

Economics and Environmental Policy Research Network

Research Symposium

October 29th – 30th, 2018

Session Notes for Panel VII: Advancing Research on Natural Infrastructure

1. Context of Discussion

This session sought to explore the key research gaps and policy needs for supporting and advancing natural infrastructure.

Key themes discussed in the session include:

- Canada's long history with natural infrastructure, dating back to as early as the 1900's, when the Canadian Commission on Conservation noted that we should live on the interest of our natural assets. Currently, a commonly used definition of natural infrastructure in Canada is *the use of naturally occurring resources or engineered use of natural resources to provide mitigation or adaptation services*.
- Natural infrastructure is recognized as a valuable asset for **climate resilience** in Canada, and a strong complement to traditional, grey infrastructure solutions for flood and drought control. Climate resilience is a significant area of focus in Canada, where the financial impacts of extreme weather events are being felt by a growing number of homeowners and communities. For example, the increase in property and casualty insurance losses is indicative of the growing costs associated with these events. These losses averaged \$405 million per year between 1983 and 2008, and \$1.8 billion between 2009 and 2017. Water damage is the key driver behind these growing costs. Natural infrastructure can be a cost-effective way to mitigate material financial losses that would otherwise result from flooding and other climate-related catastrophes.
- Recent advances in natural infrastructure include a [report](#) by the *Intact Centre on Climate Adaptation* that develops an implementation framework natural infrastructure, addressing a number of valuation issues. Similarly, the [2018 report on Best Practices and Resources on Climate Resilient Natural Infrastructure](#) also advances the state of the natural infrastructure discussion in Canada, identifying key opportunities for the future.
- There is a lot that Canada can learn from other countries around the world in the implementation of Natural Infrastructure. For instance, the US Army Corps of Engineers has made extensive strides in applying real-world use of natural infrastructure.
- That said, there remain substantial **knowledge-based challenges** that hinder the implementation of natural infrastructure. These include technical and institutional capacity issues among local governments, and the inadequate ability of relevant stakeholders to make a strong business case in support of natural infrastructure. It is unclear what the most effective approach is to improve the technical and institutional capacity of government and other stakeholders, thereby improving their ability to provide guidance in policy and regulation.
- In addition to knowledge-based challenges, the need to conduct total economic value analysis (including multiple benefits) in support of natural infrastructure is also a challenge. Furthermore, much of the necessary **data is either hard to access or does not exist**. However, this accounting

for the value of natural assets will be crucial in supporting more widespread consideration of natural infrastructure.

- The **irreducibly place-based character of natural infrastructure** creates a challenge for large-scale uptake and endorsement of these approaches. For instance, a northern versus southern wetland performs differently when looking at greenhouse gas sequestration, just as a young versus mature forest does.
- The **inter-disciplinary nature** of natural infrastructure is also a challenge. It involves not just different levels of government, but landscape architects, engineers, ecologists and planners. Interdisciplinary collaboration is crucial for the success of such an integrative activity. Additionally, substantial culture changes will be required in certain disciplines. For example, engineers are trained to reduce risk; but green infrastructure cannot mimic the relative certainty of built infrastructure.
- Furthermore, there is a **need for increased awareness** among decision makers and technical experts of natural infrastructure as a viable option to consider and of the potential benefits it may bring. While case studies do raise awareness about individual examples of natural infrastructure projects, there is a need to develop a more comprehensive approach that looks at transformational rather than incremental reform of the existing policy regime as a whole. It is expected that such reform will expose the complication of **overlapping political jurisdictions** in this field. That said, the barriers to implementation of such a new policy regime are likely the same as for other long-lived capital projects e.g. spillover effects, network externalities, discounting etc.
- **Financing** was also raised as a core challenge for the field, with a need to scale investments into projects that appeal to funders beyond government alone. Central to this will be the need to make a strong financial case for investment in natural infrastructure, which relies on being able to monetize ecosystems more clearly. One particular area of focus is utilizing such financial instruments and green bonds to scale natural infrastructure restoration and conservation projects. The Climate Bonds Taxonomy, a global guide to climate aligned assets and projects, already recognizes nature-based solutions for climate resilience to be eligible for green bond issuances. Canada is endowed with vast natural resources, including forests and wetlands, which can become investable assets, given creative financial engineering.
- **Accounting** for natural infrastructure assets in Canada should also be improved. Today, Canada's Public Sector Accounting Board Handbook (Financial Statement Concepts, Section PS 1000, Paragraph .57) contains a prohibition clause preventing natural infrastructure from being accounted by public entities:

"Purchased natural resources and Crown lands are recognized in government financial statements. However, when natural resources and Crown lands have been inherited by the government in right of the Crown and have not been purchased, they are not given accounting recognition as assets in government financial statements. These items are not recognized as assets because the costs, benefits and economic value of such items cannot be reasonably and verifiably quantified using existing methods. Similarly, art and historic treasures are also not recognized as assets."

There is a growing support from industry, academic and NGO stakeholders in Canada to remove this prohibition clause, as well as the prohibition against recognizing any and all intangible assets (in paragraph PS 1000.58) from the conceptual framework.

- The question of **grey versus green infrastructure** was also raised. Whereas grey infrastructure is designed and created for a very specific, well-defined purpose, natural infrastructure results in the creation of important co-benefits. It would be helpful to have a clearer assessment of the types of functions typically fulfilled by grey infrastructure that could conceivably be substituted by natural infrastructure. For instance, it is unlikely that natural infrastructure will ever replace

highways, but it has been shown to be effective at replacing traditional infrastructure that have watershed management and climate adaptation functions.

- **The monitoring and evaluating of outcomes** associated with natural infrastructure is also an important area where much work remains to be done. Natural systems are not predictable and experience many more temporal variations than grey infrastructure (e.g. in some times of year they provide reliable benefits; other times of year they need more deliberate management). With this in mind, there is a need to define more clearly what we are looking to get out of a particular natural infrastructure project and how we measure those outcomes.
- Additionally, the question of **prioritizing efforts** is an important one: it will likely never be possible to save every wetland, so where should we focus natural infrastructure efforts in order to target those geographic and ecologic areas that will provide the most optimum combination of services and benefits? Additionally, we must be careful not to view natural infrastructure as a silver bullet. There are important **trade-offs** to be considered. For instance, an ecosystem that is excellent at carbon sequestration might create a lot of nutrient run-off.
- Finally, in a Canadian context it might be valuable to seize low-hanging fruit and **replicate successful natural infrastructure cases to increase uptake and address cultural/status quo biases**. More specifically, taking a largely, proven and well received natural infrastructure sub-domain such as wetlands and facilitating wider uptake, data collection and evaluation, may help drive appropriate use of natural infrastructure in other sub-domains.

2. Research Questions Identified

- **How do you make a strong business case for natural infrastructure that speaks to certainty and reliability of service levels, etc.?** Among other things, more work will need to be done on emphasizing and pricing benefits e.g. improvements in air quality etc.
- **How do we account for the value of natural assets so that it can be included on standard accounting balance sheets? What data is needed to conduct this kind of valuation? Who is currently in possession of such data or who should be collecting it? What barriers are currently complicating the inclusion of the value of natural assets in financial statements?** E.g. in Canada, there is a clause that purchased natural resources and crown lands are recognized on government financial statements, but existing natural resource assets are not recognized as assets because the costs, benefits, and value of these assets cannot be reliably quantified. **How do we address these barriers?**
- **With policy-making and implementation in mind, what can the valuation of natural infrastructure actually capture?** E.g. What are the capture-able benefits that show up in property values, that are taxable etc?
- **What will be needed to create a national standard for assessing the value of natural infrastructure assets and incorporating these values into our financial balance sheets? What would such a national accounting standard mean for liability issues, and management incentives/frameworks?**
- **How do we take the study of natural infrastructure beyond individual case studies, looking instead at the development of a more comprehensive policy regime in support of widespread mitigation and adaptation?**

- **How do we support the transition to full cost valuation and capital asset pricing frameworks? How do we ensure buy-in from local governments and regional authorities on this?**
- **Community planning is crucial – how do we involve the business sector and individuals in these conversations?**
- **How do we move past the common academic notion that research in this area is too applied for true researchers to engage with?**
- **Grey infrastructure is typically designed and created for a very specific, well-defined purpose. What are the types of functions typically fulfilled by grey infrastructure that could conceivably be substituted by natural infrastructure?**
- **Given that natural systems are less predictable and experience more temporal variations than grey infrastructure, how can we develop a framework that more clearly defines objectives and measures outcomes for natural infrastructure projects? Can such objectives and standards be assessed and enforced? Or would it be more beneficial to move towards ranges and non-specific standards that take into account uncertainty in risk, climate, etc?**
- **How do we identifying the most valuable geographic and ecologic areas that will provide the most optimum combination of services and benefits, acknowledging that we will never be able to conserve/restore all natural areas?**
- **How do we implement the many inter-disciplinary culture changes required to drive adoption of natural infrastructure forward?** E.g. how to reconcile engineers' quest for low risk and relative certainty with the increased variability and delayed outcomes of natural infrastructure? What does the relative distribution of outcomes associated with green versus grey infrastructure mean for relative implementation rates?
- **When it comes to infrastructure, there is no standard of procurement for quality. How much standardization is useful and in what context? How should we trade-off standardization with the risk of lock-in, as many natural infrastructure questions are location-specific?**
- **How do we deal with cross-sector linkages when talking about natural infrastructure?** e.g. what does increasing self-insurance/exposure to flood risk (in uninsurable areas) mean for financial sector lending risk and municipal/provincial/federal public backstops?