THE APPLICATION OF ECOSYSTEM SERVICES CONCEPTS IN CANADIAN URBAN PLANNING

by

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Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq.

We are all Treaty people.

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ABSTRACT

The purpose of this qualitative research was to understand if and how the actors with roles in urban planning in three Canadian cities applied ecosystem services (ES) and related concepts (for example, green infrastructure, natural assets) in their work. ES are the benefits that nature provides for human well-being. Sustainability science researchers advocate for ES science to be applied in urban planning to address the problems that urban areas pose for ecosystems globally. Planners are interested in increasing the quantity and quality of ES in urban areas and learning how to apply ES science to address contemporary environmental challenges. However, the uptake of ES in planning is minimal, and there is little clear guidance on how ES approaches can improve decision-making. Research participants were working in planning in Halifax, Calgary, and Vancouver and were interviewed about their experiences in applying ES ideas and approaches. Data was analysed using inductive and deductive techniques. The research comprised three linked studies. First, knowledge utilization theory was applied to understand ES use, finding that planners used ES ideas, rhetoric, and tools to argue for ecosystem protection in the face of climate change and urbanization. Second, theory from policy science guided an analysis for the criteria of the practical fit of ES concepts in municipal policy. Local relevance and adaptability were core criteria for practical fit; policy entrepreneurs (PEs) played a role in meeting these criteria. Third, the tactics of PEs in promoting ES and changing urban policy were explored; for example, PEs were found to be framing problems with ES to connect with politicians' concerns. Research sampling was limited by the modest uptake of ES in Canada and difficulty accessing participants during the pandemic; there was assumed participant bias toward the use of ES due to positive deviance sampling. Recommendations for research include further ethnographic study of municipal planning practice, assessment of whether ES is improving urban environmental policy, and research on PEs in planning. Recommendations for practice and education include encouraging PE qualities in planning staff, the broadening of use of the ES concept, and increasing ecological planning education for planners.

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CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Urban planning and sustainability science are disciplines that share important related challenges. The research presented in this dissertation was designed to address two contemporary challenges they have in common. In sustainability science, researchers have called for ecosystem services (ES) science to be operationalized (applied in practice) to address the multiple challenges facing urban areas and the problems that urban areas pose for ecosystems globally (McPhearson et al., 2015; Sirakaya et al., 2018). Meanwhile, urban planning scholars and practitioners are seeking ways to improve planning processes and environmental policy to address an increasing number and severity of environmental issues in cities, including many related to climate change (Hill, 2016; Hurlimann et al., 2021).

1.1.1 ES and sustainability science

The ES concept draws attention to the once-unacknowledged role of ecosystems in providing essential services to humans (Gómez-Baggethun et al., 2010). The Millennium Ecosystem Assessment (MA) framework categorizes ES as: provisioning services, such as food and water; regulating services that control processes such as flooding; cultural services, non-material benefits like recreational and aesthetic opportunities; and supporting services, such as soil formation and nutrient cycling (MA, 2005). Urban ES are produced by natural, managed, and constructed ecosystems in urban and peri-urban areas and include food and drinking water (provisioning ES), mitigation of stormwater

flows by the urban forest (regulating ES), mental health benefits provided by greenspace (cultural ES), and pollinator habitat that supports urban food production (supporting ES) (Elmqvist et al., 2015). Urban residents are also dependent and have a large impact on ES located far outside urban areas (Seto et al., 2017). As cities grow in population and extent, the need for the sustainable production of ES within cities is becoming more pressing, while the opportunities for ES production are decreasing because of competition for space and the impacts on natural structures and ecosystems in and outside cities (Grunewald & Bastian, 2017). Investments in green infrastructure (GI; Table 1.1) and in ecosystem-based restoration for climate-change adaptation can be economically advantageous, produce multiple co-benefits (including cultural ES such as health and social cohesion), and increase environmental stewardship behaviours among urban residents (Elmqvist et al., 2015). Investments to increase ES also enhance urban resiliency over the long term, thus reducing known and also unforeseen risks related to future climate-change impacts (Elmqvist et al., 2015).

The ES concept conveys "the idea that natural systems provide benefits that support human wellbeing", but there is no agreed-upon definition for ES (Costanza et al., 2017, p. 2). In addition, there are an increasing number of concepts and terms closely related to ES; their definitions and goals vary with the disciplinary context in which they are being applied (VNCST, 2017; Table 1.1).

Table 1.1 Definitions for ES and related terms used in this dissertation

Term	Representative Definition(s)
ecosystem services	"The ecological characteristics, functions, or processes that *directly or indirectly* contribute to human wellbeing: that is, the benefits that people derive from functioning ecosystems" (Costanza et al., 2017, p. 3).
green infrastructure (GI)	"In an *urban* context, GI has been understood as a strategic approach to open space or landscape planning to fulfil a wide range of ecological, social, and economic objectives as well as a narrowly focused spatial solution to local storm water management" (Hansen et al., 2021, p. 258). GI for greenspace planning: "the overall spatial patterns in which greenspaces are woven into urban areas – e.g. through ribbons of greenways or encircled by a greenbelt – to provide various social and environmental benefits" … GI for urban ecology: "a network of vegetated land or open space" ... GI for water/stormwater management: "site-level designs that improve hydrological functions, some of which might not even include vegetation (e.g. permeable pavement)" (Matsler et al., 2021, p. 9).
natural capital	"The land, air, water, living organisms and all formations of the Earth's biosphere that provide us with ecosystem goods and services" (International Institute for Sustainable Development, 2008, as cited in Mooney & Brown, 2013).
natural assets	"Refers to the use of preserved, restored, or enhanced elements or combinations of vegetation and associated biology, land, water, and naturally occurring ecological processes to meet targeted infrastructure outcomes" (NAI, 2024, p. 4).

Term	Representative Definition(s)
nature-based solutions	"Nature-based solutions or nature-based climate solutions are measures that protect, restore and sustainably manage natural or modified ecosystems, with the aim of maintaining or enhancing the services provided to human communities and benefits to biodiversity… These include natural assets and enhanced assets, but exclude engineered assets that mimic natural functions but use grey infrastructure to do so" (NAI, 2024, p. 4). "Nature-based solutions are actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits" (United Nations, 2022, as cited in Remme et al., 2024, p. 5).

Research and interest in ES science have resulted in better understanding about human reliance on ecosystems and have spurred initiatives such as ES assessments at national, multi-national, and global levels, payments for ES (PES) programs, and the uptake of ES approaches by environmental agencies (Rall et al., 2015; Scott et al., 2018). However, ES science has not yet been translated into widespread policies and action at the local level, including in urban areas (Palo et al., 2016; Rall et al., 2015; Ronchi, 2021). The spatial and temporal dynamics of ES are difficult to measure and map, and thus create difficulties for policy development (Bagstad et al., 2013). In addition to technical and policy challenges, there are unresolved difficulties in coordinating ES governance both horizontally (across jurisdictions) and vertically (from the local level upward) (Wilkinson et al., 2013). Moreover, there are often disconnections between local-level and higher-

level environmental mandates and policies (Simeonova and van der Valk, 2009; Theobald et al., 2005).

Land-use planning has an important role in operationalizing ES science because land uses have a direct impact on ecosystems and the ES they produce (Cortinovis & Geneletti, 2018a; Longato et al., 2021; VNCSF, 2017). The ES concept has been shown to have considerable utility in communicating the importance of nature for human benefit, and it has been recognized for its qualities as a boundary object capable of bringing together multiple perspectives for collective problem-solving, for example, for urban sustainability (Luederitz et al., 2015). In practical applications, the use of systematic ES assessments that comprehensively and precisely measure and map ecological conditions and ES beneficiaries have advantages over conventional planning approaches (BenDor et al., 2017). ES approaches are effective in identifying the locations of ES flow and thus for protecting ecologically valuable areas, and enable transparency in decision-making, for example, when used in trade-off analyses to decide among competing land uses or development locations (DeLoyde & Mabee, 2023; Zhang & Muñoz Ramírez, 2019).

Case studies of the real-world application of ES in planning, although limited, are revealing the advantages of ES approaches over conventional planning approaches in supporting decision-making and in acknowledging and accounting for human beneficiaries. For example, Cortinovis and Geneletti's (2018b) case study in Trento, Italy, showed that an ES approach was effective in accounting for vulnerable communities during planning for greenspace restoration. Nijhum et al. (2021) developed

an ES-based strategic environment assessment approach that engaged citizens in a choice experiment for alternative scenarios in Saskatoon, Saskatchewan; they found that the approach was transparent and provided useful information in land-use decision-making for the protection of valued ecosystems. DeLoyde & Mabee (2023) found an ES approach to be an improvement over conventional planning approaches in their study in urbanizing southern Ontario. The approach increased transparency in decision-making over other methods when identifying peri-urban areas that should be protected to ensure the long-term flow of ES in the context of rapid urban growth (DeLoyde & Mabee, 2023).

1.1.2 Environmental issues in Canadian cities

Canadian cities, like cities worldwide, are facing multiple, serious, and complex environmental challenges. Cities are affected to varying degrees by these challenges, which include: climate-change impacts such as sea-level rise, more frequent and higher floods, wildfires in peri-urban areas, and intensification of the heat-island effect; increased urbanization and the resulting impacts on biodiversity and hydrological regimes; increased human demands for ES; aging and deteriorating grey infrastructure; and the physical and psychological disconnection of urban residents from the natural environment (Berke & Stevens, 2016; Dhakal & Chevalier, 2017; Eraydin & Tasan-Kok, 2018). Cities have been able to adapt to some of these impacts, for example by drawing on ES from distant areas, and investing in renewed grey infrastructure. However, environmental challenges are predicted to increase and become more costly over time, as climate-change effects intensify (Bush & Lemmen, 2019). To ensure the protection of urban integrity as well as human health and well-being, many Canadian cities have

mounted initiatives for adaptation to climate change (FCM, 2024), and have developed climate action plans (Herbert et al., 2022). There are also projects to reform municipal asset accounting practices to recognize and include natural assets that provide ES flow (Tang Kai et al., 2022).

For reasons of environmental sustainability, urban planners have also been introducing or increasing the use of alternatives to conventional planning and engineering approaches, for example, via implementation of GI to replace or supplement conventional infrastructure (and thus lower costs), and naturalization of public lands to restore natural ecosystem functions (FCM, 2024; Tang Kai et al., 2022). Urban GI has been demonstrated to build capacity to adapt to climate change, improve biodiversity, and provide multiple human benefits from the flow of ES (Andersson, 2018; Elmqvist et al., 2015; Niemela et al., 2010). A recent survey of Canadian urban planners found that "90% of respondents recognized the relationship between ES, human health and well-being and its applicability for urban sustainability", but the survey "also found that respondents were largely unaware of the ES body of literature" (Tang Kai et al., 2022, p. 163).

1.1.3 The urban planning – ES science gap

Despite the interest by ES researchers and urban planners in ES approaches and recognition of their high relevance for urban planning, the "real world factors of implementation" for ES are not well understood (Rall et al., 2015, p. 231). There is little comprehensive understanding of why and where ES measures are being implemented, how they are impacting urban planning policies, and in what circumstances they improve

outcomes for ecosystem health and human well-being. In addition, most ES approaches have been studied by scholarly researchers and applied in urban planning practice outside Canada, largely in the European Union (EU). Therefore, Canadian planners have little guidance to draw on, except for that provided by resources such as the Ecosystem Services Toolkit, a national-provincial-territorial initiative to support the incorporation of ES assessments into various applications, including land-use planning (VNCST, 2017), and technical guidance for natural asset assessments by the Natural Assets Initiative, a Canadian not-for-profit organization (mnai.ca).

Researchers have examined multiple factors in whether and how ES approaches are taken up in planning, but these have not yet been assembled into a coherent theoretical base. An issue is that the institutional, organizational, and political dimensions influencing the uptake of ES approaches are not well understood (Grêt-Regamey et al., 2017; Kremer et al., 2015). For example, the role of institutional cultures—including collaboration within and across various disciplines—is believed to be key to putting ES approaches in place (Carmen et al., 2018; Kremer et al., 2015). Other factors include the knowledge and values of city staff and the availability of government resources (BenDor et al., 2017; Boulton et al., 2018), and political context and leadership (Boulton et al., 2018; Rall et al., 2015). In addition, organizational culture may be an important factor in applying ES approaches (Boulton et al., 2018; Rall et al., 2015). The quality of communication and collaboration among government departments and staff such as urban planners, park planners, city engineers, and urban foresters, may influence knowledge-sharing and problem-solving (Boulton et al., 2018; Elmqvist et al., 2013).

1.2 Research Rationale and Purpose

Sustainability science has pointed out the pressing need to operationalize the ES concept in urban areas for the benefit of humans and to address impacts on ecosystems at all levels. ES approaches are perceived by ES researchers to offer many benefits for addressing the multiple and complex issues facing cities. However, there are few examples of ES being applied in practice as an explicit approach, and little clear guidance on how ES approaches can improve decision-making in practice (Saarikoski et al., 2017). Although there are many proposals for implementing ES (for example, Zhang & Muñoz Ramírez, 2019; Cortinovis & Geneletti, 2019), more research is needed on how planners may be supported to incorporate ES science usefully into planning processes. For example, processes for data gathering and modelling—achievable with the resources available to municipal planning departments—must be developed to create reliable ES knowledge that may be linked with real-world action (BenDor et al., 2017; Carmen et al., 2018; Grêt-Regamey et al., 2017; Schubert et al., 2018).

In short, although the protection and restoration of urban ES is viewed by planners and sustainability researchers to be important, and the benefits of applying ES approaches in urban areas are becoming increasingly clear, there is a lack of precedent for their practical application. The knowledge base on current application of ES needs to be increased to enable future application. In addition, understanding how ES can be applied in the Canadian municipal planning system context would assist Canadian planners, as research has so far been focused on the EU. Therefore, the purpose of this research was to understand if and how the actors with roles in urban planning in Canadian cities applied

ES and related concepts (for example, GI, natural assets, natural capital) in their work. My aim was to provide insight to urban planning practitioners, as well as urban planning and ES scholars, into how ES approaches in Canadian cities were influencing planning practice and what factors might enable the use of ES approaches in planning. My central research question was: How and to what effect do the actors in Canadian urban planning apply ES concepts and approaches?

1.3 APPROACH

As an urban and environmental planning educator and practitioner, I have reflected on how theory and knowledge from research are applied in practice. I believe that urban planning and decision-making should be improved in terms of environmental outcomes. I am interested in how planners' values, training, practice environment, the ideas they encounter, and the tools they employ influence their practice, policy, and ultimately environmental sustainability outcomes. My approach to research is constructivist, in that I rely upon the perspectives and experiences of research participants and the meanings they construct from their experiences (Creswell, 2007). Constructivism is an appropriate choice for this type of research as well as a natural inclination for me as a social scientist. A constructivist approach is applied in qualitative research, which is intended to build theory and provide answers to questions about complex human phenomena such as the use of concepts in institutionalized practice, as opposed to a positivist approach, used in quantitative research to test theory and answer questions about relationships among variables.

Although the research was not strictly an ethnography, my experiences and position allowed me to bring an "an ethnographic sensibility" to the work to help with "uncovering the nuances of contemporary urban governance settings [to produce] evidence that is robust for practical application and potent for theory development" (Henderson, 2016, p. 28). Because of my prior involvement in planning communities and my level of comfort with the planning topics in the research, I could bring a valuable "insider afterwards" perspective to the work (Henderson, 2016, p. 31). As a constructivist researcher, I interpreted participants' accounts of their experiences and the meaning they ascribed to them and used those to develop conceptual models for understanding their experiences (Creswell, 2007).

The research was exploratory, aimed at gaining an understanding of the experiences and perspectives of planners in applying ES ideas and approaches within a specific context: the complex and sometimes opaque processes of decision-making in Canadian cities (Moore, 2015; Othengrafen, 2016). A qualitative research approach was an appropriate choice for a couple of reasons. First, qualitative research affords a rich investigation and interpretation of human perspectives and experiences in their context, and it is well suited for the development of hypotheses about these behaviours through inductive analysis of data such as interviews (Stake, 2010). Second, a qualitative approach was a good fit for my research interest in the theory-practice relationship, which can be explored through learning about planners' perceptions and experiences.

Within the qualitative framework, this research was a descriptive, multi-site study (Creswell, 2007) of the phenomenon of interest: the use of ES concepts and approaches

in urban planning. I maintained attention on the essential connection to context as I interpreted participants' experiences. I generated over-arching themes from the individual experiences shared by participants in each site and present my findings here in the form of syntheses across all cities.

1.4 METHOD

1.4.1 Screening for study sites

I was interested in learning about planners who were using ES approaches, which are not widely applied in Canadian urban planning. Therefore, my participant selection process was designed to seek out those who were applying ES. This is a positive deviance approach to inquiry, aimed at "identifying efficacious innovations in low resource settings" (Dearing & Singhal, 2020, p. 310). To identify cities where ES approaches were actively used, I conducted a phone screening with planners in 12 Canadian cities. Additionally, I had conversations about ES with urban planners in several cities (August 2018), and with knowledge-holders in ES-related organizations to understand the general level of ES application and understanding in each city. I also drew on previous research (Thompson et al., 2019) on the use of ES concepts in Canadian urban plans and reviewed the modest amount of peer-reviewed literature on the use of ES ideas in Canadian urban planning.

The locations chosen for the study demonstrated the explicit use of ES ideas in planning practice (for example, the use of mapping and assessment tools), planning policy (for example, municipal plans), or municipal guidelines (for example, for site-level

development). I conducted a pilot study in the Halifax Regional Municipality (Halifax) to test and refine the research design and the procedures for participant selection and data collection (Yin, 2009). The two other locations selected were the Metro Vancouver Region (Vancouver) and the City of Calgary (Calgary).

1.4.2 Limitations

There were some limitations to the research resulting from the approach and methods chosen. For the positive deviance sampling, individuals were purposefully selected for their relatively high knowledge and use of ES concepts and approaches, but it was unavoidable that not all of those using ES in each city were sampled. In addition, I was made aware that some planners with knowledge about the use of ES approaches were likely unwilling to participate because of personal philosophical or ethical differences with the ES concept; for example, critiques of the anthropocentric focus of ES and the use of monetary ES valuation are well known. The perspectives of these planners would have been valuable.

It must also be kept in mind that the assessments of the utility of ES by participants are subjective judgements. The policies or outcomes they mentioned have not been independently examined to evaluate their effectiveness. Other limitations for each of the study phases are presented in each chapter as applicable.

1.4.3 Data collection

The key sources of data were individual interviews and focus groups. I also referred to secondary data, consisting of publicly available and internal documents from each city. During interviews and focus groups, I departed occasionally from the suggested questioning route to explore topics of relevance brought up by participants that were not anticipated during the research design.

Initially, potential research participants were purposively selected from the group of people involved in planning in each city (Creswell, 2014). I identified other participants through snowball sampling by asking participants for referrals (Berg & Lune, 2012). Individual and focus-group participants included city planners (urban, park, and environmental planners); municipal staff such as foresters, ecologists, and engineers; a councillor; and private-sector consultants. Although I had planned for in-person interviews, all interviews and one focus group were held online because of COVID-19 pandemic travel restrictions. The pandemic hindered participant recruitment, because most planners were working from home and not available via their work numbers or the central switchboard in the municipalities.

I interviewed 26 individuals about their experiences related to their knowledge or application of ES ideas within the institutional context of urban planning. Interviews were semi-structured, guided by a protocol (Appendix B). They ranged in length between one and two hours. I also organized focus groups in Halifax and Vancouver to understand why and how ES approaches are applied in the organizational and

institutional context. I was not able to convene a focus group of urban planners in Calgary. I moderated the group discussion with the guidance of a sequence of open-ended questions (Silverman & Patterson, 2015) (Appendix C). Each focus group session ranged in length between one and two hours.

1.4.4 Data analysis and synthesis

Coding

Interviews and focus groups were digitally recorded, transcribed for analysis, saved as digital files, and secured under password on my research computer. I used NVivo analysis software (Lumivero, 2020) to assist with data organization and analysis.

The first step in the analysis was inductive coding of the entire set of interview and focus-group data. The coding process consisted of an initial open coding, in which I reviewed the textual data line by line and assigned codes to groups of text (Silverman & Patterson, 2015). Subsequently, I employed focussed coding, in which I compared open codes to synthesize them into broad thematic categories. The analysis software enabled the examination and comparison of codes and themes by city and across all cities.

Application of theory

During each subsequent phase of the research, I relied on a different area of theory to inform further analysis and conclusions. The analysis procedures and conclusions are summarized in the chapter descriptions, below. Detail on each analysis technique and on the theoretical frameworks is provided in chapters two, three, and four.

I received approval for the research through the Dalhousie Social Sciences and Humanities Research Ethics Board (REB File Number 2019-4787; Appendix A).

1.5 Organization of the Dissertation

The dissertation is presented in a publication format and comprises five chapters. In addition to the introductory and concluding chapters, chapters two, three, and four are manuscript chapters. Chapters two and three have been published in peer-reviewed journals, co-authored with Kate Sherren, Peter Duinker, Mikiko Terashima, and Anders Hayden, who are all members of my supervisory committee. Chapter Four, at the time of writing, was submitted to Environmental Management journal and is under editorial review.

I took the lead on proposing the research and conducting all data collection, analysis, interpretation, and writing. Committee members made editorial suggestions.

Chapter One provides background, an overview of the rationale for the research, the research approach and methods, and a summary of the component chapters.

In the study presented in Chapter Two, I employed theory on knowledge utilization (Weiss, 1979; 1999) to guide a deductive analysis to understand how urban planners in the three locations used ES science. A key finding in this work was that planners used ES ideas, rhetoric, and tools to build the case for protection of urban nature in the face of urban challenges such as climate change and increased urbanization. Recommendations

to inform ES research and planning practice and research are included, such as using ES as a bridging concept to coordinate municipal policies, encouraging more collaboration between ES researchers and planning practitioners, and evaluating the effectiveness of the use of ES for improving urban environmental policy. Chapter Two was published as a peer-reviewed paper in *Ecosystem Services*, with the title, "Building the case for protecting urban nature: how urban planners use the ideas, rhetoric and tools of ecosystem services science".

Chapter Three documents a study framed around themes from the first inductive analysis: the challenges and opportunities for the use of ES in urban planning contexts. Theory from policy science about the uptake of ideas for policy (Kingdon, 2003; Stevenson et al., 2021) was used to answer the question: What are the criteria for the practical fit of the ES concept in urban planning? A central conclusion was that local relevance and adaptability were the core criteria for practical fit, and that the actions of policy entrepreneurs played a role in meeting these criteria. Chapter Three was published as a peer-reviewed paper in *Planning Practice and Research* with the title "The ecosystem services concept in urban planning: the criteria for practical fit".

Chapter Four presents the results of analysis focused on another theme produced from the initial inductive analysis: the actions of certain individuals in promoting the ES concept. Kingdon's (1984, 2003) theoretical notions from the public policy field were applied with an emphasis on the concept of policy entrepreneurship within the multiple streams framework. This study built upon the conclusions from the previous chapter and was

intended to answer a third research question: What were the tactics of urban planning policy entrepreneurs (PEs) to promote ES ideas? The study delineated several tactics that PEs applied to promote ES with the goal of changing urban environmental policy. Chapter Four is, at this time, under editorial review by *Environmental Management* with the title: "Policy entrepreneurship in urban planning: tactics for promoting and engaging the ecosystem services concept for urban environmental sustainability". Co-authors are Peter Duinker, Kate Sherren, Anders Hayden, and Mikiko Terashima.

Chapter Five concludes by summarizing the central findings of the research and providing an assessment of the overall contribution of the body of work. Several recommendations for planning education and practice as well as a proposed research agenda are also provided.

CHAPTER 2: BUILDING THE CASE FOR PROTECTING URBAN NATURE: HOW URBAN PLANNERS USE THE IDEAS, RHETORIC, AND TOOLS OF ECOSYSTEM SERVICES SCIENCE

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2.1 ABSTRACT

Ecosystem services (ES) researchers have recognized the important role of urban planning decisions in influencing the quantity and distribution of ES in cities. However, knowledge about ES among planners is still modest, and more research is needed about planners' experiences with ES. For this qualitative study, interviews and focus groups were conducted with actors with roles in urban planning in three Canadian cities. The aim was to understand participants' knowledge of ES and how they use it. These early adopters were creative, practical, and politically astute in using ES ideas, rhetoric, and tools to build the case for natural urban ecosystems. ES was used in multiple and intersecting ways for awareness-raising, to justify the protection and restoration of natural ecosystems, to provide direction to plans, and to support and supplement existing planning approaches. The strategic use of ES was notable. As a boundary object, ES helped to bridge perspectives and to integrate policies. The ability of ES to facilitate

policy coordination is promising. Further research on the effectiveness of ES to improve urban policy is needed.

2.2 INTRODUCTION

Ecosystem services (ES) are the "benefits that people derive from functioning ecosystems" (Costanza et al., 2017). Understanding of ES ideas, rhetoric, and tools for assessing and valuing ES is emerging but is still modest among planners (Grunewald et al., 2021). ES researchers have recommended the application of ES ideas and tools in planning, for example, to integrate multiple environmental approaches and policies (Ronchi, 2021), to support the creation of urban green infrastructure (GI: natural, semi-natural, or designed networks and elements in the city that supply ES) (Dupras et al., 2015), and to increase urban resiliency in the face of climate change impacts (Osmond & Wilkinson, 2021; Tang Kai et al., 2022). There are many existing tools and opportunities in urban planning to address ES, and actions involving ES can address urban problems (Cortinovis & Geneletti, 2018a). Nevertheless, there is little overall understanding about whether the application of ES ideas improves decision-making for the environment in any context, including urban planning (Saarikoski et al., 2018).

In Canada, urban plans incorporate attention to environmental sustainability, and general awareness of issues such as climate change has heightened recently. However, environmental sustainability still tends to be less important in urban decision-making than population growth and economic development (Grant et al., 2018a). In addition, urban institutions are resistant to change, presenting challenges for new approaches to

address sustainability (Filion et al., 2015). As a result, some planners may feel compelled to be vocal and creative advocates for the environment. ES rhetoric, assessment and valuation tools offer many ways to support this advocacy.

Although there is interest in ES, there is a lack of skills and knowledge at the local planning level about ES (Tang Kai et al., 2022), and few models or precedents for its use (Cortinovis & Geneletti, 2018a; Scott et al., 2018). Practitioners obtain information about ES ideas and tools via grey literature, such as trade magazines and websites (Harrison et al., 2018), and through professional networks. Organizations like the non-profit Municipal Natural Assets Initiative (MNAI) in Canada provide technical support for municipalities to recognize, assess, quantify, and value the natural assets that provide ES in urban areas. An ES "Toolkit", a joint publication of the Canadian federal, provincial, and territorial governments, provides information about ES and its application at the local level (VNCSF, 2017). However, uptake of this guidance has been modest at best (Kerr et al., 2021) .

To narrow the gap between theoretical propositions and the reality of ES application, a better understanding is needed about how and why ES is used in practice (Beery et al., 2016; Grunewald et al., 2021; Ronchi, 2021). The experiences of practitioners can provide insight into the practical aspects of ES use in a planning context, with its political, social, and institutional complexities (Scott et al., 2018).

European researchers have documented the experiences of planners with applying ES in the municipal environment; for example, Albert & Von Haaren, (2014) in Germany; Hysing (2021), Kaczorowska et al. (2016), and Khoshkar et al. (2020a) in Sweden; and Di Marino et al. (2019) in Finland. Planners use ES ideas, rhetoric, and tools for communicating the value of urban nature to citizens and policy-makers, for bringing diverse urban actors together, and for bolstering support for the development of GI (Grunewald et al., 2021). Studies are sparse and are confined to a few locations and planning systems. Therefore, more research is needed to understand a wider range of practitioners' experiences in different locations and municipal contexts.

The aim of this study was to understand how the actors with roles in urban planning in three Canadian cities currently use ES science. Individual and focus-group interviews were conducted to understand participants' knowledge of ES and how they use the concept. Weiss's (1979; 1999) typology of knowledge use was the basis for interpreting ES use. Planners use ES in multiple and intersecting ways to build a case with the public and politicians that natural urban ecosystems are worth protecting and must be elevated in importance during urban decision-making processes. The practical insight, political astuteness, and optimism with which those working in urban planning use ES reflect an approach in keeping with pragmatism, a tradition in planning theory and practice.

2.3 THEORETICAL FRAMEWORK

2.3.1 Knowledge Use

Knowledge is used in a range of ways, determined by various interacting circumstances: individual roles, capabilities, and interests; systems of beliefs; the information available; and the institutional context (Weiss, 1999). To make sense of the ways that knowledge is employed, Weiss (1979; 1999) proposed what has developed into a widely adopted typology of knowledge use as conceptual, strategic, and instrumental.

Conceptual knowledge use is for the purpose of influencing, conditioning, and shaping thinking in general ways (Dunlop, 2014). Conceptual knowledge users need not be experts; mutual learning occurs during dialogue between knowledge users and recipients (Dunlop, 2014). Strategic (or political) knowledge use is intended to argue for or against a pre-existing position (Weiss, 1999) and to persuade using the "symbolic value of a body of knowledge" (Waylen & Young, 2014). Strategic use relies on the ability to defend a stance, and therefore rhetoric is intrinsic to this type of use. Instrumental knowledge use refers to the direct use of evidence or facts "to solve policy problems by filling data gaps or reducing uncertainty" (Waylen & Young, 2014), and to the design of policy around knowledge frameworks (McKenzie et al., 2014). Instrumental use conforms to a linear-rational model, and assumes that established knowledge, evidence, and facts can be transferred directly to recipients to effect policy change and outcomes on the ground (Waylen & Young, 2014).

The typology of knowledge use presented above is a useful analytical tool for distinguishing types of use and underlying motivations and social processes. However, in practice these categorical boundaries are somewhat fuzzy, and knowledge can "be used in different ways at different times by different actors" (Haines-Young & Potschin, 2014, p. 306). In addition, knowledge may be used in more than one way simultaneously (Haines-Young & Potschin, 2014). Knowledge may also not be used for various reasons, from unwitting ignorance to intentional rejection (Dunlop, 2014).

2.3.2 Pragmatism and policy-relevant knowledge in urban planning contexts

The use of knowledge by planners is influenced by the constraining, multiple, and layered legal, fiscal, social, and institutional contexts they navigate. Planners work within the formal structures of municipal government, including: institutional decision-making hierarchies; municipal bureaucracies; and municipal planning departments and their associated cultures, norms, and practices (Filion, 1997; Healey, 2018). They are obligated to adhere to legally established procedures and must consider multiple and competing fiscal and social objectives (Cowell & Lennon, 2014; Filion, 1997)

Planning theorists suggest that the philosophic movement of pragmatism offers theorists a model for the complexity of contemporary urban planning practice and provides planners with a guiding normative framework within ever-changing and challenging contexts (Forester, 2013; Healey, 2009; Lester, 2019). Pragmatism recognizes the primacy of the need to act, to reflect on and learn from the results of acting, and that "the

production of knowledge…is less about providing technical certainty and more about helping to construct a better future" (Lester, 2019, p. 3). Lester (2019) points out that pragmatism appeals to what motivates many planners: an enduring hope that their actions will result in positive change and the improvement of living conditions.

In the pragmatic tradition, there are no absolutes. Knowledge is imperfect, and truth is contingent: truth is "what helps us solve problems in a given context" (Lester, 2019, p. 3). Pragmatic planners are on a constant search for multiple types of knowledge that can support the creation and implementation of policy, i.e., policy-relevant knowledge ((Weiss, 1979; 1999; Dunlop, 2014). For example, pragmatic planners are technically aware but politically astute: they respect expertise but realize that scientific evidence to support policy is irrelevant without political support (Lauria & Long, 2017).

2.3.3 ES in Planning

Overall, despite the urging of ES researchers to integrate ES ideas and tools into planning, practicing planners have not engaged to a great extent with ES (Ronchi, 2021). This is not surprising, for several reasons. Superficially, ES is a simple idea, but it is value-laden and the implications of its use are extensive and complicated. The thinking that has developed around ES includes a rich mixture of "normative beliefs, cause-and-effect claims, agreed methodological standards, and policy aspirations" (Dunlop, 2014, p. 208). The planning contexts for ES ideas and tools are similarly complex: value-laden, political, and diverse.

In addition, there are few connections between planners and environmental scientists. Ronchi's (2021) review of the body of research recommending the use of ES for planning found that many of the proposals for its introduction did not demonstrate an understanding of planning processes, thus reducing its practical applicability. From their study of the use of ES information in German planning, Albert et al. (2014) recommended that ES researchers should have a better understanding of the needs and contexts of ES users, including practicing planners, to provide them with the information applicable to their decision-making. Seeking to understand how to connect the disparate perspectives of planners and scientists, Brunet et al. (2018) tested several techniques— measuring, visualizing, storytelling, and gamification— for making ES knowledge "actionable", or useful to planners during land-use planning processes in France and Finland. Brunet et al. (2018) concluded that many techniques must be employed, and that selection of techniques must be adaptable and responsive to the context and the needs of the users.

The research-practice misalignment is reproduced in the larger body of ES research, which assumes that transferring ES ideas into practice via instrumental uses such as ES mapping and valuation will improve decision-making (Olander et al., 2017). However, the linear-rational model for the influence of environmental knowledge on decisions, which neglects the institutional, social, and political contexts of practice, is contested in the literature (Cowell & Lennon, 2014).

A gradual increase in the practical use of ES ideas has afforded a recent turn in ES research toward investigating practitioners' perceptions and experiences (for example, see Grunewald et al., 2021; Longato et al., 2023; and Sang et al., 2021). Practitioners say that they use ES in multiple and diverse ways, including for communicating the value of nature, for supplying arguments for including green and blue spaces in urban areas, and for providing reasons for nature conservation and implementation of green infrastructure (GI) (Grunewald et al., 2021; Saarikoski et al., 2018). In Canada, Tang Kai et al. (2022) found that ES was not well understood by urban planners. Kerr et al. (2021) noted a gap between the presence of ES in policy and guidance documents at the Canadian federal and provincial/territorial levels and its implementation.

ES ideas have entered the urban planning vocabulary partly through the closely related notions of GI and natural assets. The implementation of GI in the form of ecological networks has been adopted in urban planning in some Canadian cities, notwithstanding many associated challenges (Dupras et al., 2015). In a German study, the use of GI as a concept appeared to have promise for communicating with the public and politicians on ways to provide a sustainable flow of ES (Albert & Von Haaren, 2014). Matsler et al. (2021) found that GI, like ES, was a bridging concept that promotes cooperation among different disciplines.

Natural assets are elements such as forests, riparian areas, and wetlands that can replace or complement urban grey infrastructure in providing services. Municipal management of natural assets is accomplished via standard financial asset management procedures

(Matsler, 2019). The MNAI has been key in promoting natural asset management across Canada, thus bringing the idea of ES and support for the retention and creation of GI for urban sustainability and climate-change resilience to the attention of planners. The organization directs its efforts toward "municipal decision-makers, staff with responsibility for managing municipal assets, and financial and accounting staff" in "identifying, valuing and accounting for natural assets in their financial planning and asset management programs" (Ogden & Wilson, 2019, p. 2).

Techniques for ES assessments in planning are increasing in number, and include the mapping and modelling of biophysical attributes, non-monetary valuation techniques for understanding human preference for various ES, and monetary valuation techniques for estimating economic values (Harrison et al., 2018). Monetary valuation is often conflated with ES assessment; but is not a requirement of ES assessments. Monetary valuation is controversial; some decision-makers view it as a strong ES tool, while other actors have rejected it (Hysing, 2021). In addition, there is little agreement on monetary valuation techniques, which means that monetary valuation is not (yet) a useful tool (Hysing, 2021).

2.4 METHODS

The study was conducted to improve understanding of the ways in which those working in Canadian urban planning are thinking about and using ES ideas in practice and inform ES researchers about what ES knowledge would be most relevant for urban planning. A qualitative approach was chosen because the study aimed to explore the experiences and

perspectives of participants engaging with ES (Creswell, 2014). Selection of the three cities— Halifax Regional Municipality (Halifax), Calgary, and Metro Vancouver (Vancouver)—was informed by a content analysis of the official plans of 19 Canadian municipalities (Thompson et al., 2019). Plans for the three selected cities showed a higher degree of explicit and implicit use of ES in municipal plans than other locations (Thompson et al., 2019). Further, a screening via phone interviews with planners in several Canadian cities and a scan of environmental policies across the country showed that there was interest in ES and related concepts in the three selected cities. The screening also revealed that consideration of ES in urban planning in Canada is emerging but not commonplace.

Halifax, Nova Scotia, was selected as the initial site for interviews and focus groups (the pilot location to test the methodology for the research) for reasons of convenience for the primary investigator (Yin, 2009). Halifax (2021 population 440,072; [Statistics Canada, 2023]) is a regional centre for industry, government, defence, and commerce on the east coast. In addition, Halifax's Regional Municipal Planning Strategy had been found to contain implicit reference to ES via multiple references to the values and services of nature (Thompson et al., 2019). Other Halifax plans were found to reflect acknowledgement of the value of nature's services: for example, Halifax's *Urban Forest Master Plan* (2013), a pioneering urban forest plan in Canada, and the *Green Network Plan* (2017).

Calgary, Alberta, (2021 population 1,590,639; [Statistics Canada, 2023]) is a national centre for the financial and energy sectors. Calgary has experienced significant growth in population and spatial extent since the 1990s, and its sprawling urban development has converted agricultural land and natural prairie around the city into residential areas. Calgary's municipal development plan was found to make frequent reference to the use of low-impact development techniques and green infrastructure (Thompson et al., 2019). Metro Vancouver, British Columbia, (2021 population 2,642,825; [Statistics Canada, 2023]) comprises 23 constituent municipalities on the west coast. Known for its spectacular wilderness landscapes, the region and some of its municipalities have been early adopters of natural asset approaches. West Vancouver, for example, was one of the first participants in the pilot work of the MNAI. There is planning coordination between constituent municipalities and Metro Vancouver: planning policies for each municipality are required to be consistent with Metro Vancouver's Regional Growth Plan.

Initial sampling was purposive: planners or other individuals with knowledge about ES and about decision-making around urban sustainability and the environment were sought (Creswell, 2014). Further participants were recruited through referrals from early participants (Berg & Lune, 2012). We sought participants with knowledge of ES ideas, rhetoric, and tools in relation to their work in urban planning, and who were interested in contributing to the research. Not all participants identified themselves as urban planners; however, all were involved with urban planning processes or decision-making.

A total of 31 people from the three cities (Table 2.1) were interviewed via 26 semi-structured individual interviews of approximately one hour each, and two focus-group sessions of approximately 90 minutes each. The inquiry was intended to gather data about individual experiences related to the perception, knowledge, and application of ES in urban planning. Focus groups were employed in Halifax and Vancouver to allow access to "group meanings, processes, and norms" that are rarely articulated outside the group (Bloor, 2001). We were unable to connect with local-level planners in Calgary to convene a focus group. Because of restrictions related to the Covid-19 pandemic, all but one of the interviews were conducted remotely. The primary investigator (first author), who was trained as a planner and has worked and taught in planning, is an insider who readily established a rapport with participants in inquiring about their experiences and perspectives and capturing their "practice stories" (Forester, 2015, p. 145). The interviews were audio-recorded and transcribed.

Table 2.1 Participants' roles

Location	Role in planning
Halifax	parks planner
	parks policy and planning manager
	urban forester
	energy and environment program manager
	planning applications manager
	regional planning policy program manager
	city councillor
	regional planning manager; principal planner, environmental planner (focus group)

Location	Role in planning
Calgary	planning policy coordinator
	climate adaptation planner
	resilience & infrastructure planner
	drainage technical lead
	watershed planner
	parks ecologist
	ENGO (stormwater) director
	consulting planner
Vancouver	regional environmental planner
	sustainability specialist (planning)
	parks planner
	consulting planner
	biodiversity conservation planner
	drainage and utilities manager
	senior environmental planner
	climate adaptation coordinator
	financial director; MNAI Board Member
	principal planner (2), agricultural planner, environmental planner (focus group)

The interview data and research memos written by the first author were analysed with the assistance of NVivo software (Lumivero, 2020). Although three municipalities were targeted, the unit of analysis here was the individual planner, because analysis at this level helped to capture an individual's thoughts and motives, and provided an understanding of context. Additionally, we were interested in understanding how individual roles and backgrounds related to the use of ES. A hybrid coding process employing deductive and inductive coding was utilized (Silverman & Patterson, 2015).

The deductive coding process employed Weiss's (1979; 1999) categories of conceptual, strategic, and instrumental use. To prepare for the deductive coding process, the three categories of ES use were carefully defined for consistent utility in the analysis (Table 2.2).

Table 2.2 How categories of ES use were defined for the deductive coding process

Use category (code)	**conceptual use**	**strategic use**	**instrumental use**
Definition	Where the concept that nature provides multiple services for urban residents was used in a general way to inform or to change mindsets	Where ES was used with the intent to legitimate an existing policy or new policy, or to bring people on-side with a policy	Where ES was used as the basis for a plan, where data from ES assessments or valuations informed or improved a plan, or where ES tools were integral to an existing method or approach
Example	"It gives us a way of talking about the incredible benefit that we get from these somewhat intact, functioning ecosystems" (V2).	"One of our councillors said 'what is the value proposition of biodiversity?' and so it was through ecosystem services that we said 'this is the value proposition'" (C8).	"Information is presented publicly through the iTree platform on every street tree: how much value it has, and it looks at air quality, water absorption, and carbon sequestration … and then [this information is] built into a tree ordinance" (C2).

All transcripts were reviewed and relevant text about ES use was coded into one of three use categories: conceptual, strategic, or instrumental. Subsequently, an open, inductive analysis process (Silverman & Patterson, 2015) was carried out during a close reading of text in each use category to generate sub-codes; these were synthesized into themes (Table 2.3).

Table 2.3 ES use categories and themes generated during the inductive analysis with examples

Theme	Example
conceptual use	
awareness	"By using the ecosystem services approach it's a great way to build awareness around … inherent value of those ecosystems, but also why they are important to people, and I think that especially comes through in land use planning, where you're often trying to meet those needs" (V3)
interpretation	"When I'm talking about some of our resources related to urban forestry, I have certainly used the ecosystem services wheel as a communication device in describing why some of these programs are effective or important when it comes to urban planning trends in the region." (V3)
strategic use	
persuasion	"If you applied ecosystem service concepts you would be … able to say … we need that for all of these reasons and also there would be a benefit to people." (V4)
justification	"It has been what we were taught in school and what we try to use to justify the funding and the investment into green infrastructure" (H9)

Theme	Example
buy-in	"The concept is integral to garnering support for nature-based land-use planning and political buy-in in relation to that." (V6)
bridging	"I really believe in this work because you need an extension agent or you need common language that bridges the ecology to the engineering, finance, and planning. I think ecosystem services does that." (V4)
instrumental use	
assessment	"We went up to the 50,000 foot level and said: 'We're going to look at foreshore, we're going to look at our tree canopies, we're going to look at our streams … and our watershed, and put together whatever information we have'" (V1)
valuation	"We have a consultant working on doing that financial valuation for our natural assets … we're looking at wetlands, riparian areas, grasslands, urban forests, and public trees." (C2)
natural asset management	"The reason Parks wanted me … this time was to start a natural asset management program, and it's a great fit for me because it's this intersection of the data and the science and planning." (V2)
integration into policy	"Looking at policy integration and ensuring that there's some language in our municipal development plan and our regional growth strategy, and that it is considered in even our downtown strategy" (C1)

There were methodological limitations on this research inquiry. As Canadian cities are in the early stages of understanding and uptake of ES, even within these relatively early

adopters it was sometimes difficult to identify interviewees interested in participating or who considered themselves knowledgeable enough to provide informed responses. Pandemic travel restrictions affected participant recruitment because it was difficult to follow up on emailed interview requests with phone calls to workplaces. Interviews were held online, and as a result, some of the behavioural nuances observable during in-person interviews may have been missed.

2.5 Results

Participants spoke about using ES for many reasons and in ways that were related to their background, the goals of their work, and the context (Table 2.4). They also described situations of non-use. Most participants were in environmental roles and were supportive of the use of ES in their work; some provided critical insight about its use. We reveal how each use was expressed and explore the variation in how participants use ES.

Table 2.4 Types of ES use, organized by planning context, for participants with high ES knowledge. Bold type in the use columns indicates emphasis on a specific theme.

Role	Education/ Background	Perception of ES	Conceptual Uses for ES	Strategic Uses for ES	Instrumental Uses for ES
Local-level planning					
climate change adaptation & env. planning	ecology	positive	**awareness; interpretation**	persuasion; bridging	natural asset management
environment & parks	environmental planning	positive	**awareness**	persuasion; bridging	integration into policy
agricultural planning	environmental planning	positive	**awareness**	buy-in	**natural asset management**
Urban regional policy planning					
resilience planning	environmental planning	positive	awareness	persuasion; **bridging**	natural asset management; valuation; **integration into policy**
climate adaptation	environmental science	positive	awareness	persuasion; **bridging**	assessment; natural asset management; **integration into policy**
source water protection	geography - climate change	positive	awareness	persuasion; **justification; buy-in**	integration into policy

Role	Education/ Background	Perception of ES	Conceptual Uses for ES	Strategic Uses for ES	Instrumental Uses for ES
parks planning	wildlife biology	positive	**awareness;** interpretation	persuasion; **justification**; buy-in	assessment; **integration into policy**
parks planning	biology and geographic information science	positive	**awareness;** interpretation	persuasion; justification; **buy-in; bridging**	assessment; **natural asset management; integration into policy**
environment & agriculture	biology and environmental planning	positive	awareness; interpretation	persuasion; justification; buy-in; **bridging**	assessment; **integration into policy**
ecosystems & ecological health	env. planning, meteorology, env. physics, chemistry	critical	awareness; interpretation	**justification**; buy-in; bridging	assessment
Consulting					
municipal-scale ES assessment	ecology	critical	awareness	---	**assessment;** valuation
urban forest planning	forestry	critical	awareness	**justification**; buy-in	**assessment;** natural asset management

2.5.1 Conceptual use

As participant V10 explained, ES provides a way to create awareness or understanding about ecosystems, for example, to convey the importance of riparian areas:

> It doesn't matter which group I work with, I always get pushback on riparian setbacks, and I find it helpful to get my point across about their importance when I convey the services that they provide as opposed to just relating it to fish habitat.

Participants also reported that ES language can simplify or help with interpreting abstract concepts such as ecology, biodiversity, or resilience, that are often difficult for the general public to comprehend and relate to. For example, V2 felt that people find ES relatable: “The basic, core piece is [that natural assets in the city] provide us with lots of important services that benefit our lives, and here are some examples. I think people can connect with that”. C7 stated, “the value is … getting people to see the direct benefit to themselves. I think, oftentimes, environmental components can be esoteric and hard to understand”.

Those with less knowledge of ES were more likely to use it conceptually than in other ways. For those with comprehensive ES knowledge, conceptual use was usually a forerunner to strategic use of ES, as the endgame for conceptual use was to convince politicians, developers, and citizens that there were alternative ways to think about how to develop within the city, and to elevate the role of natural systems within urban

decision-making. We noted more emphasis on conceptual use of ES among local level planners than among other participants (Table 2.4).

2.5.2 Strategic use

The most commonly described use of ES by planners was strategic. ES was used to persuade others to change their perspective on the value of urban ecosystems, allowing the participants in roles that required environmental knowledge and promotion of environmental values to better advocate for the environment in their work:

> I personally am very happy for natural areas to exist for their own good, for their integral value, but I see throughout my work all the time that not everybody comes to that position. They need to be convinced that these areas are providing value and importance (V2).

Using ES to justify decisions to invest in protecting or enhancing natural urban ecosystems was prevalent among those working in environmental roles at the regional level:

> We use the ecosystem services to justify why those trees are a “need to have”, not a “nice to have”, and … monetize…all those services those trees provide. Then we can justify the investment … Working in public service, you oftentimes have to justify your investment - you don't always, but particularly when it comes to green infrastructure it seems to be the case (H9).

Regional-level planners were positive about ES, and used it strategically (as well as instrumentally). For example, participant C3 used an economic argument to convince politicians of the value of natural systems in providing ES:

> It costs a whole lot less to protect our watershed than it does to build and maintain a very expensive water treatment plant that may or may not remove all the contaminants that we're worried about. In terms of ecosystem services, we've framed that for Council, who is very much driven by economics, as an economic service.

Many of the participants referred to the essential need to obtain buy-in for environmental policies in plans. The economic argument provided by ES could help achieve political buy-in; for example, participant V6 used it to obtain broad political support:

> …having that deep ecological economic approach is really important in trying to get decision makers (who tend to be very much based in a traditional economic lens) to understand that there's a good dollars-and-cents reason why integrating ecosystem services into the work that we do around city planning is important. They may not really care. I certainly deal with the whole gambit of ideologies when it comes to elected decision-makers. Some of them may get it, some of them don't, and even if they don't, they're still willing to go outside the box in regards to looking at those things because of the economic arguments that are being made.

Because ES use the "service" language employed by municipal staff, bureaucrats, and politicians, the importance of nature can be brought into the city's financial decision-making:

> …in bridging to the service-based language that cities use…in terms of allocating our operational budgets, and being very clear that there are tangible important services that are essential to municipalities that nature provides, I think is an important evolution of this work, so that it is funded and valued in cities. (C1)

Political buy-in is important; however, also having other planners and developers on-side can assist with plan approval. Terms associated with ES, such as natural assets, value, co-benefits, and natural capital, were used informally as powerful rhetoric, for example, to promote the benefits of urban greenspace and GI. Significantly, planners used ES rhetorically as a bridge (boundary object) to connect and mediate among individuals and groups in different disciplines. For example, V4 stated: "I really believe in this work because you need an extension agent or you need common language that bridges the ecology to the engineering, finance, and planning and I think ecosystem services does that". Participants used the bridging ability of ES to connect with engineers, for whom the ability to quantify ES was compelling because they work from a basis of risk reduction, quantification, and standardization.

In bridging, ES can also bring attention to the "co-benefits" (V3) from multiple ES produced by ecosystems, thus helping different interest groups to see their value. ES may also be an entry point for connecting with other city organizations. For example, Calgary regional planners were using ES to help the Calgary Board of Education, a large landowner, with "better tools to…build park spaces that can provide multiple space benefits as well" (C1), with the goal of informing the Board's planning decisions to include ES considerations in future.

2.5.3 Instrumental use

Participants spoke about multiple, recent initiatives to apply ES instrumentally. ES assessment tools were used to augment the methods that urban planners already use to protect ecosystems. An ES lens was being incorporated in environmental planning, for example, in land suitability analyses, restriction of development in riparian areas, and protection or restoration of wetlands. The technical aspects of mapping, assessing, and quantifying ES, which may be viewed as difficult or onerous for planners with an already heavy burden of responsibilities, were often contracted out to consultants. Participants reported that there was little use of ES assessment at local planning levels.

Additionally, ES considerations were being incorporated by those working at the regional level into policy in a variety of ways: for example, in policies to protect greenway networks, in high-level climate resilience plans regarding natural infrastructure, in "setting ecosystem protection targets" (V8) and in "incentivizing development to incorporate biomass" (V5). Participant V3 stated that ES was advantageous in plans

because it served as a link between various concepts and priorities (such as climate-change adaptation and increasing biodiversity), thus facilitating horizontal policy coherence across the region and between regional and local-level plans. However, despite the integration of ES language into regional policy, participants did not recount significant impacts at the local level.

Although instrumental use of ES through assessment or valuation was important to participants, it appeared to be less important than the overall goal of elevating nature's services in the minds of citizens and decision-makers, leading to the eventual integration of environmental considerations in urban plans.

2.5.4 Non-use and critical views on use of ES

Those participants who were not explicitly using ES concepts, rhetoric, or tools still saw their potential. For example, H10 was keen to learn more about how to apply ES because they saw it as akin to the ways that planning is done, but with the inclusion of ecological fundamentals:

> [ES] is really about understanding how things are connected, and how things flow…[Planners] study how people move, and how traffic flows, and how cars move, and…how wastewater moves and how water moves, but we're not really dealing with the foundation of what's there, and what we need to protect in order to support the environment…

Some planners (notably in Halifax) who were not using ES did not appear to appreciate or need its strategic possibilities. For example, H4 felt that "although [ES] is seemingly very, very interesting, that's not something that's been front and centre we have been asked to justify: why it is that we're pursuing increased areas of open space, or what the importance of that is to citizens". H7, when considering instrumental ES use, was cautious:

> So it's the ability to correctly use information and have that inform your decision, as opposed to being broadly aware of a definition and a concept or but you've never actually seen it applied … sometimes a little bit of information can be more dangerous than none.

Participants with the least ES knowledge were most likely to perceive barriers to its use. Although most of the individuals with substantial ES knowledge had a positive take on ES, there were differing views in this group. Participant H9 was less enthusiastic than others about the instrumental and strategic uses of ES because of what they saw as its low salience for citizens and the challenges of valuation:

> But oftentimes, those ES don't have a real tangible value—they're sort of like soft values … Stormwater mitigation … well what does that mean to the average taxpayer? Ultimately, it does mean something … lower taxes. But as much as you can place a dollar value on that it's still very hard to convince the average citizen in a municipality that this investment is worth

> it, and from my experience it's very tricky—it's very difficult to do, and I think it's very rarely done well.

Participant C5 felt that ES was ill-defined and over-used conceptually, but they were positive about natural asset management:

> And if you just talk about this nebulous ecosystem services thing—somehow it's just too difficult to deal with. And so I think it seems to kind of have gotten overshadowed by the MNAI and this bringing the economics into it has been a very good thing, and the idea of getting it named as an asset and put on the books as an asset …

Consultants had a comprehensive understanding of instrumental ES use but were more critical (including concerns about instrumental use such as the misuse of valuation) and were the least likely to use it as a boundary object. These findings were predictable: consultants had little need to use the strategic qualities of ES, and the most experience with applying ES science. In addition, they were less involved in the politics of municipal planning processes.

Some participants pointed out that there may be resistance by planners not part of the study or by the public to the mainstreaming of ES in urban planning. Some disagreed with its anthropocentric focus, some were not comfortable with monetary valuation, and some felt that "reciprocity"—the idea that humans had a role in both contributing to and

benefiting from ecosystems—needed to be included in the ES concept. However, individuals often set aside their misgivings:

> That's what our project in our group is trying to do, is to build that better understanding and if it means we have to talk about it in dollar values to people who understand dollars, then we'll do that. It's not my first preference, but if that's what speaks to them then we'll speak that language. (C2)

2.5.5 Simultaneous use

We observed the simultaneous application of conceptual, strategic, and instrumental uses of ES: for example, quantifying ES in an assessment exercise simultaneously created overall awareness of nature's role (conceptual use), provided ES data to support the creation of policy (instrumental use), and was used to justify a policy to politicians (strategic use). For example, C2 discussed the multiple ways that ES was used in Calgary, including creating a "dashboard of all of our natural assets" to "provide the evidence basis" to protect them, and writing natural infrastructure into plans "to build that understanding of the services provided by natural assets…into city planning and city processes":

> The hope is that by completing this asset evaluation, that we'll be able to have a better understanding of what's there, an understanding of what is provided, and move forward with that: building those pieces into planning

> policy, so it gives a different way of looking at applications, a different way of looking at land. (C2)

Individuals were clearly using ES as an organizing concept to construct a coherent argument to elucidate the role of nature for human benefit, justify the inclusion of nature's services in urban decision-making, and build the case for the environment:

> I've talked to other environmental staff at municipalities, and they do think of themselves as salespeople. You're building the case, you're building the case, continually building the case. [Ecosystem services is] one tool to help build that case and it's this really strong tool to help build that case. (V8)

V8 further expanded on their point, declaring that ES "is a valuable tool to sell the concept of protecting [sensitive} areas", and that "quantification helps to build the case for protection".

2.6 Discussion

The environmental impacts of urban processes and urban growth are significant, complex, and increasing (Bai, 2018). Most planners felt the need to increase general awareness of the role of nature for human well-being among the urban public, politicians, and other stakeholders, and also felt compelled to create convincing arguments for the

role of nature in urban ecosystems that can compete with other urban issues, such as economic growth and social problems, in the minds of decision-makers.

2.6.1 Conceptual use

In these early stages of the uptake of ES in Canada, conceptual uses of ES nurtured awareness of nature and played a pedagogical role for planners in interpreting difficult ecological concepts for stakeholders. Although it was more common for those with limited ES knowledge to use ES in a conceptual way, this use should not be diminished in importance or undervalued as rudimentary. In a study of awareness and perception of ES among Swedish municipal stakeholders, Beery et al. (2016) note that conceptual use of ES may play an important role in the eventful mainstreaming of ES in the municipal context, because conceptual use "lays the foundation for strategic and instrumental knowledge use" (p. 128). Waylen & Young (2014), who studied a nationwide ES assessment in the UK, noted substantial conceptual and strategic uses of ES in early stages of the process that bolstered communication and dialogue about ES. Additionally, case studies of spatial planning practice in three global locations found that instrumental ES use appeared later in the uptake of ES, building on the "understanding and compromise" established during conceptual and strategic uses (McKenzie et al., 2014, p. 320).

It is during conceptual use that ES acts to change "paradigms of thoughts and values" (Beery et al., 2016, p. 129). Participants appeared to leverage the conceptual power of ES: from the observations in our study, for example, ES was used to inform the public about the importance of ecosystems but this informational role connected directly with

the intent to persuade the public and politicians to change their perspectives on nature. The normative message embedded in ES—that action ought to be taken to recognize and protect nature's services that support human well-being—was generally recognised and appreciated as important for planning.

Currently, there is additional conceptual utility in ES because of its general novelty outside of ES science, and thus the concept's ability to create sudden shifts in perception about nature's role for humans: "aha" learning moments. This kind of novelty-driven conceptual use should have less effect if ES is adopted more widely.

2.6.2 Strategic use

As other research revealed (Grunewald et al., 2021; Saarikoski et al., 2018), the study found that ES is compelling for planners working on environmentally-related tasks (for example, climate change, sustainability, parks planning, and stormwater planning), because it can provide robust justification for existing pro-environmental policies or actions and new initiatives. ES can be used to argue for the utilization of GI, often perceived as risky because of the difficulty in quantifying its efficacy. It can also elicit essential buy-in for environmental policies from other planners, engineers, and, importantly, politicians. Strategic use of ES, in part, leverages the high status accorded to scientific knowledge (Waylen &Young, 2014).

The flexibility of ES enabled the participants to bridge with politicians (for policy buy-in), bureaucrats (in linking to the fiscal imperatives of municipal operations), citizens (by

connecting with shared values), and engineers (because ES tools offer the possibility of quantifying the benefits of nature to well-being). These findings are mirrored in previous studies. ES has been found to be a useful boundary object to bridge different perspectives and enable communication because the idea of nature's benefits resonates with most people (Ainscough et al., 2019; Escobedo et al., 2019; Longato et al., 2021; Spyra et al., 2019).

As some participants mentioned, ES located in different plans can be linked to create a coherent, connected urban environmental policy framework with greater credibility. ES as a bridging concept is a natural fit for planners who themselves perform bridging roles: communicating, information-seeking, mediating, and collaborating across disciplinary boundaries. Spyra et al. (2019) suggested further exploiting the bridging qualities of ES in participatory planning processes that include local and indigenous knowledge. These recommendations seem especially promising for more inclusive and place-based urban planning.

Planners who were contracting out instrumental uses of ES such as ES assessments and valuations still used ES rhetoric to obtain political or public buy-in. The observed investment in the conceptual and strategic uses of ES agrees with Ainscough et al.'s (2019) findings and supports Cowell & Lennon's (2014) criticism of erroneous and pervasive ideas about linear-rational ES uptake.

2.6.3 Instrumental Use

Instrumental use of ES appeared to be developing by way of individuals who were testing and importing elements of ES science into established planning processes, rather than replacing established approaches with new ES approaches. This uptake is suggested in the Canadian ES Toolkit (VNCST, 2017), although it is not clear whether this guidance had an influence on the participants' decisions. The argument for this approach to uptake is that ES assessments are well-positioned to be inserted into planning processes at suitable entry points because ES assessments parallel the fundamentals of the "rational planning process" applied in Canada (VNCST, 2017). Suggestions for this manner of introducing ES science into planning have also been presented in the literature; for example, Albert et al.'s (2016) "ES-in-planning" framework, applied in German landscape planning.

In addition, although some participants had hoped to leverage ES across all urban decision-making, their ultimate aim did not appear to be having ES as a core part of planning methods. Participants used ES to achieve the greater goal of having citizens, politicians, and other urban stakeholders recognize the importance of the environment—natural ecosystems, natural processes and structures, biodiversity, and engineered GI—to cities, and include the environment as a higher-priority consideration in urban decision-making, including urban planning.

The opposition to the use of ES voiced by participants may be because they were introduced to tools and methods of ES instrumentation before they had a thorough

introduction to ES and a clear understanding of the concept. Without foundational knowledge of ES and its implications, complexity, and nuances, potential users who are introduced to ES via specific methods of implementation may misunderstand its flexible character, and perhaps perceive that certain aspects are being imposed.

The study found that resource-intensive assessment and valuation of ES at the municipal level is usually contracted out to consultants. Instrumental use appeared to be less available to some people working at the local and regional level in municipal planning because it was perceived to be more involved, more knowledge-intensive, and to require a higher level of technical understanding (McKenzie et al., 2014).

Ainscough et al. (2019) found that the instrumental use of ES tends to decrease its ability to act as a boundary object, as the concept becomes narrower and less adaptable to different perspectives. We found that the focused instrumental use of ES in certain circumstances did not appear to diminish its usefulness as a boundary object, nor its conceptual and strategic uses overall by planners. On the contrary, the instrumental use of ES and its role as a boundary object seemed to be both valuable and compatible, as exemplified in our finding that planners were using ES in multiple ways to argue for the environment. However, should one kind of instrumental use become prevalent and widespread, this may have an influence on its strategic usefulness, especially if there are ethical issues for users with an approach, for example monetary valuation, which seems to trigger the most disapproval. If ES can be instrumented for specific purposes, alongside a continuing, active, critical discourse about ES and a willingness to entertain

broader theories in the wider ES community (Ainscough et al., 2019; Hermelingmeier and Nicholas, 2017), then ES may be able to retain its multi-faceted nature in building the case for the environment.

Natural asset management was promoted by the MNAI for routine asset management in municipalities. Although not all municipalities were working with the MNAI, most participants had heard of natural asset management, and looked favourably on its use, likely because it could support planners in making a direct connection with municipal bureaucrats (e.g., those in finance departments) to convey the importance of accounting for ES in urban decision-making.

Although the perception of the participants toward ES was generally positive, there was enough criticism among participants that other planners and other players in municipal planning may be resistant to the use of ES in planning. Specifically, and as other research has found (Hysing, 2021), opinions about ES monetary valuation were divided. Since most monetary valuation work is new, and is mostly contracted to consultants, it was difficult to draw conclusions about this specific use. It is also possible that attempts to use ES instrumentally in planning may never be successful, just as multiple attempts to include environmental sustainability in municipal planning have fallen short (Grant et al., 2018a).

2.6.4 Synthesis: building the case

In synthesizing an overall picture of ES use, we hypothesize that participants were using ES in multiple and intersecting ways to build the case that nature in the city is important

and should be included in urban decision-making (Figure 2.1). This intersection of uses is an outcome of the conceptual malleability of ES, the comprehensiveness of the ES concept, and its bridging qualities (Ainscough et al., 2019).

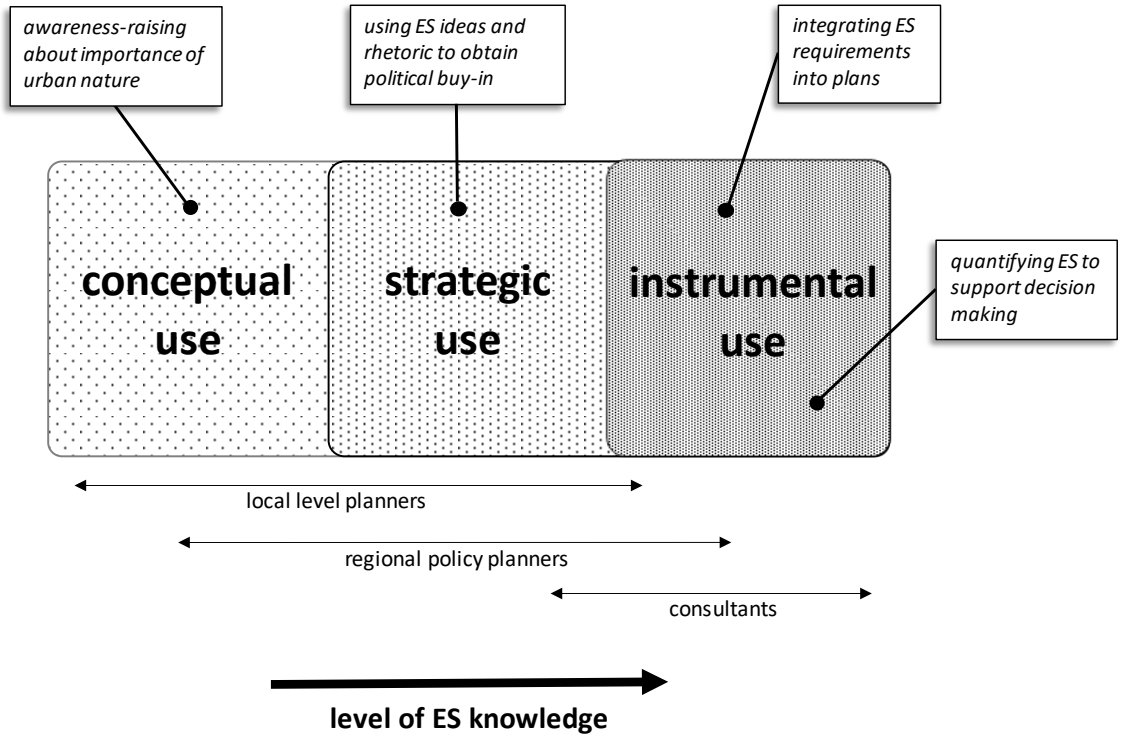

Figure 2.1 Building the case: the intersecting ways that ES was used to elevate the status of environmental considerations in urban planning and policy.

As knowledge of ES increased, so did the dimensions of ES use. For example, instrumental use encompassed conceptual and strategic uses. Even without instrumental use, however, conceptual and strategic uses of ES knowledge were valid and helpful (Weiss, 1979) and readily available to most planners, including those working at the local and regional levels who are not specialists in valuation or assessment of ES. The findings

suggest that even when ES is not used instrumentally to a great extent, it may be influential in planning and have a positive effect on urban environmental policy.

The sense of urgency among some participants to respond to the challenges of impacts produced by climate change and urbanization was notable. Those who were conversant with ES and actively applying it displayed an optimistic, politically astute—that is, pragmatic—approach of drawing on any available concepts, tools, and persuasive tactics (Lester, 2019) to argue for the environment in urban areas. Pragmatism can also help to explain why some individuals overlooked personal distaste about some of the premises of ES, or disagreement with some aspects of ES, or their fears that it might be misused. The ideas, rhetoric, and tools of ES provided multiple opportunities for pragmatic planners to inform, influence, and provide evidence for change within the urban planning context.

2.6.5 Limitations and recommendations

The scope of the study was limited. The study captures the perceptions of selected individuals in three Canadian municipalities with a relatively high awareness about ES. The participants do not reflect a cross-section of all urban planners, and it was apparent from the comments of some participants that other planners who were not interviewed might have concerns with ES based in philosophical and ethical differences. The assessments of the utility of ES are judgements by participants, and the policies they linked to ES use have not been independently examined to evaluate whether they are an improvement on previous environmental policies or result in better outcomes.

The findings of the study, as well as its limitations, suggest recommendations for ES researchers to investigate and support the use of ES in planning practice, as well as an extension of the research.

1. The strategic use of ES by the participants in the study, and especially its bridging role, was notable. Our observations suggest further avenues for research to inform planning practice:

    a. Policy and plan coordination is an important aspect of ensuring that urban planning objectives can be achieved (Grant et al., 2018b). Although the bridging qualities of ES have been investigated, studying how municipal environmental policy coordination might be enhanced using ES as an organizing concept is a promising area for research to support planning outcomes.

    b. Spyra et al. (2019) have suggested that the bridging qualities of ES can be valuable during participatory planning processes. Canadian planners have a mandate to carry out more place-based and inclusive planning; understanding how participation in urban environmental planning might be improved by the use of ES should be investigated.

2. A close examination of how practitioners are incorporating ES into current planning approaches would further inform the suggestions from the literature, such as those tested by Albert et al. (2016) in German landscape planning. Significantly, the methods developed for integrating ES into existing planning methods require testing in the

Canadian urban planning context, given that the current research recommendations mostly originate from the European context and may not be suitable for application in the Canadian municipal context.

3. Although it is often recommended, it is worth repeating that collaboration among ES researchers, planning practitioners, and other actors such as engineers, citizens, and local politicians would advance understanding of a role for ES science in planning. One area that is especially important to consider is creating a critical dialogue among ES researchers and planning practitioners about the ES concept that could serve to develop the idea, as well as create a foundational understanding about ES among planners that would inform how they use its tools.

4. Related to this study's limitations, a useful extension of this work would involve examining and comparing the different uses for ES in urban planning contexts and evaluating their effectiveness for improving environmental policy against criteria developed in conjunction with urban practitioners. In addition, the perspectives of planners who are consciously not using the ES concept would be insightful to understand why and what other approaches they find more useful.

2.7 Conclusion

ES use by the participants in the study was ultimately a means to achieve a greater goal of having citizens, politicians, and other urban stakeholders recognize the importance of the natural environment (natural ecosystems, natural processes, biodiversity, natural

structures) and GI to cities. Including the environment as a higher priority in urban decision-making, including urban plans, was another important focus.

The aspects of ES use—conceptual, strategic, and instrumental—were intersecting. They could be and were often applied simultaneously to build the case for recognizing and protecting natural urban ecosystems and implementing GI. The study participants used ES conceptually, for awareness-raising, and instrumentally, to provide direction to plans and to support and supplement existing approaches. Strategically, ES serves to justify decision-making to protect and restore natural ecosystems in urban areas, and to gain political and public buy-in for environmental policies. The choice of ES as a tool or as the basis for plans is a choice that is simultaneously instrumental and conceptual, and effectively strategic. Given the ways that planners negotiate the structures of the municipal organization, planning institutions, and the political context to meet planning goals and establish policies, it is clear that adoption and use of ES is a matter of pragmatism for the planners in this study.

CHAPTER 3: THE ECOSYSTEM SERVICES CONCEPT IN URBAN PLANNING: THE CRITERIA FOR PRACTICAL FIT

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3.1 ABSTRACT

Application of the ecosystem services (ES) concept in urban planning has potential for improving environmental and human health outcomes in cities. We aimed to narrow an identified ES implementation gap by identifying the criteria for the practical fit of the ES concept in urban planning. We found that local relevance and adaptability within current planning approaches were core criteria for practical fit. If not met immediately, these criteria may be met over time through policy entrepreneurship. Further research in different locations and planning systems would increase understanding of the enabling factors for applying ES in urban planning.

3.2 INTRODUCTION

Urban planners are under pressure to respond to the emerging and complex challenges of urbanization processes, environmental degradation, and climate change mitigation and adaptation. As a result, planners are looking for novel policy options and more powerful arguments to justify stronger urban environmental policies.

The application of the ecosystem services (ES) concept at the local level is an emerging area of environmental policy. ES are the benefits that nature provides for human well-being. Globally, ES science has been highly effective when applied at a conceptual level, as a strategy to communicate the value of nature, and in broadening ecological research to its human dimensions (Lele et al., 2013).

Urban ES are 'directly provided by ecological structures within urban areas or peri-urban regions' (Luederitz et al., 2015, p. 99). These ecological structures are associated with public and private green spaces, individual parks, park networks, urban forests, and vacant land. Natural and managed hydrological features such as wetlands, rivers, streams, drainage channels, and lakes, as well as engineered structures such as swales and stormwater retention areas also provide ES (Grunewald & Bastian, 2017). Important ES supplied to urban residents from these features include stormwater mitigation by wetlands, local climate regulation by the urban forest, and mental and physical health benefits from urban parks (McPhearson et al., 2015). In addition, ES sources and sinks outside the urban area are critical to urban functioning (Jansson, 2013). For example, there is extensive 'transboundary environmental trade', consisting of the export of urban waste in various forms and the import of food and water (Douglas, 2012, p. 386).

Some urban planners are interested in applying ES-based approaches as routes to urban sustainability, for example, in addressing climate change adaptation, or for assessing trade-offs between land uses and ecosystem functions (Tang Kai et al., 2022). A few planners have begun to adopt aspects of the ES concept, for example, in communicating,

assessing, and valuing the contributions of aspects of urban nature to urban residents (Grunewald et al., 2021). Likewise, sustainability researchers identify urban planning as having significant potential for applying ES science and contributing to urban sustainability (Cortinovis & Geneletti, 2018a).

Despite its international and national currency, and overall optimism about its potential, the ES concept has proved difficult to translate into local-level policy and practice. Consequently, planners who seek to adopt ES-based approaches in practice and in policy recommendations find little practical guidance from within planning contexts.

Research reveals a broad set of factors implicated in impeding local-level adoption of the ES concept, including the knowledge and values of municipal staff, and the fiscal and technical capacity of municipal governments (BenDor et al., 2017; Boulton et al., 2018). Political context, leadership, and organizational culture also appear to be important for implementation of the ES concept (Rall et al., 2015; Boulton et al., 2018). There is also evidence that the framing of the concept may influence its uptake (Opdam et al., 2015).

Once a new concept like ES is introduced into the policy-making realm, its adoption is dependent on passing practicality or 'fitness' tests (Meadowcroft & Fiorino, 2017). The most basic tests for policy concept fitness are alignment with the values and identities of the users (normative fit) and the ability to be applied in practice (practical fit) (Stevenson et al., 2021). Widespread interest in the ES concept for planning (Ronchi, 2021), and extensive acceptance of the ES concept by researchers and organizations (Stevenson et

al., 2021) indicate that the ES concept passes the normative fitness test. Identifying the criteria for its practical fit will be central to increasing its adoption.

The purpose of our research was to contribute to narrowing the ES implementation gap by identifying the criteria for the practical fit of the ES concept in urban planning. We conducted our inquiry into ES use by interviewing urban planning practitioners in three Canadian cities. We analyzed planners' perceptions of challenges with ES adoption, and their insights about the opportunities for more use of the concept. We then identified the criteria for the practical fit of the ES concept. Planners and researchers can use the criteria to increase the application of the ES concept in urban planning.

The research will be of interest to both urban planning practitioners and ES researchers in identifying routes to more substantive adoption of ES thinking in local municipal contexts. The study focused on the ES managed by cities within their boundaries. Although there are also ES in rural areas that serve cities, they fall beyond the scope of this study. Our proposed model of the practical fit of the ES concept may potentially be useful in other areas of policy adoption.

3.3 Background

3.3.1 ES

The term ES conveys the notion that nature provides beneficial services to humans (Danley & Widmark, 2016). The ES concept has been embraced in some areas of environmental science and management as novel and game-changing, but ideas

analogous to ES have been embedded in other disciplines, including planning, for decades (Thompson et al., 2020).

The hope of those who developed the ES concept was that increasing people's understanding of nature's supporting role in human well-being would translate into improved attitudes toward nature, eventually leading to better public policies and thus positive outcomes in environmental decision-making (Opdam et al., 2015). While the ES concept is often cited by government and organizations at the international and national levels, and ES research has burgeoned, the ES concept has yet to be implemented significantly at the local level (Stevenson et al., 2021).

Identifying the 'real world factors of implementation' (Rall et al., 2015, p. 231) appears to be the central problem to resolve in relation to the integration of ES thinking in urban decision-making. There is research exploring the ES implementation gap (for example, Kerr et al., 2021). Some researchers have commented that ES research outputs do not provide useful guidance for operationalizing the ES concept (Olander et al., 2017; Ronchi, 2021; Edler et al., 2022). In addition, multiple barriers impeding local-level ES adoption have been identified, including limited capacity among those tasked with implementation (Kaczorowska et al., 2016), the need for policies requiring ES thinking to be fully integrated across government departments and with other levels of governance (Schleyer et al., 2015), the requirement for stakeholders to be involved in identifying and assessing relevant ES (Schleyer et al., 2015), and a lack of agreed-upon approaches to assess and value ES at the local level (Blicharska & Hilding-Rydevik, 2018). In addition,

researchers have noted the lack of agreement on a definition for ES, leading to conceptual incoherence and possibly contributing to slow progress in the adoption of ES thinking (Danley and Widmark, 2016). Finally, although ES valuation activities are an important application of the ES concept in decision contexts involving cost-benefit analysis (albeit requiring improvement) (Jacobs et al., 2016), ES valuation often elicits strong negative reactions, such as claims regarding the commodification of nature (Schröter et al., 2014).

3.3.2 ES for urban planning

Human land use has a significant impact on the quantity and quality of urban ecosystems, and thus on urban ES and their flows. Urban planning initiatives can increase the potential for urban land to supply ES; for example, via natural and constructed wetlands for regulating stormwater flows, and in public open space for supporting food production. Therefore, urban planning has been identified as an important route for operationalizing the ES concept. In addition, planners, based on their training and roles in a dynamic urban system, are well-positioned to develop, test, and apply ES ideas.

Besides the benefits that accrue to humans from ES supplies, it has been suggested that ES thinking has additional value during planning processes. The ES concept helps the public and politicians understand the value of conservation, and ES rhetoric can justify investments in green infrastructure (GI) (Thompson et al., 2024). ES ideas may draw together diverse perspectives to increase collaboration on sustainability (Ainscough et al. 2019; Spyra et al. 2019), be used to facilitate communication and networking among planning professionals (Hysing, 2021), and for integrating environmental policies across institutional silos (Rall et al., 2015). ES assessments also provide crucial information

about the trade-offs between urban development and land conservation (Tang Kai et al., 2022). The use of ES thinking by planners is also consistent with current planning ideas concerning the central importance of environmental sustainability (Tang Kai et al., 2022). Historically, urban planning included consideration of urban nature for its protection or conservation, but mainly to provide space for human restoration, recreation, social interaction, and exercise (for example, in urban parks) (Lapintie & di Marino, 2020). Measurements of ecosystem quality and health, such as those carried out in ES assessments, have not typically been used to inform planning processes; instead, the environmental data that inform plans usually include only a 'basic assessment of quality', such as area of open space or wetlands, or length of trails (BenDor et al., 2017, p. 261). These simplified ways of including urban nature in planning do not allow for consideration of how ecosystems may deliver services to humans (BenDor et al., 2017; Tang Kai et al., 2022).

Although most planning approaches do not provide detailed insight on ecosystem quality or health, nor on human beneficiaries, some traditional environmental planning approaches such as suitability and sensitivity analyses are based in ideas analogous to ES (Thompson et al., 2019), and ES has been identified as an implicit concept in urban plans (e.g., Cortinovis & Geneletti, 2018a; Thompson et al., 2019). However, ES is far from being mainstreamed in urban planning.

The development of novel ideas and tools tied to the ES concept has been growing in urban planning practice and scholarship in recent years. Aspects of ES are being taken up

explicitly but gradually by urban planners interested in improving environmental decision-making in cities (Lam & Conway, 2018; Grunewald et al., 2021; Ronchi, 2021). Planning practitioners are increasingly turning to unconventional means of service provision in cities, such as GI, in pursuit of creating livable and sustainable places, especially in the face of climate challenges (Tang Kai et al., 2022). Another notable new development is nature-based solution (NbS) approaches that employ ecological components producing ES flows to respond to challenges such as flooding or increased heat in cities (Remme et al., 2024). These related approaches have created many opportunities for sustainable planning practices, but at the same time, their similarities and overlaps have produced some uncertainty around their use for urban planning (Hansen et al., 2021).

Multiple studies have been directed toward understanding how the ES concept is applied in real-world decision-making processes, and what this means for successful application in the future (e.g., McKenzie et al., 2014; Rall et al., 2015; Ruckelshaus et al., 2015; Thompson et al., 2024). In planning contexts, ES uptake has been studied using a framework that organizes the many ways that ES is employed into conceptual, strategic, and instrumental modes of use (McKenzie et al., 2014; Thompson et al., 2024). Conceptual ES use (for example, for awareness-raising about the important role of nature in human well-being) prevails during early adoption in planning as knowledge of ES concepts and tools expands (McKenzie et al., 2014; Thompson et al., 2024). Strategic use (where planners may employ ES rhetoric to obtain public and political buy-in, for example) is used concurrently with instrumental use (in which ES information is

introduced into planning policy to increase the quality of environmental considerations, or ES-based tools inform planning decisions) in later stages of ES uptake (Thompson et al., 2024). Ruckelshaus et al. (2015) suggest that successful application of the ES concept would include knowledge production and dissemination about the importance of ES for humans and the environment, increased understanding about ES, incorporation of ES considerations into policy, and ultimately, improvements in biodiversity, ES supply, and human well-being.

3.3.3 The practical fit of new ideas in public policy

New ideas enter the planning profession through various social learning processes, that is, by planners engaging with colleagues, those in other disciplines, and the public in 'developing knowledge (including skills and experiences) through human interaction' (von Schönfeld et al., 2020, p. 411). Urban planning practitioners also rely on practice-based case studies and experts (Henderson, 2016; Thomas & Bertolini, 2020), and best practices developed in other geographic and policy contexts (Patel et al., 2015). Experimentation has been used in planning (often in covert ways) for the adoption of new ideas and practices (Scholl & Kraker, 2021). In addition, the movement of planning professionals across disciplines, between different localities, and among public and private sector organizations contributes to the acquisition and development (and the loss) of planning knowledge and its application within planning offices (Muldoon-Smith & McGuinness, 2020).

Depending on their personality, location, position, and seniority, planners have varying degrees of agency, willingness, and ability to innovate, influence other actors, and recommend new policies. In addition, they are constrained by numerous informal and formal institutional structures, including municipal departments, working groups of planners, communities of practice, professional planning institutions and their ethical and professional guidance, consulting planning groups, land-use legislation and regulatory tools, the norms and practices of each municipality and planning department, the norms of the local community, and larger social norms and practices (Healey, 2018). These multiple institutional layers produce and maintain 'rigidity traps' (Angeles et al., 2021) that limit planners' ability to anticipate change and innovate.

Extensive and rapid environmental change around the globe is prompting the generation of novel approaches to address complex, emerging problems. The public policy realm is increasingly subject to the influx of new ideas (Craig et al., 2019; Stevenson et al., 2021; Nylén & Jokinen, 2023). As an idea is introduced into public policy discussions, immediate or eventual adoption cannot be assumed. A new idea must compete with other ideas and prove its fitness before it can be adopted for policy (Meadowcroft & Fiorino, 2017).

Numerous criteria are involved in the fitness test for ideas. Kingdon (2003) proposed technical and fiscal feasibility, along with political and public acceptability as the 'criteria for survival' (p. 131) of an idea in the public policy realm. Relatedly, Stevenson et al. (2021) proposed that ideas must possess both 'normative fit' (alignment with an

actor's or a group's identity and values) and 'practical fit' (ability to be applied in practice) to be taken up by policy actors. In other words, the extent to which a new idea is adopted is related to the idea, the adopter (or group of adopters), and their contexts (Wejnert, 2002). Kingdon also suggested a key role for 'policy entrepreneurs', actors who use various tactics, such as attention-shaping, demonstrating, and rhetoric, to advocate for new ideas and policy change during the public policy process (Kingdon, 2003; Mintrom & Norman, 2009).

3.3.4 Fitness of ES for use in sustainability

To advance understanding of the reasons for the weak operationalization of ES, Stevenson et al. (2021) claimed that, although ES has normative fit in global governance, its practical fit is poor. Similarly, Allan et al. (2022) argued that the success of ES as a 'frame but not a programme of action' is because of the difficulty of translating the idea of ES into practice, which would involve 'the complex steps of *recognizing* the myriad ways in which nature supports human wellbeing and economic development, *measuring* the value of these functions, and *integrating* these values into decision making processes and on-the-ground practices' (p. 71). Therefore, attention on the practical fit of the ES concept offers a way to understand how to make progress in its adoption.

Relatedly, sustainability researchers have explored factors enabling knowledge transfer from research to practice to inform decisions on environmental sustainability. The work of boundary organizations, 'designed to facilitate collaboration and information-flow between the research and public policy communities' (Parker & Crona, 2012, p. 263), figures prominently in such work. Case study research, including investigations of ES

application, supports Cash et al.'s (2003) hypothesis that boundary work facilitates the knowledge transfer process when it meets three criteria: stakeholders must perceive the knowledge to be salient (relevant to the user), credible (deemed adequate as technical evidence or argument) and legitimate (seen as unbiased and fair, and respecting stakeholder values and beliefs) (Clark et al., 2016; Adem Esmail et al., 2017; Adem Esmail & Geneletti, 2017). Van Oudenhoven et al. (2018) synthesized a checklist of indicators for quality and quantity of ES from the scientific literature based around the same three categories. Following Schröter et al.'s (2015) example, they urged the addition of a feasibility criterion (related to data, time, resource availability, and adaptability) to further ensure indicator uptake. Posner et al. (2016) concluded that legitimacy of ES knowledge, scientist and decision-maker interaction, institutional capacity, and local knowledge appear to be important in predicting the policy impact of ES.

3.3.5 The uptake of ES in urban planning

Research on progress in the application of the ES concept in urban planning has centred in cities in the European Union (EU). Analysis of urban plan content has revealed a focus on a few ES, for example, regulating services such as stormwater runoff, and cultural services such as recreation (Cortinovis & Geneletti, 2018a; Sang et al., 2021). Urban plan content analysis in the EU and the US (Hansen et al., 2015) and interviews with stakeholders in Finland (Rinne & Primmer, 2016) showed there was little explicit use of ES concepts. An extensive review of Swedish municipal plans and interviews with Swedish practitioners revealed that although attention to ES has increased in

comprehensive plans, there is still an implementation gap at the local level (Khoshkar et al., 2020b).

Mirroring the situation in the EU, an ES implementation gap has been observed in Canada (Kerr et al., 2021). For example, Lam & Conway's (2018) review of planning documents in Ontario showed that explicit reference to ES was rare; among those plans that incorporated ES concepts, cultural and supporting ES were most identified. Thompson et al. (2019) found more implicit than explicit attention to ES in Canadian municipal plans, and the ES most identified were stormwater regulation, food and drinking water provision, aesthetics, and recreation.

Increasingly severe climate change impacts are forcing Canadian cities to adapt swiftly, and to apply innovative solutions to increasingly complex problems (Baynham & Stevens, 2014; Hill, 2016). ES has caught the attention of Canadian urban planners because it offers solutions to emerging problems. Yet many planners have little detailed knowledge about ES and its potential (Tang Kai et al., 2022). As most of the research on the adoption of ES in planning has occurred in the EU, studying Canadian experiences can provide support for Canadian planners faced with rapidly emerging issues. In addition, an understanding of ES use in the North American context expands the general understanding of ES use and may provide lessons for ES researchers aiming to encourage the use of ES locally.

In summary, the ES concept has received ample attention at the global level, and ES research has proliferated. Urban planners are interested in applying ES, and ES holds promise for planners to create more-sustainable places. Although the adoption of ES has

been explored in various locations, and impediments to its uptake have been delineated, it is still not adequately understood why ES is not well incorporated into urban planning. Understanding the experiences and perspectives of planners who are engaged with adopting the ES concept is vital to identify the criteria for the practical fit of ES, and ultimately for improving outcomes for such current challenges as climate change adaptation and environmental sustainability. The purpose of the research was to identify the criteria for the practical fit of the ES concept in urban planning to contribute to narrowing the ES implementation gap.

Some points of clarification around the ES concept and its application are warranted here. We are aware there are many ways to think about 'application' of the ES concept, but we chose a broad view encompassing conceptual, strategic, and instrumental modes as described earlier (McKenzie et al., 2014; Thompson et al., 2024). Each mode influences decision-making during planning processes, and has a significant but different purpose for the various actors in a planning process. We also recognize that the ES concept is closely tied to many other concepts and tools, such as GI, natural capital, and NbS, and often the terms are confused or used interchangeably (Kerr et al., 2021). Given the early-stage uptake of the ES concept and approaches in Canadian urban planning, we expected to encounter the use of such related concepts alongside ES terminology, and evidence of the uptake of the ES idea because of these related concepts. Therefore, our understanding of narrowing the implementation gap for ES implied that associated approaches and their terminology were employed, and we included those concepts as ES in our analysis.

3.4 MATERIALS AND METHODS

A qualitative approach via interviews in three locations was selected for this exploratory study because the various and complex contexts of planning are key to understanding planners' work (Yin, 2009; Flyvbjerg 2010). Selection of the three cities (Table 3.1) was guided by a previous research project that investigated the use of ES concepts in municipal plans (Thompson et al., 2019). A content analysis of the official plans of 19 Canadian cities revealed more use of ES ideas—explicitly and implicitly—in the selected cities than other municipalities (Thompson et al., 2019). An additional screening via phone interviews with planners in several Canadian cities located cities where there was interest in ES and related concepts such as GI and natural capital.

Table 3.1 Cities selected for the study

City	2021 Population (Statistics Canada, 2023)	Municipal Structure
Halifax, Nova Scotia	439,819	Regional Municipality
Calgary, Alberta	1,306,784	Regional Municipality
Metro Vancouver, British Columbia	2,642,825	Federation of 23 local authorities: 21 municipalities, one electoral area, and one treaty First Nation

Halifax Regional Municipality (Halifax) was identified for the study because Halifax's Regional Municipal Planning Strategy contained multiple references to the values and services of nature (Thompson et al., 2019); Halifax was selected as the pilot location (to test and refine the research design and the procedures for participant selection and data

collection [Yin, 2009]) for reasons of convenience and access. Calgary was identified for the study because Calgary's Municipal Development Plan made frequent reference to ES-related ideas, including LID techniques and GI (Thompson et al., 2019). Finally, Metro Vancouver (Vancouver) was identified because the region and some of its municipalities were early innovators and adopters of natural asset approaches.

Purposive sampling (Creswell, 2014) was used to locate key participants with awareness of the ES concept and associated approaches, or experience with ES tools, methods, and implementation. Further participants were located by referral (snowball sampling) from key participants. All participants were involved with urban planning processes or decision-making. Most participants were working for a municipal department directly involved with planning and were supportive of the introduction of ES thinking. Several were consultants to such departments and were more critical.

Interview and focus-group questions explored the understanding and adoption of the ES concept by the participants in their work. Participants were not queried about the specific ES they sought to advance in their work. The interviewer (first author) had worked and taught in planning and established a rapport with participants that elicited robust and insightful responses. Participants were encouraged to explore avenues of conversation beyond the planned line of questioning.

A total of 31 people from various urban planning functions participated (Table 3.2). Individual semi-structured interviews of approximately one hour were conducted with 24 participants. Due to COVID-19 pandemic travel restrictions, interviews were conducted online. An additional seven people participated in two focus-group sessions (one online)

of approximately one-and-a-half hours. The interviews and focus groups were audio recorded and transcribed. Each participant was assigned an alpha-numeric code; for example, 'H1' indicates a Halifax participant.

Table 3.2 Roles of participants in their municipalities

Halifax	
	interviews: parks policy and planning manager regional planning policy program manager energy and environment program manager urban forester planning applications manager city councillor **focus group**: regional planning manager; principal planner, environmental planner
Calgary	
	interviews: planning policy coordinator climate adaptation planner resilience & infrastructure planner drainage technical lead watershed planner ENGO (stormwater) director consulting planner
Vancouver	
	interviews: senior environmental planner sustainability specialist (planning) parks planner consulting planner biodiversity conservation planner drainage and utilities manager climate adaptation coordinator financial director; MNAI Board Member **focus group**: principal planner (2), agricultural planner, environmental planner

Qualitative analysis applied both inductive and deductive techniques (Bingham & Witkowsky, 2022) (Figure 3.1) with the assistance of NVivo 13 software (Lumivero, 2020). Transcriptions and research memos (Silverman & Patterson, 2015) were inductively analyzed through open coding (Silverman & Patterson, 2015) and focussed coding to generate themes and subthemes related to the lessons from the participants' experiences. The body of data was also deductively analyzed, using the themes from the interview questions to understand level of adoption, sources of ES knowledge, and where ES thinking was applied. Although the interview and focus group questions were not oriented toward the idea of understanding practical fit, we applied it as a lens during the data analysis process and in structuring our results. We synthesized our findings into a model for understanding the criteria for practical fit of ES in urban planning.

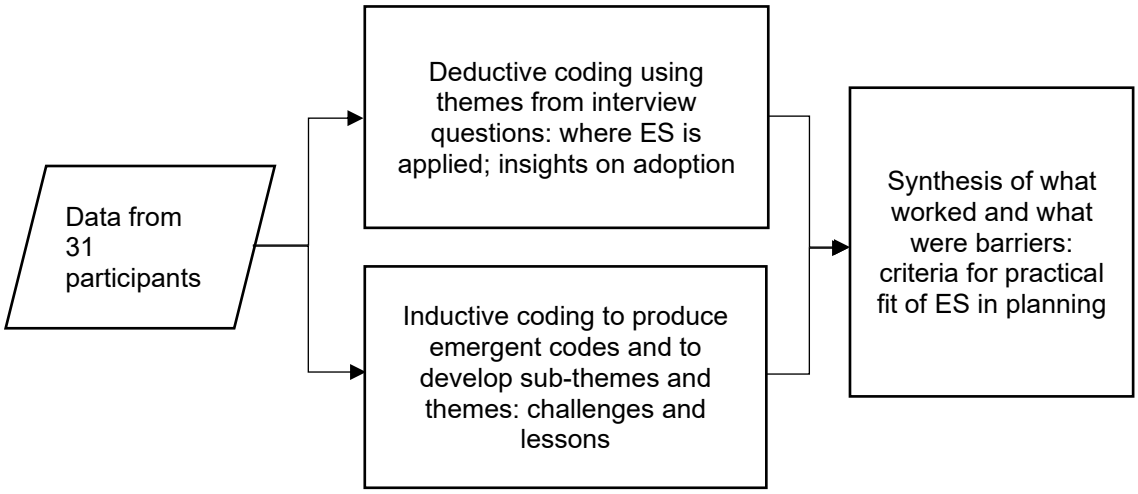

Figure 3.1 Data analysis procedure

3.5 RESULTS

Here we provide a general picture of the practical fit of the ES concept, or how it was being incorporated into the work of the participants and some of their colleagues. We summarize what we learned about the penetration of ES thinking into the participants' work, how they learned about the ES concept, and their motivations for considering its adoption. We also provide a synopsis of what participants offered as challenges and barriers to the adoption of ES thinking, and their insights about its adoption so far in planning.

3.5.1 Level of adoption and sources of knowledge about the ES concept

In general, participants in the study looked favourably on the ES concept, and revealed how they were working toward ES thinking as "the normal thing to do" (C2). Most felt that the ES concept had the potential to inform and improve urban planning. ES thinking was viewed as an "holistic" (V2) and "integrated" (V5) idea, in keeping with progressive thinking by urban planners. Most suggested that ES thinking had the capacity to expand the conversation about the importance of urban nature.

The varying degree of penetration of ES thinking was indicated by participant responses to the question: "what does ES mean to you?". In Halifax, modest appreciation for ES and associated ideas was indicated by the *ad hoc* definitions offered by participants. In contrast, familiarity with the ES concept in Calgary was reflected by more detailed responses. A theme among Calgary participants was that ES "[aligns] with municipal services" (C1). In Vancouver, participant definitions were similar, suggesting a common

source: a short definition in guidance documents disseminated within Vancouver for over a decade.

Participants from all three cities mentioned education and workplace experiences most often as sources of knowledge on ES. Many participants had a background in environmental studies or a related field and had acquired foundational knowledge on ES and similar concepts through formal education. Their interest in ES concepts was enhanced because they had a personal investment—sometimes expressed as a "passion"—in environmental matters. They reported ES knowledge sharing within their workplace and professional networks via: "collaboration circles" (C1); "convening on [ES and similar] topics, acquiring data, distributing that data, that knowledge-sharing and information-sharing piece" (V3); and the "interface and interchange of collaborative policy and communication" (V3). We observed a minority of individuals in all cities to be more knowledgeable about the ES concept than the rest, and more persistent and more invested in facilitating its adoption.

We inquired where in planning was ES thinking being applied in each city (Table 3.3). Participants mainly referred to the ES concept playing a supporting role within new or traditional planning approaches, for example, in work on climate change adaptation, urban forest planning, stormwater management, biodiversity planning, and planning for coastal and marine areas. Most participants thought of ES as a new term describing the benefits produced from GI. Pilot GI projects were being organized collaboratively, helping the public, local politicians, and skeptical colleagues to become comfortable with the idea of nature's services. The ES concept was supplementary to other approaches in

helping to legitimate and justify decisions to protect urban ecosystems. However, ES thinking or tools did not play a critical role in these approaches.

The adoption of new ES-explicit approaches or tools was most evident in Calgary and Vancouver, where ES assessments and valuations, mainly carried out by external consultants, were used for input to decision-making in planning and for municipal asset management. The Municipal Natural Assets Initiative (MNAI) was a relatively well-known Canadian organization that engaged with municipalities (Stanley et al., 2019) and provided technical support for participants. Natural asset management was recognized by the participants in all three cities as an area of focus for planning, and they anticipated it would be mandated in future. Although ES assessments were part of urban forest management in Halifax at the time of the interviews, other ES approaches were not yet integrated into urban planning.

Participants were aware of the "buffet" (V6) of ES tools being promoted internationally. However, Canadian-based approaches such as MNAI were regarded most positively. As V6 expressed: "where am I going to invest my time and resources? … With organisations and partners … providing relevant resources and support, and knowledge to my local situation".

Table 3.3 Main areas of planning where ES was applied

	Halifax	**Calgary**	**Vancouver**
ES-explicit approaches			
ES assessment and asset management	x	x	x

	Halifax	Calgary	Vancouver
ES valuation	x	x	x
Existing planning approaches			
GI	x	x	x
climate change	x	x	x
urban forest	x	x	x
stormwater		x	x
biodiversity		x	x
coastal and marine	x		x
restoration	x	x	x
parks		x	x
naturalization	x	x	
resilience		x	x
source water management		x	
wetland protection		x	

3.5.2 Challenges with adoption of ES

Participants volunteered their opinion on a variety of challenges they had experienced, had observed others experiencing, or anticipated with the ES concept or its tools. We present these challenges in two categories: individual-level and systemic (the latter includes institutional, governance and organizational challenges).

Individual-level challenges

Although most participants had a favourable view of the ES concept, some commented that this view was not shared by all their colleagues (Table 3.4). Specifically, and frequently, participants noted that municipal engineers associated a large degree of risk

with ES-related approaches like GI because they were perceived to be unconventional, unproven, and unquantifiable. A couple of participants noted generational differences among their planning colleagues: older planners were seen as less apt to adopt ES thinking.

Table 3.4 Individual level challenges to adoption of the ES concept, illustrated with sample quotes.

Sub-themes	Examples
disagreement about approaches	"Admittedly [ES is] not fully recognized or adopted by all key decision makers and that's not necessarily due to the ... political side or ideological side. That's also within our organization. Sometimes we deal with challenges due to generational / professional perspectives." (V6)
discomfort with valuation	"Land prices are so high … I'm worried that we're gonna value all these services and it's still not gonna equal land values ... we could still sell this property and make more if it's residential." (V2)
risk aversion	"We think we should just come out of the gate fully formed – and that's a function of our risk averse society… How do we become less risk averse? Or ... what's the fall back position, instead of this 'we don't know'? And so what then? How do we make progress?" (C5)
discomfort with imprecision and loss of control by engineers	"Many engineers ... [are reticent] to do it because it's different, or it's potentially risky, or you're not sure. You can't quite quantify it, you can't put your finger on that precise value, or you just haven't made the tool yet that tells you how to do that." (C2)

Aware of their colleagues' risk aversion, some participants spoke about moving slowly to introduce the ES concept. For example, planner C1 spoke of being "cautious" about "pushing the language" until there was "more readiness". H6, V2, and V6 referred to sowing ES ideas by introducing ES terminology via plan updates and guidance documents. As well, Canadian ES-based approaches, like MNAI, helped to alleviate the perception of risk, and demonstrated to decision-makers that ES approaches were feasible and capable of being implemented in the municipal context. The adoption of well-publicized "best practices" (associated with natural assets management in Gibsons, BC, and the Credit Valley Conservation Authority in ON, for example) also provided an added layer of respectability and credibility.

Monetary valuation of ES appeared to be a concern for some participants. For example, consultant C7 commented: "putting a dollar value on it just abstracts it into a level that more easily fits onto a budget sheet as a line item, without really addressing the irreplaceable nature of natural systems". A few participants in Vancouver suggested that other potential participants in this research chose not to participate because they were opposed to monetary valuation of ES, an approach often conflated with the ES concept. Other critiques of monetary valuation included that the ES concept "makes it easier to ignore areas outside of human experience" (C7), and that it could be "alienating" (V5).

Systemic challenges

Other impediments to ES adoption were systemic. They included obstructions such as institutional inertia, rigidity, and siloing, as well as governance obstacles (Table 3.5). Although ES thinking was filtering into individual practice, participants in all cities spoke

about the lack of general adoption of ES ideas and tools within planning departments and related municipal departments, and a lack of integration of ES ideas across other municipal departments and in municipal policies. Participants also cited governance-related barriers to adoption of the ES concept: the historic and chronic lack of cooperation in establishing mutual agreement on environmental policies across jurisdictional boundaries (for example, between adjoining municipalities); and municipal-provincial rifts in relation to environmental planning and management (for example, differences in priorities and unclear areas of responsibility).

Table 3.5 Systemic challenges to adoption of the ES concept related to institutions and governance

Sub-themes	Examples
institutional rigidity	"Our ability to respond right now seems really limited. We ... say "Hey - why can't we do this? Can we fix that? Can we do that?" [But] ...that'll take you two years of planning process in Council and public consultation - it's all very, very, very rigid." (H6)
institutional fragmentation	"You probably have champions who understand it, get it, and might be trying to advance it … But that doesn't mean that the person in the next cube over [is]. It's my gut that it's somewhat ad hoc. ... We don't have a clear group or champion for this natural infrastructure work." (C3)

Sub-themes	Examples
provincial impediments	"We don't have the ability to collect information. We don't even know which information to collect and we don't have necessarily that partnership with the province." (H2)
cross-jurisdictional challenges	"How [do] you have influence over those that you don't have jurisdiction over? And that's why the planners within a jurisdiction aren't necessarily the key folks who have to drive it." (C5)

Another set of interconnected challenges (Table 3.6) hindering adoption of the ES concept included the low priority of the environment in municipal decision-making, the overall lack of municipal investment to address environmental issues, and a lack of knowledge and expertise among planners on environmental matters. In Halifax and some small constituent municipalities in the Vancouver region, participants noted challenges with their capacity to collect environmental data, and to understand how to interpret and use them; on the other hand, regional planners in Calgary and Vancouver did not voice capacity concerns. In addition, the substantial responsibilities of planners in Halifax and the smaller Vancouver municipalities were barriers to addressing environmental considerations, specifically, the breadth of topics that planners must account for when making proposals to Council; adding to this burden was daunting: "They've asked for a social lens and ecological lens and a risk lens and a financial lens and a gender lens and diversity and inclusion…" (H6).

Table 3.6 Systemic challenges to adoption of ES related to municipal priorities, knowledge, and resourcing

Sub-themes		Example
Environment ranks low in municipal decision-making processes	lack of attention to natural values in planning	"In a new planners' orientation ... one of the senior people said … they start with land that has no value and through the planning and development process they create value. And I was [shocked] because [this] is exactly counter to what we should be thinking." (C8)
	the environment has low priority	"[In Halifax] there's a lot of priority on vehicle movement so we have a great number of resources on traffic. In my job I'll talk to traffic engineers everyday. The number of times I talk to someone in the energy and environment group is few and far between." (H7)
Lack of ES knowledge or expertise	complexity of ES and similar approaches	"There are so many different aspects that come into play, and you're constantly playing with dominoes ... it's so interrelated, and a hundred other things can happen. ... what we do, it's not rocket science - not at all - but these interconnections, that puzzle, people are struggling with." (C4)
	lack of understanding how to implement	"Everybody's [saying] 'how do we move from theory to implementation?' The technical stuff is coming, and now we know how to do it - but: Where do we put it? When do we put it? How do we have the mandate? What is the planning framework it lives in?" (C5)

Sub-themes		Example
	lack of expertise	"One of the barriers is that there aren't scientists in municipal government. ...You really need scientists and planners to work together. ... Numbers are a challenge for planners. And I get scared about that sometimes." (H10)
	lack of knowledge about ES	" I would say even though these things [naturalization projects, GI] are all happening, I don't feel like there's a lot of discussion about the fact that these are ecosystem services ... with that language." (H5)
Lack of Resourcing	scarce human and financial resources	"As a small municipality ... our asset management office is very small, and our asset management planning here is very immature. ... As a municipality, we still don't have inventories of any of our hard infrastructure assets … It still takes money and investment to inventory what we know we've got, let alone value it." (H9)
	lack of environmental data	"There's a lack of reliable, up-to-date data that would be really helpful … we have the Green Network Plan … that was a pretty large effort, but I think we could use some more on that." (H6)
	lack of ability to analyze and interpret data	"Municipalities rarely have a lot of capacity for ongoing analysis. Even if they have a GIS department they're generally more focused on just providing data and not necessarily analyzing or interpreting data." (C7)

3.5.3 Holistic insights

Some participants provided particularly cogent insights based in their experiences with the ES concept. Consultants especially had broad, substantive, and generally critical views about ES in planning based on experiences in many municipalities. For example, C5 spoke about the difficulties in linking the idea of ES with its implementation:

> I think the term has been too big to translate down into the different ways it has to be enabled or acknowledged or implemented. …This nebulous ecosystem services thing—somehow, it's just too difficult to deal with. Getting the asset on the books [is] the pivotal element to it—whether or not ecosystem services as a term or concept is ever invoked.

C5 was not committed to the ES concept, suggested that the role of planning in its municipal adoption was not yet clear:

> That's the decade we're in right now: how do we translate what we are learning from science, what we know we want to see on the landscape, and what the planners have at their disposal to make that [happen], or at least not get in the way of it happening? … Whose court are these different things in? … Maybe it's a provisioning kind of thing … a making space thing … it could be in the wording, the ability for some [map] overlay to come in…

Consultant V5 was more optimistic, including about the ability of the ES concept to connect planning with the public, yet saw room for improvement:

> There is a common language that's spoken now, even though not it's not very well understood. …From a climate adaptation perspective, it works well because those services are so clearly felt.
>
> I'm always looking for … new tools we can use, or new ways we can use spatial data to try and convey those services—and make them measurable, visual, narrative.

However, like C5, V5 was not convinced that the ES concept could be integrated into conventional municipal infrastructure planning:

> Ecosystem services tools are still trying to lever into the engineering world, to try to elevate green infrastructure … into this system that isn't built to accommodate it … ultimately, there might need to be a subversive rethinking of these things.

3.6 Discussion

The picture of adoption of the ES concept in our study resembled what researchers have observed in other locations: with some exceptions, there was general enthusiasm about the ES concept and its potential in planning (Beery et al., 2016; Dick et al., 2018). Since participants were selected for the study because of their interest in or use of ES, the interest was not surprising. However, they balanced their enthusiasm with criticisms about valuation, terminology that was confusing and alienating, the complexity of the concept, and the lack of guidance on applying it. These criticisms reflect observations elsewhere, that ES as an approach was not yet fully embraced or implemented in planning and why that might be (Hysing, 2021; Ronchi, 2021).

Adoption of ES thinking was not extensive, as we had anticipated and as noted by others (Grunewald et al., 2021). Although these are relatively early days for ES adoption, and partial uptake would be anticipated, the challenges that participants identified closely resembled those identified by other researchers—such as limited capacity (Kaczorowska et al., 2016) and the need for policy integration (Schleyer et al., 2015)—and so were likely playing a part in the limited degree of uptake. In other words, the level of departmental adoption of the ES concept did not match the level of planner acceptance and enthusiasm for the idea and its potential for planning. As we will discuss, participants found it difficult to fit the ES concept into their working contexts—but some were making significant progress.

3.6.1 Normative and practical fit of the ES concept

It was clear that the ES concept had a good normative fit among interviewees: most of their values in relation to the environment were strongly aligned with the key idea underlying ES (i.e., the need to acknowledge and protect the supporting role of nature in human well-being, barring its implementation through monetary valuation) and many felt responsible for promoting ES ideas and approaches. The normative fit of the ES concept in the broader urban decision-making context was less certain, judging from participant accounts of the low priority placed on the environment, and the limited resources provided for environmental planning. Other authors attribute the slow progress on environmental sustainability in Canadian municipal planning to lack of political will (Epstein, 2017) and under-resourcing (Grant et al., 2018a).

While the normative fit of the ES concept was generally strong, issues with practical fit were evident from the relatively low level of adoption and the multiple barriers described to more extensive adoption. Although not voiced by other participants, C5's opinion about the gulf between the big idea of ES science and implementation in municipal planning accurately captured our general sense of how ES adoption was playing out in the contexts we studied.

Participants noted various levels of success with ES adoption: for example, where the concept was invoked to support existing environmental planning work, and in ES assessments, when supported by municipal initiatives (including by municipal bureaucrats) to fully account for municipal assets. Along with the challenges in adopting ES thinking, these modest successes provided insight into the routes through which the ES concept was being adopted, and how more adoption might occur.

Where the ES concept had been adopted in some way, the actors involved saw the idea of ES or ES tools as being relevant to the work they were doing or to the local context. For example, the MNAI was the most popular approach participants described that explicitly employed the ES concept. Some use of the ES concept was spurred by organizational mandates related to climate change adaptation. Conversely, where there was less local understanding of the ES concept, or where the environment was a low priority, ES approaches were not seen to "fit".

In addition, we noted the ES concept was being introduced in ways that did not disrupt planning practices; they could be described as adoption paths of least resistance. For example, ES language was adopted to supplement but not disrupt current environmental

planning methods; for instance, ES concepts were included in limited scope, such as experimental use of GI, to test the waters and slowly build trust. Studies of adoption processes in the field of agricultural innovation revealed a similar pattern of new practice discovery, trialing, and evaluation (Montes de Oca Munguia et al., 2021). Trialing is used for evaluation and can reduce uncertainty about innovative practices; demonstrating the relevance of new practices to the user is key to eventual adoption (Montes de Oca Munguia et al., 2021).

Although most participants were receptive to the use of ES, certain individuals stood out as having more drive to adopt ES thinking and facilitate its widespread uptake. In their efforts to revise and improve urban environmental practices and policies, they were less discouraged by the barriers they encountered, partly because they had a greater sense of agency in their work than others. Some of these individuals were responsible for the experimental aspects of ES adoption, exploring and testing how to bridge the gap between ES science and implementation (as also found by Stevenson et al., 2021). Such individuals were using tactics such as knowledge sharing, piloting of GI, and establishing high-level ES policies. We believe that these individuals can be categorized as policy entrepreneurs (Kingdon, 2003), and discuss them more fully elsewhere (Thompson et al., 2024, forthcoming).

We suggest that at least two criteria were at play in whether an aspect of the ES concept was used to any extent in planning practice or policy in the study—that is, whether there was practical fit: the perception of local relevance and the ability to be adapted for use within existing planning approaches (Figure 3.2). In addition, the tactics or interventions

of actors such as policy entrepreneurs was observed to exert a controlling influence (Figure 3.2).

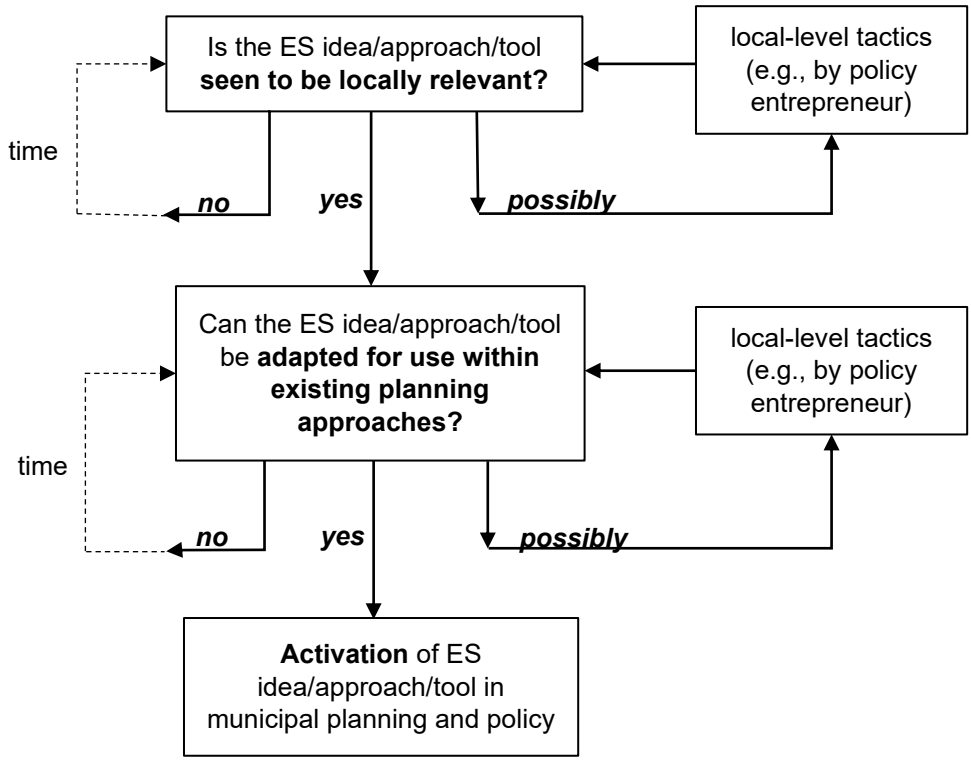

Figure 3.2 Implicit decision process for practical fit of ES

The first criterion in the practical fitness test—that the ES concept must be seen to be locally relevant—is obvious, yet complex and critical to the process of adoption. The perceived relevance of a policy idea may be influenced by many factors, including the user's (or groups of users') knowledge, institutional and governance contexts, the idea's ability to solve a perceived problem, fortunate timing, whether the idea is externally validated, and novelty. Meadowcroft and Fiorino (2017) suggested that three factors are most at play in an idea's policy relevance: its ability to respond to a "perceived need; the

ability to appeal to a variety of constituencies; and some affinity with dominant ideas and practices" (p. 341). Salience has also been shown to be an enabling criterion, with credibility and legitimacy, in knowledge transfer from research to practice (Clark et al., 2016).

For most participants with high ES awareness, its relevance was clear and reinforced by external validation from colleagues in other locations. In addition, these participants were interested in novel ideas like the ES concept to replace conventional solutions that were considered no longer adequate for emerging problems. The low relevance of the ES concept in the local institutional contexts was apparent from some of the challenges to ES adoption that participants voiced. These included: the low priority of the environment means ES is less likely to be seen to solve a perceived problem in municipal decision-making, and the consequent lack of resourcing by the municipality for data gathering and knowledge dissemination.

The model presented in Figure 3.2 suggests that even if the criterion of relevance is not met initially, over time, decision contexts may change (for example, with increasingly severe climate-change impacts) and ES may eventually become perceived as relevant. In addition, our study suggests that policy entrepreneurs are important in making ideas relevant, for example, drawing on Kingdon's description of policy entrepreneurs (2003), through tactics like active persuasion using ES rhetoric, or the presentation of accepted conditions as problems and offering ES approaches as solutions.

The second criterion in the practical fitness test is adaptability, or the ease in shaping an approach to fit existing practices. Here, the often-critiqued conceptual malleability of ES

offers an advantage. Rather than radically changing established planning practices, the individuals we identified as policy entrepreneurs were involved in adapting ES approaches to their various planning contexts. This was exemplified in our study by the incremental addition of salient elements of ES, such as the ES language invoked when introducing GI projects. A parallel has been observed in the health care field, where the adoption of innovative practices was found to be most successful over the long term when the practices were allowed to evolve to adapt to each local application context (Onie et al., 2018). Van Oudenhoven et al. (2018) have also suggested that indicators of ES quantity and quality must be adaptable, to ensure they remain feasible and relevant over time, even under changing social, technological, political, and economic conditions.

3.6.2 The potential for ES in urban planning: recommendations for practice and research

Wholesale adoption of ES in urban planning is unlikely in the short term, given the substantial number of challenges identified by participants, most significantly those created within institutional contexts. However, a transformation may occur if urban planning undergoes a radical shift toward an environmental focus, spurred by a major, disruptive, driving force such as climate change (Hill, 2016).

As we had anticipated at the outset of the study, the ES concept was strongly associated with other approaches and terminology, especially GI and natural assets. The existing planning approaches that incorporated ES, including climate-change, urban forest, and stormwater planning (Table 3.3), will, we expect, continue to be applied. These associations bode well for the continuation of ES thinking in these planning contexts.

That said, further research could explore whether other, related terminology has more potential to close the implementation gap.

There was a general desire among participants for increasing use of the ES concept in planning. The following recommendations for those seeking to foster the adoption of ES seem generally relevant to the introduction of other novel ideas as well:

- Although ES has been thought to offer some promise in helping with integration of environmental policies across municipal departments, in fact, institutional hurdles impede ES adoption (Jordan & Lenschow, 2010; Adlakha & John, 2022). Dismantling the persistent barriers to change in municipal policy would help in increasing ES adoption.
    - Policy or institutional entrepreneurship will likely be part of a response to dismantling systemic barriers related to laws and regulations (Meadowcroft & Fiorino, 2017; Rahman et al., 2019). Urban planning directors seeking to innovate within planning departments should search for entrepreneurial qualities in new employees and cultivate entrepreneurial traits among others.
    - Furthermore, research is needed on understanding the role of policy entrepreneurs in leading other practitioners, politicians, and the public toward understanding of and engagement with ES and other novel ideas.

- Based on participants' perspectives, and as our model indicates, we suggest the development of locally relevant solutions using ES (as also suggested by Tusznio et al., 2020).

    - These initiatives will require experimentation, which needs to be acknowledged as a valid process for innovation in planning (Patel et al., 2015; Scholl and Kraker, 2021). Municipalities with limited capacity may wish to pursue partnerships with neighbouring municipalities, universities, or environmental non-governmental organizations, as Murphy et al. (2023) describe for management of marine vegetated ecosystems in Canada.
    - Some participants were making inroads toward local solutions by developing, piloting, and evaluating locally developed GI projects supported by ES rationale. These solutions also served to increase ES knowledge among municipal colleagues, the public, and politicians. Their findings should be disseminated within communities of practice in the planning profession.

- The lack of technical knowledge at the local level about the application of ES is a knowledge and resource problem (Allan et al., 2022).
    - In our study, this problem appeared to be exacerbated because ES work was being outsourced to consultants. Therefore, we suggest overcoming ES knowledge and experience gaps in municipalities through municipal planners collaborating with ES knowledge brokers (e.g., ecologists), as also suggested by Jax et al. (2018).
    - Although participants recounted learning about ES through their work experiences, formal education on environmental topics was important for supporting and justifying new initiatives. Therefore, we suggest enhanced

content on ES and linked environmental topics in planning education, and continuing professional education for planners.

- The enthusiasm about ES and the agreement among participants about its utility may be attributed at least partly to the sampling process, which selected for those participants who had knowledge or awareness of ES. It would be fruitful to sample more broadly to collect the perceptions of participants with diverse experiences with ES and its utility.

- The findings of the study are limited by scope (selected planning practitioners in three cities) and context (Canadian municipalities of medium to large size) and the relative novelty of the ES concept in planning, which meant that it was difficult to identify those with sufficient ES experience to contribute substantively. The findings should therefore be tested in different locations, planning systems, and in cities of different sizes.

3.7 Conclusions

The ES concept has attracted the attention of urban planners, and its adoption is promoted by ES researchers because it promises many benefits, including improved response to climate change and increased environmental sustainability in cities. Why ES has not been implemented to a significant degree at the local level is not adequately understood. Our goal in this research was to contribute to narrowing the ES implementation gap by identifying what criteria the ES concept must meet for adoption, or practical fit, in urban planning. We found that the ES concept must be, first, seen to be locally relevant and, second, adaptable within the existing planning approaches. If not met immediately, these

criteria may be met over time through the efforts of actors such as policy entrepreneurs, who are dedicated to the ES concept and its potential.

There are no off-the-shelf solutions to the mounting environmental issues facing cities, and the ES concept must be tailored to the local context for practical fit. Our study found that, despite numerous challenges for ES adoption, participants' optimism about the potential for ES in urban planning was clear. For ES to grow in planning practice, its adoption challenges must be acknowledged and addressed. Furthermore, the ES concept can be both relevant and adaptable for planning if planners and their municipal colleagues make investments in education, cooperation, and encouraging openness to new initiatives.

CHAPTER 4: POLICY ENTREPRENEURSHIP IN URBAN PLANNING: TACTICS FOR PROMOTING AND ENGAGING THE ECOSYSTEM SERVICES CONCEPT FOR URBAN ENVIRONMENTAL SUSTAINABILITY

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4.1 ABSTRACT

The application of ecosystem services and associated ideas is believed to improve urban environmental planning processes and policy, but the uptake of ecosystem services ideas in urban planning is limited. The purpose of this research was to understand the tactics of policy entrepreneurs to promote ecosystem services and associated ideas in urban planning. Policy entrepreneurs are persistent and resourceful public policy actors who advocate for ideas and policy proposals they favour with the goal of producing policy change. Research participants employed in urban planning in three Canadian cities were interviewed about their experiences in applying ecosystem services ideas. Data were analysed using inductive and deductive techniques. Policy entrepreneurs among the participants were found to be leveraging personal qualities such as social acuity to overcome resistance to change. Their tactics included framing issues (such as those presented by climate change) with ecosystem services to connect with politicians'

concerns, and convening cross-disciplinary discussions. Our findings highlight the important role that PEs may play in advancing ES thinking and meeting sustainability objectives in urban planning. Recommendations for research include assessing the effectiveness of ecosystem services ideas and approaches to improve urban environmental policy and expanding the under-researched area of policy entrepreneurship in planning. Recommendations for planning education and practice include increasing ecological planning knowledge among planners, broadening the use of the ecosystem services concept, and encouraging policy entrepreneurship qualities among planning staff in the face of emerging challenges.

4.2 Introduction

Some urban planners tasked with developing environmental policy have identified that certain environmental objectives are insufficiently addressed in urban plans and planning policies. These objectives include improved resilience to climate-change impacts (e.g., sea-level rise, flooding from storms, heat-island effect); increased quality and extent of urban greenspace; more use of green infrastructure (GI) for functions such as stormwater management; and better environmental stewardship for improving biodiversity and human health. These planners are interested in promoting ecosystem services (ES) ideas and tools to meet these objectives.

ES are the benefits that humans derive directly and indirectly from natural and semi-natural ecosystems. The ES concept may offer advantages in urban environmental planning, for example, for including more knowledge about ecosystems in decision-

making (BenDor et al., 2017; Longato et al., 2023), for addressing climate-change impacts in cities (Marques et al., 2022), and for providing rationale to retain natural and semi-natural ecosystems (Thompson et al., 2024). The uptake of the ES concept and its tools in urban planning for addressing environmental sustainability has been urged by environmental scientists conducting research on ES implementation (Cortinovis & Geneletti, 2018a), but they are rarely operationalized (Qiu et al., 2022).

Although the value of nature's services has historically been incorporated into planning (Thompson et al., 2020), the explicit adoption of ES thinking is a substantial shift for planners. In Canada, challenges to ES adoption in federal, provincial, and territorial government contexts include poor understanding of the ES concept and ES terminology, lack of regulatory mandates to proceed with using ES approaches, lack of capacity, and path dependency (i.e., the tendency to repeat past approaches and processes, typically due to earlier decisions limiting later options) (Kerr et al., 2021). However, certain individuals may overcome such challenges with persistence and social acuity and move new ideas onto the governmental policy agenda (Mintrom & Norman, 2009). These people are policy entrepreneurs (PEs).

PEs are "advocates of policy change" (Mintrom & Norman, 2009) who make significant personal and professional investments and deploy opportunistic strategies to influence the public-policy process. The role of PEs in advancing policy change was advanced by Kingdon (1984, 2003) as a component of the multiple streams approach (MSA), a model for the agenda-setting phase of the public-policy process under conditions of ambiguity.

The MSA, developed in the context of US federal politics, has been applied extensively in other geographies and areas of policy (Cairney & Jones, 2016; Jones et al., 2016). The MSA has contributed significantly to understanding how ideas are introduced, shaped, and eventually influence people's beliefs, and why and how certain ideas ascend public policy agendas (Béland, 2016; Mehta, 2011).

In the study presented here, our research question was: What were the tactics of urban planning PEs to promote ES and associated ideas with the goal of advancing environmental outcomes in their cities? The question stemmed from our previous inquiry that sought to understand how and why the ES concept was being used in urban planning (Thompson et al., 2024). We found that PEs were relying on ES ideas to increase the environmental content of urban plans and planning policies. Although the context for this study was Canadian cities, the study findings contribute to the overall understanding of ES use at the local level and provide general insight into policy entrepreneurship tactics in planning to address growing environmental challenges being experienced worldwide in municipal policy contexts.

This paper begins by providing background about dominant issues facing Canadian cities, the interest in the ES concept by urban planners, and the ES implementation gap at the local level. We introduce the idea of policy entrepreneurship and its role in applications of the MSA (Kingdon, 1984, 2003) to the policy process. We present what we learned about the tactics of the PEs in the study to promote ES, and we discuss the relevance of

our findings to future research on planning practice at the local level and on ES implementation.

4.3 Background

4.3.1 Urban environmental issues in Canada

There is growing awareness of the pressing need to change how planning is carried out in the context of increasing urbanization and climate change mitigation and adaptation (Hill, 2016). Established urban planning approaches and the technologies of conventional infrastructure engineering have produced urban forms that are not adaptable and resilient in the face of climate change (Frantzeskaki et al., 2022). For example, planning tools such as single-use zoning (along with car-dependence) have contributed to low-density, sprawling urban development with extensive areas of impervious surfaces, resulting in increased stormwater runoff and peak flows, soil erosion, and flooding (Chocat et al., 2007). Development in coastal areas and floodplains formerly considered low risk is now at high risk. Grey infrastructure such as stormwater and wastewater pipes, designed for more stable climatic conditions, is aging and undersized to manage extreme flows.

As cities and their residents become increasingly vulnerable to climate-change impacts, there is mounting interest by planners in alternatives such as NbS (Frantzeskaki et al., 2022) and GI to provide regulation and maintenance ES (Tsatsou et al., 2023), such as stormwater mitigation and treatment in natural, managed, or constructed wetlands, buffering of wave action by coastal wetlands, and climate regulation by the urban forest. In addition, cities and urbanization processes continue to produce substantial

environmental impacts far beyond their physical footprints (including climate-change impacts from greenhouse gas emissions). Urban decision-makers bear a responsibility to understand and mitigate these impacts (Hoornweg et al., 2016).

Climate-change is a central challenge facing Canadian cities (Scanu & Guay, 2019; Tang Kai et al., 2022). Acknowledging the need for urgent action on mitigation and adaptation, policy-makers in many Canadian cities, including those in this study (Halifax, Calgary, and Vancouver), have declared climate emergencies (Baggio & Tozer, 2023). Many cities have also adopted and are starting to implement climate action plans (Herbert et al., 2022).

The need for effective climate-change response is generally acknowledged by urban policy-makers in Canada, but there has been little substantial progress, partly due to the inability of local governments to regulate environmental matters with the regulatory powers given and limited by provincial and federal governments (Epstein, 2017). In addition, other serious issues compete for policy-makers' attention. Urban growth and development, historically encouraged in Canada, has led to challenges such as shortages of affordable housing, increasing homelessness, deepening social inequity, and the need to bolster transportation and transit infrastructure (FCM, 2020). Unless a significant event takes place to draw their attention, policy makers may lose sight of environmental issues. In addition, the resolution of complex environmental problems requires foresight and a sustained focus, which municipal policy-makers usually lack (Boston, 2020). Therefore,

it is not surprising that aspirational statements about addressing climate change have not yet manifested in practical, timely solutions.

4.3.2 ES thinking and approaches as planning solutions

While current planning approaches are limited in providing climate-change responses, the ES concept and its tools offer opportunities to improve urban environmental planning practice and policy, including awareness-raising among politicians and the public about the importance of nature and broadening the environmental knowledge base via ES assessments. In addition, the ES concept, as a boundary object for urban sustainability, brings diverse interests and perspectives into focus on shared solutions (e.g., Steger et al., 2018). ES rhetoric and assessments have been shown to offer planners robust supporting rationale for urban environmental policies (Thompson et al., 2024), and ES mapping and ES assessments can provide key inputs for the optimal implementation of NbS (Longato et al., 2023). In cities experiencing rapid growth, modelling ES supports trade-off assessments during land-use decision-making (Shoemaker et al., 2019).

The ES concept and its tools appeal to a broad audience. For some, the central and effective message about human dependence on nature's services is a call to action. Others see the potential of ES tools to identify and quantify nature's services and bring them into conventional decision-making processes, and the promise of low-cost and sustainable solutions using ES-related principles. For example, ES science is applied in national, multi-national, and global ES assessments (Costanza et al., 2017; Meraj et al., 2022), in payments for ES programs (Salzman et al., 2018), and by large international

organizations such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), albeit in those contexts, the term ‘Nature’s Contributions to People’ is increasingly used (Costanza et al., 2017). However, ES ideas are seldom applied at the local level, including in urban planning (Levrel et al., 2017; Scott et al., 2018).

Researchers in environmental science view planning as key for operationalizing the ES concept because land uses and covers determine the presence and flow of ES (Hasan et al., 2020), and because of planning’s bridging role between policy and community goals and values (BenDor et al., 2017; Hansen et al., 2015). Planning also shares fundamental principles with some ES approaches, such as the central importance of citizen participation in decisions affecting people, and society’s responsibility to manage resources (Scott et al., 2018).

The prominence of the ES concept has stimulated interest among urban planners (Tang Kai et al., 2022). In Canada, ES valuations and natural asset assessments by local municipalities (for example, to assess the value of wetlands for services such as flood mitigation and groundwater recharge) are becoming increasingly frequent, in part thanks to the efforts of the non-profit Natural Assets Initiative (NAI) and an ES Toolkit (VNCST, 2017) produced by a government taskforce (Kerr et al., 2021). Currently, however, the uptake of the ES concept in urban planning is in the early stages, and most planners lack sufficient knowledge about it (Tang Kai et al., 2022; Murphy et al., 2021).

4.3.3 Who are policy entrepreneurs?

The concept of the PE emerged in the public policy literature, became popularized by Kingdon (1984, 2003) and was elaborated upon by multiple authors including Mintrom and Norman (2009) and Zahariadis (2014, 2016). PEs are distinguished by their motivation to use their skills and agency in promoting ideas and policy proposals they favor (Kingdon 1984, 2003). PEs are persistent and tenacious in advocating for causes important to them (Arnold, 2022), as the problems or issues that attract the attention of the public and policymakers—perhaps through such advocacy—are the most likely to end up on planning policy agendas (Kingdon, 2003). As the term entrepreneur suggests, PEs willingly "invest their resources—time, energy, reputation, and sometimes money—in the hope of a future return" (Mintrom & Norman, 2009). Effective PEs have a keen understanding of political and institutional systems (Petridou & Mintrom, 2019). They display persistence, resourcefulness, expertise, an ability to influence policy-makers, and social acuity (Table 4.1). PEs may also perceive themselves to be creative, unconventional, and agreeable; they can see themselves as "transformational" leaders (Timmermans et al., 2014).

Table 4.1 PE qualities

Quality	Example
Persistence	PEs have “a willingness to invest large and sometimes remarkable quantities of [their] resources” (Kingdon, 2003, p. 181) PEs "distinguish themselves through their desire to significantly change current ways of doing things in their area of interest" (Mintrom & Norman, 2009, p. 650)
Resourcefulness	PEs are “energetic actors who work with others in and around policymaking venues, leveraging resources to promote a favored policy change" (Frisch Aviram et al., 2020, p. 614)
Expertise	“another important element of policy entrepreneurship [is] the dissemination of information and evidence” (Anderson et al., 2020, p. 589)
Ability to influence policy-makers	[PEs combine] technical expertise with political savvy” Kingdon, 2003, p. 181) “policymakers are particularly receptive to entrepreneurs who provide new and reliable information" (Anderson et al., 2020, p. 587)
Social acuity	“[PEs] must be able to understand the workings of a given context without becoming so acculturated to it that they lose their critical perspective and their motivation to promote change” (Mintrom & Norman, 2009, p. 656) “[PEs] are adept at addressing the concerns of other interest groups and policymakers” (Anderson et al., 2020, p. 589).

PEs employ a range of advocacy activities, as well as purposeful strategies to promote innovation and change (Capano & Galanti, 2021). PEs are most active in the public sector, may work at all government levels (but are most common at the national level), and act both within and outside organizations (Frisch Aviram et al., 2020). Environment, health, and planning are important areas of activity for PEs, likely because of the amount of public attention on those policy fields (Frisch Aviram et al., 2020).

4.3.4 What tactics and strategies do policy entrepreneurs employ?

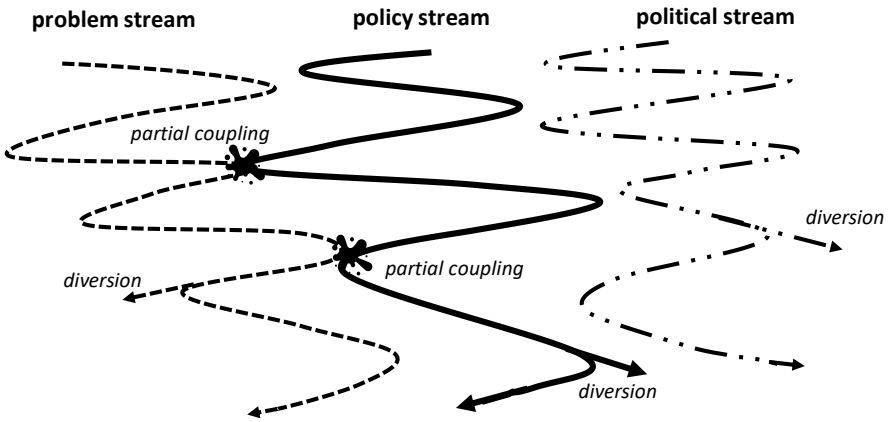
Along with their key qualities (Table 4.1), PEs are remarkable for their actions intended to produce policy change (Brouwer & Huitema, 2018). Research has elucidated PE strategies and their effects, including framing problems to attract attention, building teams to direct resources toward a goal, networking to marshal knowledge, demonstrating successes to overcome risk aversion, and sharing success stories to create higher-level policy changes (Petridou & Mintrom, 2021). PEs may also use ideas as "coalition magnets" (Béland & Cox, 2016) to build support for policies. Brouwer and Huitema (2018) studied the strategies of PEs in Dutch water management policy change in the context of climate change. PEs selected and "juggled" strategies according to their organization, the policy proposal at hand, and their networks, as well as their personal inclinations (Brouwer & Huitema, 2018). The authors found four broad categories of strategies: attention- and support-seeking (e.g., demonstration, persuasion, and exploiting events), linking (e.g., building coalitions and compromising), relational management (e.g., networking and trust-building), and arena seeking (i.e., for venues and timing). Frisch Aviram et al.'s (2020) systematic review produced a comprehensive list of PE

strategies, including problem-framing, solution-seeking, strategic use of symbols and words, forging partnerships, and networking. In general, PEs tell "a persuasive story to frame a policy problem", prepare policy solutions in advance, and exploit opportunities to have their policy solutions adopted (Cairney, 2018 p. 13).

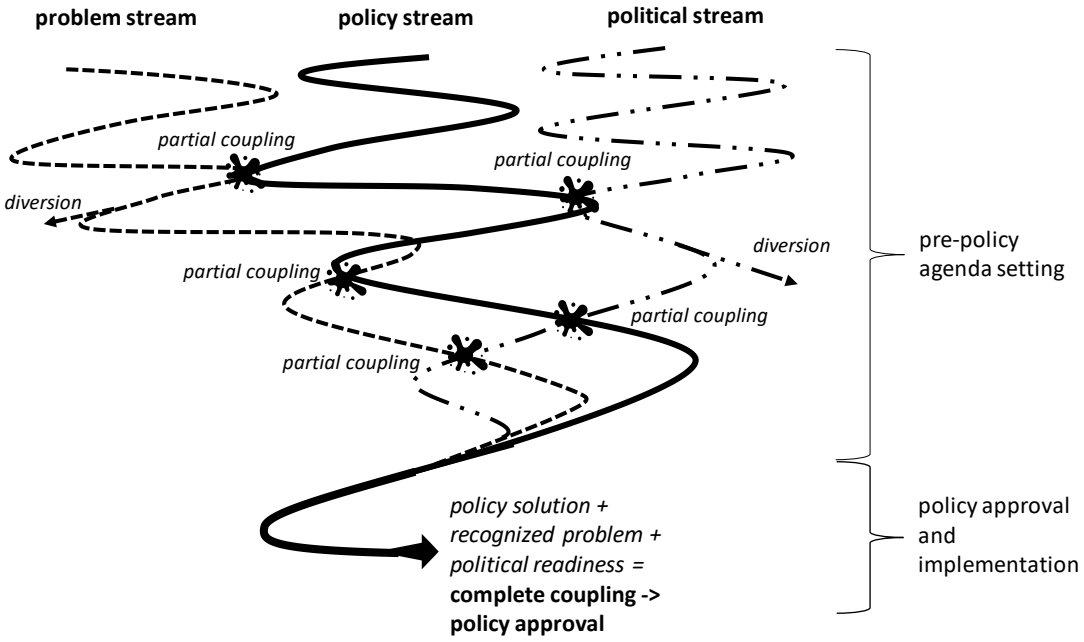
4.3.5 The role of PEs in achieving policy change

For our study, the role of PE is best interpreted via Kingdon's (1984) conception of policy-making processes in the context of ambiguity (Cairney, 2018). Kingdon discussed extensively the role of PEs in the three independent "process streams" of the MSA (p. 87) (Figure 4.1): the problem stream, where recognition and definition of problems occurs; the policy stream, where ideas from various origins are refined into policy proposals by policy specialists within policy communities; and the political stream, the realm of "electoral, partisan, or pressure group factors" (Kingdon, 2003, p. 145).

Winkel and Leipold (2016) conceptualized the process streams as filled with "discursive practices" or "communication and shared sense-making" activities (p. 115). The streams flow through "discursive terrain, partially contained by discursive and institutional dikes" or barriers (Winkel & Leopold, 2016, p. 115). Each stream's discourse flows from a different core set of actors, is subject to different influences, and experiences distinct dynamics (Zahariadis, 2014).



a. Agenda-setting without policy entrepreneurs



b. Agenda-setting with policy entrepreneurs drawing the streams together and coupling with change tactics

Figure 4.1 Interpretation of Kingdon's process streams in urban planning policy development (based on Buse et al., 2012)

Kingdon (1984, 2003) suggested that policy change is most likely to take place when the three usually independent streams are completely "coupled" or merged: a recognized problem is matched with an acceptable policy response and the political situation is favorable for the adoption of the emerging policy (Reardon, 2018). PEs "engineer" coupling of the streams by exploiting the "discursive connections between streams" (Winkel & Leipold, 2016, p. 114) (Figure 4.1b). Without PEs (Figure 4.1a), the streams may still intersect, but the intersections are less coordinated and thus less likely. There is also a greater likelihood that each stream will be diverted, for example, when the focus on a problem is lost, or following political leadership changes.

Complete coupling is rare, especially for complex and emerging issues like climate-change adaptation (Dolan, 2021). However, Kingdon suggested an important role for partial couplings in agenda-setting (Dolan, 2021; Figure 4.1b). For example, coupling of the problem and policy streams may occur when existing conditions are recognized as problems, for instance, when PEs use indicators or feedback to draw attention to something concerning; or when PEs interpret the occurrence of "focusing events", such as natural disasters, for the public, or use symbols or language to seize attention (Birkland & DeYoung, 2012). PEs may also use focusing events or symbols to spur or reinforce "group coalescence and mobilization" within their policy communities (Birkland & DeYoung, 2012, p. 178). The political and policy streams may be coupled by PEs who "soften up" politicians and the public (Kingdon, 1984, 2003) with persuasive language at opportune moments. PEs may also break down "dikes" between streams, by bringing

other policy-stream actors, the public, and politicians together to engage in discourse and share ideas (Winkel & Leopold, 2016).

The outcome of "multiple partial couplings" is a greater likelihood of complete coupling (Dolan 2021 p. 164). PEs strategically draw the three streams together, maintain extended and coherent discourse on a policy issue, and eventually exert enough influence on their colleagues in the policy stream, the policymakers, and the public to produce their desired policies.

Mintrom and Norman (2009) recommended exploring the PE concept in diverse contexts to test and expand the concept. Henstra (2010) applied the MSA in analyzing local emergency management policy choices in southern Ontario, Canada, noting that bureaucrats and politicians took on PE roles. Petridou (2018) studied PE bureaucrats in community visioning in Sweden, finding that PE teamwork was essential for success. The potential for PEs to promote ES has been touched on in the literature (Ferraro et al., 2022), but has been explored only to a limited extent; one example is Bussola et al.'s (2021) research examining innovation in governance of forest ES.

There has been little investigation of urban planners as PEs, perhaps related to the desire of many planners to hide their entrepreneurial traits, preferring to be seen as apolitical, and focusing on technical solutions (Ioannides, 2015). However, planning theory on planners' roles does address how planners may—or may not—promote certain positions and policies. Although planners may see themselves in a purely technical role, as

information and knowledge providers "without displaying a personally preferred policy position", they are more likely to see themselves in a political or hybrid role (Lauria & Long, 2017, p. 204). Planners in a political role are "activists or advocates for particular policies using their expertise and position to ensure that their preferred policies and programs are implemented" (Lauria & Long, 2017, p. 204). Planners who take on a hybrid, or pragmatic role, tailor their approach to the situation, and may be especially important in planning for sustainable development, which demands that the planner's work be both technically sound and "politically and socio-culturally informed" (Briassoulis, 1999, p. 895).

4.3.6 Municipal planners' relationships with politicians and the public

Since we focused our research on how urban planning PEs influence the policy change process, background on planners' relationships with politicians and the public is relevant. Municipal politicians and planning staff have a complex and highly interdependent relationship (Campbell, 2001; Hodge & Gordon, 2014). Politicians serve a broad and diverse constituency but may have a limited understanding of technical or planning-related matters (Hodge & Gordon, 2014). Thus, they rely on planners for technical advice (such as data and analyses about specific issues), guidance on planning policy (such as interpretation of current policies and policies adopted in other jurisdictions with similar issues), as well as accurately conveying the views of the community (through engagement and close contact with community members). In general, municipal politicians have little time for learning and reflection (Throgmorton, 2021) and they need reliable, easily understood information.

Through their specialist expertise, and the amount, type, and quality of information and advice that they provide, planners possess varying degrees of influence over politicians. They develop and maintain this influence (Throgmorton, 2000), by "developing relationships of trust, cooperation, and encouragement, and cultivating channels of communication" (Hodge & Gordon, 2014 p. 365). Innovative planners must move slowly, exercise tact, press politicians gently for change, and develop relationships with both politicians and other actors such as developers to gain influence (Hodge & Gordon, 2014).

In the context of climate-change, where conditions are evolving and specialist technical knowledge is essential, planners conversant with climate-change and environmental concepts and associated policy guidance hold important knowledge for politicians and the public. However, decision-making in Canadian cities continues to reflect a neoliberal ideology, meaning that planning tends to be seen as "obstructive and unduly regulatory" (Seasons, 2021, p. 31). To maintain traction, planners—consciously or unconsciously—frame their ideas and policy recommendations in economic terms. For example, natural asset management approaches (which attempt to bring natural assets such as GI onto the municipal balance sheet) translate well into economic thinking in the urban decision-making context. Therefore, the approaches piloted by the NAI and promoted by planners have become the most well-known of the ES-related approaches in Canadian cities (Thompson 2024).

Planners' relationships with the public are similarly involved and extensive. Planners mediate between citizens and politicians by conveying public sentiment on planning issues to politicians and gathering feedback from the community. They also inform community members about the rationale for planning approaches, policies, implementation, and the consequences of planning decisions (Hodge & Gordon, 2014). In indirect ways, then, planners influence politicians through interactions with their constituents, by providing the public with information and promoting planning initiatives and approaches they favour.

4.3.7 Studying PEs to understand ES uptake

With little use of the ES concept in urban planning, we have a poor understanding about how it is used, where it is applied, and whether it improves decision-making. Studying the experiences and perceptions of the relatively early adopters of the ES concept can offer insight into the real-world factors of its implementation, including how some urban planning actors, in their role as PEs, promote ES. Therefore, our aim in this study was to investigate the tactics of urban planning PEs to promote ES and associated approaches to advance environmental outcomes in their cities.

4.4 METHOD

The research involved the analysis of interviews with 31 urban planning professionals in Halifax Regional Municipality (Halifax; 2021 population 439,819), the City of Calgary (Calgary; 2021 population 1,306,784), and Metro Vancouver (Vancouver; a federation of 23 local-level authorities with a 2021 population of 2,642,825). Key participants with

awareness and experience with ES and associated approaches were identified through purposive sampling (Creswell, 2014). Snowball sampling, or the use of referrals from participants, was conducted to find further participants.

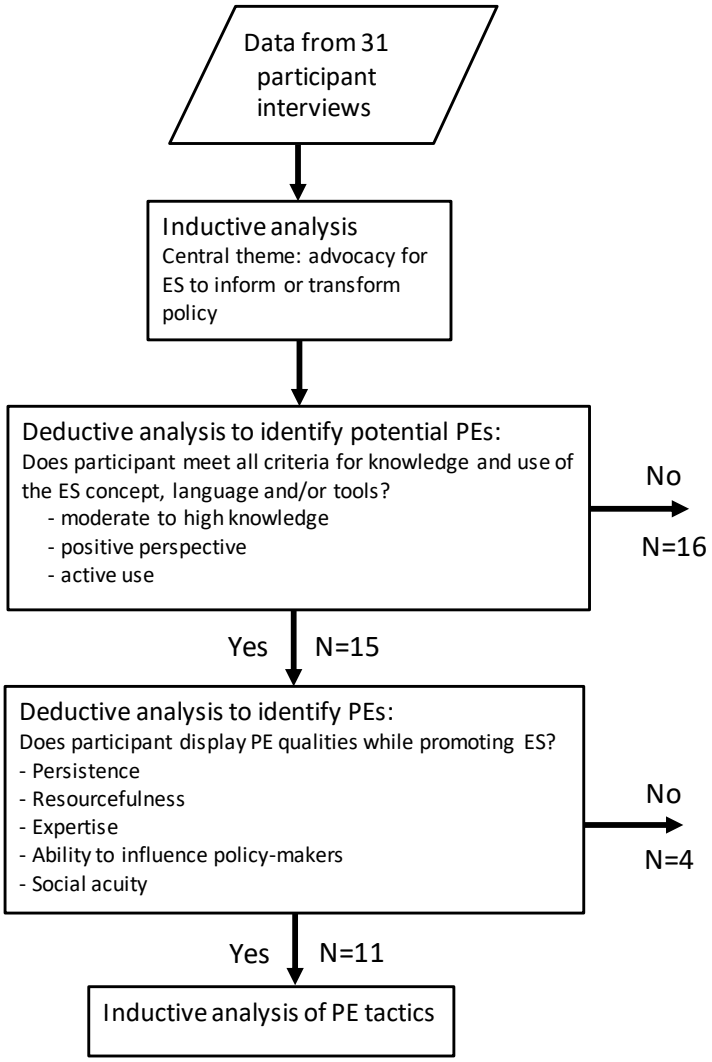


Figure 4.2 Analysis to identify PEs and their tactics

Twenty-four interviews of approximately one hour in length and two focus groups of approximately one-and-a-half hours were conducted with individuals in each city about their experiences with ES ideas and tools. Participants were planners (urban, park, and

environmental planners, for example), municipal staff such as ecologists and engineers, a councillor, and private consultants. Because of pandemic travel restrictions, all interviews and one focus group were carried out online. The interview and focus group data were transcribed and analyzed (Figure 4.2) with the assistance of NVivo 13 software (Lumivero, 2020). Participant attributes including background, position in municipal government, and views on ES were documented.

An inductive analysis applying open and focused coding (Silverman & Patterson, 2015) determined major thematic categories, including a central theme of advocacy for urban policy change by a significant number of participants: specifically, advocacy involving the introduction of ES to inform or transform urban environmental policies. Subsequently, deductive analyses employed two sets of criteria to identify PEs. The first group of criteria included: moderate to high knowledge of ES; an overall positive perspective on ES; and active use of ES ideas, rhetoric, and/or tools. The data from 15 participants were moved into the next analysis, where another set of criteria that included Kingdon's (1984, 2003) and other researchers' conception of PEs (Table 4.1) was applied to find those of the 15 who were displaying PE qualities. The criteria were: displaying perseverance, resourcefulness, expertise, and social acuity in pursuing policy change for ES; and having the ability to influence policy-makers. The process produced a list of 11 participants (of the 31 in total) identified as PEs promoting ES ideas in their environmental policy advocacy. Data from these PE participants were then analyzed inductively to understand their tactics. Line-by-line coding identified individual tactics;

these were grouped into eight common themes, organized into two categories, defined by the way that ES was employed (Table 4.3).

Of the 11 participants who met the criteria for PEs, all but one had a background in environmental studies, and all worked in a planning-related role where their knowledge of the environment was critical (Table 4.2), such as climate adaptation planning, parks planning, or urban environmental planning. Most worked at the regional planning level, and most described personal and professional commitments to the environment; for example, as the participants recounted: “[ES] fits with my non-work personal values” (C3); “I'm very passionate about environmental protection” (V8); and “I would describe myself as a green person” (V1).

Several PEs were working in teams with other PEs. In the Metro Vancouver regional government, participants V2, V3, and V4 were collaborating to promote ES in policy agendas at the community level. In Calgary, regional planners C1, C2, and C8 were collaborating to create widespread uptake of ES across all municipal departments and in planning policy. These people were well-positioned to influence policy and were building on previous policy foundations that incorporated ES and analogous ideas.

V1, from one of the constituent cities in the Vancouver region, was an active proponent of the ES concept, natural asset management, and ES valuation within their city and other municipalities. C3 was working to promote ES thinking in source water protection within Calgary and neighboring jurisdictions. H5 was working independently to bring ES

awareness to those working in parks planning. V10 was also working mostly independently in promoting ES approaches like GI and the urban forest.

Table 4.2 PE participants

Background	Planning role
environmental planning	resilience
environmental science	climate adaptation
environmental planning	environmental planning
environmental science & planning	parks
public finance	asset management
biology / GIS	parks
biology	environment and agriculture
ecology	sustainability
meteorology, environmental physics	ecosystems & ecological health
climate change	source water protection
wildlife biology	parks

The 20 study participants not deemed to be PEs had an interest in or knowledge of ES, but for various reasons could not or did not want to promote its use. Planners at the local level in Halifax and Vancouver municipalities had limited knowledge of ES. A few participants did not view ES to be useful in their work, and others were not committed to environmental policy change or were not able to influence policy. Three ES consultants were knowledgeable about ES and its tools and offered informed perspectives on ES in

planning in various cities; however, none was positioned to advance the use of ES within any municipality. A few participants were working in municipalities where the ES concept had made its way into planning policy agendas and saw no need to promote the idea further.

4.5 FINDINGS

The study was conducted at a relatively early stage of the uptake of ES in urban planning in Canada. Most participants indicated that their long-range goal was to mainstream environmental sustainability outcomes in urban planning through promoting the ES concept. Like Tang Kai et al. (2021) we noted little substantial uptake of ES in policy reported by the participants. This may be the early stage of the policy process for ES, or the agenda-setting phase captured by Kingdon's (1984, 2003) model; however, current interest in the ES concept may not develop into substantial policy change in the cities studied.

4.5.1 What tactics did the PEs employ?

Our study revealed short-term actions that we have termed tactics (Table 4.3). First, groundwork tactics primed politicians, the public, and other members of the policy stream to be receptive to the ES concept and its tools. Second, PEs exploited the ES concept to create more opportunities for incorporation of the concept and its tools and opened possibilities for improved urban environmental outcomes.

Table 4.3 PE tactics to promote ES identified from the study, by presence in PE interviews.

	Tactic	Example	C1	C2	C3	C8	V1	V2	V3	V4	V8	V10	H5
Groundwork	Getting to know the audience	tailoring the message to the audience; taking the time to understand others	*	*	*	*					*		
	Securing	introducing ES in policy language; integrating ES across the city to secure ES thinking		*	*			*			*	*	
	Timing judiciously	pacing the introduction of ideas to the circumstances; incrementalism; anticipating; strategic preparation	*	*	*					*			
Exploiting the qualities of the ES concept	Framing	framing problems to show that an ES solution is consistent with the way problems are already addressed	*		*			*	*		*		
	Attention-getting using symbols and stories	employing ES visuals, words, and stories to gain attention and persuade	*	*		*	*			*		*	*
	Quantifying	employing ES data as evidence to persuade and develop trust					*	*	*				
	Convening	partnering, networking to build understanding and buy-in, and disseminating knowledge					*	*	*		*		

4.5.2 Groundwork

Generally, PEs recounted slow, incremental progress while they primed their audiences. Persistence was evident in the PEs' references to waiting for "more readiness" (C1), using "multiple phase-in approach[es]" (i.e., incrementalism; C1), "sneakily using [ES]" (V4), and the use of repetition, or "trying to hit it as much as possible" (C8). C1 spoke about their careful work in introducing new ideas:

> I'm curious about how far to push the language. How ready are we to do that? I think I've been very cautious ... And I've been more cautious in terms of having a more anthropocentric lens on things and municipal service lens.

The PEs made efforts to know their audience: to understand the public, colleagues, and politicians, whether this knowledge was gained formally through "citizen satisfaction surveys" (C1) or from their experience in social settings and professional work. Then they used the ES concept to convey ecological ideas in relevant ways. For example, V4 found the ES concept was suitable for communicating environmental values and ideas:

> [ES] is a concept to communicate the value of the environment in a way that people understand, especially in settler, colonial government systems, because we are set up to value grey infrastructure and grey systems - we are not set up to value natural systems with the exception of parks.

While the intrinsic value of nature is not convincing in an urban decision-making context, C2 found ES language was effective in conveying the instrumental value of nature:

> [ES] has given me one more tool to speak about [the value of nature]. Instead of saying "how wonderful it is to see the birds at the wetland", we [say] "You know what? If we put homes in that wetland … everyone's going to have flooding in their basements, and we're going to have to build a bigger pond and you're going to have to manage this" …. that's the way to talk to the planners and the engineers, and the developers … adding that piece of language that helps to speak with the rest of the people.

A good understanding of the needs of politicians and the diversity of the public set the stage for further tactics. For example, C1 spoke at length about their efforts to develop policy wording that linked ES to other major urban priorities:

> We frame it in a slightly different way depending on what that audience is … we may not mention services or ecosystem services at all – [we may] talk about nature, quality of life, and spaces in cities. For example, [in drafting our] Regional Growth Strategy … and economic resilience policy … ensuring that our natural assets, or natural infrastructure … are seen as a contributor to a robust, resilient economy … because [they] contribute to quality of life, and attract talent, or can help to support business continuity by reducing flood risk.

> If you want a strong economy, you need a strong environment, and you need to address equity and safe places—showing those connections … therefore going back to the ecosystem services provided.

While progress was underway in broaching ideas around ES to politicians, the public, and their colleagues, the PEs introduced ES and associated terms and references into high-level policy (in Calgary and Vancouver) and regional plans and guidance documents (in Vancouver). In Metro Vancouver, V2, V3, and V4 directed their collaborative efforts: "to support our [constituent] environmental planners who work in municipal land use planning—to advance our regional goals … around protecting natural areas, conserving connectivity". Therefore, one tactic was inserting ES language and concepts in the regional plan "quite early that we have been able to build on incrementally" (V2). V3 explained:

> Having the language in the plan is a step forward because it normalizes the concept, or provides a consistent definition, a consistent approach that all member jurisdictions can strive to meet. There's value [in] introducing a concept into the plan so it becomes the common lexicon and hopefully it's the concept that's understood by the local planners in those jurisdictions (V3).

Tactics could be combined; V4 advocated natural assets with engineering colleagues (knowing the audience) and introduced natural assets into plan language (securing). They noted the slow-paced process (judicious timing):

> We incubated the idea [of natural assets], created some high-level statements and now engineering is running with that ... [for] things like ditches. That's an easy first step …. Soils might be too complex for them, so we start with ditches.

Groundwork drew on the PE qualities of social acuity, persistence, and the ability to influence decision-makers. For example, 'knowing the audience', intended to build trust, required empathy and social acuity.

4.5.3 Exploiting ES

Other tactics took advantage of aspects of the power and persuasiveness of the ES message (Thompson et al., 2024); ES as a boundary object facilitating communication across disciplinary boundaries (Steger et al., 2018); the increasing credibility of the idea (because of increased use of ES elsewhere, and the possibility of quantification); and the utility of ES as a symbol and for conveying a story (Brouwer & Huitema, 2018). The tactics that exploited ES created further opportunities for ES to be included in policy development.

In Vancouver, V2 made an economic case for the environment, stating:

> [ES] came forward as a useful frame for thinking about this connection between … environmental protection … and [nature's] importance to people. Why should you care about this? … because it's providing all these services you … take for granted. Then [we] can put on the financial lens, so… you're spending a lot of money that you don't need to because you're taking down environmental areas and not accounting for the importance of the services that they provide.

C2 spoke about the persuasive power of the ES concept, used in storytelling to encourage audiences of politicians and other planners to recognize the natural elements they valued in parkland (ES). Vancouver PEs created simple and colorful graphics to illustrate the importance of urban ES, in efforts to counter entrenched views: "In a lot of development scenarios or local government scenarios, the environment can be a 'nice to have' and there is this pervasive attitude in some places that we control nature" (V4).

Some PEs quantified and valued ES to persuade decision-makers of the importance of ES to the city economy. For example, C1 stated about the Calgary experience:

> We have a strong emphasis on capital infrastructure and services, so [putting] an infrastructure lens on our riparian areas, rivers, and on urban forestry [means that] we can say those are tangible benefits that are provided and we can measure that and we can create a stronger business

> case to invest in it. So it's not just Parks or Water [departments] saying, "we need to invest in our assets"

As a boundary object, ES supported convening (networking and partnering, for example) and provided a focal point for policy integration and discourse on the environment. Participants learned "from other jurisdictions who are making headway in this space and that's something that we're doing regularly" (V3). V2 commented on some success in drawing ES to the attention of politicians:

> [Natural asset management] is something our politicians are asking us about. They'll see it mentioned in a document and they want to know about it because they've heard their staff talking about it, and they're thinking about doing something ... We have it as a major [idea] in our climate plan: making natural asset management a mainstream thing.

The ES concept was seen for its ability to integrate municipal policies:

> [ES is] a very useful concept for linking other key priorities at both the local and regional scale … for example, drawing a linkage between new policies you want to implement from a climate-change perspective or from a biodiversity perspective. You may have a separate climate-change strategy, a separate biodiversity strategy, but by using the ES concept you can … have more integration (V3).

4.5.4 PE tactics as coupling activities

Placed within the MSA framing, the PEs' tactics can be seen to support the goal of partial coupling or complete coupling of the streams (Table 4.4).

Table 4.4 Examples of tactics and goals

Tactic	Example	Coupling Goal
re-framing (of existing problems)	• framing a known urban problem (stormwater mitigation) in terms of ES, e.g., protecting a floodplain, creating or retaining a wetland for ES, to highlight it and link to cost savings	problem – policy
framing (of less-known problems)	• framing a difficult problem (e.g., increasing environmental resilience) or a less-known concept (e.g., biodiversity) in terms of ES	problem – policy
attention-getting through symbols and story	• using ES language and ideas (especially natural assets) to draw the attention of politicians and the public to the value of ecosystems in urban areas (e.g., ecosystems associated with parkland are assets providing recreational and aesthetic values, and unrecognized regulating ES, such as the absorption of runoff to mitigate flooding)	political – policy
quantifying	• measuring and valuing ES (as a municipal service) to make a business case that appealed to politicians and bureaucrats	problem – policy

Tactic	Example	Coupling Goal
convening	• ES knowledge sharing across disciplinary boundaries to keep ES and environmental issues in the spotlight and to increase receptivity of politicians to ES as a policy solution	political – policy

PEs used ES to re-frame urban environmental problems considered less relevant by politicians (source water protection, or stormwater mitigation, for example) or problems that were difficult to understand (urban resilience, or biodiversity, for example). Some PEs noted that city councillors, despite their lip-service to climate action, were primarily interested in policies that could lead to positive economic outcomes:

> In terms of ecosystem services, we've really framed [source water protection] for Council, who is very much driven by economics, as an economic service… That framing's been really useful for us to talk about why Calgary should care about what's happening upstream (C3).

Participants noted that ES knowledge—and environmental knowledge in general—is limited among municipal politicians, and although climate-change adaptation was on municipal agendas, environmental problems tended to be dismissed or overlooked. Community members and Council could relate to an ES framing for the difficult concept of resilience: "Our Regional Climate Plan … is framed around ES - about how we really need ecosystems to help us become carbon-neutral and to help us become, or make sure that we are, a resilient region moving forward" (V2). The goal of framing was to join the

policy and problem streams, enabling people to see abstract concepts such as resilience as problems for which there were ES solutions. Relatedly, C8 communicated the relevance of biodiversity for politicians through ES: "One of our councillors said 'what is the value proposition of biodiversity?' and so it was through ecosystem services that we said: this is the value proposition".

The PEs understood that local decision-makers needed to link climate-change issues to other imperatives, such as economic and social issues. An urban servicing frame for natural infrastructure facilitated its incorporation into urban decision-making. In Calgary, the PEs were developing a tool to integrate natural assets valuation with other municipal approaches:

> We're creating a Resilience Dividend Tool … a roll up of a climate lens, natural infrastructure valuation tool, and an equity lens …. to inform our capital infrastructure investments. … Do we invest in a rec centre or a bridge? How do we make those big tradeoff decisions? … How do we show the broader benefits and consider climate, equity, nature, economic diversification, when we're building a bridge? So that we're not just thinking of the primary use of something. (C1)

Some politicians and planning colleagues were interested in natural asset assessments and valuations carried out elsewhere, supported by the NAI. Calgary and Vancouver PEs built on this interest by convening planners, politicians, and other municipal representatives to

discuss and share knowledge. Here, convening was a tactic to couple the political and policy streams, aimed at maintaining attention on urban environmental problems and legitimizing ES solutions.

Events such as natural disasters may raise awareness about environmental problems among the public and policy-makers, thus coupling the problem and political streams, without the intervention of PEs. In our study, however, Calgary PEs recounted a major event, the 2013 flooding of the Bow River that prompted them to produce a resilience strategy that included, among other initiatives, policy linking the ES provided by GI to future flood mitigation. ES arguments were persuasive, partly because the solution was linked to municipal savings on grey infrastructure: the parkland re-design along the river reinstated the former floodplain to "accept and integrate the flooding" (C9). We suggest this example represents complete coupling, where PEs facilitated convergence of the three streams and the creation of new policy.

4.6 Discussion and Conclusion

PEs are strategists who maintain focus on a specific topic (in this case, ES) and who draw the process streams together with coupling tactics. Our purpose was to investigate the tactics of urban planning PEs to promote ES and associated ideas with the goal of advancing urban environmental outcomes. Tactics such as knowing the audience, securing ES ideas in high level documents, and judicious timing prepared the ground for the more-focused tactics that exploited ES. The most consequential tactics used ES to frame current issues or poorly understood or unrecognized issues, to convene discussions

around ES ideas, and to draw in and maintain the attention of politicians on ES ideas. If these are the early stages of policy development in the municipal context involving ES, the outcome of these tactics should eventually be the merging of the three streams (when a recognized problem, an acceptable policy response, and a favorable political situation meet) with the outcome being the mainstreaming of environmental objectives in urban areas based on ES (Figure 4.3).

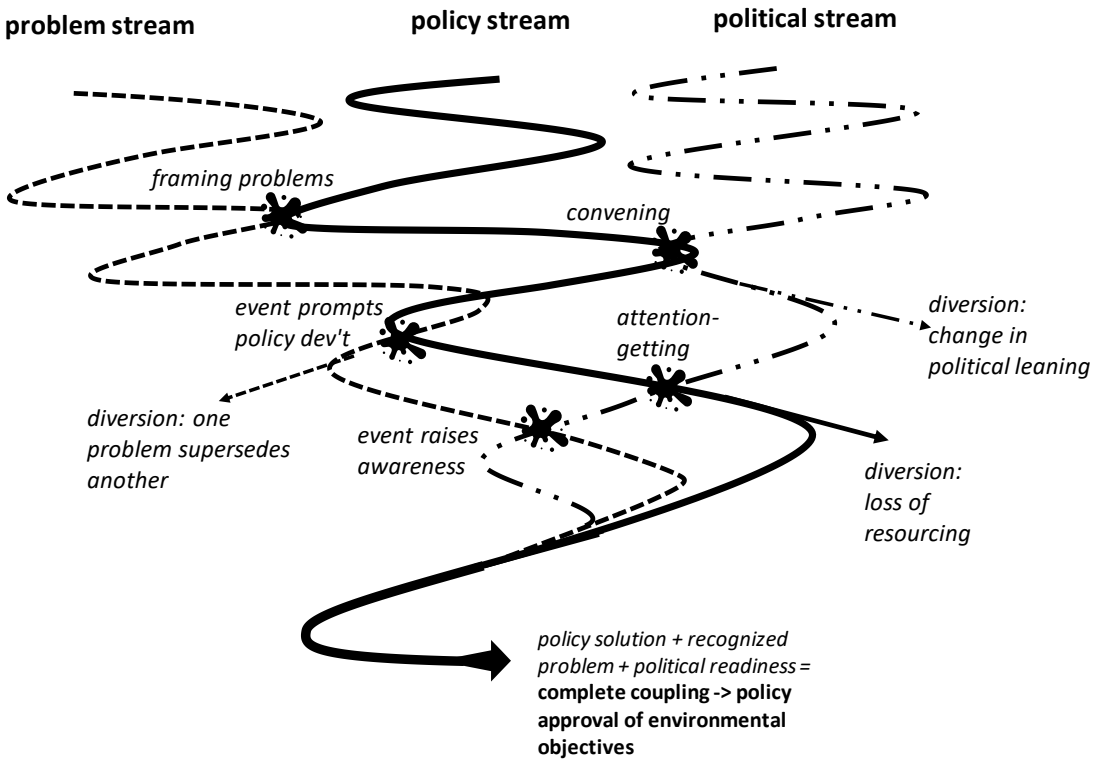


Figure 4.3 Overview of the actions of PEs to merge the three streams

4.6.1 Framing, attention-getting, quantifying, and convening tactics as coupling activities

ES was an effective and compelling frame for perennial and emerging environmental problems that linked to cost-effective solutions. ES framings employed a municipal

servicing language, were introduced readily into municipal discussions, and thus resonated with decision-makers. ES framings also introduced an appealing economic rationale for natural infrastructure. For example, the PEs showed that urban problems (often related to climate change) such as increased stormwater flows could be solved using approaches such as conservation of existing wetlands rather than expenditures on design and construction of grey infrastructure. ES could also frame abstract concepts such as environmental resilience to demonstrate how they may be operationalized, for example, through accommodating natural processes like flooding via the retention and enhancement of natural structures such as floodplains and wetlands that provided ES. The research also revealed storytelling with ES to draw attention to less obvious or overlooked issues. Because municipal staff and politicians are burdened with an increasing number of challenging and competing issues, the tactic kept environmental issues in the spotlight. Additionally, quantifying and valuing ES and natural assets conveyed a compelling message about the importance of ecosystems and natural structures in the economy of the city.

The ES concept and natural assets accounting were novel ideas gaining credibility in other places, and ES resonated with a range of disciplinary thinking. Therefore convening was employed as a tactic to bring together interested parties, including from other places, to develop a discussion on ES, keep the focus on the environment, and reinforce the credibility of the approach. There is comfort and less perceived risk in approaches and policies adopted elsewhere and that have strong credibility from widespread application.

Maintaining attention on issues was challenging: participants in Halifax and Vancouver noted that the attention of politicians waxed and waned with changes in the composition of Council. Furthermore, the ascendance of issues like the COVID-19 pandemic drew attention and human and financial resourcing away from natural assets and ES work. In these cases, diversion of the streams is a likely possibility (Figure 4.3) as other problems arise, or as political interest in the environment wanes. Although there was insufficient data to allow us to describe specific diversions, we surmise that PEs may try to reduce the impact of diversions by re-doubling their efforts to promote ES. Or, as entrepreneurs, they may take advantage of diversions as opportunities to promote the ES idea, for example, by communicating the co-benefits of GI.

4.6.2 Relation to previous research on PE

The tactics we observed were a subset of those seen by other researchers. For example, Frisch-Aviram et al. (2020) identified 20 diverse PE strategies in their systematic review, including many like those we identified, and some that could be classified as subcategories of ours. Notably absent in our study were venue shopping (seeking different policy arenas), using media coverage, and becoming politically active (Frisch Aviram et al., 2020) — strategies that may entail overt political involvement, rather than subtler approaches of persuasion and influence that those working in local government would be comfortable using (Ioannides, 2015). Brouwer and Huitema's (2018) categories (attention and support-seeking, linking, relational management, and arena) organize strategies closely resembling the tactics we identified, including influencing people, establishing policies, finding opportunities at the right time, and appropriate pacing.

Unlike PEs in other studies, our group of PEs did not appear to be personal risk-takers. However, all the PEs were working against various forms of resistance to environmental policy change, which is not surprising when the essential nature (and in many cases value) of the institutions of planning is in part their stability and continuity (Sorensen 2018). Path dependency within institutional structures has long been recognized as an impediment to innovation (Dunlop, 2014).

4.6.3 Limitations

The small sample size, the lack of politicians among the participants, and the research design place limits on extending the study insights. A significant limitation is the relatively small number of PEs (11) identified from a larger group of research participants. Subsequent studies should be designed to select entrepreneurship qualities in potential participants and should include municipal politicians for a richer dataset.

The success of the PE work is difficult to evaluate without examining policy change over time. Our understanding of the tactics employed and their success was derived from the participants' observations about their own work and they may have been overestimating the future impact of their efforts. The participant selection process also favoured those with a positive take on ES, thus potentially biasing their opinion of their success. Future research should evaluate PE success based on the content of environmental policy in urban areas. Additionally, most of our participants were from medium to large cities with significant resources that likely aided in the development of PEs' skills and thus their ability to effect change.

4.6.4 Recommendations

The tactics of the PEs in this study most closely correspond to the actions of hybrid planners, or those who combine technical competence with political savviness (Briassoulis, 1999). We recommend further research into policy entrepreneurship in urban planning in different contexts as a promising yet overlooked way to understand how policy change is enabled, especially in light of climate change challenges. Planning theory on policy processes and policy change acknowledges actors such as change agents and champions, and the role of institutions and structure-agency tensions (e.g., Grant et al., 2018b; Savini et al., 2015). The discursive foundations of the MSA and the PE concept are consistent with advocacy planning and communicative planning (Ioannides, 2015; Petridou, 2018); however, specific research on policy entrepreneurship in planning is scarce.

We found that the use of the PE characterization within the MSA helped to clarify the behaviours of our participants. Better understanding of PE qualities and behaviours in planning could offer valuable insights for planning theory and practice. Potentially, encouraging PE traits and tactics among planners is one route to initiating progress to deal with emerging urban challenges. We note, however, that policy entrepreneurship requires knowledge, positioning, and personal qualities not held by all people involved in urban planning: PEs possess "the knowledge, power, tenacity, and luck to be able to exploit key opportunities" (Cairney, 2018). Their close teamwork facilitated social learning on ES within their teams and with their larger communities of practice (Pyrko et al., 2019). Their networks and teams also enabled broader influence within and outside

their organization, as suggested in the theory on organizational knowledge creation (for example, Nonaka, 1992). Because most were working on regional plans that established frameworks for lower-level plans, the PEs were able to secure ES language in high-level policy as an effective tactic.

The research findings are relevant for operationalizing ES and for improved environmental outcomes at the local level. The most effective tactics appear to be framing existing and difficult problems with ES, attention-getting through ES concepts, quantifying ES and ES values, and convening for knowledge sharing. In short, PEs aiming to increase environmental outcomes in planning must draw the attention of decision-makers by making environmental issues apparent and understandable, and showing that cost-effective and reliable solutions exist.

CHAPTER 5: CONCLUSION

5.1 RESEARCH GOAL

The benefits of increasing the amount and quality of urban ES to respond to challenges such as climate change and urbanization have been recognized in planning (Hill, 2016; Hurlimann et al., 2021) and sustainability science (McPhearson et al., 2015; Sirakaya et al., 2018). Research is also revealing that the use of ES approaches can improve urban planning outcomes (Cortinovis & Geneletti, 2018a; Longato et al., 2021). However, with few examples of the practical application of ES approaches in planning to draw on, there is little guidance for increasing their use. In addition, most of the research on the application of ES has been conducted in a European Union (EU) context. Therefore, the aim of the study was to provide insight to urban planning practitioners and urban planning and ES scholars into how urban planners in Canadian cities were applying ES concepts and approaches, and what factors might enable more use.

The central research question was: How and to what effect do the actors in Canadian urban planning apply ES concepts and approaches? The qualitative, exploratory research was conducted via studies in Halifax, Calgary, and Vancouver.

5.2 MAIN FINDINGS

The inquiries presented in this dissertation began with an analysis of the modes of ES use by planners in the three cities, included an examination of the challenges and opportunities for ES use in planning and the identification of a model for the criteria for ES adoption within municipal planning contexts. They concluded with a description of

the tactics of entrepreneurial planners, and how these tactics were used to promote ES to advance environmental outcomes in municipal policy.

5.2.1 Building the case for protecting urban nature

The study utilized Weiss's (1979, 1999) widely applied typology of knowledge use to understand how urban planners in the three cities used ES science. All three types of knowledge use—conceptual, strategic, and instrumental—were employed by the planners in intersecting ways.

Participants conveyed a sense of urgency about the environmental impact of issues such as urbanization and climate change, and most welcomed the opportunity afforded by the ES concept to communicate the value of nature. Moreover, participants working in municipal offices were aware of the need to draw the attention of urban decision-makers to environmental concerns, as decision-makers were also dealing with increasing levels of complex social and economic challenges. Thus, of the three uses for ES, strategic use was most common, and was employed to obtain buy-in from politicians and stakeholders for environmental policies and justify protecting valued ecosystems. The participants also used the ES concept strategically to bridge disciplinary boundaries and in efforts to integrate environmental policies across the municipal spectrum.

ES was used conceptually to connect with the public, urban stakeholders, and politicians in enlightening them about nature's services with language familiar to municipal stakeholders. The ES concept also had a pedagogical role in increasing knowledge among other planners, stakeholders, politicians, and the public about the presence and benefits of urban nature for health and well-being as well as urban prosperity.

Instrumental use of ES science was emerging and apparent in the use of ES assessment tools (iTree, for example), in pilot natural assets assessments promoted by the Natural Assets Initiative (NAI; MNAI.ca), and in the use of ES in high-level policy wording, for example, in requirements to protect greenway systems (as noted in Thompson et al. [2019]). However, instrumental uses of ES involving specialized knowledge and technical expertise (for example, ES mapping, assessments, and quantification) were usually carried out by consultants. The planners working within municipal offices, although enthusiastic about the potential of ES tools to inform planning, were not trained or resourced to apply ES. Predictably, of the participants, the consulting planners were the most knowledgeable about ES.

5.2.2 The criteria for practical fit of ES in urban planning

In this component study, I found that perception of the local relevance of the ES concept and its adaptability within existing planning approaches were the two central criteria for the practical fit of ES—that is, the ability for the ES concept to be adopted within an urban planning context. I synthesized data about the challenges, successes, and potential for adoption of the ES concept into a model that illustrates these criteria and the pathways for ES adoption in planning.

The model was informed by theory from policy science about the uptake of ideas in public policy. Stevenson et al. (2021) proposed that the meagre uptake of ES at the local level was because of its poor practical fit: potential users cannot easily make a connection between the ES concept and how it might be applied in their work. Kingdon (1984, 2003) proposed that new ideas that become part of policy must be technically and fiscally

feasible, and politically and publicly acceptable. The tactics of policy entrepreneurs (PEs; actors who advocate for new ideas and policy changes) are key to adoption of new ideas in policy (Kingdon, 1984, 2003; Mintrom & Norman, 2009; Zahariadis, 2014, 2016).

The model produced in this study suggested that PEs helped decision-makers to see the connection between ES approaches and municipal problems. They were using tactics (for example, framing existing municipal problems with the ES concept) to convince others (politicians or colleagues, for example) of the relevance of ES concepts and approaches for municipal planning. The PEs also orchestrated the adaptation of ES approaches (for example, the incremental addition of salient elements of ES such as ES language, or small-scale ES assessments) into existing planning approaches such as the incorporation of green infrastructure within the network of the built urban form.

5.2.3 A closer look at the tactics of policy entrepreneurs

In the final study, I built on the findings of the previous study in which PEs were seen to be influencing the adoption of ES approaches through their tactics. I identified 11 PEs by their qualities (persistence, resourcefulness, expertise, ability to influence policymakers, and social acuity) from the group of 31 research participants. Next, I delineated their tactics and interpreted the reasons for those tactics through the lens of the MSA, a conceptual model for the agenda-setting phase of public policymaking (Kingdon, 1984; 2003). Kingdon (1984, 2003) suggested that policy adoption is most likely when the three process streams of policy-making—problem, political, and policy—are coupled, which occurs when a recognized problem is matched with an acceptable policy response and the political situation is conducive to adoption. PEs are hypothesized to be important in bringing about policy change by engineering the coupling (Winkel & Leopold, 2016).

The study showed that the PEs were using ES tactically, in attempts to partially couple the process streams, with the goal of full coupling of the streams and the adoption of policies to improve environmental outcomes. Tactics included groundwork activities to familiarize others with ES and environmental issues, and activities that exploited some of the qualities of the ES concept: framing problems with ES; attention-getting using ES visuals, words, and stories; quantifying ES to supply persuasive evidence; and convening with others to build understanding. Knowing that politicians are concerned with multiple issues and highly aware of fiscal accountability, the PEs used ES to frame environmental issues and initiatives with an economic lens. Although ES concepts and wording had been inserted into guidance documents and high-level policy, there was only one instance noted (in Calgary) at the time of the study where policy change had occurred because of the PE's efforts.

5.3 Contributions

The research makes three substantial contributions to the research on ES and on the entry of ideas like ES into the urban planning context: it enhances the knowledge base on how ES is applied in urban planning, clarifies pathways for the introduction of ES and other ideas into the urban planning context, and reveals an important role for PEs in advocating the use of ideas such as ES in urban planning. In addition to adding to knowledge on the application of ES, these contributions are valuable for understanding the uptake of ideas in urban planning in general.

Before describing the research contributions, I want to reflect upon the adoption of ES in urban planning and how the insights may be transferrable beyond that concept. These

relate to the research findings but also have implications for the research contributions and my recommendations.

The ES concept has brought the ideas of human dependence on natural structures and functions and the necessity of gathering ecosystem data for informing land-use decisions to a global audience (Costanza et al., 2017). However, principles based on these ideas have a long history in environmental planning and are reflected in the way that environmental planning is conducted and in the language of urban planning policy in Canada (Thompson et al., 2019; Thompson et al., 2020).

It should be acknowledged that the ES concept has advanced understanding of ecology and land use and has the potential for improving environmental planning, for example, through its comprehensiveness as well as its potential to connect land-use change with well-being, assess trade-offs in decision-making, and account for human beneficiaries (BenDor et al., 2017; Thompson et al., 2019). However, there are major challenges with applying ES that have been recognized but not resolved, including the extent of adaptation of practice required for ES adoption and the lack of knowledge and technical capacity in local municipal planning offices.

Suggestions for incorporating explicit ES approaches into urban planning have noted the need for new ES tools suitable for use in planning (for example, Jax et al., 2018) but not satisfactorily addressed how to orchestrate the integration of these tools within the institutionalized, local contexts of urban planning (Scott, 2020). It is difficult to see how even minor changes to planning processes to include environmental considerations can be accomplished while an increasing number of complex urban problems (growth, housing

affordability, and social inequity, for example) are presenting themselves for urban planners and politicians to attend to. This may be in part why environmentally oriented PEs such as the participants in this study have attached themselves to ES concepts to effectively connect with politicians in the face of competing issues.

Additionally, a lack of ecological knowledge among urban planners and limited technical and resource capacity of local planning offices are impediments to the adoption of ES approaches, especially for the instrumental uses of ES such as assessments. Knowledge and capacity issues are implicitly acknowledged in the ES research literature by way of recommendations that ES tools formulated for use in urban areas must be enabled with the assistance of specialist expertise (Grunewald et al., 2021) or scientific knowledge brokers (Jax et al., 2018). A lack of human resources, including ecological knowledge and technical skills, were cited by participants in this study as reasons for the technical aspects of instrumental use of ES to be contracted out to external consultants. However, even with the presence of consultants to handle ES assessments, challenges remain—of sustaining the monitoring and assessment of ES over the long term and providing meaningful, ongoing input to policy. As Costanza et al. (2017) stated, there is a need to "continuously gather and integrate appropriate information regarding ES, with the goal of learning, adapting and better inform [sic] policy" (p. 10).

Moreover, planning theory and practice is characterized by the constant flow of new ideas and approaches (Harris and Moore, 2013). For instance, over the eight years of this dissertation work, the ES idea has been challenged by the related concept of Nature's Contribution to People. In the application of sustainability science in urban areas, the focus has shifted recently from ES to NbS (Remme et al., 2024). ES may become

established as a core idea for urban environmental planning, or it may be supplemented or displaced. Possibly, as Hill (2016) maintains, climate change itself will be the driving force for a new, emergent urban environmental planning to respond to rapid and permanent change.

If impediments related to adaptation and capacity cannot be overcome, or if other approaches supplant ES in popularity, the widespread adoption of ES in urban planning may not be achieved. The ES concept would still be of value, even if limited to use in selected tools to support planning processes or in the strategic use of ES terms and ideas, as participants in this study shared. I discuss the research contribution and recommendations with that possibility in mind. Therefore, what may be the most lasting contribution of this study relates to the broader picture of how new ideas enter planning practice and policy and how the actors in planning make use of them.

5.3.1 Enhancing the knowledge base on how ideas like ES are used

The study achieved its goal of contributing to the understanding of the use of the ES concept and approaches in urban planning in Canadian urban planning contexts. The research complements previous studies on the uptake of ES in urban plans and practices in other locations, primarily the European Union (EU) (e.g., Cortinovis & Geneletti, 2018a; Khoshkar et al., 2020a). The findings on ES use were largely in agreement with the findings of other studies about the conceptual use of ES for awareness and education (Beery et al., 2016), its strategic use, especially as a boundary object (Ainscough, 2019), and the limited and often slow uptake of instrumental ES use (McKenzie et al., 2014). The finding that strategic use was predominant was linked with policy entrepreneurship and laid the groundwork for other contributions of the research, discussed later.

The research also establishes an understanding of the application of ES in urban planning in a Canadian context. Although urban planners and planning processes globally have much in common, there are distinct differences related to geographic contexts and planning systems. Most of the research into the application of ES in planning has focused on the EU. A better understanding of its application in Canada is required should the application of ES become popular or required at the local level in Canada, the latter of which may come about, for example, through federal or provincial requirements, or through the downloading of responsibilities to municipalities.

Additionally, as one of the first inquiries in this topic area in Canada, the study lays the groundwork for more Canadian research on ES that may provide other areas of the world with guidance on ES related to climate-change response. Canada is experiencing warming from climate change at about double that of the global average (Bush & Lemmen, 2019). Climate change impacts and the dramatic growth of Canadian cities from rural to urban migration and international immigration are putting Canadian urban planners under intense pressure to respond with proposals for effective adaptation measures and to protect and enhance ES flows in urban centres. The understanding that this research brings can help to support these kinds of planning decisions and actions. For example, the initiatives of PEs within local governments will likely be key to developing climate change responses that are suited to the local context.

5.3.2 Clarifying the criteria and pathway for adoption of new ideas in planning

The second main contribution of this research was to clarify the criteria for the adoption of ES (perceived relevance and adaptability to existing processes), show how these were related, and demonstrate the role of PEs in facilitating adoption (or the role of time in eventual uptake). Most of the research on the application of ES in planning has produced insights into challenges, barriers, and opportunities for uptake, with recommendations for research and for actions by decision-makers (for example, Grunewald et al., 2021; Rall et al., 2015). However, information and recommendations like these have limited utility for practicing planners or researchers to further uptake of ES, because they do not provide a clear overview of the essential criteria and main pathways for adoption, and they may require wholesale adjustments of planning processes.

This study complements other research in knowledge transfer in environmental sustainability about the criteria for the adoption of knowledge, for example, Posner et al.'s (2016) research on the knowledge attributes that most influence the policy impact of ES science. As well as providing general principles for the adoption of ES, the model may be relevant for the adoption of other new ideas into planning and other practical contexts.

5.3.3 Identifying the actions of planning PEs to promote ideas like ES

The most novel contribution of the research was the identification of PEs and their tactics to promote ES in urban planning to further environmental outcomes. The explicit notion of policy entrepreneurship is not a significant area of study in planning practice and

theory (Ioannides, 2015) nor has there been substantial focus on PEs in the ES research literature (except for examples like Ferraro et al. [2015] and Bussola et al. [2021]). The contribution is significant because the entrepreneurial qualities and tactics PEs apply are especially relevant and required as climate change impacts continue, and the urban planning profession is confronted with other major changes and challenges such as social inequity and political division.

Additionally, the study contributed to testing the utility of aspects of the multiple streams approach (MSA; Kingdon, 1984, 2004), although limited by the small sample size and the post-hoc analysis, which meant that research questions were not created with the possibility of policy entrepreneurship in mind. There have been few analyses using the MSA in local government contexts, in contrast with its main application at the national and regional levels. The MSA was found to be a useful analytical framework that helped to make sense of the actions and motivations of the planning participants in promoting ES to advance environmental issues in policy development in the cities. The study is a modest contribution to planning theory about the practices and strategies planners use in their work, which is an understudied area of planning, in comparison with the attention spent on plans, according to Forester (2011).

5.4 RECOMMENDATIONS

The study recommendations are presented in three categories: research, practice, and education, although in some cases, recommendations relate to more than one of these focus areas. Some of the recommendations relate directly to the findings of the component studies in the dissertation, and some were developed in response to issues or

unanswered questions that were encountered over the course of the research and that are worthy of further investigation.

5.4.1 Urban Planning Research and ES Research

There are relatively few studies on the use of ES in urban planning, and more research is needed in this area to provide a fuller picture of the practical application of ES. Different approaches that allow researchers to become closer to the social processes involved would be helpful. For example, although my approach to the research was ethnographically oriented, it was not an ethnography. An ethnographic study of the use of ES approaches in an urban planning department, employing participant observation over a suitably longer period, would provide a richer data set, allow a fuller appreciation of the behaviours of planning actors, including politicians, account for the multiple contexts for planning, and provide more insight into the actions of PEs.

Study participants noted the outsourcing of ES work to consultants. Outsourcing of planning work has become common in municipal planning offices (Momani & Khirfan, 2013). However, there are significant gaps in our understanding of the work of private-sector planning consultants, including their role in shaping public policy (Linovski, 2019; Loh & Norton, 2015), and what negative impacts outsourcing is having on planning processes, including on social learning and capacity building within public planning offices (Loh & Norton, 2015). Gaining an understanding of the role and impact of outsourcing of municipal planning work could be a component of an ethnographic study in a planning department.

Practicing planners are often not able to access relevant research from planning research communities about advances in knowledge for planning. I noted from the responses of participants that there is a lack of access to a breadth of research and practice guidance on the use of ES, corresponding to the research-practice gap that has been noted in planning generally (Krizek et al., 2009). The problem of lack of access to ES research needs to be addressed. The PEs in the study referred to convening ES knowledge holders, attending conferences, and networking with other ES users to share knowledge. In addition, municipal planners are recommended to convene an ES community of practice (for interdisciplinary knowledge-sharing) or connect with an existing community of practice, based on Wenger's (2000) principles for knowledge-sharing and mutual learning.

In complementary work, it would be valuable to design and conduct a collaborative research project that builds on the study findings about the criteria and pathways to ES adoption. Such a project would involve ES researchers and practicing planners in understanding planners' needs for relevant and adaptable ES knowledge and guidance and would include an assessment to determine whether the inclusion of ES in policy produces better environmental outcomes on the ground.

Research on policy entrepreneurship in planning is a relatively unexplored area. The study findings about the involvement of urban planning PEs suggest that more research into policy entrepreneurship in urban planning would be fruitful in expanding the planning literature about the role of planners in advocating certain positions and for initiating change. For ES research, further understanding of the role of PEs in any discipline (environmental science, or ecology for example) in promoting ES and other

approaches (such as NbS) could advance environmental outcomes in other contexts and at other levels of governance.

5.4.2 Planning Practice

Where it is applicable and acceptable, municipal planning departments should seek to hire new planners with PE qualities, and to encourage PE qualities in planning staff to support the advancement of novel ideas such as ES in planning. Generating change from within is especially important in enabling innovation in institutional planning contexts, where swiftness in responding to environmental, political, and social change needs to be developed. In addition, and relating to the need for innovation in planning, municipal planning units should consider investing in more experimental and pilot work to incorporate GI or NbS (Frantzeskaki, 2021). Partnership with research institutions or NGOs is valuable when municipal capacity is an issue in experimentation or piloting of GI (for example, as Murphy et al. [2023] describe).

Whether or not ES is further adopted more extensively into urban planning, there are some aspects of the concept that have the potential to improve urban environmental planning if implemented. Among the aspects that have high relevance for urban planning are:

- The role of ES for ecosystem health assessments, as demonstrated in DeLoyde & Mabee's (2023) study
- The multifunctionality of natural and semi-natural ecosystems in urban areas (Connop et al., 2016), including the role of cultural ES in supporting mental and physical health and sense of place

- The linkages between ES supply, ecosystem health, and human health (Elmqvist et al., 2015)
- The notions inherent in ES of beneficiaries and social values, as demonstrated in Nijhum et al.'s (2021) case study
- The ability to address equity issues though ES supply (Cortinovis & Geneletti, 2018b)

In line with the research findings, PEs may choose to frame the above notions to demonstrate their relevance for planning, and to work with municipal staff or researchers to develop methods for the adoption of suitable methods in planning practice.

The participants revealed the lack of investment and the need for cross-jurisdictional collection and monitoring of environmental data on ecosystem health in urban areas. Having ecological planning specialists on staff with the knowledge to apply ES in urban planning and the ability to integrate ES knowledge into planning processes would help to bridge these gaps.

5.4.3 Planning Education

Although Canadian urban planners are receptive to the idea of ES concepts and approaches (Tang Kai et al., 2022), as others have pointed out (Steiner, 2018) there appears to be a lack of deep understanding of ecological concepts in the urban planning profession, and therefore an inability to apply these concepts in practice and integrate them with other areas of planning practice. The lack of ecological knowledge by other planners was noted by some participants, and was behind the conceptual use of ES. Therefore, training for urban planners should at a minimum include fundamentals about

the ecological-human connection, so that planners have a good general understanding of environmental principles in planning. Increasing the ecological content of planning education may be limited by the number of trained instructors in this subject area, and the additional burden of increasing the already broad scope of planning education. Ideally, the number of planners who are trained as ecological planning specialists with knowledge about ES and who intend to work in urban planning should be increased.

There are opportunities for researchers in ES to link with planning schools for the education of professional planners, in developing curricula for the teaching of ecological principles during university planning education, and for continuing professional education in planning. The Professional Standards Board (PSB) for the planning profession in Canada should increase the required competencies for planning education practice to include more ecological knowledge training, including on ES, which would align with recent policy developed by the Canadian Institute of Planners (CIP) to support and encourage planning professionals to respond to climate change and to create healthy communities (CIP, 2024).

5.5 Conclusion

The research included three linked studies in municipal planning contexts to investigate the modes of ES use by planners, the criteria for ES adoption within municipal planning contexts, and the tactics that entrepreneurial planners used to promote ES to advance environmental outcomes in municipal policy. The research increased knowledge on how ES is applied in urban planning, clarified pathways for the introduction of ES and other ideas into the urban planning context, and revealed an important role for policy entrepreneurs (PEs) in advocating the use of ideas such as ES in urban planning. These

contributions are valuable for understanding the application of ideas in urban planning in general. In addition, the research prompts suggestions for avenues of research in planning and ES science and for improving planning practice and education, whether or not the use of ES in planning increases.

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APPENDIX A ETHICS APPROVAL

Social Sciences & Humanities Research Ethics Board
Letter of Approval

June 28, 2019

Katherine Thompson
Architecture & Planning\School of Planning

Dear Katherine,

REB #: 2019-4787
Project Title: The innovative application of ecosystem services concepts in Canadian urban planning

Effective Date: June 28, 2019
Expiry Date: June 28, 2020

The Social Sciences & Humanities Research Ethics Board has reviewed your application for research involving humans and found the proposed research to be in accordance with the Tri-Council Policy Statement on *Ethical Conduct for Research Involving Humans.* This approval will be in effect for 12 months as indicated above. This approval is subject to the conditions listed below which constitute your on-going responsibilities with respect to the ethical conduct of this research.

Sincerely,

Dr. Karen Beazley, Chair

Post REB Approval: On-going Responsibilities of Researchers

After receiving ethical approval for the conduct of research involving humans, there are several ongoing responsibilities that researchers must meet to remain in compliance with University and Tri-Council policies.

1. Additional Research Ethics approval
Prior to conducting any research, researchers must ensure that all required research ethics approvals are secured (in addition to this one). This includes, but is not limited to, securing appropriate research ethics approvals from: other institutions with whom the PI is affiliated; the research institutions of research team members; the institution at which participants may be recruited or from which data may be collected; organizations or groups (e.g. school boards, Aboriginal communities, correctional services, long-term care facilities, service agencies and community groups) and from any other responsible review body or bodies at the research site

2. Reporting adverse events
Any significant adverse events experienced by research participants must be reported **in writing** to Research Ethics **within 24 hours** of their occurrence. Examples of what might be considered "significant"

include: an emotional breakdown of a participant during an interview, a negative physical reaction by a participant (e.g. fainting, nausea, unexpected pain, allergic reaction), report by a participant of some sort of negative repercussion from their participation (e.g. reaction of spouse or employer) or complaint by a participant with respect to their participation. The above list is indicative but not all-inclusive. The written report must include details of the adverse event and actions taken by the researcher in response to the incident.

3. Seeking approval for protocol / consent form changes
Prior to implementing any changes to your research plan, whether to the protocol or consent form, researchers must submit a description of the proposed changes to the Research Ethics Board for review and approval. This is done by completing an Amendment Request (available on the website). Please note that no reviews are conducted in August.

4. Submitting annual reports
Ethics approvals are valid for up to 12 months. Prior to the end of the project's approval deadline, the researcher must complete an Annual Report (available on the website) and return it to Research Ethics for review and approval before the approval end date in order to prevent a lapse of ethics approval for the research. Researchers should note that no research involving humans may be conducted in the absence of a valid ethical approval and that allowing REB approval to lapse is a violation of University policy, inconsistent with the TCPS (article 6.14) and may result in suspension of research and research funding, as required by the funding agency.

5. Submitting final reports
When the researcher is confident that no further data collection or participant contact will be required, a Final Report (available on the website) must be submitted to Research Ethics. After review and approval of the Final Report, the Research Ethics file will be closed.

6. Retaining records in a secure manner
Researchers must ensure that both during and after the research project, data is securely retained and/or disposed of in such a manner as to comply with confidentiality provisions specified in the protocol and consent forms. This may involve destruction of the data, or continued arrangements for secure storage. Casual storage of old data is not acceptable.

It is the Principal Investigator's responsibility to keep a copy of the REB approval letters. This can be important to demonstrate that research was undertaken with Board approval, which can be a requirement to publish.

Please note that the University will securely store your REB project file for 5 years after the study closure date at which point the file records may be permanently destroyed.

7. Current contact information and university affiliation
The Principal Investigator must inform the Research Ethics office of any changes to contact information for the PI (and supervisor, if appropriate), especially the electronic mail address, for the duration of the REB approval. The PI must inform Research Ethics if there is a termination or interruption of his or her affiliation with Dalhousie University.

8. Legal Counsel
The Principal Investigator agrees to comply with all legislative and regulatory requirements that apply to the project. The Principal Investigator agrees to notify the University Legal Counsel office in the event that he or she receives a notice of non-compliance, complaint or other proceeding relating to such requirements.

9. Supervision of students
Faculty must ensure that students conducting research under their supervision are aware of their responsibilities as described above, and have adequate support to conduct their research in a safe and ethical manner.

APPENDIX B INTERVIEW SCRIPT

Role of the individual

Please describe your role in urban planning in [city].

Understanding of ES concept

What does the term "ecosystem services" mean to you?

How did you learn about the application of ES concepts [in urban planning]?

How does the ES concept relate to your [professional; educational; personal] background?

Projects they are aware of that have employed ES ideas

How have you applied the concept of ES in your work?

Please tell me about your experiences with ES tools, [such as iTree] if you have used them.

Have you seen the concept of ES applied by other people in your planning group, or in other places?

Rationale for use of ES ideas

Why do you think that [city] has chosen to apply ES concepts and similar notions?

Were you part of that decision?

If so, how did you decide to apply ES ideas?

Assessment of utility of ES ideas

How does the ES concept compare with other concepts you use as a planner? Does it help us to make better decisions or better plans and policies compared with other concepts?

What do you see as the strengths or weaknesses of ES approaches for urban planning?

Do you consider the ES concept to be useful for urban planning?

Has using ES approaches changed the way you think about your work?

Conclusions

Who else can I talk to in [city] about this concept?

Is there anything else that you'd like to share?

APPENDIX C FOCUS GROUP SCRIPT

Introduction

How did you come to settle on the ES approach applied in this project(s)?

What would be a more typical approach?

How is the ES approach different from your usual approaches?

Did the application of an ES approach change the way you worked as a team? How?

Do you think having different roles or different backgrounds changes the way you think about ES and related ideas, or apply them?

What difficulties or barriers did you encounter with the application of the ES concept within your organization?

What factors contributed to the [success or failure] of the use of the ES concept for planning in [city]?

Exercise: identifying type of ES use

I will define and summarize three categories of use of a concept: conceptual, strategic or political, and instrumental (see table, following). Participants will engage in a group exercise of breaking down their engagement with the ES concept by giving examples of each kind of use.

Conclusions

How has the application of the ES approach changed planning policy or planning outcomes in [city]?

What are the main things you have learned about the application of ES ideas in the urban planning process?

Do you consider that applying the ES concept in [city] was a success? What made it a success?

What opportunities can you see for the application of ES concepts in [city] in the future?

What advice would you give others thinking about applying an ES approach?

Would you be an advocate for implementing ES ideas in urban planning? Explain

Is there anything else you would like to add?

Examples of use to share with focus group participants

Conceptual use	**Strategic use**	**Instrumental use**
Did you or anyone else learn something from using the ES idea?	Did you notice that an ES approach was persuasive in getting a plan or policy approved or in getting people onside with a plan or policy?	Did an ES approach help you to design a plan or policy, or improve the effectiveness of a plan or policy?
Did you use the idea to convey something new to citizens, politicians, or other planners?	Did you find that scientific information about ES helped to mediate a dispute, or to escalate it?	Did you use scientific information on ES to clarify tradeoffs, or to help decide among options?
Did you use the concept to get a point across?		Did the use of ES influence any plans?
Did information about ES affect how you think about planning processes?		