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**DERIVATION OF AN EVALUATION INSTRUMENT
FOR JUDGING THE QUALITY OF
ECOSYSTEM-BASED MUNICIPAL PLANS**

by
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**A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy**

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ABSTRACT

A basic conundrum associated with evaluating the quality of municipal plans involves the range of interests — public, special, vested — that are either supported or confounded by the plan. Traditionally, comprehensive plan evaluation has proceeded by attaching weights to the evaluation criteria. Yet, such a procedure is inherently flawed since it is self-evident that interested parties are unlikely to fully agree with any weighting scheme that places a lower weight on their own specific priorities. Other factors also challenge the origin and applicability of evaluation criteria that characterize good plans and planning, including the lack of a codified theoretical foundation for both planning in general and planning frameworks in particular (e.g., ecosystem-based planning).

These factors make the search for a methodologically-grounded and theoretically-oriented basis for judging plan quality a priority for both planning theory and practice. Currently, the theories *of*, *in* or *for* planning provide little guidance about how to resolve these issues. Using the ecosystem approach to planning as the field of inquiry, this study investigates the attributes (i.e., the necessary and sufficient conditions) of good ecosystem-based plans, and then explores and interprets these attributes using hierarchy theory.

The primary relationship under investigation is between ecosystem-based plans and their quality (i.e., their goodness). The central research question seeks a descriptive answer and is stated as follows:

What are the attributes of good ecosystem-based municipal plans?

The subsequent research question seeks explanative content and is stated as follows:

How can hierarchy theory be used to explore and interpret the attributes of good ecosystem-based municipal plans?

In order to address these two questions, the research process consists of four general phases. First, after a comprehensive and systematic literature review, a tentative plan evaluation framework for ecosystem-based municipal plans is posited. Second, the Delphi survey technique is employed to build on the tentative evaluation framework in order to determine which plan form, plan content and planning process conditions are necessary and sufficient for the evaluation of ecosystem-based plan quality. In the Delphi survey design, individual response stability testing is undertaken before level of consensus criteria are applied. Third, the results of the Delphi exercise are then critically examined in terms of meta-criteria analysis. Fourth, the research results are explored and interpreted by employing hierarchy theory, and then made operational for subsequent field work.

The primary results of the research include the following:

1. **Contribution to methodology.** A methodologically-grounded and theoretically-oriented evaluation instrument suitable for judging the quality of ecosystem-based municipal plans is derived;
2. **Contribution to theory.** Hierarchy theory is synthesized into a framework of objects and implications suitable for applicability to ecosystem-based planning. In other words, the applicability of hierarchy theory is extended to include ecosystem-based planning, and ecosystem-based planning is simultaneously grounded in theory; and,
3. **Contribution to identification of needed research directions.** Potential directions for future research are recorded throughout the investigation.

RÉSUMÉ ANALYTIQUE

L'évaluation de la qualité de plans d'urbanisme est souvent rendue plus difficile par un de ses aspects fondamentaux, soit les effets variés et parfois divergents du plan sur les parties intéressés – les intérêts publics, privés et matériels. Dans le passé, l'évaluation globale des plans se faisait en accordant des facteurs de pondération aux critères d'évaluation. Cette approche est normalement vouée à l'échec parce qu'il est toujours peu probable que les divers groupes d'intérêt acceptent qu'une faible valeur soit accordée aux éléments qu'ils considèrent de grande importance. D'autres facteurs viennent contester l'origine et l'applicabilité des critères d'évaluation qui caractérisent même les plans efficaces et les bonnes pratiques d'aménagement, comme l'absence de fondements théoriques documentés pour l'aménagement en général et les méthodes spécifiques d'aménagement en particulier, par exemple la planification écosystémique.

Ces facteurs rendent prioritaires la recherche de fondements valides sur les plans méthodologique et théorique pour l'évaluation de la qualité théorique et pratique des plans. Les théories courantes de l'aménagement ne contribuent guère à la résolution de ces enjeux. En utilisant la planification écosystémique comme point de départ, la présente étude, qui se veut exploratoire, examine les caractéristiques (c.-à-d., les conditions minimales et suffisantes) des plans écosystémiques de bonne qualité, pour ensuite analyser et interpréter ces caractéristiques suivant la théorie des hiérarchies. Les résultats de cette recherche exploratoire pourront aider les futurs chercheurs à vérifier leurs hypothèses.

La présente étude examine principalement la relation entre les plans écosystémiques et leur qualité. Cette question de recherche, qui exige une réponse descriptive, est exprimée de la façon suivante :

Quelles sont les caractéristiques des plans écosystémiques réussis?

La question de recherche qui en découle et qui se veut plus explicative est exprimée comme suit :

Comment utiliser la théorie hiérarchique pour examiner et interpréter les caractéristiques des plans écosystémiques réussis?

Pour répondre à chacune de ces questions, la démarche de recherche se divise en quatre étapes. La première étape comprend une analyse bibliographique complète et systématique, pour ensuite proposer une approche méthodologique pour l'analyse des plans d'urbanisme municipaux écosystémiques. En deuxième lieu, la méthode Delphi est utilisée pour renforcer la méthode d'analyse en vue de déterminer quels sont les caractéristiques du format et du contenu du plan et de la démarche de planification qui sont nécessaires et suffisantes pour l'évaluation quantitative des plans écosystémiques.

La conception du questionnaire Delphi comprend une vérification de la stabilité des réponses individuelles avant l'application des critères de consensus. En troisième lieu, les résultats de l'exercice Delphi sont évalués au moyen d'une analyse de méta critères. En quatrième lieu, les résultats de la recherche sont examinés et interprétés au moyen de la théorie hiérarchique et ensuite rendus opérationnels pour les travaux d'observation en milieu ouvert subséquents.

Les résultats primaires de la recherche comprennent les éléments suivants :

1. **Contribution à la méthode scientifique.** Développement d'un outil d'évaluation basé sur des fondements méthodologiques et théoriques rigoureux pour l'évaluation de la qualité des plans d'urbanisme écosystémiques.
2. **Contribution à la théorie scientifique.** La théorie hiérarchique est synthétisée pour devenir un cadre d'objets et de conséquences convenables pour l'évaluation de la planification écosystémique. En d'autres mots, le champ d'application de la théorie est élargi de sorte à englober la planification écosystémique, qui à son tour devient ancrée sur le plan théorique.
3. **Identification de nouvelles possibilités de recherche scientifique.** De nouvelles avenues de recherche scientifique sont identifiées tout au long de cette étude.

Acknowledgements

First and foremost, I would like to take this opportunity to thank my supervisor, Dr. Barry Wellar. Once, in a class for advanced methods, Dr. Wellar explained the crux of his view concerning Ph.D. level research: "Counting penguins is boring. However, if you derive a new way of counting penguins, then that's exciting." I kept his maxim in mind while designing my research methodology. Dr. Wellar has been, and will forever be, my inspiration.

I would also like to extend my gratitude to my committee members: Dr. Johnson, Dr. Lagarec, Dr. Ploegaerts, and Dr. Sadar. And, I also wish to acknowledge the substantial contribution made by the members of the Delphi panel convened during my research. Ten ecosystem-based planning experts from across the continent reached consensus on criteria for evaluating ecosystem-based municipal plans. I am indebted to their expert and unselfish effort.

Finally, I would like to pledge my love to *le gang* (GG, ML, BM, VN, DP, JS) and to my parents, Amy and Nick.

TABLE OF CONTENTS

	ABSTRACT	i
	ACKNOWLEDGEMENTS	vi
1	PROBLEM STATEMENT	
	Introduction	1
	Planning Problems and Society	1
	Planning Problems and Science	4
	Summary	7
2	LITERATURE REVIEW OF THE THREE SUBJECT DOMAINS: THE ECOSYSTEM APPROACH TO PLANNING, PLAN EVALUATION AND HIERARCHY THEORY	
	Introduction	8
	The Ecosystem Approach to Planning	8
	Plan Evaluation	25
	Theory in General and Planning Theory in Particular	38
	Hierarchy Theory	43
	Summary	64
3	THE RESEARCH DESIGN	
	Introduction	65
	Research Questions	65
	Research Boundaries and Scope	66
	Research Design	67
	Literature Review	67
	The Delphi Technique	67
	Meta-Criteria Analysis	98
	Interpretation and Exploration of the Research Results with Hierarchy Theory	99
	Operationalisation	101
	Summary	102
4	THE RAW RESULTS OF THE DELPHI SURVEY AND PRELIMINARY DATA TREATMENT	
	Introduction	103
	Raw Results: The Sufficient, Necessary and Important Conditions of Good Ecosystem-based Plans	103
	Validity of the Delphi Survey Results	110
	Meta-Criteria Analysis	118
	Summary	127

5	USING HIERARCHY THEORY TO INTERPRET AND EXPLORE THE EVALUATION CRITERIA DERIVED FROM THE DELPHI PROCESS	
	Introduction	129
	The Interpretation and Exploration of the Evaluation Criteria Using Hierarchy Theory	130
	• Principles of the Ecosystem Approach to Planning	130
	• The Ecosystem Approach to Planning Process	161
	• Feasibility of Plan Implementation (Process Foundation)	190
	• Environmental Quality Strategies	198
	• Rational Content	212
	• Recognition of the Legal Requirements Facing the Plan	223
	• Strong Language for Priority Policy Areas	224
	• Adaptive Capacity of Plan to Address Change	225
	• Feasibility of Plan Implementation (Content Foundation)	229
	• Effective Communication of Planning Information to Relevant Groups	232
	• Effective Communication of Spatial Information to Relevant Groups Through Maps	243
	• Environmentally-sensitive Plan Production	245
	Summary	246
6	OPERATIONALIZATION OF THE EVALUATION CRITERIA	
	Introduction	248
	Operationalization of the Evaluation Instrument	248
	Meta-Evaluation of the Derived Instrument	261
	Summary	262
7	CONCLUSIONS	263
	BIBLIOGRAPHY	268
	APPENDIX I: GLOSSARY	303
	APPENDIX II: MEMBERS OF THE DELPHI PANEL	310
	APPENDIX III: FOUR ROUNDS OF THE DELPHI PROCESS	312
	APPENDIX IV: THE SPECIFIC ATTRIBUTES OF ECOSYSTEM-BASED PLANS	354
	APPENDIX V: FINAL RESEARCH RESULTS — THE DERIVED EVALUATION INSTRUMENT	362

LIST OF FIGURES

Figure 2.1	A Representation of Hierarchy Theory as a Conceptual Bridge Between Plan Evaluation, the Ecosystem Approach to Planning and the Ecosystem-based Plan ...	56

Figure 2.2	Identification of the Holon of Interest	62
Figure 3.1	Flowchart of the Practical Research Design	68
Figure 3.2	Flowchart of the Delphi Survey Process	72
Figure 3.3	The Level of Consensus Criteria	96
Figure 5.1	Ecological Footprint as a Measure of Human Dependence on Nature	158
Figure 5.2	An Interpretation of the Delphi Results in Characterizing the Ecosystem Approach to Planning Process	162
Figure 5.3	The Importance of Context to Perceived Scales	211
Figure 5.4	Different Scales of Planning Maps	244

LIST OF TABLES

Table 2.1.	Illustrating the Benefits of Ecosystem-Based Planning Through Comparison to Conventional Planning	14
Table 2.2	An Indicative Chronological List of Justifications Supporting Research Investigating the Ecosystem Approach to Planning	17
Table 2.3	Selected Evaluation Approaches Employed in Planning	32
Table 2.4	An Indicative Chronological List of Justifications Supporting Plan Evaluation Research	35
Table 2.5	An Indicative Chronological List of Justifications Supporting Theory-Based Research in Environmental Planning	59
Table 3.1	Research Techniques that Employ Experts	74
Table 4.1	The Raw Results of the Delphi Process	104
Table 4.2	Criticisms of Individual Delphi Efforts and the Related Research Design Response	115
Table 4.3	The Evaluation Instrument After Meta-Criteria Analysis	121
Table 6.1	Identification of Measures for the Preliminary Operationalization of the Evaluation Instrument	253

CHAPTER I

THE PROBLEM STATEMENT

INTRODUCTION

Research questions arise from a number of sources, including problems in society (generated by a desire to improve the *status quo* or to plan for the future), problems in science, or problems driven by curiosity (see Wellar, 1999; Sproull, 1995; Lounsbury and Aldrich, 1986; Walizer and Wienir, 1978).^{*} The proposed research is derivative of a combination of societal and scientific problem sources. Concerning society, municipal and environmental issues continue to become increasingly complex as more and more human-generated variables are introduced into urban ecosystems. Concerning science, there is a well-documented paucity of appropriate evaluation instruments suitable for comprehensively judging municipal plans. By examining these dimensions of society and science as they pertain to planning, specifications concerning a pressing planning problem can be established.

PLANNING PROBLEMS AND SOCIETY

According to Brown (1996), history is accelerating. Advances in technology, unprecedented population growth, increasing levels of urbanization, and even faster economic growth are combining to stress the limits of the earth's natural systems. Between 1900 and 1995, the proportion of the global population living in urban areas increased from 14% to 43%. By 2025, this proportion is anticipated to be 61% (Miller,

^{*} Please note that any series of in-text references is presented in descending chronological order. For subsequent in-text references, page references are also provided if quotations or figures/tables are involved.

1997). Simultaneously, Canadian society is becoming more heterogeneous in its value systems as a result of increased levels of immigration, higher levels of education, and proliferation of cultural alternatives through television and the Internet (see Foot, 1996; Gregg and Posner, 1990). Since existing municipal planning problems are normally multi-dimensional, it is tenable that problem complexity must increase if current levels of urbanization, technological advancement, and value plurality continue to increase.

The range of municipal planning problems is extensive, and consists of both *in situ** problems and problems related to the planning process itself. Selected *in situ* problems and related references include the following:

- deteriorating environmental quality (Roseland, 1998; Quammen, 1998; Miller, 1997);
- urban sprawl (Kunstler, 1996; Kunstler, 1993);
- traffic congestion (TAC, 1993; Jacobs, 1961);
- dominance of the automobile in urban contexts and diminished pedestrian security (Wellar, 1998);
- loss of urban green space, open space, wetlands, and other areas of high biomass productivity to aggressive residential, commercial and infrastructural development (Tamminga, 1996; Porter and Salvesen, 1995);
- loss of prime agricultural soils (Sparrow, 1984);
- loss of heritage resources (Attoe, 1988);
- high immigration rates and increasing levels of education contribute to the heterogeneity of values expressed by the electorate;
- increasing income disparity, leading to shortages of affordable housing (see Roseland, 1998) and to power being concentrated in fewer and fewer hands in the political arena (Warner and Molotch, 1995);
- on-going concern with incompatible land uses as expressed by the proliferation of adversarial NIMBY (Not-In-My-Backyard) planning contexts (Kunstler, 1996; Hodge, 1993; Coon and Damsky, 1993);
- denuclearization of the family, which creates different housing and recreational needs (Hollingsworth *et al.* (1999);
- edge cities that are already failing (Fulton, 1996); and,
- place-based alienation (Hough, 1990).

* Please note that a Glossary is provided in Appendix I.

Problems with existing planning processes themselves include the following: expensiveness, time-intensiveness, fragmentation of jurisdictions, reactive rather than anticipatory goals, rigidity and arbitrariness, and the lack of transparency in the process (Warner and Molotch, 1995; Tomalty *et al.*, 1994a).

Municipal planning problems are fundamentally characterized by a discrepancy between an existing state of affairs and a preferred state of affairs (Wellar, 1987). And, since municipal planning problems are both caused by and affect social needs and values, they are complex (Rittel and Webber, 1973). The emerging challenges in planning require not only a new way of planning, but a new way of thinking about planning in order to achieve a preferred state of affairs.

Meanwhile, the conclusions and methods of conventional science work best with tame or benign problems (i.e., problems lacking an explicit value component). Having a human dimension, planning problems represent an on-going challenge for traditional science because of the multiplicity of variables involved. For example, the problems faced in municipal planning have no stopping rules, and are often ill-defined (i.e., difficult to specify), symptomatic of more fundamental problems, unique, and rarely true or false but good or bad (Rittel and Webber, 1973).

The residual message is that municipal and environmental issues are increasingly

complex and continue to require planning attention, and that a more holistic* approach like ecosystem-based planning may represent an emerging framework for addressing both on-going and new planning concerns. As Lister (1996: 20) contends, "we must resist the urge to simplify the complex: stop trying to homogenize diversity; and above all, wean ourselves from the false comfort of prediction and control." Also aware of the need for more relevant frameworks to deal with the complexity of formulating and implementing plans in an evolving planning context, Kessler (1996: 68) states that,

To appreciate the effects and magnitude of city development, there is a need to introduce a more integrated approach to research into the building, planning, design, and other components that are necessary if the city is to function effectively. Among other things, we need to look more closely at how the city makes use of the ecosystems that support it.

PLANNING PROBLEMS AND SCIENCE

If ecosystem-based planning represents an emerging framework for improving planning processes and products, then certainly evaluation of both its process and its products should be used to improve their quality. As suggested by Scriven (1991: 1), evaluation is "one of the most powerful and versatile of the 'transdisciplines' — tool disciplines such as logic, design and statistics — that apply across broad ranges of the human investigative and creative effort." The overriding reason that evaluation has wide-ranging pertinence and utility appears to be because its consequences are so important to both the design and

* Holism refers to the attempt "to reveal the properties of complex systems such as ecosystems by studying the systems as a whole" (Jorgensen, 1992: 58). In contrast to reductionism, holism involves research on the system level, rather than decomposing an ecosystem into its components and studying them in isolation. The research objective of holistic study involves system properties, rather than component properties.

implementation of products and services. For example, inferior products and services can cost lives, waste resources, and degrade a community's quality of life (Scriven, 1991). Consequently, the refinement of evaluation efforts is of broad scientific and societal relevance (Wellar *et al.*, 1996).

In the planning- and geography-related literature, there is a research void surrounding the origin and application of evaluation criteria that address what constitutes a *good* municipal plan (in Chapter II, see Table 2.2 where an indicative list of exhortations concerning this research void is presented). As Shefer and Kaess (1990: 84) observe, "in spite of the wide array of techniques now available to practitioners, the field [of plan evaluation] is rather conservative in its trends...A few ideas for changing the general direction of the field as well as future research and the implementation of evaluation schemes seem in order."

Traditionally, the challenge to generating a definitive list of evaluation criteria for municipal plan quality has been compounded by a number of pervasive conditions, including the following:

1. In subjective terms, plan quality or goodness can be dependent upon the client involved (Kent, 1990; Lacey, 1986; Voogd, 1983). Criteria for plan quality are usually derived from value systems, cultural traditions and ideologies. In order for the criteria to be useful, the relative importance or weight to be attached to each one has to be determined and this is usually done for a particular context or plan (Devas and Rakodi, 1993);
2. The subject matter is complex and subsequently difficult to make operational (Steger and Lakshmanan, 1968). For example, the range of possible evaluation criteria is enormous and multi-dimensional;
3. The evaluation criteria may be in conflict (Devas and Rakodi, 1993); and,

4. The theoretical foundation for both planning and evaluation is lacking (Evans, 1994; Parkin, 1993; Shefer and Kaess, 1990; Alexander and Faludi, 1989).

Overall, plan evaluators face the difficult, multi-dimensional task of ascertaining interests (public, special, vested), reconciling which ones are to be served by the plan, understanding the reasons behind positions and decisions, and assessing the potential consequences arising from plan implementation.

Under these circumstances, an argument supporting the need for methodologically- and theoretically-grounded plan evaluation instruments has considerable conceptual appeal. However, such an argument can be quickly eroded in the face of harsh day-to-day realities. That is, the question of *what to do* inevitably arises since "no widely accepted method exists for generating prioritized criteria of merit" (Shadish *et al.*, 1991: 459). Furthermore, planners and decision makers may be genuinely interested in whether a plan is good or bad, but may choose not to investigate the explanations and details about *why* a plan is good or bad since the persons, groups or enterprises whose interests may be affected are often more concerned with the short-run, practical and context-specific repercussions of planning — and tend to be politically rather than scientifically motivated (Greene, 1993; Smith and Wellar, 1992). This creates a planning context where values are permitted to shape or orient the conduct and conclusions of evaluations. Consequently, there is a need to derive an evaluation instrument that transcends short-run imperatives through methodologically- and theoretically-grounded design.

Slocombe (1993: 291), for example, suggests that "the mainstream planning profession as a whole still emphasizes the process or procedural dimension of planning over the substantive." By limiting theoretical dialogue in planning to procedural frameworks (e.g., the rational comprehensive, mixed scanning, disjointed incrementalism), planning thought has not been extensively cross-fertilized by some of the emerging descriptive and explanative frameworks like hierarchy theory, self-organization theory, and chaos theory.

SUMMARY

In this chapter, two fundamental social and scientific problems are identified:

- the increasing complexity of municipal and environmental problems; and.
- the paucity of evaluation instruments for municipal plans.

Emerging frameworks like the ecosystem approach to planning may be capable of dealing with the increasing complexity of municipal and environmental problems. One way of improving the efficacy of ecosystem-based plans could involve the derivation of an evaluation instrument capable of judging their quality. However, the specification of plan evaluation criteria has traditionally suffered from a number of underlying problems, including the following: client-dependence, complex subject matter, conflicting values, and the lack of methodological and theoretical foundations. These pressing problems in planning invite an investigation into the derivation of a plan evaluation instrument capable of judging the quality of ecosystem-based plans.

CHAPTER II

LITERATURE REVIEW OF THE THREE SUBJECT DOMAINS: THE ECOSYSTEM APPROACH TO PLANNING, PLAN EVALUATION AND HIERARCHY THEORY

INTRODUCTION

The increasing complexity of municipal problems and the need for a new planning framework to address them was expressed in the Problem Statement (Chapter I), as was the need for instruments to improve planning practices and products. In this literature review, the following three subject areas are investigated in order to provide orientation to subsequent research:

- the ecosystem approach to planning;
- plan evaluation; and,
- hierarchy theory, following an introduction to theory in general.

For these three subject areas, relevant research voids are identified, and the benefits and weaknesses of each are critically examined in order to gain insight into potential complexities or problems that may need to be accounted for in the research process.

THE ECOSYSTEM APPROACH TO PLANNING

The ecosystem approach is one of the newer planning frameworks that pursues the meaningful integration of environmental concerns with more traditional economic and social concerns. When compared to conventional planning, ecosystem-based planning represents an evolving approach in terms of how humanity is conceptually situated within the environment. The fundamental basis of the ecosystem approach is associated with the notion of *home*.

Background to the Ecosystem Concept*

Although analogous terms such as *microcosm* were used in the 19th century, the word *ecosystem* apparently first appeared in 1935 in the work of Arthur Tansley (Bocking, 1994). Ecosystem comes from two roots: *eco* from the Greek *oikos* for home and *system*.** Miller (1997: 64) defines *ecosystems* as "communities of species interacting with one another and with their nonliving environment of matter and energy." Instead of seeing nature in terms of species against the backdrop of an abiotic environment, the ecosystem concept underplays the distinction between living and non-living components of the environment. Ecosystemic relationships are inter-connected and inter-dependent, regardless of origin. In *A Theory of Good City Form*, Lynch (1981: 98) states that "people and their cities are as much natural phenomena as trees, streams, nests and deer paths. It is crucial that we come to see ourselves as an integral part of the total living community."

Introduction to the Ecosystem Approach to Planning

The ecosystem approach to planning is increasingly being implemented across North America (see Roseland, 1997; Belsky, 1995; Tomalty *et al.*, 1994a; MOEE and MNE, 1993a, 1993b, 1993c; UNCED, 1992; Crombie, 1992; GLRAB, 1978). Although the ecosystem approach embraces many aspects of other environmental planning approaches (e.g., sustainability, healthy communities, bioregionalism, ecocities/ecovillages, green cities), its underlying orientation involves a subtle but profound counterpoint to the other

* A *concept* is the end product of conceptualization. A concept is both the label (word) and the complex set of events or ideas that form the whole referred to by the word (Walizer and Wienir, 1978). Conceptualization is the mental process of organizing observations and experiences into meaningful and coherent wholes (Walizer and Wienir, 1978).

** The term *ecology* is older than *ecosystem*, and literally means *the study of homes*. Ecology "was coined by Haeckel in 1869 to mean the study of organisms in their organic and inorganic environments" (Robertson *et al.*, 1991: 9).

approaches with respect to the conceptual positioning of humanity within the environment. As Vallentyne and Beeton (1988: 58) contend,

the shift from an environmental to an 'ecosystemic' point of view is actually quite radical. It calls for a change in the entire field [of environmental planning] within which opportunities and problems are examined — a change from a view of environment in a political or people-oriented context to a view of politics in an 'ecosystem' context.

In one sense, the traditional view posits the environment as a *house* — external and detached. Conversely, the ecosystem approach suggests a *home* — where humanity and all things form an integrated whole (Christie *et al.*, 1986).

The theme of *the ecosystem as home* began to be explored in the North American planning and environmental management literature following the adoption of the ecosystem approach by the International Joint Commission and the Great Lakes Research Advisory Board (GLRAB, 1978). A more recent example of the ecosystem approach to planning in Canadian practice is provided by the Royal Commission on the Future of the Toronto Waterfront (Crombie, 1992). Other examples of ecosystem-based planning contexts in Canada are contained in Roseland (1997), FCM (1995), and Tomalty *et al.* (1994a).

At the international level, there has also been "a movement towards a general legal mandate for ecosystem-based research, management, and protection" following the 1992 Earth Summit on Environment and Development in Rio de Janeiro (Belsky, 1995: 217). At the local level, when Bogach (1994: 59) asked for "planning in an ecological context" at a planning exercise held by the Region of Ottawa-Carleton, she was expressing the public's growing interest in ecosystem-based planning. The interest in the ecosystem

approach to planning is, perhaps, the logical extension of the increasing presence of ecological thinking in science as a whole (Capra, 1994).

As Belsky (1995: 218) observes, the "planning and management of land resources must be premised on an understanding that such resources are 'organized in ecosystems'." The notion of **organization** is critical to understanding the structure and function of ecosystems, and requires careful elaboration. The ecosystem approach to planning, which applies ecosystem science to real-world planning problems, recognizes the linkages and relationships between living (all biota — including humans) and non-living environmental components (e.g., air, land, water, soil, etc.) within the framework of ongoing processes (including the hydrological, carbon, phosphorus, sulfur, economic, political, and other cycles). Or, to re-phrase the organizational aspect at a higher level of generality, the ecosystem approach to planning provides a more systematic framework for planning and decision making that focuses on the dynamic interrelationships between all elements of the urban community, as well as fostering an appreciation of natural processes (Crombie, 1992).

The fundamental premise of ecosystem planning is that "human activity is part of the environment, in that it shapes the environment and is in turn limited by environmental factors of resource availability and system resiliency" (Tomalty *et al.*, 1994a: 1). The Tomalty *et al.* (1994a) survey of ecosystem-based planning and subsequent revisions (i.e., Gibson *et al.*, 1997) to the research by the original authors can be regarded as providing the first and second generations of ecosystem-based planning principles demonstrated in Canadian experience.

The first generation of ecosystem-based planning principles identified and described by Tomalty *et al.* (1994a) include the following (see Chapter V for their definition):

1. planning units should be based on natural boundaries;
2. jurisdictions should be designed with nature;
3. global and cumulative effects should be considered;
4. inter-jurisdictional decision making should be encouraged;
5. consultation, cooperation and partnering should be ensured;
6. long-term monitoring, feedback and adaptation should be initiated; and.
7. an interdisciplinary approach to information should be adopted.

Second generation principles provided by Gibson *et al.* (1997) include the first generation principles plus the following:

8. a precautionary but positive approach to development should be employed;
9. planning should integrate (rather than merely 'balance') environmental, social and economic objectives; and.
10. land use planning should be linked with other aspects of democratic change, social learning, community building and environmental enlightenment.

As shown by the employment of the verb *should* in how these premises are formulated, the ecosystem approach to planning represents a normative* framework for planning.

The Benefits of Ecosystem-based Planning Demonstrated Through a Comparison With Conventional Planning

When compared to conventional planning (i.e., planning as it is typically practiced in

* A framework or theory is *normative* if its use prescribes using norms or standards, either explicitly or implicitly. Normative statements either employ or imply the verbs 'ought' or 'should' (Lacey, 1986: 161). An example of a normative framework is provided by Wellar (1987) who employs the term 'preferred' in reference to future states.

most Canadian municipalities), the evolution and benefits of planning processes and planning products guided by the ecosystem approach become evident. Perhaps the most important benefit of the ecosystem approach is that it provides a new and comprehensive framework for dealing with increasingly complex planning problems. New science and new thinking is welcomed in an ever-expanding horizon of possibility. As Tomalty *et al.* (1994a: 1) contend,

the ecosystem approach acknowledges that development takes place in the context of a highly complex matrix of interrelated elements, including other living species and non-living elements. Because of its emphasis on and appreciation of ecological complexity and vulnerability, ecosystem planning can avoid expensive environmental mistakes and the need for remediation.

As more and more variables are introduced into human communities, adaptive and transformative planning frameworks need to be in place in order to meet the concomitant challenges. Historically,

planners, who were trained as neutral technicians whose recommendations would be accepted on their inherent value, became disillusioned as they realised that this stance could not compete in a political environment in which special interests, bargaining, and short-term results assumed greater importance (Shefer and Kaess, 1990: 78-79).

The ecosystem approach, because of its adaptive capacity to new science and new information, plus its meaningful inclusion of relevant groups in the planning process, is well-suited for dealing with complexity. Table 2.1 illustrates other benefits of ecosystem-based planning when compared to conventional planning.

Table 2.1 Illustrating the Benefits of Ecosystem-Based Planning by Comparing it to Conventional Planning
Source: Adapted from Tomalty *et al.* (1994a).

CONVENTIONAL PLANNING	BENEFITS OF ECOSYSTEM-BASED PLANNING
<i>Goals and Objectives</i>	
Traditional planning is oriented toward adapting to existing economic and social trends (and the demands they give rise to) rather than setting community goals to be achieved through the planning process.	In ecosystem-based planning, the formulation and achievement of goals is understood to be of fundamental importance to the planning process. The stress placed on the future orientation of planning reaffirms planning's overall contribution to society. Ecosystem-based planning is anticipatory rather than reactive.
<i>Planning Units</i>	
Traditional planning uses a hierarchy of politically defined planning units, which, from an environmental perspective, are arbitrarily defined and often fragmented.	An ecosystem approach replaces the politically- and jurisdictionally-driven hierarchy of planning units with nested units based on natural boundaries. The trans-boundary nature of many environmental problems makes them difficult to address at the system level in a fragmented context. Ecosystem-based planning attempts to counteract this shortcoming by more accurately matching jurisdictional scales to the issues or by facilitating inter-jurisdictional cooperation and decision making.
<i>Design</i>	
Traditionally, planners have relied on engineered 'linear' systems that replace ecological processes and regard land as a blank slate ready for human uses.	New planning and design approaches based on ecological principles favor more creative solutions based on the biological productivity of natural systems, the cycling of resources, and the reduced need for services through demand management. This improves the fit between human settlements and the ecosystems in which they are nested. Communities that are designed with nature are more effective in terms of resource conservation, and more likely to persist over time in the face of a rapidly evolving biosphere.

Table 2.1. Continued.

CONVENTIONAL PLANNING	BENEFITS OF ECOSYSTEM-BASED PLANNING
<i>Approach to Information</i>	
Social, demographic and economic information has dominated traditional planning methods and research. Little attempt has been made to connect these variables to ecological capacity or to predict the effects of meeting demands on ecological functions.	The ecosystem approach implies a greater scale of information gathering, more integration of information and greater cooperation among information providers — both amateur and expert. It is recognized that information will not eliminate uncertainty in planning and that relevant information may only become available as the planning process unfolds.
<i>Consideration of Development Impacts</i>	
Traditional approaches to planning tend to favor short-term and local considerations at the expense of longer-term, and more global concerns.	The ecosystem approach involves a much longer and broader planning horizon. Consideration of off-site effects and their accumulation are included in the planning process. The site-based environmental assessment of projects and other initiatives employed in conventional planning does not account for important cumulative effects like the following: ecological fragmentation, synergistic effects, compounding effects, the crossing of ecological thresholds, time and space crowding, and time lags. Cumulative effects such as these are ecologically-based, and can be accounted for in the ecosystem approach.
<i>Decision Making</i>	
Conventional planning is commonly carried out in isolation from other significant planning and management activities.	The ecosystem approach attempts to overcome jurisdictional fragmentation by encouraging new planning units, agencies and methods that promote inter-jurisdictional decision making. The cooperation of agencies — in the absence of new planning jurisdictions — improves the regional reach of planning efforts. As well, the integration of conventionally disparate functions (e.g., agencies for planning and economic development) contributes to a cohesive treatment of existing issues.

Table 2.1. Continued.

CONVENTIONAL PLANNING	BENEFITS OF ECOSYSTEM-BASED PLANNING
<i>Consultation, Cooperation and Partnering</i>	
Land use planning decisions are often made in a technocratic manner after discharging the legal obligation for some perfunctory public involvement.	The ecosystem approach involves the widest range of interested parties as possible in the planning process. This is a pre-condition for meaningful public participation. Improved consultation and cooperation improves the legitimacy of planning, while simultaneously improving the likelihood of successful plan implementation because those affected by the plan have participated in the formulation of the plan.
<i>Monitoring and Feedback</i>	
In conventional land use and environmental planning, few resources are expended to assess ecosystem health and changes to the environmental baseline as plan implementation unfolds.	Monitoring mechanisms suggested by the ecosystem approach facilitate (a) community assessment of achieved progress in plan implementation, (b) tracking of the response of ecosystem elements to plan implementation, and (c) providing an objective basis for adapting plans to changing conditions.

As demonstrated in Table 2.1, ecosystem-based planning represents evolution from what is conventional planning to a new or different mode. That is, traditional relationships are seen in new ways, and the tools to achieve results are evolving as a result of research and applications that support the transition.

Justifications for Research Involving the Ecosystem Approach to Planning Revealed Through the Identification of Research Calls and Potential Limitations of the Approach

Despite the many benefits of the ecosystem approach to planning, the emerging framework continues to face a daunting array of research voids and underlying weaknesses. As shown in Table 2.2, there have been many expressions of support for research into the viability and operational utility of the ecosystem approach to planning.

Table 2.2 An Indicative Chronological List of Justifications Supporting Research Investigating the Ecosystem Approach to Planning.

	Reasons or Concerns Supporting Research Pertaining to the Ecosystem Approach to Planning	References
1	"The ecosystem approach recognizes that some of the ways we have defined the ecosystem before now have been less powerful than they might be...it emerges that we need new interdisciplinary ways of defining the system and specifying its parts. Perhaps we even need new disciplines altogether."	Allen <i>et al.</i> , 1993: 7-9.
2	"What is needed is to demonstrate the utility of ecology in one or more particular case studies that illustrate concretely how ecological information might be used in specific management situations."	Shrader-Frechette and McCoy, 1994: 303.
3	"Putting ecosystem-based planning into a practice will require the sharing of practical experiences and information among planners and other disciplines."	Joyner <i>et al.</i> , 1994: 20.
4	"We need to reconceive the planning system as embedded within a set of environment constraints."	Owens, 1994: 171
5	"Two recent developments suggest the possible future evolution of the ecosystem concept...one is ecosystem integrity; the other is the adoption of the ecosystem concept by experts, agencies and interest groups outside the ecological research community."	Bocking, 1994: 17.
6	"Unfortunately, few attempts have been made to translate the ecosystem planning concept into a systematic approach to land use planning in urban areas."	Tomalty, 1994a: 1.
7	"The ecosystem approach, for example, while identifying principles to guide planning and management activity, can be criticized for being somewhat vague and abstract for managers, practitioners, or researchers developing policy instruments or planning and management systems."	Armitage, 1995: 470.
8	"A variety of indicators running the gamut from early warning signs of ecosystem dysfunction to indicators that confirm the presence of significant ecosystem pathology have been proposed...yet few indicators have thus far been adequately validated."	Rapport, 1995: 5.
9	"Planning and management of land resources must be premised on an understanding that such resources are 'organized in ecosystems.'"	Belsky, 1995: 218.
10	"There is a real need for the application of more realistic models of ecosystem dynamics in land resource management...Models with high utility must account for both the physical and cultural complexities encountered by resource managers and policy makers and yet be simple enough to be understood by people of varied backgrounds and inclinations."	Brown and MacLeod, 1996: 291.
11	"To appreciate the effects and magnitude of city development, there is a need to introduce a more integrated approach to research into the building, planning, design, and other components that are necessary if the city is to function effectively. Among other things, we need to look more closely at how the city makes use of the ecosystems that support it."	Kessler, 1996: 68.
12	"Processes of re-democratization and 'green' land use legislation are providing opportunities for planners to put some flesh on the still skeletal paradigm of ecosystem planning."	Tamminga, 1996: 10.

The messages communicated from the research calls (Table 2.2) include the following:

- expansion of the application of the ecosystem approach outside the ecological research community is suggested;
- the framework and components of the ecosystem approach to planning require further elaboration;
- urban planning processes continue to require integrative mechanisms;
- specific planning functions (e.g., plan evaluation) in ecosystem-based planning need to be investigated; and,
- the on-going development of ecosystem-based planning is predicated upon the integration of a range of disciplines.

In addition to the more conceptual and theoretical limitations identified above, practical barriers to the implementation of the ecosystem approach are also compelling. A preliminary list of potential barriers and obstacles to the ecosystem approach includes the following:

1. **the dominant North American environmental worldview.*** Most voters in North America hold what is termed a human-centred environmental worldview (Miller, 1997). Within this worldview, human beings are regarded as the planet's most important and dominant species, and can and should manage the planet mostly for their own benefit. There are certain subsidiary beliefs of the human-centred worldview that impinge on the viability of implementing the ecosystem approach to planning:
 - *there is always more*, which suggests that if resources run out, new technologies and advances in science will find new ways of meeting consumer demands (rather than changes to human behaviour and consumption of resources);
 - *the potential for economic growth is limitless*, which means that society merely needs new mechanisms for accommodating growth; and,
 - *the free market school*, which argues that the best way to manage the planet for human benefit is through a free market economy with minimal government interference and regulation (Miller, 1997).

* *Environmental worldviews* are how individuals think that the world works, what they think their role in the world is, and what they believe are right and wrong environmental behaviours (Miller, 1997: 33).

Ecologists, it could be argued, would find the human-centred worldview conceptually suspect since it places humanity outside its home and designates humanity as the master of worldly destiny. If all problems can be solved by inventiveness, product substitution or technological innovation, then why is ecosystem-based planning required? This is a compelling question because science, technology and the market provide society with powerful adaptive capabilities.

However, the gap between the ecological crisis (see Quammen, 1998, for example) and the lack of urgency attendant to it is perhaps symptomatic of the observation that Western societies — for the most part — are shielded or are able to be shielded from environmental degradation. Technological innovations like air conditioning, water purifiers, air purifiers, sunblock and advances in respiratory and cancer-related medicine reduce the urgency of signals from the environment. In affluent Western societies, it is the children, the poor and the disenfranchised that are the most likely to receive unattenuated signals from the environment (Holling, n.d.). And, it is important to note that children and the disenfranchised are not voters.

2. **the on-going lack of institutional adaptation to ecological imperatives.** In his study of organizational *versus* natural structure, Wuichet (1995) found that bureaucracies tended to be structured differently from ecosystems (i.e., bureaucracies are typically non-nested since their scope and jurisdiction do not follow natural laws). The implication is that bureaucratic institutions cannot adequately deal with environmental problems which are, by their very nature, trans-boundary and manifested across a variety of scales. The implication is that environmental problems are difficult to solve from fragmented institutional platforms.

Meanwhile, "to add a whole ecosystem level to a management plan is to resolve to manage, in addition to managing components of the system for resource production, the system as a system" (Norton and Ulanowicz, 1992: 246). And, planning for a system as a system requires complex inter-jurisdictional arrangements. Successful ecosystem-based planning is therefore predicated on inter-jurisdictional cooperation if complex planning issues are to be tackled systematically (Richardson, 1984). Until institutional jurisdictions are made consistent with ecosystem structure, or convincing inter-jurisdictional arrangements are demonstrated, the ecosystem approach to planning remains difficult to implement. In light of these factors, it is not surprising that Vallentyne and Beeton (1988) observe that no new institutional or administrative structures were ever implemented to facilitate the ecosystem approach to planning in the Great Lakes Basin context.

In a related vein, **challenges to the *status quo*** are also a complicating factor. As Dowling and MacLachlan (1997: 14) observe, "each of the ecosystem approach characteristics poses significant challenges to traditional 'top down' decision making. Control by a few, through segregated mandates and jurisdictions, frustrates attempts to define and solve problems using a more collaborative approach." In other words, governments and their jurisdictions are so fragmented (i.e., lacking integration) that they do not mimic nature and therefore cannot adequately regulate or shape human interaction with due regard for nature.

Furthermore, Vallentyne and Beeton (1988: 60) state that the ecosystem approach:

calls for an inversion of the order of priority of the great system of power on which human societies depend. In governance, the flow of power proceeds downwards from political systems to economic systems and thence to technological production systems and finally to natural resource systems. In ecological theory the perceived flow of power (i.e., of available energy) is just the reverse: from natural resource systems to technological production systems and thence to economic systems and finally to political systems.

Vallentyne and Beeton are positing that the way that power is manifested in existing human-based hierarchies does not mimic the structures and functions of nature. This suggests that new governance and administrative mechanisms need to be created in order to make ecosystem-based planning viable. Both a top-down or bottom-up reorganization of institutions or political processes could be implemented (Wuichet, 1995). For example, the principle of *subsidiarity* (i.e., taking decisions at the lowest political level compatible with achieving identified objectives) has a number of political and therefore power-based benefits (Blowers, 1993). More specifically, subsidiarity promotes participation and therefore increases the feasibility of ecosystem-based planning and its implementation. Nevertheless, a simultaneous difficulty concerning any alteration to political processes is that any impact on a power structure implies that someone or something will be affected, and this could precipitate a situation of conflict unless a high level of cooperation exists (particularly when authority and constraint is delivered top-down);

3. **the multiplicity of government agencies involved in environmental planning.** Often, government agencies have antagonistic goals and conflicting jurisdictions, which complicates the efficacy of implementing the ecosystem approach (Coates, 1992). In Ottawa-Hull, for example, watershed planning involves a complicated envelope of government actors: the National Capital Commission, provincial agencies like the Ministry of the Environment and the Conservation Authorities, the three regional municipalities, and at least 28 local governments — each with different mandates and jurisdictions;

4. **the lack of available environmental data and information.** At universities, proprietary rights exerted by clients who fund research can impede the flow of data and information to both planning agencies and to the public. At the regional and local levels of government, agencies are not legally required to undertake comprehensive ecological surveying and data gathering, so there is little incentive to do so within a context of limited municipal funding. Even if considerable ecological information existed at the regional and local levels, there may still be incentives not to provide it to the public or to interest groups (Wellar, 1989a). As it currently stands, "information is disseminated to lower levels of government, to public interest groups and the people, largely in order to inform and gain reactions about acceptability, rather than to provoke involvement or participation" (Nelson, 1992: 206-207). Basically, Nelson is suggesting that the motive(s) underlying government dissemination of data and information pre-emptively negates its optimal effectiveness. Furthermore, Bregha (1992: 191) identifies further government-based impediments to data and information sharing, including the following: "the compartmentalization of environmental information among several departments, the manipulation of information to protect vested bureaucratic or political interests and, lastly, the [deliberate] withholding of information."

The ecosystem approach to planning requires an extensive information input in order to be viable, and impediments to information availability compromise the ability of both planners to implement the approach and the public to assimilate relevant details concerning their interests. Other factors also complicate data and information availability, including the media's ineffective coverage of environmental issues and the small number of well-funded environmental groups capable of disseminating their message (Bregha, 1992). With this combination of factors at work, the likelihood of good information transfer among interested parties in the planning context becomes more difficult to achieve.

Concerning ecosystem-based planning in particular, Tomalty *et al.* (1994a: 20) observe that,

Social, demographic, and economic information has been emphasized in traditional planning, with information gathering efforts centred on predicting future demand for such things as housing, transportation facilities, and social services. Little attempt has been made to determine ecological capacity or to assess how efforts to satisfy the anticipated socio-economic demands may affect ecological functions.

Until this situation is ameliorated, ecosystem-based planning remains an ideal rather than a practical option. However, a number of municipalities have made important progress into this data and information void, including the Region of Ottawa-Carleton (Tomalty *et al.*, 1994a).

5. **the desire for short-run effectiveness.** At lower levels of government, parochial and short-run interests are even more pressing than at the federal level (Coates, 1992). Since planning is primarily a provincial responsibility in Canada, short-run imperatives are tantamount, and this serves to undermine the long-run perspective of ecosystem-based planning;
6. **the openness of public participation protocols.** On the one hand, the mandated requirement for public participation in planning processes under provincial planning acts is profoundly beneficial. On the other hand, "it leaves the door open to aggressive action by relatively small groups to slow, stymie, thwart, distort or redirect" federal, provincial, and local policy (Coates, 1992: 30). If special interest groups (e.g., representing the development industry) are able to mobilize a pro-development consensus within the political machinery of local government, then ecosystem-based planning will be undermined;
7. **the lack of strong language in plans.** Warner and Molotch (1995) acknowledge the role of equivocating language in existing plans. The lack of translation of *should* to *shall* in the terminology of planning policy permits environmental priorities to be abnegated (Smith and Wellar, 1992);
8. **the lack of inter-disciplinary education.** "Since most professionals have been trained in universities that are organized around disciplinary departments, and professional associations are primarily based on disciplines, planning techniques promoting the necessity of interdisciplinary relationships will meet some resistance" (Rickson *et al.*, 1990: 235). For example, a fundamental weakness or barrier to developing and/or implementing the ecosystem approach is that ecology and planning are not necessarily related in planning school curricula, nor in the curricula of planning-related disciplines such as geography, architecture, transportation engineering, and so on. That is, an examination of university calendars and departmental representatives reveals that it is possible for planners or would-be planners to graduate with a planning or planning-related degree and have no formal exposure to ecology or ecological thinking. This suggests that planners — on the whole — may not be adequately equipped to implement the approach;
9. **the existing gap between the practical and normative characteristics of ecosystem-based planning.** As a normative framework for planning, another potential weakness of the ecosystem approach concerns the gap between the characteristics of how it is currently practiced and its normative characteristics. In other words, how closely does the ecosystem approach in practice reflect the idealized ecosystem approach in principle? Although the cornerstones of the ecosystem approach have intuitive and normative value, existing governmental institutions and the historical inertia of decades of planning practice may be ultimately incapable of supporting the approach;

10. **the complexity of ecological systems.** It has been suggested that not only are ecosystems more complicated than we think, they may be more complicated than we can think (Miller, 1997; Livingston, 1990). The interactions and relationships inherent in a system (e.g., the weather) may be so complex that attempts to predict their behaviour with any long term accuracy is rendered futile.

Brown and MacLeod (1996: 291) see both the complexity and simplicity dimensions of the system/planning dichotomy. They suggest that "there is a real need for the application of more realistic models of ecosystem dynamics...models with high utility must account for both the physical and cultural complexities encountered by resource managers and policy makers and yet be simple enough to be understood by people of varied backgrounds and inclinations." In other words, capture the inherent complexity, but keep it simple;

11. **the ecosystem approach is too vague or too ephemeral for adequate operationalization.** Armitage (1995: 470) suggests that "the ecosystem approach, for example while identifying principles to guide planning and management activity, can be criticized for being somewhat vague and abstract for managers, practitioners, or researchers developing policy instruments or planning and management systems." The abiding challenge behind the difficulties mentioned, and this is part-and-parcel of the research process, is ascertaining how to move from the conceptual to the operational (Wellar, 1998; Walizer and Wienir, 1978; Ackoff, 1953). Specifically, which criteria can planners employ to gauge their productivity within the framework?;

12. **the lack of a theoretical basis for the ecosystem approach to planning.** As Briassoulis (1989: 390-391) notes, "the body of environmental planning theory is still meager. Contributions from both theoreticians and practitioners are necessary to bring the field as a whole to maturity." Similarly, Beatley (1989: 2) exhorts that, "there is a clear and immediate need for those involved in the area of 'environmental planning' to develop a theoretical and moral basis to support and guide their activities." While the lack of a theoretical underpinning for ecosystem-based planning may be lacking, this may not represent a substantive impediment to the process as a whole. Theories abound, and the task is to find or derive a theoretical framework that expediently offers relevance and understanding to the process.

As Bracken (1981: 102) suggests, "theory is not an optional extra, it is the foundation upon which a better understanding of the nature and possibilities of urban planning may be sought." Historically, planning theory has been principally concerned with procedure rather than substance (Briassoulis, 1989). The descriptive, explanative and predictive functions of substantive theory could potentially meet some of the deficiencies of both the ecosystem approach and of planning in general.

Müller (1992: 228) also identifies a lack of theoretical underpinning for ecology in general by stating that, "one of the most significant problems of ecosystem research is the lack of a specific *ecological theory*." Müller's contention can be extended to imply that the many characteristics of the ecosystem approach are not cohesively framed within one compelling conceptual framework, which makes the discussion of a particular principle or process stage subject to the question of potential arbitrariness. Is there an exit from this conundrum? Emerging interdisciplinary frameworks like hierarchy theory provide powerful heuristic tools capable of modeling and investigating complex systems, and may redress the current lack of explanative power underlying the ecosystem approach to planning.

Concluding Remarks on the Ecosystem Approach to Planning

Overall, the ecosystem approach posits that the big picture (the ecosystem in its entirety) is to be considered as the planning unit. Ecological boundaries (e.g., as delimited by the watershed, vegetative cover, topography, etc.) are used to delineate the perimeter or membrane of the ecosystem. As well, environmental effects are recognized as cumulative, and an understanding of ecosystem functions and interactions is required to adequately anticipate and mitigate the impacts of human settlements.

For those municipalities and agencies currently employing it, the ecosystem approach to planning represents a conceptual shift within the planning profession in terms of how planning processes are undertaken and implemented. Overall, the problems associated with the ecosystem approach have one consistent characteristic: they are not generated by inconsistent logic or practical impossibility, but by human historical inertia and insufficient theory.

Based on the identified problems, it appears clear that new, exploratory research is needed to address some of the inherent weaknesses and knowledge voids that exist. As

demonstrated in Table 2.2, there is considerable support for research that contributes to: (a) making the ecosystem approach operational; and, (b) finding or exploring a theoretical underpinning that supports, serves and promotes the approach. In other words, the ecosystem approach is not sufficiently grounded in theory to provide a solid descriptive, explanative and predictive foundation for establishing which planning goals, practices and products are related to ecosystem complexity.* Specifying the attributes of good ecosystem-based plans in a methodologically- and theoretically-grounded manner represents one way to refine ecosystem-based planning processes and products, and could contribute to closing the conceptual-operational gap.

PLAN EVALUATION

Evaluation

According to Scriven (1991: 139), the key sense of the word evaluation "refers to the process of determining the **merit, worth, or value** of something, or the product of that process."" In other words, evaluation as a process refers to the study and application of procedures for objectively and systematically investigating merit, worth, or value, or it refers to meta-evaluation (i.e., the evaluation of evaluations). Scriven's operational definition has three components: the evaluation process or determination; the criteria related to merit, worth or value; and the stimulus or activity (i.e., the object of an evaluation exercise called the *evaluand*). The methods of quantitative or qualitative research can then be employed for determining the relationship of the stimulus to the

* See Wellar and Harris (1992) for further discussion of the descriptive, explanative and predictive dimensions of methodologically-based inquiry.

** Emphasis employed on the terms *merit, worth* and *value* was provided by Scriven (1991).

objective (the end-values held for the stimulus) in terms of quantifiable or qualifiable criteria (Suchman, 1967).

Municipal Plans

Functionally, municipal plans represent the expression of how a municipality will be guided from an existing state of affairs to a preferred state of affairs (Gladki, 1991; Wellar, 1987). Structurally, a municipal plan is a policy document (usually with legal status) that typically contains the following information fields: a *state-of-the-community* summary, assumptions and forecasts, planning principles, community goals and objectives, and policy statements that indicate the manner in which a municipality intends to achieve its objectives (Kaiser and Godschalk, 1995; Kent, 1991).

A municipal plan does not regulate development itself, but provides the architecture of the implementing by-laws, capital improvement programs, and other planning instruments that drive the implementation function. In other words, a plan expresses the municipality's intentions, while the related planning instruments delineate land uses and desired behaviours in the spirit of those intentions. Nevertheless, although a plan usually has legal status, it can still be circumvented by discretionary decisions on the part of municipal government (e.g., through plan amendments, etc.), particularly when the client proposing change is capable of exerting political influence (Warner and Molotch, 1995; King and Harris, 1989; Bressi, 1988).

Ecosystem-based plans represent a subset of plans in general, and are generated and implemented within the framework of the ecosystem approach to planning. The overall

goal is the same: guidance towards the achievement of a preferred state of affairs. Although conventional plans and ecosystem-based plans have the same overall goal, the specification and means of achieving that goal are different. Ecosystem-based plans are concerned with demonstrating that human settlements are living *at home* in their environment, and this is accomplished by ensuring that planning "integrates (rather than merely 'balances') environmental, social and economic objectives" (Gibson *et al.*, 1997: 34). As demonstrated in the previous section (see Table 2.1), the ecosystem approach to planning represents an evolution of planning practice and products from conventional planning.

Plan Evaluation

Since plan evaluation involves the process of determining the merit, worth, or value of a plan, it presupposes that a good plan can be differentiated from a bad one. *Goodness*, in this context, refers to "the property or characteristic of a thing giving rise to commendation" (Lacey, 1986: 86). Since Plato, and later Aristotle in his examination of *good* in the *Nicomachean Ethics*, the history of thought has generally discriminated between *intrinsic good* and *instrumental good* (Stumpf, 1977).

Some things are *good* as ends unto themselves or for their own sakes (intrinsic goods). Other good things can be regarded as means to ends (i.e., a way of achieving a higher good) and are referred to as instrumental goods (Lacey, 1986). A good plan, therefore, would be an instrumental good, since it contributes to achieving a preferred state of affairs. More specifically, a good ecosystem-based plan is an instrumental good if it contributes to the attainment of the principles of ecosystem-based planning (both in

theory and in practice). Nonetheless, given the existing lack of a consensus-based foundation for ecosystem-based planning, the following exploratory question does not currently have an answer: what are the attributes of a good ecosystem-based municipal plan?

There is a wide range of circumstances in which evaluation is and can be applied to planning products and processes. A typology of plan/planning evaluation contexts provided by Talen (1996) includes the following four categories:

1. plan evaluation prior to implementation (i.e., *ex ante* evaluation);
2. evaluation of planning practice;
3. policy implementation analysis; and,
4. evaluation of plan implementation (i.e., *ex post* evaluation).

In this study, emphasis is concerned with the first instance: the comprehensive, *ex ante* evaluation of a plan that is being considered for adoption by a municipal government or the relevant authority.

A primary distinction among plan evaluation methods involves differentiating between *ex ante* and *ex post* applications (Wellar, 1987). An *ex ante* evaluation "focuses on that part of a planning procedure which concentrates on the preparation of a planning proposal" (Voogd, 1983: 16). Conversely, *ex post* evaluation is concerned with "what happened after the implementation" (Voogd, 1983: 16). Consequently, the distinction focuses on whether the municipal plan has been implemented (*ex post*) or has not yet been implemented (*ex ante*).

The Benefits of *ex ante* Plan Evaluation

The benefits of *ex ante* plan evaluation are associated with pragmatic need, ethics, societal interests, decision making, learning, process transparency, and professional credibility. Concerning pragmatic need, the over-riding reason that evaluation processes have wide-ranging pertinence and utility appears to be because its consequences are so important to both the design and implementation of products and services (Wellar *et al.*, 1996). For example, inferior products and services can cost lives, waste resources, and degrade community or individual quality of life (Scriven, 1991).

Evaluation answers fundamental questions. Were the optimal planning decisions made? Have all the variables been considered? If methodologically-designed, plan evaluation should reveal any weaknesses of the process or product against the set of evaluation criteria (Mitchell, 1989). To the degree that it serves intrinsic goods (e.g., equity, beauty, effectiveness, health), plan evaluation represents an instrumental good and can improve the quality of planning processes and products, and related results.

As stated, plan evaluation serves intrinsic goods (such as equity), and in this way, provides an ethical function. If an ecosystem-based plan is evaluated on the basis of the equitable redistribution of public goods (e.g., green space), and the equitable locational distribution of public problems (e.g., landfills, power transmission corridors, prisons, etc.), then the evaluation process is instrumental to equity-achievement.

In social terms, "evaluation directs effort where it is most needed, and endorses the 'new and better way' when it is better than the traditional way" (Scriven, 1991: 43). For

decision makers, the evaluation process condenses a great deal of data and information and crystallizes it into a recommendation of good or bad, better or worse. Conversely, if the evaluation is meant to clarify the issues rather than make a recommendation to decision makers, it provides a mechanism for highlighting the most contentious variables. Either way, as Lichfield *et al.* (1975: 7) observe, plan evaluation provides "a factual basis of the issues for decision to the various participants in the planning process."

Plan evaluation also contributes to the learning process, where new insights are obtained and knowledge is generated (e.g., through the exploration of relationships between *in situ* plan particulars with general ideals). Evaluation, in general, is:

a science in that it involves the production of knowledge rather than of art, anecdotes, or artefact [sic]...science itself is only distinguishable from pseudoscience by means of evaluation — by evaluation of the quality of evidence, research designs, instruments, interpretations, and so on (Scriven, 1981: 3-4).

As long as the results are made public and represent part of the dialogue among planning partners, plan evaluation also contributes to process transparency and reveals where the process and products can be improved. Furthermore, public dissemination of evaluation results make planners and planning agencies more accountable, which improves the fit between social needs and the demands of vested interest groups. Finally, professional credibility (for the planners who formulated the plan) can be supported by plan evaluation — assuming that the results of the evaluation are favorable.

Justifications for Research Involving Plan Evaluation Revealed Through Potential Limitations of Evaluation Processes and Through Identification of Research Calls

In order to demonstrate some of the limitations of existing plan evaluation techniques, it is instructive to present some of the most common techniques-in-use. For existing *ex ante* evaluation techniques, one way of organizing them is to look at their objectives:

- techniques that focus on a single objective (e.g., economic efficiency like Cost-Benefit Analysis);
- techniques that set one objective at a particular level as a constraint (e.g., the Planning Balance Sheet); or,
- techniques that formulate a multi-objective utility function to address trade-offs among the objectives like the Goals Achievement Matrix or Decisions Analysis (Shefer and Kaess, 1990).

In Table 2.3, a selection of such techniques-in-use are presented. While a variety of books, monographs, journal articles and on-line references appear to trumpet one particular evaluation method over another, McAllister (1980: ix) states that "no single [evaluation] method is generally superior; each has its limits."

The evaluation techniques presented in Table 2.3 all have limitations, including the following:

Table 2.3. Selected Evaluation Approaches Employed in Planning.
Sources: Shefer and Kaess, 1990; Maclaren, 1985.

Name of the Approach	A Snapshot Description of the Approach
Cost-benefit Analysis (CBA)	Cost-benefit analysis represents an attempt to systematically identify and rank alternative initiatives by attaching monetary values to variables of interest. The method is essentially a dual-entry accounting system with costs in one column and benefits in the other, which are summed and then combined to generate a ratio. Ratio values greater than 1 reflect the extent to which costs exceed benefits. The alternative selected normally demonstrates the lowest cost to benefit ratio (Mitchell, 1989).
Planning Balance Sheet (PBS)	The planning balance sheet approach estimates the costs and benefits of a variety of public investments, sector by sector, for two or more plan alternatives. Where possible, costs and benefits are quantified with monetary values. Non-monetary and qualitative costs (e.g., pollution) and benefits are also employed and entered into the balance sheet. Weighting is not employed (Lichfield <i>et al.</i> , 1975).
Multi-Variate Analysis (MVA)	Earlier plan evaluation approaches (e.g., CBA and PBS) failed to address the political dimension of planning (i.e., which can involve special interests, bargaining, and short-term results). Multi-variate analysis provides a multi-objective utility function to address trade-offs among objectives (Shefer and Kaess, 1990). Examples of multi-variate analysis include the goals achievement matrix, decisions analysis and concordance analysis.
Goals Achievement Matrix (GAM)	Using a matrix, the costs and benefits of goals of the plan are arrayed along one axis and the affected groups are listed on the other. Numerical weights are attached to both the goals and to the affected groups. Then, the likelihood of goal achievement is assessed and summed (Voogd, 1983).
Decisions Analysis (DA)	Decisions analysis is an analogue of cost-benefit analysis, except that it addresses uncertainty in its treatment of the decision objective. As Buckley (1988: 65) states, "the decision objective in CBA, the social welfare function, is stated explicitly whereas the decisions analysis approach is concerned with the implicit decision objective of the relevant decision taker (or takers)."
Concordance Analysis (CA)	Concordance analysis is a process where the criteria are determined, weighted, compared pair-wise and then calculated into matrices in order to determine the concordance and discordance indexes of alternatives (Shefer and Kaess, 1990). "The concordance index represents aggregate criteria weight differences between alternatives while the discordance index represents the maximum weighted difference, across all criteria, between any given pair of alternatives" (Maclaren, 1985: 228).

1. **complicated to understand and to implement.** A number of the evaluation techniques presented have been severely criticized for their complexity and for being difficult to implement. Cost-benefit analysis, for example, comes to planning via economics and is supported by a vocabulary unfamiliar to both conventional planners and to members of the public (e.g., shadow prices, discounting, opportunity costs, etc.). This is a particularly important detail because decision makers (e.g., often politicians) may not have the background to appropriately review the results of an evaluation (Shefer and Kaess, 1990);
2. **expensive.** Expense often accompanies complicated techniques. If extensive time, effort and money are required, the overall obligation may be daunting;
3. **data acquisition.** Breheny and Hooper (1985) suggest that the paucity of comprehensive planning-related data represents a refusal of planning to record its activities in a manner suitable for evaluation. Healey (1986) has identified a number of problems associated with obtaining relevant data for plan evaluation: confidentiality and access to the data, lack of data in quantified form, and overall lack of data relating to processes and outcomes;
4. **quantification of intangibles.** Attempted quantifications of intangibles (e.g., environmental beauty, personal well-being) that lack exchange markets has come under considerable attack (e.g., see Mishan, 1970);
5. **potential for abuse.** Evaluation processes and results can be egregiously abused. For example, in a development context where a decision has already been made, evaluation could be used to justify the decision after-the-fact, with facts and figures supporting the undesired outcome being hidden or expunged from the evaluation entirely. Imposition of an evaluation process might also be employed to postpone action. Postponement using evaluation is a double-edged sword. On the one hand, it might prevent a harmful development from proceeding until further research is conducted (and therefore beneficially reducing uncertainty). On the other hand, it may simply be used to stall any activity whatsoever. As well, evaluation can also be used in a bid for power. If an adversary's process or product receives an evaluation that is critical or unflattering, the results can be used to undermine the adversary's agenda;
6. **legal ramifications of evaluation.** Professional credibility may be at stake in a plan evaluation exercise, and if professionals (e.g., planners, architects, engineers) impugn the reputation of other professionals with the results of an evaluation, it is conceivable that they could be disciplined under their professional codes or by law (e.g., slander or libel laws). This could conceivably introduce a lack of objectivity into the process;

7. **weighting of criteria.** The weighting of criteria and groups implies a fundamental democratic contradiction: the values of one group are given more weight than another (Voogd, 1983), sometimes on a seemingly arbitrary and unequitable basis. This represents a fundamental flaw in many evaluation exercises unless a compelling framework can be used for justification (e.g., utilitarianism); and,
8. **aggregation of quantified and qualified variables.** Aggregation "conceals information about individual criteria levels and has a number methodological problems" (Maclaren, 1985: 223). When different evaluation criteria are measured with incommensurate units, any attempts at aggregation are methodologically unsound. For example, if qualitative criteria are ranked on nominal or ordinal scales, they cannot be aggregated in a mathematically valid manner (Maclaren, 1985).

Overall, plan evaluation issues related to complexity, expense, and data acquisition are solvable with the transparent commitment of decision makers. The final two issues (weighting of criteria and aggregation) are methodological, and represent a more fundamental challenge to evaluation techniques-in-use.

Research calls found in the literature search and review (see Table 2.4) substantiate these and other methodological concerns. In fact, the two primary themes of the research calls are the following:

- plan evaluation processes are immature and require methodological development; and,
- the theoretical basis for plan evaluation continues to be meager.

As illustrated in Table 2.4, Steger and Lakshmanan (1968) were observing that plan evaluation efforts were thwarted by the complexity of the subject matter even in the 1960s. More recently, Baer (1997) contends that — in the intervening years — planners have still developed few guidelines for evaluating plans.

Table 2.4. An Indicative Chronological List of Justifications Supporting Plan Evaluation Research.

	Reasons or Concerns Supporting Plan Evaluation Research	References
1	"The contextual (goal setting), synthetic (alternative plan development) and evaluation phases [of planning] have received scant attention, partly because of their inherent complexities."	Steger and Lakshmanan, 1968: 34.
2	"The values which have supported planning have remained largely implicit or self-evident. This has been, and still largely is, the nature of most exercises in evaluation. A judgment is made but the assumptions on which it is based, or on which the criteria are selected, are left largely unexamined."	Dakin, 1969: 15.
3	"It is also more difficult to say with certainty that official plans are much better, or even that they are more effective or more comprehensive."	Bacon, 1984: 117.
4	"A way forward which would eventually improve the possibility of systematic decision making methods is to take a long-term view about the production of meaningful impact measures. The aim must be to devise measures which become known and understood outside their use in a specific planning study."	Buckley, 1988: 62.
5	"Early studies using the historical approach [to evaluation] tended to be loosely conceptualized, with little attention given to defining criteria explicitly."	Mitchell, 1989: 227.
6	"If planning is to have any credibility as a discipline or a profession, evaluation criteria must enable a real judgment of planning effectiveness: good planning must be distinguishable from bad."	Alexander and Faludi, 1989: 127.
7	"The status of evaluation in the twentieth century represents one of the most striking paradoxes in the history of thought: An essential — and perhaps the most important — ingredient in all intellectual and practical activity has been explicitly banned or implicitly excluded from discussion or acknowledgment in most of its natural territory."	Scriven, 1991: 10.
8	"Current evaluative methods in...planning appear to be either threateningly mathematical or lacking a fully accepted theoretical foundation."	Parkin, 1993: 2.
9	"The planning literature is surprisingly narrow when it comes to what constitutes a good plan. The planning profession has generally avoided this normative question and focused instead on the methods and processes of plan making."	Berke and French, 1994: 238.
10	"Very few empirical studies have examined the quality and performance of adopted plans."	Dalton and Burby, 1994: 447.
11	"We need to produce criteria for good planning practice offering guidance despite the openness of planning following from the emerging and welcome contingency approaches and the multirationality models."	Sager, 1995: 172.
12	"Perhaps the most salient reason that quantitative, empirically based planning evaluation has not moved forward is the inherent difficulty of obtaining appropriate data."	Talen, 1996: 256.
13	"Because plan evaluation is still a young field and its products are relatively unproven, it would be wise to err on the side of simplicity."	Kaiser <i>et al.</i> , 1995: 434.
14	"How would you know a good plan if you saw one?...As a profession, we have developed few guides."	Baer, 1997: 329.

This is further corroboration of Shefer and Kaess's (1990: 84) contention that, "in spite of the wide array of techniques now available to [planning] practitioners, the field [of evaluation] is rather conservative in its trends...A few ideas for changing the general direction of the field as well as future research and the implementation of evaluation schemes seems in order."

In other words, part of the challenge is to find new frameworks for implementing plan evaluation. The statements in Table 2.4 point towards the need for plan evaluation research. Not only are new evaluation instruments required, but methodological and theoretical bases for new instruments are also mandated. The need for the methodological design of the evaluation instrument is related to the observation that the results of an evaluation are often politically sensitive.

Since there are both winners and losers as a result of any evaluation exercise that resulted in a determination of poor quality, the losers have a vested interest in undermining the evaluation results. A launch against the evaluation methodology is often a preferred style of repudiation. As Morehouse (1972: 868) contends, if evaluation results "do not support program aims and agency commitments, they may be simply ignored or, if acknowledged, criticized as methodologically unsound." And, as soon as the methodological basis of an evaluation has been challenged, "the grounds have been laid for justifiable disregard of its findings" (Schick, 1971: 70). In fact, the institutional fear of evaluation is so widespread that it has a name: *valuephobia* (Scriven, 1991). For these reasons, the methodological design of research supporting the derivation of evaluation criteria is imperative.

Concerning the need for a theoretical basis for plan evaluation, Berke and French (1994) provide a possible explanation for the lack of evolution of plan evaluation: planners have focused on what is less difficult and more *doable*, and have therefore committed their energy to procedural theory rather than to normative or substantive theory. However, a theoretical basis for a plan evaluation instrument would contribute to not only the descriptive power of the instrument, but also to its explanative power. And, as established above, concerns and questions continue to arise regarding the origin and applicability of criteria that characterize good planning. The task is presented most clearly by Baer (1997: 329), who states: "how would you know a good plan if you saw one?...As a profession, we have developed few guides."

The nature and difficulty of the challenge to producing a definitive list of plan evaluation criteria is illustrated by the following complicating factors:

- the determination of what constitutes a good plan can depend on the affected parties or participants involved;
- there may be a wide range of potential evaluation criteria;
- evaluation criteria may be in conflict; and,
- it may be difficult to establish the relative importance or weight to be attached to each criterion (Devas and Rakodi, 1993; Kent, 1990; Lacey, 1986).

These factors introduce the need for a descriptive and explanative theory that transcends value judgments or, at the very least, helps to organize and clarify them.

Concluding Remarks on Plan Evaluation

Two important research deficiencies discovered in the literature review concerning plan evaluation are the following: the need for methodological design, and the need for a theoretical basis to ground the evaluation instrument. In other words, if the quality of a plan (or, more specifically, the quality of an ecosystem-based plan) is to be judged, the evaluation instrument should be methodologically-designed and consistent with relevant theory. After exploring what is meant by the term *theory* in the next section, hierarchy theory is introduced and explored as a potential underpinning for the evaluation of ecosystem-based plans.

THEORY IN GENERAL AND PLANNING THEORY IN PARTICULAR

Theory

Structurally, theory can be defined as "a system of conceptual constructs" (Pickett *et al.*, 1994: 58). Similarly, Walizer and Wienir (1978: 13) state that theory refers to "sets of statements that fit together to make sense out of some phenomena." Functionally, the general roles of theory in science can be multifold: identification of structural and functional regularities in a complex world; providing an understanding-based and predictive capacity for phenomena; and guiding the direction of research (Bordens and Abbott, 1996; Mitchell, 1989; Walizer and Wienir, 1978).

As a starting point to a discussion of theory, it needs to be explicitly acknowledged that many researchers do not agree on what theory represents. Shadish *et al.* (1991: 30) corroborate this observation by asking "*what do we mean by theory?*" No single understanding of the term is widely accepted." In the planning literature, this problem is

further compounded by authors (e.g., Kaiser *et al.*, 1995; Levy, 1988; Beauregard, 1987) who freely substitute the word *theory* for *model* and vice-versa in their discussions of planning theories and models. Colloquial use of the term *theory* also leads to confusion. Similarly, Schwandt (1993: 6) observes that theory "is multivalent, that is, it has various meanings."

In order to mitigate the semantic difficulties associated with the term *theory*, a functional taxonomy can be formulated by combining discussions of scientific theory provided by Bordens and Abbott (1996) and Flinders and Mills (1993). The taxonomy permits the researcher to explicitly identify the theoretical level that their research encompasses and recognizes that theory operates in fulfillment of different roles and purposes. Taxonomic categories of theory include the following:

1. **understanding.** Understanding-oriented theories are used to understand (describe and explain) a particular topic or phenomenon. More specifically, these theories can be used to account for existing data in their subject area (Bordens and Abbott, 1996);
2. **prediction.** Theories with predictive capacity provide insight into anticipated changes to a system under different values for its constraint or controlling variables (Bordens and Abbott, 1996). Predictive theoretical capacity is separated from understanding-based capacity because a theory can actually provide accurate predictions while lacking any understanding of the topic or while being empirically untested (e.g., the demonstrated accuracy of the ancient Mayans concerning the prediction of celestial positions while lacking any real insight into the laws of astronomy);
3. **epistemology.** Epistemological theories apply not only to what the researchers observe, but also to how they go about making observations. These are methodological theories and are sometimes called the *theories of the instrument*. The tradition of epistemology can be characterized as the search for principles that constitute the source and essence of knowledge, and the inquiry into defensible procedures or methods that will lead to these principles (Lacey, 1986). Epistemological theories address these central concerns through "the separation of the inquiring subject from the object of inquiry, by the search for the foundations of knowledge, by the quest to discover the way things really are, [and] by a bid to

find a final vocabulary for explaining human action untainted by the vicissitudes of time, place and human intention" (Schwandt, 1993: 16-18);

4. **guidance.** Theory can be employed to guide the direction of research by revealing the following: which questions to ask, which research techniques to use and how to organize and interpret research results (Bordens and Abbott, 1996); and,
5. **metatheory.** Metatheories address the role and nature of theory itself. This role of theory includes a broad range of critical assumptions about the relationships of theory, practice, knowledge, and the aims of inquiry. Basically, metatheories are the theories of theory (Sparkes, 1991).

Despite the wide range of conventional roles of theory presented above, a major void exists that is directly pertinent to the evaluation of plans and planning. That is, there is no reference to normatively- or ethically-based theory. A possible explanation for this void could consist of the following: since normative theory is not about how the world is, but rather how the world should be, it may be overlooked in discussions of conventional theory.

Planning Theory In Particular

The so-called *crisis in planning* — which has been a matter of record for decades and involves such fundamental factors as planning purpose and credibility — is driven (at least in part) by the lack of theoretical consensus within the discipline. As Checkoway (1986) suggests, "suffice it say that the search for various explanatory theories is indicative of the fact that planning is in transition." And, according to Kaiser *et al.* (1995: 37), "no single theory of planning or urban change adequately describes the full range and complexity of land use planning practice." A functional categorization of planning theories provided by Faludi (1973) in *A Reader in Planning Theory* continues to be useful for organizing the vast range of existing but uncoded planning theory (see Hendler, 1995; McConnell, 1981).

Faludi's (1973) organizational framework for planning theory consists of three categories:

- **theory *in* planning.** Theories *in* planning involve ideas developed in other disciplines that may be used by planners and planning theorists. These theories are sometimes referred to as *substantive theories* and are concerned with specific planning actions used to achieve particular results (e.g., the use of growth theory to predict future population levels or gravity theory for calculating traffic demand);
- **theory *of* planning.** Theories *of* planning involve the ideas used to express the ways planners and planning operates. Important foci addressed include planning procedures and process, how planners make decisions and act, and how planning organizations function. When specifically oriented to the planning process, these theories are sometimes referred to as *procedural theories* and include the rational-comprehensive, mixed scanning and incrementalism (Levy, 1988); and,
- **theory *for* planning.** Theories *for* planning involve the role of planning in society. According to Hendler (1995: 4), "they unify, uphold, and justify planning values in the form of a conceptual foundation for the field and the profession." Theories *for* planning are concerned with the impacts, norms and purposes of planning and include environmental ethics and theories of justice.

This categorization can be advanced by recognizing that planning theory can have either descriptive/explanative content or prescriptive/normative content (Hendler, 1995).

Planning is, after all, an interdisciplinary process and uses a wide range of theories, models and techniques from across the natural and social sciences, as well as the humanities (particularly philosophy). The distinction between descriptive/explanative and prescriptive/normative content is an important one since planning, like philosophy (especially ethics), is interpenetrated by the concern for idealized or preferred end-states.

Planning theories with a descriptive/explanative orientation attempt to describe and explain how planning and urban change occur. More specifically, descriptions need to be *explained* by the use of theory (Bracken, 1981).

Conversely, theories with prescriptive/normative content prescribe how planning and urban change should or ought to occur in order to achieve a preferred end-state (Kaiser *et al.*, 1995). A notable difference between the two content-orientations of planning theory is that prescriptive/ normative theories can be broken by human behaviour and impacts, and do not necessarily cease to be theories. On the other hand, if descriptive/explanative theories are dispelled by empirical evidence, then they are refuted (Sparkes, 1991).

Concluding Remarks on Theory in General and Planning Theory in Particular

There are many potential roles for theory, including the following: understanding, prediction, epistemology, guidance, meta-theory, and normative theory. A fundamental point of departure for research is the specification of which theoretical roles are to be involved. As established in the literature review on ecosystem-based planning, there is currently no underlying theoretical framework for describing and explaining the approach's organizational structure and functionality.

Insofar as the Canadian context is concerned, the premises and attributes of the ecosystem approach have been largely deduced from the empirical investigation of its practice (see Gibson *et al.*, 1997; Tomalty *et al.*, 1994a). In the next section, the potential employment of hierarchy theory in an understanding- and guidance-based role for underpinning the ecosystem approach is explored.

HIERARCHY THEORY

Complex Systems

A system can be defined as a set or arrangement of things so related or inter-connected as to form a unity or organic whole. More specifically, a system can be defined as $S = (T, R)$ where S denotes the system, T denotes a set of things distinguished within S , and R denotes a relation (or set of relations) defined on T (Klir, 1991). This basic definition covers both living (e.g., ecosystems, animals) and non-living (e.g., computers) systems, where all the elements of the system aggregation are either directly or indirectly interdependent (see von Bertalanffy, 1968). However, a meaningful distinction is that ecological systems have attributes over and above those demonstrated for mechanical systems, so Klir's definition can be regarded as useful but only preliminary (see Kauffman, 1995; Mainzer, 1994).

While mechanical systems can also have emergent properties, ecological systems demonstrate the emergent property of life. In general, emergent properties are the manifestation of the Hegelian maxim that *the whole is greater than the sum of its parts* (Kauffman, 1995; van Gigh, 1978). More specifically, emergent properties are attributes exhibited by a system level that are new and independent of the attributes of their lower-level components (Jorgensen, 1992). As posited by Kauffman (1995: 24),

Life, in this view, is not to be located in its parts, but in the collective emergent properties of the whole they create...no vital force or extra substance is present in the emergent, self-reproducing whole. But the collective system does possess a stunning property not possessed by any of its parts. It is able to reproduce itself and evolve. The collective system is alive. Its parts are just chemicals.

Life as an emergent property lies in *catalytic closure*. As defined by Kauffman (1995: 275),

catalytic closure means that every molecule in the system either is supplied from the outside as 'food' or is itself synthesized by reactions catalyzed by molecular species with the autocatalytic system. Catalytic closure is not mysterious. But it is not a property of any single molecule; it is a property of a system of molecules. It is an emergent property.

Kauffman (1995: 23) argues that life is a natural and inevitable property of complex systems and that humanity is *at home in the universe* — "expected in it, rather than present despite [what have traditionally been perceived to be] overwhelming odds." Life and its attendant degrees of freedom constitute the complexity that characterizes human and other biological communities (Mainzer, 1994). In this research, complex systems refer to systems that are living, open, and non-linear.*

Problems in planning share a variety of fundamental characteristics that demonstrate their complexity. According to Rittel and Webber (1973), planning problems are complex because they:

- involve human values, aspirations, and motives;
- have no definitive formulation;
- have no stopping rule;
- are not true or false, but good or bad;
- have no immediate or ultimate test for a solution;
- are unique in each and every instance; and,
- can be considered symptomatic of another problem in a network of problems.

* Non-linear relationships mean that when variable X increases, variable Y increases and decreases in a patterned way (Walizer and Wienir, 1978: 57). The patterned change cannot be described or modeled with a straight line.

Rittel and Webber (1973) go so far as to rename complex problems in planning as *wicked problems*, due to the level of difficulty associated with their resolution. However, Rittel and Webber (1973) were writing in a timeframe that preceded scientific inertia recognizing the non-linear nature of complex problems. In this research, the emergent property attribute of complex systems is instructive for introducing hierarchy theory. As will be demonstrated in the next section, emergent properties are useful for identifying the conceptual membrane to system levels in a hierarchy.

Advances in ecological thinking are positing that the traditional reductionist, piecemeal approach to problem solving should be replaced by a *big picture* systems approach (Capra, 1994). As discussed in the next several paragraphs, this is the critical juncture at which hierarchy theory is brought into the research as a possible means of dealing with the complexity dimension of ecosystem-based plan evaluation.

Basically, "much of the complexity that is apparent in ecological systems arises from the interaction of many phenomena operating at different spatial and temporal scales" (Lee and Grant, 1995: 18). However, according to Odum (1986: 4), "most ecosystems, and many of our day-to-day problems, as delimited in practice, are 'middle-numbers systems.'" In Odum's comment, reductionism is implicit because problem-solving is both analytic and synthetic. Day-to-day problems can be reduced to their component elements, but these elements are always inter-dependent with other ecosystem elements and levels, and therefore the synthetic and wider context ultimately forms part of the problem solution.

Overall, *middle-numbers systems* fall between the extremes of small-numbers systems (e.g., a hot spring, the tundra) that have only a few basic components (and emergent properties), and large-numbers systems (e.g., the biosphere) which consist of multiple entities having multiple features and multiple inter-relationships. More specifically, middle number systems "are cases where there are too few parts to average their behavior reliably and too many parts to manage each separately with its own equation" (Allen and Starr, 1982: xi).

In *Hierarchy: Perspectives for Ecological Complexity*, Allen and Starr (1982) concluded that the best way to study and manage middle-numbers systems was in terms of hierarchy rather than through mechanistic reductionism.

Medium number systems operate under a very wide range of rates, which causes great difficulties in modeling these systems. However, in most cases, the rates can be grouped into classes and if the classes are sufficiently distinct, then the system can be considered as a hierarchical system and dealt with as a small number system (Jorgensen, 1992: 207-8).

Overall, hierarchy theory is consistent with the precepts of complex systems, and also provides specific theoretical objects (i.e., holons) and interactive rules (e.g., vertical and horizontal decomposition) to investigate ecosystems (Wu and Loucks, 1995; Norton, 1995a; Jorgensen, 1992; Norton, 1990).

Background to Hierarchy Theory

Hierarchy theory was originally developed by ecologists to provide a theoretical framework for heuristically describing and explaining the organizational structure and function of ecosystems (Lee and Grant, 1995: 18; Allen and Roberts, 1992; O'Neill *et al.*, 1986; Allen and Starr, 1982; Pattee, 1973; Simon, 1973, 1962; Koestler, 1969, 1967).

There are three primary views of how ecosystems function — the Clementsian concept, the Gleasonian concept, and hierarchy theory (Jorgensen, 1992).

The Clementsian or superorganism concept views ecosystems as organisms of a higher order and defines succession as ontogenesis of the superorganism. For example, a plant community has functional significance and interaction over and above its component parts (Jorgensen, 1992; Ricklefs, 1990). Conversely, the Gleasonian or individualistic concept assumes that populations respond independently to the external environment. "The local community, far from being a distinct unit like an organism, was merely the fortuitous association of species whose adaptations enabled them to live in a particular place" (Ricklefs, 1990: 174). The presence or absence of a particular species is argued to be independent of other species. Hierarchy theory, meanwhile, can be considered dominant because it represents a compromise between the Gleasonian and Clementsian concepts, and is "consistent with our observations in nature" (Jorgensen, 1992: 42).

In the past decade, the scope of hierarchy theory has been enlarged to embrace policy analysis (e.g., Norton, 1995a, 1990), institutional analysis (e.g., Wuichet, 1995), mapping (e.g., Bailey, 1987), and the management of environmentally sensitive areas (e.g., Jennings and Reganold, 1991) — among many other research applications. Despite the range of fields of application for hierarchy theory, it has not yet been extended to planning, even though there has been a variety of research calls made within the planning and geography literatures for a theoretical foundation for environmental planning and management (see, for example, Table 2.4).

In order to prepare a foundation for establishing potential linkages among disciplines and among system levels of human settlements, it is necessary to decompose hierarchy theory into its component parts. This facilitates the exploration and interpretation of the inter-relationships between hierarchy theory and ecosystem-based planning.

According to Pickett *et al.* (1994), the three central dimensions of a theory are:

- **objects;**
- **interactions** (e.g., the dynamic relationships among the objects; the rules of interaction); and,
- **the states or static relationships that exist in the system** and is the subject of the theory (i.e., the boundaries of the interactions).

By detailing each of these three theoretical dimensions, the structure and function of hierarchy theory can be demonstrated, alongside its potential inter-relationships with ecosystem-based planning.

The Objects/Units of Hierarchy Theory

In hierarchy theory, the objects or units of interest are *holons*. As defined by Koestler (1967), the term *holon* comes from the Greek *holos* (for whole) and *on* (for part). Consequently, the holon is simultaneously both a whole and a part, and is situated within a nested hierarchy. The holon is an entity (e.g., a forest, a city) in that it is an integration of its parts (Allen and Starr, 1982). It has inputs, throughputs and outputs, and displays emergent properties. Once again, the emergent properties of the holon are a manifestation of the Hegelian maxim that *the whole is greater than the sum of its parts* (van Gigh, 1978).

In *Ghost in the Machine*, Koestler (1967: 343) states that,

every holon has dual tendency to preserve and assert its individuality as a quasi autonomous whole; and to function as an integrated part of (an existing or evolving) larger whole. This polarity between the self-assertive and integrative tendencies is inherent in the concept of hierarchic order; and a universal characteristic of life. The self-assertive tendencies are the dynamic expression of holon wholeness, the integrative tendencies of its partness.

Koestler is arguing that the holon enforces its own identity by looking after its component parts and by competing with other holons at the same level of organization. At the same time, the holon supports the high level (e.g., a forest or society) on which it depends for control and survival. In other words, the non-linear feedback mechanisms work both horizontally and vertically (see pages 51-53).

Although Koestler restricted the notion of holons to biological contexts, later theorists generalized the meaning of *holon* to include all entities (Giampietro, 1994; Allen and Starr, 1982). Regardless of context, a holon is both (a) a whole made up of smaller parts and (b) a part of some greater whole. And, since each component of a hierarchy is a holon, the holon is both a window up the hierarchy, and a window down. In this way, the holon is Janus-faced — after the Roman god of gateways (Koestler, 1967). In Roman art, Janus is represented with a face on both the front and the back of his head. The Janus-like boundary of each holon "depends on the scale and extent from which one needs to observe the whole, given the purpose of the study being undertaken" (Kay and Schneider, 1994: 35). Or, phrased slightly differently,

the complexity of a system is in the eyes of the beholder. It concerns both the system observed and the observer who seeks to understand causes, to expect behaviour and, in acting, to achieve some defined purpose (Holling, 1994: 598).

Process rates (e.g., rates of change) and other heuristic rules of interaction or structure can be employed to delimit the boundary, surface or membrane enclosing each holon (Wu and Loucks, 1995).

The Rules of Interaction of the Objects

This dimension is concerned with how the objects of a theory interact with each other. Basically, the architecture of an ecosystem is structured according to a nested hierarchy. A fundamental premise of hierarchy theory is that hierarchical organization results from differences in **process rates** (O'Neill *et al.*, 1986). In other words, medium-number systems operate over a wide variety of process rates which refer to the frequency of occurrence of a phenomenon (two or more variables interacting) within the context of an ecological process (e.g., forest succession, urban development). If the process rates (e.g., rates of change) are sufficiently distinct to be identifiable, the system can be considered hierarchical, and then dealt with as a small-number system (O'Neill *et al.*, 1986). The variety of rates permits the decomposition of a complex system into organizational levels, and then into discrete components within each level.

In hierarchy theory, there are two primary rules of interaction that are derivable from the differentiation of process rates: **vertical decomposition** and **horizontal decomposition**. Process rates can be expressed in a variety of ways, including cycle time, response time, or frequency of occurrence (Wu and Loucks, 1995). For example, if investigating the public transit sub-system of an urban ecosystem, per capita transit ridership could be used as a process rate to differentiate transit use from other holons nested within the transportation system (which is, in turn, nested inside the urban ecosystem). Although

process rates are a common criterion of decomposition, tangible holon boundaries or structural components can also be employed.

Vertical decomposition can be illustrated by the following. Let the ecosystem or system of interest be n . The vertical structure of the hierarchy can be arrayed into levels of organization (e.g., n , $n+1$, $n-1$). With n as the level of research interest (or the so-called *window of observation*), $n+1$ becomes the higher level of organization and $n-1$ becomes the lower level. Observed process rates associated with higher levels of organization occur at slower rates and those associated with lower levels occur at higher rates. In other words, the $n+1$ system containing the n and other systems occupies a larger spatial territory and its systems and processes operate more slowly than the n level. The $n+1$ level can be considered the *constraint level* for the n level. In other words, the $n+1$ level controls the n level. Conversely, the $n-1$ level operates/changes more quickly and can be regarded as the dynamics of the n level. Or, as Allen and Starr (1982: 15) suggest, "the positive aspects of organization emanate from the freedom that comes with constraint. The constraint gives freedom from an unmanageable set of choices; regulation [from the $n + 1$ level] gives freedom within the law."

Consequently, smaller and faster systems (i.e., $n-1$) are restricted by the larger systems (i.e., n and $n+1$) of which they constitute a component. In effect, individual elements of the smaller system are too ephemeral (short-lived) in relative terms to initiate significant changes in the larger system. In other words, components of smaller systems affect the larger system only as combined contributors to trends among their cohorts (Norton,

1990). Consequently, levels in the hierarchy can be isolated from each other because they operate at distinctly different process rates.

For example, let a person be the holon (n). This person's metabolic system ($n-1$) and its sub-systems (e.g., $n-2$ = protein synthesis, fatty acid assimilation, etc.) are nested inside. Meanwhile, the person can be nested inside a kitchen ($n+1$), which is nested inside a home ($n+2$), which is nested inside a neighbourhood, which is nested inside a metropolitan area. This represents one possible vertical decomposition of a person and his/her environment. Other vertical decompositions can arise — depending upon the research question being asked.

In **horizontal decomposition**, each level of the vertical hierarchy can be decomposed into analogous holons at the same level, and also investigated on the basis of observed differences in rates. "Within each holon, components interact frequently (i.e., strongly) with each other but only infrequently (i.e., weakly) with components of other holons" (O'Neill *et al.*, 1986: 79). The exterior of the holon itself may be either tangible (e.g., a tree's bark or a person's skin) or intangible (e.g., the perimeter of a successional forest or an urban ecosystem). Process rates are relatively rapid and uniform inside the exterior of the holon (e.g., human metabolism), and are relatively slow and weak outside the holon.

Since the holons at one level become the interacting components of higher-level holons, this sets the stage for the spatio-temporal scale dimension of hierarchy theory. "The greater number of intervening levels separating two scales of interest, the less will be the recognizable influence of lower-level behavior on a higher level in the system" (O'Neill *et*

al., 1986: 80). When moving across hierarchical levels, it is important to recognize features that are dynamic at one scale but static at another, or deterministic at one scale but stochastic at another (Lee and Grant, 1995). Overall, these rules of interaction determine how ecosystems are structurally and functionally organized, *viz.*, the underlying structure and function of nature is hierarchical.

The Delimitation of Hierarchy Theory's Boundaries

Hierarchy theory delimits the spatial, temporal and conceptual boundaries within which reality is heuristically organized. Spatially, the $n-1$ level is nested inside the n level, while the n level is nested inside the $n+1$ level. Temporally, three (or more) time frames can be employed. Norton (1995a) conceptualizes time as *horizons of human concern*: **personal time** (individual, experiential time associated with or within the human lifespan); **ecological time** (multigenerational time associated with ecosystem survival); and, **deep time** (the indefinite temporal scale during which planetary geomorphology changes and human evolution occurs). Personal time is nested inside ecological time, and ecological time is nested inside deep time.

From the hierarchy theory perspective, the definition of the system is directly influenced by the *window of observation* through which the researcher is exploring reality (i.e., the range of rates that are of research interest). The window is spatio-temporal. Spatially, the holon could be a person, the neighborhood, the city or, analogously, a tree, the woodlot, the forest. Temporally, the holon can be expressed in personal time, ecological time, or in deep time. Ultimately,

Ecosystems are very complex systems and we have to decompose them to be able to analyze their behavior, understand their underlying principles, model them for predictive purposes and so on...hierarchy theory approaches this problem by searching for a structure that is already there; either it is a [process] rate or a spatial structure (Jorgensen, 1992: 209).

In order to illustrate the range of perspectives involved, the phenomenon of *the city* is briefly considered. A city can be perceived as an extremely complex system with a range of processes and structures determining its overall morphology and functionality. Or, the city can be treated as constant, within which transportation, greenspace, telecommunication and built form or land use systems are operating. Or, as a further alternative, the city can even be regarded as inconsequential noise within the event horizon of planetary geomorphological processes. As demonstrated, hierarchy theory permits the city to be viewed from a spatio-temporal scale of observation relevant to the research task.

Benefits of Hierarchy Theory

The primary benefit of hierarchy theory is the variety of theoretical roles that it fulfills. Due to its extensive scope and wide range of applicability, hierarchy theory is both an understanding-oriented theory (i.e., it can be used to facilitate understanding through its descriptive and explanative capacities) and an epistemological theory (i.e., since it is concerned with the spatio-temporal scaling of the relationship between the observer and the observed or the planner and the planning area).

For planning theory, hierarchy theory can conceivably be categorized as a theory *in, of* and *for* planning. For example, hierarchy theory can be employed as a descriptive/explanative theory *in* planning that involves,

the ordering of ecosystems along a spatio-temporal gradient according to their spatial patterns and rates of process, for the purpose of understanding the relationships between ecosystems of different scales (Jennings and Reganold, 1991: 214).

Descriptively, hierarchy theory characterizes the nesting of ecosystem levels and their inter-relationships. Explanatively, hierarchy theory accounts for why ecosystems are organized as they are at various levels, and how the levels are nested and inter-related.

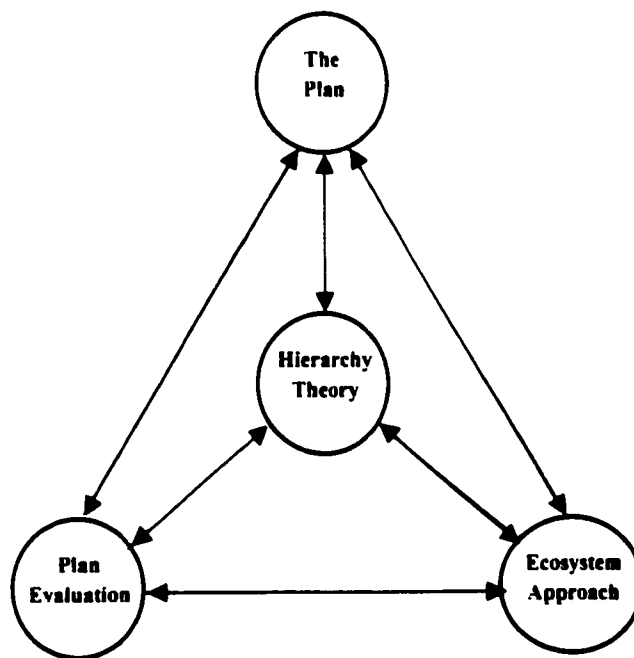
Hierarchy theory can also be regarded as a theory *for* planning since it is *epistemic* — the relationship between the observed and the observer is made explicit through the delineation of a structured space-time gradient that explains the same processes at different levels within the same hierarchy (Ahl and Allen, 1996). In other words, hierarchy theory can be employed to structure how ecosystems are perceived and known.

Hierarchy theory also provides an underpinning for ecology. The ecosystem approach to planning is normatively-based because it represents an idealized planning process. However, a shortcoming of the approach is that it lacks a robust theoretical basis. In other words, the ecosystem approach is not sufficiently grounded in theory to provide a solid descriptive, explanative and predictive foundation for establishing which planning goals, practices and products are related to ecosystem complexity. The position developed in the present study to address this theoretical weakness is that hierarchy theory may provide a basis for making the ecosystem approach theoretically-grounded.

Figure 2.1 illustrates how hierarchy theory can be used to link the ecosystem approach to planning, ecosystem-based municipal plans and plan evaluation. To demonstrate how the

bridging mechanism works, consider the following. First, hierarchy theory potentially provides a foundation upon which the building blocks of ecosystem-based planning can be based. Second, an ecosystem-based plan is the product of the ecosystem approach to planning. Third, the product (i.e., the ecosystem-based plan) can then be evaluated with an instrument consistent with hierarchy theory. In other words, Figure 2.1 illustrates how hierarchy theory provides common ground for inter-relating the ecosystem approach, the ecosystem-based planning product and the planning product's refinement through evaluation.

Figure 2.1. A Representation of Hierarchy Theory as a Conceptual Bridge Between Plan Evaluation, the Ecosystem Approach to Planning and the Ecosystem-based Plan.



Hierarchy theory also stresses the importance of scale to research. According to Vasishth (1996: 1), "all systems, including ecosystems, are conceptual constructs rather than real 'things,' and thus allows for a much richer conception of scale — one that has spatial, temporal and organizational dimensions." This is perhaps one of hierarchy theory's most important contributions — to recognize and elaborate upon the critical significance of scale to complexity. At the same time, scale and planning are intrinsically linked.

Another advantage of hierarchy theory is its reconciliation of the two approaches to studying ecosystems. The first approach is bottom-up, where there is an attempt to assemble large-scale phenomena from smaller-scale components, thereby focusing on larger-scale implications — for example, using a model to simulate the growth process of a single tree as a basis for projecting the long-term dynamics of forest landscapes (Shugart, 1984). Conversely, the top-down approach involves analysing the patterns seen in a forested landscape to infer the processes that generated the pattern (e.g., working out the finer-scale details). Because hierarchy theory is useful for structuring the investigation of multi-scaled phenomena, it provides a framework for reconciling the bottom-up and top-down approaches to studying ecosystems.

Yet another benefit of hierarchy theory is that traditional science has tended to reduce complex systems to one spatio-temporal scale. However, hierarchy theory permits investigation of a number of spatio-temporal scales, and how they are inter-related. Planning in general and ecosystem-based planning in particular involve a multitude of time frames and spatial scales, and cannot be dealt with solely in terms of reductionism. Hierarchy theory can ameliorate this limitation of traditional planning research.

In this research, the central advantages of using hierarchy theory are twofold:

1. it may offer insights into the understanding of ecosystem-based planning practice and functions (including plan evaluation); and,
2. it may facilitate discussion of the issues in scientific terms since it provides a vocabulary for ecosystem structure and function (Giampietro, 1994).

Justifications for Research Pertaining to Hierarchy Theory Revealed Through the Identification of Research Calls and Potential Limitations of the Theory

An indicative range of research calls surrounding hierarchy theory is presented in Table 2.5, where the following residual messages are communicated:

- communities are known to depend upon their environment and this larger frame of reference is frequently ignored in formal study;
- the inter-disciplinarity of planning needs an organizing theoretical framework;
- environmental planning theory continues to be scant (e.g., does not address context or interconnectedness between system levels); and,
- existing planning theory does not provide direction for the integration of research in the social and natural sciences.

A deduction that follows from examination of Table 2.5 is that linking hierarchy theory to planning practice/products can conceivably satisfy a number of these research themes.

With regard to the perceived limitation of hierarchy theory that it is non-metaphysical,

Norton (1990: 124) observes,

hierarchy theory raises again the question of parts and wholes: how seriously should we take any particular designation of 'parts' and 'wholes,' of 'cells' and 'contexts?' Hierarchy theorists avoid this problem by insisting that their model resides not in reality, but in our understanding of reality.

Table 2.5: An Indicative Chronological List of Justifications Supporting Theory-Based Research in Environmental Planning.

	Reasons or Concerns Supporting Theory-based Research in Environmental Planning	References
1	"Scholars are quite aware that any modern community is a functionally dependent part of a much larger whole; but in general they have not yet taken account of this larger frame of reference in community study."	Steward, 1950: 22.
2	"We do not even have a theory that tells us how to find out what might be considered a societally best state."	Rittel and Webber, 1973: 168.
3	"There has been a substantial body of work criticising the 'contextless and contentless' nature of procedural planning theory....advocating instead a focus on the interconnected economic and social processes."	Healey, 1986: 105.
4	"The body of environmental planning theory is still meager. Contributions from both theoreticians and practitioners are necessary to bring the field as a whole to maturity."	Briassoulis, 1989: 390-391.
5	"There are hints, here and there — not only in sociology, but in geography, political science, economics — of ideas which, if put together in the right way, might just conceivably constitute a fresh, relevant, policy-oriented, place-based science, from which planning could draw new vigour."	Auster, 1989: 17.
6	"There is a clear and immediate need for those involved in the area of 'environmental planning' to develop a theoretical and moral basis to support and guide their activities."	Beatley, 1989: 2.
7	"One of the most significant problems of ecosystem research is the lack of a specific <i>ecological theory</i> ...many theoretical ecologists have found promising approaches in other disciplines dealing with systems analysis."	Müller, 1992: 228.
8	"There is a need for a framework that the scientist can use to organize experience; that is the challenge of ecology."	Allen and Hoekstra, 1992: 2.
9	"The mainstream planning profession as a whole still emphasizes the process or procedural dimension of planning over the substantive; a very few efforts to transcend both the procedural/substantivist and the mainstream/environmental planning movements exists."	Slocombe, 1993: 291.
10	"Environmental planning needs an integrated method and theory all its own."	Slocombe, 1993: 292.
11	"Current discourse on social science methodology reveals conceptual confusion and misunderstanding surrounding what theory is, and how it is and should be manifest in qualitative or, more broadly, interpretive studies."	Schwandt, 1993: 5.
12	"To make operational the best known formulation [of sustainable development] — 'meeting the needs of the present generation without compromising the ability of future generations to meet their needs' — requires a definition of need, which in turn must be informed by a theory of value."	Owens, 1994: 170.
13	"This article looks forward to the new policy approaches to land use which are rapidly displacing classical town planning, in order to appraise the role and function of knowledge and theory in the 'new environmental agenda.' In particular, I want to consider if it might be possible for the embryonic process of environmental planning, as promoted by the TCPA [Town and Country Planning Association], to avoid the theoretical shortcomings of classical town planning."	Evans, 1994: 186.
14	"We need an enlargement of the purposes of scientific inquiry that should be expanded to include also an understanding of the different roles that different levels play in the hierarchy."	Giampietro, 1994: 625.
15	"Hierarchy theory was introduced as a useful conceptualization for understanding ecological systems, but I propose a broader use for it. Hierarchy theory will provide the basic structure and methodology of a new paradigm of environmental management. As an activist paradigm, it must guide judgments of social goals as well as incorporate the best science of the day into an analysis of environmental problems."	Norton, 1995a: 234.

If Norton's observation holds, then the domain of hierarchy theory is decidedly epistemological rather than metaphysical. Further, and following Norton's interpretation, hierarchy theory's value is heuristic rather than ontological according to Müller (1992: 220), who contends that hierarchy theory is "a heuristic supposition for making our memory or our computers able to understand complex systems." Similarly, "Allen and Starr (1982) and Norton (1992) view discrete hierarchical levels as convenient conceptual tools rather than ontological building blocks of the universe" (Wuichet, 1995: 162). Ontology refers to a branch of metaphysics concerned with the nature of being (e.g., does something really exist?). For Plato, the eternal forms are the actual and ultimate reality (Stumpf, 1977). Some ontologies of art, for example, suggest that the real artwork resides in the brain synapses of the artist and that only an artifact of the artwork is shared with the world.

For hierarchy theorists, hierarchical levels are not reality, but windows to reality. And, each window has an observation-delimited frame.

The classic notion of hierarchy involves discrete levels. Although they may be both conceptually and pedagogically helpful, the implicit discontinuities between even levels that appear singularly real and discrete are to some extent arbitrary. Discrete levels need to be recognized as convenience, not truth...Philosophers are careful to identify whether an argument pertains to existence in terms of objective external reality — that is to say, whether an argument is an ontological discussion — or is concerned with experience and is restricted to that which is knowable — an epistemological discourse (Allen and Starr, 1982: 6).

Hierarchy theory's ontological status (or lack thereof) has not proved to be a true impediment to its employment, particularly in exploratory research contexts involving a normative framework like the ecosystem approach.

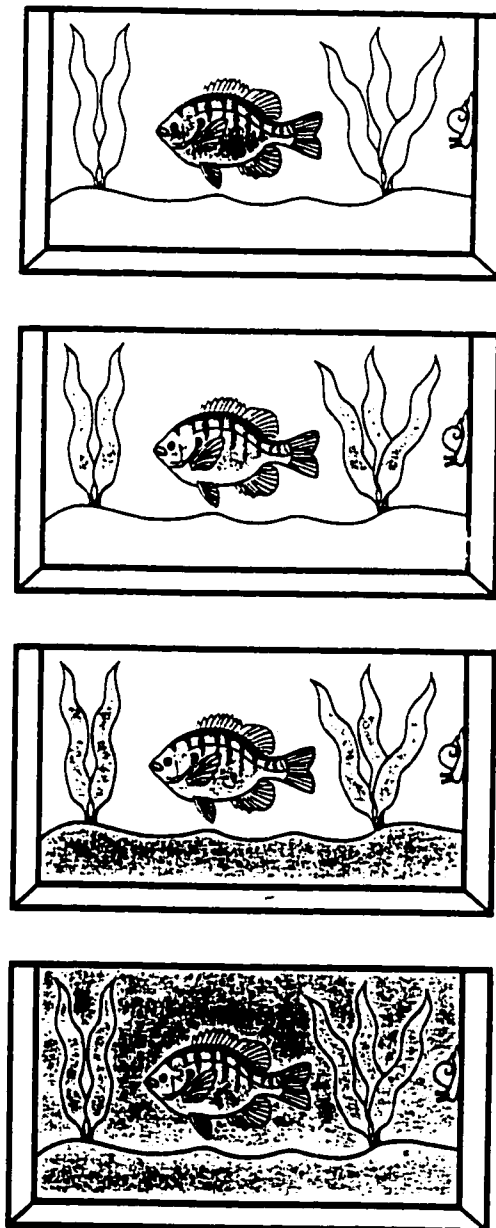
Some authors (e.g., Lawton, 1986) have also criticized hierarchy theory for being too qualitative. If the theory cannot be quantified, then how can it become rigorously predictive? However, this question may also be premature. That is, perhaps it is merely too early in the theory's maturation to be able to incorporate quantification. For example, the horizontal and vertical couplings concept is inexact. How strong or weak do the couplings need to be to induce hierarchical instability? Similarly, there is no identification of thresholds beyond which the hierarchy will become unstable. The theory does not yet provide answers to these questions, but this shortcoming does not appear sufficient to negate the theory in a substantive way.

Other authors (e.g., Ricklefs, 1990) have chosen to criticize the accumulation of jargon within the theory (e.g., *holon*, *decomposition*, *deep time*). Finally, some difficulty has been associated with assigning boundaries to holons (Eldredge and Salthe, 1984). How, exactly, is the boundary to a holon to be delimited? And, more importantly, how can researchers be sure that the boundary is the appropriate one?

From the perspective of this research, hierarchy theory provides an answer for this latter concern. The holon is defined by the question being asked since the wording of the research question is critical. Figure 2.2 demonstrates how different relationships can define the research holon. The fish, for example, could be the system of interest (n). Conversely, maybe the fish's aquatic environment is n and the fish is merely a contributing cohort to a still-to-be-determined trend. The four panels presented in Figure 2.2 reveal the same material system, but differ in terms of how the selected holon inter-relates with and is distinguished from its environment. More generally,

Figure 2.2. Identification of the Holon of Interest. The four panels shade different holons or systems of research interest (and leave its environment or $n+1$ level unshaded). Regardless of panel, it is the same material system, but the explanation of how it works and inter-relates depends on how the holon is distinguished from its environment.

Source: Ahl and Allen, 1996: 22.



the ordering of levels in an empirical hierarchy depends on which aspect of the situation the observer considers significant. Change the significance, and the order of levels can change. A pair of levels populated by their respective classes of entities could switch orders without there being any contradiction, if the question used to construct the hierarchy changes. If the question is, '**Which species depends on the other as a food supply?**' Then the deer are the upper-level context of the wolf. Conversely, if the question is, '**Which species controls the number of the other through predation?**' then the wolf is the upper contextual level for the deer. The change from deer to wolf as the upper level comes from changing the point of view. That change identifies a different type of relationship between the two animals. The reordering from deer at the upper level to wolf at the upper level comes about because the new relationship gives a different order in terms of 1) frequency of behavior; and 2) context. These two criteria, sometimes accompanied by physical size, converge in the ordering of empirical levels of observation, such that different observers asking the same question can attain consensus on which ordering is most useful or appropriate (Ahl and Allen, 1996: 98).*

As the re-ordering of the research questions above reveals, hierarchy theory is a tool-based theory in that its focus can be changed to suit the requirements of the researcher.

Overall, the criticisms of hierarchy theory — from its qualitative nature to its lack of predictive capacity to its proliferation of jargon — do not appear to involve substantive interference with the theory's potential application in this research. Hierarchy theory is epistemological, and provides heuristic insight into the structure and function of ecosystems. For this reason, its application to ecosystem-based planning may bridge normative plan content and ecological understanding.

* Note: Emphasis has been added.

Concluding Remarks Concerning Hierarchy Theory

In this research, the central advantages of using hierarchy theory are twofold:

1. it may offer a variety of descriptive and explanative insights into the understanding of ecosystem-based planning practice and functions (including plan evaluation); and,
2. it may facilitate discussion of the issues in scientific terms since it provides a vocabulary for ecosystem structure and function (Giampietro, 1994).

In this research, hierarchy theory is to be predominantly employed in a descriptive and explanative capacity to understand the principles and planning process activities underlying the ecosystem approach to planning. Consequently, it will operate primarily as a theory *of* and *for* planning (see page 41).

SUMMARY

As a result of the literature search and review, three related research opportunities were identified:

1. research addressing the operational-conceptual gap in ecosystem-based planning is warranted;
2. plan evaluation research, particularly if methodologically- and theoretically-grounded, is warranted in general, and can address the operational-conceptual gap in ecosystem-based planning in particular. The underlying research question is the following: What are the attributes of a good ecosystem-based plan?;
3. hierarchy theory is simultaneously an understanding-oriented theory and an epistemological theory and, as such, may provide a way to theoretically-ground the ecosystem approach to planning and related evaluation instruments. In other words, hierarchy theory may provide a conceptual framework and vocabulary for describing and explaining ecosystem-based plan evaluation criteria.

In the next chapter, the methodology for addressing these research opportunities is presented.

CHAPTER III

THE RESEARCH DESIGN

INTRODUCTION

Using the ecosystem approach to planning as the field of inquiry, this study investigates the attributes (i.e., the necessary and sufficient conditions) of good ecosystem-based plans, and then interprets and explores these attributes using hierarchy theory. For subsequent researchers, these exploratory research findings can be employed as the basis for future hypothesis testing. The primary relationship under investigation is between ecosystem-based plans and their quality (i.e., their goodness).

RESEARCH QUESTIONS

The central research question seeks a descriptive answer and is stated as follows:

What are the attributes of good ecosystem-based municipal plans?

The subsequent research question seeks explanative content and is stated as follow:

How can hierarchy theory be used to explore and interpret the attributes of good ecosystem-based municipal plans?

In order to address these two questions, the research process consists of four phases. First, after a comprehensive and systematic literature review, a tentative plan evaluation framework for ecosystem-based municipal plans is posited. Second, the Delphi survey technique is employed to build on the tentative evaluation framework in order to determine which plan form, plan content, and planning process conditions are necessary and sufficient for the evaluation of ecosystem-based plan quality. In the Delphi survey

design, individual response stability testing is undertaken before level of consensus criteria are applied.

Third, the results of the Delphi exercise are then critically examined in terms of meta-criteria analysis. Fourth, the research results are explored and interpreted by employing hierarchy theory, and then made operational for subsequent field work. In this chapter, the research design is presented in order to demonstrate how the research questions are to be answered. Research boundaries and the scope of the study require delimitation first.

RESEARCH BOUNDARIES AND SCOPE

This research is bounded in three primary ways.

1. Research results cannot be generalized to all municipal plans. Only those municipal plans that have been formulated within a planning jurisdiction that has implemented the ecosystem approach to planning are suitable candidates for application of the derived evaluation instrument.
2. The evaluation framework is organized as an *ex ante* evaluation instrument, as opposed to an *ex post* evaluation instrument or combination. And,
3. The panel for the Delphi questionnaire is comprised of environmental planning experts with authority on the ecosystem approach to planning. According to Wellar (1994; 1990) and Lash (1976), there are two other primary parties whose interests are central to the planning process — elected officials and the public. However, the views of elected officials and the public are outside the scope of the present inquiry due to the research focus on the theories, methods, and operations of plan evaluation. Following the models of Wellar and Lash, it would be appropriate to involve elected officials and the public when the evaluation instrument is being applied to real, day-to-day planning situations that involve making choices among alternative plans and planning means.*

* As a case in point, the Walking Security Index (Wellar, 1998) research program engaged professionals and the professional literature to formulate technical indexes for pedestrian *safety*, *comfort*, and *convenience*. The study then involved elected officials and the public to rate the variables in terms of their relative real-world significance.

RESEARCH DESIGN

The *practical* research design* is presented in Figure 3.1. Academic and professional interest in the central research questions as topics warranting research is substantiated by the literature review (Chapter II), and is captured by more than 40 expressions of support that are documented in Tables 2.2, 2.4, and 2.5 in the previous chapter. Each of the steps presented in Figure 3.1 are now elaborated.

LITERATURE REVIEW

In Chapter II, conventional non-quantitative literature reviews (see Bausell, 1991) are employed to identify research voids in the three subject areas: the ecosystem approach to planning, plan evaluation and hierarchy theory. As well, a critical examination of the subject matters specify those areas that need to be accounted for in the research design and in the exploration/interpretation of results.

THE DELPHI TECHNIQUE

The Delphi technique is used to answer the first research question:

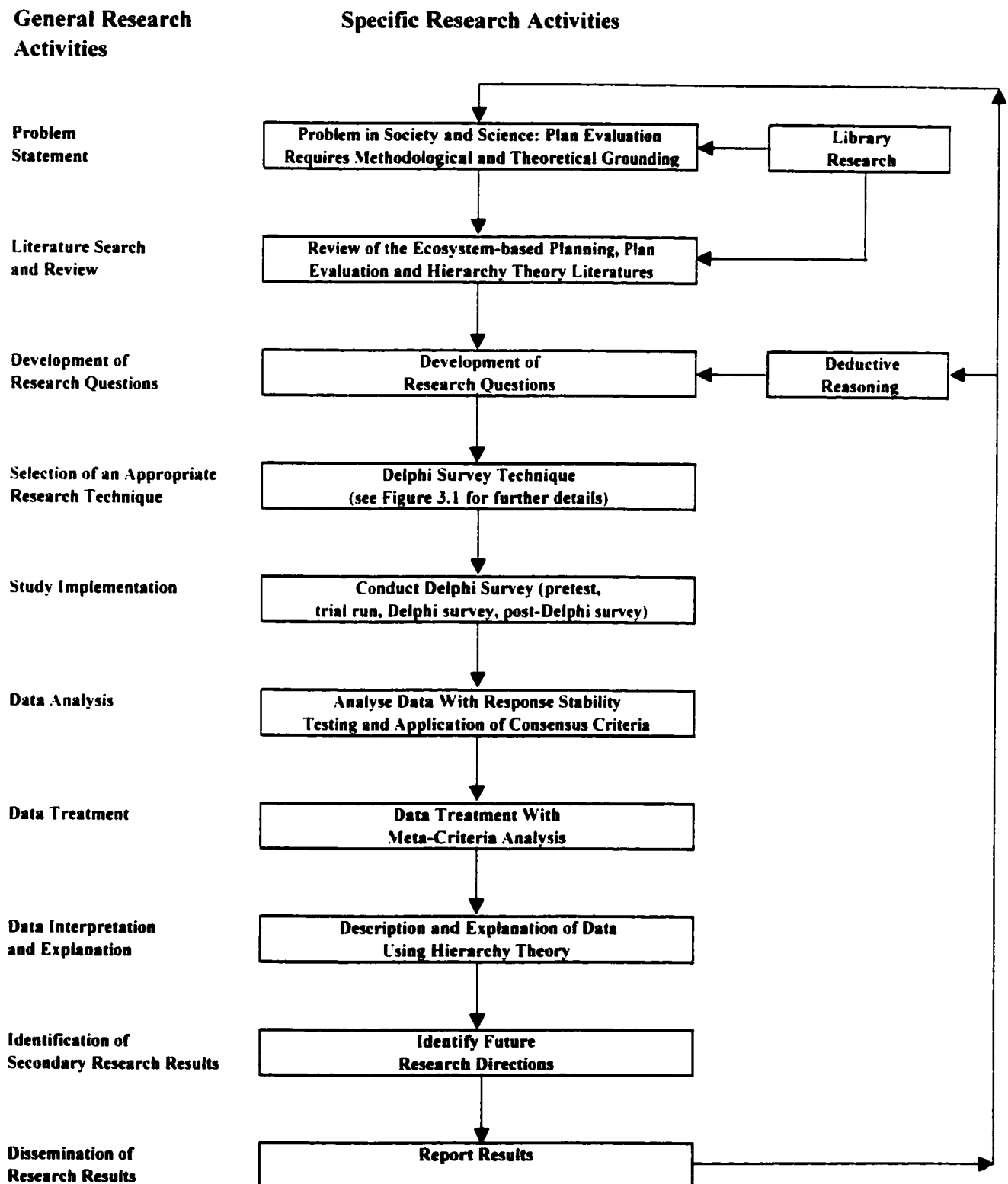
What are the attributes of good ecosystem-based municipal plans?

The Delphi technique was developed by Norman Dalkey and Olaf Helmer at the Rand Corporation in 1953 in order to explore the potential bombing strategies that Soviet military planners might implement in the event of an atomic war (Rieger, 1986; Helmer, 1983; Linstone and Turoff, 1975; Dalkey, 1969). The client of the Rand Corporation was the U.S. Air Force, which recognized the complexity of the subject matter and needed a

* Ackoff (1953) provides a distinction between practical and ideal research designs.

Figure 3.1. The Practical Research Design

Source: Adapted from Bordens and Abbott (1996: 23).



way to tap into the considerable military expertise that existed in the United States after World War II. Once the military applications of the Delphi technique were declassified in the 1950s, the technique entered the academic mainstream. The Delphi technique is described by Linstone and Turoff (1975: 3) as follows:

Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem.

This definition is cited by many authors in the Delphi literature, including Webler *et al.*, (1991); Rowe *et al.*, (1991); Richey *et al.*, (1985); and Morgan *et al.*, (1979). Important features of the technique include *group communication*, *structuring*, and *complex problems*.

The individuals involved in the group communication are usually experts, although there have been layperson exceptions (e.g., see Bardecki, 1984). The structuring of the group communication is designed by a *monitor* (or monitor team) who formulates a survey to address the research topic. For this Delphi exercise, the survey topic is: which criteria should be used to evaluate the goodness of an ecosystem-based municipal plan? Consequently, it is a normative Delphi exercise (sometimes called a *normative preference probe*).

The survey is then sent to the designated group of expert respondents (known as the *Delphi panel*), who answer the questions in anonymity and return their responses to the Delphi monitor. The send-out is normally repeated until the group achieves stable responses. Each of the iterative mail-outs is called a *round*. After the first round, the monitor reviews and summarizes the responses and then employs a measure of central

tendency (e.g., usually the mean, median, or mode) to indicate where the majority of the panel responses are located on the response continuum (Adler and Ziglio, 1996). In other words, the monitor tabulates the number of responses for each of the response categories and the category with the highest number of responses is summarized with a measure of central tendency.

The second round survey reveals the response dispersion and also includes the feedback obtained from the first round's open-ended question. Upon receipt of the second round, the experts are asked to consider the position of the measure of central tendency and are permitted to revise their initial responses if they choose. The process of response and reiteration can be repeated as many times as required, although review of Delphi practice reveals that the rate of response convergence is highest between rounds 1 and 2 (Linstone and Turoff, 1975).

In summary, the Delphi technique usually involves four general phases:

1. exploration of the topic;
2. gaining an understanding of how the expert panel views the topic;
3. investigation of panel agreement or disagreement surrounding the topic; and,
4. evaluation of all information gathered in the process.

Anonymity is a prerequisite to Delphi success since, in the context of expert groups, it prevents a dominant personality from exerting an influence upon potentially less assertive panel members. Referring to expert-based techniques other than the Delphi, Richey *et al.* (1985: 137) observe that:

minority views sometimes receive less than adequate consideration because of the over-riding influence of dominant personalities, lack of time, or some other logistical shortcoming. Alternatively, an outspoken minority can inflict its ideas on a weak majority group, even if these ideas are poorly founded.

Through the anonymity requirement, the Delphi technique appears to deal with these personality-related concerns. All Delphi exercises should demonstrate the same overall structure in terms of anonymity, iteration, and summarization of the panel's survey response dispersion. Finally, three conditions that are important for successful Delphi completion include: (1) sufficient time for at least three iterations of the survey; (2) skill in written communication; and, (3) motivation among the respondents (Fazio, 1986).

Transparency Surrounding the Execution of This Delphi Exercise

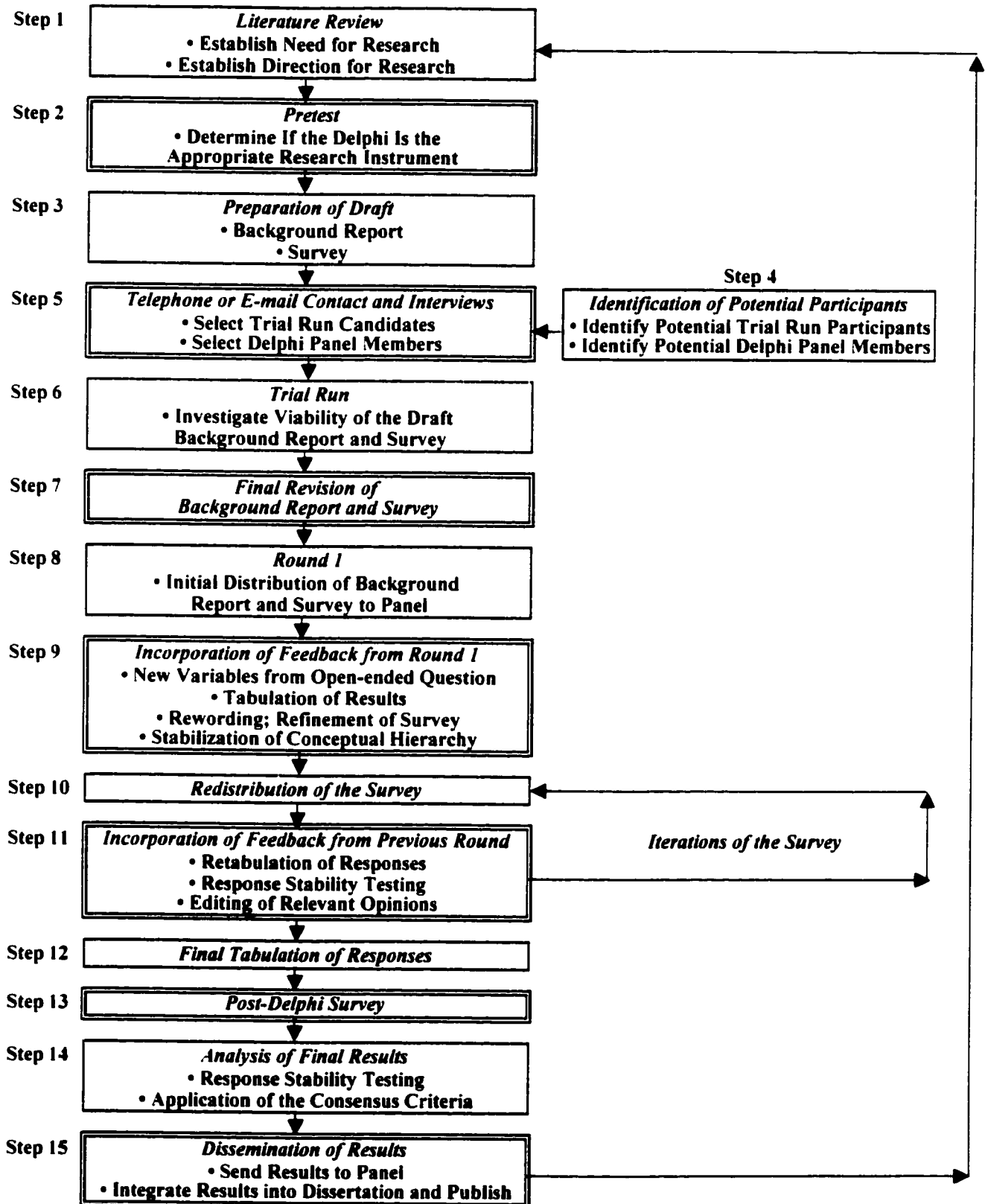
The overall purpose of the Delphi process employed in this research is to reach consensus on identifying the criteria which characterize a *good* ecosystem-based municipal plan. Figure 3.2 illustrates the sequential and recursive steps of the Delphi survey employed to achieve this purpose.

Step 1: Literature Review

To undertake the evaluation of an ecosystem-based plan, there needs to be a starting point that identifies the priority variables to be employed in the survey. However, the literature review of the ecosystem approach to planning and plan evaluation domains revealed that no such point of departure exists. In fact, many related calls for needed research were identified in these two domains (see Tables 2.2 and 2.4 in Chapter II). Essentially, the knowledge voids required that this research proceed on the basis of undertaking original research, rather than building on an existing platform. However, findings from the

Figure 3.2. Flowchart of the Delphi Survey Process

Sources: Adapted from BP Petroleum Development Ltd., 1986; Riggs, 1983; Morgan *et al.*, 1979



literature review do permit the generation of a preliminary list of *potential* evaluation criteria that can be distributed to the panel to initiate the process in Round 1.

Step 2: The Pretest

Although the terms *pretest* and *trial run* are often used interchangeably in the research design context, Ackoff (1953) provides an explicit differentiation of these two research procedures. The pretest provides the opportunity to investigate alternative operational procedures for undertaking the research (Ackoff, 1953). In other words, the pretest addresses whether the appropriate research technique has been selected. Conversely, the trial run addresses the viability and efficiency of the specific instrument and research plan before the final run, *viz.*, the trial run addresses whether the research plan and instrument — as designed — will yield results efficiently. Unlike the pretest (which is concerned with comparative consideration of techniques or methods), the trial run is directed towards one overall research plan (Ackoff, 1953). The trial run is fully addressed in Step 6 below.

In the absence of real world/empirical evidence, an expert may be considered a reasonable *place* for the researcher to begin (Sproull, 1995). The literature review reveals the state-of-the-art knowledge in the three subject domains (ecosystem-based planning, plan evaluation and hierarchy theory) and provides a basis for the conclusion that an expert-based technique was an appropriate way to proceed. The central task of the pretest involved selecting which technique involving expert opinion was the most suitable. There are many techniques that can be used to elicit expert opinion, and the primary ones are listed in Table 3.1.

Table 3.1: Research Techniques That Employ Experts

Name of the Research Technique	Selected References
Committee Approach	Turoff, 1970
Cross Impact Analysis	Adler and Ziglio, 1996; Helmer, 1983; Jones and Twiss, 1978
Delphi Technique	Gupta and Clarke, 1996
Nominal Group Technique	Adler and Ziglio, 1996; Ritchie, 1987
Panel Evaluation Method	Stauth <i>et al.</i> , 1993
Parliamentary Procedure	Delbecq <i>et al.</i> , 1975
Professional Polling	Knox, 1993
Roundtables	Helmer, 1983
Survey	Sheskin, 1985
Workshops	Webler <i>et al.</i> , 1991

Recognizing the range of available techniques, a number of factors require assessment due to practical considerations. These considerations are summarized as follows:

- **cost minimization.** The necessity of bringing an expert panel together in person represents both (a) considerable expense and (b) considerable inconvenience to panel members. The employment of the Delphi process largely short-circuits these concerns. The Delphi process — while not inexpensive — is less expensive than paying for an expert group to convene. More importantly, in a research context constrained by fiscal imperatives, the Delphi process permitted experts from across the country to be involved. Employment of a mailed Delphi survey could improve the geographic coverage for engaging the most desired panelists.
- **maintenance of anonymity.** In expert scenarios, anonymity can be critical. With anonymity, the submission of the views of individual experts to the anonymous criticism and review of fellow experts can be accomplished without face-to-face confrontation. More importantly, the anonymity dimension permits panel members to feel free to reconsider their opinions in light of the dominant response categories revealed in each subsequent round — without anyone other than the Delphi monitor knowing that they have done so (Jones and Twiss, 1978). In this way, the Delphi technique facilitates consensus.
- **minimization of the personality-factor in influencing results.** Among expert panels, there are three primary concerns related to the *cult of personality*. First, there is the threat that a dominant personality might overwhelm other participants when the panel convenes. Secondly, considerable *noise* may result in time-wastage if experts maneuver to support for their own disciplinary and/or subjective biases. Third, there is always a concern that more inhibited participants

may be unwilling to express minority opinions in the presence of their peers. As observed by Miller (1984: 365), "expert groups often suffer from debilitating internal problems which make it difficult to achieve effective collaboration." The Delphi method minimizes the personality factor through its anonymity requirement.

- **providing insight into *the big picture*.** The open-ended question provided in Round 1 of the process ensures that the survey is not prematurely confined. One manifestation of tapping the panel's expertise is being able to ensure that the big picture is tested, rather than merely the pre-conceptions of the survey designer. The longer time horizon of the Delphi permits panel members to enlarge the scope of their deliberations.
- **overall suitability of the technique for the central research questions** (see below for specifics).

Examination of the literature suggests that the Delphi process is the only research technique listed in Table 3.1 that adequately satisfies these important factors. Further, no other technique was encountered that could perform the necessary research tasks as effectively, as efficiently, as economically and as transparently as the Delphi Technique.

Concerning the final selection criterion (**overall suitability of the technique for the central research questions**), the Delphi technique appeared to be the appropriate choice for several specific reasons:

- **suitability for public sector research.** Preble (1983) identifies the following specific public sector research contexts where the Delphi technique is particularly useful: identification and/or prediction of future events or issues; obtaining a consensus among public sector employees with potentially divergent viewpoints; exploration of the diversity of opinions; derivation of data where none existed previously; development of evaluation criteria; and the identification, setting and ranking of goals. The latter factors represent central dimensions of this research plan.

- **suitability of the research question to treatment with the Delphi technique.** What sorts of research questions are suitable for investigation with the Delphi technique? First, complex research questions involving a wide range of variables and factors are considered suitable. Because of the Delphi technique's reliance on experts, it is particularly amenable to complex topics and this was one of the factors leading up to the technique's development and implementation by the Rand Corporation in the 1950s.

Second, Richey *et al.* (1985: 142) observe that the Delphi technique "lends itself more readily to conceptual or philosophical issues than to issues that require exact, or quantitative, answers." Third, many research domains that are comprised of a mix of physical, social and normative laws and principles are extremely difficult to test empirically in the field. Perhaps the interaction of variables is so complex and multi-faceted that it is impossible to isolate relationships that are susceptible to fieldwork investigation. Or, perhaps the research process would be impossible to implement due to time and resource constraints. These latter considerations were considered especially important in selecting the Delphi technique because of the financial implications involved.

- **breadth and depth of the supporting literature.** The Delphi technique has maintained a strong research tradition since its development in the 1950s. The professional and academic literature supporting its employment and viability has considerable breadth and depth (see Gupta and Clarke, 1996). According to Masser and Foley (1987: 217), the Delphi is "the most widely used technique for eliciting expert opinion." Extensive supporting documentation facilitates the emulation of successful research designs.
- **effective consensus-building.** There is a documented tendency for viewpoints and opinions to converge and synthesize within the format of the Delphi.
- **comprehensiveness.** There is considerable opportunity for alerting the researcher to all of the possible necessary conditions involved, as well as highlighting both the areas of conflict and consensus. Furthermore, the method demonstrates potential for the identification and exploration of the underlying assumptions that lead to different judgments.
- **removal of bias.** On the one hand, the removal of bias is facilitated by short-circuiting the possibility of a dominant personality exerting his or her will on a consensus-building exercise. On the other hand, panel selection can also ensure that many panel biases (whether gender- or disciplinary-driven) cancel each other out. And,
- **equity.** The Delphi process provides an equal opportunity for participants to express their opinions. The responses are neither ranked nor weighted according to participant (Adler and Ziglio, 1996).

The pretest was formally conducted at the candidate's research proposal defense on December 5th, 1996. At the defense, alternative methods for carrying out the research were discussed (e.g., the use of conventional one-time surveys; re-iterative surveys; face-to-face committee discussions; the use of non-expert panels). The applicability of the Delphi technique in this research context was established and the research task then became the specification of the selection criteria for the panel. When preliminary expert selection criteria were suggested during the pretest, the committee concluded that those proposed were neither sufficiently demanding nor representative in terms of disciplinary- and gender-based expertise (see Step 4). Recognizing that changes to the selection criteria required refinement, the pretest indicated that the Delphi was the research technique to employ.

Step 3: Preparation of Draft Background Report and Survey

Once it was decided that the Delphi technique was an appropriate course of action, the next step involved drafting a background report explaining the *whys*, *whats* and *hows* of the inquiry. The draft survey to accompany the draft background report was visualized as a full-blown round, rather than an information-seeking round. Some Delphi designers like Helmer (1983) suggest that Round 1 can be preceded by a so-called Round Zero — which is used to open up the subject matter to expert *brainstorming*.

Due to the complexity of the subject and the number of details involved in each round, it was decided in consultation with the research supervisor that a Round Zero (which would not count as a formal round since responses would not be counted/tabulated) would constitute an extra time imposition on panel members and could contribute to panel

fatigue. This is a particularly important consideration in a research project where the panelists are not being paid.

Instead, a preliminary list of potential conditions and attributes extracted from a comprehensive and systematic literature review (of the plan evaluation and ecosystem approach to planning research domains) comprised the basis of the draft survey. The literature review was considered a first step in arriving at a final inventory of necessary conditions surrounding ecosystem-based plan quality. By providing this preliminary inventory, panelists could be presented with a framework of variables for their consideration. The open-ended question at the end of the survey ensured that supplementary conditions or attributes felt to be important by panelists were not overlooked.

In the draft survey, conditions and attributes were organized according to three topical envelopes: plan form, plan content, and plan-making process. It is important to recall and reemphasize that the focus of this research is *ex ante* evaluation. For that reason, a fourth envelope dealing with *plan performance* was not addressed since it is beyond the scope of the study.

The central task of this Delphi process involves establishing the *necessary* and *sufficient* conditions of good ecosystem-based plans. Later, the necessary conditions are translated into formal evaluation criteria. The necessary conditions — in combination — represent the sufficient condition for *plan goodness*. More specifically, necessary and sufficient conditions refer to causation and may be distinguished as follows. To demonstrate the

relationship between necessary and sufficient conditions, let X represent possible necessary conditions or attributes and Y represent a good ecosystem-based plan.

Recognizing that the tilde (i.e., $\sim$) signifies *not*, then,

- given any X and Y, X is a **sufficient condition** for Y if, given X, then Y;
- given any X and Y, X is a **necessary condition** of Y if, given $\sim X$, then $\sim Y$ (Blackburn, 1994; Sparkes, 1991; Lacey, 1986; Reese, 1980).

For example, consider the relationship between oxygen and fire. Oxygen (X) is a necessary but not a sufficient condition for fire (Y). Oxygen plus other necessary conditions like the presence of combustibles, a spark, and suitable environmental conditions, in combination, comprise the sufficient condition for fire. Employing the same underlying logic, the Delphi process is used to explore which necessary and sufficient conditions constitute a good ecosystem-based plan.

Within each of the three envelopes of the survey, potential necessary conditions and their attributes were listed. If required, potential measures and examples were provided in parentheses for explanatory or illustrative purposes. Panelists were encouraged to comment on, and agree or disagree concerning the inclusion or exclusion of all listed conditions, characteristics and attributes. More specifically, as the panelists reviewed the list of potential necessary conditions and attributes, they were asked to consider the following two questions:

1. For variables listed in column one of the Round 1 survey — referred to as **POTENTIAL CONDITIONS OR CHARACTERISTICS** — panelists were asked to consider the following: is this a *necessary*, *important* or *not important* condition of a good ecosystem-based plan? If panelists were reminded of a potential necessary/important condition or characteristic for plan quality that was not listed, they were asked to provide it in their answer to the open-ended question at the end of the survey; and,

2. For variables listed in column five of the Round 1 survey — called POSSIBLE ATTRIBUTES — panelists were asked to consider the following: is this a *necessary*, *important* or *not important* attribute of the potential conditions of column one? Once again, the panelists were asked to select one of the response categories. If panelists thought of other attributes capturing a particular necessary/important condition that were not listed, they were asked to provide them in their response to the open-ended exhortation at the end of the Round 1 survey.

The open-ended exhortation ensured that the full range of variables would be provided in Round 2, and permitted the panelists to test their own ideas among the other panelists. Panelists were asked to respond to each variable. Neutral response categories were not provided (e.g., a category between *important* and *not important* such as *neither important/unimportant*) since the purpose of the Delphi is to address a panelist's perspective rather than their lack of perspective or indifference. As Turoff (1975: 90) observes, "it is usually desirable to force the respondent to think the issue out to a point where [s]he can take a nonneutral stance."

The wording of the variables follows standard procedural guidelines for survey design (see Sheskin, 1985). Variables were presented in plain language with minimal complexity so that ambiguity was minimized. Explanatory information was provided by offering illustrative comments and examples in parentheses. Brevity was also addressed in order to optimize clarity and speed. However, if the wording or phrasing of the survey variables was too concise, then excessive freestyle interpretation by the panelists might have resulted. On the other hand, if the variables were too lengthy (i.e., *wordy*), they might have imposed the assimilation and/or interpretation of too many dimensions, and this could have lead to confusion (Linstone and Turoff, 1975). The challenge, therefore, was

finding the compromise between these extremes by identifying the core meaning of the variables.

Although the number of people who respond to a questionnaire is inversely related to its length, survey length was not amenable to compromise in this research (Sheskin, 1985). That is, there was no way to address the length issue since an inventory of applicable evaluation criteria was a desired product of the research process. As a result of that condition, more than 100 variables were listed in each of the first three rounds of the survey. By Round 3, however, stable responses were achieved for nearly 30% of the variables, so the survey length contracted as the Delphi progressed.

Finally, the question of how the variables should be organized needed to be addressed. The easiest and simplest way was to provide an unorganized list of potential conditions/attributes of good ecosystem-based plans. This could have been presented as the so-called Round Zero. However, as stated, this was not desired for a number of reasons. First, a relatively pithy and manageable sufficient condition of ecosystem-based plan quality was desired. Second, a hierarchical conceptual framework was also desired (Lee and Colley, 1991). Consequently, a hierarchically-organized set of potential evaluation criteria was presented in the draft survey. The preparation of the draft background report and draft survey at this stage (Step 3) made it possible to move into Step 4 with a solid foundation concerning the sort of round that the panelists would be examining.

Step 4: Identification of Potential Participants

In establishing the Delphi panel, the first question that required resolution concerned how large the panel should be. Review of the literature indicated that if a larger panel was desired, the selection criteria could not be stringent because ecosystem-based planning authorship is still relatively immature. However, if a smaller panel was appropriate, then the selection criteria could be more stringent.

For planning-related contexts, the literature revealed that a "typical Delphi panel has about 8 to 12 members" (Cavalli-Sforza and Ortolano, 1986: 325). A similar perspective is suggested by Richey *et al.* (1985: 142) who state that "a small panel (e.g., eight) would be sufficient to develop appropriate consensus views." This is further corroborated by Adler and Ziglio (1996) and Delbecq *et al.* (1975). Consequently, it was decided that at least eight and not more than 12 environmental planning experts from across Canada would be engaged. Hence, the decision to use ten experts can be considered methodologically sound, and permits some flexibility in case one or two of the participants choose to withdraw. Traditionally, dropout levels in Delphi exercises are lower than for other survey instruments because the use of experts means that the participants have a defined and sustained interest in the topic (Bardecki, 1984).

Actual identification of potential participants for the trial run and final run required investigating the definition of the term *expert*, viz., what are the attributes that characterize an expert? In this Delphi exercise, the legal aspects of *expert* were employed as a starting point. Then, the legal determinants were cross-referenced to discussions of *expert* in the planning and Delphi literatures. The legal view of *expert* and what it is

constituted by represents the *stock and trade* of expert witnesses used in planning-related jurisprudence. In a legal context, opinion-based evidence (as opposed to observation-based evidence) is normally admissible in court only when it is provided by an expert. The expert, in this case, is "a person who, because of education or experience in a field, is an authority on a particular subject" (Estrin and Swaigen, 1993: 85). Consequently, the two crucial attributes of authority are **education** and **experience**.

Moving to the planning and social sciences literature, Cavalli-Sforza and Ortolano (1984: 325) suggest that the layperson possesses no special knowledge of complex problems and can provide "no more than a sensible guess based on the information provided." This is not to say that the opinions and beliefs of laypersons do not matter. Instead, the issue is that where a knowledge void exists, the opinions of experts represent a valuable and valid point of departure for subsequent research. The theory of errors suggests that a true answer has a higher probability of resulting from the thinking of experts than from non-experts (Rowe *et al.*, 1991). Taking these factors into consideration, the selection criteria for potential members of the Delphi panel were established.

Based on the above *guidelines* and recognizing discussions with the research supervisor and members of the research committee, the Delphi panelists were systematically selected according to the following criteria:

1. An **advanced university degree** (e.g., Master's degree or higher) in disciplines related to the ecosystem approach to planning;
2. A **publishing record** demonstrating a professional or academic interest related to ecosystem-based or environmental planning;

3. At least four years of **relevant work experience** including at least two of those years in a municipality or academic environment involving the ecosystem approach to planning;
4. Current **professional affiliation** (e.g., the Canadian Institute of Planners; the Canadian Society of Landscape Architects; Royal Architectural Institute of Canada; etc.). Professional affiliation presupposes that professional experience in the subject domain has been or is taking place. The employment of this criterion is supported by Richey *et al.* (1985);
5. Direct **familiarity with municipal plan making** rather than experience predominated by background research, site planning or by-law administration; and,
6. **Willingness to participate** in the Delphi process (Sproull, 1988; Richey *et al.*, 1985).

In addition to the above criteria, the pretest indicated that the panel as a whole needed to demonstrate representativeness according to both gender and disciplinary attributes. Concerning gender, the ten member panel was equally represented with five males and five females.

With regard to disciplinary attributes and the need to avoid bias in a panel's training, experience, and expertise, the panelists were selected so that a broad range of disciplines was represented. The range of disciplinary expertise represented by panel members is illustrated as follows:

- **Undergraduate degrees:** architecture; classical civilization; environmental studies; geography; history; landscape architecture; life sciences; planning; political science; resource and environmental management; and sociology.*
- **Master's degrees:** applied ecology and planning; architecture; Canadian heritage; geography; planning; public administration; and regional science.
- **Ph.D. degrees:** architecture; geography; planning; and regional science.

* The total number of different undergraduate degrees does not sum to ten because some panelists have multiple degrees.

As well, occupational bias is accounted for by observing that the work experience criterion ensured that the panel was not composed solely of *ivory tower* participants. Although seven of the ten panelists are employed as university professors (in one case as a part-time professor), at least three of the professors are involved in ecosystem-based plan making and implementing through their consultancy work. In other words, six of the panelists have direct on-the-ground experience with formulating and implementing ecosystem-based plans. In combination, a panel with a representative range of these characteristics appears likely to effectively cancel out potential gender-, disciplinary- and occupationally-based biases.

Although a geographically-based selection criterion was superficially appealing, it is arguable that experts are in demand across the continent and are not tied to a particular location. In other words, experts are mobile. Consequently, a geographical distribution criterion was not employed. Overall, Delphi monitors endeavor to create a panel that reflects "a wide range of experience and a diversity of opinions" (Masser and Foley, 1987: 218).

Step 5: Telephone and E-Mail Interviews

The original list of potential participants was extracted from the literature review according to their contribution to ecosystem-based planning. Identification of their place of employment in the literature permitted some presupposition concerning potential candidates' advanced degrees. At this early stage in the development of the panel, there was still the need to find two female candidates, who were later located through dialogue with other potential candidates. At this point, the existing list was cross-referenced to the

directories of the Canadian Institute of Planners, the American Planning Association, the Canadian Society of Landscape Architects, and the Royal Architectural Institute of Canada. Potential panel members remaining on the list after this stage were then contacted either by phone or by e-mail, starting with those authors who appeared to have made a significant contribution to the literature.

Once a potential panelist was reached, questions pertaining to each of the selection criteria were asked if this information was not already known. The telephone interview series was short since considerable information had already been assembled from the literature review and from professional networking. Except for two refusals (including one related to planned residency in Australia), all of the experts agreed to participate on the first contact. The names and affiliations of the members of the Delphi panel are presented in Appendix II.

Step 6: The Trial Run

A trial run was undertaken to determine whether any final adjustments to the survey instrument and the background package were required before the final run. In this step, the trial run for the Delphi questionnaire was previewed by a surrogate Delphi panel of seven experts meeting all selection criteria discussed above in Step 4 — except for the *publishing record on ecosystem-based or environmental planning topics* criterion (although four of the seven did, in fact, meet this criterion). Five of the seven participants responded. The non-participation of the two individuals who had agreed to be involved but were obliged to withdraw was due to a time constraint.

The trial run revealed the following:

- some points in the explanatory package were identified as either (1) ambiguous, or (2) requiring elaboration;
- a number of the conditions and attributes were unclear and required further explanation. At least 30 suggested refinements were incorporated after the trial run; and,
- a number of conditions and attributes of good ecosystem-based plans that could be meaningful were not yet included.

In particular, some of the cells in the survey matrix needed to be clarified, and this was done by adding examples or potential measures in parentheses in order to provide guidance concerning the specific and intended meaning or intent of some of the proposed evaluation criteria.

Step 7: Final Revision of the Background Report and Survey

All of the suggestions made during the trial run were incorporated into the background report and survey: points and concepts in the explanatory package requiring further explanation were elaborated; clarity was improved by word changes and rephrasing of the survey variables; and, potentially meaningful conditions and potential attributes of good ecosystem-plans that had not been included were added.

Step 8: Round 1 (see Appendix III for the presentation of the rounds)

Once the final version of the background report and survey was ready, the next step was to distribute them to the panel members. Panelists were contacted by phone or e-mail concerning when to expect Round 1. One week after mailing, panelists were contacted to ensure that they had received their copy and that they did not have any questions. Unfortunately, at this time, it was learned that most of the panelists had not yet received

their copies. Originally, large high-quality envelopes were used, but their size interfered with the speed of their delivery since they were processed as parcels by Canada Post. Due to the complexity of how the questionnaire was organized within a large Excel spreadsheet, e-mail transmission of the survey was not feasible. Calls over the next two weeks eventually confirmed receipt of the survey by all panelists. Any questions concerning the survey were dealt with immediately.

Step 9: Incorporation of Feedback from Round 1

When all ten panel members had responded to Round 1, the questionnaire was revised in three ways:

1. A measure of central tendency (i.e., the mode) was provided to identify the dominant response category within the response continuum;
2. New conditions or attributes that were suggested by the panelists in the open-ended question at the end of the survey were added; and,
3. Individual conditions and attributes were refined (rephrased, reworded) following suggestions from the panel.

The rationale behind the revisions is as follows. First, this exercise involves a normative Delphi rather than a forecasting Delphi. Hence, the measure of central tendency employed was the *mode* — because the categories are based on an ordinal scale (Sharma *et al.*, 1993). The *mode* is the response category in a distribution with the largest number of observations or frequency of response (Bohrnstedt and Knoke, 1994). In other words, the mode was provided to gauge the overall position of the panel as a whole.

When two response categories displayed the same level of agreement, bimodality was recognized (as the *bimode*). More formally, in a bimodal distribution, the two categories

with the highest number of observations have exactly the same number of observations (Bohrenstedt and Knoke, 1994). It was noted for the panel that, after Round 1, no response polarization occurred (e.g., bimodes or consolidating sub-groups occurring at either end of the response continuum). Response polarization might have indicated either faulty wording or unanticipated bias on the panel.

Second, twenty-five new variables were added to the survey after Round 1. The new additions permitted the panel members to circulate their own ideas about what they felt was relevant to the research question. Some of the suggestions made by panel members were strongly related to existing variables and, in such cases, were added as explanatory notes inside the parentheses of the attributes. Third, some panel comments also revealed that several of the variables from Round 1 could be combined or reworded. Rewording was approached with caution to ensure that core-meanings were not altered. Five specific variables were tracked to ensure that the rewording did not subsequently result in unstable responses.

Step 10: Redistribution of the Survey

Round 2 was sent as soon as the survey was revised and the modes were tabulated. If a non-modal response was to be chosen in Round 2, panelists were asked to succinctly identify why. In this way it was possible to gain some insight into residual dissensus by: (a) exploring the differences of opinion and (b) identifying factors that the other experts might not be considering (Widstrand and Kruus, 1996). Dissensus could arise from the following: different perspectives; different knowledge bases; different semantic

interpretations of variables; different theoretical views; and/or disciplinary bias, among other things (Helmer, 1983).

For Round 2, the members of the Delphi panel were asked to re-consider the variables in light of the identified measure of central tendency or anchor (i.e., in this case — the mode). Typically, there are three ways in which the panelist can respond to the measure of central tendency:

- The panelist ignores it;
- The panelist shifts judgment away from the mode by responding in an extreme fashion in the interest of moving the anchor closer to the panelist's true desire. For example, an ongoing concern with Delphi results is that individual panel members may intentionally bias or over-accentuate their responses to consolidate their own research or other agenda (Jones, 1975). Since the results of this Delphi exercise do not have impacts on research funding allocations or pertain to professional esteem, it is suggested that these possibilities are not relevant factors; and,
- The panelist shifts judgement towards the mode. This is called *assimilation* or *convergence* (Bardecki, 1984). Traditionally, levels of convergence are highest between Rounds 1 and 2.

Round 1 responses were not returned with Round 2. A point of concern was that returning Round 1 responses to the panel could yield increased levels of response stability between rounds because panel members could check on how they voted on the previous round. However, for that argument to hold, it is necessary to first presume that expert panel responses may be unstable. The Delphi monitor was not comfortable with this presumption and did not want to implicitly transmit that message to panel members. However, if Round 1 responses were specifically requested by panelists, then they were supplied.

In addition to the stability/instability matter, there were several other reasons behind the design decision not to return previous round responses. They are summarized as follows:

- If panelists know their previous round responses, they **may waste time apologizing** for converging on the mode, even though facilitated consensus is the whole point of a Delphi exercise. This activity was, in fact, recorded for some of the panelists that did request their Round 1 responses.
- **The belief that knowledge and opinions evolve over time.** The Delphi process took over nine months to complete and there is no adequate way to account for the evolution of thought and opinion over such an extended time period. A Canadian Delphi expert not on the panel corroborated this decision (Ley, 1997: Pers. Comm.). During this nine-month timeframe, two important new books on ecosystem-based planning were released and the New Urbanism movement started to gain momentum in Canada. Quite simply, much can happen in nine months. For example, some panelists took vacations (e.g., China, Oregon, Scotland) and it would be difficult to gauge how these out-of-country experiences helped shape the evolution of their perspectives. And,
- Providing previous round responses **imposes further information for the panel member to process.** As noted above, the time imposition on unpaid experts needed to be minimized in every conceivable way.

Step 11: Incorporation of Feedback from Previous Rounds

Feedback from Round 2 included reasons why panel members were choosing non-modal responses. This information was provided in an inventory with Round 3. Without exception, all feedback of this nature was recorded and transmitted to the panel. Grammatical standardization was the only editing done to panel comments.

Each round in the Delphi process served different functions. In summary, the following information or actions resulted from Round 1:

- a measure of central tendency was tabulated to identify the dominant response category within the response continuum;
- new conditions or attributes suggested by the panelists in the open-ended question at the end of the survey were added; and,
- individual conditions and attributes were refined (rephrased, reworded) following suggestions from the panel.

The following information or actions resulted from Round 2:

- on-going modal consolidation; and,
- creation of an inventory detailing the reasons underlying non-modal responses.

The following information or actions resulted from Round 3:

- continued modal consolidation; and,
- on-going refinement of the survey instrument.

As demonstrated, each round served specific functions within the overall process. Generally, three rounds tend to prove sufficient to attain stability in Delphi responses. "Further rounds tended to show very little change and excessive repetition was unacceptable to participants" (Linstone and Turoff, 1975: 229). In this research, four rounds were ultimately required in order to demonstrate the more stringent test of *individual response stability*.

Step 12: Final Tabulation of Responses

Delphi responses should be considered final only when they are stable. The final tabulation of responses occurred as soon as the following termination criterion was met: two or fewer of the panelists were changing their decisions between rounds. A review of the Dissertation Abstracts CD-ROM from 1990 to 1997 revealed that many Ph.D. dissertations continue to employ levels of panel consensus as the stopping criterion, despite widespread recommendations in the Delphi literature suggesting that consensus criteria should be applied only after response stability is established (see Sharma *et al.*, 1993; Rieger, 1986; Chaffin and Talley, 1980; and Dajani *et al.*, 1979). As Schiebe *et al.* (1975: 262) observe, using response stability rather than consensus levels as the stopping

criterion "allows much more information to be derived from the Delphi, and in particular, preserves opinion distributions that achieve a multimodal consensus." Once the responses are deemed stable, then the level of consensus criteria can be applied.

Stability itself "refers to the consistency of responses between successive rounds of a Delphi survey" (Chaffin and Talley, 1980: 67). In other words, *are panel members selecting the same responses between successive rounds and, if so, to what degree?* In the Delphi literature, a number of statistical and mathematical tests have been suggested for investigating the degree of response stability between rounds: the co-efficient of variation (standard deviation divided by the mean); the chi-square test; and the F-test.

When smaller samples or populations are involved, Dajani *et al.* (1979) suggest using the binomial or poisson distributions. While the observations of Dajani *et al.* (1979) are not an issue, subsequent research revealed that an important distinction must be addressed. That is, the stability of individual responses implies the stability of the group, but not vice-versa (Chaffin and Talley, 1980). This means that individual response stability represents a more stringent test. Following the suggestion of Rieger (1986), the approach adopted for this research is to test individual response stability, both because the logic of doing so is more sound and because the test itself can be efficiently employed.

Chaffin and Talley (1980) measure the extent of individual response stability between rounds by employing an index of individual stability or, more specifically, an index of predictive association:

In measuring the degree of individual stability between two consecutive rounds, the index gives the proportional reduction in the probability of error in predicting the responses of round $i + 1$ given that the responses of the i th round have been specified. If the information about the responses of the i th round does not reduce the probability of error at all, the index will be zero; hence there is no predictive association. Alternatively, if the index is 1.00, there is complete predictive association.

However, when the panel size is ten, the need for the computation of the index can be set aside by a practical rule of thumb. More specifically, Nelson (1978: 45) asserts that survey questions can be "considered stable when 20% or less of the participants changed their responses." In other words, if two or fewer of the ten panelists are changing their responses concerning the importance rating of the evaluation criteria between rounds, then the variable can be considered stable. As soon as all of the variables in the survey are identified as stable, then the level of consensus criteria can be imposed (see Step 14 for a full explanation).

Step 13: Post-Delphi Survey

The post-Delphi survey is intended to provide insight into both the effectiveness and the delivery of the process. Scheibe *et al.* (1975) suggest that suitable directions to investigate include the following: participant satisfaction with results between rounds, communication of information pertaining to the process, facilitation of learning, facilitation of participation, and overall performance of the Delphi monitor. All of these dimensions were addressed in the post-Delphi survey, as discussed in Scheibe *et al.* (1975).

Step 14: Treatment of the Final Results

The first treatment of the results of the Delphi has two stages: analysis of consensus, and evaluation of the survey instrument itself. Outside the scope of the Delphi process, the Delphi results (as the basis for deriving an evaluation instrument) are analyzed and synthesized through meta-criteria analysis, and interpretation and exploration with hierarchy theory.

a. Treatment of Survey Responses

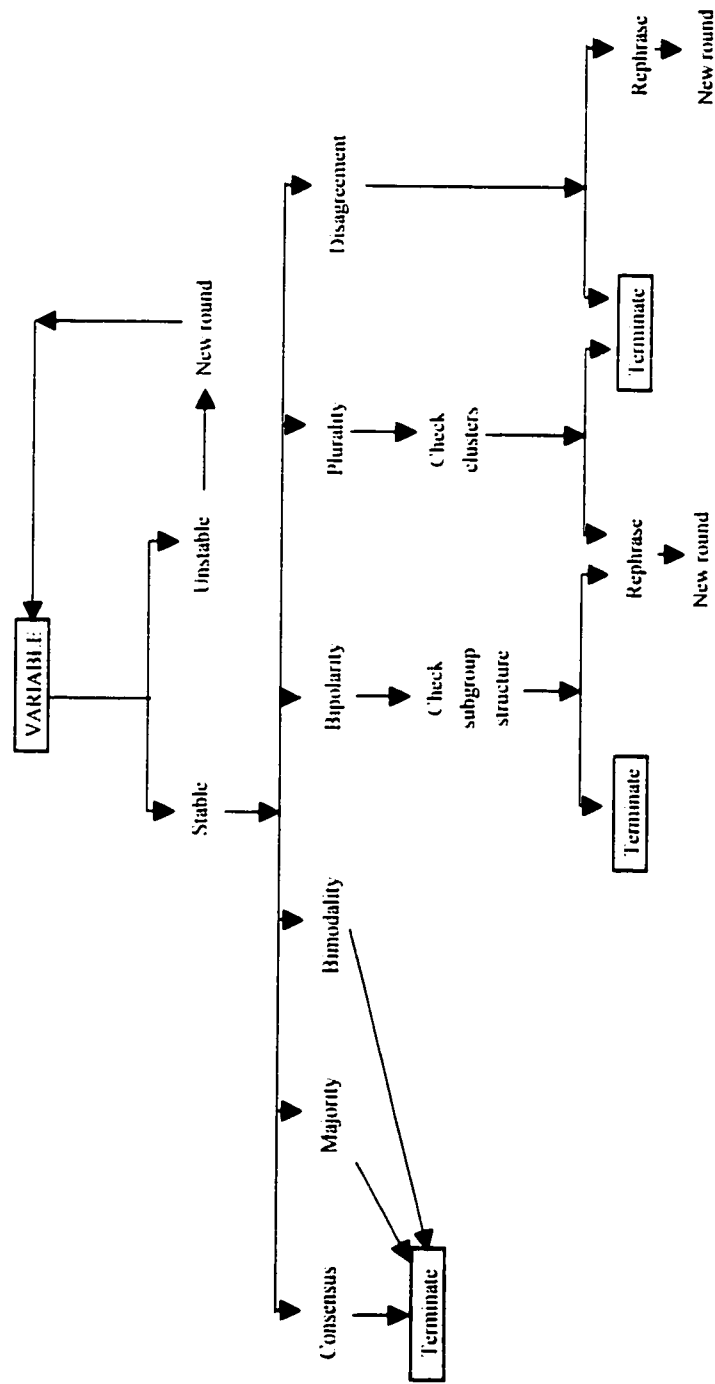
As soon as the responses in the survey were identified as stable, the survey iteration process was halted and the *level of consensus* criteria were applied. All variables whose mode was in the *not important* response category were removed from the inventory. Building on the work of Dajani *et al.* (1979) by adding bimodality, six possible agreement levels or stopping criteria are recognized: consensus, majority, bimodality, bipolarity, plurality and disagreement. As shown in Figure 3.3, the level of consensus criteria are utilized only after stability is established. The level of consensus criteria are defined as follows:

Complete consensus: occurs when the response category has unanimous agreement among respondents. This means that 10 out of the 10 panel members agree. By the end of Round 2, over 30% of the variables demonstrated unambiguous consensus. Complete consensus is assumed to be immediately stable since departure from the consensus — once established — is suggested to be a pathology.

Majority: occurs when more than 50% of the respondents choose the same response category. Once a stable response is attained, *majority* becomes a decision rule.

Figure 3.3. The Level of Consensus Criteria
Source: Adapted from Dajani *et al.* , 1979

Once the variables are identified as stable, then their level of consensus can be addressed.



Bimodality: occurs when an equal number of respondents are grouped in two categories. This could be exemplified by five panel members choosing the *necessary* response category and five respondents choosing the *important* category. In the case of bimodality, two immediate courses of action appeared feasible. First, a new panel member could have been introduced to break the tie. Or, the precautionary principle could be applied and the more stringent response category could be chosen since all of the variables were expressed as positive attributes of good ecosystem-based plans. This latter course of action was chosen because it was unclear about the methodological soundness of introducing a new panel member into the process after-the-fact. Further, the precautionary principle has received considerable attention in the ecosystem approach to planning and other environmental planning literature (Kingsley, 1997).

Bipolarity: occurs when respondents are consolidating in two response categories at opposite ends of the response continuum. In this research context, this could be exemplified by consolidating sub-groups choosing the *necessary* response category and the *not important* category. Bipolarity did not occur for any of the variables in any of the rounds.

Plurality: occurs when a large portion of the panel (but less than 50%) reaches stable agreement in different response categories. Although possible, plurality did not occur in any of the response distributions. Consensus, majority or bimodal dominance was always exerted. And,

Disagreement: occurs when each respondent maintains views independent of each other respondent.

In summary, the treatment of the Delphi process results proceeds as follows. Stability/instability for each variable is addressed first. If instability is discerned, then a new round is necessitated for those variables. If stability is found, then a decision rule is applied to establish *consensus*, *majority*, *bimodality*, *bipolarity*, *plurality* or *disagreement* and the variable can be removed from further consideration in the Delphi process.

The variables identified as *necessary*, in combination, represent the sufficient condition for good ecosystem-based municipal plans. This sufficient condition *cum* evaluation framework is later adjusted and refined through meta-criteria testing, theoretical consistency testing and operational feasibility testing on a case study.

b. Evaluation of the Validity of the Delphi Exercise Results and the Survey Instrument

The probity of the research results is explored in the next chapter. As well, the post-Delphi survey provided insight into how the Delphi process might be improved and a discussion of these results is provided in Chapter VIII (Secondary Research Results).

Step 15: Dissemination of Research Results

The dissemination of research results is a concluding step in the building block approach to scientific inquiry. Three types of dissemination are attempted here: (1) providing panel members with a summary of research results; (2) use of the results in a doctoral thesis; and (3) publishing the results in the learned and related literatures (Walizer and Wienir, 1978; Ackoff, 1953).

Concluding Remarks On the Delphi Technique

Historically, three iterations of the Delphi technique have proved sufficient to result in stable responses. After three iterations, a point of diminishing returns tends to be experienced (Linstone and Turoff, 1975). In this research context, four iterations were required due to both the complexity of the subject matter and the employment of the more stringent individual response stability test (as opposed to group stability).

META-CRITERIA ANALYSIS

Meta-criteria analysis is employed to streamline the research results (e.g., to reduce repetition, etc.) and to facilitate the potential operationalization of the evaluation instrument for future hypothesis testing. Basically, meta-criteria analysis is the

application of criteria to criteria. This procedure is employed because "the process of stating the criteria for the evaluation...is the most important element of the evaluation" (Dakin, 1969: 7).

Criteria can be defined as "the standards of judgement" (Voogd, 1983: 28). Meta-criteria provided by Lee and Colley (1991) that can be employed on the derived evaluation framework include the following:

- each criterion should be well-defined and unambiguous;
- each criterion should be capable of reasonably consistent and objective application;
- each criterion should serve a distinct purpose;
- each criterion should be sufficiently important to influence the evaluation;
- the number of criteria should be as limited as possible; and,
- the criteria should be usable by reviewers who may not possess specialist knowledge.

Meta-criteria analysis is employed to refine and streamline the evaluation instrument, by minimizing duplication and clarifying variables. These results are presented in Chapter IV.

INTERPRETATION AND EXPLORATION OF THE RESEARCH RESULTS WITH HIERARCHY THEORY

One of the central functions of theory is the interpretation of research results (Bordens and Abbott, 1996). In this research, hierarchy theory is used descriptively and explanatively. The evaluation instrument (i.e., the derived framework) being developed involves the necessary conditions of *good* ecosystem-based plans identified through the

Delphi survey technique. The necessary conditions associated with ecosystem-based planning in particular are explored and interpreted in terms of the premises of hierarchy theory.

More particularly, hierarchy theory is used to interpret and explore those necessary criteria that are specific to ecosystem-based plans. Using the comparison of ecosystem-based planning and conventional planning provided in Table 2.1, it is possible to select those evaluation criteria that apply primarily to ecosystem-based plans and those that apply to municipal plans in general. Since there are a variety of planning scales and approaches (e.g., development-oriented, sustainability, site, etc.), some of the evaluation criteria conceivably represent best practices for all plans — developed and refined over decades of professional planning practice. Nevertheless, many of the attributes of good ecosystem-based plans would not necessarily be addressed by a planning agency or consultant that is not employing the ecosystem approach to planning.

The following organizing criteria from the evaluation instrument are considered specific to ecosystem-based plans:

1. **The Principles of the Ecosystem Approach to Planning.** As demonstrated in Table 2.1, most of the principles of the ecosystem approach represent an evolution of the values underlying planning;
2. **The Ecosystem Approach to Planning Process.** The planning process that supports the achievement of the principles has also evolved;

3. **Environmental Quality Strategies.** Although conventional plans and ecosystem-based plans have the same overall goal, the specification and means of achieving that goal — a preferred state of affairs — are different. Ecosystem-based plans are concerned with demonstrating that human settlements are living *at home* in their environment, and this is accomplished by ensuring that planning "integrates (rather than merely 'balances') environmental, social and economic objectives" (Gibson *et al.*, 1997: 34). Environmental quality strategies are critical to ecosystem-based planning, so they are also explored with hierarchy theory.

For these three categories of ecosystem-based plan evaluation criteria, each of the sub-criteria is also explored and/or interpreted in terms of hierarchy theory. In addition, any other necessary conditions identified will also be explored with hierarchy theory. Other criteria not captured by the selection rules may, due to their meaning or associated planning results, invite theoretical expansion or clarification. In summary, hierarchy theory is applied to the following selection of criteria from the evaluation instrument:

- The twelve organizing criteria that were identified as *necessary*;
- All *necessary* sub-criteria associated with the three organizing criteria specifically related to ecosystem-based plans (The Ecosystem Approach to Planning, Principles of the Ecosystem Approach and Environmental Quality Strategies); and,
- Any other sub-criterion that appears amenable to hierarchy-based discussion.

OPERATIONALIZATION

Operationalization involves specifying the way a variable is measured or manipulated (Sproull, 1995). More specifically, a "nominal definition articulates what you were after; the operational definition specifies how you propose to capture it" (Palys, 1997: 63). Some measures are strictly quantitative and some are qualitative (i.e., the observed entity demonstrates an attribute). The combination of qualitative and quantitative measures is necessitated in this research because "in order to be effective, a measurement protocol must accommodate to what is out there" (Ahl and Allen, 1996: 55). By making the

criteria of the evaluation instrument operational, the research provides opportunities for subsequent hypothesis testing (e.g., Plan X is a good plan), where the relationship under exploration is between a Plan X and the ideal prototype of ecosystem-based plans.

SUMMARY

In order to address the two primary research questions, the research process consists of four general phases. First, after a comprehensive and systematic literature review, a tentative plan evaluation framework for ecosystem-based municipal plans is posited. Second, using the preliminary evaluation template, the Delphi survey technique is employed to determine which plan form, plan content and planning process conditions are necessary and sufficient for the evaluation of ecosystem-based plan quality. In the Delphi survey design, individual response stability testing is undertaken before level of consensus criteria are analyzed. Third, the results of the Delphi exercise are then critically examined in terms of meta-criteria analysis. Fourth, the research results are interpreted and explored by employing hierarchy theory, and made operational in order to facilitate future field research. Consequently, the overall intent of the research can be regarded as the development of a methodologically- and theoretically-grounded evaluation instrument capable of judging the quality of ecosystem-based plans.

CHAPTER IV

THE RAW RESULTS OF THE DELPHI SURVEY AND PRELIMINARY DATA TREATMENT

INTRODUCTION

In this chapter, the raw results of the Delphi survey are presented. The raw results represent the preliminary answer to the following research question: **What are the attributes of good ecosystem-based municipal plans?** Then, the validity of the raw results is addressed. Finally, using meta-criteria analysis, the raw results undergo the first stage of data treatment.

RAW RESULTS: THE SUFFICIENT, NECESSARY AND IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED PLANS

The goal of the Delphi process in this research is to identify which necessary conditions — in combination — constitute the sufficient condition of good ecosystem-based plans. As shown in Table 4.1, a total of fourteen necessary (i.e., organizing) conditions comprising the sufficient condition for good ecosystem-based plans were ascertained from the Delphi process. These fourteen conditions are the higher-order necessary conditions that organize lower-order necessary and important conditions. The necessary conditions, in combination, represent the sufficient condition of a good ecosystem-based plan.

As demonstrated in Table 4.1, the evaluation criteria resulting from the Delphi survey are hierarchically grouped following a recommendation by Lee and Colley (1991). This hierarchical grouping was employed throughout the survey process, starting in

Table 4.1. The Raw Results of the Delphi Process (untreated except for the removal of variables identified as *not important* by the Delphi panel).

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	STATUS OF THE CONDITION	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS (including potential measures or descriptors in parentheses)	STATUS OF THE ATTRIBUTE
1 PLANNING PROCESS Ecosystem Approach to Planning Process	Necessary	A. Visioning (e.g., exploration of interested party/relevant group values, needs, desires; discovery of entrenched attitudes, etc.)	Necessary
		B. Scoping (e.g., identification of priority issues, problems and opportunities; setting of initial goals, etc.)	Necessary
		C. Definition and surveying of planning region (e.g., inventory-driven factors such as background studies are complete, background information is based on different scales -- Landsat, air photo, field inventories, traditional or Aboriginal knowledge is recognized, SOI Reporting, use of longitudinal data to assess land use change, delineation of natural heritage system, reports based on best science, etc.)	Necessary
		D. Modeling and analysis of planning region (e.g., delineation of major systems and their relationships; identification of trends, etc.)	Necessary
		E. Development of a structure plan and formulation of rival alternatives	Necessary
		F. Assessment of plan alternatives and selection of two to three to pursue (e.g., strategic environmental assessment, etc.)	Necessary
		G. Meaningful debate/negotiation of plan contents (e.g., relevant groups involved; consolidation of priorities, etc.)	Necessary
		H. Choice of one of the plan alternatives	Necessary
		I. Refinement of plan choice (e.g., development of more detail in the plan; elaboration of zoning; frameworks for planning procedures; frameworks for keeping relevant groups up-to-speed; investigation of full range of implementation strategies, etc.)	Necessary
		J. Monitoring (e.g., of the environment; of plan performance; identification of evaluation/decision criteria; development of framework for adaptation of plan content, etc.)	Necessary
		K. Information feedback loops internal and external to each stage in the planning process	Necessary
2 Feasibility of Plan Implementation (Process foundation)	Necessary	A. Plan implementation to be done by trained planning staff or consultants	Important
		B. Available funds to employ planning staff or consultants	Important
		C. Available resources to carry out planning strategies (e.g., \$, time, community input, etc.)	Necessary
		D. Political commitment to carry out the plan (e.g., mayor and community endorse the plan, etc.)	Necessary
		E. Cooperation commitment among inter-jurisdictional partners (e.g., memoranda of intent, etc.)	Necessary
		F. Credibility of local political structure (e.g., no history of scandals, etc.)	Important
		G. Institutional power to implement the plan (e.g., clearly defined authority for implementation by the agency involved)	Necessary
		H. Credible institutional transparency	Necessary
		I. Credible institutional accountability (e.g., bottom-up and top-down directions of accountability)	Necessary
		J. Ongoing involvement of relevant groups during plan formulation and implementation	Important
		K. Process oriented to municipality's growth rate (e.g., process focuses on regulation-based strategies only if region is high growth)	Important
		L. Integration of planning and economic development offices (e.g., cooperation; two-way flow of information)	Necessary
		M. Flexible/speedy plan amendment protocols for new data or new circumstances	Necessary
		N. Liaison officer used to optimize information flow between planning agency, decision makers, relevant groups etc.	Important
		O. Use of a representative environmental advisory committee (e.g., minimal number of politicians in membership; rotation of committee members, etc.)	Necessary

Table 4.1. The Raw Results of the Delphi Process (continued)

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	STATUS OF THE CONDITION	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS (including potential measures or descriptors in parentheses)	STATUS OF THE ATTRIBUTE
PLAN CONTENT			
3 Principles of the Ecosystem Approach to Planning	Necessary	A. Planning units are based on natural boundaries or take them into consideration (e.g., delineation according to bioregions, ecodistricts, watersheds, etc.)	Necessary
		B. Design with nature -- work with living processes, topography, sunlight access etc.	Necessary
		C. Consideration of the cumulative effects of policies, plans and projects (could include biophysical, socio-cultural and economic/fiscal assessment; comprehensive strategic environmental assessment)	Necessary
		D. Consideration of the global effects of policies, plans and projects	Necessary
		E. Inter-jurisdictional decision-making	Necessary
		F. External consultation, cooperation and partnering among relevant groups/interested parties	Necessary
		G. Long-term monitoring, feedback and adaptation of plan content	Necessary
		H. Inter-disciplinary approach to information (e.g., holistic approach, both lay-person and expert sources, natural heritage system based on the principles of conservation biology and other sources like landscape architecture, etc.)	Necessary
		I. Precautionary but positive approach to development (e.g., prevention of further damage, reduction of ecosystem stress, recognition of interdependence of factors, <i>humility</i> approach, special care if irrevocable consequences projected, support for restorative development, etc.)	Necessary
		J. Planning integrates rather than merely balances environmental, social and economic objectives	Necessary
		K. Linkage of ecosystem planning to democratic change, social learning, community building and environmental enlightenment	Necessary
		L. Cross-scale management (e.g., coordinated approach concerning geographic and time scales; short- vs. long-term goals, etc.)	Necessary
		M. Explicit recognition of the municipality's ecological footprint (e.g., identification and mitigation of municipality's primary sources of resource waste and environmental degradation, etc.)	Necessary
4 Environmental Quality Strategies	Necessary	A. Air quality strategies (e.g., transit-orientation; compact urban form; mixed use zoning; performance zoning, etc.)	Necessary
		B. Water quality strategies (e.g., education; tertiary sewage and stormwater treatment, etc.)	Necessary
		C. Land/water conservation strategies (e.g., growth management; land swaps/acquisition; restrictive covenants; easements, etc.)	Necessary
		D. Biodiversity strategies (e.g., green corridor systems; shoreline preservation areas; naturalization; mitigation banking, etc.)	Necessary
		E. Resource conservation strategies for land, energy, potable water etc. (e.g., impact fees; transfers of development rights, etc.)	Necessary
		F. Land/water rehabilitation or compensatory obligation strategies (e.g., engineering; covenants; public-private partnerships, etc.)	Necessary
		G. Waste minimization strategies (e.g., human scale dominates car scale; mixed use zoning, etc.)	Necessary
		H. Natural disaster strategies (e.g., for flooding, unstable slopes, earthquakes, etc.)	Necessary
		I. Socio-cultural strategies for sense of place, livability, local pride (e.g., heritage protection; facilitation of public art, etc.)	Necessary

Table 4.1. The Raw Results of the Delphi Process (continued)

	NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	STATUS OF THE CONDITION	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS (including potential measures or descriptors in parentheses)	STATUS OF THE ATTRIBUTE
5	Rational Content	Necessary	A. Completeness (e.g., no issues relevant to the context are avoided, etc.) B. Hierarchical framework of vision, planning principles, issues, goals, objectives and policies C. Consistency (e.g., logical consistency within hierarchical framework; minimization of contradiction among goals/objectives, etc.) D. Vision reflects a representative range of relevant groups/interested parties E. Ethically- or scientifically-based principles (e.g., principles are based on scientifically-substantiated needs/requirements or ethical maxims). Note: value-based principles like <i>convenience</i> or <i>beauty</i> can be substantiated in terms of either induction (science; previous research) or deduction (ethics). F. Issues are both opportunity- and problem-based (e.g., issues recognize both opportunities for ecosystem enhancement and problem-based needs) G. Goal specificity (e.g., goals are related to particular issues/desires and based on best science/evidence) H. Clearly defined goals (e.g., quantitatively/qualitatively measurable objectives are provided to characterize goals; goals are defensible as stated; goals lack ambiguity) I. Doable but challenging objectives J. Operationalization of identified planning priorities through policy K. Action- or strategy-based policies (e.g., majority of policies can be related to implementation techniques/tools) L. Science- or ethics-based land use designations (e.g., zoning reflects available scientific knowledge and/or ethical maxims) M. Demonstration of relationships between the plan and the supporting research/background documentation	Necessary Necessary Necessary Necessary Necessary Necessary Necessary Necessary Necessary Important Necessary Necessary Necessary Necessary
6	Artistic	Important	A. Innovation (e.g., inventiveness; reflection of zeitgeist; beauty; the X-factor of artistic merit; demonstration of creative impulse)	Important
7	Recognition of Legal Requirements Facing the Plan (is the plan legal?)	Necessary	A. Meets requirements of existing laws (e.g., planning law; related laws; relevant regulations; upper-tier plans if applicable, etc.) B. Substantially exceeds the minimum requirements of the law (e.g., pushes the envelope of antecedent planning)	Necessary Necessary
8	Consensus on the Values Used to Define Best Planning Practices	Necessary	A. Identification of priority planning values (e.g., beauty; efficiency; convenience; biodiversity; ecological integrity; intergenerational equity; intragenerational equity; compensatory obligation, etc.) B. Demonstration of best planning practices (e.g., separation of incompatible land uses; combination of compatible land uses, etc.) C. Meaningful negotiation/dialogue among relevant groups (e.g., participatory; collaborative; conflict resilient; accountable)	Necessary Necessary Necessary
9	Strong Language for Priority Policy Areas	Necessary	A. Strong rather than permissive verbs and qualifiers (e.g., <i>shall</i> rather than <i>should</i> ; <i>must</i> rather than <i>may</i> ; <i>no</i> means <i>no</i>)	Necessary
10	Adaptive/transformative Capacity of Plan to Address Change/Chaos	Necessary	A. Community/relevant group empowerment (e.g., identification of where to get information who can help what the decision levers are; how to get involved; on-going negotiation and consensus-building, etc.)	Necessary

Table 4.1. The Raw Results of the Delphi Process (continued)

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	STATUS OF THE CONDITION	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS (including potential measures or descriptions in parentheses)	STATUS OF THE ATTRIBUTE
11 Feasibility of Plan Implementation (Plan Content Foundation)	Necessary	B. Mechanisms/frameworks for supporting plan evolution (e.g., monitoring of biophysical, socio-cultural and economic dimensions; monitoring plan performance; re-visioning; plan amendment protocols; environmental advisory committee membership, etc.)	Necessary
		C. Flexibility given the wide breadth of the tool envelope (e.g., wide range of planning instruments are employed in the plan)	Necessary
		D. Ability to respond to surprise (e.g., public liaison officer; on-going communication and info-sharing with other ecosystem-based planning contexts; monitoring framework; contingency plans, etc.)	Necessary
		E. New ways of problem-solving or goals achievement (e.g., new planning tools; innovations in public participation, etc.)	Necessary
		A. Fact-basis (e.g., projections are scientifically-grounded; data is sound; data is specific to planning region, etc.)	Necessary
	Important	B. Plan currency (e.g., plan uses up-to-date information; plan is relatively recent)	Necessary
		C. Equitable spatial and socio-economic distribution of NIMBYs, I.L.U.s and BANANAs (e.g., explicit distribution criteria provided)	Important
		D. Acceptable synthesis of different public and private agendas (e.g., consensus-building exercises, meaningful negotiation/dialogue, etc.)	Necessary
		E. Implementation strategies involve community participation (e.g., education; community outreach; community effort)	Necessary
		A. Definition of key concepts (e.g., in-text; in margin notes; in glossary; etc.)	Necessary
		B. Animation/friendliness of plan (e.g., photos; graphics; data; art; etc.)	Important
12 Effective Communication of Planning Information to Relevant Groups	Necessary	C. Use of plain language (e.g., minimal planning jargon; minimal obfuscation)	Necessary
		D. Well organized (e.g., logical progression of topics and ideas; grouping of concepts according to an underlying framework)	Necessary
		E. Ease of locating information (e.g., table of contents; page tabs; index; etc.)	Necessary
		F. Well written (e.g., no spelling mistakes; good grammar; fluidity; etc.)	Necessary
		G. Self-containment (e.g., inclusion of related maps, bibliography, etc.)	Necessary
		H. Identification of how to get further information (e.g., contacts; bibliography; web addresses, etc.)	Necessary
		I. Text legibility (e.g., good reproduction; appropriate font style and size, etc.)	Important
		J. Plan availability in relevant languages, if applicable (e.g., Official Languages; local ones like Cree or Chinese, etc.)	Necessary
		K. Plan conciseness (e.g., plan focuses primarily on vision, planning principles, goals, objectives, policies and monitoring; need to know rather than <i>nice to know</i> ; information predominates in plan text -- excluding margin notes and animation; etc.)	Necessary
		L. Detailed background information found in supporting documentation (e.g., detailed background information is not presented in plan text; conversely, references to detailed background reports are found in-text)	Necessary
		M. Minimal in-text duplication (e.g., minimal repetition of policies, concepts or arguments)	Important

Table 4.1. The Raw Results of the Delphi Process (continued)

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	STATUS OF THE CONDITION	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS (including potential measures or descriptors in parentheses)	STATUS OF THE ATTRIBUTE
13 Effective Communication of Spatial Information to Relevant Groups Through Maps	Necessary	N. Range of plan availability alternatives (e.g., plan is available in hard copy; plan could be available on both PC and Mac diskettes; plan could also be available at a web-site)	Important
		O. Update potential within the planning cycle (e.g., plan could be available in a binder so that amendments can be physically added; plan is available on diskette; plan is maintained on a web-site)	Important
		A. Appropriate/relevant level of map detail (e.g., legend has a manageable number of attributes; lack of visual clutter)	Necessary
		B. Appropriate level of boundary accuracy (e.g., if plan is conceptual/strategic, then maps can be conceptual or fuzzy; conversely, if the plan is site-specific, maps demonstrate exceptionally accurate boundaries; if plan is a mixture of conceptual and site-specific, then the appropriate level of boundary accuracy is situation-specific)	Important
		C. Plan maps are reflective of policies and policies are reflective of maps (e.g., relationship can be demonstrated)	Necessary
14 Environmentally-sensitive Plan Production	Necessary	D. Manageable map size (e.g., size of adult arm-span or smaller)	Important
		A. Use of environmentally-responsible materials (e.g., recycled paper; biodegradable inks, etc.)	Necessary

Round 1.* First, the overall groupings are organized according to *planning process*, *plan content* and *plan form*. Then, each of these three dimensions is characterized by the organizing concepts identified in the literature review and tested in the Delphi process.

Potential plan conditions, characteristics or attributes were assessed by the Delphi panel according to three response categories: *necessary*, *important*, and *not important*. As presented in Chapter III, the response categories are defined as follows:

- *Necessary* means that the plan condition, characteristic, or attribute is essential;
- *Important* means that the plan condition, characteristic, or attribute is relevant to the determination of plan quality. The *important* rating includes sub-categories such as *very*, *moderately* and *slightly important*. Since the distinction between *very*, *moderately* and *slightly important* is not pertinent to the underlying research purpose, these sub-categories are combined; and,
- *Not important* means that the plan condition, characteristic or attribute is not relevant to a determination of plan quality. It will have no measurable significance to any discussion relating to plan goodness or merit, and is excluded from further consideration in this research context.

If the panelists believed that the attributes were necessary to a good ecosystem-based plan, then they selected *necessary* — and similarly for *important* and *not important*. The variables identified as *necessary* can be combined to represent the sufficient condition for *good* ecosystem-based plans. The validity of the survey results is discussed in the next section.

Plan evaluation criteria identified as *not important* have been deleted from the inventory of necessary and important conditions presented in Table 4.1. The evaluation criteria identified as *not important* include the following:

* Please note that all four rounds of the Delphi survey are presented in Appendix III.

- *Orientation of plan according to municipal growth rate*, which was a potential sub-criterion of Feasibility of Plan Implementation (Plan Content Foundation);
- *Planning staff or consultants are professionally affiliated*, which was a potential sub-criterion of Feasibility of Plan Implementation (Process Foundation); and,
- *Use of an Insert/bookmark that suggests sharing the plan*, which was a potential sub-criterion of Effective Communication of Planning Information to Relevant Groups.

VALIDITY OF THE DELPHI SURVEY RESULTS

The validity of the Delphi survey results is demonstrated in the following ways:

1. **overall confidence in the Delphi as a research technique;**
2. **methodological design of the survey;**
3. **full transparency of the Delphi process** to both Delphi panelists and to subsequent reviewers/users of the research results; and,
4. **the overall success of the survey implementation.**

Confidence in the Delphi as a Research Technique

According to Masser and Foley (1987: 217), the Delphi is "the most widely used technique for eliciting expert opinion." Despite its widespread use, criticisms leveled against the Delphi form an important dimension of the technique's development and refinement over the near half-century of its employment. Important criticisms of the technique include the following:

1. **the supposed superiority of expert opinion** (Johnston, 1970). This contention brings the entire question of the value of experts under scrutiny. Yet, as noted in Chapter III, Cavalli-Sforza and Ortolano (1984) argue that the layperson possesses no special knowledge of complex problems and can provide "no more than a sensible guess based on the information provided." The expert, after all, has the benefit of education and experience to see both the whole and the parts of a complex issue or problem. Furthermore, as suggested by Rowe *et al.* (1991), the theory of errors suggests that a true answer has a higher probability of resulting from the thinking of experts than from non-experts;
2. **the claim that confidentiality surrounding the identity of participants during the Delphi survey encourages freer responses to survey content** (Feather, 1973). In fact, this has come to be recognized as one of the strengths of the Delphi technique. Anonymity is a prerequisite to Delphi success since, in the context of expert groups, it prevents a dominant personality from exerting an influence upon potentially less assertive panel members. Referring to expert-based techniques other than the Delphi, Richey *et al.* (1985: 137) observe that "minority views sometimes receive less than adequate consideration because of the over-riding influence of dominant personalities, lack of time, or some other logistical shortcoming. Alternatively, an outspoken minority can inflict its ideas on a weak majority group, even if these ideas are poorly founded." With anonymity, the submission of the views of individual experts to the anonymous criticism and review of fellow experts can be accomplished without face-to-face confrontation. More importantly, the anonymity dimension permits panel members to feel free to reconsider their opinions in light of the dominant response categories revealed in each subsequent round — without anyone other than the Delphi monitor knowing that they have done so (Jones and Twiss, 1978). In this way, anonymity of participants in the Delphi technique facilitates consensus;
3. **whenever a measure of central tendency is provided, a possible implication is that a more correct answer has been identified and is lost in the averaging function.** This possibility represents a potential conceptual limitation for quantitative and forecasting-oriented Delphi exercises (depending on the research questions involved). In fact, some research (e.g., Hastie, 1986; Hill, 1982) has argued that group judgment is inferior to the judgment of the group's best participant. However, selection of one so-called best participant would be a *slippery slope*, and would not involve information sharing and dialogue for participants facilitated by the monitor — an important component of the Delphi process. Lock (1987) also suggests that groups enhance individual commitment to a process, encourage resolving ambiguity and conflicting knowledge, facilitate creativity, and promote watchfulness for errors. Ultimately, the question becomes the following for quantitative Delphis: is relevant information lost in the averaging process? Likely, if the researcher is willing to use the Delphi, then they are willing to accept this limitation.

Meanwhile, for consensus-oriented Delphis on normative topics such as the current research (which employ qualitative categories as the answers to the survey questions), this limitation is not relevant. The possibility of losing relevant information in the averaging process was short-circuited by using the qualitative categories of *necessary* and *important* conditions of good ecosystem-based plans;

4. **composition of panels.** The composition of Delphi panels has also received attention (see Gupta and Clarke, 1996; Sackman, 1975). In questionably-designed Delphi exercises, *self-assessment as expert* by potential panel candidates has been employed. Yet, Rowe *et al.* (1991) severely criticize self-assessment as a legitimate selection criterion. In the current research, objective selection criteria such as the following were employed: advanced degrees, professional affiliation, contribution to the literature, work experience, and direct familiarity with plan formulation.

Another important concern in convening a panel concerns their representativeness. According to Webler (1991: 255), "an incapable or misrepresentative expert panel will compromise the process. To achieve legitimate results, it is important that all relative viewpoints are represented." Since ecosystem-based planning is an inter-disciplinary subject domain, it is particularly important to ensure that the breadth of viewpoints within the subject domain is represented. In the current research, the expert panel is representative to the degree that the following are accounted for: disciplinary bias, gender bias, and occupational bias. Insofar as the panel is composed of anglophone Canadian experts, the panel is argued to be representative. In support of the potential cultural bias that this representativeness may engender, Linstone and Turoff (1975: 7) suggest that "misunderstandings may arise from differences in language and logic if participants come from diverse cultural backgrounds." Cost and lack of the researcher's familiarity with the French-language literature on ecosystem-based planning were important factors in considering the composition of the panel. The bottom line is that the terminology and application of the ecosystem-based approach is *emerging* and does not yet have the history to be well-codified. For complex subject matter, a standardized vocabulary for interaction among the panelists appeared important and was accepted at the proposal defense stage;

5. **the implication that group psychology plays a role in survey responses** (i.e., the measure of central tendency induces a so-called bandwagon effect where the *urge to conform* to the measure of central tendency becomes engaged). While this might be a valid rudimentary concern, it has been refuted by a number of studies (e.g., Scheibe *et al.*, 1975). Researchers have intentionally manipulated Delphi feedback data to measure the true effect of the measures of central tendency and have found that immediate rounds after the numerically-manipulated padding did, in fact, move towards the manipulated measure. However, by the third round, the response distribution reverted to the true measure. This suggests that experience, education and dominant belief systems over-ride the impact of group psychology; and,

6. **lack of consistent methodological design underlying Delphi surveys** (Rowe *et al.*, 1991; Rieger, 1986; Linstone and Turoff, 1975; Linstone, 1975; Sackman, 1975). This important criticism of individual applications of the Delphi technique is addressed in detail in the next section.

Methodological Design of the Delphi

Since its inception in 1953, the Delphi technique has received considerable attention, both exemplary and critical. The primary journal cataloguing the development and implementation of the Delphi technique — *Technological Forecasting and Social Change* — demonstrates the breadth of methodological refinements suggested since the technique's genesis. In the mid-1970s, the Delphi received a resounding and apparently unanticipated attack from inside the Rand Corporation* by Sackman (1975). Sackman was primarily concerned with perceived issues pertaining to methodological design and qualitative research.

Since then, Sackman's arguments have been largely discredited due to both their bias and their Kuhnian point of view within the history and philosophy of science (see Rowe *et al.*, 1991; Rieger, 1986; Linstone, 1978; Coates, 1975; Linstone and Turoff, 1975). In particular, Sackman's bias was identified through the observation that he focused on particularly poor executions of the Delphi and ignored significantly supportive research (Rowe *et al.*, 1991; Linstone, 1978).

Fully aware of the spirit of the critique of Sackman and others, Rieger (1986) addresses the quality of over 440 Ph.D. dissertations employing the Delphi technique between 1981

* As discussed in Chapter III, the Rand Corporation is where the Delphi technique originated.

and 1984. Drawing on the research and evidence of a number of authors, Rieger's itemization of lessons learned and methodological refinements to Delphi implementation are presented in Table 4.2. Alongside each of Rieger's criticisms of Delphi implementation, the methodological design response of the current research is provided.

Over and above Rieger's suggested refinements to Delphi design, a number of *best practices* were also extracted from a variety of other authors. These refinements include the following:

- **employment of a post-Delphi survey.** The post-Delphi survey is intended to provide insight into both the effectiveness and the delivery of the process. Scheibe *et al.* (1975) suggest that suitable directions to investigate include the following: participant satisfaction with results between rounds, communication of information pertaining to the process, facilitation of learning, facilitation of participation, and overall performance of the Delphi monitor. All of these dimensions were addressed in the post-Delphi survey;
- **skill in written communication** (Fazio, 1986). The essence of the Delphi involves written rather than oral communication. In fact, after the panel selection was completed, there was no oral communication whatsoever except for the three panelists that requested individual attention. No portion of the Delphi process involved face-to-face communication between the panelists and the monitor. Consequently, great care was taken in the exposition of each round and the research supervisor reviewed their grammatical structure and content before mailing;
- **drawing the distinction between the pretest and the trial run.** Although the terms *pretest* and *trial run* are often used interchangeably in the research design context, Ackoff (1953) provides an explicit differentiation of these two research procedures. The pretest provides the opportunity to investigate alternative operational procedures for undertaking the research (Ackoff, 1953). In other words, the pretest addresses whether the appropriate research technique has been selected. Conversely, the trial run addresses the viability and efficiency of the specific instrument and research plan before the final run, *viz.*, the trial run addresses whether the research plan and instrument — as designed — will yield results efficiently. Unlike the pretest (which is concerned with comparative consideration of techniques or methods), the trial run is directed towards one overall research plan (Ackoff, 1953);

Table 4.2. Criticisms of Individual Delphi Efforts and the Related Research Design Response
Source: Regier. 1986.

	Criticisms of Individual Delphi Efforts by Rieger (1986)	Summary of the Research Design Response
1.	The absence of an open-ended first round question to ensure that <i>the big picture</i> is addressed	An open-ended opportunity for feedback from the panelists was provided as the last line of the Round 1 survey. The following exhortation was provided: PLEASE SUGGEST POTENTIAL CONDITIONS/ CHARACTERISTICS OF A 'GOOD' ECOSYSTEM-BASED PLAN THAT YOU BELIEVE ARE CRITICAL OR IMPORTANT. This exhortation was provided at the end of Round 1 to ensure that panelists were able to (a) test their own ideas among the other panel members, and (b) feel comfortable that the full range of possible variables contributing to plan quality would be explored in subsequent rounds.
2.	Inadequate response rates (i.e., panel members either did not respond to Round 1 or withdrew in mid-process)	Complete response rates from the panelists were facilitated by stressing the on-going importance of their continued participation and by providing panel members with individual attention if they desired. Each round was checked and double-checked by the researcher and supervisor for grammar, spelling and user-friendliness. As well, missing responses to some of the questions were immediately followed up by e-mail queries. Finally, specific commentary from the panelists was catalogued and provided in the Round 3 mail out.
3.	Absence of pretest procedures	Both a pretest and a trial run were undertaken in order to facilitate methodological design. The pretest indicated that the Delphi technique was the best choice of research technique to explore the nature and conditions of 'good' ecosystem-based plans. The trial run ensured that the introduction to the Delphi technique and instructions were clear, and that oversights concerning important evaluation criteria were remedied.
4.	Failure to establish questionnaire reliability	Questionnaire reliability was established in the trial run. As well, feedback from panel members arising from Round 1 also served to consolidate reliability of the survey instrument as the process unfolded.
5.	Failure to survey drop-outs	The surveying of dropouts was unnecessary since all ten panel members continued with the process until its conclusion. A post-Delphi survey was employed at the completion of the exercise in order to gain insight into how to improve the overall implementation of the process.
6.	Lack of response stability testing before application of stopping criteria	Response stability testing was formally undertaken before the stopping criteria were employed.
7.	Inadequate use of Chaffin and Talley's (1980) test for individual response stability	As suggested by Chaffin and Talley (1980), individual response stability testing was employed instead of group response stability (see Dajani <i>et al.</i> , 1979). Individual response stability testing is considered the more stringent test and contributes to superior Delphi results.

- **neutral response categories were not employed.** Neutral response categories (e.g., a category between *important* and *not important* such as *neither important/unimportant*) were not employed since the purpose of the Delphi is to address a panelist's perspective rather than their lack of perspective or indifference. As Turoff (1975: 90) observes, "it is usually desirable to force the respondent to think the issue out to a point where [s]he can take a nonneutral stance";
- **strict panel selection criteria.** The panel selection criteria were strict and, for 1997, are replicable. The selection criteria include the following: advanced university degrees in disciplines related to the ecosystem approach to planning; a publishing record demonstrating a professional or academic interest related to ecosystem-based or environmental planning; relevant work experience including at least two of those years in a municipality or academic environment involving the ecosystem approach to planning; professional affiliation in a discipline related to ecosystem-based planning; familiarity with municipal plan making rather than experience predominated by background research, site planning or by-law administration; and, willingness to participate in the Delphi process (Sproull, 1988; Richey *et al.*, 1985);
- **investigation and communication of residual dissensus.** In Round 2, if panelists were selecting the non-modal response, they were asked to succinctly identify *why*. In this way, it was possible to gain some insight into residual dissensus by: (a) exploring the differences of opinion, and (b) identifying factors that the other experts might not be considering (Widstrand and Kruus, 1996). Dissensus could arise from the following circumstances: different perspectives; different knowledge bases; different semantic interpretations of variables; different theoretical views; and/or disciplinary bias, among other things (Helmer, 1983). Comments arising from the panel in Round 2 were communicated back to the panel in Round 3. Rowe *et al.* (1991) contend that providing more feedback than merely the measure of central tendency is an important methodological decision; and,
- **Transparency of the process to both (a) Delphi panelists and (b) the users of the research results.** This important methodological decision is discussed in the next section, and is particularly relevant concerning the importance given to process transparency in ecosystem-based planning.

Overall, since the entire Delphi process was methodologically designed and best practices were incorporated, the probity of the research results is supported.

Full Transparency of the Delphi Process to Panelists and to the Users/ Reviewers of the Research Results

Transparency of the Delphi process to panelists is important since it increases their confidence in the process and supports the likelihood of their continued participation. In the introductory letter to Round 1, a flow chart and description of the Delphi process was provided so that panelists would know what to anticipate. In Round 2, a number of methodological decisions were made explicit so that panelists would know why the process was unfolding as it was. More importantly, transparency makes the researcher accountable to participants. As well, transparency facilitates the early discovery of mistakes, establishes confidence in the process, and substantiates greater support of the outcomes (Palfrey *et al.*, 1992; Elcock and Haywood, 1980).

Overall Success of the Delphi Survey Implementation

In most Delphi exercises, drop-out rates can seriously compromise the research results by skewing the response distributions (particularly if the panelists who drop out have been answering in opposition to the measure of central tendency). This was not an issue in the current research because no panelists dropped out, even though (a) the process took longer than the pretest indicated it would, and (b) it often took over a month for all ten panelists to mail in their responses to each round. Furthermore, full completion of each and every survey question was obtained by asking for full completion in the last line of the survey, and by making an e-mail request for any missed answers that still resulted. This means that there were no gaps in the data inputted into the *response stability testing* and *application of consensus criteria* phases of the research design.

META-CRITERIA ANALYSIS

Introduction

In this section, the evaluation instrument undergoes meta-criteria analysis in order to streamline it (e.g., reduce redundancy, improve clarity). Streamlining is a quality control activity that optimizes the effectiveness of the evaluation instrument.

Using Meta-Criteria Analysis

"In the language of tests and measurement, a criterion is whatever is to count as success" or as having merit or worth (Scriven, 1991: 111). More specifically, in plan evaluation, criteria are the *standards* upon which judgements are made (Voogd, 1983: 28). Basically, meta-criteria analysis is the application of criteria to criteria. This procedure is employed because "the process of stating the criteria for the evaluation...is the most important element of the evaluation" (Dakin, 1969: 7). Meta-criteria analysis represents the second step in making the evaluation instrument operational (the first step was the removal of the *not important* criteria).

The results of the Delphi process consist of 117 evaluation criteria (which include the 14 organizing criteria) that are suitable for determining whether a particular ecosystem-based municipal plan is a *good* one. **A *good* ecosystem-based plan would demonstrate all of the evaluation criteria identified by the Delphi panel as *necessary*.**

In their discussion of selecting generic evaluation criteria, Lee and Colley (1991) identify the following meta-criteria:*

1. each criterion should be **well-defined and unambiguous**. This represents the content of Chapter V;
2. each criterion should be capable of **reasonably consistent and objective application**. Measures for each criterion are provided in the operationalization chapter — Chapter VI;
3. each criterion should serve a **distinct purpose**. This meta-criterion serves to remove superfluous content that is not demonstrating an individual purpose. This meta-criterion is imposed and itemized in the section below;
4. each criterion should be **sufficiently important to influence the evaluation**. If a necessary criterion is not fulfilled by the plan and the process that supports its formulation, then the plan is not considered a good one. Since each necessary criterion in the proposed instrument is sufficient to influence the evaluation outcome, this meta-criterion is considered achieved;
5. the number of criteria should be **as few as possible**, but consistent with covering all of the topics identified as essential. An ecosystem-based plan is a complicated, inter-disciplinary planning product. Consequently, the evaluation of an ecosystem-based plan is also complex. However, the number of criteria can be minimized by eliminating overlap among them. One effective way of identifying overlap is if the measures used for two evaluation criteria are the same; and,
6. the criteria should be **usable by reviewers** who may not possess specialist ecosystem-based expertise (but who have a basic non-specialist understanding of planning and environmental issues). In other words, jargon should be minimized.

Once the criteria are *optimized* by imposing meta-criteria #3, #5, and #6 above, then the more elaborate research activities supported by meta-criteria #1 (exploration and interpretation with hierarchy theory) and #2 (operationalization of the criteria by positing measurement protocols) are addressed in the two subsequent chapters (Chapters V and VI).

* These criteria were briefly presented in Chapter III.

Data Treatment: Meta-Criteria Analysis

The evaluation instrument after meta-criteria analysis is presented in Table 4.3. Using the alphanumeric identifiers (i.e., each organizing criterion is assigned a number and each attribute a letter of the alphabet) provided in Table 4.3, the following criteria were either combined with other criteria, deleted or altered in order to meet the requirements of the meta-criteria set forth above:

1. **Ecosystem Approach to Planning Process.** Criterion 1-H (**choice of one of the plan alternatives**) was deleted on the following grounds. First, *choice of one of the plan alternatives* is assumed to occur as a result of implementing Criterion 1-G (**meaningful debate/negotiation of plan contents**). In other words, 1-H is not sufficiently distinct to warrant inclusion and separate investigation. Second, if a choice among alternatives is not made, then the planning process as a whole is moot;
2. **Feasibility of Plan Implementation (Process Foundation).** Criterion 2-I (**credible institutional accountability**) was combined with Criterion 2-H (**credible institutional transparency**). Institutional accountability is the point of institutional transparency, and therefore not sufficiently distinct to warrant being a criterion on its own. Furthermore, institutional transparency can be considered a necessary condition of institutional accountability;
3. **Principles of the Ecosystem Approach to Planning.** Criterion 3-D (**consideration of the cumulative effects of policies, plans and projects**) is combined with 3-C (**consideration of global effects of policies, plans and projects**) since they both have the same importance rating. The words **global** and **cumulative** are combined in the same criterion since global effects can be considered a subset of cumulative effects in general. As well, the literature on ecosystem-based planning combines them (e.g., Tomalty *et al.*, 1994a);
4. **Environmental Quality Strategies.** Criterion 4-G (**waste minimization strategies**) is insufficiently distinct from 4-E (**resource conservation strategies**) in terms of measurement and they are therefore combined. In other words, there is some overlap between strategies that conserve resources and strategies that minimize waste. The line of reasoning can be extended to include criterion 4-C (**land/water conservation strategies**) since land and water can be regarded as either resources or as ends unto themselves. Ultimately, 4-G and 4-C were combined into 4-E. Ideally, resource conservation strategies always precede waste minimization strategies, *viz.*, waste minimization following resource exploitation is inconsistent with the ecosystem approach to planning;

Table 4.1. The Raw Results of the Delphi Process (untreated except for the removal of variables identified as *not important* by the Delphi panel).

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	STATUS OF THE CONDITION	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS (including potential measures or descriptors in parentheses)	STATUS OF THE ATTRIBUTE
1 PLANNING PROCESS Ecosystem Approach to Planning Process	Necessary	A. Visioning (e.g., exploration of interested party/relevant group values, needs, desires; discovery of entrenched attitudes, etc.)	Necessary
		B. Scoping (e.g., identification of priority issues, problems and opportunities; setting of initial goals, etc.)	Necessary
		C. Definition and surveying of planning region (e.g., inventory-driven factors such as background studies are complete, background information is based on different scales -- Landsat, air photo, field inventories, traditional or Aboriginal knowledge is recognized, SOE Reporting, use of longitudinal data to assess land use change, delineation of natural heritage system, reports based on best science, etc.)	Necessary
		D. Modeling and analysis of planning region (e.g., delineation of major systems and their relationships; identification of trends, etc.)	Necessary
		E. Development of a structure plan and formulation of rival alternatives	Necessary
		F. Assessment of plan alternatives and selection of two to three to pursue (e.g., strategic environmental assessment, etc.)	Necessary
		G. Meaningful debate/negotiation of plan contents (e.g., relevant groups involved; consolidation of priorities, etc.)	Necessary
		H. Choice of one of the plan alternatives	Necessary
		I. Refinement of plan choice (e.g., development of more detail in the plan; elaboration of zoning; frameworks for planning procedures; frameworks for keeping relevant groups up-to-speed; investigation of full range of implementation strategies, etc.)	Necessary
		J. Monitoring (e.g., of the environment; of plan performance; identification of evaluation/decision criteria; development of framework for adaptation of plan content, etc.)	Necessary
		K. Information feedback loops internal and external to each stage in the planning process	Necessary
2 Feasibility of Plan Implementation (Process foundation)	Necessary	A. Plan implementation to be done by trained planning staff or consultants	Important
		B. Available funds to employ planning staff or consultants	Important
		C. Available resources to carry out planning strategies (e.g., \$, time, community input, etc.)	Necessary
		D. Political commitment to carry out the plan (e.g., mayor and community endorse the plan, etc.)	Necessary
		E. Cooperation commitment among inter-jurisdictional partners (e.g., memoranda of intent, etc.)	Necessary
		F. Credibility of local political structure (e.g., no history of scandals, etc.)	Necessary
		G. Institutional power to implement the plan (e.g., clearly defined authority for implementation by the agency involved)	Important
		H. Credible institutional transparency	Necessary
		I. Credible institutional accountability (e.g., bottom-up and top-down directions of accountability)	Necessary
		J. Ongoing involvement of relevant groups during plan formulation and implementation	Necessary
		K. Process oriented to municipality's growth rate (e.g., process focuses on regulation-based strategies only if region is high growth)	Important
		L. Integration of planning and economic development offices (e.g., cooperation; two-way flow of information)	Important
		M. Flexible/speedy plan amendment protocols for new data or new circumstances	Necessary
		N. Liaison officer used to optimize information flow between planning agency, decision makers, relevant groups etc.	Important
		O. Use of a representative environmental advisory committee (e.g., minimal number of politicians in membership; rotation of committee members, etc.)	Necessary

Table 4.1. The Raw Results of the Delphi Process (continued)

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	STATUS OF THE CONDITION	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS (including potential measures or descriptors in parentheses)	STATUS OF THE ATTRIBUTE
PLAN CONTENT			
3 Principles of the Ecosystem Approach to Planning	Necessary	A. Planning units are based on natural boundaries or take them into consideration (e.g., delineation according to bioregions, ecodistricts, watersheds, etc.)	Necessary
		B. Design with nature -- work with living processes, topography, sunlight access etc.	Necessary
		C. Consideration of the cumulative effects of policies, plans and projects (could include biophysical, socio-cultural and economic/fiscal assessment; comprehensive strategic environmental assessment)	Necessary
		D. Consideration of the global effects of policies, plans and projects	Necessary
		E. Inter-jurisdictional decision-making	Necessary
		F. External consultation, cooperation and partnering among relevant groups/interested parties	Necessary
		G. Long-term monitoring, feedback and adaptation of plan content	Necessary
		H. Inter-disciplinary approach to information (e.g., holistic approach, both lay-person and expert sources, natural heritage system based on the principles of conservation biology and other sources like landscape architecture, etc.)	Necessary
		I. Precautionary but positive approach to development (e.g., prevention of further damage, reduction of ecosystem stress, recognition of interdependence of factors, <i>humility</i> approach, special care if irreversible consequences projected, support for restorative development, etc.)	Necessary
		J. Planning integrates rather than merely balances environmental, social and economic objectives	Necessary
		K. Linkage of ecosystem planning to democratic change, social learning, community building and environmental enlightenment	Necessary
		L. Cross-scale management (e.g., coordinated approach concerning geographic and time scales; short- vs. long-term goals, etc.)	Necessary
		M. Explicit recognition of the municipality's ecological footprint (e.g., identification and mitigation of municipality's primary sources of resource waste and environmental degradation, etc.)	Necessary
4 Environmental Quality Strategies	Necessary	A. Air quality strategies (e.g., transit-orientation; compact urban form; mixed use zoning; performance zoning, etc.)	Necessary
		B. Water quality strategies (e.g., education; tertiary sewage and stormwater treatment, etc.)	Necessary
		C. Land/water conservation strategies (e.g., growth management; land swaps/acquisition; restrictive covenants; easements, etc.)	Necessary
		D. Biodiversity strategies (e.g., green corridor systems; shoreline preservation areas; naturalization; mitigation banking, etc.)	Necessary
		E. Resource conservation strategies for land, energy, potable water etc. (e.g., impact fees; transfers of development rights, etc.)	Necessary
		F. Land/water rehabilitation or compensatory obligation strategies (e.g., engineering; covenants; public-private partnerships, etc.)	Necessary
		G. Waste minimization strategies (e.g., human scale dominates car scale; mixed use zoning, etc.)	Necessary
		H. Natural disaster strategies (e.g., for flooding, unstable slopes, earthquakes, etc.)	Necessary
		I. Socio-cultural strategies for sense of place, livability, local pride (e.g., heritage protection; facilitation of public art, etc.)	Necessary

Table 4.1.1. The Raw Results of the Delphi Process (continued)

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	STATUS OF THE CONDITION	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS (including potential measures or descriptors in parentheses)	STATUS OF THE ATTRIBUTE
5 Rational Content	Necessary	A. Completeness (e.g., no issues relevant to the context are avoided, etc.)	Necessary
		B. Hierarchical framework of vision, planning principles, issues, goals, objectives and policies	Necessary
		C. Consistency (e.g., logical consistency within hierarchical framework; minimization of contradiction among goals/objectives, etc.)	Necessary
		D. Vision reflects a representative range of relevant groups/interested parties	Necessary
		E. Ethically- or scientifically-based principles (e.g., principles are based on scientifically-substantiated needs/requirements or ethical maxims). Note: value-based principles like <i>convenience</i> or <i>beauty</i> can be substantiated in terms of either induction (science; previous research) or deduction (ethics).	Necessary
		F. Issues are both opportunity- and problem-based (e.g., issues recognize both opportunities for ecosystem enhancement and problem-based needs)	Necessary
		G. Goal specificity (e.g., goals are related to particular issues/desires and based on best science/evidence)	Necessary
		H. Clearly defined goals (e.g., quantitatively/qualitatively measurable objectives are provided to characterize goals; goals are defensible as stated; goals lack ambiguity)	Necessary
		I. Doable but challenging objectives	Necessary
		J. Operationalization of identified planning priorities through policy	Necessary
		K. Action- or strategy-based policies (e.g., majority of policies can be related to implementation techniques/tools)	Necessary
		L. Science- or ethics-based land use designations (e.g., zoning reflects available scientific knowledge and/or ethical maxims)	Necessary
		M. Demonstration of relationships between the plan and the supporting research/background documentation	Necessary
6 Artistic	Important	A. Innovation (e.g., inventiveness; reflection of zeitgeist; beauty; the X-factor of artistic merit; demonstration of creative impulse)	Important
7 Recognition of Legal Requirements Facing the Plan (is the plan legal?)	Necessary	A. Meets requirements of existing laws (e.g., planning law; related laws; relevant regulations; upper-tier plans if applicable, etc.)	Necessary
		B. Substantially exceeds the minimum requirements of the law (e.g., pushes the envelope of antecedent planning)	Necessary
8 Consensus on the Values Used to Define Best Planning Practices	Necessary	A. Identification of priority planning values (e.g., beauty; efficiency; convenience; biodiversity; ecological integrity; intergenerational equity; intragenerational equity; compensatory obligation, etc.)	Necessary
		B. Demonstration of best planning practices (e.g., separation of incompatible land uses; combination of compatible land uses, etc.)	Necessary
		C. Meaningful negotiation/dialogue among relevant groups (e.g., participatory; collaborative; conflict resilient; accountable)	Necessary
9 Strong Language for Priority Policy Areas	Necessary	A. Strong rather than permissive verbs and qualifiers (e.g., <i>shall</i> rather than <i>should</i> ; <i>must</i> rather than <i>may</i> ; <i>no</i> means <i>no</i>)	Necessary
10 Adaptive/transformational Capacity of Plan to Address Change/Chaos	Necessary	A. Community/relevant group empowerment (e.g., identification of where to get information, who can help, what the decision levers are; how to get involved; on-going negotiation and consensus-building, etc.)	Necessary

Table 4.1. The Raw Results of the Delphi Process (continued)

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	STATUS OF THE CONDITION	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS (including potential measures or descriptors in parentheses)	STATUS OF THE ATTRIBUTE
11 Feasibility of Plan Implementation (Plan Content Foundation)	Necessary	B. Mechanisms/frameworks for supporting plan evolution (e.g., monitoring of biophysical, socio-cultural and economic dimensions; monitoring plan performance; re-visioning; plan amendment protocols; environmental advisory committee membership, etc.)	Necessary
		C. Flexibility given the wide breadth of the tool envelope (e.g., wide range of planning instruments are employed in the plan)	Necessary
		D. Ability to respond to surprise (e.g., public liaison officer; on-going communication and info-sharing with other ecosystem-based planning contexts; monitoring framework; contingency plans, etc.)	Necessary
		E. New ways of problem-solving or goals achievement (e.g., new planning tools; innovations in public participation, etc.)	Necessary
		A. Fact-basis (e.g., projections are scientifically-grounded; data is sound; data is specific to planning region, etc.)	Necessary
12 Effective Communication of Planning Information to Relevant Groups	Necessary	B. Plan currency (e.g., plan uses up-to-date information; plan is relatively recent)	Necessary
		C. Equitable spatial and socio-economic distribution of NIMBYs, LULUs and BANANAs (e.g., explicit distribution criteria provided)	Important
		D. Acceptable synthesis of different public and private agendas (e.g., consensus-building exercises, meaningful negotiation/dialogue, etc.)	Necessary
		E. Implementation strategies involve community participation (e.g., education; community outreach; community effort)	Necessary
		A. Definition of key concepts (e.g., in-text; in margin notes; in glossary; etc.)	Necessary
PLAN FORM	Necessary	B. Animation/friendliness of plan (e.g., photos; graphics; data; art; etc.)	Important
		C. Use of plain language (e.g., minimal planning jargon; minimal obfuscation)	Necessary
		D. Well organized (e.g., logical progression of topics and ideas; grouping of concepts according to an underlying framework)	Necessary
		E. Ease of locating information (e.g., table of contents; page tabs; index; etc.)	Necessary
		F. Well written (e.g., no spelling mistakes; good grammar; fluidity; etc.)	Necessary
		G. Self-containment (e.g., inclusion of related maps, bibliography, etc.)	Necessary
		H. Identification of how to get further information (e.g., contacts; bibliography; web addresses, etc.)	Important
		I. Text legibility (e.g., good reproduction; appropriate font style and size, etc.)	Necessary
		J. Plan availability in relevant languages, if applicable (e.g., Official Languages; local ones like Cree or Chinese, etc.)	Necessary
		K. Plan conciseness (e.g., plan focuses primarily on vision, planning principles, goals, objectives, policies and monitoring; need to know rather than nice to know information predominates in plan text -- excluding margin notes and animation; etc.)	Necessary
		L. Detailed background information found in supporting documentation (e.g., detailed background information is not presented in plan text; conversely, references to detailed background reports are found in-text)	Necessary
		M. Minimal in-text duplication (e.g., minimal repetition of policies, concepts or arguments)	Important

Table 4.1. The Raw Results of the Delphi Process (continued)

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	STATUS OF THE CONDITION	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS (including potential measures or descriptors in parentheses)	STATUS OF THE ATTRIBUTE
13 Effective Communication of Spatial Information to Relevant Groups Through Maps	N.	Range of plan availability alternatives (e.g., plan is available in hard copy; plan could be available on both PC and Mac diskettes; plan could also be available at a web-site)	Important
	O.	Update potential within the planning cycle (e.g., plan could be available in a binder so that amendments can be physically added; plan is available on diskette; plan is maintained on a web-site)	Important
	A.	Appropriate/relevant level of map detail (e.g., legend has a manageable number of attributes; lack of visual clutter)	Necessary
	B.	Appropriate level of boundary accuracy (e.g., if plan is conceptual/strategic, then maps can be conceptual or fuzzy; conversely, if the plan is site-specific, maps demonstrate exceptionally accurate boundaries; if plan is a mixture of conceptual and site-specific, then the appropriate level of boundary accuracy is situation-specific)	Important
	C.	Plan maps are reflective of policies and policies are reflective of maps (e.g., relationship can be demonstrated)	Necessary
14 Environmentally-sensitive Plan Production	D.	Manageable map size (e.g., size of adult arm-span or smaller)	Important
	A.	Use of environmentally-responsible materials (e.g., recycled paper; biodegradable inks, etc.)	Necessary

5. **Environmental Quality Strategies.** Criterion 4-F (**land/water rehabilitation or compensatory obligation strategies**) is reworded so that it does not include the term *compensatory obligation*. The focus of the criterion relates to strategies that can be included in the plan to address degraded or contaminated ecosystem components. A number of the Delphi panelists indicated a lack of familiarity with the term *compensatory obligation*, so the term is deleted;
6. **Rational Content.** In Criterion 5-I (**doable but challenging objectives**), the adjective *doable* is replaced by the adjective *obtainable* to increase the clarity and quality of the language employed;
7. **Rational Content.** Criterion 5-H (**clearly defined goals**) is combined with 3-G (**goal specificity**). Goal specificity subsumes a requirement for clearly defined goals;
8. **Rational Content.** Criterion 5-M (**demonstration of relationships between the plan and supporting research**) was deleted as a criterion since it can be better dealt with as a measure supporting **plan conciseness** (Criterion 12-K);
9. **Recognition of Legal Requirements Facing the Plan.** Criterion 7-A (**meets requirements of existing laws**) is combined with 7-B (**substantially exceeds the minimum requirements of the law**). The rationale for combining them is that 7-B presumes 7-A;
10. **Consensus on the Values Used to Define Best Planning Practices.** Criterion 8 (**consensus on the values used to define best planning practices**), as a whole, is deleted since each of its attributes is covered by other variables. Criterion 8-A (**identification of priority planning values**) and 8-C (**meaningful negotiation/dialogue among relevant groups**) can be carried by 1-A (**visioning**), 1-G (**meaningful debate/negotiation of plan contents**) and 11-A (**fact basis**). Criterion 8-B (**demonstration of best planning practices**) is covered by the operational definitions of 1-E (**development of a structure plan and formulation of rival alternatives**) and 1-I (**refinement of plan choice**);
11. **Adaptive/Transformative Capacity of Plan to Address Change/Chaos.** Organizing criterion 9 (**adaptive/transformative capacity of the plan to address change/chaos**) is streamlined. First, the semantic distinction between the adjectives *adaptive* and *transformative* is not sufficient to substantiate retaining both terms. Since *adaptive* is already part of the planning vernacular (e.g., adaptive management), it is retained and *transformative* is deleted. Furthermore, the same argument is employed for the nouns *change* and *chaos*. *Chaos* is less inclusive than *change* and is therefore deleted;

12. **Feasibility of Plan Implementation.** Criterion 10-C (**equitable spatial and socio-economic distribution of NIMBYs, LULUs and BANANAs**) is revised to remove the jargon terms LULUs (Locally Unwanted Land Uses) and BANANAs (Build Absolutely Nothing Anywhere Near Anything). The NIMBY term is argued to be an operational part of the modern vocabulary and is retained.
13. **Effective Communication of Planning Information to Relevant Groups.** Criteria 12-L (**detailed background information found in supporting documentation**) and 12-N (**minimal in-text duplication**) are combined under Criterion 12-K (**plan conciseness**). *Plan conciseness* can use 12-L and 12-N as measures in the evaluation process; and,
14. **Effective Communication of Planning Information to Relevant Groups.** Criterion 12-0 (**update potential within the planning cycle**) is deleted since it can be dealt with as a measure for Criterion 10 (**adaptive capacity of plan to address change**).

These activities (i.e., the combination, deletion, or rewording of criteria) represent the optimization of the evaluation instrument through fulfillment of criteria #3, #5 and #6 from the Lee and Colley (1991) framework.

SUMMARY

In this chapter, the raw results of the Delphi process were presented in order to answer the following question: **what are the attributes of good ecosystem-based municipal plans?** These results demonstrate that it is possible to identify necessary and sufficient conditions for ecosystem-based plan quality through expert consensus. The probity of the research results was also established by addressing the following factors:

1. overall confidence in the Delphi as a research technique;
2. methodological design of the survey;
3. full transparency of the Delphi process to both Delphi panelists and subsequent reviewers/users of the research results; and,
4. the overall success of the survey implementation.

Then, the application of meta-criteria analysis permitted the evaluation instrument to be optimized. This includes combining or removing redundancies and duplications, and minimizing ambiguities. Importantly, meta-criteria analysis makes the evaluation instrument more lucid for theoretical interpretation. Twelve necessary organizing criteria (column 1) are presented in Table 4.3 which, in combination with the seventy-two related sub-criteria (column 3), represent the attributes defining the sufficient condition for a good ecosystem-based plan. In the next chapter, hierarchy theory is used to explore the *necessary* evaluation criteria on a criterion-by-criterion basis.

CHAPTER V

USING HIERARCHY THEORY TO INTERPRET AND EXPLORE THE EVALUATION CRITERIA DERIVED FROM THE DELPHI PROCESS

INTRODUCTION

One of the central functions of theory is the interpretation of research results (Bordens and Abbott, 1996). In this chapter, the following research question is addressed:

How can hierarchy theory be used to explore and interpret the attributes of good ecosystem-based municipal plans?

The evaluation instrument being developed in this study involves the necessary conditions of *good* ecosystem-based plans identified through the Delphi survey technique. Hierarchy theory is used to interpret and explore those necessary criteria that are specific to ecosystem-based plans. In Appendix IV, the attributes of good ecosystem-based plans that are specific to ecosystem-based plans — as opposed to best practices demonstrated in municipal plans in general — are identified.

The following organizing criteria are interpreted with hierarchy theory in this chapter:

1. **The Principles of the Ecosystem Approach to Planning;**
2. **The Ecosystem Approach to Planning Process;**
3. **Environmental Quality Strategies.** Although conventional plans and ecosystem-based plans have the same overall goal, the specification and means of achieving that goal — a preferred state of affairs — are different. Ecosystem-based plans are concerned with demonstrating that human settlements are living *at home* in their environment, and this is accomplished by ensuring that planning "integrates (rather than merely 'balances') environmental, social and economic objectives" (Gibson *et al.*, 1997: 34). Environmental quality strategies are critical to ecosystem-based planning, so they are also interpreted with hierarchy theory.
4. **Necessary criteria that appear amenable to hierarchical exploration.**

For these four categories of ecosystem-based plan evaluation criteria, each of the (necessary) sub-criteria is also interpreted or explored with hierarchy theory. As Kaplan (1964: 309) contends, "theory is a way of looking at the facts, of organizing and representing them."

THE INTERPRETATION AND EXPLORATION OF THE EVALUATION CRITERIA USING HIERARCHY THEORY

Principles of the Ecosystem Approach to Planning

In combination, the principles of the ecosystem approach to planning provide a conceptual framework that can be used to shape both how the planning process unfolds and how plan content is oriented. Furthermore, each of the principles of the ecosystem approach becomes — *prima facie* — a principle of any and all ecosystem-based plans. With each ecosystem-based planning scenario, two sets of planning principles need to be combined: those inherent to the ecosystem approach in general (and presented here) and those relevant to the specific community (and identified through visioning or other public participation exercises).

A first generation of ecosystem-based planning principles was provided by Tomalty *et al.* (1994a) and a second by Gibson *et al.* (1997):

First Generation Principles

1. planning units should be based on natural boundaries;
2. jurisdictions should be *designed with nature*;
3. global and cumulative effects should be considered;
4. inter-jurisdictional decision-making should be encouraged;

5. consultation, cooperation and partnering should be ensured;
6. long-term monitoring, feedback and adaptation should be initiated; and,
7. an interdisciplinary approach to information should be employed.

Second Generation Principles (in addition to First Generation Principles)

8. a precautionary but positive approach to development should be adopted;
9. planning should integrate (rather than merely 'balance') environmental, social and economic objectives; and,
10. land use planning should be linked with other aspects of democratic change, social learning, community building and environmental enlightenment.

This research has lead to the addition of two additional principles — *cross-scale management* and *ecological footprint* — which are considered sufficiently distinct to warrant individual attention.

Hierarchy Theory Input

Basically, hierarchy theory supports planning in general insofar as planning is directly concerned with facilitating or maintaining hierarchical stability.

...the time required for a complex system, containing k elementary components, say, to evolve by processes of natural selection from those components is very much shorter if the system is itself comprised of one or more layers of stable component subsystems than if its elementary parts are its only stable components...the mathematical model shows that if a system of k elementary components is built up in a many-level hierarchy, and s components, on the average, combine at any level into a component at the next higher level, then the expected time of evolution for the whole system will be proportional to the logarithm to base s of k . In such a hierarchy, the time required for systems containing, say, 10^{25} atoms to evolve from systems containing 10^{23} atoms would be the same as the time required for systems containing 10^3 atoms to evolve from systems containing 10 atoms. The form of the generalization is interesting, in that it describes a relation between two levels of a system that is independent of absolute level (Pattee, 1973: 7-8).

In other words, as long as the constraint levels of the hierarchy are stable, the urban ecosystem can evolve more quickly and therefore more successfully.

The evolution of urban ecosystems has been occurring rapidly in recent history — in response to powerful regional and global trends (e.g., population growth, urbanization, immigration, war, longer lifespans, better health care, etc.). Successful and faster evolution means that urban ecosystems will be more likely to be able to absorb and/or adapt to changing environmental conditions without collapse of the hierarchy's stability. As Pattee (1973: 133) suggests, "the speed of evolution of complex systems will favor those [hierarchies] with stable, intermediate levels of structure." Insofar as planning contributes to the stability of these intermediate hierarchical levels, planning is validated.

Hierarchy theory can also be used to provide an interpretation of democratic values. Quite simply, voters provide the dynamics and their bottom-up flow of information — if manifested in a trend among cohorts — leads to a choice from among the envelopes of governance. At the same time, policy envelopes of the party elected provide the constraint or background noise within which societal evolution unfolds. As Wuichet (1995: 166) states:

There is a symbiotic relationship in general systems between the dynamics of lower-level activities and the constraints imposed on those activities from higher levels.

In Canada, municipal planning is typically a provincially-delegated responsibility (with a few exceptions like the National Capital Commission in Ottawa-Hull, which is a federal crown corporation). Normally, the provincial government therefore represents the upper-tier holon and is not constrained from above. Yet, in democratic terms, a national

planning platform makes sense, since different provinces are providing different constraints and consequently different levels of stability. It is pertinent to note that:

when a system becomes unstable, upper-level constraints cannot maintain the system's current configuration. There are two possible outcomes: either the system collapses to a diffuse, low level of organization; or, alternatively, a new set of upper-level constraints emerge and the system moves to a higher level of organization. In psychology, the first outcome is pathology, as the human psyche collapses and is more vulnerable to external pressure. The second is growth and learning. In this case, learning can produce a more mature condition that is more robust, existing at a higher level. In both cases the material components of which the system was made persist through the collapse. What disappears are the relationships that held the material in some special configuration. An example of a collapse to a lower level of organization is the death of an organism (Ahl and Allen, 1996: 171).

In this respect, municipal planning should relinquish its traditional inertia and adopt the purpose of planning as a holistic enterprise that not only deals with specific holons, but also with the repercussions of the interactions of holons both horizontally and vertically. A refocusing on ecosystem-based principles is therefore appropriate.

- **Planning Units Are Based on Natural Boundaries (or Take Them into Consideration)**

It is noteworthy that this criterion contains the following proviso in parentheses: *or take them into consideration*. This proviso was recommended by the Delphi panel in recognition of the difficulty of identifying and employing natural boundaries. More specifically, Canadian administrative boundaries are infrequently delineated according to ecological criteria.

Historically, land across the country has tended to be platted geometrically and platting subdivides land into parcels with rigid and arbitrary property lines (Perks, 1986). As

Wolfe (1994: 12) states, "the geometry of the original land surveys have shaped and still shape the form and morphology of Canadian settlements." In old Québec, land division originally followed the *long lots* of the seigneuries, stretching out in long rectangles from the rivers. In Upper Canada, the township-concession system imposed an equivalent rigidity to the square mile grids "flung across the Prairies and draped over the Rocky Mountains" (Wolfe, 1994: 12). These practices, in turn, have influenced how administrative boundaries were later determined. The historical inertia of platting traditions has meant that Canadian cities have tended to be grid-like and that road construction has tended to follow straight lines rather than the contours of topography.

Van der Ryn and Cowan (1996: 42) state that "if we impose a Cartesian grid on a fractal landscape, settlements will be too large or small, flows will not be of a sensible scale, and we will compromise the ecological resources we depend on." The ease and cost reduction associated with the engineering of linear space, plus territoriality following the incorporation of land, consolidate the historical inertia of non-ecological boundaries.

Furthermore, as Bryant *et al.* (1982: 179) state, "the rights of municipalities within their boundaries are often guarded with the same zeal as private property rights." Recognizing this observation, this represents a formidable obstacle to the integration of municipal components into a regional system of planning influence where environmental problems and issues can be addressed at their optimal level of resolution.

Although local municipalities may be resistant to any change in boundaries that affects their power base, the federal government has expressed an interest in modeling

ecosystems from an ecological perspective. For example, relatively recent work from Environment Canada and Agriculture and Agri-Food Canada (1996) has divided Canada into ecozones, ecoregions and ecodistricts — which are based on a wide variety of ecological criteria ranging from topography to macro- and micro-climate to soil to watershed boundaries. Having ascertained a preliminary delineation of boundaries that recognize ecological criteria, the important question remains: how can jurisdictional boundaries evolve to reflect ecology? Hierarchy theory provides some insight into this conundrum.

Hierarchy Theory Input

Grumbine (1992) has expressed concern that jurisdictional and ecological boundaries can never match. His reservation is based on a number of factors. First, ecosystems are in a constant state of non-linear flux and therefore their boundaries evolve over *ecosystem time* and *deep time*, and possibly even within *individual time* when thresholds have been passed or cumulative effects begin to dominate the system. Second, jurisdictional boundaries tend to be rigid, and jealously protected by bureaucracies. Third, jurisdictions are already so fragmented that meaningful integration may become adversarial.

Dowling and MacLachlan (1997: 14) observe that "each of the ecosystem approach characteristics poses significant challenges to traditional 'top down' decision making. Control by a few, through segregated mandates and jurisdictions, frustrates attempts to define and solve problems using a more collaborative approach." In other words, governments and their jurisdictions are so fragmented (i.e., lacking integration) that they

do not mimic nature and therefore cannot adequately regulate or shape human interaction with due regard for nature.

The normative desire for planning units with natural boundaries can be deduced from hierarchy theory. The human experience is becoming more complex in terms of technology, bureaucratic structures, and the number of choices available to or facing each individual. At the societal level, the piecemeal approach to problem solving needs to be replaced by holistic *big picture* investigation since the consequences of bad decisions in an increasingly complex society are becoming more expensive and more difficult to rectify (Capra, 1994). Ecosystems need to be planned for and managed as complex systems (Norton and Ulanowicz, 1992). And, this means planning and managing human behaviour and its impacts on the hierarchy.

Wuichet (1995) found that bureaucracies tend to be structured differently from ecosystems. Basically, bureaucracies are usually non-nested: their scope and jurisdiction do not follow natural laws. The implication is that bureaucratic institutions cannot adequately deal with environmental problems which are, by their very nature, trans-boundary, trans-scale, and non-linear. This contributes to the explanation concerning why environmental problems are so difficult to solve from fragmented institutional platforms.

"To add a whole ecosystem level to a management plan is to resolve to manage, in addition to managing components of the system for resource production, the system as a system" (Norton and Ulanowicz, 1992: 246). And, planning for a system as a system requires complex inter-jurisdictional arrangements. Successful plan implementation is

therefore predicated on inter-jurisdictional cooperation if complex planning issues are to be tackled systematically (Richardson, 1984).

Ideally, societally-driven environmental issues need to be addressed from the institutional platform with the appropriate jurisdiction within the hierarchy. Matching the problem with the proper jurisdiction, or successfully integrating different jurisdictions, is therefore critical. Norton and Hannon (n.d.a) agree, suggesting that the best policy scale for dealing with an environmental issue has an analogous temporal and spatial scale to the environmental issue.

The basic hierarchy-related limitation associated with arbitrary jurisdictions involves nesting. Wuichet (1995: 164) states the following:

In Koestlerian (1967) terms, the regional ecological unit is a 'Janus-faced' holon appearing on the one hand as a whole composed of forests, wetlands, rivers, estuaries, and the like, and on the other as one part among many in a larger, slower-moving system of geologic proportions. The regional bureaucratic unit is also a Janus-faced holon, appearing from below as a cooperative venture among agencies spanning cadastral management boundaries, and from above as one cooperative effort among many throughout the nation.

While the ecological and bureaucratic holons are both Janus-faced, they are different in terms of type. The ecological holons are nested, while the bureaucratic holons are not (Allen and Starr, 1982).

For example, the Jock River sub-watershed is nested inside the Rideau River watershed, which in turn is nested inside the Ottawa River watershed. Meanwhile, in terms of bureaucratic jurisdiction, the City of Ottawa is, in fact, nested inside the Region of

Ottawa-Carleton (ROC). However, the federal level for planning (the National Capital Commission or NCC) is superimposed on top of the ROC and has fragmented land ownership, legal paramouncy and jurisdiction throughout the entire National Capital Region. Basically, the NCC can operate as an autonomous decision making authority, which contributes to instability in the planning and implementation hierarchy. If the top-down flow of legitimated planning authority could be nested at the National Capital Region level, then this might constitute a first step in meaningfully de-fragmenting the sources that lead to intermittent planning-related instabilities.

As Wuichet (1995: 166) states,

The point which must be stressed is that the current structure of interagency bureaucracy is such that level n is without legitimizing constraint from the $n - 1$ level, rendering any effort presently made at the n level disappointing at best.

Given Wuichet's observation, it is likely not realistic to expect that jurisdictions with natural boundaries will appear without significant reorganization. In practice, all of the $n - 1$ level bureaucracies would have to demonstrate consistency with those on the n level, which would need to be simultaneously legitimated by the $n + 1$ level.

Furthermore, even if they did appear, harmonized jurisdictions would still require a built-in organic component so that the jurisdictional boundaries evolved as the ecosystem did (Grumbine, 1992). In fact, if taken at face value, the implication of Wuichet's observation is that only planning contexts demonstrating comprehensive jurisdictions which enclose entire ecosystems are capable of successfully implementing the ecosystem approach (e.g., National Parks subject to federal control alone).

However, this does not mean that jurisdictional evolution is not occurring. Following the promulgation of the Rio Summit's Agenda 21 (a UN-sponsored initiative corresponding to the $n + 1$ international level), member nations of the European Community (n) and New Zealand (n) — among others — are in the process of implementing ecosystem-based planning. New Zealand, in particular, is already in the process of formulating new planning units (e.g., Waitakere City) at the $n - 1$ level (Laituri, 1997).

Until this evolution is complete, a remaining problem concerns those parts of a natural unit that fall outside a particular agency's jurisdiction. Inter-jurisdictional cooperation is the primary conduit of ecosystem-based planning in this situation. Inter-jurisdictional cooperation is a viable option if the lead agency for ecosystem-based planning is a regional power, and can exert influence on its outlying hinterland. If this is not the case, then ecosystem-based planning faces a formidable task. However, as stated in Chapter II, ecosystem-based planning is a normative framework, and as such, represents an idealized process to which incremental progress may be all that is possible. Stated another way, the adoption of an ecosystem-based approach can represent a rational comprehensive shift if the planning agency employing it has sufficient jurisdictional coverage of the natural unit. If the planning agency does not have complete coverage, then incremental movement towards the ideal is predicated.

- **Design With Nature.**

The term *design with nature* received widespread use following McHarg's (1969) influential book of the same name. Designing with nature involves recognizing nature's opportunities, characteristics (e.g., hierarchical structure, topography, natural processes), and limitations.

Traditionally, planners have seen 'raw' land as a blank slate ready for human manipulation and use. They have not hesitated to replace complex ecological processes with engineered, often linear, systems. In ecosystem planning, human activity is part of the environment and the limits of resource availability and ecosystem resilience must be respected. Accordingly, new ecological planning and design approaches favor more creative solutions based on the biological productivity of natural systems, cycling of resources, or demand management to reduce need for new services (Gibson *et al.*, 1997: 30-31).

Design with nature, or ecological design, uses natural processes and laws as the point of departure. Van der Ryn and Cowan (1996: 24) state that,

Ecological design brings natural flows to the foreground. It celebrates the flow of water on the landscape, the rushing wind, the fertility of the earth, the plurality of species, and the rhythms of the sun, moon, and tides. It renders the invisible visible, allowing us to speak of it and carry it in our lives. It brings us back home.

Design solutions for development need to grow from place, and integrate local soils, vegetation, materials, culture, climate and topography (Van der Ryn and Cowan, 1996).

In general, nature should be regarded as the community's design partner where nature's own *design intelligence* is recognized and integrated. The growing relevance of so-called *biomimicry* (innovation inspired by nature) is currently reshaping the design disciplines through the search for efficient and timeless shapes, forms and solutions (Benyus, 1997).

Hierarchy Theory Input

Once again, human activities or processes "that reinforce the identity of the system at a particular level have a positive value for that system described at that level" (Giampietro, 1994). This suggests that whatever human processes support the stability or complexity of the hierarchy are good or have merit. Similarly, in an updated version of Aldo Leopold's land ethic, Meffe and Carroll (1994) suggest that a thing is right when it tends to protect the health and integrity of ecosystems and evolutionary processes, and wrong when it doesn't. Such an ethical postulate establishes the moral prerogative of hierarchy theory. Ultimately, the stability of the hierarchy should be the over-arching planning goal. This means mimicking and/or integrating the designs of nature.

- **Consideration of the Cumulative and Global Effects of Policies, Plans and Projects**

A salient dimension of environmental planning concerns cumulative and global effects predicted over space and time. Overall, the strength of environmental planning can depend on how well it identifies and deals with cumulative effects, which are generated locally but can accumulate both regionally (i.e., ecosystemically) and globally (Novakowski and Wellar, 1997). Using the analytical framework of Spaling (1994), there are many dimensions to cumulative effects that need to be considered and addressed in terms of plan content: time crowding, space crowding, compounding, timelags, expanded spatial extent, crossing thresholds, indirect effects, and fragmentation of natural assets.

Hierarchy Theory Input

The survival or success of organisms/ecosystems (n) depends on their adaptive behaviour with respect to the regularities presented to them by the level above them ($n+1$). At the same time, the cumulative impacts of organisms and ecosystems on the n level eventually affect the larger regularities of the $n + 1$ level (which changes the context of future adaptations). Evolutionary theory asserts that increased complexity is how biological systems survive the changing ranges of information originating from the environment (Michaels, 1995; O'Neill *et al.*, 1986). An implication of this assumption is that human behaviour and planning should be oriented to preserve complexity.

Humans are the dominant forces in many natural hierarchies. Typically, the accumulation of many individual choices interact to coalesce as alterations in ecosystem states (Norton, 1995b). This characterizes the dual nature of human activity as it relates to the ecosystems — as the exercise of free choice on one level and as a reaction to constraints imposed from the higher level. According to Norton (1995b: 230),

the cumulative impacts of individual choices reverberate as changes in environment — and alter the ratio of opportunities to constraints faced by future persons. The intergenerational impacts of a culture on the landscape can, therefore, be understood in terms of cross-generational exchanges in which the operative currency is freedom (options) expressed as a ratio of opportunities to constraints. These opportunities are stored in the structure of the ecological system. If growth in human impacts erode natural capital stored in ecological systems on larger and slower time scales, future generations will face more constraints and fewer opportunities as cumulative impacts of many human individual actions skim off opportunities (such as capital stored in ancient forests) and leave constraints (poor and eroding soils exposed by clear-cuts).

In other words, natural capital built up over ecosystemic and deep time cannot be depleted during individual time without eventually destabilizing a hierarchy's complexity.

Current science is confounded by the inability to predict the behaviour of extremely complex systems (e.g., the weather) in a precise manner. Indirect human intervention in climatic processes has reached dangerous levels where some threshold (e.g., the melting point for polar ice caps) may, in fact, be crossed. According to hierarchy theory, the combined behaviour of cohorts (e.g., the global consumption of carbon-based fuels and its accompanying impact on climate) can be sufficiently strong to affect the couplings sustaining the hierarchy. Or, as Giampietro (1994: 621) recognizes,

humans and their economic systems have expanded so much as holons, that they are endangering the stability of the higher level (ecological system) of the hierarchy to which they belong. This implies that when technological development of socio-economic systems is assessed, the biosphere level and its related perspective must be included in the process of comparing and mediating between contrasting values.

Historically, humanity has endured with the *luxury* that the biosphere level of change could be held constant. However, combined human activities are now sufficiently influential to alter even planetary processes (e.g., global warming).

- **Inter-jurisdictional Decision-making**

Conventional land use planning is commonly carried out by many separate planning and management authorities acting largely in isolation from each other. The ecosystem approach attempts to overcome this fragmentation by encouraging new planning units, agencies, and methods that promote integrated, inter-jurisdictional decision-making (Gibson *et al.*, 1997: 31).

Integrated decision-making should ensure that all partners have a voice in the process, without one agency or relevant group usurping the responsibilities and mandate of another. For example, one study that addressed the application of municipal environmental assessment revealed that the demise of the process was predicated on the fact that the municipal engineering department would not let its activities be monitored or

approved by the planning department — which was the administrating and approvals department for the process (Kaufmann, 1981). The threat of the omnipresent *turf war* cannot be discounted.

Hierarchy Theory Input

Wuichet (1995) found that bureaucracies tend to be non-nested (i.e., their scope and jurisdiction does not follow natural laws). The implication is that bureaucratic institutions cannot adequately deal with environmental problems which are, by their very nature, trans-boundary and trans-scale. Ideally, societally-driven environmental issues need to be addressed from the institutional platform with the appropriate jurisdiction within the hierarchy. Matching the problem with the proper jurisdiction, or successfully integrating different jurisdictions, is therefore critical. Norton and Hannon (n.d.a) agree, suggesting that the best policy scale for dealing with an environmental issue has an analogous temporal and spatial scale to the environmental issue. Another implication is that "bureaucratic boundaries must in some way approximate ecological boundaries, no matter how nebulous the boundary in either system may be" (Wuichet, 1995: 162).

- **External Consultation, Cooperation and Partnering Among Relevant Groups/ Interested Parties**

"Unlike conventional planning, in which land use decisions are often made in a technocratic manner after discharging any legal obligation for perfunctory public involvement, the ecosystem approach actively seeks to involve the widest range of stakeholders effectively and openly in the process" (Gibson *et al.*, 1997: 31). Wight (1996: 22) contends that the important aspect of engagement of relevant groups "is the

distinction between mere communication, more meaningful co-operation and truly substantial collaboration." By involving as many relevant groups as possible in the planning process and engaging them meaningfully, the content of the plan, its authority, and the likelihood of its implementation are improved.

Hierarchy Theory Input

External consultation, cooperation and partnering are antithetical to the historical inertia of traditional top-down decision-making. "Control by a few, through segregated mandates and jurisdictions, frustrates attempts to define and solve problems using a more collaborative approach" (Dowling and MacLachlan, 1997: 14). This 'control by a few' dimension of traditional decision-making is inherently flawed, since it denies the principles of democracy. For social hierarchies to be stable over time, there should be a two-way flow of social information — both top-down and bottom-up. Decisions made without public or relevant group input are not sustainable over time. Valid public concerns (e.g., the right to due process or to vote) that are consistently denied or deemed irrelevant can conceivably coalesce into revolution.

The dominant mode of governance, by its very nature, should be constantly questioned if it is to stay relevant to the governed. By consulting, cooperating and partnering with relevant groups, government institutions ensure their own evolution and longevity. Nevertheless, hierarchy theory cannot be used to discriminate between the importance of vertical *versus* horizontal inter-jurisdictional partnering. The task, obviously, is to ensure that both vertically- and horizontally-related jurisdictions are involved.

- **Long-term Monitoring, Feedback and Adaptation of Plan Content**

In the Ministry of Municipal Affairs' (1982: 2) *Monitoring Guidelines: An Approach to Monitoring Official Plans*, plan monitoring is defined as the "collection of predefined data and information, the evaluation of alternative actions to correct divergence and advice to council on the appropriate action to take." In other words, plan monitoring takes the pulse of the municipal context as it continues to evolve and ensures that plan content changes or adapts in response. Typically, monitoring has different goals. On the one hand, plan monitoring will test whether the assumptions and forecasts upon which the plan is based do, in fact, continue to be valid. Second, plan monitoring can be used to demonstrate how effective plan policies are (i.e., whether they are achieving their intended result). Third, monitoring can be employed to investigate the compliance of developers with decisions made concerning proposals.

Hierarchy Theory Input

In some respects, hierarchy theory is a theory of adaptation and transformation. Adaptation and evolution are, after all, closely related. As stated earlier, "the speed of evolution of complex systems will favor those [hierarchies] with stable, intermediate levels of structure" (Pattee, 1973: 133). Consequently, monitoring should focus on the upper and intermediate levels of hierarchical structure, since they contribute the most strongly to overall hierarchical stability. The monitoring program itself needs to be structured according to specific temporal frames since some systems cycle more quickly than others (e.g., intra-urban traffic cycles more frequently than inter-urban traffic).

- **Inter-disciplinary Approach to Information**

"Social, demographic, and economic information has been emphasized in traditional planning, with few attempts to assess ecological capacity or to assess how efforts to satisfy anticipated socio-economic demands may affect ecological functions" (Gibson *et al.*, 1997: 32). Similarly, Bregha (1992: 18) suggests that "the compartmentalization of environmental information among several departments, the manipulation of information to protect vested bureaucratic or political interests and, lastly, the [intentional] withholding of information" are among the central impediments to viable information dispersion and public participation. And,

a holistic interdisciplinary approach challenges decision-makers to consider the impact of management options from a wide range of perspectives that includes the natural, economic and social environments. Many government programs lack integration because of the fragmentation within and between government departments. One department rarely has the sole authority required to make a decision with respect to complex ecosystem issues (Dowling and MacLachlan, 1997: 23).

The challenge, therefore, is to ensure that the data and information of different disciplines are integrated.

With respect to the **how** of achieving data, information and knowledge integration, a word of qualification is needed. That is, the matter of how to achieve information integration is a separate and significant research and applications task in its own right (Wellar and Harris, 1992; Smith and Wellar, 1992). And, it is a topic which has received intensive and extensive attention in the journals and conference proceedings of organizations such as the Urban and Regional Information Systems Association (URISA).

It is explicitly acknowledged, therefore, that the scope of the present study is limited to the *why* behind the need for an inter-disciplinary approach to generating and using information for plan evaluation purposes. The *how* dimension, and the technical and technological aspects in particular is an important research and applications activity that could (and should) build on the plan evaluation framework developed in this dissertation.

Hierarchy Theory Input

Hierarchy theory is, in some ways, reductionist. It reduces complex systems to middle number systems to make them accessible to the human mind and to computers. However, hierarchy theory is also synthetical in that it draws the various holons into the hierarchical dance and is concerned with emergent properties at the system level. As Eldredge and Salthe (1984: 205) contend,

There are ecologic theories, selection theories, speciation theories, theories of epigenesis and replication of the genome. [By using hierarchy theory.] we have merely tried to suggest how all the various sorts of biological theories generally fit together — and that all are relevant to understanding evolution. It is our conviction that, based on this structural hatrack, paelontologists, systematists, ecologists, population geneticists, developmental biologists and molecular biologists can see more clearly how their data and theories potentially fit in with those emanating from other disciplines — disciplines long accustomed to dealing with different sorts of ontological entities on different orders of scale.

As such, hierarchy theory can be regarded as conceptual framework within which a range of inter-disciplinary theories and data can be combined, integrated and interpreted. It is a conceptual *hatrack* that positions different disciplines in relative relationships according to the research question(s) being asked.

- **Precautionary But Positive Approach to Development**

The adoption of a precautionary but positive approach to development is multidimensional. First, precaution should be exercised to prevent further damage to ecosystems. Simply stated, the precautionary approach involves the following: "when the ecological impacts of resource use and investment are uncertain, take a precautionary approach, give preference to risk-averse decisions and avoid irreversible actions" (Young, 1992: 67).

Second, a positive approach to development entails ensuring that development enhances the integrity of ecosystems and their communities. "Unlike more fragmented agencies and interests, ecosystem planning bodies are in a good position to identify and support economic activities that restore and enhance communities and ecosystems" (Gibson *et al.*, 1997: 33). This represents the *compensatory obligation* dimension stressed by Tamminga (1996) where planning efforts are made to improve degraded ecosystem components.

Hierarchy Theory Input

Hierarchy theory suggests that the stability of urban ecosystems is difficult to model and its mechanisms are poorly understood. In fact, hierarchy theory itself is largely heuristic — it is a conceptual framework to seek out the embedded structures underlying reality. It does not actually capture reality, since reality may, in fact, be unknowable. Wuichet (1995: 162) observes that some authors (e.g., Norton, 1992; Allen *et al.*, 1987; Allen and Starr, 1982) regard hierarchical levels as "convenient conceptual tools rather than ontological building blocks of the universe." There is profound uncertainty about the epistemological extent to which ecosystems are understood. Livingston (1990) has

suggested that not only are ecosystems more complicated than scientists think, they are more complicated than scientists can think. Similarly, Rittel and Webber (1973: 160) have speculated that in planning contexts, "our intelligence is insufficient to our tasks."

In her strategic environmental assessment framework, Kingsley (1997: 28) suggests that the principle of precaution stresses "the need for care and precaution when changes to the natural environment are contemplated. This is particularly important when scientific understanding of a natural system is incomplete or when an area is unusually susceptible to damage." The concern with precaution is made even more important with the recognition that even small changes can bring about severe consequences for ecosystem stability.

Our experience with many different types of complex systems, both natural and artificial, warns us that loss of hierarchical controls often results in sudden and catastrophic failure...as systems grow in size and complexity they reach a limit where a new level of hierarchical control is necessary if the system is to function reliably (Pattee, 1973: xi).

This suggests that precaution needs to be exercised in all planning contexts involving uncertainty, particularly when ecological thresholds may be crossed or previous experience with synergistic interactions has indicated a threat.

- **Planning Integrates Rather Than Merely Balances Environmental, Social and Economic Objectives**

This principle addresses authority.

Getting things done through ecosystem planning depends heavily on broad support in the affected community. Integrating ecological, social, and economic concerns in land use decisions requires changes in attitudes, institutional structures, and behaviour...no single agency has a sufficiently comprehensive mandate and, in any event, resistance is too easy. Willing cooperation is crucial (Gibson *et al.*, 1997: 34).

The challenge of integrating rather than merely balancing environmental, social and economic objectives suggests the importance of returning to first principles when making decisions — particularly the *design with nature* principle.

Hierarchy Theory Input

According to Meffe and Carroll (1994: 16), "the old 'balance of nature' concept...is inaccurate and misleading; ecosystems or populations or gene frequencies may appear constant and balanced on some temporal and spatial scale, but other scales soon reveal their dynamic character." In other words, nature is not about balance. Rather, nature is characterized by unbalanced asymmetrical interaction (i.e., asymmetrical integration).

The ecosystem approach to planning is sometimes explained in terms of the balanced interdependence of the environment, society and the economy (e.g., Crombie, 1992). However, these three dimensions of the human reality are presented on an equal footing, as if all three were holons co-existing and interacting at the same level. Yet, hierarchy theory suggests that the larger spatio-temporal environment is the constraint level. The challenge becomes integrating human activities and behaviours inside the constraint level imposed by the environment.

The environment's hierarchical structure, when it receives unattenuated signals from human behaviours, may eventually collapse into a less complex and less stable holon. This is a central implication of hierarchy theory for the ecosystem approach. Society and the economy can be viewed as holons at the same level (n), and the environment is $n+1$.

Horizontal integration of the social and economic holons in combination with vertical integration with the environment is called for, rather than balance. Otherwise, the *double asymmetry* (or *need for equipollence*) that maintains the stability of the hierarchy becomes vulnerable. Meanwhile, the removal of barriers to integration (e.g., improvement of information transactions between levels) contributes to the overall stability of the hierarchy (Smith and Wellar, 1992; Wellar, 1989a, 1984).

- **Linkage of Ecosystem Planning to Democratic Change, Social Learning, Community Building and Environmental Enlightenment**

"Advances in planning must...be linked to concurrent, broader changes in social attitudes and values that are democratic, community-oriented and environmentally responsible" (Gibson *et al.*, 1997: 35). Otherwise, the fact that human communities undergo evolution (like other biological communities) is short-circuited. Evolution in human terms is not only related to the human body as the vessel of genetic transmission, but to the evolution of human thought and technology in its ability to receive and understand information from the environment. The collective psyche of communities and nations evolves.

Consider, for example, longstanding land claims by Canada's aboriginal peoples. The claims are increasingly on the public agenda and in the media, and are currently regarded with due respect. However, aboriginal Canadians were only permitted to vote in Canada in 1960 (Colombo, 1993). As aboriginal Canadians gained the vote, their concerns entered the legislative corridors of the nation and subsequently became a part of public consciousness. This demonstrates how social learning brings new issues and new power levers to the public agenda. As Norton (1995b: 239) observes, "the search for social

learning must encourage learning regarding human values and perceptions as well as provide the information base for environmental decision making."

Hierarchy Theory Input

Norton (1995b) provides a framework for making the implications of hierarchy theory amenable to social learning. Providing a framework for social learning involves the search for:

scale-sensitive, descriptive models that organize information and values into models for environmental problems and associate these values with important ecological processes. This can be accomplished by hypothesizing a relationship between scales of human concern and particular physical dynamics that are associated with broad social values (Norton, 1995b: 239).

The decomposition of environmental issues according to the spatial and temporal framework of hierarchy theory can make the issues amenable to public assimilation. In terms of social learning, hierarchy theory can be used to demonstrate the relevance of the issues to individual citizens by showing how they are manifested on different time scales and how each citizen is both affected and affects different time and space scales. Basically, Norton (1995b) generates a framework that makes hierarchy theory accessible and applicable to the real world in an immediate sense. He does this by reducing time and space to easily comprehensible scales.

Norton's (1995b) framework for the engagement of social learning is the following:

- The world is a tangled web of opportunities and constraints;
- In the short run, adults make decisions about how to make a living, be entertained and which products to buy. Norton calls this individual/economic time and it is defined as a period of approximately five years or less. The current market is the $n + 1$ level;

- In the medium run, adults make decisions about constitutions, laws and the sort of society that they want to become. The shift of concern is from individual interest to societal interest and can be up to 200 years. It is best addressed in a national forum; and,
- In the long run, adults are beginning to care about global culture, global security (e.g., war), improvement in global ecosystems and even consideration of interactions with intelligent aliens. The shift in concern here is from society to the survival of the species and can only be adequately addressed in an international forum.

The contribution of this framework to social learning is that environmental values become more easily assimilated into public awareness. In other words, "environmental values must be associated with scales that are meaningful from a human perspective" (Norton, 1995b). Concepts like *sustainable development* or *ecosystem health* need to be discussed in terms of these temporal and spatial components so that they are understandable and meaningful to human experience.

Hierarchy theory can also be used to provide an interpretation of democracy. Voters provide the dynamics and their bottom-up flow of information — if manifested as a trend among cohorts — leads to the choice among the available envelopes of governance. If lower-level behaviour becomes more informed and behaves accordingly, the system begins to gain inertia that may ultimately impose a new and more complex constraint level, thereby improving the chances not only for the society's survival but its excellence.

Or, to use an alternative perspective to make the same point,

when a system becomes unstable, upper-level constraints cannot maintain the system's current configuration...What disappears are the relationships that held the material in some special configuration (Ahl and Allen, 1996: 171).

Furthermore, "if there is too much development of any one type of structure [within the hierarchy], the system becomes overextended and brittle...inevitably then, human management strategies that focus on maximizing or minimizing some aspect of these systems will always fail" (Kay and Schneider, 1994: 35). In other words, human strategies aimed at ameliorating perceived environmental issues must take a comprehensive and flexible approach (i.e., addressing the whole system level rather than just a part of it). This stresses the importance of social learning to hierarchical stability. The reach of social learning is horizontal across the human holon, but its effects are vertical.

- **Cross-Scale Management**

Planning is a multi-scalar discipline, since land and populations exist, function and operate at different time and space scales. The need to recognize both the inter-relationships existing between the different scales of planning and the integration of local and wider interests is critical (DOE, 1992). Scale can be addressed in a number of different ways. For example, policy consistency between vertical jurisdictional levels can be addressed (e.g., national, provincial, regional, local, neighbourhood). Ecological units can also be vertically employed (e.g., ecozone, ecoregion, ecodistrict or super-watershed, watershed and sub-watershed). Temporal time scales range from current to ecosystem to deep time scales (Norton, 1995b).

As well, nature unfolds in cycles. Hence, Canadian municipal plans should specifically account for seasonal changes, and especially account for the presence of winter in the cycle. By way of illustration, winter planning can be used to account for snow dump siting criteria, snow disposal, street orientation to maximize sun exposure for snow

melting, building (i.e., window) orientation in subdivision planning, and other factors. Cross-scale management could be used to account for cycles occurring across scales — either spatial or temporal.

Hierarchy Theory Input

While traditional science often reduces complex systems to one spatio-temporal scale, hierarchy theory facilitates investigation of a number of spatio-temporal scales and how they inter-relate. "Hierarchy theory must be formulated to describe at least two levels at a time" because conceptual domains (e.g., municipal and environmental planning; sustainable development) involving a multitude of time frames and spatial scales cannot be adequately dealt with in terms of reductionism (Pattee, 1973: 149). Hierarchies require a synthesizing framework to provide a holistic view of the ecosystem with respect to its constituent holons. Cross-scale management addresses the layering of holons.

Hierarchy theory leads researchers away from searching for a fundamental hierarchy or level of analysis when/where none exists. The theory suggests different ways of choosing both (a) the hierarchy and level of interest according to the problem at hand; and, (b) how to structure the data that is collected (Fox, 1992). In other words, hierarchy theory imposes a multi-scalar approach on both problem solving and the planning research that is undertaken. As Grumbine (1994) observes, to focus on any one level of the hierarchy is insufficient.

When working on a problem at any one level or scale, researchers and planners must seek the connections between or among all levels in order to provide holistic insight and to

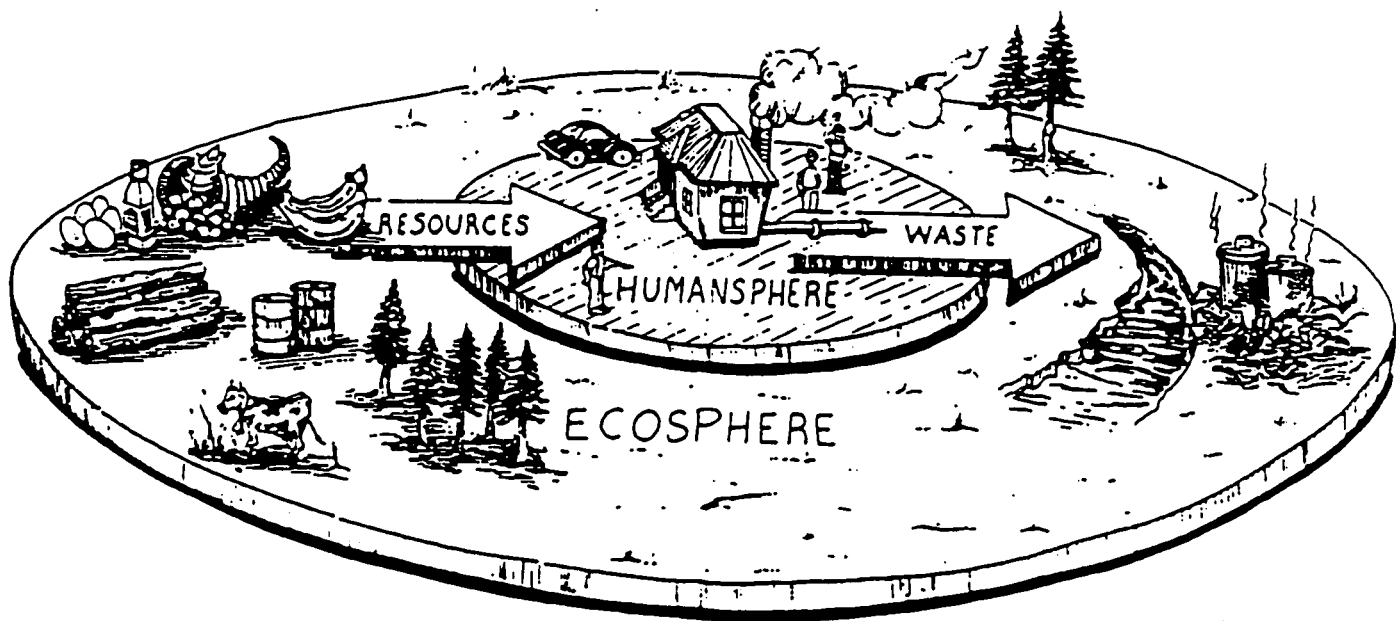
identify the most appropriate level for remediative response. Since scale-based issues define government institutions, the best way to approach cross-scale management is through coordinated and cooperative approaches set up between or among governments, NGOs and relevant groups — both vertically and horizontally across holons.

- **Explicit Recognition of the Municipality's Ecological Footprint**

Ecological footprint is a relatively new concept, and methodological problems still surround its employment. The analogous concepts of *ecological footprint*, *urban footprint*, *urban shadow* and *appropriated carrying capacity* are related to but not synonymous with *carrying capacity*. In ecological terms, carrying capacity is "the number of individuals of a given species that can be sustained indefinitely in a given area" (Miller, 1997: 118). Within that definition is a presumption that there is a population or ecosystem-based threshold beyond which only dieback or the innovation of resource-production processes can solve. The regional carrying capacities of the earth are in constant flux and can be increased by conservation/preservation/rehabilitation, increased inputs (e.g., sunlight, fertilizer), and time. Ecological footprint addresses the human dependence on nature. As illustrated in Figure 5.1, resources are the inputs, the consumption and use of the resources is the throughput, and wastes and by-products dispersed into the ecosphere are the outputs.

Ecological footprint is directly related to carrying capacity and "is the land that would be required on this planet to support our current lifestyle" (Wackernagel, 1994: 1). More

Figure 5.1. Ecological Footprint as a Measure of Human Dependence on Nature.
Source: Wackernagel *et al.*, 1997: 3.



specifically, "ecological footprinting provides an area-based estimate of the natural capital requirements of any defined human population, from an individual to an entire city or country" (Walker and Rees, 1997: 97). It involves the relationship between lifestyle and carrying capacity. In other words, it represents the land and resources (e.g., energy, food, building materials) required from nature to support each individual's level of resource consumption. In Wackernagel's (1994) interpretation of the concept, land area (or ecosystem surface coverage) is used as a proxy for natural capital.

Rees and Wackernagel (1995) have estimated that the average North American requires between four and five hectares (10-12 acres) of ecologically productive land to support his/her lifestyle, and this presumes that those four to five hectares are used sustainably over time. From this calculation, it is possible to estimate the ecological footprint of an urban area by multiplying this land requirement by the number of metropolitan residents. Not surprisingly, "if everyone on Earth lived like the average Canadian, we'd need at least three Earths to provide all the material and energy essentials we currently use" (Wackernagel, 1994: 21).

This phantom planet hypothesis reveals how Canadians are consuming a disproportionately large share of the globe's carrying capacity. Obviously, the affluent areas of the world are running ecological deficits with the rest of the world because of their high per capita rates of resource consumption and waste generation. Globally, Canada is the fourth highest in terms of per capita ecological footprint — following Iceland, New Zealand, and the United States. On the other hand, Germany (one of the G7 nations) is ranked 21st (Wackernagel *et al.*, 1997).

Explicit recognition of a municipality's ecological footprint entails addressing how a city is nested within its bioregion and how it consumes inputs, metabolizes throughputs and releases outputs of energy, waste, and resources. In a very general sense, ecological footprint can be regarded as an overall measure of the sustainability exhibited by a particular area.

Hierarchy Theory Input

Analogous to the evolution of species, municipalities also evolve. Successful municipalities (e.g., cities that continue to prosper across centuries or ecosystemic time) are able to receive environmental information and continue to undergo complexification. Yet, the demise of many cities and cultures is recorded throughout history. For example, the Mayan collapse has been attributed to many things: mysterious diseases, draught, conquest, and civil war (Fagan, 1977). However, the abuse of carrying capacity and the accompanying starvation of an increasingly urbanized Mayan society remains a viable explanation. In other words, perhaps the Yucatan Peninsula could not bear the Mayan footprint.

In terms of hierarchy theory, it is tenable that resource demand and supply in the Mayan culture transpired on different temporal scales. Soil production unfolds in *deep time*, while population growth and erosion occur in *individual time* (see Bazimya, 1993; Sparrow, 1984). When ecosystemic functions become stressed and cross a threshold, the reaction is often swift and unpredictable. As Fox (1992: 292) states, when the higher-level constraints are relaxed or destabilized, the dynamics of the lower levels are unrestrained — which can "change the system drastically."

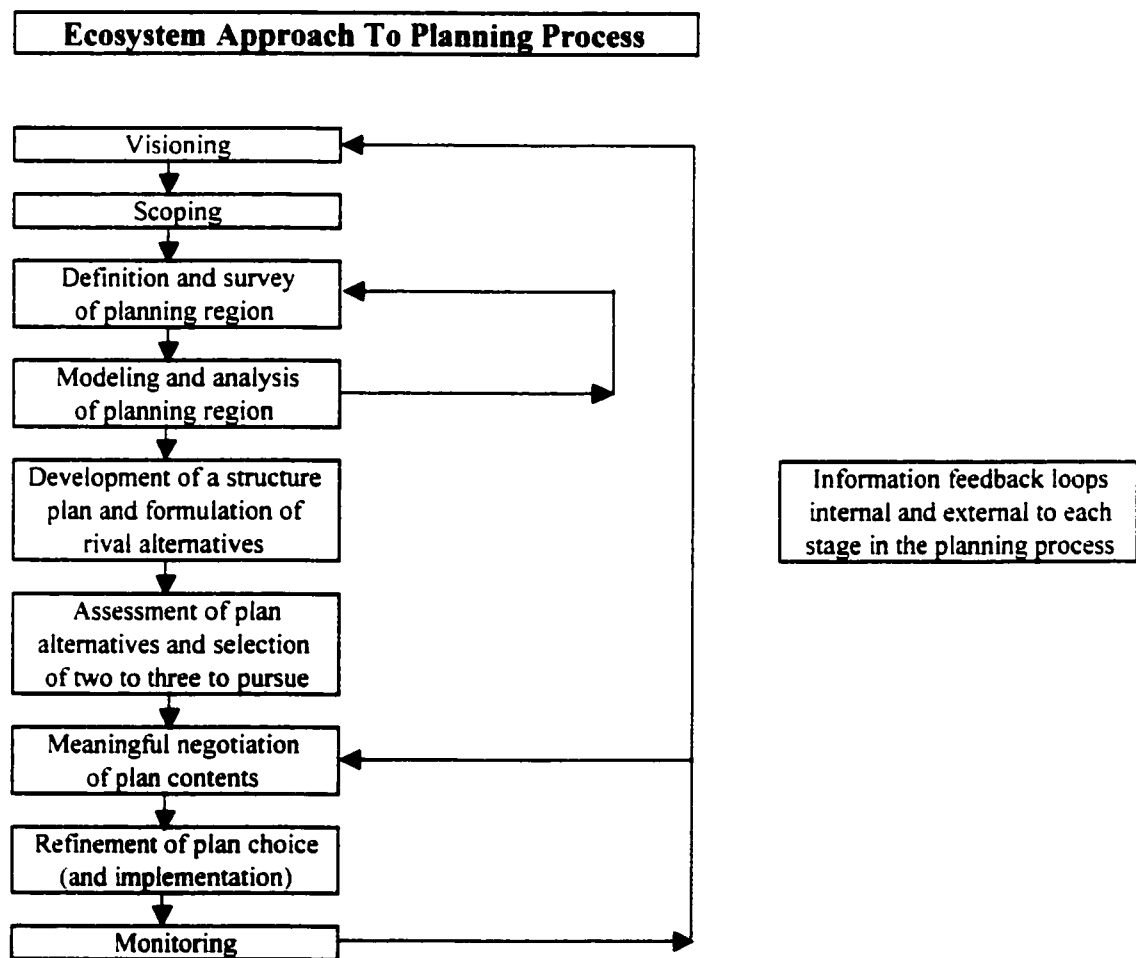
Ecological footprinting provides a framework for determining critical inputs, throughputs and outputs. Cities in southern California, for example, are running water deficits with northern California (Miller, 1997). Water supply issues are or should be limiting factors to their growth. Unless the water-based footprint of the city is somehow mitigated, a city cannot sustain itself indefinitely except at great inefficiency and cost. Supply-side solutions are expensive and not sustainable in *ecosystem time*. Hierarchy theory suggests that ecological footprinting is a theoretically-based mechanism that reveals the importance of limiting factors to urban planning decisions.

The Ecosystem Approach to Planning Process

The activity stages of the ecosystem approach to planning presented in this section build on the recent work of Gibson *et al.* (1997) and Tomalty *et al.* (1994a) with the addition of the Visioning and Scoping stages, plus the explicit recognition of information feedback loops (see Figure 5.2). In this section, the stages of the planning process are linked to the ecosystem-based planning principles presented in the previous section.

There has been a shift in the evaluation literature away from a strict dependence on judging process outcomes from the processes themselves. Instead, the process (e.g., planning, manufacturing, design) becomes the evaluand alongside the product (Alexander and Faludi, 1989). This dual purpose is synthesized within the derived evaluation instrument.

Figure 5.2. An Interpretation of the Delphi Results in Characterizing the Ecosystem Approach to Planning Process



Hierarchy Theory Input

Hierarchy theory can be used to both interpret and support the rationale for planning processes. Support for planning arises from hierarchy theory's focus on constraint and hierarchical levels. As O'Neill *et al.* (1986: 94) observe,

hierarchically structured systems will not be fully connected, and, due to differences in rate processes, some relationships will be asymmetric: *X* [the upper level in the hierarchy] will affect *Y*, but *Y* cannot affect *X*...[whereas] on a given hierarchical level, the holons are operating at a similar rate and can 'interact' at least potentially. The relationships are symmetric.

In other words, asymmetric relationships occur between vertically associated hierarchical levels, and the super-ordinate level can be considered the constraint level. Meanwhile, horizontal interaction among holons on the same level is dynamic and symmetric.

Also according to O'Neill *et al.* (1986: 95),

the higher level appears as an immovable barrier to the behavior of lower levels. This constraint is a natural consequence of the asymmetry in rate constants. The rates always become slower as one ascends the hierarchy.

This so-called *double asymmetry* is a reflection that "lower-level behaviors are essential to the functioning and persistence of higher-level structure that, in turn, constrains the behavioral flexibility of all lower-level objects" (O'Neill *et al.*, 1986: 95). One implication of these observations is that there may be a hierarchical basis supporting some types of government (e.g., democracy, benevolent dictatorship) that demonstrate relative stability.

A subsequent implication of *double asymmetry* is that there is a rationale for planning. For example,

notice how the Supreme Court and Constitution constrain the lower levels, not by being energetic and active but by preserving tradition and allowing change to occur only infrequently...frequent changes of the upper level threatens the stability of the entire society (Ahl and Allen, 1996: 105).

In this sense, stability at the higher levels in the hierarchy is good because it facilitates the evolution of the system to move more efficiently and effectively towards greater complexity (i.e., evolution). Conversely, a malevolent dictatorship or arrogant monarchy might induce hostility and revolution, which destabilizes the hierarchy and short-circuits the evolutionary processes of the society involved.

The relevance of more efficient and effective evolution is that it means that urban ecosystems will be more likely to either absorb or adapt to changing environmental conditions without collapse of the hierarchy's stability. For example,

one can show on quite simple and general grounds that the time required for a complex system, containing k elementary components, say, to evolve by processes of natural selection from those components is very much shorter if the system is itself comprised of one or more layers of stable component subsystems than if its elementary parts are its only stable components (Pattee, 1973: 7-8).

Analogously, an urban ecosystem is extremely complex and stable intermediate holons like transportation, communications, construction, and recreation therefore contribute to the system's evolutionary success over time (e.g., ecosystem and deep time). The rudimentary theoretical point being made here is that hierarchy theory demonstrates that planning should have one underlying concern: minimizing the impact of human development and growth on the environment. Otherwise, the stability of the hierarchy is compromised.

Hierarchy theory also makes it possible to dissect "a phenomenon out of its complex spatiotemporal context" (Fox, 1992). Since urban ecosystems are complex phenomena (see Dorney and McLellan, 1984), an investigation into the potential application of hierarchy theory to both the research supporting the planning process and the planning process itself is appropriate. Hierarchy theory permits the urban ecosystem to be studied at various scales, thereby providing a rationalization for the appropriate governmental and community response to their existing contextual circumstances.

These observations set the stage for addressing the so-called *wicked problems* in planning which have historically confounded planners (Rittel and Webber, 1973). The essence of wicked problems is that they are complex system dysfunctions operating on different spatial and temporal event horizons. That being the case, it therefore follows that hierarchy theory may provide a heuristic vehicle into their investigation by facilitating both the spatio-temporal organization of the problems, and specifying the explicit relationship between planners and problems.

Another general implication of hierarchy theory to planning in general is that a rationale for a national policy for planning and cities can be deduced. For example, Wuichet (1995) sees environmental problems as requiring bottom-up democratic feedback combined with super-ordinate constraint from above for problems to be effectively resolved. As Wuichet (1995: 166) states, "there is a symbiotic relationship in general systems between the dynamics of lower-level activities and the constraints imposed on those activities from higher levels."

In other words, the constraint level provides the *freedom within the law*. In Canada, where the federal Ministry of State for Urban Affairs has been disbanded (see Wellar, 1996, 1987, 1982), these reflections represent a theoretical basis for re-establishing national planning standards and protocols. Without a national level framework for planning, the bureaucratic structures supporting planning remain non-nested. Ideally, bureaucratic structures should be nested analogues of the environmental sub-systems that they are formulated to address.

Significantly, the discipline of planning itself is an analogue of nature in that the behaviour of living organisms is typically teleonomic or oriented towards a future state (Heylighen, 1997). Since planning is a future-oriented discipline, it requires an explanatory theory as a basis that also entertains some predictive capacity, however rudimentary that predictive capacity may be. The extent to which planning mimics nature may, in fact, determine the overall long-term viability of the discipline.

There are, however, *forces* at work which create major tensions for plans, planners and planning. On the one hand, as Beeton and Vallentyne (1988: 60) observe, "the flow of power proceeds downwards from political systems to economic systems and thence to technological production systems and finally to natural resource systems." But, as they also observe, ecological theory suggests that "the perceived flow of power (i.e., of available energy) is just the reverse: from natural resource systems to technological production systems and thence to economic systems and finally to political systems" (Beeton and Vallentyne, 1988: 60).

By providing insight into the relationship between the bottom-up and top-down flows of energy and information, hierarchy theory can offer a comprehensive point of departure to deal with the anomaly. Currently, the way that power is manifested in existing human-based hierarchies does not mimic nature and is not sustainable. This suggests that new administrative and self-governance mechanisms need to be created. For example, the principle of *subsidiarity* — taking decisions at the lowest political level compatible with achieving identified objectives — has a number of political and therefore power-based benefits (Blowers, 1993). More specifically, subsidiarity promotes participation and therefore increases the feasibility of plan implementation.

Analogously, hierarchy theory provides a basis upon which the practice of planning could be reoriented. Typically, a municipal plan and the process that supports it regards the environment structurally (e.g., the urban ecosystem is divided up into land uses like residential, recreational, commercial, industrial, etc.). But, "we will have to learn that we don't manage ecosystems, we manage our interaction with them" (Kay and Schneider, 1994: 33). By recognizing that hierarchical structure is an inherent ecological characteristic regardless of human presence, the planning response should target human behaviours rather than ecological components. This perspective could reorient how the planning profession has traditionally regarded the relationships between humanity and the environment. That is, human uses of land and resources suggest that the relationships can be captured as process rates — which suggests that the mechanisms through which human behaviour affects those rates should become the planning research focus.

Hierarchy theory also suggests a modification to how ecosystem-based planning is conceptually described in the planning and geography literature. In *Regeneration* (RCFTW, 1992), the ecosystem approach is explained in terms of the interdependence of the environment, society and the economy. However, these three dimensions of human experience are presented on an equal basis, as if all three were holons co-existing and interacting at the same level. But, hierarchy theory implies that the larger spatio-temporal environment is the constraint level. Ideally, societies and economies should be able to *see* their roles in reality, and the range of choices they face. While they are living at home in the universe (Kaufmann, 1995), they should also respect their home.

The environment's hierarchical structure, when it receives unattenuated signals from human activities, may eventually collapse into a less complex and less stable holon following an environmental disaster or the crossing of a threshold. This is a central implication of hierarchy theory for the ecosystem approach. Society and the economy should be viewed as holons operating at the same level (n), and are nested within the environment ($n+1$).

- **Visioning**

For Klein (1993: 10), visioning represents bringing together the diverse interests of a municipality to try "to reach agreement on a common vision of the future." Overall, visioning represents a major opportunity for environmental planning at the front-end of the process since it can be used to provide the general orientation of a plan and is amenable to the incorporation of community-specific environmental values (Government

of Saskatchewan, 1994). The vision statement, once articulated, provides an underlying foundation for the plan's principles, goals, objectives, and policies.

It is noteworthy that visioning is associated with the *external consultation, cooperation and partnering among relevant groups* principle of ecosystem-based planning. Visioning is the first step in formally engaging the relevant groups, and sets the stage for subsequent consultation, cooperation and partnering. For this reason, it is important that the visioning exercise be methodologically-designed (e.g., employs a statistically-valid sample or used representative proxies) so that confidence in the consulting and partnering process is established.

Hierarchy Theory Input

Hierarchy theory provides an analogue of grassroots democratic input into the planning process. In this case, the level of interest is the planning process n and public input is $n-1$. Participants in the visioning exercise are providing the dynamics and their bottom-up flow of feedback — if manifested in a trend among cohorts — leads to a community-based selection of a preferred future. As Wuichet (1995: 166) states:

A grassroots move toward integrating locally scaled values into the regional policy arena may not only serve to protect the democratic ideal, because of its compatibility with the notion of emergent qualities, it could also be viewed as a viable option in terms of systems theory. There is a symbiotic relationship in general systems between the dynamics of lower-level activities and the constraints imposed on those activities from higher levels.

In other words, visioning represents the first step in tapping into the dynamics (e.g., needs, feelings, aspirations, and dreams) of the electorate.

In some respects, the vision supporting a plan can be regarded as analogous to the Constitution. Ideally, it offers contextual stability in terms of providing the very generalized value framework in which planning principles, goals, objectives and policies are expressed. When the researcher changes the point of view — where the principles become the level of interest (n) — then the vision can be employed as level $n+1$ or the constraint level. Goals become $n-1$, objectives become $n-2$ and policies become $n-3$. This re-positioning of interest is theoretically sound since "the ordering of levels in an empirical hierarchy depends on which aspect of the situation the observer considers significant. Change the significance, and the order of levels can change" (Ahl and Allen, 1996: 98).

In this way, the vision becomes the stable background context against which principles, goals, objectives and policies are either maintained or modified. The collective community has indicated where it would like to see itself in the long term, and one of the planner's jobs is to provide movement towards the identified end-state in a series of hierarchically-organized shorter-term actions.

Overall, the visioning exercise is normally manifested in general statements of community *goods*, where the level of broad generality is significant since it is more inclusive (e.g., encloses a larger field of options). If the vision statement is too specific, then it could potentially introduce instability into the lower levels because complexification over time would be constrained. By remaining general in form, vision statements have greater longevity because they are more flexible without straying from the core value statements that a particular community has chosen to embrace.

- **Scoping**

Duffy (1986: 17) defines *scoping* as the identification of "the important issues and alternatives that should be examined." In other words, the challenge of the scoping stage of the ecosystem-based planning process is the determination of importance, *viz.*, what does the municipality and its relevant groups identify as important? Planning is characterized by fiscal constraint, so choices have to be made and priorities require identification. The identification of current problems and issues, as well as the relevant groups, are scoped for their importance in this stage (Tomalty *et al.*, 1994a).

Hierarchy Theory Input

In concert with the priority values expressed by the community, hierarchy theory can also be used to identify urban or regional elements that are important. Since stability of the hierarchy can conceivably be regarded as the overarching planning agenda, goals that are stability-oriented are the scientifically-based priorities which have to be integrated with identified community-based priorities. The contribution of the planner's expertise may reside, to some extent, in an ability to identify and promulgate the scientifically-based priorities that contribute to ecosystem stability. There is, however, one difficult circumstance that can arise in this context: what does the planner do when science-based priorities are in conflict with community priorities?

Community values and scientific priorities are both important. On the one hand, if community values are not expressed in the plan, there will be resistance to plan implementation, and this represents a potentially fatal outcome for the planning agency.

On the other hand, if ecological priorities are not expressed in the plan, the long run stability of the hierarchy can be threatened.

In cases where community values are in direct conflict with ecological values, the answer is simple: impact minimization. Community values, in this case, need to be expressed in a way that minimizes their impact on the ecosystem. Impact minimization works with the ecosystem temporal scale, while community priorities tend to be oriented to the individual or current time scale. In other words, by necessity, community values must prevail, but the impacts of those values can be ameliorated with the meaningful implementation of the following ecosystem-based planning principles:

- design with nature;
- considerations of global and cumulative impacts;
- precautionary but positive approach to development;
- linkage of ecosystem-based planning to democratic change, social learning, environmental enlightenment; and,
- explicit recognition of the municipality's ecological footprint.

In other words, even aggressive development values expressed by a community are nested within a framework that self-corrects (up to a threshold) through impact minimization.

Overall, respecting community values contributes to making the plan operational, and since the behaviour of the electorate — if displeased — can become a destabilizing trend, it is vitally important that their priorities are respected and planned for. So, hierarchy theory simultaneously recognizes community values (bottom-up) and scientific priorities (top-down). Community values, if not respected and nurtured, will ultimately undermine the hierarchy. Insight into the potential resolution of this problem was addressed in the subsequent section on *social learning* (see page 151).

As well, because the scoping exercise is concerned with the identification of priorities, it brings the epistemological dimension of hierarchy theory into play since "hierarchical models organize either levels of organization or levels of observation" (Ahl and Allen, 1996: 79). Once the important elements of the planning inquiry are known, the framework to address them can be arranged. Spatial and temporal scales should be specified for each identified priority both in terms of how they will be addressed and how they will be understood (Ahl and Allen, 1996).

- **Definition and Survey of the Planning Region**

Definition and surveying of the planning region represents the foundation of the technical dimension of planning. The three target systems for data gathering are the following: the biophysical system, the infrastructural system, and the built system. "Initial ecosystem planning work will need to include efforts to gather, map and interpret enough basic data on the three systems to allow planning for the ecosystem region. Thereafter, information gathering will be a continuous part of the process, not a separate step" (Tomalty *et al.*, 1994a: 139). As a first step, the planning region needs to be delineated and this is associated with the *planning units are based on natural boundaries* principle.

If the employment of the ecosystem approach is already in place and the planning process is in a plan revision cycle, the potentially contentious issue of the planning unit may have already been resolved. However, at this early stage in the evolution of the ecosystem approach, it is possible that this issue has not yet been comprehensively addressed in a given Canadian municipality.

As it is currently practiced in Ontario, the conventional ecosystem approach suggests that environmental and municipal planning should occur at the watershed level (MOEE and MNR, 1993a). Other authors like Alexander (1990) agree. The watershed holon can be effectively mapped and represents a cohesive conceptual whole that supports the advantages of regional planning (e.g., efficiencies of scale, lack of planning duplication, etc.).

The implied second step of this stage is linked to the *inter-jurisdictional decision making* principle, and involves making the planning region operational. This represents a more challenging undertaking. Depending on how the planning region is delimited, it is quite possible that parts of the ecosystem will fall outside the jurisdiction of the planning agency. Here, the technical dimension of planning is necessarily usurped by political *know how* and inter-jurisdictional cooperation. Successful ecosystem-based planning is predicated on inter-jurisdictional cooperation if complex planning issues are to be tackled systematically and planning authority is non-nested (Richardson, 1984). Until institutional jurisdictions are made consistent with ecosystem structure, or convincing inter-jurisdictional arrangements are demonstrated, the ecosystem approach to planning remains difficult to implement.

There are a number of options available to planning agencies seeking inter-jurisdictional cooperation. For example, cooperation can be mandated politically. In Ontario, the *Planning Act* is written such that local municipal plans are legally required to demonstrate consistency with regional plans (within a year of the regional plan's approval) in order to be legally tenable. If the regional government is employing the ecosystem approach, the

regional plan could be written to induce ecologically-sensitive responses from the local planning agencies. Or, if hierarchical jurisdictions are not applicable (e.g., the ecosystem-oriented jurisdiction is adjacent to rather than super-imposed on top of the non-ecosystem-oriented jurisdiction), then the planning agencies can strike a formal memoranda of intent to achieve certain goals. In an adversarial planning context (e.g., the City of Ottawa versus the National Capital Commission as expressed by Robinson, 1998), the planning agency may be forced to contract its planning region and move incrementally towards stated objectives.

Definition and survey of the planning region can also involve the *explicit recognition of the municipality's ecological footprint* principle. Once the planning region is circumscribed, population can be calculated and the attendant footprint related to energy requirements, metabolism of automobile and human wastes, food production, material imports and exports, etc. can then be analyzed. This is also tied to the *linkage of ecosystem planning to democratic change, social learning, community building and environmental enlightenment* principle. Once the ecological footprint of the area has been calculated, it can be used as a teaching device to contribute to social learning. The ecological footprint concept is a powerful pedagogical tool and highlights the impact of metropolitan metabolism on its hinterland.

Hierarchy Theory Input

Hierarchy theory states that higher levels in the hierarchy can be more readily used to predict the outcome of a given event on a lower level rather than vice-versa (Fox, 1992). For example, if something is known about a regional-level phenomenon, then the effect at

the local level can be more readily described, explained or predicted. In other words, information available at the super-ordinate holon level should be the point of departure for background research, and then shaped, specified and complemented with lower level or community-based input. This observation can be employed to organize the design of the planning research process.

Basically, the issue is related to the so-called *aggregation problem* — that it is premature to assume it is possible to add up local data into regional data (Fox, 1992). The aggregation of local data does not necessarily provide insight into the $n+1$ or higher levels because aggregation does not account for the emergent properties of system levels (Müller, 1992). Fox (1992: 296) corroborates this by stating that "hierarchy theory suggests that using small-scale data (upper level) to make predictions about large-scale events is more accurate than the reverse."^{*}

Similarly, "hierarchy theory, which is useful for structuring mathematical models to simulate multiscale phenomena, may also help reconcile the 'bottom-up' and 'top-down' approaches to studying ecosystems" (Shugart and Urban, 1988: 280). The basis of this reconciliation is that hierarchy theory provides the framework for studying and integrating the two directional flows of vertical environmental signals. In the bottom-up approach to ecosystems, there is the attempt to assemble large-scale phenomena from smaller-scale components, thereby focusing on larger-scale implications — perhaps using a model to simulate the growth process of a single tree as a basis for projecting the long-

^{*} Please note that the use of the term *scale* in hierarchy theory is sometimes contrary to its use in cartography.

term dynamics of forest landscapes. Conversely, the top-down approach would involve analyzing the patterns seen in a forested landscape to infer the processes that generated the pattern (e.g., working out the finer-scale details). The implication of hierarchy theory is that the planning research program should start with the top-down approach and subsequently fill in the data gaps with the bottom-up approach.

As noted by Jorgensen (1992: 214), there are two other points of view concerning ecosystems: "the population ecological view emphasizing individuals into populations, guilds and communities and the process-functional view emphasizing productivity, nutrient cycling and other processes." A duality appears because function is embodied in the population and a population is embodied in the function. Hierarchy theory permits the derivation of dual hierarchies accounting for each point of view, without sublimating either in the interests of the other. The implication is that constraints from both dimensions are likely to play a role in understanding environmental problems and solutions. In other words, the challenge for ecosystem-based planning is to ensure that plan content is integrated with the planning process.

Overall, in the delimitation of the super-ordinate ecosystem and sub-ecosystem levels at which data are gathered and information is generated, hierarchy theory suggests that no system level should be surveyed and researched in isolation. That is, vertical relationships between system levels should be addressed alongside the horizontal relationships demonstrated between the three dominant urban systems.

- **Modeling and Analysis of the Planning Region**

Modeling and analysis of the planning region addresses the optimal locations for different types of land uses. Tomalty *et al.* (1994a) suggest the following criteria for making decisions: suitability, efficiency and compatibility. Tomalty *et al.*'s (1994a) work is particularly salient to ecosystem stability since it makes three differentiations among land uses: (1) lands that serve essential ecosystem functions; (2) lands that are degraded but can be enhanced by development; or (3) lands that serve human values and needs (e.g., housing, transportation, etc.), but not ecological functions. Many planners regard this stage of the process as the *nuts and bolts* of planning, despite the observation that this stage supports the regulatory role of planning more than any other one.

This planning stage is linked to the *external consultation, cooperation and partnering* and the *cross-scale management* principles. First, in new subdivisions and newly incorporated areas of cities destined for development, neighbouring communities should have a say in how the new development is going to proceed. Secondly, in built-up communities, zoning amendments or zoning by-law overhauls can be a complexity-fraught, adversarial enterprise since property values and quality of life variables can be affected.

In order to minimize the occurrence of NIMBYs, the planning agency needs to establish the ground rules concerning how to effectively disseminate zoning information and engage the public in dialogue. If the public has contributed meaningfully to the process, then the new zoning by-law will be far easier to implement and will, over the long run, be far more effective with fewer amendment attempts. Concerning the *cross-scale management* principle, the modeling and analysis stage of the planning process provides a

rationale for ensuring that seasonal change is accounted for in the plan, and that mixed zoning is stressed to minimize energy-inefficient movement between scales.

Hierarchy Theory Input

The most basic planning tool employed in the regulatory role is planning's traditional implementation instrument: zoning. What are the implications of hierarchy theory for zoning? Zoning is based upon a land classification system. And, any comprehensive taxonomy or classification system implies hierarchical structure because it involves giving order to complexity. Typically, land in a municipal plan is organized according to land uses: residential, recreational, industrial, commercial, etc.

Within each land use designation, there is often a series or hierarchy of intensities (e.g., single-detached dwellings *versus* multiple dwellings *versus* apartments). The classification system is always spatially nested (e.g., higher density land uses are, by definition, always nested inside lower density uses) and designated by a hierarchical system (e.g., residential designations such as R-1, R-2, and R-3 where R-1 represents the lowest residential intensity).

Another immediate implication of hierarchy theory for zoning is its support for complexity. Urban areas that are particularly complex (e.g., support an extensive variety of different land uses) are more likely to endure and be successful along a longer time horizon. For example, consider the recently observed demise of some edge cities. Garreau (1991) trumpeted edge cities as the planning trend of the 1990s and yet they are already dying. The cause of their demise, it appears, is due to the over-specialization of edge

cities and their related vulnerability to the vagaries of business cycles that are controlled by extra-metropolitan factors like interest rates, inflation, and the global economy (Fulton, 1996).

Mixed-use zoning at higher densities can be supported by hierarchy theory since this type of zoning is efficient and effective due to the spatial containment of process rates. People can live, work and recreate in the same area and travel only when they choose to do so. Moreover, mixed-use zoning contributes to the stability of the hierarchy because it contributes to the minimization of waste (e.g., less time and energy are required to complete tasks) and maximizes efficiency (e.g., proximity to a variety of activities increases synergy).

For the hierarchy to be stable, the vertical and horizontal couplings within and between holons can neither be too loose or too strong (Giampietro, 1994). In a suburban municipality manifesting sprawl, the horizontal coupling between human holons is too loose. For example, a suburban dweller with an automobile is able to carry out all life-sustaining activities without ever interacting or competing with other holons at the same level. Conversely, in a mixed-use neighborhood where automobile travel is not required, the human holon interacts, moves, makes space and yields to other holons at the same level. Mixed-use zoning more adequately supports the *dance* of evolution.

- **Develop a Structure Plan and Formulate Rival Scenarios**

The structure plan is a formulation of detailed goals and objectives (Gibson *et al.*, 1997).

Rival scenarios are suggested which express different ways of achieving goals (e.g.,

compact urban form *versus* suburban sprawl). Each of the rival scenarios can then be explored with assessments of their effects upon the targeted goals and objectives.

Hierarchy Theory Input

Rival plan scenarios can be viewed as alternative planning adaptations to an ever-changing environmental context. It is assumed that the plan revision or the need for ecosystem-based planning is necessitated by a measurable shift in the planning context. In response, the scenarios should be assessed for the likelihood of their long-term contribution to the achievement of community goals and hierarchical stability. Once again, the difficulty arises concerning what the planning agency should do when science-based priorities are in conflict with community priorities?

Hierarchy theory suggests that science-based priorities are important at the $n+1$ level (because of long-term stability variables), and that community objectives at the $n-1$ level are just as important (because of short-term stability variables and, realistically, community objectives are the first priorities for resource allocations). Planning for the successful urban ecosystem (n) should be concerned with finding the optimal compromise between $n+1$ and $n-1$ in their articulation of alternative plans.

- **Assessment of Plan Alternatives and Selection of Two to Three to Pursue**

From among the rival scenarios, two to three alternatives will be arrived at through evaluation and negotiation (Tomalty *et al.*, 1994a). These final alternatives should be addressed in terms of environmental assessment and public debate. This is a critical stage

in the planning process because it provides the opportunity to explore the implications of plan content for the natural, social and economic environments.

This planning stage is related to the *consideration of the cumulative and global effects of policies, plans and projects* principle. First of all, the simultaneous strategic environmental assessment (SEA) should not be perfunctory (i.e., merely to meet the needs of federal, provincial or local legislation). The SEA should ensure that scoped environmental issues are accounted for, and that cumulative effects are addressed in methodologically sound manner (see Spaling, 1994). The consideration of global effects contribute to the *social learning* principle, and provides the public with virtual meaning for the widely espoused view: think globally, act locally. Overall, while the results of the simultaneous strategic environmental assessment process will be influencing plan content, this stage permits a formalized evaluation and negotiation concerning the options.

Hierarchy Theory Input

As Giampietro (1994) contends, a significant implication of hierarchy theory is that a stable hierarchy or ecosystem structure has to reach a compromise between the intensities of both horizontal and vertical interactions of the holons (horizontal and vertical couplings). As long as the couplings are neither too loose nor too strong, it is possible to avoid the destruction or debasement of the hierarchy's complexity. Meanwhile, the importance of complexification in terms of evolutionary theory is a fundamental principle unifying all living systems (Michaels, 1995; Meffe and Carroll, 1994). The stability of each level in a complex hierarchy depends on the stability of the other levels (either

higher or lower), and this is known as *double asymmetry* or *the need for equipollence* (Giampietro, 1994).

The concept of *double asymmetry* forms the basis for bridging the potentially empirically-grounded basis for hierarchy theory with the existing normative constructs of the ecosystem approach to planning. The basic operational premise for making the argument is this: acts or processes "that reinforce the identity of the system at a particular level have a positive value for that system described at that level" (Giampietro, 1994: 617).

By implication, whatever (e.g., human behaviours, natural processes etc.) supports the stability of the hierarchy is *good* or exhibits merit. And, whatever destabilizes the hierarchy is not good (i.e., bad). The assessment of plan alternatives must take this into account. The optimal choice from a longer-term basis is always the plan that improves the stability of the hierarchy most. The challenge for planners, then, is to ascertain how to successfully integrate the demands of longer-term planning with the shorter-term needs and desires of the community. The most successful planning adaptation is one that provides benefits over the full range of temporal scales (including ecosystem and deep time).

- **Meaningful Debate/Negotiation of Plan Contents**

The rationale for public participation is predicated on the principle that those affected by a decision should have some input into the decision-making process. In the municipal planning context, debate and negotiations refer to the interactions between relevant groups and can be further refined to be "any action taken by an interested public

(individual or group) to influence a decision, plan or policy beyond that of voting in an election" (Smith, 1984: 253-254). Overall, public participation of this nature plays an important role in establishing the objectives of land use and resource use, as well as determining the acceptability of particular policies, plans and projects as a means of achieving those objectives.

Public participation is a cornerstone of democratic empowerment. This fundamental North American political belief "is reflected in the millions of words and dollars expended annually to encourage citizens to get involved in the political process" (Canan, 1989: 333). For example, in Sections 15 through 22 of Ontario's *Planning Act*, the legal requirements of disseminating the plan to the public before its adoption are circumscribed (Government of Ontario, 1996).

Clearly and realistically, the degree to which affected or interested groups are permitted to actually get involved in decision-making processes remains subject to debate. In the municipal planning context, there is recognition (although perhaps difficult to substantiate) that some municipalities continue to use *ghost plans* — back room plans with no legal status that drive municipal land use decisions (Cullingworth, 1987). As well, if some of the groups do not agree with the plan's stated objectives, then this factor can seriously compromise the evaluability of the plan (Palfrey *et al.*, 1992). That is, if some of the affected or interested parties do not agree with the stated objectives (e.g., the environment *versus* jobs continuum), then whose circumstances or interests are to be served by the plan?

In response to the fundamental question about different objectives, a particular point of view is adopted in this research which needs to be made explicit. That is, the study posits that a plan evaluation framework involving weights is conceptually flawed, since individuals and groups are unlikely to be comfortable with any scheme that gives less weight to their own objectives, interests, priorities, etc. (Voogd, 1983). Recognizing this position, meaningful dialogue and negotiation needs to transpire. There must be give and take. As well, "too much reliance on expert opinion in deciding when ecosystems are sick can erode the sense of personal responsibility citizens feel for their own local bioregions" (Chipeniuk, 1996: 108). A range of values needs to be expressed and acted upon in plan content.

Chipeniuk's point stresses the linkage of this planning stage to the *external consultation, cooperation and partnering among relevant groups* principle. Without meaningful public participation and cooperation, plan content will not adequately reflect community desires. Even though visioning, strategic environmental assessment and inter-jurisdictional relationships may have been established or undertaken, unless plan content reflects these exercises, then the ecosystem-based planning process is moot. The negotiation of plan content is a critical step in establishing credibility for the plan, the planning process that supports it, and its future implementation.

Hierarchy Theory Input

Characteristics of meaningful plan negotiation include the following: participatory, collaborative, conflict resilient and accountable (Dowling and MacLachlan, 1997). Using hierarchy theory, the first concern with the meaningful debate of plan content is to ensure

that enough people get involved. The notion of meaningfulness suggests that horizontal and particularly vertical couplings between the holons cannot be too weak (a far more likely concern in this context than being too strong). The challenge is to ensure that sufficient numbers of people are interacting in the process. Otherwise, the couplings between the public, the planning agency and decision makers can be too weak for viable informational transactions of any substance to take place, and a less valid choice could result (e.g., because a particularly vocal interest group overpowers other groups).

- **Refinement of Plan Choice**

Once a plan alternative has been chosen, the challenge of how the plan will be implemented needs to be addressed. Lower-level plans (e.g., neighborhood plans) and zoning by-laws need to be generated in order to implement the plan. Requirements establishing how to review and approve individual projects under the plan also need to be addressed at this stage.

The *design with nature* principle, although interpenetrating most of the stages of the planning process, is particularly important to this stage. Design solutions need to grow from place, and integrate local soils, vegetation, materials, culture, climate and topography (Van der Ryn and Cowan, 1996). This stage provides the planning agency with the opportunity to ensure that their plans reflect their ecological context, and that design guidelines are detailed accordingly.

Hierarchy Theory Input

On one level, the refinement of the selected plan choice can be related to efficiency. Nature is efficient, since organisms and ecosystems that are not efficient are selected out of the evolutionary process. The challenge for the planning agency is to find an appropriate mix of plan implementation techniques that can make both the plan and the planning area resilient to change. For example, over-reliance on regulation makes the planning process brittle and insensitive to change, rather than resilient. As well, over-regulation can induce a reaction or revolution in the electorate who may find the inflexibility of the system counter-productive. Ideally, the refinement of the plan choice should embrace a full range of plan implementation instruments (including developmental, fiscal, regulatory, consensus-building, educational, infrastructural, etc.).

- **Monitoring**

Monitoring is "included in the ecosystem approach to allow communities to assess progress in implementing a plan, to track the response of ecosystem elements when plans are implemented, and to provide a reliable basis for adapting plans to changing conditions" (Tomalty *et al.*, 1994a: 18). There are three primary foci for monitoring in an ecosystem-based planning context:

1. **ecosystem monitoring** — which concerns measurable change to ecosystem variables such as population and employment growth, changes to housing stock, air quality, water quality, etc. (Catanese and Snyder, 1988);
2. **performance monitoring** — which concerns whether plan policies and strategies are having their intended effects, or if proposals/initiatives are behaving as anticipated (Sadler, 1996; MMA, 1982); and,

3. **compliance monitoring** — which concerns verification of whether the proponents are respecting existing regulations and development codes, and have properly implemented the mitigation measures they committed themselves to for site plan approval, etc. (Sadler, 1996; Duffy, 1986).

Ideally, the results of monitoring exercises are fed back into the planning process as a basis for the adaptation of plan content.

With respect to implementation of the monitoring function, there are also implications involving information and information systems development. In particular, information is derived as a result of applying analytical and synthetical procedures to data (Smith and Wellar, 1992; Wellar, 1989a). So, an information development plan should be designed and implemented in order for the monitoring function to be performed.

The monitoring phase of the planning process reflects the *long-term monitoring, feedback and adaptation of plan content* principle. As stated, the purposes of monitoring are information-building, performance enhancement and compliance. The monitoring framework should be presented in the plan before it is adopted, and a number of provisions related to other ecosystem-based planning principles need to be included (e.g., continuous engagement of the public in planning exercises, plan adaptations, ecological footprinting, evolution of the ecosystem boundaries over time, etc.).

Hierarchy Theory Input

A central hierarchy theory dimension of monitoring is related to interaction, feedback and adjustment. Complex systems persist through feedback loops. Equivalently, if idealized

ecosystem-based planning is providing an analogue to natural processes, then it also requires feedback loops. For example,

each set of interacting components — forming a distinct hierarchical level — affords a specific state-space description with variables and parameters pertaining to that particular level. The interacting variables (and/or the parameters) at a higher hierarchical level are 'collective properties' (statistical moments or convolutions) of the dynamics going on at the level underneath. Therefore, as we move to a higher level, we usually witness a tremendous reduction in the number of degrees of freedom. The higher level receives selective information 'from below,' and in turn it exercises (efferent) feedforward control commands on the dynamics of the lower level (Nicolis, 1986: 1).

In other words, the stability of the hierarchy is dependent on two-way feedback loops. Two-way feedback loops (top-down and bottom-up) suggest the importance of two-way monitoring regimes supporting plan evolution. On the one hand, monitoring messages from the constraint or $n+1$ level (the ecosystemic level) reveals changing ecosystem trends and conditions that the plan must account for in order to remain viable. Similarly, plan performance monitoring provides evidence and insight into the effectiveness of plan content on changing or maintaining the $n-1$ level. Simultaneously, bottom-up monitoring arising from the electorate assesses the perceived performance of the plan.

- **Information Feedback Loops Internal and External to Each Stage of the Planning Process**

This is a more specific requirement for feedback than addressed in monitoring. In general, "the phases [of the planning process] are not necessarily followed in sequence in all cases, and recycling to an earlier phase is frequently necessary" (ASCE, 1986: 8). Feedback loops are also necessary since new information frequently becomes available on a timeline, so it must be introduced back into the process. Feedback can be defined as "the reciprocal effect in a SYSTEM, whereby a change in one variable (A) influences change

in others (B and C, perhaps), which in turn influence change in A. The influences may be either negative or positive" (Johnston, 1994: 192).

Hierarchy Theory Input

Through feedback, living systems are able to adjust and adapt to changing environmental conditions (Heylighen, 1997). If the transmission of environmental information to a holon is ineffective (i.e., impeded), the system becomes vulnerable until such a point where a threshold to a new information requirement may be passed and catastrophe or system debasement ensues. Feedback is critical to the stability of system hierarchies.

According to Levett (1991: 10), the bottom line concerning feedback and environmental policy is recognizing that there is "a need for policy development to recognize complexity and the inter-connectedness of things, and to be flexible and imaginative about a range of possible methods to achieve solutions." As new data and information become available, planning responses need to evolve. If it is positive feedback involved (e.g., the response increases the original stimulus) and the repercussions are destabilizing to the hierarchy, then negative feedback mechanisms need to be explored.

Feasibility of Plan Implementation (Process Foundation)

From a process orientation, plan implementability has a number of dimensions. The *political will* dimension is itself multi-faceted. "Those institutions which have to implement the plans, policies and actions must have the administrative capacity to do so. This requires technical skills, financial resources, management competence and legal

powers" (Devas and Rakodi, 1993: 60). Feasibility of implementation has an established tradition in plan evaluation (e.g., Barron and Ng, 1996).

- **Available Resources to Carry Out Planning Strategies**

In their study of plan quality, Dalton and Burby (1994: 448) found that "a community's resources might affect its ability to act. Most previous studies...have found local resources, including staffing, to be important." They used planning staff per capita (number of planning staff per 1000 residents) as an indicator of available resources. In his comparative evaluation of metropolitan plans across the United States, Boyce (1970) employs a criterion that he terms *fiscal feasibility*. If the fiscal resources are not available, there can be little optimism about successfully implementing the plan (Wellar *et al.*, 1982). Nonetheless, in a planning context where funds are scarce, it becomes the planning agency's task to engage planners in new implementation roles to mobilize other resources (community and otherwise).

Hierarchy Theory Input

Trained professionals build public confidence in the planning system. Interested parties (council, developers, landowners, etc.) need to know that their proposals are handled in a professional and knowledgeable way in order for them to respect and comply with plan content. Trained professionals provide a more adequate constraint level (e.g., $n+1$) than untrained plan administrators, and therefore contribute to hierarchical stability. Sufficient funds need to be available to employ trained professionals.

- **Political Commitment To Carry Out the Plan**

According to Berke and French (1994: 247), "without an adequate level of political commitment, all of the technical assistance and detailed planning information provided [in the plan] may be of little use."

If plans and policies are to be implemented effectively, they also require a commitment of political will. If that is to occur, plans and policies must somehow be acceptable to those in positions of political power. Hardline determinists might argue that, since those in power always have a vested interest in the status quo, significant reforms can never be implemented. But this is not necessarily the case. Those in power are not (generally) a homogeneous group, but rather a variety of individuals and groups with different objectives and agendas. Some will have achieved their positions as a result of a commitment to change. Others can be persuaded that change is in their interest (Devas and Rakodi, 1993: 60).

Conversely, not everyone is convinced that political feasibility is important. Boyce (1970: 121), for example, states that "evaluation of political feasibility [of plans] is tantamount to second guessing the decision makers." But, Boyce is ignoring two important facts: (a) that a political climate actually exists in given municipalities and provinces (e.g., fiscal austerity under the Harris Conservatives of Ontario in the late 1990s); and (b) if the visioning is methodologically-designed and its conclusions are valid, then the pulse of the electorate has already been addressed concerning planning issues.

Hierarchy Theory Input

The biosphere does send messages to humanity — including strong ones like those included in the doomsday map depictions of environmental problems developed by Wellar (1990c). However, the impacts of things gone or going wrong in the biosphere are not distributed evenly. As stated in Chapter II, it is the poor, the disenfranchised and children that often hear the messages first — since they are either interacting first hand

with the environment or are unable to afford the technological advances and devices (e.g., heating, air conditioning, water purification systems) that provide a buffer between the average Western consumer and the environment (Holling, n.d.).

And, since many of the messages from the environment that are noticed tend to be bad ones and because they "have to be read on a spatiotemporal scale that escapes that of individuals or corporations, those messages tend to be ignored wherever possible by politicians" (Giampietro, 1994: 622). The bottom line for corporations is short-term profitability. For politicians, it is short-run re-election. It is noteworthy that children and the disenfranchised tend not to be voters.

The denial of the varied timeframes upon which environmental catastrophes are occurring suggests that perhaps too many decisions with long term repercussions are being addressed by individuals with largely short-run concerns. The implicit message is that short-term political concerns are critical, but this argument cannot be adequately used to defend a short-term planning platform. The ideal temporal scale of planning should be *ecosystem time* (i.e., multigenerational time associated with ecosystem survival) interpenetrated with short-term concerns (i.e., Norton's individual time).

Current 20 to 30 year time horizons for plans typically do not address the survival of cities over generations, and are weak in principle and even ignored in practice. More importantly, if decision makers do not support the implementation of the plan, then the message from the political constraint level ($n+1$) may be ambiguous and therefore undermine planning's contribution to hierarchical stability over ecosystemic time.

- **Cooperation Commitment Among Inter-jurisdictional Partners**

Plan implementation depends upon the realization of inter-jurisdictional relationships. Inter-jurisdictional cooperation is a basic premise of ecosystem-based planning (Gibson *et al*, 1997; Tomalty *et al*, 1994a).

Hierarchy Theory Input

In his study of organizational *versus* natural structure, Wuichet (1995) found that bureaucracies tend to be structured differently from ecosystems. Basically, bureaucracies are usually non-nested (i.e., their scope and jurisdictions do not follow natural laws). The implication is that bureaucratic institutions cannot adequately deal with environmental problems which are, by their very nature, trans-boundary and trans-scale. This contributes to the explanation concerning why environmental problems are so difficult to solve from fragmented institutional platforms.

"To add a whole ecosystem level to a management plan is to resolve to manage, in addition to managing components of the system for resource production, the system as a system" (Norton and Ulanowicz, 1992: 246). And, planning for a system as a system requires complex inter-jurisdictional arrangements. Successful plan implementation is therefore predicated on inter-jurisdictional cooperation if complex planning issues are to be tackled systematically (Richardson, 1984).

- **Institutional Power To Implement The Plan**

This is a self-evident criterion. If the agency involved with the planning does not have the jurisdiction to implement what has been conceived and designed, then the planning process is moot.

Hierarchy Theory Input

Institutional power is a politically delegated power and, as such, depends upon the hierarchical structures of developed societies (Smith and Wellar, 1992). Institutional power is part of the plan evaluation equation because without it, there would be no stability flowing from the $n+1$ level in order to give shape and substance to lower-order behaviours.

- **Credible Institutional Accountability**

According to Palfrey *et al.* (1992) and Elcock and Haywood (1980), institutional accountability has four important dimensions: the **location** of accountability (i.e., who?); the **direction** of accountability (i.e., top-down or bottom-up?); the content of accountability (i.e., for what is someone being held accountable?) and the **mechanisms** of control or accountability (how is accountability established?). Recognizing that credible institutional accountability supports plan implementation, it is also relevant to ensure that "the capacity of the institution is not diverted by competing private interests — in other words, corruption" (Devas and Rakodi, 1993: 60). Corruption operates at different levels and the ecological footprint of the municipality is often the reservoir of the capital that is abused.

Once the messages from the environment (e.g., climate, the seasons, pollution) are dulled due to technology and other factors qualifying as components of quality of life, society can be lulled into a sense of complacency. When the population is complacent, the so-called *establishment* can find new opportunities to exploit the environment.

Powerful development interests now receive benefits from public resources that are (arguably) disproportionate to their reciprocal contribution to the general public. This has occurred because — despite constitutional safeguards for preventing the abuse of power — private interests were able to obtain control of public resources and hence, over time, more power to shape government processes and decisions (Birkeland, 1996: 21).

This spiral raises accountability issues, which are, in turn, closely related to transparency issues. To be accountable, institutional transparency must exist and this is particularly relevant in ecosystem-based planning contexts (Palfrey *et al.*, 1992; Elcock and Haywood, 1980).

Hierarchy Theory Input

Ideally, all decisions with public impacts (e.g., many planning decisions) should be made in a public arena where the agents and rationale of decisions can be rendered explicit. Transparency of institutional processes that are undertaken with public funds facilitate the early discovery of mistakes, permits the public to comment on institutional issues as they arise and, most importantly, establishes public confidence and compliance with outcomes (Palfrey *et al.*, 1992; Elcock and Haywood, 1980). Compliance as a combined trend among cohorts at the n level is therefore critical to hierarchical stability.

- **Ongoing Involvement of Relevant Groups During Plan Formulation and Implementation**

Engagement of relevant groups throughout the plan formulation and implementation processes is critical to implementation success. By involving as many relevant groups as possible in the planning process, both the authority of the plan and the likelihood of its implementation are improved. In *Regeneration*, the Royal Commission (RCFTW, 1992: 81) observes the following:

ecosystem planning involves all key stakeholders working together in an open, public, fair, and efficient process. Relationships have to be worked out among many interests — the public, different levels and agencies of government, the private sector, special-interest groups, and other. Processes should be designed to facilitate co-operation, encourage conflict resolution, and build consensus. This should result in more timely and efficient decision-making, with fewer antagonistic procedures than often occur in traditional planning and environmental assessment processes.

- **Flexible/Speedy Plan Amendment Protocols for New Data or New Circumstances**

Ideally, a municipal plan (ecosystem-based or otherwise) should not be considered a static entity. Rather, it should embody the precept of potential adaptation and transformation to evolving environmental circumstances and community objectives. In terms of plan content, update potential is critical. Planning is, ideally, an organic process that on the one hand tries to support stability (e.g., maintains property values, keeps incompatible land uses separated, etc.) and, on the other hand, also recognizes the evolving characteristics of a particular municipal context. In other words, planning should be flexible and adaptive. *Ergo*, plans should be amendable.

Hierarchy Theory Input

Adaptive capability of the plan ensures that plan content stays current with evolving environmental circumstances. Facilitated adaptation makes the hierarchy more likely to survive over ecosystemic time. In one sense, cities are like organisms and follow a lifecycle of birth, growth and deterioration. "Living systems are born, mature, senesce and die, all performing their little dance of life within a finite time frame" (Hershey, 1986: 6). Cities and corporations are no different, although the event horizon is longer than for organisms.

- **Use of a Representative Environmental Advisory Committee**

Environmental advisory committees are normally appointed committees that fulfill an advisory role for local council. Ideally, membership is representative of the range of relevant groups.

Environmental Quality Strategies

Environmental quality strategies are the *how to* elements of ecosystem-based planning. They demonstrate actions and behaviours that the plan identifies for the realization of plan goals and objectives. In this section, the measures are oriented to policy content and the implementing policies/tools that exist to optimize environmental dimensions. The three *top-of-mind* local environmental concerns that Canadians identified as priorities are: water pollution, air pollution and garbage/landfill waste (Angus Reid, 1996).

Hierarchy Theory Input

In Ontario, ecosystems can be delimited as ecozones, ecoregions or ecodistricts (Environment Canada and Agriculture and Agri-Food Canada, 1996) or as watersheds and sub-watersheds (MOEE and MNR, 1993a, 1993b, 1993c). Natural ecosystems and cities are composites of smaller, faster-changing subsystems embedded in larger, slower-changing systems. Elements of the slower system, therefore, affect the larger system only as contributors to trends among their cohorts. Or, as Ahl and Allen (1996: 30) suggest, "everything important coming from the lower levels turns out to be some sort of average condition."

Managerially, this implies that ecosystem-based planning or management should focus on trends in the behaviour of parts understood within the whole. Ecological breakdowns (e.g., famines, dust bowls) "occur when rapid changes in social trends overbound the parameters of normally slower change in larger systems" (Norton, 1990: 119). This suggests that the faster-changing trends affecting the slower-moving super-ordinate system should be the managerial target. In other words, identify the trends and address them hierarchically (i.e., both horizontally and vertically).

Vertically, the survival or success of organisms/ecosystems depends on their adaptation to regularities presented to them by their constraint level ($n+1$). Horizontally, the cumulative impacts of organisms and ecosystems on the n level eventually affect the larger regularities of the $n+1$ level (which changes the context of future adaptations). Since evolutionary theory assumes that increased complexity is how biological systems survive the changing ranges and rates of information originating from the environment

(Michaels, 1995), human behaviour and planning should be oriented to optimize complexity and respond to it.

"When a system becomes unstable, upper-level constraints cannot maintain the system's current configuration. There are two possible outcomes: either the system collapses to a diffuse, low level of organization; or, alternatively, a new set of upper-level constraints emerge and the system moves to a higher level of organization" (Ahl and Allen, 1996: 171). In terms of city morphology, the first instance could be caused by traffic congestion where the transportation infrastructure can no longer support the number of cars and gridlock or multiple accidents occur. Or, growth and social learning might occur. In this case, "learning can produce a more mature condition that is more robust, existing at a higher level" (Ahl and Allen, 1996: 171). It is through learning that human interactions with the environment can evolve.

In the former instance, planners could respond to excessive levels of metropolitan car use by employing impediments (e.g., designation of transit-only lanes, minimization of parking spaces downtown, traffic calming techniques) and facilitating alternatives such as walking, cycling, and public transit (Wellar, 1998; 1994). In the latter instance, planners could employ community outreach to educate the public in terms of which transportation modes are available to them and which should be employed and why. "In both cases the material components of which the system was made persist through the collapse. What disappears are the relationships that held the material in some special configuration" (Ahl and Allen, 1996: 171).

Hierarchy theory also addresses how environmental quality strategies need to be addressed in spatio-temporal terms, since they are predicated on the observation that measurable environmental difficulties have been observed within the planning area. Each of the environmental strategy domains discussed below transpires on different spatial and temporal scales. Air and water pollution are highly mobile, and require a more trans-boundary approach (e.g., cooperation with neighboring municipalities, etc.). Conversely, traffic congestion is frequently a multi-nucleated problem occurring throughout a metropolitan region according to traffic-generation properties of each identified nucleus. The challenge in elaborating strategies is identifying the appropriate spatio-temporal level(s) for the planning intervention.

In very specific terms, environmental quality strategies are concerned with how change will be effected. Yet, hierarchy theory suggests that the $n+1$ level of the hierarchy is the context or the *why* dimension. The $n-1$ level is the lower-level mechanics or the *how* dimension (Ahl and Allen, 1996). So, when decomposing the urban ecosystem, it is important to reflect on how the behaviour of the $n-1$ level is affecting the upper levels and should be regarded as the object of planning concern for strategy-response.

- **Air Quality Strategies**

Air quality is affected by both human (e.g., industry, vehicles, chimneys) and natural (e.g., volcanic activity, forest fires and wind-blown dust) processes. Air quality affects human health, animal health, agriculture, forest growth and building materials. In 1952, for example, a four-day smog killed over 4000 people in London, England (Environment Canada, 1991). Ultimately, air quality has both micro- (e.g., air quality inside buildings)

and macro-dimensions (e.g., regional and cumulative global relevance like acid rain and global warming).

Air quality objectives can be defined as statements concerning "the concentration of a specified air pollutant that should not be exceeded beyond a specified length of time, in order to provide adequate protection against adverse effects on humans, animals, plants and materials" (Environment Canada, 1992). The five common air pollutants are airborne particles, ground-level ozone, nitrogen dioxide, carbon monoxide and sulphur dioxide (Environment Canada, 1996).

Hierarchy Theory Input

When investigating air quality, a number of scale-related details are immediately apparent. First, air cycles at both the micro- and macro-levels. Air quality issues that are generated locally can accumulate regionally and globally. Estrin and Swaigen (1993) observe that scientists now understand that air pollutants travel much further and persist much longer than originally anticipated (e.g., chemicals manufactured in the industrial world have been detected in concentrated form in the organs of Arctic and Antarctic fauna). Second, air pollutants and their effects can be persistent and extend over various temporal scales. For example, CFCs that are relatively inert at ground level react synergistically with other compounds in the upper atmosphere where the rate of ozone regeneration is much slower than its consumption.

As demonstrated, air quality issues are significant at a variety of scales. However, and despite the counter-arguments of the automobile and petroleum industries, Canadian

cities are ever more at risk. Car registration continues to escalate, the average size of road vehicles continues to increase, distances traveled per person continue to get longer, public transit modal shares are falling, and the inter-city trucking of freight has increased at the expense of rail (Neville, 1997). Planning-based strategies for reducing air pollution include the maximization of mixed-use zoning (to reduce automobile use), densification (to increase walkability), public transit and other multi-modal transportation strategies (e.g., prioritization of support for walking and cycling). Hierarchy theory is useful in exploring the scales at which each air quality issue is expressed.

- **Water Quality Strategies**

"The largest source of water pollution is air pollution" (Estrin and Swaigen, 1993: 466). Since air is transregional, a city may be experiencing water quality problems from sources far outside its jurisdiction. Therefore, water quality strategies need to be considered in tandem with air quality strategies. Although many aquatic contaminants are found naturally (e.g., arsenic, lead, mercury or uranium), others like PCBs or DDT are entirely generated by human processes. Many of the contaminants in today's water are toxins in yesterday's workplace. Consequently, the impacts on human health of some contaminants are well understood. Conversely, water quality phenomena like *cold condensation* — where contaminants condense because evaporation rates are suppressed due to lower temperatures — are more current and have only recently begun to be investigated (Spears, 1998).

Water-based strategies need to be concerned with both quality and quantity and can include the following: water use education; water pricing; planned improvement for

existing wastewater treatment options (e.g., if the municipality currently has only secondary sewage treatment, then the plan should address how getting tertiary treatment will be facilitated); strategies for stormwater management; policies for increasing the amount of coverage of treated areas; and policies supporting the treatment of snow dumps. Not surprisingly, many of these options are Promethean in nature (i.e., technology-based). For example, Nebel (1990) identifies state-of-the-art landfill siting and construction design criteria that can be mandated (e.g., landfills should be on high ground above the water table; an impervious barrier is employed; leachate is collected and treated; and surrounding water quality is monitored).

Hierarchy Theory Input

According to MOEE and MNR (1993b: 4), "the primary boundary for an ecosystem approach to land use planning should be the watershed." The employment of the watershed as a planning unit is based on several critical observations, namely that the watershed is a basic building block of:

the hydrologic cycle as the pathway that integrates physical, chemical and biological processes...water continuously moves through watershed and influences numerous life cycles and physical processes throughout its cycle. An action or change in one location within a watershed has potential implications for many other natural features and processes that are linked by the interactive movement of surface and ground water (MOEE and MNR, 1993b: 4-5).

Watersheds and their tiering continue to be the appropriate ecological boundaries to structure water quality research and problem-solving. Since water quality issues are transboundary and a regional response is considered necessary, standardization of water quality policies across a metropolitan region is mandated — so that some local municipalities are not able to circumvent comprehensive standards.

- **Resource Conservation Strategies**

"A baby born in the United States will consume during its lifetime twenty times as much of the world's resources as an African or an Indian baby" (Sagoff, 1997: 80). Similarly, land and water conservation strategies are a response to a Canadian myth: that land and water are available in unlimited supply. In fact, "between 1961 and 1975, Canada lost more than 3.5 million acres of farmland [to urban uses] — the equivalent of the size of Prince Edward Island" (Sparrow, 1984: 4).

Similarly, water conservation is also an important policy/plan consideration and is the supply-side dimension of the water issue (the other dimension being water quality). Canadians are the second highest per capita users of water in the world (Environment Canada, 1991). For Canadians and most of world, water has many important uses: drinking, recreation, agriculture, habitat for biodiversity, and industry (e.g., cooling). The challenge for municipalities is to find ways to minimize the waste of clean water resources and increase the supply the clean water (in this latter sense, policies supporting water quality are critical).

Resource conservation is also directly related to waste minimization. Waste, in this context, refers to both solid and liquid waste. Waste minimization, as the output dimension of ecological footprinting, involves the efficiency and effectiveness of the metropolitan throughputs of resource inputs (Wackernagel *et al.*, 1997).

Waste minimization is specifically related to resource conservation strategies (i.e., the fewer resources used, the less waste resulting). Just as there is a solid waste crisis (e.g.,

finding new ways and locations for disposal) in this country, there is also a wastewater crisis (Sinclair, 1987). For example, municipal sewage treatment has not kept pace with urban growth rates. Similarly, rural sewage treatment (septic tanks and septic tile systems) are proving to have disastrous effects on local ground and surface water.

Overall, there are three primary types of strategies for addressing waste: behavioural changes, working with nature, and technology. The full range needs to be employed in an ecosystem-based municipal plan. Recycling is a behavioural change with profound implications. For example, "if 50% of a resource is recycled every time it is used, then the effective size of the available stock is doubled. An 80% recycling rate increases the effective stock five times" (Young, 1992: 61). Important plan-based strategies for waste minimization target human behaviour (e.g., education, recycling). Strategies involving working with nature may also reduce waste (e.g., using wetlands for sewage treatment and aquatic flowers to detoxify water). Technology-based solutions may also reduce the impact of waste (e.g., improvement of existing sewage treatment facilities).

Hierarchy Theory Input

Resource conservation strategies contribute to the minimization of a municipality's ecological footprint. If available natural capital is maintained or even enhanced, then an urban ecosystem has a greater likelihood for hierarchical stability over *ecosystem time* (Constanza *et al.*, 1997; Pimm, 1997). More specifically, resource wastage and contamination provide barriers to the horizontal and vertical integration of holons. Hierarchical control is compromised when inefficiencies (e.g., over-use of non-renewable resources) are introduced into the system. "The loss of these [hierarchical] controls at any

level is usually malignant for the organization under that level" (Pattee, 1973: xi). Resource conservation strategies should be implemented at the regional scale (n) in order to facilitate super-imposition over the $n-1$ holons.

- **Biodiversity Strategies**

Evolution is a strong contributor to biological diversity (see Kaufmann, 1995), which is represented by "the forms of life that can best survive the variety of conditions currently found on the earth" (Miller, 1997: 68). According to Miller (1997), biodiversity is three-dimensional and includes: (1) **genetic diversity** (the genetic variability among individual within each species); (2) **species diversity** (the variety of different species); and (3) **ecological diversity** (the variety of ecosystems).

Hierarchy Theory Input

Human beings appear to enjoy the diversity of life forms. Consider, for example, Wilson's (1984) biophilia hypothesis. Biophilia applies a distinct human value to biodiversity (i.e., human pleasure or appreciation related to the environment). Conversely, in hierarchical terms, biodiversity serves its own intrinsic function — complexification. The more complex the system, the more likely that some elements within it will be resilient to environmental change over time. This observation holds for each of the three dimensions of biodiversity.

Planning for biodiversity should occur so that each of its three dimensions is addressed. Hierarchy theory provides a basis for spatio-temporally organizing the planning tasks. At the ecosystem level, "efforts at maintaining biodiversity should be directed at maintaining

the total diversity of the landscape over multiple generations" (Norton and Ulanowicz, 1992: 249). At the species level, the protection of biodiversity is best executed at the landscape ecosystem level, since maintaining habitat supports species biodiversity. At the genetic level, planning has little to contribute because of its jurisdiction — only that diverse communities are more likely to result in vigour. Mixed-use zoning and its accompanying spatial diversification makes these areas more likely to survive over ecosystem time.

At the ecosystem level, the opposite of biodiversity is monoculture. By concentrating agricultural productivity into monoculture, agro-ecosystems become more brittle. Essentially, monoculture is "more prone to shift into a new steady, functional state...such new stable states are almost always less desirable for humans" (Norton, 1995b: 230). By analogy, less diverse human communities are equally brittle if they become too specialized. Resource-based towns (e.g., mining towns) are subject to the volatility of national and global economies. For example, Elliot Lake in Northern Ontario experienced the boom-and-bust cycle of the uranium industry for several decades (Tunnock, 1998).

- **Land/Water Rehabilitation Strategies**

The rehabilitation of degraded ecosystems appears to be a largely overlooked topic in the planning literature (see Tamminga, 1996). Yet,

the need for restoration is one of the most important environmental issues of the day and is a consequence of many factors including a growing awareness of the role of natural processes in urbanization, its connections to sustainability and the quality of life, and community concerns and commitments to healing environmental ills of the past (Hough *et al.*, 1995: 2).

Since the need for rehabilitation is well-founded and understood, one possible explanation for the lack of action is that the implementation of rehabilitation strategies is neither well-developed nor well-documented.

Hierarchy Theory Input

"Ecological restoration consists of re-establishing biological diversity and resilience to land and its life processes that have been seriously disturbed or destroyed, usually by human intervention" (Hough *et al.*, 1995: 2). As such, the hierarchy-related arguments for biodiversity and ecological footprint hold as well. The degraded landscape (land, land cover, and water) is compromised in terms of its biological productivity. Hence, its ability to complexify is also compromised. As established, complexification is a cornerstone of evolutionary speed and ultimate success.

- **Natural Disaster Strategies**

Natural disaster planning has a long tradition in urban and regional planning. Available strategies address the following: flood plains, unstable slopes, avalanche threat, falling rock, earthquakes, icicle formation, and ice and other storms, etc.

Hierarchy Theory Input

Hierarchy theory views natural disasters in a specific way. Natural disasters or perturbations (e.g., fire, draught, flooding, earthquakes) are generated by the context of the system. They are an input from outside the normal functioning of the hierarchy. And,

Only systems that are large relative to their perturbations maintain a relatively constant [hierarchical] structure...the Caribbean Islands are small compared to hurricanes and cannot avoid being constrained by these events. On the other hand, the Appalachian Forests are large compared to the average wildfire and are relatively constant in composition over time (Jorgensen, 1992: 214).

Sometimes the perturbation is even beneficial to the holon, since it induces a new configuration to the hierarchy. However, when the destruction of human property is involved, value systems dictate that the effects of natural disasters require minimization. The *design with nature* principle (e.g., recognize the importance of topography to development) is particularly relevant to this context.

- **Socio-Cultural Strategies for Sense of Place, Livability and Local Pride**

"Simply put, place matters. We are spatial creatures, and much of the business of our existence occurs in the tangible, morphologic world. Landscapes, organisms and entities are what we sense and interact with most directly" (Vasishth, 1996: 1). Scale and context, in combination, contribute to the appreciation of place (Figure 5.3).

Hierarchy Theory Input

An inherent dimension of *sense of place* is that it requires the "adoption of an appropriate sense of scale for interpreting events that affect one's experience" (Norton, n.d.a: 5-6). A sense of place, in some ways, develops from social learning. And, as the sense of place develops, the individual may be less likely to harm it due to a sense of belonging and interconnectedness with other holons at the same level. As the lower-level behaviour becomes more informed and behaves accordingly, the system begins to gain inertia that

Figure 5.3. The Importance of Context to Perceived Scales.

In this figure, both monsters are exactly the same size and have the same facial expression. Nevertheless, cognitive cues for scale and interpretation make the monster being chased appear smaller and frightened. Meanwhile, the chasing monster appears bigger and menacing. The context makes the difference in the interpretation.

Source: Ahl and Allen, 1996: 182.



may ultimately impose a new more complex constraint level, thereby improving the probabilities for the urban ecosystem's survival and excellence.

Conversely, "if there is too much development of any one type of structure [within the hierarchy], the system becomes overextended and brittle...inevitably then, human management strategies that focus on maximizing or minimizing some aspect of these systems will always fail" (Kay and Schneider, 1994: 35). These observations stress the importance of sense of place to hierarchical stability. The reach of a developing sense of place in a community is initially horizontal across holons, but its effects can be vertical.

Rational Content

In this evaluation context, *rational content* reflects Alexander and Faludi's (1989: 128) use of the term *rationality* where "rationality means the superiority of a proposed course of action over its alternatives." In other words, rational content involves plan characteristics that are superior to their alternatives. More specifically, rational content means that content conforms to certain normative requirements and benchmarks (e.g., *consistency* is superior to *inconsistency*). If something is rational, it is logical. There is a wide range of attributes grouped under rational content, but they all share one dimension: they are the consequence of decades of planning experience, and are indicative of best planning practices. Furthermore, as rationally-based axioms, it is illogical to argue for their opposite.

Hierarchy Theory Input

The evaluation criteria related to rational content are stated such that their alternatives would be irrational. Many of them are self-evident. In some cases, hierarchy theory can be used as a framework for justifying their relevance. For example, if the plan is incomplete (e.g., important issues are ignored), then the municipality may become vulnerable to surprise (unexpected and perhaps unfortunate events). Environmental conditions can change rapidly, and if there is no identified planning response, the hierarchy can quickly become brittle. Further, if the plan is incoherently organized or inconsistent, it can contribute to the lack of authority of the plan and contribute to a breakdown in the integrity of the urban ecosystem.

- **Completeness**

In this context, completeness refers to the "reasonable acquisition and use of available knowledge and information, and the 'design' and evaluation of alternative courses of action" (Alexander and Faludi, 1989: 135). In other words, all the issues that are relevant to the planning context must be addressed (Baer, 1997). The ecosystem approach has a wide reach concerning topics that need attention. Moreover, all of the topics identified as *necessary* for this evaluation instrument should have been considered.

On the other hand, hierarchy theory can also be invoked to address omission. For example, in the National Capital Commission's *Plan for Canada's Capital*, there is no mention of the possibility of Québec separating from Canada (NCC, 1998). Given the recent results of the most recent referendum on Québec's potential separation from Canada, the separation issue remains an important one — yet the plan did not address it.

This is a profound oversight that was possibly imposed in the interests of political expediency. If this is the case, hierarchy theory can be used to suggest that by recognizing the possibility of Québec's separation, the activity of doing so actually increases the likelihood of it happening by contributing to the destabilization of the *status quo*. In situations like this where the potential for self-fulfilling prophecies may play a role, hierarchy theory does not provide a uniform or unambiguous platform to guide decisions.

- **Hierarchical Framework of Vision, Planning Principles, Issues, Goals, Objectives and Policies**

A requirement for a hierarchical framework of plan content is related to consistency. A hierarchical framework facilitates consistency by asserting traceable linkages of causation or influence between levels. Establishment of the causal links supports consistency and minimizes contradiction.

For example, the vision is the most general statement of values to be pursued by the plan. Plan principles are related to the vision and provide a normative context for plan content. Issue identification itemizes the problems and opportunities facing the municipality. Goals address the issues and objectives reveal targets that contribute to the achievement of goals. Finally, policies provide the strategies and actions that facilitate the achievement of the objectives (Thompson and Strickland, 1984).

Hierarchy Theory Input

Moving from the most general to more specific represents the basis of information storage, retrieval and assimilation (Wellar and Harris, 1992). For example, computer

programmers employ a hierarchical structure in software development. They break the large problem down into a series of simpler steps, break those steps into a series of smaller actions and so on — until the problem has been sufficiently decomposed into actions that are simple enough to be expressed using the *primitives* of whatever programming language is employed (Peters, 1998: Pers. Comm.). Computer languages themselves support this hierarchical layering by necessitating *nested* subroutines.

- **Consistency**

Consistency refers to the "logical consistency in the data, methods used in their analysis and synthesis, and strategies presented in the conclusions and recommendations" (Alexander and Faludi, 1989: 135). In other words, a system/framework of axioms or statements is consistent if no contradictions can be derived from it (Lacey, 1986). Consistency among the vision, plan principles, goals, objectives and policies increases efficiency.

Hierarchy Theory Input

Consistency is a function of efficiency. If an ecosystem is functioning inefficiently, it will eventually be replaced by a more efficient ecosystem-type or composition, or be destabilized.

- **Vision Reflects a Representative Range of Relevant Groups/Interested Parties**

The primary question of a visioning exercise is this: how does the municipality envision itself in the future? Prosperous? Safe? Green? Fiscally-sound? If the visioning exercise is

part of the planning (or plan evolution) process, then it is appropriate that the participant groups/interested parties are representative of the community.

Hierarchy Theory Input

While it is possible that an elite may speak for a community, the $n+1$ level needs to be supported by n or dissensus can ensue over ecosystem time. If the vision is not a representative one, then the component holons are more likely to express their discontent as trends among cohorts.

- **Ethically- or Scientifically-based Principles**

Planning principles require a rationale. Typically, principles are derivative of either science or ethics (values). Scientific principles receive their authority from induction (e.g., generalizations from some to many, and many to all) and ethical principles get their authority from cognitive processes and deduction. A planning principle without an underlying rationale lacks authority.

Hierarchy Theory Input

If the principles do not have an ethical or scientific rationale, then what is their basis? Suppose a community in the Niagara Escarpment, endowed with Class 1 agricultural land, decides that it wants employment growth (and development) more than anything. Is this a rational planning decision? Hierarchy theory would say *yes*, in the short term, because the community is getting what it wants and this contributes to stability. But, hierarchy theory can also provide insight into the ramifications of such a decision over various temporal scales. Hierarchy theory could be used to argue that in terms of long

term sustainability, the non-agricultural use of Class 1 agricultural land is not supported over ecosystem or deep time, and should be considered a short-term possibility only if it represents community values and can be mitigated (through social learning, restrictions on the amounts permitted to change use, etc.).

- **Issues Are Both Opportunity- and Problem-based**

Issue identification is a component of the rational planning model that continues to underlie planning practice in Canada (see ASCE, 1986). Traditionally, planning issues have been problems (e.g., incompatible land uses, pollution, traffic congestion). However, every municipality is assumed to have its own resource endowment and idiosyncracies, and as such, also entertains its own spectrum of opportunities (Wellar, 1994; 1987). It is as important to plan for opportunities as it is to attempt the amelioration of problems.

Hierarchy Theory Input

As Spinoza remarked in the 16th Century, "nature abhors a vacuum." Opportunities, if they increase the probability of increased complexification, can be supported by hierarchy theory. The more complex the urban ecosystem, the more likely it will be able to withstand negative environmental signals transmitted by its context.

- **Goal Clarity**

"Goals are statements of directions in which planning or action is aimed. They derive from human values and as such are ethical" (Eddison, 1973). Similarly, Berke and French (1994: 238) suggest that goals "represent general aspirations, problem alleviations, and

needs that are premised on shared local values." In other words, goals should also include opportunities.

Goal clarity has two primary dimensions: specificity (e.g., specifiable relationships to the goals that support them as well as to the issues that the goals address) and lack of ambiguity. Clearly defined goals are a critical dimension surrounding the evaluability of municipal plans (Palfrey *et al.*, 1992: 24). If the goals are vague or ambiguous, there is no way to address whether plan policies and programs have any likelihood of being successful or of being implemented. As well, budget requirements can be made explicit when the goals and their supporting objectives are specific (Palfrey *et al.*, 1992). Overall, goal clarity will make performance appraisal of the plan and its implementation easier.

More importantly, clearly defined goals are critical to achieving compliance (Dalton, 1989). If the plan's goals are vague, how are private and public developers to know how to interpret them? If the wording is vague, then it is arguable that proposed developments can be or will have to be similarly vague (Wellar, 1990a). In a related sense, goal clarity can contribute to the minimization of government corruption in a transparent planning system since it provides less room for discretionary decisions (Dalton, 1989). As well, "clearly defined goals, which are translatable into objectives that can be monitored, are important" (Alexander, 1986: 85). In other words, goal clarity contributes first to the formulation of explicit objectives, which becomes the foundation of the monitoring process. Finally, goal clarity contributes to the overall authority of the plan. If the goals are clear, plan amendments will less likely be required in contentious development contexts (Dalton, 1989).

Fishman (1978) asserted that superior plans contain specific goals that are linked to local conditions rather than to vague motherhood statements that are non-substantive and not grounded in the municipal context. In a study of ten Florida land use plans, Connerly (1990) found that the most successful plans (e.g., plans that were actually used) contained goals that were clearly stated and revealed how the goals were to be achieved. In other words, objectives that are measurable should be used as tools of goals achievement. Goals can be regarded as the *ends*, and objectives are a dimensions of the *means to the ends*. Wherever possible, the objectives supporting goals should be: explicit; specific; measurable in reality rather than in theory; scheduled (on a timeline); prioritized; owned (by a worker, team or department); related to each other and communicated (Palfrey *et al.*, 1992).

Hierarchy Theory Input

If the goals of the plan are unclear, then the constraint level ($n+1$) for planning becomes unclear. And, since a lack of clarity contributes to hierarchical instability, then clarity becomes a central manifesto for lucid planning. Information barriers transmitted horizontally and vertically result in the inefficient use of resources.

- **Obtainable but Challenging Objectives**

While plan goals represent specific end-states, objectives are the measurable components of goals. If the objectives are too difficult to achieve, they will be unpalatable and frustrating for both planning staff and the relevant groups. However, if they are attainable but challenging, they can become a strong motivator for change (Palfrey *et al.*, 1992). If

the objectives are not challenging, then the plan can be considered a mere instrument of the *status quo* (Law-Yone *et al.*, 1990: 142). Thompson and Strickland (1984) specifically identify challenging objectives as a policy priority. In a community experiencing little growth pressure or out-migration due to economic recession, a *status quo* plan may be all that is politically feasible. However, it is doubtful that a *status quo* plan could ever be considered a good one since it appears fair to say that there is always room for improvement in Canadian cities.

Hierarchy Theory Input

Surviving evolutionary processes is a challenge. By definition, no species can survive without competition (or, in the possible case of the human exception involving endowed wealth, without competition to *maintain* wealth). If all species could do it, then all species would survive. However, some species have an evolutionary destiny (e.g., humanity) that is largely predicated on work or effort. Without work, the species cannot feed itself, support itself, protect itself, or reproduce itself. Stability of the human hierarchy is predicated on human effort.

- **Operationalization of Planning Objectives Through Policy**

Policy is "a course of action or inaction chosen by public authorities" (Pal, 1987: 10). In other words, policy represents how objectives and goals are to be achieved. More specifically, objectives are made operational by having policies that support them and objective-oriented policies help to prevent the organization from drifting (Smith and Wellar, 1992).

- **Action- or Strategy-based Policies**

A policy should be a statement of how a goal or objective will be accomplished. Berke and French (1994: 238) state that one of the characteristics of quality plans is that "policies are specific and action oriented in achieving plan goals." In other words, policies should demonstrate *how* goals will be accomplished. Policy instruments (e.g., zoning, site plan control, infrastructure programs, environmental assessment) "are the specific means whereby a policy, as a response to a problem, is implemented and has effect" (Pal, 1987: 13-14).

Hierarchy Theory Input

Nature is characterized by energy flows and transactions, and the laws of thermodynamics regulate its operation (Miller, 1997). If policies have no relevance in terms of activity, then they are moot. Further, a policy that merely specifies an end-state without a means of accomplishment is, at best, of limited productive purpose since it does not assist in deciding how to achieve this end-state.

- **Science- and/or Ethics-based Land Use Designations**

Land use designations (i.e., zoning) should have a rationale beyond the separation of incompatible land uses and the combination of compatible land uses. Otherwise, context-related opportunities can be overlooked. Zoning should reflect available scientific knowledge of the planning area (e.g., identified wetlands should be protected).

Zoning should also reflect ethical values such as equity. Proposals that are characterized as NIMBYs (Not-In-My-Backyard), LULUs (Locally-Unwanted-Land-Uses) and

BANANAs (Build-Absolutely-Nothing-Anywhere-Near-Anything) — such as homeless shelters and waste disposal sites — should be distributed fairly throughout the urban ecosystem, rather than concentrating them in low-income areas (Rose, 1993).

It is, after all, unethical to consistently allocate society's *problems* to those areas that are least able to achieve redress in the legal, quasi-legal, or political arenas. Similarly, areas with detached homes on large lots do not require as much open green space as high density residential areas. The equity-based explanation for this is twofold: first, private green space provides many of the functions of public green space; and second, owners of detached homes on large lots may be more likely to own a means of transportation which gives them access to recreational green space located at a distance.

Hierarchy Theory Input

Nature operates under various laws and rules, including those of gravity, thermodynamics, evolution, energy efficiency, and hierarchy. Human society, if it is to persist, must also operate under analogues. And, since human society exists within the context of nature (e.g., flora, fauna, land, water, air, etc.), it follows (by definition) that human society also operates under or is affected by those and related analogues. Otherwise, society is working against nature and therefore becomes inefficient.

If zoning does not have an ethical or scientific rationale, then what is its basis? Can a planning agency be allowed to arbitrarily zone according to one time scale (e.g., the short run) at the expense of another scale? Ideally, zoning should support ecosystem time (or

better, deep time) while meeting the needs and values of the community. If it does, then it increases the likelihood that the life support systems supporting humanity will endure.

Recognition of the Legal Requirements Facing the Plan

Legality is a cornerstone of planning. The importance of the extent to which plans fulfil the intentions of legislation is noted by Khakee (1994). For a plan to have authority, it must itself be legal. Otherwise, the courts may be used by relevant groups to supplant due process with their own agendas.

Hierarchy Theory Input

The essence of governance is its operation as an $n+1$ holon. Government is a constraint level and imposes order on the trends among cohorts at the n and $n-1$ levels. If laws are disobeyed, then entropy is introduced into the behavioural trends of society. Laws, backed by sanction, contribute to hierarchical stability. If the plan is not legal in terms of higher-order constraints, then instability is introduced into the architecture of the planning system. In their evaluation of alternative regional plans, Shefer *et al.* (1997) employ compatibility of lower tier plan with higher tier plans as an evaluation criterion. Doing so minimizes friction between hierarchically-organized bureaucracies.

- **Substantially Exceeds the Minimum Requirements of the Law**

In Canada, a municipal plan must respect and meet the requirements of pertinent federal, provincial, and regional laws and by-laws. For example, an Official Plan in Ontario is required to meet the provisions of the *Planning Act*, the *Municipal Act*, the

Expropriations Act, the *Endangered Species Act*, the *Environmental Assessment Act* and many others. As well, lower-tier plans must conform to the provisions of upper-tier plans.

For some planning administrations, a good plan is one that merely meets the scope of the laws or jurisdictional directives that regulate it (see Colley and Lee, 1990). Nevertheless, the law provides the basic and **minimum** requirements for plan quality — assuming plans are mandated at all. Ideally, plans should attempt to transcend the legal baseline. Ultimately, a plan cannot be a good one if it is not legal (i.e., it is unimplementable if it is illegal and would be challengeable in court or in quasi-legal arenas like the Ontario Municipal Board). As McAllister (1980: 271) observes, "a proposed action that does not pass legal criteria for air quality, water quality, private property rights or rights guaranteed by the Constitution is automatically unacceptable, unless of course the laws are changed."

Strong Language for Priority Policy Areas

The strength of the language employed in the plan is critical. A basic observation concerning ecosystem-based planning is that it is not *status quo* planning. Plan policies are included to direct action, not to placate or obfuscate (Wellar, 1990a). In a general sense, the wording of plan content in the active voice is more vigorous than the passive voice and usually saves space in the plan (Leach, 1993). Furthermore, employment of the passive voice can obscure the agent* performing plan-generated activities and thereby decreases process transparency and agency accountability.

* Here is an example of the active voice: *Physicians sometimes make fatal errors*. In this case, physicians are identified as the agents of error. Conversely, the same sentence can be expressed in the passive voice: *Fatal errors are sometimes made*. In the latter case, the agent of the error is disguised.

Hierarchy Theory Input

Like the legal basis for planning, strong language provides an $n+1$ level or constraint level. If the language of the plan is not intended to be followed, then the plan cannot be a contributor to the support or enhancement of the hierarchy.

- **Strong Rather Than Permissive Verbs and Qualifiers**

In a study undertaken to investigate how to improve plans in California, Dalton and Burby (1994) used strong policies as an analytical premise. *Strong*, in the Dalton and Burby work, refers to required policy adherence rather than requested policy adherence. The importance of strong policy language (e.g., *must* rather than *should*; *no* means *no*) is that development proposals are more likely to be consistent with the policy platform. Furthermore, if an appeal is launched, then there is less doubt concerning the appropriateness of the proposal (Smith and Wellar, 1992).

Adaptive Capacity of Plan to Address Change

As Kent (1990: 79) observes, "no one should accept the plan as final and immutable." That is, because environmental, societal and economic variables evolve in a particular municipal context, it is imperative that plan content also changes. The adaptive/transformative capacity of the plan and the planning agency to meet change is particularly important when legislatively mandated plan revisions cannot be met by the municipality due to fiscal constraints (e.g., as experienced in many rural municipalities).

Voogd (1983: 14) observes that "urban and regional planning can be associated with continuous deliberations and negotiations. This means that the ideas and insights into the

planning objects are constantly changing." Ecosystem-based planning does not follow the traditional planning paradigm that focuses on land regulation for implementation. Ecosystem-based plans draw on a variety of plan implementation instruments, and this range of tools highlights the adaptive capacity of idealized ecosystem-based planning organization.

Flexibility is the "capability of the metropolitan system and the plans and policies for that system to respond or adapt to a change in conditions. Here, conditions are broadly defined as physical, social, economic, political and technological factors and characteristics" (Boyce, 1970: 122). Of course, it is another question entirely whether the agency itself is actually empowered or funded to employ the theoretical range of choice of tools at its disposal. As long ago as at least 1970, the flexibility to respond to changing conditions has been employed as an evaluation criterion for plans (see Boyce, 1970).

Hierarchy Theory Input

"The greater the number of intervening levels separating two scales of interest, the less will be the recognizable influence of lower-level behavior on a higher level in the system" (O'Neill *et al.*, 1986: 80). This means that the greater the distance between the lower level holons and the planning level, the less efficient planning is since planning tries to address the behaviour of the $n-1$ level (i.e., when the planning agency is regarded as n). By increasing the adaptability of plan content and planning agency responses, the urban ecosystem becomes more likely to survive over ecosystem time because planning can be regarded as an intermediate level holon. As established earlier, the speed with which evolution takes place is increased with intermediate-level holon stability.

- **Community/Relevant Group Empowerment**

If the community/relevant groups have been empowered to act in the planning process by such means as a public participation policy or an intervenor funding program, they will be more likely to bring evolving conditions forward as items for consideration (Wellar, 1989b). If the *n-1* level is not empowered, the hierarchy becomes brittle and vulnerable to catastrophe.

- **Mechanisms/Frameworks For Supporting Plan Evolution**

According to Kent (1990), plans should be amendable. Amendment enhances the organic character of a plan and permits it to evolve in concert with the community context. Furthermore, if the plan is rigidly maintained, it is more likely to be abandoned since it cannot meet the needs of the community.

- **Flexibility Given the Wide Breadth of the Tool Envelope**

Dalton and Burby (1994: 447) contend that "communities with more techniques in place had more potential for managing development successfully, because different techniques lend themselves to different situations." In other words, a range of implementation techniques increases the likelihood of the planning agency to adequately respond to changing municipal circumstances.

Hierarchy Theory Input

Conclusions reached at one scale can only be applied to other problems posed at the same level (Fox, 1992). This means that ecosystem-based plans must employ a wide spectrum of plan implementation techniques, since specific techniques may work at only one

spatial or temporal scale. Zoning, the central implementation instrument of land use planning, is extremely limited when regarded from this perspective.

By enlarging the scope of planning techniques available to the municipality, the likelihood of the municipality's planning process to be successful is also increased. Quite simply, having more planning techniques at their disposal makes the planning agency able to deal with a wider range of environmental information, and environmental contingencies.

- **Ability to Respond to Surprise**

The ability to respond to surprise (i.e., unexpected events or situations) is related to flexibility. Holling (1978) stresses the importance of prepared responsiveness in light of uncertainty about ecosystemic knowledge.

- **New Ways of Problem-Solving or Goals Achievement**

In order to be able to mitigate the consequences of surprise, the full spectrum of practical planning instruments should be considered. This permits the planning agency to examine and respond to the particulars of a surprise from all available perspectives. New ways of problem-solving are critical to all plans; otherwise, planning as a process does not evolve.

Hierarchy Theory Input

Once again, the municipality's exploration of pertinent planning instruments increases its ability to adapt or transform to evolving environmental information. Complexification of the planning toolkit increases the flexibility of a municipal response to surprise. Once

again, flexibility is the "capability of the metropolitan system and the plans and policies for that system to respond or adapt to a change in conditions. Here, conditions are broadly defined as physical, social, economic, political and technological factors and characteristics" (Boyce, 1970: 122).

Feasibility of Plan Implementation (Content Foundation)

"However good a plan, policy or programme may be...it will not be effective if it cannot be implemented" (Devas and Rakodi, 1993: 60). Leung (1989: 24) agrees by stating that "a plan is only as good as its implementation." As well, the Delphi panel reached perfect consensus on the necessity surrounding the feasibility of plan implementation. Devas and Rakodi (1993) suggest that there at least two dimensions to implementability — administrative capacity and political will.

Hierarchy Theory Input

A plan without implementation is, for all intents and purposes, (merely) a body of text, and an instrument of the *status quo*. Feasibility of implementation is analogous to the likelihood of an animal surviving in an evolving environment. If the plan is no longer current, then the planning agency may not be able to respond to evolving environmental information. Consequently, it cannot adapt or facilitate municipal transformation, making the municipality vulnerable to replacement by a new, less complex hierarchy.

- **Fact Basis**

A number of authors (Dalton and Burby, 1994; Berke and French, 1994) have stressed the importance of the *fact basis* supporting the plan. The fact basis is related to the complete

and accurate data provided in the plan, and the data in turn are the basis of the information derived through analysis and synthesis procedures (Wellar and Harris, 1992; Wellar, 1984). If the plan reveals non-transparent research or the application of inappropriate methodologies, then the fact basis and the conclusions drawn from derived information would be suspect, thereby compromising the credibility and authority of the document.

- **Plan Currency**

If the plan is not current (e.g., has not been updated or monitored), then it may not be reflective of evolving municipal circumstances. Plan currency is recognized by Dalton (1989) as an element affecting the perceived implementability of the plan. Recent plans are more reflective of current municipal conditions and therefore more implementable. There are many conditions when plan currency may be a specific issue: when the plan itself is old; the provincial planning act or policy statements supporting the act have been updated or revised; upper tier plans have been revised; a new council has been voted in; new economic development activities have arisen; new large development projects are being initiated; and/or the municipal boundaries have been altered (MMA, 1988).

Some authors (e.g., Kent, 1990) suggest that a plan should be less than seven years old. In fact, the measure of seven years appears to be arbitrary. The notion of *currency* would appear to be municipality-specific and depend on a number of factors related to the rates at which the municipality's three systems (biophysical, infrastructural and built) are evolving.

- **Acceptable Synthesis of Different Public and Private Agendas**

Who are the relevant groups? In a pluralistic society like Canada, the presence of a homogenous like-thinking public at the regional, city or neighbourhood level is unlikely. Hence, "in the management of every proposed action, we must deal with many different publics, each with its own special interests and peculiarities" (Jain *et al.*, 1993: 224). The challenging dimension of this criterion is the definition of the term *acceptable*. Acceptable, in this context, suggests that alternatives have been explored and, if agreement has not been reached, then the decision supported by the best planning rationale should be made.

To illustrate this point, consider the contentious issue concerning the enlargement of the Champlain Bridge between Ottawa-Carleton and the Outaouais. It is possible that this situation cannot be resolved through negotiation and litigation. The vested interests are entrenched, and there is no easy solution except to build a bridge elsewhere (e.g., in Orleans or in Kanata or beyond). However, building the bridge outside the Greenbelt will likely promote sprawl on both sides of the river and sprawl cannot be supported with a planning rationale. The planning rationale for building or not building a new bridge in the core area of Ottawa-Hull should take precedence.

- **Implementation Strategies Involve Community Participation**

Community participation is a double-edged sword. On the one hand, if the community is made responsible for its own destiny, then implementation will more likely be carried out to the community's satisfaction. On the other hand, communities are as subject to internal division as they are to cohesion and community-based implementation can be fractious.

Nonetheless, plan implementation tools that can be employed with community participation include the following: information gathering (making an inventory of environmental resources); education; restrictive covenants; land trusts; public/private partnerships; conservation easements; and site rehabilitation (Skibicki, 1993; Schwarz, 1993; Poole, 1992).

Effective Communication of Planning Information to Relevant Groups

"The word *communication* comes from the Latin word *communis*, meaning common. Thus, for successful communication we are trying to meet on common ground" (Treece, 1983: 24). Effective communication of planning information concerns the effective transmission of planning information to the intended recipients (e.g., optimization of transmission and minimization of potential impediments to transmission). *Effective*, in this context, is defined to be "the degree to which the [planning] organization — or part of the organization — is achieving its objectives" (Palfrey *et al.*, 1992: 86). A planning agency employing the ecosystem approach will be interested in engaging all the relevant groups (Tomalty *et al.*, 1994a). To do so, effective communication of planning information needs to be facilitated and this means communication in terms of words, graphics and numbers (*writing* and *graphics* are addressed in subsequent sections).

Although Canada has the highest literacy rate in the English-speaking world, "over one-third of the workers in Canada (36%) possess marginal literacy skills" (Crompton, 1996: 14). This means that more than a third of Canadian workers have "limited capabilities" in terms of reading, writing and numeracy. Recognizing this observation, the platform

requiring the effective transmission of planning information is established. In support, Lamont (1990: 357) suggests that:

the strength and longevity of a plan as a community policy guideline is embodied in the validity of the plan's ideas and in their expression. Clearly, if the concepts are not communicated so that people can understand them, decide if they agree or disagree with them, and embrace the result, the plan will never achieve credibility.

Effective communication of planning-related information is also important to the educational capacity of the plan and the planning process. Ideally, the plan "stimulates people to think about their city and its future. It is an extremely valuable tool in making possible effective, responsible citizen participation in local self-government" (Kent, 1990: 87). Without effective communication, the educational and debate facilitation capacities of the plan are lost.

Hierarchy Theory Input

Through information feedback, living systems are able to adjust and adapt to changing environmental conditions. If the transmission of environmental information is ineffective (i.e., impeded), the system becomes vulnerable until the point is reached where a threshold to a new information requirement is passed, and catastrophe or system debasement ensues. Similarly, if the transmission of planning information is impeded by poor writing or inadequate exposition, then the relevant groups are unable to effectively understand and react to the proposed plan or anticipated future environment.

Insight into the hierarchical organization of information is provided by computer programming. As stated,

computers and notions of hierarchy have a reciprocal relationship. The machines are at once son of and father to the development of hierarchy theory. On the one hand evolution of computer technology has certainly incorporated hierarchical form into the construction of both hardware and software. On the other hand the development of a general theory about hierarchies has in turn been facilitated by computer-assisted summary and modeling (Allen and Starr, 1982: 5).

Both software and hardware are based upon hierarchical design. If the code (supporting a computer program) is not hierarchically organized, the program would quickly become inefficient and impractical (Peters, 1998: Pers. Comm.). This suggests that information storage, retrieval and transmission should also be organized hierarchically because there can be efficiency-based benefits for doing so. Similarly, Holleb (1969: 82) suggests that:

the information system for urban planning...should embrace social and economic data for the metropolitan area as a whole since it is the functional urban entity. Such data, however, must be in a form that can be broken down and tabulated by municipalities since most policy questions in planning are decided by the separate local governments.

Hierarchy can also be used to investigate language and grammar.

In a hierarchical model, nouns and their articles are grouped together and then subjects with verbs. Ideas are contained in phrases and so on. This allows for the construction of many sentences all with the same meaning, merely by rearrangement within the rules of association set down by the allowed classes. It also allows predictions as to the changes in meaning that would follow from certain changes in word order: 'The dog bites the man' and 'The man bites the dog.' The rules of the hierarchy give a very general although perfectly accurate account of the sentence and its intended meaning (Allen and Starr, 1982: 16).

Consequently, hierarchical analysis is also applicable to the structure and function of written and spoken communication.

- **Well Written**

A well written text is a rudiment of any good plan. It makes reading less arduous and increases the authority of the document (e.g., a poorly written document would unlikely be inspirational in societies that demand excellence). Similarly, "it is all too easy to obscure critical issues with poor organization and writing" (Ross, 1987: 143). Of course, the notion of a document being well written is, to some extent, subjective, since stylistic dimensions may play a role. For a quantitative basis for the examination of writing, the Flesch Reading Ease Scale defines *readability* as a function of sentence length and the number of syllables per word (see Gallagher and Patrick-Riley, 1989).

- **Definition of Key Concepts**

According to Mayda (1996), the employment of precise language is an important foundation for professional concepts and analysis, and represents an element of good writing. Consequently, all technical and/or specialized terms must be clearly defined somewhere in the plan text (Elkin and Smith, 1988). The employment of definitions introduces clarity into subsequent discussions about plan content and facilitates their consistent application across a range of contexts. More importantly, the definition of key terms should facilitate the discrimination between methodologically-derived facts and subjective judgments on the part of plan authors.

- **Use of Plain Language**

The employment of plain language in public documents has received considerable attention in the United States (e.g., Christ and Pharr, 1980; Barry, 1980; Klare, 1976). In more than half of American states, so-called *plain English laws* have been enacted to

protect the rights of the American consumer in such activities as banking, purchasing insurance, and buying products with warranties.

Similarly, in the interests of reaching a wider audience, newspapers are generally written between the sixth- and tenth-grade levels. In their research on plan readability and the use of plain language, Gallagher and Patrick-Riley (1989: 87) conclude that "the strongest case can be made that plain language is written at or below the tenth-grade level. The average person would prefer simpler language, about the eight-grade level, and will accept more difficult text if motivated." This suggests that the use of plain language, both in terms of word use and grammatical structure, is critical for ecosystem-based plans to meet a wider audience.

The desirability of plain language suggests that planning jargon (e.g., street furniture, noise cones, pedestrian activity generators) should be avoided (Nelessen, 1994; Schibuola and Byer, 1991; Solnit *et al.*, 1988). If plan authors find the employment of jargon unavoidable, there are different strategies for lessening its overall impact: minimize its use; if employed, standardize its use in the document to demonstrate consistency in its different applications; and provide an explicit glossary (Shibuola and Byer, 1991).

Like jargon, obfuscation attempted through the employment of sophisticated vernacular should also be avoided (Leach, 1993). According to Wellar (1998; 1994) and Lash (1976), there are three general client domains for municipal plans: professional staff including planners, politicians (decision makers) and the public (which includes the public at large, special interest groups and developers). Ecosystem-based plans and the

background documents that form part of the planning dialogue should, therefore, be presented in whatever ways are necessary to reach the widest possible audience possible.

Gallagher and Patrick-Riley (1989) state that readability and plain language issues have penetrated other inter-subjective disciplines (e.g., law, economics, and engineering). However, this is not necessarily the case with planning. This suggests an anomaly since public participation is such an important mandated dimension of planning in general and ecosystem-based planning in particular. These observations do not necessarily suggest that plans should be written-down for weak readers — only that extra care should be taken in plan exposition (Voogd, 1983). Ultimately, it is important to recognize that "convoluted language hides fuzzy thinking...[and] is probably the biggest barrier to better communication" (Campsie, 1998: 28).

- **Animation/Friendliness of the Plan**

Animation of the plan (i.e., through the use of colour, art, graphics, cartoons, etc.) can be correlated with the friendliness of a plan. A text without graphic support remains just that — a text. Such a text lacks visual life and therefore the potential for engaging its audience. The plan "should be written and designed in a manner that will be both understandable and interesting to the average citizen" (Kent, 1990: 79). More importantly, engagement of the reader may lead to more time and consideration being given to the plan by the relevant groups, which is constructive to the ecosystem-based planning process. Ultimately, MacLuhan's observation is valid: "the medium does affect how the message is conveyed" (Campsie, 1998: 27).

- **Well-organized**

Superior organization of planning documents contributes to their lucidity and is accomplished by having an underlying rationale for organization (e.g., complex to simple). A logical progression of ideas can be verified by reviewing the plan's table of contents.

Hierarchy Theory Input

Nature is organized hierarchically. Hierarchies can be either nested or non-nested. The basic difference between the two types of organization concerns the relationship between the $n+1$ levels and the n and $n-1$ levels. Non-nested hierarchies (e.g., army generals and their officers and corps) are characterized by four characteristics of the upper levels (e.g., $n+1$). The upper levels:

1. behave at lower frequencies;
2. behave with less integrity;
3. offer context; and,
4. constrain lower levels (Ahl and Allen, 1996).

Conversely, nested hierarchies are those where the upper levels spatially and temporally contain the lower levels (e.g., ecosystems). In this sense, a hierarchically organized plan is nested.

Hierarchy theory states that higher levels can be used to predict the outcome of a given event on the lower level (Fox, 1992). However, it is more difficult to move in the opposite direction (e.g., bottom-up). For example, if something is known about a regional level phenomenon, then the effect at the local level can be more readily described,

explained or predicted. The analogical implication here is that information should proceed from the most general to the specific, rather than from the specific to the general.

Conversely, when information is presented in an unorganized fashion (movement between levels skips levels or confuses levels), it is more difficult for the reader to assimilate. And, as it becomes more difficult to assimilate, understanding is impeded and becomes more likely to break down. Ecosystem-based documents should, ideally, mimic nature. And, as Solnit *et al.* (1988: 143) state, "an easily read and referenced report is the result of separating information categories to the greatest extent possible. Where the information is labeled and set apart visually, commissioners [and other plan clients] can scan the whole report readily for a quick overview or concentrate on the parts that need more attention."

In other words, ease of locating information supports more efficient and effective use of plan contents. It maximizes the speed of information flow. According to Solnit *et al.* (1988: 143), "using headings indexes the information, making it easy to find." Tables of contents and indexes also contribute to the ease of finding information. Background reports should employ the same format as the plan since this creates an expectancy from document users to anticipate a particular type or style of presentation, and consequently prevents them from struggling with a new format each time they move into the background documentation (Solnit *et al.*, 1988). Overall, once the plan has been introduced, hierarchy theory suggests that plan content should begin with the environment (the planning jurisdiction) and then move to the holons nested within it.

- **Text Legibility**

Criteria for legibility or typography are as old as printing (Gallagher and Jacobson, 1993). Reproductions of the plan must be high quality (clear and clean) and the style and size of the font must be easy to discern by average visual capabilities. Text legibility is necessary. With poor reproduction or illegible fonts, information can be obscured and reading comprehension and enjoyment diminished.

Gallagher and Jacobson (1993: 100) observe that "the most readable size for continuous text...is 10-11-point type." Type that is too small fatigues readers. And, it makes the document "look cramped and uninviting" (Felker *et al.*, 1981: 77). The preferred type of text normally involves serifs (the little feet at the bottom of the letter strokes), much like the New Times Roman font used in this dissertation. "The serifs create a consistent horizontal direction at the end of strokes, which provide a visual pattern that helps the reader quickly distinguish letters" (Gallagher and Jacobson, 1993: 101).

Superior reproduction is also an important dimension of legibility. "Poor reproduction can make an otherwise well-typeset document unreadable, with a dramatic effect on legibility" (Gallagher and Jacobson, 1993: 103). Miscellaneous variables that might also be addressed include: line length, justification, hierarchical headings, highlighting, spacing, and margins.

- **Plan Availability in Relevant Languages**

Although most of the Canadian rural hinterland tends to be relatively homogeneous in terms of language (e.g., English-, French- or Aboriginal-speaking), Canadian urban

centres tend to be polylingual. For example, approximately 40% of the population of Toronto is foreign-born and immigration from English- or French-speaking nations has decelerated drastically over the past twenty years (Badets, 1993). Recognizing the social ecology of in-migration patterns (i.e., that new immigrants tend to cluster in neighborhoods), substantial portions of urban areas may be predominately characterized by non-Official Languages (Ley, 1983).

In some situations, the ramifications of social ecology may create a need for plans (or plan versions) to be distributed in various languages, which assists in transmitting planning information. If sufficient numbers of non-Official Language speakers live in an area, then this issue should be addressed. Otherwise, the dissemination of planning information is impeded.

- **Plan Conciseness**

According to Berke and French (1994), a key distinction between high and low quality plans is that high quality plans only contain the data and analysis that provide a foundation for policy platforms. Wellar (1994, 1989a, 1984) goes even further and puts heavy emphasis on synthesis as a means of achieving conciseness. He sets the need to focus on policy variables as the *bottom line* for policy platform documents and discussions. In other words, background details are found in supporting documentation. As Solnit *et al.* (1988: 144) observe, "the use of narrative should be restricted to sections such as the analysis and recommendations."

In a study of environmental impact statement (EIS) effectiveness, Ross (1987: 143) suggests that,

one of the common features of EISs which makes them less than the concise, readable documents they should be is information overload. The provision of excessive detail is probably a result of a perceived need to cover all the bases by including everything conceivably relevant; the result is bureaucratic paperwork, the net effect of which is nothing but obfuscation.

Ergo, in the interests of efficiency and effectiveness, the plan should be kept as concise as possible.

Plan conciseness is based on a number of platforms. First, the plan should focus primarily on vision, planning principles, goals, objectives, policies and monitoring. These are the primary content requirements of plans. Also, *need to know* rather than *nice to know* information should predominate (excluding margin notes and animation). Detailed background materials should be found in supporting documentation rather than in the plan text proper. This ensures that the plan does not become "the proverbial doorstep" (Pitkin, 1992: 8). Finally, it warrants noting that there is an on-going push-and-pull tension among the evaluation criteria of *conciseness*, *completeness* and *self-containment*. The challenge is to find the balance that works best for each municipality.

- **Self-containment**

The plan should exist as a self-contained entity on its own (Kent, 1990). If plan users are forced to go outside of the plan for critical or explanative information, then the efficiency of plan-related activities is diminished. The *self-containment criterion* is distinct from the *completeness criterion* discussed earlier, since it concerns the plan-related products that

should be actually included in or with the plan (e.g., in-text references, a bibliography, maps).

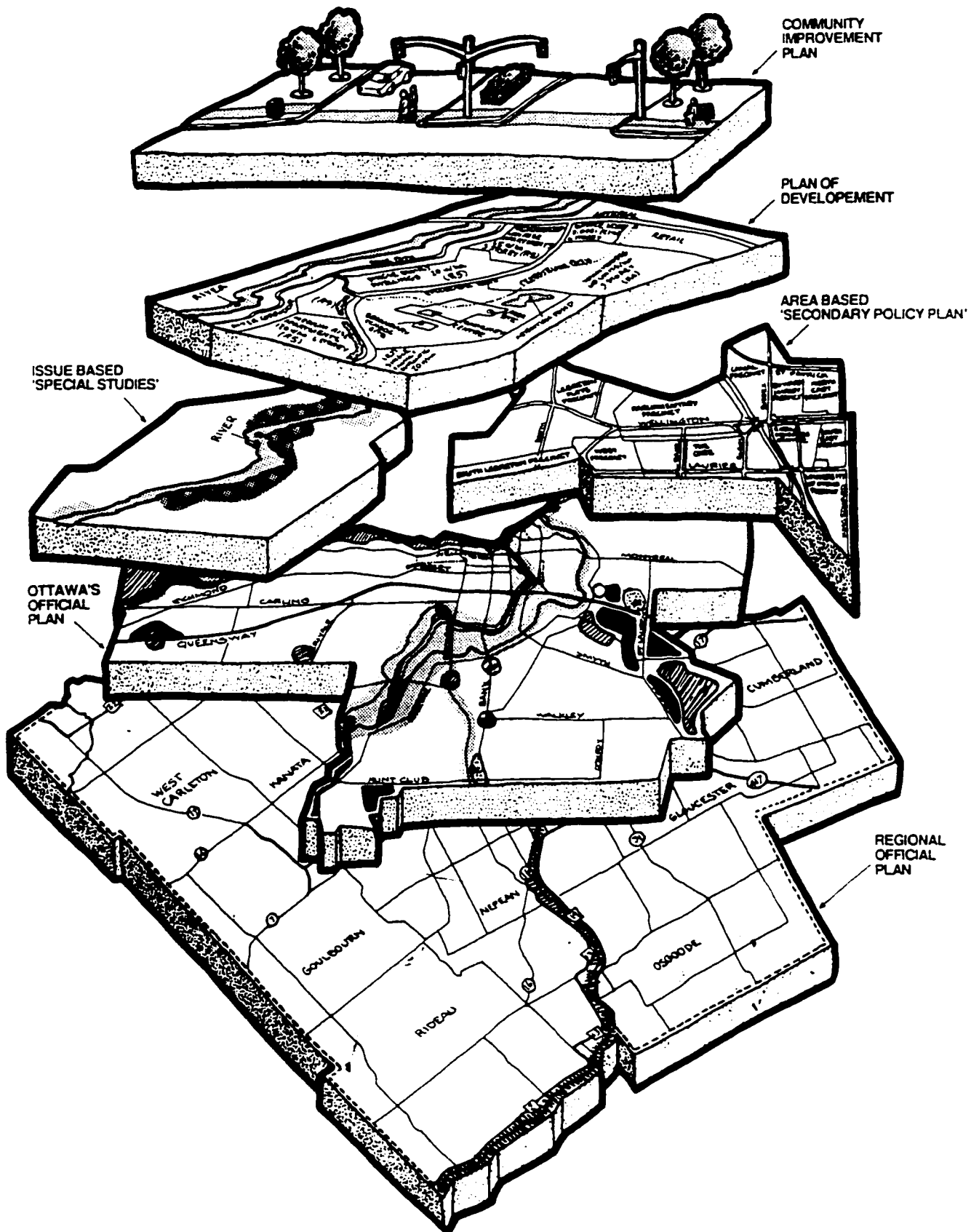
Effective Communication of Spatial Information to Relevant Groups Through Maps

Maps can greatly simplify what would take substantial text to express. In their discussion of watershed plans, Slater *et al.* (1994: 382) state that "it is essential for both the planning professional and for public consultation to have clear, referenced and problem-oriented maps." But, planning maps also serve more general functions like expressing a concept or demarcating jurisdictional or planning area boundaries (Figure 5.4). For all plan maps that have policy implications, the basics are assumed (e.g., legend, scale, identification of direction, map title, identification of source, etc.).

Hierarchy Theory Input

Hierarchy theory imposes a multi-scalar approach on problem solving and on the planning research that is undertaken. Plan maps should be approached in a similar way. They should detail the region at different scales appropriate to the issues being characterized. To focus on any one level of the hierarchy is insufficient (Grumbine, 1994). When working on a problem at any one level or scale, researchers and planners must seek the connections between all levels (e.g., the systems perspective). This provides holistic insight and ensures that maps can be cohesively inter-related.

Figure 5.4. Different Scales of Planning Maps.
 Source: City of Ottawa, 1989: 8.



- **Appropriate/Relevant Level of Map Detail**

In a study concerning how to achieve better communication in planning documents, Leach (1993: 26) observes that "predictably, the readers had little patience with reports that were cluttered with confusing tables and overly complex maps." Consequently, it is necessary to prioritize map detail.

- **Plan Maps Reflective of Policies and Policies Reflective of Maps**

Maps need to be formulated directly from the plan since the plan's background and policy platform is the basis of map content. However, in planning process iterations (e.g., feedback loops involving public consultation or among planners), the maps themselves may be used as the basis for planning dialogue. The (in)viability of some policies, indeed the contradiction among policy variables and policy objectives, may not become apparent until they are mapped. In such cases, the plan text needs to be updated or revised to be congruent with map revisions. In this sense, there should always be a demonstrably reciprocal relationship between the plan text and the plan maps.

Environmentally-sensitive Plan Production

The plan itself should be produced in a way that is inherently sensitive to the environment (e.g., respects the conservation of resources). In a general sense, this could mean limiting the number of hard copies produced, fixing production runs to an as-needed basis, and maximizing alternative modes of production (e.g., using internet service providers which plunder electrons rather than forests, or providing the plan on diskette for non-essential uses). More specifically, the materials of plan production should reflect environmental

sensitivity. Otherwise, the plan authors are presenting an inconsistency: *do as we say, but not as we do*.

Hierarchy Theory Input

Environmentally-sensitive production of the plan minimizes resource consumption. Recycled materials minimize the consumption of raw resources and reduce the ecological footprint of plan-related production, thereby — *albeit* indirectly — contributing to the stability of the regional hierarchy.

- **Use of Environmentally-Responsible Materials in Plan Production**

The materials used to produce an ecosystem-based plan represent how seriously the agency takes its own message. To use *slick*, petrochemically-based colours and sheens on bleached paper suggests an inconsistency and interferes with the overall credibility of the plan.

SUMMARY

In this chapter, the necessary conditions of good ecosystem-based plans are explored and interpreted with hierarchy theory. The following research question was answered:

How can hierarchy theory be used to explore and interpret the attributes of good ecosystem-based municipal plans?

The answer is: as an understanding-based theory, *viz.*, descriptively and explanatively. The *how* about using hierarchy theory is demonstrated in the content of this chapter. Without exception, the criteria specifically related to ecosystem-based plans (i.e., The Ecosystem Approach to Planning Process, The Ecosystem Approach to Planning

Principles and Environmental Quality Strategies) are amenable to description and/or explanation through hierarchy theory. One unanticipated finding was that many of the criteria which are also applicable to other types of municipal plans (i.e., not just ecosystem-based plans) could also be explored or refined with hierarchy theory. Ultimately, descriptions need to be explained by the use of theory. As Bracken (1981: 102) contends, "theory is not an optional extra, it is the foundation upon which a better understanding of the nature and possibilities of...planning may be sought."

CHAPTER VI

OPERATIONALIZATION OF THE EVALUATION CRITERIA

INTRODUCTION

The purpose of this chapter is to discuss the extent and degree to which the criteria of the evaluation instrument can be made operational. Measures for the evaluation criteria are suggested in light of the literature search and review in Chapter II, and the theoretical interpretation and exploration of the criteria in Chapter V. This discussion is the final step in preparing the evaluation instrument for future implementation.

OPERATIONALIZATION OF THE EVALUATION INSTRUMENT

Introduction

Operationalization involves specifying the way a variable is measured or manipulated (Sproull, 1995). More specifically, a "nominal definition articulates what you were after: the operational definition specifies how you propose to capture it" (Palys, 1997: 63). Some measures are strictly quantitative and some are qualitative (i.e., the observed entity demonstrates an attribute). The combination of qualitative and quantitative measures is necessitated in this research because "in order to be effective, a measurement protocol must accommodate to what is out there" (Ahl and Allen, 1996: 55).

In her discussion concerning the selection of urban sustainability indicators, Maclaren (1996: 189-190) states that:

since indicator choices are shaped by community-driven sustainability goals, and these in turn are influenced by local environmental, economic, and social conditions, there may be considerable discrepancies among communities in terms of their preferred indicators. The search for core indicators is a search for certain fundamental characteristics that are of concern to all communities, regardless of differences in their situational context or sustainability goals.

Maclaren's observation suggests two considerations for the discussion of an evaluation instrument criterion. First, a level of generality can be pursued in identifying indicators (e.g., the purpose of the Delphi exercise); and second, the envelope of evaluation criteria for a good plan will likely need to be enlarged to reflect the needs and aspirations that are specific to an individual community. In other words, the evaluation instrument being developed in this research is predicated on the assumption that a municipality will need additional evaluation criteria to address situations that are specifically pertinent to the municipality involved.

Criteria For Selecting the Measures for the Evaluation Criteria

Maclaren (1996) provides the following criteria for selecting indicators. The indicator should be:

1. scientifically valid (e.g., cause and effect can be demonstrated; there is pertinence to the subject matter; the literature supports the use of the measure as a component of the indicator);
2. representative of a broad range of conditions;
3. responsive to change;
4. relevant to the needs of users;
5. based on accurate and accessible data;
6. based on data that are available over time;
7. understandable by potential users;

8. comparable with indicators developed in other jurisdictions;
9. cost-effective to collect and use;
10. attractive to the media; and,
11. unambiguous.

Except for criteria #2 (representative of a broad range of conditions), #6 (based on data that are available over time) and #8 (comparable with indicators developed in other jurisdictions), the selection of criteria provided above are all relevant to the task of identifying *measures* supporting the evaluation instrument and criteria under development. Concerning criterion #2, indicators are more general than measures and have a larger scope (Campbell *et al.*, 1996). That is, measures are specific quantifiable or qualifiable variables and, in this research context, are not indicative of a broad range of conditions like indicators.

Regarding criterion #6, some of the evaluation data may only be available in one document and not necessarily along a timeline. Therefore, this criterion is premature considering the current lack of ecosystem-based indicators for plan evaluation. Similarly, for criterion #8, it is possible that because of the immature state of ecosystem-based plan evaluation and its literature, other planning jurisdictions may not have developed their own evaluation indicators and, hence, comparable indicators may not exist.

In recognition of these observations, the indicator selection rationale proposed by Maclaren (1996) provides a context for the selection of the measures for each of the evaluation criteria in the following ways:

1. **scientifically valid.** Scientific validity means that a relationship between each measure and the evaluation criterion can be demonstrated. For example, if evidence of planning jargon is present, then the clarity of plan sections affected are suspect. Scientific validity can also be substantiated by the identification of measures in learned journals and other academic sources. In this research, the presentation of a measure in a learned journal or textbook was considered to be of primary importance, and on par with valid deduction of the measure from its definition or typical use;
2. **responsive to change.** All measures have at least two possible outcomes: achievement or non-achievement. The full range of evaluation criteria are expressed as positive conditions, so the evaluation instrument can be used to record achievement as a *yes*, and non-achievement as a *no*;
3. **relevant to the needs of potential users.** There is a large number of clients for research results arising from the evaluation instrument, including the following: plan makers; decision makers; members of advisory committees supporting the plan making function; and members of the public with an interest in their quality of life. Because of this range of potential clients, the measures should be understandable, easy to use, and topical;
4. **based on accurate and accessible data.** There are four proposed data sources for the evaluation instrument: the plan itself, plan maps, background documentation on the planning process and plan, and interviews with both planners on staff and other interested parties. These are all accessible and presumably accurate sources of data;
5. **understandable by potential users.** Because of the range of potential clients for the plan and the evaluation instrument, it is important that the instrument is understandable, minimizes jargon, and is unambiguously expressed. This means that the evaluation criteria and the associated measures need to be relatively easy to understand and employ (Wellar, 1998). In other words, the degree of difficulty associated with the instrument's use should not be beyond the capacity of someone with a basic understanding of planning and environmental issues and topics (see the discussion of Lee and Colley's (1991) Criterion 6 in Chapter IV);
6. **cost-effective to collect and use.** The major cost associated with employing the evaluation instrument is payment for the time required by the evaluator(s) to complete the task. Background material will need to be collected in conjunction with data obtained from the interviews held with key officials. Municipal plans and background documentation authored in municipalities using the ecosystem approach should be available free of charge (possibly on-line) or at cost;

7. **attractive to the media.** Attractiveness to the media means that the conclusions of the evaluation should be easy to communicate. As well, if problems are uncovered in the evaluation process, these problems should be communicated lucidly to the media so that public participation can be encouraged. On the other hand, attractiveness that involves so-called *punch* or *jazz* is not considered a priority in this evaluation context. Problems that are identified need to be addressed and solved by planning staff, as opposed to being sensationalized because they are potentially inflammatory or newsworthy in their own right. Furthermore, contentious issues pertinent to a particular community are, by definition, newsworthy. Consequently, there is a continuum of *attractiveness to the media* depending on the individual context being investigated; and,
8. **unambiguous.** The measures need to be clear and simple to quantify/qualify.

Actual Operationalization of the Evaluation Criteria

Using the criteria discussed above as the selection template, the measures suggested to comprise the evaluation instrument are presented in Table 6.1. All of the measures are extracted from the literature or are deduced from the definition of the variable in question (as noted). Once again, the plan and the process supporting it are evaluated on a binary or two-point scale: the measure is either *achieved* or *not achieved*. All *necessary* measures have equal weight *vis-à-vis* each other and all *important* measures have equal weight *vis-à-vis* each other.

The Proposed Evaluand

The proposed evaluation instrument uses a plan draft that has not yet been submitted to council, since the rationale for investigating the quality of plans that have undergone consideration and debate by politicians is open to debate. Politicians are concerned with a different agenda from planners — namely re-election and the short-term. At the pre-council stage, the content and value of the plan is as close to the ecosystem-based ideal as

TABLE 6.1. Identification of Measures for the Preliminary Operationalization of the Evaluation Instrument.

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS N for necessary, and I for important	SELECTED MEASURES	SOURCES OF THE MEASURES
PLANNING PROCESS Ecosystem Approach to Planning Process (Necessary)			
Visioning (N)		Visioning took place Visioning engaged a representative sample Shaping of plan content with vision results Identification of entrenched attitudes	Government of Saskatchewan (1994), Klein (1993) Amir and Mosseri (1997), Klein (1993) Government of Saskatchewan (1994), Klein (1993) Tomalty <i>et al.</i> (1994a)
Scoping (N)		Identification of problems and opportunities Identification of relevant groups (e.g. registry of relevant groups) Participation invitations sent out to relevant groups either by newspaper, TV or through mailing Derivation of initial list of goals and priorities Identification of prioritization criteria	Berke and French (1994), Elkin and Smith (1988) Tomalty <i>et al.</i> (1994a), Campbell <i>et al.</i> (1995) Wellar (1998), Government of Saskatchewan (1994) Tomalty <i>et al.</i> (1994a) Tomalty <i>et al.</i> (1994a)
Definition and survey of planning region (N)		Identification of variables/parameters to be measured Initiation of background studies Delineation of ecologically-based planning boundaries Delineation of scale-based protocols for data gathering	Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a) Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a) Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a) Smith and Theberge (1987)
Modeling and analysis of planning region (N)		Identification of needs and trends Analysis of biophysical, infrastructural and built systems as well as their inter-relationships across scales Initial determination of optimal locations for different land uses according to science or ethics Begin/continue the foundation of a SOE reporting-style monitoring framework	Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a) Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a) Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a) MacLaren (1996), Campbell <i>et al.</i> (1995)
Development of a structure plan and formulation of rival alternatives (N)		Formulation of detailed goals and objectives Formulation of rival scenarios	Gibson <i>et al.</i> (1997), Boyce (1970) Gibson <i>et al.</i> (1997), Boyce (1970)
Assessment of plan alternatives and selection of two to three to pursue (N)		Assessment of rival scenarios in light of goals and objectives Selection of two or three alternatives through negotiation	Gibson <i>et al.</i> (1997), Baer (1997), Elkin and Smith (1988) Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a)
Meaningful debate/negotiation of plan contents (N)		List of relevant groups Meaningful negotiation involving relevant groups (e.g. participatory, collaborative, conflict resilient, accountable) Selection of final choice Program (use of TV, radio, newspapers, etc.) used for stimulating citizen involvement	Palfrey <i>et al.</i> (1992) Gibson <i>et al.</i> (1997), Dowling and MacLachlan (1997) Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a) Oregon (1996)
Refinement of plan choice (N)		Strategic environmental assessment to fine-tune policy content Development of detailed scale-based plans Development of detailed zoning if local plans are not nested within the ecosystem-based plan Establishment of requirements for project planning and approval Exploration of a full range of implementation strategies	Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a) Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a) Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a) Dalton and Hurby (1994), Voogd (1983)
Monitoring (N)		Establishment of requirements for monitoring plan performance Establishment of requirements for monitoring municipal context Establishment of requirements for compliance monitoring Establishment of protocols for plan amendment	Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a) Gibson <i>et al.</i> (1997), Tomalty <i>et al.</i> (1994a) Kaiser <i>et al.</i> (1997) Kaiser <i>et al.</i> (1997)
Information feedback loops internal and external to each stage in the planning process (N)		Mechanisms for deciding when and how to conduct a planning intervention are identified	ASC-E (1986)
Plan implementation to be done by trained planning staff or consultants (I)		Plan implementation to be done by experienced planners	Fishman (1978)
Available funds to employ planning staff or consultants (I)		Funds are available for plan implementation	Dalton (1989), Boyce (1970)
Available resources to carry out planning strategies (N)		Sufficient time Sufficient money Community input Funds are available to implement plan Effective strategies requiring least financial inputs are chosen	Dalton and Hurby (1994), Fishman (1978), Boyce (1970) Dalton and Hurby (1994), Fishman (1978), Boyce (1970) Dalton and Hurby (1994), Fishman (1978) Fishman (1978) Baron and Ng (1996), Beasley <i>et al.</i> (1994)
Feasibility of Plan Implementation Process foundation (Necessary)			

TABLE 6.1. Identification of Measures for the Preliminary Operationalization of the Evaluation Instrument (continued).

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	SELECTED MEASURES	SOURCES OF THE MEASURES
	Political commitment to carry out the plan (N)	Mayor/regional chair endorses the plan Community endorses the plan	Fishman (1978), Boyce (1970) Fishman (1978), Boyce (1970)
	Cooperation commitment among inter-jurisdictional partners (N)	Memoranda of intent or an analogue	Kaiser <i>et al</i> (1995), Fishman (1978), Boyce (1970)
	Credibility of local political structure (I)	No history of scandals	Devas and Rakodi (1993)
	Institutional power to implement the plan (N)	Legally-defined authority Viable working relationships between inter-jurisdictional partners	Baer (1997), Beke and French (1994) Fishman (1978)
	Credible institutional transparency (N)	Top-down accountability from the upper tier government(s) Top-down accountability from the mayor or an analogue Bottom-up accountability from the electorate All discretionary planning decisions are open to public attendance All planning meetings involving issues with public impacts are open to the public Relevant groups have been involved from visioning onwards to implementation	Palfrey <i>et al</i> (1992), Elcock and Haywood (1980) Palfrey <i>et al</i> (1992), Elcock and Haywood (1980) Palfrey <i>et al</i> (1992), Elcock and Haywood (1980) Palfrey <i>et al</i> (1992), Elcock and Haywood (1980) Palfrey <i>et al</i> (1992), Elcock and Haywood (1980) Baer (1997), Nelesson (1994)
	Ongoing involvement of relevant groups during plan formulation and implementation (N)		
	Process oriented to municipality's growth rate (I)	Plan is primarily regulation-centered only if municipality is high growth	Fishman (1978), Boyce (1970)
	Integration of planning and economic development offices (I)	Cooperation Two-way flow of information	Maynes (1991) Maynes (1991)
	Flexible/speedy plan amendment protocols for new data or new circumstances (N)	Plan amendment protocols are identified in the plan	Voogd (1983), Fishman (1978)
	Liaison officer optimizes info flow between agency, decision makers, relevant groups, etc. (I)	Liaison officer on staff	Maynes (1991)
	Use of a representative environmental advisory committee (N)	Mutual number of municipal politicians Rotation of committee members Environmental advisory committee considers the engagement of the public in planning as one of its priorities	Maynes (1991) Maynes (1991) Oregon (1990)
	Planning units are based on natural boundaries or take them into consideration (N)	Ecological rationale for boundary delineation is evident	Gibson <i>et al</i> (1997)
	Design with nature (N)	Natural design is recognized and rewarded (e.g. How is housing set up? Development credits?) Natural design criteria are employed in either site plan control or general design guidelines and procedures	Van der Ryn and Cowan (1996), McHarg (1969) Van der Ryn and Cowan (1996), McHarg (1969)
	Consideration of the cumulative and global effects of policies, plans and projects (N)	Cumulative effects are accounted for in the strategic environmental assessment Global effects are accounted for in the strategic environmental assessment References to and recognition of cumulative and global benchmarks (e.g. Kyoto Conference, Rio)	Novakowski and Wellar (1997), Spaling (1994) Novakowski and Wellar (1997), Spaling (1994) Novakowski and Wellar (1997), Spaling (1994)
	Inter-jurisdictional decision-making (N)	Memoranda of intent have been addressed and are formalized	Fishman (1978), Boyce (1970)
PLAN CONTENT Principles of the Ecosystem Approach (Necessary)	External consultation, cooperation and partnering among relevant groups/interested parties (N)	Public participation is on-going Memoranda of intent concerning partnerships are on file	Dowling and MacLachlan (1997), Gibson <i>et al</i> (1997) Dowling and MacLachlan (1997), Gibson <i>et al</i> (1997)
	Long-term monitoring, feedback and adaptation of plan content (N)	Evidence that indicators to be monitored were systematically selected (e.g. in terms of scientific validity, relevance, representativeness, data availability, and cost) Many of the indicators are specifically related to plan goals and to performance objectives Identification of how monitoring results will be reported and lead to modifications of plan content	Wellar (1998), Campbell <i>et al</i> (1995) Talen (1996), Smith and Wellar (1992) Kaiser <i>et al</i> (1995)
	Inter-disciplinary approach to information (N)	Both expert and lay-person sources are employed Range of disciplinary inputs: ecology, conservation biology, landscape architecture Formal liaison groups between planning department and other departments that interact (e.g. Public Works, engineering, recreation, etc.)	Wellar (1998), Gibson <i>et al</i> (1997), Tomalty <i>et al</i> (1994a) Gibson <i>et al</i> (1997), Tomalty <i>et al</i> (1994a) Gibson <i>et al</i> (1997), Tomalty <i>et al</i> (1994a)

TABLE 6.1. Identification of Measures for the Preliminary Operationalization of the Evaluation Instrument (continued).

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	SELECTED MEASURES	SOURCES OF THE MEASURES
Environmental Quality Strategies (Necessary)	Precautionary but positive approach to development (N)	Results of strategic environmental assessment are integrated with plan content Ecosystem-rehabilitation strategies are rewarded by planning process Humility of planners is demonstrated by formal recognition of uncertainty In cases where irrevocable consequences are unavoidable, special care is demonstrated	Novakowski and Wellar (1997), Tammenga (1995) Tammenga (1995) Pearman (1985), Schaefferman (1974) Tammenga (1995)
	Planning integrates rather than merely balances environmental, social and economic objectives (N)	Evidence of movement towards greater integration of environment, economy and society with respect to attitudes, institutions and behavior	Gibson <i>et al.</i> (1997), Wellar (1994, 1990b)
	Linkage of ecosystem planning to democratic change, social learning, community building and env'l enlightenment (N)	Public outreach techniques are used for implementation	Norton (1995)
	Cross-scale management (N)	Time scales are recognized (e.g. short- vs. long-term goals, etc.) Spatial scales are recognized Plan maps are cross-scaled spatially Plan issues are discussed in terms of cross-scaling Implementation strategies are cross-scaled Cumulative effects are addressed at different scales	Norton (1995) Baer (1997), DOE (1992) Norton (1995) Norton (1995) Norton (1995) Norton (1995) Norton (1995), Spaling (1994)
	Explicit recognition of the municipality's ecological footprint (N)	Ecological footprint of major systems is calculated (e.g. transportation, sewage, etc.) Metropolitan inputs (e.g. oil) and outputs (e.g. CO ₂ , sewage) are calculated Strategies oriented towards minimizing inputs and outputs are provided Employment of thresholds (e.g. identified thresholds beyond which ecological carrying capacity changes unpredictably)	Rees and Wackemagel (1995), Wackemagel (1994) Rees and Wackemagel (1995), Wackemagel (1994) Rees and Wackemagel (1995), Wackemagel (1994) Rees and Wackemagel (1995), Wackemagel (1994)
	Air quality strategies (N)	Examples are demonstrated (e.g. transit-orientation, densification, mixed use zoning, multi-modal transit like HOV, support of telework, etc.) Identification of relevant legislation and related air quality targets Use of latest science (e.g. Kyoto Conference, Rio)	Kaiser <i>et al.</i> (1995), Oregon (1990) Oregon (1990) Baer (1997)
	Water quality strategies (N)	Examples are demonstrated (e.g. education, tertiary sewage and stormwater treatment, snow dump strategies, design with nature using wetlands or aquatic flowers, etc.) Air quality strategies are provided State-of-the-art landfill siting and construction criteria are provided (e.g. landfills above water table, impervious barrier, leachate is collected and treated)	Dalton and Burby (1994), Oregon (1990) Oregon (1990) Nebel (1990)
	Resource conservation strategies (N)	Examples are demonstrated – especially those oriented towards human behavior (e.g. 3Rs, impact fees, growth management, mitigation banking, restrictive covenants, easements, etc.) General planning strategies like densification, protection of resources like viable agricultural land and ESAs Water pricing Evidence of waste minimization Human scale dominates car scale	Oregon (1990), Boyce (1970) Eagles (1984) Kaiser <i>et al.</i> (1995) Boyce (1970) Lewing (1989)
	Biodiversity strategies (N)	Examples are demonstrated (e.g. green corridor systems, shoreline preservation areas, naturalization, etc.) Identification of endangered and vulnerable species (both plants and animals) at risk Public education is addressed Habitat protection is prioritized Environmental constraint maps are used	Norton and Ulanowicz (1992) Norton and Ulanowicz (1992) Norton and Ulanowicz (1992) Norton and Ulanowicz (1992) Norton and Ulanowicz (1992)
	Land/water rehabilitation strategies (N)	Examples are demonstrated (e.g. engineering, covenants, public-private partnerships, etc.)	Tammenga (1995), Hough (1995), Oregon (1990)
Rational Content (Necessary)	Natural disaster strategies (N)	Examples are demonstrated (e.g. measures for flooding, unstable slopes, avalanche threat, earthquakes, etc.) Emergency preparedness lesson identified	Kaiser <i>et al.</i> (1995), Oregon (1990), Fishman (1978) Oregon (1990)
	Socio-cultural strategies for sense of place, livability, local pride (N)	Examples are demonstrated (e.g. archaeological and heritage protection, facilitation of public art, etc.)	Kaiser <i>et al.</i> (1995)
	Completeness (N)	All pertinent issues are addressed	Baer (1997), Kent (1990), Alexander and Fahd (1989)
	Hierarchical framework of vision, planning principles, goals, objectives and policies (N)	Table of contents reveals either a top-down or bottom-up hierarchy	All and Allen (1996)

TABLE 6.1. Identification of Measures for the Preliminary Operationalization of the Evaluation Instrument (continued).

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	SELECTED MEASURES	SOURCES OF THE MEASURES
	Consistency (N)	Logical consistency within hierarchy (e.g. policies are consistent with goals, goals are consistent with principles, principles are consistent with vision) If goals conflict, a rationale for resolving the conflict is provided Minimization of contradictions within hierarchical framework	Berke and French (1994), Alexander and Faludi (1989) Berke and French (1994), Alexander and Faludi (1989) Berke and French (1994), Alexander and Faludi (1989)
	Vision reflects a representative range of relevant groups/interested parties (N)	Vision statement is provided Representative statistical sample used for vision derivation	Klein (1993) Klein (1993)
	Ethically- or scientifically-based principles (N)	Principles based on best science or ethical maxims	Smith and Theberge (1987)
	Issues are both opportunity- and problem-based (N)	Issues recognize both problems and opportunities Identification of municipal assets and how to optimize those assets Identification of municipal problems and how to minimize those problems	Berke and French (1994) Baer (1997) Baer (1997)
	Goal specificity (N)	Goals are related to specific issues/desires Based on best evidence Lack of ambiguity Goals are clearly written (e.g. neither vague nor ambiguous) Objectives supporting the goals are measurable if feasible Objectives supporting the goals are prioritized Objectives supporting the goals are owned by specific individuals, teams or departments Objectives are communicated	Berke and French (1994), Thompson and Strickland (1984) Thompson and Strickland (1984) Thompson and Strickland (1984) Connerly (1990) Thompson and Strickland (1984) Thompson and Strickland (1984) Thompson and Strickland (1984) Thompson and Strickland (1984)
	Obtainable but challenging objectives (N)	Objectives are obtainable Objectives are challenging	Thompson and Strickland (1984) Thompson and Strickland (1984)
	Operationalization of identified planning priorities through policy (N)	Policies address objectives and goals Policies are not freestanding without a rationale or goal-orientation	Berke and French (1994), Smith and Wellar (1992) Berke and French (1994), Smith and Wellar (1992)
	Action- or strategy-based policies (N)	Majority of policies are related to implementation techniques	Berke and French (1994)
	Science- or ethics-based land use designations (N)	Zoning reflects available scientific knowledge or ethical maxims	Coon and Damsky (1993)
	Innovation (I)	Demonstration of inventiveness, artistic merit, creative impulse	Baer (1997), Berke and French (1994)
Artistic (Important)			
Recognition of Legal Requirements Facing the Plan (Necessary)	Substantially exceeds the minimum requirements of the law (N)	A lower tier plan is consistent with an upper tier plan Plan is consistent with provincial law and substantially surpasses it State-of-the-art ecosystem-based planning is evident (e.g. evidence of new techniques/creative solutions)	Siefer <i>et al.</i> (1997), Berke and French (1994), Oregon (1990) Elkin and Smith (1988), McAllister (1980) Baer (1997), Berke and French (1994)
Strong Language for Priority Policy Areas (Necessary)	Strong rather than permissive verbs and qualifiers (N)	Use of strong/directive verbs and qualifiers (e.g. <i>shall</i> rather than <i>should</i> , <i>must</i> rather than <i>may</i> ; <i>no</i> means <i>no</i> , etc.)	Berke and French (1994), Coon and Damsky (1993), Smith and Wellar (1992), Fishman (1978)
Adaptive Capacity of the Plan to Address Change (Necessary)	Community/relevant group empowerment (N)	Identification of where to get further information Identification of who can help Identification of where the decision levels are Identification of how relevant groups can get involved Opportunities for input into the planning process exist throughout the planning process	Baer (1997), Kent (1990) Baer (1997), Kent (1990) Baer (1997), Kent (1990) Baer (1997), Kent (1990) Baer (1997)
	Mechanisms/frameworks for supporting plan evolution (N)	Monitoring framework for the urban or other ecosystem Monitoring framework for plan performance Plan amendment protocols are identified Plan up-date potential is maximized by having plan available in a binder, on a web-site or on diskette	Kaiser <i>et al.</i> (1995) Kaiser <i>et al.</i> (1995) Kaiser <i>et al.</i> (1995) Kaiser <i>et al.</i> (1995)
	Flexibility given the wide breadth of the tool envelope (N)	Wide range of planning techniques ranges of choice if plan is local compare actual/practic difficulties	Dallon and Burby (1994)
	Ability to respond to surprise (N)	Public liaison officer Media relations officers with the power to action investigation of a problem or opportunity On-going communication and information-sharing with other ecosystem-based agencies Contingency plans for more likely surprises	Ann and Mosseri (1997) Maynes (1991) Lonally <i>et al.</i> (1994a) Oregon (1990)
	New ways of problem-solving or goals achievement (N)	Employment of new planning techniques and implementation techniques (e.g. mitigation banking)	Baer (1997), Berke and French (1994)

TABLE 6.1. Identification of Measures for the Preliminary Operationalization of the Evaluation Instrument (continued).

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans demonstrate these)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	SELECTED MEASURES	SOURCES OF THE MEASURES
Feasibility of Plan Implementation Plan Content Foundation (Necessary)	Fact basis (N)	Projections are scientifically grounded All analyses are based on sound data and information Data is specific to planning region Bases for conclusions are identified Background research is referenced in-text	Wellar (1998), Dalton and Burby (1994), Elkin and Smith (1988) Wellar (1998), Dalton and Burby (1994), Oregon (1990) Berke and French (1994), Dalton and Burby (1994) Wellar (1998), Dalton and Burby (1994), Oregon (1990) Amir & Musseri (1997), Elkin & Smith (1988)
	Plan currency (N)	Plan is less than seven years old All of the following situations are accounted for: the provincial planning act has been substantially revised, a new upper tier plan was adopted, new economic engines have appeared, substantial new development is arising, or municipal boundaries are altered	Kent (1990), Fishman (1970) MMAHI (1982)
	Equitable spatial and socio-economic distribution of NIMBY's	Distribution criteria are provided	Rose (1993), Boyce (1970)
	Acceptable synthesis of different public and private agendas (N)	The results of consensus-building exercises are incorporated	Lamont (1990)
	Implementation strategies involve community participation (N)	Plan implementation is combined with public outreach, education and participation	Maynes (1991)
	Well written (N)	No spelling mistakes Few grammatical errors Few overly long sentence lengths Few large polysyllabic words No evidence of institutional or public criticism of writing	Gallagher and Patrick-Riley (1989) Gallagher and Patrick-Riley (1989) Gallagher and Patrick-Riley (1989) Gallagher and Patrick-Riley (1989) Gallagher and Patrick-Riley (1989), Ross (1987)
PLAN FORM Effective Communication of Planning Information to Relevant Groups (Necessary)	Definition of key concepts (N)	Definitions are provided in-text, in margin notes, in a glossary or in appendices	Gilpin (1995), Leach (1993), Elkin and Smith (1988)
	Animation/friendliness of plan (I)	Employment or anticipated employment of photos, graphics, color, cartoons, art, data, etc	Campue (1998), Kent (1990)
	Use of plain language (N)	Minimal planning jargon Minimal obfuscation Definition of jargon terms that are used in glossary or in margin notes Distillation of different versions of plan (e.g. plan summaries or synopses targeted to specific audiences)	Schibuola and Byer (1991), Solnit <i>et al.</i> (1988) Schibuola and Byer (1991), Solnit <i>et al.</i> (1988) Schibuola and Byer (1991), Solnit <i>et al.</i> (1988) Schibuola and Byer (1991), Solnit <i>et al.</i> (1988)
	Well organized (N)	Logical progression of topics and ideas Grouping of concepts according to an underlying framework Topics move from general to specific or specific to general	Ross (1987) Ross (1987) Ross (1987)
	Ease of locating information (N)	Table of contents, index or labeled page tabs Background reports employ same format as plan	Lamont (1990), Solnit <i>et al.</i> (1988) Solnit <i>et al.</i> (1988)
	Text legibility (N)	Good reproduction quality Appropriate font size Appropriate font style employing serifs	Gallagher and Jacobson (1993), Felker <i>et al.</i> (1981) Gallagher and Jacobson (1993), Felker <i>et al.</i> (1981)
	Plan availability in relevant languages, if applicable (N)	If appropriate, plan is available in both Official Languages and other relevant ones	Laurin (1997), Government of Canada (1969)
	Plan conciseness (N)	Plan focuses primarily on vision, principles, goals, objectives, policies and monitoring Need to know rather than move to know proviso is followed Detailed background information is found in background reports Minimal in-text duplication of policies, concepts or arguments	Berke and French (1994) McKay (1998) Pers Comm) Kent (1990) Kent (1990)
	Self-containment (N)	Inclusion of maps, bibliography no need to step outside plan except for more detailed information	Baer (1997)
	Identification of how to get further information (I)	List of contacts (including web addresses) is provided Bibliography is provided References to background reports are located in-text	Amir and Musseri (1997) Elkin and Smith (1988)
	Range of plan availability alternatives (I)	Plan is available in hard copy plus another option (e.g. web site, PC Mac, diskette, summary form, etc.) During plan formulation stage plan is available free of charge or at minimal cost	Kent (1990) Kent (1990)

TABLE 6.1. Identification of Measures for the Preliminary Operationalization of the Evaluation Instrument (continued).

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	SELECTED MEASURES	SOURCES OF THE MEASURES
Effective Communication of Spatial Information to Relevant Groups Through Maps (Necessary)	Appropriate/relevant level of map detail (N)	Legend has a manageable number of attributes Lack of visual clutter Public documentation reveals no indication that plan maps are unreadable or cluttered	Slater <i>et al.</i> (1994) Leach (1993) Slater <i>et al.</i> (1994), Leach (1993)
	Appropriate level of boundary accuracy (I)	The accuracy of map boundaries reflect whether the plan is conceptual/strategic or site-specific	NCC Steering Committee (1998)
	Plan maps are reflective of policies and policies are reflective of maps (N)	Plan maps reflect plan text Plan text reflects plan maps Although plan text can have unmapped dimensions, map-based characterizations must relate to plan text	NCC Steering Committee (1998) NCC Steering Committee (1998) NCC Steering Committee (1998)
	Manageable map size (I)	Maps are the size of an adult arm-span or smaller	Baer (1997)
Environmentally-sensitive Plan Production (Necessary)	Use of environmentally-responsible materials (N)	Plan is printed on recycled paper Plan text is written with vegetable inks (e.g. soy-based inks are popular) Plan availability alternatives exist (e.g. plan is available on web-site and on diskette) Limited production run	Johnson (1990) Johnson (1990) Kent (1990) Johnson (1990)

possible before it is subject to the direct machinations of politics and special interests. An evaluation occurring after the political machinery has been set in motion will not be fair to the planning agency involved nor will it be particularly illuminating, since plan content may reflect political expediency and vested interests rather than ecosystem-based planning expertise and representative community input.

Qualifications for Implementation of the Proposed Evaluation Instrument

The individual criteria and associated measures presented in Table 6.1 have been cross-referenced to Maclaren's modified selection framework provided in the previous section. Scientific validity provided by sourcing the measure in the learned literature or through valid deduction represent the primary selection criteria. In the final column, the sources of the measures are stated. With no exceptions, the measures are sourced from either the planning- or geography-related literature, or deduced from the definition of the necessary or important condition itself. All of the measures are expressed so that the binary decision mode of *achieved* or *not achieved* can be imposed.

A concern that might arise in the implementation of Table 6.1 is that the instrument is too strict and that no existing ecosystem-based plan will be sufficiently comprehensive to cover the domain. In answer to this concern, first, it is important to realize that it is the necessary and important conditions of a good ecosystem-based plan that were provided by the Delphi panel. So, there can be no equivocation on the evaluation criteria.

Conversely, the measures provided for the evaluation criteria are derived from the literature review and deduction. In other words, there is built-in flexibility in the

evaluation instrument in that different measures can be selected by the planning agency or the community to signify achievement of a particular criterion. One of Maclaren's (1996) selection criteria is the following: *relevant to the needs of potential users*. A particular community has complete flexibility in choosing its measures, as long as a rationale can be demonstrated. However, once again, in consideration of how the Delphi survey was designed, the criteria themselves cannot be altered or manipulated to reach different levels of compliance. Either the necessary criteria are met, or they are not.

Another related qualification concerns the applicability of **all** of the proposed measures to a particular criterion. As detailed by Tomalty *et al.* (1994a), a variety of jurisdictional contexts are employing the ecosystem approach to planning (e.g., urban areas, watersheds, and National Parks). These differences in jurisdiction (e.g., regional versus local) may invalidate the applicability of some of the proposed measures. In fact, the range of planning tools available to a particular planning agency may vary widely. For example, the planning tools available to National Parks can be powerful but limited, since the federal government does not have the power to impose zoning (which is a provincially-delegated power).

Instead, the federal government can only zone the land that it owns, but can do nothing (barring expropriation) about locally-owned or adjacent land except through planning tools such as moral suasion or public-private partnership. In this example, the effectiveness of the *range of planning tools* measure works better when local plans are involved. In such a case, an *n/a* signifying *not applicable* can be inserted into the appropriate evaluation matrix cell. It is suggested that this jurisdiction dimension does not

warrant removal of the measure from the template, since the criterion continues to be applicable to all jurisdictional levels for which it is relevant.

META-EVALUATION OF THE DERIVED INSTRUMENT

In MacAllister's (1980) *Evaluation in Environmental Planning*, meta-evaluation criteria for assessing evaluation instruments are provided. The evaluation instrument should be:

- **systematic.** Evaluation instruments and methods are increasingly concerned with process along with the product of the process. The derived evaluation instrument of this research comprehensively addresses both process and product;
- **simple.** According to Kaiser *et al.* (1995: 434), "because plan evaluation is still a young field and its products are relatively unproven, it would be wise to err on the side of simplicity and reliability. Thus, we suggest that it is not necessary to convert all measures to a single metric, that weights be used sparingly if at all, and that results be shown as individual indicators rather than aggregated into possibly misleading single supermeasures." In the development of this evaluation instrument, the evaluator uses the measures and checks four data sources (the plan, the plan maps, background documentation, and interviews with key informants) to see if the measures are realized or achieved. If all the necessary conditions are achieved, then the plan is a good one. There is no weighting of factors and no so-called *supermeasures* or planning balance sheets are employed.
- **quick.** The term *quick* is relative and must be weighed against the meta-criteria *systematic* and *comprehensive*. Given the level of comprehensiveness of the derived evaluation instrument, it is arguably *not quick*. Nonetheless, it does not require the evaluator to go out and define or investigate new and onerous criteria — other than those that are scoped or considered important to the individual municipality, or those that appear in the municipality's visioning statement.
- **comprehensive.** Ecosystem-based plans are, by their nature, comprehensive. Overall, the challenge was to find evaluation criteria that were specific enough to be useful, but general enough to be widely applicable.
- **inexpensive.** As Shefer and Kaess (1990: 75) observe, "decision makers and analysts from a variety of backgrounds criticized many of the existing [evaluation] methods for their high cost, the large amounts of time they required, their lack of attention to the needs both of officials and programme recipients, as well as their difficulty in implementation." The planning balance sheet, cost-benefit analysis and other methods used in plan evaluation have often been expensive and time-consuming. While the derived instrument may be regarded as relatively expensive

in terms of the time required to implement the procedure, it is — overall — inexpensive since planning documents are normally available at little or no cost, and key informants are usually government employees or informed citizens. And,

- **legally acceptable.** No legal provisions are transgressed by the evaluation instrument.

SUMMARY

A primary concern of plan evaluation instruments articulated by Dakin (1969: 7) involves the specification of the criteria:

If values are the key element in evaluation, the process of stating the criteria for evaluation, the type phrase used, is the most important element in evaluation. This fact is generally missed, the selection of the criteria receiving scanty explicit examination in the haste to set the material to be judged against the criteria. Yet the primary work to be done is the careful selection of the standards of judgement.

In previous chapters, the evaluation criteria were developed through a methodologically-designed Delphi process and then described and explained using hierarchy theory. In this chapter, measures for the evaluation criteria were provided in order to facilitate the operationalisation of the instrument. Since the measures for the evaluation instrument are ultimately community-specific, the final version of the instrument is presented in Appendix V without them.

CHAPTER VII

CONCLUSIONS

In this chapter, contributions of the research are summarized, and avenues for future research that may be rewarding for subsequent researchers in the three subject domains (the ecosystem to planning, plan evaluation and hierarchy theory) are identified. The fundamental objective of this research is the methodologically-grounded determination of the attributes of good ecosystem-based municipal plans. Then, using meta-criteria analysis and the interpretation/exploration of the necessary conditions of good ecosystem-based plans with hierarchy theory, an evaluation instrument was derived, described, explained and made operational.

The contributions of this research to methodology and theory are summarized as follows:

1. **Contribution to methodology.** The contribution to plan evaluation methodology can be itemized in three ways:
 - Derivation of evaluation criteria that are methodologically-grounded.
 - Description and explanation of significant evaluation criteria that are theoretically-grounded. And,
 - Positing of an operational evaluation instrument suitable for judging the quality of ecosystem-based plans.
2. **Contribution to theory.** In biology, *ontogeny* is the development of the organism over time, *ergo* evolution. Pickett *et al.* (1994) suggest that there are three primary ways in which to contribute to the ontogeny of theory:

- **completeness** (where the contribution is made by adding components to increase the theory's descriptive, explanative or predictive power). In other words, completeness refers to the inventory of components present in a theory (e.g., domain, assumptions, concepts, definitions, facts, confirmed generalizations, laws, models, translation modes, hypotheses and frameworks);
- **development** (where the contribution is made by fine-tuning the components of the theory). "Development refers to the degree of complexity or derivativeness of components of a theory. Components of theory that are better developed are explicit, clearly derived from other components of theory, empirically rich, and more thoroughly worked out than poorly developed components" (Pickett *et al.*, 1994: 89-90); and,
- **integration** (where the contribution is made by improving the articulation of how the components of the theory are connected or related). Integration refers to the degree of connectedness of theory components.

The contribution of this research to the theoretical ontogeny of hierarchy theory is threefold. First, the implications of hierarchy theory as discussed by a wide range of authors were synthesized into a cohesive framework for application to ecosystem-based planning. In other words, the *completeness* dimension of the theory was advanced by synthesizing its objects and implications into a more cohesive framework than previously existed in the literature.

Second, hierarchy theory's unexamined applicability to ecosystem-based planning was explored, thereby advancing the scope of applicability of the theory in a new and original direction. The application of hierarchy theory to planning appears to have been, until this point, uninvestigated. Third, the grounding of ecosystem-based planning in hierarchy theory appears tenable. The specific characteristics of ecosystem-based plans (as opposed to municipal plans in general) demonstrate, without exception, hierarchical dimensions and implications for plan evaluation.

A final contribution of the research concerns the identification of avenues for future study that may be rewarding for subsequent researchers. Knowledge voids encountered during the study are organized according to the three subject domains of this research: the ecosystem approach to planning, plan evaluation, and hierarchy theory. This contributes to the building block and network dimensions of social science (see Capra, 1994; Wellar and Harris, 1992; Walizer and Wienir, 1976; Ackoff, 1953).

The Ecosystem Approach to Planning

- A comprehensive inventory of the obstacles to the ecosystem approach to planning represents a preliminary research topic. The ecosystem approach needs greater application in a variety of contexts before its overall practical adequacy as a planning framework can be assessed. Feasibility research for the approach could simultaneously be addressed (i.e., recognizing the barriers to the approach, how feasible is the approach in real time?);
- Actual implementation of the evaluation instrument derived in this research. As more planning agencies adopt the ecosystem approach, application of the instrument to their products will serve to fine-tune the instrument and provide insight into evolving processes; and,
- Another avenue for investigation could address the timing of when the evaluation instrument is employed. A draft plan that is submitted to evaluation before it goes to council may achieve quite different evaluation results from the plan that has actually been carried and adopted by council. The comparison of evaluation results in a range of case studies (e.g., contrasting before- and after-council plans) might be instructive.

Plan Evaluation

- An important research challenge and opportunity concerns investigation into plan implementation. Related questions involve the effectiveness of plan implementation and how to address the subject. The gap between the plan intentions and plan outcomes, known as *planning drift*, needs serious attention (Talen, 1996). Due to the problem of attribution (i.e., did the plan cause the change or did the local economy?), implementation research in planning is complex but critical (McGibbon, 1990); and,
- One significant research avenue specifically relating to this dissertation topic involves the evaluation criteria that would be selected by the other relevant groups (e.g., elected officials, members of the public) and whether there was any discrepancy between those results and the selections made by the experts on this panel. A case in point is provided by the variable selection criteria employed by Wellar (1998). In his Walking Security Index study, three groups (electeds, professional staff, citizens) participated in the variable selection process. Their choices manifested both similarities and differences in selecting variables, and in being concerned about the relative merits of evaluation criteria. Clearly, there is both the need and opportunity for more research into this aspect of plan evaluation.

Hierarchy Theory

- An important research direction to pursue is in the domain of hierarchical models capable of capturing the nesting and functioning of urban ecosystems. Early attempts were undertaken by Dorney and McLellan (1984), but they do not express the intricacy and hierarchical structure of a municipality;
- It may be rewarding to investigate whether hierarchy theory applies to conceptual hierarchies and in what way. For example, how do complex arguments and grammatical structures exhibit the axioms of hierarchy theory?;
- In a disciplinary context, the question arises to the degree to which hierarchy theory (a theory of spatial and temporal scaling) can be used as a theoretical basis for geography. In a related vein, how does hierarchy theory apply to planning in general (i.e., not just to ecosystem-based planning)?;
- It also appears that hierarchy theory may provide a valuable theoretical framework for organizing and investigating cumulative impacts. Norton and Hannon (n.d.a: 7) delve into how the combination and interaction of impacts have different repercussions depending on the scale involved. Hierarchy theory appears to provide a framework for explaining and organizing cumulative effects;
- The relationship between the successional stages of cities and hierarchy theory may offer some rewarding avenues to pursue. What stages do cities go through? How do cities evolve? Young cities likely behave differently than mature cities and how does the urban planner attempt to plan for the successional stages? Does evolutionary theory explain the succession of cities? Cities are like organisms in that they grow, mature, senesce and die. Yet, "beyond a certain size, uncontrolled growth and gigantism become a burden, which contribute to the malfunction of the system" (Hershey, 1985: 3). Hierarchy theory may provide some insight into urban succession and long-term stability; and,
- One element of hierarchy theory remains troubling. Giampietro (1994) suggests that as long as the vertical and horizontal couplings of a hierarchy are neither too loose nor too strong, it is possible to avoid the destruction or debasement of the hierarchy's complexity. *Too loose* or *too strong* are vague terms and the specification of this statement needs exploration.

Overall, the generation of a methodologically- and theoretically-grounded plan evaluation instrument for judging the quality of ecosystem-based plans represents the primary result of this research (see Appendix V for the prototype). Ecosystem-based plans are currently

in their infancy. The importance of quality of life for Canadians remains a paramount concern and the systematic evaluation of planning efforts must be considered an important underpinning for methodologically-designed and theoretically-consistent planning practice. Ultimately,

The best course of action is not that course which most quickly, least painfully, least expensively, etc., leads to the gaining of our ends, but it is the course of action which is supported by the best reasons (Baier, 1963: 278).

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Personal Communication

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McKay, Barb. Personal Communication. Industrial Psychologist. Bell Canada. Montréal. January, 1998.

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APPENDIX I

GLOSSARY

Carrying Capacity

In ecological terms, carrying capacity is "the number of individuals of a given species that can be sustained indefinitely in a given area" (Miller, 1997: 118).

Catalytic Closure

Life as an emergent property lies in *catalytic closure*. As defined by Kauffman (1995: 275), "catalytic closure means that every molecule in the system either is supplied from the outside as 'food' or is itself synthesized by reactions catalyzed by molecular species with the autocatalytic system. Catalytic closure is not mysterious. But it is not a property of any single molecule; it is a property of a system of molecules. It is an emergent property."

The Clementsian Concept

According to Jorgensen (1992), the Clementsian or superorganism concept views ecosystems as organisms of a higher order and defines succession as ontogenesis of this superorganism (e.g. self-organization of ecosystems). However, organisms are different in one important respect: they cannot be dismantled without destroying them. Ecosystems are also different with respect to the fact that they have more linkages in their network than an organism, but most of these linkages are weaker, which makes the ecosystem less sensitive to external perturbations.

Complex Systems

A system can be defined as a set or arrangement of things so related or inter-connected as to form a unity or organic whole. More specifically, a system can be defined as $S = (T, R)$ where S denotes the system, T denotes a set of things distinguished within S , and R denotes a relation (or set of relations) defined on T (Klir, 1991). This basic definition covers both living (e.g., ecosystems, animals) and non-living (e.g., computers) systems, where all the elements of the system aggregation are either directly or indirectly interdependent (see von Bertalanffy, 1968). However, a meaningful distinction is that ecological systems have attributes over and above those demonstrated for mechanical systems, so Klir's definition can be regarded as useful but only preliminary (see Kauffman, 1995; Mainzer, 1994).

While mechanical systems can also have emergent properties, ecological systems demonstrate the emergent property of life. Life and its attendant degrees of freedom constitute the complexity that characterizes human and other biological communities (Mainzer, 1994). In this research, complex systems refer to systems that are living, open, and non-linear (Jorgensen, 1992).

Concept

A concept is the end product of conceptualization. A concept is both the label (word) and the complex set of events or ideas that form the whole referred to by the word (Walizer and Wienir, 1978). Conceptualization is the mental process of organizing observations and experiences into meaningful and coherent wholes (Walizer and Wienir, 1978).

Double Asymmetry

An important implication of hierarchy theory is that a stable hierarchy or ecosystem structure is the result of a compromise between the intensities of both horizontal and vertical interactions of the holons — known as horizontal and vertical couplings. As long as the couplings are neither too loose nor too strong, it is possible to avoid the destruction or debasement of the hierarchy's stability. The stability of each level depends on the stability of the other levels (either higher or lower), and this is known as *double asymmetry* or the *need for equipollence* (Giampietro, 1994).

Ecosystem

Miller (1997: 64) defines *ecosystems* as "communities of species interacting with one another and with their nonliving environment of matter and energy." Instead of seeing nature in terms of species against the backdrop of an abiotic environment, the ecosystem concept underplays the distinction between living and non-living components of the environment.

Emergent Properties

Emergent properties are the manifestation of the Hegelian maxim that *the whole is greater than the sum of its parts* (Kauffman, 1995; van Gigh, 1978). More specifically, emergent properties are attributes exhibited by a system level that are new and independent of the attributes of their lower-level components (Jorgensen, 1992). A notable emergent property is life.

Entity

An entity is an integration of all its parts (Allen and Starr, 1982).

Environmental Worldview

Environmental worldviews are value systems concerning how individuals think that the world works, what they think their role in the world is, and what they believe are right and wrong environmental behaviors (Miller, 1997). The continuum of environmental worldviews range from human-centred worldviews that place humanity at the apex of the framework to life-centred worldviews which regard humanity as one of many sentient life forms.

Epistemology

The primary concern of epistemology is the search and understanding of the foundations of knowledge. In other words, what do we know and how do we know it? (Lacey, 1986). The tradition of epistemology can be characterized as the search for principles that constitute the essence of knowledge, and the search for procedures or methods that will unquestionably lead to these principles. This will be accomplished by "the separation of the inquiring subject from the object of inquiry, by the search for the foundations of knowledge, by the quest to discover the way things really are, by a bid to find a final vocabulary for explaining human action untainted by the vicissitudes of time, place and human intention" (Schwandt, 1993: 16-18).

Evaluand

Evaluand refers to whatever is being evaluated, unless it is a person (Scriven, 1991). In this research, the evaluand is an ecosystem-based plan and the planning process that supports its formulation.

Evaluation

"Evaluation is the process of determining the merit, worth or value of things, and evaluations are the products of that process" (Scriven, 1991: 1). Because of its wide range of applications, it has compelling inter- and trans-disciplinary dimensions. Scriven (1991: 1) suggests that evaluation is "one of the most powerful and versatile of the 'transdisciplines' — tool disciplines such as logic, design and statistics — that apply across broad ranges of the human investigative and creative effort." The purpose or objective of evaluation research is to provide data and information to decision makers that can be used to make a decision about an evaluand — the product, program or plan under investigation (Scriven, 1991; Walizer and Wienir, 1978).

The Gleasonian Concept

The Gleasonian or individualistic concept assumes that populations respond independently to the external environment (Jorgensen, 1992).

Hierarchical Stability

Hierarchical stability can be considered an instrumental good, because it facilitates an intrinsic good: evolution. As O'Neill *et al.* (1986: 121) observe, within a hierarchy, only "relatively stable subsystems endure long enough for the next level of organization to evolve."

Hierarchy

Allen and Starr (1982: xiv) define a hierarchy as "a system of behavioral interconnections wherein the higher levels constrain and control the behavior of the lower levels."

Holism

Holism refers to the attempt "to reveal the properties of complex systems such as ecosystems by studying the systems as a whole" (Jorgensen, 1992: 58). In contrast to reductionism, holism involves research on the system level, rather than decomposing an ecosystem into its components and studying them in isolation. The research objective of holistic study involves system properties, rather than component properties.

Good: Instrument versus Intrinsic

Good refers to "the property or characteristic of a thing giving rise to commendation" (Lacey, 1986: 86). Some things are good as ends unto themselves (e.g. normative principles) or for their own sakes (e.g. *intrinsic goods*). Other good things can be regarded as means to ends and are referred to as *instrumental goods*. *Good* is a relative term, since there are no positions or actions that are universally good without conditions.

Holism

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in situ

Latin adjective meaning *in its original place* (Sykes, 1976).

Model

A model is a set of propositions, where propositions are statements about the nature of relationships between concepts (Simon, 1978; Walizer and Wienir, 1978). Simon (1978: 64) refers to models as mini-theories, since they focus on only "a few elements abstracted from all of reality." However, they are different from theories in that the scope of theory is broader and reflects the integration of models to result in inter-related sets of propositions (Walizer and Wienir, 1978).

Necessary and Sufficient Conditions

Necessary and sufficient conditions refer to causation. Let P and Q represent circumstances. Then,

- given any P and Q, P is a sufficient condition of Q if, given P, then Q.
- given any P and Q, P is a necessary condition of Q if, given $\sim P$, then $\sim Q$ (Blackburn, 1994; Sparkes, 1991; Lacey, 1986; Reese, 1980; Flew, 1979).

For example, oxygen is a necessary but not a sufficient condition for fire. Oxygen plus other necessary conditions like the presence of combustibles, a spark, and suitable environmental conditions, in combination, comprise a sufficient condition for fire.

NIMBYs, LULUs and BANANAs

NIMBY is an acronym for Not-In-My-Back-Yard and represents adversarial planning contexts where communities object to proposed planning initiatives that are perceived as damaging to neighbourhood quality (e.g., through noise, traffic congestion, decreased property values, etc.). NIMBY is blamed for costly delays in plan formulation and for holding up construction projects (Hodge, 1993). LULU (Locally-Unacceptable-Land-Uses) and BANANAs (Build-Absolutely-Nothing-Anywhere-Near-Anything) are analogues of NIMBY (Kunstler, 1996).

Non-linear Relationships

When variable X increases, variable Y increases and decreases in a patterned way (Walizer and Wienir, 1978). The patterned change cannot be described or modeled with a straight line.

Normative

Normative is the adjectival form of *norm*. A framework or theory is *normative* if its use prescribes the employment of standards (e.g., norms), either explicitly or implicitly. Normative statements either employ or imply the verbs 'ought' or 'should' (Lacey, 1986).

Operationalization

Operationalization involves the translation of concepts into a set of measurement-driven activities (Asher, 1984).

Plan Evaluation

Plan evaluation is concerned with establishing the merit, high quality or goodness of a plan. There are two primary types of plan evaluation: *ex ante* and *ex post*. In *ex ante* evaluation, the focus concerns plans that have not yet been implemented. Conversely, *ex post* evaluation is concerned with the content and performance of a plan that has already been implemented (Nijkamp, Rietveld and Voogd, 1990; Leung, 1989; Voogd, 1983).

Reductionism

In contrast to holism, reductionism "attempts to reveal the properties of nature by separating the components from their wholeness" (Jorgensen, 1992: 58). In other words, reductionism separates the whole into its parts and involves subjecting the parts to study.

Scale

"Scale pertains to size in both time and space; size is a matter of measurement, so scale does not exist independent of the scientist's measuring scheme. Something is large-scale if perceiving it requires observations over relatively long periods or time or across large parcels of space, or both" (Allen and Hoekstra, 1992: 2). This intuitive definition of scale is counter to its use in cartography, where a large-scale map shows small things with greater clarity than a small-scale map.

Validation

One difference between descriptive/explanative and normative/prescriptive theories is that prescriptive laws or theories can be broken by human behaviour and impacts, and do not cease to be laws or theories (Sparkes, 1991). In fact, to be repudiated, prescriptive laws and theories must be demonstrated to be invalid in terms of a lack of logical consistency (e.g. the premises of its arguments or positions do not imply the conclusions). So, to be valid, the premises of the prescriptive law or theory, taken conjointly, must imply its conclusions (Sparkes, 1991). In other words, to validate a prescriptive theory, it is necessary to demonstrate the underlying logic of conclusions drawn from the theory.

Wicked Problems

Problems in planning share a variety of fundamental characteristics that demonstrates their complexity. According to Rittel and Webber (1973), planning problems are complex because they:

- involve human values, aspirations, and motives;
- have no definitive formulation;
- have no stopping rule;

- are not true or false, but good or bad;
- have no immediate or ultimate test for a solution;
- are unique in each and every instance; and,
- can be considered symptomatic of another problem in a network of problems.

Rittel and Webber (1973) go so far as to rename the complex problems in planning as *wicked problems*, due to the level of difficulty associated with their resolution.

APPENDIX II
MEMBERS OF THE DELPHI PANEL

Members of the Delphi Panel in alphabetical order, plus their affiliations:

Donald Alexander. Simon Fraser University. Vancouver, British Columbia.

Dianna Colnett. Fraser River Management Board. Vancouver, British Columbia.

Penelope Gurstein. University of British Columbia. Vancouver, British Columbia.

Nina-Marie Lister. University of Waterloo. Toronto, Ontario.

Virginia Maclaren. University of Toronto. Toronto, Ontario.

Deborah Ramsay. Niagara Escarpment Commission. Georgetown, Ontario.

Kenneth Tamminga. Pennsylvania State University. University Park, Pennsylvania.

Ray Tomalty. University of Toronto. Toronto, Ontario.

Ian Wight. University of Manitoba. Winnipeg, Manitoba.

Graham Whitelaw. Ministry of the Environment and Energy. Toronto, Ontario.

APPENDIX III
FOUR ROUNDS OF THE DELPHI PROCESS*

* Please note that the Delphi surveys presented in this appendix are provided for illustrative purposes and have been reformatted in order to fit on either letter- or legal-sized paper.

Round 1

Introduction to the Research Topic

The purpose of the research is to investigate the following research question: **what conditions or characteristics constitute a good ecosystem-based municipal plan?** The scope of the research is confined to planning contexts or jurisdictions where the ecosystem approach to planning is employed. The evaluation framework to be derived is intended for application before plan adoption, so plan performance criteria are not addressed.

Berke and French (1994) contend that "the planning literature is surprisingly narrow when it comes to what constitutes a good plan." Yet, whether a municipal plan is good or not depends on which value systems are shaping the evaluation process. In other words, a so-called *good* plan is related to the ranges of values held by the various interested parties (including citizens, professional planners and elected officials). A municipal plan that is good for the public at large, or for special interest groups, is not necessarily good for the development community or for elected officials. Consequently, separating and filtering out the various value systems at work in a particular planning situation can be fraught with difficulty. Through the Delphi survey method, it may be possible for planning experts to identify and agree upon necessary and/or important conditions/characteristics that constitute a *good* ecosystem-based plan. *Good*, in this research, refers to the property of "a thing giving rise to commendation" (Lacey, 1986).

The potential conditions/characteristics of a good plan listed in the questionnaire are the result of a comprehensive and systematic review of the planning, geography and related literature. Important sources of the evaluation criteria for this study include the following: Tamminga, 1996; Van der Ryn and Cowan, 1996; Dalton and Burby, 1994; Berke and French, 1994; Tomalty *et al.*, 1994; MOEE, 1994; Calthorpe, 1993; Gallagher and Jacobson, 1993; Crombie, 1992; Schibuola and Byer, 1991; Kent, 1990; Lamont, 1990; Alexander and Faludi, 1989; Voogd, 1983; Fishman, 1978; and Boyce, 1972. The Tomalty *et al.* (1994) publication was particularly important in providing indicators for the following two plan conditions/characteristics: (1) The Principles of the Ecosystem Approach to Planning, and (2) The Ecosystem Approach to Planning Process.

Overall, the questionnaire lists an extensive range of potential evaluation criteria and asks the panel members to decide on their importance. In this study, each of the suggested evaluation criteria can be identified as a *necessary condition*, an *important characteristic* or not an *important characteristic* of a good plan. Although each community may differ in their

composite beliefs of what constitutes a a good plan, it is tenable to assert that there are, nonetheless, certain fundamental conditions or characteristics that all communities should likely consider in evaluation efforts.

Now, for the purposes of clarification, please consider the following logic-based argument. Necessary and sufficient conditions refer to causation. Let P and Q represent circumstances. Then,

- given any P and Q, P is a sufficient condition of Q if, given P, then Q.
- given any P and Q, P is a necessary condition of Q if, given $\neg P$, then $\neg Q$ (Blackburn, 1994; Sparkes, 1991; Lacey; 1986; Reese, 1980).

Note that the tilde (e.g. $\neg$) signifies *not*. By way of explaining the argument, oxygen is a necessary but not a sufficient condition for fire. Oxygen plus other necessary conditions like the presence of combustibles, a spark, and suitable environmental conditions, in combination, comprise the sufficient condition for fire.

Ultimately, by attempting to establish which necessary conditions combine to represent the sufficient condition for plan quality (according to planning expertise), it may be possible -- by employing hierarchy theory -- to explore a theoretically-based foundation for ascertaining the quality of existing or proposed ecosystem-based municipal plans.

Introduction to the Delphi Survey Method

The Delphi survey method is used "for obtaining and refining the opinions of a group of informed individuals, referred to collectively as the Delphi panel" (Cavalli-Sforza and Ortolano, 1984). Basically, the Delphi method is concerned with establishing consensus among experts. The Delphi method achieves this consensus with a planned and orderly program of sequential individual interrogations (called *rounds*), normally by mailed or faxed questionnaires, but sometimes by e:mail. For reasons related to privacy and to the organizational structure of the questionnaire, this Delphi survey has been mailed. The second and third questionnaires will incorporate anonymous feedback from each expert to emphasize increasingly informed judgment.

How will this particular Delphi proceed?

Ten planning experts from across Canada -- all with publication records associated with environmental or ecosystem-based planning and with advanced degrees in planning, environmental science, geography, or a related discipline -- have been engaged to identify the conditions/characteristics that they believe constitute a good ecosystem-based municipal plan. In the questionnaire that accompanies this information package, an extensive but preliminary list of potential conditions/characteristics is provided. This list, generated from an exhaustive literature review related to both plan evaluation and the ecosystem approach to planning, can be considered a first step in arriving at a consensus surrounding the characteristics of good or high-quality ecosystem-based plans.

As shown in Figure 1, the Delphi survey unfolds in a structured manner. In the telephone interview series, the research context was explained to panelists. Then, this information package and the first questionnaire were distributed. Panel members respond to the questionnaire and the Delphi administrator summarizes the results and then re-iterates the process.

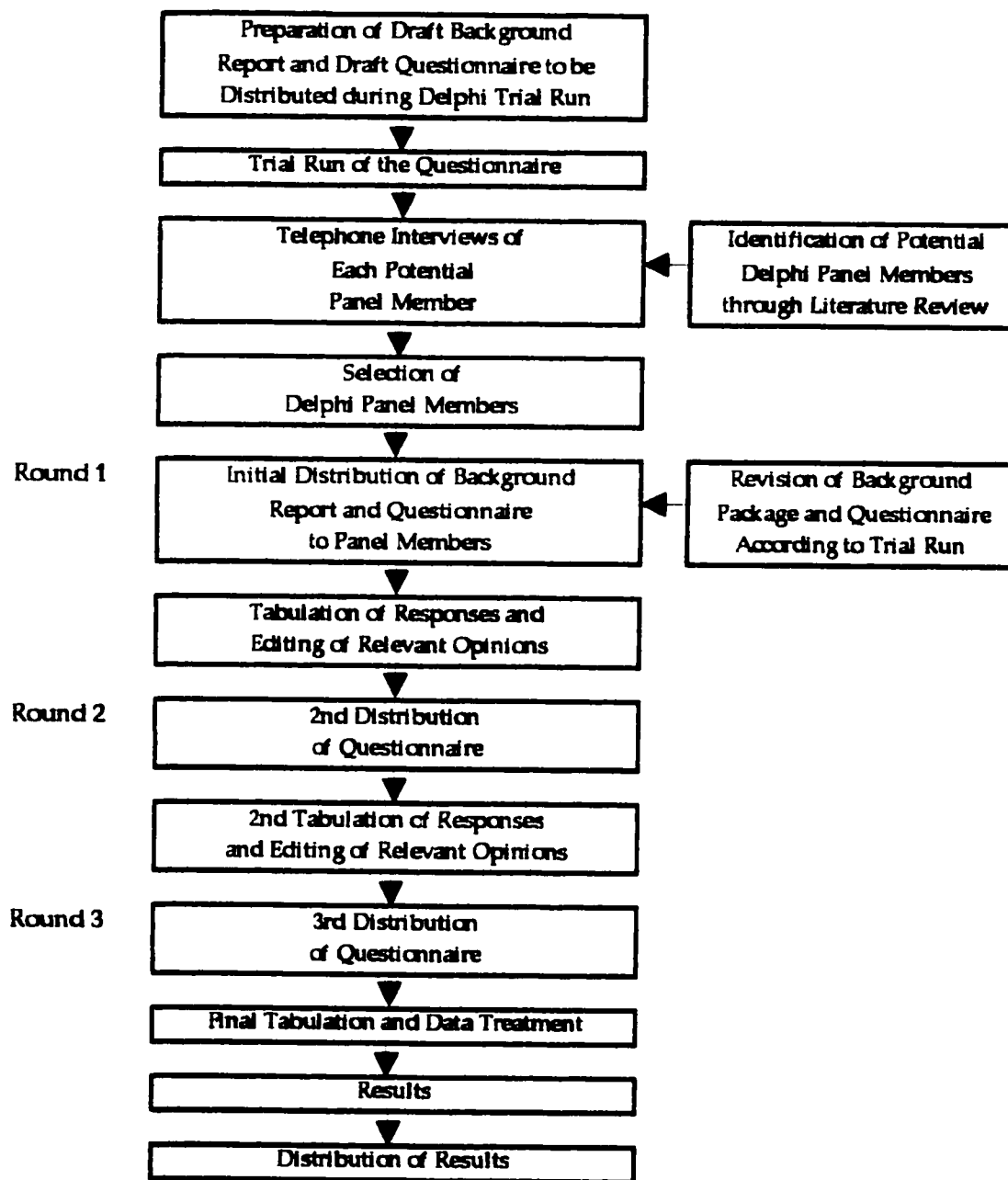
Completion of the Delphi Questionnaire

Panel members are asked to fill in the shaded portions of the questionnaire. Following the covering page of the survey, the first page of the questionnaire requests some very general personal information. In the remainder of the questionnaire, panelists will notice that the potential evaluation criteria are organized into three envelopes: *plan form*, *plan content*, and *planning process*. *Plan form* relates to how a plan is presented, written and organized. *Plan content* refers to the conceptual and policy substance of a plan. *Planning process* refers to the stages or steps taken in the plan formulation functions. Once again, it is important to emphasize that the focus of this research is on *ex ante* evaluation (i.e. before the plan is actually implemented). Ultimately, the panelist is asked to agree whether the potential conditions or characteristics of a good ecosystem-based plan are *necessary*, *important*, or *not important*. Please note that the selection *important* includes the distinctions of *very important*, *moderately important*, and *slightly important*.

For each potential condition/characteristic listed in the first column, associated indicators are provided in column five. Panelists are asked to agree or disagree if the indicators chosen are appropriate. Indicators provided represent a combination-based indicator framework (see MacLaren, 1996). If the indicators are not appropriate or need additional criteria, panelists are

Figure 1. Flowchart of the Delphi Survey Process

(Source: Adapted from BP Petroleum Development Ltd., 1986)



encouraged to provide alternatives. Panelists can make notes on individual pages or use the blank pages provided at the end of the survey.

In subsequent rounds, consensus surrounding which conditions should be considered *necessary* and which as *unnecessary* may be achieved. Then again, consensus cannot be presumed. There are no right or wrong answers in a Delphi exercise – after all, experts are being asked to express their *opinions*. After each iteration of the survey, the results will be tabulated to show how many people on the panel concur concerning each condition or characteristic. As well, the degree of their consensus will be summarized concerning each of the Column 1 conditions/characteristics. These results, along with selected commentary arising from the survey, will then be transmitted at the start of the next round for panelists to consider.

As shown, the Delphi survey method is consensus-driven. The notion of *complete consensus* in this study is represented by unequivocal agreement among panel members concerning the identification of necessary conditions or characteristics of a good plan. Yet, in democratic societies, other forms of consensus are acceptable. The goal of a consensus-based process is to reach closure by finding a mutually acceptable outcome (Cormick, 1991). Unequivocal agreement may, after all, be unattainable. Consensus-based issues will be addressed as they arise. Overall, it is anticipated that levels of response stability can be achieved in three and not more than four iterations. After three iterations, a point of diminishing returns tends to be experienced (Linstone and Turoff, 1975).

You will be contacted ten days after the mailing date of this questionnaire to ensure that there are no questions or problems. Please feel free to contact me at any time, either by phone (613-224-4555) or by e:mail (ar948@freenet.carleton.ca). Thank you again for participating.

ROUND ONE OF THE DELPHI SURVEY: THE CONDITIONS/CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED MUNICIPAL PLAN

Here is a summary of points to remember while completing the questionnaire

- The underlying research question for this survey is: *what conditions or characteristics constitute a good or high-quality ecosystem-based municipal plan?* In other words, the research focus is concerned with those conditions or characteristics that you feel or believe are necessary or important to determining the goodness or quality of an ecosystem-based municipal plan. More specifically, I am interested in your expert opinions. There are no right or wrong answers in this Delphi survey.
- The questionnaire applies only to municipal plans formulated in planning contexts where the ecosystem approach to planning has been employed. Evaluation criteria cannot be generalized to all types of municipal plans.
- The items listed as potential conditions or characteristics of a good plan in no way represent an imposition of what the investigator feels or believes constitutes a good plan. Potential plan quality characteristics identified during a comprehensive and systematic review of the planning and related literature have merely been summarized and grouped.
- For descriptive and explanatory reasons, the *indicators* (Column 5) are sometimes listed with *one or more measures* (quantifiable/qualifiable variables) in parentheses. In subsequent applications of the framework, one or more measures will be linked to each indicator.
- You are asked to complete the *shaded* portions of the questionnaire. If you want to comment on the contents of the questionnaire, feel free to write in the margins or use the blank page provided at the end of the survey. When providing commentary, try to use the numbers at the far left of the questionnaire pages to identify the characteristics/conditions that are being addressed.

- Evaluation criteria are grouped according to *plan form, plan content* and *planning process*. Since this study is concerned with evaluation initiated before a plan is implemented, plan performance criteria are not addressed.
- You have been asked to agree with an importance rating (by choosing one of three possible ratings) for potential conditions or characteristics of a good plan. These *importance ratings* are defined as follows:

Necessary condition means that the characteristic is critically important. Unless the plan demonstrates it, the plan can not be considered a good one.

Important means that the plan characteristic is relevant to plan quality. It also includes sub-categories such as *very, moderately* and *slightly important*.

Not important means that the plan characteristic is not relevant to a determination of a plan being a good one. It will have no measurable significance to any discussion relating to plan goodness, quality or merit and should be excluded from further consideration in this research context.
- This questionnaire has been pretested. Nevertheless, if you find that any portion of the questionnaire requires further explanation, please contact me immediately for clarification. This is critical because you must respond to all the questions. My phone number is 613-224-4555. My e-mail address is: ar948@freenet.carleton.ca
- It is imperative that you sign the ethics consent form before you begin the questionnaire. This is an important condition attached to research at the University of Ottawa.
- You will be contacted 10 days after this questionnaire has been mailed to ensure that there are no problems. Please respond as quickly as possible to each round. Thank you again for your time and effort.

Yours sincerely,

Full name:

Please indicate how you would prefer to be addressed in subsequent correspondence (e.g. Dr., Professor, Ms., Mr., your first name):

Your e-mail address:

Today's date:

Education (i.e. please list all of your university degrees and the disciplines of specialization):

Professional memberships or affiliations (e.g. CIP, AIP, RAIC, CSLA, etc.):

Total number of years of planning experience (including teaching but excluding years as a student):

Total number of years of interest in the ecosystem approach to planning (including years as a student):

Is your planning experience (including research interests) more concerned with plan formulation or plan administration?

Please provide the reference for your most recent publication that uses the word 'ecosystem'

POTENTIAL CONDITIONS OR CHARACTERISTICS FOR A GOOD ECOSYSTEM BASED PLAN (i.e. good plans would demonstrate them)	THIS IS A NECESSARY CONDITION OF A GOOD PLAN	THIS IS AN IMPORTANT INDICATOR OF THE CHARACTER OF A GOOD PLAN	THIS IS NOT AN IMPORTANT INDICATOR OF THE CHARACTER OF A GOOD PLAN	POSSIBLE INDICATORS OF THE POTENTIAL CONDITIONS OR CHARACTERISTICS FOR A GOOD PLAN (i.e. a good plan will demonstrate these indicators, please indicate if or explain why purposes, measures or individual indicators are sometimes protected or prioritised)	THIS IS A NECESSARY INDICATOR OF THE CHARACTER OF THE PLAN/THIRSE	THIS IS AN IMPORTANT INDICATOR OF THE CHARACTER OF THE PLAN/THIRSE	THIS IS NOT AN IMPORTANT INDICATOR OF THE CHARACTER OF THE PLAN/THIRSE
	Please agree with one of the above three statements by checking marking the appropriate box below				Please agree with one of the above three statements by checking marking the appropriate box below		

PLAN CONTENT (cont'd)

8 Artistic	Agree?	Agree?	Agree?	- Innovation (inventiveness, reflection of 'zeitgeist', beauty, the X factor or artistic merit) - New ways of goals achievement (new planning tools, innovations in public participation etc.)	Agree?	Agree?	Agree?
9 Legality	Agree?	Agree?	Agree?	- Consistency (with planning law, other relevant regulations, upper tier plans) - More than the minimum requirements of the law	Agree?	Agree?	Agree?
10 Flexibility	Agree?	Agree?	Agree?	Wide breadth of the tool envelope (a full range of planning instruments employed in the plan)	Agree?	Agree?	Agree?
11 Consensus on the Values Used to Define Best Planning Practices	Agree?	Agree?	Agree?	- Identification of priority planning values (beauty, effectiveness, efficiency, safety etc.) - Demonstration of best practices (separation of incompatible land uses etc.)	Agree?	Agree?	Agree?
12 Ease of Plan Implementation (Plan content foundation)	Agree?	Agree?	Agree?	- Fair basis (propositions are scientifically grounded, data is sound etc.) - Quantifiable by growth (plan is regulation based only if region is high growth) - Plan currency (plan uses up to date information, < five years old) - Equitable spatial and socio-economic distribution of NIMBY's - Acceptable synthesis of different public and private agendas	Agree?	Agree?	Agree?
13 Principles of the Ecosystem Approach to Planning	Agree?	Agree?	Agree?	- Planning units are based on natural boundaries (watersheds, catchments etc.) - Introductions are designed with nature natural processes topography - Consideration of the cumulative effects of policies, plans and projects - Consideration of the global effects of projects, plans and projects - Inter jurisdictional decision making - External consultation, cooperation & partnering among interested parties/stakeholders - Long term monitoring, feedback & adaptation of plan content - Inter disciplinary approach to implementation - Clearly defined authority for implementation by planning body - Information supporting the plan is context specific (relevant to the area) - Dialogue/interaction sharing with other ecosystem based contexts - Sharing of individual attitudes & practices - Intergenerational equity - Intra-generational equity - Recognition of ecological footprint or regional carrying capacity - Acceptable synthesis of the concerns of the natural, economic and social environments	Agree?	Agree?	Agree?

POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM BASED PLAN (i.e. good plans would identify and manage them)	THIS IS A NECESSARY CONDITION OF A GOOD PLAN	THIS IS AN IMPEDIMENT	THIS IS NOT AN IMPEDIMENT	POTENTIAL INDICATORS OF THE POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD PLAN (i.e. a good plan will data indicate these indicators, please indicate if and for explanatory purposes, measures for individual indicators are sometimes provided in parentheses)	THIS IS A NECESSARY CONDITION OF THE PLAN (CONTRIBUTION/CHARACTERISTIC)	THIS IS AN IMPEDIMENT INDICATOR OF THE PLAN (CONTRIBUTION/CHARACTERISTIC)	THIS IS NOT AN IMPEDIMENT INDICATOR OF THE PLAN (CONTRIBUTION/CHARACTERISTIC)
Please agree with one of the above three statements by check marking the appropriate box below							

14 Environmental Quality Strategies

PLANNING PROCESSES

• Air quality strategies (multi-modal transport planning, compact urban form, mixed uses, etc.) • Water quality strategies (education, tertiary sewage & stormwater treatment, etc.) • Land conservation strategies (land swaps/acquisitions, growth management, easements, etc.) • Biodiversity strategies (green corridors, systems, shoreline preservation areas, etc.) • Resource conservation strategies (impacts, transfers of development rights, etc.) • Land rehabilitation strategies (engineering, re-vegetation, public-private partnerships, etc.) • Waste minimization strategies (human scale, stimulates car scale, mixed use, zoning, etc.) • Natural disaster strategies for flooding, unstable slopes, earthquakes, etc.	Agree?	Agree?	Agree?

15 Environmental Impact Minimization

PLANNING PROCESSES

• Strategic environmental assessment or environmental review of the plan	Agree?	Agree?	Agree?

16 Ecosystem Approach to Planning Process

• Visioning (exploration of interested party/stakeholder values, needs, desires, etc.) • Scoping (identification of priority issues, problems and opportunities) • Definition & surveying of planning region (background studies are completed) • Analysis of the planning region in terms of potentials • Assessment of plan alternatives • Public debate or plan options • Refinement of plan options and choice • Employment of a full range of implementation strategies • Monitoring of plan performance • Feedback loops internal and external to each stage	Agree?	Agree?	Agree?

17 Ease of Plan Implementation

(Process formulation)

• Process done by trained planning staff or consultants • Planning staff or consultants are professionally affiliated • Available funds to employ planning staff or consultants • Available funds to carry out planning strategies • Political commitment to the plan (may or may not be the plan, etc.) • Co-operation or commitment among inter-jurisdictional partners (municipal, etc.) • Credibility of local political structure (no history of scandals or law breaking, etc.) • Institutional power to implement the plan • Credible institutional transparency • Credible institutional accountability (bottom up and top down directions of accountability) • Ongoing public involvement during plan formulation • Process appropriate to growth (regulation, critical only if high growth) • Integration of planning & economic development efforts • Flexible/special plan amendment processes for new data, new circumstances	Agree?	Agree?	Agree?

PLEASE SUGGEST OTHER POTENTIAL CONDITIONS/CHARACTERISTICS OR INDICATORS OF A GOOD ECOSYSTEM BASED THAT YOU BELIEVE ARE CRITICAL OR IMPORTANT

Round 2

BACKGROUND TO ROUND 2 OF THE DELPHI SURVEY

May 23rd, 1997

Dear

Hello. Thank you for your input into Round 1 of the Delphi survey concerning the evaluation of *goodness* or quality of ecosystem-based municipal plans. A number of the panel members have expressed considerable interest in the Delphi technique, so the following synopsis has been prepared to provide an introductory overview of how the process is evolving in this research context.

Notes on Survey Design

The Delphi survey that you are currently participating in has been designed to recognize the following factors:

- **minimizing the time involved in the survey process.** A Delphi survey typically involves a minimum of three rounds and usually not more than four rounds, although many exceptions exist. When strictly consensus-based as opposed to forecasting-based, three rounds of the Delphi survey are normally presumed when an open-ended question has been provided in the first round. Obviously, the survey monitor must attempt to ensure that the survey moves as quickly as possible towards response stability and consensus to prevent panelists from becoming disinterested with needless rounds (i.e. more than four);
- **staying on the learning curve.** An open-ended question was provided at the end of the Round 1 questionnaire. This open-ended question enabled panel members to circulate their own ideas about what is important and relevant to good ecosystem-based plans among the other panel members;
- **maximizing the opportunity for opinion convergence.** To maximize the opportunity for opinion convergence, the survey design employs only those decision categories that are specifically necessary for the underlying research purpose. More specifically, the results of this survey will be used as a point of departure for addressing possible theoretical underpinnings for ecosystem-based plans and planning through the application of hierarchy theory. Ultimately, this means that the primary focus of this survey is to discriminate between those conditions, characteristics or attributes of good ecosystem-based plans that are necessary *versus* important; and,
- **ease of understanding.** The use of the *mode* as the identifier of dominant responses is intuitively appealing. More importantly, it clearly indicates which of the three response categories provided in the survey is dominant for each variable, rather than the mean or median which cannot adequately capture nominative or unscaled categories.

It is important to emphasize that this research is employing a strictly consensus-based Delphi, rather than a forecasting-based Delphi. Consequently, a specific set of rules apply to its administration, so the median/mean and interquartile ranges of response are not the primary loci of interest. After Round 2, methodological interests will concern two factors: response stability testing between subsequent rounds, and application of the level of agreement or consensus criteria. Please note that *complete consensus* (i.e. each and every panel member agrees on a variable) -- regardless of the round involved -- is assumed to be a stable response and the condition, characteristic or attribute

involved will be removed from subsequent iterations by emptying its *agreement cells* (i.e. the boxes in the survey where you checkmark your responses). In this way, streamlining of the survey can be achieved.

Observations Concerning Round 1

Round 1 was exploratory. Panel members were provided with a list of potential conditions, characteristics or attributes of *good* ecosystem-based plans that were extracted and grouped from an extensive and systematic literature review. Then, as a group, panelists reviewed the list and -- by answering the open-ended question at the end of the survey -- made suggestions of conditions, characteristics or attributes that were felt to warrant inclusion in the survey. Each of the panel's suggestions from Round 1 has been incorporated into the latest version of the survey (either by the inclusion of a new category or by expanding on the qualifiers provided for the attributes). In order to control (i.e. minimize) the number of iterations of this Delphi survey, the list of potential conditions, characteristics and attributes is now closed to additional inserts for subsequent rounds. Henceforth, please do not suggest new variables for deliberation in the survey because it will not be possible to adequately test them in subsequent rounds; however, this should not prevent panelists from making suggestions or providing qualifiers in the survey margins or elsewhere.

In Round 2, panelists are asked to consider where the majority of the panel is positioned, and to vote with this knowledge. Nevertheless, please bear in mind that while consensus may be instructive, so are differences of opinion. In fact, the bases of disagreement are turning out to be extremely illuminating from the personal communications provided by most panel members. Various camps (i.e. consolidating sub-groups) on the panel are in the process of self-identifying. Paraphrasing the feedback of panel members who did provide commentary, identified camps along various conceptual continua include the following:

- **the *science versus values* continuum.** Some panel-members argue for the penultimate importance of science in driving the ecosystem approach to planning. On the other hand, some panel members believe the process should be entirely value-driven and merely supported by science as a means of authority;
- **the *reform versus revolution* continuum concerning institutional structures.** A difficulty encountered in formulating and implementing ecosystem-based plans concerns the considerable historical inertia of complex government institutions found in federal and other nations. Some panel members suggest that the challenge of ecosystem-based planning is working within the limitations of existing institutions. The implication is that change to institutional structures, if it occurs, would involve incremental reform. The hand has been dealt and the planner, decision maker or activist etc. must optimize the preferred solution given the institutional restrictions. Conversely, a number of panel members adamantly argue that institutional structures need to be drastically overhauled immediately and that little progress can be made without extensive governmental and political restructuring. In other words, existing governmental structures are pre- or anti-ecological;

- **the *benefit maximization versus impact minimization* continuum.** Some panel members argue that by supporting environmental impact minimization, mitigation and remediation, we implicitly perpetuate unsustainable decisions and behaviours. Instead, governance and planning should focus on the *net ecosystem benefit* of decisions and behaviours and be compelled to discard more conventional planning worldviews. The challenge is to begin negotiation among interested parties/relevant groups from a positive point of departure (rather than from the lowest common denominator -- the minimization of impacts). Yet, other panel members find that the ecological footprint of urbanized areas is escalating so quickly that we cannot, in fact, extricate ourselves from growth and change so easily without explicitly addressing economically-predicated impacts and clearly demonstrating society's interest in doing so; and.
- **the *planning as inflexible (and outmoded) versus planning as flexible* continuum.** Some panel members argue that planning techniques are totally outmoded and inflexible (e.g. Euclidean zoning). In other words, existing planning practices and techniques are too inflexible to recognize and deal with the complexity of ecosystem-based planning contexts. Conversely, other panel members suggest that existing planning structures and legislation are sufficiently flexible to permit the on-going evolution of planning practices and tools required to meet the challenges of ecosystem-based planning. For example, new(er) planning techniques like performance zoning, visioning and mitigation banking represent a range of techniques that are supported by existing North American legislation. In other words, the suggestion is that the task in ecosystem-based planning is to re-orient or transform planning processes and goals, and then to find, develop or reshape existing or new planning techniques that are capable of guiding or invoking beneficial change.

When completing the survey, panel members are asked to recognize that these and other continua exist. Furthermore, the survey is designed in a precautionary fashion to ensure that the widest possible representation of variables continues to be available. No doors have been or will be prematurely closed. Ultimately, it will be the task of the plan evaluator using the final results of this survey to adapt the conclusions to the specific circumstances of the municipality and municipal plan under their investigation.

How do panel members complete Round 2?

In Round 2, each variable is presented with its *mode* -- the category in the distribution with the largest number of observations or frequency of response from Round 1 (Bohrnstedt and Knoke, 1994). The mode is provided to gauge the overall position of the panel as a whole and is listed under the related *agreement cell* for each variable in the survey. When two of the three *importance categories* display the same level of agreement, bimodality is recognized (as the *bimode*). In Round 2, you are being asked to reconsider the importance of each variable in light of the identified mode. If your responses in Round 2 are not in accordance with the mode identified from Round 1, you are asked to succinctly (i.e. in less than ten words) identify why your opinion diverges. You can provide the explanation in the margin. Please note that while explanation is strongly encouraged, it is not mandatory. However, you are urged to keep in mind that by stating why your responses deviate from the mode, you may identify factors that the other panel members are not considering. Then again, maybe your expert opinion is just different. Edited summaries of these explanatory comments may be included in the next round of the survey. It is noted that at the end of Round 1, none of the variables indicated *response polarization* (bimodality occurring in the *necessary* and *not important* categories).

After Round 2, it is conceivable that testable levels of both response stability and consensus may be achieved for some variables. An immediate implication of response stability and subsequent consensus is that the survey will start to be contracted in size – perhaps considerably. After Round 2, it will be possible to provide insight into *response stability* between the first two rounds by employing an *index of predictive association* on suitable variables (Regier, 1986; Chaffin and Talley, 1980). The index of predictive association is a non-parametric estimate of probability suitable for testing small populations and samples. A derived value between 0 and 1 will indicate the degree of confidence that responses can be argued to exhibit with respect to stability between rounds. Once stability is ascertained, then the level of consensus criteria can be applied. These criteria will be discussed in more detail in the notes introducing Round 3.

Finally, a *literature cited* section will accompany the summary of research results that will be provided to you after completion of the survey. If you require feedback on bibliographic information before then, please indicate this somewhere on the survey form.

Thank you again for your participation.

Sincerely,

ROUND 2 OF THE DELPHI SURVEY

Here is a summary of points to consider while completing Round 2:

- The underlying research question for this survey is: *what conditions or characteristics constitute a good or high-quality ecosystem-based municipal plan?* In other words, the research focus is concerned with those conditions or characteristics that you feel or believe are necessary or important to determining the goodness or quality of an ecosystem-based municipal plan.
- The questionnaire is intended to apply only to those municipal plans that are formulated in planning contexts where the ecosystem approach to planning has been employed. The evaluation criteria provided cannot be generalized to all types of municipal plans. However, it is important to remember that many of the conditions, characteristics and attributes of good ecosystem-based plans do, in fact, apply to all plans (e.g. effective communication of planning information to interested parties, etc.).
- For descriptive and explanatory reasons, the *attributes* provided in Column 5 are sometimes listed with one or more measures or qualifiers in parentheses.
- Evaluation criteria are grouped according to *plan form*, *plan content* and *planning process*. Since this study is concerned with evaluation initiated before a plan is implemented, plan performance criteria are not specifically addressed.
- You have been asked to agree with an importance rating (by choosing one of three possible ratings) for potential conditions or characteristics of a *good* plan. These *importance ratings* are defined as follows:

Necessary means that the plan condition, characteristic, or attribute is critically important. Unless an ecosystem-based plan demonstrates it, the plan can not be considered a good one.

Important means that the plan condition, characteristic, or attribute is relevant to the determination of plan quality. The *important* rating includes sub-categories such as *very*, *moderately* and *slightly important*. Since the discrimination of *very*, *moderately* and *slightly important* is not pertinent to the underlying research purpose, these sub-categories have been combined.

Not important means that the plan condition, characteristic or attribute is not relevant to a determination of a plan being a good one. It will have no measurable significance to any discussion relating to plan goodness, quality or merit and should be excluded from further consideration in this research context.

- For each variable in the survey, the *mode* or dominant frequency of response from Round 1 is identified to provide insight into the position of the Delphi panel as a whole. Please consider the position of the panel when responding. If your vote is not in agreement with the mode, you are encouraged to succinctly identify *why not* in the margins, although this is not mandatory. The mode for each variable is identified under its related *agreement cell*.
- The Round 2 questionnaire is longer than the Round 1 questionnaire because (a) more information is being transmitted due to the inclusion of the modes and (b) suggestions made by panel members in Round 1 have been fully incorporated. Also, please note that the suggestions of panel members from Round 1 may have been inserted in a different location than originally targeted. All new variables are presented in both bold and italics. Obviously, new additions have not been tested yet and will not have an identified mode.
- Overall, Round 1 provided important insight into supplementary research variables that require attention. If you find that any of the new portions of the questionnaire require clarification, please contact me immediately. **This is critical because you must respond to all the questions.** My phone number at home is 613-224-4555. My phone number at the National Capital Commission is 613-239-5036. My e:mail address (which only accepts text-based mail) is: ar948@freenet.carleton.ca
- You will be contacted within two weeks after this questionnaire has been mailed to ensure that there are no problems. Please respond as quickly as possible and remember to print when answering questions or providing editorial commentary. Thank you again for your time and effort.

Name?

Today's Date?

Will there be any change to your mailing address, phone number or e:mail address over the summer?

If you were participating in an employment survey, how would you self-identify yourself by discipline? For example, do you call yourself a planner, environmental planner, landscape architect, geographer, ecologist, natural resources manager, biologist, etc.? Note: if you find the suggested categories too generic, please come up with your own (e.g. architect/ecologist; professor of environmental planning).

In Round 1, you provided your e:mail address. This time, could you identify whether you actually use your e:mail. Please circle one response below.

Yes

No

Optional Question: If you are able to, please identify one or two members of your community or in local special interest groups that are interested in or actively involved in ecosystem-based planning and issues. Please indicate their name, organization and city (e.g. John Doe, Ecovision, Ottawa). If you happen to have their phone number, please include it.

POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans would demonstrate them)	THIS IS A NECESSARY CONDITION OF A GOOD PLAN	THIS IS AN IMPORTANT CHARACTERISTIC OF A GOOD PLAN	THIS IS NOT AN IMPORTANT CHARACTERISTIC OF A GOOD PLAN	POSSIBLE ATTRIBUTES OF A GOOD PLAN (please note: these are for individual attributes, not for the plan as a whole)
	Please agree with one of the above three statements by checkmarking the appropriate box below			

PLAN FORM

Effective Communication of Planning Information to Interested Parties (e.g. relevant groups, stakeholders) -- (was 'Ease of Communication')

Agreed? Agreed? Agreed?
Mode=8

Note: by identifying the mode as 8 in this row and column, I am telling you that 8 out of the 10 panel members agreed that "Effective Communication of Planning Information to Interested Parties" is a necessary condition of a good ecosystem-based plan

- Definition of key concepts (in-text, in margin notes, in glossary)
- Animation/friendliness of plan (photos, graphics, data, maps)
- Use of plain language (no planning jargon, minimal obfuscation)
- Well organized (logical progression of topics and ideas, good flow)
- Ease of locating information (table of contents, page tabs)
- Well written (no spelling mistakes, good grammar; fluidity)
- Self-containment (inclusion of related maps, bibliography)
- Identification of how to get further information (contacts; phone numbers)
- Text readability (good reproduction, suitable font size)
- Plan availability in relevant languages (e.g. both of Canadian languages)

Effective Communication of Spatial Information to Interested Parties Through Maps (was 'Map Effectiveness')

Agreed? Agreed? Agreed?
Bimode=5 Bimode=5

- Appropriate level of map detail (legend has a manageable number of items)
- Appropriate level of boundary accuracy (if plan is conceptual, maps demonstrate accuracy; conversely, if the plan is site-specific, maps demonstrate accuracy)
- In all cases, plan maps are reflective of policies & policies are reflective of maps
- Manageable map size (size of adult arm-span or smaller)

Streamlined Plan Size

Agreed? Agreed? Agreed?
Mode=5

- Conciseness (the plan itself focuses on vision, planning principles, and action items)
- Detailed background information found in supporting documents
- No in-text duplication (minimal repetition of policies, concepts, etc.)

Plan Update Potential (was 'Organic Potential')

Environmentally-sensitive Plan Production

Environmentally-sensitive Plan Distribution (was 'Availability')

Agreed? Agreed? Agreed?
Bimode=4 Bimode=4

Agreed? Agreed? Agreed?

Agreed? Agreed? Agreed?
Mode=4

- Plan updating possible through the physical addition of amendments
- Environmentally responsible materials used in plan production
- Plan availability at a web site
- Use of an insert/bookmark that suggests sharing plan (e.g. "Share this plan")

PLAN CONTENT

Rational Content (was 'Scientific')

Agreed? Agreed? Agreed?
Mode=8

- Completeness (no issues relevant to the context are avoided)
- Hierarchical framework of vision, planning principles, issues, and action items
- Consistency (logical consistency within hierarchy, minimizing contradictions)
- Vision reflects a representative range of interested parties/interests
- Ethically- or scientifically-based principles (principles are based on values or ethical maxims) Note: value-based principles like 'conviction' (science; previous research) or deduction (ethics)
- Issues are both opportunity- and problem-based (issues recognize both problem-based needs and opportunity-based needs)

POSSIBLE ATTRIBUTES OF THE 'POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN' LISTED IN COLUMN 1
(please note that for explanatory purposes, 'measures' for individual attributes are sometimes provided in parentheses)

THIS IS A NECESSARY
ATTRIBUTE OF THE
COLUMN 1 CONDITION/
CHARACTERISTIC

THIS IS AN IMPORTANT
ATTRIBUTE OF THE
COLUMN 1 CONDITION/
CHARACTERISTIC

THIS IS
IMPORTANT
THE COLUMN
CHARACTER

Please agree with one of the above three statements by checkmarking the appropriate box below

- Definition of key concepts (in-text, in margin notes, in glossary etc.)
- Animation/friendliness of plan (photos, graphics, data, art etc.)
- Use of plain language (no planning jargon, minimal obfuscation)
- Well organized (logical progression of topics and ideas; grouping of concepts according to an underlying framework)
- Ease of locating information (table of contents, page tabs, index etc.)
- Well written (no spelling mistakes; good grammar; fluidity etc.)
- Self-containment (inclusion of related maps, bibliography etc.)
- Identification of how to get further information (contacts; bibliography, web addresses etc.)
- Text readability (good reproduction, suitable font size)
- Plan availability in relevant languages (e.g. both of Canada's Official Languages; local ones like Cree or Chinese etc.)
- *Appropriate level of map detail (legend has a manageable number of attributes; lack of visual clutter)*
- Appropriate level of boundary accuracy (if plan is conceptual/strategic, then maps can be conceptual or 'fuzzy'; conversely, if the plan is site-specific, maps demonstrate exceptionally accurate boundaries)
- In all cases, plan maps are reflective of policies & policies are reflective of maps (relationship can be demonstrated)
- *Manageable map size (size of adult arm-span or smaller)*
- Conciseness (the plan itself focuses on vision, planning principles, goals, objectives & policies – only)
- Detailed background information found in supporting documentation (not in plan text; reference to background reports in-text)
- No in-text duplication (minimal repetition of policies, concepts, or arguments etc.)
- Plan updating possible through the physical addition of amendments (plan is in a binder etc.)
- *Environmentally responsible materials used in plan production (recycled paper; biodegradable inks etc.)*
- Plan availability at a web site
- *Use of an insert/bookmark that suggests sharing plan (encouragement to return plan to municipal library/municipal hall)*
- Completeness (no issues relevant to the context are avoided etc.)
- Hierarchical framework of vision, planning principles, issues, goals, objectives & policies
- Consistency (logical consistency within hierarchy, minimization of contradiction among goals/objectives etc.)
- Vision reflects a representative range of interested parties/relevant groups
- Ethically- or scientifically-based principles (principles are based on scientifically-substantiated needs/requirements or ethical maxims) Note: value-based principles like 'convenience' or 'beauty' can be substantiated in terms of either induction (science; previous research) or deduction (ethics).
- Issues are both opportunity- and problem-based (issues recognize both opportunities for ecosystem enhancement and problem-based needs)

Agreed? Mode=8

Agreed? Mode=5

Agreed? Mode=8

Agreed? Bimode=5

Agreed? Mode=6

Agreed? Mode=6

Agreed? Mode=6

Agreed? Mode=6

Agreed? Mode=6

Agreed? Bimode=4

Agreed? Mode=5

Agreed? Mode=7

Agreed? Mode=5

Agreed? Mode=5

Agreed? Mode=6

Agreed? Mode=4

Agreed? Mode=6

Agreed? Mode=8

Agreed? Mode=8

Agreed? Mode=8

Agreed? Mode=8

Agreed? Mode=8

Agreed? Mode=8

Agreed? Mode=8

Agreed? Mode=8

Agreed? Mode=8

Agreed? Mode=8

Agreed? Mode=8

Agreed? Bimode=5

ES OF THE 'POTENTIAL CONDITIONS OR ECOSYSTEM-BASED PLAN' LISTED IN COLUMN 1 (for explanatory purposes, 'measures' are sometimes provided in parentheses)	THIS IS A NECESSARY ATTRIBUTE OF THE COLUMN 1 CONDITION/ CHARACTERISTIC	THIS IS AN IMPORTANT ATTRIBUTE OF THE COLUMN 1 CONDITION/ CHARACTERISTIC	THIS IS NOT AN IMPORTANT ATTRIBUTE OF THE COLUMN 1 CONDITION/ CHARACTERISTIC
	Please agree with one of the above three statements by checkmarking the appropriate box below		

etc)
 n)
 ing of concepts according to an underlying framework)
 x etc.)
)
 ography, web addresses etc)
 Ticial Languages, local ones like Cree or Chinese etc.)
 attributes; lack of visual clutter)
 strategic, then maps can be conceptual or 'fuzzy'.
 tionally accurate boundaries)
 effective of maps (relationship can be demonstrated)
 es, goals, objectives & policies -- only)
 ation (not in plan text; reference to background reports in-text)
 or arguments etc.)
 nents (plan is in a binder etc.)
 n (recycled paper; biodegradable inks etc.)
 agement to return plan to municipal library/municipal hall)
)
 oals, objectives & policies
 of contradiction among goals/objectives etc)
 ant groups
 on scientifically-substantiated needs/requirements
 ce' or 'beauty' can be substantiated in terms of either
 e both opportunities for ecosystem enhancement and

Agreed?	Agreed?	Agreed?
Mode=8		
Agreed?	Agreed?	Agreed?
	Mode=5	
Agreed?	Agreed?	Agreed?
Mode=8		
Agreed?	Agreed?	Agreed?
Bimode=5	Bimode=5	
Agreed?	Agreed?	Agreed?
Mode=6		
Agreed?	Agreed?	Agreed?
Mode=6		
Agreed?	Agreed?	Agreed?
Mode=6		
Agreed?	Agreed?	Agreed?
Mode=6		
Agreed?	Agreed?	Agreed?
Bimode=4	Bimode=4	
Agreed?	Agreed?	Agreed?
Agreed?	Agreed?	Agreed?
	Mode=5	
Agreed?	Agreed?	Agreed?
Mode=7		
Agreed?	Agreed?	Agreed?
Agreed?	Agreed?	Agreed?
Mode=5		
Agreed?	Agreed?	Agreed?
Mode=5		
Agreed?	Agreed?	Agreed?
	Mode=6	
Agreed?	Agreed?	Agreed?
	Mode=4	
Agreed?	Agreed?	Agreed?
Agreed?	Agreed?	Agreed?
Mode=6		
Agreed?	Agreed?	Agreed?
Agreed?	Agreed?	Agreed?
Mode=5		
Agreed?	Agreed?	Agreed?
Mode=8		
Agreed?	Agreed?	Agreed?
Mode=8		
Agreed?	Agreed?	Agreed?
Mode=8		
Agreed?	Agreed?	Agreed?
Mode=8		
Agreed?	Agreed?	Agreed?
Bimode=5	Bimode=5	

POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans would demonstrate them)	THIS IS A NECESSARY CONDITION OF A GOOD PLAN	THIS IS AN IMPORTANT CHARACTERISTIC OF A GOOD PLAN	THIS IS NOT AN IMPORTANT CHARACTERISTIC OF A GOOD PLAN	POSSIBLE ATTRIBUTES CHARACTERISTICS OF A GOOD PLAN (please note that for individual attributes)
	☐	☐	☐	
	Please agree with one of the above three statements by checkmarking the appropriate box below			

Rational Content (continued)

- Goal specificity (goals are related to particular issues and bases)
- *Clearly defined goals (measurable objectives are provided to)*
- Doable but challenging objectives
- Operationalization of identified planning priorities through pol
- Action- or strategy-based policies where appropriate (policies i
- *Science- or ethics-based land use designations (zoning reflect*
- *Demonstration of relationships between the plan and the supp*

Artistic

Recognition of the Legal Basis for the Plan
(was 'Legality')

Agreed?	Agreed?	Agreed?
Mode=5		

- Innovation (inventiveness, reflection of 'zeitgeist,' beauty, the X
- Meets requirements of existing laws (planning law, related laws
- Greatly exceeds the minimum requirements of the law (pushes

Consensus on the Values Used to Define
Best Planning Practices

Agreed?	Agreed?	Agreed?
Mode=6		

- Identification of priority planning values (beauty, efficiency, co
- equity, intragenerational equity, compensatory obligation etc.)
- Demonstration of best planning practices (separation of incompe
- *Meaningful negotiation/dialogue among relevant groups (part*

Anticipated Ease of Plan Implementation
(Plan Content Foundation)

Agreed?	Agreed?	Agreed?
Bimode=5	Bimode=5	

- Fact-basis (projections are scientifically-grounded, data is sound
- Orientation of plan according to municipal growth rate (plan is p
- Plan currency (plan uses up-to-date information, plan is less tha
- Equitable spatial and socio-economic distribution of NIMBYs, l
- Acceptable synthesis of different public and private agendas (co
- *Where feasible, implementation strategies involve community*

Principles of the Ecosystem Approach to Planning

STABLE RESPONSE
Mode=10

- Planning units either take natural boundaries into consideration (
- bioregions, ecodistricts, watersheds etc.)
- Design with nature -- work with living processes, topography, su
- Consideration of the cumulative effects of policies, plans and pr
- assessment; comprehensive strategic environmental assessment)
- Consideration of the global effects of policies, plans and projects
- Inter-jurisdictional decision-making
- External consultation, cooperation & partnering among intereste
- Long-term monitoring, feedback & adaptation of plan content
- Inter-disciplinary approach to information (holistic approach, bor
- based on the principles of conservation biology etc.)
- *Precautionary but positive approach to development (prevention*
- *recognition of mutual interdependence of factors etc.)*

POSSIBLE ATTRIBUTES OF THE 'POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN' LISTED IN COLUMN 1 (please note that for explanatory purposes, 'measures' for individual attributes are sometimes provided in parentheses)	THIS IS A NECESSARY ATTRIBUTE OF THE COLUMN 1 CONDITION/ CHARACTERISTIC	THIS IS AN IMPORTANT ATTRIBUTE OF THE COLUMN 1 CONDITION/ CHARACTERISTIC	THIS IS NOT AN IMPORTANT ATTRIBUTE OF THE COLUMN 1 CONDITION/ CHARACTERISTIC
	Please agree with one of the above three statements by checkmarking the appropriate box below		
are related to particular issues and based on best science)	Agreed?	Agreed?	Agreed?
(measurable objectives are provided to characterize goals; lack of ambiguity)	Mode=7		
g objectives	Agreed?	Agreed?	Agreed?
identified planning priorities through policy	Mode=7		
ed policies where appropriate (policies identify implementation techniques/tools)	Agreed?	Agreed?	Agreed?
ed land use designations (zoning reflects available scientific knowledge and/or ethical maxims)	Mode=7		
relationships between the plan and the supporting research/background documentation	Agreed?	Agreed?	Agreed?
ess; reflection of 'zeitgeist,' beauty, the X-factor of artistic merit)	Agreed?	Agreed?	Agreed?
existing laws (planning law; related laws; relevant regulations, upper-tier plans if pertinent etc.)	Mode=5		
imum requirements of the law (pushes the envelope of all antecedent planning)	Agreed?	Agreed?	Agreed?
y planning values (beauty; efficiency; convenience; biodiversity, ecological integrity, intergenerational al equity; compensatory obligation etc.)	Mode=6		
planning practices (separation of incompatible land uses; combination of compatible land uses etc.)	Agreed?	Agreed?	Agreed?
ndialogue among relevant groups (participatory; collaborative; conflict resilient; accountable)	Bimode=4	Bimode=4	
are scientifically-grounded, data is sound, data is specific to planning region etc.)	Agreed?	Agreed?	Agreed?
ording to municipal growth rate (plan is primarily regulation-based only if the region is high growth)	Mode=5	Mode=5	
es up-to-date information; plan is less than five years old)	Agreed?	Agreed?	Agreed?
ocio-economic distribution of NIMBYs, LULUs and BANANAS (explicit distribution criteria provided)	Mode=7		
f different public and private agendas (consensus-building exercises; meaningful negotiation/dialogue)	Agreed?	Agreed?	Agreed?
mentation strategies involve community participation (education; community outreach)	Mode=5		
ke natural boundaries into consideration or are based on them (delineation according to s, watersheds etc.)	Agreed?	Agreed?	Agreed?
ork with living processes, topography, sunlight access etc.	Mode=7		
umulative effects of policies, plans and projects (includes biophysical, socio-cultural & economic/fiscal nsive strategic environmental assessment)	Agreed?	Agreed?	Agreed?
lobal effects of policies, plans and projects	Mode=9		
nsion-making	STABLE RESPONSE		
cooperation & partnering among interested parties/relevant groups	Mode=10		
feedback & adaptation of plan content	Agreed?	Agreed?	Agreed?
ach to information (holistic approach, both lay-person and expert sources; natural heritage system of conservation biology etc.)	Mode=6		
itive approach to development (prevention of further damage; reduction of ecosystem stress; interdependence of factors etc.)	Agreed?	Agreed?	Agreed?
	Mode=7		
	Agreed?	Agreed?	Agreed?
	Mode=8		
	Agreed?	Agreed?	Agreed?
	Mode=9		
	Agreed?	Agreed?	Agreed?
	Mode=8		
	Agreed?	Agreed?	Agreed?

POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans would demonstrate them)	THIS IS A NECESSARY CONDITION OF A GOOD PLAN	THIS IS AN IMPORTANT CHARACTERISTIC OF A GOOD PLAN	THIS IS NOT AN IMPORTANT CHARACTERISTIC OF A GOOD PLAN	POSSIBLE ATTRIBUTES OF A GOOD PLAN (please mark for individual)
	Please agree with one of the above three statements by checkmarking the appropriate box below			

Principles of the Ecosystem Approach (continued)

- Planning integrates rather than merely balances environmental and social objectives
- *Linkage of ecosystem planning to democratic change*
- *Cross-scale management (coordinated continuous approach)*
- Explicit recognition of the municipality's ecological footprint

Environmental Quality Strategies

Agreed?	Agreed?	Agreed?
Mode=8		

- Air quality strategies (transit-orientation, compact urban form)
- Water quality strategies (education, tertiary sewage & stormwater management)
- Land conservation strategies (growth management, land use patterns)
- Biodiversity strategies (green corridor systems, shoreline protection)
- Resource conservation strategies for land, energy, potable water
- Land rehabilitation or compensatory obligation strategies
- Waste minimization strategies (human scale dominates)
- Natural disaster strategies for flooding, unstable slopes, etc.
- *Socio-cultural strategies for 'sense of place,' livability, etc.*

Strong Language for Priority Policy Areas

Adaptive/transformational Capacity of the Plan to Address Change/Chaos (was 'Flexibility')

Agreed?	Agreed?	Agreed?

Agreed?	Agreed?	Agreed?
Bimode=5	Bimode=5	

- *Strong rather than permissive verbs & qualifiers ('shall' vs 'should')*
- *Community/interested party/relevant group empowerment (what the decision levers are, how to get involved; on-going participation)*
- *Mechanisms/frameworks for supporting plan evolution (monitoring plan performance; re-visioning; plan amendment)*
- Flexibility given the wide breadth of the tool envelope (range of options)
- *Ability to respond to surprise (public liaison officer; on-going monitoring framework; contingency plans etc.)*
- *New ways of problem-solving or goals achievement (new approaches)*

PLANNING PROCESS

Ecosystem Approach to Planning Process

STABLE RESPONSE
Mode=10

- Visioning (exploration of interested party/relevant group input)
- Scoping (identification of priority issues, problems and opportunities)
- Definition & surveying of planning region (background studies at different scales – Landsat, air photo, field inventories; trend analysis; use of longitudinal data to assess land use change; report on findings)
- Modelling & analysis of planning region (delineation of natural resource areas)
- *Develop a structure plan and formulate rival scenarios*
- Assessment of plan alternatives & selection of two to three alternatives
- *Meaningful debate/negotiation of plan contents (relevant stakeholders)*
- *Choice of one of the plan alternatives*

POSSIBLE ATTRIBUTES OF THE 'POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN' LISTED IN COLUMN 1 (please note that for explanatory purposes, 'measures' for individual attributes are sometimes provided in parentheses)	THIS IS A NECESSARY ATTRIBUTE OF THE COLUMN 1 CONDITION/CHARACTERISTIC	THIS IS AN IMPORTANT ATTRIBUTE OF THE COLUMN 1 CONDITION/CHARACTERISTIC	THIS IS NOT AN IMPORTANT ATTRIBUTE OF THE COLUMN 1 CONDITION/CHARACTERISTIC
Plan merely balances environmental, social and economic objectives	Agreed? Mode=8	Agreed?	Agreed?
Planning to democratic change, social learning, community building & environmental enlightenment	Agreed?	Agreed?	Agreed?
Coordinated continuous approach re: geographic & time scales; short- vs. long-term goals etc.)	Agreed?	Agreed?	Agreed?
Community's ecological footprint or appropriated carrying capacity	Agreed? Mode=9	Agreed?	Agreed?
Form-orientation; compact urban form; mixed use zoning, performance zoning etc.)	Agreed? Mode=9	Agreed?	Agreed?
Infrastructure; tertiary sewage & stormwater treatment etc.)	Agreed? Mode=9	Agreed?	Agreed?
Land management (growth management, land swaps/acquisition, restrictive covenants, easements etc.)	Agreed? Mode=9	Agreed?	Agreed?
Land corridor systems, shoreline preservation areas, naturalization, mitigation banking etc.)	Agreed? Mode=9	Agreed?	Agreed?
Land use policies for land, energy, potable water etc. (impact fees, transfers of development rights etc.)	Agreed? Mode=8	Agreed?	Agreed?
Land use regulatory obligation strategies (engineering, covenants, public-private partnerships etc.)	Agreed? Mode=8	Agreed?	Agreed?
Land use patterns (human scale dominates car scale; mixed use zoning etc.)	Agreed? Mode=8	Agreed?	Agreed?
Land use risk (flooding, unstable slopes, earthquakes etc.)	Agreed? Mode=7	Agreed?	Agreed?
Land use 'sense of place,' livability, local pride (heritage protection; facilitation of public art etc.)	Agreed?	Agreed?	Agreed?
Land use verbs & qualifiers ('shall' rather than 'should'; 'must' rather than 'may'; 'no' means 'no')	Agreed?	Agreed?	Agreed?
Land use relevant group empowerment (identification of where to get information, who can help, how to get involved; on-going negotiation and consensus-building etc.)	Agreed?	Agreed?	Agreed?
Land use supporting plan evolution (monitoring of biophysical, socio-cultural and economic dimensions; plan change; re-visioning; plan amendment protocols; env'l advisory committee membership etc.)	Agreed?	Agreed?	Agreed?
Land use breadth of the tool envelope (robust range of planning instruments are employed in the plan)	Agreed? Mode=7	Agreed?	Agreed?
Land use public liaison officer; on-going communication with other ecosystem-based planning contexts; emergency plans etc.)	Agreed?	Agreed?	Agreed?
Land use progress or goals achievement (new planning tools; innovations in public participation etc.)	Agreed?	Agreed?	Agreed?
Land use interested party/relevant group values, needs, desires; discovery of entrenched attitudes etc.)	Agreed? Mode=9	Agreed?	Agreed?
Land use priority issues, problems and opportunities; setting of initial goals etc.)	Agreed? Mode=8	Agreed?	Agreed?
Land use planning region (background studies are complete; background information is based on aerial photo, field inventories; traditional or Aboriginal knowledge is recognized; SOE Reporting, land use change; reports based on best science etc.)	Agreed? Mode=6	Agreed?	Agreed?
Land use planning region (delineation of major systems & their relationships; identification of trends etc.)	Agreed? Mode=7	Agreed?	Agreed?
Land use and formulate rival scenarios	Agreed?	Agreed?	Agreed?
Land use objectives & selection of two to three to pursue (strategic environmental assessment etc.)	Agreed? Mode=7	Agreed?	Agreed?
Land use definition of plan contents (relevant groups involved; consolidation of priorities etc.)	Agreed?	Agreed?	Agreed?
Land use alternatives	Agreed?	Agreed?	Agreed?

POSSIBLE ATTRIBUTES OF THE 'POTENTIAL CONDITIONS' OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN' LISTED IN COLUMN 1 (please note that for explanatory purposes, 'measures' for individual attributes are sometimes provided in parentheses)	THIS IS A NECESSARY ATTRIBUTE OF THE COLUMN 1 CONDITION/ CHARACTERISTIC	THIS IS AN IMPORTANT ATTRIBUTE OF THE COLUMN 1 CONDITION/ CHARACTERISTIC	THIS IS NOT AN IMPORTANT ATTRIBUTE OF THE COLUMN 1 CONDITION/ CHARACTERISTIC
	Please agree with one of the above three statements by checkmarking the appropriate box below		
inclusion of more detail in the plan, elaboration of zoning, frameworks for planning procedures, groups up-to-speed, investigation of a robust range of implementation strategies etc.)	Agreed? Mode=7	Agreed?	Agreed?
improvement of plan performance; identification of evaluation/decision criteria, development of framework	Agreed? Mode=9	Agreed?	Agreed?
involvement of internal and external to each stage	Agreed? Mode=7	Agreed?	Agreed?
employment of trained planning staff or consultants	Agreed?	Agreed? Mode=8	Agreed?
employment of professionally affiliated	Agreed?	Agreed?	Agreed? Mode=6
employment of planning staff or consultants	Agreed?	Agreed? Mode=7	Agreed?
implementation of planning strategies	Agreed? Mode=8	Agreed?	Agreed?
endorsement of the plan (mayor and community endorse the plan etc.)	Agreed? Mode=9	Agreed?	Agreed?
involvement of inter-jurisdictional partners (memoranda of intent etc.)	Agreed? Mode=7	Agreed?	Agreed?
absence of scandals (no history of scandals etc.)	Agreed?	Agreed? Mode=6	Agreed?
clear authority for the plan (clearly defined authority for implementation by the agency involved)	Agreed? Mode=8	Agreed?	Agreed?
accountability (bottom-up and top-down directions of accountability)	Agreed? Mode=6	Agreed?	Agreed?
involvement of groups during plan formulation and implementation	Agreed? Mode=7	Agreed?	Agreed?
focus on regulation-based strategies only if the region is high growth)	Agreed? Mode=6	Agreed?	Agreed?
development of offices (cooperation, two-way flow of information)	Agreed?	Bimode=4	Bimode=4
protocols for new data, new circumstances	Agreed? Bimode=4	Agreed? Mode=4	Agreed?
information flow between planning agency, decision makers, relevant groups etc.	Agreed? Bimode=4	Agreed?	Agreed?
advisory committee (minimal # of politicians in membership; rotation of committee members)	Agreed?	Agreed?	Agreed?

Round 3

August 21, 1997

Dear

Thank you for responding to Round 2 of the Delphi survey and to the mini-survey executed by e-mail. This round -- Round 3 -- is the last big step in the process that requires your active involvement. If a fourth Round is required to stabilize any of the variables, it will be small and will be sent by e-mail. Because stable responses have resulted for nearly 30% of the variables, Round 3 is that much shorter than Round 2 in terms of what you need to address. Rather than deleting them from the survey, the stable responses continue to be included in order to:

- provide a sense of continuity and *the big picture*;
- ensure that panelists do not worry that variables are suddenly missing; and,
- demonstrate which variables the panel is converging on for participants that may be interested in interim results.

As in Round 2, stable responses are identified as such by the insertion of the term *stable response* in the related agreement cells of the survey spreadsheet. Panelists may find that using a ruler horizontally while completing the survey may facilitate immediate recognition of the stable responses that can be skipped over.

In Round 1, the panel provided conditions and attributes that they believed required incorporation into the evaluation instrument (i.e. the inventory of the variables presented in the survey). In Round 2, the panel reacted to identified modes and to new variables derived from Round 1. In Round 3, panel members should keep two things in mind:

- Round 3 still provides an opportunity for refining the wording and content of the evaluation instrument; and,
- if panelists are still considering/reconsidering their selection among the response distribution (e.g. selecting one of the *necessary*; *important* or *not important* categories), they have a number of options. Like Round 2, they can consider the identified modal response. Or, they can review the commentary provided in Round 2 by panelists who chose non-modal responses. Providing this commentary from Round 2 ensures that many of the variables can be approached from different angles if the panelist desires. This seven-page document is included in this package and is entitled: **OPTIONAL READING: Feedback from Round 2 Concerning Panel Explanations for Non-Modal Responses.**

Miscellaneous Points

- When the Delphi process is completed, each panel member will be provided with the following items (which can be read at the panelist's leisure):
 1. a summary of the Delphi survey results;
 2. a full description of how this Delphi process was designed; and,
 3. a work-in-progress bibliography on (a) the ecosystem approach to planning and (b) the Delphi method.

- As a brief aside, I would like to take this opportunity to remind panelists not to discuss their responses with any other members of the panel that they may know or have identified. Although I have no reason to believe that this has occurred, I merely wanted to present this caution. After the completion of the Delphi process, panelists will have an opportunity to self-identify to other members if they wish. Networking, information-sharing and publishing synergy can hopefully be facilitated by doing so at that time.
- In terms of survey completion, I would also like to stress that for the attributes provided in column five, you are asked to react to the core-attribute presented before the parentheses. The contents of the parentheses are provided as potential explanatory examples or measures only. In a specific planning context, not all of the examples provided in the parentheses can or will necessarily apply. In this research context, each municipality is assumed to have its own personality and resource endowment (Novakowski and Needham, 1996; Hodge, 1991). Therefore, a certain level of generality is recognized as expedient to the elaboration of the evaluation criteria.
- As a final point, I have been asked -- by two panelists -- for an elaboration of variable 8-B (which is also an analogue of variable 14-L). Variable 8-B is **Orientation of plan according to municipal growth rate**. In newer communities where growth and building rates are **high**, primarily regulation-based plans may be the way to proceed. The *planner as regulator's* toolkit of zoning, site plan control, regulations, standards, permits, exactions, impact fees and environmental assessment could constitute the primary implementation orientation.

In older and more established communities that are **low** growth because they've already been developed, there may be higher levels of resistance to new development (NIMBYs, BANANAs etc.). In these communities, community and inter-jurisdictional participation in plan making and plan implementation may or may not be more critical. In such a case, the *planner as consensus builder*, the *planner as advocate* and the *planner as land steward* roles may become more important in order for the plan to be implemented. Role-related planning tools like public-private partnerships, easements, land swaps, land trusts, community outreach, circuit riding, public education and many others may have to become priorities. This may also be true in areas that are low growth due to an economic downturn or out-migration.

Overall, 8-B addresses how important it is for plan authors to orient their plan -- in a general way -- according to the existing or projected municipal growth rate. Please note that I have intentionally equivocated in many of the phrases employed in the explanation because I do not want to telegraph my own opinion.

Thank you again for your participation.

Yours sincerely,

**OPTIONAL READING: Feedback from Round 2 Concerning
Panel Explanations for Non-Modal Responses**

The *modal response* is defined as the dominant response of the panel for a particular variable. If panelists were choosing a non-modal response in Round 2, they were encouraged to provide a succinct explanation concerning their reason(s) for doing so. By providing an explanation, panelists have the opportunity to ensure that each variable is approached from different angles and that their own diverging points of view are recognized. Panel comments of this nature can also facilitate refinement of the survey instrument.

The commentary from panelists provided below is organized in the sequence that the variables appear in the Round 3 survey. Please note that all feedback from the panel concerning **non-modal responses** is provided -- with no exceptions. Also note that if panelists provided an explanation or commentary for choosing one of the bi-modal responses or for one of the new variables that do not have a mode, then that explanation is not included. The comments have not been altered/edited except for grammatical standardization. Any subsequent editorialization or comment by the Delphi monitor is presented in square parentheses.

In order to facilitate providing the feedback in an organized manner, the variables are now presented in the survey with an alpha-numeric identifier (i.e. column 1 conditions have a number and column 5 attributes have been assigned a letter of the alphabet). For example, 1-A refers to **Definition of key concepts**. In the inventory below, the comments that panel members made concerning non-modal choices are presented as individual bullets:

1. **Effective communication of planning information to relevant groups.** [The panel's mode is *necessary*].
 - A plan can still be a good ecosystem-based plan even if communication is less than effective. [Therefore, this panelist's non-modal response was *important*].
- 1-A. **Definition of key concepts.** [The panel's mode is *necessary*].
 - Nice to have, but definitions can be found elsewhere. [Therefore, this panelist's non-modal response was *important*].

- 1-B. Animation/friendliness of plan.** [The panel's mode is *important*].
- [Animation/friendliness] enhances the text in two ways: communication and ability to convince. Many people are visual thinkers and conceptualize non-textually. [Therefore, this panelist's non-modal response was *necessary*].
 - This [attribute] is especially important in ecosystem-based plans to offset lay-public unfamiliarity with ecosystem-based planning. [Therefore, this panelist's non-modal response was *necessary*].
- 1-C. Use of plain language.** [The panel's mode is *necessary*].
- Planning jargon, although a burden, can be translated by planners. [Therefore, this panelist's non-modal response was *important*].
- 1-E. Ease of locating information.** [The panel's mode is *necessary*].
- These are highly subjective in interpretation (based on the *status quo*). Substance is essential, not stylistics (important but not essential). [Therefore, this panelist's non-modal response was *important*].
 - Guard against over-elaborate presentation formats. [Therefore, this panelist's non-modal response was *important*].
- 1-G. Self-containment.** [The panel's mode is *necessary*].
- I don't believe that this is entirely feasible. [Therefore, this panelist's non-modal response was *important*].
- 1-H. Identification of how to get further information.** [The panel's mode is *important*].
- More important (therefore necessary) to push further substantiating information. [Therefore, this panelist's non-modal response was *necessary*].
- 2-B. Appropriate level of map boundary accuracy.** [The panel's mode is *important*].
- [This attribute] is related to map detail [which the panelist deemed *necessary*]. [Therefore, this panelist's non-modal response was *necessary*].
 - Planning deals with spatial elements. Thus, mapping quality/accuracy is a necessary attribute. [Therefore, this panelist's non-modal response was *necessary*].
- 4-A. Completeness.** [The panel's mode is *necessary*].

- No such completeness can ever be achieved. [Therefore, this panelist's non-modal response was *important*].
 - Many issues can be argued as relevant. Need to focus on key or essential issues where a difference can be made. [Therefore, this panelist's non-modal response was *important*].
 - This is desirable, but perhaps not completely achievable. Inevitably, some issues will be left out. These omissions do not necessarily make the plan unsuccessful. This characteristic may also conflict with the need for clarity and conciseness. [Therefore, this panelist's non-modal response was *important*].
- 4-B. Hierarchical framework of vision, planning principles, issues, goals, objectives and policies.** [The panel's mode is *necessary*].
- Maybe there are other ways of presenting plans that make sense to people. [Therefore, this panelist's non-modal response was *important*].
 - This [the term *hierarchical*] can turn 'ordinary' folks off. Consider 'flatter' formulations such as the medicine wheel from aboriginal 'circles.' As well, the terms *goals* and *objectives* are indicative of a planner's jargon. Mark the 'operationalization' of public values in planner terms. [Therefore, this panelist's non-modal response was *important*].
- 4-D. Vision reflects a representative range of relevant groups/interested parties.** [The panel's mode is *necessary*].
- Depending on the location of the planning taking place, the 'representative' vision may undermine the 'science' or water down the ecosystem approach. [Therefore, this panelist's non-modal response was *important*].
- 4-G. Goal specificity.** [The panel's mode is *necessary*].
- This is very technical and unfriendly to ordinary folk. Why not 'common sense' or 'common knowledge'? [Therefore, this panelist's non-modal response was *important*].
- 5. Artistic.** [The panel's mode is *necessary*].
- *Artistic* is not the right word. 'Designed' or 'elegant', or both may be more in order. [Therefore, this panelist's non-modal response was *important*].
- 5-A. Innovation.** [The panel's mode is *important*].
- In comparison to *status quo* planning, ecosystem-based plans must innovate by definition. [Therefore, panelist's non-modal response was *necessary*].

- There is a mixing of art and design in the elaboration [of the attribute]. [Therefore, this panelist's non-modal response was *necessary*].
- 6. Recognition of legal basis of the plan.** [The panel's mode is *necessary*].
- Can't ignore, but need to go beyond the existing legal basis. [Therefore, this panelist's non-modal response was *important*].
 - It is important that a plan is as much a product of the community as it is of 'officialdom.' Critical where respect for the *spirit* of the law is as critical as respect for the *letter* of the law. And what about respect for *nature's law*? [Therefore, this panelist's non-modal response was *important*].
- 6-A. Meets requirements of existing laws.** [The panel's mode is *necessary*].
- What if those laws are part of the problem? [Therefore, this panelist's non-modal response was *important*].
 - Ideally, yes, but more importantly, [the plan] must provide opportunity to push precedent within the law (i.e. realistically challenge legislation). [Therefore, this panelist's non-modal response was *important*].
 - Sometimes laws need to be tested to move forward. [Therefore, this panelist's non-modal response was *important*].
- 8-B. Orientation of plan according to municipal growth.** [The panel's mode is *not important*].
- Depends on context. [Therefore, this panelist's non-modal response was *important*].
 - It [the plan] has to be capable of re-shaping the pattern of growth, whether positive or negative. [Therefore, this panelist's non-modal response was *important*].
- 8-C. Plan currency.** [The panel's mode is *necessary*].
- Plans older than five years can still be excellent ecosystem-based plans. [Therefore, this panelist's non-modal response was *important*].
- [Note: The Delphi monitor has relaxed the *five-year* qualifier].
- 8-D. Equitable spatial distribution of NIMBYs, LULUs and BANANAs.** [The panel's mode is *important*].

- Justice is an integral part of sustainability [Therefore, this panelist's non-modal response was *necessary*].
 - Distribution of groups depends on issues -- it's not always possible to be equitable. [Therefore, panelist's non-modal response was *not important*].
 - Social/distributive justice/fair-sharing of 'regional' goods and bads. [Therefore, this panelist's non-modal response was *necessary*].
- 9-A. Planning units either take natural boundaries into consideration or are based on them.** [The panel's mode is *necessary*].
- Desirable [as opposed to necessary]. [Therefore, this panelist's non-modal response was *important*].
- 9-D. Consideration of global effects of policies, plans and programs.** [The panel's mode is *important*].
- We should work towards it. [Therefore, this panelist's non-modal response was *necessary*].
 - [Do this in situations where it's] feasible. In principle, this is a key to sustainability issues inherent in ecosystem-based planning. [Therefore, this panelist's non-modal response was *necessary*].
- 9-E. Inter-jurisdictional decision-making.** [The panel's mode is *necessary*].
- An ideal, but we shouldn't wait for it. [Therefore, this panelist's non-modal response was *important*].
- 9-M. Explicit recognition of the municipality's ecological footprint or appropriated carrying capacity.** [The panel's mode is *necessary*].
- *Municipality* is too small a scale for this concept to be applied. [Therefore, this panelist's non-modal response was *important*].
- 10-H. Natural disaster strategies.** [The panel's mode is *necessary*].
- Natural disaster strategies often involve *hard solutions* which are not always in balance with ecosystems. [Therefore, this panelist's non-modal response was *important*].
- 13-C. Definition and surveying of planning region.** [The panel's mode is *necessary*].
- We shouldn't wait until all this is assembled. [Therefore, this panelist's non-modal response was *important*].

- 13-F. Assessment of plan alternatives and selection of two to three to pursue.** [The panel's mode is *necessary*].
- If you have an open debate and an extended peer community of participants, you've already done this in a more collaborative and less adversarial way. [Therefore, this panelist's non-modal response was *important*].
- 14. Ease of plan implementation.** [The panel's mode is *necessary*].
- Innovation is rarely "easy." Too easy = *status quo*. [Therefore, this panelist's non-modal response was *important*].
- 14-B. Planning staff or consultants are professionally affiliated.** [The panel's mode is *not important*].
- Does not need to be exclusive. Non-affiliated professionals are also key. [Therefore, this panelist's non-modal response was *important*].
- 14-D. Available resources to carry out strategies.** [The panel's mode is *necessary*].
- We somehow need to tie reform and change strategies to funding opportunities. [Therefore, this panelist's non-modal response was *important*].
 - Creative planning proposals should anticipate and address such a possible constraint. [Therefore, this panelist's non-modal response was *important*].
- 14-F. Cooperation commitment among inter-jurisdictional partners.** [The panel's mode is *necessary*].
- In a perfect world, yes. But, in many cases, despite commitments/memoranda, organizations will actively work against the ecosystem approach. [Therefore, this panelist's non-modal response was *important*].
- 14-H. Institutional power to implement the plan.** [The panel's mode is *necessary*].
- In some cases where actions are pushing legal and policy envelopes, authority to implement [the plan] may not exist yet. [Therefore, this panelist's non-modal response was *important*].
 - Equally important moral power base of a *together* community. [Therefore, this panelist's non-modal response was *important*].
- 14-M. Integration of planning and economic development offices.** [The panel's mode is *important*].

- We don't want them [the offices] working at crossing purposes. [Therefore, this panelist's non-modal response was *necessary*].
 - Humanity has to learn how to create wealth without significant negative environmental impacts. [Therefore, this panelist's non-modal response was *necessary*].
- 14-N. Flexible/speedy plan amendment protocols for new data, new circumstances.** [The panel's bimode is *necessary* and *important*].
- Planning by amendment should be avoided. [Therefore, this panelist's non-modal response was *not important*].
- 14-O. Liaison officer used to optimize information flow between planning agency, decision makers and relevant groups.** [The panel's mode is *important*].
- Too prescriptive. [Therefore, this panelist's non-modal response is *not important*].
- 14-P. Use of a representative environmental advisory committee.** [Panel's mode is *necessary*].
- [Like the previous variable, panelist finds it] too prescriptive. [Therefore, this panelist's non-modal response is *not important*].

ROUND 3 OF THE DELPHI SURVEY

Here is a summary of points to consider while completing Round 2:

- The underlying research question for this survey is: *what conditions, characteristics or attributes constitute a good or high-quality ecosystem-based municipal plan?* In other words, the research focus is concerned with those variables that you feel or believe are necessary or important to determining the goodness or quality of an ecosystem-based municipal plan. Ultimately, the conditions, characteristics and attributes that are being addressed will be employed as components of a plan evaluation framework.
- The questionnaire is intended to apply only to those municipal plans that are formulated in planning contexts where the ecosystem approach to planning has been employed. The evaluation criteria provided cannot be generalized to all types of municipal plans. However, it is important to remember that many of the conditions, characteristics and attributes of good ecosystem-based plans do, in fact, apply to all plans (e.g. effective communication of planning information to relevant groups, etc.).
- For descriptive and explanatory reasons, the attributes provided in Column 5 are sometimes listed with one or more potential measures or qualifiers in parentheses. Nevertheless, the core-attribute outside the parentheses is ultimately the variable of interest. The contents of the parentheses are more specific and would have to be vetted in an individual municipality for their relevance/applicability. The core-attributes of column 5 have been highlighted in bold for Round 3.
- Evaluation criteria are grouped according to *plan form, plan content and planning process*. Since this study is concerned with evaluation initiated before a plan is implemented, plan performance criteria are not specifically addressed.
- You have been asked to agree with an importance rating (by choosing one of three possible ratings) for potential conditions or characteristics of a good plan. These *importance ratings* are defined as follows:
 - Necessary** means that the plan condition, characteristic, or attribute is critically important. Unless an ecosystem-based plan demonstrates it, the plan can not be considered a good one.
 - Important** means that the plan condition, characteristic, or attribute is relevant to the determination of plan quality. The *important* rating includes sub-categories such as *very, moderately* and *slightly important*. Since the discrimination of *very, moderately* and *slightly important* is not pertinent to the underlying research purpose, these sub-categories have been combined.
 - Not important** means that the plan condition, characteristic or attribute is not relevant to a determination of a plan being a good one. It will have no measurable significance to any discussion relating to plan goodness, quality or merit and should be excluded from further consideration in this research context.

- For each variable in the survey, the *mode* or dominant frequency of response from the previous round is identified to provide insight into the position of the Delphi panel as a whole. Please consider the position of the panel when responding. You can also consult the accompanying document entitled **OPTIONAL READING: Feedback From Round 2 Concerning Non-Modal Responses** -- which provides an inventory of Round 2 feedback from panel members.
- The Round 3 questionnaire is nearly 30% shorter than Round 2. Nevertheless, the vast majority of the panel's survey-based feedback has still been incorporated into the latest survey -- although possibly not in the location originally targeted by the panelist.
- I recently made the transition from Mac to PC. Unfortunately, 11 X 17 spreadsheets do not appear to be supported by the Excel software that I am using for the survey. Consequently, I apologize for any inconvenience experienced because of the small font.
- If you find that any parts of the questionnaire require clarification, please contact me immediately. This is critical because you must respond to **all the questions**. My phone number at home is 613-224-4555. I am still using my phone at the National Capital Commission where voice-mail can be left 24 hours a day at 613-239-5036. Although I will be out of the country until September 5th, I will pick up my messages and telnet to my magna e-mail account regularly. My new e-mail address is nickknova@magna.ca.
- You will be contacted between September 6th and 10th to ensure that there have been no problems. Please respond as quickly as possible and remember to print when answering questions or providing editorial commentary. Thank you again for your time and effort.

Name?
Today's Date?
Will there be any change to your mailing address, phone number or e-mail address over the next three months?

POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans would demonstrate them)	NECESSARY CONDITION OF A GOOD PLAN	IMPORTANT CHARACTERISTIC OF A GOOD PLAN	IMPORTANT CHARACTERISTIC OF A GOOD PLAN	POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN LISTED IN COLUMN 1	NECESSARY ATTRIBUTE OF COLUMN 1 VARIABLE 1	IMPORTANT ATTRIBUTE OF COLUMN 1 VARIABLE 2	POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN LISTED IN COLUMN 1			
POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans would demonstrate them) PLAN FORM Effective Communication of Planning Information to Relevant Groups Please recall that by identifying the mode as 9 in this row and column, I am telling you that 9 out of 10 panel members agreed that <i>Effective Communication of Planning Information to Relevant Groups</i> is a necessary condition of a good ecosystem-based plan.	Please agree with one of the above three statements by marking the appropriate box below ☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	Note 1: For explanatory purposes, possible measures or examples for individual attributes are provided in parentheses. Note 2: Decisions should be based on panelists' interpretation of the core attribute only --> highlighted in bold in the column below.	Please agree with one of the above three statements by marking the appropriate box below ☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	Please agree with one of the above three statements by marking the appropriate box below ☐ Agreed ☐ Modest ☐ Disagreed			
				A. Definition of key concepts (e.g. in-text, in margin notes, in glossary etc.)				☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed
				B. Animation/friendliness of plan (e.g. photos, graphics; data; art etc.)				☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed
				C. Use of plain language (e.g. minimal planning jargon, minimal obfuscation)				☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed
				D. Well organized (e.g. logical progression of topics and ideas; grouping of concepts according to an underlying framework)				☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed
				E. Ease of locating information (e.g. table of contents; page tabs; index etc.)				☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed
				F. Well written (e.g. no spelling mistakes; good grammar; fluidity etc.)				☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed
				G. Self-containment (e.g. inclusion of related maps, bibliography etc.)				☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed
				H. Identification of how to get further information (e.g. contacts; bibliography; web addresses etc.)				☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed
				I. Text legibility (e.g. good reproduction, appropriate font style and size etc.)				☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed
J. Plan availability in relevant languages, if applicable (e.g. Official languages, local ones like Creole or Chinese etc.)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
K. Plan conciseness (e.g. plan focuses primarily on vision, planning principles, goals, objectives, policies & monitoring; need to know rather than nice to know information predominates in plan text -- excluding margin notes & annotation; etc.)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
L. Detailed background information found in supporting documentation (e.g. detailed background information is not presented in plan text; conversely, references to detailed background reports are found in-text)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
M. Minimal in-text duplication (e.g. minimal repetition of policies, concepts or arguments)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
N. Range of plan availability alternatives (e.g. plan is available in hard copy, plan could be available on both PC and Mac diskettes; plan could also be available at a web-site)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
O. Insert/bookmark that suggests sharing the plan (e.g. insert of bookmark recommends returning the plan to the municipal library/hall or sharing the plan with friends/co-workers)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
P. Update potential within the planning cycle (e.g. plan could be available in a binder so that amendments can be physically added; plan is available on diskette; plan is maintained on a web-site)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
Q. Appropriate/relevant level of map detail (e.g. legend has a manageable number of attributes; lack of visual clutter)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
R. Appropriate level of boundary accuracy (e.g. if plan is conceptual/strategic, then maps can be conceptual or fuzzy; conversely, if the plan is site-specific, maps demonstrate exceptionally accurate boundaries; if plan is a mixture of conceptual and site-specific, then the appropriate level of boundary accuracy is situation-specific)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
S. Plan maps are reflective of policies & policies are reflective of maps (e.g. relationship can be demonstrated)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
T. Manageable map size (e.g. size of adult arm-span or smaller)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
U. Use of environmentally-responsible materials (e.g. recycled paper, biodegradable inks etc.)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
V. Completeness (e.g. no issues relevant to the context are avoided etc.)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
W. Hierarchical framework of vision, planning principles, issues, goals, objectives & policies	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							
X. Consistency (e.g. logical consistency within hierarchical framework; minimization of contradiction among goals/objectives etc.)	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed	☐ Agreed ☐ Modest ☐ Disagreed							

POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans would demonstrate them)	NECESSARY CONDITION OF A GOOD PLAN	IMPORTANT CHARACTERISTICS OF A GOOD PLAN	NOT AN IMPORTANT CHARACTERISTIC OF A GOOD PLAN	POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN LISTED IN COLUMN 1	NECESSARY ATTRIBUTE OF COLUMN 1 VARIABLE	IMPORTANT ATTRIBUTE OF COLUMN 1 VARIABLE	NOT AN IMPORTANT ATTRIBUTE OF COLUMN 1 VARIABLE
	These agree with one of the above three statements by marking the appropriate box below			Note 1: For explanatory purposes, possible measures or examples for individual attributes are provided in parentheses. Note 2: Decisions should be based on panelist's interpretation of the core attribute only --> highlighted in bold in the column below.	These agree with one of the above three statements by marking the appropriate box below		
5 Artistic				D. Vision reflects a representative range of relevant groups/interested parties	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
6 Recognition of Legal Requirements Facing the Plan (i.e. is the plan legal?)				E. Ethically- or scientifically-based principles (e.g. principles are based on scientifically-substantiated needs/requirements or ethical maxims). Note: Value-based principles like <i>convenience</i> or <i>beauty</i> can be substantiated in terms of either induction (science; previous research) or deduction (ethics).	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
7 Consensus on the Values Used to Define Best Planning Practices				F. Issues are both opportunity- and problem-based (e.g. issues recognize both opportunities for ecosystem enhancement and problem-based needs)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
8 Feasibility of Plan Implementation (Plan Content Foundation)				G. Goal specificity (e.g. goals are related to particular issues/desires and based on best science/evidence)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
9 Principles of the Ecosystem Approach to Planning				H. Clearly defined goals (e.g. quantitatively/qualitatively measurable objectives are provided to characterize goals; goals are defensible as stated; goals lack ambiguity)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				I. Drable but challenging objectives	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				J. Operationalization of identified planning priorities through policy	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				K. Action- or strategy-based policies (e.g. majority of policies can be related to implementation techniques/tools)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				L. Science- or ethics-based land use designations (e.g. zoning reflects available scientific knowledge and/or ethical maxims)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				M. Demonstration of relationships between the plan and the supporting research/background documentation	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				A. Innovation (e.g. inventiveness; reflection of <i>Zeitgeist</i> ; beauty, the X-factor of artistic merit; demonstration of creative impulse)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				A. Meets requirements of existing laws (e.g. planning law, related laws; relevant regulations; upper-tier plans if applicable etc.)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				B. Substantially exceeds the minimum requirements of the law (e.g. pushes the envelope of antecedent planning)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				Identification of priority planning values (e.g. beauty, efficiency, convenience; biodiversity; ecological integrity; intergenerational equity, intragenerational equity; compensatory obligation etc.)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				B. Demonstration of best planning practices (e.g. separation of incompatible land uses; combination of compatible land uses etc.)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				C. Meaningful negotiation/dialogue among relevant groups (e.g. participatory; collaborative; conflict resilient; accountable)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				Fact-basis (e.g. projections are scientifically-grounded; data is sound; data is specific to planning region etc.)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				B. Orientation of plan according to market growth rate (e.g. plan is primarily regulation-based only if the region is high growth)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				C. Plan currency (e.g. plan uses up-to-date information; plan is relatively recent)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				D. Equitable spatial and socio-economic distribution of NIMBYs, LULUs and BANANAs (e.g. explicit distribution criteria provided)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				E. Acceptable synthesis of different public and private agendas (e.g. consensus-building exercises; meaningful negotiation/dialogue etc.)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				F. Implementation strategies involve community participation (e.g. education; community outreach; community effort)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				A. Planning units are based on natural boundaries or take them into consideration (e.g. delineation according to bioregions, ecodistricts, watersheds etc.)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				B. Design with nature -- work with living processes, topography, sunlight access etc.	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				C. Consideration of the cumulative effects of policies, plans and projects (could include biophysical, socio-cultural & economic/fiscal assessment; comprehensive strategic environmental assessment)	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9
				D. Consideration of the global effects of policies, plans and projects	Agreed? Modus-9	Agreed? Modus-9	Agreed? Modus-9

POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans would demonstrate them)	NECESSARY CONDITION OF A GOOD PLAN	IMPORTANT CHARACTERISTIC OF A GOOD PLAN	NOT AN IMPORTANT CHARACTERISTIC OF A GOOD PLAN	POSSIBLE ATTRIBUTES OF THE POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN LISTED IN COLUMN 1	NECESSARY ATTRIBUTE OF COLUMN 1 VARIABLE	IMPORTANT ATTRIBUTE OF COLUMN 1 VARIABLE	NOT AN IMPORTANT ATTRIBUTE OF COLUMN 1 VARIABLE
	Please agree with one of the above three statements by marking the appropriate box below			Note 1: For explanatory purposes, possible measures or examples for individual attributes are provided in parentheses. Note 2: Decisions should be based on panelist's interpretation of the core attribute only --> highlighted in bold in the column below.			
				ii. Inter-jurisdictional decision-making	Agreed? ☒ Mod=8	Agreed? ☐ Agreed? ☐	Agreed? ☐ Agreed? ☐
				f. External consultation, cooperation & partnering among relevant groups/interested parties	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				g. Long-term monitoring, feedback & adaptation of plan content	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				h. Inter-disciplinary approach to information (e.g. holistic approach, both lay-person and expert sources, natural heritage system based on the principles of conservation biology and other sources like landscape architecture etc.)	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				i. Precautionary but positive approach to development (e.g. prevention of further damage; reduction of ecosystem stress; recognition of interdependence of factors, humility approach; special care if irreversible consequences projected; support for restorative development etc.)	Agreed? ☐ Mod=9	Agreed? ☐ Agreed? ☐	Agreed? ☐ Agreed? ☐
				j. Planning integrates rather than merely balances environmental, social and economic objectives	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				k. Linkage of ecosystem planning to democratic change, social learning, community building & environmental enlightenment	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				l. Cross-scale management (e.g. coordinated approach concerning geographic & time scales; short- vs. long-term goals etc.)	Mod=7	Agreed? ☐ Agreed? ☐	Agreed? ☐ Agreed? ☐
				m. Explicit recognition of the municipality's ecological footprint (e.g. identification & mitigation of municipality's primary sources of resource waste & environmental degradation etc.)	Mod=9	Agreed? ☐ Agreed? ☐	Agreed? ☐ Agreed? ☐
				A. Air quality strategies (e.g. transit-orientation; compact urban form; mixed use zoning; performance zoning etc.)	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				B. Water quality strategies (e.g. education, tertiary sewage & stormwater treatment etc.)	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				C. Land/water conservation strategies (e.g. growth management; land swaps/acquisition; restrictive covenants; easements etc.)	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				D. Biodiversity strategies (e.g. green corridor systems; shoreline preservation areas; naturalization, mitigation banking etc.)	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				E. Resource conservation strategies for land, energy, potable water etc. (e.g. impact fees; transfers of development rights etc.)	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				F. Land/water rehabilitation or compensatory obligation strategies (e.g. engineering, covenants; public-private partnerships etc.)	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				G. Waste minimization strategies (e.g. human scale dominates car scale; mixed use zoning etc.)	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				H. Natural disaster strategies (e.g. for flooding, unstable slopes, earthquakes etc.)	Mod=10	STABLE RESPONSE	Agreed? ☐ Agreed? ☐
				I. Socio-cultural strategies for sense of place, livability, local pride (e.g. heritage protection, facilitation of public art etc.)	Mod=9	Agreed? ☐ Agreed? ☐	Agreed? ☐ Agreed? ☐
				A. Strong rather than permissive verbs & qualifiers (e.g. <i>shall</i> rather than <i>should</i> ; <i>must</i> rather than <i>may</i> ; <i>no</i> means <i>no</i>)	Agreed? ☐ Mod=7	Agreed? ☐ Agreed? ☐	Agreed? ☐ Agreed? ☐
				A. Community/relevant group empowerment (e.g. identification of where to get information, who can help, what the decision levers are; how to get involved, on-going negotiation and consensus-building etc.)	Agreed? ☐ Mod=6	Agreed? ☐ Agreed? ☐	Agreed? ☐ Agreed? ☐
				B. Mechanisms/frameworks for supporting plan evolution (e.g. monitoring of biophysical, socio-cultural & economic dimensions; monitoring plan performance; re-visioning; plan amendment protocols; environmental advisory committee membership etc.)	Agreed? ☐ Mod=9	Agreed? ☐ Agreed? ☐	Agreed? ☐ Agreed? ☐
				C. Flexibility given the wide breadth of the tool envelope (e.g. wide range of planning instruments are employed in the plan)	Agreed? ☐ Mod=9	Agreed? ☐ Agreed? ☐	Agreed? ☐ Agreed? ☐
				D. Ability to respond to surprise (e.g. public liaison officer; on-going communication & info-sharing with other ecosystem-based planning contexts; monitoring framework; contingency plans etc.)	Agreed? ☐ Mod=8	Agreed? ☐ Agreed? ☐	Agreed? ☐ Agreed? ☐
				E. New ways of problem-solving or goals achievement (e.g. new planning tools, innovations in public participation etc.)	Agreed? ☐ Mod=8	Agreed? ☐ Agreed? ☐	Agreed? ☐ Agreed? ☐
10 Environmental Quality Strategies							
11 Strong Language for Priority Policy Areas							
12 Adaptive/transformative Capacity of Plan to Address Change/Chaos							

POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans would demonstrate them)	NECESSARY CONDITION OF A GOOD PLAN	IMPORTANT CHARACTERISTICS OF A GOOD PLAN	IMPORTANT CHARACTERISTICS OF A GOOD PLAN	Possible attributes of the potential conditions or characteristics of a good ecosystem-based plan listed in column 1
				Note 1: For explanatory purposes, possible measures or examples for individual attributes are provided in parentheses. Note 2: Decisions should be based on panel's interpretation of the core attribute only -> highlighted in bold in the column below.

PLANNING PROCESS

13 Ecosystem Approach to Planning Process

POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans would demonstrate them)	NECESSARY CONDITION OF A GOOD PLAN	IMPORTANT CHARACTERISTICS OF A GOOD PLAN	IMPORTANT CHARACTERISTICS OF A GOOD PLAN	Possible attributes of the potential conditions or characteristics of a good ecosystem-based plan listed in column 1
				Note 1: For explanatory purposes, possible measures or examples for individual attributes are provided in parentheses. Note 2: Decisions should be based on panel's interpretation of the core attribute only -> highlighted in bold in the column below.

14 Feasibility of Plan Implementation (Process foundation)

POTENTIAL CONDITIONS OR CHARACTERISTICS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans would demonstrate them)	NECESSARY CONDITION OF A GOOD PLAN	IMPORTANT CHARACTERISTICS OF A GOOD PLAN	IMPORTANT CHARACTERISTICS OF A GOOD PLAN	Possible attributes of the potential conditions or characteristics of a good ecosystem-based plan listed in column 1
				Note 1: For explanatory purposes, possible measures or examples for individual attributes are provided in parentheses. Note 2: Decisions should be based on panel's interpretation of the core attribute only -> highlighted in bold in the column below.

Thank you for completing the survey. Please double-check to ensure that you have addressed all the questions.

Do you have any comments or refinements to suggest?

Round 4

THE POST-DELPHI SURVEY

The primary purpose of the post-Delphi survey is to provide panelists with an opportunity to comment on or critique the process that they have participated in. This will facilitate the improvement of the Delphi process as a whole, and serve to consolidate the viability of research results achieved. Please circle or mark the appropriate response for each question.

1. Recognizing the subject matter of this Delphi exercise, do you feel that you were appropriately selected for participation? Yes No
2. Were the instructions for completing the survey clear? Yes No
3. Overall, was the background/supporting documentation for the process well-written? Yes No
4. In Round 1, was sufficient background information provided concerning how a generic Delphi process should unfold? Yes No
5. Was sufficient background information provided for completing each round? Yes No
6. Did the Delphi monitor provide prompt individual attention if you requested it? Yes No N/A
7. Were individual responses from the Delphi monitor sufficiently useful and comprehensive to make completion of the survey more effective? Yes No N/A
8. Was there any evidence of the Delphi monitor transmitting a particular bias or identifiable slant that influenced your response selections? Yes No
If yes, please identify specific instances if possible.

9. Do you believe that the potential conditions and attributes (Column 1 and Column 5 of the survey) should have been hierarchically-grouped (as was done) or would you have preferred a simple single column listing of all the variables with no grouping?
Grouped Not Grouped
If you selected *not grouped*, please elaborate.

10. Did the employment of the measure of central tendency (e.g. the mode) have a stronger impact on your decisions than you originally anticipated? Yes No
11. Are you satisfied with the results of this Delphi and how they were achieved? Yes No
If no, please elaborate.

12. Did you enjoy participating? Yes No
If no, please elaborate.
13. Can you think of any other planning-related questions where a Delphi exercise could be useful with respect to your particular research interests or job? Yes No
If yes, please identify one.
14. Did you find that this Delphi process helped to clarify or provide elaboration of your ecosystem-based point of view? Yes No
15. Other than monetary compensation, what measures could be employed by a Delphi monitor to maintain the interest of the panel in continuing with a particular Delphi exercise?
16. Do you have any specific criticisms of this particular ecosystem-based Delphi exercise (and that were not addressed in any of the questions above)? Yes No
If yes, please identify and explore.

Please double-check that all of the questions have been answered. THANK YOU AGAIN FOR PARTICIPATING!

APPENDIX IV

THE SPECIFIC ATTRIBUTES OF ECOSYSTEM-BASED PLANS

Although ecosystem-based planning represents a rational-comprehensive shift from conventional planning in some respects (e.g., inter-jurisdictional decision-making, cross-scale management, planning areas follow natural boundaries, etc.), many of its attributes are actually an incremental evolution from best practices developed over decades of professional planning practice. In other words, for many of the attributes of good ecosystem-based plans, it is *a question of degree rather than kind*.

On the next page, the derived evaluation instrument is presented with proposed measures and the references for the measures. The references themselves actually reveal that best practices in conventional planning are still widely reflected in ecosystem-based planning. Those attributes that can be argued to be specific to ecosystem-based planning have been italicized. As mentioned in Chapter V, the Ecosystem Approach to Planning Process, the Ecosystem Approach to Planning Principles, and Environmental Quality Strategies are assumed to be specific to ecosystem-based planning because of the approach's evolving perspective concerning how these subject matters are addressed.

APPENDIX IV. IDENTIFICATION OF THOSE EVALUATION CRITERIA THAT ARE SPECIFIC TO ECOSYSTEM-BASED PLANNING

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS (N for necessary and I for important)	SELECTED MEASURES	SOURCES OF THE MEASURES
PLANNING PROCESS <i>Ecosystem Approach to Planning Process (Necessary)</i>	Visioning (N)	- Visioning took place - Visioning engaged a representative sample - Shaping of plan content with vision results - Identification of entrenched attitudes	- Government of Nakhosivane (1991), Klein (1991), Heller (1996a) - Isari and Visser (1997), Klein (1991) - Government of Nakhosivane (1991), Klein (1991), Heller (1996a) - Tumulty et al. (1994a)
	Scoping (N)	- Identification of problems and opportunities - Identification of relevant groups (e.g. registry of relevant groups) - Participation invitations sent out to relevant groups either by newspaper, TV or through mailing - Prioritization of initial list of goals and priorities - Identification of prioritization criteria	- Tumulty et al. (1994a), Borko and French (1994), Eldon and Smith (1988) - Tumulty et al. (1994a), Campbell et al. (1991) - Heller (1996), Government of Nakhosivane (1991) - Tumulty et al. (1994a) - Tumulty et al. (1994a)
	Definition and survey of planning region (N)	- Identification of variables parameters to be measured - Initiation of background studies - Delineation of ecologically-based planning boundaries - Delineation of scale-based protocols for data gathering	- Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Smith and Thierberg (1987)
	Modeling and analysis of planning region (N)	- Identification of needs and trends - Analysis of biophysical, infrastructural and built systems as well as their inter-relationships across scales - Initial determination of optimal locations for different land uses according to science or ethics - Begin continue the foundation of a SDE reporting-style monitoring framework	- Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Campbell et al. (1996), Van Lierne (1996), Campbell et al. (1991)
	Development of a structure plan and formulation of rival alternatives (N)	- Formulation of detailed goals and objectives - Formulation of rival scenarios	- Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a)
	Assessment of plan alternatives and selection of two to three to pursue (N)	- Assessment of rival scenarios in light of goals and objectives - Selection of two or three alternatives through negotiation	- Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a)
	Meaningful debate negotiation of plan contents (N)	- List of relevant groups - Meaningful negotiation involving relevant groups (e.g. participatory, collaborative, conflict resilient, accountable) - Selection of final choice - Program (use of TV, radio, newspapers, etc.) used for stimulating citizen involvement	- Puffrey et al. (1992) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a)
	Refinement of plan choice (N)	- Strategic environmental assessment to fine-tune policy content - Development of detailed scale-based plans - Development of detailed zoning if local plans are not nested within the ecosystem-based plan - Establishment of requirements for project planning and approval - Exploration of a full range of implementation strategies	- Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a) - Gibson et al. (1997), Tumulty et al. (1994a)
	Monitoring (N)	- Establishment of requirements for monitoring plan performance - Establishment of requirements for monitoring municipal context - Establishment of requirements for compliance monitoring - Establishment of protocols for plan amendment	- Gibson et al. (1997), Tumulty et al. (1994a), Smith and Heller (1992) - Gibson et al. (1997), Tumulty et al. (1994a), Smith and Heller (1992) - Kaiser et al. (1997) - Kaiser et al. (1997)
	Information feedback loops internal and external to each stage in the planning process (N)	Mechanisms for deciding when and how to conduct a planning intervention are identified	ASL (1986)
	Plan implementation to be done by trained planning staff or consultants (I)	Plan implementation to be done by experienced planners	Fishman (1978)
	Available funds to employ planning staff or consultants (I)	Funds are available for plan implementation	Dillon (1989), Boyce (1970)
	Available resources to carry out planning strategies (N)	- Sufficient time - Sufficient money - Community input - Funds are available to implement plan - Effective strategies requiring least financial inputs are chosen	- Dillon and Huths (1994), Fishman (1978), Boyce (1970) - Dillon and Huths (1994), Fishman (1978), Boyce (1970) - Dillon and Huths (1994), Fishman (1978) - Fishman (1978) - Barron and Ng (1996), Bailes et al. (1994)
Feasibility of Plan Implementation: Process foundation (Necessary)			

APPENDIX IV. IDENTIFICATION OF THOSE EVALUATION CRITERIA THAT ARE SPECIFIC TO ECOSYSTEM-BASED PLANNING (continued)

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans demonstrate these)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	SELECTED MEASURES	SOURCES OF THE MEASURES
	Political commitment to carry out the plan (N)	Mayor/regional chair endorses the plan Community endorses the plan	Fishman (1978), Boyce (1970) Fishman (1978), Boyce (1970)
	Cooperation commitment among inter-jurisdictional partners (N)	Memoranda of intent or an analogue	Gibson <i>et al.</i> (1997), Kainer <i>et al.</i> (1995), Fishman (1978), Boyce (1970)
	Credibility of local political structure (I)	No history of scandals	De las and Rakodi (1993)
	Institutional power to implement the plan (N)	Legally-defined authority Viable working relationships between inter-jurisdictional partners	Bier (1997), Berke and French (1994) Fishman (1978)
	Credible institutional transparency (N)	Top-down accountability from the upper tier government(s) Top-down accountability from the mayor or an analogue Bottom-up accountability from the electorate All discretionary planning decisions are open to public attendance All planning meetings involving issues with public impacts are open to the public	Palfrey <i>et al.</i> (1992), Elcock and Haywood (1980) Palfrey <i>et al.</i> (1992), Elcock and Haywood (1980) Palfrey <i>et al.</i> (1992), Elcock and Haywood (1980) Palfrey <i>et al.</i> (1992), Elcock and Haywood (1980) Palfrey <i>et al.</i> (1992), Elcock and Haywood (1980)
	Ongoing involvement of relevant groups during plan formulation and implementation (N)	Relevant groups have been involved from visioning onwards to implementation	Bier (1997), Neilsen (1994)
	Process oriented to municipality's growth rate (I)	Plan is primarily regulation-oriented only if municipality is high growth	
	Integration of planning and economic development offices (I)	Cooperation Two-way flow of information	Fishman (1978), Boyce (1970) Maynes (1991) Maynes (1991)
	Flexible/speedy plan amendment protocols for new data or new circumstances (N)	Plan amendment protocols are identified in the plan	Vogel (1983), Fishman (1978)
	Liaison officer optimizes info flow between agency, decision makers, relevant groups, etc. (I)	Liaison officer on staff	Maynes (1991)
	(Use of a representative environmental advisory committee (N)	Minimal number of municipal politicians Rotation of committee members Environmental advisory committee considers the engagement of the public in planning as one of its priorities	Maynes (1991) Maynes (1991) Maynes (1991) Oregon (1990)
PLAN CONTENT Principles of the Ecosystem Approach (Necessary)	Planning units are based on natural boundaries or take them into consideration (N)	Ecological rationale for boundary delineation is evident	Gibson <i>et al.</i> (1997)
	Design with nature (N)	Natural design is recognized and rewarded (e.g. flow is basing set up 'development credits') Natural design criteria are employed in either site plan control or general design guidelines and procedures	Van der Ryn and Cimin (1996), McHarg (1969) Van der Ryn and Cimin (1996), McHarg (1969)
	Consideration of the cumulative and global effects of policies, plans and projects (N)	Cumulative effects are accounted for in the strategic environmental assessment Global effects are accounted for in the strategic environmental assessment References to and recognition of cumulative and global benchmarks (e.g. Kyoto Conference, Rio)	Nordenskiöld and Wellar (1997), Spilling (1994) Nordenskiöld and Wellar (1997), Spilling (1994) Nordenskiöld and Wellar (1997), Spilling (1994)
	Inter-jurisdictional decision-making (N)	Memoranda of intent have been addressed and are formalized	Fishman (1978), Boyce (1970)
	External consultation, cooperation and partnering among relevant groups, interested parties (N)	Public participation is ongoing Memoranda of intent concerning partnerships are on file	Lawling and MacLachlan (1997), Gibson <i>et al.</i> (1997) Lawling and MacLachlan (1997), Gibson <i>et al.</i> (1997)
	Long-term monitoring, feedback and adaptation of plan content (N)	Evidence that indicators to be monitored were systematically selected (e.g. in terms of strength, validity, relevance, representativeness, data availability, and cost) Many of the indicators are specifically related to plan goals and to performance objectives Identification of how monitoring results will be reported and fed to modification of plan content	Wellar (1998), Campbell <i>et al.</i> (1995) Loken (1998), Smith and Wellar (1993) Kainer <i>et al.</i> (1995)
	Inter-disciplinary approach to information (N)	Both expert and lay person voices are employed Range of disciplinary inputs: ecology, conservation biology, landscape architecture, normal business groups, business planning department and other departments that intersect (e.g. Public Works, engineering, recreation, etc.)	Wellar (1998), Gibson <i>et al.</i> (1997), Tomulits <i>et al.</i> (1994a) Gibson <i>et al.</i> (1997), Tomulits <i>et al.</i> (1994a) Gibson <i>et al.</i> (1997), Tomulits <i>et al.</i> (1994a)

APPENDIX IV. IDENTIFICATION OF THOSE EVALUATION CRITERIA THAT ARE SPECIFIC TO ECOSYSTEM-BASED PLANNING (continued)

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans demonstrate these)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	SELECTED MEASURES	SOURCES OF THE MEASURES
Environmental Quality Strategies (Necessary)	Precautionary but positive approach to development (N)	Results of strategic environmental assessment are integrated with plan content Ecosystem-rehabilitation strategies are rewarded by planning process Humidity of planners is demonstrated by formal recognition of uncertainty In cases where irreversible consequences are unavoidable, special care is demonstrated	Avonkian et al. and Wallar (1997), Lumming (1995), Lumming (1995), Peurman (1985), Schermer (1974), Lumming (1995)
	Planning integrates rather than merely balances environmental, social and economic objectives (N)	Patterns of movement towards greater integration of env't, economy, and society w.r.t. attitudes, institutions, and behaviour	Gibson et al. (1997), Wallar (1994, 1996b)
	Linkage of ecosystem planning to democratic change, social learning, community building and env't enlightenment (N)	Public outreach techniques are used for implementation	Norton (1995)
	Cross-scale management (N)	Time scales are recognized (e.g. short- vs. long-term goals, etc.) Spatial scales are recognized Plan maps are cross-scaled spatially Plan issues are discussed in terms of cross-scaling Implementation strategies are cross-scaled Cumulative effects are addressed at different scales	Norton (1995) Barr (1997), IMR (1992) Norton (1995) Norton (1995) Norton (1995) Norton (1995), Spaling (1994)
	Explicit recognition of the municipality's ecological footprint (N)	Ecological footprint of major systems is calculated (e.g. transportation, sewage, etc.) Metropolitan inputs (e.g. oil) and outputs (e.g. CO ₂ , sewage) are calculated Strategies oriented towards minimizing inputs and outputs are provided Employment of thresholds (e.g. identified thresholds beyond which ecological carrying capacity changes unpredictably)	Rees and Wackernagel (1995), Wackernagel (1994) Rees and Wackernagel (1995), Wackernagel (1994) Rees and Wackernagel (1995), Wackernagel (1994) Rees and Wackernagel (1995), Wackernagel (1994)
	Air quality strategies (N)	Examples are demonstrated (e.g. transit orientation, densification, mixed use zoning, multi-modal transport, etc.) Use of latest science (e.g. Kyoto Conference, Rio)	Kaiser et al. (1995), Oregon (1990) Oregon (1990) Barr (1997)
	Water quality strategies (N)	Examples are demonstrated (e.g. education, tertiary sewage and wastewater treatment, snow dump strategies, design with nature using wetlands or aquatic flows, etc.) Air quality strategies are provided State-of-the-art landfill siting and construction criteria are provided (e.g. landfills above water table, impervious barrier, leachate is collected and treated)	Hallam and Barby (1994), Oregon (1990) Oregon (1990) Nebel (1990)
	Resource conservation strategies (N)	Examples are demonstrated, especially those oriented towards human behaviour (e.g. 3Rs, impact fees, growth management, mitigation banking, restrictive covenants, easements, etc.) General planning strategies like densification, protection of resources like viable agricultural land and LAMs Water pricing Evidence of waste minimization Human scale dominates car scale	Oregon (1990), Boyce (1970) Eagles (1984) Kaiser et al. (1995) Boyce (1970) Leung (1989)
	Biodiversity strategies (N)	Examples are demonstrated (e.g. green corridor systems, shoreline preservation areas, naturalization, etc.) Identification of endangered and vulnerable species (both plants and animals) at risk Public education is addressed Habitat protection is prioritized Environmental constraint maps are used	Norton and Ulanowicz (1992) Norton and Ulanowicz (1992) Norton and Ulanowicz (1992) Norton and Ulanowicz (1992) Norton and Ulanowicz (1992)
	Land water rehabilitation strategies (N)	Examples are demonstrated (e.g. engineering, covenants, public-private partnerships, etc.)	Lumming (1995), Hough (1993), Oregon (1990)
Rational Content (Necessary)	Natural disaster strategies (N)	Examples are demonstrated (e.g. measures for flooding, unstable slopes, avalanches, threat earthquakes, etc.) Emergency preparedness liaison identified	Kaiser et al. (1995), Oregon (1990), Fishman (1976), Oregon (1990)
	Socio-cultural strategies for sense of place, livability, local pride (N)	Examples are demonstrated (e.g. archaeological and heritage protection, facilitation of public art, etc.)	Kaiser et al. (1995)
	Completeness (N)	All pertinent issues are addressed Table of contents reveals either a top-down or bottom-up hierarchy	Hess (1997), Kent (1990), Alexander and Faldut (1989), Auld and Alkan (1996)

APPENDIX IV. IDENTIFICATION OF THOSE EVALUATION CRITERIA THAT ARE SPECIFIC TO ECOSYSTEM-BASED PLANNING (continued)

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	SELECTED MEASURES	SOURCES OF THE MEASURES
	Consistency (N)	Logical consistency within hierarchy (e.g., policies are consistent with goals, goals are consistent with principles, principles are consistent with vision) If goals conflict, a rationale for resolving the conflict is provided Minimization of contradictions within hierarchical framework Vision statement is provided Representative statistical sample used for vision derivation Principles based on best science or ethical maxims Issues recognize both problems and opportunities Identification of municipal assets and how to optimize those assets Identification of municipal problems and how to minimize those problems Goals are related to specific issues/desires Based on best evidence Lack of ambiguity Goals are clearly written (e.g., neither vague nor ambiguous) Objectives supporting the goals are measurable if feasible Objectives supporting the goals are prioritized Objectives supporting the goals are owned by specific individuals, teams or departments Objectives are communicated Objectives are obtainable Objectives are challenging Policies address objectives and goals Policies are not freestanding without a rationale or goal-orientation Majority of policies are related to implementation techniques Zoning reflects available scientific knowledge or ethical maxims Demonstration of inventiveness, artistic merit, creative impulse A lower tier plan is consistent with an upper tier plan Plan is consistent with provincial law and substantially surpasses it Status of the art ecosystem based planning is evident (e.g., evidence of new techniques and creative solutions) Use of strong/directive verbs and qualifiers (e.g., <i>shall</i> rather than <i>should</i>, <i>must</i> rather than <i>may</i>, <i>no</i> means <i>no</i>, etc.) Identification of where to get further information Identification of who can help Identification of where the decision levers are Identification of how relevant groups can get involved Opportunities for input into the planning process exist throughout the planning process Monitoring framework for the urban or other ecosystem Monitoring framework for plan performance Plan amendment protocols are identified Plan update protocol is measured by having plan available in a binder on a web site or on diskette Wide range of planning techniques compare actual/practical/theoretical ranges of choices (if plan is local) Public liaison officer Media relations officers with the power to action misperception of a problem or opportunity Ongoing communication and information sharing with other ecosystem based planning agencies Contingency plans for more likely surprises Implementation of new planning techniques and implementation techniques to monitor short-term	Berke and French (1994), Alexander and Faludi (1989) Berke and French (1994), Alexander and Faludi (1989) Berke and French (1994), Alexander and Faludi (1989) Klein (1993) Klein (1993) Smith and Thorberg (1987) Berke and French (1994) Bier (1997) Bier (1997) Berke and French (1994), Thompson and Strickland (1984) Thompson and Strickland (1984) Thompson and Strickland (1984) Connerly (1990) Thompson and Strickland (1984) Thompson and Strickland (1984) Thompson and Strickland (1984) Thompson and Strickland (1984) Thompson and Strickland (1984) Berke and French (1994), Smith and Weller (1992) Berke and French (1994), Smith and Weller (1992) Berke and French (1994) Coon and Demsky (1993) Bier (1997), Berke and French (1994) Stefer <i>et al.</i> (1997), Berke and French (1994), Oregon (1990) Ellen and Smith (1988), McAllister (1980) Bier (1997), Berke and French (1994) Berke and French (1994), Coon and Demsky (1993), Smith and Weller (1992), Fabman (1978) Bier (1997), Kent (1990) Bier (1997), Kent (1990) Bier (1997), Kent (1990) Bier (1997), Kent (1990) Bier (1997) Kaiser <i>et al.</i> (1995) Kaiser <i>et al.</i> (1995) Kaiser <i>et al.</i> (1995) Kaiser <i>et al.</i> (1995) Nowakowski and Noddman (1996), Dalton and Harby (1994) Amur and Minsci (1997) Maynes (1991) Tomlinson <i>et al.</i> (1994a) Oregon (1990) Bier (1997), Berke and French (1994)
	Vision reflects a representative range of relevant groups/interested parties (N)		
	Ethically- or scientifically-based principles (N)		
	Issues are both opportunity- and problem-based (N)		
	Goal specificity (N)		
	Obtainable but challenging objectives (N)		
	Operationalization of identified planning priorities through policy (N)		
	Action- or strategy-based policies (N)		
	Science- or ethics-based land use designations (N)		
	Innovation (I)		
Artistic (Important)			
Recognition of Legal Requirements Facing the Plan (Necessary)	Substantially exceeds the minimum requirements of the law (N)		
Strong Language for Priority Policy Areas (Necessary)	Strong rather than permissive verbs and qualifiers (N)		
Adaptive Capacity of the Plan to Address Change (Necessary)	Community/relevant group empowerment (N)		
	Mechanisms/frameworks for supporting plan evolution (N)		
	Flexibility given the wide breadth of the tool envelope (N)		
	Ability to respond to surprise (N)		
	New ways of problem-solving or goals achievement (N)		

APPENDIX IV. IDENTIFICATION OF THOSE EVALUATION CRITERIA THAT ARE SPECIFIC TO ECOSYSTEM-BASED PLANNING (continued)

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	SELECTED MEASURES	SOURCES OF THE MEASURES
Feasibility of Plan Implementation Plan Content Foundation (Necessary)	Fact basis (N)	Projections are scientifically grounded All analyses are based on sound data and information Data is specific to planning region Bases for conclusions are identified Background research is referenced in-text	Weller (1998), Dalton and Burby (1994), Elkin and Smith (1988) Weller (1998), Dalton and Burby (1994), Oregon (1990) Weller (1998), Isick and Trach (1994), Dalton and Burby (1994) Weller (1998), Dalton and Burby (1994), Oregon (1990) Weller (1998), Anur & Mosseri (1997), Elkin & Smith (1988)
	Plan currency (N)	Plan is less than seven years old All of the following situations are accounted for: the provincial planning act has been substantially revised, a new upper tier plan was adopted, new economic engines have appeared, substantial new development is arising, or municipal boundaries are altered	Kent (1990), Frubman (1970) MMAH (1982)
	Equitable spatial and socio-economic distribution of NIMBYs (I)	Distribution criteria are provided	Rose (1993), Boyce (1976)
	Acceptable synthesis of different public and private agendas (N)	The results of consensus-building exercises are incorporated	Lanum (1990)
	Implementation strategies involve community participation (N)	Plan implementation is combined with public outreach, education and participation	Maynes (1991)
	Well written (N)	No spelling mistakes Few grammatical errors Few overly long sentence lengths Few large polysyllabic words No evidence of institutional or public criticism of writing	Gallagher and Patrick-Riley (1989) Gallagher and Patrick-Riley (1989) Gallagher and Patrick-Riley (1989) Gallagher and Patrick-Riley (1989) Gallagher and Patrick-Riley (1989), Ross (1987)
	Definition of key concepts (N)	Definitions are provided in-text, in margin notes, in a glossary or in appendices	Gilpin (1995), Leach (1993), Elkin and Smith (1988)
	Animation/friendliness of plan (I)	Employment or anticipated employment of photos, graphics, colour, cartoons, art, data, etc	Cumque (1998), Kent (1990)
	Use of plain language (N)	Minimal planning jargon Minimal obfuscation Definition of jargon terms that are used in glossary or in margin notes Distillation of different versions of the plan (e.g. plan summaries or synopses targeted to specific audiences)	Schibada and Byer (1991), Solnit <i>et al.</i> (1988) Schibada and Byer (1991), Solnit <i>et al.</i> (1988) Schibada and Byer (1991), Solnit <i>et al.</i> (1988) Schibada and Byer (1991), Solnit <i>et al.</i> (1988)
	Well organized (N)	Logical progression of topics and ideas Grouping of concepts according to an underlying framework Topics move from general to specific or specific to general	Ross (1987) Ross (1987) Ross (1987)
	Ease of locating information (N)	Table of contents, index or labeled page tabs Background reports employ same format as plan	Lamont (1990), Solnit <i>et al.</i> (1988) Solnit <i>et al.</i> (1988)
	Text legibility (N)	Good reproduction quality Appropriate font size Appropriate font style employing serifs	Gallagher and Jacobson (1993), Folker <i>et al.</i> (1981) Gallagher and Jacobson (1993), Folker <i>et al.</i> (1981)
	Plan availability in relevant languages, if applicable (N)	<i>If appropriate, plan is available in both official languages and other relevant ones</i>	Lairner (1997), Government of Canada (1989)
	Plan conciseness (N)	Plan focuses primarily on vision, principles, goals, objectives, policies and monitoring <i>Need to know</i> rather than <i>nice to know</i> proviso is followed - excluding margin notes Detailed background information is found in background reports Minimal in-text duplication of policies, concepts or arguments	Berke and French (1994) McKen (1998, Pers. Comm.) Kent (1990) Kent (1990)
	Self-containment (N)	Inclusion of maps, bibliography - no need to step outside the plan except for more detailed information	Isack (1997)
	Identification of how to get further information (I)	List of contacts (including web addresses) is provided Bibliography is provided References to background reports are located in-text	Anur and Mosseri (1997) Elkin and Smith (1988)
	Range of plan availability alternatives (I)	Plan is available in hard copy plus another option (e.g. web site, on PC or Mac, diskette, in summary form, etc.) During plan formulation stage, plan is available free of charge or at minimal cost	Kent (1990) Kent (1990)

PLAN FORM Effective Communication of Planning Information to Relevant Groups (Necessary)

APPENDIX IV. IDENTIFICATION OF THOSE EVALUATION CRITERIA THAT ARE SPECIFIC TO ECOSYSTEM-BASED PLANNING (continued)

NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e. good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	SELECTED MEASURES	SOURCES OF THE MEASURES
Effective Communication of Spatial Information to Relevant Groups Through Maps (Necessary)	Appropriate/relevant level of map detail (N)	Legend has a manageable number of attributes Lack of visual clutter Public documentation reveals no indication that plan maps are unreadable or cluttered	Slater <i>et al.</i> (1994) Leach (1993) Slater <i>et al.</i> (1994), Leach (1993)
	Appropriate level of boundary accuracy (I)	The accuracy of map boundaries reflect whether the plan is conceptual/strategic or site-specific	NCC Steering Committee (1998)
	Plan maps are reflective of policies and policies are reflective of maps (N)	Plan maps reflect plan text Plan text reflects plan maps Although plan text can have untagged dimensions, map-based characterizations must relate to plan text	NCC Steering Committee (1998) NCC Steering Committee (1998) NCC Steering Committee (1998)
	Manageable map size (I)	Maps are the size of an adult arm-span or smaller	Baer (1997)
Environmentally-sensitive Plan Production (Necessary)	Use of environmentally-responsible materials (N)	Plan is printed on recycled paper Plan text is written with vegetable inks (e.g. soy-based inks are popular) Plan availability alternatives exist (e.g. plan is available on web-site and on diskette) Limited production run	Johnson (1990) Johnson (1990) Kent (1990) Johnson (1990)

APPENDIX V

**FINAL RESEARCH RESULTS —
THE DERIVED EVALUATION INSTRUMENT**

In Appendix V, the derived evaluation instrument is presented with measures. Users of the instrument are reminded that only the necessary and important criteria presented in columns 1 and 2 were generated from the Delphi exercise. Measures, as discussed in Chapter VI, are at the discretion of the community involved to determine. The measures that are provided are suggestions and deductions from the literature alone, and have not been vetted for applicability to a particular planning context.

APPENDIX V. Final Research Results: The Derived Evaluation Instrument.

Note: Some of the criteria may not be possible to qualitatively assess due to the stage of the planning process involved or due to the style of the plan.

1	2	3	4	5
NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	STATUS OF THE ATTRIBUTE	POTENTIAL OPERATIONAL MEASURES	Type of Evidence? Background, Interview, Map or Plan-based
1 PLANNING PROCESS Ecosystem Approach to Planning Process (Necessary)	A Visioning	Necessary	Visioning took place Visioning involved a representative sample Shaping of plan content with vision results Identification of entrenched attitudes	Background Background Plan, Interview Background
	B Scoping	Necessary	Identification of problems and opportunities Identification of relevant groups (e.g., registry of relevant groups) Participation invitations sent out to relevant groups either by newspaper, radio, TV or mailing Derivation of initial list of goals and priorities Identification of prioritization criteria	Background Background Interview, Background Background Interview
	C Definition and survey of planning region	Necessary	Identification of variables to be measured Initiation of background studies Delineation of ecologically-based planning boundaries Delineation of scale-based protocols for data gathering	Background Background Background Background
	D Modeling and analysis of planning region	Necessary	Identification of needs and trends -- starting with demography Analysis of biophysical, infrastructural and built systems as well as their inter-relationships across scales Initial determination of optimal locations for different land uses according to science or ethics Establish/continue the foundation of a SOE reporting-style monitoring framework	Background Background, Plan Interview
	E Development of a structure plan and formulation of rival alternatives	Necessary	Formulation of detailed goals and objectives Formulation of rival scenarios	Background Background
	F Assessment of plan alternatives and selection of two to three to pursue	Necessary	Assessment of rival scenarios in light of goals and objectives Selection of two or three alternatives through negotiation	Background Background Interview
	G Meaningful debate/negotiation of plan contents	Necessary	List of relevant groups Meaningful negotiation involving relevant groups (e.g., participatory, collaborative, conflict resilient, accountable) Selection of final choice Program (use of TV, radio, newspapers, etc.) used for stimulating citizen involvement	Background Background Background Plan Background
	H Refinement of plan choice	Necessary	(Strategic) environmental assessment to fine-tune policy content Development of detailed scale-based plans Establishment of requirements for project planning and approval Exploration of a full range of implementation strategies	Background Background Background Plan Plan
	I Monitoring	Necessary	Identification of requirements for monitoring plan performance Identification of requirements for monitoring municipal context Identification of requirements for compliance monitoring Identification of protocols for plan amendment	Plan Plan, Background Plan Plan
	J Information feedback loops internal and external to each stage in the planning process	Necessary	Identification of mechanisms for deciding when and how a planning intervention should be orchestrated	Plan, Interview
2 Feasibility of Plan Implementation (Process foundation -- Necessary)	A Plan implementation to be done by trained planning staff or consultants	Important	Plan implementation to be done by experienced planners	Interview, Background
	B Available funds to employ planning staff or consultants	Important	Funds are available to implement plan	Background
	C Available resources to carry out planning strategies	Necessary	Sufficient time Sufficient money Community input Funds are available to implement the plan Effective strategies requiring least financial input are prioritized	Interview Interview Background Background Background

APPENDIX V. Final Research Results: The Derived Evaluation Instrument (continued).

Note: Some of the criteria may not be possible to qualitatively assess due to the stage of the planning process involved or due to the style of the plan.

1 NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	2 ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	3 STATUS OF THE ATTRIBUTE	4 POTENTIAL OPERATIONAL MEASURES	5 Type of Evidence? Background, Interview, Map or Plan-based
3 Principles of the Ecosystem Approach (Necessary)	D Political commitment to carry out the plan	Necessary	Mayor/regional chair endorses the plan (community endorses the plan)	Interview Interview, Background
	E Cooperation commitment among inter-jurisdictional partners	Necessary	Memoranda of intent or an analogue	Background, Interview
	F Credibility of local political structure	Important	No history of scandals	Interview
	G Institutional power to implement the plan	Necessary	Legally-defined authority Viable working relationships between inter jurisdictional partners	Background Interview
	H Credible institutional transparency	Necessary	Top-down accountability from the upper tier government(s) Top-down accountability from the mayor or an analogue Bottom-up accountability from the electorate All discretionary planning decisions are open to public attendance All planning meetings involving issues with public impacts are open to the public	Background Interview Interview Interview Interview
	I Ongoing involvement of relevant groups during plan formulation and implementation	Necessary	Relevant groups have been involved from visioning onwards to implementation	Background
	J Process oriented to municipality's growth rate	Important	Plan is primarily regulation-based only if municipality is high growth	Background, Plan
	K Integration of planning and economic development offices	Important	Cooperation Two-way flow of information between planning agency and economic development office	Interview Interview
	L Flexible/speedy plan amendment protocols for new data or new circumstances	Necessary	Plan amendment timeline exists	Background
	M Liaison officer optimizes info flow between agency, decision makers and relevant groups, etc	Important	Liaison officer on staff	Background, Interview
3 Principles of the Ecosystem Approach (Necessary)	N Use of a representative environmental advisory committee	Necessary	Minimal number of municipal politicians Rotation of advisory committee members Environmental advisory committee considers the engagement of the public in planning as one of its priorities	Background Interview Interview
	A Planning units are based on natural boundaries or take them into consideration	Necessary	Ecological rationale for boundary delineation is evident	Background
	B Design with nature	Necessary	Natural design is recognized Natural design is rewarded (e.g., How is housing set up? Development credits?)	Interview Plan, Interview
	C Consideration of the cumulative and global effects of policies, plans and projects	Necessary	Natural design criteria are employed in either site plan control or general design guidelines and procedures Evidence of planning protocols for climate (e.g., winter planning provisions)	Interview Plan, Interview
	D Inter-jurisdictional decision-making	Necessary	Cumulative effects are accounted for in the (strategic) environmental assessment Global effects are accounted for in the (strategic) environmental assessment Reference to and recognition of cumulative and/or global benchmarks (e.g., Kyoto Conference, Rio)	Background Background Background
	E External consultation cooperation and partnering among relevant groups/institutional parties	Necessary	Memoranda of intent have been addressed and are formalized Public participation is on-going Memoranda of intent concerning partnerships are on file	Background, Interview Background Background
	F Long-term monitoring, feedback and adaptation of plan content	Necessary	Evidence that indicators to be monitored were systematically selected (e.g., in terms of scientific validity, relevance, representativeness, data availability, and cost) Many of the indicators are specifically related to plan goals and to performance objectives Identification of how monitoring results will be reported and lead to modifications of plan content	Background Background Background Plan, Background

APPENDIX V. Final Research Results: The Derived Evaluation Instrument (continued).

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1	2	3	4	5
NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	STATUS OF THE ATTRIBUTE	POTENTIAL OPERATIONAL MEASURES	Type of Evidence? Background, Interview, Map or Plan-based
4 Environmental Quality Strategies (Necessary)	G Inter-disciplinary approach to information	Necessary	Both expert and lay-person sources are employed Range of disciplinary inputs: ecology, conservation biology, landscape architecture Formal liaison groups between planning department and other departments (e.g., Public Works, recreation)	Background Background Interview
	H Precautionary but positive approach to development	Necessary	Results of (strategic) environmental assessment are integrated with plan content Ecosystem-rehabilitation strategies are rewarded by planning process Humility of planners is demonstrated by formal recognition of uncertainty In cases where irrevocable consequences are unavoidable, special care is demonstrated	Background Plan, Interview Plan, Interview Interview
	I Planning integrates (rather than merely) balances environmental, social and economic objectives	Necessary	Evidence of movement towards greater integration of env't, economy and society w.r.t. attitudes, institutions and behavior	Interview
	J Landscape of every item planning to demonstrate change, visual learning, community help and env't enlighten	Necessary	Public outreach techniques are used for implementation Meaningful public participation	Plan Background
	K Cross-scale management	Necessary	Time scales are recognized (e.g., short- vs. long-term goals, development phasing, etc.) Spatial scales are recognized Plan maps are cross-scaled spatially Plan issues are discussed in terms of cross-scaling Implementation strategies are cross-scaled Cumulative effects are addressed at different scales	Interview, Plan Interview Maps Plan Plan Plan Plan, Background
	L Explicit recognition of the municipality's ecological footprint	Necessary	Ecological footprint of major systems is calculated (e.g., transportation, construction, sewage, etc.) Metropolitan inputs (e.g., fuel) and outputs (e.g., CO ₂ , sewage) are calculated Strategies oriented towards minimizing inputs and outputs are provided	Background Background Background Plan
	A Air quality strategies	Necessary	Examples are demonstrated (e.g., transit-orientation, densification, mixed use zoning, multi-modal transpo like HOV, support of telework, etc.) Identification of relevant legislation and related air quality targets Use of latest science (e.g., Kyoto Conference, Rio)	Plan Plan Plan Plan
	B Water quality strategies	Necessary	Examples are demonstrated (e.g., education, upgrading existing sewage and stormwater treatment, snow dump strategies, design with nature using wetlands or aquatic flowers, etc.) Air quality strategies are provided State-of-the-art landfill siting and construction criteria are provided (e.g., landfills above water table, impervious barrier, leachate is collected and treated)	Background, Plan Plan Plan, Background
	C Resource conservation strategies	Necessary	Examples are demonstrated -- especially those oriented towards human behavior (e.g., 3Rs, impact fees, growth management, mitigation banking, restrictive covenants, easements, etc.) General planning strategies like densification, protection of resources like viable agricultural land and ESAs Water pricing Evidence of waste minimization strategies	Plan Plan Plan, Interview Plan
	D Biodiversity strategies	Necessary	Examples are demonstrated (e.g., green corridor systems, shoreline preservation areas, naturalization, etc.) Identification of endangered and vulnerable species (both plants and animals) at risk Public education is addressed Habitat protection for species at risk Environmental constraint maps are used	Plan Plan Interview Plan Maps Interview
	E Land/water rehabilitation strategies	Necessary	Examples are demonstrated (e.g., engineering, covenants, public-private partnerships, etc.)	Interview
	G Natural disaster mitigation strategies	Necessary	Examples are demonstrated (e.g., for flooding, unstable slopes, avalanche threat, earthquakes, etc.) Identification of emergency preparedness hazards	Plan Plan
	H Socio-cultural strategies for sense of place (identity), local pride	Necessary	Examples are demonstrated (e.g., archaeological and heritage protection, facilitation of public art, etc.)	Plan

APPENDIX V. Final Research Results: The Derived Evaluation Instrument (continued).

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NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	STATUS OF THE ATTRIBUTE	POTENTIAL OPERATIONAL MEASURES	Type of Evidence? Background, Interview, Map or Plan-based
5 Rational Content (Necessary)	A Completeness	Necessary	All pertinent issues are addressed	Plan
	B Hierarchical framework of vision, planning principles, issues, goals, objectives and policies	Necessary	All variables itemized in this evaluation framework have been addressed	Plan, Background, Maps
	C Consistency	Necessary	Table of contents reveals either a top-down or bottom-up hierarchy	Plan
	D Vision reflects a representative range of relevant groups/interest parties	Necessary	Logical consistency within conceptual hierarchy (e.g., policies are consistent with goals, goals are consistent with principles, principles are consistent with vision) If goals conflict, a rationale for resolving the conflict is provided	Plan
	E Ethically- or scientifically-based principles	Necessary	Vision statement is provided Representative statistical sample used for vision derivation	Plan, Interview
	F Issues are both opportunity- and problem-based	Necessary	Principles based on best science or ethical maxims	Plan, Background
	G Goal specificity	Necessary	Issues recognize both problems and opportunities Identification of municipal assets and how to optimize those assets Identification of municipal problems and how to minimize those problems	Plan
	H Obtainable but challenging objectives	Necessary	Goals are related to specific issues/opportunities/needs/desires Based on best evidence Goals are clearly written (i.e., neither vague nor ambiguous) Objectives supporting the goals are measurable if feasible Objectives supporting the goals are prioritized Objectives supporting the goals are owned by specific individuals, teams or departments Objectives are communicated	Interview Interview Plan
	I Operationalization of identified planning priorities through policy	Necessary	Objectives are obtainable Objectives are challenging	Plan Background
	J Action- or strategy-based policies	Necessary	Policies address objectives and goals Policies are not freestanding without a rationale or goal orientation	Plan Plan
	K Science- or ethics-based land use designations	Necessary	Majority of policies are related to implementation techniques	Plan
6 Artistic (Important)	A Innovation	Important	Zoning reflects available scientific knowledge or ethical maxims	Background
7 Recognition of Legal Requirements Facing the Plan (Necessary)	A Substantially exceeds the minimum requirements of the law	Necessary	Demonstration of inventiveness, artistic merit, creative impulse	Plan
8 Strong Language for Priority Policy Areas (Necessary)	A Strong rather than permissive verbs and qualifiers	Necessary	A lower tier plan is consistent with an upper tier plan Plan is consistent with provincial law and substantially surpasses it State-of-the-art ecosystem based planning is evident (e.g., evidence of new techniques and creative solutions)	Plan, Background Interview Plan
9 Adaptive Capacity of the Plan to Address Change (Necessary)	A Community/relevant group empowerment	Necessary	Use of strong verbs and qualifiers (e.g., shall rather than should, must rather than may, no means no, etc.)	Plan
	B Mechanisms/frameworks for supporting plan evolution	Necessary	Identification of where to get further information Identification of who can help Identification of where the decision levers are Identification of how members of relevant groups can get involved Opportunities for input into the planning process exist throughout the planning horizon	Plan Plan, Background Plan, Background Plan Background
			Monitoring framework for municipal context Monitoring framework for plan performance Plan amendment protocols are identified Plan up-date potential is maximized by having plan available in a binder, on a web-site or on diskette	Plan Plan Plan Plan

APPENDIX V. Final Research Results: The Derived Evaluation Instrument (continued).

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NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	STATUS OF THE ATTRIBUTE	POTENTIAL OPERATIONAL MEASURES	Type of Evidence? Background, Interview, Map or Plan-based
10 Feasibility of Plan Implementation (Plan Content Foundation) (Necessary)	C Flexibility given the wide breadth of the tool envelope	Necessary	Wide range of planning techniques are employed Employment of alternative development standards	Background, Plan Plan
	D Ability to respond to surprise	Necessary	Public liaison officer Media relations officers or ombudsperson with the power to action investigation of a problem or opportunity On-going communication and information-sharing with other ecosystem-based planning agencies (contingency plans for more likely surprises (e.g., ice storms))	Background, Interview Interview Interview Interview
	E New ways of problem-solving or goals achievement	Necessary	Employment of new planning techniques and implementation techniques (e.g., mitigation banking)	Interview
	A Fact-based	Necessary	Projections are methodologically grounded Analyses are based on sound data and information Data is specific to planning region Bases for conclusions are identified Background research is referenced in-text	Plan, Background Plan, Background Plan, Background Plan Plan
	B Plan currency	Necessary	Plan is less than seven years old All of the following situations are accounted for: the provincial planning act has been substantially revised, a new upper tier plan was adopted, new economic engines have appeared, substantial new development is arising, or municipal boundaries have been altered	Background, Interview
	C Equitable spatial and socio-economic distribution of NIMBYs	Important	Distribution criteria are provided	Interview, Plan
	D Acceptable synthesis of different public and private agendas	Necessary	The results of consensus-building exercises are incorporated	Background
	E Implementation strategies involve community participation	Necessary	Plan implementation is/will be combined with public outreach, education and participation	Plan
	A Well written	Necessary	No spelling mistakes Few grammatical errors Few overly long sentence lengths Few large polysyllabic words No evidence of institutional or public criticism of writing	Plan Plan Plan Plan Background
	B Definition of key concepts	Necessary	Definitions are provided in-text, in margin notes, in a glossary or in appendices	Plan
11 Effective Communication of Planning Information to Relevant Groups (Necessary)	C Animation/friendliness of plan	Important	Employment or anticipated employment of photos, graphics, colour, cartoons, art, data, etc	Interview
	D Use of plain language	Necessary	Minimal planning jargon Minimal obfuscation Definitions of any jargon terms that are used are provided in glossary or in margin notes Distribution of different versions of the plan (e.g., plan summaries or synopses targeted to specific audiences)	Plan Plan Plan Background
	E Well organized	Necessary	Logical progression of topics and ideas in the table of contents going from most general to specific or vice-versa (grouping of concepts according to an underlying framework)	Plan Interview
	F Ease of locating information	Necessary	Table of contents, index or labeled page tabs Background reports have same format and appearance as plan	Plan Background
	G Text legibility	Necessary	Good reproduction quality Appropriate font size Font style has serifs	Plan Plan Plan
	H Plan availability in relevant languages, if applicable	Necessary	If appropriate, plan is available in both Official Languages or other relevant ones	Plan

PLAN FORM

11 Effective Communication of Planning Information to Relevant Groups (Necessary)

APPENDIX V. Final Research Results: The Derived Evaluation Instrument (continued).

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1 NECESSARY OR IMPORTANT CONDITIONS OF A GOOD ECOSYSTEM-BASED PLAN (i.e., good plans demonstrate them)	2 ATTRIBUTES OF THE NECESSARY OR IMPORTANT CONDITIONS OF GOOD ECOSYSTEM-BASED MUNICIPAL PLANS	3 STATUS OF THE ATTRIBUTE	4 POTENTIAL OPERATIONAL MEASURES	5 Type of Evidence? Background, Map Interview, Map or Plan-based
12 Effective Communication of Spatial Information to Relevant Groups Through Maps (Necessary)	I Plan conciseness	Necessary	Plan focuses primarily on vision, principles, goals, objectives, policies and monitoring <i>Need to know</i> rather than <i>nice to know</i> provision is followed -- excluding margin notes Detailed background information is found in background reports Minimal in-text duplication of policies, concepts or arguments	Plan Plan Background Plan
	J Self-containment	Necessary	Inclusion of maps, bibliography -- no need to step outside the plan except for more detailed information	Plan
	K Identification of how to get further information	Important	Points of contact (including e-mail and web addresses) are provided Bibliography is provided References to background reports are located in-text	Plan Plan Plan Plan
	L Range of plan availability alternatives	Important	Plan is available in hard copy plus another option (e.g., web site, on PC or Mac diskette, in summary form, etc.) During plan formulation stage, plan is available free of charge or at minimal cost	Background Interview
	A Appropriate/relevant level of map detail	Necessary	Map legends have a manageable number of attributes Lack of visual clutter Public commentary on the plan reveals no indication that plan maps are unreadable or cluttered	Maps Maps Background
	B Appropriate level of boundary accuracy	Important	The accuracy of map boundaries reflects whether the plan is conceptual/strategic or more spatially-specific	Maps
	C Plan maps are reflective of policies and policies are reflective of maps	Necessary	Plan maps reflect plan text Plan text reflects plan maps Although plan text can have unmapped dimensions, map-based characterizations must relate to plan text	Maps, Plan Maps, Plan Maps, Plan Maps, Plan
	D Manageable map size	Important	Maps are the size of an adult arm-span or smaller	Maps
	A Use of environmentally responsible materials	Necessary	Plan is printed on recycled paper Plan text is written with vegetable inks (e.g., soya-based inks are popular) Plan availability alternatives exist (e.g., plan is available on web-site and on diskette) Production run is executed on an as-needed basis	Plan, Interview Interview Interview Interview
13 Environmentally-sensitive Plan Production (Necessary)				