft growth management plan asks for much higher density targets in these and other areas of the region.

A recent study conducted by planning students from the University of Alberta (Penchuk et al., 2016) under my guidance reveals that the MDPs within the capital region are largely consistent

with the principles of the CRB’s growth plan. However, the approaches MDPs take to accomplish this vary—mainly along the urban and rural lines, and their size and their location within the capital region. The principles most explicitly addressed are:

- Protect the environment and resources
- Strengthen communities
- Support regional economic development

Inter-municipal cooperation to align with these principles is marked by how close together the communities are—proximity and adjacency are essential for success. The smaller municipalities tend to cooperate for shared provision of services, while the larger ones focus on transportation, economic development, and areas where their boundaries meet. The CRB has identified targets in PGAs and Cluster Country Residential Areas that are not fully addressed, but the CRB still seems to have had an effect on the way municipalities in the region grow.

Between 1974 and 2014, Edmonton region’s urban footprint grew by over three-fold.

Including Edmonton’s Urban Footprint

As of 2014, 17.7% of the Edmonton Metropolitan Region has been urbanized (See 2014 CRB Footprint Map 1.01), with the urban footprint increasing by 312%, or more than three times, since 1974.⁶ However, using the urbanized footprint as a base, over this same period the region’s population density has decreased to half of 1974 levels— from 10.5 persons per hectare to 5.7 persons per hectare in 2014.

Using the PGIS dataset and population census data from Alberta Municipal Affairs, it is apparent that population density across the urbanized Edmonton Metropolitan Region decreased from 7.61 persons per hectare to 6.1 between 1991 and 2012. City of Edmonton’s population density dropped from 24.3 persons per hectare in 1991, to 21.0 before increasing slightly in 2012 to 21.4 persons per hectare. Dwelling unit density as of 2011 was 9.3 dwelling units per gross hectare, which is catching up to the density in 1991.

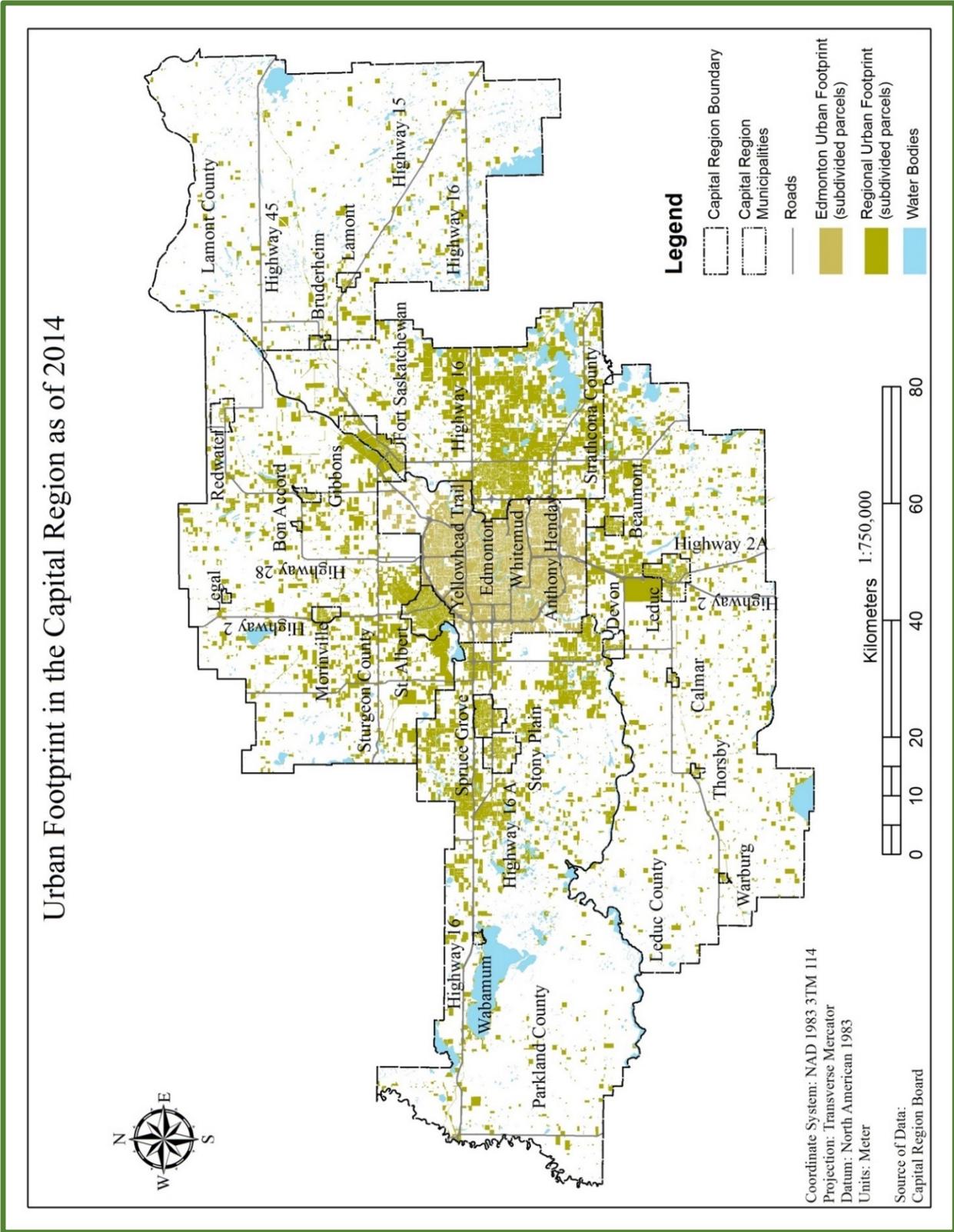
ABMI data, combined with the population census data from Alberta Municipal Affairs, shows similar results⁷ to the PGIS data. The period between 2007 and 2012 showed slight increases in population density, from 20.9 to 21.3 persons per hectare, and dwelling unit density, from 8.7 to

⁶ The Region’s evolving urban footprint between 1974 and 2014 are encapsulated in Maps 1.02 to 1.06.

⁷ Note that densities may differ between PGSI (refer to note 1) and ABMI data, as the footprint of each is calculated differently. The ABMI dataset consists of polygons (similar to the PGIS parcel data); however, it classifies each polygon as a “type”—Urban, Other Disturbed Vegetation, Rural (Residential/Industrial), Industrial Site Rural—to build the human footprint.

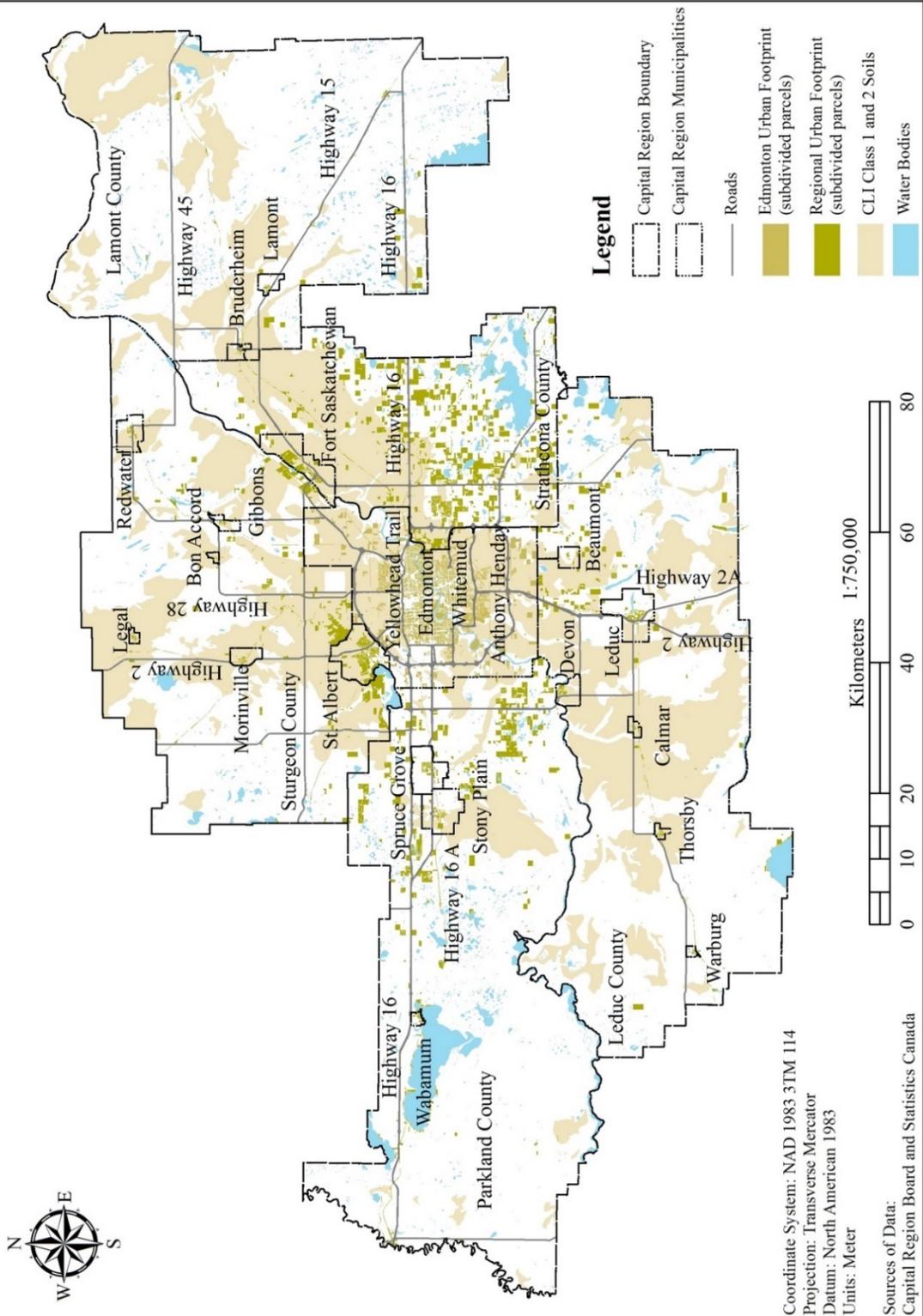
9.3 units per gross hectare. Throughout the region, including the city of Edmonton, population density rose by 5.5%, from 10.4 persons per hectare in 2007 to 11.0 in 2012.

Urban Footprint in the Capital Region as of 2014

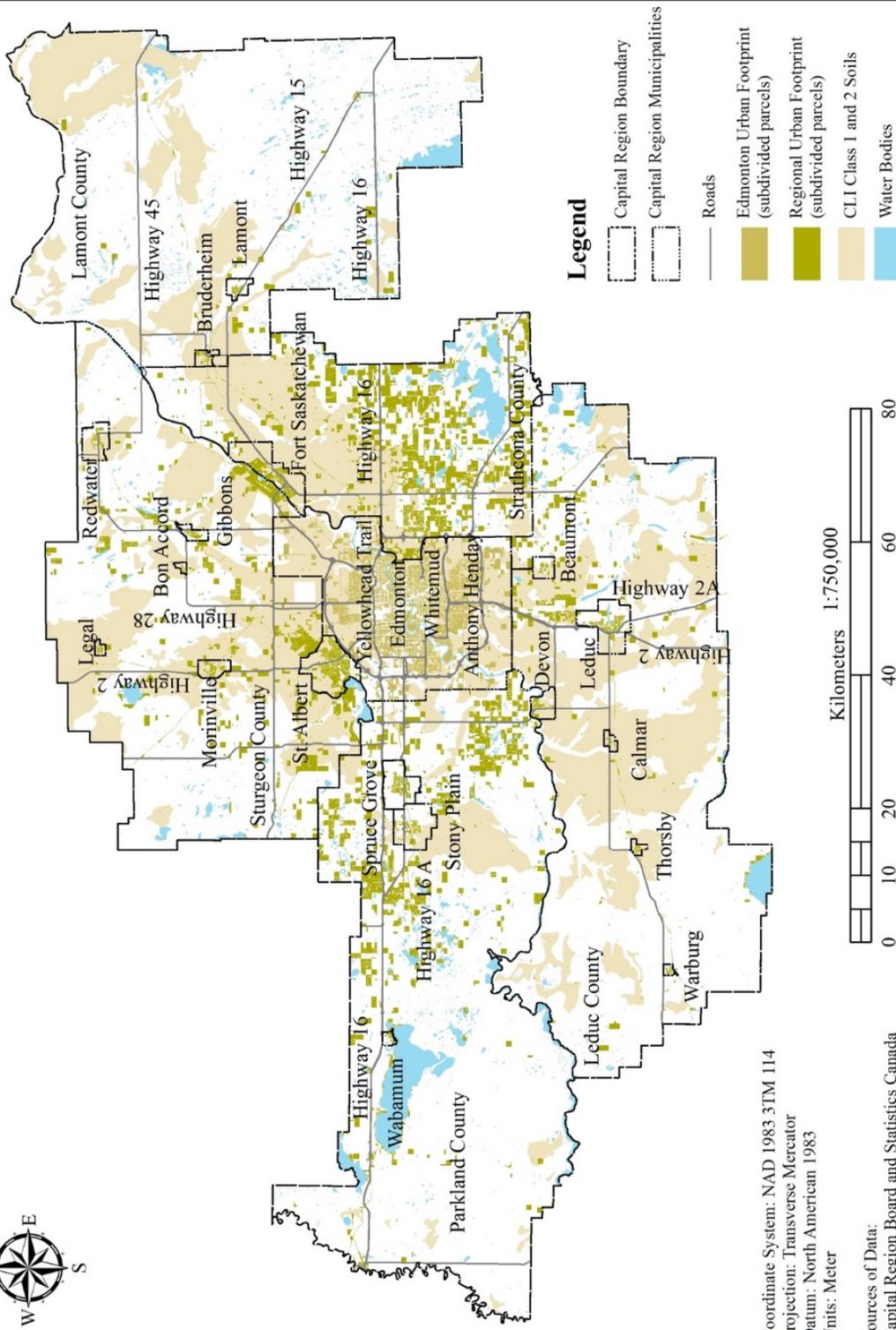


Map 1.01

Urban Footprint in the Capital Region as of 1974 and CLI Class 1 and 2 Soils



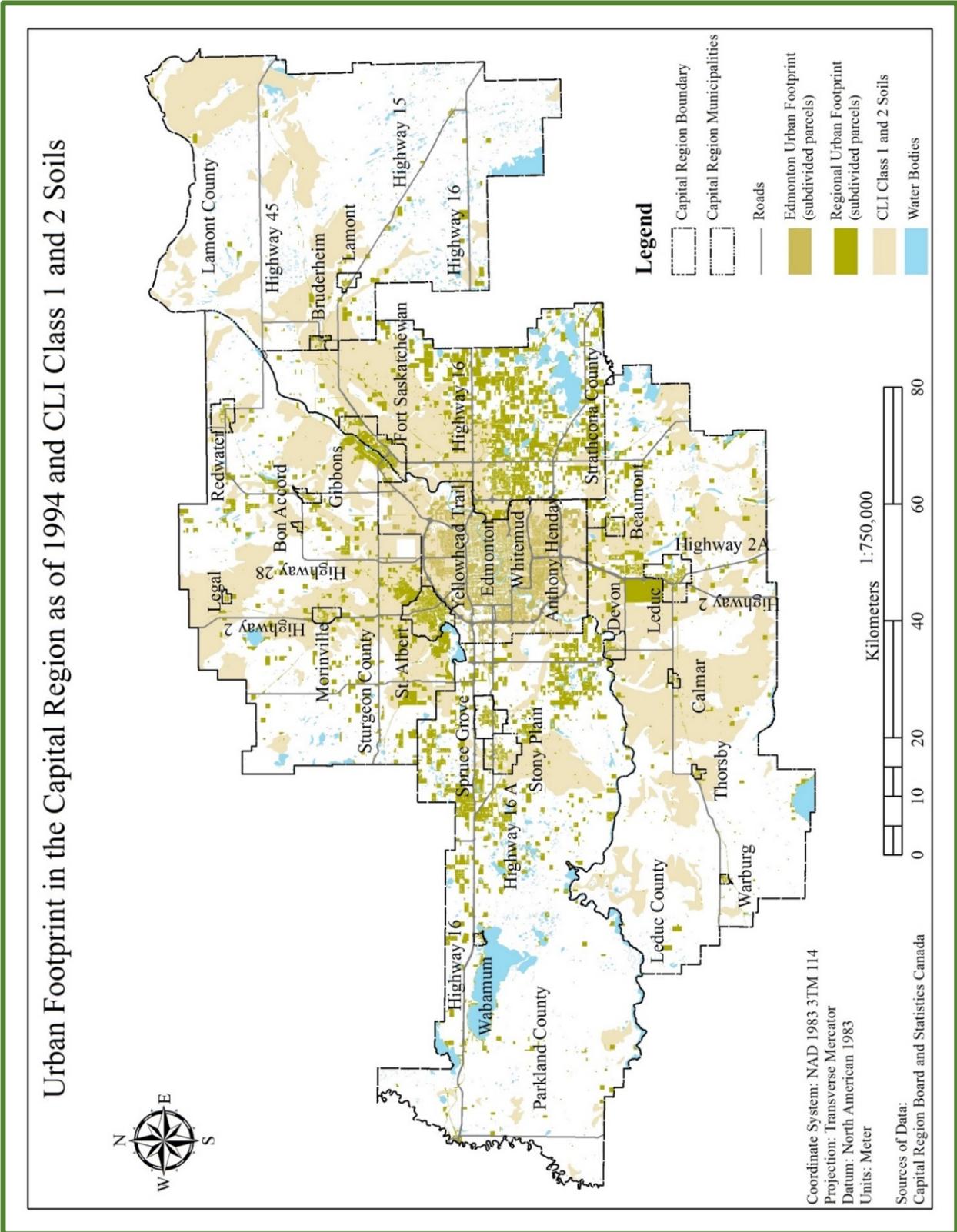
Urban Footprint in the Capital Region as of 1984 and CLI Class 1 and 2 Soils



Coordinate System: NAD 1983 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983
 Units: Meter

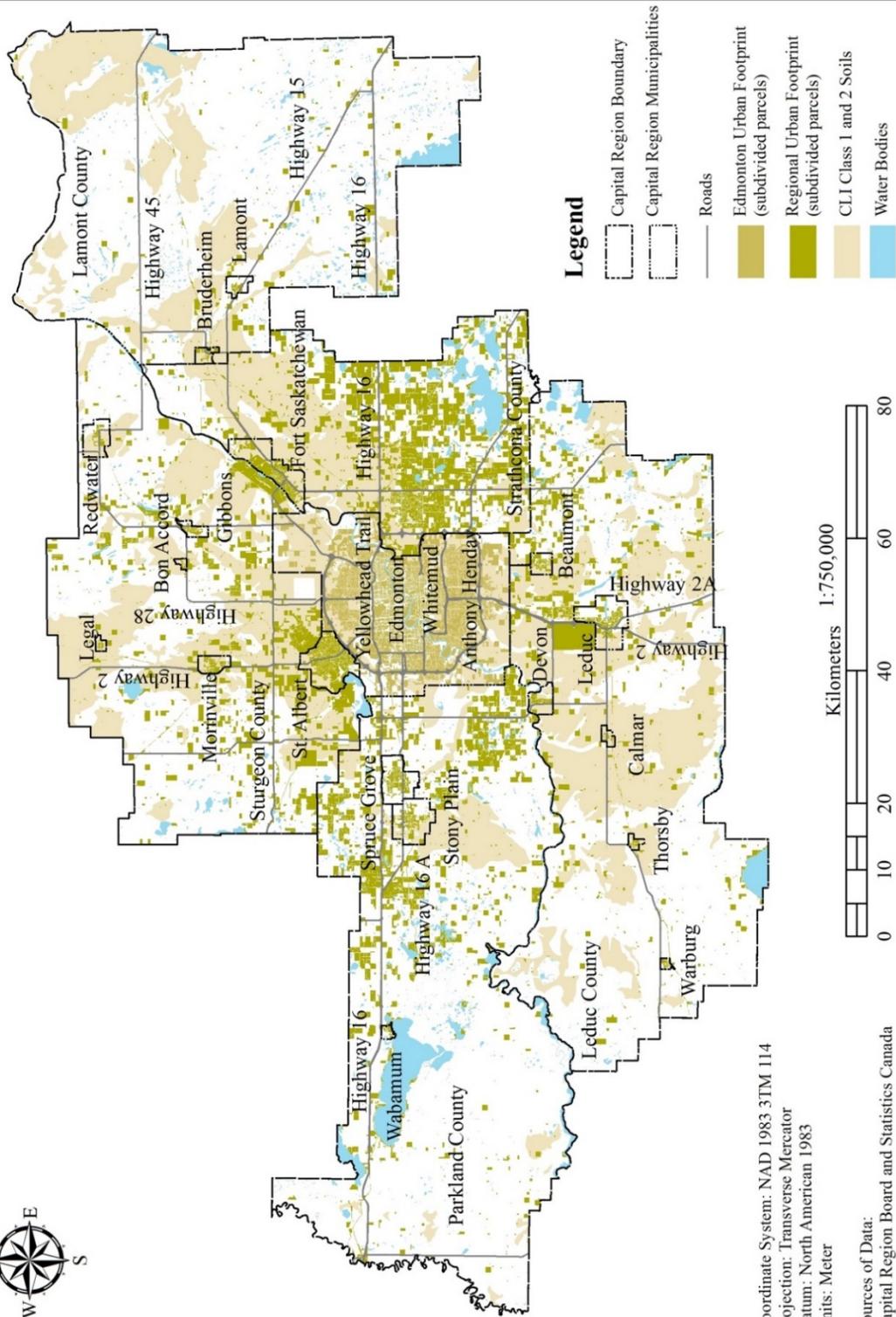
Sources of Data:
 Capital Region Board and Statistics Canada

Urban Footprint in the Capital Region as of 1994 and CLI Class 1 and 2 Soils



Map 1.04

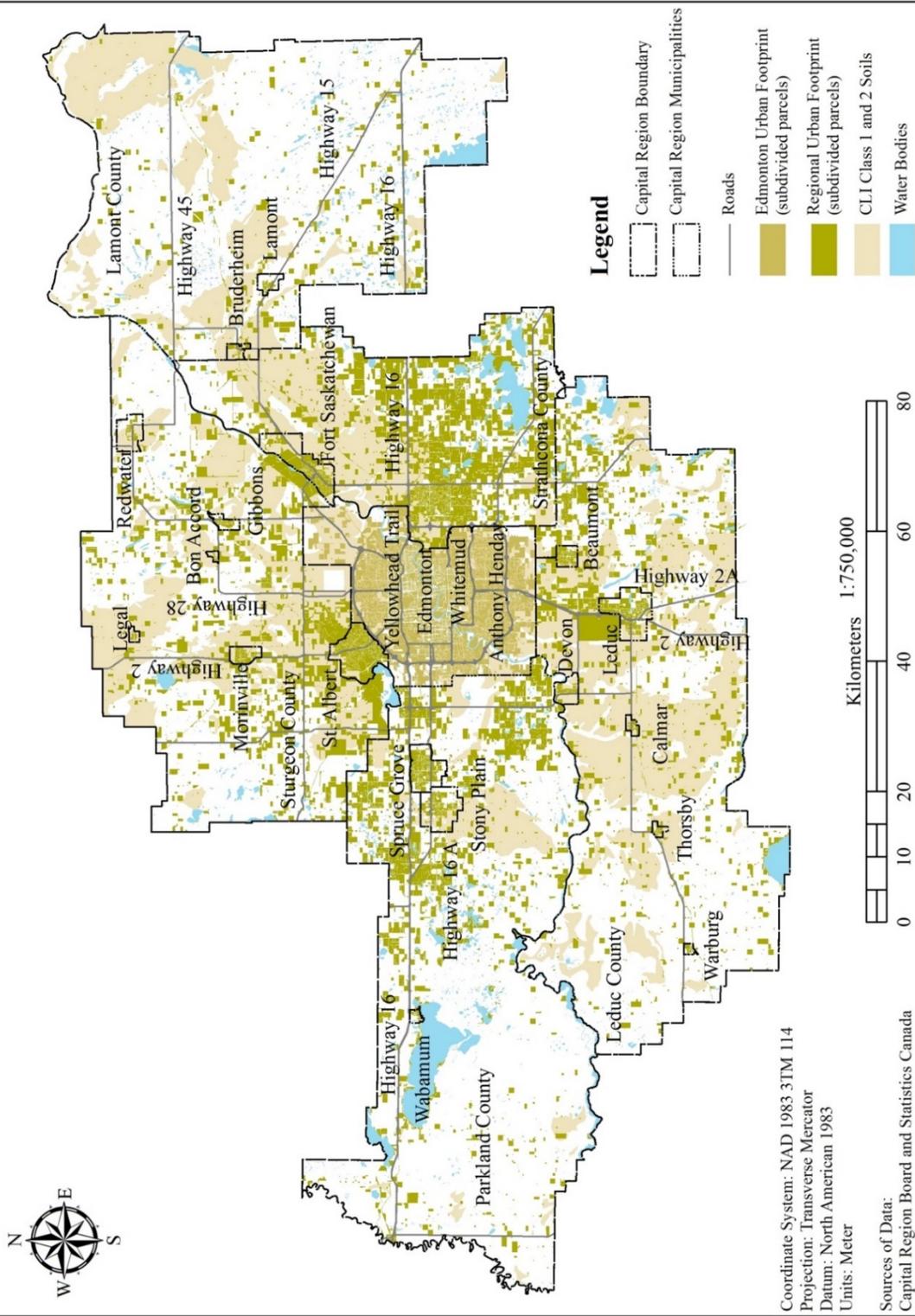
Urban Footprint in the Capital Region as of 2004 and CLI Class 1 and 2 Soils



Coordinate System: NAD 1983 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983
 Units: Meter

Sources of Data:
 Capital Region Board and Statistics Canada

Urban Footprint in the Capital Region as of 2014 and CLI Class 1 and 2 Soils



Map 1.06

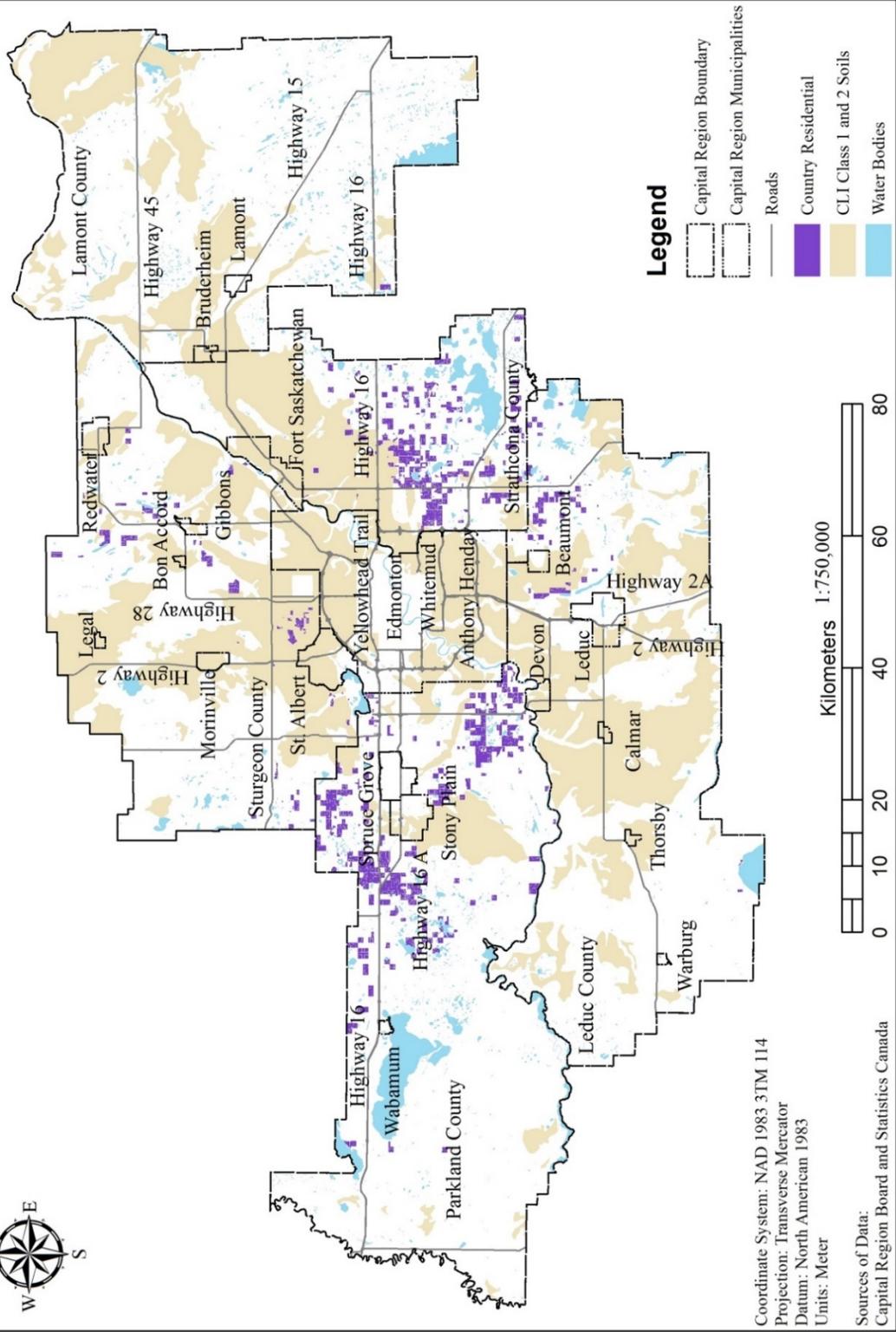
Excluding Edmonton's Urban Footprint

To ascertain the urbanization trend outside of the Edmonton city limits, we excluded Edmonton's urban footprint from the Edmonton Metropolitan Region. We then find that urbanization in the rest of the region is about 15.3% (slightly less than 17.7% when the city of Edmonton was included). Of this urban footprint, 15.6% is classified as country residential development (See Map 1.07). Between 1974 and 2014, the urban footprint outside of Edmonton increased by more than three and a half times, expanding by 364%, while the population over the same period rose from 115,134 in 1974 to 366,502 in 2014, an increase of three times. Proportionately, over the past 40 years the footprint outside of Edmonton has expanded at a greater rate than the population growth.

Looked at over 10-year intervals, the maximum proportional increase in the urban footprint is between 1974 and 1983, which shows an increase of 97%. This period of rapid expansion coincides with the 1970s Energy Crisis and soaring oil prices, which brought about the economic boom in Alberta (CBC Learning, n.d.). Over this time period, the largest increase in urban footprint beyond the city limits occurred in the years 1976, 1977, and 1978. However, the collapse of oil prices and the 1980s oil glut would slow the Edmonton Metropolitan Region's growth over the next two decades. Another turn came with the rising oil prices during the 1990s, coupled with the Progressive Conservative government's belt-tightening on expenses, which would again bring periods of prosperity and expansion to Alberta (CBC Learning, n.d.). Overall, a 42.7% increase in the urban footprint occurred between 1974 and 2014, with the largest increases in 2007, 2008, and 2009.

Interestingly, when looking only at the areas surrounding the city of Edmonton, the combined PGIS data and population data from Alberta Municipal Affairs show density decreased rapidly from 2.7 persons per hectare in 1991 to 2.3 in 2001, before dropping slightly again in 2012 to 2.1 persons per hectare. This differs slightly from the ABMI data, which shows a slight population density increase between 2007 to 2012, from 4.2 to 4.6 persons per hectare, and a dwelling unit density increase from 1.8 to 2.1 dwelling units per gross hectare. As noted before, the two datasets use different method and variables, which account for the differences in the results.

Capital Region Country Residential Urban Footprint and CLI Class 1 and 2 Soils



Map 1.07

GROWTH AND SOIL CONVERSION

The Canada Land Inventory Soil Class Rating System provides a numerical ranking from 1 to 7 based on the growing capability of soil. Class 1 soils are considered to have little to no limitations for producing crops while also being deep, adequately drained, and able to hold moisture well (Strathcona County, 2007). Class 2 soils, like Class 1, are both deep and hold moisture well.

Based on our calculations from Statistics Canada data, 29% of the area from Edmonton to Calgary, including the two metropolitan regions and the counties along the Queen Elizabeth 2 (QE2) highway corridor, consists of class 1 and 2 soil.

Between 2007 and 2012, the rate of consumption of agricultural land was 9.2%, but this rate varied considerably between the two metropolitan areas and the connecting corridor. It is much higher (20%) in the Calgary area, about 8.5% in the Edmonton area and 3.6% along the QE 2 corridor.

Between 1974 and 2014, Edmonton region saw nearly four-fold increase in development on the most fertile land in the area.

Between 1974 and 2014, the Edmonton Metropolitan Region experienced a nearly four-fold increase (386%) in development on some of the most fertile land in the area, accounting for approximately 16% of the total Class 1 and 2 soils in the region (346,276.93 Ha, ~ 28% of the region). Of the development currently covering these highly fertile soils, 14.7% is country residential (Map 1.07).

Before the formation of the CRB in 2008, about 28% of new development took place on Class 1 and 2 soil; five years after its formation, this figure dropped to 18%. Unsurprisingly, the majority of this soil disturbance occurred from 1974 to 1983 (85% of new development) and more recently from 2004 to 2014 (44% of new development). These two particular decades had the largest maximum proportional increases in the urban footprint. Comparing soil disturbance, exclusive of the city of Edmonton, Class 1 and 2 soil disturbances have decreased substantially to 14% from the 32% prior to the board's establishment.

CALGARY AND REGION

The Calgary Regional Partnership (CRP) is a voluntary partnership that consists of 14 municipalities working collaboratively to coordinate sustainable growth within the Calgary region. Although not members of the CRP, we have included the four surrounding rural counties within the CRP region. The CRP region spans 1,735,529 hectares and is home to 1,440,818 residents (Government of Alberta, 2014).

Density Targets in the Calgary Metropolitan Plan

The Calgary Metropolitan Plan promotes high-density infill development as a form of sustainable planning, which highlights the City's concern with accommodating 2 million people

by 2070. The plan's minimum density targets are from 8 to 10 units per gross residential acre, tied to regional water and wastewater servicing. This plan also proposes to accommodate at least 25% of new residents by intensifying built-up areas.

As stated previously, the density targets are a concern to rural municipalities. These intensification efforts are seen as contrary to the rural lifestyles that are desirable in these communities. The challenge becomes one of how the region can balance this need for intensification with residents' desires for a traditional rural lifestyle. What is the provincial interest in growth at a regional scale? These difficult questions point to the complexities of land use planning, particularly in housing and urban forms, in the absence of a regional framework. They also point to the importance of building trust between rural and urban counterparts.

The Calgary partnership does not collect data similar to the Edmonton's CRB PGIS data. We therefore used ABMI data to compare the Calgary and Edmonton areas (see Maps 1.11 to 1.13), as well as the cities of Edmonton and Calgary. This allowed us to gather valuable insights into the region. Unfortunately, a drawback of using the ABMI data is that it is available for only 2007 and 2012 and is not parcel-level data. When analyzing the ABMI data and population census data from Alberta Municipal Affairs from 2007 to 2012, Calgary saw a slight decrease in population density from 24.2 persons/hectare to 23.0. City's built-up area and population data from the census also confirm slight decrease in density from 24.7 persons/hectare in 2007 to 23.5 in 2012. However, the city experienced an increase in dwelling unit density from 9.2 per gross hectare in 2007 to 10.2 in 2012.

Across the region, excluding the city of Calgary, between 2007 and 2012 both population and dwelling unit densities increased from 3.7 persons per hectare to 4.2, and from 1.8 dwelling units per gross residential hectare up slightly to 2.2. When including the city of Calgary, population density increased by 1.2% between 2007 and 2012, from 13.2 to 13.2 persons per hectare.

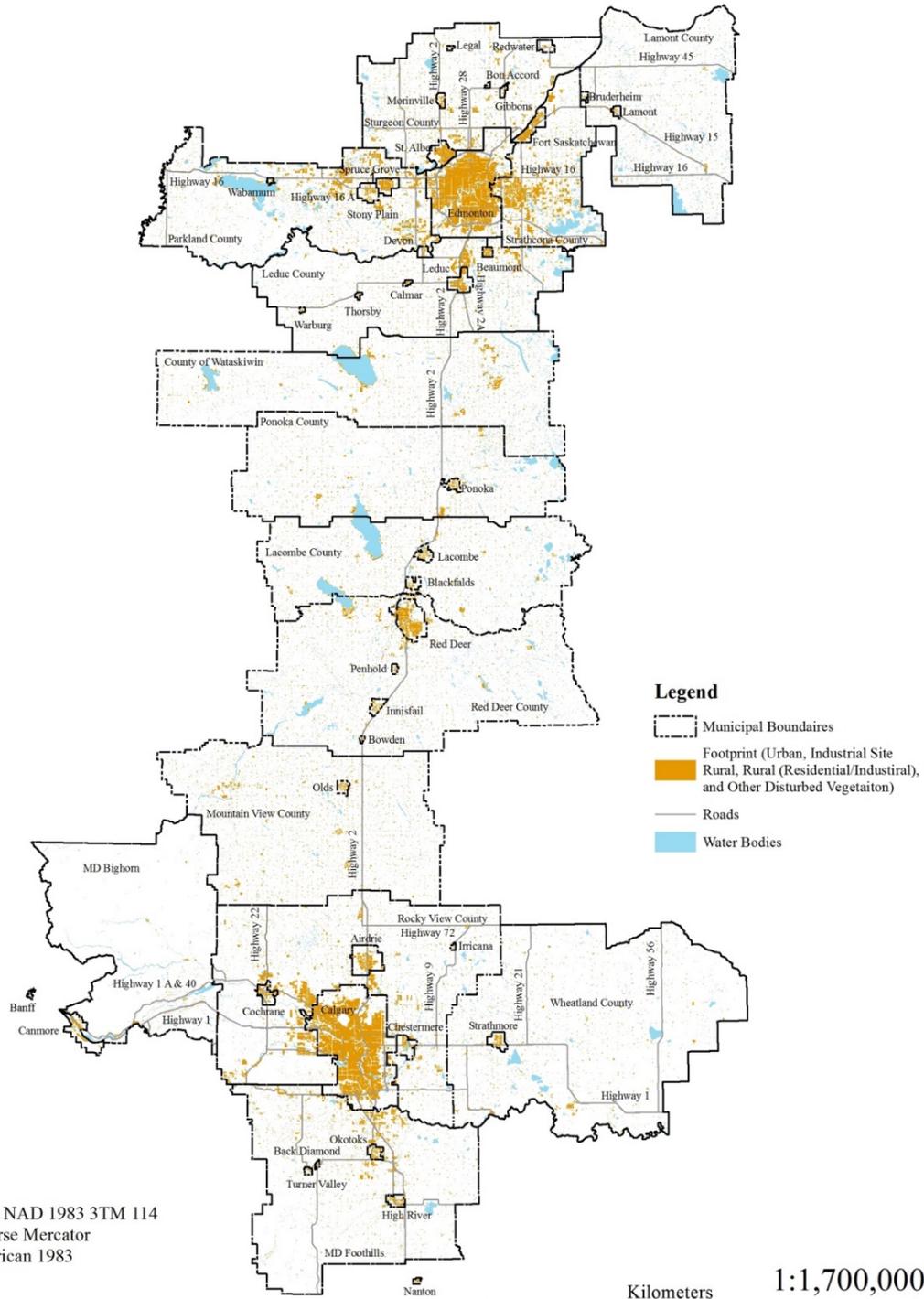
Edmonton-Calgary Corridor

Along the 1,765,954-hectare corridor from Edmonton to Calgary, excluding the Edmonton and Calgary regions, between 2007 and 2012, 4.7% of agricultural land was converted to non-agriculture purposes. This evolving urban footprint can be observed in Maps 1.08 to 1.10. The urban use in the counties—Wetaskiwin, Ponoka, Lamont, Red Deer, and Mountain View—along the QE2 corridor and outside of the boundaries of CRB and CRP, has increased by about 5.3% (slightly over 500 hectares in raw numbers). When we include other types of non-agricultural uses like industrial, rural residential, and other disturbed vegetation, the increase diminishes slightly, to about 4.6% (2033 ha).

Over the years, however, the cumulative effect could be much larger. For instance, at this rate of land conversion—usually an irreversible one—by about 2050, changes might amount to a land area close to that of cities of Lethbridge and Grande Prairie combined. It is noteworthy that across Alberta the area for rural residential has increased five-fold between 2011 and 2015

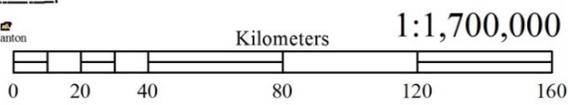
(Alberta Agriculture and Forestry, 2016). Although the government figures show that the area of agricultural land has not changed much, it is possible that more forest, vegetation, and other unused land is being cleared for farming purposes.

Urban Footprint between Edmonton and Calgary as of 2007



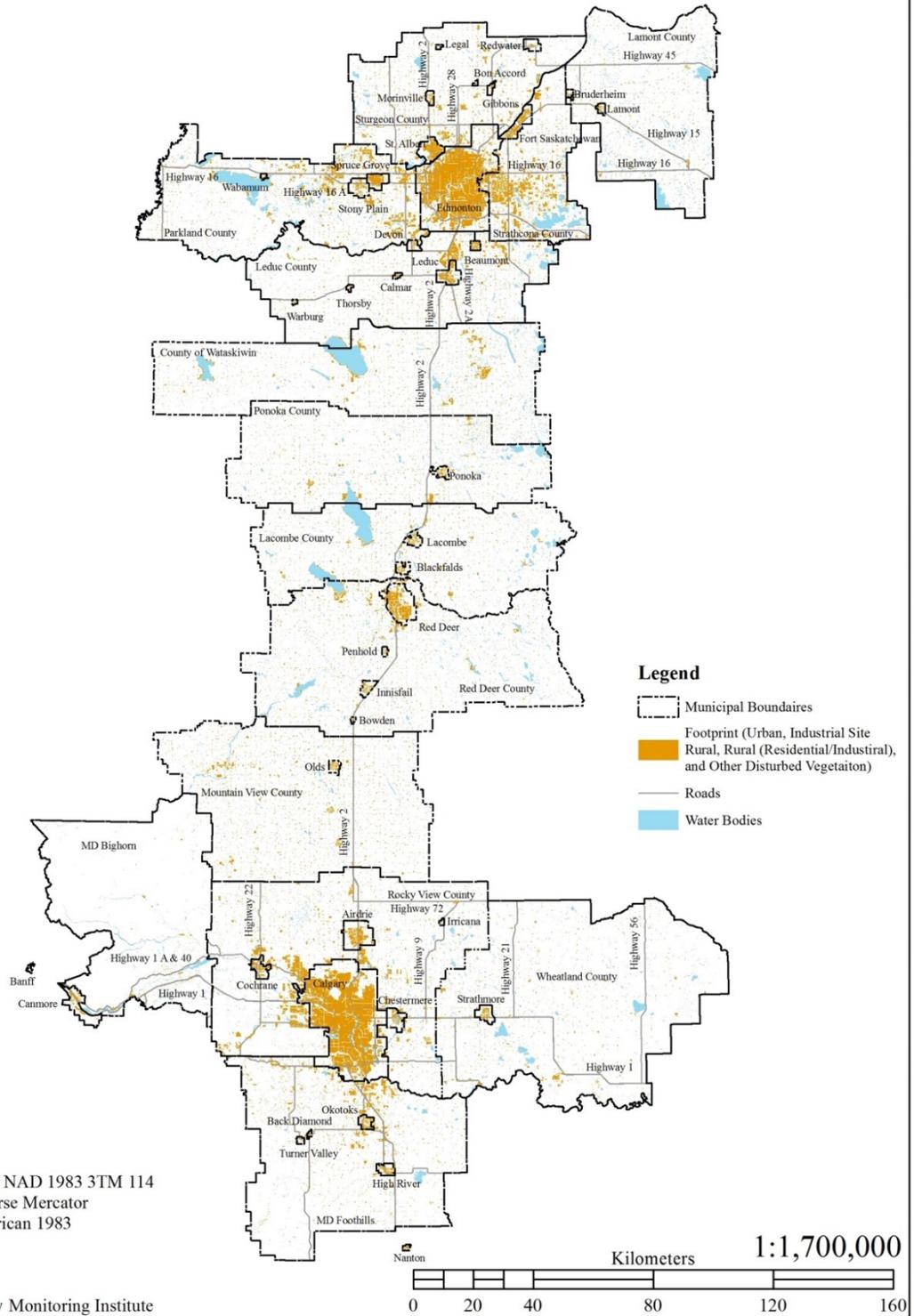
Coordinate System: NAD 1983 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983
 Units: Meter

Source of Data:
 Alberta Biodiversity Monitoring Institute



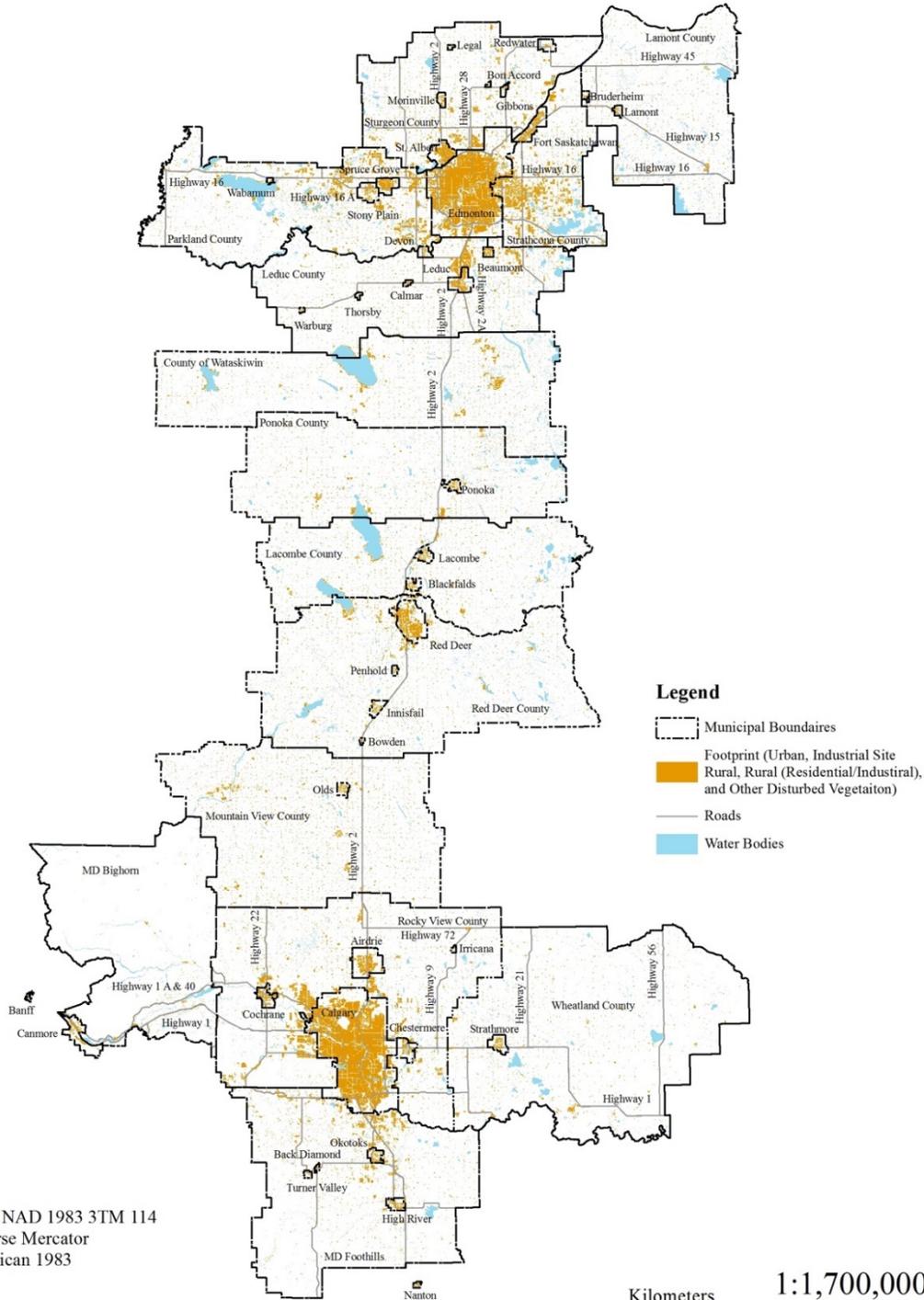
Map 1.08

Urban Footprint between Edmonton and Calgary as of 2010



Map 1.09

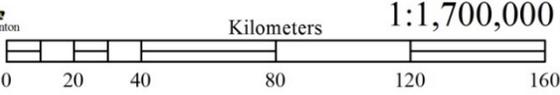
Urban Footprint between Edmonton and Calgary as of 2012



- Legend**
- Municipal Boundaries
 - Footprint (Urban, Industrial Site Rural, Rural (Residential/Industrial), and Other Disturbed Vegetation)
 - Roads
 - Water Bodies

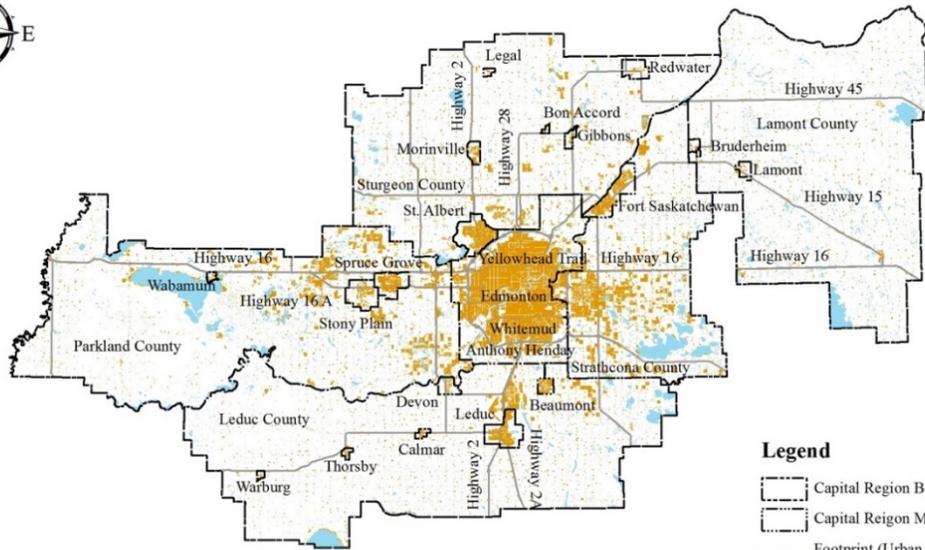
Coordinate System: NAD 1983 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983
 Units: Meter

Source of Data:
 Alberta Biodiversity Monitoring Institute



Map 1.10

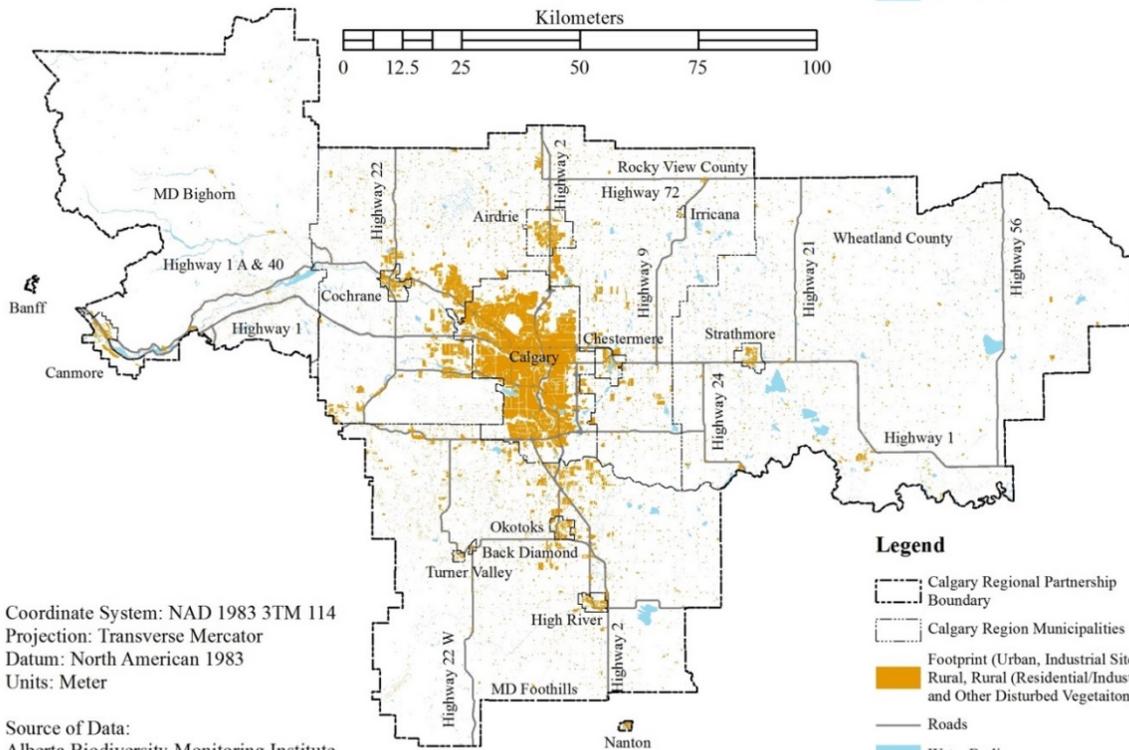
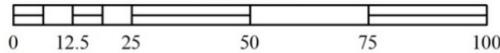
Urban Footprint in the Calgary and Edmonton regions in 2007



- Legend**
- Capital Region Boundary
 - Capital Region Municipalities
 - Footprint (Urban, Industrial Site Rural, Rural (Residential/Industrial), and Other Disturbed Vegetation)
 - Roads
 - Water Bodies

1:1,200,000

Kilometers



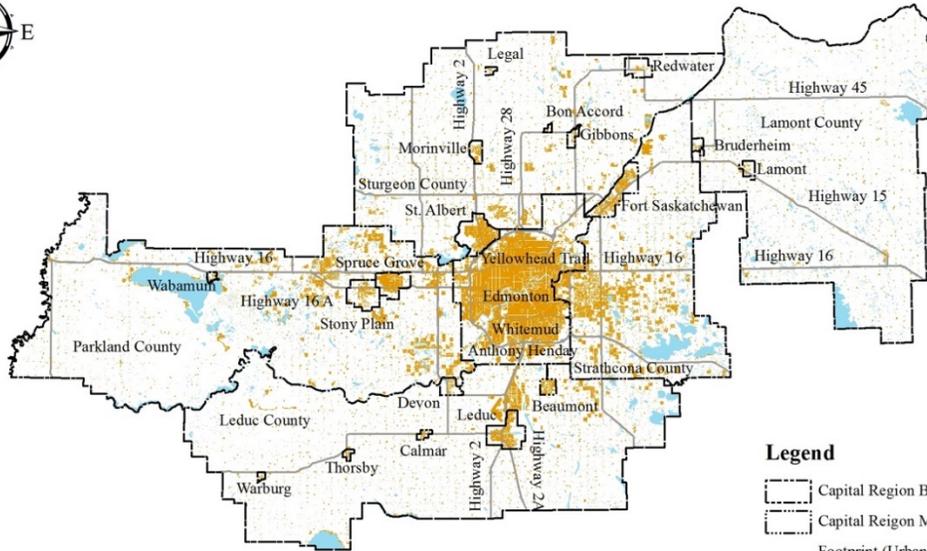
- Legend**
- Calgary Regional Partnership Boundary
 - Calgary Region Municipalities
 - Footprint (Urban, Industrial Site Rural, Rural (Residential/Industrial), and Other Disturbed Vegetation)
 - Roads
 - Water Bodies

Coordinate System: NAD 1983 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983
 Units: Meter

Source of Data:
 Alberta Biodiversity Monitoring Institute

Map 1.11

Urban Footprint in the Calgary and Edmonton regions in 2010

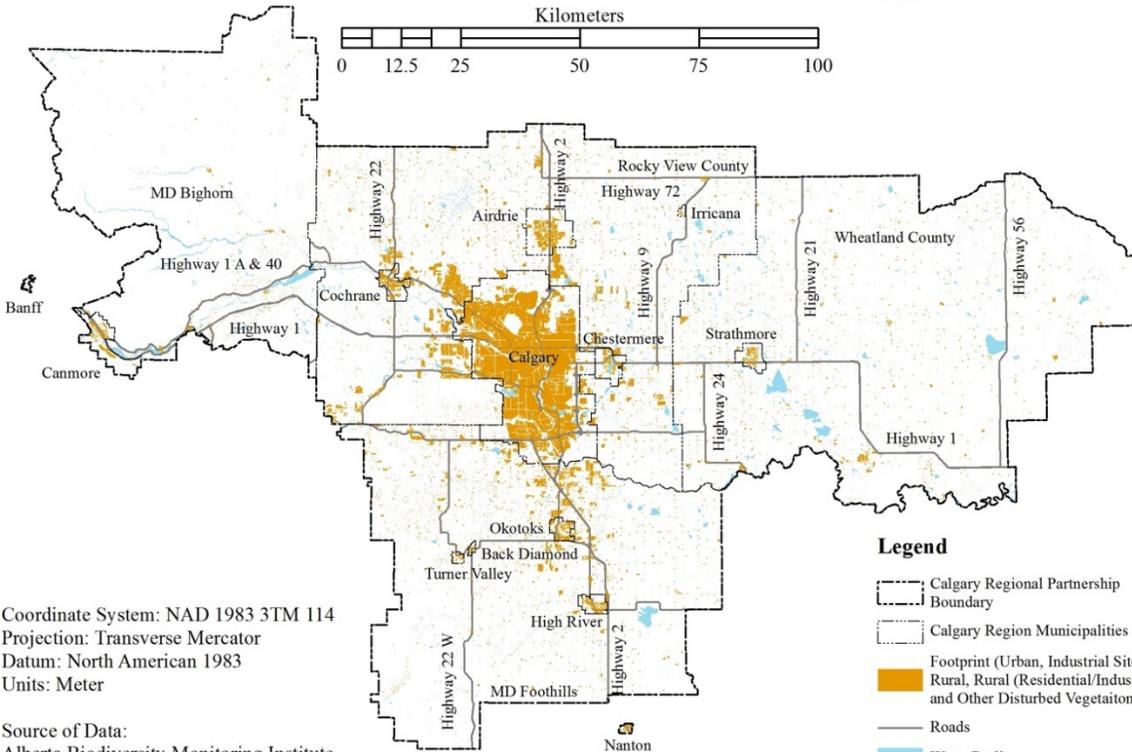
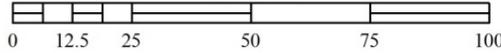


Legend

- Capital Region Boundary
- Capital Region Municipalities
- Footprint (Urban, Industrial Site Rural, Rural (Residential/Industrial), and Other Disturbed Vegetation)
- Roads
- Water Bodies

1:1,200,000

Kilometers



Legend

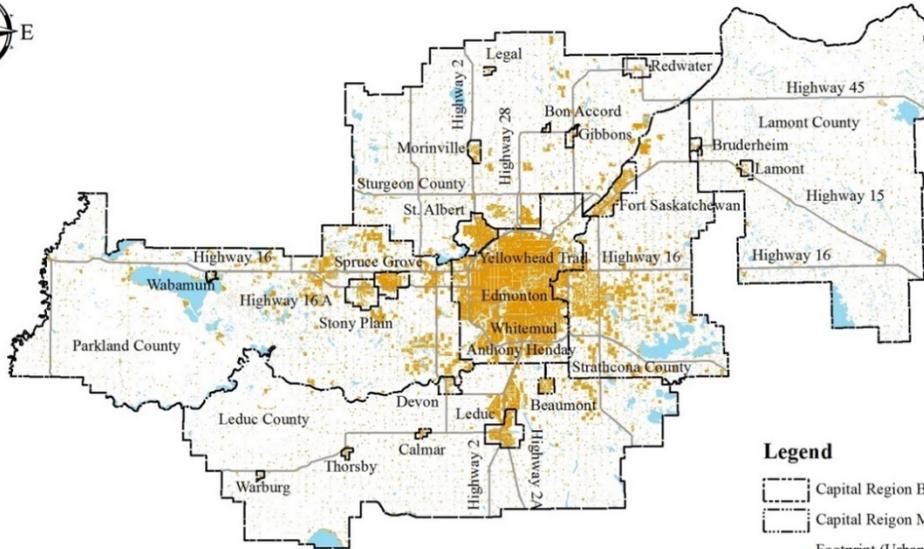
- Calgary Regional Partnership Boundary
- Calgary Region Municipalities
- Footprint (Urban, Industrial Site Rural, Rural (Residential/Industrial), and Other Disturbed Vegetation)
- Roads
- Water Bodies

Coordinate System: NAD 1983 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983
 Units: Meter

Source of Data:
 Alberta Biodiversity Monitoring Institute

Map 1.12

Urban Footprint in the Calgary and Edmonton regions in 2012

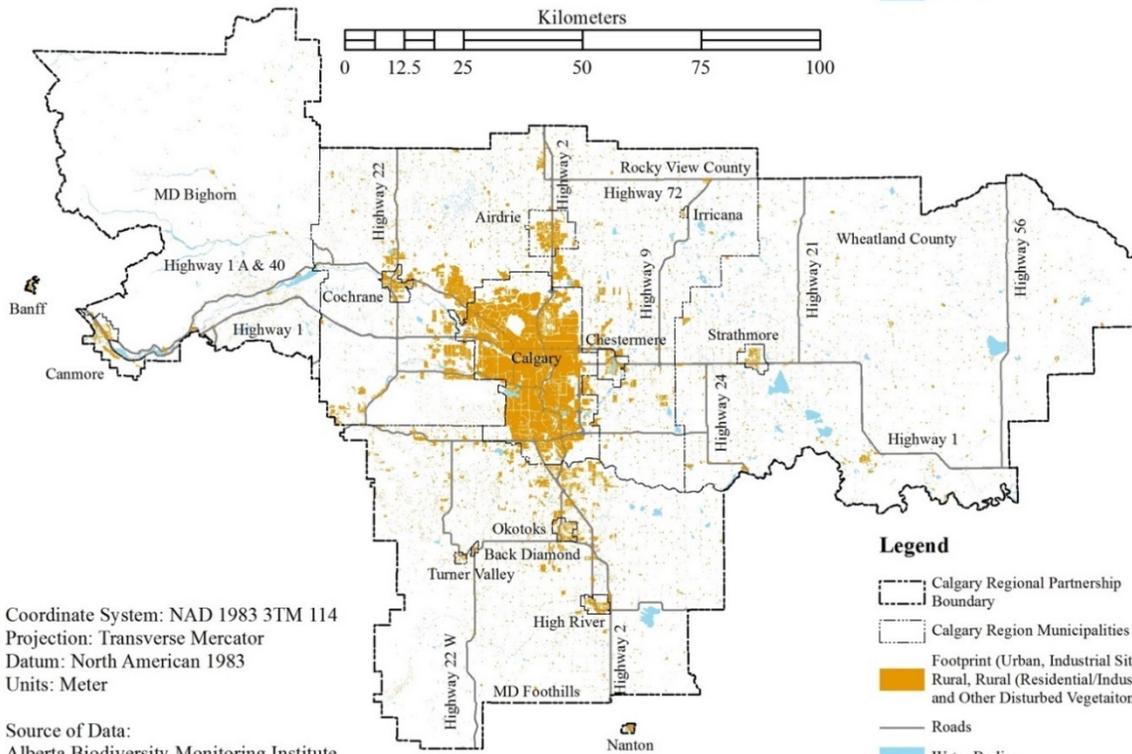
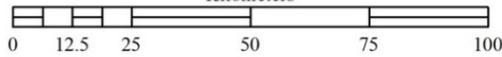


Legend

- Capital Region Boundary
- Capital Region Municipalities
- Footprint (Urban, Industrial Site Rural, Rural (Residential/Industrial), and Other Disturbed Vegetation)
- Roads
- Water Bodies

1:1,200,000

Kilometers



Legend

- Calgary Regional Partnership Boundary
- Calgary Region Municipalities
- Footprint (Urban, Industrial Site Rural, Rural (Residential/Industrial), and Other Disturbed Vegetation)
- Roads
- Water Bodies

Coordinate System: NAD 1983 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983
 Units: Meter

Source of Data:
 Alberta Biodiversity Monitoring Institute

SUMMARY

All in all, both Calgary and Edmonton grew, expanding out rapidly in the last few decades, with some indications of intensification in the last few years. The city of Edmonton grew much faster in the 1980s and 1990s. Only recently have municipal policies in both cities begun to put brakes on the pace of growth and move towards intensification. Calgary's density is slightly higher than that of Edmonton. On the other hand, Edmonton shows healthier increase in density than Calgary does. Nonetheless, both cities have grown slightly denser in the last few years. This effect is evident at the regional scale as well, especially in the Edmonton area. It is likely that CRB's growth management strategies contributed to these positive increases across the region. Of great concern, however, is the changing land use between the Edmonton and Calgary regions, mostly in the form of country and rural residential. All of this is putting tremendous pressure on the prime agricultural areas of the province.

6. CONCLUSIONS, RECOMMENDATIONS, & FUTURE RESEARCH

Despite the current wealth of knowledge about urban and suburban forms, absent from this expansive literature was a systematic understanding of development patterns in Alberta and the reasons, contexts, and regulatory framework in which they have grown. The chapters in this report, recognizing these gaps, provide insight into the diversity of issues surrounding urban growth in Alberta.

Analyzed from a regional context, the Calgary Metropolitan Region has experienced barriers to growth, with the limited availability of water potentially having a positive effect on its urban growth patterns. This has restricted growth to municipalities that can afford water licenses, but has also resulted in more efficient land use patterns to minimize servicing costs. Moreover, the City of Calgary's recent bylaws—that use development charges both as a source of municipal revenue and as a planning tool—can be seen as a further step towards promoting more efficient land uses.

More broadly however, Edmonton Metropolitan Region's growth management strategies have been more effective, with Edmonton showing increased population densities from 2007 to 2012. Interestingly, this period also happens to coincide with the creation of the Capital Region Board (CRB) in 2008, which has resulted in a much more unified and coordinated approach to planning within the capital region as seen in the use of Priority Growth Areas (PGAs) and density targets.

Even with these density increases, post-CRB, less Class 1 and 2 agricultural lands have been converted to urban uses. It can therefore be assumed that the collaboration between municipalities at the regional level has had a positive impact on growth and the environment. However, while demonstrating the effectiveness of regional partnerships, the CRB members would benefit from discussing the development of country residential properties. These properties not only sprawl, but also occupy just under 15% of development currently on Class 1 and 2 soils.

Undoubtedly, the subsequent revisions of the Planning Acts indicate that legislation has been used as the primary means to guide municipalities on urbanization during high growth periods that coincide with economic booms. Although the current slump in oil prices has interrupted Alberta's pattern as a fast-growing province, it has created an opportunity for decision-makers to prepare for the next boom and to consider a regional perspective on growth matters.

Clearly, Alberta cannot afford to carry out its regional planning activities through proxy, and/or adversarial measures such as annexation or amalgamation. Such strategies lead to further distrust and competition among municipalities, or depend entirely on voluntary cooperation among municipalities as an act of goodwill. The proposed amendment to the MGA is supposed to incorporate measures that will increase cooperation among municipalities, including a fair share of taxes, especially industrial taxes. These measures for increasing cooperation will work if they

are accompanied by both incentives and appropriate penalties—in other words, both “carrots and sticks.”

The existing patchwork of regional structures and a legislative framework in Alberta indicate that progress has been made, but with mixed successes. Perhaps a more essential question is whether the existing growth patterns are a sustainable way of moving forward. As Radke (2007) aptly said, in his report to the provincial government, “strengthening the region is not a choice—it’s a necessity” (Letter to then Premier Ed Stelmach). In the end, the extent to which Alberta demonstrates an efficient regional planning system will dictate the type of growth for future generations; ideally it will reflect the diversity of values across municipalities of all sizes, whether they are urban or rural.

The findings of this study are summarized in the following assertions:

1. Water is the new frontier that we will have to tackle in the near future. Alberta can be a leader in using water as a tool to manage regional growth across the province. Integrating water planning into the Land Use Framework would promote efficient land use, as long as municipalities must comply.
2. At present, Strategy 5—efficient use of land—in the Land Use Framework is not a part of the legally binding regulatory part of the regional plans. It should be made legally binding on the municipalities.
3. Growth comes with a price. It should pay for itself through pre- or post-development charges, fees, taxes, or other forms of revenue. Alberta cities will have to calculate the real cost of growth and design their model of development charges and/or any other form of levies accordingly to ensure that the new developments are fully covered. The Municipal Government Act should be amended to allow municipalities to charge for infrastructure needed for community services, such as recreation facilities, library, police stations, and so on.
4. Barring a few piecemeal approaches here and there, since 1995, regional planning in Alberta has been largely non-existent. It is time to create mandatory growth management boards, like the Capital Region Board, for other metropolitan areas in the province.
5. The Land Use Secretariat cannot possibly keep track of over 300 municipalities to ensure their plans align with the regional plans. The provincial government should establish regional governance structures to manage each region as identified in the Province’s Land Use Framework.

6. The provincial government should allow these regional bodies to not only devise policy framework with respect to land use, transportation, and housing, but also provide services such as transit, police, fire, water, and others as per individual municipal needs, along the lines of British Columbia's regional districts.
7. Alberta has one of the world's most productive agricultural economies, representing almost a quarter of Canada's primary agricultural production. Every effort must be made to preserve Alberta's fertile and productive farmlands and to avoid agricultural land fragmentation. The provincial government can and should lead the operationalization of the Transfer of Development Credits contained in the Alberta Land Stewardship Act, with the help of urban and rural municipalities. Other legislation, such as Municipal Government Act, require amendments to that they provide incentives and bonuses that promote these credits.

FUTURE RESEARCH

The research themes that surround urban and suburban growth need to be further studied to extend the findings of this research project. In particular, the concept of wet growth needs systematic exploration in the Alberta context to answer important questions such as:

- What are the analytical and mapping tools available to measure land development capacity in watershed areas?
- How might wet growth fit in with the current Land Use Framework?
- What changes to various legislation might be necessary to put this idea to work—for example, the Alberta Land Stewardship Act, Municipal Government Act, the Water Act, Environmental Protection and Enhancement Act and Wildlife Act?

Further, to find a made-in-Alberta regional governance model we need more thorough analysis of regional planning models and approaches, as well as governance and growth management boards. This analysis must consider these factors both as they exist in other provinces and as they presented in the pre-1995 era in Alberta. It should also include an in-depth analysis of legislative frameworks related to regional planning in other jurisdictions and their effectiveness.

One of the serious and perennial issues in regional planning is that average citizens typically have limited understanding of the regional issues. They tend to view a region from the perspective of the community in which they live. However, geographically, a region tends to be much more expansive than a town, a city, or a municipality. Indeed, it falls somewhere between two politically-defined boundaries—municipal and provincial. These boundaries are frequently amorphous, which means that the average citizen is unlikely to spend much time thinking about these distinctions or why they may matter.

Similarly, issues also fail to resonate with an average community member and so any benefits of regional planning tend to be rather abstract and distant. All of this does not bode well in securing citizens' support for regional issues or for those politicians and policy-makers who champion them.

Given this landscape, two further questions for researchers to consider are these:

- How can we build regional understanding among citizens?
- What other governance structures could be more communicative, inclusive, and participatory in nature?

Much has already been written on municipal finance, and development charges in particular, and yet further empirical research work is still needed in this area. Newly proposed changes to off-site levies in the Municipal Government Act and the move towards the Big City Charters⁸ could present us with alternative ways of financing new growth and infrastructure in Alberta cities. We need to know more.

For the Edmonton region, the Capital Region Board assembles spatial datasets from its member municipalities. The board analyzes the data to monitor the land use situation across the region, compare it against their growth plan, and support regional decision-making processes. The board also gives the public open access to these data.

Unfortunately, this type of information is grossly lacking for the Calgary region—whatever does exist is disparate in nature and not available in the public domain, but both regions have to augment their data gathering and analytical capacity. Perhaps academic researchers could help these and other regions to collect and develop new datasets if need be, and/or help put together a Participatory Geographic Information Systems (PGIS)⁹.

Finally, another area of potential research is to carry out a detailed review of the feasibility and implementation of Transfer of Development Credits in Alberta, including how they would potentially affect the nature and degree of economic benefits to rural land owners. It is of paramount importance that we develop understanding about whether this is the most conducive approach to minimizing loss of farmlands and fragmenting of agricultural land. Future researchers could also explore other legislative tools or compensation models that might work alongside or independent of the development credit program.

⁸ A City Charter is a special legislative tool used by the Province to support the unique needs of large cities. This special legislation could recognize Edmonton and Calgary as important economic and social drivers for all of Alberta and allow increased municipal authority in the areas such as assessment, taxation, and planning and development.

⁹ PGIS combines a range of geo-spatial technologies to make them more used-friendly, flexible and adaptable to allow interactive participation of both experts and lay people for spatial learning, discussion, information exchange, analysis, decision making and advocacy purposes.

REFERENCES

- Agricultural Operation Practices Act (AOPA Legislation). (n.d) Alberta Agriculture and Forestry. Retrieved from:
[http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/epw12498](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/epw12498)
- Alberta Agriculture and Forestry. (2008). Understanding groundwater. Retrieved from
[http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/wwg406](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/wwg406).
- Alberta Agriculture, Food and Rural Development. (2002). Loss and fragmentation of farmland Resource Planning Group, Policy Secretariat. Edmonton: AB.
- Alberta Agriculture and Forestry. (2016). *Fragmentation and Conversion of Agricultural Land in Alberta* (pp. 1–14) (Canada, Alberta Agriculture and Forestry).
- Alberta Government. (2015). Managing growth. Retrieved from
<http://mgareview.alberta.ca/whats-changing/managing-growth/>
- Alberta Health Services. (2009). *Urban sprawl and health*. Retrieved from
<http://www.albertahealthservices.ca/poph/hi-poph-hpp-info-urban-sprawl.pdf>
- Alberta Municipal Affairs. (2012). The legislative framework. Retrieved June 18, 2015, from
http://www.municipalaffairs.alberta.ca/documents/ms/THE_LEGISLATIVE_FRAMEWORK_2012-08_Version.pdf
- Alberta Water Portal. (n.d.) Learn: Water Licences, Transfers, and Allocation. Retrieved from <http://albertawater.com/how-is-water-governed/water-licences-transfers-and-allocation>
- Almujhairy, A. (2014). The central role of collaborative planning in shaping the future of the metropolis: An evaluation of collective decision making in the Calgary Metropolitan Region (Doctoral dissertation, University of Calgary).
- Alonso, W. (1964). Location and Land Use. Cambridge, MA: Harvard University Press.
- Apartment Living is Green. (n.d). Federation of rental housing providers Ontario. Retrieved from
<http://www.skylineliving.ca/assets/Skyline-Living-PDFs/Apartment%20Living%20is%20Green%20-%20Accessibility%20Friendly.pdf>
- APPI. (2014). Alberta Professional Planners Institute Municipal Government Act Review: Recommendations for proposed amendments to the Municipal Government Act. Retrieved June 19, 2015, from
<http://www.albertaplanners.com/sites/default/files/APPI%20MGARRecommendations.pdf>
- Arnold, C. A. T. (2005). Is wet growth smarter than smart growth?: The fragmentation and integration of land use and water. *Environmental Law Reporter*, 35(3), 10152.

- Badger, E. (2013). *The suburbanization of poverty*. Retrieved on January 26, 2014 from <http://www.citylab.com/work/2013/05/suburbanization-poverty/5633/>
- Bart, I. L. (2010). Urban sprawl and climate change. A statistical exploration of cause and effect, with policy options for the EU. *Land Use Policy*, 27(2), 283–292.
- Batchis, W. (2010). Enabling urban sprawl: Revisiting the Supreme Court’s seminal zoning decision *Euclid v. Ambler* in the 21st century. *Virginia Journal of Social Policy and the Law*, 17(3), 373–403.
- Baumeister, M. (2012). Development charges across Canada: An underutilized growth management tool? *IMFG Papers on Municipal Finance and Governance*, (9), 1–33.
- BC Government (2006). *A primer on regional districts in British Columbia*. Victoria, BC: Ministry of Municipal Affairs.
- Bentley, A., Doll, C., Haarsma, D., Jeffrey, S., & Qiu, F. (2014). *Agricultural land conversion and fragmentation in Alberta: A review of land cover patterns 2000–2012 and land use policy*. pp. 1–84. Edmonton, AB: Alberta Land Institute, University of Alberta
- Bettison, D. G., Kenward, J. K., & Taylor, L. (1975). *Urban affairs in Alberta*. Edmonton, AB: University of Alberta.
- Beveridge, M., & Droitsch, D. (2010). Making the connection: Water and land in Alberta. *Water Matters Society of Alberta, Canmore, AB*. Available at: <http://www.water-matters.org/docs/making-the-connection-v2.pdf>.
- Blais, P. (2010). *Perverse cities: Hidden subsidies, wonky policy, and urban sprawl*. Vancouver, BC: UBC Press.
- Bonser, S.P., Neil, K.E., & Pelley, J. (2003). *Sprawl hurts us all: A guide to the costs of sprawl development and how to create livable communities in Ontario*. Toronto, ON: Sierra Club Canada.
- Brueckner, J. K., & Largey, A. G. (2008). Social interaction and urban sprawl. *Journal of Urban Economics*. 64(1), 18–34. doi:10.1016/j.jue.2007.08.002
- Bruegmann, R. (2005). *Sprawl: A compact history*. Chicago, IL: University of Chicago Press.
- Brunnen, B. (2013). Managing the costs of growth. Available at <http://manningscentre.ca/sites/default/files/docs/Municipal-Expenditures.pdf>
- Bunting, T., Filion, P., & Warriner, K. (1999). The entrenchment of urban dispersion: Residential preference and location patterns in the dispersed city, *Urban Studies*. 36(8), 1317–1347.

- Bunting, T., Filion, P., Langlois, P., & Pavlic, D. (2010). Intensification and sprawl: Residential density trajectories in Canada's largest metropolitan regions, *Urban Geography*, 31(4), 541–596.
- Burchell, R. W., Shad, N. A., Listokin, D., Phillips, H., Downs, A., Seskin, S., & Gall, M. (1998). *The Costs of Sprawl-Revisited*. [TCRP report 39]. Washington, DC: National Academy Press.
- Burchell, R., Downs, A., McCann, B., & Mukherji, S. (2005). Chapter 5: Infrastructure consequences. In *Sprawl costs: Economic impacts of unchecked development* (pp. 50–63). Washington DC: Island Press.
- Burton, T. L. (1981). The roles and relevance of Alberta's regional planning commissions: Discovery Service for University of Alberta Libraries. Retrieved June 21, 2015, from <http://eds.b.ebscohost.com/login.ezproxy.library.ualberta.ca/eds/detail/detail?sid=23dc5d4f-256f-4ef3-a07c-8f6a0be2d9aa%40sessionmgr198&vid=0&hid=126&bdata=JnNpdGU9ZWRzLWxpdmUmc2NvcGU9c2l0ZQ%3d%3d#db=cat03710a&AN=alb.667558>
- Calgary Metropolitan Plan (2014). Calgary regional partnership. Retrieved from <http://www.calgaryregion.ca/cmp/bin2/pdf/CMP.pdf>
- Canada Land Inventory. (n.d.). Government of Canada. Retrieved from: <http://sis.agr.gc.ca/cansis/nsdb/cli/index.html>
- Capital Region Board. (2009a). Land Use Plan. Appendix 2 of the Capital Region Growth Plan. Retrieved from <http://capitalregionboard.ab.ca/-/reports/crlanduseplan031209.pdf>
- Capital Region Board. (2009b). Addendum October 2009: Capital Region Growth Plan. Retrieved June 21, 2015, from <http://capitalregionboard.ab.ca/-/reports/9%20october%202009%20addendum-revisedsept2010.pdf>
- Cashaback, D. (2001). Regional district governance in British Columbia: A case study in aggregation. *Institute on Governance*.
- CBC Learning. (n.d.). Boom and bust in Alberta. Retrieved from <http://www.cbc.ca/history/EPISCONTENTSE1EP17CH3PA1LE.html>
- Chiasson, C., Good, K., Greenway, G., & Unger, J. (2012). Conservation easements for agriculture in Alberta: A report on a proposed policy direction. Retrieved from <https://landuse.alberta.ca/LandUse%20Documents/Conservation%20Easements%20for%20Agriculture%20in%20Alberta%20-%202012-03.pdf>
- Cinyabuguma, M., & McConnell, V. (2013). Urban growth externalities and neighborhood incentives: Another cause of urban sprawl? *Journal of Regional Science*, 53(2), 332–348.

- City of Calgary. (2010). Financing municipal infrastructure report. Retrieved from http://www.chba.ca/uploads/Urban_Council/May2011/Tab 3-Financing Municipal Infrastructure-Calgary Report.pdf
- City of Calgary. (2013). Corporate growth management report. Retrieved from http://www.calgary.ca/PDA/pd/Documents/growth_management/prioritizing-growth.pdf
- City of Calgary. (2016a). Calgary off-site levy bylaw. Retrieved January 17, 2016, from <http://www.calgary.ca/CS/build-calgary/Pages/Build-Calgary-Off-Site-Levy-bylaw.aspx>
- City of Calgary. (2016b). Off-site levy bylaw *C2016-0023* (pp. 1–17) (Canada, Deputy City Manager’s Office). Retrieved from <http://www.calgary.ca/CS/build-calgary/Documents/Build-Calgary-Council-Report-2015-12-17> and Attachments 1-4.pdf
- City of Calgary. (n.d). Water services. Retrieved from: <http://www.calgary.ca/UEP/Water/Pages/Water-Services.aspx>
- City of Edmonton (2011). Council report on the *costs and revenues for new areas*. Retrieved from : http://www.chba.ca/uploads/urban_council/Oct2011/Tab%206%20-%20Costs%20and%20Revenues%20for%20New%20Areas%20-%20City%20of%20Edmonton%20paper.pdf
- City of Edmonton. (2016). Integrated infrastructure management planning. *Report: CR_2705*, 1–20. Retrieved from <http://sirepub.edmonton.ca/sirepub/cache/2/bleyhtjlmbsl3pf5ymkxmdet/5309580406201610494165.PDF>
- City of Edmonton. (2016). 2016-18 YEG City Budget. Retrieved from http://www.edmonton.ca/city_government/documents/Budget%202016-18%20Primer.pdf
- City of Edmonton. (n.d.-a). Permanent area contributions (PAC). Retrieved from http://www.edmonton.ca/city_government/utilities/permanent-area-contributions.aspx
- City of Edmonton. (n.d.-b). Integrated infrastructure management planning framework (IIMP). Retrieved from http://www.edmonton.ca/city_government/initiatives_innovation/integrated-infrastructure-management-plan.aspx
- Climenhaga, D. J. (1997). *The death and life of regional planning in the Calgary area*. Ottawa, ON: National Library of Canada= Bibliothèque nationale du Canada.
- Climate Leadership report to the Minister. Available at <http://www.alberta.ca/documents/climate/climate-leadership-report-to-minister.pdf>
- Curtis, D. (2014, November 21). Has Toronto’s greenbelt done more harm than good? *The Globe and Mail*.

- Cuthbertson, R. (November 21 2010). Time to stop subsidizing urban sprawl. *The Calgary Herald*.
- Daniels, T., Bowers, D., (1997). *Holding our ground: Protecting America's farms and farmland*. Washington, DC: Island Press.
- Drummond, L., & Labbé, D. (2013). We're a long way from Levittown, Dorothy: Everyday suburbanism as a global way of life. In R. Keil (Ed.), *Suburban Constellations: Governance, Land and Infrastructure in the 21st Century* (pp. 1–208).
- Edmonton Metropolitan Regional Planning Commission. (1984). Edmonton Metropolitan Regional Plan: With changes adopted up to July 4, 1984. Edmonton, AB : Edmonton Metropolitan Regional Planning Commission, [1984].
- Emerson, C.D. (2008). All sprawled out: How the federal regulatory system has driven unsustainable growth. *Tennessee Law Review*. 75, 411–451.
- Environmental Defense Canada. (August 2013) The high costs of sprawl: Why building more sustainable communities will save us time and money. Government of Canada. Available at <http://environmentaldefence.ca/report/report-the-high-costs-of-sprawl/>
- EPCOR. (n.d.). Who we are. Retrieved from <http://corp.epcor.com/about/Pages/who-we-are.aspx>
- Ewing, R., & Rong, F. (2008). The impact of urban form on US residential energy use. *Housing Policy Debate*, 19(1), 1–30.
- Ewing, R., Schmid, T., Killingsworth, R., Zlot, A., & Raudenbush, S. (2003). Relationship between urban sprawl and physical activity, obesity, and morbidity. *American Journal of Health Promotion*, 18(1), 47–57.
- Federal Agricultural Census, Snapshot. (2006) Retrieved from <http://www.statcan.gc.ca/ca-ra2006/articles/snapshot-portrait-eng.htm>
- Filion, P., & Kramer, A. (2011). Metropolitan-scale planning in neo-liberal times: Financial and political obstacles to urban form transition. *Space & Polity*, 15(3), 197–212. doi:10.1080/13562576.2011.692567
- Foley, J. A., DeFries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R., Chapin, F.,... Snyder, P. (2005). Global consequences of land use. *Science*, 309(5734), 570–574.
- Francis, C. A., Hansen, T. E., Fox, A. A., Hesje, P. J., Nelson, H. E., Lawseth, A. E., & English, A. (2012). Farmland conversion to non-agricultural uses in the US and Canada: Current impacts and concerns for the future. *International Journal of Agricultural Sustainability*, 10(1), 8–24.

- Frank, L. D., Andresen, M. A., & Schmid, T. L. (2004). Obesity relationships with community design, physical activity, and time spent in cars. *American Journal of Preventive Medicine*, 27(2), 87–96.
- Frumkin, H. (2002). Urban sprawl and public health. *Public Health Reports (1974-)*, 3, 201.
- Furlong, E.T., Mahler, B.J., & Van Metre P.C. (2000). Urban sprawl leaves its path signature. *Environmental Science & Technology*, 34, 4064–4060.
- Furusest, O.J. (1987). Public attitudes toward local farmland protection programs. *Growth and Change*, 18(3), 49–61.
- Gee, M. (2015). Suburban homelessness is a problem often neglected in Toronto. *The Globe and Mail*. Retrieved from <http://www.theglobeandmail.com/news/toronto/suburban-homelessness-is-an-often-neglected-problem/article22456533/>
- Gibson, R., & Vodden, K. (2010). Prosperity through collaboration: Review of regional development models and potential applications to the burin peninsula. St. John's, NL, CAN: Newfoundland and Labrador Rural Secretariat. Retrieved from <http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10901240>
- Glaeser, E.L., & Kahn, M.E. (2003). Sprawl and urban growth. *Harvard Institute of Economic Research* (Discussion paper no. 2004). Cambridge, MA: Harvard University.
- Glaeser, E.L., & Kahn, M.E. (2004). Sprawl and urban growth. *Handbook of Regional and Urban Economics*, 4, 2481–2587.
- Gordon, D. L., & Shirokoff, I. (2014). Suburban nation? Population growth in Canadian suburbs, 2006–2011. *Council for Canadian Urbanism*. Available at <http://www.canadianurbanism.ca/wp-content/uploads/2014/07/CanU%20WP1%20Suburban%20Nation%202006-2011%20Text%20and%20Atlas%20comp.pdf>
- Government of Alberta. (2014). *Municipal census and population lists* (Canada, Municipal Affairs). Retrieved from http://municipalaffairs.gov.ab.ca/mc_official_populations
- Government of Alberta. (n.d.). Alberta, Canada. Retrieved from <http://www.albertacanada.com/opportunity/choosing/economic-taxes.aspx>
- Greenway, G. & Good, K. (2008). Transfer of Development Credits in Alberta: A Feasibility Review. Calgary: Miistakis Institute.
- Gurin, D. (2003). Understanding sprawl: A citizen's guide. *David Suzuki Foundation*. Retrieved from http://www.davidsuzuki.org/publications/downloads/2003/Understanding_Sprawl.pdf

- Hodge, G., & Robinson, I. M. (2001). Planning Canadian regions. [electronic resource]: Discovery service for University of Alberta libraries. Retrieved June 18, 2015, from <http://eds.b.ebscohost.com/eds/detail/detail?sid=4efbc045-947c-40ed-a204-3280e0869233%40sessionmgr112&vid=0&hid=103&bdata=JnNpdGU9ZWRzLWxpdmUmc2NvcGU9c2l0ZQ%3d%3d#db=cat03710a&AN=alb.4354369>
- Hofmann, N. (2001). *Urban consumption of agricultural land*. Statistics Canada, Agriculture Division. Available at: <http://publications.gc.ca/Collection/Statcan/21-006-X/21-006-XIE2001002.pdf>
- Huffington Post. (2014, September 30). Canada's highest, lowest property taxes. *Huffington Post*. Retrieved from http://www.huffingtonpost.ca/2014/09/27/property-taxes-canada_n_5890090.html
- Hulchanski, D. 2006. The three cities within Toronto: Income polarization among Toronto's neighbourhoods, 1970-2005. Available at: <http://3cities.neighbourhoodchange.ca/>
- Hyndman, L. (2000). An agenda for action: Alberta capital region governance review: Final report. [Edmonton]: *Alberta Capital Region Governance Review*, 2000.
- Keil, R., & Shields, R. (2013). Suburban boundaries. In *Suburban constellations: Governance, land and infrastructure in the 21st century*, pp. 69–76. Berlin, Germany: Jovis.
- Kneebone, E., & Berube, A. (2013). *Confronting suburban poverty in America*. Washington, DC: Brookings Institution Press.
- KPMG. (2015). Municipal Government Act review: Summary of input and identified issues. Retrieved June 21, 2015, from <http://mgareview.alberta.ca/wp-content/uploads/media/Input-and-Issues.pdf>
- Kramer, A., Burchfield, M., & Taylor, Z. (2014). Alberta cities at the crossroads: Urban development challenges and opportunities in historical and comparative perspective. *The School of Public Policy, University of Calgary, SPP Research Papers*, 9(12).
- Latruffe, L., & L. Piet (2013). Does land fragmentation affect farm performance? A case study from Brittany, France. Working paper SMART-LERECO 13-04. Available at : <http://ageconsearch.umn.edu/bitstream/207854/2/WP%20SMART-LERECO%2013-04.pdf>
- Lewyn, M. (2006). The law of sprawl: A road map. *Quinnipiac Law Review*, 25, 147–171.
- Lewyn, M. (2012). Sprawl in Canada and the United States. *The Urban Lawyer*, 1, 85.
- Macdonald, S., & Keil, R. (2012). The Ontario greenbelt: Shifting the scales of the sustainability fix? *The Professional Geographer*, 64(1), 125–145.

- Mariola, M.J., (2005). Losing ground: Farmland preservation, economic utilitarianism, and the erosion of the agrarian ideal. *Agriculture and Human Values*, 22, 209–223.
- Martellozzo, F., Ramankutty, N., Hall, R. J., Price, D. T., Purdy, B., & Friedl, M. A. (2014). Urbanization and the loss of prime farmland: a case study in the Calgary–Edmonton corridor of Alberta. *Regional Environmental Change*, 15(5), 881–893.
- Masson, J. K., & LeSage, E. C. (1994). *Alberta's local governments: Politics and democracy*. Edmonton, AB: The University of Alberta Press.
- Masuda, J. R., & Garvin, T. (2008). Whose heartland? The politics of place in a rural-urban interface. *Journal of Rural Studies*, 24(1), 112–123.
- Meredith, J.M. (2003). Sprawl and the new urbanist solution. *Virginia Law Review*, 89(2), 447–450.
- Miceli, T. J., & Sirmans, C. F. (2007). The holdout problem, urban sprawl, and eminent domain. *Journal of Housing Economics*, 16(3–4), 309–319. doi: <http://dx.doi.org/login.ezproxy.library.ualberta.ca/10.1016/j.jhe.2007.06.004>
- Mickleburgh, R. (2012, September 17). BC farmers' anger turns to support for Agricultural Land Reserve. *The Globe and Mail* (Toronto).
- Miron, J. (2003). *Urban sprawl in Canada and America: Just how dissimilar*. Toronto, ON: University of Toronto, Department of Geography. Retrieved from <http://www.utoronto.ca/~miron/Miron2003USCAJHD.pdf>
- Nechyba, T.J., & Walsh, R.P. (2004) Urban sprawl. *The Journal of Economic Perspectives*, 18(4), 177–200.
- Nelson, A., Pendall, R., Dawkins, C., & Knaap, G. (2002). The link between growth management and housing affordability: The academic evidence. The Brookings Institution Center on Urban and Metropolitan Policy, 1–37. Retrieved from <http://www.brookings.edu/es/urban/publications/growthmang.pdf>
- Neptis Foundation. (2014). Rethinking sprawl. *Neptis Publications*. Retrieved from <http://www.neptis.org/publications/rethinking-sprawl>
- Neufeld, S. (2010). North Saskatchewan River water quality. The Edmonton sustainability papers—discussion paper 4. Retrieved on April 17th 2016 from http://www.edmonton.ca/city_government/documents/PDF/Discussion_Paper_4_North_Saskatchewan_River_Water_Quality.pdf.
- Nugent, M. (2011). Reformed development: How Edmonton can benefit from globalization through improved development strategies. *The Agora: Political Science Undergraduate Journal*, 1(1), 32–38.

- Parkland County. (2013). CRB Presentation REF# 2012-019. Proposed new Acheson Area Structure Plan. Proposed Municipal Development Plan Amendments February 14, 2013. Retrieved June 22, 2015, from <http://www.parklandcounty.com/Assets/About+Us/Projects+and+Studies/Acheson+ASP/CRB+Presentation+Acheson+Feb+14+2013.pdf>
- Penchuk, D., Sherwin, L. Gillispie, D., & Tin, K. (2016) *Inter-municipal and Municipal Development Plan Review*. Report prepared for Capital Region Board. Edmonton, AB
- Pernitsky, D.J., & Guy, N.D. (2010). Closing the South Saskatchewan River Basin to new water licenses: Effects on municipal water supplies. *Canadian Water Resources Journal*, 35(1) 79–92.
- Pouliou, T., & Elliott, S. J. (2010). Individual and socio-environmental determinants of overweight and obesity in urban Canada. *Health and Place*, 16(2), 389–398.
- Preston V., Murdie, R., Wedlock, J., Agrawal, S., Anucha, U., D'Addario,... Murnaghan, A. (2009). Immigrants and homelessness – at risk in Canada's outer suburbs. Vol 53, Issue 3, 288–304.
- Province of Ontario (2008). Planning for Employment in the Greater Golden Horseshoe. Retrieved from https://www.placestogrow.ca/index.php?option=com_content&task=view&id=366&Itemid=15&utm_source=shortlinks&utm_medium=web&utm_campaign=bzpd
- Qadeer, M., & Kumar, Sandeep. 2006. Ethnic enclaves and social cohesion. *Canadian Journal of Urban Research*. Special Issue on Immigration and Cities. 15(2), 1–17.
- Qadeer, M., Agrawal, S., & Lovell, A. 2010. Evolution of ethnic enclaves in the Toronto Metropolitan Area 2001–2002. *Journal of International Migration and Integration*. 11(3), 315–339.
- Querengesser, T. (January 13, 2014). Alberta's future water wars. *Alberta Venture*. Retrieved from <http://albertaventure.com/2014/01/future-water-wars-alberta/>
- Radke, C. D. (2007). Working together: Report of the Capital Region Integrated Growth Management Plan project team. Retrieved from http://www.municipalaffairs.alberta.ca/documents/working_together.pdf
- Robinson, L., Newell, J. P., & Marzluff, J. M. (2005). Twenty-five years of sprawl in the Seattle region: Growth management responses and implications for conservation. *Landscape and Urban planning*, 71(1), 51–72.
- Rocky View County. (2011). Rocky View County to lease water license capacity to service Conrich. Retrieved from

<http://www.rockyview.ca/NewsEvents/News/tabid/145/Article/684/Rocky-View-County-to-lease-water-licence-capacity-to-service-Conrich.aspx>

Rusk, D. (2006). Social framework: Sprawl, race and concentrated poverty—changing the rules of the game. In D. Soule (Ed.), *Urban sprawl: A comprehensive reference guide*. Westport, CT: Greenwood Press.

Seliske, L., Pickett, W., & Janssen, I. (2012). Urban sprawl and its relationship with active transportation, physical activity and obesity in Canadian youth. *Health Reports*, 82-003-X, 1–8.

Seto, K. C., Güneralp, B., & Hutyra, L. R. (2012). Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. *Proceedings of the National Academy of Sciences*, 109(40), 16083–16088.

Shepel, C., Neufeld, S., & Raimondo, R. (2010). Edmonton's water supply. EPCOR Water Services Inc. 1-20. Retrieved from http://www.edmonton.ca/city_government/documents/Discussion_Paper_3_Water_Supply.pdf

Skaburskis, A., & R. Tomalty. (2000). The effects of property taxes and development cost charges on urban development: Perspectives of planners, developers and finance officers in Toronto and Ottawa. *Canadian Journal of Regional Science* 23(2): 303–25.

Slack, E. (2002). *Municipal finance and the pattern of urban growth*. Toronto, ON: CD Howe Institute.

Slack, E. (2003). Three ways we subsidize sprawl. *Alternatives Journal*, 29(3), 12.

Smart Water–Western Resource Advocates. (2003) Chapter 4: Urban Sprawl: Impacts on Urban Water Use. In *A Comparative Study of Urban Water Use Across the Southwest*. (pp. 93–10).

Smith, H., & Ley, D. (2008). Even in Canada? The multi-scalar construction and experience of concentrated immigrant poverty in gateway cities. *Annals of the Association of American Geographers*, 98(3), 686–713.

Soule, D. C. (2006). *Urban sprawl: A comprehensive reference guide*. Westport, CT: Greenwood Publishing Group.

Statistics Canada (2002) A profile of the Canadian population: where we live. Available at <http://www.publications.gc.ca/site/eng/314581/publication.html>

Statistics Canada (2011a). *Population, urban and rural by province and territory. Statistics Canada Census of 2011*. Retrieved from <http://www.statcan.gc.ca/tables-tableaux/sum-som/101/cst01/demo62j-eng.htm>

- Statistics Canada (2011b). *Population, urban and rural by province and territory. Statistics Canada Census of 2011*. Retrieved from <http://www12.statcan.ca/census-recensement/2011/as-sa/98-310-x/98-310-x2011001-eng.cfm>
- Statistics Canada. (2011c). *Households and the Environment: Energy Use* (Canada, Statistics Canada). Retrieved from <http://www.statcan.gc.ca/pub/11-526-s/11-526-s2013002-eng.pdf>
- Statistics Canada (2012) *The Canadian population in 2011: population counts and growth*. Ottawa.. Retrieved from <http://www12.statcan.gc.ca/census-recensement/2011/as-sa/98-310-x/98-310-x2011001-eng.pdf>
- Statistics Canada. (2016). *Human activity and the environment: The changing landscape of Canadian metropolitan areas* (Canada, Statistics Canada). Retrieved from <http://www.statcan.gc.ca/pub/16-201-x/16-201-x2016000-eng.htm>
- Strathcona County. (2007). *Municipal Development Plan*. Strathcona County. pp ii. Retrieved from http://www.strathcona.ca/files/files/enclosure_iv_mdp_consolidated.pdf
- Sturm, R., & Cohen, D. A. (2004). Suburban sprawl and physical and mental health. *Public Health (Elsevier)*, 119(1), 488–496. doi:10.1016/j.puhe.2004.02.007
- Talen, E. (2013). Zoning for and against sprawl: The case for form-based codes. *Journal of Urban Design*, 18(2), 175–200. doi:10.1080/13574809.2013.772883
- Thompson, D. (2013). *Suburban sprawl: Exposing hidden costs, identifying innovations*. Report from Sustainable Properties. Ottawa, ON: University of Ottawa.
- Tomalty, R., & Haider, M. (2008). *Housing Affordability and Smart Growth in Calgary*. Available at http://www.fonvca.org/agendas/may2011/housing_afford_and_smarth_growth_report.pdf
- Tuckey, B. (2014, December 15). Need for GTA development competing with Greenbelt Act. *The Toronto Star*.
- Vandegrift, D., & Yoked, T. (2004). Obesity rates, income, and suburban sprawl: An analysis of US states. *Health and Place*. 10(3), 221–229.
- Wang, S., & Zhong, J. (2013). *Delineating ethnoburbs in metropolitan Toronto*. Toronto, ON: CERIS-The Ontario Metropolis Centre.
- Wetherel, D. (2005). Making new identities: Alberta small towns confront the city, 1900-1950 (English). *Journal of Canadian Studies*, 39(1), 175–197.
- Wilson, R. W. (1995). Suburban parking requirements: A tacit policy for automobile use and sprawl. *Journal of the American Planning Association*. 61(1), 29–42.

