# SUSTAINABLE COMMUNITY INDICATORS SOFTWARE

## GUIDELINES

## FOR THE DEVELOPMENT OF SUSTAINABILITY INDICATORS: USER REFERENCE


***March 1999***

***SUSTAINABLE COMMUNITY INDICATORS SOFTWARE***

***GUIDELINES FOR THE DEVELOPMENT OF SUSTAINABILITY INDICATORS: USER REFERENCE***

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## *TABLE OF CONTENTS*

# ABOUT THESE GUIDELINES

These Guidelines were developed based on existing literature and case-studies. They are primarily designed to work with the Sustainable Community Indicators (SCI) Software. For each guideline, sources are given and all the references used are listed fully in "General References". Also given under each guideline are related topics in the Guidelines and in the software manual and help system. A key word search system is incorporated.

A major impetus for all of this work was the workshop sponsored by Environment Canada and Canada Mortgage and Housing Corporation, on Urban Sustainability Indicators which took place in Toronto in June 1995 (CMHC and Environment Canada, 1996).

At Environment Canada, Dennis O'Farrell, Wayne Bond, and Michael Ditor with assistance from Jeff Dean integrated, drafted, and revised the Guidelines based on a wide assortment of information sources.

# INDICATOR DEVELOPMENT PROCESS

It is useful to consider an overview of the indicator development process, to provide scope for developing an indicators program and give context to many of the concepts described in the Guidelines. This section outlines a number of generic steps that can be taken in developing a sustainability indicators program. The section concludes with a case study using Environment Canada's National Environmental Indicator Series.

**Contents**



**Key Words**

Indicator, define, framework, develop, process, steps

## *Step 1: Define and conceptualize sustainability*

*Step 1: Define and conceptualize the nature of sustainability and the sustainability goals for which indicators are needed.*

- Sustainability goals to be achieved will vary from community to community
- Create an individual, working definition to be used for the indicators program
- A visioning exercise is a useful technique for articulating this definition and its associated sustainability goals

  ⇒ multi-stakeholder, consensus-based approach to identify how a community should look, in order for it to be regarded as a sustainable community

**Source:**

Maclaren, 1996.

**See also:**

DEFINITIONS

OBJECTIVES

Preparing a community vision of sustainability

**Key Words**

concept, goals, vision, plan, preparing, sustainability

## *Step 2: Identify target audience and purpose of indicators*

*Step 2: Identify the target audience, the associated purpose for which indicators will be used, and the relative number of indicators needed.*

- Format and number of indicators depend on target audience

| Target Audience | Indicators/Data Format |
|---|---|
| **Professional analysts, Scientists** | • raw data<br>• highly detailed and complex indicators<br>• emphasis on scientific validity and system complexity |
| **Policy-makers** | • indicators directly related to:<br>⇒ policy objectives<br>⇒ evaluation criteria<br>⇒ target values |
| **Media, General Public** | • reduced set of indicators;<br>• easy-to-understand<br>• represent issues of direct concern |

**Source:**

Maclaren, 1996.

**See Also:**

SELECTING INDICATORS

**Key Words**

audience, purpose, format, indicators, scientists, policy-makers, public, media

## *Step 3: Choose an appropriate framework*

*Step 3: Choose an appropriate indicator framework.*

**Indicator frameworks may be classified into six general types:**

- Goal-based
- Issue-based
- Sectoral
- Domain-based
- Causal
- Combination ⇒ *advantage*: draws on all of the strengths while downplaying the weaknesses of above frameworks

For example, if the target audience is the municipal policy-maker, then a sectoral framework may be most appropriate. If it is important to have indicators for monitoring cause-effect relationships, then a causal framework may be most appropriate. Alternatively, a combination sectoral-causal framework may be most appropriate if the municipal policy-maker audience is concerned about cause-effect relationships.

**Source:**

Maclaren, 1996.

**See also:**

Indicator frameworks

### Key Words

framework, structure, type, causal, sectoral, conceptual

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## *Step 4: Define indicator selection criteria*

*Step 4: Define indicator selection criteria.*

The Guidelines recommend eleven indicator selection criteria for choosing a final set of indicators:

- Scientific Validity/Theoretical Soundness
- Responsiveness to Change
- Evident Links of Cause and Effect
- Representative of Sustainability Issues
- Accurate Time-Series Data Available or Collectable
- Cost-Effectiveness
- Relevant & Understandable to Users
- Comparable Among Jurisdictions
- Useful at Large & Small Geographic Scales
- Comparability to Target, Thresholds or Standards
- Integrates Social, Economic & Environmental Factors

Communities may wish to adapt these criteria to select indicators that are individual to the sustainability vision and goals that are defined in earlier steps of the indicator development process (see Guidelines under “Selection criteria for indicators”).

***Source:***

Maclaren, 1996.

***See also***

Selection criteria for indicators

### Key Words

criteria, selection, indicator, define, valid, representative, understandable, comparable

## *Step 5: Identify and evaluate potential indicators*

*Step 5: Identify a set of potential indicators and evaluate them against the selection criteria.*

Once selection criteria have been defined, they can be used to evaluate potential indicators for the program. It likely will be difficult to find indicators that satisfy all selection criteria simultaneously. Consequently, judgements will have to be made about the relative importance. Meaningfulness to individuals in the community should be given first place in the list of selection criteria. Whether data availability limitations should exclude certain otherwise desirable indicators is also open to question. It may be necessary, in the end, to apply criteria sequentially, and to accept trade-offs among them.

**Source:**

Maclaren, 1996.

**See also:**

Rating potential indicators

### Key words

evaluate, indicators, identify, choose, criteria

## *Step 6: Choose final indicators*

*Step 6: Choose a final set of indicators and test their effectiveness.*

- Determine if indicators measure what they were meant to measure
- Data availability may limit number of indicators in the final set and require a new round of indicator identification
- The final indicator list will need to be re-evaluated as better data become available, community goals evolve, as scientific knowledge advances concerning the validity of indicators, and as other factors change over time.

**Source:**

Maclaren, 1996.

### Key Words

test, effectiveness, measure, indicators, evaluate, choose

### *Case Study: National Environmental Indicators Series*

The following text offers an example of how an indicator program may be developed, using Environment Canada's National Environmental Indicator Series as a case study.

*Develop goals and establish issues:*

(see also Guidelines under "OBJECTIVES" and/or "ISSUES")

Environment Canada's national environmental indicator program is guided by three principal goals for sustainable development: assuring the maintenance and integrity of ecological life-support systems; assuring human health and well-being; and assuring natural resource sustainability. Influencing the attainment of these three goals in a pervasive way are population, lifestyle, and consumption patterns. Together, these four themes provide the context for the national set of environmental indicators.

An "issues" approach has been adopted as the basis for indicator development. Current key environmental issues were selected through a process of wide ranging consultations and analysis. Issues of long-standing importance were selected, not the "here-today, gone-tomorrow" variety. The issues were grouped under the four themes or issue areas noted above. Indicators for the environmental issues are being developed and reported as part of the national set of environmental indicators (Table 1).

Table 1. Issue areas described by the National Set of Environmental Indicators

| Theme | Issues |
|---|---|
| | |
| Ecological Life Support Systems | Acid Rain<br>Biodiversity Change<br>Climate Change<br>Forest Ecosystems<br>Marine Ecosystems<br>Stratospheric Ozone Depletion<br>Toxic Contaminants in the Environment |
| | |
| Natural Resources Sustainability | Agricultural Resources<br>Sustaining Canada's Forests<br>Sustaining Marine Resources |
| | |
| Human Health & Well-Being | Freshwater Quality<br>Urban Air Quality<br>Urban Green Space<br>Urban Water Use & Wastewater Treatment |
| | |
| Pervasive Influencing Factors | Canadian Passenger Transportation<br>Energy Consumption<br>Population Growth and Lifestyle Patterns<br>Solid & Hazardous Waste Generation |

*Analyze issues:*

(see also Guidelines under “Assessing priority issues”)

For each issue, potential indicators of stress, condition and societal response are identified and developed based on the stress-condition-response model (Figure 1) first developed by Statistics Canada and later adopted in a slightly modified form by OECD. Through a simplified "cycle" diagram (Figure 2), it is possible to show that stresses influence condition and effects which can be linked to societal response which in turn influence the human activities and stresses (it is acknowledged that natural forces may also cause stresses, but the focus for indicators is on human causes since decision-makers in society have more ability to do something about them). It is not necessarily essential to have an indicator for each stage in the cycle as long as the links can be established (see Guidelines under “Stress-condition-response model”).

**Figure 1. General stress - condition - response model showing hierarchical levels of detail (the enclosed rectangles).**

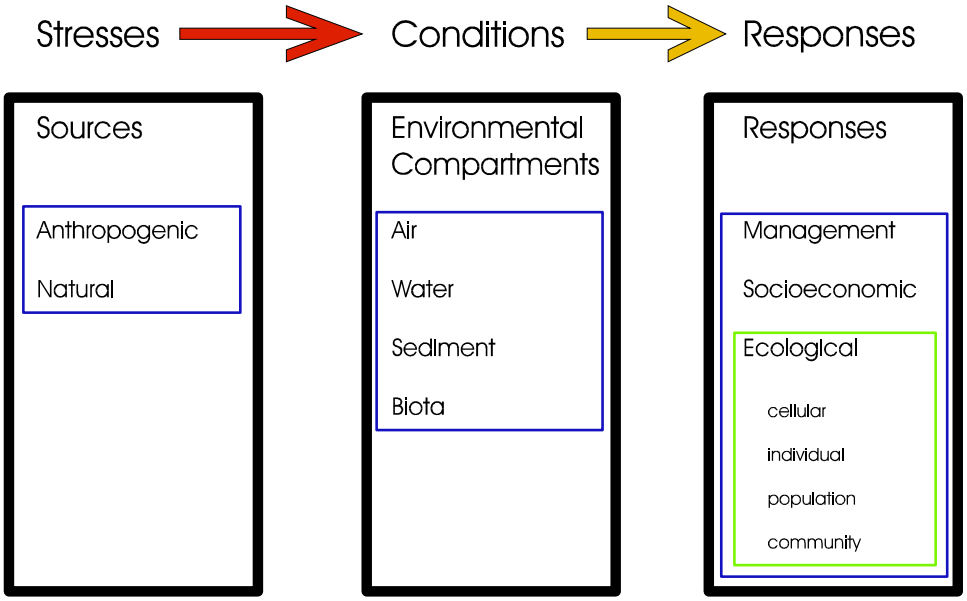
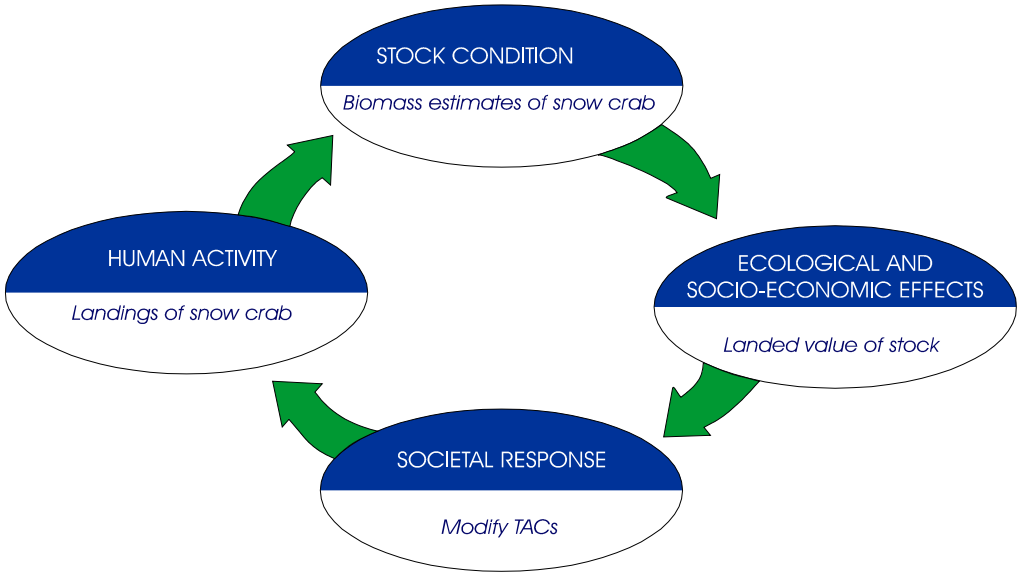


**Figure 2. The stress - condition - response model shown as a "cycle diagram" (or "bubble" diagram) for the issue of sustaining marine resources, in this case portions of the Atlantic invertebrate fishery.**




*Apply criteria:*

(see also Guidelines under “SELECTING INDICATORS”)

At each stage in the selection and development of key indicators, a series of criteria are applied as a screen. Good indicators are sensitive to change, supported by reliable, readily available data, relevant to the issue, and understood and accepted by intended users (Table 2.).

Note: These criteria do not precisely match those that are presented in the software, although the same concepts are covered. Please see the Guidelines section “SELECTING INDICATORS”.

Table 2. General criteria used for indicator selection

| |
|---|
| scientific validity |
| data availability over time |
| responsive to change |
| representative of the issue |
| understandable |
| relevant to needs of users |
| ability to compare data to a target or threshold value |
| national perspective |
| geographic coverage |
| data adequacy |
| cost effectiveness |
| predictive (if possible) |

*Reporting:*

(see also Guidelines under “REPORTING”)

Regular reporting on the national series of environmental indicators has been initiated through the use of bulletins. A two page "Issue Context" provides background information and includes a cycle diagram which shows where each indicator fits in the cycle. The following pages provide graphs, figures and bullet style text to describe each of the indicators. The bulletins are designed to be easily read, with careful use of white space, text alignment and graphics. A typical indicator bulletin is 5 to 8 pages long, with both French and English language versions. The audiences are very broad based, including decision-makers / stakeholders, corporate agencies, schools, interested public and the media. Technical supplements are also produced for each bulletin which provide the data and descriptions of data accuracy, methodologies and sources of information. Published bulletins are printed in hard copy and posted on the Internet (http://www.ec.gc.ca/). Access to the core data used in the bulletins and the technical supplements is available to individuals.

*Public and stakeholder involvement:*

(see also Guidelines under “Community consultations”)

Consultations and partnerships are a fundamental and essential part of the indicators process. During the development of each indicator bulletin, stakeholders from all parts of the country with a range of perspectives are asked to provide input to and review draft indicator packages and provide comments. The package is revised and a draft bulletin is re-circulated to provide opportunity for a final review. The objective is to have these indicators accepted and used as "common currency"; stakeholder involvement in their development is critical to achieving this end.

***Source:***

Vandermeulen, 1997.

***See also***

OBJECTIVES
ISSUES

Assessing priority issues
SELECTING INDICATORS
Stress-condition-response model
Selection criteria for indicators
DATA COLLECTION
INDICATOR ANALYSIS
REPORTING
Community consultations

## Key Words

case study, example, goals, objectives, issues, framework, stress-condition-response, selecting indicators, criteria, reporting, public involvement

# DEFINITIONS

The following section is designed to familiarize the user with some of the concepts involved with developing a sustainability indicators program. These definitions are taken primarily from literature and workshops on sustainability and indicators. It will become clear that several of these concepts have no one true definition and the user may find it practical to adapt these definitions to suit the needs of individual community visions and goals of sustainability (see Guidelines under "Preparing a community vision of sustainability").

***See also:***

Preparing a community vision of sustainability

**Contents**



**Key words**

define, sustainability, social, economic, environmental, urban, indicators, definitions

## *Definitions - sustainability*

Many different definitions of sustainable development and urban sustainability have been proposed and discussed since the publication of Our Common Future by the United Nations World Commission on Environment and Development (WCED), more commonly known as the Brundtland commission. The WCED (1987) defined sustainable development as:

"**development that meets the needs of the present without compromising the ability of future generations to meet their own needs**."

While there are many variations on how sustainable development should be defined, a consensus has emerged that there must be progress on three fronts - economic development, social development, and preservation of the environment - to move towards a sustainable state, and that strong linkages exist between these dimensions.

***Source:***

CMHC and Environment Canada, 1996.
World Commission on Environment and Development (WCED), 1987.

***See also:***

DEFINITIONS
Sustainability characteristics in the literature

**Key Words**

sustainability, definition, sustainable development, economic, social, environment

## *Definitions - urban sustainability*

Most definitions of urban sustainability reflect the need for progress on the economic, social and environmental conditions in urban areas. Urban sustainability also implies an orientation towards the future, reflecting the importance of inter-generational equity. The literature provides many definitions of urban sustainability and its related concepts. Richardson (1989) defines sustainable urban development as:

"…**a process of change in the built environment which fosters economic development while conserving resources and promoting the health of the individual, the community and the ecosystem** (recognizing that…the urban environment cannot be separated from the region of which it is a part)."

Haughton and Hunter (1994: 27) highlight the importance of the urban contribution to global sustainability when they define a sustainable city as "... **one in which its people and businesses continuously endeavour to improve their natural, built and cultural environments at neighbourhood and regional levels, whilst working in ways which always support the goal of global sustainable development**".

Urban sustainability implies a balanced integration of environmental, economic and social considerations:

"**Urban sustainability involves the complex and difficult task of finding balances among social, economic, and environmental pluses and minuses, between short- and long-term considerations, and between the immediate interests of a part of the population and the more diffuse interests of everyone**" (Government of Canada, 1996).

***Source:***

CMHC and Environment Canada, 1996.
Government of Canada, 1996. (Chapter 12)
Haughton and Hunter. 1994.
Maclaren, 1996.
Richardson, 1989.

***See also***

DEFINITIONS
Sustainability characteristics in the literature

**Key Words**

Urban, sustainability, social, economic, environmental

## *Definitions - economic sustainability*

*Economic sustainability* implies that the local economy is both stable and diversified (Richardson 1994).

*Economic sustainability* also means that economic activities have minimal impacts on the natural environment and are efficient in their consumption of resources.

*Economic stability* can be enhanced by development of a strong local or community-based sector where local resources and local jobs meet local needs (Ekins et al. 1992, Richardson 1994). A global component to a local economy, however, is still important. Haughton and Hunter (1994) *caution* that too strong a shift to local economic self-reliance can be damaging to economic sustainability because of the global nature of the capitalist economic system and the opportunities for innovation that are associated with a more open local economy. *Economic stability* can also be enhanced by the development of strengths in more than one

sector or area. Change is inevitable and a community is more likely to be able to adapt when there is a broad range of economic activities.

***Source:***

Ekins et al., 1992.
Haughton and Hunter, 1994.
Maclaren, 1996.
Richardson, 1994.

***See also***

DEFINITIONS
Sustainability characteristics in the literature

**Key Words**

economic, economy, finance, consumption, sector, environment, stability, sustainability

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## *Definitions - environmental sustainability*

Jacobs (1991: 79-80) provides a definition of sustainability that might appropriately be labeled "environmental" sustainability:

"**Sustainability means that the environment should be protected in such a condition and to such a degree that environmental capacities (the ability of the environment to perform its various functions) are maintained over time: at least at levels sufficient to avoid future catastrophe and at most at levels which give future generations the opportunity to enjoy an equal measure of environmental consumption**".

Embodied in this definition are what Jacobs refers to as minimum sustainability and maximum sustainability. *Minimum sustainability* means not allowing environmental degradation to occur to the point where the future is characterized by environmental catastrophes, while *maximum sustainability* means providing future generations with at least the same level of environmental consumption that current generations receive.

A *weakness* of Jacob's definition (and most definitions of sustainability) is that neither minimum sustainability nor maximum sustainability imply that intra-generational equity will require improvements in environmental quality, but simply maintenance of current conditions, at a minimum. If current conditions are already severely degraded, then this conceptualization of sustainability means that future generations will inherit those conditions rather than a clean or cleaner environment.

It is clear that environmental sustainability is a *key component* of sustainability, in that both our health and economy are dependent on the condition of the environment. Clean air and water, our food, natural resources, medicines, climate regulation, etc. that come from a healthy environment are all vital necessities to a sustainable community

***Source:***

Jacobs, 1991.
Maclaren, 1996.

***See also***

DEFINITIONS
Sustainability characteristics in the literature

**Key Words**

environmental, ecological, ecosystem, sustainability, equity

## *Definitions - social sustainability*

The British Columbia Round Table (1993: 80-81) presents a detailed set of social sustainability principles that emphasize social equity, meeting basic needs, personal development, and responsible citizenship. *Social sustainability* is achieved when individuals in a society are able to:

- achieve and maintain personal health: physical, mental and psychological;
- feed themselves adequately;
- provide adequate and appropriate shelter for themselves;
- have opportunities for gainful and meaningful employment;
- improve their knowledge and understanding of the world around them;
- find opportunities to express creativity and enjoy recreation in ways that satisfy spiritual and psychological needs;
- express a sense of identity through heritage, art and culture;
- enjoy a sense of belonging;
- be assured of mutual social support from their community;
- enjoy freedom from discrimination and, for those who are physically-challenged, move about a barrier-free society;
- enjoy freedom from fear, and security of person;
- participate actively in civic affairs.

The Round Table contends that an additional key element of social sustainability should be community self-reliance. Self-reliance in this context does not mean that communities become isolated but rather that they develop the capacity to respond to local concerns while recognizing that local needs must be balanced against regional, provincial, national and global sustainability goals.

***Source:***

British Columbia Round Table on the Environment and the Economy, 1993.
Maclaren, 1996.

***See also***

DEFINITIONS
Sustainability characteristics in the literature

**Key Words**

social, people, sustainability, basic needs, community self-reliance, equity

## *Definitions - indicators*

Indicators have been defined in many different ways and from many different perspectives. A definition adapted from the Organization for Economic Cooperation and Development (OECD, 1994) reads as follows:

"…**a statistic or parameter that, tracked over time, provides information on trends in the condition of a phenomenon and has significance extending beyond that associated with the properties of the statistics itself**."

The following are other sample definitions of indicators:

**Indicators are a way of seeing the 'big picture' by looking at a smaller piece of it. They tell us which direction we are going: up or down, forward or backward, getting better or worse or staying the same** (Jacksonville Community Council, 1992).

**An indicator is a statistic or measure which facilitates interpretation and judgements about the condition of an element of the world or society in relation to a standard or goal** (US EPA, 1972).

While the definitions vary, there is a consensus that an indicator should be more than just a simple statistic or measurement. Unlike simple statistics, indicators provide a summary indication of a condition or problem, and permit the observation of progress or change. This progress can be measured over time or against benchmarks, targets or visions for the future.

***Source:***

CMHC and Environment Canada, 1996.
Jacksonville Community Council, 1992.
OECD, 1994.
US EPA, 1972.

***See also***

DEFINITIONS

### Key Words

indicators, definition, statistics, parameter

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## *Definitions - sustainability indicators*

Sustainability indicators are selected key statistics or parameters that, tracked over time, can represent or summarize trends in social, economic, and environmental conditions.

***Source:***

CMHC and Environment Canada, 1996.

***See also***

DEFINITIONS
Sustainability characteristics in the literature

### Key Words

parameters, sustainability indicators, statistics

# OBJECTIVES

Establishing objectives (or goals) for a community's sustainability program will define the context for the indicators and provide scope for the project. Indicators are typically designed to help focus on sustainability issues and measure progress achieved towards the defined sustainability objectives. This section describes the process of establishing objectives, and recommends what should be incorporated into a community's sustainability objectives. Examples of sustainability objectives are also provided.

**Contents**



**Key Words**

goals, objectives, community vision, sustainability, establish, community consultations

## *Preparing a community vision of sustainability*

The key steps are:

1. Developing a clear vision of community sustainability is a key first step for communities developing an indicators program[1].
2. The visioning exercise typically uses a multi-stakeholder, consensus-bases approach in identifying what the community should look like at some specified future date in order for it to be regarded as sustainable[2].
3. To balance economic, environmental and social needs, the community vision should consider both long-term and short-term planning and incorporate the diverse views of the community.

Each vision will be individual to the community creating it, as every community will express specific requirements to sustain themselves and their environment. Typically, the vision will be synthesized in some form of vision statement that outlines the principles defining their sustainable community. These principles will indicate the issues with which the community is concerned.

Listed below as an example are the vision principles from the Alberta Round Table on Environment and economy in 1991.

Vision Principles from the Alberta Round Table on Environment and Economy

- The quality of air, water and land is assured.
- Alberta's biological diversity is preserved.
- We live within Alberta's natural carrying capacity.
- The economy is healthy.
- Market forces and regulatory systems work for sustainable development.
- Urban and rural communities offer a healthy environment for living.

- Albertans are educated and informed about the economy and the environment.
- Albertans are responsible global citizens.
- Albertans are stewards of the environment and the economy.

The elements outlined in each community's vision statement should provide a scope for their indicators project and a framework from which to create specific goals and objectives. The Ontario Round Table on Environment and Economy have outlined a practical, step-by-step method that can be used for developing a community vision of sustainability.

**Note:** Step-by-step method is described in the Guidelines under "Preparing a community vision of sustainability - The Single Scenario approach".

***Source:***

Environment Canada, CMHC and Westland Resource Group, 1999
Maclaren, 1996.

***See also***

Sustainability objectives
ISSUES
Community consultations
Preparing a community vision of sustainability - the Single Scenario approach

## Key Words

community vision, community sustainability, principles, issues

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**Preparing a community vision of sustainability - The Single Scenario approach**

Visioning can be carried out in several different ways by a community. One way is called the Single Scenario Approach. It involves developing a set of assumptions that reflect a community's best prospects for the future. Out of this process, a vision statement is produced and serves as a starting point for the development of a framework for a plan of action. Another method of carrying out the visioning process is called the Creative Visioning Approach. This method, however, may require facilitators and professional resource people, depending on the amount of time and effort the organization is willing to put into it. Creative Visioning differs from Single Scenario visioning in that it is less an exploration of the values of a community and more of a process involving exercises such as guided imagery, brainstorming and visualization. The Single Scenario Approach is outlined.

*Single Scenario Approach*

Step 1

Ask the members of your organization to imagine your community as a "sustainable community" at some point in the future (for example, in the year 2020). Ask them to answer the following questions about this future state and how to achieve it.

Questions:

1. What does your "sustainable" community look like? Describe the desired environmental, social, health and economic characteristics of the community.
2. What ecological characteristics need to be preserved and enhanced?
3. What services are provided to community members?
4. What types of relationships exist among local government, service organizations, business and industry?
5. What aspects of the community's heritage and traditions should be preserved for the future?
6. What aspects of the community's economic base should be supported and strengthened?

7. What aspects of living and working in this community should be protected at all costs?
8. What ecological characteristics need to be preserved or enhanced?

Step 2

Group sharing occurs at this stage when everyone presents their responses to Step 1.

Step 3

Use a consensus-building exercise to develop common ideals. This can be done by identifying shared ideals and concerns and recording them on a flip chart. Ideals shared by everyone become the common value base. Those not shared should be dropped.

Step 4

Develop value statements that reflect the shared ideals.

Step 5

Writing the Vision Statement

The vision statement is the culmination of the visioning process. It defines the preferred future directions for the organization. The statement should encapsulate the prevailing community values, community issues of overriding concern and images of the desired future of the community. Going from vision to action involves a number of different steps, which are described in the following section.

Step 6

Translate Vision into Community Action Plan

To realize the vision statement it is necessary to set goals for the future. Going from vision to action involves a number of different steps including:

- laying out specific strategies;
- setting goals for the future;
- prioritizing actions that will contribute to the creation of things in the vision statement;
- setting larger policy context goals for the long-term future of the group.

***Source:***

Ontario Round Table on Environment and Economy. 1995.

***See also***

Sustainability objectives
ISSUES
Community consultations
Preparing a community vision of sustainability

### Key Words

scenario, community vision, sustainability, action plan

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## *Sustainability objectives*

Sustainability objectives (or “goals”) comprise the description of what a community wants to achieve to become a sustainable community, integrating environmental, social and economic issues and concerns. These objectives can serve as criteria for selecting indicators for the community.

If a community vision of sustainability has been prepared, then the development of these objectives should come easily from the principles and issues outlined in the vision statement and reflect sustainability characteristics.

The objectives that a community sets for itself will clearly have some overlap with other developmental aspects of the indicators program.

Elements of the *community vision of sustainability* may themselves define objectives. For instance the *vision* element, "the water quality in all regional streams and lakes should be clean and suitable for swimming" also sets a objective for the community.

Indicators can then be chosen to help meet this objective.

Alternatively, the sustainability objective "to identify and eliminate all significant sources of water contamination by the year 2000" expresses a more detailed *objective* which defines the indicator. It is possible to have various levels of sustainability goals and objectives. The development of sustainability goals and objectives can be organized into issues that the community wishes to deal with. These issues should also be apparent from the community vision of sustainability.

Looking at issues such as water quality and housing and environmental integrity will point out what objectives need to be established. A list of generalized goals is available in the Guidelines section, "Suggested Objectives".

***Source:***

Maclaren, 1996.

***See also***

Preparing a community vision of sustainability
Preparing objectives
Suggested objectives
Sustainability characteristics in the literature
ISSUES
Sustainability issue areas

HELP FILES: Adding a new objective

**Key Words**

community vision, sustainability goals, objectives

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## *Sustainability characteristics in the literature*

Key characteristics of sustainability are described below and summarized in Figure 3. This may serve as a useful starting point for municipalities attempting to develop their own conceptualizations of sustainability and specific sustainability goals.

Environmental, social and economic urban sustainability are all concepts which have been defined separately from the more general concept of urban sustainability, but it is generally acknowledged that all three are inter-related and essential for urban sustainability. Definitions of urban, social, environmental and economic sustainability are provided elsewhere in the guidelines (see Guidelines under "DEFINITIONS")

INTER-GENERATIONAL EQUITY

The term "sustainable development" was popularized by the World Commission on Environment and Development (1987) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." A foremost characteristic of this definition is the concept of inter-generational equity, which embraces the notion that the needs of future generations are as important as the needs of the current generation.

INTRA-GENERATIONAL EQUITY

This form of equity has two important components: social equity and geographical equity. "Social equity" refers to the fair distribution of the benefits and costs of natural resource use and environmental protection, taking account of such basic human needs as food, shelter, employment, public facilities and services. To many, social equity in the context of sustainability also means the improvement of equity in a broader sense, for example, more equitable distribution of income, and the elimination of discrimination.

The second essential component of intra-generational equity is "geographical equity". This term was coined by Haughton and Hunter (1995) to underline the undesirability of achieving economic growth, or a higher quality of life, in one community at the expense of environmental degradation in another. They contend that this type of development is inequitable unless some form of reparation or compensation takes place between the communities. Geographical equity also implies that sustainable communities support global sustainability by minimizing their contribution to global environmental problems, such as global warming and depletion of the ozone layer.

MINIMAL IMPACT ON THE NATURAL ENVIRONMENT

This term implies that waste discharges of all types (including emissions to the air, water effluents, contaminants of land and biota, and the disposal of solid waste) should not exceed the assimilative capacity of the natural environment, where assimilative capacity refers to the capacity of physical, biochemical and geochemical processes in the ecosystem to decompose and render inert certain types of waste products. Impacts due to development and management practices should also be minimal, so that habitat and natural ecosystem functions are preserved as much as possible.

"LIVING OFF THE INTEREST" OF RENEWABLE RESOURCES

Similarly, sustainability means that the depletion rates for renewable resources, such as timber and fisheries, should not exceed the regenerative capacity of the natural system that produces them.

Together, these two concepts make up "carrying capacity", which has been defined as " the maximum rate of resource consumption and waste discharge that can be sustained indefinitely in a given region without progressively impairing the functional integrity and productive activity of relevant ecosystems" (Rees, 1992).

MINIMAL USE OF NON-RENEWABLE RESOURCES

By definition, consumption of non-renewable resources is unsustainable because the resources will eventually run out. Therefore, the emphasis must be on minimizing their use, using them as efficiently as possible, through reduction, reuse and recycling, and by seeking renewable resource substitutes.

EFFICIENCY

Increased efficiency in the consumption of resources reduces the need to harvest or extract additional resources. From an urban perspective, increased efficiency in the use of land and resources can be accomplished by reducing sprawl and moving towards a more compact urban form. When the space occupied by the built environment of an urban area becomes more compact in form, economic efficiencies in the provision of public transit services increase and reliance on the automobile as a means of transportation can decrease. The debate over how to implement sustainability goals in an urban context centres in large part on the advantages and disadvantages of compact urban form.

LONG-TERM ECONOMIC DEVELOPMENT

Enduring economic vitality is an essential component of urban sustainability. This condition is also frequently described as economic “prosperity”.

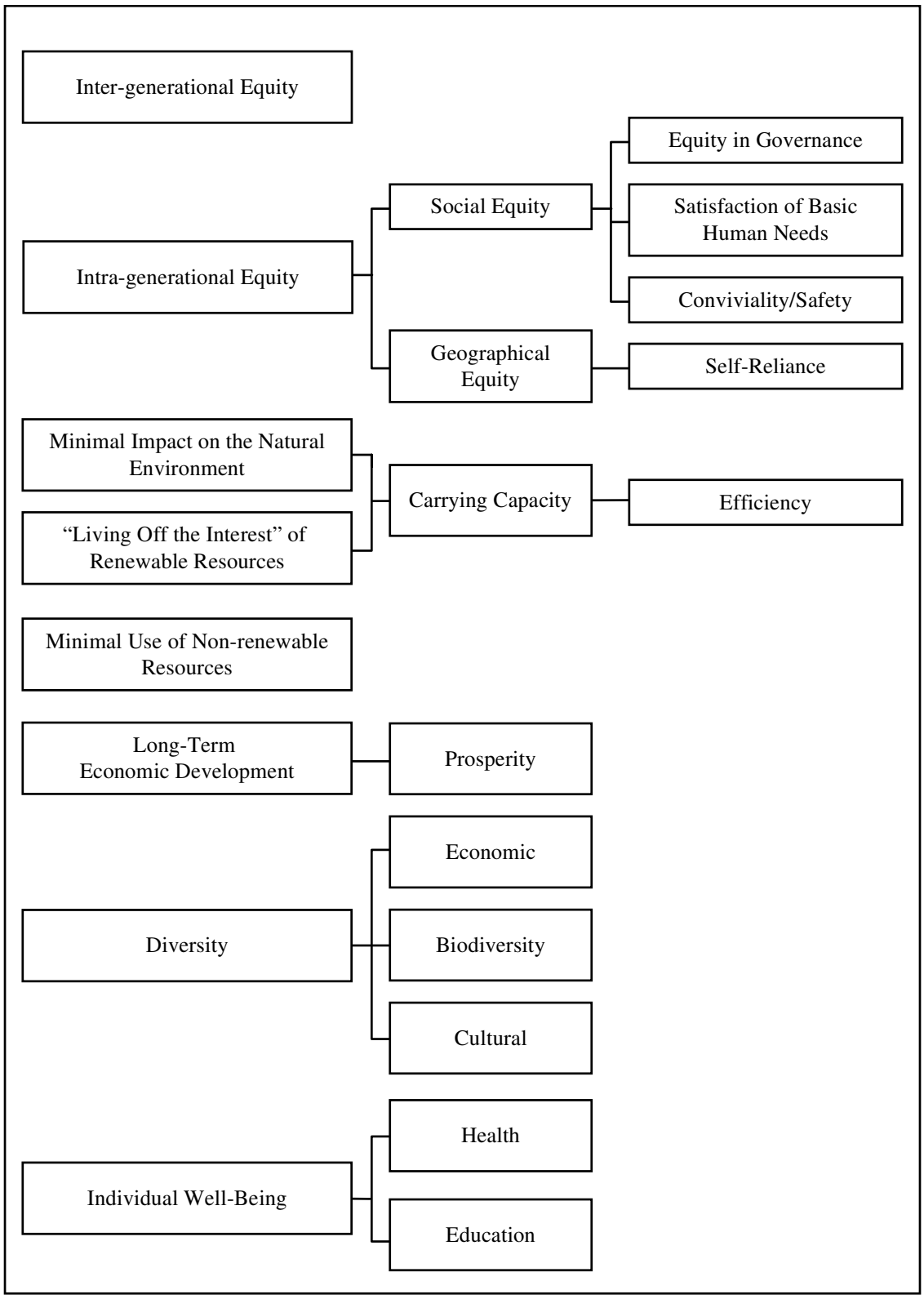
DIVERSITY

Diversity in the economic, biological and cultural elements of an urban system helps to increase its ability to adapt to change, and so contributes to urban sustainability.

INDIVIDUAL WELL-BEING (or Quality of Life)

An individual’s well-being extends to his or her physical, social and mental well-being. Health and education, by developing human potential, contribute to individual well-being, which also requires the satisfaction of basic physical and economic needs.

**Figure 3: Characteristics of Sustainability**




Source: Maclaren (1996); CMHC & DOE (1996).

***Source:***

CMHC and Environment Canada, 1996.
Girardet, 1990.
Haughton and Hunter, 1994.
Haughton and Hunter, 1995.
Maclaren, 1996.
Rees, 1992.
World Commission on Environment and Development (WCED), 1987.

***See also***

Preparing a community vision of sustainability
Sustainability Objectives
Sustainability Issues
Definitions - urban sustainability
Definitions - environmental sustainability
Definitions - economic sustainability
Definitions - social sustainability

**Key Words**

sustainability, characteristics, concepts, economic, social, environmental, equity, resources, efficiency

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## *Preparing objectives*

Once the community has settled on its vision (see Guidelines under "Preparing a community vision of sustainability"), the next step is to identify the specific, realistic objectives to be reached within set time periods, how this is to be done, and what group, organization or public agency has the lead responsibility.

Priorities will have to be determined within this exercise, governed in part by practical judgments about what can be accomplished.

Goals and objectives can be at various levels of detail and, where possible, should specify targets and how they will be achieved.

Example:

The objective to create and protect natural areas and park-lands might have with it the target to protect 100% of environmentally sensitive areas and a benchmark achievement for number of trees to be planted.

At the stage of preparing objectives, the *leadership*, planning, and decision-making role *begins to shift from the community as a whole to the individual organizations* and groupings within it, while remaining within the framework that the community has agree on.

***Source:***

Ontario Round Table on Environment and Economy, 1995.
Campbell et al., 1996

***See also***

Suggested objectives
Preparing a community vision of sustainability
Sustainability characteristics in the literature

**Key Words**

preparing, goals, objectives, priorities, decision-making

### *Suggested objectives in the SCI Software*

It is useful to organize objectives (or "goals") by sustainability issue, as shown below. This allows for continuity between the community vision and the actions the community wishes to take to achieve sustainability. The objectives shown below show a range of possible sustainability objectives that communities may wish to incorporate into their indicators program. It is organized into the five issue areas listed in the SCI software (see Guidelines under "Sustainability issue area"). It is not always easy to categorize an objective but it is not required in the software. Objectives that cross the different categories may, in fact, be highly appropriate as sustainability indicators.

Many of the objectives listed here are included in the pick-lists of the software. The software also allows for users to add their own objectives. Objectives can be very unique to a community's needs and can be at a general level or at a more detailed, operational level.

Note: In some discussions the word "goal" is used for more general statements while "objectives" tend to be more specific. In these guidelines, and in the software, these terms are used interchangeably and the term "targets" is used to refer to very specific objectives with quantitative values attached.

- **Employment and commerce**

⇒ ensure agriculture is a viable local economic activity

⇒ Enable the community to be self-sufficient in selected areas

⇒ Preserve and enhance agricultural land

⇒ Provide for a diversity of commercial and employment opportunities

⇒ improve ability of local businesses to compete both locally and globally

⇒ increase number of non-polluting businesses and businesses that produce quality of life products that control, reduce and prevent pollution

⇒ promote training in local labour force

- **Environmental health**

⇒ promote sustainable farming techniques

⇒ ensure high air quality

⇒ reduce concentrations/emissions of atmospheric pollutants

⇒ Eliminate discharge of persistent toxins

⇒ Eliminate use of ozone depleting substances

⇒ Encourage conversion to habitat, natural gardens etc. on private lands

⇒ Enhance CO2 absorption

⇒ Enhance connectivity of greenspace and natural areas

⇒ Incorporate plans for ecosystem functions and habitat into development

⇒ Manage stormwater to avoid natural system contamination

⇒ Manage waste water to avoid natural system contamination

⇒ Minimize discharges and leaching pollutants to the soil

⇒ Protect ecologically sensitive areas maintain adequate areas for ecosystem functions and wildlife habitat

⇒ create/protect natural areas and park-lands

⇒ promote healthy, environmentally friendly and cost-saving modes of transportation

⇒ reduce/eliminate hazardous waste

⇒ ensure high water quality for both surface water and groundwater to support ecosystem processes, wildlife populations, consumption and recreation

⇒ identify chemical contaminants and reduce/eliminate chemical contamination

- **Human Well-Being**

⇒ allow all citizens to participate in community institutions (governmental, cultural, educational, heath, social service)

⇒ ensure government is coordinated, efficient, effective and accessible to all citizens

⇒ develop cultural institutions for benefit of all citizens

⇒ develop social and physical environments to allow all citizens to participate in community

⇒ develop within the population: literacy, education, useful skills, support for sustainable development concept

⇒ increase health of citizens

⇒ Allow for maximum solar access to buildings

⇒ Offer attractive public spaces and recreational services

⇒ Offer efficient and effective health and educational services

⇒ Provide facilities and services related to health promotion

⇒ Provide high quality potable water

⇒ Reduce areas with excessive noise

⇒ Reduce crime

⇒ Reduce hazards from fire, traffic, chemicals, radiation and flooding

⇒ Reduce health impacts of air quality to near-zero

⇒ Use "human scale" and provide visually attractive built environment

⇒ develop public transportation system that is: environmentally friendly, affordable, efficient, convenient, accessible, meets community needs, accessible to disabled, considers safety, provides access to all areas, integrates other modes of transport,

- **Resource consumption**

⇒ Encourage the meeting of high standards rather than minimum compliance

⇒ Gradually decrease reliance on non-renewable energy sources

⇒ Maintain demand within limits of local natural systems

⇒ Minimize energy demand

⇒ Minimize use of non-renewable resources

⇒ Reduce $CO_2$ production to a level 20% less than 1990 levels by 2005

⇒ implement waste prevention and management plan

⇒ increase diversion of waste for reuse or recycling

⇒ reduce waste production

⇒ reduce water consumption

- **Settlement Patterns**

⇒ Allow maximum return to groundwater and surface water systems

⇒ Encourage household design of usable open-air space for private use

⇒ Make optimum use of existing infrastructure

⇒ Offer wide range of housing choices

⇒ curb urban sprawl and suburban encroachment on rural and agricultural lands

⇒ encourage efficient and economical development

⇒ minimize costs (environmental, social, economical) of new development

⇒ preserve natural and historical heritage

⇒ prevent urban decay/maintain urban core

⇒ reduce commuting distances

⇒ reduce dependence on automobile/encourage use of alternate forms of transportation (walking, cycling, public transit)

***Source:***

Maclaren, 1996.
Regional Municipality of Hamilton-Wentworth, 1995.
CMHC, 1996.
Environment Canada, CMHC and Westland Resource Group, 1999.

***See also***

Sustainability objectives
Preparing objectives

Sustainability issue area
Sustainability characteristics in the literature

**Key Words**

goals, objectives, , Environmental health, Resource consumption, Settlement Patterns, Human Well-Being, Employment and commerce, sustainability, community objectives, issues

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## *Community consultations*

Public involvement is essential in the development of a sustainability indicators program, most importantly during the preparation stage and in determining a community vision and sustainability objectives.

By involving the public, you are better able to understand the environmental issues of significance to the community, and how these issues might impact on social, economic and health aspects of concern to the public. The public's views on these matters may help you decide which indicators are of greatest importance to them and therefore to include in your final report. This interaction will provide the decision-makers with an idea of which approach and framework to use (Section 3, Appropriate Framework).

Public involvement is also important in gaining support for new programs that may be proposed as a result of the sustainability indicators program.

*Example:*

*While proposals to set up vehicle emission testing programs or new bicycle lanes may be controversial, linking such programs with air monitoring data from the indicators program may help achieve greater support in the community.*

In planning for public involvement, you need to consider:

1. the stage of involvement
2. the type of involvement
3. whom to involve; and the intensity of involvement
4. early involvement creates greater flexibility in direction and incorporating public concerns

Public concerns must be heard to satisfy demands. The views of the public should influence the scope, direction, and framework of the project. Public involvement is particularly useful at the stage of developing a community vision and setting the goals, objectives and scope of your program. At this early stage, the public can bring its most important issues to the table for consideration in setting the scope and reporting framework.

Getting public involvement can take many forms. Be sure to tap into existing consultation mechanisms involving the community and be mindful of not overburdening the public with demands for input. The following list of consultation mechanisms is not exhaustive, hopefully just enough to spark a few ideas of your own:

- Public representation on a Community Sustainability Steering Committee.
- Involvement of existing committees or community groups that have public representation.
- Inclusion of representatives from the public in Community Sustainability planning discussions.
- Public meetings with presentations, panel discussions and/or question and answer periods.
- Open Houses with displays and the opportunity to have questions answered.
- Workshops on specific topics or issues.
- Surveys or interviews with representatives of community and environmental groups.
- Presentations to community groups to invite comments.
- Inclusion of experts (e.g., technical, scientific, social and/or economic expertise) in Community Sustainability planning discussions and/or review process).
- Surveys of knowledge, perceptions and preferences of residents of the community.

Figuring out whom to involve can be difficult, particularly given the cultural and socio-economic diversity of most communities.

Some challenges include: Involving most cultural groups and literacy levels in your community; reaching those with different perceptions of environmental issues; dealing with the different types of audiences (businesses, the public etc.) in your community.

Extensive public involvement has its benefits, but you have to decide the level of involvement most suited to the terms of reference, available resources and time constraints of your sustainability indicators program.

Once you have figured out whom to involve and at what stage, you will need to plan the intensity of the involvement. This will depend on the resources available and the time constraints that the program is under, as well as the importance of the public as the primary audience of your report. With lots of resources, you can hold several workshops and interview many community leaders. However, if your resources are limited, it is recommended that you schedule **at least one public event** (such as a community meeting) at the outset, invite some

public representation on an advisory committee, and ensure that the draft report is available for some public review prior to finalization.

***Source:***

Campbell et al., 1996.

***See also***

Preparing a community vision of sustainability
Sustainability objectives
Preparing objectives

## Key Words

community, consultations, public, involvement, decision-makers, citizens, meetings

# ISSUES

Issues are some of the key sustainability themes that may be the focus of a local indicator program. These issues can help to organize the goals that a community will set for itself (see Guidelines under “OBJECTIVES”). Objectives are the stated ways communities seek to move toward sustainability. Because there could be thousands of such objectives, the software will seek to provide examples of actions communities might wish to take or examples of relevant national objectives. For instance, "citizens should be able to go outside without health concerns from breathing the air" or "the urban air quality index should register no days with poor air quality". Objectives may be reverse (positive) statements of issues, which tend to be phrased as problems. The software is not comprehensive in identifying issues and objectives since you will wish to develop and adapt your own. Linkages between issues and objectives are highlighted by the software and you will be creating your own sets of links as you fill in indicator profile forms.

This section discusses the organization of issues within an indicators program and the process of assessing priority issues. Examples of sustainability issues are also provided.

***Source:***

Environment Canada, CMHC and Westland Resource Group, 1999.

***See also***

OBJECTIVES
HELP FILES: Adding a new issue

**Contents**



**Key Words**

issues, areas, objectives, concerns, goals, sustainability

## *Sustainability issue areas in the SCI Software*

Indicator profile sheets in the software categorize sustainability issues into five broad issue areas. When entering new indicators into the software, users will be prompted to supply an issue area for that indicator (see Guidelines under “Using indicator profiles”). These issue areas are listed below:

| | |
|---|---|
| Environmental health | These issues refer to the biophysical aspects of where we live as well as of natural areas. Environmental health deals with habitats as well as air, water and soil quality. |
| Resource consumption | This issue area covers the use of natural capital, waste production/management, energy use and consumption patterns. |
| Settlement Patterns | Settlement patterns should be efficient and promote sustainable lifestyles. Urban sprawl, land use and housing diversity are examples of issues in this issue area. |

| | |
|---|---|
| Human well-being | This issue area includes quality of life issues, such as human health, happiness, fulfillment, community participation, government, cultural and social services. |
| Employment and commerce | Issues concerning economic activity, business sustainability and people's livelihood are included in this issue area. |

***Source:***

CMHC, 1996.
Environment Canada, CMHC and Westland Resource Group, 1999

***See also***

Using indicator profiles
Suggested objectives
Potential issues
National and global issues
Examples of community issues
HELP FILES: Adding a new issue area

**Key Words**

issue, areas, environmental health, resource consumption, settlement patterns, human well-being, employment, commerce, SCI Software

## *Issues in the SCI Software*

The following list summarizes many of the issues typically addressed in a sustainability indicators program. To facilitate and encourage understandable exchanges of information between communities, and to build on a consistent data base, the software includes the following list of issues as a *fixed* pick list. If users find that they need to rely too heavily on the "other" category they should contact the developers of the software to suggest additions to the issues list. Every effort has been made, however, to ensure that the list is comprehensive and at a sufficiently general level so it is relevant to all communities. The user should also keep in mind that there is a great deal of flexibility in the software for adding objectives suited to individual community circumstances. The user can state the issue as an objective that addresses the issue. These can then be added to the software set of objectives.

aesthetic quality

air quality/emissions

atmospheric change

culture and heritage

economic health of a community

education

employment

energy

governance/participation

green-space/natural areas/wildlife

housing/shelter needs

human health

income equity/social welfare

land use/urban sprawl

material consumption

natural resource use/conservation

noise

population structure and change

public safety/crime

recreation and leisure

soil quality/contamination

solid and hazardous waste

toxics

transportation

water consumption & conservation

water quality & treatment

other

***Source:***

Maclaren, 1996 (Appendices).
Other sources:
CMHC and Environment Canada, 1996. (Table 6).
Campbell et al., 1996. (Appendix 1).

***See also***

National and global issues
Examples of community issues
Assessing priority issues

**Key Words**

issues, sustainability, SCI Software

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## *National and global issues*

Certain sustainability issues have relevance at different spatial or governmental scales. Some issues may be primarily national or international concerns, such as atmospheric change. However, many global issues will obviously have roots at the scale of the community. It is important to consider a community's contribution to national and global problems, when determining the sustainability issues to be addressed by an indicator program, ("think globally, act locally"). The following are examples of national or global issues that may be relevant at the community level:

- atmospheric change
- green-space/natural areas/wildlife
- public safety/crime
- natural resource use/conservation
- air quality/emissions
- water quality & treatment
- land use/urban sprawl

- solid and hazardous waste
- energy
- material consumption

***Source:***

Bregha, 1991.

***See also***

Suggested objectives
Assessing priority issues
Examples of community issues
SELECTING INDICATORS
Indicator frameworks
Geographic levels of data
Comparisons and context

**Key Words**

national, global, issues, sustainability, community

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## *Examples of community issues*

- Certain issues to be addressed by a sustainability indicators program will be unique to the community developing the program, resulting from the community's particular geographic location, social structure or economic situation. Examples of such issues might be overpopulation of a local bird species, decline in the community's primary industry or perhaps poor integration of local ethnic groups. Involving the community in planning the sustainability indicators program will assist in determining these issues. Many sustainability issues that have relevance at a local level, will be common to most communities. Such issues will be apparent from reviewing other communities' sustainability reports available through the software. These very specific issues may not be precisely linked to the issues pick-list in the software. Most, however, should fit within the framework as an example of a more general issue category. The user can then use the goals area to insert very specific goals related to their situation.

***Source:***

Campbell et al. , 1996. (Appendix 1)
Maclaren, 1996.

***See also***

Assessing priority issues

**Key Words**

community, issues, local, municipal, sustainability

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## *Assessing priority issues*

It is worthwhile to determine which issues facing a community should be considered priority issues. This will be especially important if an *issue-based framework* is used for developing indicators (see Guidelines under "Indicator frameworks"). This process of issue selection is separate from indicator selection and it is at a more general level.

The selection process may be based on:

- public opinion,
- policy priorities and,
- evidence from the scientific community.

Such a prioritizing exercise may assist in selecting indicators that will be most useful to the community and insure that issue areas are significant in relation to the principles of sustainability (see Guidelines under "Sustainability characteristics in the literature").

When assessing priority issues, it will be beneficial to consult current research in the study of sustainability (see Guidelines under "Assessing priority issues - Research"). Another means of determining priority issues is to review media sources (see Guidelines under "Assessing priority issues - Media").

Keep in mind that very detailed issues that are relevant to your community may not be highlighted in the fixed pick-list of issues in the software. You should be able to categorize these issues, however, under one of the labels in the pick-list and then state the issue as an objective that addresses the issue. These can then be added to the software set of objectives.

***Source:***

CMHC and Environment Canada, 1996.
State of the Environment Directorate, 1994.

***See also***

Assessing priority issues - Research
Assessing priority issues - Media
Community consultations

## Key Words

assessing, priority issues, public opinion, policy, scientific, sustainability, community

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**Assessing priority issues - Research**

When assessing priority issues, it will be beneficial to consult current research in the study of sustainability. Numerous reviews of reporting documents have been performed that survey sustainability reports, Quality of Life reports (QOL) and State of the Environment reports (SOER). Quality of Life reports encompass more social and economic aspects of sustainability, where State of the Environment reports offer more objective measures of biophysical characteristics. Reviews of these reports study priority issues that affect sustainability as well as the methodologies for measuring sustainability and carrying out such reports. The papers listed below can serve as a good start to the research literature. For further references see the Guidelines under "General References".

- CMHC (Canada Mortgage and Housing Corporation) and Environment Canada. 1996. Measuring urban sustainability: Canadian indicators workshop, June 19-21, 1995, Workshop proceedings. Ottawa. pp. 37-39.
- Department for Policy Coordination and Sustainable Development. 1996. Indicators of sustainable development: methodology sheets, Background paper #15. Prepared by the Division for Sustainable Development for the Commission on Sustainable Development, 4$^{th}$ session, 18 April - 3 May 1996, New York.
- Government of Canada. 1996. State of Canada's Environment. 1996.
- Hodge, R.A. 1994. Reporting on sustainability. Montreal: McGill University.
- Maclaren, V.W. with the assistance of S. Labatt, J. McKay and M. Vande Vegte. 1996. Developing Indicators Of Urban Sustainability: A Focus On The Canadian Experience. Prepared for Environment Canada, Canada Mortgage and Housing corporation; Intergovernmental Committee on Urban and Regional Research *for* Measuring Urban Sustainability: Canadian Indicators Workshop, June 19-21, 1995. ICURR Press: Toronto.

***See also***

General References

## Key Words

research, issues, priority, priority issues, assessing, QOL, SOER, sustainability

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**Assessing priority issues - Media**

The media represents a good resource for determining priority sustainability issues. Current environmental and socioeconomic issues of general concern to the community will be reflected in media reports. Benefits of this resource is that issues are covered from the local to international scales and are timely. Caution is necessary when using media sources for determining priority issues that the topic has lasting relevance and is not simply the "latest story". The internet also offers sources of environmental and sustainability media reports that may be helpful as well. Such sites as Environment Canada's *Green Lane* (http://www.ec.gc.ca) and *Sustainability - A Choice to Consider* (http://www.cyberus.ca/choose.sustain) can offer insights to current sustainability issues. More resources for assessing priority issues are available in the "General References" section of the guidelines.

*Note: Caution is necessary when using media sources for determining priority issues that the topic has lasting relevance and is not simply the "latest story".*

***See also***

Assessing priority issues - Research
Indicator frameworks
General References

## Key Words

Media, public, source, priority issues, sustainability issues, issues, priority, newspapers, television, radio

# FUNCTIONS

The indicator development process will be affected by the level of participation within government departments and the various functions that those departments are responsible for. The level of participation may affect the range of the indicators project as well as the audience. Government functions can differ in scope and structure, often depending on the size of the city and its mandate. Clearly, a sustainability indicators program will benefit from a clear linkage to a range of government functions. The section below suggests how government departments might link to an indicators program.

**Contents**

Working from a departmental or functional perspective

**Key Words**

functions, government departments, municipal, role, departmental

### *Local Government Functions in the SCI Software*

Typical local government functions can be used as a starting point for categorizing and selecting indicators. To assist users, indicators will be linked to typical local government functions. Software users are able to access indicators through any of the following typical local government functions. Categories can be customized or added according to the local circumstances.

## Local Government Functions

- Community and Social Services
- Corporate Services
- Development control/zoning
- Drainage and sewers
- Economic Development
- Education
- Engineering and Public Works
- Environment and natural area protection
- Finance
- Fire
- Health
- Housing
- Parks and recreation
- Planning and policy
- Police
- Public consultations
- Social welfare
- Solid waste
- Transportation
- Wastewater treatment
- Water
- Utilities
- Other

***Source:***

Environment Canada, CMHC and Westland Resource Group, 1999.

***See also***

SELECTING INDICATORS

HELP FILES: Adding a new local government function

## Key Words

functions, government department, municipal, local government, involvement, role, departmental, SCIS, SCI Software

# SELECTING INDICATORS

A methodology for developing sustainability indicators requires a suitable framework as well as a set of selection criteria. This section discusses possible frameworks to serve as a conceptual model for developing sustainability indicators. The selection of indicators also poses a significant task. Criteria for choosing indicators are provided here as well as suggestions for applying such criteria.

**Contents**



**Key Words**

selection, indicator frameworks, indicators, stress-condition-responsemodel, COMLE model

## *Indicator Frameworks*

An important initial step in identifying urban sustainability indicators is to select a framework for indicator development. A framework is a conceptual model from which relevant indicators can be developed and selected based on the needs of a specific target audience. The examples of frameworks discussed here are **domain-based, issue-based, sectoral, goal-based and causal.**

It is not necessary to choose only one of these frameworks. A hybrid of these may be formed depending on the requirements of the indicators program. This might be determined by:

- the desired vision for urban sustainability (see Guidelines under “Preparing a community vision of sustainability”);
- the purpose of urban sustainability indicator development;
- the clients (users) of the framework and accompanying indicators; and
- the range of audiences which will receive and/or use the information resulting from indicator development and application.

It is recommended however, that the vision, purpose, clients and audience be identified before an appropriate framework is selected. The most likely clients for indicator frameworks would be municipal decision makers and managers responsible for policy development and evaluation. Audiences could include: lay audiences; technical audiences; municipal decision makers and managers; and international/global audiences.

The following are elements of a good urban sustainability indicator framework:

- linked to vision of urban sustainability;
- recognizes and integrates the components of urban sustainability; focuses on linkages and interrelationships; takes a systems approach; reflects causality;
- workable and practical; flexible for users (in different jurisdictions); iterative, provides possibility for adjustments (“looping back”); not limited by jurisdictional mandates and boundaries;
- results in usable information; simple, understandable, educational;

- empowering, motivational for individuals and communities; inclusive of key stakeholders; promotes partnerships between governments, and between the public and private sectors;
- compatible with other issues and frameworks; provides a foundation for action on problems/issues facing urban areas;
- amenable to both quantitative and qualitative data.

The *domain-based* framework considers the three main components of sustainability: environment, economy and society and organizes indicators within these domains. This framework is most effective for ensuring coverage of the three dimensions of sustainability and can be modified to add categories for linkages among the three domain (e.g., environment-economy, economy-society) and thereby accentuate the integrative aspect of sustainability.

The *issue-based* framework simply organizes indicators according to issues and problems within the area of study (see Guidelines under "Potential issues"). Examples of issues could include urban sprawl, solid waste management, job creation or crime and safety. The issue-based framework may have a more popular appeal than the other types of frameworks, as it deals with the relevant issues directly. However, its "shot-gun" approach to developing indicators lacks the structure provided by the explicit links to sustainability or policies found in other frameworks.

The *sectoral-based* framework organizes indicators into the relevant areas of government responsibility, such as housing, welfare, recreation, transportation, etc. (see Guidelines under "FUNCTIONS) This may be most appropriate when the chief target audience is municipal government politicians or staff. the sectors can be tied to individual government departments, making it easier to determine accountability for particular problems or positive results revealed by the indicators. A disadvantage of the sectoral approach is that, because it compartmentalizes the indicators into specific areas of government responsibility, it is therefore not very effective for showing linkages across different areas.

A *goal-based* framework develops indicators using the sustainability objectives developed from the community vision, such as the providing of basic human needs, economic prosperity and participation in governance (see Guidelines under "Sustainability objectives"). The strength of a goal-based framework is that it reduces the number of indicators that need to be considered to those relating to specified sustainability objectives. Use of a goal-based framework and its explicit characterization of sustainability also helps in evaluating whether indicators are showing movement towards or away from sustainability.

Causal and combination frameworks are described in the guidelines under "Indicator frameworks - The stress-condition-response model" and "Indicator frameworks - The COMLE model", respectively.

***Source:***

Environment Canada, CMHC and Westland Resource Group, 1999.
Maclaren, 1996.

***See also***

INDICATOR DEVELOPMENT PROCESS
Case Study: National Environmental Indicator Series
Preparing a community vision of sustainability
Potential issues
FUNCTIONS
Sustainability objectives
Indicator frameworks - The stress-condition-response model
Indicator frameworks - The COMLE model

## Key Words

indicator frameworks, domain, issue, sectoral, causal, goal, objectives, sustainability

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**Indicator frameworks - The stress-condition-response model**

The *causal-based* framework considers the interactions between different elements of the community and organizes indicators into categories of stress, condition, and response. These categories can be described as follows:

1. **Stress Indicators** - Why are changes occurring? The **cause** of degradation of the environment or natural resources, social well-being, or economic conditions (i.e. fossil fuel emissions, smoking,)
2. **Condition Indicators** - What is happening to the state of the environment or natural resources? **What is being affected**? (i.e. Health, air, water)
3. **Response Indicators** - What are we doing about it? **Solutions to problems**

   (i.e. Mass transportation improvement to limit fossil fuel usage).

Some indicators may not clearly fall into one category.

*Example:*

*Motor vehicle traffic volumes could be a condition in relation to a transportation issue, or a stress in relation to air quality or fuel consumption.*

Whether an indicator is a condition, stress, or response can be found in the answer to the following question, with regard to the primary specified issue for that indicator:

"Does the indicator describe a cause of a problem (stress), the nature of the problem (condition), or society's conscious attempt to deal with the problem (response)?" The stress-condition-response framework is illustrated below in Figures 4 and 5:

Figure 4. General stress - condition - response model showing hierarchical levels of detail (the enclosed rectangles).

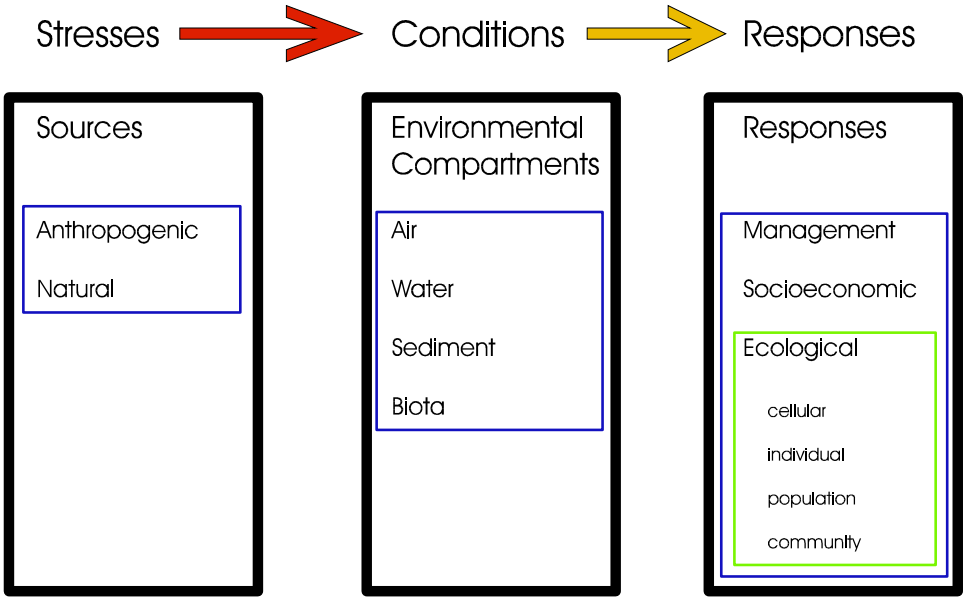
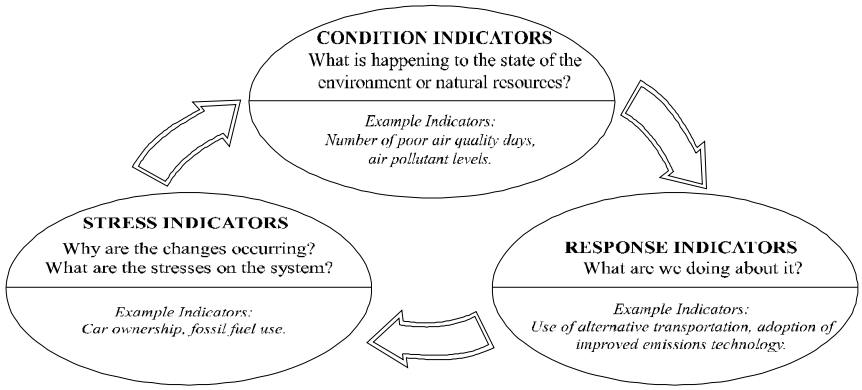


**Figure 5: The Condition-Stress-Response Model (Example: Urban air quality)**




A causal framework has the significant advantage of being able to suggest why certain indicators are rising or falling, and to show whether or not policy interventions are having an impact. The main difficulty with the stress-condition-response causal framework is deciding on what the connection is between the categories. Causal links are debatable and do not necessarily have to be proven to use the stress-condition-response framework but the community will need to consider if the relationship is appropriate with the indicator analysis over time or new scientific knowledge.

***Source:***

Environment Canada, CMHC and Westland Resource Group, 1999.
Maclaren, 1996.
State of the Environment Directorate, 1994.
Vandermeulen, 1997.

***See also***

Indicator frameworks - The COMLE model

## Key Words

indicator frameworks, stress, condition, response, cause-effect, causal, stress-condition-responsemodel

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**Indicator frameworks - The COMLE model**

In practice, a combination framework is probably the most useful type of framework for urban sustainability indicators. The advantage of a combination framework is that it can consolidate the advantages of several individual frameworks while simultaneously overcoming some of their weaknesses. CMHC has developed a combination domain-based/sectoral framework known as the **Community Oriented Model of the Lived Environment (COMLE).** In this framework, indicators are organized under areas of municipal government responsibility, such as housing and transportation and are linked to sustainability goals of environmental integrity, economic vitality and social well-being (see Figure 6).

**Figure 6: Community Oriented Model of the Lived Environment**

| SOCIAL POLICIES/ PROGRAMMES | COMPONENTS OF LIVEABILITY | MONITOR: PRESENT STATE & CHANGE OVER TIME |
|---|---|---|
| Housing | | |
| | Economic Vitality | |
| Land Use | | |
| | Social Well-being | |
| Transportation | | Indicators of Liveability |
| Natural Environment | | |
| | Environmental Integrity | |
| Employment/ Commerce | | |
| | Cultural Congruence | |
| Public Services: Health, Education, Recreation, Police, Fire Protection, Public Works, Social Welfare. | | |

***Source:***

Environment Canada, CMHC and Westland Resource Group, 1999. Maclaren, 1996.

***See also***

Indicator frameworks - The stress-condition-response model

**Key Words**

indicators, framework, CMHC, COMLE model, government functions, government responsibilities

## *Selection criteria for indicators in the SCI Software*

Although criteria for selecting indicators can be adapted to suit local needs and priorities, there are common criteria used by a range of groups and organisations, in Canada and internationally. For the purposes of facilitating the exchange of information and providing a common evaluation framework for everyone using the Sustainable Community Indicators Software, a pre-established set of criteria have been incorporated into the software. If the user finds it important to use other criteria that are very different from what are provided, these can be recorded in the "pros" or "cons" sections of the indicator profile.

The primary criterion is the indicator's value in helping to measure sustainability and introducing sustainability issues into decisions. To meet this criterion, the following criteria are included in the software and are the most basic characteristics that should be considered when evaluating indicators:

- CRITIERIA OF ISSUE RELEVANCE (OR "SCIENTIFIC VALIDITY")

  ⇒**Scientific validity/Theoretical soundness**
  Scientific validity (for both the indicator and its supporting data) is a fundamental requirement for the selection of indicators, yet there is considerable scientific uncertainty over how to measure many of the complex concepts associated with sustainability, such as ecosystem health and carrying capacity. Scientific validity is an important factor to consider when using causal frameworks, because a scientific basis for links between the stress indicators and the condition indicators selected must be established. With sustainability indices, scientific validity may have a bearing on the mathematical techniques used to aggregate the individual indicators. Some degree of uncertainty is often unavoidable and judgements will have to be made on whether an indicator should be used.

  ⇒**Representative of sustainability issues**
  A representative indicator is one which is representative of the issue of concern or of a broad range of environmental, social and economic conditions. Representativeness is an important characteristic because of the frequently-stated requirement that the number of indicators be manageable and therefore relatively small. (United Kingdom, 1994; Regional Municipality of Hamilton-Wentworth, 1994)

  ⇒**Evident links of cause and effect**
  A good sustainability indicator is not only representative of an issue but highlights the links and interrelationships on the stress-condition-response cycle. The movement in a condition indicator (e.g. global temperatures) would be obviously related to changes in a stress indicator (e.g. carbon dioxide emissions). This criterion can often be difficult to meet given the complex cause-effect relationships involved in an issue.

  ⇒**Responsiveness to change**
  A responsive or sensitive sustainability indicator has been defined as one that can distinguish between normal cycles and movement away from or towards a sustainable state (Liverman et al., 1988). A responsive indicator can be expected to exhibit detectable change during the proposed planning horizon and will respond to changes in external stimuli, such as policy interventions.

  **Sub-criteria - Predictive**
  This criteria is closely related to "responsive" and emphasises the idea of providing an early warning of future trends that have implications for human health and well-being, the economy and the

environment. "Stress" and "response" indicators have more potential to be predictive since they influence the "condition".

- CRITIERIA OF USER RELEVANCE (OR "UNDERSTANDABLE")

⇒**Relevant and understandable to users**

This criterion ensures that the needs of the target audience are being met. For example, policy-makers may be most interested in indicators of policy performance, while the general public may want indicators which can be linked with individual behaviour, such as waste generation per capita or level of public transit use.

The level of scientific detail that can be understood by different user groups will vary. The scientific content of an indicator must therefore match the assumed scientific knowledge of the target audience. Gosselin et al. (1991) interpret this criterion as "meaningfulness for the potential user". They refer to it as the "symbolic value" of an indicator, and suggest, for example, that an indicator of salmon or cod stocks would have a higher symbolic value to the general public than an indicator of smelt stocks.

**Sub-criteria - Unambiguous**

Indicators should be unambiguous. Everyone should be able to agree that a certain direction is desirable. However, many indicators can be interpreted in more than one way. For example, to some people, high rates of economic growth are good because they imply a healthy economy. To others, they are bad because they may be accompanied by environmental degradation and other externalities that outpace the assimilative capacity of the environment.

**Sub-criteria - Attractive to the media**

Gosselin et al. (1991:27) have as their stated goal the development of indicators that "…could make the front **page of newspapers in a condensed form, and be attractive enough to generate more detailed presentation on** the inside pages." They provide illustrations of how each of their proposed sustainable society indicators could be represented in graphic form and then summarized in a report card format. This format has become a popular choice for communicating indicator results in sustainability reports released to date.

⇒**Comparability to target, thresholds or standards**

For sustainability indicators, this criterion means that the indicators should be relevant to a set of sustainability goals (see Guidelines under "OBJECTIVES"), or to a broad vision of sustainability (see Guidelines under "Preparing a community vision of sustainability").

The use of thresholds or targets in indicator development is an effective tool for measuring progress towards a variety of goals and are therefore important from a policy perspective.

⇒**Comparable among jurisdictions**

Fulfilling this criterion allows municipalities to compare their progress towards sustainability with the progress being achieved by other municipalities and facilitates reporting on urban sustainability at the national scale. A disadvantage of this criterion is that some municipalities may not wish to be compared with others. Another consideration is that it may simply not be appropriate to use common indicators for comparing communities with widely divergent social, economic and environmental characteristics.

⇒**Useful at large and small geographic scales**

An indicator that can be used at different geographic scales can help users relate their own behaviours and decision-making to the local context and regional, national and international issues.

⇒**Integrates social, economic and environmental factors**

Fulfilling this criterion allows municipalities to truly assess sustainability rather than components of sustainability. Indicators which fulfil this criteria fully are rare but potentially quite useful. On the other hand, indicators that are more fully integrative

may rely on a number of assumptions and calculations which could result in a compromise of other criteria, such as scientific validity.

- CRITIERIA OF DATA RELIABILITY (OR "DATA AVAILABILITY")

  ⇒**Accurate, time-series data available or collectable**
  In the short term, this may mean working with indicators for which data already exists. In the longer term, this need not be a unyielding constraint since the indicator development process can identify data collection gaps that need to be filled. Involving all stakeholders, including local government departments who might have responsibility for collecting data, in the indicators development process, provides an understanding for all involved of the importance of additional information, and helps build support for future data-gathering exercises.

  **Sub-criteria - Appropriate geographic coverage**
  The data used for an indicator at a particular geographic level should be appropriate to that level. If the user is interested in the neighbourhood scale then data collected at the local level would be most appropriate. Data can be available at too broad a scale for local concerns or it may be too local and spotty for municipal, regional or national concerns.

  ⇒**Cost-effective**
  Cost-effectiveness will clearly have to be a consideration when selecting indicators, but cost should not be a permanent barrier against the use of a particular indicator. For example, in the longer term, it may be possible to develop data-sharing programs with other jurisdictions in order to reduce collection costs. The introduction of computerized information systems can also reduce costs in the long run.

**It is very difficult to find indicators that satisfy all criteria perfectly**. Often, trade-offs need to be made and the software will allow for a flexible application of selection criteria. You may want to organize and prioritize the selection criteria according to your intended audience and the objectives behind an indicator program. To some extent a balance needs to be achieved between two main types of criteria - reliable information versus useful information. This balance is key to moving toward sustainability: if the information is not reliable then mistakes can be made and policies and actions could in fact move us away from sustainability. On the other hand, if the indicators are very difficult to understand, they will not be used in spite of the scientific credibility behind them.

| **reliable information** | | **useful information** |
|---|---|---|
| Data Reliability | Relevance | Usefulness to Decision-Makers |
| cost-effectiveness | scientific validity | understandable |
| geographic coverage | representative | relevant |
| data adequacy (accuracy) | responsive to change | potential for comparison target/threshold |
| data availability | cause-effect links / predictive | integrative |

***Source:***

CMHC and Environment Canada, 1996.
Environment Canada, CMHC and Westland Resource Group, 1999.
Gosselin et al., 1991.

Liverman et al., 1988.
Maclaren, 1996.
Regional Municipality of Hamilton-Wentworth, 1994.
United Kingdom, 1994.

***See also***

OBJECTIVES
Preparing a community vision of sustainability
Rating potential indicators
HELP FILES: Adding a new rating criterion

### Key Words

selection, criteria, indicators, priorities, validity, responsive, comparable

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## *Selecting and rating potential indicators*

The indicator program team needs to select an initial set of indicators based on an analysis of the issues, vision, and objectives for sustainability. The process is an iterative one of trial and analysis in consultation with interested experts and through internal consultations and meetings until a final tentative set of indicators is arrived at. Selection criteria can be used as a tool to help evaluate the proposed indicators during this phase. If the assistance of scientific/technical experts is possible, they too can refer to the selection criteria. Once proposed indicators have gone through an initial round of scrutiny, and the list is shortened to a manageable number, consultations with interested stakeholders can be undertaken. Again, the selection criteria can be brought forward and explained as part of the consultations so that all concerned are using the same reference points when considering the indicators. Experts may have a better sense of the data issues and the scientific rigour related to the proposed indicators while stakeholders will likely have pertinent views on the understandability criteria.

At this stage a final list of indicators can be established taking into account expert and stakeholder input and the selection criteria. This whole process can be done in a qualitative manner through discussion, debate and consensus (or a final arbitration by the indicator project team, if there are differing views). The selection criteria can be brought to bear on the indicator selection simply by making sure that all those involved are aware of them and consider them in their deliberations. Alternatively, the criteria can be applied in a particular order or their perceived relevance can be quantified. (see Guidelines under “Rating potential indicators - Applying criteria”).

Indicator project teams need to keep in mind that it may not be possible to find an indicator that fulfils all of the general selection criteria simultaneously. For example, it is possible that some indicators found to be scientifically valid may not be as easily understandable or as relevant to the needs of potential users. Conversely, those which are more intuitive in nature, may have less scientific support. If such is the case, then decisions will have to be made about the relative importance of the criteria. These trade-offs can be brought forward and discussed during the consultations with experts and stakeholders.

Indicator project teams also need to remain flexible. It may be that certain issue areas are not adequately represented when new research and scientific understanding comes to light or new data sources may become available. In these situations, as the evaluation process continues in stages, new indicators will need to be added to the list for evaluation.

***Source:***

CMHC and Environment Canada, 1996.
Maclaren, 1996.
State of Environment Directorate, 1994.

***See also***

Selection criteria for indicators
Rating potential indicators - Applying criteria
Sustainability issue areas

## Key Words

selection, rating, ranking, indicators

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**Rating potential indicators - Applying Criteria in the SCI Software**

Criteria can be applied in a particular order. One approach is to consider criteria of **data availability** first, as they are essential for proceeding with any proposed indicator. **Geographic coverage** and **cost effectiveness** considerations would also come near the beginning of the process. **Scientific validity, representativeness** and **responsiveness to change** would then be second in order of priority when making indicator proposals. At this stage, user-related criteria become more important and questions are raised as to whether the indicators are **relevant, understandable, relate to a target or threshold** and **have the potential for comparison**. Criteria related to "reliable information" need to be kept under consideration, however, to insure the balance of reliability and utility.

Another approach would be to leave the "practical issues" aside at first . Then, once an indicator is deemed to be scientifically valid and understandable, it would have to pass the "data availability" and other tests of whether it in fact can be implemented. In this way a supplementary list of indicators that would be useful, but for which new data collection is needed, could be presented to responsible organisations.

A quantitative criteria rating scheme can help the indicator development team distil the results of the process of selecting indicators and applying criteria. Quantitative methods that have been used for selecting indicators, typically start with a point system that rates whether the indicator meets a desired criterion or not: present/absent = 1/0; or how well the indicator rates according to that criterion: high/medium/low = 3/2/1. A five-point scale could be used if needed: 1 = lowest, 5 = highest. After the indicators have been rated against all the criteria, points can be tallied for each indicator. ***The Sustainable Community Indicators Software includes a built-in quantitative criteria rating system* (*see the user manual or help files for an explanation of how this works using the Sustainable Community Indicators Software).***

This kind of rating system could also be presented to all those who are consulted to provide a concise way for individuals to report their estimations of the extent to which proposed indicators meet criteria. It should be kept in mind, however, that discussion and analysis of proposed indicators in relation to criteria cannot be replaced by a ranking or weighting system. It may not be the indicators with the highest point scores that should be chosen. Other factors should be taken into consideration, such as, how well the indicators are balanced amongst the relevant sustainability components (environmental, social, economic). Judgements and trade-offs need to be considered in an ongoing manner. The perspectives of individuals with given expertise and experience allows for a dynamic application of the criteria that they have a particular interest in. The exchange of ideas and information in discussion and reviews can greatly assist in establishing a full understanding of the trade-offs and compromises required in order to have indicators that can be used. A more informal process ensures that rigid assumptions are not applied in an area where highly complex systems and scientific uncertainty must be considered. A ranking/weighting scheme should not be used as the final arbitrator for choosing indicators.

***Source:***

Environment Canada, Indicators and Assessment Office (Unpublished).

***See also***

Rating potential indicators
Selection criteria for indicators in the SCI Software

HELP FILES: Rating selection criteria

**Key Words**

rating, ranking, potential, geographic, importance, indicators, selection criteria, SCIS, SCI Software

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## *Levels of detail in indicators*

*Tiering*

Some indicators may have national relevance, whereas others may only be meaningful locally. Indicators also vary in levels of detail, with some giving a general overview of the topic, while others provide more detailed, technical information. Tiering can be used to distinguish between different types of indicators. The three tiers recommended for the software are:

- Tier 1, Core Indicators --The best summary indicators of the most important issues. These indicators target commonly-identified key sustainability topics. Such topics are central to monitoring community sustainability, and the results would be of interest nationally. **All Indicators in the Core Set of Indicators for the SCI software are Tier 1 indicators.** All participating communities nationwide could develop and collect these indicators regularly.
- Tier 2, Desirable Indicators -- Relevant to community sustainability, but not as important on a national basis as Tier 1 indicators. Tier 2 indicators may have regional importance (e.g., communities that depend on specific resources such as forest, fisheries, or agricultural soils may include indicators that measure the resource condition). Tier 2 indicators may also be more technical than Tier 1 indicators (e.g., measures of specific air quality or water quality parameters relevant to regional or local conditions).
- Tier 3, Supporting Indicators -- Detailed indicators, specific to a particular sector, community, or technical issue. Tier 3 indicators may provide necessary background to interpret Tier 1 and Tier 2 indicator results, but may not have national public appeal or be comparable among jurisdictions. These indicators might also be very detailed, spatially.

***Source:***

Environment Canada, CMHC and Westland Resource Group, 1999.

***See also***

SELECTING INDICATORS
Selection criteria for indicators in the SCI Software
Geographic levels of data

**Key Words**

detail, tiering, core, indicators, national, local, municipal

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## *Using indicator profiles in the SCI Software*

"Indicator profiles" are a key aspect of the software, they guide the full documentation of new indicators as well as provide a front-end interface for selecting and finding out details behind existing indicators. The core indicators are linked to indicator profiles and data profiles nested in the software. Indicator profiles include more detailed information about each indicator, while data profiles include meta-data - that is information about the source data. Users are

able to browse through profiles, or create ones for their own community-specific indicators. Buttons in the software allow users to click between indicator lists, indicator profiles and data profiles.

The profiles present the following information for each indicator:

- Sustainability component—What component of sustainability does the indicator reflect (environment, social or economic)?
- Sustainability issue area—What is the broad issue area revealed by the indicator (e.g., environmental health, resource consumption, etc. –see Guidelines under “Sustainability issue area”)?
- Issue—What is the specific theme or problem revealed by the indicator (see Guidelines under “Sustainability issues and objectives”)?
- Objective—What local, regional or national policy objectives might be linked to the indicator? This can also be a goal related to community programs for which the indicator measures progress toward sustainability.
- Related issues—In addition to the primary issue, what other issues might be linked to the indicator?
- Related objectives—In addition to the primary objective, what other objectives might be supported by the indicator?
- Originating framework—What indicator program (and associated framework, if applicable) originally guided the work of developing the indicator (e.g., National Environmental Indicators Series, CMHC Community Oriented Model of the Lived Environment (COMLE) indicators—see Guidelines under “Indicator Frameworks”)?
- Local government functions—What local government activities are most relevant to the indicator (see Guidelines under “Working from a departmental or functional perspective”)?
- Definition and rationale—Why is the indicator relevant and important? How does the phenomena measured by the indicator represent the issue?
- Pros—What are the indicator's strengths, particularly with regard to revealing community sustainability?
- Cons—What are the indicator's weaknesses?
- Relationship to issue—In relation to the specified issue or objective, is the indicator best categorized as a measure of stress, condition, or societal response (see Guidelines under “Stress-Condition-Response framework”)?
- Rating criteria—Does the indicator deserve a "high", “medium” or "low" rating with regard to:
  - ⇒ scientific validity,
  - ⇒ being understandable,
  - ⇒ data availability, and
  - ⇒ related sub-criteria.
- Targets and benchmarks—What local, provincial, or federal standards, thresholds, or targets have been established for the indicator.
- Examples of Indicators in use—Are there notable examples where this indicator has been successfully used?

- Geographic Scale—At what scale should the indicator be measured or presented in order to reveal the state of sustainability? Are there geographic limits to the indicators' use?
- Methods and Interpretation—How is the data incorporated into the indicator (explain any assumptions and/or estimates used, calculations and data limitations). What needs to be kept in mind when interpreting the indicator?
- Indicator source/contact—Where does the data come from? (Names are given for each database used which should be equivalent to the names of the data tables in the software that are accessed through the data profile. Names, contacts and Internet links are provided for the person(s) involved in developing the indicator.)

***Source:***

Environment Canada, CMHC and Westland Resource Group, 1999.

***See also***

ISSUES
Sustainability issue areas in the SCI Software
Indicator Frameworks
Working from a departmental or functional perspective
Stress-Condition-Response framework
HELP FILES: Accessing an indicator profile

## Key Words

indicator profiles, issues, objective, criteria, sustainability, SCIS, SCI Software

# DATA COLLECTION

Data sets need to be compiled, analyzed and interpreted in ways that convey information about environmental stresses and conditions and their associated trends. In order to be useful for sustainability indicator reporting, data must also be recent and updated regularly.

All reporting programs rely primarily on data held by various government agencies. Statistical and meta-level data are usually stored in computer databases. Some data from non-government sources such as universities and research institutes can be used as required, or data collection can be commissioned. Northern jurisdictions, and some provinces, have noted a need to incorporate traditional and local knowledge into reporting products and have begun to act on this priority. While a significant amount of existing data is likely to be found (see Guidelines under “Using existing data”), lack of existing data should not discourage the use of preferred indicators. Where resources are available original data can be created (see Guidelines under “Creating original data”).

It should be noted that many data sets can be difficult to obtain because of technical, administrative or legal obstacles, or because of financial constraints. Reporting efforts may be hindered by data gaps and inconsistencies, inadequate linkages with information holders and uneven monitoring efforts.

The purpose for which the data will ultimately be used will determine how they are compiled and analysed. This can result in report data or indicators that may not be comparable among different jurisdictions. When collecting data, consideration should be given to standardization with other data sources and indicator programs. This will facilitate information sharing and comparison. The software will provide access to data reports from other programs for this purpose.

In order to compile data in a coordinated manner and ensure consistency in the data used, the following efforts should be made:

- identify specific reporting data needs
- identify recognized data sources and encourage consistent use of these sources
- identify data gaps
- determine report scope based on available data
- work with the data holders to encourage data collection and sharing
- coordinate access to data with monitoring functions
- consider non-traditional methods of collecting information (e.g., through partnership programs)
- document sources

***Source:***

Canadian Council of Ministers of the Environment (CCME), 1995.

***See also***

HELP FILES: Adding new data

Contents

Creating original data - monitoring
Documenting data: using data profiles

### Key Words

data, collection, compiled, analyzed, meta-data, data needs, data gaps, data sources

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## *Types of data in the SCI Software*

There are several different types of data that can be entered and accessed using the software. These data are found using the Data profile - it is possible to select “Indicator data”, “Related data” or “Benchmark or target data”. These categories are explained below.

*Indicator data*

These are the source data for the indicator used to produce indicator charts and tables. Sometimes, analysis and calculations must be done with the raw data from the originating source to produce the indicator data. Direct access to the raw data will not typically be available through the software. However, a contact name and phone number can be provided (see Guidelines under “Using data profiles”).

*Related data*

Indicator data alone may not be sufficient to show the complete picture behind sustainability trends. Related data may be included that will help to explain what is occurring in the indicator data or provide context to help interpret the data. If, for example, contaminant levels in trout species were used to indicate pollution in a local body of water, related data might include the amount of contaminant loading contributed by local industry or the migratory range of the species.

*Target data*

Indicators will often have benchmarks or targets associated with them for the purpose of comparison and to give the indicator a “forward-looking” aspect. These are reference points that can show the progress of the community with respect to the given indicator (see Guidelines under “Analyzing indicators - comparisons”). National and provincial means, policy targets, regulatory standards or health standards (such as for drinking water or air quality) can be used for this purpose.

***Source:***

Environment Canada, CMHC and Westland Resource Group, 1999

***See also***

DATA COLLECTION
Analysing indicators - comparisons
Using data profiles
HELP FILES: Adding a new target or benchmark

### Key Words

types, data, meta-data, related data, benchmark data, target data, raw data

## *Using existing data*

Typically, a mosaic of data holdings exists in any one region. Environmental and socioeconomic data tend to be collected independently by diverse agencies, using different methods and classifications, and for quite specific purposes. Data on the environment itself are usually derived from monitoring programs, field studies and the interpretation of remotely sensed images. Socioeconomic data tend to be collected from statistically designed surveys.

The use of existing data will greatly facilitate the development of a sustainability indicators program. Data availability is a significant criterion when selecting indicators and accessible data may assist with indicator selection. The use of existing data has the advantage over the creation of original data in that a time series will already be established from which to interpret trends. Furthermore, if significant resource constraints affect the indicator program, the use of existing data will be favoured.

All reporting programs rely primarily on data held by various government agencies. Development of a sustainability indicators program with a multi-stakeholder approach will involve local government departments that are already responsible for collection of the relevant data. Some data from non-government sources such as universities and research institutes can also be used as required (see Guidelines under "Using existing data - data from other agencies"). Statistical and meta-level data are usually stored in computer databases.

It should be noted that many data sets can be difficult to obtain because of technical, administrative or legal obstacles, or because of financial constraints. Reporting efforts may be hindered by data gaps and inconsistencies, inadequate linkages with information holders and uneven monitoring efforts.

Existing data will likely be suited for specific data reporting requirements. Where possible, data should be used that is consistent with other data sources and indicator programs to assist in comparative studies and information sharing.

***Source:***

Campbell et al., 1996. (pp.37-41).
CCME (Canadian Council of Ministers of the Environment ), 1995.
Statistics Canada, Canadian Council of Ministers of the Environment and Environment Canada. 1998.

***See also***

DATA COLLECTION
Using existing data - local data
Using existing data - data from other agencies

### Key Words

existing data, data, meta-data

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**Using existing data - local data**

The use of local data will comprise a significant part of data collection in a sustainability indicators program. Programs that have used a multi-stakeholder approach to developing indicators will benefit from the involvement of local government departments that have responsibility in collecting data. This action will be especially beneficial if resource constraints affect the indicators program. Using a sectoral framework for indicator selection (see Guidelines under "Indicator frameworks"), will likely define the government department that will serve as data source for a particular indicator. However, a sectoral framework is not required to take advantage of local data sources. Examples of data that will be available from local government agencies might be:

- municipal water use by sector
- number of beach closings during summer season
- number of low income housing residences
- per capita residential solid waste generation
- green space inventory
- traffic volumes on major roads
- building permits
- subdivision applications

Government affiliated organizations will also be a source of local data. For example, hospitals, local transit companies and electrical utilities may be able to provide such data as birth rates of low weight babies, transit ridership and energy usage.

Local community organizations can be an additional source of local data. Community groups that may provide useful data might be:

- conservation authorities
- birding clubs
- health and safety organizations
- naturalist groups
- sport fishing and hunting clubs
- horticultural groups
- business associations
- waste management business and associations
- energy research institutes
- chamber of commerce
- waste collection or recycling entities
- real estate and land use agencies and associations
- professional organizations (e.g., civil engineers, planners…)

***Source:***

Campbell et al., 1996. (p.40)
Canadian Council of Ministers of the Environment (CCME), 1995.
Maclaren, 1996
Statistics Canada, Canadian Council of Ministers of the Environment and Environment Canada, 1998.

***See also***

DATA COLLECTION
Using existing data
Using existing data - data from other agencies
Geographic levels of data in the SCI Software

## Key Words

existing data, data, local, municipal, data collecting, community

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**Using existing data - data from other agencies**

There are numerous agencies from which indicator data can be collected. Federal agencies such as Environment Canada and Statistics Canada will be valuable data sources as well as provincial agencies and departments within government ministries. Examples of these would be the Department of Labour, the Department of Health or the Ministry of Environment and Energy. Non-government sources such as universities and research institutes can also be used as required.

Catalogues of databases (meta-databases) exist that will assist in locating required data. These meta-databases provide such information as descriptions of the available data, the responsible organization, database contacts, data acquisition methods, etc. An example of such meta-databases that may be useful is Databases for Environmental Analysis: Federal, Provincial and Territorial Governments (Statistics Canada, Canadian Council of Ministers of the Environment and Environment Canada, 1998) (see http://www.mbnet.mb.ca/ccme/5e_othertopics/5ef_database/5ef.html ).

***Source:***

Statistics Canada, Canadian Council of Ministers of the Environment and Environment Canada, 1998.
See also: Campbell et al., 1996. (pp.38-39)

***See also***

DATA COLLECTION
Using existing data
Using existing data - local data

**Key Words**

existing, data, agencies, federal, national

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## *Creating original data*

While a significant amount of existing data is likely to be found (see Guidelines under "Using existing data"), lack of existing data should not discourage the use of preferred indicators. Where resources are available original data can be created. This is a significant concern however, as creating original data can be both time consuming and expensive. One method of mitigating this cost is to solicit the involvement of the community.

The purpose for which the data will ultimately be used will determine how they are compiled and analyzed. This can result in report data or indicators that may not be comparable among different jurisdictions. When collecting data, consideration should be given to standardization with other data sources and indicator programs. This will facilitate information sharing and comparison. The software and associated web-site will provide access to data reports from other programs for this purpose.

Data on the environment itself are usually derived from monitoring programs, field research and the interpretation of remotely sensed images (see Guidelines under "Monitoring"). Socioeconomic data tend to be collected from statistically designed surveys (see Guidelines under "Local surveys").

***Source:***

Canadian Council of Ministers of the Environment (CCME), 1995.

***See also***

DATA COLLECTION
Creating original data - Local surveys
Creating original data - Monitoring
Community consultations

**Key Words**

creating, original, data, new

**Creating original data - Local surveys**

Local surveys can be used for gathering socioeconomic data for community sustainability indicators. Surveys are useful in gathering diffuse information from the community about various activities that contribute to socioeconomic trends. Subjective or attitudinal data can be gathered from surveys, such as perceptions of community health or opinions towards policy. Local surveys can also gather quantitative and objective data pertaining to such areas as resource use, lifestyle practices, business practices, expenditures, employment, sales, etc. Business organizations, local industries, community groups and households may be solicited to participate in surveys, depending on the requirements of the indicator data and the need to reduce collection costs.

***Source:***

Maclaren, 1996.

***See also***

DATA COLLECTION
Creating original data

## Key Words

local, original data, creating data, local surveys, public, citizens

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**Creating original data - Monitoring**

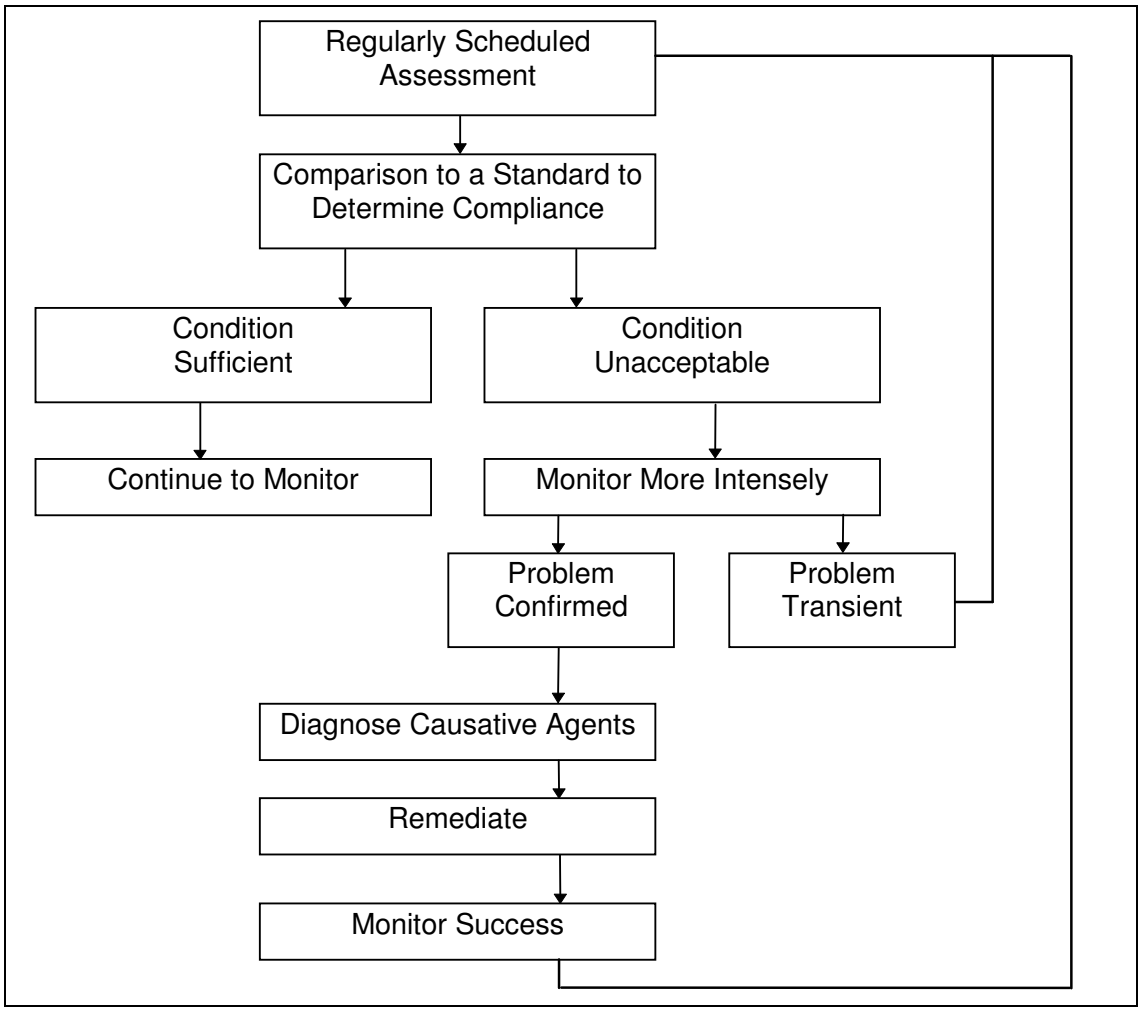
Biophysical data for sustainability indicators will likely be gathered through monitoring. Monitoring is defined as the repetitive measurement of indicators which will enable one to anticipate and provide a better understanding of spatial and temporal changes in environmental quality. Monitoring may also be used to track socioeconomic trends where appropriate measures are in place, in which case one may define environmental quality broadly to include biophysical, social, cultural and economic components.

In general, designing and implementing monitoring programs consist of the following steps:

- Establishing management goals (see Guidelines under “OBJECTIVES”);
- Identifying the units (natural, social, cultural, economic) for the monitoring program;
- Developing a monitoring framework;
- Selecting indicators and parameters or targets to be measured;
- Deciding on sampling frequency, locations, etc.;
- Selecting measures which can be used to determine the significance of data collected (e.g., environmental standards and guidelines);
- Collecting the data;
- Managing and interpreting the data (see Guidelines under “INDICATOR ANALYSIS”); and
- Reporting and using the information to assess and modify goals and objectives, management practices and the monitoring system itself (see Guidelines under “REPORTING”).

Monitoring programs can be established for many reasons. The schematic shown below in Figure 7 illustrates the operation of a monitoring program to ensure compliance with respect to an environmental regulation. New programs can sometimes piggyback on existing monitoring programs that are already in place. This can take advantage of existing infrastructure while supplementing the data being created to be more suitable for indicators.

Figure 7: Schematic of Monitoring Program (from Council of Great Lakes Research Managers, 1991)




***Source:***

Ontario Ministry of Environment and Energy, 1994.
Council of Great Lakes Research Managers, 1991.

***See also***

DATA COLLECTION
Creating original data
OBJECTIVES
INDICATOR ANALYSIS
REPORTING

**Key Words**

creating data, original data, data, monitoring, local, measuring

### *Geographic levels of data in the SCI Software*

Data are categorized in the SCI software according to the geographic scale that it represents. There are eight geographic levels in the SCI software for classifying data sets:

| | |
|---|---|
| National | These are data sets that represent trends for all of Canada. |
| Regional (sub-national) | This classification is intended specifically for data organized to represent one of the 6 political/geographic regions of Canada: Atlantic Canada, Quebec, Ontario, the Prairies, British Columbia, the North. |
| Provincial/ Territorial | These are data sets that represent one of the provinces or territories. |
| Census Metropolitan Area (CMA) | A CMA (census metropolitan area) is a large urban area defined by Statistics Canada, representing an urban core, (with a population of at least 100,000) together with adjacent urban and rural areas that have a high degree of economic and social integration with that urban core. There are specific criteria for defining a CMA and it should be noted that the resulting geographical boundaries are often different from municipal jurisdictional boundaries. |
| Census Agglomeration (CA) | A census agglomeration (CA) is defined by Statistics Canada as representing a large urban area (known as the urban core) together with adjacent urban and rural areas (known as urban and rural fringes) that have a high degree of social and economic integration with the urban core. A CA has an urban core population of at least 10,000, based on the previous census. However, if the population of the urban core of a CA declines below 10,000, the CA is retired. Once a CA attains an urban core population of at least 100,000, based on the previous census, it is eligible to become a CMA. |
| Regional Municipality (Census Division) | This geographic level is for data sets representing upper tier municipal government jurisdictions. This government tier is used primarily in Nova Scotia, Quebec, Ontario and British Columbia.<br>Census division is the general term applied to areas established by provincial law which are intermediate geographic areas between the municipality and the province level. Census divisions represent counties, regional districts, regional municipalities and other types of provincially legislated areas. Newfoundland, Manitoba, Saskatchewan, and Alberta do not have these administrative areas, so Statistics Canada and these provinces have created comparable statistical units for reporting purposes. |
| Municipality (Census subdivision) | This classification is for data sets representing the jurisdictional boundaries of municipal governments.<br>Census subdivision is the general term applying to municipalities or their equivalent (e.g., Indian reserves or unorganized territories). |
| Neighbourhood or census tract | The software provides this classification to allow for geographic representation at the sub-municipality scale.<br>Census tracts are small geographic units representing urban or rural neighbourhoods or communities within CMAs or CAs of 50,000 population or more at the previous Census. |

***Source:***

Statistics Canada, 1997. (for Census definitions)

***See also***

DATA COLLECTION

**Key Words**

geographic levels, data, geographic coverage, national, municipal, regional, provincial, CMA

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## *Documenting data: using data profiles in the SCI Software*

Data profiles are linked to the indicator profile; they are templates within the software for users to record information about the data they have collected. Data profiles will help users to organize data in a clear, referenced and structured manner. Data for indicators may come from a wide range of different sources. Information should be clearly catalogued and referenced, to facilitate the task of updating indicators in future years. Data profiles will also help users to document data quality. Monitoring data must be reliable. A reader must be able to trust that trends shown by the data are a result of changes in the phenomena being measured, not the techniques being used for measurement.

Metadata describes when, where, why, who, and how the data were collected. Providing this information allows for comparison and consistency in data collection. To assist in organizing and documenting data, the user will be prompted to include the information described in the table below. The table also includes reference to the FGDC Content Standard for Digital Geospatial Metadata. This is to provide an idea of the how the organization of metadata in the SCI Software is consistent with major evolving metadata standards.

**Table: Explanation of data profile categories (metadata)**

| Category in "data profile" | Definition | Detailed Explanation | Closest Related area within the The FGDC Content Standard for Digital Geospatial Metadata |
|---|---|---|---|
| **Smallest Geographic Units** | What is the smallest geographic scale at which the data is relevant (e.g. neighbourhood, municipality, province?) | Describe here the smallest area that the data has been collected at and could be useable. For example, while air-quality data may cover the country (i.e. "geographic coverage" = "national") the data is measured at air pollutant monitoring stations and the data is supplied here, in the core indicators of the software, down to the city level. | Spatial domain (1.5)<br>http://biology.usgs.gov/fgdc.metadata/ideninfo/sptldo.htm |
| **Time Period of Data Series** | Beginning and ending date and/or time (years, months, days). | Every data series has different time parameters. When entering time period information, different formats are available. There is no set date format in the software for this entry, make sure it is clear what format you are using. The following date format is suggested: year-month-day (e.g. 1999-01-01). Give the start time (year plus month and day if appropriate) and end time of the data you are using for the indicator. If known, note if the data is being collected on an ongoing basis. | Time Period of Content (1.3)<br>http://biology.usgs.gov/fgdc.metadata/ideninfo/timepd.htm |

| | | | |
|---|---|---|---|
| **Data Collection Frequency** | How often is the data recorded (hourly, daily, monthly, yearly) | | Time Period of content (1.3) http://biology.usgs.gov/fgdc.metadata/ideninfo/timepd.htm |
| **Notice of Proprietary Data** | Ownership and permission requirements for using data. | Record who owns the data and ways to access data. Describe any special restrictions or limitations on obtaining the data set. | Access Constraints(1.7)<br>http://biology.usgs.gov/fgdc.metadata/ideninfo/access.htm |
| **Data Sources & Contact(s)** | The agency responsible for collecting the data and/or an appropriate contact person. | Record the agency responsible for collecting the data, along with an appropriate contact person. This will provide users with the name of a person and how they make contact to obtain additional information. | Citation (1.1)<br>http://biology.usgs.gov/fgdc.metadata/ideninfo/citat.htm |
| **Method of Data Collection** | What monitoring, surveying methods, and calculations were performed? | If the data comes from an outside source you can note here what is known but it is not essential as the data holder has the ultimate responsibility of documenting methods. If the data is your own or from your own agency and methods have not been documented, then you should enter in this section a thorough explanation, in order to allow others to compare and/or repeat procedures. Where and how did you collect the data? What monitoring and surveying methods did you use? What calculations did you perform? | Lineage (2.5)<br>http://biology.usgs.gov/fgdc.metadata/dataq/lineage.htm |
| **Reliability** | Data quality and reliability based on the collection methods and other aspects of the data. | There are two types of data:<br>direct and indirect.<br>Direct data is data that has not been manipulated or altered from its raw state. Indirect data has been manipulated and interpreted. When analyzing data, you should use greater caution when dealing with manipulated data.<br>If the data comes from an outside source you can note here what is known and give your own estimate of the data's reliability. Detail here is not essential as the data holder has the ultimate responsibility of documenting reliability. If the data is your own or from your own agency you should describe in more detail your estimate of reliability and provide examples of procedures used to maintain data quality. Try to cover 1) assumptions and caveats that should go with the data, 2) a note on any quality assurance that has been done, and 3) if any specific confidence limits can be assigned to the data. | Attribute Accuracy (2.1)<br>http://biology.usgs.gov/fgdc.metadata/dataq/attaccy.htm |

| | | | |
|---|---|---|---|
| **Geographic Coverage** | The geographic area covered by the data. | Select from the options in the software the best description of the extent of area coverage of the data. See Guidelines: Geographic levels of data. | Spatial domain (1.5)<br>http://biology.usgs.gov/fgdc.metadata/ideninfo/sptldo.htm |

As well as organizing and documenting data, the software will allow access to other data sets associated with the indicator data (i.e. "Related data" and "Benchmark or target data"). (see Guidelines under "Types of data").

***Source:***

Environment Canada, CMHC and Westland Resource Group, 1999.

***See also***

DATA COLLECTION
Types of data in the SCI Software
Geographic levels of data SCI Software
HELP FILES: Accessing a data profile

## Key Words

data profiles, smallest data units, time period of data series, data collection frequency, notice of proprietary data, data sources, data contacts, method of data collection, reliability, geographic coverage

# INDICATOR ANALYSIS

In the analysis of the selected indicators it is important to discuss the indicator values and trends in terms of what they mean for sustainability, i.e., *Is the quality of the environment declining, improving or unchanged over a given period of time? Are we making progress towards sustainability?* For much of your audience, the answer to this question is the reason for your indicators program, so you need to be clear in explaining any trends. You may wish to include an explanation of why the indicator is at a particular level, how significant that is and point out any trends that have occurred or may be anticipated.

Trends and comparisons in indicator analysis are also discussed within the Guidelines (see the Index links below).

In addition to discussing the significance in trends for each indicator (or related group of indicators), you will want to discuss the overall picture based on all your indicators as to whether your community is moving towards sustainability.

It is also useful to explain why the selected indicators are representative of a particular aspect of community sustainability. It is a good idea to connect this explanation with the background information and to discuss any linkages with other indicators. An introductory discussion may address why particular indicators were selected and why and how they are representative; how the indicators are related to the issues in the report; and what reference points are being used and why.

If there are gaps or shortcomings present in the indicator data it is important to clearly state what they are to avoid misinterpretation. This also identifies opportunities to improve data collection for the next analysis and indicates difficulties that other communities should aware of.

***Source:***

Campbell et al., 1996.

***See also***

HELP FILES: ANALYZING DATA

Contents



**Key Words**

indicator, analysis, trends, comparisons, gaps, progress towards sustainability, charts, graphs, GIS, geographical information systems

## *Comparisons and context*

*Compare data from different time periods and regions*

Comparative data can provide context for indicators, showing temporal trends, such as "is air quality getting better or worse?" Similarly, it may not be clear whether a waste disposal rate of 500 tonnes per person per year is good or bad, without comparing it to other parts of the province, country or world.

Communities should be careful, however, to ensure that comparisons are valid. To be comparable data should be based on:

- the same definitions (e.g., does the air quality index mean the same thing in all provinces?)
- the same data collection methods (e.g., some information may be collected through a survey of part of the population, others may be actually measured, and others may be estimated)
- the same data collection periods (e.g., can 1994 data from one region be compared with 1996 data from another, or have circumstances changed significantly between these two time periods?)
- the same calculation and estimation procedures and quality control methods.

It is also useful to compare data to selected reference points such as provincial means, regulatory standards or policy targets to provide a context for your indicator data that is understandable and meaningful to the target audience. The table below presents several examples of reference points that can be used at the local level. The meaning conveyed by your indicator is influenced by the reference points selected. For example, showing that average ground-level ozone levels in air have been steady in the last decade conveys the meaning that air quality is not deteriorating. However, showing the frequency of exceedances of the ground-level ozone standard each year could convey the meaning that air quality continues to be impaired.

**Table: Reference Points for Urban Indicators**

| Type of Reference Point | Sample Indicators and Reference Point |
|---|---|
| Provincial/National Means | • Municipal household waste production per capita compared with provincial/national mean<br>• Percentage of local population using bottled water compared with provincial/national mean |
| Policy Targets | • Percent reduction in herbicide use compared with Premier's Council's target<br>• Percent reduction in emission of $CO_2$ compared with target in local Official Plan |
| Regulatory | • Number of days/year that ozone exceeds the provincial air quality standard<br>• Number of days/year that beaches are closed to swimming due to guideline exceedances for bacteria |
| Temporal | • Percent decrease in lead levels in ambient air in the past decade<br>• Percent increase in vehicle counts in the past decade |
| Intra-community | • Percent of population living in park-deficient neighbourhoods in one quadrant of the city compared with another<br>• Modal split (vehicle/transit use) in one part of the municipality compared with another |
| Inter-community | • Levels of PCBs in breast milk in one community compared with other communities<br>• Creation of historical land use inventory in one community compared with other communities |

***Source:***

Environment Canada, CMHC and Westland Resource Group, 1999.
Maclaren, 1996.

***See also***

INDICATOR ANALYSIS

Trends
Types of data in the SCI Software
Selection criteria for indicators in the SCI SOftware

**Key Words**

comparisons, context, analysis, periods, time, regions, targets, benchmarks

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## *Trends*

It is important when analysing the indicator data to look for trends that appear over time. As trends are found, one should ask the following questions:

*Why are such trends happening? What factors are involved? What is being done about the condition of the environment? How are these trends connected to each other and with other aspects of the environment?*

While the indicator data will provide good information on trends over time, it is up to you to explain or hypothesize as to why these trends are happening and what factors are involved. If you use the condition - stress - response reporting framework, your explanation of the trends may be easier since you will have concurrent information on stressors, the condition of the environment and the actions ('responses') underway to reduce the stresses. For example, if the amount of garbage going to landfill is identified as a stressor indicator, tracking the participation rate in home or communal composting programs (i.e., 'response') would be expected to correlate (inversely) with the amount of garbage landfilled. Such linkages in trends between indicators should be discussed because they can reveal progress or lack of it in your community's environmental improvement programs.

This is also where you can make the linkages between different components of the economy and the environment and different disciplines (e.g., health, economic, social aspects). Sometimes your report will reveal trends or situations that you can't explain. It's important to be very clear about what the data can and cannot tell you.

***Source:***

Maclaren, 1996.

***See also***

Stress-condition-response framework
INDICATOR ANALYSIS
Comparison and context

**Key Words**

trends, analysis, time, correlation

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## *Charts and Statistics in the SCI Software*

In addition to written analysis, displaying data visually is a very powerful way of emphasizing data and trends. The SCI software is compatible with Microsoft Excel, allowing data to be displayed in numerous forms. Bar, line, scatter and pie charts are effective formats of displaying data to enhance trends and significant values. Statistics and correlation are the other two features available which offer a different perspective. The statistics option performs calculations on data tables which have been selected and creates statistics such as: mean, median, mode, variances, standard deviations, max/min values. The derived statistics are useful for trend analysis and summarizing data tables in an understandable format.

Correlation displays the relationship between two variables as being dependent or independent. The following are outputs that may be generated using the charts and statistics function:

- charts (useful in reports and presentations)

  ⇒trend analysis

  ⇒value comparisons

- statistics (numerical and graphical)

  ⇒histograms

  ⇒spreadsheet summary

- correlation

  ⇒dependent or independent relationship

***See Also***
Trends
INDICATOR ANALYSIS
Comparison and context

**Key Words**
trends, analysis, charts, statistics, visual, presentation, correlation, time

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## *Use of Geographical Information Systems with the SCI Software*

Many communities and municipalities are taking advantage of the mapping and geographic analysis that is possible using Geographic Information Systems (GIS). As with many areas where data presentation is important, GIS can be useful when working with indicators. If you have indicator data that includes information on where the variable is located spatially (i.e. data that includes geo-referencing) then you can make use of a GIS in conjunction with the SCI Software. The SCI Software includes tutorials that show examples of how geo-referenced indicator data can be exported from the Software to three of the main desk-top GIS - ArcView, MapInfo and RAISON. With this kind of facility you can show differences in indicator trends between nieghbourhoods or communities or show graphically on a map how other communities compare with your own. Analysis done on the GIS can result in new data tables that can then be imported back into the SCI Software as new indicator data or background data. Geo-referenced data can be exchanged with other users of the SCI Software who also have access to a GIS. Maps that are produced in the GIS can be pasted into indicator reports to illustrate trends and issues.

***See Also***

REPORTING

**Key Words**

trends, analysis, charts, maps, visual, presentation, correlation, Geographic Information Systems, GIS, ArcView, MapInfo and RAISON

# REPORTING

*Purpose*

The products of a sustainability indicators program represent the end results of interpreting and assessing the sustainability of a community. They are the essential communication link between the program and the clients. The clients should represent the starting point when considering reporting products if the indicators program is to deliver demand-driven information. Specifying the target audience may be difficult and will include some combination of following: the general public, interest groups, policy decision makers and their analysts, the education community, industry and their associations, regional and community planners, natural resource managers, the media, scientists, and consultants. In general, sustainability reporting products should present themselves with the purpose of contributing to decision-making and informing the public.

***Source:***

Rump, 1996.

***See also***

HELP FILES: Generating reports

Contents



**Key Words**

report, final, summary, end, product, results, interpretation, assessing

## *Reporting templates in the SCI Software*

The SCI Software provides template options for creating indicator reports. To create a report, follow the instructions in the user manual or help files. You can choose those aspects of the indicator and data profiles that you want to include in the report and select one of the formats (i.e. text, Microsoft Word document, Rich Text Format or HTML). A general report template and a brochure template are provided with the SCE software. The user can also copy charts and tables created using the analysis tools from the SCI Software and paste these into the report where appropriate. The templates consist of headings under which report text can be organized. The user can adjust the content and/or the format as required. An example of an indicator report template is provided below. Under each heading is a brief description of the text that the user will write for the report. The indicator brochure template can be used as a very concise framework for presenting one or two indicators in an easy-to-read format.

### Introduction

**Current issues**

<Brief description of the main issues facing the community in the areas of economics, society (health and social well-being) and the environment.>

**The global context**

<A community is part of the larger context of global sustainability. How is it part of the problem and how can it become part of the solution.>

**The vision for the community: sustainability goals and objectives**

<A view of how the community wants to be in the future and a description of the goals and objectives that need to be addressed in the short and medium term.>

**The Indicator program**

<A description of the sustainability indicators program, who is involved, how broad participation is/will be encouraged, when the report will be updated etc.>

# Indicator: (name of indicator)

### Issue context

<Brief description of the rationale behind this indicator, what it is measuring and how it relates to community sustainability.>

### Trends and prospects

<Description and commentary on the trend so far seen in the indicator, how it relates to targets and goals and to national, provincial or other benchmarks (if any), and some discussion of what might be needed to change the direction of the trend if needed.>

### Indicator chart(s)

<A simple and clear presentation of the charts resulting from the analysis done with the Community Sustainability Indicators software.>

# Conclusions

### Where are we going?

<An overview of the trends reported, the issues that need more urgent attention, what the community will look like if there is no change in course.>

### Monitoring and data

<A summary of the quality of the data and confidence in the indicator results. Suggestions for improved monitoring and where the priorities may lie.>

### Changing course

<A discussion of possible courses of action to increase the likelihood of reaching the stated goals, commenting on what areas should be priorities based on the trends, examples of programs dealing with the same issue areas in other communities.>

### What do you think?

<An invitation to policy-makers and individuals to comment on possible actions and programs in response to the indicators.>

# Data, sources, background and technical notes

### Indicator: (name of indicator)

#### *Data*

<A simple table of the data directly behind the indicator chart(s)>

#### *Sources, background and technical notes*

<A compact print-out of the Indicator Profile and Data Description.>

The reporting template will include the headings and contents of the Indicator Profile and Data profile.

### Acknowledgments

<Contributors of advice, concepts, methods and information>

## *See also*

REPORTING
HELP FILES: Generating reports

## Key Words

reports, templates, results, product

# INDICATOR LIST: IDEAS FOR YOUR PROGRAM

The list below compiles indicators that have been used by other municipalities for various programs. They are categorized according to a set of sustainability issues (not exactly the same as in the SCI Software). These indicators may be used for developing a sustainability indicators program, or may give ideas for other indicators that could be used.

**Habitat**

- Greenspace as percentage of total land area (greenspace may include protected and unprotected natural areas, parks, vacant Crown land with greenspace value, agricultural land, forest land)
- Total area of environmentally sensitive habitat and percentage of area protected from development (i.e. protected area or covenanted land)
- Number of species at risk.
- Population trends of species at risk
- Population trends of keystone species.

**Urban air quality**

- Ambient levels and exceedances for ground-level ozone, $PM_{10}$, CO, NO, $SO_2$, benzene

**Water quality and consumption**

- Municipal water consumption per capita (total, residential commercial, other).
- Phosphorus levels in lakes compared with water quality guidelines or objectives
- Percent of households with water meters.
- Beach closures (annual number of days specified beaches closed due to unacceptably high coliform counts)
- Percentage of households serviced by sewage treatment (e.g., by level - none, primary, secondary, tertiary)
- Average annual faecal coliform level in stormwater
- Average annual concentrations of substances of environmental concern in sediments at selected stormwater discharges
- Exceedances of sewage effluent guidelines (number of occurrences)

**Contaminated Sites**

- Remediated contaminated sites as percentage of total known sites

**Energy**

- Energy consumption per household
- Energy consumption by sector

**Transportation**

- Modal split (percentage of trips by bikes, cars, passengers, transit, and walking)
- Motor vehicle ownership per capita (or per household)
- Annual amount of fossil fuel consumed for transportation per household
- Annual costs of roads and road maintenance per household.
- Transit ridership (total, and per capita per year)
- Amount of land used for automobile-related uses (roads, parking lots, service stations, etc.)
- Length of bikeways as a percentage of total length of major vehicle lanes.
- Average number of people per car per trip

**Solid waste**

- Waste generation and disposal
- (total and per capita)
- Recycling and composting participation rates
- Percent of households covered by blue box recycling program

**Urban sprawl**

- Total area of rural land converted to urban uses, and rate of change per 1,000 population growth.
- New housing starts by type (percentage of detached, attached ground, attached non-ground of total new starts)
- Percent of households within 400 m of schools hospitals, transit stops, natural parks.
- Urban and non-urban residential densities
- Percent mixed-use zoning (e.g. commercial-residential)
- Average residential lot sizes (new lots and total inventory)

- Renovation permits as percent of building permits
- Percent of new or renovated development within the built-up area, compared with all development in the urban region or CMA.
- Average length of journey to work
- Percent of labour force working within 400 m of home

**Income equity**

- Percentage of households with incomes below Low Income Cut-off
- Annual average (or median) household (or individual) income by group (i.e. women, men, native, immigrants)
- Middle income earners as a percentage of total population
- Real average weekly earnings
- Percentage of children, elderly, and disabled with low incomes [e.g. household income below LICO (low income cut off)]
- Ratio of income earned by richest 20% of population to poorest 20% of population
- Total annual number of meals provided (or annual number of people served ) by food banks

**Housing**

- Average waiting time for those in need of subsidized housing
- Number and percentage of households in core housing need, by tenure
- Affordability (percent of households spending 30% or more of income on housing (principal, interest, taxes and utilities), by tenure)
- Adequacy (percent of housing stock below adequacy standard)
- Suitability (percent of households below national occupancy standard for number of people per bedroom)
- Annual total number of people using homeless shelters (annual total number of overnight stays)
- Average price of serviced residential lots (total and as a percent of average price of house)
- % of total housing stock made up of social housing units
- Vacancy rates, by price and housing type.
- Supply of serviced residential land coming on stream to meet future demand
- Estimates of homeless population
- Changes in occupancy rates of shelter beds, using a moving 12 month average.

**Human health**

- Percentage of population (or households) within 400 meters of recreational or natural parks.
- Park area per capita (e.g. protected natural and recreational greenspace)
- Area of greenspace per capita (greenspace may include protected and unprotected natural areas, recreational parks, golf courses, vacant Crown land with greenspace value, etc.)
- Hospital admission rate for asthma
- Low birth weight babies (<2500 g) per 100 live births
- Suicide rate (suicides per 1000 population)
- Life expectancy
- Drinking water quality: exceedances of provincial or Canadian standards for selected parameters (e.g. trihalomethanes, coliforms, Giardia, turbidity, Cryptosporidium, trace metals, etc.)
- Teenage mothers (less than 20 years of age) per 1000 live births
- Infant mortality rate

**Education**

- Education levels (as a percent of population over 15 years of age; < grade 9, grades 9-13, post secondary)
- Literacy rate
- Percentage of youths aged 15-18 attending school

**Public safety**

- Accident rates (by type)
- Crimes against persons
- (offences per 1000 population)
- Crimes against property
- (offences per 1000 population)
- Number of charges laid (by victim and by police) in domestic violence incidents reported to police (also as percentage of all incidents)

**Governance**

- Percent of population voting in municipal elections
- Percent of population participating in voluntary community service organizations

**Economic activity**

- Bankruptcies and incorporations (per 1000 population)
- Annual number of new business licences issued
- Number and value of building permits annually

**Employment**

- Percent of labour force employed by sector (manufacturing, industry, agriculture, service, etc.)
- Population dependency ratio
- Percentage of Employment Insurance beneficiaries as percentage of total population aged 19-64
- Big, (> 100 employees) and small (< 20 employees) as percentages of total number of businesses
- Average number of person weeks unemployed per year by age group

For other municipal indicator lists, see:

Campbell, 1996, Appendix 1; and
CMHC and Environment Canada, 1996, pp. 37-38.

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