



Statistics Canada  
www.statcan.gc.ca



# Asset Accounts

## SEEA Training Seminar for ESCAP

February 23-26, 2016

Chiba, Japan

**Joe St. Lawrence**

**Statistics Canada**

# Policy relevance

***“Conventional economic aggregates generated through national accounting, such as GDP, do not reflect the extent to which production and consumption activities may be using up environmental assets and limiting the capacity for these assets to generate ecosystem services in the future.”***

**-TEEB Guidance Manual for Countries (2013)**

**OECD: indicators and reports: *Green Growth and Material Flows and Resource Productivity***

**World Bank: *Wealth Accounting and the Valuation of Ecosystem Services (WAVES)***

# Asset Accounts: Applications

- Monitoring and management of natural wealth
  - What is the contribution of natural assets to national wealth?
  - Are we maintaining total wealth (produced and natural) over time, both in total and per capita?
  - To what extent are we substituting produced assets for natural assets?
  - Is resource rent recovered successfully by governments?

# Linking natural assets to the SNA

**Table 378-0121**

**National Balance Sheet Accounts**  
quarterly (dollars x 1,000,000)

Data table [Add/Remove data](#) [Manipulate](#) [Download](#) [Related information](#) [Help](#)

The data below is a part of CANSIM table 378-0121. Use the [Add/Remove data](#) tab to customize your table.

**Selected items** [[Add/Remove data](#)]

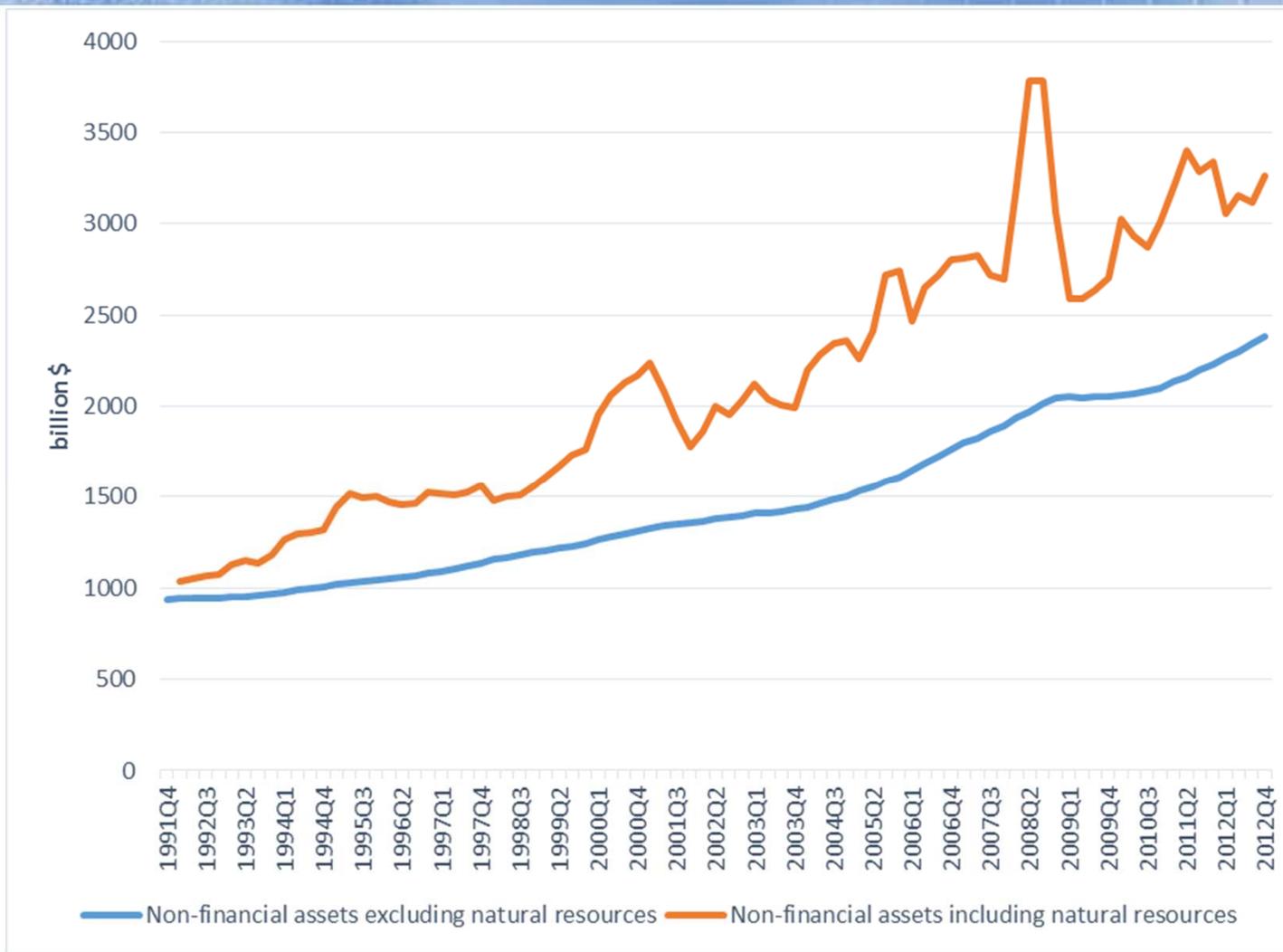
**Geography** = Canada

**Sectors** = Total all sectors

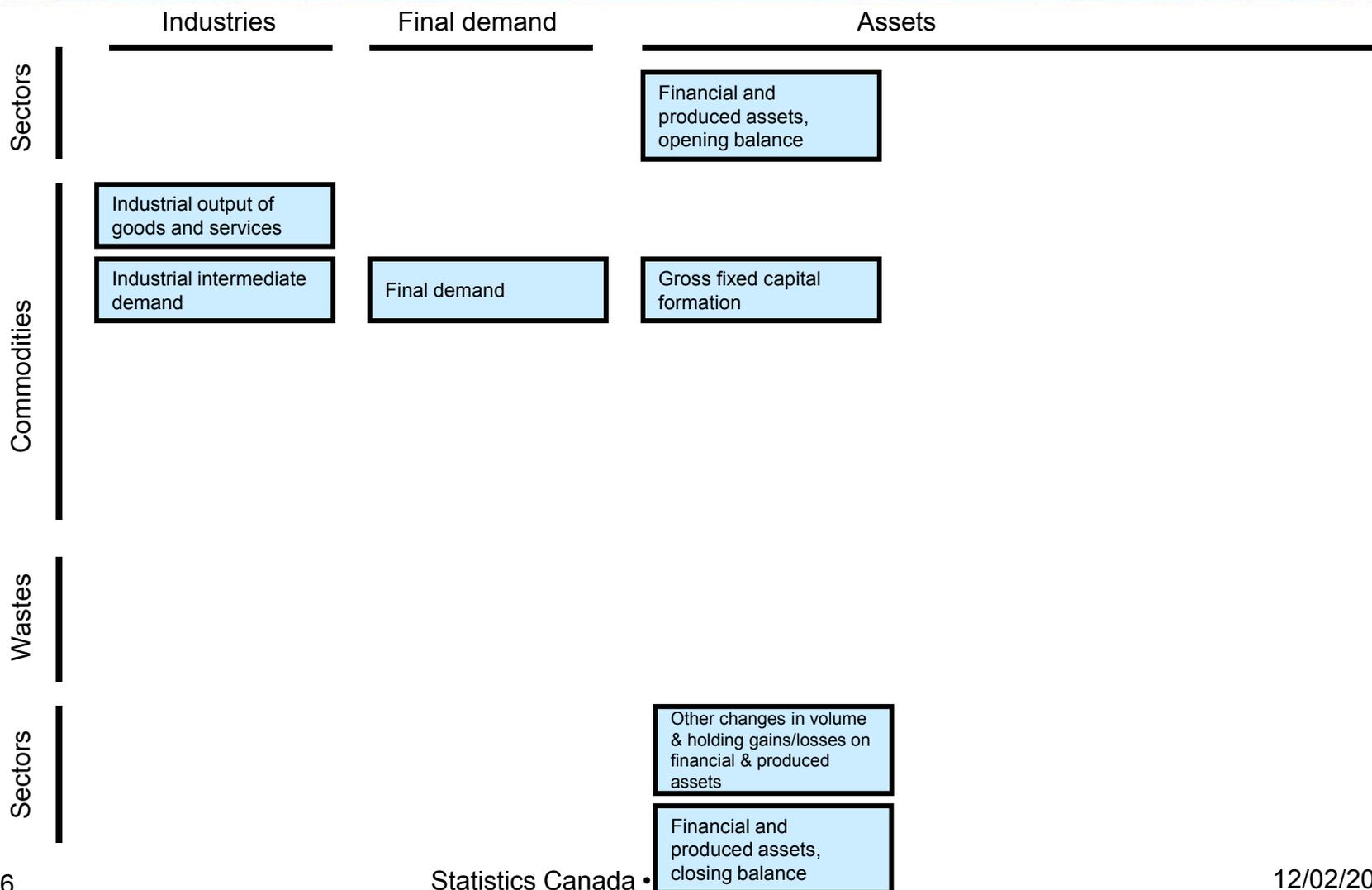
**Valuation** = Market value

Categories	2013				2014				2015		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
<b>Total assets</b>	30,812,653	30,828,353	31,588,251	32,023,925	32,977,336	33,658,262	33,735,019	33,983,523	35,191,166	35,470,712	35,096,548
<b>Non-financial assets</b>	8,570,455	8,625,366	9,024,332	8,793,297	9,237,700	9,534,674	9,357,212	9,036,126	9,092,292	9,395,210	9,204,858
<b>Produced non-financial assets<sup>±</sup></b>	4,827,772	4,864,557	4,953,465	5,017,329	5,074,602	5,160,215	5,246,899	5,313,126	5,380,340	5,410,243	5,472,545
<b>Non-produced non-financial assets<sup>±</sup></b>	3,742,683	3,760,809	4,070,867	3,775,968	4,163,098	4,374,459	4,110,313	3,723,000	3,711,952	3,984,967	3,732,313
<b>Land<sup>4</sup></b>	2,988,103	3,053,233	3,100,706	3,151,494	3,218,669	3,287,868	3,310,619	3,335,469	3,382,724	3,435,594	3,468,332
<b>Natural resources<sup>±</sup></b>	754,580	707,576	970,161	624,474	944,429	1,086,591	799,694	387,531	329,228	549,373	263,981

# Corporate sector net worth



# SNA view



# SEEA view

	Industries	Final demand	Assets		
Sectors			Financial and produced assets, opening balance	Natural resource assets, opening balance	Natural resource assets, opening balance
Commodities	Industrial output of goods and services				
	Industrial intermediate demand Environmental protection expenditures	Final demand Environmental protection expenditures	Gross fixed capital formation Capital expenditures for environmental protection		
	Resource production by industries Resource use by industries	Resource production by households/gov't Resource use by households/gov't			
Wastes	Waste consumption by industries Waste output by industries	Waste consumption by households/gov't Waste output by households/gov't			
Sectors			Other changes in volume & holding gains/losses on financial & produced assets	Changes in and holding gains/losses on natural resource assets	Changes in natural resource assets
			Financial and produced assets, closing balance	Natural resource assets, closing balance	Natural resource assets, closing balance

# Accounting structure

- **Structure:** conforms with a balance sheet structure - opening stocks, closing stocks and annual variations

Table 5.8

Physical asset account for mineral and energy resources

	Type of mineral and energy resource (Class A: Commercially recoverable resources)				
	Oil resources (thousands of barrels)	Natural gas resources (cubic metres)	Coal and peat resources (thousands of tonnes)	Non-metallic minerals (tonnes)	Metallic minerals (thousands of tonnes)
Opening stock of mineral and energy resources	800	1 200	600	150	60
<b>Additions to stock</b>					
Discoveries					20
Upward reappraisals		200		40	
Reclassifications					
<i>Total additions to stock</i>		200		40	20
<b>Reductions in stock</b>					
Extractions	40	50	60	10	4
Catastrophic losses					
Downward reappraisals			60		
Reclassifications					
<i>Total reductions in stock</i>	40	50	120	10	4
Closing stock of mineral and energy resources	760	1 350	480	180	76

[United Nations, 2012, System of Environmental-Economic Accounting: Central Framework, New York.](#)

# Physical stock accounts: an example for crude bitumen

**Table 153-0122** [1](#), [2](#), [3](#), [4](#), [5](#), [6](#), [7](#)

**Selected natural resource reserves**  
annual (data in thousands)

**Data table**

Add/Remove data

Manipulate

Download

Related information

Help

The data below is a part of CANSIM table 153-0122. Use the [Add/Remove data](#) tab to customize your table.

**Selected items** [[Add/Remove data](#)]

**Geography** = Canada <sup>8</sup>

**Asset type** = Established crude bitumen reserves (cubic metres) <sup>10</sup>

Stock	2005	2006	2007
Opening stock	1,660,000	1,620,000	3,340,000
Additions	17,258	1,785,707	237,000
Depletion	57,258	65,707	77,000
Closing stock	1,620,000	3,340,000	3,500,000

# Monetary stock accounts: an example for crude bitumen

**Table 153-0121** <sup>1, 2</sup>

**Value of selected natural resource reserves**  
annual (dollars x 1,000,000)

Data table

Add/Remove data

Manipulate

Download

Related information

Help

The data below is a part of CANSIM table 153-0121. Use the [Add/Remove data](#) tab to customize your table.

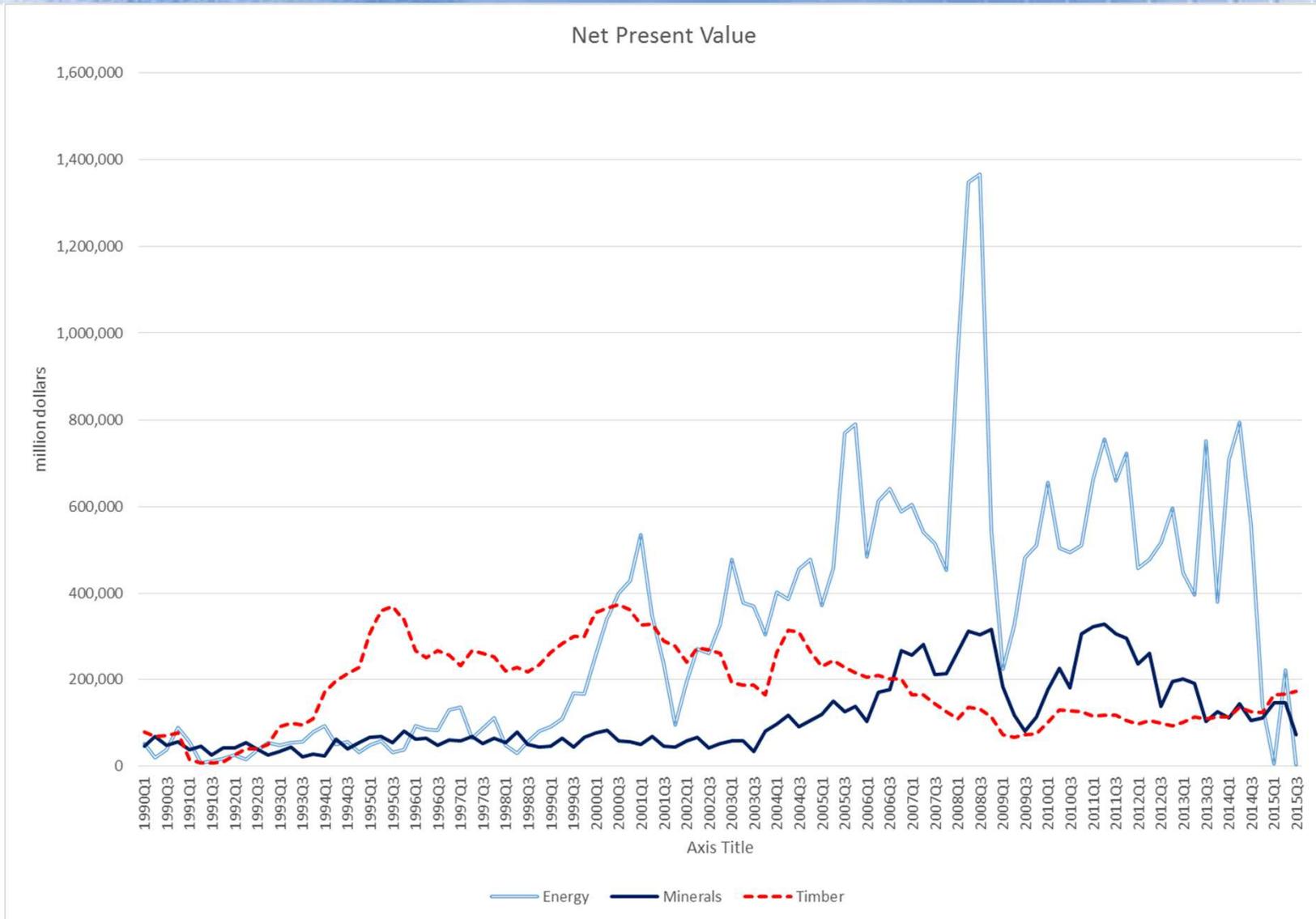
## Selected items [[Add/Remove data](#)]

**Geography** = Canada

**Asset type** = Established crude bitumen reserves

Stock	2008	2009	2010	2011
Reconciliation account opening stock <sup>a</sup>	191,145.4	476,744.1	182,194.4	336,498.2
Reconciliation account additions <sup>a</sup>	97,122.8	103.7	611.1	3,244.6
Reconciliation account depletion <sup>a</sup>	8,426.2	3,733.8	7,618.1	10,571.1
Reconciliation account revaluation <sup>a</sup>	196,902.1	-290,919.7	161,310.8	95,764.8
Reconciliation account closing stock <sup>a</sup>	476,744.1	182,194.4	336,498.2	424,936.5

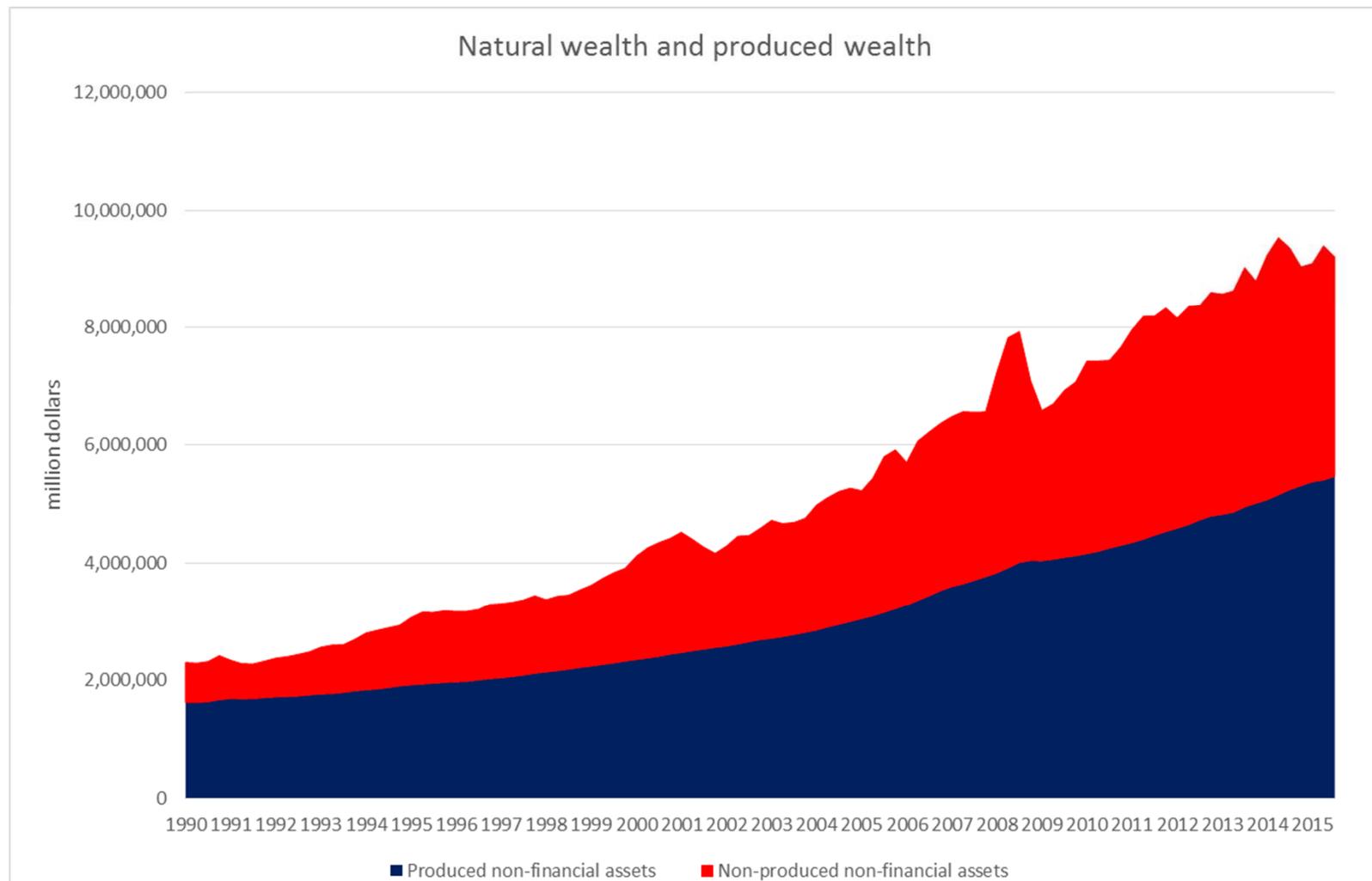
# Sample results – Canada's natural resource wealth



# Links to the SNA

- The monetary accounts are integrated with the National Wealth Account of the CSNA
  - The addition of the monetary values of key natural resource assets (energy, minerals, timber and land) recognizes that these resources, although provided by nature, contribute significantly to Canada's national wealth

# Natural resource assets and national wealth



# Accounting structure

- **Is wealth really going up like this all the time?**
  - **Not really, since the stock is valued in current prices and includes inflation.**

# Accounting structure

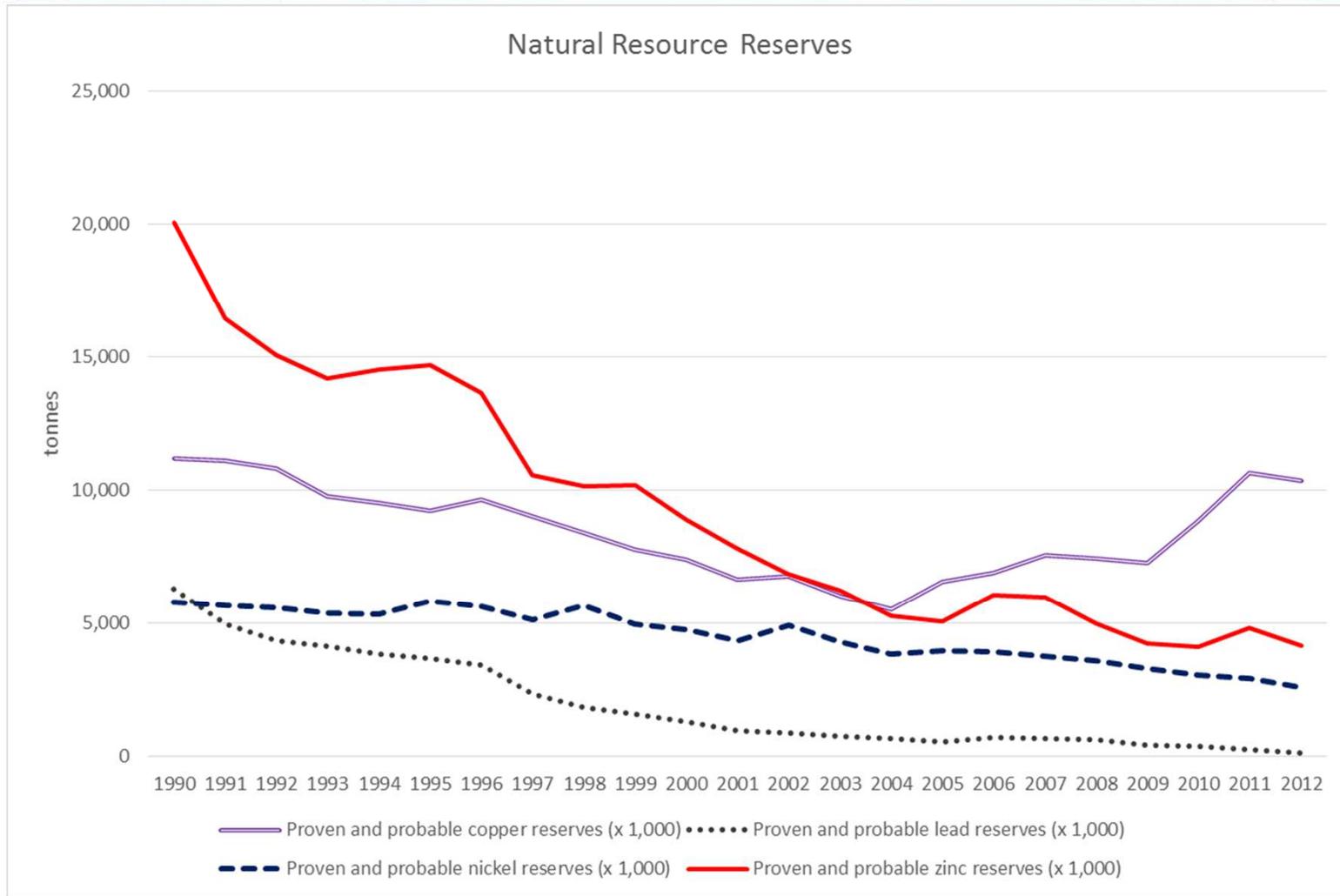
- **Why value assets in current prices?**
  - The assumptions on resource rent, stocks, extraction, etc. are all based on current prices.

# Natural Resource Stock Accounts: Applications

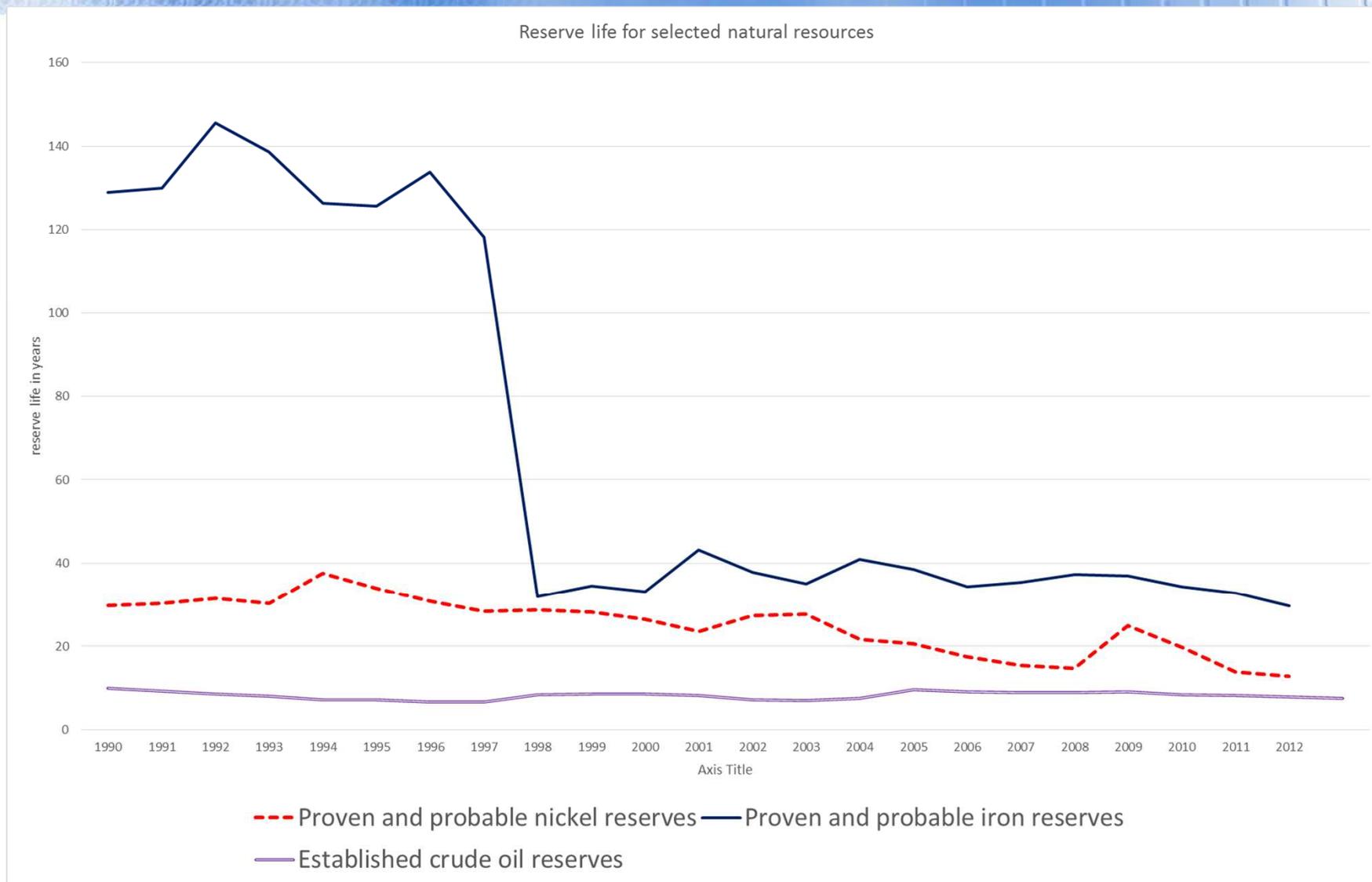


- Physical indicators that relate to the management of natural resource stocks and their use in the economy
  - *Are resource stocks growing / declining over time?*
    - *Stocks of mineral and energy assets*
    - *Remaining reserve life of energy and mineral assets*
    - *Annual depletion of mineral and energy reserves*
    - *Total natural resource base*
  
- Monetary indicators that tell us if our resource base (natural wealth) is being maintained or at least replaced by adequate produced capital.

# Physical stocks of selected minerals



# Reserve life for selected resources (Closing stock)/(extraction)





## Physical stocks of selected minerals

- How can we have 10 years of crude oil for the last 17 years?
  - Extraction is balanced by discoveries and other additions to stock.

# How are natural resources valued?

- In order to be included within the balance sheet accounts, natural resource assets must fit into the asset boundary of the SNA – i.e. they must be economic assets

*“Economic assets are entities over which ownership rights are enforced by institutional units, individually or collectively, and from which economic benefits may be derived by their owners by holding them, or using them, over a period of time”*

- They also must be recoverable under current technological and economic conditions
  - E.g., for oil sands (crude bitumen) we only value “known deposits under active development”

# Physical stock accounts: an example for crude bitumen

**Table 153-0012<sup>1</sup>**

**Established crude bitumen reserves**  
annual (cubic metres x 1,000)

[Data table](#) [Add/Remove data](#) [Manipulate](#) [Download](#) [Related information](#) [Help](#)

The data below is a part of CANSIM table 153-0012. Use the [Add/Remove data](#) tab to customize your table.

**Selected items** [\[Add/Remove data\]](#)

**Geography**= Canada

Stock	2005	2006	2007	2008	2009	2010	2011
Opening stock, established crude bitumen reserves	1,660,000	1,620,000	3,340,000	3,500,000	4,300,000	4,216,000	4,130,000
Additions, established crude bitumen reserves	17,258	1,785,707	237,000	876,000	2,000	1,332	31,000 <sup>r</sup>
Depletion, established crude bitumen reserves	57,258	65,707	77,000	76,000	86,000	87,332	101,000 <sup>r</sup>
Closing stock, established crude bitumen reserves	1,620,000	3,340,000	3,500,000	4,300,000	4,216,000	4,130,000	4,060,000

**Symbol legend:**

[Back to original table](#)

<sup>r</sup> Revised

**Footnotes:**

1. Alberta Energy Regulator.

**Source:** Statistics Canada. *Table 153-0012 - Established crude bitumen reserves, annual (cubic metres)*, CANSIM (database). (accessed: 2014-06-06)

[Back to search](#)

# Accounting structure

- **Question: what factors could lead to the large jump in stocks in 2006?**
  - **Prices increase making existing deposits profitable to extract.**
  - **New technology making extraction more profitable or opening formerly unrecoverable stocks to exploitation.**

# Monetary stock accounts: an example for crude bitumen

**Table 153-0005<sup>1, 2</sup>**

**Value of established crude bitumen reserves**  
annual (dollars x 1,000,000)

[Data table](#) [Add/Remove data](#) [Manipulate](#) [Download](#) [Related information](#) [Help](#)

The data below is a part of CANSIM table 153-0005. Use the [Add/Remove data](#) tab to customize your table.

**Selected items [Add/Remove data]**

Geography= Canada

Value	2005	2006	2007	2008	2009	2010	2011
Reconciliation account, established crude bitumen reserves, opening stock <sup>3</sup>	107,560.2	111,305.7	197,972.4	167,541.6	437,070.6	143,720.4	301,647.0
Reconciliation account, established crude bitumen reserves, additions <sup>3</sup>	1,185.8	105,844.5	11,345.0	89,040.4	68.2	97.3	2,872.7
Reconciliation account, established crude bitumen reserves, depletion <sup>3</sup>	3,934.1	3,894.6	3,685.9	7,725.0	2,931.7	6,378.5	9,359.3
Reconciliation account, established crude bitumen reserves, revaluation <sup>3</sup>	6,493.8	-15,283.1	-38,089.8	188,213.5	-290,486.7	164,207.9	81,064.9
Reconciliation account, established crude bitumen reserves, closing stock <sup>3</sup>	111,305.7	197,972.4	167,541.6	437,070.6	143,720.4	301,647.0	376,225.2

## Footnotes:

[Back to original table](#)

1. Data source: Statistics Canada, Environment Accounts and Statistics Division.
2. For concepts, sources and methods, see "Concepts, Sources and Methods of the Canadian System of Environmental and Resource Accounts", catalogue number 16-505-GPE.
3. The reconciliation account entries are calculated using the present value methodology.
4. Negative values for net price I, net price II and present value are set to zero.

**Source:** Statistics Canada. *Table 153-0005 - Value of established crude bitumen reserves, annual (dollars)*, CANSIM (database). (accessed: 2014-06-06)

[Back to search](#)

# Accounting structure

- **Question: what factors could lead to the large revaluation in 2009?**
  - **The economic crisis leading to a drop in prices.**

# Valuation of energy and mineral stocks



- Valuation: indirect estimation of market values of natural assets
  - *Valuation of natural resource asset stocks would **ideally** be based on observed market value for transactions in these assets*
  - *Such values are not available for most resource assets however, since there are few transactions in resource assets in their “natural” state*
  - *Estimates of market value must be derived indirectly (economic or resource rent)*
  - *The total value, or wealth, associated with the stock is calculated as the present value of all future annual rent that the stock is expected to yield*

# The concept of resource rent

Resource rent is the part of the revenue from the sale of the resource which remains after having deducted all costs associated with extraction – *including fuel, labour and capital costs.*

# Calculation of resource rent

$$RR_t = TR - C - (r_c K + \delta)$$

*where:*

*RR = resource rent (annual)*

*TR = total annual revenue*

*C = annual non-capital extraction cost (excluding taxes)*

*$\delta$  = annual depreciation*

*$r_c K$  = return to produced capital*

# Valuation – Net present value

- Net present value (NPV) is the discounted value of future economic benefits from a given asset
  - *Follows conventions adopted in the System of National Accounts to value capital assets*

$$NPV = \sum_{t=1}^T \frac{RR_1}{(1 + r_i)^t}$$

*where:*

*RR=resource rent*

*T= reserve life, i.e. Closing stock ÷ extraction*

*r<sub>i</sub>= discount rate*

## Data sources: Monetary data

- Generally, the data in monetary terms come from Statistics Canada. Those data include (but not exclusively):
  - *Value and quantity of production*
  - *Capital expenditures*
  - *Operating costs (materials and supplies, fuel and electricity, and wages and salaries)*
  - *Value of the produced capital stock and the value of the annual depreciation of that stock*

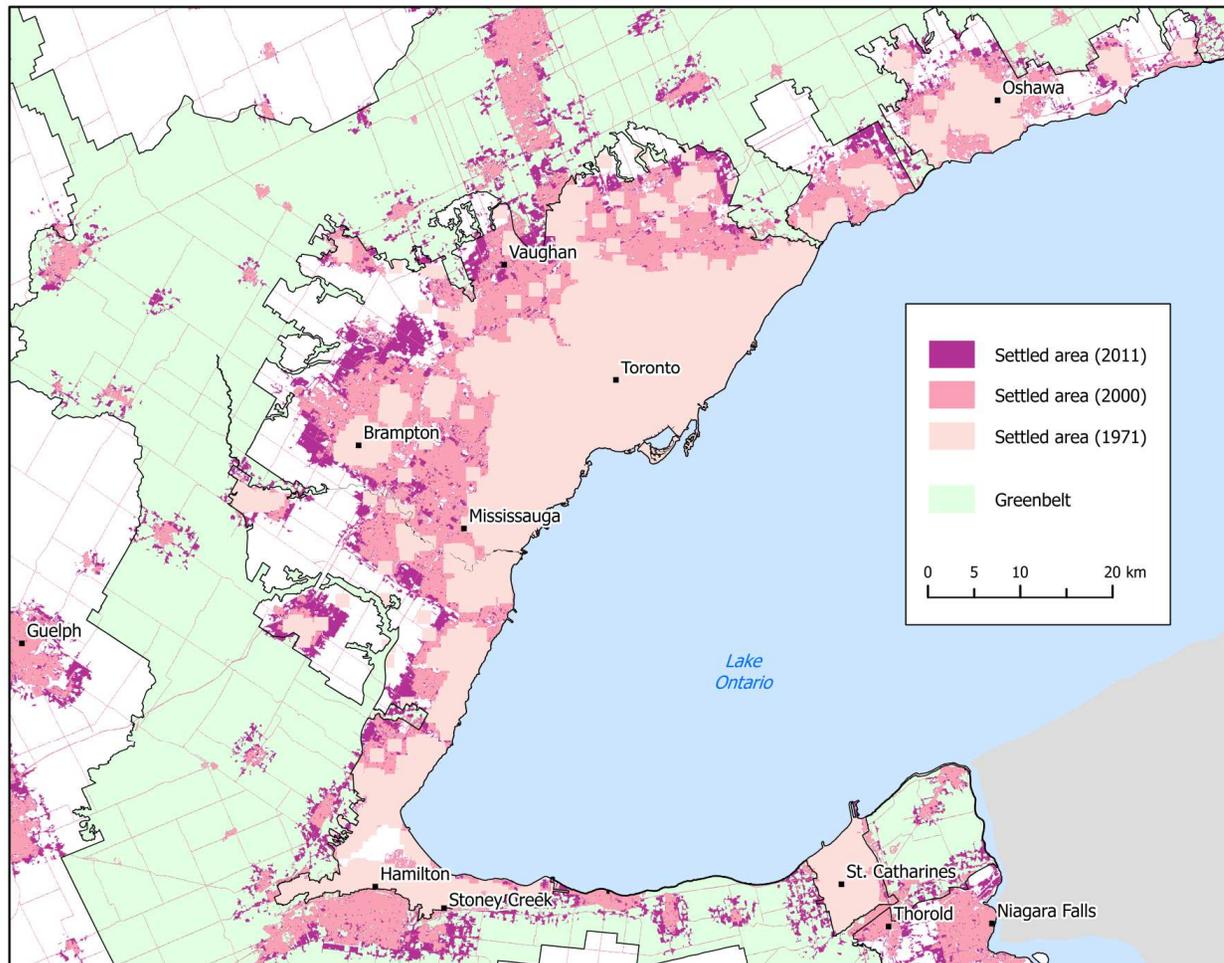
## Data sources: Physical data

- Generally, the data in physical terms (mainly reserve estimates) come from Federal and Provincial natural resource departments. Data suppliers include:
  - *Natural Resources Canada*
  - *Canadian Association of Petroleum Producers*
  - *Alberta Energy Regulator*
  - *British Columbia Ministry of Energy, Mines and Petroleum Resources*
  - *Manitoba Energy and Mines, Petroleum and Energy Branch*
  - *Saskatchewan Department of Energy and Mines*

# Land Assets

- The Land Accounts provide information on the cover and the use of Canada's land
- Respond to questions like:
  - What is the distribution and quality of the land?
  - How is land used and what are the trends in this use?
  - How quickly is rural land being converted to urban land?
  - What share of urban land is occupying prime agricultural land?
- At the moment, only agricultural and built-up land are valued and included in the country's National Wealth Account
  - In future we hope to develop methods and estimates for other land types, such as parkland and recreational land

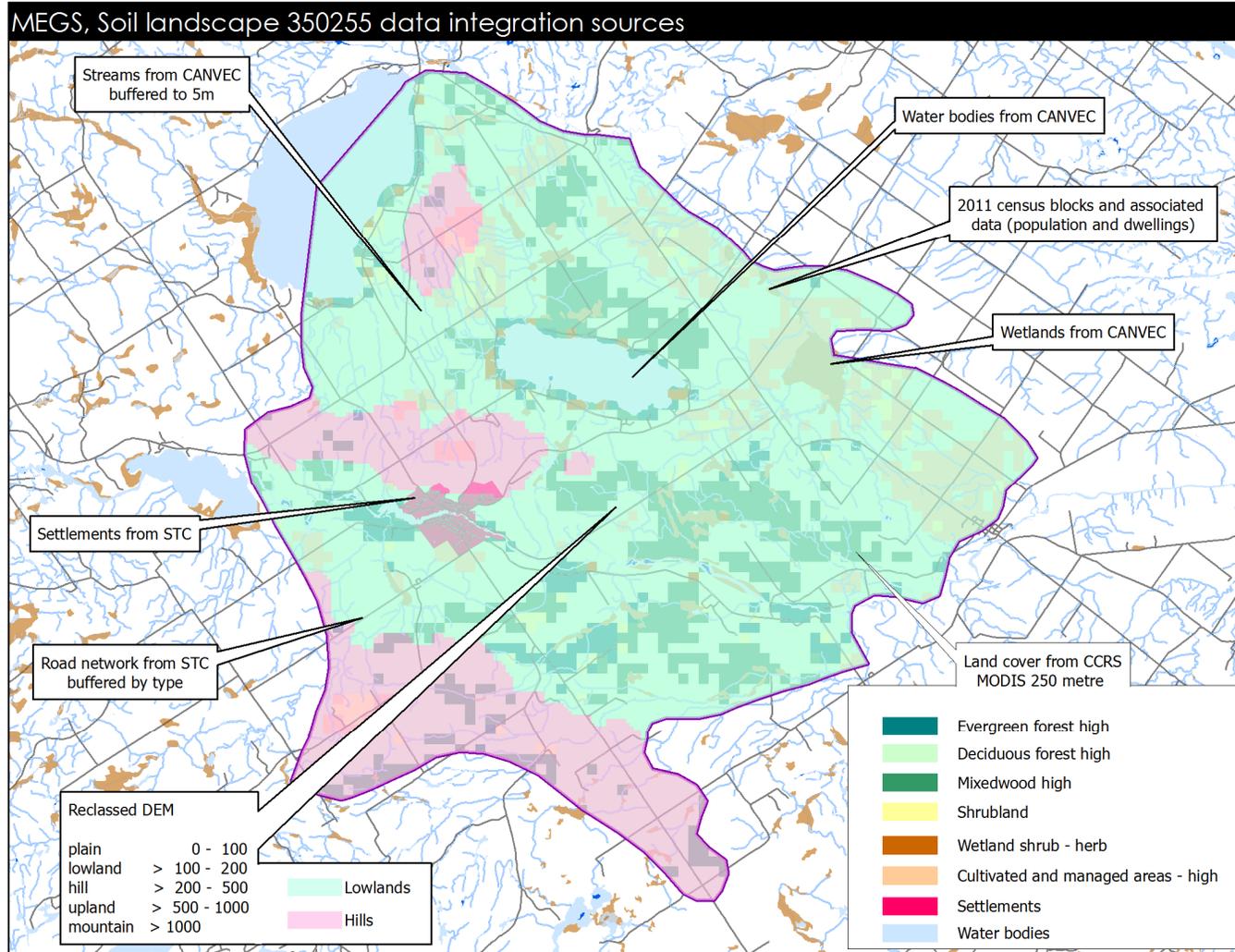
# Land use change



**Note(s):** The settled area boundary inside the greenbelt is derived from a special tabulation of data from the 1971 Census of Population. The greenbelt boundary is defined by the Government of Ontario's *Greenbelt Act, 2005*.

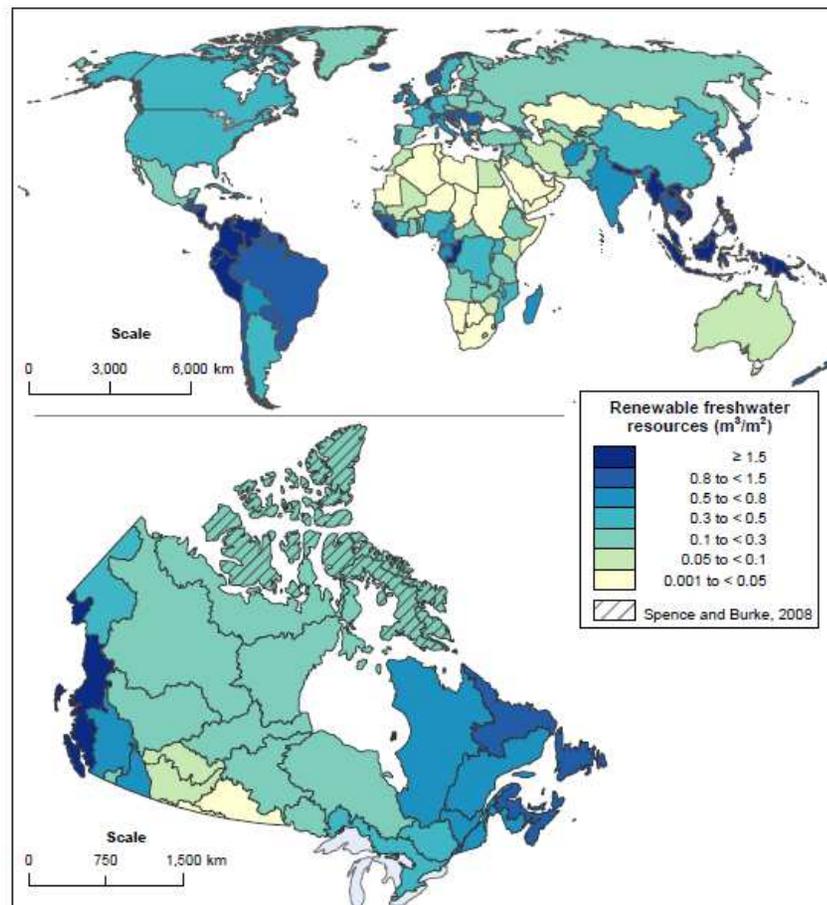
**Source(s):** David Suzuki Foundation, 2013, *Nature on the Edge: Natural Capital and Ontario's Growing Golden Horseshoe*, [www.davidsuzuki.org/publications/downloads/2012/DSF\\_whitebelt\\_2013\\_web\\_edited\\_version.pdf](http://www.davidsuzuki.org/publications/downloads/2012/DSF_whitebelt_2013_web_edited_version.pdf) (accessed August 13, 2013). Ontario Ministry of Municipal Affairs and Housing, 2013, *The Greenbelt Act, 2005*, [www.mah.gov.on.ca/Page195.aspx](http://www.mah.gov.on.ca/Page195.aspx) (accessed June 27, 2013). Statistics Canada, Environment Accounts and Statistics Division, 2013, special tabulation of data from the 1971 Census of Population. Agriculture and Agri-Food Canada, 2009, *Land Cover for Agricultural Regions of Canada (circa 2000)*, version 12, <http://data.gc.ca/data/en/dataset/f5ded3b0-a5b4-4599-95d6-d853a825792b> (accessed October 9, 2012). Agriculture and Agri-Food Canada, 2012, *2011 AAFC Crop Type Map of Canada*, [ftp://ftp.agr.gc.ca/pub/outgoing/aesb-eos-gg/Crop\\_Inventory/2011/](http://ftp.agr.gc.ca/pub/outgoing/aesb-eos-gg/Crop_Inventory/2011/) (accessed October 9, 2012). Agriculture and Agri-Food Canada, 2001 and 2011 landcover 30 metres.

# Land characteristics



# Water stocks

Map 1.1  
Renewable freshwater resources by country, and water yield by drainage region within Canada



**Note(s)** Data for Canada were derived from discharge values contained in Environment Canada, 2010, *Water Survey of Canada, Archived Hydrometric Data (HYDAT)* ([www.wsc.ec.gc.ca/hydat/H20/index\\_e.cfm?cname=main\\_e.cfm](http://www.wsc.ec.gc.ca/hydat/H20/index_e.cfm?cname=main_e.cfm)).

**Source(s):** Food and Agriculture Organization of the United Nations, 2009, *AQUASTAT main country database*, <http://www.fao.org/nr/water/aquastat/dbase/index.stm> (accessed December 15, 2009).  
Spence C., and A. Burke, 2008, "Estimates of Canadian Arctic Archipelago Runoff from Observed Hydrometric Data," *Journal of Hydrology*, Vol. 362, pages 247 to 259.  
Statistics Canada, Environment Accounts and Statistics Division, 2010, special tabulation.



# Questions?

## **Joe St. Lawrence**

**Environment, Energy and Transportation Statistics  
Statistics Canada / Government of Canada  
joe.stlawrence@canada.ca / Tel: 613-882-8598**

**Statistique de l'environnement, l'énergie et des transports  
Statistique Canada / Gouvernement du Canada  
joe.stlawrence@canada.ca / Tél: 613-882-8598**