



Natural Capital Accounts: Measuring and Managing the Value of Ontario's Nature

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1. Executive Summary

Canada's natural capital and ecosystem services (nature) play an essential role in supporting Canadians' health, economic success and well-being. Natural resources such as timber, minerals and oil are key inputs to economic production. Land provides the space needed for homes, farms, recreation and other activities. Ecosystems provide services such as carbon storage and flood protection that regulate the environment and make our world liveable.

In order to ensure the sustainability of our health, economy and well-being, natural capital must be managed so it can be passed on to the next generation.

Addressing this challenge will require a mix of perspectives (e.g. government, First Nations, industry, non-profit, community group interests, etc.) and the ability to learn and experiment together on innovative practices that can act as stepping-stones towards this future. The Natural Capital Lab (NCL) is intended to create the space for this. The NCL brings together a cohort of influential leaders to address current and emerging challenges and generate opportunities to identify, test and scale new initiatives and collaborations.

This first report from the Natural Capital Lab introduces the concept of natural capital accounting (NCA) as a promising framework for the Government of Ontario to improve decision-making by developing more coherent, complete and comparable environmental data. NCA provides a systematic approach to the measurement of the stocks and flows of natural capital in physical and monetary terms that is fully consistent with existing economic data. It allows the cost and benefits of using and protecting our natural capital to be assessed and integrated into decision-making.

NCA will allow Ontarians to ensure that our natural wealth is being used in a sustainable manner for generations to come. Therefore, we recommend that NCA be investigated for potential adoption across the Government of Ontario.

Specific recommendations include:

1. **Build a business case and create demand for NCA.** Given that Ontario has no NCA program at the moment, the starting point must be a convincing business case. This report offers a starting point for building out a comprehensive business case which will, in turn, help create demand for NCA in Ontario. A lead department or organization should be identified to complete this work.
2. **Adopt the UN System of Environmental-Economic Accounting (SEEA) as a framework for designing and implementing NCA in Ontario.** The SEEA

contains the concepts, definitions, classifications, accounting rules and tables necessary to produce NCA. The accounts should all be compiled for the province as whole and, where possible, at the sub-provincial level. Sub-provincial accounts could include any of ecodistricts, watersheds and census regions as spatial reporting units.

3. **Identify current policy priorities of the government where existing natural capital data are liable to fall short of what is needed for decision making.**

As in most jurisdictions where no clear framework for environmental data exists, environmental data in Ontario's existing data are mainly found in isolated silos managed by specific individuals within specific departments. Decision-making regarding policies ranging from priorities such as sustainable forest management, to biodiversity targets, to protecting the Great Lakes and the sustainable development of the Ring of Fire would benefit if natural capital were more systematically measured in the province.

4. **Engage stakeholders through a series of sessions to identify priorities for NCA implementation.**

Partners from a variety of sectors are necessary to ensure the success of NCA. Governments, businesses, academics and civil society must all be represented. Some partners will primarily be involved as data providers and others will primarily be data users; some will be both.

While NCA can be implemented by both businesses and governments, as stewards of much of Canada's natural capital, governments have a particular role to play in measuring natural capital and using those measures to guide decision making.

2. Introduction

Canada's natural capital plays an essential role in supporting Canadians' health and well-being. Natural resources such as timber, minerals and oil are key inputs to economic production. Land provides the space needed for homes, farms, recreation and other activities. Ecosystems provide services such as carbon storage and flood protection that regulate the environment and make our world livable. In order to ensure the sustainability of our health and well-being, natural capital must be managed so it can be passed on to the next generation.

But today we are releasing more carbon into the atmosphere than ecosystems can sequester. We are degrading our freshwater resources and losing biodiversity at an unprecedented rate. We can feel ourselves bumping up against nature's limits but don't have a clear understanding of the true cost of our actions.

Canadians intuitively grasp the importance of natural capital but we do not measure it as well as we should. As noted, natural capital is the basis of much of our health and well-being. Despite this, our businesses, communities and governments have no shared, robust means of factoring the value of natural capital into their decisions. In contrast, we've long understood the value of economic capital like buildings, highways and factories. But seeing just one part of the equation isn't good enough anymore.

Sound decision making today requires that Canada's natural capital and ecosystem services be consistently valued and integrated into corporate, government and community decision-making. This will ensure that Canada continues to benefit from its vast natural capital while protecting and restoring it for future generations. With the right investments, Canada can become a global leader in valuing and sustainably managing ecosystems services.

Natural capital is not a new idea but the field is fragmented. Important work is being done across the country on better measurement and management but initiatives are largely disconnected from each other. As a result, the public is largely unaware of the concept and even interested stakeholders in business and government are faced with a confusing variety of metrics, definitions, and methodologies for valuing natural capital.

2.1 The Natural Capital Lab

No single person or organization has the knowledge or capacity to create and promote the accounting system that the future requires of us. Doing so will require a mix of perspectives (e.g. government, First Nations, industry, non-profit, community group interests, etc.) and the ability to learn and experiment together on innovative practices that can act as stepping-stones towards this future. The Natural Capital Lab (NCL) is intended to create the space for this.

The NCL is co-convened by The Natural Step Canada, Chartered Professional Accountants of Canada, TD Bank Group, The Cooperators, Deloitte, Sustainable Prosperity and the Municipal Natural Asset Initiative. The NCL will serve as a:

- **Platform** for ongoing experimentation, innovation, and collaboration
- **Network** to share lessons and knowledge among participating organizations and their stakeholders
- **Channel** to spark a new narrative that inspires dialogue and action on key issues and challenges related to natural capital.

The NCL brings together a cohort of influential leaders to address current and emerging challenges, and to generate opportunities to identify, test and scale new initiatives and collaborations. The Lab's activities are divided into three workstreams, including the Government workstream that is the topic of this note. The other two are the Corporate and Municipal workstreams:

The Corporate Workstream is launching a pilot project to experiment with the Natural Capital Protocol – a protocol aimed at facilitating natural capital accounting by businesses – and is seeking active involvement from Canadian financial-sector companies. The NCL will help participating businesses to identify opportunities for integrating natural capital accounting into internal decision-making.

The Municipal Workstream aims to support, amplify and enhance municipal efforts to protect and preserve natural capital and ecosystem services through projects to 1) support the integration of natural capital in asset management software and record keeping systems and 2) develop detailed case studies of municipalities that are integrating natural capital into various types of decision-making.

3. Why account for natural capital?

3.1 Introduction

The case for natural capital accounting is compelling but not well known, in part because the concept of natural capital itself is novel. This section builds the case for natural capital accounting by looking first at what natural capital is and what natural capital accounts are and then by drawing an analogy with economic statistics to show the power of integrated data.

3.2 What is natural capital and what are natural capital accounts?

Natural capital includes traditional natural resources such as timber, minerals and oil that are essential inputs to the market economy. It also includes the land that provides space for homes, farms and other businesses, recreation and other activities. Finally, it includes ecosystems that provide the services, such as carbon storage and flood protection, that regulate the environment and make our world livable. In order to ensure long-term sustainability, all these types of natural capital must be managed so it can be passed on to the next generation.

The need for sound management of natural capital is greater than ever. Climate change, population and economic growth, pollution and changing public and political objectives are all increasing the pressure on governments to be wise resource stewards.

Managing natural capital requires that we first understand what we have. **Natural capital accounting** (NCA) focuses on measurement of these assets and how they are being used. It provides a systematic approach to the measurement of the stocks and flows of natural capital in physical and monetary terms. It allows the cost and benefits of using and protecting our natural capital to be assessed. Importantly, it allows us to ensure that our natural wealth is being used **sustainably** (see Text Box 1).

Text Box 1 - Measuring sustainability with NCA

Wealth is the value of the assets owned by a given entity, be it a household, a corporation, a province or a nation. Wealth represents the basis upon which both current and future income and, more broadly, well-being are generated.

Until the advent of NCA, the measurement of wealth focussed exclusively on the value of produced assets like machinery and buildings. The value of natural assets was not considered. This is particularly problematic in jurisdictions, like Ontario, that rely heavily upon income from the exploitation of natural assets.

Exclusion of natural assets from wealth measures leads to a situation in which resources can be depleted or degraded without any impact on future income potential – that is, on sustainability – being recorded. A province or nation could, in theory, deplete its natural resource base entirely – losing the associated income-earning potential in the process (not to mention the loss of natural heritage) – without the loss appearing in its statistics. Clearly, statistics do not provide appropriate signals when such a loss is allowed to go unmeasured. Without knowledge of how natural wealth is evolving, it is not possible to be sure whether income enjoyed today is sustainable.¹

Tracking natural wealth helps governments and the public know whether they are getting the most out of their natural assets while not endangering sustainability.

3.2.1 The UN System of Environmental Economic Accounting

An¹ international set of guidelines for NCA – the UN *System of Environmental Economic Accounting* (SEEA) – has been established and is being used to support decision making in Canada and other countries along with the World Bank, the OECD, the UN and other international bodies.

The SEEA contains the concepts, definitions, classifications, accounting rules and tables necessary to produce NCA. The system is divided into two volumes:

- The *Central Framework* contains internationally standardized concepts, definitions, classifications, accounting rules and tables for natural assets (and associated flows) other than ecosystems.²

¹ See International Institute for Sustainable Development, 2016, *Comprehensive Wealth in Canada: Measuring What Matters in the Long Run*. Available at <http://www.iisd.org/comprehensivewealth/en/>

² See United Nations, European Commission, Food and Agriculture Organization of the United Nations, Organisation for Economic Co-operation and Development and World Bank Group, 2014a, *System of Environmental-Economic*

- The *Experimental Ecosystem Accounts* contains internationally endorsed best practices in terms of concepts, definitions, classifications, accounting rules and tables for ecosystem assets and associated flows of ecosystem goods and services.³

Building upon the *System of National Accounts* (SNA – see Text Box 2), the SEEA organizes environmental and economic information in a system that covers the stocks and flows that are relevant to the analysis of environmental and economic issues.

The SEEA includes three main categories of accounts:

- **Natural asset stock accounts** – These measure *in situ* quantities of natural resource assets (minerals, timber, water, fossil fuels, land and ecosystems) and, where possible, their economic value.
- **Physical flow accounts** – These measure the flows of materials and energy from the environment to the economy in the form of natural inputs and flows from the economy back to the environment in the form of waste materials and energy. They are generally measured in physical terms only, though they may be combined with economic data to permit calculation of efficiency indicators (*e.g.*, energy use per dollar of GDP).
- **Activity/purpose accounts** – These accounts explicitly identify environmental transactions that are already captured in the SNA but are hidden because of aggregation. They include accounts measuring the production and use of goods and services designed to protect the environment; and accounts of taxes, subsidies and other fiscal measures designed to achieve environmental goals.

Text Box 2 - The System of National Accounts

The System of National Accounts (SNA) is the internationally agreed system for measuring the economic performance of nations. It is the basis for the calculation of gross domestic product (GDP), productivity and other important economic indicators. All countries adhere to the SNA guidelines when measuring their economies, ensuring that GDP and other indicators are measured comparably around the world.

Accounting 2012 - Central Framework, New York: United Nations. Available at <https://unstats.un.org/unsd/envaccounting/seearev/>

³ United Nations, United Nations European Commission, Food and Agriculture Organization of the United Nations, Organisation for Economic Co-operation and Development and World Bank Group, 2014b, *System of Environmental-Economic Accounting 2012 – Experimental Ecosystem Accounting*, New York: United Nations. Available at <https://unstats.un.org/unsd/envaccounting/seearev/>

Figure 1 below portrays the SEEA accounts (green boxes) alongside the corresponding accounts of the SNA (blue boxes). **Column A** represents the natural asset stock accounts, showing the opening balance at the beginning of the year, changes due to various factors and then the end-of-year closing balance. **Row 1** represents the activity/purpose accounts in which standard SNA transactions are disaggregated to make environmental protection expenditures explicit. **Rows 2 and 3** represent the physical flow accounts in which flows of natural resources and wastes between the environment and the economy are recorded.

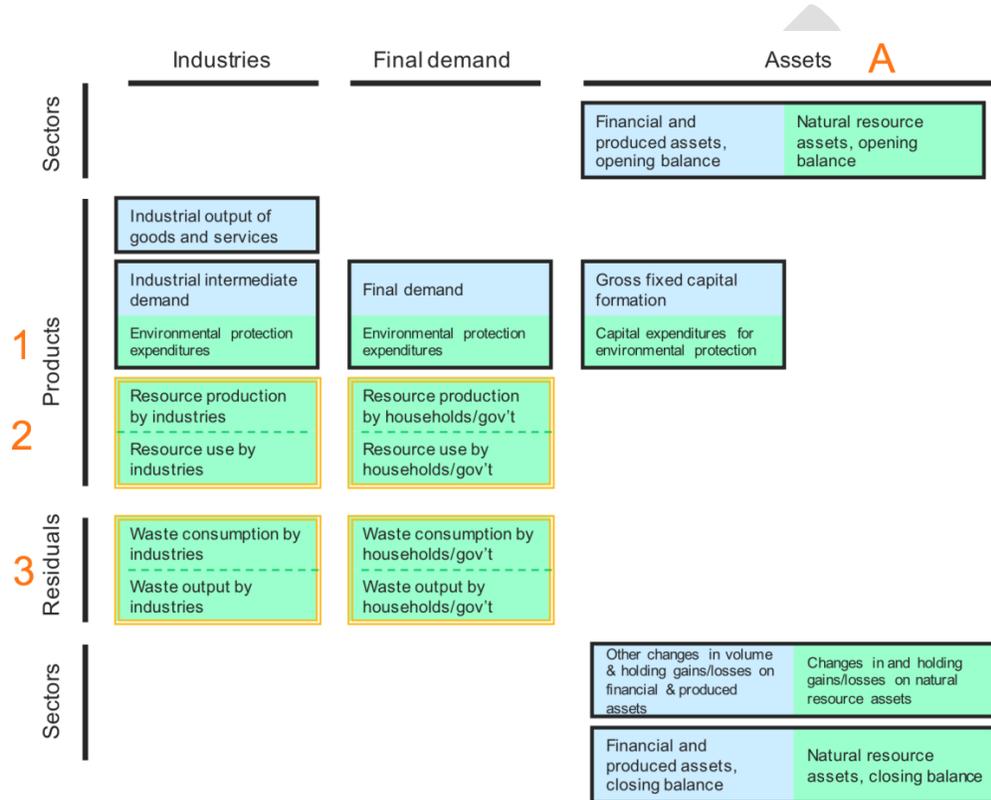


Figure 1 - The SEEA and the SNA

Policymakers and managers using NCA compiled according to the SEEA benefit from the consistent, comparable and comprehensive statistics and indicators it provides. The SEEA brings into direct focus the relationship between the environment and well-being not revealed through traditional measures of economic activity, such as GDP. The SEEA does not propose or recommend any single indicator or basket of indicators for use in developing and assessing policy. Indeed, one of its major strengths is its flexibility to serve multiple purposes and multiple scales of analysis. Examples of the indicators that can be derived from the SEEA include:

- **Emissions of pollutants per unit of GDP**, which measures whether the economy is evolving sustainably. Figure 3 gives an example of this for greenhouse gas emissions for Canada, with emissions (kilotonnes) and emissions intensity (kilotonnes/million dollars real GDP) shown as indexes with 2009 as the base year. As can be seen, the Canadian 2013 and stayed unchanged in terms of emissions per dollar of real GDP (intensity index).
- **Value of natural resource wealth**, which provides a basis for analyzing the sharing of economic benefits from resource exploitation. **Error! Reference source not found.** gives an example of this for Canada as a whole. In recent years, the value of land (agricultural and built-up) and energy assets increased substantially, while minerals and, especially, timber have been flat or declined. The decline in the value of timber assets is mainly a function of falling prices for wood products.

Figure 2 - Natural resource wealth, Canada - 1990-2012 (Statistics Canada, CANSIM Table 153-0121)

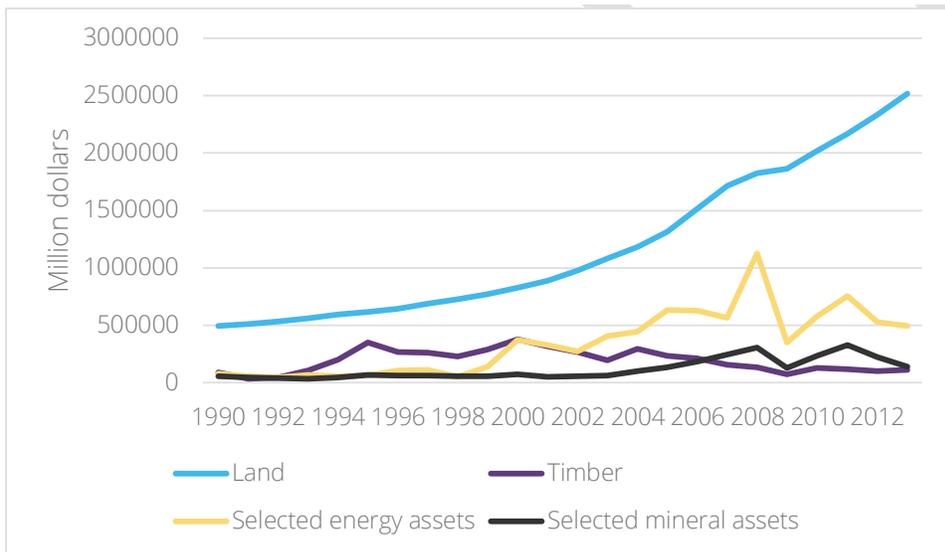
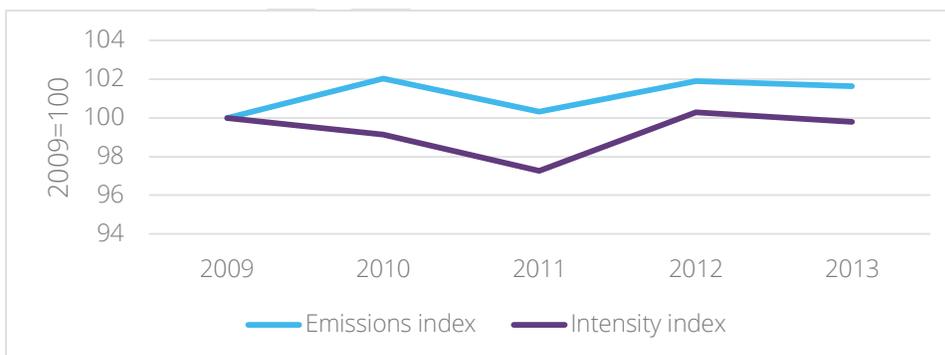


Figure 3 - GHG emissions indexes, Canada, 2009-2013 (Statistics Canada, CANSIM Table 153-0114)



3.3 Why is NCA needed?

3.3.1 Lessons from the history of economic statistics

Economic statistics are the “gold standard” in terms of statistical quality today, though this was not always the case. Economists and statisticians struggled in the early part of the 20th century to present a coherent and complete portrait of the economy. Indeed, Canada’s economic statistics in the 1920s offered little real insight into the economy’s workings. The head of the Dominion Bureau of Statistics (today’s Statistics Canada), Robert Coats, admitted as much in 1931 when he noted that “statistics [on national wealth] are suggestive and indicative rather than strictly accurate...”⁴

Coats and his contemporaries knew their statistics were not up to the task. But they lacked consensus on how to improve them. The struggle to understand the causes of Great Depression and concerns about how to fund the war effort in the 1930s heightened the calls for better economic statistics. Economists and statistician thus attacked the problem with increased focus.

The resulting flood of effort led to the development of the modern theory of macroeconomics, attributed primarily to the British economist, John Maynard Keynes. Keynes’ theory succeeded in providing a central *conceptual* framework for economic statistics where none had existed before. This, in turn, stimulated the creation of an overarching *statistical* framework, which came to be known as the *System of National Accounts* (SNA). The SNA, which emerged in the 1940s and 50s, remains the guiding force behind economic statistics to this day. In it, basic statistics collected from hundreds of sources are integrated through a process of aggregation and estimation into a set of coherent and complete accounts. The accounts serve as the basis for deriving, among others, the influential macroeconomic indicator known as gross domestic product (GDP).

With a clear and widely accepted framework to guide them, economic statistics evolved from their 1920s patchwork of limited utility to the highly coherent and complete system we benefit from today.

⁴ Dominion Bureau of Statistics, 1931, *Report on the National Wealth of Canada and its Provinces as in 1929*, publication II-D-20, p. 1, as quoted in McDowall, D., 2008, *The Sum of the Satisfactions: Canada in the Age of National Accounting*. Montreal and Kingston: McGill-Queen’s University Press, p. 21.

3.3.2 Where do environmental statistics fall short today?

Like the economic statistics of the 1920s, environmental statistics today offer more of a patchwork than a coherent and complete portrait. Even in advanced countries with mature statistical systems like Canada, environmental statistics suffer from serious shortcomings.

Most importantly, environmental statistics are often **incomplete**. Data on the extent and quality of wetlands, for example, suffer from many gaps in Canada. Such gaps prevent complete understanding of trends in the environment.

Even where gaps are not a major problem, other shortcomings can limit the usefulness of environmental statistics. It may be difficult to **access** and **interpret** the statistics because governments do not invest the effort necessary to centralize and document them. Sometimes governments are not the custodians of environmental statistics at all, but researchers or corporations. In these cases, access to the statistics by the public will be even more difficult.

Perhaps most frustratingly, environmental statistics are subject to **inconsistency** and **incoherence**. They are **inconsistent** because they often suffer from methodological and conceptual changes over time. These changes, which are rarely implemented backwards in time, limit the usefulness of environmental statistics in analysis. A noteworthy example is national statistics on toxic pollutant emissions, which cannot be analyzed over time because of changes in the way they have been collected.⁵

Environmental statistics are **incoherent** in that statistics on different environmental issues – say greenhouse gas emissions and sulphur dioxide emissions – cannot always be compared with one another. This is so for various reasons, the most common being that the statistics are often compiled using different organizational structures and collection methods. In the case of greenhouse gases and sulphur dioxide emissions, different classifications of industries are used to organize the statistics.

In addition to the incompatibility of environmental statistics among themselves, their compatibility with economic and social statistics is limited. Environmental statistics cannot usually be combined easily with economic statistics in, for example, modelling frameworks. This further restricts researchers' ability to analyse the linkages between human activities and environmental quality.

⁵ See Commissioner of the Environment and Sustainable Development, 2000, *Fall Report of the Commissioner of the Environment and Sustainable Development 2009*. Available at <https://goo.gl/8LExVt>

These limitations mean that environmental statistics struggle more than they should to realize their full impact, especially in the important world of public policy analysis. It is to this challenge that NCA rises.

3.3.3 What does NCA offer?

Sound management of natural capital requires sound statistics. But, as just outlined, environmental statistics are not as sound as they might be. To realize their full potential for decision making, environmental statistics need to be better *integrated*; that is, they need to be made more structured, complete and coherent.

Environmental statistics are mainly found today in what might be called “data silos”, with limited connections among them. Data silos make it difficult to get a complete sense of any given issue (Figure 4).

Figure 4 - Data silos - The picture is hard to grasp and there is no way of knowing whether a given silo is missing something important



Figure 5 - Integrated data - The picture becomes clear and any missing pieces are obvious



NCA addresses this by providing integrated environmental data that are fully compatible with economic data, permitting the full picture to be seen (Figure 5). In doing so, NCA allows data users to more easily study the interactions between the environment and the economy.

NCA facilitates this by adopting a standardized framework that is consistent with the *System of National Accounts* – the UN SEEA. This permits analysis of the impacts of the economy on the environment and, *vice versa*, the contribution of the environment to the economy. A coherent set of indicators and statistics can be derived from the SEEA to inform a wide range of policies related to the sustainable management of natural assets.

Beyond improving the structure and coherence of environmental statistics, NCA also helps address their completeness. Unlike data silos, which can be filled with any statistics, NCA is clear about which statistics are relevant and which are not. This is useful to those tasked with the collection of statistics, as they will know with certainty when and where data gaps must be filled. In the absence of NCA, identifying gaps is likely to be driven purely by short-term policy objectives. While filling gaps in response to policy is

perfectly appropriate and necessary in many instances, it is not ideal as the primary basis for data collection. Unless very carefully managed, it can lead to statistics of limited coherence and structure (i.e., data silos), as we see in the environmental field today and as was the case in the economic field prior to the emergence of national economic accounting.

NCA is a flexible approach that can be adapted to specific situations and priorities of different jurisdictions. Its implementation can be incremental, starting with simple, highly aggregated accounts that can be elaborated over time based on policy needs and refinement of source data.

Not all parts of the system must be implemented at once. Rather, the accounts of greatest relevance and feasibility in a given jurisdiction can be prioritized for early compilation. Some accounts may never be developed in some jurisdictions (*e.g.*, a timber stock account may be of little relevance in a small, desert nation).

In all cases, implementation should begin with accounts measured in physical terms. Only when physical accounts are completed should efforts be made to move on to accounts in monetary terms and only if these are deemed necessary. (Physical accounts are required as the basis for valuation in most instances, so this order of implementation is more or less imposed on compilers.) Limiting implementation to accounts measured only in physical terms is an option if comparison of NCA data with economic data is not a priority. For example, if there is no desire to compare the value of forest assets with other assets, measuring them in physical terms only is sufficient. Of course, activity/purpose accounts can only be implemented in monetary terms, so they would be out of scope in an implementation that included only physical accounts.

Generally speaking, valuation – if it is to be undertaken – is easiest for natural assets that are exploited commercially (such as the working forest) and most difficult for ecosystem assets that provide benefits realized outside of the marketplace (such as the flood control service of wetlands). This is because the SEEA provides standardized methods for the valuation of commercial natural assets and because market prices are generally available for such assets. In contrast, valuation methods for non-market ecosystem assets have not yet been standardized and price data are more difficult to come by. This does not mean that valuation of non-market assets is less desirable or useful – only that it is more

challenging. Whatever the asset, though, valuation should only be carried out when meaningful⁶ and only where robust methods and reliable price data are available.⁷

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⁶ Some natural assets – called *critical* natural capital – are effectively priceless because they provide benefits that are irreplaceable. Endangered species or rare habitats are an example of critical natural capital. These should be measured in physical terms only.

⁷ Markets are known to suffer from the effect of externalities (such as the cost of climate change) that are not fully integrated into the prices consumers pay for goods and services. As a result, market prices may not in all cases fully reflect the marginal costs and benefits of consuming these goods and services and may not, therefore, be fully appropriate as the basis for valuing natural capital.

4. Why should governments invest in NCA?

4.1 Introduction

While NCA can be implemented by both businesses and governments, as stewards of much of Canada's natural capital, governments have a particular role to play in measuring natural capital and using those measures to guide decision making. Governments at all levels – municipal, provincial/territorial and federal – already collect large amounts of environmental data. They use these data to guide public decision making and provide them to others for use in private decision making. As noted in the previous section, however, the environmental data collected by governments today are not usually well integrated. Rather, they are often purpose-built and kept in individual “data silos”. While valuable for their intended purpose, such data fall short of the full potential of a complete, coherent and consistent system for measuring natural capital and its contribution to Canadians' health and well-being.

Governments that choose to pursue NCA today stand to benefit in several ways. Obviously, there is the opportunity to create better integrated data to drive better decision making. Beyond this are opportunities to save money, increase collaboration and build upon Canada's already strong track record in this emerging area.

At the same time, implementing NCA in the public sector brings with it challenges. Data gaps, resistance to change and unfamiliarity with the concepts of NCA are all factors that stand in the way of its implementation.

The remainder of this section discusses these opportunities and challenges in more detail.

4.2 Implementing NCA in the public sector – Opportunities

There has never been a better time for governments to consider implementing NCA. The world has largely agreed on the international guidelines for NCA; citizens are calling for a balance between environmental protection and economic growth; and financial pressures mean that every government is looking for ways to become more efficient. These and other opportunities are discussed below.

Building on environmental momentum – Right across the country, the public sector in Canada is arguably more committed to reconciling economic growth with environmental protection today than at any time in the country's history. This commitment reflects citizens' concern for the quality of the environment, especially in light of climate change. Rather than seeing the environment as something that must be sacrificed in the name of social and economic well-being, Canadians now understand that the environment is an essential pillar in well-being. As a result, there is growing interest in approaches, like NCA, that attempt to measure the environment in terms that can also be used to measure the economy and society. The need to address climate change and its social and economic implications adds urgency to the public's concern, further strengthening the case for governments to act.

Improving collaboration – Responsibility for managing natural capital is cross-cutting in every jurisdiction. Implementing NCA therefore requires collaboration within and across government departments and professional disciplines. At a minimum, implementing NCA involves statisticians, analysts, biologists, natural resource managers and economists. Thus, it provides opportunities and reasons for public officials to work together that might otherwise not.

Maximizing the utility of existing data – Governments collect and hold large amounts of environmental data but, as previously noted, the data are often widely dispersed and poorly integrated. This stands in stark contrast to economic data, which are generally highly centralized and well integrated thanks to their organization in a single, widely adopted framework.⁸ NCA offers the chance to achieve the same for environmental data, bringing diverse sets of environmental data together within the same framework and thereby increasing their coherence, accessibility and, ultimately, their relevance.

Identifying and prioritizing data gaps – Though many good environmental data are collected and held by governments, important gaps remain in all jurisdictions. These gaps prevent a full understanding of the state of natural capital and its contribution to the economy and society. Without a clear organizing framework – such as that offered by NCA – these gaps can be hard to identify and even harder to prioritize. By providing such a framework, NCA offers the chance to compare existing data against an “ideal” dataset. Gaps are therefore more easily identified when data are organized through NCA. The gaps can be prioritized by identifying those needed to complete the highest priority elements of

⁸ The UN *System of National Accounts* is used by every government in the world as the basis for organizing economic statistics.

the NCA; for example, if water accounts are deemed more important than forest accounts in a given jurisdiction, the data gaps preventing implementation of the water accounts will be higher priority than those related to the water accounts.

Reducing costs and improving efficiency – Data collection is costly in all cases but all the more so when it is not carried out using a standardized framework. Without a common framework to guide data collection, statisticians will focus on meeting data needs within their specialized domains but may not do so in a way that ensures coherence of their data with other data. Air pollution data experts may build excellent air pollution databases and water pollution experts may build excellent water pollution databases – but they are likely to build their databases to their own specifications using their own methods. The result is often the “data silos” referred to earlier. Data silos may meet their intended purposes very well but fail to meet other needs they potentially could, thus reducing their overall value (see the discussion in Section 2.2.3 for more on this point). In contrast, data collected according to a common framework are more likely to be “multi-purpose”, maximizing their efficiency and minimizing the overall cost of data collection.

Improving data integration – Decision making is a complex process in which many competing needs must be balanced. Environmental policies must consider economic and social goals and *vice versa*. An important part of the decision-making process is data analysis to help understand trade-offs between competing priorities. This kind of analysis is much easier with data that are well integrated. Existing environmental data are not well integrated, however, either among themselves or, in particular, with economic and social data. For example, air pollution data collected by the federal government use several different classifications for economic sectors, none of which is fully consistent the classification used in economic statistics. Building a coherent picture of air pollution and its relation to economic activity in the country is, therefore, harder than it should be. NCA offers the opportunity to improve the integration of environmental data by applying common concepts and methods in their collection.

Making the case for better data – Three major environmental reports released within weeks of one another in 2017 all came to the same conclusion: environmental data are severely wanting in Canada.⁹ These reports took years to compile, cost hundreds of

⁹ See:

1. International Institute for Sustainable Development. 2017. *Costs of pollution in Canada: Measuring the impacts on families, businesses and governments* (available at <https://goo.gl/V2rpAA>)
2. WWF-Canada. 2017. *Watershed reports: A national assessment of Canada's freshwater* (available at <https://goo.gl/b3GoJD>)

thousands of dollars and yet failed to answer key questions because of poor data. Efforts to understand the state of Canada's natural capital and its contribution to Canadians' health and well-being should not be hampered like this. Canadians would not tolerate it if poor data prevented a clear understanding of social and economic trends – why should they live with this in the environmental domain? NCA, if it were implemented, would go a long way toward improving this situation. By revealing data gaps and helping prioritize them, NCA help make an objective and well-grounded case for better environmental data. In the absence of a “touchstone” against which to compare existing data, stakeholders calling for better data are forced to go to great lengths to define the scope of the problem. This approach has worked extraordinarily well in the domain of economic statistics, where the SNA provides the touchstone. It can work just as well in the environmental domain.

Building on success – Canada is already known as an international leader in NCA. Statistics Canada has had an active program in the area since the mid-1990s and has one of the most complete sets of natural capital accounts in the world (though it remains incomplete in many ways, including in terms of sub-national detail, and is far less complete than the agency's economic accounts). Statistics Canada plays an important role internationally in the development of standardized concepts and methods for NCA and is well respected for its leadership. Implementing NCA in provinces and territories would benefit from this already established leadership position.

4.3 Implementing NCA in the public sector – Challenges

Though the opportunities for governments that pursue NCA are many, there are important challenges that must also be acknowledged. None of them is insurmountable but all need to be taken seriously by any jurisdiction planning on implementing NCA.

Lack of data – Though governments already collect a great many environmental data, the gaps are even larger. The fact that Statistics Canada employs a few dozen environmental statisticians compared with hundreds upon hundreds of economic and social statisticians speaks volumes about the federal government's ability to measure and understand the environment. The same imbalance exists in the provinces and territories. Any effort at compiling NCA will, then, face inevitable shortcomings in available data.

3. Global Forest Watch Canada. 2017. *Open Data Assessment of Geospatial Concession Datasets in Canada* (available at <https://goo.gl/gXigfM>).

Ensuring collaboration - As already noted, the fact that the management of natural capital is cross-cutting means that NCA offers the opportunity for collaboration. At the same time, it means no obvious lead agency for NCA exists within most Canadian governments. At the federal level, Statistics Canada can play that role because it is mandated to be the federal government's main data compiler. Among the provinces and territories, however, only Quebec has a statistical agency with a similar mandate. One of the challenges of NCA, then, is to identify a lead agency (or agencies) and ensure it is equipped and able to do the job. This requires collaboration among departments that may not always be accustomed to working with one another and that may have differing approaches to and priorities for data collection. Fostering such collaboration is both an opportunity offered by NCA and a challenge.

Upsetting the *status quo* – Because it requires bringing together data and people that might not otherwise come together, NCA poses a potential threat to the *status quo*. Researchers and analysts accustomed to doing things their own way and controlling how and where their data are used may resist taking part in NCA. Managers may resist dedicating resources to NCA if it means losing control over the conclusions drawn about their policies and programs. This is particularly true where NCA leads to integration of environmental and economic data, as this may reveal uncomfortable truths about the economy's impact on the environment (and *vice versa*). Thus, simply getting agreement among the agencies needed to get NCA off the ground may prove challenging.

Lack of understanding of natural capital – The term “natural capital” is relatively new and still not widely used or understood. Even within the environmental community, there are different understandings of what natural capital is. While a clear definition of natural capital exists,¹⁰ much work remains before it could be expected that an average Canadian would both understand the term and define it consistently to other Canadians.

Lack of understanding of natural capital *accounting* – Given that the concept of natural capital remains new, it is not surprising that NCA is also not widely known. To the extent they think about it at all, “accounting” is seen by most people as a financial exercise focused purely on the economy. They may have trouble understanding how or why it

¹⁰ The NCL uses the following definition: Natural capital is the stock of renewable and non-renewable resources (e.g. plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people. The benefits provided by natural capital include clean air, food, water, energy, shelter, medicine, and the raw materials we use in the creation of products. It also provides less obvious benefits such as flood defense, climate regulation, pollination and recreation.

should be applied to the environment. They may see NCA as an inappropriate application of economic thinking and methods to the environment when it is the economy that has got us into environmental trouble in the first place. They may object in particular to the environment being measured in monetary terms, seeing this as treating it “just like any other item on a balance sheet”. There may also be the feeling that NCA is a “one-size-fits-all” solution that is doomed to fail in the face of the extreme complexity of the environment and public policy.

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5. Implementing NCA in the Ontario government – Improving data to meet policy needs

Like all Canadians, Ontarians rely on natural capital for much of their health and well-being. The province is fortunate to benefit from (mostly) clean air and water, vast natural resources, rich agricultural land and a cultural heritage in which provincial icons like the maple tree, the Great Lakes and Algonquin Park – to name just a few – figure prominently. These benefits are under increasing threat however. The Great Lakes and other aquatic ecosystems are afflicted with algal blooms from fertilizer run-off. Invasive species like the emerald ash borer threaten native forests. Acid rain remains a problem that may get worse again if U.S. policy on coal use is weakened. The province's best farmland is slowly being paved over by urban expansion. Climate change is an overarching challenge that will touch natural capital of every type.

Accounting for the value that natural assets contribute to Ontarians and their well-being would seem essential to good public management. Yet, aside from pilot efforts by the Ministry of Natural Resources and Forestry to account for land cover and forest stocks, no systematic measures of the province's natural capital exist. This is not to say the provincial government has no useful environmental data, at it certainly does. But, as in most jurisdictions where no clear framework for environmental data exists, existing data are found in isolated silos managed by specific individuals within specific departments. Forestry and some kinds of land data (e.g., protected areas) are managed by experts in the Ministry of Natural Resources and Forests; agriculture data are managed by experts in the Ministry of Agriculture and Food and Rural Affairs; mineral data by the Ministry of Northern Development and Mines; data on ecosystems and pollution by the Ministry of the Environment and Climate Change. No coherent, complete picture of natural capital and its value can be easily extracted from the data managed by all these different agencies. Thus, Ontarians know less about their natural capital than they should given its importance to their health and well-being.

Some of the areas where Ontarians would benefit from better decision making if natural capital were more systematically measured in the province are discussed below. Each reflects a current policy priority of the government where existing data are liable to fall short of what is needed for good management.

5.1.1 Sustainable forest management

The Ministry of Natural Resources and Forests is charged with ensuring that “Crown forest resources are being put to their best use in an economically, socially and environmentally sustainable fashion”.¹¹ To do this, complete, coherent and consistent data on forest stocks and the flows of timber and other forest resources are required. These data must show whether the forest is being managed sustainably from a biophysical viewpoint – both as a source of timber and as a source of other forest ecosystem goods and services – and also from economic and social perspectives. Existing forest data in the province are not up to this task. They are heavily focused on measuring physical timber stocks and harvests in the central part of the province known as the “area of the undertaking” where the province directs most of its management effort. These data do not measure the value of the forest and so cannot be used to address the economic sustainability of the asset. Nor do they provide sufficient detail on the forests in the northern and, especially, southern parts of the province to fully address issues of environmental sustainability.

5.1.2 Preserving biodiversity

Ontario is committed to meeting the goal of the United Nations’ Convention on Biodiversity to protect 17% of the earth’s terrestrial and inland water areas by 2020.¹² While data measuring the area of protected land in Ontario already exist¹³, these data do not form part of a systematic accounting of Ontario’s land and its value as a source of space for human activities and ecosystems. Rather, the data are compiled by a not-for-profit organization (the Canadian Council on Ecological Areas) using underlying data from a variety of sources in “response to a longstanding need to track and report on the status of Canada’s protected areas in a consistent, standardized and authoritative manner”. While every attempt is made to provide current data, “the accuracy of the summations cannot be guaranteed” and the results “are not directly comparable to values reported in various product [for] previous years.”¹⁴ Additionally, the data do not include areas protected under specialized arrangements such as conservation easements that are particularly important in southern Ontario.¹⁵

¹¹ See <https://www.ontario.ca/page/september-2016-mandate-letter-natural-resources-and-forestry>

¹² See <http://ontariobiodiversitycouncil.ca/resource/biion/>.

¹³ See <http://sobr.ca/indicator/status-protected-areas-conservation-lands/>

¹⁴ See <http://www.ccea.org/carts/>.

¹⁵ See Davis, R. 2016, *Achieving Targets: Ontario’s System of Protected and Conserved Areas*, Latornell Conservation Symposium, November 16 (available at <https://goo.gl/vbY85r>).

A proper land account compiled by the Government of Ontario would improve upon this situation in a variety of ways. First, transferring responsibility for the account from a non-profit organization to government would increase the certainty that the human and financial resources required to compile the account would be available on an on-going basis. Second, a proper land account would be compiled using the best available data and a consistent methodology over time to ensure accuracy and comparability. Finally, a proper land account would place data on protected areas within the broader context of Ontario’s complete land base, allowing assessment of the tradeoffs when land areas are protected and comparison of the ecological and economic values of protected versus unprotected areas. This would increase the utility of protected area data in the evaluation of Ontarians’ health and well-being.

5.1.3 Taking action on climate change

Ontario’s Climate Change Action Plan¹⁶ commits the provincial government to several actions that would be facilitated by NCA. The table below lists some of these actions and the ways in which implementing NCA in the province would benefit them.

Climate change action	Benefit from implementing NCA in Ontario
Create “carbon footprint” calculators for households	A provincial GHG emissions account would provide a systematic basis on which to build a carbon footprint calculator by linking emissions with production and consumption activities in the province
Support the development of community energy and climate action plans, including the preparation of municipal GHG emission and energy-use data	Provincial GHG emissions and energy-use accounts would provide a systematic basis on which to build similar data at the municipal level by providing consistent and complete benchmark data
Integrate community data on gas, electricity, heating and cooling, water, transportation, waste consumption and buildings into a single platform to enable emissions analysis and targeted conservation spending	Provincial GHG emissions and energy-use accounts would provide a systematic basis on which to build similar data at the municipal level by providing consistent and complete benchmark data
Strengthen Ontario’s “clean-tech” sector	An account of Ontario’s environmental goods and services sector would provide systematic

¹⁶ See <https://www.ontario.ca/page/climate-change-action-plan>.

	measures of the size of the “clean-tech” sector in terms of the value of production, imports, exports and employment, providing a basis for evaluating success in supporting the sector
Explore the use of tax credits to encourage investment in low-carbon technologies	An environmental taxes account would measure the value of taxes of various sorts used to encourage environmentally beneficial behaviour
Work towards a “Waste-Free Ontario” by boosting recycling and reducing the amount of organic materials going into landfills	A solid waste emissions account would provide a systematic basis for measuring success in reducing the amount of waste going to landfill in the province
Develop a land-use carbon inventory to assess the potential of different land types for carbon sequestration	A land account would provide a systematic basis for assessing trends in the area and quality of different land types in the province, serving as a basis for the land-use carbon inventory
Develop and implement an agricultural soil health and conservation strategy to enhance soil carbon storage and protect productivity	A land account would provide a systematic basis for assessing agricultural land area and quality over time
Protect grasslands	A land account would provide a systematic basis for assessing grassland area and quality over time
Increase tree planting	A forest stock account would provide a systematic basis for measuring the area of land reforested over time

5.1.4 Protecting the Great Lakes

The Great Lakes benefit Ontarians in many ways, providing opportunities to fish, swim, boat, camp, play on sandy beaches, and hike. They are additionally important sources of commercial fish, water for drinking and industry, energy and transportation. Almost 75% of Canada’s manufacturing along with 80% of Ontario’s power generation and 95% of Ontario’s agricultural lands take place within the Great Lakes-St. Lawrence River basin.

The health of the Great Lakes is under threat today from a number of factors. Urban growth, phosphorus and nitrogen run-off from farmland, shoreline modifications, invasive species and climate change all negative affecting the lakes.

The 2015 *Great Lakes Protection Act* commits the government, among other things, to setting a target for reducing harmful blue-green algae levels in the lakes and ensuring that monitoring programs are established and maintained. The Act requires reports every three years to present the results of the monitoring programs and describe the actions taken to address issues.¹⁷

Implementing NCA in Ontario could help with the government’s commitment to managing the Great Lakes in a variety of ways:

- A land account would be valuable in tracking changes in the types, quality and uses of land in the watershed basins that feed into the lake, providing a systematic means of measuring pressures on the lake from land-use planning decisions
- A pollution emissions account would provide data on the sources and quantities of nutrients and other pollutants entering the lakes
- A water use account would provide data on the quantities of water withdrawn from the lakes and its use by various sectors
- A water availability account would track the amount of water renewed annually in the lakes through precipitation and inflows
- An ecosystem account would provide data on the quantities and value of aquatic ecosystem goods and services – such as recreation, habitat and aesthetic appreciation – provided by the lakes.

5.1.5 Sustainable development of the Ring of Fire

The Ring of Fire is one of the most promising mineral development opportunities in Ontario in almost a century. Located in Ontario’s Far North, the area contains sufficient chromite for multi-generational production, as well as significant quantities of nickel, copper and platinum. The Ministry of Northern Development and Mines has primary responsibility for mineral development in the Ring of Fire. Development has not yet started and environmental assessments are on-going.

Implementing NCA in Ontario would provide a variety of data valuable to the development of the Ring of Fire:

- A land account would help show the impact of mineral development by tracking changes in land cover and quality as the Ring of Fire is developed
- A mineral stock account would provide data on the quantities and value of the various mineral deposits in the province, allowing the value of exploiting minerals as

¹⁷ See <https://www.ontario.ca/page/protecting-great-lakes>.

a source of wealth to be compared against other uses of the environment and other economic development strategies

- A pollution emissions account would provide data on the quantities and types of pollution produced by various sectors, including mining
- An environmental protection expenditure account would provide data on spending by the mining and other sectors on equipment and activities to protect the environment.

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6. Lessons from other jurisdictions – What has worked and why

6.1 Introduction

NCA is implemented in countries around the world. Most often, the work is done by national statistical offices and the nation itself is the focus of measurement. Sub-national work is undertaken in some places as well. Below, some the elements that are common to the successful implementation of NCA are outlined, followed by examples of sub-national NCA work in Australia, the Philippines and the United Kingdom.

6.2 Success criteria

Natural capital remains a relatively new concept. Governments, businesses and others are still in the process of discovering what natural capital means for them and how to measure and act on it in practice. No single approach to NCA has yet emerged as a result. Still, certain common success factors can be identified based on experience with NCA in Canada and elsewhere.

Make the case for NCA clear – Explaining clearly why NCA are needed and how they will improve on current environmental management is key to success.

Link NCA with real policy needs – Very few people are interested in data for data's sake and it is a mistake to see NCA as an end in itself. Rather, NCA development will be supported when it responds to a clear policy need; that is, when it is a clearly better means to an agreed-upon end. This means that data users must be consulted to determine their needs. It is important not to overpromise. Though NCA are a substantial improvement over the patchwork environmental data available today, they cannot and will not meet every need.

Find champions – NCA is more likely to be supported if there are champions at senior levels. There is risk in this however, as senior staff frequently move. NCA support cannot be too closely associated with one person or it may disappear when that person moves on.

Perseverance – NCA development is a long-term activity and this must be acknowledged from the outset. Governments need to understand that the benefits of NCA will emerge over time (time series analysis is its strength) and only if the effort to build and maintain

them is sustained. This requires commitment at all levels of government. The System of National Accounts is more than 70 years old and still evolving. Sustained effort makes it easier to maintain professional expertise. When effort is stop-start, project teams are created and then disbanded, meaning that learning curves must be mounted all over again when work recommences.

Collaboration – No single organization can carry out NCA on its own. Collaboration is required across departments, across disciplines and across sectors (public and private).

Mainstreaming – Make sure that the work is used in the core of government decision making. Statistical work that is not linked with real policy needs is unlikely to be sustainable.

Use standard methods – Whenever possible, NCA should be based on standard approaches. This ensures comparability of results across jurisdictions and avoids reinvention of the wheel.

Avoid confusing accounting with cost-benefit analysis – Accounting is a sustained effort over time at compiling consistent and comparable time series on an agreed-upon set of variables that aims at answering multiple questions with a common set of data. Cost-benefit analysis is a one-off analytical approach to answering a specific question with a tailor-made dataset that may or may not be of use in answering other questions and will not likely be maintained once the specific issue has been addressed.

Practice good information management – Statistical work cannot be sustained unless the input data and results are carefully managed so that they can be readily accessed and understood over the long term. Storage of data on researchers' hard-drives is a sure way to kill statistical work.

6.3 International experience with NCA at the sub-national level

6.3.1 Australia – NCA in the State of Victoria¹⁸

The State of Victoria recognizes that environmental assets are fundamental to its economy and society. A healthy environment contributes to the state's livability and sustainability by

¹⁸ See State of Victoria, 2015, *Valuing and Accounting for Victoria's Environment: Strategic Plan 2015-2020*. Available at <https://goo.gl/3mRc6z>

providing clean water and air, habitat and other ecosystem service, as well as serving as the basis for many Victorian regional industries such as agriculture and tourism.

To provide better, integrated, and more consistent information on its environmental assets, the Government of Victoria is developing a permanent NCA program based on the UN SEEA framework. The accounts, which will be developed over the period over the period 2015-2020, will provide information about which assets have been depleted or lost, which are declining in condition, and how the health of these assets affects the state's well-being.

This program will build on experience gained in the development of pilot NCA for Victoria. In March 2013, the first set of Victorian ecosystem accounts was released (Text Box 2).¹⁹ These accounts were instrumental in gaining an understanding of the nature of historical changes in native vegetation groups and land classifications in Victoria. More recently, more detailed pilot ecosystem accounts for the Victorian parks network were developed to assess the contribution that parks make to the prosperity and wellbeing of Victorians, while providing a stronger evidence base to inform investment decisions in relation to park management (Text Box 3).²⁰

Text Box 3 - Pilot Ecosystem Accounts, State of Victoria, Selected Results

Based on pilot ecosystem accounts, the State of Victoria has found that water-borne sediment loads from state parks are 8% of what would be released if these parks were not protected.

Annual nitrogen loads from parks are 15% of what would be released into urban waterways if the parks were not protected.

These water filtration services are valued at \$AUS88 million per annum.

Text Box 3 - Pilot Park Accounts, State of Victoria, Selected Results

Victoria's native vegetation in 2005 was about half of the extent under pre-European settlement with a mean condition of 0.57 compared to a benchmark of 1.0 in 1750. Vegetation types under pressure included Tussock Grasslands covering 10% of the 1750's extent with a mean condition of 0.35 per hectare.

Wetland extent in 2004 was similar to pre-European settlement, with a loss of 165,000 natural wetlands and a gain of 154,000 non-naturally occurring wetlands. The condition of wetlands was 0.7 per hectare in 2004 compared to 1.0 in 1750.

¹⁹ See Eigenraam, M., Chua, J. & Hasker, J., 2013, *Environmental-Economic Accounting: Victorian Experimental Ecosystem Accounts*, Version 1.0. Available at <https://goo.gl/RU9EV5>

²⁰ See State of Victoria, 2015, *Valuing Victoria's Parks – Accounting for ecosystems and valuing their benefits: Report of first phase findings*. Available at <https://goo.gl/ojOvoK>

These pilot accounts have demonstrated that adopting an accounting framework makes it possible to consistently compare changes in the extent and condition of environmental assets within and across environmental initiatives.

In deciding to develop a permanent NCA program, the government's objectives are to:

- Apply best practice for consistent tracking trends in the status of Victoria's environment and the services flowing to the Victorian community using internationally accepted standards
- Value the benefits from the environment and integrate them into policy development, planning and decision-making by government
- Improve evaluation of policies, programs and investments to protect or improve Victoria's environment using consistent performance measures.

Having a common language and a consistent approach to frame environmental data will help the state government and its partners address environmental degradation and climate change risks more effectively. Over the long term, this capability will help to build a healthier and more resilient environment and support more sustainable Victorian communities.

The accounts will support government policy, planning and investment decisions affecting the environment. They will also strengthen the ability of local government, business, not-for-profit and community stakeholders to recognize benefits of protecting and investing in the environment. More particularly, the benefits of the accounts are expected to include:

- Helping Victorians better appreciate the interdependencies between their wellbeing and the environment
- Better identifying and balancing trade-offs when making policy decisions, and better communicating these decisions to others
- Increasing government's capacity to respond effectively and in a timely fashion to emerging environmental issues that are critical to Victorian communities
- Ensuring natural resource managers share a common language and improve coordination
- Being better able to describe value to the community of investing in the environment and linking this to economic decision-making
- Improving resource allocation across programs, demonstrating value-for-money and understanding tradeoffs
- Ensuring scientists have access to more coherent data over time
- Time and cost savings in accessing data that is readily available for public use
- Stronger partnerships with external stakeholders on environmental management
- More informed and evidence-based policy development
- More efficient evaluation, monitoring and reporting of program outcomes

- Improved accountability to the government and the public.

Figure 6 -Accounting for the Environment in the State of Victoria



Source: State of Victoria, Department of Water, Land and Environmental Planning (<https://goo.gl/CAuUx9>).

6.3.2 Philippines – Ecosystem Accounting for the Laguna de Bay watershed²¹

The largest inland water body in the Philippines and the source of Manila’s drinking water, the Laguna de Bay is confronted with growing pressures. Population expansion, urbanization, industrialization, deforestation and land conversion have led to degradation of the lake and its watershed. These are some of the key challenges facing the Laguna Lake Development Authority (LLDA) and other relevant government agencies tasked to manage and protect the lake and its resources.

To aid in management of the lake, the Government of the Philippines is committed to mainstream NCA as an evidence-based tool to take stock of the lake and the country’s other natural resources in policy making. The Laguna de Bay watershed was selected as

²¹ See World Bank, 2016, *Pilot Ecosystem Accounts for the Laguna de Bay Basin*. Available at <https://goo.gl/hWjYzi>

one of two pilot sites in the Philippines to develop ecosystem accounts with assistance from the World Bank.²² The pilot account comprises the following:

- a land cover account
- a water stock account
- an ecosystem condition account
- an ecosystem services account for fisheries, water, flood control and soil erosion control.

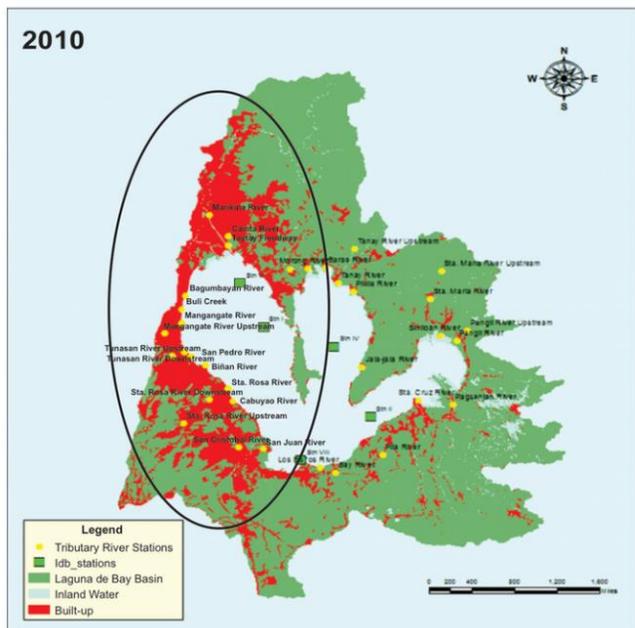
The key findings of the project include:

- Rapid and unplanned urban sprawl is a major source of land use change in the basin; built-up areas increased by 116% between 2003 and 2010
- Many new settlements are built close to the lakeshore, creating flood risks and water quality deterioration in the most densely populated sub-basins (**Error! Reference source not found.** 7)
- Forests decreased by 35%, significantly increasing soil erosion and, in turn, sedimentation of the lake, which reduces the water storage capacity of the lake, increasing flood risks to nearby Manila.

Informing these and other changes in Laguna de Bay's ecosystems highlights the value of ecosystem accounting as a tool for decision making. For example, the ecosystem accounts help identify priority areas for rehabilitation to reduce sedimentation. In contrast to the fragmented datasets that were available before the project, the integrated data and different disciplines brought together in compiling the accounts (hydrology, ecology, soil sciences, economics) aid greatly in understanding the ecosystem and its interactions with the economy.

However, the full value of the ecosystem accounts will only be realized when they are produced on a regular basis. The value of the accounts lies in showing trends in ecosystem condition, asset, and service flows over time. Given the capacities built and the lessons learned in the process of developing the accounts for Laguna de Bay, the cost of updating them in the future should be lower than the cost to establish them. Given the rate of ecosystem changes in the Laguna de Bay basin, updates should take place at least once every two or three years.

²² See <https://www.wavespartnership.org/philippines>



Built-up Areas in 2010

Laguna de Bay Sub-basins	2003	2010	2014
Marikina	C	BD	BD
Bagumbayan, Taguig		BD	BD
Buli, Muntinlupa		BD	BD
Mangagate, Mauntinlupa	BD	BD	BD
Tunasan, Muntinlupa	BD	BD	BD
San Pedro	BD	BD	BD
Binan			BD
Sta. Rosa			BD
Cabuyao	C	D	BD
San Cristobal, Calamba	D	BD	BD
San Juan, Calamba	C	A/B	C
Los Banos			A/B
Bay	A/B	A/B	C
Pila			A/B
Sta. Cruz	A/B	A/B	A/B
Pagsanjan	AA	A/B	A/B
Pangil	A/B	A/B	A/B
Sta. Maria			A/B
Siniloan	C	C	A/B
Jalajala			A/B
Pililla			C
Tanay	C	A/B	A/B
Baras			C
Morong	C	D	D
Sapang Baho, Cainta	BD	BD	BD
Manggahan Floodway, Taytay		D	BD

Water Quality Classification in the 24 Sub-basins of Laguna de Bay.

- A - Drinking Water D - Irrigation
- B - Recreation BD - Worse than D
- C - Fisheries

Figure 7 - Water quality in the Laguna de Bay watershed, 2003, 2010 and 2014

6.3.3 NCA in England and Scotland²³

In the United Kingdom, the government has committed to “put natural capital at the centre of economic thinking and at the heart of the way we measure economic progress nationally”.²⁴ As part of this, an NCA project was carried out to test ecosystem accounts for a suite of areas in England and Scotland consisting of diverse habitats. The aim of the project was to quantify the extent and condition of ecosystem assets within the six pilot areas (PA), as well as to quantify and value the flow of ecosystem services from these assets.

In addition to testing accounting methodologies, a key aim of the project was to help inform resource management decisions within the pilot areas. While land management bodies are increasingly aware of the value of ecosystem services, they often find it difficult to communicate the wider benefits in economic terms.

²³ See White, C., Dunscombe, R., Dvarskas, A., Eves, C., Finisdore, J., Kieboom, E., Maclean, I., Obst, C., Rowcroft, P. & Silcock, P. (2015), ‘Developing ecosystem accounts for protected areas in England and Scotland: Main Report’, Department for Food, Environment & Rural Affairs/The Scottish Government. Available at <https://goo.gl/sQJD3y>

²⁴ See HM Government, 2011, *The Natural Choice: Securing the Value of Nature*. Available at <https://goo.gl/KOs3Yu>

Though challenges remained at the end of the project, it demonstrated that ecosystem accounts have the potential to:

- Provide a means to promote understanding and awareness amongst key stakeholders and the wider public of the value provided by the areas beyond standard economic measures such as GDP
- Create a basis for advocacy, including influencing legislative decisions and securing funding
- Support decision-making and land management to achieve an appropriate balance between competing priorities
- Assist in identifying opportunities to enhance the ecosystem functionality of different land parcels to maximize delivery of ecosystem services
- Explore innovative mechanisms for revenue generation (e.g. payments for ecosystem Services)
- Contribute to both high-level and local monitoring of ecosystems
- Bring together data in a single framework that can be used for analysis without substantial additional primary research or data collection.

Table 1 provides a summary of the findings of the project. In general, good data were available to measure flows of materials like water and timber from ecosystems but far fewer data were available to measure the benefits of ecosystems in terms of things like air quality and recreation opportunities.

Ecosystem service	Physical flows	Rating	Monetary flows	Rating
Provisioning				
Crops	Good data on crop yields available from Defra although this indicator contains a mix of human and ecosystem inputs.	Green	Good data available on the value and costs of crop production which can be used to estimate resource rent.	Green
Livestock	Good data on livestock density available from Defra although includes human inputs and is challenging to allocate to habitats.	Orange	Good data available on the value and costs of livestock production which can be used to estimate resource rent.	Green
Wild foods	Good data on deer and game birds through the GCWT monitoring scheme but only in certain areas, less data for fish species.	Orange	Data on market values of deer, game, and fish species is available but limited in terms of the frequency it is updated.	Orange
Drinking water	Good data on water abstractions is available from the EA and SEPA across all areas and over multiple time periods.	Green	Good data available on the value and costs of water use for the public water supply which can be used to estimate resource rent.	Green
Timber	Good national data on timber harvesting which can be used to provide reasonable approximations across PAs.	Orange	Good data on softwood stumpage prices but limited information on resource rent. Data for hardwood prices is very limited.	Orange
Other water uses	Good data on water abstractions is available from the EA and SEPA across all areas and over multiple time periods.	Green	No data available on the values of water across uses other than the public water supply.	Red
Energy	Good national data on woodfuel harvesting which can be used to provide reasonable approximations across PAs.	Orange	Limited data available for estimating resource rent from woodfuel although approximations are possible.	Orange
Regulating				
Air quality	Good data on the quantity of PM ₁₀ absorbed across all PAs and over multiple time periods.	Green	Good data on the avoided damage costs of PM ₁₀ although greater spatial and temporal disaggregation would be useful.	Orange
Flood protection	Lack of scientific understanding needed to develop quantitative indicators for this service.	Red	Not possible to monetise at this stage due to a lack of quantifiable provision of this service by ecosystems.	Red
Climate regulation	Reasonable data available on average carbon sequestration rates across ecosystems.	Orange	Good time series data on the abatement costs associated with the sequestration of carbon.	Green
Cultural				
Recreation	Good data in England on total visitor numbers and reasonable approximations for visits to particular habitats through MENE.	Orange	Reasonable estimations of the value of visits across habitats are available although greater spatial and temporal detail needed.	Orange
Education	There is a lack of monitoring of flows of this service at a PA level and very limited data available.	Red	Not possible to monetise at this stage due to a lack of quantifiable provision of this service by ecosystems.	Red
Heritage	Lack of understanding needed to develop quantitative indicators linking ecosystems to physical flows of this service.	Red	Not possible to monetise at this stage due to a lack of quantifiable provision of this service by ecosystems.	Red
Aesthetic	Good data on numbers of photos taken per habitat but limited data on other aspects of aesthetic value.	Orange	Not possible to monetise at this stage due to a lack of quantifiable provision of this service by ecosystems.	Red
Existence	Good data on changes in the size of populations of charismatic species over time available for most PAs.	Green	Limited evidence base for developing estimates of the monetary value of charismatic species.	Red

Table 1 - Findings from pilot ecosystem accounts in England and Scotland.

Source: Source: White et al., 2015.

Green – good data availability; orange – moderate data availability; red – poor data availability.

7. Toward a plan of action for the government of Ontario

Implementation of NCA is a major commitment that will take many years of dedicated effort. Statistics Canada’s work on the national economic accounts, by way of comparison, began in the 1940s and continues to this day. Given this, it is important that NCA be implemented in a clearly thought-out fashion that prioritizes the accounts of greatest policy relevance from the outset.

What is set out below is not a fully elaborated plan of action for developing a program of NCA in the government of Ontario but a discussion of the elements of such a plan and the potential outputs. Some ideas regarding the substantive content of the plan are offered as starting points for its further elaboration.

7.1 Building the business case and creating demand

Given that the Ontario government has no formal NCA program at the moment, the starting point for the plan must be a convincing business case for creating one, which will, in turn, help create demand for NCA in Ontario. Much of the material necessary to build a business case has been introduced in this report:

- **Rationale** – Natural capital is essential to supporting the health and well-being of all Ontarians and yet it is not well measured in the province. Existing data, which are incomplete and fragmented, do not offer an adequate basis for managing natural capital. The goal of NCA is to provide the integrated data necessary for its sound management.
- **The benefits of NCA** – Experience with economic statistics has shown that statistics have the greatest impact when they are collected within a sound framework (the *System of National Accounts*, or SNA, in the case of economic statistics). NCA offers a similar framework – with similar advantages – for environmental statistics. Known as the *System of Environmental-Economic Accounting* (SEEA), this system is developed and promoted by the United Nations, just like the SNA. Environmental statistics organized according to the SEEA will better support decision-making aimed at supporting the health and well-being of Ontarians.
- **The costs** – Like all statistical activities, NCA demands considerable investment of resources. Much of that investment has already been made within the province, however, as many environmental data are already collected by various provincial departments and agencies. A primary goal of NCA is to improve these data by

integrating them within the SEEA framework. Data integration is much less expensive than primary data collection, so this work can be completed with an investment of relatively few additional resources (some of which could be found possibly by reallocating existing data-collection resources). The costs of any new data collection required can be controlled by adopting a stepwise approach starting with the most important data needs first. Ultimately, the cost of NCA will be justified by the increased utility of environmental statistics for decision-making to support health and well-being.

- **Why Ontario?** – Like all provinces, Ontario is responsible for managing the natural capital that falls within its borders: our protected areas, wetlands, forests, biodiversity, air, freshwater, minerals and more. And Ontarians, like all Canadians, benefit substantially from the province’s natural capital in terms of increased health and well-being. A wide variety of policy initiatives aimed to preventing and reversing declines in the province’s natural capital stand to benefit from the kind of improved environmental data offered by NCA. Experience in other jurisdictions – both national and sub-national – has shown that NCA is both feasible and relevant to real policy needs.

Creating demand for NCA is an equally important step in the process. The business case should be used to help clarify the value and benefits with key stakeholders identified in Section 6.2. Additional engagement activities will help create demand and are discussed in Section 6.5.

Potential outputs:

- Overall business case for implementing NCA in the Government of Ontario, with a discussion of the rationale, benefits and costs from the point of view of provincial departments/agencies, municipal governments, First Nations and business
- Communications material that demonstrates the value and benefits of the accounts and helps to create demand for the information.

7.2 Establishing partnerships

Partners from a variety of sectors and of various types are necessary to ensure the success of NCA. Governments (including First Nations), business, academics and civil society must all be represented. Some partners will primarily be involved as data providers and others will primarily be data users; some will be both.

Most obviously, implementation of NCA in Ontario will require partners within the government of Ontario. Ideally, a lead department within the government would be identified, with other departments/agencies cooperating to meet the goals of the program.

Ideally, the lead department would be one of the province's central agencies, as this would avoid the potential difficulties in assigning this role to a department with policy responsibilities for natural capital. It would also place responsibility for the program at the centre of government where core policy decisions are made.

Though preferable, it is not strictly necessary that implementation of NCA in Ontario be led initially from within government. An outside organization (an NGO, for example) could lead the work. In this case, the accounts would be developed and published with the goal that they be handed over to the government for on-going development, maintenance and application in decision-making. One way or another, however, government must be the ultimate steward of NCA in Ontario, as there is no business case for an external organization to provide statistics (which are a public good) on a long-term basis.

Whether the initial development of NCA is led within or outside government, cooperation of a variety of government partners would be required, as they hold many of the required data. The following departments would be key partners:

- Agriculture, Food and Rural Affairs
- Economic Development and Growth
- Energy
- Environment and Climate Change
- Indigenous Relations and Reconciliation
- Infrastructure
- Municipal Affairs
- Natural Resources and Forestry
- Northern Development and Mines
- Transportation

Provincial governments in other provinces are also potential partners. In Québec, the Institut de la statistique has undertaken substantial work on NCA. InnoTech Alberta, the technology innovation agency of the government of Alberta, has a strong interest in NCA as well. With a newly elected government that includes members of the Green Party, the government of British Columbia is also interesting as a potential partner.

In addition to provincial government partners, key agencies from the federal, municipal and First Nations levels should also be partners. At the federal level, Statistics Canada would be the most important partner, as it has the NCA mandate for the country and already produces a number of accounts, some of which offer detail for Ontario.

Beyond Statistics Canada, core federal ministries with responsibility for natural capital are obvious partners (Agriculture and Agri-Food, Environment and Climate Change, Fisheries and Natural Resources).

Municipally, large cities (the GTA, Ottawa, Hamilton, Barrie, Niagara, Sault Ste. Marie, Thunder Bay) are potentially important partners, as they all manage significant amounts of natural capital and are seen as leaders by smaller municipalities. The Federation of Canadian Municipalities and Municipal Natural Capital Initiative could be other important partners from the municipal sphere.

First Nations are important potential partners. As well as being stewards of natural capital on their lands, they would bring a unique perspective as suppliers of data based on traditional ecological knowledge. The Chiefs of Ontario, Métis Nation of Ontario and Union of Ontario Indians are all organizations representing First Nations in the province.

Conservation Authorities are another set of potential partners. Unique to Ontario, these non-profit organizations have considerable responsibilities for preservation of natural capital in specific watershed. Most conservation authorities operate in the southern part of the province. The Credit Valley Conservation Authority is one such organization with an interest in NCA.

Environmental NGOs should also be seen as potential partners. The country and province benefit from a number of well-established and effective organizations that could be invited as data suppliers and, more importantly, data users. These include, among others, ALUS Canada, Canadian Council on Ecological Areas, Conservation Ontario, Ducks Unlimited Canada, Green Infrastructure Ontario, International Institute for Sustainable Development, the Friends of the Greenbelt Foundation, the Pembina Institute, Smart Prosperity, the Suzuki Foundation WWF Canada, and Museum of Nature.

Businesses are another set of important partners, as they hold many data that are relevant to measuring natural capital and make many decisions that impact it directly. Farmers are obvious partners given their role as stewards of much of Ontario's landscape, especially in the southern part of the province. The Ontario Federation of Agriculture could be invited to represent them. The Canadian Agri-Food Policy Institute is another farm-focused organization with an interest in NCA. Beyond farmers, businesses in the forestry, mining, energy, tourism, transportation, accounting, banking, insurance and consulting industries are all potential partners. The Chartered Professional Accountants of Canada is a business-

focused organization with a strong interest in NCA. Other specific business sector partners include Deloitte, TD Bank and The Cooperators Insurance.

Finally, academic researchers should be considered as potential partners. Those with specific interest in NCA include Diane Dupont (Brock), Peter Victor (York), Marian Weber and Vic Adamowicz (University of Alberta), Nancy Olewiler (Simon Fraser), Nic Rivers (Ottawa) and Paul Thomassin (McGill).

Potential outputs:

- Identification of a lead organization, either within or outside the provincial government
- Confirmed engagements with key partners
- Clear terms of reference for partner engagement
- Steering committees, technical committees, advisory panels and other mechanisms to engage stakeholders

7.3 Defining the system and identifying priorities

The development of a plan of action must include defining the NCA system itself and then identifying the priorities for its implementation in Ontario.

7.3.1 Defining the system

Defining the system in conceptual terms is not difficult thanks to the SEEA. It provides a ready-made and internationally accepted set of guidelines for accounting for natural capital. Adopting it as the basis for NCA in Ontario would be strategically wise.

As noted earlier (Section 0), the SEEA comprises three sets of accounts:

- **Natural asset stock accounts** measuring *in situ* quantities of natural resource assets and, where possible, their economic value.
- **Physical flow accounts** measuring the flows of materials and energy from the environment to the economy in the form of natural inputs and flows from the economy back to the environment in the form of waste materials and energy.
- **Activity/purpose accounts** measuring environmental transactions that are already captured in the SNA but are hidden because of aggregation.

NCA in Ontario should include accounts of all the above types. More specifically, the system should include:

- **Natural resource stock accounts** measured in physical and monetary terms for minerals, timber and fossil fuels
- A **water account** measuring the renewal of water from precipitation an in-flow and the use of water for human activities in physical and monetary terms
- A **land account** measuring the area and value of land by cover type and, where possible, use
- **Ecosystem accounts** measuring the extent, quality and value of terrestrial and aquatic ecosystems, along with the quantities and values of the ecological goods and services provided by those ecosystems
- A **waste emissions** account measuring flows of pollutants of all types (solid, liquid, gaseous, energetic) from human activities to the environment in physical and monetary terms
- A **resource use** account measuring consumption of materials and energy by human activities
- An **environmental protection expenditure account** measuring the value of operating and investment spending by households, businesses and governments on environmental protection
- An **environmental goods and services sector account** measuring the activities of businesses producing goods and services aimed at reducing pressure on the environment
- An **environmental finance account** measuring taxes, fees, royalties, “green” bonds and other financial stocks and flows relevant to the environment.

To the extent possible, all accounts should be measured on an annual basis. Quarterly measurement could also be considered for accounts measuring variables with high policy relevance such as GHG emissions or “green jobs”.

The accounts should all be compiled for the province as whole and, where possible, at the sub-provincial level. Sub-provincial accounts could any of ecodistricts, watersheds and census regions as spatial reporting units.

In all cases, measurement in physical terms should be the starting point. Even where monetization is possible, physical data are needed first. Accounts measured in monetary terms should be reported in both current and constant (inflation-adjusted) prices.

Potential Outputs:

- The creation of an initial set of ‘accounts’ as described above. Engagement activities

7.3.2 Identifying priorities

Identifying priorities for account development is more difficult than defining the system conceptually, as it requires detailed knowledge of gaps in existing environmental data and policy priorities in the province. A high-level view of these in Ontario would suggest that priority accounts would include at least the following:

- **Land cover account**²⁵ (a land cover account is the starting point for all ecosystem accounts, so is an obvious priority)
- **Ecosystem accounts for wetlands** (wetlands are valuable in Ontario)
- **Natural resource asset accounts for timber and minerals**²⁶ (timber and minerals are key commercial natural resources in Ontario)
- **Waste emission accounts for water pollutants** (Ontario's lakes, rivers and wetlands are under pressure from pollution, especially in the populated south)
- **Environmental goods and services sector account for "clean-tech"** (this account is key to understanding the impact of federal and provincial policies to invest in green infrastructure)
- **Environmental finance account for carbon tax flows and green bonds** (with the implementation of nation-wide carbon pricing, this account is key to tracking the associated financial flows).

Potential outputs:

- A clearly defined system of NCA for Ontario consistent with the SEEA
- A clear set of priorities for implementing the system agreed upon with input from all stakeholders

7.4 Implementing the system

Once a lead organization and partners are identified, the system is defined and priorities are established, work could begin on implementing the system. The work should be carried out in phases, with the first phase focused on building the accounts for the agreed-upon priorities and then applying the accounts in decision making. Subsequent phases would build upon the lessons learned in phase 1 and progressively implement and apply more elements of the system (recognizing that full implementation will be a long-term process).

²⁵ It should be noted that the government of Ontario has, in fact, already made some progress on this priority. Pilot accounts for land cover (in physical units only) and have been developed by the Ministry of Natural Resources and Forestry on an unofficial and experimental basis.

²⁶ As with land accounts, the government of Ontario has made some progress on asset accounts for timber. Pilot timber asset accounts in both physical and monetary terms have been developed by the Ministry of Natural Resources and Forestry.

The rate of progress on implementation will vary depending on the financial and human resources available and who is identified as the lead organization. At a minimum, the initial phase of implementation would require one to two years in order to collect the required data, build and quality-check the accounts and begin the process of applying their outputs in decision-making. Overall, depending on the scope of the full system, five to ten years would be required to accomplish full implementation. Beyond that, work would be focused on maintaining the accounts, improving their quality and increasing their scope. As noted above, the implementation of the SNA, which began in the 1940s, is still going on today at Statistics Canada. It is fair to say that accounting systems are never really “finished”, as there are always improvements that can be made to concepts, methods, data sources, scope and applications.

Funding for implementation would, ideally, come largely from within the provincial government with external organizations (e.g., other levels of government, the Trillium Foundation, businesses, private charitable foundations, NGOs, universities) contributing additional cash or in-kind resources. Depending on the scope of activities included, the first phase of the project could cost up to \$500 thousand over one to two years. Full implementation could cost \$5 million to \$10 million over five to ten years, depending on the degree of new data collection required. On-going maintenance and development beyond that could cost \$500 thousand to \$1 million depending on the final scope of the system.²⁷

Individuals with a range of skills, knowledge and experience would be required to undertake the work. At a minimum, natural resource experts (biologists, foresters, ecologists), economists/statisticians and accountants would need to be involved. Five to ten full-time equivalent staff positions would be required depending on the scope of the system and the stage of implementation (more would be required during the developmental stage than during the maintenance stage).

Potential outputs:

- Phase 1: High-priority NCA implemented and applied in decision making
- Phase 2 and beyond: Progressive expansion of the implemented portion of the system and deepened application of system outputs in decision making
- Publicly accessible NCA datasets and reports made available on-line (e.g., through open data portals)

²⁷ By way of comparison, Statistics Canada spends tens of millions of dollars annually to compile the System of National Accounts.

- Integration of NCA outputs into government decision making (e.g., use of NCA indicators in the annual provincial budget).

7.5 Engaging with stakeholders

Any successful plan includes identification and engagement of the appropriate group of stakeholders. In the case of NCA in Ontario, stakeholders include the partners discussed above along with the public, media, international organizations and other nations engaged in NCA.

Stakeholder engagement is a challenge in any effort. Engaging with stakeholders on NCA is made more challenging by the fact that natural capital remains a novel concept for many people. *Accounting* for natural capital is all the more novel. Given this, the following points should be borne in mind in designing a stakeholder engagement strategy:

- **Simplicity** – Means must be found to express the sometimes-complex concepts that underpin natural capital in terms understandable to broad audiences. The concept of wealth, for example, is key to understanding why measuring natural capital is important. Wealth is often confused with income in everyday usage, however, so messaging about wealth is easily confounded.
- **Focusing on the end and not the means** – NCA is not an end in itself, but a means to an end. The goal it serves is preservation of natural capital, which, in turn, serves the end of maintaining peoples' health and well-being. For this reason, the focus of communications about NCA should be on the results and what they mean rather than on the accounts themselves.
- **Resistance from the *status quo*** – Some stakeholders may feel threatened by better accounting for natural capital. This includes those currently responsible for measuring natural capital, who may feel that NCA is an implicit attack on the quality of their work and those who benefit from the current regime for managing natural capital (e.g., companies that avoid costs by using nature's free waste assimilation processes).
- **Overpromising** – While the potential for NCA to improve the quality of environmental data for decision making is substantial, it is not a panacea. Even in the domain of economic statistics, the SNA does not answer all questions. It is important, then, to avoid promising too much from NCA. It is best to be clear about what NCA can and cannot do and then to focus on ensuring that it delivers results where it has the greatest potential to do so.
- **Timeframe** – NCA is a long-term commitment. Building accounts and using them to influence decision making will not occur overnight. Patience and a willingness to continue investing even if immediate results are not obvious is required.

Potential Outputs:

- Partnership roundtables to clarify the roles of partner organizations
- NCA forums with key stakeholders (e.g., decision makers, accountants, the media, researchers) to explore the importance and benefits of NCA and how to communicate them.
- Research reports
- Newspaper articles
- Conference presentations
- Webinars

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