SUSTAINABLE FOR WHOM?
AN ANALYSIS OF HOUSING AFFORDABILITY IN PROTO-SUSTAINABLE CITIES

by

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ABSTRACT

Is it mere coincidence that some of the world's most sustainable cities are also some of the least affordable? This study hypothesized that sustainability as a planning paradigm may be gentrifying North American cities. The findings of this study clearly show that this is possible, as determined through a comparison of the correlation between sustainability efforts and housing affordability in three sets of cities. Though this phenomenon may not be intentional, this undermines the efforts of proto-sustainable cities and inhibits their ability to develop into truly sustainable places. This small, but crucial, piece of research lays the foundation for future research on the interplay between sustainability policies and housing. Additionally, this research serves to caution urban planners against the assumption that sustainability plans and programs benefit everyone equally, and encourages them to consider the potential housing impact of planning for a sustainable future.

Keywords: city planning; sustainability; housing affordability; affordability index; gentrification; indicators

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1: INTRODUCTION

In his book, *Taking Sustainable Cities Seriously*, Kent Portney (2003) laboured to rank a list of 24 cities that were taking sustainability more or less seriously, as expressed through the adoption of sustainability initiatives. He updated and expanded this list in 2007 and identified the top 12 cities doing the most toward the goal of sustainability. While these 12 cities are shining examples of sustainable planning in practice, half of them are also world renowned for their "severely unaffordable housing markets" (Cox, 2009, p. 11). Is it mere coincidence that some of the world's most sustainable cities are also some of the least affordable?

The purpose of this study is to determine whether there is a correlation between the adoption of policies that promote sustainability and housing affordability. It is informed by the ongoing conversation on gentrification and concern about the potential usurping of sustainability language to achieve non-sustainable ends. Additionally, this research is part of the wider discussion on sustainability and sustainable development within the practice of urban planning, specifically as it pertains to housing affordability.

This research serves to caution urban planners against the assumption that sustainability plans and programs benefit everyone equally, and encourages them to consider the potential housing impact of planning for a sustainable future.

2: LITERATURE REVIEW

2.1 Gentrification

In their comprehensive book, *Gentrification*, Loretta Lees, Tom Slater, and Elvin Wyly (2007) convey the complexity and changing form of this oft used concept, noting that "gentrification has mutated over time, so that it now includes not just traditional, classical gentrification . . . but also rural gentrification, new-build gentrification, super-gentrification, and many other derivatives" (p. 159). These new forms have emerged singularly and collectively in successive generations of the concept, with Lees et al. (2007) arguing that we are now entering a "fourth wave of gentrification" (p. 163), one that is aggressively driven by government policy. While this project is concerned primarily with this fourth wave, it is worth reviewing how this present conceptualization evolved.

As noted by Lees et al. (2007), the gentrification phenomenon was first observed in the 1960s when middle-class families began purchasing, renovating, and moving into dilapidated character homes in low-income neighbourhoods. As a result of this process, former residents were pushed to the margins as housing costs increased and community class structures shifted. This process was "sporadic and state-led" (p. 175), tied closely to localized real estate market dynamics and personal home renovations.

The second wave (roughly 1978-1988) was characterized by more corporate, rather than personal or public, wealth invested in blighted areas

through the construction of large-scale, non-residential projects, such as art galleries and convention centres. During this period, gentrification efforts moved to city centres and were less neighbourhood-specific (Lees et al., 2007).

During the mid-1990s, the state become more actively involved in gentrification through sanctioning or direct investment in mega-development projects that rapidly altered entire communities. One notable example of this type of gentrification is the razing of the Cabrini Green neighbourhood in Chicago (as yet incomplete due to strong local resistance), in which public monies were granted to demolish and "replace existing high-density social housing 'projects' with new lower-density mixed income communities" (Lees, 2008, p. 2454). This example has significant implications for the research conducted herein as it highlights the transformation of the term 'gentrification' in public policy language to other, less stigmatized language. In this case, the policy directive was the development of 'socially mixed' neighbourhoods, but the end result was the displacement of more than 10,000 residents (Chicago Housing Authority, 2007).

The fourth wave of gentrification, beginning in the early part of this century, is characterized by a global scale and far greater governmental interaction (Lees et al., 2007). Neil Smith (2002) notes that gentrification is no longer tied to local neighbourhood geographies, but has expanded to a global phenomenon that is generally promoted under the guise of more socially acceptable policy goals, such as socially-mixed neighbourhoods, neighbourhood revitalization, or, as pointed out by Raco (2007) and others (Davidson, 2008; Ley and Dobson, 2008; and Smith, 2008), even sustainable development. Lees et al.

(2007) are careful to note that the precise gentrifying process varies across cities and countries, but it is still important to recognize that such processes are working at these larger scales.

Smith (2002) and Lees (2008) charge that the modern incarnation of gentrification is the purposeful policy arm of a neoliberal elite acting in a "revanchist city" (Smith, 2002, p.429). This paper acknowledges that the motivations of some (or even most) planners and policy makers may be less than benevolent; however, hidden agendas are beyond the scope of this project. Rather, this research simplifies the complex and politically charged reality of policy implementation by looking for a more mechanical relationship between policy and policy outcomes. Regardless of whether it should be classified as an intended outcome or an externality, the question here is whether sustainability policies and housing affordability are functionally linked.

This exploration is necessary, because some of the tenets of sustainable development may have gentrifying results. For instance, Lees et al. (2007) position brownfield development in the context of "new-build gentrification" (p. 138-144), which revitalizes industrial lands with the construction of (often luxury) condominiums, as seen along Vancouver, BC's False Creek. Though there are typically no existing residents to directly displace, this type of development does result in indirect displacement, particularly through the relocation of industrial jobs and the revaluing of industrial landscapes though residential speculation, and produces a "gentrified landscape/aesthetic" (Lees et al., 2007, p. 140).

2.2 Sustainability as a Planning Paradigm

Sustainability as a planning paradigm is an example of what Eugene McCann (2003) termed a “discursive frame”. In his words, “discursive framing draws on certain aspects of materiality and experience of everyday life to focus attention of a wide range of people on a common concern so as to achieve a particular political purpose” (McCann, 2003, p. 160). In his study of smart growth as a discursive framework in Austin, Texas, McCann (2003) found that discussions on city planning had been reframed around the problem of urban sprawl. This concern, while genuine, superseded all other concerns and allowed a smart growth paradigm to trump other ideas. McCann notes that, “while framing is enabling for those who construct it, it limits other actors’ ability to influence urban policy” (p. 162). Like smart growth, sustainability as a discursive framework invokes the greater good as a justification for development policy, which is difficult to argue against. In this way, sustainability as a planning paradigm, and discursive framework, may replace more individualized city visions and lull potential critics by the promise of universal benefits.

This section expands on the rise of sustainability as a framework for urban development.

2.2.1 Sustainability Definition

Sustainability is by no means a new concept. Rooted in biology, sustainability refers to the resources and processes necessary to sustain ecosystems and organisms, such as the food we eat and air we breathe to stay

alive. In this regard, sustainability has long been associated with resource and environmental management programs (Portney, 2003).

As a planning paradigm, sustainability really entered the collective imagination with the 1987 United Nations World Commission on Environment and Development report, *Our Common Future,* which attached the notion of sustainability to development. Popularly known as the Brundtland Report, after the Commission's chair Gro Harlem Brundtland, this report gives us the most common and oft repeated definition of sustainable development:

> Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland, 1987, p. 54).

While this definition is poetic, it is vague and open to much interpretation. This has spawned a plethora of sustainability definitions for use in policy applications, many aspects of which are contested.

A second definition that resonates with many is that put forth by Jeb Brugmann (1994), which purports that there are three pillars of sustainability: the environment, economy, and social equity. Though in some ways this notion of sustainability is simplistic and dated, it illustrates that sustainable development is reliant on a balance between competing, often contradictory interests. Campbell (1996) echoes this point, noting that policies that benefit one part of the triad may actually harm another.

The purpose of this paper is not to clarify this debate, but rather to explore the application of urban sustainable development as it may relate to housing

affordability. Within this paper, the terms sustainability and sustainable development will be used interchangeably.

2.2.2 Sustainability in Practice

In the decades since the Brundtland Commission, sustainable development has enjoyed widespread popularity in planning literature and is touted by many as a necessary paradigm for planning practice (Berke and Conroy, 2000; Saha and Paterson, 2008). In spite of this enthusiasm, its application as a framework for the development of city plans and policies is inconsistent, and in some cases superficial (Berke and Conroy, 2000).

The 'three pillars' approach mentioned above is not as pervasive in municipal understandings of sustainability as one might hope. Agyeman and Evans (2003) raise serious concerns about whether most cities consider social justice a necessary part of their sustainability platform. Additionally, many of the cities Portney (2003) highlights as pioneers of sustainability do not actively include social equity in their definition of sustainability, but rather expect that quality of life is improved for everyone by actions which address environmental or economic concerns (Portney, 2003).

Indeed, studies by Portney (2003) and Warner (2002) have found that social equity is rarely identified as a goal of sustainability policies, leading Portney (2003) to comment that, "if equity issues are important conceptual components of sustainability, then sustainable city initiatives in the US do not seems to take it very seriously" (p. 175). Likewise, in his study of the

connections between environmental justice and sustainability, Warner (2002) only found five cities linking these two concepts out of 77 cities.

Taking this concern one step further, Gunder (2008) argues that this is not an oversight, but rather the intentional misapplication of the term to achieve slanted political ends. In his words, "*sustainability* can be and often has been deployed selectively by planners or politicians as a materialization of dominant institutional ideologies supportive of growth and capital accumulation that maintains the existing status quo of class inequalities, with limited regard to the environment" (Gunder, 2008, p. 209). Lees (2008) and Raco (2007) agree, asserting that 'sustainability' and related terms have become tools in a gentrification agenda.

2.2.3 Impact of Planning for Sustainability on Housing Affordability

Even if the language of sustainability is present and intentions are good, there is some concern about the efficacy of sustainability policies in advancing their goal. Berke and Conroy (2000) note that "while the verbiage about sustainable development is substantial, there is little empirical evidence regarding the extent to which plans promote it" (p. 21). In their own study, Berke and Conroy (2000) compared comprehensive municipal plans that identified sustainability as a goal against those that did not to determine whether explicit use of a sustainability framework led to a more sustainable outcome. This study found no discernable difference in how well each group of plans facilitated sustainable development. Additionally, this study found that seemingly sustainable plans and policy directions did not "take a balanced, holistic

approach to guiding development and moving toward sustainability. Instead, they narrowly focused on creating more livable built environments, which is the historic mainstream focus of plans" (p. 30). This is significant in that it exposes the limitations of sustainability when applied in term only and the tendency for practitioners of sustainability to overlook components that are less marketable or politically supported. Moreover, it suggests the need for further research to consider the effectiveness of plans that integrate the principles of sustainability (economy, environment, and equity) as compared to a more piecemeal approach. Berke and Conroy (2000) point out that "governing these issues separately can be costly, and may result in unwanted consequences" (p. 31).

As noted by Saha and Paterson (2008), few studies of sustainable development have ventured beyond the scope of small-scale case studies or individual project evaluations. While these studies have significantly expanded an understanding of sustainable development in localized contexts, there is a need for more empirical studies to help identify the links between policy and outcomes.

Several notable studies have made significant contributions toward better understanding the potential link between sustainability policies and housing affordability. Burton (2003) looked at 25 cities in England inspired by the ideal of the 'compact city' as a means toward sustainability. Her research asked whether such cities were sacrificing social justice in the process of becoming more compact and found that housing affordability was indeed a 'loser' in this process. Similar results were found in the work of Bramley (2009) in his study on the

relationship between higher density development and resident satisfaction. These results, however, are equivocal. In their study on the impact of Smart Growth policies and centralized urban form on housing prices, Wassmer and Bass (2006) found “no evidence to support the contention that a successful effort to further centralize an urban area raises the price of homes in that urban area” (p. 439).

These conflicting results indicate that there is room for further inquiry to determine whether sustainability policies and housing expense are correlated.

3: RESEARCH QUESTION AND RATIONALE

In light of the literature previewed above, it is clear that a better understanding of the relationship between sustainability policy and housing affordability is needed. While other studies have taken a micro-scale look at the processes and policy outcomes within specific cities through case study analysis, this study takes a step back to explore macro-level patterns that may exist across a large sample of cities, some of which are actively pursuing the goal of sustainability through explicit policy directives and others which are not.

3.1 Research Question

This research will ask:

- Are cities in Canada and the United States adopting sustainability as a language and frame for policy as a means (intended or otherwise) of promoting and pursuing gentrification?

3.2 Rationale

This project is grounded on the assumption that municipal policies lead to a set of intended and unintended outcomes. As depicted in Figures 1 and 2, the purpose of this research is to explore the hypothesized relationship between two variables, *sustainability policy* and *housing affordability*. This small, but crucial, piece of research lays the foundation for future research on the interplay between sustainability policies and housing.

Figure 1 plays out one scenario of how these two variables may be related. In this scenario, there is an inverse correlation between sustainability policies and housing affordability, whereby affordability decreases as sustainability increases. Though correlation does not prove causation, this type of relationship could indicate that land values increase in response to improved livability, which in turn raises the cost of housing. If supported, this hypothesis illustrates how sustainability as a planning framework may be used as a means of gentrification.

Conversely, Figure 2 depicts a positive correlation, whereby housing becomes more affordable as sustainability increases. This relationship is often assumed in policy directions (such as Vancouver's EcoDensity project) that promote increased density, but this assumption has not been empirically proven (Lee, Villagomez, Gurstein, Eby, and Wyly, 2008).

Either scenario challenges the null hypothesis, that there is no relationship between the adoption of sustainability policies and housing affordability. This, or an inconclusive result, would indicate that unaffordable housing may not be an outcome (intended or otherwise) of sustainability policies. This finding would validate current practice in sustainability planning and quiet speculation about whether these efforts are contributing to rising housing costs.

Of course, correlation is not the same as causation, and these two variables may just co-occur. Therefore, if the null hypothesis is rejected, this research will show that housing affordability is *possibly* an outcome of planning for sustainability. Further research will be needed to verify whether this is so.

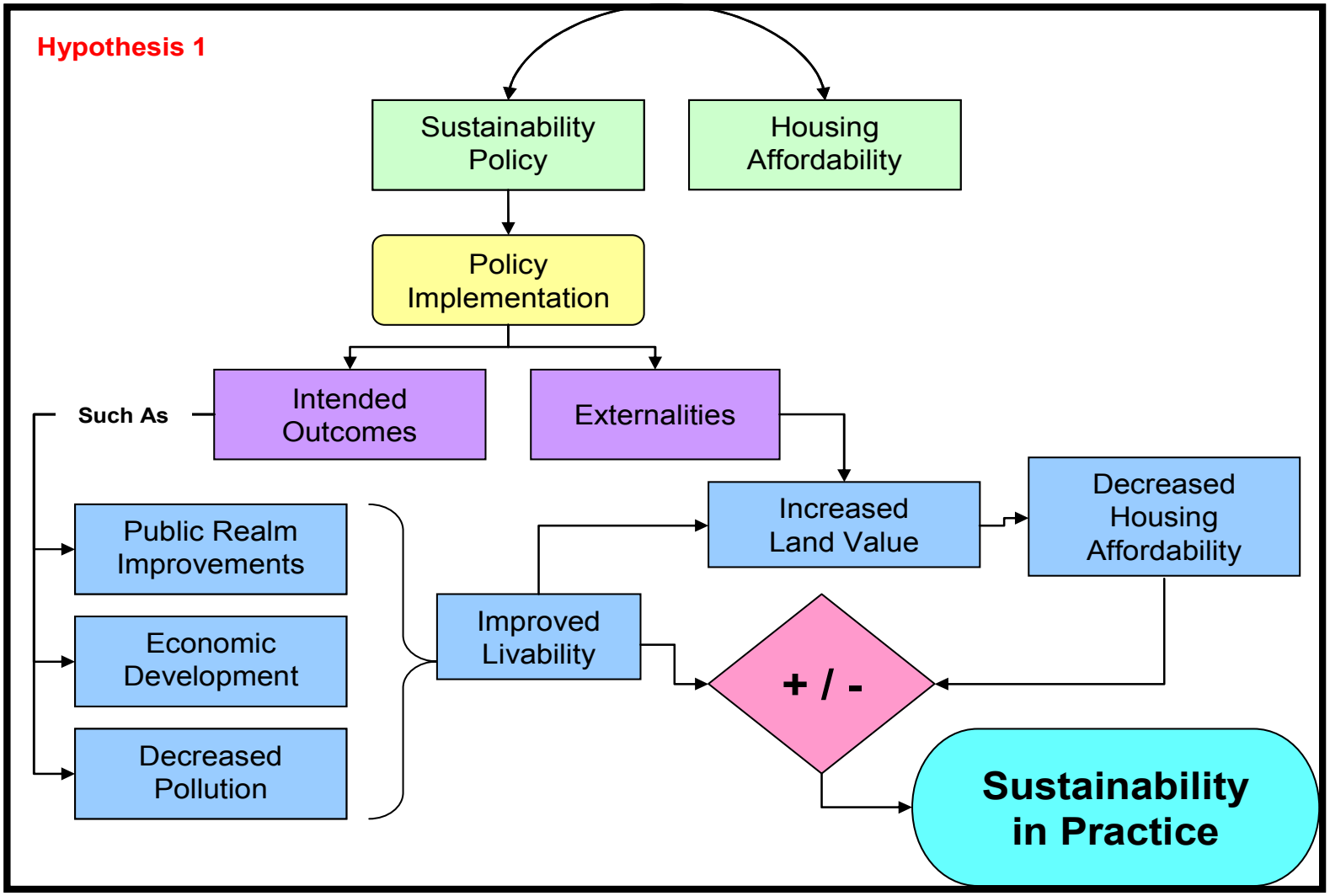

Figure 1: Model of Hypothesis 1 about the potential relationship between sustainability plans and housing affordability.

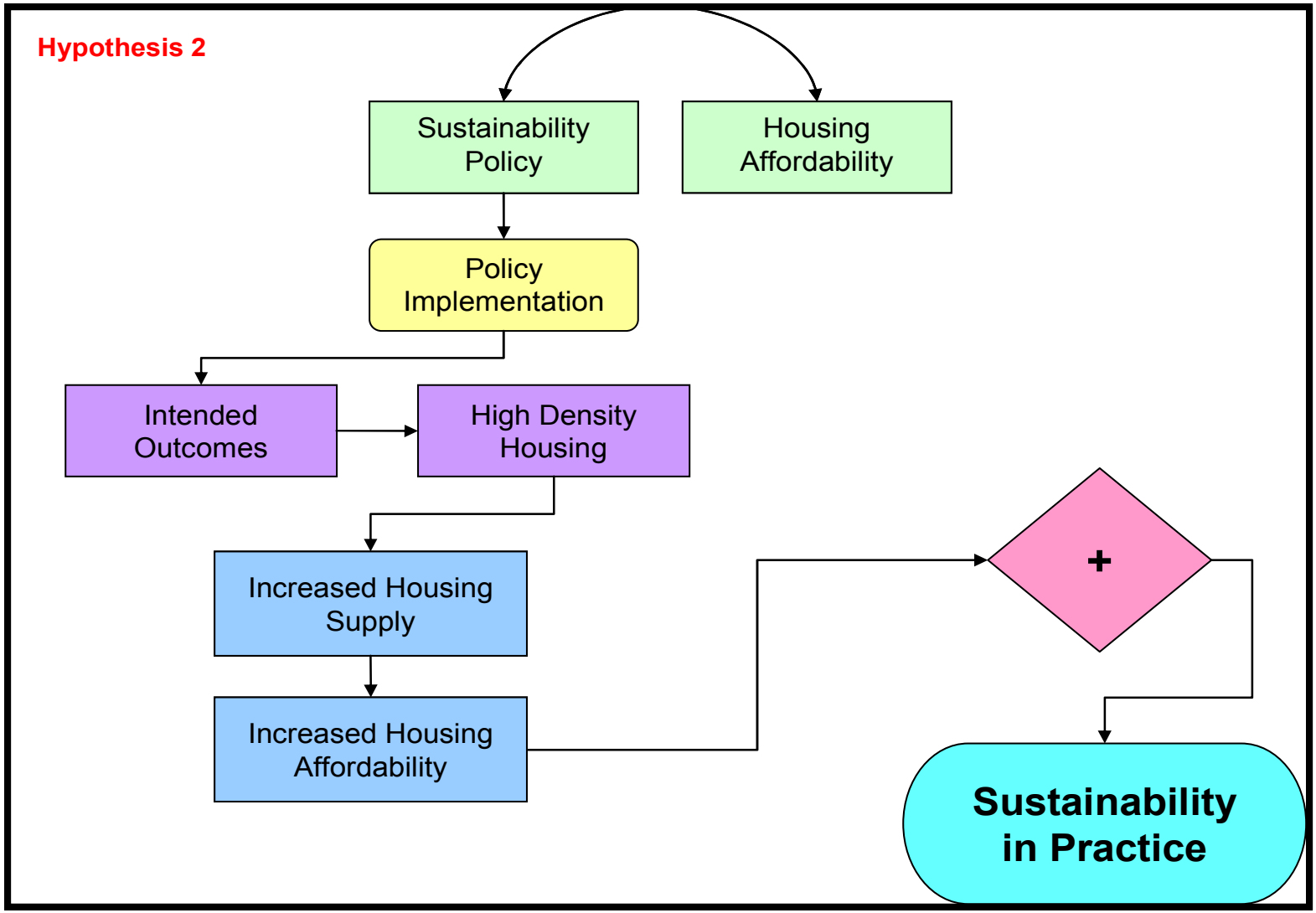

Figure 2: Model of Hypothesis 2 about the potential relationship between sustainability plans and housing affordability.

4: METHODOLOGY

To determine whether a correlation exists between the adoption of sustainability policies and housing affordability, this project looked for patterns across a large sample of cities with varying levels of commitment to sustainability. The presence of a policy with a sustainable goal (defined further below) served as a proxy indicator of sustainability. The use of policy as an indicator of sustainability is derived from the work of Portney (2003) on measuring the degree to which cities are 'serious' about sustainability.

In total, this project ranked and compared 71 cities through a three phase process. During Phase I, I produced a study group through a random sample of the most populous cities in Canada and the United States. These cities were then graded on their level of engagement with planning for sustainability, facilitated by an extensive survey of each municipal website. During Phase II, I constructed an index to determine whether housing affordability varied between cities in accordance with their commitment to sustainability. During Phase III, I conducted a series of correlation tests and analysed the results. These findings were triangulated against correlation results found using two sets of cities ranked by other sources: Portney (2007) and SustainLane (2006). Each phase is described in greater detail below.

4.1 Phase I

4.1.1 City Selection

To select the cities for my sample, I extracted a list of cities in the United States and Canada from the US Census Bureau and Statistics Canada. Figures for Canadian cities are from the 2006 Census, while figures for US cities are based on estimates for the year 2006. I elected to use the estimated population data for US cities because the estimations are reasonably accurate and this allowed me to draw population values for both countries from the same year.

This list was further refined to include only those cities with populations greater than 100,000. Though somewhat arbitrary, this population parameter was chosen in deference to the sample selection method employed in a similar study by Saha and Peterson (2008), which rationalized this choice based on the assumption that cities with a population of at least 75,000 are sufficiently large to have "enough planning and departmental staff capacity to enable pursuit of sustainability related activities" (p. 26). I opted to use 100,000 as my population threshold because the US Census Bureau publishes annual data for these cities, but not for those with lesser populations. Therefore, while smaller cities may also be engaged in the pursuit of sustainability, such efforts are beyond the scope of this research. This process yielded 48 Canadian cities and 260 US cities, for a total of 308 cities.

To ensure that Canadian cities were represented in my sample, I used a stratified random process to extract a subset of 100 cities to serve as my initial study group. I randomly selected 16 cities from the subset of Canadian cities and

added these to 84 randomly selected US Cities. These values were chosen to mirror the ratio of Canadian to US cities apparent in the master list of 308 cities. Randomizing was facilitated through the use of the Random.org (2009) List Randomizer.

I opted to draw my sample this way due to a dearth of appropriate lists for this purpose. Existing lists (produced by other studies, such as Burton, 2003; Cox, 2009; Portney, 2003; and SustainLane, 2006) do not include Canadian cities and, in the case of Cox (2009), include metropolitan areas rather than principal cities. Moreover, I sought a larger sample than has previously been studied to enable the exploration of subgroups within the dataset.

Though this initial sample included 100 cities, I only ranked the number of cities needed to produce a set of cities that can be subdivided into groups that are more and less committed to sustainable development. The sample size was deemed sufficient once I obtained a minimum of 60 cities and had reached the point of 'saturation', meaning additional cities did not add new variation to the sample group. My final sample of 71 cities is comprised of 16 Canadian cities and 55 US cities, representing six provinces and 27 states (Appendix B).

To produce a sample of cities with similar jurisdictional authorities, I eliminated any municipality that was identified as a regional or county municipal government. For instance, I omitted Lexington-Fayette Urban County in Kentucky because this city is also a county and may function somewhat differently than the other cities on my list. However, I did not omit amalgamated cities, such as Toronto, Ontario, as these cities are larger, but have no greater

authority to implement policy than traditional cities. Nor did I omit independent cities, which are primarily located in the state of Virginia and do not form part of a county or function as a county.

In addition to consolidated city-counties, I omitted cities, such as Paterson, New Jersey, with too little information on their website for me to assess their level of commitment, as well as cities that did not have a comprehensive plan (or equivalent) as of 2006. Lastly, I omitted cities in Quebec with documents in French only. Unfortunately, this criterion resulted in the omission of all cities in Quebec.

Each city removed from the sample list was replaced with a city from the original randomized list (US and Canadian cities were replaced with a city from the randomized list for that respective country). In total, I made 58 replacements (Appendix C).

4.1.2 Sustainability Indicators

At their most basic, indicators are a means of measurement. Good indicators are simple and easily understood by the general populace, and are relevant in the local context (Ghosh, Vale, and Vale, 2006). Indicators are a key component in the assessment of sustainability programs and allow us to effectively monitor our progress in the creation of sustainable cities. The Brundtland Commission recognized the importance of indicators and included the creation of sustainable development indicators as a goal (Holden, 2006).

While they agree that indicators are necessary to evaluate sustainability, Hueting and Reijinders (2004) argue that indicators should not be created for sustainability as a whole, but for economic, environmental, and social sustainability individually. They argue that the three facets of sustainability are in competition with each other and advances in one area may detract from another. Therefore, these indicators do not contribute equally to an overall measure of sustainability (Hueting and Reijinders, 2004). In the interest of simplifying this study, I did not differentially weight the sustainability indicators used in this study or consider how they interact. This is a limitation of my methodology, and one area that may be improved upon in future research.

The cities evaluated in this study are, at best, proto-sustainable cities struggling to develop into more sustainable cities. As such, this research employed a modified version of the 35 indicators developed by Portney in 2003 (updated in 2007) to measure the degree to which sustainability is taken seriously (Appendix A). It is important to note, as Portney does, that these indicators in no way measure how sustainable each city actually is, but rather the level to which each city is committed to becoming a more sustainable city.

Portney's (2007) index is unique in that it looks at the number and type of policies a city employs to promote sustainable outcomes. This index is both one-dimensional and complex. While it captures many factors that contribute to environmental sustainability, it does not capture economic sustainability as effectively, or social sustainability at all. In order to acknowledge instances of a

broader sustainability definition, I supplemented Portney's (2007) index with two indicators, explained in Table 1 in Section 4.1.3.

A second limitation of Portney's (2007) index is that it does not adequately account for the quality *or* quantity of a city's sustainability efforts, because only one point is possible for each indicator. As a result, two cities received the same point for a category regardless of how their programs actually compare. For instance, the City of Seattle (2006) has an aggressive Climate Action Plan, complete with 18 actions and specific indicators to monitor progress; however, this effort received the same score as the plethora of cities that have begun retrofitting civic buildings for greater energy efficiency. Likewise, a city with multiple programs to address a given issue will score the same as another city with one program.

What Portney's (2007) index does well is to capture the *range* of sustainability-related issues a city is addressing. This means that the cities with the highest score have the greatest program diversity, but not necessarily the greatest innovation or efficacy. That said, this measurement method levels the playing field to recognize the efforts of highly committed cities with lesser resources. Such cities are routinely overshadowed by sustainability power-houses, such as Berkeley and Seattle, but are no less committed to promoting sustainable development.

Many of the cities studied as part of this research are prototypes of what a sustainable city might look like and the testing ground for how effective sustainability plans and policies have been. This study examines these proto-

sustainable cities to evaluate whether their good intentions may be producing unforeseen consequences.

4.1.3 City Ranking

To identify any relationship between the implementation of sustainability policies and housing affordability, it is first necessary to assess each city's relative commitment to sustainable development. To this end, I evaluated and ranked 71 out of the 100 cities in my sample set using a modified version of Portney's (2007) index of seriousness about sustainability. Portney's original list is comprised of 35 indicators covering: "smart growth activities; land use planning programs, policies, and zoning; transportation planning programs and policies; pollution prevention, reduction, and remediation; energy and resource conservation/efficiency; sustainability indicators projects; and organization/ administration/management/coordination/governance" (Portney, 2007). Because I am primarily interested in the relationship between such policies on housing affordability, I added two indicators on the integration of the three pillars of sustainability and the inclusion of housing as a key program/plan/policy component (Table 1).

Table 1: Indicators added to Portney's (2007) index for this study.

Indicator	Reason for Addition
Definition of 'sustainability' in comprehensive or sustainability plan integrates economic, environmental, and social equity goals.	To determine whether this type of sustainability framework results in a different relationship with housing affordability than less holistic forms.
Housing affordability is an explicit part of a city-wide sustainability strategy.	To determine whether the recognition of housing as part of a comprehensive sustainability strategy changes any correlation.

To streamline my ranking process and allow for a cross border comparison, I omitted nine of Portney's indicators: two on the involvement of a city's mayor and council, one on the involvement of the business community and five on initiatives that are not equally operational in the US and Canada (Table 2). While engagement indicators are undoubtedly important to assessing a city's seriousness about sustainability, it is difficult to know the priorities of past governments or the extent of past business community involvement. As this research is more interested in policy adoption, these omissions do not lessen the value of the rankings as they are used here. I opted to exclude five policy indicators due to the lack of similar programs or capacity in Canada and one sustainability feature due to the difficulty in confirming its presence. Removing these policies allows for a more balanced cross-country comparison. With these adjustments, the top score possible is 26.

Table 2: Omitted indicators from Portney's (2007) index.

Indicator	Reason for Omission
Involvement of mayor or chief executive officer.	Difficult to know the priorities of past governments.
Involvement of city/county/metropolitan council.	Difficult to know the priorities of past governments.
Involvement of the business community (e.g. Chamber of Commerce, Sustainable Business organization).	Difficult to know the past involvement of the business community.
Tax incentives for environmentally friendly development (only where zoning is not permitted).	Canadian cities do not levy taxes, so are less able to offer tax incentives for development.
Superfund (non-brownfield) site remediation.	Superfund sites are identified by the EPA, which also facilitates clean up efforts through a grant process. No comparable program exists in Canada.
Alternative energy offered to consumers (solar, wind, biogas, etc.).	Canadian cities are not involved in the provision of utilities, so are not able to offer alternative energy options to consumers.
Asbestos abatement program	This initiative is in response to federal asbestos regulations and is facilitated by federal and regional EPA offices. No comparable program exists in Canada.
Lead paint abatement program	This initiative is in response to federal lead paint regulations and is facilitated by the EPA through a grant program. No comparable program exists in Canada.
Car pool lanes, HOV or diamond lanes	It proved too difficult to determine whether such features existed, or if found, when they were implemented.

To ensure a high level of rigour and consistency, I used the following method and definitions in my ranking process. Note that some of my indicator interpretations may differ from Portney's (2007) and, unlike Portney, I limited my search to those policies which were explicitly identified on city websites. Additionally, this research does not consider extra-municipal sustainability efforts, such as those by regional governments, business, or non-profit sectors. As such, some of my rankings differ from those Portney had done for the same city. This in no way invalidates either process, but does highlight one limitation of my study: as a city may be engaged in sustainability activities that are not advertised or readily found on their website, I may under-rank cities with less sophisticated or less boastful sites. I endeavoured to minimize this problem by making extensive use of city search engines, which allowed me to find less visible actions within city council minutes and departmental reports. Additionally, I excluded cities which clearly did not provide enough documentation on their website for a thorough evaluation.

To begin my ranking process, I reorganized Portney's indicators into a hierarchy of program elements and looked first for the department or governance structure to carry out sustainability goals, second for an overarching city comprehensive plan, and third for individual initiatives. Lastly, any program element indicator not found in the larger plan was searched for individually using that city's website search function and by exploring departments that may be responsible for the project in question. For instance, if a city's comprehensive plan did not refer to a pesticide reduction program, I would consult that city's

parks department and/or stormwater management plans. If after this process I was unable to locate a supporting initiative, the city received a zero for that indicator.

For a city to receive a point for a given indicator, the policy or plan must have been approved in or prior to 2006. This cut-off date was chosen to exclude policies approved after the affordability data used in this analysis was gathered. Because this project is looking for correlation, rather than causation, it is not necessary to limit inclusion to policies existing for a number of years before the housing data was collected. One problem with this date cut-off is that it is not always possible to access policies extant in 2006 if they have been superseded by newer policies. In this case, I have explored the 'background' section of the new policy for commentary on how it differs from the previous policy or explanations of amendments. Individual cities were contacted to clarify policies with ambiguous approval dates.

Policies and plans were included or not based on the language used in the title and body of the policy document. Policies which may have a sustainable goal, but do not use sustainability language (defined further below and in Appendix C), were not included. I opted to make this distinction for two reasons: first, this eliminated the need to closely examine each program and subjectively determine whether it supported sustainable ends; and second, this research is concerned with a city's use of sustainability as a planning framework, and not with a city's actual level of sustainability. As such, programs which are not actively pursuing sustainability in name are beyond the scope of this research.

For each indicator, the following rationale was used to accept or reject a policy.

Please see Appendix C for the code words used to find relevant policies:

1. **Indicator:** Single government department responsible for implementing sustainability programs.

   Rationale: The presence of an Office/Department of Sustainability, or related, shows a higher level of commitment because this "implies clear delineation of responsibility and accountability" (Portney, 2003, p. 38). To receive a point for this indicator, the department must be a full time, staffed division, not an advisory committee or community group. This is not to say that such groups are not important or do not contribute to a city's overall sustainability effort, but the purpose of this indicator is to identify the presence of a department with the authority to create, implement, and evaluate municipal policies.

2. **Indicator:** Sustainability is an explicit part of a citywide comprehensive or general plan.

   Rationale: Like indicator 1, this is a governance measure (Portney, 2003). Plans that invoke sustainability or sustainable development in name are making a stronger statement about their intent to pursue this end. The plan in question must be city-wide and intended to serve as a guide for future planning and development actions on a wide variety of city issues (as opposed to a stand-alone land use plan as in indicator 4 or other more specific policies[1]). To receive a point for this indicator, sustainability must appear as a specific goal,

[1] Certain Canadian cities presented a special case whereby two separate documents, a Strategic Plan and a Land Use Plan, were considered together in lieu of a single document containing both a vision and land use element. Combining these two plans produced something more akin to the Comprehensive City Plans typical in American cities.

objective, or vision statement. No points were awarded for climate action plans, or the like, as these policies are captured in Indicator 25.

3. **Indicator:** Definition of 'sustainability' in comprehensive or general plan integrates economic, environmental, and social equity goals.

   Rationale: I added this indicator to Portney's (2007) list to address Berke and Conroy's (2000) assertion that a balanced approach is needed to move cities "beyond the symbolic rhetoric" (p. 30) toward a genuinely sustainable result. To receive a point for this indicator, sustainability must be part of a city's comprehensive plan and must be defined as a balance between the environment, economy, and social equity (the three E's), rather than focused on one branch of sustainability. Variants, such as people, planet, and prosperity (the three P's) were also accepted.

4. **Indicator:** Indicators project active in last five years and/ or Indicators progress report in last five years (to evaluate the Comprehensive Plan). This indicator only applies to cities that received a point for Indicator 2.

   Rationale: The presence of an indicator project demonstrates a willingness to revisit policies and monitor their effectiveness in achieving their stated goal (Portney, 2003). While many Comprehensive Plans express intent to measure progress, points were only awarded if a specific set of indicators had been created and/or a progress report had been completed. No points were awarded for State of the Environment reports or piecemeal indicators present in single initiative plans, but not the comprehensive plan.

5. **Indicator:** Comprehensive Plan includes an “action plan” of policies/programs. This indicator only applies to cities that received a point for Indicator 2.

   Rationale: Much like the presence of indicators, the development of an action plan or strategy signifies a higher level of commitment than objectives alone (Portney, 2003). A point was awarded for sets of specific policy recommendations, but not for suggested areas of further research.

6. **Indicator:** Public participation in the development of the Comprehensive Plan.

   Rationale: Citizen engagement is an integral component of sustainable cities because it promotes good governance and “community-based problem solving” (Portney, 2003, p. 127). This is key as the success of any initiative is dependent on both politician and public buy-in.

7. **Indicator:** Comprehensive land use plan that includes environmental issues.

   Rationale: The environment is necessarily affected by land use decisions, so must be a consideration in any land use plan that supports the goal of sustainability (Portney, 2003). A city received a point for a Land Use Plan or Zoning Code that explicitly identified environmental concerns as part of its mission statement, purpose, or policy rationale.

8. **Indicator:** Growth management policies.

   Rationale: Portney’s (2007) version of this indicator looked for zoning mechanisms to protect environmentally sensitive areas from growth. I expanded this to include non-zoning types of protection, such as urban growth boundaries. This change preserves the intent of this indicator, but acknowledges that

zoning is not the only way to protect natural areas. Points were not granted for policies that direct growth toward urban centers or infill strategies (Indicators 9 and 11).

9. Indicator: Targeted or cluster economic development.

Rationale: Targeted or clustered land use patterns are a smart growth element to prevent sprawling development (Portney, 2003). This can include plans to promote Transit-oriented development (TOD), Urban Villages, or compact/complete neighbourhood development. While they are a type of targeted development, no points were awarded for infill development or plans to revitalize an economically blighted area (indicators 11 and 12).

10. Indicator: Eco-industrial park development.

Rationale: Eco-industrial parks are sites where industries engage in a symbiotic relationship, with one industry making use of another's waste (Portney, 2003). Misapplications of the term were not counted (for instance, development of a traditional industrial park with eco-oriented industry).

11. Indicator: Urban infill housing project or program.

Rationale: Infill housing is a type of targeted development that counters urban sprawl by building housing on underutilized spaces in already developed areas (Portney, 2003). Points were awarded for policies which actively encourage increased densification, but not for infill housing design guidelines or other policies which control or limit infill development.

12. Indicator: Brownfield redevelopment or similar revitalization effort.

Rationale: Brownfields are another type of targeted, infill development that reuses existing land in a new way. What separates brownfield development from other types of redevelopment

is that brownfields are contaminated sites in need of some form of environmental remediation. As such, development on these sites is generally incentivized (Portney, 2003). Though Portney (2007) only considered sites with environmental drawbacks, I modified this indicator to include redevelopment of underperforming areas, such as slums or downtrodden neighbourhoods. Like traditional brownfields, these areas often require governmental assistance to spur reinvestment. This change was necessary to mollify the advantage of cities with an industrial heritage and, therefore, more brownfield sites. In either type of incentivized area, redevelopment supports sustainability by discouraging greenfield development.

13. Indicator: Operation or sponsorship of public transit (buses and/or trains).

Rationale: The presence of public transit service supports sustainability by reducing auto dependency and minimizing air pollution (Portney, 2003). In many cities, transportation services are provided by a regional organization; however, the city is still an active participant in decision making or operation of that service. Points were granted on the basis of whether or not regular bus (or other) service was available to all residents, regardless of the level of service provided. Cities did not receive a point for on-call services, such as dial-a-ride and other paratransit provisions.

14. Indicator: Bicycle ridership program.

Rationale: Like mass transit service, programs to encourage bicycle use seek to improve air quality and car-free mobility (Portney, 2003). To receive a point for this indicator, a city must have a bicycle master plan, or an expressed strategy to

increase cycling as a commuting option within the comprehensive plan or master transportation plan.

15. Indicator: Limits on downtown parking spaces.

Rationale: This indicator is also aimed at increasing use of non-car alternatives. As Portney (2003) notes, limiting the availability of parking spaces produces "incentives for commuters to seek means of transportation other than the personal automobile" (p. 67). A point was granted for plans to take away parking spaces (not including street parking) or reduce the number of spaces required in new developments or specified areas. No points were awarded for the removal of street parking to ease the flow of traffic or plans to limit surface parking lots in favour of underground or otherwise concealed parking spaces.

16. Indicator: Alternatively fuelled city vehicle (green fleet) program.

Rationale: This indicator is a measure of a city's commitment to sustainability within its own operations (Portney, 2003). A point was given for city vehicle fleets powered by biodiesel, electricity, hybrids, or other alternative fuels. Pilot green fleet programs also received a point.

17. Indicator: Household solid waste recycling.

Rationale: This, along with indicators 18 and 19, express a city's commitment to waste reduction (Portney, 2003). To receive a point, a city must have some form of pick-up (curbside) recycling service. No points were awarded for the presence of a recycling depot where residents can drop off recyclables.

18. Indicator: Industrial recycling.

Rationale: For this indicator, a city must have a regular program to facilitate the recycling of construction and demolition debris, asphalt, or concrete. Commercial recycling pick-up programs did not receive a point. No points were awarded for individual projects that reclaimed or recycled waste materials.

19. Indicator: Hazardous waste recycling.

Rationale: City programs to facilitate the recycling of hazardous wastes, minor risk wastes (household hazardous waste) and or biomedical wastes received a point for this indicator. A point was given for the presence of a drop-off site for such materials if the depot was within city limits.

20. Indicator: Air pollution reduction or program to reduce heat island effects.

Rationale: Portney (2003) states that "sustainability requires explicit attention to issues of pollution remediation, reduction, and prevention" (p. 67). This indicator meets this need. While Portney (2003) only counted programs to reduce pollutants, I expanded this indicator to also consider efforts to reduce heat island effects. Heat islands are pockets of increased temperatures caused by the replacement of vegetated areas with an urbanized environment. This temperature change reduces air quality and can lead to increased energy use and related harmful emissions (Environmental Protection Agency (EPA), n.d.). Many different types of programs received a point for this indicator, including air pollution reduction strategies within the comprehensive plan, programs to reduce residential or industrial emissions, anti-idling laws, fleet upgrades that reduce particulate emissions without changing to an alternative fuel source, urban forestry tree

planting programs, and green roof projects. Points were not awarded for programs counted by other indicators, such as a green fleet program, green building program, public transportation or bicycle ridership programs, renewable energy use by municipal governments, or energy conservation efforts.

21. Indicator: Ethical and environmental purchasing by city government.

Rationale: This is a modified version of Portney's (2007) indicator, which only looked for city purchasing of recycled products. I updated this on the assumption that most cities purchase recycled copy paper whether they have a policy to do so or not. Therefore, a more meaningful indicator is one that captures environmentally preferable purchasing policies, or those that support ethical business practices, such as a fair trade or sweat free policy. Adding the ethical component also broadens the application of this indicator as a measure of sustainability by including policies that promote social equity.

22. Indicator: Pesticide reduction program.

Rationale: In 2007, this indicator was added to Portney's original 2003 index as a further measure of a city's commitment to pollution reduction and environmental remediation. To receive a point, a city must have a policy to reduce pesticide use or to employ less toxic substances and methods, such as an Integrated Pest Management (IPM) program.

23. Indicator: Green building program.

Rationale: Like indicators 24, 25, and 26, green building programs are part of a city's "energy and resource conservation" (Portney, 2003; p. 67) efforts. Points were awarded for green building

programs, codes, or policies requiring LEED standards (or equivalent). Cities did not receive a point for demonstration projects or for the publication of informative brochures or how-to guides.

24. Indicator: Renewable energy use by city government.

Rationale: A point was awarded for city buildings powered in whole or part by alternative energy sources, such as solar, wind, or methane gas captured from a local landfill. Points were not awarded for alternative fuel use in city vehicles (Indicator 19).

25. Indicator: Energy conservation effort (other than Green building program).

Rationale: To receive a point for this indicator, a city must be engaged in some form of activity to reduce energy use, such as building upgrades to improve efficiency, or have a Climate Action Plan.

26. Indicator: Water conservation program.

Rationale: A wide variety of conservation efforts received a point for this indicator, such as water use reduction efforts, plumbing retrofits, greywater or wastewater use in irrigation, xeriscaping, or rainwater collection and reuse. This indicator does not capture efforts to protect waterways or otherwise improve water quality through policies to control stormwater run-off or the dumping of pollutants. While such efforts are important to a city's commitment to sustainability, this indicator is intended to convey an interest in making efficient use of resources.

Though it did not factor into a city's overall score, I also made note of when a city included affordable housing as part of their sustainability strategy.

27. Indicator: Housing affordability is an explicit part of a city's comprehensive plan. This indicator only applies to cities that received a point for Indicator 2.

Rationale: Housing affordability, or affordable housing, as a goal or tenet of a comprehensive plan that includes sustainability as a goal. No points were awarded for this indicator, it is just noted when this element is part of such a plan.

Table 3 lists the highest and lowest ranked cities based on this methodology[2]. Appendix E contains the full list.

Table 3: The highest and lowest scoring cities based on the set of indicators used in this study.

Sustainability Score		City	Value
Most Committed to Sustainability	**1**	Berkeley	25
	2	Seattle	24
	3	San Diego	23
	3	San Buenaventura	23
	4	Long Beach	22
	4	Tucson	22
	4	Dallas	22
Least Committed to Sustainability	**1**	Lubbock	6
	2	Detroit	7
	3	Salem	8
	3	Syracuse	8
	3	Pompano Beach	8

I tested the validity of the sustainability scores I gave cities against those assigned by SustainLane in 2006 and by Portney in 2007. Portney's (2007)

[2] Toronto was the highest scoring Canadian city, with a score of 21. With a score of 18, Vancouver was ranked as the 8th most sustainable city, tied with nine other cities.

criteria differ significantly from the SustainLane (2006) criteria, but both attempt to compare how engaged cities are with sustainability. Portney's (2007) index of 35 indicators considers a city's promotion of sustainability through supportive policies, while SustainLane (2006) explores the effects of such policies.

SustainLane is a media network that is the "web's largest people-powered guide to sustainable living" (SustainLane, n.d.). Since 2005, SustainLane has annually ranked the 50 most populous US cities on the basis of sustainability. In contrast to Portney's rankings, SustainLane attempts to evaluate how successful a city has been in achieving sustainability. Rather than looking at the number or type of policies a city has enacted to support sustainability, SustainLane compares elements such as a City's air quality, carbon emissions, and the amount of waste diverted from landfills. In total, SustainLane measures 16 sustainability indicators to develop their overall rankings (SustainLane, 2006).

Though the criteria employed in the three rankings differ, each revealed the same trends. The scores that I awarded cities strongly positively correlated to those of both SustainLane (2006) and Portney (2007) (Table 4). This finding lends credibility to my selection of indicators and ranking process and confirmed that I had fairly categorized cities as more and less committed to sustainability.

Table 4: Sustainability rankings comparison.

Sustainability Score		Starkey (2010)	Portney (2007)	SustainLane (2006)
Starkey (2010)	Pearson Correlation	1	.548	.592*
	Sig. (2-tailed)		.065	.026
	N	71	12	14
Portney (2007)	Pearson Correlation	.548	1	.408*
	Sig. (2-tailed)	.065		.039
	N	12	40	26
SustainLane (2006)	Pearson Correlation	.592*	.408*	1
	Sig. (2-tailed)	.026	.039	
	N	14	26	50
*. Correlation is significant at the 0.05 level (2-tailed).				

The indicators used within this project and by Portney (2007) measure outputs, while the SustainLane (2006) indicators measure outcomes. Therefore, the strength of these correlations also suggests that outcomes are strongly correlated to outputs, which supports a major assumption of this study.

4.2 Phase II

4.2.1 Definition of Affordability

Housing affordability is a fundamental concern within sustainability, as part of the social equity pillar. This is a broad concept that covers a wide range of topics, such as publicly-funded (or social) housing for low-income families, needs-based housing for the mentally ill or physically disabled, or market-rate housing that the average wage-earner can reasonably pay for. This study is principally concerned with the latter theme: the ability of an individual earning an average income to afford housing in their community.

Much like sustainability, the affordability of housing is somewhat difficult to define. As Stone (2006) notes, “affordability is not a characteristic of housing—it is a *relationship* between housing and people. For some people, all housing is affordable, no matter how expensive it is; for others, no housing is affordable unless it is free” (p. 153).

The dominant definition of affordable housing is the ratio of income to cost of housing. Housing which costs more than 30% of a person’s income is deemed unaffordable, regardless of net pay or personal choice (Stone, 2006). Stone (2006) argues that a better measure of housing affordability is “residual income” (p. 163). He notes that housing asserts the “largest and least flexible claim on after-tax income for most households” (p. 163), which limits the ability of households to procure other life necessities. Therefore, the real measure of affordability is the *impact* the cost of housing has on a household budget, or “the residual income left after paying for housing” (p. 163). However, this approach to measuring affordability is not yet feasible due to a lack of standards on the cost of non-housing needs (Stone, 2006). In light of the inadequacies of price-to-income ratios and residual income as sole measures of affordability, this project opted to evaluate cities using an index built around a compendium of housing affordability indicators.

4.2.2 Housing Affordability Indicators

According to Thalmann (2003), “In those countries where housing standards and supply are generally adequate, affordability has become the central concern of housing policy” (p. 291). He goes on to note that, in spite of its

preeminent position in policy discussions, there are few indicators of affordability beyond the omnipresent, but insufficient, price-to-income ratio (PIR). The dominance of the PIR stems from its ease in calculation, comparability, and comprehension (Thalmann, 2003). However, as Thalmann (2003) states, "alternative indicators do exist" (p. 292).

Within his study, Thalmann (2003) sought to meld the PIR and residual income approaches into one model. This study helps to better identify households in core housing need, but does not help clarify whether one city is generally more or less affordable than another for the average housing consumer.

In her 2000 study of compact cities, Elizabeth Burton established a short list of five indicators to assess housing affordability in 25 cities across the UK:

1. "Average price of bottom-of-the-market dwelling relative to average weekly earnings.
2. Percentage change 1983–91 in average price of bottom-of-the-market dwelling relative to average weekly earnings.
3. Average weekly net unrebated local authority rent.
4. Percentage of local authority and private tenants in receipt of rent rebate.
5. Percentage homeless (persons in hostels, bed and breakfasts, rough sleepers and concealed households)" (p. 1994).

Like Thalmann (2003), Burton's (2000) indicators provide a good means to measure housing affordability for low-income residents; however, a broader set is needed to complete this study.

Malpezzi and Mayo (1997) offer a set of 10 indicators that provide a more complete picture: PIR for renters and owners; the number of housing units produced in a year; the amount of money invested in housing in a year; the amount of floor area per person for living; the amount of housing supply constructed with permanent materials; the amount of illegal or otherwise unapproved housing; the ratio of mortgage loans held to non-mortgage loans; the value of developable urban land as compared to land outside the city; the amount spent on city infrastructure per person. Unfortunately, not all of these indicators are readily available or easily comparable across countries.

These three studies all attempted to measure affordability for low-income residents. For the purposes of this study, I needed indicators that would measure affordability for renters and owners at a variety of income levels. In *The Ontario Community Sustainability Report*, The Pembina Institute (2007) offered insight into how this might be done. Within this study, The Pembina Institute (2007) created a series of indices to measure facets of sustainability, including an Economic Vitality Index and Livability/Equity Index. Though they did not create an affordability index, each index included several housing affordability indicators. From the Economic Vitality Index, The Pembina Institute (2007) cited dwelling values as an indicator of "the desirability of living in a given community" (p. 28), while the Livability/Equity Index included an indicator on "dwelling

diversity" (p. 23), and PIR for both renters and owners. Taken together, these four indicators allow for a more robust measure of housing affordability for the average citizen.

4.2.3 Unaffordability Index

Existing affordability indices are centered around one facet of the housing market: either the ability of a household earning the median national income to purchase a home, or the likelihood that a given household will require social housing assistance. While these are undoubtedly important measures of affordability, both types are insufficient for the purposes of this project. This project considers a broader conceptualization of affordability, one that includes affordability for renters, owners, low-income households, and median-income households.

In the absence of an existing index that measures unaffordability for all types of dwellers, it was necessary to construct one. Drawing on the work of Thalmann (2003), Burton (2000), Malpezzi and Mayo (1997), as well as The Pembina Institute (2007), I settled on an additive index that considered raw housing costs, the percent of household income committed to housing costs, vacancy rates, and tenure.

To construct an unaffordability index, I first looked for correlations between each possible indicator and eliminated very strongly correlated indicators to prevent double counting. I then assessed the relationships expressed by the

indicators, such as the direction of correlation between cost and levels of ownership.

As noted by The Pembina Institute (2007), a reliable measure of a housing affordability must consider dwelling costs, dwelling diversity, and price to income ratios (PIR). In light of the literature mentioned above, I added a component to consider housing tenure and vacancy rates. Taking data from the US Census Bureau and Statistics Canada, I built an index with the following data:

1. Median Dwelling Value
2. Price-to-Income Ratio: Owners
3. Price-to-Income Ratio: Renters
4. Percent of Owner Households
5. Vacancy Rate: Rental

I opted to omit an indicator of dwelling diversity, as this indicator did not have the same linear relationship to affordability as the others[3].

[3] The ideal situation for housing affordability is a balance between housing types, rather than an increase in any one type of dwelling (The Pembina Institute, 2007).

Table 5: Unaffordability Index indicators.

Indicator	Impact on Affordability
Median Dwelling Value	↓
Price-to-Income Ratio: Owners	↓
Price-to-Income Ratio: Renters	↓
Percent of Owner Households	↑
Vacancy Rate: Rental	↑

In Table 5, the arrow direction represents whether affordability increases or decreases as the value of the indicator increases. For instance, as median dwelling values increase, affordability decreases. Indicators that have a negative relationship to affordability were added to the index and those with a positive relationship were subtracted. Therefore, cities with the highest scores were the least affordable. Table 6 shows the cities with the highest and lowest affordability scores[4].

Table 6: The cities with the most and least affordable housing, as rated by the Unaffordability Index created for this study.

Unaffordability Index		City	Value
Least Affordable	**1**	Berkeley	7.13
	2	Long Beach	5.65
	3	Costa Mesa	5.48
	4	Newark	4.82
	5	Moreno Valley	4.72

[4] Vancouver scored as the least affordable Canadian city, ranking 14th least affordable overall.

Unaffordability Index		City	Value
Most Affordable	**1**	Overland Park	-5.17
	2	Thunder Bay	-4.47
	3	Sioux Falls	-4.17
	4	Winnipeg	-3.91
	5	Kansas City (MO)	-3.54

To test the validity of this index, I took a sample of the most and least affordable cities as determined by Cox (2007) in Demographia's annual international survey of housing affordability and scored them using the Unaffordability Index I created (Table 7). The Demographia study ranks cities on the basis of their "median multiple" score, which measures housing values against median incomes. One significant limitation of this comparison is that the Demographia study compares Census Metropolitan Areas rather than individual cities. However, a region's overall affordability closely mirrors that of the region, so this comparison is still valid. It is, however, important to note that I was less interested in the precise ranking of each city than in whether my index preserved the general trend. Conducting a Pearson Product Moment Correlation Coefficient test revealed that the rankings derived by both methods are very strongly correlated.

Table 7: Comparison of the Unaffordability Index to the Cox (2007) rankings.

Unaffordability Index		Starkey (2010)	Cox (2007)
Starkey (2010)	Pearson Correlation	1	.880**
	Sig. (2-tailed)		.000
	N	32	32
Cox (2007)	Pearson Correlation	.880**	1
	Sig. (2-tailed)	.000	0
	N	32	32
**. Correlation is significant at the 0.01 level (2-tailed).			

In addition to a comparison with Cox (2007), I also compared this index to the housing affordability scores awarded by SustainLane in their city rankings. As with the Cox (2007) list, I found a very strong correlation between their measure of affordability and my own (Table 8 and Figure 3).

Table 8: Comparison between the Unaffordability Index and SustainLane Affordability Score.

Unaffordability Index		SustainLane (2006)	Starkey (2010)
Starkey (2010)	Pearson Correlation	.815**	1
	Sig. (2-tailed)	.000	
	N	50	50
SustainLane (2006)	Pearson Correlation	1	.815**
	Sig. (2-tailed)		.000
	N	50	50
**. Correlation is significant at the 0.01 level (2-tailed).			

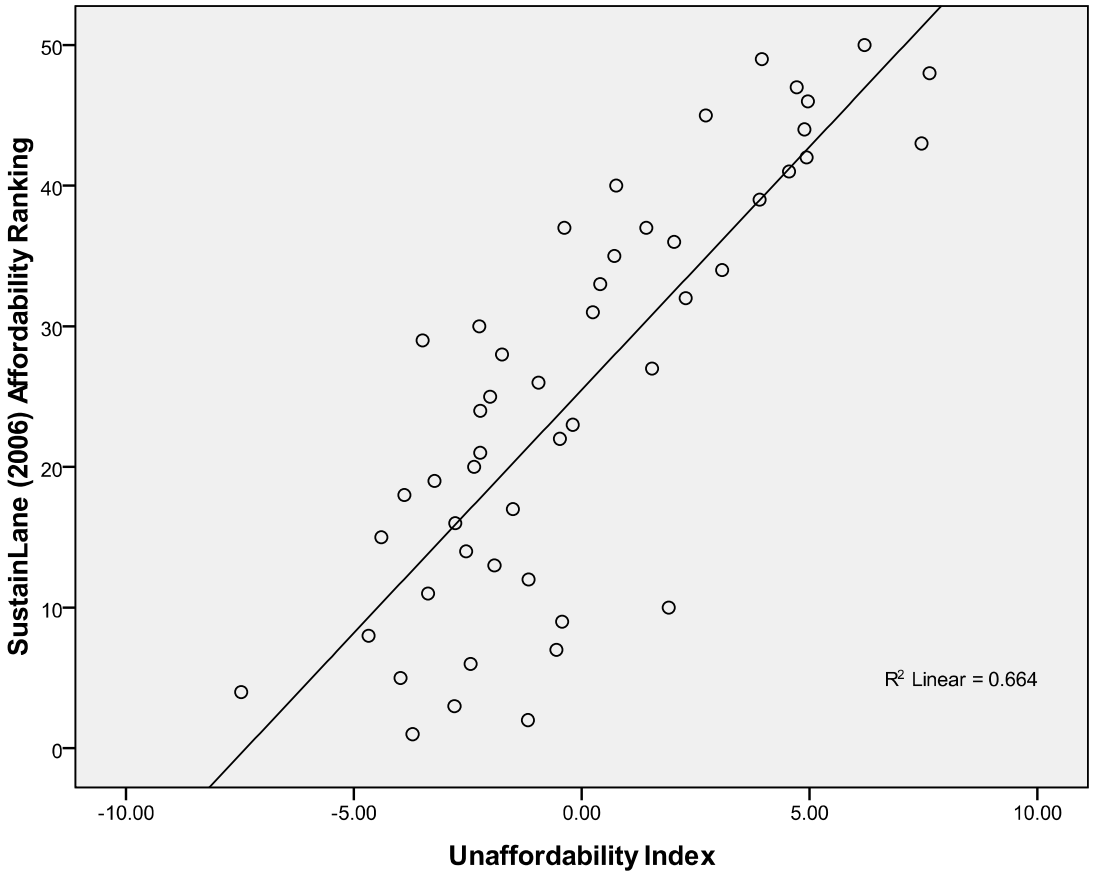

Figure 3: Scatter plot showing the comparison between the Unaffordability Index and SustainLane's (2006) Affordability Score.

This further corroborates my finding that the Unaffordability Index I constructed is correctly identifying more and less affordable cities.

4.3 Phase III

4.3.1 Data Sources

To compare the ranked cities, I gathered demographic and economic data from Statistics Canada's Census (2006), the US Census Bureau's American

Community Survey (2006), and the Canada Mortgage and Housing Corporation's (CMHC) Rental Market Study (2007). Specifically, I used the following statistics:

1. Population
    a. Statistics Canada: Population in 2006
    b. US Census Bureau: Total Population: 2006 Estimate
2. Household Income
    a. Statistics Canada: Median Income in 2005 – All private Households ($)
    b. US Census Bureau: Median Household Income (dollars)
3. Housing Characteristics
    a. Statistics Canada:
        i. Average Value of Owned Dwelling ($) [owner-occupied private dwellings]
        ii. Number of Owned Dwellings
        iii. Number of Rented Dwellings
        iv. Median Monthly Payments for Owned Dwellings
        v. Median Monthly Payments for Rented Dwellings
        vi. Single-detached houses [as a % of total occupied private dwellings]
        vii. Semi-detached houses
        viii. Apartments in buildings with fewer than five storeys
        ix. Apartments in buildings with five or more storeys
        x. Other dwellings

    b. US Census Bureau:
        i. Median Value of Owner-Occupied Units (dollars)
        ii. Housing Tenure – Owner-occupied
        iii. Housing Tenure – Renter-occupied
        iv. Median Owner Costs in Housing Units With and Without a Mortgage
        v. Monthly Owner Costs as a Percentage of Household Income
        vi. Median Rent
        vii. Gross Rent as a Percentage of Household Income

viii. Homeowner Vacancy Rate
ix. Rental Vacancy Rate
x. Units in Structure:
1. 1 Unit, Detached
2. 1 Unit, Attached, 2 Units, 3 or 4 Units, 5 to 9 Units, 10 to 19 Units, 20 or More Units

c. CMHC:
i. Rental vacancy rate

Where necessary, I adjusted the raw data (i.e. converting raw numbers to percentages or collapsing multiple categories into one total value).

4.3.2 Dataset Descriptives

The 71 cities ranked within this study displayed the following characteristics:

Table 9: Descriptives for the Starkey (2010) dataset.

	Range	Minimum	Maximum	Mean	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Population	2402635	100646	2503281	355657.82	3.051	.285
Median Household Income	61871	26464	88335	50953.87	.610	.285
Sustainability Score	19	6	25	15.59	-.064	.285
Unaffordability Index	12.29	-5.17	7.13	.0000	.565	.285

4.3.2.1 Population

As noted previously and shown in Table 9, all the cities in this sample have populations greater than 100,000. Not surprisingly, the population values are severely positively skewed, meaning that only a few cities have very high populations. The skewness of a distribution is an important consideration because it may distort the calculated correlation strength. Two variables with

significantly mismatched distribution shapes will appear less strongly correlated than may be the case (Weinberg and Abramowitz, 2008). To avoid this potential error, I transformed the population values using a base-10 logarithmic function "to symmetrize the distribution" (Weinberg and Abramowitz, 2008, p. 133). Population data for the cities ranked by Portney (2007) and SustainLane (2006) was similarly skewed, and so were transformed in the same manner.

The resultant distribution is still positively skewed, but less so. In this sample, Toronto and Phoenix are extreme outliers, with populations more than "1.5 [Interquartile Range]s beyond the 75^{th} or 25^{th} percentile" (Weinberg and Abramowitz, 2008, p. 75); however, I did not omit them as they did not appear to bias the findings (Figure 4).

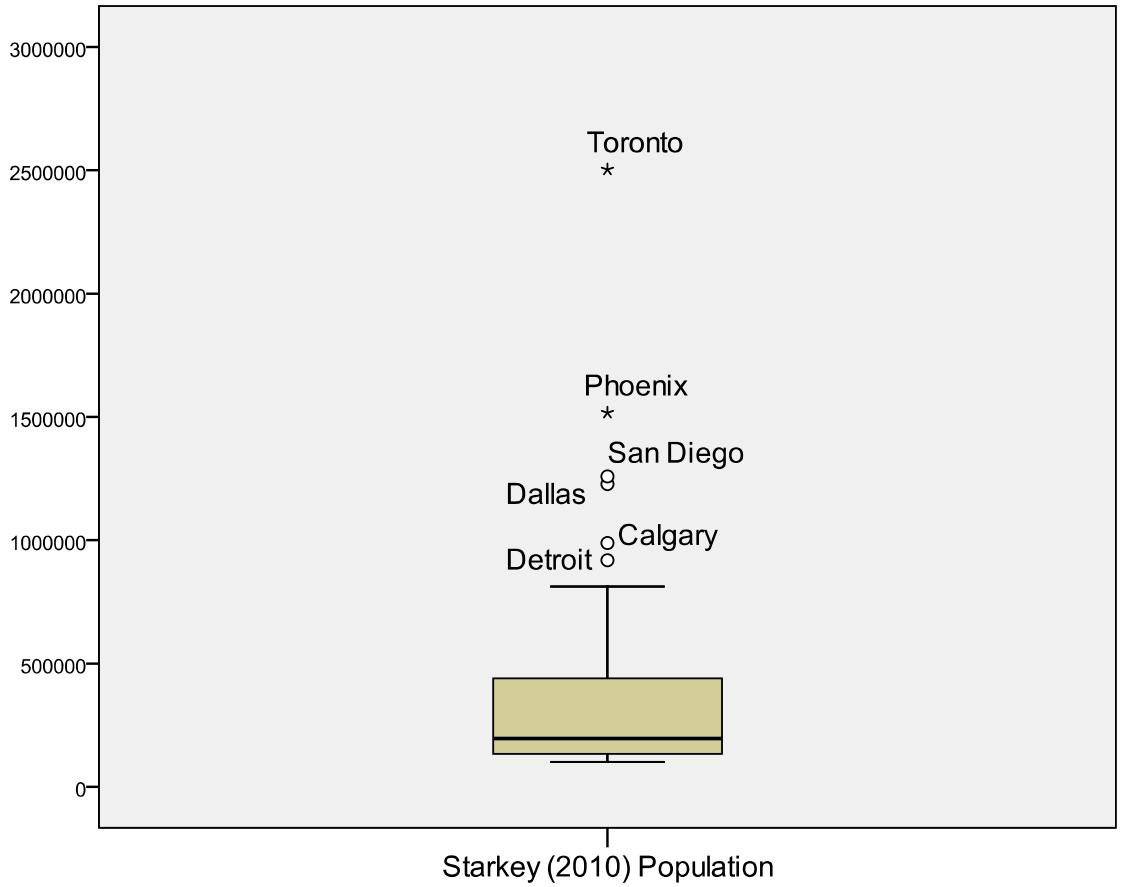

Figure 4: Box plot depicting population outliers in the Starkey (2010) dataset.

4.3.2.2 Median Income

The median income data is also severely positively skewed, indicating that very few cities have very high median incomes; however, there were no extreme outliers. As with the population data, I transformed this data through the application of a base-10 logarithm. As a result, this data is no longer skewed. This same function was performed on the Portney (2007) and SustainLane (2006) datasets.

This data displayed a slight secondary mode indicating a small cluster of cities with relatively higher median incomes. This cluster corresponds to the slightly higher median incomes found in the Canadian cities in this sample.

4.3.2.3 Sustainability Score

Scores for commitment to sustainability were distributed multimodally, with a low-score peak of 11 and a high-score peak of 18 (Figure 5). This distribution is not skewed and there are no outliers. The Portney (2007) and SustainLane (2006) sustainability score distributions were both unimodal and not skewed.

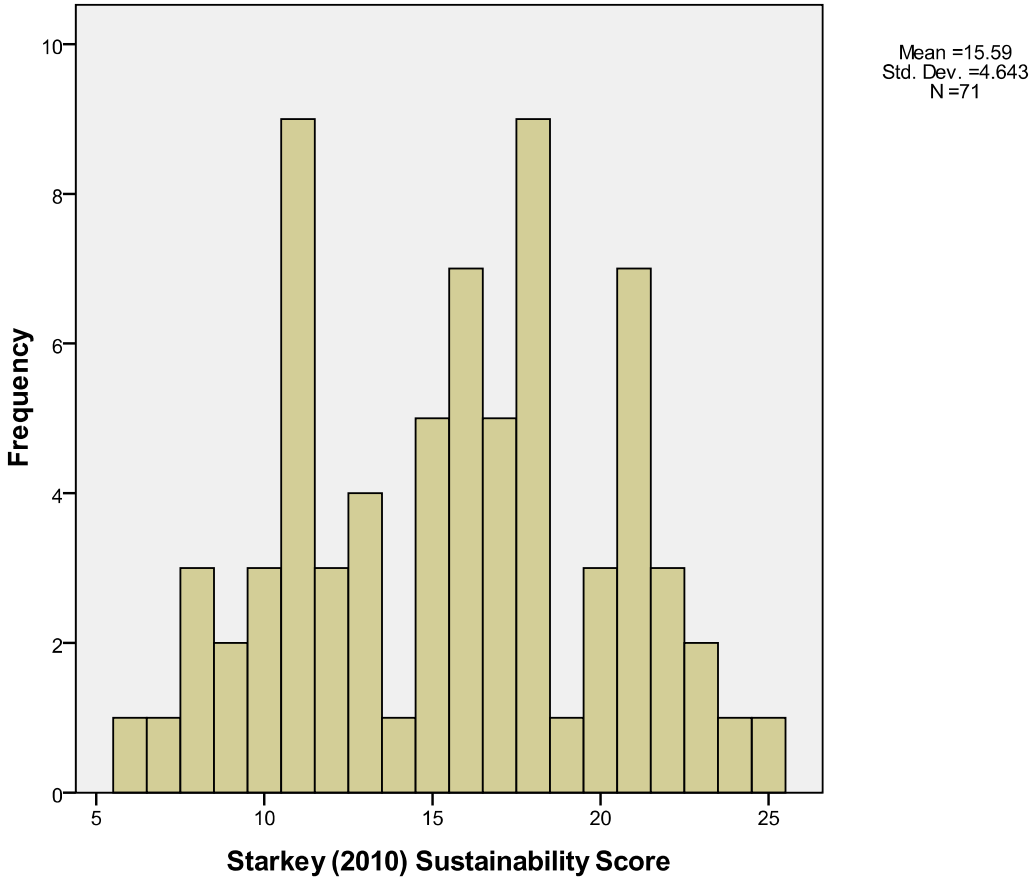

Figure 5: Distribution of the sustainability scores assigned to cities in the Starkey (2010) dataset.

4.3.2.4 Unaffordability Index

Unaffordability scores displayed a normal, unimodal distribution. This was also true of the Portney (2007) distribution, though the SustainLane (2006) distribution was bimodal. In a box plot of the Starkey (2010) dataset, Berkeley emerged as an outlier, though not extremely so (Figure 6). Similarly, Los Angeles is a slight outlier within Portney's (2007) dataset. There are no outliers in the SustainLane (2006) dataset.

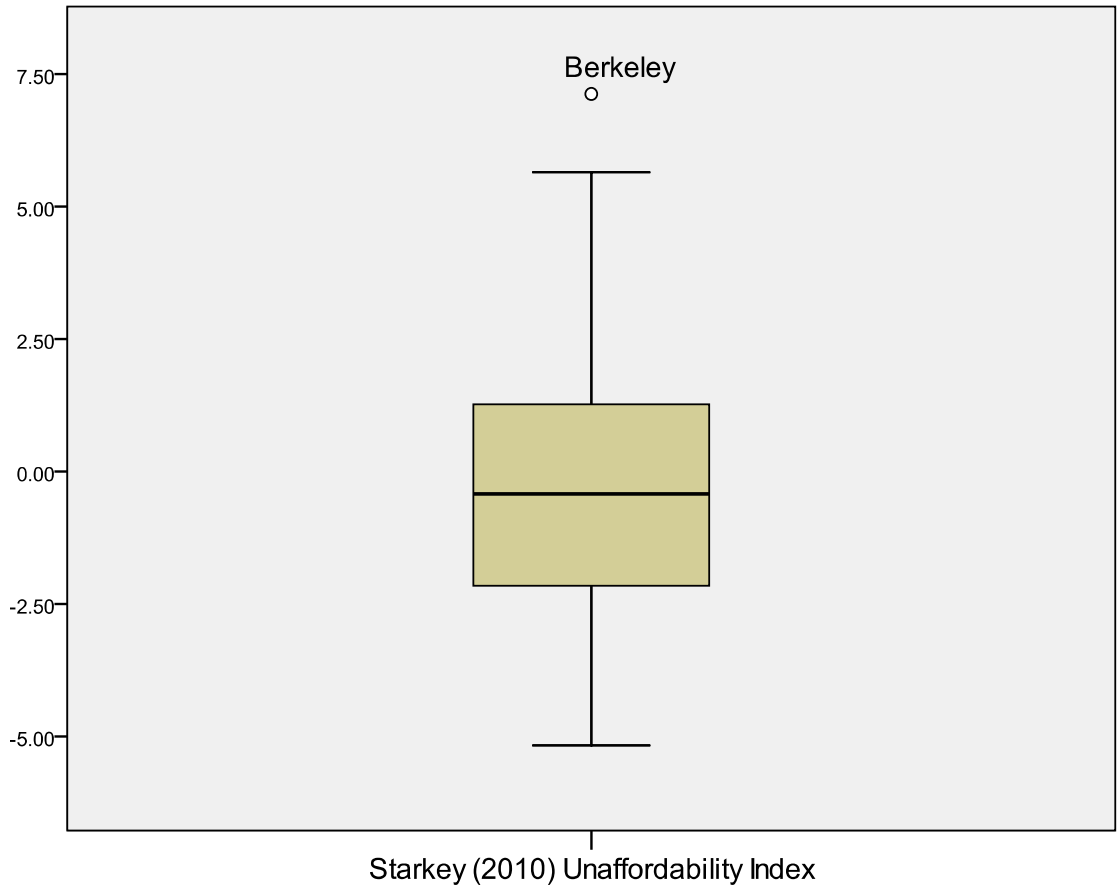

Figure 6: Box plot of unaffordability scores to identify outliers in the Starkey (2010) dataset.

4.3.3 Testing for Correlation

To determine whether a correlation exists, I conducted the following statistical tests:

1. Scatter plot: this test is to determine the shape of the relationship between two variables. Linearity is a necessary condition of relationships explored through a Pearson product-moment correlation coefficient test. Therefore, a scatter plot can identify whether a Pearson test is appropriate (De Veaux and Velleman, 2004; Weinberg and Abramowitz, 2008).
2. Pearson product-moment correlation coefficient test (Pearson): this test is used to measure the strength of linear relationships (De Veaux and Velleman, 2004; Weinberg and Abramowitz, 2008). Pearson values range between -1 and 1, with 0 denoting no correlation and 1 indicating a perfect correlation. Though there are no definitive thresholds to describe correlation strengths, convention holds that a correlation is weak with a Pearson value less than 0.3 and strong with a Pearson value greater than 0.5 (Weinberg and Abramowitz, 2008).

5: FINDINGS

This research tested for correlation between a city's sustainability score and its population, median income, and affordability. To this end, I plotted each pair of variables on a scatter plot and computed Pearson values. This process was completed for the 71 cities in my sample group as well as for 40 of the 45 cities Portney ranked in 2007[5], and the 50 cities graded by SustainLane in 2006. What follows are the results of these tests. Findings for each dataset are identified by the source of the sustainability ranking: Starkey (2010), Portney (2007), or SustainLane (2006).

5.1 Sustainability and Population

In a comparison of sustainability scores against population, both the Starkey (2010) and Portney (2007) datasets manifest a statistically significant positive correlation, meaning that cities with greater populations also tended to be more engaged with planning for sustainability (Table 10 and Figure 7). In the SustainLane (2006) sample, this correlation was still present, but it was weak.

[5] Five of Portney's (2007) ranked cities were omitted due to population sizes less than 100,000. Smaller cities are not included in the American Community Survey, so I was not able to access the same data for these five cities.

Table 10: Pearson Correlation Coefficient of the relationship between sustainability score and population for each dataset.

Sustainability Score		Population
Starkey (2010)	Pearson Correlation	.423**
	Sig. (2-tailed)	.000
	N	71
Portney (2007)	Pearson Correlation	.385*
	Sig. (2-tailed)	.014
	N	40
SustainLane (2006)	Pearson Correlation	.172
	Sig. (2-tailed)	.232
	N	50
* Correlation is significant at the 0.05 level (2-tailed).		
** Correlation is significant at the 0.01 level (2-tailed).		

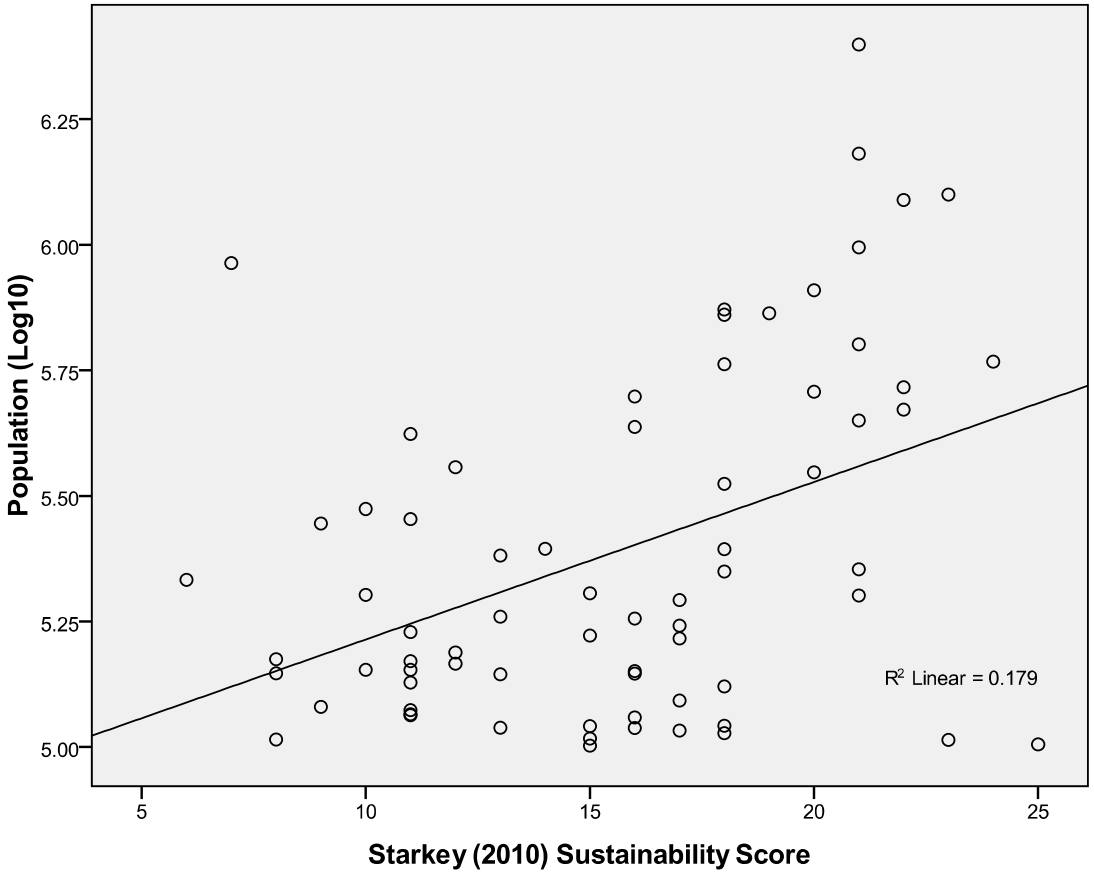

Figure 7: Scatter plot of the relationship between sustainability score and population in the Starkey (2010) dataset.

This disparity may be explained by the different sampling methodologies employed for each sample group. SustainLane (2006) evaluated the top 50 most populous cities in the US, so this dataset does not include cities as small as those found in the Starkey (2010) or Portney (2007) datasets. This may indicate that cities over a certain size have a greater need for sustainability policies, simply because they put a greater strain on resources. It may be that all the cities in the SustainLane (2006) dataset are larger than this threshold, so population is less meaningful as a predictor of engagement with sustainability. Additionally, the SustainLane (2006) dataset measures outcomes, rather than outputs, so the high scoring cities in this list were likely early adopters of a sustainability framework. These innovators may have been motivated by factors other than population challenges.

5.2 Sustainability and Median Income

In comparing a city's sustainability score to its median household income, I again found a positive correlation in the Starkey (2010) dataset, as well as in the SustainLane (2006) dataset, though this correlation is weak (Table 11).

Table 11: Pearson correlation on the strength of the relationship between sustainability score and median household income.

Sustainability Score		Median Income
Starkey (2010)	Pearson Correlation	.196
	Sig. (2-tailed)	.102
	N	71
Portney (2007)	Pearson Correlation	.512**
	Sig. (2-tailed)	.001
	N	40

Sustainability Score		Median Income
SustainLane (2006)	Pearson Correlation	.246
	Sig. (2-tailed)	.085
	N	50
**. Correlation is significant at the 0.01 level (2-tailed).		

In contrast, the correlation between these two variables is strong among the cities Portney (2007) ranked (Table 11 and Figure 8). The cities in Portney's (2007) list do not represent a different level or range of income values than the other two datasets. As such, this difference may stem from Portney's (2007) city selection method. Whereas SustainLane (2006) selected cities based on population, and I selected cities at random, Portney (2003) selected cities known to be engaged in sustainability planning. Cities commonly recognized in the literature and planning profession are often highly progressive cities, testing out new approaches and establishing the best practices other cities aspire to. It may be that this innovation is possible in part because these cities are prosperous and resources are available. As planning for sustainability becomes more common, this may no longer be the case and cities may be more likely to invest in sustainability in spite of financial circumstances. Additionally, sustainability planning may now be viewed as a means to save money through greater energy efficiency and waste reduction.

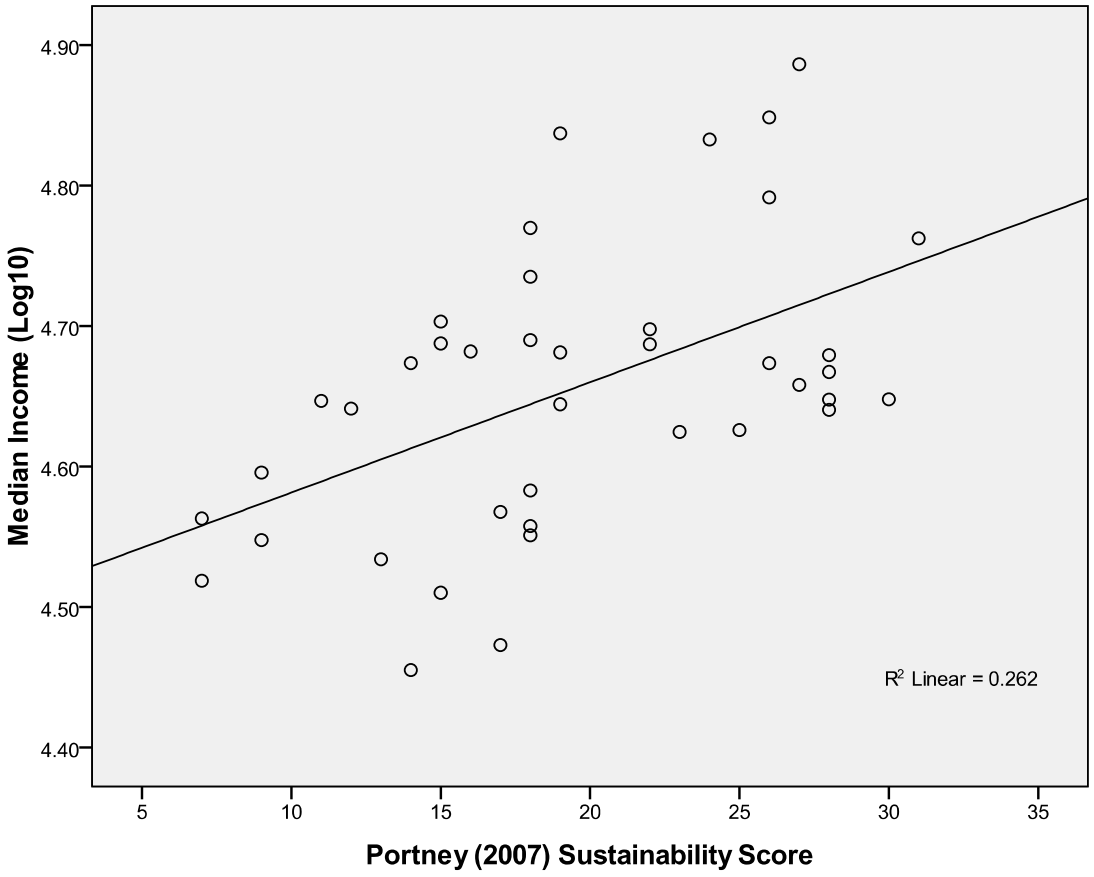

Figure 8: Scatter plot of the relationship between sustainability score and median household income in the Portney (2007) dataset.

5.3 Sustainability and Housing Affordability

Lastly, I tested the correlation between sustainability score and housing affordability based on the index I constructed. Both the scatter plot and the Pearson test revealed no discernable correlation in the Starkey (2010) dataset (Table 12).

The findings from the Starkey (2010) dataset contrasts with those for Portney's (2007) rankings, and most severely with those for the SustainLane (2006) group. The cities that Portney (2007) ranked bore a weak positive

correlation between sustainability score and affordability; however, among the SustainLane (2006) cities, sustainability score is significantly correlated to affordability (Table 12 and Figure 9). Notably, when SustainLane's (2006) sustainability score is compared against their affordability metric, this correlation is even stronger (Pearson value of 0.518).

Table 12: Correlation between the Unaffordability Index and SustainLane's (2006) sustainability scores.

Sustainability Score		Unaffordability Index
Starkey (2010)	Pearson Correlation	.045
	Sig. (2-tailed)	.708
	N	71
Portney (2007)	Pearson Correlation	.254
	Sig. (2-tailed)	.114
	N	40
SustainLane (2006)	Pearson Correlation	.481**
	Sig. (2-tailed)	.000
	N	50
**. Correlation is significant at the 0.01 level (2-tailed).		

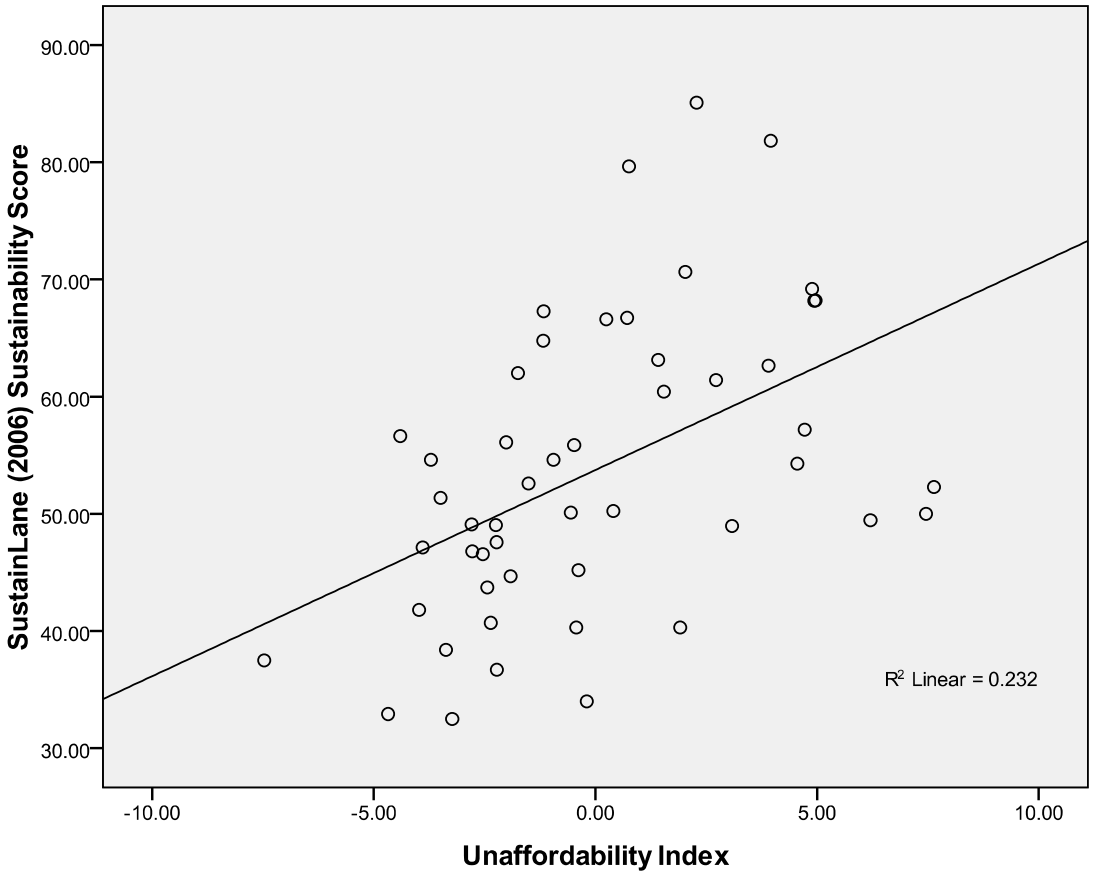

Figure 9: Scatter plot of the relationship between the SustainLane (2006) sustainability score and the Unaffordability Index.

The disparity between the SustainLane (2006) dataset and those defined by Starkey (2010) and Portney (2007) likely stems from the difference between outputs and outcomes. Portney (2007) and I both scored cities on the number of outputs (i.e. plans and policies) adopted in a particular city. In contrast, SustainLane (2006) measured the intended outcomes (i.e. CO_2 emissions and tonnage of waste diverted from landfills) of such policies. The different correlations found here support hypothesis 1 (Figure 1), which proposes that

unaffordable housing may be an unintended externality of the intended outcomes of planning for sustainability.

Interestingly, in cities where sustainability is an explicit component of the comprehensive plan, the relationship between housing affordability and sustainability score differs from that observed among the group at large. Among this subset, sustainability is weakly correlated to the Unaffordability Index (Table 13). This correlation is positive, meaning that more sustainable cities tended to be less affordable. No correlation was found in the subset of cities that do not include sustainability in their comprehensive plan (Pearson score of 0.047).

Table 13: The relationship between sustainability and affordability in selected subsets of the Starkey (2010) dataset.

Sustainability Score		**Unaffordability Index**
Sustainability is an explicit part of a citywide comprehensive or general plan	Pearson Correlation	.276
	Sig. (2-tailed)	.073
	N	43
Housing affordability is an explicit part of a citywide comprehensive or general plan that includes sustainability	Pearson Correlation	.450*
	Sig. (2-tailed)	.036
	N	22
*. Correlation is significant at the 0.05 level (2-tailed).		

This correlation was even stronger among cities that included sustainability in their comprehensive plans *and* included housing affordability initiatives as part of this plan (Table 13). Conversely, cities with comprehensive plans that include sustainability, but do not include housing affordability, displayed a weak negative correlation (-0.270). Among this subset, cities with higher sustainability scores tend to be more affordable. The presence of

affordability policies in less affordable cities may indicate that such policies are a response to an existing affordability problem, rather than a proactive attempt to avoid this condition.

To see if the highest scoring subset of my dataset exhibited a different relationship to housing affordability, I divided my sample into two groups based on the 25th and 75th percentile. The group less committed to sustainability (the 25th percentile) contained cities scoring 11 or less, while the group more committed to sustainability (the 75th percentile) contained cities scoring 19 or more. No correlation was found between sustainability and affordability in the less committed group; however, the more committed group exhibited a very strong positive correlation (Table 14 and Figure 10).

Table 14: Comparison between the highest and lowest scoring cities in the Starkey (2010) dataset.

Sustainability Score		**Unaffordability Index**
Sustainability Score in the 75th Percentile	Pearson Correlation	.765**
	Sig. (2-tailed)	.000
	N	18
Sustainability Score in the 25th Percentile	Pearson Correlation	.051
	Sig. (2-tailed)	.837
	N	19
**. Correlation is significant at the 0.01 level (2-tailed).		

This extreme variance could indicate that, while there is no general correlation between planning for sustainability and housing affordability, there is a threshold at which point a correlation begins to emerge. Sustainability as a planning paradigm has grown in popularity, meaning that many cutting edge

initiatives are now commonplace. As a result, cities earning a sustainability score below a certain level are similarly desirable places to live. It may be that only very sustainable cities are still perceived as offering a higher quality of life. If this is the case, it implies that any correlation that presently exists between sustainability and affordability will weaken as more cities adopt a sustainability approach to planning.

Alternatively, it may be that very high scoring cities have been planning for sustainability longer and their actions have begun to produce outcomes, including less affordable housing.

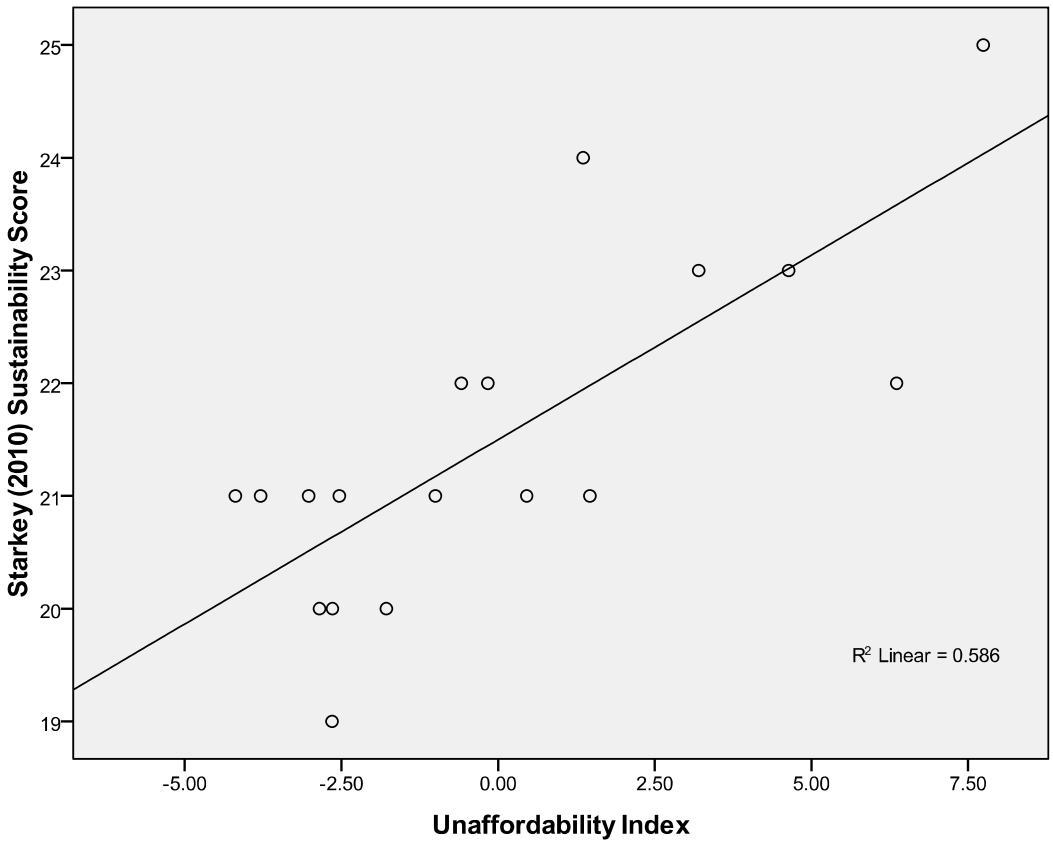

Figure 10: Scatter plot of the relationship between sustainability score and housing affordability among high scoring cities.

6: IMPLICATIONS FOR FUTURE RESEARCH

The findings of this study only answer one piece of a larger question about the relationship between sustainability and housing affordability. Several key questions remain unanswered.

Most notably is the need to pursue a better understanding of whether any causal links exist between sustainability and housing affordability. This study found that these two variables are correlated in certain circumstances. This is a necessary, but not sufficient, condition of causation. Therefore, this study simply lays the groundwork for further inquiry into this relationship.

Secondly, this research relied on a simplistic and possibly outdated set of sustainability indicators. Recognizing that policy actions do not exist in a vacuum, further research into the interplay between sustainability initiatives would help to refine the measurement of sustainability and increase the accuracy of its evaluation. Moreover, the uptake of sustainability and related programs is so widespread that some of the indicators used herein have lost their potency. For instance, 70 out of 71 cities in the Starkey (2010) dataset have public transit. This is a positive step toward a less auto-dependent future, but it dilutes the usefulness of this indicator in a city comparison.

7: CONCLUSION

Within this study, Berkeley, California was both the most committed to sustainability and the least affordable. The prevalence of sustainable, yet unaffordable, cities has led many to speculate that the pursuit of sustainability is leading to an increase in housing costs. This study hypothesized that sustainability as a planning paradigm may be gentrifying North American cities. The findings of this study clearly show that this is possible. Though this phenomenon may not be intentional, this undermines the efforts of proto-sustainable cities and inhibits their ability to develop into truly sustainable places.

This study sought to determine whether sustainability and unaffordability are functionally related. To this end, this research explored whether a correlation exists between the adoption of policies that support sustainable development and housing affordability.

There are four major findings of this study:

1. Planning for sustainability is moderately correlated to population. Larger cities tend to be more engaged with planning for sustainable development.
2. Planning for sustainability is not correlated with median household income, though it may be a factor in the level of a city's innovation.

3. In general, planning for sustainability is not correlated to housing affordability; however, there may be a tipping point of engagement whereby a very high level of sustainability planning is strongly correlated to unaffordable housing.

4. Housing affordability is more strongly correlated to the outcomes of planning for sustainability than to the outputs.

Overall, the findings of this study support the hypothesis that unaffordable housing may be an externality of sustainability planning. Therefore, *it is possible* that sustainability as a planning framework has, intentionally or otherwise, led to the gentrification of North American cities.

Recognizing this possibility, this research serves as a call to action, asking practitioners to consider the potential negative impact planning for sustainability may have on housing. To city planners, Patrick Geddes famously advised, “No Plan before Survey” (Hodge and Robinson, 2001, p. 17). Perhaps with regard to planning for sustainability, the dictum should be ‘No Plan before Housing Impact Report’. To press ahead without consideration of affordability impacts is to risk the development of elite cities, rather than equitable cities. Such a future can hardly be called sustainable.

APPENDICES

Appendix A

Indicator list to measure how seriously cities take sustainability (Portney, 2007).

Smart Growth Activities
1. Eco-industrial park development
2. Targeted or cluster economic development
3. Eco-village (urban infill housing) project or program
4. Brownfield redevelopment (project or pilot project)
Land Use Planning Programs, Policies, and Zoning
5. Zoning used to delineate environmentally sensitive growth areas
6. Comprehensive land use plan that includes environmental issues
7. Tax incentives for environmentally friendly development
Transportation Planning Programs and Policies
8. Operation or sponsorship of public transit (buses and/or trains)
9. Limits on downtown parking spaces
10. Car pool lanes (HOV or diamond lanes)
11. Alternatively fuelled city vehicle (green fleet) program
12. Bicycle ridership program
Pollution Prevention, Reduction, and Remediation
13. Household solid waste recycling
14. Industrial recycling
15. Hazardous waste recycling
16. Air pollution reduction program (i.e. VOC reduction)
17. Recycled product purchasing by city government
18. Superfund (non-brownfield) site remediation
19. Asbestos abatement program
20. Lead paint abatement program
21. Pesticide reduction program
Energy and Resource Conservation/Efficiency
22. Green building program
23. Renewable energy use by city government
24. Energy conservation effort (other than Green building program)
25. Alternative energy offered to consumers (solar, wind, biogas, etc.)
26. Water conservation program
Sustainable Indicators Project
27. Indicators project active in last five years
28. Indicators progress report in last five years
29. Does indicators project include “action plan” of policies/programs?
Organization/Administration/Management/Coordination/Governance
30. Single government or non-profit agency responsible for implementing sustainability programs
31. Sustainability an explicit part of a citywide comprehensive or general plan
32. Involvement of city/county/metropolitan council
33. Involvement of mayor or chief executive officer
34. Involvement of the business community
35. General public involvement (public hearings, visioning process, or neighbourhood groups)

Appendix B

The final sample of 71 cities included in this study.

City	State/ Province	Country	Population 2006
Abilene	Texas	USA	115,705
Albuquerque	New Mexico	USA	509,621
Atlanta	Georgia	USA	498,522
Austin	Texas	USA	725,426
Berkeley	California	USA	101,188
Boise	Idaho	USA	200,398
Brampton	Ontario	Canada	433,806
Burlington	Ontario	Canada	164,415
Calgary	Alberta	Canada	988,193
Charleston	South Carolina	USA	110,035
Columbus	Ohio	USA	742,976
Coquitlam	British Columbia	Canada	114,565
Corpus Christi	Texas	USA	284,324
Costa Mesa	California	USA	109,229
Dallas	Texas	USA	1,227,894
Denton	Texas	USA	110,304
Des Moines	Iowa	USA	196,088
Detroit	Michigan	USA	918,849
Edmonton	Alberta	Canada	730,372
Fairfield (CA)	California	USA	104,021
Fremont	California	USA	200,923
Glendale (AZ)	Arizona	USA	248,244
Hampton	Virginia	USA	146,568
Hayward	California	USA	140,071
Henderson	Nevada	USA	240,516
Kansas City	Missouri	USA	446,808
Lakewood	Colorado	USA	139,575
London	Ontario	Canada	352,395
Long Beach	California	USA	469,324
Lubbock	Texas	USA	215,203
Madison	Wisconsin	USA	226,011
Moreno Valley	California	USA	181,689
New Haven	Connecticut	USA	123,707
Newark	New Jersey	USA	278,695
Newport News	Virginia	USA	180,259
Omaha	Nebraska	USA	419,816
Orange	California	USA	134,385
Orlando	Florida	USA	223,650
Oshawa	Ontario	Canada	141,590
Ottawa	Ontario	Canada	812,129
Overland Park	Kansas	USA	166,674

City	State/ Province	Country	Population 2006
Peoria city (AZ)	Arizona	USA	142,422
Phoenix	Arizona	USA	1,517,318
Pompano Beach	Florida	USA	103,522
Port St. Lucie	Florida	USA	142,481
Provo	Utah	USA	116,217
Raleigh	North Carolina	USA	360,658
Rancho Cucamonga	California	USA	169,408
Richmond	British Columbia	Canada	174,461
Rockford	Illinois	USA	154,328
Roseville	California	USA	106,512
Salem	Oregon	USA	149,648
San Buenaventura (Ventura)	California	USA	103,288
San Diego	California	USA	1,258,603
Santa Clara	California	USA	107,883
Saskatoon	Saskatchewan	Canada	202,340
Seattle	Washington	USA	584,788
Sioux Falls	South Dakota	USA	148,244
St. Catharines	Ontario	Canada	131,989
St. John's	Newfoundland and Labrador	Canada	100,646
St. Petersburg	Florida	USA	247,710
Stamford	Connecticut	USA	118,383
Syracuse	New York	USA	140,179
Tampa	Florida	USA	334,294
Thunder Bay	Ontario	Canada	109,140
Toledo	Ohio	USA	297,806
Toronto	Ontario	Canada	2,503,281
Tucson	Arizona	USA	520,266
Vancouver	British Columbia	Canada	578,041
West Valley City	Utah	USA	120,235
Winnipeg	Manitoba	Canada	633,451

Appendix C

List of cities excluded from this study and the reason for omission.

City	State/Province	Reason for Omission
Allentown	Pennsylvania	City plan approved in 2009 . . . No access to previous version
Amarillo	Texas	Not enough information
Anchorage	Alaska	Consolidated City-County
Arlington	Texas	Not enough information
Arlington CDP	Virginia	Consolidated City-County
Beaumont	Texas	No search engine
Birmingham	Alabama	No comprehensive city plan (city centre master plan only)
Brownsville	Texas	No search engine
Chattanooga	Tennessee	Regional planning body only
Chicago	Illinois	No city-wide comprehensive plan
Clarksville	Tennessee	Regional planning body only
Coral Springs	Florida	City plan approved in 2008 . . . No access to previous version
Durham	North Carolina	Regional planning body only
El Monte	California	Comprehensive Plan not available online
Elizabeth	New Jersey	No search engine
Eugene	Oregon	Comprehensive plan is regional only.
Flint	Michigan	Planning documents are not available online.
Gatineau	Québec	Many documents only available in French
Halifax	Nova Scotia	Regional Municipal
Hialeah	Florida	No search engine
Huntsville	Alabama	Not enough information
Indianapolis (balance)	Indiana	Consolidated City-County
Inglewood	California	Not enough information
Jacksonville	Florida	Consolidated City-County
Jersey City	New Jersey	General Plan not available online
Joliet	Illinois	Not enough information
Kansas City	Kansas	Consolidated City-County
Kelowna	British Columbia	Ineffective Search Engine
Knoxville	Tennessee	Regional Planning only
Laredo	Texas	No Search Engine
Lévis	Québec	Website in French only.
Lexington-Fayette urban county	Kentucky	Consolidated City-County
Markham	Ontario	Not enough information.
McKinney	Texas	No search engine
Milwaukee	Wisconsin	No comprehensive city plan
Modesto	California	City plan approved in 2008
Montreal	Québec	Many documents only available in French

City	State/Province	Reason for Omission
Nashville-Davidson metropolitan government (balance)	Tennessee	Consolidated City-County
New York	New York	Consolidated City-County
Norwalk	California	Not enough information
Paterson	New Jersey	Not enough information
Peoria	Illinois	Not enough information
Philadelphia	Pennsylvania	Consolidated city-county
Québec	Québec	French only
Richmond Hill	Ontario	Not enough information
Salt Lake City	Utah	No comprehensive city plan in 2006
San Francisco	California	Consolidated city-county
Santa Ana	California	General Plan not available online
Sherbrooke	Québec	Many documents only available in French
Shreveport	Louisiana	No search engine
Simi Valley	California	Not enough information
Springfield	Illinois	No search engine
Tallahassee	Tennessee	Consolidated Comprehensive Plan (city-county)
Torrance	California	General Plan not available online
Wichita Falls	Texas	No Comprehensive Plan.
Winston-Salem	North Carolina	Regional planning body only
Worcester	Massachusetts	No Comprehensive Plan.

Appendix D

Indicators and related code words and phrases used to facilitate the city ranking process.

Indicator	Code Words	
	Yes	**No**
Single department responsible for implementing sustainability programs	▪ Sustainability in office name ▪ Green ▪ Environment ▪ Wildcard: department created to facilitate sustainability goals as indicated by mission statement or similar	▪ Planning ▪ Community Development ▪ Economic Development ▪ Advisory committees or Commissions
Sustainability an explicit part of a citywide comprehensive or general plan	▪ Comprehensive Plan ▪ Master Plan ▪ Strategic Plan plus Land Use Plan ▪ Wildcard plan: must be city-wide and cover more than land use or other single issue ▪ Sustainability ▪ Sustainable development ▪ Identified as a goal, objective, or vision	▪ Zoning Ordinance ▪ Land Use Plan ▪ Consolidated Plan (for HUD)
Definition of 'sustainability' in comprehensive or sustainability plan integrates economic, environmental, and social equity goals.	▪ Within the above plan ▪ Other terms OK if meaning is the same	▪ Sustainability limited to one facet
Comprehensive land use plan that includes environmental issues	▪ Land Use Plan ▪ Zoning Ordinance ▪ Wildcard: preserves natural or environmentally sensitive areas	▪ Smart growth ▪ Transit Oriented Development (TOD) ▪ Cluster development

Indicator	Code Words	
	Yes	No
Indicators project active in last five years and/or an Indicators progress report in the last five years (to evaluate the Comprehensive Plan)[6]	▪ Indicators ▪ Performance measures ▪ Progress report/Report Card ▪ Evaluation and Appraisal Reports (EAR)	▪ Singular policy indicators ▪ State of the Environment reports
Comprehensive Plan includes "action plan" of policies/programs[7]	▪ Within the comprehensive plan, indicators project documents, or progress report ▪ Action Plan ▪ Specific policy recommendations	▪ Objectives ▪ Goals ▪ General suggestions ▪ Areas for further study or consideration ▪ Climate Action Plan
Public participation in the development of the Comprehensive Plan	▪ Public involvement in plan development ▪ Open House ▪ Charrette	▪ Public notification ▪ Drafts available for feedback, but no public participation in plan creation ▪ Appointed citizen advisory group, but no general public involvement
Growth Management policies	▪ Protects or limits development/use of natural areas or agricultural lands ▪ Urban Growth Boundaries ▪ Greenbelts ▪ Open Space district or zone ▪ Buffer zones	▪ Recreational areas ▪ Working waterfronts

[6] This indicator is only assessed of Comprehensive Plans that include sustainability.
[7] This indicator is only assessed of Comprehensive Plans that include sustainability.

Indicator	Code Words	
	Yes	No
Targeted or cluster economic development	▪ Smart growth ▪ TOD ▪ Neighbourhood centers ▪ Commercial nodes ▪ Business or industrial parks ▪ Urban Village ▪ Traditional Neighbourhood Development (TND)	▪ Infill housing ▪ Revitalization efforts in a blighted area
Eco-industrial park development	▪ Eco-industrial park	▪ Traditional industrial park that clusters eco-industry
Urban infill housing project or program	▪ Infill housing ▪ Residential infill ▪ OK if confined to certain areas ▪ Must be actively encouraged	▪ Non-residential infill ▪ Infill guidelines that control infill rather than encourage it ▪ Allowed, but not encouraged
Brownfield redevelopment (project or pilot project)	▪ Brownfield ▪ Project or program ▪ Revitalization efforts in a blighted area ▪ Tax Increment Financing (TIF) zones ▪ Reinvestment zones ▪ Decay/derelict/etc . . .	▪ Infill housing ▪ Infill development
Operation or sponsorship of public transit (buses and/or trains)	▪ Presence of a public transit system ▪ Limited service OK	▪ Proposed, but not operational
Bicycle ridership program	▪ Bicycle or bike ▪ Greenways (if urban) ▪ Bikeways	▪ Trails (unless urban)

Indicator	Code Words	
	Yes	No
Limits on parking spaces	▪ Parking Maximum ▪ Moratorium on new parking ▪ Parking cap ▪ Eliminating or reducing minimum parking requirements for new developments	▪ Shared parking ▪ Designated carpool or hybrid parking spaces ▪ Bicycle parking requirements ▪ Time restrictions ▪ Street parking removed to improve circulation ▪ Recommendation without action ▪ Planner discretion allowed
Alternatively fueled city vehicle (green fleet) program	▪ Biodiesel ▪ Compressed Natural Gas (CNG) ▪ Hybrids ▪ Electric ▪ Ethanol (E85) ▪ Other alternative fuels	▪ Retrofits to reduce emissions, but not change fuel
Household solid waste recycling	▪ curb side pick up	▪ drop off service only
Industrial recycling	▪ Construction and demolition debris ▪ Asphalt or concrete re-use ▪ Must be a regular service provided	▪ Single project, but not a regular service
Hazardous waste recycling	▪ Household hazardous waste (HHW) ▪ Biomedical waste ('Sharps')	▪ Drop off sites are outside city limits

Indicator	Code Words	
	Yes	No
Air pollution reduction or program to reduce heat island effects	▪ Anti-idling laws ▪ Program to reduce industrial, commercial, or residential emissions ▪ Urban Forestry/tree planting initiative ▪ Non-fuel related city fleet upgrades (retrofits) ▪ Vegetative dust control ▪ Smog reduction ▪ Ozone reduction ▪ VOC reduction ▪ Telework/telecommute program ▪ Green roofs	▪ Green fleet ▪ Green building ▪ Energy conservation efforts ▪ Recycling ▪ Tree preservation ▪ Community gardens ▪ Compressed work week
Ethical and environmental purchasing by city government	▪ Environmentally preferred purchasing ▪ Green purchasing ▪ Recycled product ▪ Fair Trade ▪ Sweat Free ▪ Women and minority-owned business ▪ Local purchasing ▪ Disadvantaged business enterprise ▪ Policy	▪ General guideline, but not policy
Pesticide reduction program	▪ Pesticide ▪ Integrated Pest Management ▪ Outreach/education effort to reduce residential uses ▪ Demonstration Gardens	▪ Information on the website, but no active outreach program
Green building program	▪ Green building ▪ LEED	▪ Demonstration or other stand alone project

Indicator	Code Words	
	Yes	No
Renewable energy use by city government	▪ Renewable energy ▪ Alternative energy ▪ Solar ▪ Wind ▪ Landfill gas capture and use ▪ Methane ▪ Biomass ▪ Renewable Energy Certificate (REC)	▪ Energy efficiency efforts ▪ Hydro-electric
Energy conservation effort	▪ Climate action plan ▪ Energy efficiency upgrades ▪ Emission reduction targets ▪ Energy Star program ▪ District heating/cooling	▪ Green fleet ▪ Green building ▪ LEED ▪ LED traffic light conversion ▪ Goal or Objective with no action or action plan
Water conservation program	▪ Water conservation ▪ Water consumption ▪ Greywater, wastewater, or recycled water use ▪ Low-flush toilets or similar ▪ Rainwater harvesting (rain barrel program) ▪ Xeriscaping ▪ Plumbing retrofits	▪ Stormwater Management ▪ Water pollution ▪ Water quality ▪ Water/wetland habitat preservation ▪ Drought management plan

Indicators Not Included in the Ranking	
Indicator	**Make Note of**
Housing Affordability is an explicit part of a city-wide sustainability strategy	▪ Affordability within a comprehensive plan using an integrated sustainability framework ▪ How is sustainability incorporated within a housing component (i.e. green building)

Appendix E

Sustainability and unaffordability scores for the Starkey (2010) dataset.

City	Sustainability Score	Unaffordability Score
Lubbock	6	-1.08
Detroit	7	0.95
Pompano Beach	8	2.17
Salem	8	-2.48
Syracuse	8	0.79
Newark	9	4.82
West Valley City	9	-2.17
Fremont	10	1.25
Port St. Lucie	10	-1.13
Toledo	10	-2.38
Abilene	11	-2.7
Corpus Christi	11	-0.88
Omaha	11	-2.07
Orange	11	4.27
Peoria (AZ)	11	-1.19
Provo	11	2.12
Rancho Cucamonga	11	3.69
Sioux Falls	11	-4.17
Stamford	11	4.36
Hampton	12	-1.98
Raleigh	12	-2.08
Rockford	12	-0.81
Costa Mesa	13	5.48
Henderson	13	-0.03
Lakewood	13	-0.09
Moreno Valley	13	4.72
Glendale (AZ)	14	-0.42
Charleston	15	1.27
Fairfield (CA)	15	4.03
Newport News	15	0.35
Overland Park	15	-5.17
Saskatoon	15	-2.15
St. Johns	15	-2.76
Atlanta	16	-0.2
Brampton	16	-2.06
Coquitlam	16	-0.78
Hayward	16	0.06

City	Sustainability Score	Unaffordability Score
Oshawa	16	-2.95
Thunder Bay	16	-4.47
Burlington (ON)	17	-2.98
Des Moines	17	-0.76
New Haven	17	4.71
Richmond	17	-0.09
Santa Clara	17	2.96
Austin	18	-0.92
Columbus	18	-2.39
Denton	18	0.94
Orlando	18	2.8
Roseville	18	0.98
St. Catharines	18	-2.61
St. Petersburg	18	-0.43
Tampa	18	1.24
Vancouver	18	2.86
Edmonton	19	-2.47
Albuquerque	20	-1.67
London	20	-2.51
Ottawa	20	-2.55
Boise	21	-2.74
Calgary	21	-1.94
Kansas City (MO)	21	-3.54
Madison	21	0.23
Phoenix	21	-0.84
Toronto	21	1.26
Winnipeg	21	-3.91
Dallas	22	-0.94
Long Beach	22	5.65
Tucson	22	-0.35
San Buenaventura (Ventura)	23	3.22
San Diego	23	4.3
Seattle	24	1.23
Berkeley	25	7.13

REFERENCE LIST

Agyeman, J. and Evans, T. (2003). Toward just sustainability in urban communities: Building equity rights with sustainable solutions. *Annals of the American Academy of Political and Social Science, 590*, 35-53.

Berke, P. and Conroy, M. (2000). Are we planning for sustainable development? An evaluation of 30 comprehensive plans. *Journal of the American Planning Association, 66*(1), 21-33.

Bramley, G. (2009). Urban form and social sustainability: The role of density and housing type. *Environment and Planning B-Planning & Design, 36*(1), 30-48.

Brugmann, J. (1994). Who can deliver sustainability? municipal reform and the sustainable development mandate. *Third World Planning Review, 16*(2), 129-146.

Brundtland, G. H., & World Commission on Environment and Development. (1987). *Our common future*. Oxford ; New York: Oxford University Press.

Burton, E. (2003). Housing for an urban renaissance: Implications for social equity. *Housing Studies, 18*(4), 537-562.

Campbell, S. (1996). Green cities, growing cities, just cities? urban planning and the contradictions of sustainable development. *Journal of the American Planning Association, 62*(3), 296-312.

Chicago Housing Authority (CHA). (2007). *Cabrini-green homes.* Retrieved March 31, 2009, from http://www.thecha.org/housingdev/cabrini_green_homes.html.

City of Seattle, (2006). Seattle, A Climate of Change: Meeting the Kyoto Challenge-Climate Action Plan. Retrieved April 19, 2009 from http://www.seattle.gov/environment/Documents/SeaCAP_plan.pdf.

Cox, W. (2007). 3rd Annual Demographia International Housing Affordability Survey. Retrieved July 7, 2009 from http://www.sos.org.au/new_docs/housing_cost.pdf.

Cox, W. (2009). 5th Annual Demographia International Housing Affordability Survey. Retrieved March 3, 2009 from http://www.demographia.com/dhi.pdf.

Davidson, M. (2008). Spoiled mixture: Where does state-led 'positive' gentrification end? *Urban Studies, 45*(12), 2385-2405.

De Veaux, R. and Velleman, P. (2004). *Intro stats*. Boston: Pearson Education, Inc.

Environmental Protection Agency (EPA), (n.d.). Reducing Urban Heat Islands: Compendium of Strategies. Retrieved July 12, 2009 from http://www.epa.gov/hiri/resources/pdf/BasicsCompendium.pdf.

Ghosh, S., Vale, R., and Vale, B. (2006). Indications from sustainability indicators. *Journal of Urban Design, 11*(2), 263-275.

Gunder, M. (2006). Sustainability - planning's saving grace or road to perdition? *Journal of Planning Education and Research, 26*(2), 208-221.

Hodge, G. & Robinson, I. (2001). *Planning Canadian Regions*. Vancouver: UBC Press.

Holden, M. (2006). Urban indicators and the integrative ideals of cities. *Cities, 23*(3), 170-183.

Hueting, R., & Reijnders, L. (2004). Broad sustainability contra sustainability: The proper construction of sustainability indicators. *Ecological Economics, 50*(3-4), 249-260.

Joint Center for Housing Studies, (2009). The State of the Nation's Housing: 2007. Retrieved March 30, 2009 from http://www.jchs.harvard.edu/publications/markets/son2007/.

Lee, M., Villagomez, E., Gurstein, P., Eby, D., Wyly, E. (2008). *Affordable EcoDensity: Making affordable housing a core principle of Vancouver's EcoDensity charter*. Vancouver, BC: Canadian Centre for Policy Alternatives. Retrieved from http://www.policyalternatives.ca/documents/BC_Office_Pubs/bc_2008/affordable_ecodensity.pdf.

Lees, L. (2008). Gentrification and social mixing: Towards an inclusive urban renaissance? *Urban Studies, 45*(12), 2449-2470.

Lees, L., Slater, T., & Wyly, E. K. (2008). *Gentrification*. New York: Routledge/Taylor & Francis Group.

Ley, D. and Dobson, C. (2008). Are there limits to gentrification? The contexts of impeded gentrification in Vancouver. *Urban Studies, 45*(12), 2471-2498.

Malpezzi, S., & Mayo, S. K. (1997). Housing and urban development indicators: A good idea whose time has returned. *Real Estate Economics, 25*(1), 1-11.

McCann, E. (2003). Framing space and time in the city: Urban policy and the politics of spatial and temporal scale. *Journal of Urban Affairs, 25*(2), 159-178.

Mog, J. M. (2004). Struggling with Sustainability—A comparative framework for evaluating sustainable development programs. *World Development, 32*(12), 2139-2160.

Pembina Institute, (2007). The Ontario Community Sustainability Report. Retrieved July 8, 2009 from http://pubs.pembina.org/reports/ocsr-07-report.pdf.

Portney, K. (2009). The Top 12 Most Sustainable Cities. Retrieved March 3, 2009 from http://ourgreencities.com/.

Portney, K. (2007). The Top 12 Most Sustainable Cities: Criteria. Retrieved March 3, 2009 from http://ourgreencities.com/.

Portney, K. (2005). Civic engagement and sustainable cities in the United States. *Public Administration Review, 65*(5), 579-591.

Portney, K. E. (2003). *Taking Sustainable Cities Seriously : Economic development, the environment, and quality of life in American cities*. Cambridge, Mass.: MIT Press.

Raco, M. (2007). Securing sustainable communities - citizenship, safety and sustainability in the new urban planning. *European Urban and Regional Studies, 14*(4), 305-320.

Saha, D. and Paterson, R. (2008). Local government efforts to promote the "three es" of sustainable development - survey in medium to large cities in the united states. *Journal of Planning Education and Research, 28*(1), 21-37.

Sairinen, R. (2004). Assessing social impacts of urban land-use plans: From theory to practice. *Boreal Environment Research, 9*(6), 509-517.

Smith, D. (2008). The politics of studentification and '(un) balanced' urban populations: Lessons for gentrification and sustainable communities? *Urban Studies, 45*(12), 2541-2564.

Smith, N. (2002). New globalism, new urbanism: Gentrification as global urban strategy. *Antipode, 34*(3), 427-450.

Stone, M. E. (2006). What is housing affordability? the case for the residual income approach. *Housing Policy Debate, 17*(1), 151-184.

SustainLane, (n.d.). About Us. Retrieved July 11, 2009 from http://www.sustainlane.com/sp/about/about-us.jsp.

SustainLane, (2006). The SustainLane 2006 US City Rankings. Retrieved July 11, 2009 from http://www.sustainlane.com/us-city-rankings-2006/.

Thalmann, P. (2003). ‘House poor’ or simply ‘poor’? *Journal of Housing Economics, 12*(4), 291-317.

US Census Bureau, (2009a). American Community Survey (ACS). Retrieved March 30, 2009 from http://www.census.gov/acs/www/SBasics/.

US Census Bureau, (2009b). Housing Vacancies and Homeownership. Retrieved March 30, 2009 from http://www.census.gov/hhes/www/housing/hvs/hvs.html.

US Department of Housing and Development, (2008). Retrieved March 30, 2009 from http://www.census.gov/hhes/www/housing/ahs/ahs.html.

Warner, K. (2002). Linking local sustainability initiatives with environmental justice. *Local Environment, 7*(1), 35.

Wassmer, R. and Bass, M. (2006). Does a more centralized urban form raise housing prices? *Journal of Policy Analysis and Management, 25*(2), 439-462.

Weinberg, S. & Abramowitz, S. (2008). *Statistics using SPSS: An integrated approach*. Cambridge: Cambridge University Press.

Winston, N. & Eastaway, M. (2008). Sustainable housing in the urban context: International sustainable development indicator sets and housing. *Social Indicators Research, 87*(2), 211-221.