

**Learning Plans for Learning Communities:
Adaptive Management applied in the Urban Planning Context**

by

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Abstract

Over the past few decades natural resource policymakers and managers have embraced adaptive management as a means to ensure that policies continue to meet the goals and objectives for which they were originally designed. As practical realities change in a static policy environment, policy decisions originally intended for one purpose can end up being clumsy, outdated, and impractical. But in the dynamic policy environment of adaptive management – increasingly found in the natural resources field – active learning is a guiding principle, decisions are viewed as experiments in order to yield progressive improvement over time, and mechanisms are in place to trigger policy changes in response to changes on the ground.

Like natural resources, urban social problems change over time, and policies do not always keep pace; they may even become so out of synch with original objectives that they are at odds with facilitating practical, affordable solutions to urban social problems. Can knowledge gained through experience with adaptive management in the natural resource environment be applied to the urban social environment?

This report explores the application of adaptive management principals used within the natural resource policy framework to the urban social policy framework. It is also an exploration into other methods of linking management and policymaking to action in a dynamic way. Finally, in order to illustrate how the adaptive management approach works in an urban context, it examines the implementation of adaptive management principals in three different municipalities.

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1.0 Introduction

Land use planning has evolved over the past two centuries from a response to urban public health problems to a highly complex management system for cities and regions. Planners are called on to anticipate and respond to a tremendous range of issues from new construction, to conflicts over public space, to exploding concerns about the environment. In addition, expanding technical knowledge, growing public expectations, politics, and public opinion exert great influence on the work of urban planners. All of these factors have conspired to create a contemporary urban planning environment of unprecedented complexity, uncertainty, and change.

Despite the fact that planning issues today are anything but simple and straightforward, predictability and certainty remain the coveted objectives within urban planning of what has long been considered good management. Planners often use prescriptive municipal bylaws, codes and other regulations in an attempt to force some measure of predictability and certainty into the increasingly complex world of urban planning (Guttenberg 1993 and 2002).

More and more, failed urban social policies are demonstrating the limitations of this traditional prescriptive management approach in today's rapidly evolving environment. When regulations undergo review, changes take years to implement, as municipal staff is already struggling to keep up with base workload, much less the rewriting of outdated codes and bylaws; bureaucratic processes and political interests take their toll; and learning encounters resistance. Revisions happen far too slowly to keep up with the rate of societal evolution, and by the time changes are finalized they may already be obsolete. Thus the cumbersome process continues.

Some intrepid planners have begun to depart from command-and-control strategies in order to incorporate increasingly diverse groups of stakeholders and respond to growing threats to environmental health and sustainability. However, management decisions continue to support urban policies that take a static broad-brush approach (McMahon 2001). Individuals within agencies may find ways around the hurdles and

shepherd new ideas through the bureaucracy via personal channels, but without an institutional champion (or the threat of litigation), innovation is nearly certain to run into a dead-end.

Studies in the field of natural resource management have clearly illuminated how the prescriptive approach falls short of achieving successful and timely results. A 1986 examination of twenty-three managed ecosystems led to the conclusion that “any attempt to manage ecological variables (e.g., fish, trees, water, cattle) inexorably led to less resilient ecosystems, more rigid management institutions, and more dependent societies” (Holling 1995, 6). These results caused great pause for natural resource managers, and led to the emergence of adaptive management as an attempt to increase the resilience of ecosystems through management experiments.

Adaptive management of natural resources has proven effective and, at its best, can result in “an abrupt reevaluation of the fundamental source of the problems, a redirection of policy toward restoration, and implementation of a process of planning and management that provides continually updated understanding as well as economic or social product” (Holling 1995, 3).

The urban social policy arena lags far behind the ecological planning arena in terms of experimenting with adaptive policy and management. In response, this professional project has been prepared for a hypothetical client such as the Canadian Federation of Municipalities, or some similar organization of municipalities. Its overall objective is to help the client organization’s members understand the broad concepts and potential relevance of adaptive learning within urban planning contexts. The more specific goals of this report are:

- To review the basic concepts and synthesize relevant literature on adaptive management and related approaches to ongoing learning for relevance to urban municipal planning; and

- To use the above analysis to explore an approach to urban policy planning and management in which learning is central through discussion of some case examples.

This report is organized in the following manner. Section 2 discusses the origins and definitions of adaptive management, explores other related approaches to adaptive learning and governance, and examines an illustrative adaptive management case study. Section 3 outlines the framework for the convergence of adaptive management and urban planning: it identifies current planning issues and challenges, and discusses the relevance of adaptive management for urban planning on individual and agency scales. Section 4 lays out indicators for the review and assessment of urban adaptive management strategies, and applies these indicators to three case studies in urban planning: housing in Vancouver, Canada; stormwater management in Portland, US; and neighbourhood development in Ballerup, Denmark. Finally, Section 5 draws conclusions about the contribution of adaptive management to urban planning, recommends policy development to support adaptive learning, and suggested four specific areas for further academic research.

2.0 A Learning Approach to Management

2.1 Adaptive Management Defined

In natural resource planning, the adaptive management approach has been used with some success over the past few decades. In short, adaptive management takes a learning approach to management. It asks, how can our policies reflect certainty if our understanding is uncertain? In adaptive management, the uncertainties that exist are made explicit, and as knowledge unfolds over time, changes are made to management strategies that respond to the new knowledge. Ideally, from a broad public policy viewpoint, representative stakeholders are involved who make clear their values and objectives, and together discuss the tradeoffs necessary to come up with balanced and workable management policies reflecting agreed-upon goals that specifically embrace learning.

Adaptive management calls for dynamic management strategies that allow for changing practices (Oglethorpe 2002). C.S. Holling engaged in thinking in terms of adaptive management in the 1970s when his and his colleagues' and students' work on modeling ecosystems led them to the concept (1978). The work has been furthered and refined over the years, primarily through case studies involving large-scale ecosystems (Lee 1993; Gunderson et al 1995). In 1990, Carl Walters with Holling drew the distinction between active and passive adaptive management. In essence, active adaptive management involves the *purposeful perturbation* of systems in order to scientifically monitor and learn from the responses, and subsequently adapt management practices accordingly. Passive adaptive management involves the *inference* of system dynamics in response to management practices, and continued monitoring, learning and adjusting of practices over time. The analysis contained herein does not generally distinguish between the two, unless otherwise stated.

The key features for implementing adaptive management strategies are very similar to those outlined as key to any policy making process: 1) Define the problem; 2) Assemble evidence; 3) Construct alternatives; 4) Select criteria for judging outcomes; 5)

Project the outcomes of alternative strategies; 6) Consider the tradeoffs and uncertainties; and 7) Recommend a decision (adapted from Bardach 2000). The primary difference is that learning itself becomes an explicit objective (McDaniels & Gregory 2004).

Adaptive management is problem or goal-oriented. Unfortunately, politics, routines, and public opinions can get in the way of good goal-oriented policy development. “A weak understanding of the goals is very problematic, especially when it comes to analyzing the tradeoffs and coming to a compromise solution” (Baskerville 1995, 98). This situation is all-too-common. When citizens are accustomed to particular processes and procedures, there is resistance to changing them even when the change is needed to keep the process in line with the fundamental goals & objectives.

Stakeholder participation in management decision-making is critical, however, especially at early stages of idea-formation. Participation from a broad representation of stakeholders – including from informal networks – is important to increase the likelihood of good, consensual decisions and longstanding cooperation (Light, Gunderson & Holling 1995). Adaptive management case studies have found that informal networks can be key initiators of new ideas and understandings.¹

It is also important to note that adaptive management has been said to justify experiments that lead to perceived inequitable gain for one party’s interests (economic or otherwise).² If the accusation proves accurate, it is likely due to deficient stakeholder involvement, or other imbalance related to a lack of consideration and balancing of representative interests in the decision-making approach.

¹ Examples of cooperating networks include formal agreements such as memoranda of understanding, informal shadow networks and consortia, NGOs, ad-hoc groups, and meshing organizations such as technical oversight committees.

² For example, the Sitka Conservation Society (Alaska) monitors – among other things – activities in the Tongass National Forest. A draft environmental impact statement for a new forest management plan contains a rubric of adaptive management that shifts required protections for a number of resources including fish and wildlife and karst (limestone cave areas) to an approach which permits the agency to use a much less stringent approach (Fields 2007). The fear is that the adaptive management approach is being used in order to more easily weaken protective practices that have been hard-fought through years of political lobbying. Yet the true question is how well forest practices have been working to address environmental, social, and economic needs of the broad community, and whether the politics can be sufficiently shifted from positioning to negotiating in order to create better practices. It is not adaptive management, per se, that is the issue, but the ability of the community to productively negotiate, implement, monitor, and adapt management practices through ongoing dialogue and experimentation amidst a history of longstanding political rifts and mistrust.

2.2 Sustainable Development and Other Approaches to Adaptive Governance

The most commonly-used definition of sustainable development came in 1987 with the Brundtland Commission: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” However, when it comes to defining what it means to ‘do’ development sustainably, strategies vary widely and at times conflict (Dale 2001).

There is growing consensus that sustainable development refers to a process involving adaptation, change, or evolution over time (Holling 2001; Jokinen et al 1998; Rammel and Van Den Berg 2003). Instead of a fixed point in time when any sustainable development is ‘done,’ there is instead an ongoing process that changes its form over time as human knowledge changes. Sustainable development and adaptive management are arguably inextricable from one another. C. S. Holling refers to sustainable development as the goal of “fostering adaptive capabilities and creating opportunities” (2001). Learning to manage adaptively is key to implementing the sustainable goals that are now widely articulated at various scales of governance.

Another way of referring to the process of adaptation in management and governance is the term ‘reflexive governance.’ Reflexive governance is the response of society to the huge complexity of today’s problems with their varying scales, interconnectedness, and cascading effects across time and domain (Knoflacher and Gigler 2004). In their exploration into reflexive governance, Knoflacher and Gigler point out “The studies demonstrate that managing regeneration adaptively enables stakeholders to deal with inherent uncertainty more successfully and can contribute to sustainable outcomes even in a setting where sustainability is not an explicit goal” (2004).

Closely related to adaptive management, ecosystem-based management is yet another strategy that addresses complexity by encouraging democratic and dynamic management. Slocombe’s (1998) ecosystem-based management goals are highlighted in Figure 2.2-1.

Like adaptive management, ecosystem-based management is a departure from previous command and control strategies. It is also a reaction to environmental management plans which did not adequately protect the urban environment due to a project-by-project focus and corresponding lack of jurisdictional coordination (UNU/IAS 2003).

Figure 2.2-1. Goals of Ecosystem-Based Management
(Slocombe 1998)

Normative	Imply and reflect specific values and limits
Principled	Reflect 'higher' values and ethical principles and rules
Integrative	Reflect the wide range of interests, goals and objectives that exist
Complex	Work with, not artificially reduce, complexity
Dynamic	Accept and recognize the inevitability of change
Transdisciplinary	Synthesize a wide range of information and knowledge
Applicable	Be applicable to a wide range of ecosystem types and conditions
Participatory	Involve people and actors
Understandable	Be explainable and operationalizable in a consistent way to different people and groups
Adaptive	Be evolving as conditions and knowledge change

Other models exist, such as participatory governance. These models do not necessarily focus on the central issue of adaptability, but they do provide guidance on inclusive and dynamic forms of leadership and management.

With all these ingredients for good governance, the task seems to be straightforward: simply use the recipes above in the practice of municipal planning and

management. And yet, this intersection of governance and planning can be a treacherous one. Can these principals be pragmatically applied to local planning practices?

Planners often do perceive their role as having the power to effect change. Angeles and Gurstein put it this way: “Like politicians and governors, planners have also adapted and learned to perform increasingly varied roles as advocates, policy analysts, facilitators, negotiators, and problem-solvers, and in the process, have become more comfortable in dealing with power, and in acknowledging and exercising their own power” (2007, 4).

Planners work in service to public interests, and “...the articulation, communication, and mobilization of those public interests are key in bringing about deliberate and controlled changes so as to keep societies and communities on a stable, peaceful, and orderly course” (Angeles and Gurstein 2007, 4).

The process of defining those public interests is anything but simple and straightforward, and thus, there is a strong need for an adaptive management approach to the inherent complexity and change involved in the work of the planner.

2.3 An Adaptive Management Experiment

Following is an example of one partially successful adaptive management experiment that took place with a group in New South Wales, Australia. Because all of the research explicitly focused on the implementation of adaptive management stems from the natural resource management field, this experiment is used as an illustrative example to help draw theoretical parallels between natural resource management and management in an urban social context.

The objectives of the New South Wales projects were to evaluate certain water management plans and strategies. A published article then examined the projects “to evaluate the contribution of the adaptive management approach to water cycle management on the urban fringe in New South Wales” (Gilmour et al 1999).

The three projects all involved a series of workshops with local stakeholders. The projects were clearly framed in the context of experimentation and learning. Their goals were three-fold (Gilmour et al 1999):

1. To meet doubts about the wisdom of adaptive management by acknowledging the difficulty of managing ecosystems;
2. To create a platform for follow-through by framing workshop-based policy investigations as negotiations; and
3. To reduce vulnerability to institutional change by developing community ownership of strategies.

The project organizers were successful in their first goal, largely through explicit discussions about uncertainties, risks, and the dual roles of judgement and science. However, the second and third goals were more challenging.

Each sponsoring organization chose the adaptive management approach as potentially the best way to choose a solution with broad community support. Yet, “none of the sponsors appeared to have thought through the issues involved in implementing the workshop outcomes” (Gilmour et al 1999). The organizers would have, in retrospect, worked to get commitment at the beginning from sponsoring organizations to implement the results of the workshop if consensus was reached, and placed more emphasis on the workshops as forums for negotiation.

One of the key lessons learned in this project had to do with the critical role of an “institutional champion” in addition to generating institutional buy-in. This manager of a sponsoring organization would participate in all three project phases (one to lay the groundwork for the workshops, one to carry out the workshops, and another that focuses on the implementation of workshop recommendations), and help to cultivate community participation and buy-in. They found that without such a person, the pressure against continuation of the adaptive management process would be too great, and it would not succeed.

In all three of our projects, political pressures to create broadly acceptable solutions made a participatory process attractive to the lead institutions. Yet, having achieved a degree of consensus, with a resulting reduction in political pressure, each lead institution scaled back the level of community involvement. There is a tendency to revert to familiar, less inclusive processes, and this works against the long-term needs of ecosystem management (Gilmore et al 1999).

Having a strong institutional champion, they felt, would reduce this tendency. They also suggested an approach which included building community development into the stakeholder workshop process, in order to build skills that result in holding stakeholders accountable to one another over time.

This experience of the New South Wales group points to the critical role of institutions and those who lead them in order to develop widespread support for adaptive management principles. While the science, data, stakeholder involvement, and many other factors are very important, it is in the institutional realm that there seems to be the greatest gap between the theory of adaptive management, and the extent to which it is carried out on the ground.

This gap is highlighted in the context of current US water laws by Neuman, a professor at Lewis and Clark College. Here, rights for water are forfeited if not used within a prescribed period of time. Efficiency (for instance, through conservation), is trumped by the seemingly major goals of predictability and certainty. In order for this system to embrace the principles of adaptive management, it would, in short, need to follow effective decision-making guidelines as mentioned earlier, and incorporate explicit objectives that include social, ecological, and economic values and information (Neuman 2001).

The New South Wales example puts the implementation of adaptive management principles in context, and illustrates the importance of focusing on institutions and those who lead them in order to shift policy practices toward adaptive management in any substantial way. Developing a strong theoretical perspective on the intersection of urban

social policy and adaptive management will provide a foundation for subsequent work looking at potential outcomes of implementing adaptive management principles in a specific policy area.

3.0 Management Tools for Urban Planners

3.1 Framework Defined for Urban Management Context

Adaptability, flexibility, resilience, social learning, and knowledge sharing are all terms that repeatedly come up in discussions about effective management – whether the discussion is about corporate, environmental, or municipal management issues. In practice, the corporate and environmental management fields have taken these terms to task. The drive toward efficiency in management has been complemented over the past few decades with an emphasis on dialogue and flexibility. This is especially apparent in the literature on ‘knowledge management’, ‘organizational learning’ and adaptive management. Universal approaches to problems are not thought to be desirable strategies; instead, managers recognize the value of approaches that respond to the particular stakeholders and issues within a specific context, even when faced with a common problem (Cook et al 1997).

Urban social planning and management is fraught with rapid change and uncertainty. Though the highly rational and technical approaches to planning have been criticized for some time (for example, by Rittel and Webber 1973; Sandercock 1998), the planning profession’s history of trying to control the urban context through universal approaches to infrastructure, public health and development still pervades planning practice today.

Historical attempts to manage ecological systems have led to failure in the form of less resiliency, more dependent societies and more rigid institutions, driving managers to more adaptive approaches that attempt to avoid these failures and encourage more resilient systems (Holling 1995). Urban planning is also complex, and struggles with strengthening a resilient urban fabric, working with independent constituencies, and promoting flexibility within related institutions.

According to Lee, learning how to sense, expect and control the way in which humans impact the natural world is the central task necessary to create a sustainable

economy (1995). This must be done through understanding biological uncertainty and institutional complexity. Lee calls social learning the “combination of adaptive management and political change.” By this he means that we learn socially both from the active experimentation with our economic uses of nature (his definition of adaptive management), and the bounded conflict formalized in our political processes (political change) (Lee 1995, 228).

The adaptive management approach came in part out of frustration with positional conflicts related to regional resource issues (fisheries, forests, etc.). Polarization bred public mistrust and did not help the economic and resource issues at stake (Holling 1995). Land and people are the essential resource of urban planning.³ Millions of public tax dollars are at stake. Decisions have long-term implications with direct effects on the day-to-day lives of urban residents. Conflicts are also longstanding, with positions entrenched.

There is a strong basis on which to build a more adaptive approach to urban planning. In recent years, urban planners have done well with including multiple stakeholder voices. When Sherry Arnstein published her “Ladder of Participation” in 1969, planners were generally only allowing token citizen inclusion in planning processes. Since the failures of large-scale planning in the 1960s and 70s – most typified by US Federal policy in the form of the Model Cities and Urban Renewal programs – planners have looked to communities as partners or even leaders rather than adversaries (Friedmann 1987).

Learning does of course already occur in municipal environments; both within and across organizations. “Many organizations that have been on the leading edge of knowledge management activities have demonstrated the tremendous cost savings that can be achieved through sharing knowledge” (Dixon 2000, 31). There is far more information on what *should* be done, however, than evidence of what *is* being done in this

³ Humans (and their labour) can be viewed as a renewable resource just like the forests and salmon. Like environmental resources, human labour has been driven to greater efficiency and more constant supply.

realm (For discussion of these issues, see Ackerman et al 2003; Cook et al 1997; and Senge 1994).

3.2 Urban Planning Challenges

The politics inherent in every level of municipal management create a complex dynamic. In a political climate it is very difficult to maintain the tolerance for experimentation – and therefore the possibility of mistakes – that is so central to learning (Cook et al 1997). “Rather than seeking the social welfare optimum, the authority that regulates the system is responding to political pressure” (Gunderson et al 2002, 222). Political and economic forces tend to maintain the status quo, rather than encourage adaptation over time (Lee 1993).

One widely-recognized example of a failed, broad-brush planning policy is the 1949 US Housing Act passed by Congress. The Act provided federal direction and funding for urban renewal. The large-scale, public housing projects that resulted from the urban renewal strategies eventually became recognized as failures of public policy. While their fundamental goal was to improve public health and safety, they failed to do this. The drive for efficiency in management and other blinders caused a vast underestimation of the negative social consequences of the projects.

Another example is the practice of stormwater management. Prescriptive curb-and-gutter street design standards have been part of the policy norm in North America for decades. These stormwater systems provide a convenient way to collect water from the street so it can be treated and released in a controlled manner (Webb 2006).⁴ Despite well-known failings of these systems, change to the emerging best management practice of Low-impact Development (LID) has been slow. The LID solution can be less expensive, more aesthetically pleasing, and is significantly more environmentally sound

⁴ These traditional systems collect all water runoff from a broad surface area, requiring large storage basins. They often do not adequately treat the stormwater to remove pollutants, and (if not specifically designed to avoid it) can easily be overwhelmed during a large storm. The collection process also deprives nearby natural areas of the water they normally depend on through natural infiltration and groundwater recharge (Hinman 2005).

(Hinman 2005).⁵ Even though a better solution in many circumstances, it is not widely embraced.

As a contrast in scale, we can look at the example of issuing building permits within a municipality. If a would-be building developer follows prescriptive guidelines, s/he will receive a permit in a timely fashion and may then proceed with development. If after a number of months the realization occurs that the regulations are resulting in less-than-desirable urban form, it is not easy to shift course to achieve a more desirable result. Ironically, developers who respond to this sentiment and propose better development often face tremendous hurdles because their proposals do not fit the prescriptive regulations (McMahon 2001 and APA 1998).

Another example of static policy on a detailed scale is ceiling height regulations of homes. Some fixed target is developed after taking into account public health, safety and economics. After the approval process, this target is written down and broadcast through relevant channels as a new rule. The target necessarily ignores difference in human height as well as human resiliency in terms of being flexible to ceiling height variations and choices. It is meant to provide certainty and ease the burden of enforcement. Yet compelling arguments can be made to relax these requirements with a result that still maintains a balance of health and safety needs, economic costs, and social implications (see Section 4.2 for a detailed example of this).

The same sorts of arguments can be made for electrical and plumbing codes and bylaws, educational facilities, public recreational space, and others. In each area, a fundamental goal of providing services or protecting the public was distilled into policies that reflected certain realities at a fixed point in time, and a balance of values, which in turn were broken down into concrete regulations carried out on the ground. How often do the regulations truly correspond to the original goal over time? Regulations, policies

⁵ LID promotes the use of stormwater collection and treatment that increases groundwater recharge and provides enhanced stormwater treatment through phytoremediation (treatment with plants). When this LID approach is used, no-curb designs can be implemented that allow water to sheet flow into proximal bioretention areas or bioswales that cleanse the runoff through natural ecological processes, allowing most to infiltrate into the soil and dispersing the remainder into neighbouring natural areas.

and goals are revisited periodically to see if they are in check with current needs and values, but this process is cumbersome and typically linear, not iterative.

We cannot answer “it depends on the circumstances” whenever a query is submitted on building a new home. The desires for certainty and for ease of enforcement are quite valid. A municipality’s planning department has limited resources in terms of staff and finances, and faces difficult challenges when it comes to building and maintaining support for their activities from elected bodies.

There are demonstrated ways, however, that increased flexibility can be allowed within parameters, without derailing important bureaucratic activities. The incentive of increased learning, improved operations, and most importantly, better cities should be enough to justify the shift in effort.

Urban planning policy choices have tremendous impacts on society: the affordability of housing and housing choice; space available for public, private and infrastructure use; quality and quantity of essential services such as health and education facilities; the availability and distribution of dollars for needed public amenities.

The goals of democracy and sustainability point toward a more inclusive strategy that works with stakeholders and interests for particular situations (one neighbourhood, for example), instead of the broad-brush approach that is common today. In practice, urban planning has become much more participatory of late. However, that inclusivity does not necessarily filter up to effect public policy decision-making. Nor does inclusivity on its own equate to an adaptive management approach. There are a variety of ingredients that together create the setting for potentially effective urban adaptive management strategies, which are discussed in detail in Section 4.

3.3 Individuals as Adaptive Managers

The role of the individual manager is as important as the organizational or institutional environment in which the manager works. While we are primarily looking

here at strategies adopted across institutions to promote an adaptive management environment, it is ultimately up to the individual manager to embrace these strategies and use them effectively to manage their various projects adaptively (March and Heath 1994; Westley 2002).

Francis Westley writes in detail about the decision-making context of an individual manager, and compellingly argues that “...the social system that the adaptive manager seeks to manage does not correspond to a single institution or even to a single organization. Rather, it is the problem domain, the system of actors brought together by their stake in a particular problem, that is the relevant unit of analysis” (2002, 355). To this end, she sees four lessons emerge that inform how an individual can manage adaptively (highlighted in Figure 3.3-1).

Figure 3.3-1. Adaptive management for the individual manager
(Westley 2002)

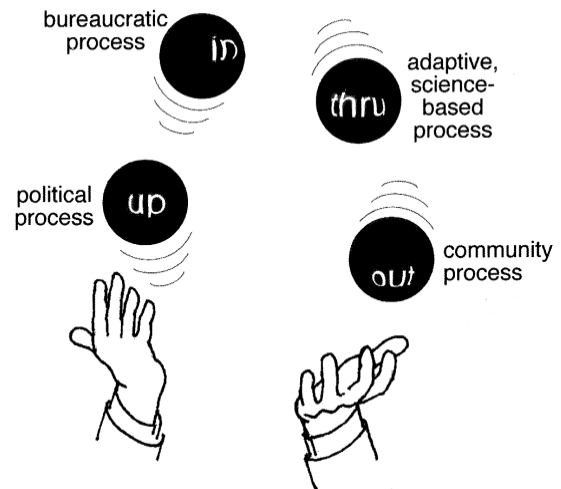
1. To manage adaptively requires strong values as opposed to rational analysis.
2. To manage adaptively and respond to complexity, it is necessary to juggle multiple strategies and goals (Figure 3.3-2).
3. To manage adaptively requires strong control of emotions, little fear of conflict, and great humility.
4. In order to manage adaptively, the manager needs to capitalize on the energy & movement of others. The historical moment is hence important.

The individual manager must be sensitive to the decision environment. In other words, the decision process of the manager must be as adaptive and varied as the rate of change going on in the environment s/he is attempting to manage (March and Heath 1994).

Figure 3.3-2. Image and description of manager juggling four balls
(Westley 2002, 338)

Balls juggled represent:

- **Managing through:** commitment to scientific approach, treating management interventions as experiments to learn from, as opposed to solutions to be implemented.
- **Managing out:** commitment to involve external groups or stakeholders in management processes and decisions.
- **Managing in:** the need to manage position and influence within the department or organization; maintaining internal support for experiments and external stakeholder activities.
- **Managing up:** need to take into account the larger political context in which career and strategies unfold. Unless actions taken at the community, organizational, or scientific level were considered from the point of view of the larger political arena, much excellent effort could be ended with the slash of a pen.



Juggling is an apt metaphor for the challenge of being an effective adaptive manager (see Figure 3.3-2). There are many challenges to confront; not least of them, the issues of stakeholder disempowerment and bureaucratic procedures that can hamper implementation and action in the planning and government-led learning environment (Westley 1995). In addition, learning may be considered a 'luxury' that is politically, economically, or socially unaffordable in certain environments (Lee 1993).

3.4 Summary

There is a lack of structured learning over time in urban planning and management, with a corresponding need for better responses to growing pressures and uncertainties in the urban environment. Adaptive management principles can provide a

tool for urban planners as they strive to create good policy in the face of growing uncertainty.

There are no shortages of policy recommendations for integrating adaptive management principles into *natural resource* management. These recommendations incorporate broad stakeholder involvement in decision-making, governance based on natural (watershed) boundaries, explicit discussion of values in the negotiation efforts of the stakeholders, and the ongoing ability to incorporate new knowledge through experimentation and evaluation of practices over time (Neuman 2001).

There is great tension between attempting to maintain institutional power and efficiency, and incorporating the flexibility inherent in the adaptive management approach. Increasing financial and population pressures are putting strain on managers to keep up with demands amidst very tight budgets. Yet we know there are examples of adaptive management principles being implemented even within the context of these pressures, as well as increasing incentives to look toward an adaptive management approach. Adaptive management has the potential to aid urban planners in implementing projects, ensuring they are monitored effectively, and incorporating the results into ongoing management practices that are flexible and contribute to the building of new knowledge.

4.0 Application: Examples of Urban Adaptive Management in Practice

4.1 Introduction

We do not know what results can come from adaptive management of our cities, as it does not happen today on a wide-spread basis. There are, however, some examples of adaptive management in practice (though it may not be referred to explicitly as adaptive management). Through explorations and a close look at some of these adaptive management approaches, we can look at ways in which urban planning, too, can move toward better understanding of the problems and issues, as well as improved economic and social outcomes.

Using the policy indicators outlined below in Figure 4.1-1 of this report, I found a number of planning and management strategies that did indeed reflect elements of an adaptive management approach in the urban municipal planning context. Three strategies are highlighted below. They each incorporate learning and assessment, but not one explicitly sets out as an adaptive management experiment or even articulates learning as an objective of the management strategy at the outset. So, while not quintessential adaptive management experiments, they still serve as useful examples that can be built on in order to create an effective adaptive management approach to urban policy planning.

There are undoubtedly other examples of urban management policies that meet the eight criteria set out in Figure 4.1-1. The goal of this report is not to chronicle every example that reflects some element of adaptive management in the urban environment. It is instead to look at some examples that reflect a variety of strategies in order to understand the breath and depth of situational possibilities in which to consider implementing urban adaptive management.

Figure 4.1-1. Indicators guiding the review and assessment of adaptive management strategies (to determine their relevance for the urban municipal planning environment ⁶)

1. The management policies are relevant to urban issues, which are here defined as the provision of essential services, public works, & regulation of private activities.
2. Policies acknowledge the key importance of ongoing learning, make uncertainties explicit, and incorporate flexibility.
3. Policies are appropriate for the relevant scope of governance. They are neither too broad-reaching for the intended goal, nor too narrow.
4. The process for policy-making is explicitly democratic and participatory in nature, incorporating appropriate voices for the level and scope of governance. Policies reflect goals, objectives, values and risks that have been discussed by representative group(s) of stakeholders.
5. Policies are relevant to practical application and management on a day-to-day basis (they are easy to understand and to implement).
6. Policies encourage field observation and experimentation.
7. Policies facilitate continued relevance over time, iteratively linking back management to research and visa versa.
8. Policies take a systems approach; they include techniques for coordination across agency scales and scopes (as appropriate), as urban issues are rarely limited to isolated geographic areas or single-agency issues.

⁶ In contrast the following indicators lead to quite the opposite: "...crisis, conflict, and gridlock emerge whenever the problem and the response have the following characteristics:

1. A single target and piecemeal policy.
 2. A single scale of focus, typically on the short term and the local.
 3. No realization that all policies are experimental.
 4. Rigid management with no priority to design interventions as ways to test hypotheses underlying policies"
- (Holling 1995, 9).

4.2 Housing Policies in Vancouver, BC, Canada

In Vancouver, BC, the policies surrounding the presence and legality of secondary suites⁷ can be viewed as demonstration policies. Demonstration policies reflect important community issues that have uncertainties associated with them. There is no one clear course of action that will lead to resolution; therefore some degree of experimentation is helpful to determine the appropriate course of action.

Vancouver has been operating with some sort of secondary suites policy since the 1920s. The changing policies have reflected the larger cultural and social context of the times. For example, in the 1940s, returning war veterans influenced a change in policy to encourage secondary suites (which were illegal prior to that time).

The policies continued to change, with the pendulum swinging back and forth, attempting to find a balance where housing needs, health and safety issues, and neighbourhood perceptions could find some common ground. The additional housing offered by secondary suites has long been recognized by city staff as one solution to Vancouver's tight rental housing market. However, the issues of health and safety code enforcement, and a lack of public acceptance have been difficult to address. For years, the city had a 'don't ask, don't tell' attitude, passively choosing not to enforce illegal suites unless complaints were made.

City staff and city council have undertaken public processes to involve local citizens in the secondary suites discussion. Surveys, meetings, hearings, ballot votes, and open house events have occurred – primarily since the early 1990s – to engage neighbours in the dialogue and debate. Decision makers have taken the public discourse into consideration, as well as other 'public goods' that have not been as well represented in discussions.⁸

⁷ Secondary suites are also referred to as accessory dwelling units in some municipalities. A secondary suite is a residential unit accessory to the main residential unit on the property, and may be attached or detached depending on the governing regulations.

⁸ See <http://www.tenants.bc.ca/othpubs/impact.html> for a discussion by the BC Tenants Rights Action Coalition of the underrepresented voices in the debate on secondary suites.

Even while secondary suites were illegal, many thousands of them existed throughout the city. These illegal suites often had low ceilings and did not meet other health and safety codes. Some of them were severely substandard in their conditions. And yet residents of the suites could not lobby for healthier housing when any complaint would cause the loss of the housing entirely.

Over time, both city staff and the citizens of Vancouver have undergone significant learning in relation to this issue. Certain negative perceptions about suites and suite residents have been proven to be misconceptions. The importance of suites in the overall rental housing and homeownership contexts are better understood. And decision-makers are more sophisticated with regard to reviewing zoning, building, and health and safety regulations and making accommodations to remove barriers to suite legalization.

Beginning in 1989, the City of Vancouver responded to neighbourhood-specific initiatives to legalize secondary suites. If an area voted yes, an implementation program followed to rezone the neighbourhood and facilitate legalization of existing suites. Three areas were rezoned as a consequence of this initiative.

This program was not as successful as the city had hoped. The objective of the 1989 policies was to bring more suites into legal compliance by legalizing suites in areas of the city that voted to have them, and closing suites in other areas. Homeowners in legal suite areas with existing non-permitted suites were allowed the option to phase-out their suite over a period of time, or make upgrades to legalize the suite.

The city had hoped that the suites declared as phase-outs would be upgraded to permanent status at the end of the phase-out period to maintain the overall number of secondary suites while increasing compliance. However, of the 363 phase-out suites that came to the end of their cycle, only 21 had upgraded to permanent status while 246 had closed. The remaining phase-out suites were awaiting action (French 1999). These shortcomings caused the city to re-evaluate the program.

In March 2004, the city relaxed the code and allowed for the legalization of suites city-wide in all residentially-zoned areas. Ceiling height requirements were reduced and

sprinkler retrofit requirements were eliminated (Whitlock 2004). As a result of this change, applications and permits related to suite legalization nearly doubled the following year. To further facilitate removing barriers to legalization, in 2005 the city again relaxed building code regulations; this time, eliminating a requirement for internal access between secondary suites and the main dwelling unit and other minor adjustments to by-laws (Whitlock 2005). Continuing their review, in 2006, the city extended legalization of secondary suites into CD-1 (customized) zoning districts which have (or could have) single-family homes in order to make these districts consistent with surrounding residentially-zoned areas (Uyesugi 2006). The city continues to examine ways to reduce the barriers to individual owners wishing to make their existing suites legal. Vancouver is still a long way from the ultimate goal of having all existing suites registered and legalized within the city, but they are working toward that goal.

Vancouver's policies with regard to secondary suites reflect a systematic learning process in which practical considerations, politics and public debate, research, observation and review are coordinated with management strategies to achieve more desirable results; all while remaining focused on the overall goal of maintaining affordable housing and the health and safety of residents.

4.3 Low Impact Development in Portland, OR, United States

Beginning in the mid-1990s, the City of Portland, Oregon began an ambitious project aimed at reducing the amount of stormwater runoff entering the stormwater system. They began with a demonstration project involving about 522,000 cubic yards of untreated runoff that was draining into the Willamette River from the parking lot of the Oregon Museum of Science and Industry. Here is the story, in brief:

The museum agreed to the construction of a series of 10 vegetated swales that would receive runoff from the surrounding parking lots. The runoff from the lots is conveyed to the vegetated swales through cuts in the parking lot curbs. As constructed, the

swales had a footprint of 13,980 square feet and a capacity of 14,000 cubic feet. This exceeded the city's capacity requirements for a trench receiving runoff from a catchment area of equal size. The use of the vegetated swales over conventional methods resulted in cost savings of \$78,000. Maintenance and upkeep of the swales has been worked into the regular landscape budget for the museum, and has required slightly more work to keep curb cuts free of debris.

From a physical design standpoint, the project has shown that it is possible to obtain significant cost savings and benefits from the construction of sustainable management systems over conventional ones. It has further shown that these systems have the potential to surpass the performance of traditional practices. Where shortfalls in the system have been found, modifications were made to address them. Where it was found that the swales could have performed better, for example, the number of curb cuts was increased. The performance of particular plants was evaluated, and where appropriate, they were replaced by better-performing ones (City of Portland 2006).

This demonstration project became a model for subsequent projects across the United States. Initially, its success influenced both the planning policy and physical design of a broader 'Green Streets' initiative across the City of Portland that focused on 'water-quality-friendly' streets and parking lots. Learning from this initiative went on to inspire an 'Innovative Wet Weather Program' in Portland that broadened the scope from streets and parking lots to include eco-roofs, downspout disconnections, monitoring and feasibility studies, and educational efforts.

The value of these projects is monitored over time, and the accumulated knowledge is used in an ongoing manner to more effectively determine stormwater management policy. Thus, project performance has had a direct impact on related regulatory codes, such as stormwater management and parking requirements.

The educational efforts responded to public feedback and addressed misconceptions. In response to data showing the vast majority of residents did not understand the concept of combined sewers or combined sewer overflows, and

underestimated pollution coming from stormwater outflows, an exhibit on the problem of stormwater overflows opened in 2003 at the Museum of Science and Industry.

Here again, learning has occurred over time as a result of an iterative, coordinated process linking on-the-ground practice with experimentation, public dialogue, research, monitoring, and management strategies.

4.4 Sustainable Neighbourhood Development in Ballerup, Denmark

David van Vleit undertook a thorough examination of one demonstration project in Ballerup, Denmark. His central question was: “In what ways can demonstration projects increase social learning of effective planning, design and policy alternatives that assist in developing sustainable urban communities?” (2000). He found that the new Egebjerggard neighbourhood in Ballerup increased social learning and he showed that socially and environmentally responsible neighbourhoods can be planned and successfully implemented (van Vliet 2001). He describes the neighbourhood in the following way:

Egebjerggard is a 782 unit, 38 ha. mixed use, urban extension and neighbourhood intensification project located in the municipality of Ballerup (50,000 population) 15 km northwest of Kobenhavn. A new pattern for ‘integrated neighbourhoods’ emerged through public debate, design competition, experiment and an innovative system of planning guidelines and regulation. Egebjerggard was the venue of an international building exhibition in 1996. Construction of dwellings started in June 1988 and by the end of 1997, the planning was complete and all the housing schemes in the urban quarter’s four stages were nearly finished. Limited selective infill is occurring on a few sites reserved for commercial or institutional use (2001).

Innovations occurred both in the processes and products of the neighbourhood development. They included: identity and character, variation in form and households, mixed ownership, affordable housing, environmentally sound materials and approaches,

mixed land use, integration of works of art, strengthening the social structure, crime prevention, and participation of future inhabitants. Many of these have since been incorporated into the overall municipal plan, and into other projects both within and outside of the municipality of Ballerup.

Strategies used in the Egebjerggard project have had far-reaching influences that stretch beyond the residents and local neighbourhood. These are outlined specifically in Figure 4.4-1. The project took a systems approach, incorporating coordination across agency scales and scopes, and its results have in turn influenced the entire system.

Figure 4.4-1. Influences of Egebjerggard demonstration project on various entities

The Danish Ministry of Housing	Adopted the financing pilot project used in the neighbourhood as a new procedure for all housing receiving public financing.
Large developers	Adopted action plans and/or policy statements on urban ecology that influence business procedures and management strategies based on the debate that occurred within the Egebjerggard housing societies.
Municipality	Adopted better cooperation across departments due to the professional development and increased capacity building that took place as part of the project.
	Adopted multiple criteria in the pre-qualification stage of project development review.
Broadly	Confirmed the importance of integrated citizen participation in the planning and development process in part because of the contributions provided by the citizenry to this project.
	Adopted procedures that include interdisciplinary and intersectoral cooperation because of the better planning and product realized by the close cooperation and collaboration that took place in Egebjerggard.

4.5 Analysis of Adaptive Management Applications

These demonstrations of urban policies-in-action can serve to inform our understanding of adaptive management applications. In each of the above examples, learning is central. While it was not an explicit objective at the outset, at some point in the process, learning did become an important aspect, as witnessed through the attention paid to review and adjustment of policies as results unfolded over time.

Using the policy indicators outlined in Figure 4.1-1, we can gain insight into the ways in which the case studies applied adaptive management strategies. The three examples highlighted as demonstrations all occur within an urban context, though, by design, they address very different aspects of the urban environment: housing policy, stormwater infrastructure, and mixed-use neighbourhood development.

Demonstrations policies and demonstration projects such as these are a strong pathway to bridging disconnection between policy and action. “An effective demonstration can be looked upon as a sort of staging area and half way house between implementation and general policy making. It is a zone for social and developmental learning” (van Vliet 2001, 2).

As an adaptive management approach, demonstrations have much promise as a way to undertake policy experiments in a manner that promotes maximum learning and minimizes negative consequences. Demonstrations allow policies to be implemented on a limited, experimental basis. Outcomes and behaviour can be monitored over time, and changes and refinements can be made as learning takes place. If projects are successful, the refined policies can then be ‘mainstreamed’ and adopted on a wider basis as appropriate.

In these examples, municipalities use the demonstrations as grounds for learning and refinement that lead to better policy and the mainstreaming of innovation over time.

While explicitly talking about adaptive management applications as ‘experiments’ is typically not politically feasible as discussed earlier, that is essentially what

demonstrations can be. Each example here begins with the intention to try out a policy or project to see how well it works. “The research suggests the gap between ‘what we know’ and ‘what we need to know’ can be addressed through a more experimental framework and through purposeful demonstration-diffusion” (van Vliet 2001, 2). These demonstrations are hypotheses-in-action in the urban context.

The examples in this section all included flexibility, incorporated stakeholder participation, and kept coming back to the original goal. Monitoring was done over time, and the information gathered informed changes, linking management back to practice and *visa versa*. There was also exceptional coordination across departments or disciplines.

Though these examples show a remarkable use of adaptive management strategies, there can be specific limitations to the use of demonstration policies and projects. It is difficult to isolate cause-and-effect in some cases, particularly when recessions or other large economic changes occur within a close timeframe of project implementation. Time lags occur in the diffusion of knowledge. Diffusion is likely to increase over time; yet as time passes, it is harder to link increased knowledge and the use of successful innovations back to a single policy or project’s influence (van Vliet 2001).

When planning or evaluating the application of adaptive management, van Vliet suggests five important considerations (see Figure 4.5-1). The application of adaptive management does not need to follow a prescriptive path. It can be initiated by an individual or agency. It can be in the form of a policy, a project, or other strategy. It simply must involve the elements central to the adaptive management approach (see Figure 4.1-1) including embracing learning, participation, coordination, experimentation and monitoring; and linking practice and management back to one another regularly while keeping sight of the original goals.

Figure 4.5-1. Adaptive management application considerations
(van Vliet 2001)

Relative advantage	Is the application better than the status quo, or is it perceived as better than the status quo?
Compatibility	Is the application a good fit for the people and environment of this place at this time? How strong might the resistance be? This characteristic is somewhat similar to Francis Westley's lesson four for the individual manager (see Section 3.3), which involves taking advantage of the moment in time when one can most optimally capitalize on the energy and movement of others.
Complexity	Is the application too difficult to understand and apply? The managers must juggle multiple strategies and goals well and in turn communicate them to others. This characteristic is closely related to Westley's lesson two for the individual manager (see Section 3.3).
Trialability	Can other people try out aspects of the policy or project, or must they commit all at once? Including dialogue, flexibility, and choice is important for ongoing learning and change to occur.
Observability	How visible and discernable are the results of the policy or project? Communicating these well is key to broadening the acceptance and adoption of the policy or project, and expanding learning beyond its boundaries.

5.0 Conclusions and Recommendations

5.1 Summary of Potential Contribution of Adaptive Management to Urban Policies

Adaptive management shows great promise for promoting better urban planning. Adaptive management strategies are at play in the urban environment as discussed in the previous section, though not in a widespread or explicit manner. As is the case in the natural resources arena, there is evidence that practical improvements can be expedited through an approach that explicitly embraces learning through experimentation.

As with any good management regime, adaptive management takes considerable resources for adequate development, monitoring, and adjustment over time. It also requires openness to dialogue and negotiation based on goals and principles.⁹

Continued relevance over time of urban adaptive management policies is swayed not only by management and research, but also by the political climate. Working out an effective adaptive management strategy will look different in different areas because of this. The political arena is one in which planners have worked for decades, however. Effective implementations of adaptive management in this highly political environment may result in strategies that are conversely useful in the natural resources arena, as science is also rarely untouched by politics.

One challenge of adaptive management in natural resource management is that the scale is often quite large. There are rarely mechanisms in place regionally that facilitate discussion and decision-making over large geographic areas and long time horizons (Baskerville 1995). Here is one potential advantage of using adaptive management in an urban context: project and policy scales often easily fit within the boundaries of a municipality or neighbourhood, and the opportunity for dialogue is likely pre-existing in the form of neighbourhood or municipal councils or advisory boards.

⁹ For an in-depth discussion of effective negotiation techniques, see Fisher and Ury (1991).

The examples given in Section 4 demonstrate how adaptive management is already used within municipalities. Following are two hypothetical situations that further demonstrate how adaptive management strategies can contribute to effective urban planning in a more explicit manner:

Situation A: Public spaces in urban areas are important locations for public engagement, relaxation, and recreation. They are typically small, fixed geographic areas (a park or recreation centre, for example). Adaptive management experiments cover both the policy and programming arenas, with implementation, monitoring, assessment, and changes over time resulting in better, more useful public spaces.

Situation B: Urban infill is mandated by growth management laws in many municipalities. Public resistance may work against increased density. One neighbourhood is willing to accept infill in exchange for some needed public amenities. The municipality focuses on this neighbourhood as a demonstration site using adaptive management, and builds on the experience to inform infill policies in other areas of the municipality.

Within any given municipality or organization, it is important to provide this allowance for learning. Following the main tenets of adaptive management, learning must be more than allowed, it must be encouraged within the work environment of an urban planner, and the overall culture of the organization. Structural problems within institutions¹⁰ are barriers to detecting and correcting errors (Levitt and March 1990). Encouraging learning means to encourage information flow both ways between policy makers and those who implement policies. In contrast, “maintaining a strict dichotomy between policy formulation and implementation across institutions at different levels thwarts feedback and undermines learning” (Light et al 1995, 156).

Incorporating adaptive management – and therefore explicit learning – into municipal planning endeavours carries great promise on many levels. As discussed herein, planning practice does not always respond effectively and in a timely fashion to on-the-ground realities (be they practical, political, environmental or otherwise). Both

¹⁰ Examples of structural problems include lack of coordination; legalistic, intransigent, and other similar traits.

planning practitioners and organizations can use adaptive management techniques to improve the degree to which their practice responds to realities. Learning can occur through adaptive management within many contexts: an individual manager, within a municipal organization, within a municipality or other geographic boundary, or across municipalities. Similar concepts apply in each of these situations. Adaptive management is a critically useful tool for navigating the complex and uncertain terrain inherent in municipal planning.

5.2 Recommendations for Policy Development

There is a huge opportunity to develop and broaden the application of adaptive management to urban policies and practices. And yet, the foundation must be in place for allowing learning and adaptive management to occur. Policies must support the building of an open political environment through negotiation and consensus-building that sets the stage for adaptive management (Lee 1995). They must also support open dialogue across disciplines by removing barriers to collaboration within organizations (Levitt and March 1990).

Municipal managers must find a way to create internal policies that strengthen and reward learning among individuals and the organization as a whole. “In general, rewards in a bureaucracy are greater for finding better ways to do what we already do than they are for finding different (better) things to do” (Baskerville 1995, 100). Organizations can create environments that encourage questioning and review with peers across disciplines in order to learn from experience, learn from observation, and to generate new ideas regarding better implementation, management, and policy (Arygris and Schon 1978; Light et al 1995; Westley 2002).

A municipal planning organization that supports ongoing learning is in a good position to use the tools of adaptive management to guide their planning practice. In the limited analysis contained herein, we can see that demonstrations are one practical way to

begin adaptive management urban applications. Including wider use of demonstration projects which incorporate explicit adaptive management principals is an obvious place to start expanding the use of urban-based adaptive management.

Other opportunities exist as well, such as including adaptive management strategies in the policy analysis and recommendations coming out of regional, national and international urban planning organizations. These organizations also have the opportunity to highlight effective adaptive management practices in an illustrative manner in publications and other media.

Highlighting adaptive management case studies also serves to inform the public of the role adaptive management can play in an urban context. It is important, however, to help citizens understand that problems do not disappear upon the creation of new adaptive management policy solutions. Rather, effects of policies appear over time as the results unfold in reaction to new implementation strategies.

5.3 Recommendations for Further Study

The analysis contained in this report aims to explore an adaptive management approach to urban policy planning and management in which learning is central. Very little direct research exists on which to base this analysis, though there is a vast quantity of relative adjacent research available.

Attention is only now being paid to the intersection of adaptive management, learning organizations, and public policy analysis; so there is a great deal of opportunity here for more in-depth study, such as:

- The roles and relationship between the individual and the organization. How can the roles of the institution and the individual be mutually supportive in managing adaptively?
- Partnerships between researchers and practitioners to develop practical solutions for municipalities. For example, how can adaptive management

strategies help to plan and implement better permit service delivery within a municipal planning organization?

- Study the learning process and develop strategies to aid in knowledge diffusion through adaptive management across municipalities. What failed, what succeeded, and why? How can knowledge sharing be operationalized in a practical manner across municipalities?
- Model urban adaptive management policies. Strategic modeling and analysis can look at urban planning policies related to a single topic area that exists across municipalities (or regions or nations), and pull out features that demonstrate learning and change over time in response to different contexts.

Even with in-depth study of these and other related issues, there are reasons why policy development may not respond to research recommendations. Rapid responses leading to change and adaptation are likely to be present in less hierarchical organizations, where relatively uniform distribution of resources is present (Quinn 1985). Most municipalities have some concentration of power and wealth within certain organizations, leading to strong political resistance to change (Westley 1990).

There is evidence that systems and organizations with a more equalized distribution of resources and decentralized decision-making structures represent a “learning” model which is better able to respond to problems (Scheffer et al 2003). In order to increase the likelihood of success and increase the pace of learning, it is appropriate to advance strong adaptive management policy experiments within systems that to some degree reflect this structure.

Learning can and does take place everywhere, however. And as learning is central to the adaptive management approach, there are numerous opportunities to begin introducing adaptive management to the urban environment. “Politicians, bureaucrats, and organizations (public and private) must all learn, in a representative democracy of citizens, and they must all remember to permit the evolution of sustained policy, which is necessary to sustainable achievement of *any* goal” (Baskerville 1995, 99).

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