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# Asset Accounts: Overview

**UNSD SEEA Training of Trainers Seminar**

7-10 July 2015, Santiago

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**Statistics Canada**



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# Outline

- Background
- The accounting structure
- Physical accounts
- Valuation
- Data sources
- Land, water, and ecosystem assets

# 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?

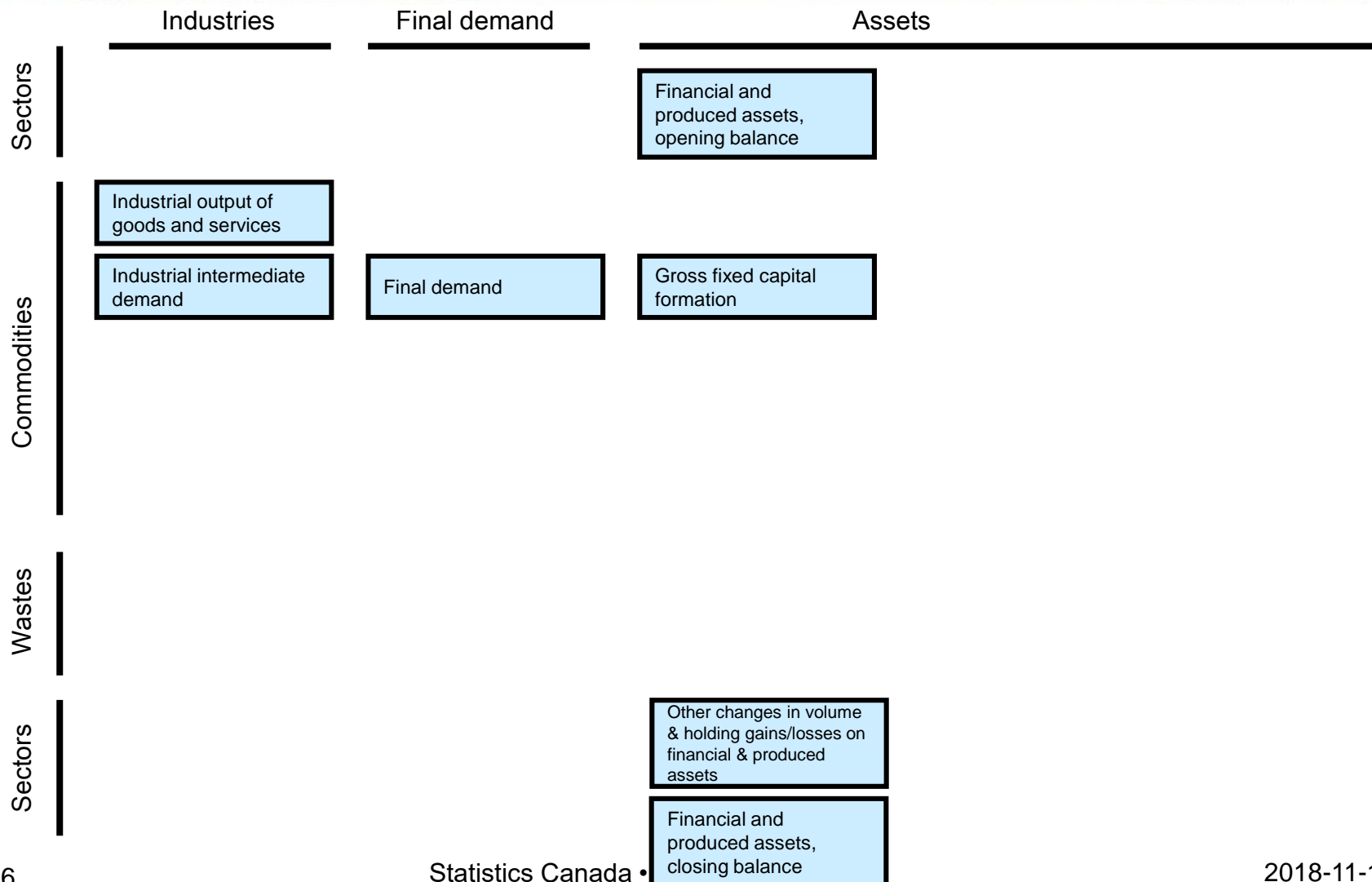
**Table 378-0005** <sup>3</sup>**Natural resource assets and produced assets**

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 378-0005. Use the [Add/Remove data](#) tab to customize your table.**Selected items** [[Add/Remove data](#)]**Geography** = Canada

Categories	2010	2011	2012
<b>Non-financial assets</b>	7,300,919	7,908,875	7,989,008
<b>Produced non-financial assets</b>	4,341,079	4,542,844	4,798,608
<b>Residential structures</b>	1,746,076	1,830,149	1,940,622
<b>Non-residential structures</b>	1,363,751	1,450,086	1,547,386
<b>Machinery and equipment</b>	311,650	306,210	318,904
<b>Consumer durable goods</b>	489,082	503,721	519,597
<b>Inventories</b>	232,458	248,493	260,014
<b>Non-produced non-financial assets</b>	2,959,840	3,366,031	3,190,400
<b>Land</b>	2,016,993	2,166,234	2,333,898
<b>Timber</b>	126,552	120,035	102,454
<b>Subsoil resource stocks</b>	816,295	1,079,762	754,048
<b>Selected energy resources</b> <sup>1</sup>	580,180	753,024	529,671
<b>Selected mineral resources</b> <sup>2</sup>	236,115	326,738	224,377

# SNA framework



# SEEA framework

	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	Final demand	Gross fixed capital formation		
	Environmental protection expenditures	Environmental protection expenditures	Capital expenditures for environmental protection		
	Resource production by industries	Resource production by households/gov't			
	Resource use by industries	Resource use by households/gov't			
Wastes	Waste consumption by industries	Waste consumption by households/gov't			
	Waste output by industries	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



# Asset Accounting

	Industries	Final demand
Sectors		
Commodities	<div>Industrial output of goods and services</div> <div>Industrial intermediate demand</div> <div>Environmental protection expenditures</div> <div>Resource production by industries</div> <div>Resource use by industries</div>	<div>Final demand</div> <div>Environmental protection expenditures</div> <div>Resource production by households/gov't</div> <div>Resource use by households/gov't</div>
Wastes	<div>Waste consumption by industries</div> <div>Waste output by industries</div>	<div>Waste consumption by households/gov't</div> <div>Waste output by households/gov't</div>
Sectors		

Assets		
Financial and produced assets, opening balance	Natural resource assets, opening balance	Natural resource assets, opening balance
Gross fixed capital formation	Capital expenditures for environmental protection	
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

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

**Table 5.5.3 Physical asset account for mineral and energy resources (physical units\*)**

	Type of mineral and energy resource (Class A: Commercially recoverable resources)				
	Oil resources (‘000 barrels)	Natural gas resources (m3)	Coal & peat resources (‘000 tonnes)	Non-metallic minerals (tonnes)	Metallic minerals (‘000 tonnes)
<b>Opening stock of mineral and energy resources</b>	800	1 200	600	150	60
<b>Additions to stock</b>					
Discoveries					20
Upwards 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					
Downwards reappraisals			60		
Reclassifications					
<i>Total reductions in stock</i>	40	50	120	10	4
<b>Closing stock of mineral and energy resources</b>	760	1 350	480	180	76

\* Different physical units (e.g. tonnes, cubic metres, barrels) will be used for different types of resources.

# 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**

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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	

# Accounting structure

- Question: what factors could lead to the large jump in stocks in 2006?

# 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 153-0121** <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
<b>Reconciliation account opening stock</b> <sup>a</sup>	191,145.4	476,744.1	182,194.4	336,498.2
<b>Reconciliation account additions</b> <sup>a</sup>	97,122.8	103.7	611.1	3,244.6
<b>Reconciliation account depletion</b> <sup>a</sup>	8,426.2	3,733.8	7,618.1	10,571.1
<b>Reconciliation account revaluation</b> <sup>a</sup>	196,902.1	-290,919.7	161,310.8	95,764.8
<b>Reconciliation account closing stock</b> <sup>a</sup>	476,744.1	182,194.4	336,498.2	424,936.5



# Accounting structure

- **Question: what factors could lead to the large revaluation in 2009?**

# Accounting structure

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

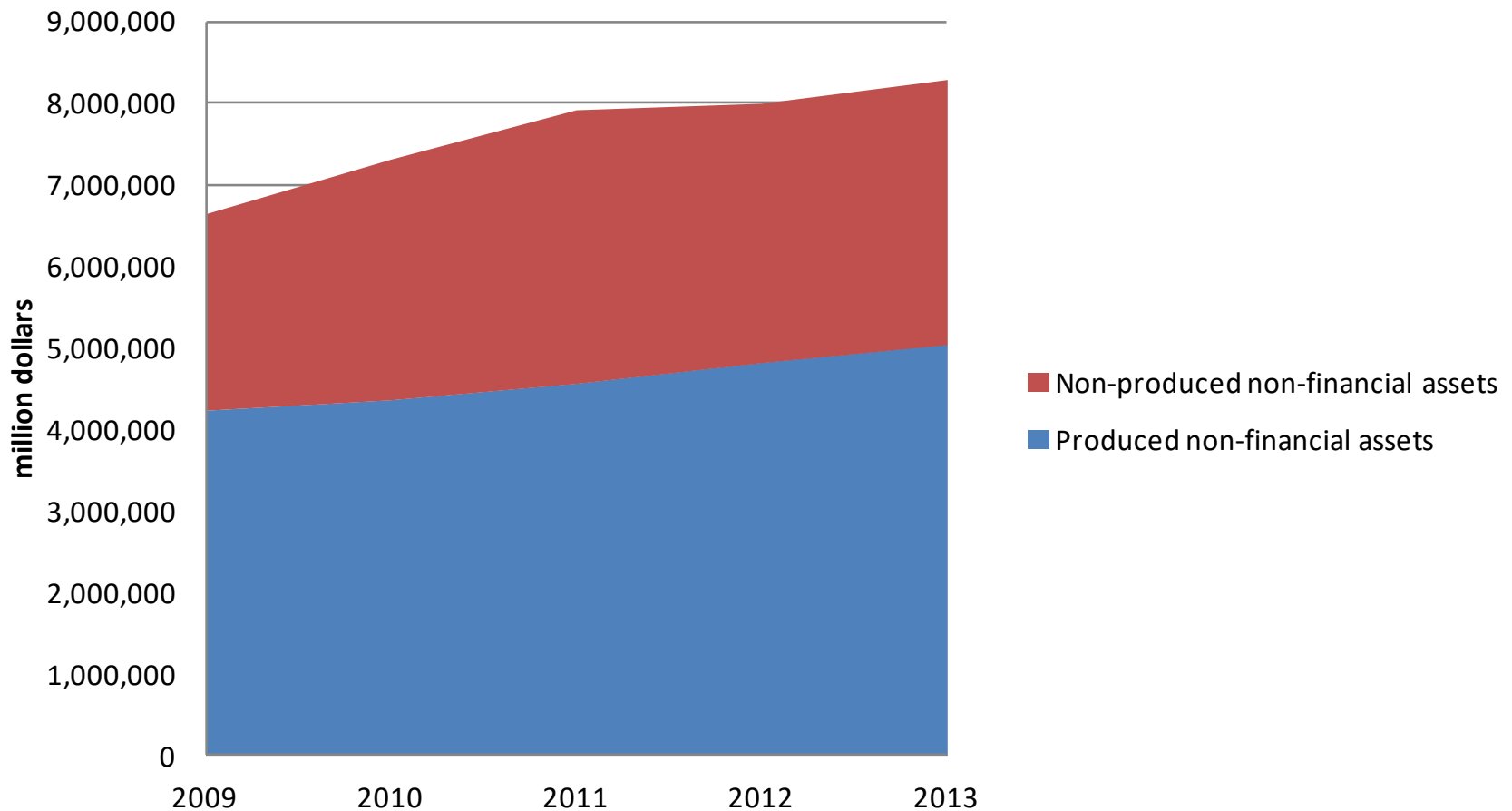


# Links to the SNA

- 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

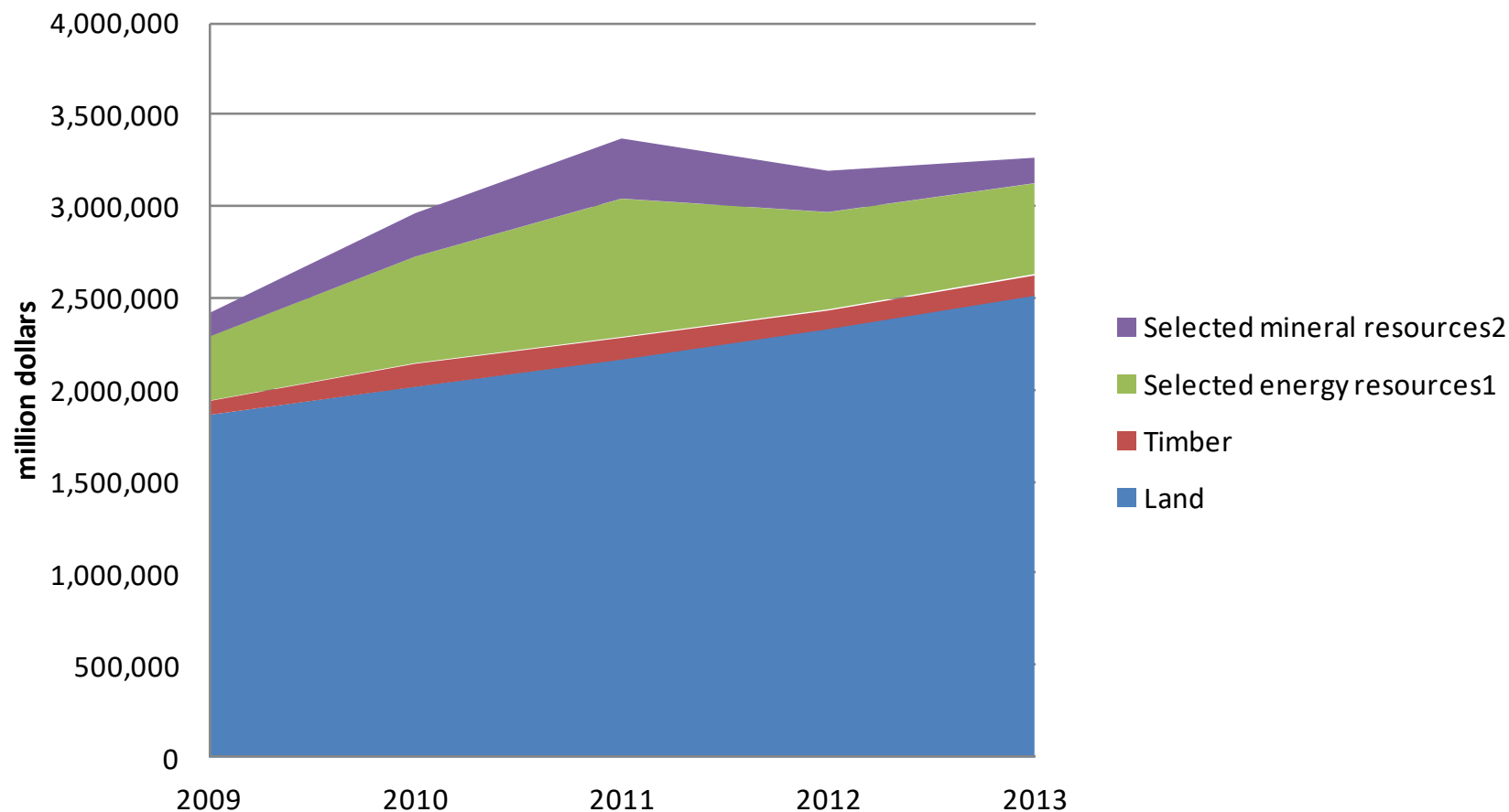
# Natural resource assets in context

## Non-financial assets



# Natural resource assets in context

## Non-produced non-financial assets



# Accounting structure

- Is wealth really going up like this all the time?

# 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?

# Accounting structure

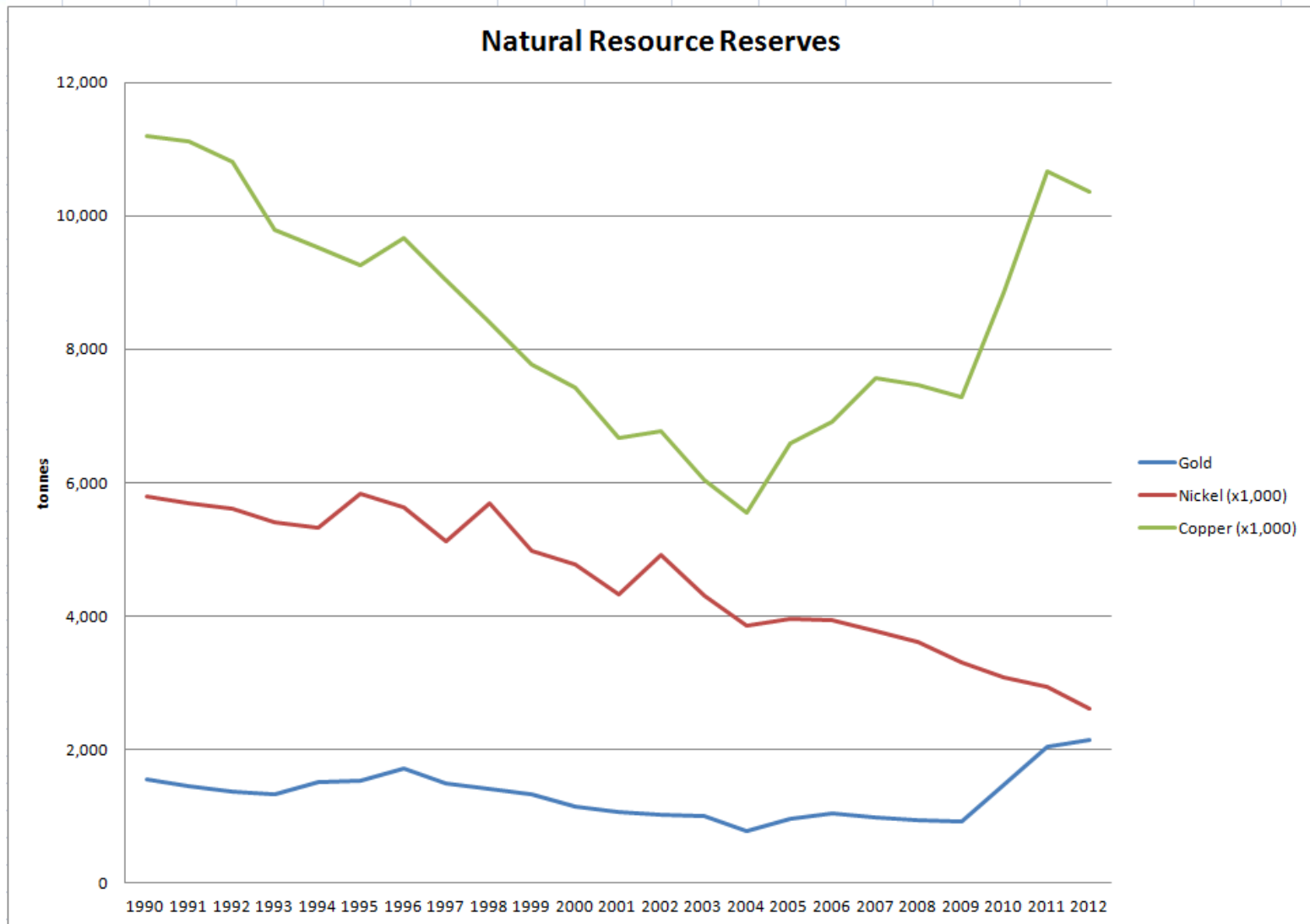
- Why value assets in current prices?
  - The assumptions on resource rent, stocks, extraction, etc. are all based on current prices.



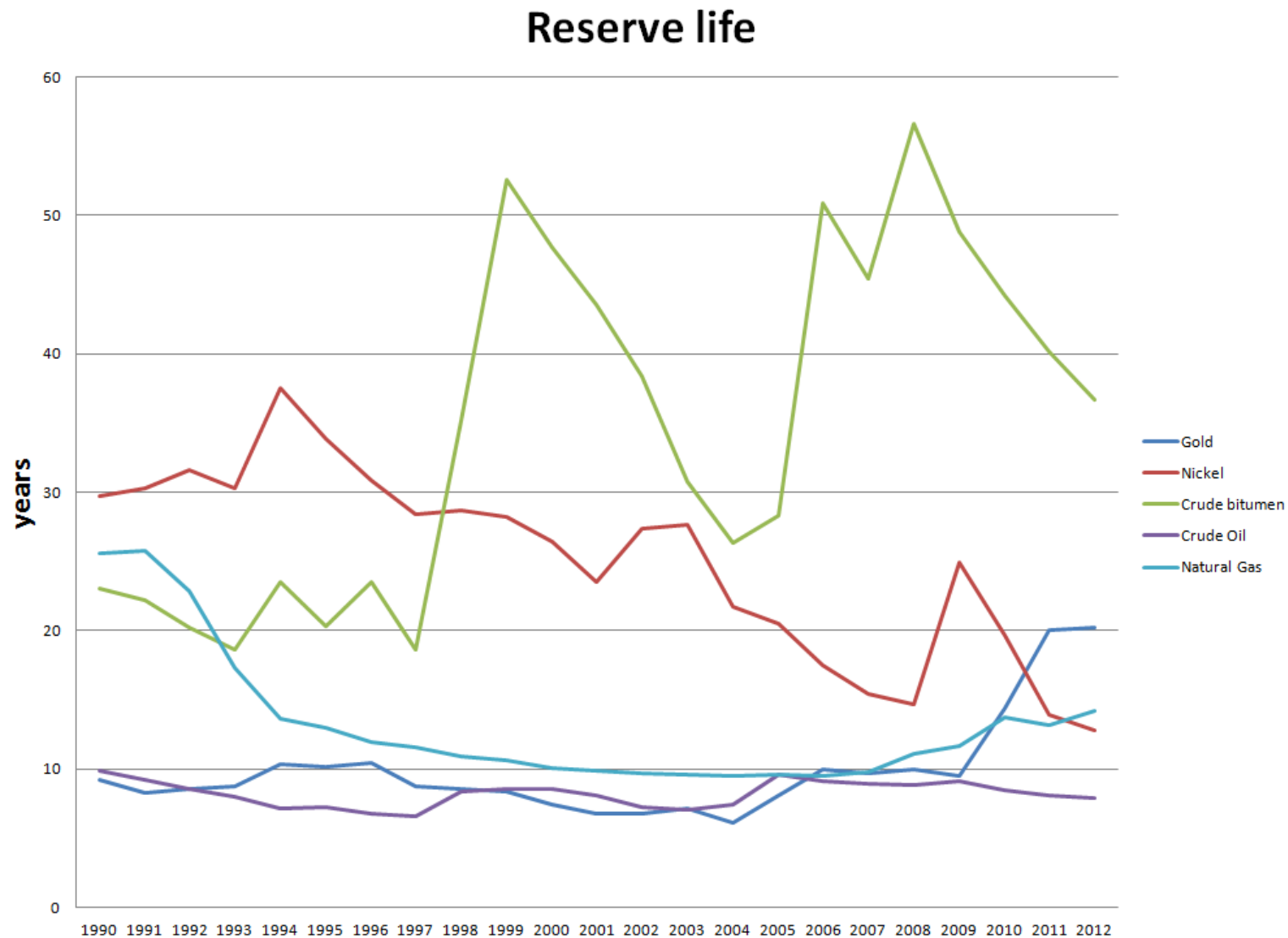
# Natural Resource Stock Accounts: Applications

- 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 assets



# Reserve life for selected resources, 1990 to 2012 (Closing stock)/(extraction)





# Physical stocks of selected minerals

- How can we have 10 years of crude oil for the last 17 years?

# 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”

# 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

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

*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*

# Valuation – Estimate the stock

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
Crude Bitumen - 211114																
Reserves after active development															4.00% = Discount rate	
Physical accounts																
Year	Total revenues	Total production costs	Depreciation	Net capital stock	Rate of return	Return to capital	Total extraction costs	Resource cost	Opening Stock	Additions / Revisions	Depletion / Quantity of production	Closing Stock	Reserve life	Discount factor	Net Present Value	
	\$ '000	\$ '000	\$ '000	\$ '000		\$ '000	\$ '000	\$ '000	'000 m³	'000 m³	'000 m³	'000 m³	Years	%	\$'000 000	
	CAPP¹	CAPP²	CANSIM 031-0002³		Rate of return folder	(E*F)	(C+D+G)	(B-H)	(Mt-1)	(M-J+L)	AER ST98⁴	AER ST98⁴	(M/L)	(PV(N\$2,N##,-1/N##))	(I*N*O)/1000	
1	10,000.00	4,000.00	100.00	10,000.00	0.02	200.00	4,300.00	5,700.00	..	100,000	1,000	99,900	99.90	0.25	139.67	

# Valuation – Estimate the rent

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
Crude Bitumen - 211114																
										Reserves under active development			4.00% = Discount rate			
GEOMETRIC										Physical accounts						
Year	Total revenues	Total production costs	Depreciation	Net capital stock	Rate of return	Return to capital	Total extraction costs	Resource rent	Opening Stock	Additions / Revisions	Depletion / Quantity of production	Closing Stock	Reserve life	Discount factor	Net Present Value	
	\$ '000	\$ '000	\$ '000	\$ '000		\$ '000	\$ '000	\$ '000	'000 m³	'000 m³	'000 m³	'000 m³	years	%	\$'000 000	
	CAPP¹	CAPP²	CANSIM 031-0002³		Rate of return folder		(E*F)	(C+D+G)	(B-H)	(Mt-1)	(M-J+L)	AER ST98⁴	AER ST98⁴	(M/L)	(PV(NS2,N##,-1/N##))	(I*N*O)/1000
1 10,000	4,000.00	100.00	10,000.00	0.02	200.00	4,300.00	5,800.00	..	100,000	1,000	99,900	99.90	0.25	139.67		

GEOMETRIC								
Year	Total revenues	Total production costs	Depreciation	Net capital stock	Rate of return	Return to capital	Total extraction costs	Resource rent
	\$ '000	\$ '000	\$ '000	\$ '000		\$ '000	\$ '000	\$ '000
	CAPP¹	CAPP²	CANSIM 031-0002³		Rate of return tab	(E*F)	(C+D+G)	(B-H)
sample	10000	1000	100	10000	1.00%	100	1200	8800

$$RR_t = TR - C - (r_c K + \delta) \quad \text{where:}$$

$RR$  = 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

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
Crude Bitumen - 211114																
Reserves under active development															4.0% = Discount rate	
Physical accounts																
Year	Total revenues	Total production costs	GEOMETRIC		Rate of return	Return to capital	Total extraction costs	Resource rent	Opening Stock	Additions / Revisions	Depletion / Quantity of production	Closing Stock	Reserve life	Discount factor	Net Present Value	
	Depreciation	Net capital stock														
	\$ '000	\$ '000	\$ '000	\$ '000		\$ '000	\$ '000	\$ '000	'000 m³	'000 m³	'000 m³	'000 m³	years	%	\$'000 000	
	CAPP¹	CAPP²	CANSIM 031-0002³		Rate of return folder	(E*F)	(C+D+G)	(B-H)	(Mt-1)	(M-J+L)	AER ST98⁴	AER ST98⁴	(M/L)	(PV(NS2,N##,-1/N##))	(I*N*O)/1000	
1	10,000.00	4,000.00	100.00	10,000.00	0.02	200.00	4,300.00	5,700.00	..	100,000	1,000	99,900	99.90	0.25	139.67	

# 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*



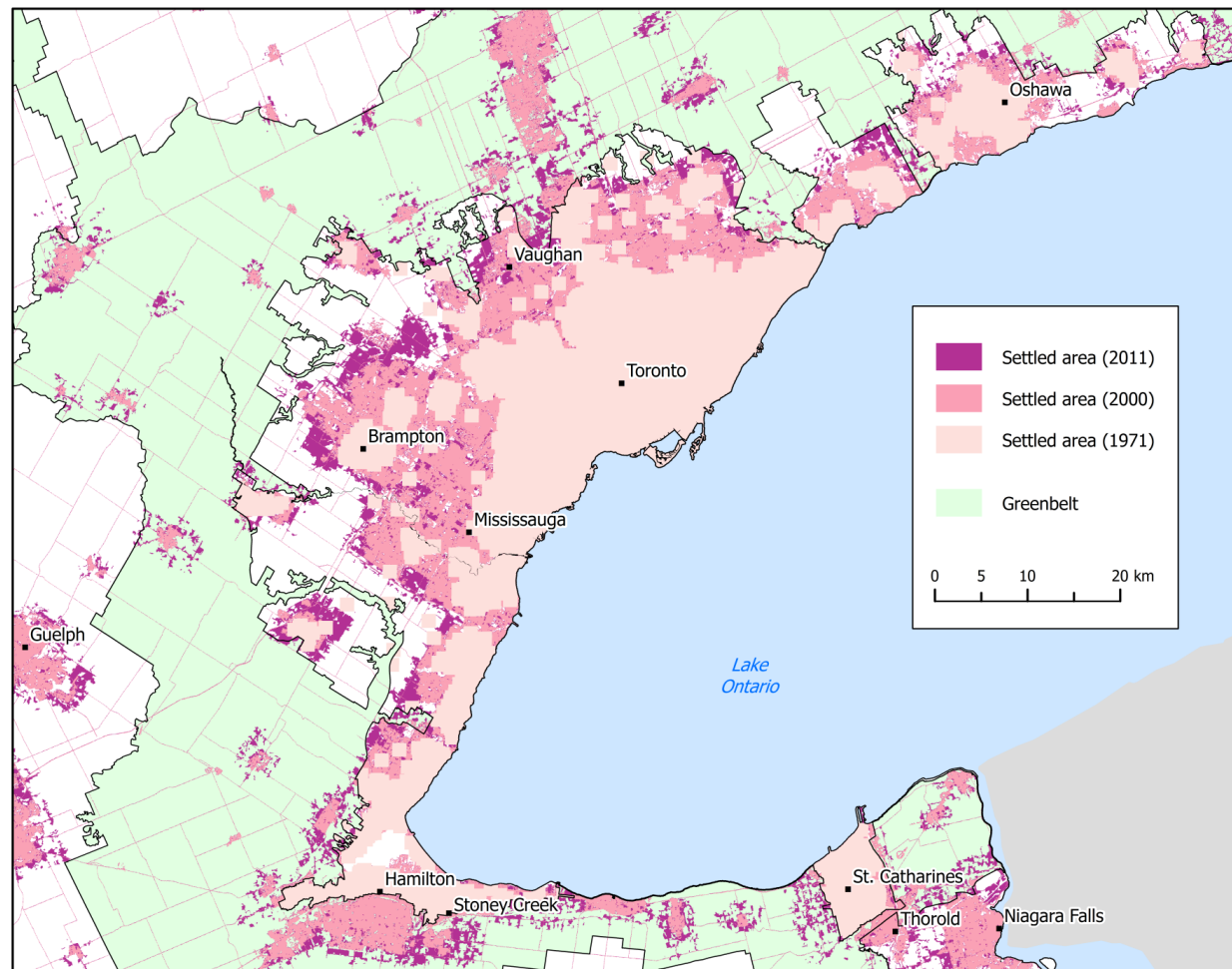
# Data sources: Physical data

- 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

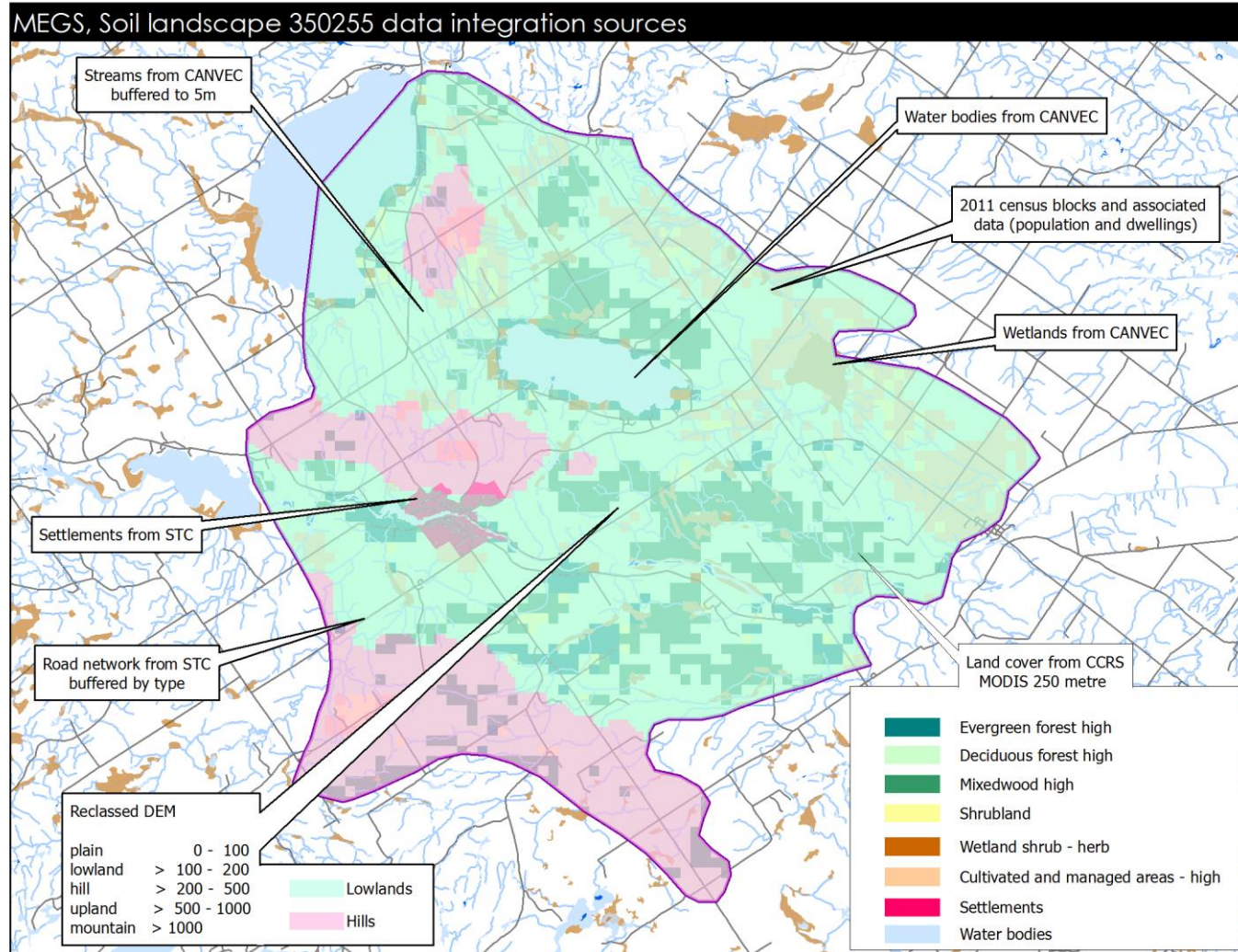


**Note(s):** The settled area boundary inside the greenbelt is derived from a special tabulation of data from the 1971 Census of Population. The greenbelt boundary is defined by the Government of Ontario's *Greenbelt Act, 2005*.

**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*, [http://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.



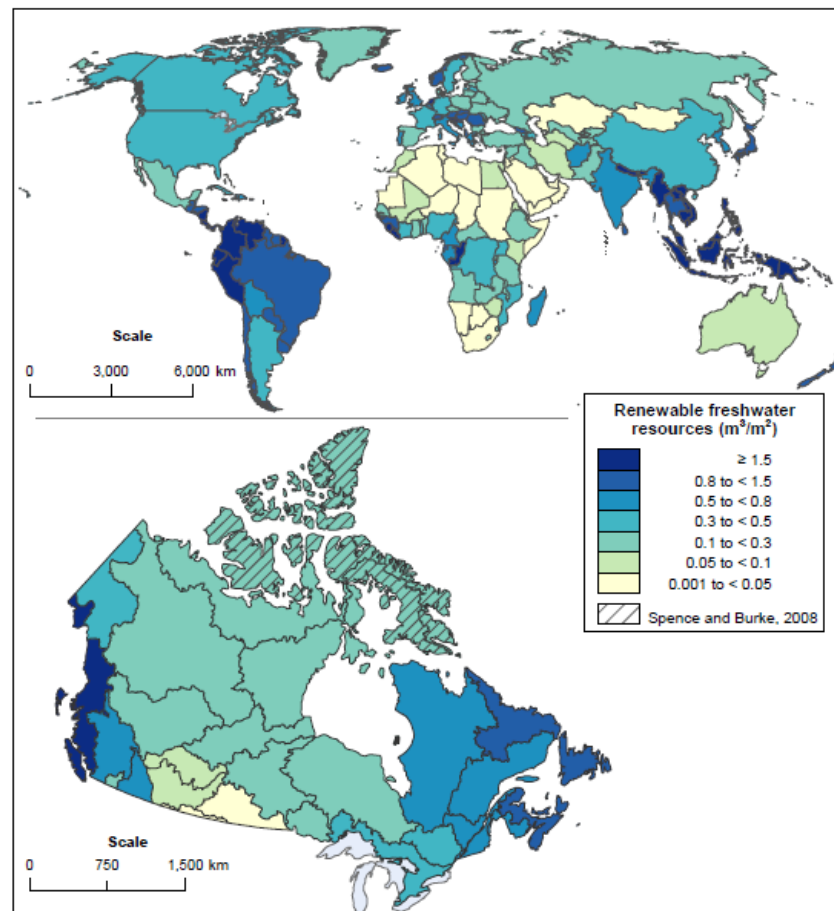
# Land characteristics



# 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/H2O/index\\_e.cfm?cname=main\\_e.cfm](http://www.wsc.ec.gc.ca/hydat/H2O/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??

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