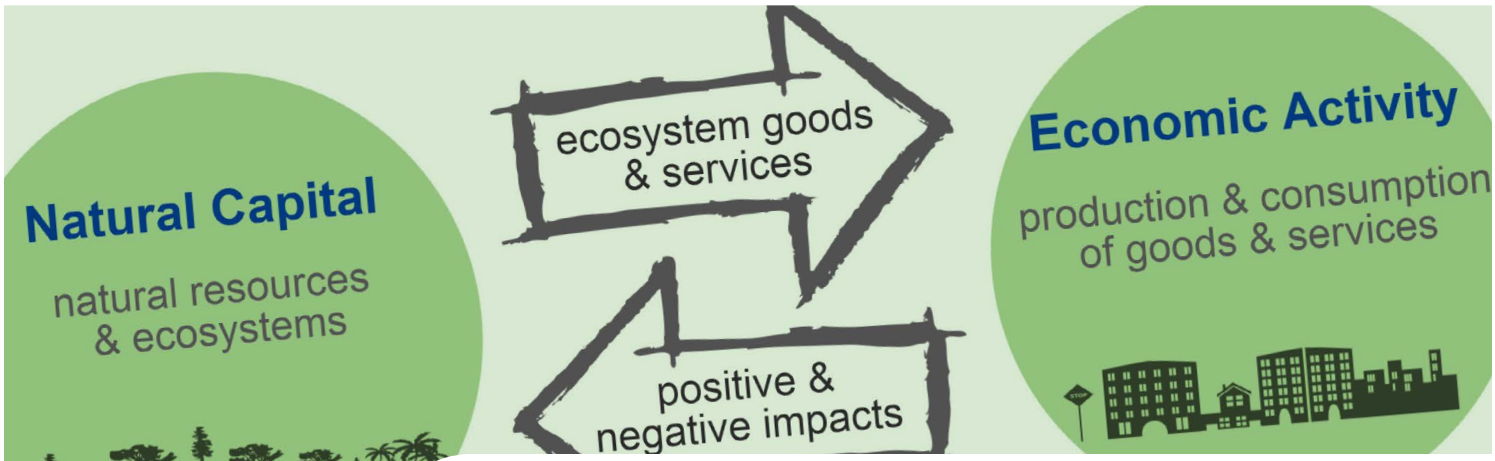
Sustainable Prosperity

Policy Brief March 2014

ENVIRONMENTAL MARKETS



The Importance of Natural Capital to Canada's Economy

Key Messages

- Canadians enjoy immense wealth from our natural environment. We extract goods from the environment in the form of renewable and non-renewable resources (such as metal ores and timber), and benefit from the ecosystem services the environment provides (such as the filtering of air by trees and the absorption of flood waters by plains and wetlands).
- Like our labour force, machinery, financial resources and knowledge, our natural environment is an asset. **Natural capital** comprises nature's assets that produce value -- and like all assets, we must understand, measure and manage our natural capital in order to use it optimally.
- Traditional economic indicators and measures (such as gross domestic product, balance sheet accounting, and productivity indicators) have not fully measured natural capital. We are not measuring how much natural capital we have, at what rate we are using it, or how it is being devalued by pollution, environmental degradation and unsustainable resource extraction.
- Without valuing natural capital and including it in our national accounts, we are making decisions without full information -- and we risk making poor decisions. Unvalued natural capital and uncosted environmental degradation can lead us to economic activity that will degrade our economy's natural capital and put at risk its ability to generate goods, services and income into the future.
- Efforts are underway to develop frameworks for including the value of natural capital in our national accounts. Measuring the value of our natural capital helps us to see where we are not using our resources optimally and allows informed decision-making about our economic activity.
- Canada's economy relies on natural capital. Using our resources more efficiently, and increasing their productivity, is crucial to Canada's sustainable economic growth.

Sustainable Prosperity is a national research and policy network, based at the University of Ottawa. SP focuses on market-based approaches to build a stronger, greener, more competitive economy. It brings together business, policy and academic leaders to help innovative ideas inform policy development.

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The Issue

As Canadians, we are fortunate to have a large and diverse geography and natural environment. Canadians benefit from the environment in terms of personal enjoyment and leisure, spiritual value and community connections, extraction of natural resources, and provision of key *ecosystem services* such as air purification by forests, pollination of crops by bees and flood control by plains and wetlands.

What we often fail to recognize is the inter-relationship between the environment and the economy. The state of the economy and the health of the environment are so tightly linked that almost any change in one has the potential to impact the other – in essence, they are an inseparable system. In economic theory, the economy and the environment are sometimes referred to as "mutually-determined" because it is not possible to separate the health of the economy and the health of the environment.

FORMS OF CAPITAL

Produced capital: machinery, buildings, telecommunications and other types of infrastructrue

Financial capital: stocks, bonds and currency deposits

Human capital: educated and healthy workforce

Social capital: functioning social networks and institutions

Natural capital: land, mineral and energy resources, water resources, cultivated plants and animals, biotic ecosystems

One way in which this environment-economy system is seen is through the concept of **natural capital.** The term capital refers to the stock of assets that a business -- or country -- has on hand and which it uses to produce income. Traditionally, capital is broken down into sub-categories: produced capital, financial capital, human capital and social capital. Natural capital can also be seen as such a sub-category in recognition of the fact that natural resources and ecosystems contribute significantly to income generation and national wealth. As the United Nations Environment Program (UNEP) explains it, "much as an investor will use financial capital to generate profits, a stock of forest or fish will provide a future flow of timber or food, which if used sustainably will provide long-term benefits to people."[1]

These natural assets are provided by our natural environment, and used in our economic activity, and yet how we use them affects the natural environment and its ability to continue to provide value. Degrading our natural capital puts in jeopardy the contribution it makes – both as an input into economic activity but also in the various services it provides – and so puts our economic health at risk. In essence, the feedback loops between the environment and the economy are numerous and complex. Understanding the importance of natural captial to Canadians is critical to ensuring our economic and environmental well-being.

1 United Nations Environment Programme 2012 Natural Capital Declaration (Signed at Rio +20 Event) http://www.naturalcapitaldeclaration.org/the-declaration/

While it is inherently understood that natural assets are important to the functioning of economies and to humans' standards of living, unless natural assets are explicitly bought and sold, their value is generally not accounted for within traditional measures of wealth, such as gross domestic product (GDP) or income. Measures of income and GDP growth do not account for degradation of natural ecosystems due to economic activity, and balance sheets largely do not account for changes in natural capital assets such as declines in mineral stocks, declines in regional fish stocks or loss of arable land. And some ecosystem services, like a stable climate, erosion control and air purification are not valued at all. Factors that threaten our natural capital, such as climate risk and degradation of environmental quality, are not considered.

This *Policy Brief* explores the concepts of natural capital, the critical role of natural capital in Canada's economy, and current developments in natural capital measurement. It also considers the potential role for policy to focus on increasing the productivity of our natural capital. In doing so, it builds the case for inclusion of natural capital valuation in private and public decision-making.

> Neither ecosystem services, nor the stock of natural capital that provides them, are adequately valued compared to social and financial capital. Despite being fundamental to our wellbeing, their daily use remains almost undetected within our economic system. Using natural capital this way is not sustainable. The private sector, governments, all of us, must increasingly understand and account for our use of natural capital and recognize the true cost of economic growth and sustaining human wellbeing today and into the future."
>
> 2012 United Nations Environment Programme
> *Natural Capital Declaration*

The Knowledge Base

Definition of Natural Capital

Financial, produced, human and natural capital represent the building blocks of economic activity.[2] Investments in capital - be it land, advanced equipment, technology, employee skills, intellectual property, experience or other - allow economies to produce goods and services, and thus create income and wealth. However, we are increasingly recognizing that traditional measures of the capital stock in an economy tend to significantly underestimate the full asset base and wealth potential of an economy because they often undervalue – or completely ignore – the contribution of natural capital.

2 Note that social capital, as defined in The Issue section of this policy brief is also a form of capital. Given that the recognition, valuation and use of the concept of social capital is also at a nascent stage, for simplicity it is not discussed in detail here.

In short, **natural capital is a region's stock of natural assets and ecosystems that provide flows of goods and services**. The natural assets include the soil, air, water, flora and fauna that make up our environment. We extract from this stock a flow of goods including the natural resources we traditionally think of – such as minerals and fossil fuels, arable land, timber, freshwater, solar, hydro and wind energy – and a flow of services that ecosystems provide -- such as the regulation of climate, erosion control, moderation of spread of disease, and water and air purification. The resources we extract from our natural capital are just a small fraction of our natural capital wealth.

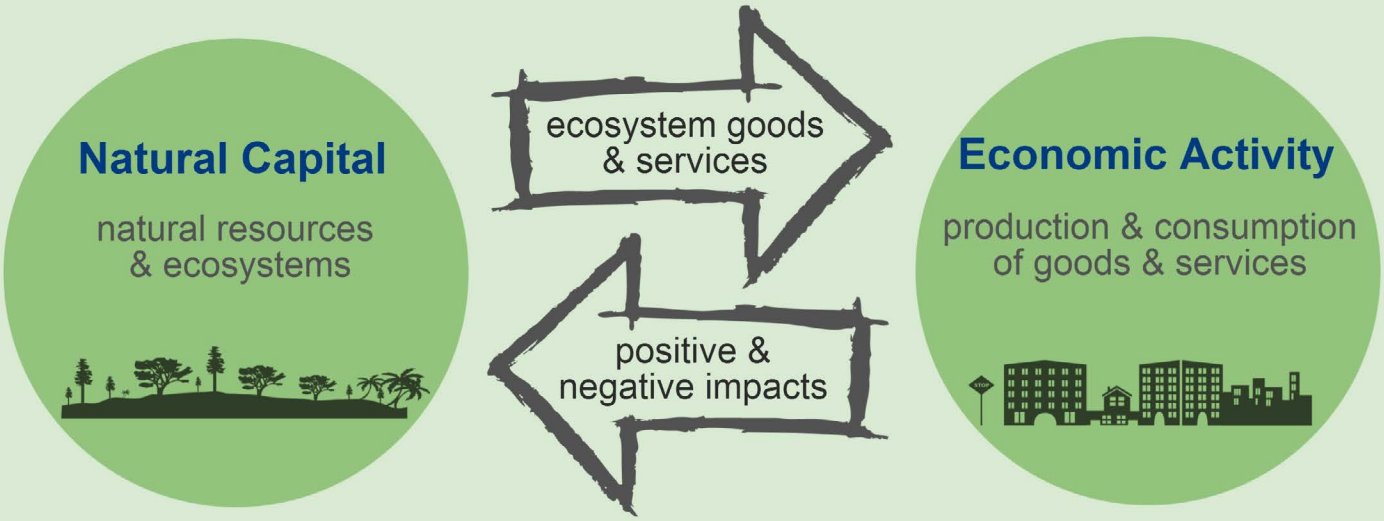
Natural capital is a complex concept because the value of our natural asset is in both our stock of natural capital, and the flow of goods and services it provides to us. The relationship between the two is complex and mutually dependent.

Consider the extraction of non-renewable resources. If we extract some mineral ore or oil, we gain value from using it or selling it. But as a result, we have depleted some of our capital stock. Further, the impacts of the extraction may have influenced nature's ability to provide ecosystem services, if, for example, we've disrupted wetlands or forests in the process of resource extraction. With renewable resources the picture is even more complex because changing the rate of resource extraction can lead to growth, depletion or a steady state for the stock.

Our scientific understanding of nature and all its ecosystem services is by no means complete, but there is an increased recognition that these systems are complex and inter-related - and that the unrestrained extraction of goods and services from nature can significantly affect nature's ability to provide those services in the same way in the future. Our use of non-renewable and renewable resources, and of ecosystem services, can impact the overall natural capital stock and its future value.

Why is Natural Capital Important?

Natural capital and economic activity are highly linked. . .



. . . if we extract too much from nature or cause environmental damage, we degrade our natural capital and put our economy at risk

"A company with positive cash flow can be running itself into the ground as its capital depreciates. Economies are no different.... "

Joseph Stiglitz, Nobel Laureate in Economics, 2006

The Economic Importance of Natural Capital

Without doubt, Canada's economy is inescapably linked to Canada's natural capital. Canada controls one of the largest primary resource bases in the world. Our asset base is ranked third in the world for forested area, renewable freshwater resources and oil reserves; we're ranked seventh for arable land.

Table 1: Resource Wealth, Top Ten Countries

Rank	Forested Area[1]	Renewable Freshwater Resources[2]	Arable Land[3]	Oil Reserves[4]
1	Russian Federation	Brazil	United States	Venezuela
2	Brazil	Russian Federation	India	Saudi Arabia
3	**Canada**	**Canada**	Russian Federation	**Canada**
4	United States	United States	China	Iran
5	China	China	Brazil	Iraq
6	Congo, Dem. Rep.	Colombia	Australia	Kuwait
7	Australia	Indonesia	**Canada**	United Arab Emirates
8	Indonesia	Peru	Argentina	Russian Federation
9	India	India	Nigeria	Libya
10	Peru	Myanmar	Ukraine	Nigeria

[1] World Bank World Development Indicators, 2011 http://wdi.worldbank.org/tables
[2] ibid
[3] ibid
[4] US Energy Information Administration http://www.eia.gov/countries/index.cfm?view=reserves

Canada's mining, metals, forestry and energy industries accounted for 15 percent of nominal GDP in 2011. When the indirect impacts of these sectors are included, they account for a further four percent of Canada's nominal GDP. In other words, directly and indirectly, these sectors represent approximately one-fifth of all the economic activity in Canada. There are 800,000 resource sector jobs in Canada – the number grows to 1.6 million when jobs that supply the natural resources sector in industries such as construction, manufacturing, financial services and engineering are included. That represents close to 10 percent of all the jobs in Canada.[3] These numbers would be larger still if they reflected other natural resources, such as fisheries and agriculture. Canada's natural capital however, is more than just minerals and trees to be harvested; it is also the clean water provided to communities, the climate and heat units to grow crops and the natural beauty and biodiversity that generate some $70 billion in tourism activity each year.[4] Proper management of Canada's

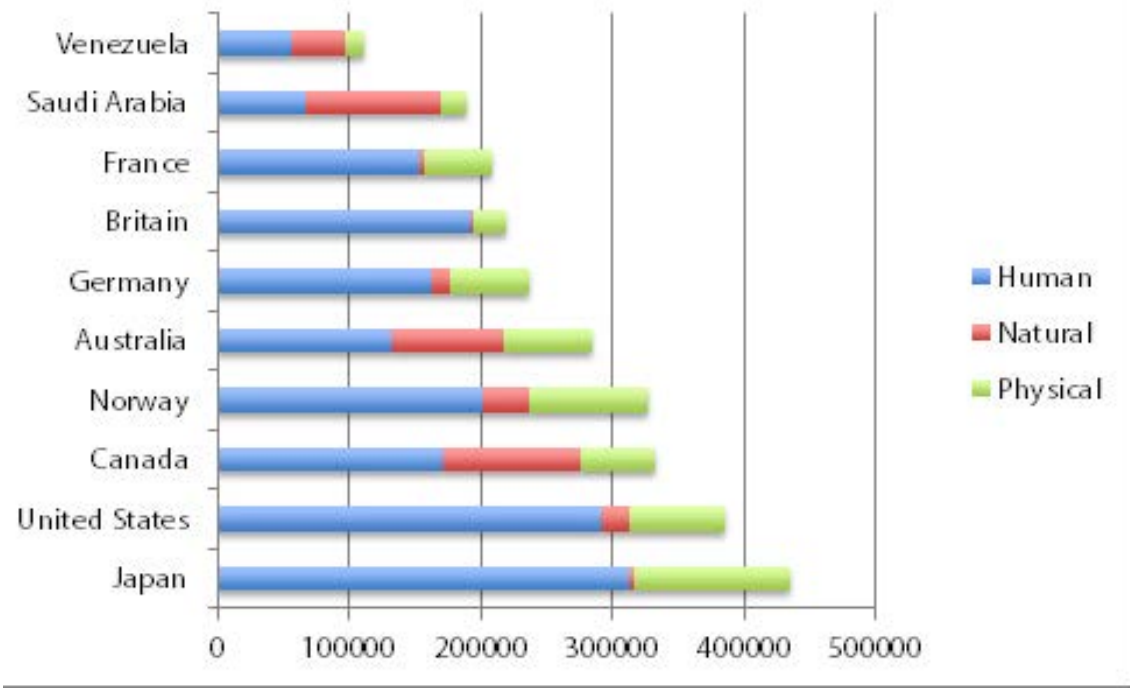
3 Remarks by the Honourable Joe Oliver, Minister of Natural Resources. September 4, 2012, https://www.nrcan.gc.ca/media-room/speeches/2012/3357.
4 Statistics Canada, January 9, 2014. National Tourism Indicators, http://www.statcan.gc.ca/daily-quotidien/140109/t140109b001-eng.htm.

natural capital, in all its forms, is fundamental to sustaining jobs and economic growth into the future.

Proper management of Canada's natural capital, in all its forms, is fundamental to sustaining jobs and economic growth into the future.

In 2012, a joint initiative of the United Nations University International Human Dimensions Programme on Global Environmental Change (UNU-IHDP) and the United Nations Environment Programme (UNEP) called *The Inclusive Wealth Report 2012*,[5] looked at developing a broader definition of wealth by including some measures of resource wealth into national indicators. Human and physical capital[6] are measured, as is natural capital. For this analysis, natural capital includes fossil fuels, minerals, forest resources, agricultural land, and fisheries, including known reserves/stocks and production. On a per capita basis, when traditional measures of capital were supplemented with this measure of natural capital, Canada had among the highest levels of total wealth, and among the highest proportion of wealth resulting from natural capital. Note that this definition of natural capital does not include values for ecosystem services or all components of natural capital; if it did, the natural capital values would be even greater.

Table 2: Inclusive Wealth Per Capita (in thousands of US dollars, 2008)



5 University of the United Nations-International Human Dimensions Programme and United Nations Environment Programme, 2012. Inclusive Wealth Report 2012: Measuring progress toward sustainability. Cambridge: Cambridge University Press, http://www.ihdp.unu.edu/article/iwr.

6 In this study, the term physical capital can be understood to be similar to produced capital.

Measuring Capital

The Current Approach to Measuring Wealth and Income

The first step to better understanding natural capital, and the risks it faces, is to measure its current contribution to wealth and wellbeing. Without inclusion of natural capital, traditional economic measures of wealth can be misleading.

A country could exhaust its mineral resources, cut down its forests, erode its soils, pollute its aquifers, and hunt its wildlife and fisheries to extinction, but measured income would not be affected as these assets disappeared.

Robert Repetto, US National Academy of Science, 1994

For instance, **income statements** of businesses and nations measure total revenue minus associated costs in order to demonstrate how much wealth has been generated over a given time period. For a country, gross domestic product (GDP) represents the market value of all goods and services produced by a country. GDP per capita is often considered as a key indicator of a country's standard of living.

Whereas GDP indicates how much income has been produced in a given time period, **balance sheets** are often used to help understand a business' or nation's ability to generate income into the future. Measuring the sum total of a business' or nation's capital assets – its land, its people, its knowledge and machinery – the balance sheet outlines the tangible and intangible building blocks from which goods and services flow. For a country, national accounts are a form of balance sheet.

However, these measures of income and wealth, as they are currently calculated, do not fully incorporate natural capital. Without inclusion of environmental damage or annual measures of degradation/depreciation of natural capital assets, income statements and GDP do not reflect the true value of economic activity. To do so, they would need to indicate the net benefit of economic activity by showing both the benefits and the costs. Currently, GDP only captures a small piece of natural capital -- the market value of the natural resources that are extracted and sold in the given time period. Similarly, Canada's national accounts do not capture the full stock of natural capital. Known reserves of key resources such as minerals, timber and oil and gas are included but this falls short of the value of natural capital and all its ecosystem services.

Without inclusion of natural capital in a nation's capital accounting - including how natural capital is depreciating as we extract resources or degrade ecosystems - a business or an economy will not understand the true breadth of the contribution of its assets to its production, and thus it will not truly understand the sustainability of its business or economy in the long-run.

Rationale for Expanding Measurement to Include Natural Capital

Increasingly, governments and businesses are noting the importance of expanding their measurement of capital to include natural capital. Some businesses are including the environmental costs of their production, including that of their supply chain.[7] National efforts are underway to value natural capital as well.

The broad objectives that define the rationale to measure and integrate natural capital in national accounts can be summarized as follows:

- Economic measures of income and GDP will reflect true cost accounting. Profit will be measured as revenue minus all associated costs including the costs of pollution and environmental damage. Economic decision making, profit and social benefit will thus reflect true marginal costs of production and begin to internalize environmental consequences and the costs of environmental mitigation;
- Business and national balance sheets will reflect all real assets contributing to the production of goods and services in the economy, including natural capital – land, renewable and non-renewable resources and ecosystems. Revised balance sheets will thus demonstrate whether a company or country is growing its income/GDP through depletion or sustainable use of its natural resources and ecosystems;
- Income and balance sheet statements can begin to reflect risks to all capital. In the private sector, risk assessments are performed and reported annually describing the potential risks to future income and balance sheet values – market price risks, demand shocks, political risks. By understanding the value of natural capital, businesses and nations will begin to understand and include the risks associated with mismanagement of natural capital and the consequential impacts on profit and value in the economy; and
- Productivity, the key measure of efficiency and progress, can reflect true net income including all costs to society, and natural capital productivity can be measured and benchmarked. If firms and national economies can improve productivity with respect to the use of natural capital (fuel efficiency of cars, increased solar energy capture, advanced manufacturing using fewer materials) costs can be saved, economic growth can be enhanced and natural ecosystems can be protected.

It is evident that if these four objectives were met, full economic and environmental information would be available to decision-makers, enabling sound policies and investments. However, the challenges in implementing the measurement of natural capital's value are significant.

7 For example, Puma has developed a method of accounting for the impacts of its operations and those of its supply-chain through an "environmental profit and loss" accounting. See http://about.puma.com/category/sustainability/epla/

Natural Capital Measurement Challenges

While many governments and institutions have made progress towards these objectives, significant measurement and methodological challenges exist. Whereas the measurement of more tangible assets of non-renewable and renewable resources such as timber, fish stocks and energy is relatively simple, the measurement of the ecosystem benefits of natural capital is more difficult.

Within the literature, significant work has been done defining the theory and practice of environmental valuations. Anderson et al. outlined five major challenges with respect to environmental valuations.[8]

- First the number of environmental services provided by ecosystems are diverse – water filtration, air filtration, habitat provision for biodiversity, recreational value, existence value, climate regulation, etc. Given the breadth of environmental good and services, it is difficult to measure them all.
- Second, society's preferences, hence the values placed on certain environmental goods and services, change over time. In the valuation of environmental goods and services, costs and benefits into the future are difficult to estimate as preferences through time can significantly change the present value of an asset.
- Third, market prices, when used, can be poor estimates of value because they often fail to account for ecosystem services. Sometimes other valuation methods, such as revealed preference, are used to create proxies for the environmental value derived from nature. However, even these values are not fully representative and do not integrate with the market values used in national accounts.
- Fourth, the goods and services provided by ecosystems are variable. Heat units, precipitation and other climatic factors are variable, continually changing the flow of goods and services from an ecosystem and thus changing its value.
- Lastly, the benefits generated by ecosystems are interactive. As ecosystem goods and services are interrelated in complex ways, calculating their value is not as simple as calculating the sum of their parts.[9]

Recognizing these challenges does not mean that efforts should not be made to undertake the valuation of natural capital. Rather, they underscore the importance of doing so if we are to properly understand the role that natural capital plays in our economy.

8 Anderson, A., Gomez, C., McCarney, G., Adamowicz, V., Chalifour, N., Weber, M., et al., 2010. Natural Capital: Using ecosystem service valuation and market-based instruments as tools for sustainable forest management, Sustainable Forest Management Network.

9 Anderson, A., Gomez, C., McCarney, G., Adamowicz, V., Chalifour, N., Weber, M., et al., 2010. Natural Capital: Using ecosystem service valuation and market-based instruments as tools for sustainable forest management, Sustainable Forest Management Network.

Natural Capital Measurement in Practice

International Efforts

Over the last decade, international awareness of the importance of natural capital has grown. In 2007 the European Commission and the German Ministry for the Environment initiated a global study of the concept of natural capital named The Economics of Ecosystems and Biodiversity (TEEB).[10] TEEB aims to highlight the economic value of biodiversity and the growing cost of biodiversity loss. TEEB draws together experts from science, economics and policy to develop ways to speed the action on biodiversity loss, including via natural capital accounting.

In 2010, the World Bank launched its Wealth Accounting and the Valuation of Ecosystem Services (WAVES) project, aimed at assisting five pilot countries (Botswana, Costa Rica, Colombia, Madagascar and the Philippines) to implement natural capital accounting.[11] Three more countries were added to the list recently (Rwanda, Indonesia and Guatemala), and WAVES plans to expand its work to additional countries in the coming year.

In 2011, the European Union (EU) presented its first framework for natural capital accounting and adopted regulations requiring its 27 member countries to report regularly on the status of various resources and environmental indicators.[12] And in 2012 at the Rio+20 United Nations (UN) Conference on Sustainable Development, 57 countries and the EU supported a document that called on governments, businesses and other international organizations to implement natural capital accounting into national accounting systems.[13]

The UN Statistical Commission oversees the process for maintaining and revising the System of Environmental-Economic Accounting (SEEA), which is an internationaly agreed statistical standard for evaluating environmental and natural capital measures. The SEEA framework is the first international statistical standard for environmental-economic accounting, and it was adopted as such in 2012. The SEEA includes standard concepts, definitions, classifications and accounting rules so that statistics produced from it are internationally comparable, and it follows a similar accounting structure as the System of National Accounts (SNA) model. Recent revisions to the SEEA have included new experimental frameworks for economic accounting of ecosystem values.[14] The SEEA framework is followed in most national statistical offices incorporating environmental accounting, and countries at the forefront include a number in the EU, Australia, Mexico and Canada. The intent of the SEEA is that it is a flexible framework in which countries can apply parts of the standard adapted to their own priorities and policy needs.

10 To learn more about TEEB, see http://www.teebweb.org/

11 To learn more about WAVES, see http://www.wavespartnership.org/natural-capital-accounting-0

12 European Environment Agency, 2011. An Experimental Framework for Ecosystem Capital Accounting in Europe,, http://ipbes.unepwcmc-004.vm.brightbox.net/system/assessment/75/references/files/209/original/An_experimental_framework_for_ecosystem_capital_accounting_in_Europe.PDF?1349950134

13 United Nations Rio+20 Conference on Sustainable Development., January 10, 2012. The Future We Want, http://www.uncsd2012.org/futurewewant.html

14 For additional information, see http://unstats.un.org/unsd/envaccounting/seea.asp

Table 3 shows how the SEEA is built upon, but different from, the SNA.

Table 3: Comparison of Statistical Frameworks

	System of National Accounts (SNA)	System of Environmental-Economic Accounting (SEEA)	
		Central Framework	Ecosystem Accounting
Recognition by the United Nations Statistical Commission	Statistical standard	Statistical standard (2012)	"important first step in the development of a statistical framework for ecosystem accounting" (2013)
Measurement boundaries	• Economic assets (including subset of environmental assets) • Economic transactions	• All environmental assets • Flows of natural inputs used in economic processes • Flows of residuals	• Ecosystem assets (environmental assets from a systems perspective) • Ecosystem services
Measurement Units	Monetary	Physical and monetary	Physical and monetary
Aggregated measures	Economic measures of production, consumption, etc. (e.g., GDP)	Environmental asset wealth, depletion of assets, resource efficiency indicators, etc.	Aggregated measures of ecosystem services and assets, measures of ecosystem degradation, economic measures adjusted for degradation

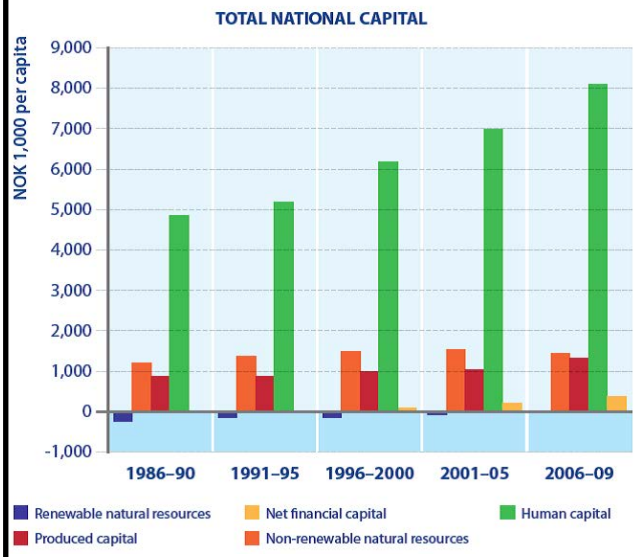
Source: © Gouvernement du Québec, Institut de la statistique du Québec, 2013.

Today a handful of countries including Norway, Australia, Japan, France (and Canada, as will be described below) are beginning to measure the value of land and some sub-soil mineral assets such as oil and minerals, and incorporate them in some fashion in their national accounts.[15] Norway has taken a unique approach to valuing capital, by including natural capital in its calculation of national capital. However, Norway has taken this beyond an accounting practice and has embedded the concept of natural capital in its policies, as noted below.

15 Piketty, T., & Zucman, G., 2013. Capital is Back: Wealth-Income Ratios in Rich Countries 1700-2010 Data Appendix, Paris School of Economics.

Case Study: Norway Measures and Values Natural Capital

Figure 1: Norway's Total National Capital (1986–2009)



Norway is one of the leading jurisdictions when it comes to using natural capital as a measure of economic sustainability. Norway measures its stock of human capital, produced capital, financial capital, and both renewable and non-renewable natural resource capital. Norway's goal in doing so is to ensure the preservation of its natural resource wealth for future generations and to ensure that non-renewable natural capital exploitation contributes to sustainable national wealth through conversion into other forms of capital. For that reason, a portion of the revenue from its natural resources is put into a Sovereign Wealth Fund. Norway's Sustainable Development Strategy requires that decreases in the country's natural capital (such as through the extraction of oil and gas) must be offset by increases in other forms of wealth. Statistics Norway estimates that human capital represents 73% of total national capital, while oil and gas reserves represent only 12%.[16] For more information, see Sustainable Prosperity's *Issue Summary: National Capital*. [17]

16 Organisation for Economic Co-operation and Development, 2011. Environmental Performance Reviews: Norway 2011 (highlights), http://www.oecd.org/env/country-reviews/47689079.pdf.

17 Sustainable Prosperity, 2012. Issue Summary: National Capital, http://www.sustainableprosperity.ca/article2651.

Canadian Initiatives

In Canada, civil society and national and provincial governments have taken several steps towards defining natural capital's value in Canada's economy. Some of the most significant initiatives are outlined below.

Local Studies

A number of studies have estimated values for local natural capital, particularly local ecosystem values:

- In 2007, Mark Anielski and Sara Wilson, together with the Canadian Boreal Initiative and the Pembina Institute, assessed the value of Canada's boreal forests (2006).[18] They estimated the

18 Anielski, M., & Wilson, S., 2006 . Counting Canada's Natural Capital: Assessing the Real Value of Canada's Boreal Ecosystems, Canadian Boreal Initiative and the Pembina Institute.

Anielski, M., & Wilson, S., 2007. The Real Wealth of the Mackenzie Region: Assessing the Natural Capital Values of the Northern Boreal Ecosystem, Canadian Boreal Initiative.

total non-market value of boreal ecosystem services in 2002 was $93.2 billion, equivalent to 8 percent of Canada's GDP. The main components of non-market ecosystem services were (1) flood control and water filtering by peatlands ($77.0 billion); (2) pest control services by birds in the boreal forests ($5.4 billion); (3) nature related recreational activities ($4.5 billion); (4) water filtering and biodiversity value by non-peatland wetlands ($3.4 billion); and (5) net carbon sequestration ($1.85 billion).

- In 2012, the David Suzuki Foundation estimated the economic value for British Columbia's Lower Mainland's water ecosystems and found that areas such as wetlands and coastal areas provide $30 to $60 billion in benefits every year, through benefits such as flood protection, assuring water supply, buffering climate instability, supporting fisheries and food production, maintaining critical habit, providing waste treatment, and more.[19] Also, in 2013 the David Suzuki Foundation considered the value of the greenbelt in the Greater Montreal area and calculated the value of services provided by the region's natural environment at more than $4 billion a year.[20]
- In 2012, a study found the total recreational value and non-use value of the 20 sub-watersheds in the Muskoka River Watershed and the northern portion of the Black River-Lake Simcoe Watershed to be approximately $4.3 billion.[21]
- In 2013, as part of the Measuring Ecosystem Goods and Services initiative lead by Statistics Canada (see below for more detail), a case study analysis of the Thousand Islands National Park found an estimated annual value of ecosystem services provided by the park to be between $12.5 million and $14.7 million, and recreational services provided by the park to be valued at $3.9 million annually.[22]

Provincial Initiatives

At the provincial level, Nova Scotia and Québec have taken leadership. In early 2010, the Nova Scotia Department of Economic and Rural Development drafted an initial proposal to develop natural capital indicators, including natural capital productivity.[23] L'Institut de la Statistique du Québec also published a study in 2010 looking into the concept and measurement of natural capital.[24] In 2011, it began creating land accounts for Southern Québec following the SEEA approach, with a view to eventually developing ecosystem

19 David Suzuki Foundation and Earth Economics, 2012. Valuing the Aquatic Benefits of British Columbia's Lower Mainland: Nearshore Natural Capital Valuation, http://www.davidsuzuki.org/publications/downloads/2012/DSF_aquatic_lower%20mainland_med_res_for_website.pdf.

20 David Suzuki Foundation, http://mobile.davidsuzuki.org/publications/finding-solutions/2013/fall/montreal-greenbelt-offers-natural-value/.

21 Austin, D., Cerman, G., Heywood, T., Marshall, R., Refling, K., Van Patter, L., 2012. Valuing Natural Capital and Ecosystem Services, University of Guelph, http://www.muskokawatershed.org/wp-content/uploads/2012/11/EcosystemServices1.pdf.

22 Statistics Canada, 2013. Human Activity and the Environment: Measuring Ecosystem Goods and Services in Canada, http://www.statcan.gc.ca/pub/16-201-x/16-201-x2013000-eng.htm.

23 Nova Scotia Department of Economic and Rural Development. (2010). Development of Environmental Goals and Sustainable Prosperity Measures for Nova Scotia.Nova Scotia Department of Economic and Rural Development.

24 Uhde, S., Marchand, G., Brehain, S. and R. Barbeau, 2010. Les comptes de l'environnement et l'approche par capitaux pour appuyer la mesure du developpement durable au Quebec. Gouvernement du Quebec, Institut de la statistique du Quebec.

accounts. The government of Québec has chosen the Joint UNECE/Eurostat/OECD Working Group on Statistics on Sustainable Development's "Capital Approach" for measuring sustainable development[25] and publishes indicators on the human, social, produced, financial and natural capital.[26] Québec's current measures of natural capital include water and air quality, land protection, the state of forest ecosystems and trends in climate.

Federal Initiatives

At the national level, Environment Canada and Statistics Canada embarked on the valuation of some elements of natural capital as early as 1999, establishing a working group examining the value of Canada's water resources in all of their uses. The project, named "Monitoring the Value of Natural Capital: Water," aimed to develop a comprehensive valuation framework for Canada's natural capital encompassing both market and non-market valuation, and to eventually integrate the value of natural assets within Canada's system of national economic accounts.[27]

In 2002, Environment Canada made a proposal to develop measures of environmental goods and services and integrate these values into Canada's national accounts including:

- *"Reorganizing the SNA (System of National Accounts) framework to include the addition of certain natural capital to the balance sheet component of the national accounts. Suggested broad components of natural capital include: land, sub-soil resources (e.g., minerals, oil), non-cultivated biological resources (e.g., timber, wildlife) and water….*
- *Developing material flow or material mass-balance components or modules to add to the national accounts with these material flows measured in physical units (e.g. water intake, discharge);* and,
- *Calculating an environmentally adjusted measure of net domestic product which accounts for resource depletion and environmental degradation."*[28]

And in 2011, Statistics Canada launched its prototype Measuring Ecosystem Goods and Services (MEGS) Project. The project aims to develop and consolidate Canada's statistical data and knowledge and link it with the international community of ecosystem accounting by following closely the SEEA framework and refining it to the Canadian context. The MEGS project report, produced in 2013, noted success in the development of national ecosystem accounts including the development of:

25 United Nations Economic Commission for Europe, 2009. Measuring Sustainable Development, United Nations, http://www.unece.org/fileadmin/DAM/stats/publications/Measuring_sustainable_development.pdf.

26 Institut de la statistique du Québec and Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs du Québec, 2014. Recueil des indicateurs de développement durable, http://www.stat.gouv.qc.ca/statistiques/developpement-durable/indicateurs/recueil-indicateurs-dd.html.

27 Pinfold, G., Renzetti, S., Cairns, R., & Grafton, Q., 2002. Monitoring the value of natural capital: water. Environment Canada, http://environment.alberta.ca/documents/Valuation_of_Natural_Capital_Water.pdf.

28 Gardner Pinfold Consulting Economists Ltd., Renzetti, S., Cairns, R., & Grafton, Q., 2002. Monitoring the Value of Natural Capital: Water, Final Report, Environment Canada and Statistics Canada.

- National-level land cover maps;
- Experimental national indicators of ecosystem quality;
- National wetlands indicators; and
- Case studies on protected areas and coastal zones.

With MEGS, Statistics Canada demonstrated some of the practical applications of ecosystem valuation principles and helped evaluate the extent, quality and value of Canada's natural capital.[29]

How these international and Canadian initiatives will proceed remains to be seen, but the level of interest in natural capital valuation appears to be growing, not receding, and new projects are announced on a regular basis.[30]

Threats Facing Natural Capital

While natural capital contributes to Canada's wealth and Canadians' wellbeing, natural capital also faces threats from over-consumption and degradation. The unrestrained extraction of goods and services from nature can significantly affect nature's ability to provide those services in the same way in the future. Our use of non-renewable and renewable resources, and of ecosystem services can impact both the overall stock of natural capital stock and the flow of resources and services it provides to our society.

The key point here is that **understanding and addressing threats to natural capital is not simply a question of environmental sustainability - it is a matter of economic sustainability.**

This is not unique to Canada - the consumption and degradation of natural capital jeopardizes the sustainability of future economic growth throughout the globe. However, it is particularly important to resource dependent economies such as Canada.[31] Locally, poor understanding of the costs of resource consumption will lead to poor management of natural capital assets and development will place increasing pressures on ecosystems. And climate change, biodiversity loss and pollution of oceans are causing global impacts.

29 Statistics Canada, 2013, Human Activity and the Environment: Measuring Ecosystem Goods and Services in Canada, http://www.statcan.gc.ca/pub/16-201-x/16-201-x2013000-eng.htm.

30 See for example, the Natural Capital Project at www.naturalcapitalproject.org and The Natural Capital Hub at http://www.naturalcapitalhub.org/.

31 This is not unique to developed countries such as Canada; in 2008 the World Bank estimated that in developing countries natural capital represented upwards of 36% of the total wealth in low-income countries. The agricultural and resource-based economies of developing countries rely heavily on healthy ecosystems and resource management, and as such the inclusion of natural capital values is critical to informing better economic decision-making.

Over the last century the world's population has quadrupled, global economic output has expanded 20-fold and world demand for materials, biomass, fossil fuels and minerals has steadily increased. Today, global human activity is estimated to withdraw some 3.9 trillion litres of water[32] and deforest 13 million hectares of land each year.[33] From 1980 to 2009, global extraction of mineral and biotic material increased from 38 billion to 68 billion tonnes, and the trend is projected to continue.[34] Between 1970 and 2006[35] the UN estimates nearly a quarter of plant species were threatened with extinction and the abundance of vertebrate species fell by nearly a third.

Looking forward, the OECD's recently released Environmental Outlook to 2050 outlines the challenges of growth extending out over the long term. The study predicted significant growth in energy and water 'strain', and under their baseline scenario a continued global decline in biodiversity despite actions already taken to stem losses.[36] In the next 20 years McKinsey & Company[37] estimates that the world's middle-class could grow from 1.8 billion to 4.8 billion, adding an additional 1,850 cubic kilometers of water consumption per year, 140 million to 175 million hectares of deforestation and an additional 66 gigatonnes of carbon dioxide emissions.

These global trends are seen in Canada. One way in which to see this trajectory of resource use and the environment's ability to sustain that activity is via the concepts of ecological footprint[38] and biocapacity.[39] The Global Footprint Network calculates these concepts to show the trend of each.[40] What is important to note is that while Canada's ecological footprint is growing, Canada's biocapacity is in decline. If current trends continue, Canada's per capita ecological footprint will exceed its biocapacity. This will have important implications for our economy and society.

32 The World Bank, 2013. World Development Indicators: Freshwater, http://wdi.worldbank.org/table/3.5.

33 Food and Agriculture Organization, 2010. Global Forest Resources Assessment 2010, http://foris.fao.org/static/data/fra2010/KeyFindings-en.pdf.

34 Sustainable Europe Resource Institute, http://www.materialflows.net/home/

35 Secretariat of the Convention on Biological Diversity, 2010. Global Biodiversity Outlook 3, http://www.cbd.int/doc/publications/gbo/gbo3-final-en.pdf.

36 Organization for Economic Co-operation and Development, 2012. OECD Environmental Outlook to 2050, OECD Publishing. http://dx.doi.org/10.1787/9789264122246-en.

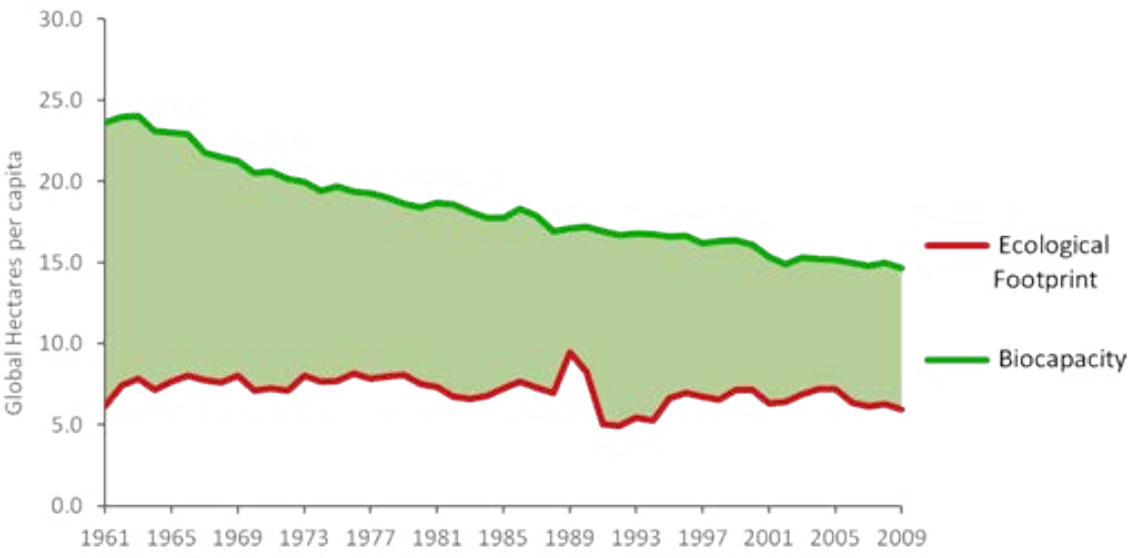
37 McKinsey Global Institute, 2011. Resource Revolution: Meeting the world's energy, materials, food and water needs, http://www.mckinsey.com/insights/energy_resources_materials/resource_revolution.

38 As defined by the Global Footprint Network, ecological footprint is a measure of how much area of biologically productive land and water an individual, population or activity requires to produce all the resources it consumes and to absorb the waste it generates, using prevailing technology and resource management practices.

39 As defined by the Global Footprint Network, biocapacity is the capacity of ecosystems to produce useful biological materials and to absorb waste materials generated by humans, using current management schemes and extraction technologies.

40 For more on how to interpret ecological footprint and biocapacity, see Sustainable Prosperity's 2012. White Paper: Towards a Green Economy for Canada, http://www.sustainableprosperity.ca/dl864&display.

Figure 2: Canada's Ecological Footprint and Biocapacity



The Conference Board of Canada has found that Canada consumes 1,131 cubic metres of water per capita per year, second only to the US in the developed world and double the average per capita water consumption of its 16 developed country peers.[41] On energy, Canada ranks last amongst developed countries with regards to energy intensity, consuming 0.25 tonnes of oil equivalents per $1000 in GDP.[42] Similarly, we are last among developed countries on waste production, producing 777 kg of municipal waste per capita, twice as much as the best performer, Japan.[43] In many cases, natural capital can replenish itself and ecosystems can continue to function well – though we do not always fully understand what its regenerative capacity may be.

While the use and consumption of natural capital have played a significant part in Canada's economic growth, these withdrawals have depleted mineral stocks, polluted rivers and land, and led to unprecedented declines in biodiversity -- which can have lasting impacts on our ecosystems and on the value of the remaining stock. For instance, extraction and consumption of fossil fuels leads to greenhouse gas emissions, which impact climate, causing increasing occurrences of extreme weather events, which in turn have negative economic impacts and further degrade nature. Degrading the stock puts the delivery of the flow of services at risk.

41 The Conference Board of Canada. How Canada Performs: A Report Card on Canada. http://www.conferenceboard.ca/hcp/details/environment/water-consumption.aspx

42 The Conference Board of Canada. How Canada Performs: A Report Card on Canada. http://www.conferenceboard.ca/hcp/details/environment/energy-intensity.aspx

43 The Conference Board of Canada. How Canada Performs: A Report Card on Canada. http://www.conferenceboard.ca/hcp/details/environment/municipal-waste-generation.aspx

Focusing on Productivity as Part of the Solution

One way to address the various pressures on our natural capital is to focus on the productivity of its use. **Productivity** is the measure of how efficiently a business or an economy uses inputs such as labour or natural capital to produce goods and services. Among economists, productivity is generally considered the single most important source of long-term economic growth and per capita income growth. For that reason, when different types of capital are discussed, their contribution to the economy is often considered through the lens of productivity. In short, countries that are innovative and invest in more effective use of their capital improve productivity, improve their economic output, and thus improve their standard of living.

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

For decades Canada's productivity growth has trailed much of the developed world. In particular, Canada has trailed the US, our largest trading partner and competitor, since the 1970s.[44] This record has deteriorated Canada's competitiveness and limited the incomes and standard of living of Canadians.

Natural Capital Productivity

There is significant, and growing, literature relating to the causes and solutions to Canada's productivity challenge.[45] But it is rare to see, in that literature, reference to Canada's natural capital productivity. That is a missed opportunity that should be addressed. As noted earlier, Canada is a natural capital-intensive nation, and Canada's current consumption patterns point to the fact that there is significant room for improvement with regards to our use of natural capital.

The most obvious downside to using natural capital inefficiently is that inefficient consumption of natural capital leads to waste and inefficient resource allocation. This is bad in the short-term, as financial returns are not as high as they could be and competitiveness suffers.

However, as we noted earlier, the more serious long-term impact of this unsustainable extraction of natural capital is the degradation of the stock of natural capital, and so too the flow of goods and services – including natural resources - it can provide in the future. This has long-term impacts: if we do not use our natural assets efficiently, we risk extracting them at a rate that is unsustainable, putting our current and future wealth and wellbeing at risk. And the more natural capital we use, the greater the pressures on a declining stock

44 Today, Canada's labour productivity (a key contributor to overall productivity) has fallen to 80 percent of US labour productivity, and the gap is widening. Conference Board of Canada, July 2013. Labour Productivity Growth. http://www.conferenceboard.ca/hcp/details/economy/measuring-productivity-canada.aspx

45 For a good overview of Canadian productivity issues, see TD Economics Special Report., June 3, 2010, The Productivity Puzzle: Why is the Canadian Record So Poor and What Can be Done About It?, http://www.td.com/document/PDF/economics/special/td-economics-special-ab0610-productivity.pdf, and Drummond, D., 2011. Confessions of a Serial Productivity Researcher, http://www.csls.ca/ipm/22/IPM-22-Drummond.pdf.

of natural capital to absorb the pollution and waste that we create through the use of that natural capital.[46]

From a risk-management perspective, the argument is clear that we should be using our natural capital as efficiently as possible. However, there is also an argument to be made for efficient use of natural capital that goes beyond simply avoiding declines in wealth. **The potential of natural capital productivity growth is the 'double dividend'- the win-win of cutting costs, thus improving profitability and productivity, while simultaneously reducing pressure on the environment.** For instance, in extracting lower levels of fossil fuels, we draw down the balance of our natural capital less, and we emit fewer greenhouse gas emissions, causing less pressure on the environment via climate change and land use change.

In measuring the value of natural capital, perhaps Canada can begin to understand how natural assets are used and how to improve production, reduce waste and ultimately reduce resource use in Canada's economy. Given Canada's economic reliance on natural capital, perhaps natural capital productivity can provide insight to understanding Canada's national productivity question.

Productivity, an Opportunity to Perform Better

Canada's current resource productivity levels present significant room for improvement. Canada remains one of the world's highest per capita producers of waste and air pollutants, and consumer of energy and water. Across the elements of natural capital that are measured, the country ranks low relative to developed nation peers in terms of our ability to transform resources into income for our population. However, with proper management and improvements in resource productivity, our current and future resource demand could be mitigated significantly.

Looking globally, McKinsey estimates successful implementation of resource productivity improvements could address nearly 80 percent of expected growth in energy demand, 60 percent of growth in water, and one-quarter of growth in the demand for steel. In total the value to society associated with these productivity improvements could sum to $2.9 trillion by 2030.[47] To achieve this savings, McKinsey estimates it will require over $1 trillion in incremental annual capital investment in 15 key initiatives.[48]

46 Finding an optimal rate of extraction is not a simple task -- and in the case of non-renewable resources, any extraction will lead to depletion – but failing to account for natural capital stock depreciation will not lead to fully-informed decisions about resource extraction rates.

47 McKinsey Global Institute, 2011. Resource Revolution: Meeting the world's energy, materials, food and water needs, http://www.mckinsey.com/insights/energy_resources_materials/resource_revolution.

48 ibid

Highest global impact resource productivity 'levers' identified in McKinsey Study

1. Increasing building energy efficiency
2. Improving large scale farm yields
3. Addressing food waste
4. Municipal water leakage reduction
5. Urban densification
6. Energy efficiency in iron / steel production
7. Increasing smallholder farm yields
8. Transportation efficiency
9. Deploying electric / hybrid vehicles at scale
10. Land degradation
11. Increasing efficiency of end use of steel
12. Enhanced oil and coal recovery
13. Implementing improvements in irrigation technology
14. Road freight shifting
15. Power plant efficiency

The McKinsey report echoes messages that have been expressed by private, public and social sector institutions on the topic of resource productivity – that the fundamental challenge in capturing the resource productivity opportunity is one of investment and execution, rather than one of technology.

Technologies that are available today are able to address the vast majority of the opportunity; however a series of market and non-market barriers must be addressed to focus the flow of capital into these opportunities:

1. **Increasing transparency** - improving the quality and availability of information to analyze and manage resource productivity issues, including the measurement and reporting of natural capital values and impacts of economic activity;
2. **Creating strong, relevant price signals** - effecting policies that allow for an economically meaningful value to be assigned to economic activities and ensuring that pricing mechanisms are stable and predictable to encourage investment;
3. **Ensuring that the price transmission mechanisms are efficient and effective** – ensuring policies are in place (or removed) to eliminate distortions in price signals (e.g direct and indirect subsidies); and
4. **Use institutional resources to build scale and depth in critical areas** - encouraging governments at all levels to take leadership roles in building expertise and knowledge in key areas of innovation.

There is a strong role to be played by policy makers in shaping Canada's natural capital and natural capital productivity agenda. The development and inclusion of natural capital in economic measures of income and GDP will result in economic decision-making reflective of the true costs of economic activity and will result in increased wellbeing for Canadians. Natural capital's reflection in economic balance sheets will provide a measure of the sustainability of Canada's economy into the future. And there are actions that can be taken now, such as those high impact levers identified above, which can begin to have an immediate impact.

Several countries have taken successful action to improve their resource use. For instance, since 2000, Germany has set bold national targets and has increased its resource productivity by some 40% and decreased its domestic material consumption in absolute terms.[49] Japan has had similar success, outlined below.

Case Study: Japan Focuses on Resource Productivity

Through the early part of the new millennium Japan defined a vision of a more sustainable society and implemented legislation to double its resource productivity (GDP/direct material input) by 2010, achieve a 40% improvement in the rate of recycling, and reduce the amount of waste produced in the Japanese economy by 50%. Together, the initial vision, the coordination and legislation helped Japan achieve impressive results. From 2001-2005 Japan's resource productivity increased 19%, an average of 5.4% per year. By 2007 Japan had successfully increased the recycling rate of waste in its economy from 42% to 49%, reduced industrial waste in its economy by 55% from 45 million tonnes in 2000 to just 20 million tonnes in 2007, and non-industrial waste by 62% from 3.1 million tonnes to 1.2 million tonnes.[1]

1 Statistics Bureau, Government of Japan, 2011. Statistical Handbook of Japan, http://www.stat.go.jp/english/data/handbook/index.htm.

Experience from Japan and Germany suggest that a framework to improve natural capital productivity should be founded on a clear national vision and supported with deliberate action. By setting clear and ambitious targets to measure natural capital and integrate government, civil society and industry efforts to achieve progress, Japan and Germany have achieved remarkable reductions in resource use within their national economies while maintaining economic growth.

49 The Federal Government of Germany, 2008. For a Sustainable Germany: Progress Report 2008 on the National Strategy for Sustainable Development, Berlin: Press and Information Office of the Federal Government.

Implications for Policy Makers

Natural capital represents immense wealth for Canadians. Canadians draw goods and services from Canada's natural environment in the form of renewable and non-renewable resources (metal ores, timber, etc), as well as ecosystem services (filtering of air, absorbing floodwaters, etc). Ensuring the best management of our natural capital requires knowledge and transparency of the true costs of economic activity - including the costs of using and degrading natural capital. Sustainable Prosperity believes there are some steps we can take right now to make this happen:

- Like any asset, we must understand and measure this asset in order to manage it optimally. The development and inclusion of natural capital in economic measures of income and GDP will result in economic decisions reflective of their true costs and risks. Natural capital's inclusion in economic balance sheets will provide a measure of the sustainability of an economy into the future.
- Further, Canada today faces large scale, largely irreversible development choices around the future of its energy assets (oil and gas assets, power plants); transportation infrastructure (pipelines); land base (mineral and timber asset development) and urban design choices (planning urban development for a growing population). These choices require a framework that allows for the best possible information around environmental and economic costs and benefits to inform decision-making.
- Canada's economy has and will continue to rely heavily on its natural capital into the future. As a result, the risks of mismanagement of its natural capital assets are high. Experience from leading nations shows that by setting clear and ambitious targets to improve resource use and integrate natural capital values within government, civil society and industry, Canada can improve productivity, reduce resource use, and limit degradation of the environment all while sustaining economic growth.