# INDICES OF GOOD STEWARDSHIP

## GENERAL

It seems that the overall goal should be to increase the social welfare of U.S. and Canadian citizens. This includes maximizing the contribution of Lake Ontario to economic and non-economic values of the current population without jeopardizing the opportunities for future generations to achieve similar values, i.e., sustainability

## QUESTIONS

1) Where resources are degraded, how much is the current population willing to sacrifice today to restore resources and associated values for themselves in the future?

2) Where resources are degraded, how much is the current generation willing to sacrifice to improve conditions for future generations?

3) What are the social costs in terms of restoration expenditures, pollution abatement costs, and foregone opportunities of restoring Lake Ontario resources and achieving good ecological stewardship goals?

4) Which segment of society bears the costs of "good stewardship" and which segment enjoys the benefits?

It seems that good stewardship should also mean conserving/restoring Lake Ontario resources as long as the marginal social benefits of conservation/restoration exceed the marginal social costs of the conservation/restoration, i.e., efficiency.

PERFORMANCE CRITERIA - changes in values and impacts associated with lake resources and changes in intragenerational and intergenerational equity.

| | |
|---|---|
| Socio-Economic Value | profits/enjoyment from fishing/hunting, aesthetics, etc. |
| Economic Impacts | jobs, sales, tax revenues, etc. from water dependent industries |
| Natural Capital | quantity/quality of resources (accumulating or depreciating) |
| Equity | Distribution values/impacts |

## PERFORMANCE INDICATORS

- o characteristics, functions or values
- o state or flow variables
- o stressors, exposure, effects
- o sources of problems

# TYPES OF WETLAND VALUES

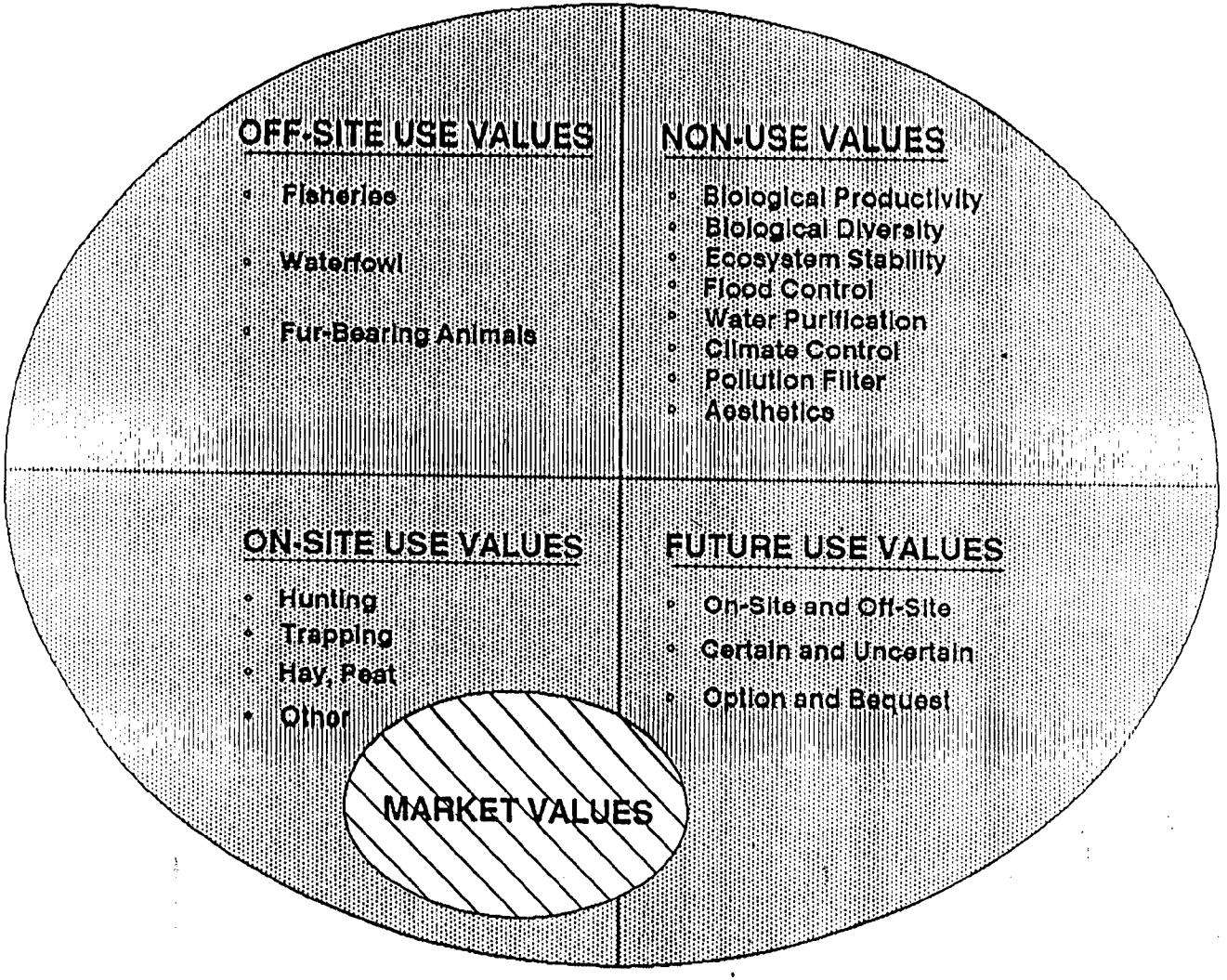


Table 4

## CLASSES OF WETLAND VALUES

**DIRECT VALUES**

- associated with wetland services and outputs that contribute directly to the utility of individuals or the profitability of businesses.
- can be estimated through expressed or revealed preferences using market prices, travel cost, contingent valuation.

1) Active Recreation (i.e. hunting, fishing, birdwatching, etc.).
2) Passive Recreation (i.e. nature study, sightseeing, contemplating, etc.).
3) Natural Products (i.e. timber, hay, peat, cranberries).
4) Education and Research (i.e. wetland as natural laboratory/classroom).
5) General Aesthetics (i.e. open space, scenic views, etc.).

**INDIRECT VALUES**

- associated with wetland function that have well established links with goods and services that have direct value.
- must be estimated using more complex methods such as net factor income, substitution and replacement costs, costs avoided.

1) Commercial harvest of wetland-dependent fish, fowl, fur-bearing animals.
2) Municipal and agricultural water supplies (groundwater recharge).
3) Regional wastewater treatment.
4) Protection of property against flood and wave/surge damage.
5) Beach and shoreline protection.

**LIFE SUPPORT VALUES:**

- associated with basic wetland functions that support ecological and economic systems.
- cannot be estimated using available methods because specific linkages between wetland functions level economic values are not known.

1) Food chain support - terrestrial and aquatic ecosystems.
2) Micro-climate regulation.
3) Global climate regulation.
4) Carbon/Nutrient/Oxygen Recycling.
5) Bio-diversity (unique species, seed banks, genetic pools).

Table 3
WETLAND FUNCTIONS AND VALUES

| WETLAND FUNCTION | TYPES OF VALUE | METHODS OF VALUATION* |
|---|---|---|
| A Groundwater Recharge/Discharge | Maintain healthy drinking water | |
| B Floodwater Storage Conveyance/ Desynchronization | Reduces soil erosion, property damage | |
| C Shoreline Anchoring | Protects beaches, property, ecosystem | |
| D Storm Wave/surge Protection | Reduces erosion, property damage | |
| E Sediment Trapping | Maintains aquatic ecosystems; reduces dredging requirements; maintains hydropower | |
| F Pollution Assimilation | Reduces treatment costs, improves public health | |
| G Nutrient Retention/Cycling | Maintains nitrogen balance | |
| H Fishery Habitat | Better commercial/recreational fishing; lower seafood prices; improved international balance of trade | |
| I Waterfowl Habitat | Better hunting, birdwatching, etc. | |
| J Habitat for Fur-bearers | Improved commercial and recreational opportunities | |
| K Food-chain Support | Off-site benefits to freshwater anadromous, marine fish, etc. | |
| L Agriculture - low intensity grazing | Higher productivity, lower farm costs | |
| M Energy (peat, etc.) | Major subsistence energy source with some commercial value | |
| N Natural Products-timber, hay, etc. | Supply wholesale/retail markets | |
| O Microclimate Regulation | General life support; ill-defined economic linkages | |
| P Global Climate Regulation | General life support; ill-defined economic linkages | |
| Q Carbon Cycling | General life support; significant but unknown economic linkages | |
| R Storehouse of bio-diversity | Direct, indirect andserendipity value of scientific, medical discoveries, genetic pools, seed banks | |
| S Active Recreation | Boating, swimming, etc. | |
| T Passive Recreation | Sight-seeing, birdwatching, etc. | |
| U Natural Laboratory/Classroom | In-field research/teaching - kindergarten through adult | |
| V General Aesthetics | Open space, natural beauty, spiritual enrichment | |

*METHODS:

| | | | | |
|---|---|---|---|---|
| MA | Market Analysis | TC Travel Cost | AC Avoided Costs |
| FI | Net Factor Income | CV Contingent Valuation | |
| SC | Substitute cost | HP Hedonic Pricing | |
| RC | Replacement Cost | PM Participation Models | |

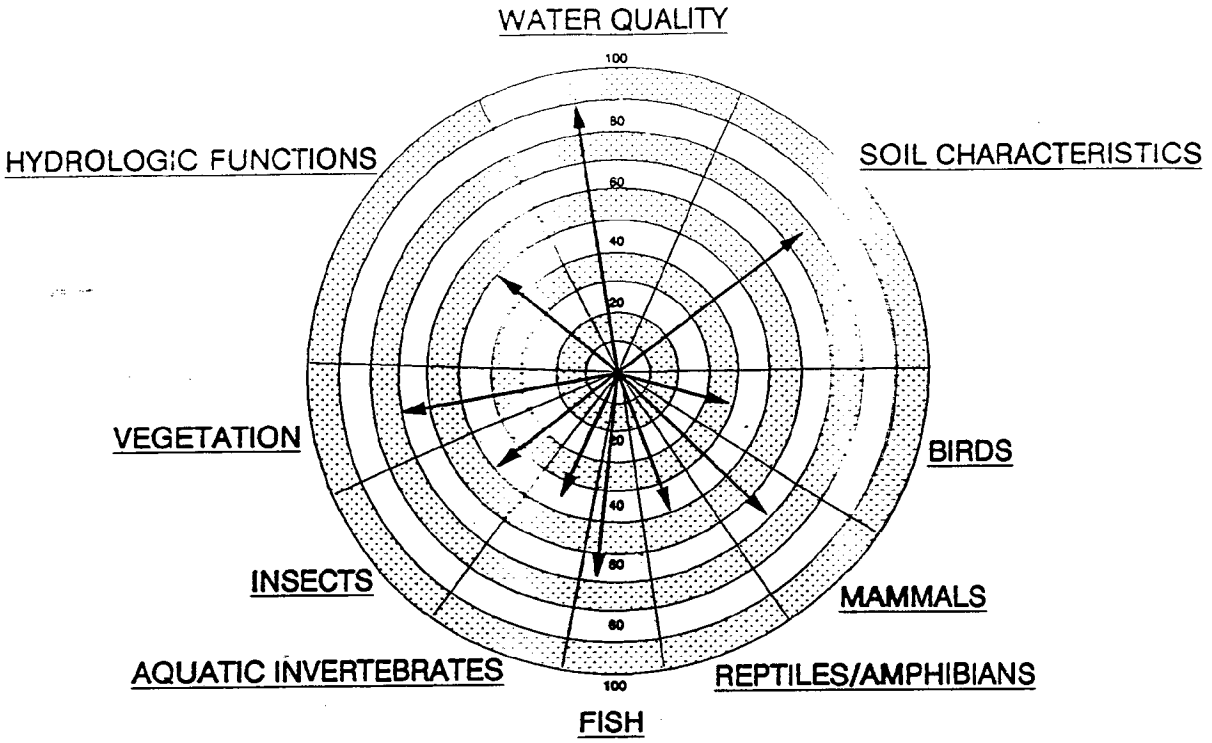
Table 2
WETLAND VALUATION METHODS

| METHOD | DESCRIPTION OF METHOD |
|---|---|
| Market Price Method | Estimates the economic value of commercially traded products and services from wetlands (.e.g, peat, hay, hunting rights) on the basis of their market prices. Does not deduct market value of other resources used to bring wetland products to market. |
| Net Factor Income Method | Estimates the value of wetland resources in commercial production by estimating the profits of wetland-dependent commercial activities after payments are made to other factors of production. |
| Travel cost (TC) Method | Used to estimate the value of recreational benefits generated by wetlands. Assumes that the value of a site is reflected in how much people are willing to pay to get there. |
| Hedonic Pricing -- Property Value (PV) Analysis | Hedonic techniques assume that the price paid for a commodity is directly related to the supply of the commodity's attributes. Most common is the PV approach, which uses variations in property values to reveal implicit values and demand for environmental amenities. |
| Contingent Valuation (CV) Method | The only available technique for estimating most nonuse values. Questions individuals directly about their willingness to pay (WTP) or willingness to accept payment. |
| Valuation Transfer: The Activity Day Method | Simple transfer: an activity day valued at one site is used to value the same activity at the study site. Values are usually site/location/user specific, but transfers can be useful for gross estimates of recreational values. |
| Replacement Cost (RC) Method | Estimates the value of a non-market service based on the cost of substitution. This involves three steps: estimate level of service provided, identify least cost alternative, and establish public demand for this alternative. |
| Damage Cost (DC) Method | Estimates the value of a service based on the cost of damage that may result from its loss. Steps include: assess service level, estimate potential damage, translate to dollar terms, and identify possible substitute. |
| Opportunity Cost Method | Proxy value for uncertain wetland functions/services calculated on the basis of the cost of foregone development values and appropriate least-cost substitutes. |

Exhibit B

# Functional Equivalency Rose *

Coastal Wetlands




## MEASURABLE CHARACTERISTICS of COASTAL WETLANDS

**HYDROLOGIC FUNCTIONS**
- Inundation Regime
- Elevation
- Water Column Stratification

**WATER QUALITY**
- Temperature
- Salinity
- Light Attenuation
- Nutrients
- Algae
- Zooplankton

**SOIL CHARACTERISTICS**
- Bulk Density
- Water Content
- Particle Size
- Soil Salinities
- Soil pH
- Redox Potential
- Inorganic Nitrogen
- Total Nitrogen
- Percent Organic Matter
- Organic Carbon
- Nitrogen Fixation
- Nitrogen Mineralization

**VEGETATION**
- Percent Groundcover
- Percent Desirable Species
- Density
- Biomass
- Primary Productivity
- Net Aerial Primary Productivity
- Algal Productivity

**INSECTS**
- Abundance
- Diversity
- Percent Desirable

**INVERTEBRATES**
- Abundance
- Diversity
- Percent Desirable

**REPTILES/AMPHIBIANS**
- Abundance
- Diversity
- Percent Desirable

**MAMMALS**
- Abundance
- Diversity
- Percent Desirable

**FISH**
- Abundance
- Diversity
- Percent Desirable

**BIRDS**
- Abundance
- Diversity
- Percent Desirable