



Valuing the Non-Market Impacts of Energy Infrastructure

Patrick Lloyd-Smith
University of Saskatchewan
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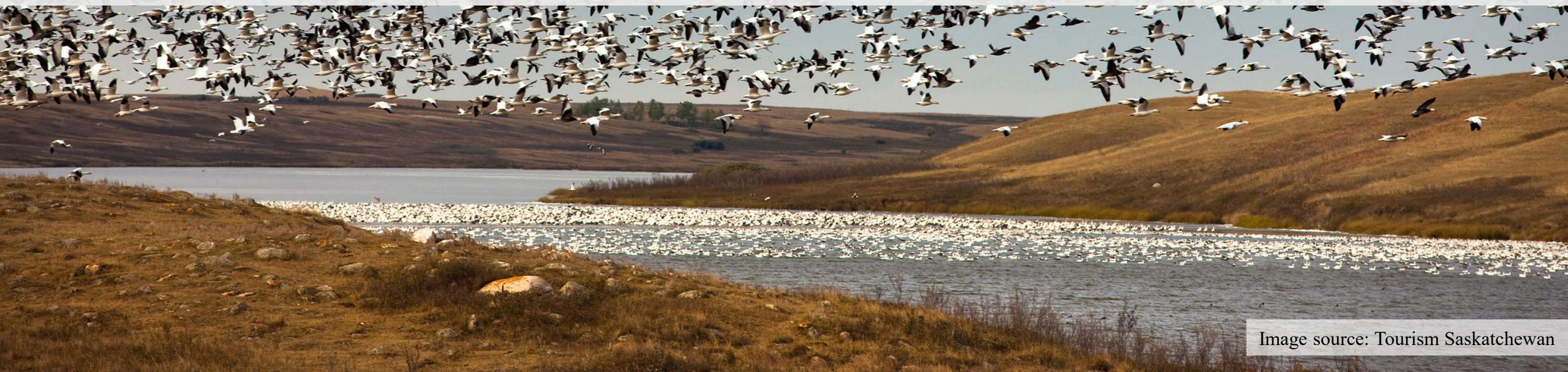


Image source: Tourism Saskatchewan

Are externalities of energy infrastructure important?

Pipelines



Wind farms



How can we incorporate these non-market impacts into economic analyses?

Natural gas plant



Hydropower



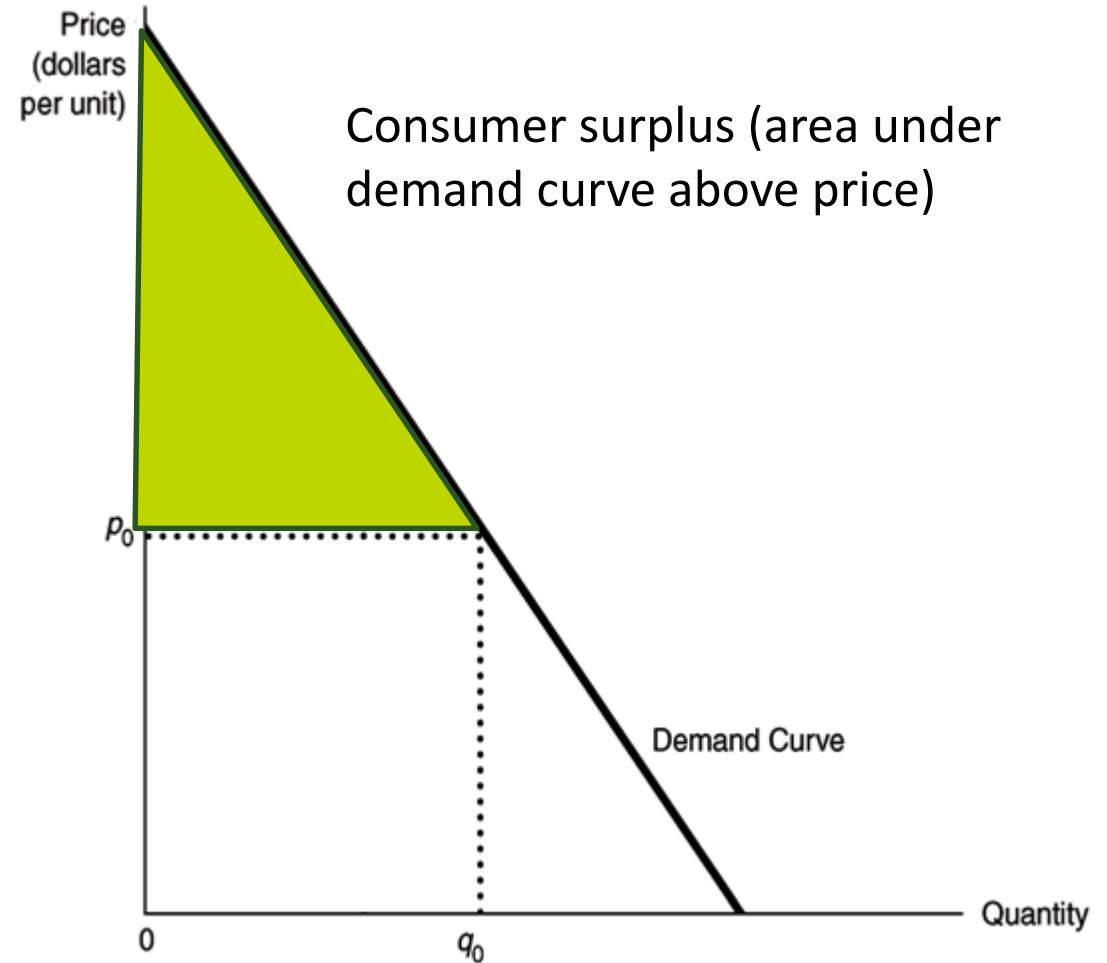
Top left: Jason Payne / Png
Top right: Colin Mcconnell / Toronto Star
Bottom left: Richard Lautens / Toronto Star
Bottom right: Chad Hipolito / Canadian Press

Why value non-market impacts?

- Growing demand for including environmental impacts in economic analysis
 - **Benefit-Cost Analysis (BCA)**
 - **Compensation Payments in Pollution Incidents**
 - **Environmental Costing/ Liabilities**
 - Setting Green Taxes
 - Green National Accounting

What do we (economists) mean by value?

- Economic theory says consumer surplus plus producer surplus.
- Interested in valuing changes from baseline (Willingness-to-pay/willingness-to-accept)
- What impacts are not valid welfare measures?
- Change in GDP (GDP is not a metric of welfare).
- Increased household expenditures (expenditure change does not measure welfare)



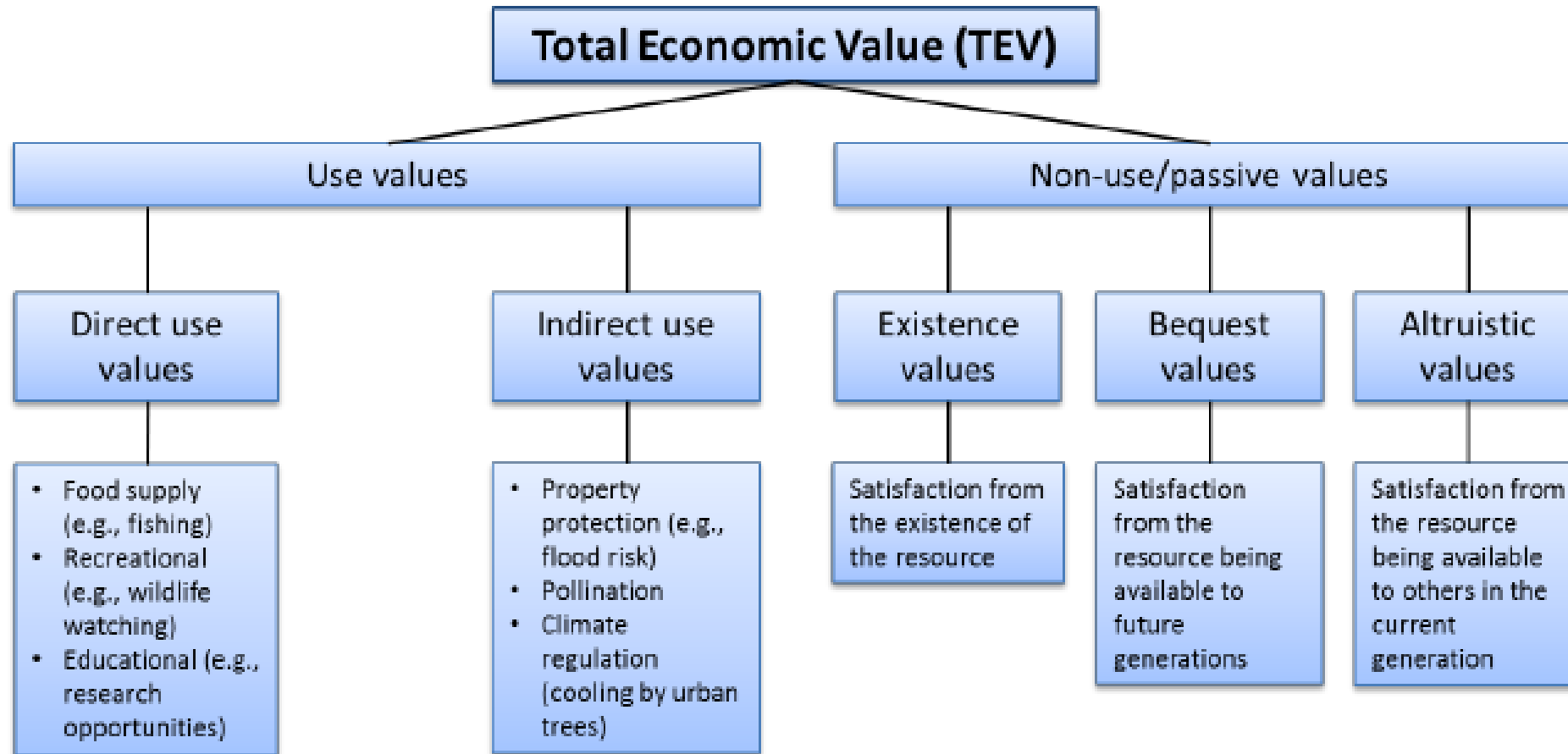
Why are economic values useful?

- Consistent means to quantify and compare changes in outcomes, in terms of their values to people
- Credibly estimated economic values are (Johnston, 2016):
 - Quantified in units with clear meaning (i.e. dollars),
 - Comparable to project costs and market values quantified in monetary units,
 - Of consistent interpretation across projects and methods, and
 - Directly comparable across individuals, regions, impacts, etc.
- One piece of complementary information to help make decisions

The non-market valuation challenge

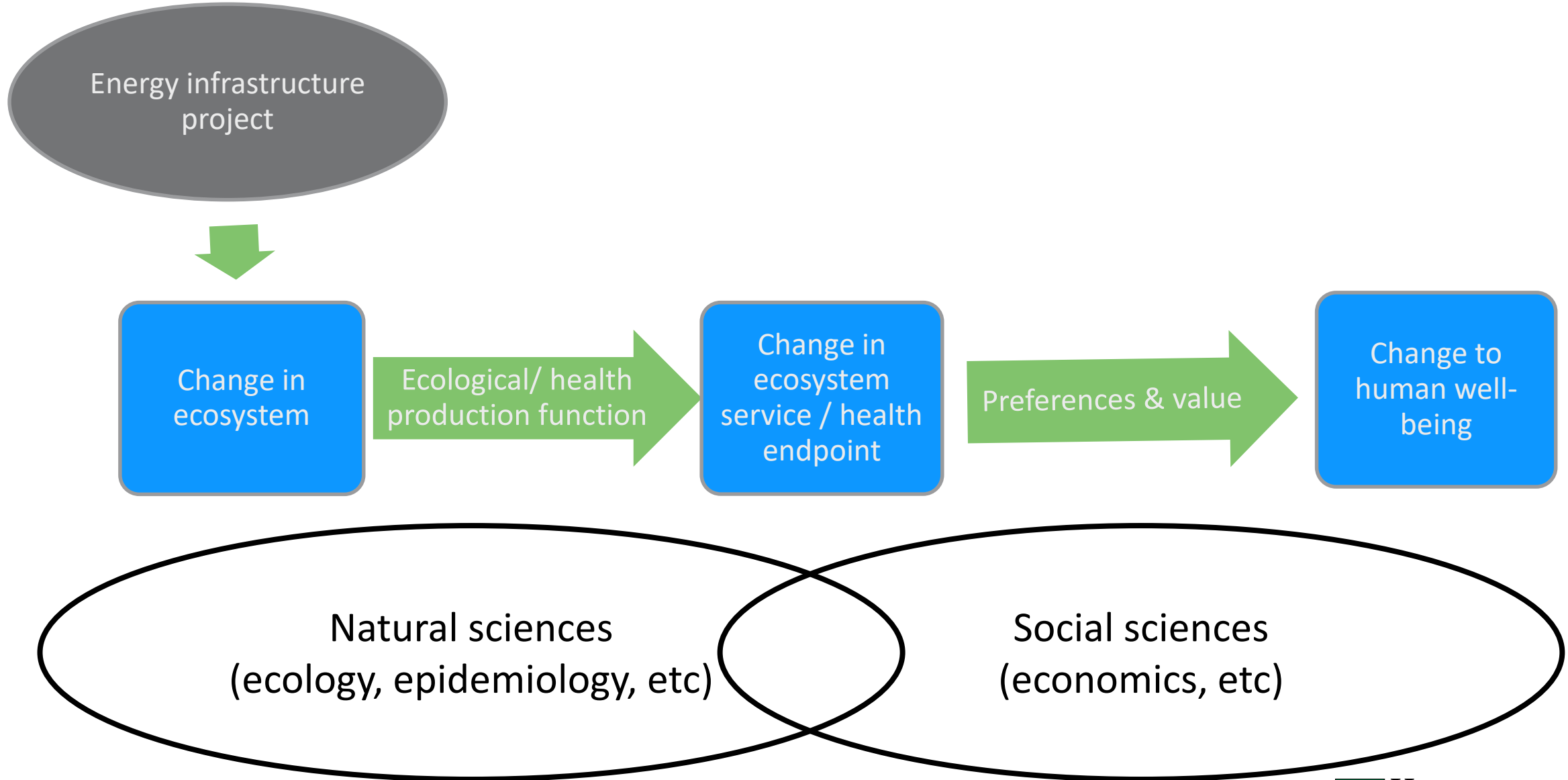
- For market goods, we generally have a good understanding of the dimensions/attributes that affect value
 - The result of years of market observations and everyday “cost-benefit” decision making by individuals
- What's different about environmental goods/services?
- Practitioner needs to define the unit of measurement (quantity or quality) and the prices (willingness-to-pay/willingness-to-accept)
- Just because something doesn't have a market price \neq zero value

Different types of economic values



*Note: Source: NESP guidebook. Adapted from R.K.K. Turner, S.G. Georgiou, and B. Fisher, *Valuing Ecosystem Services: The Case of Multi-Functional Wetlands* (London: Earthscan, 2008).*

Non-market valuation as one part of larger assessment

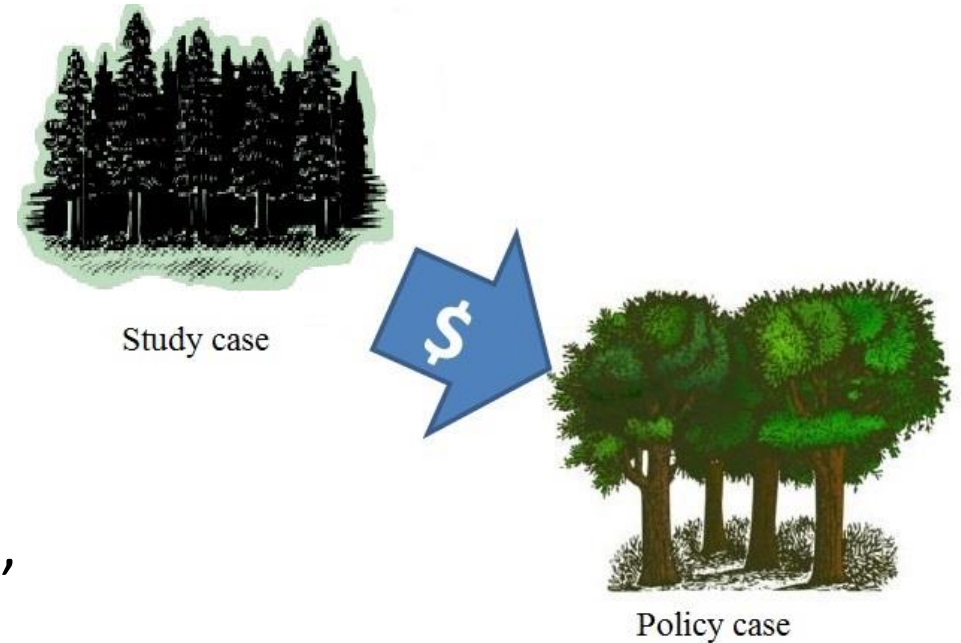


The non-market valuation toolbox

- Choice of methods depends on specific change, values, and available data
- Primary valuation methods
 1. What trade-offs did people make? (**revealed preference**)
 - Learn about preferences/values through past choices
 - Examine house prices, recreation trips, drinking water choices, etc.
 2. What trade-offs do people say they will make? (**stated preference**)
 - Structured conversations with people
- Flexible set of methods that have been refined over last ~40 years

Benefit transfer

- We always prefer primary valuation, but...
its time consuming, expensive, and require specific expertise
- **Benefit transfer** uses economic value estimates from existing research to approximate the value of a similar but separate change elsewhere
- Very (too?) popular, but...
Not always possible, or proper, to transfer values between study areas
Not advisable if you need a precise estimate
- Best viewed as providing a quick 'order of magnitude' estimate



Benefit transfer errors

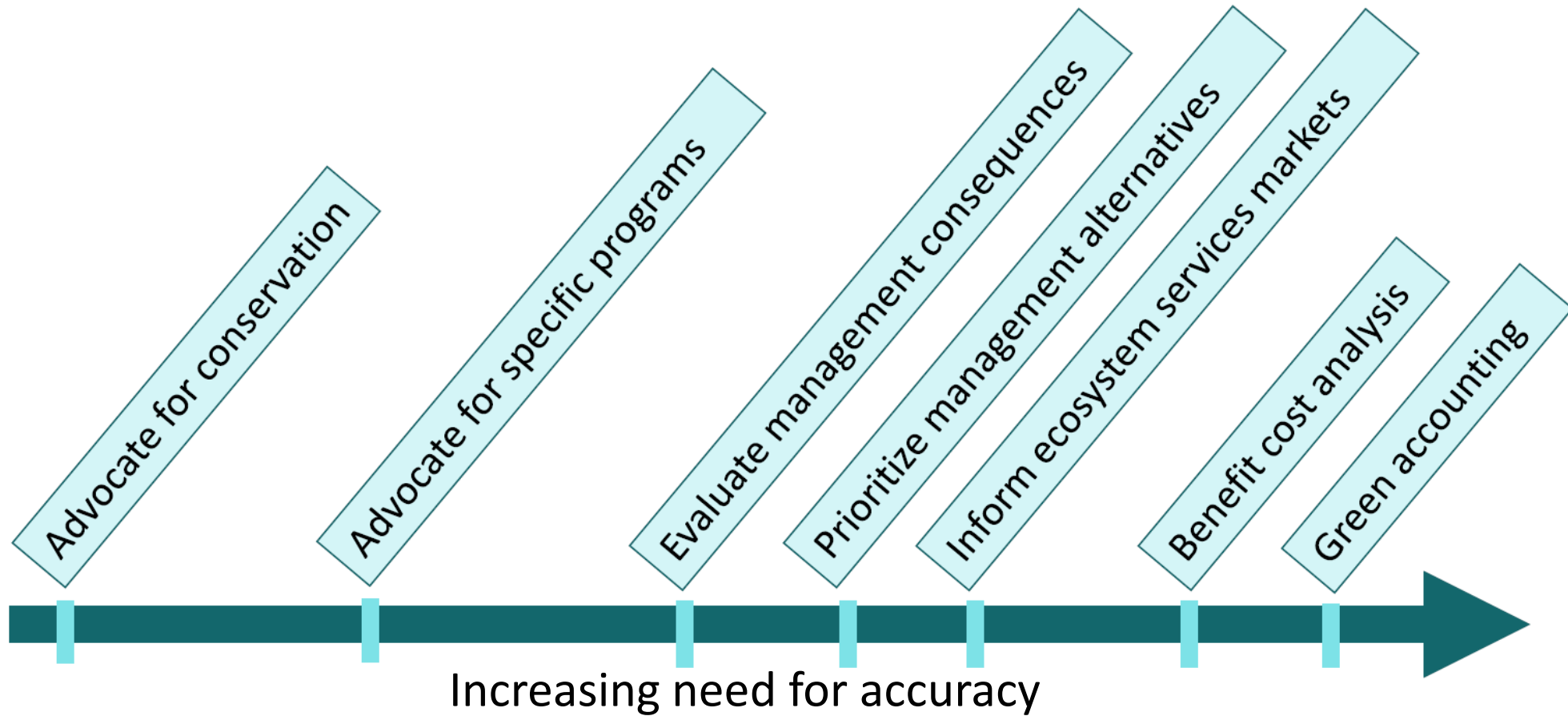
Benefit Transfer Method	Mean Absolute Value Error	Median Absolute Value Error	Range of Absolute Value Errors	Number of Studies
Unit Value	140%	45%	0-7496%	1,792
Benefit Function	65%	36%	0-929%	756

Rosenberger (2015)

Are we ok with a ~100% error?

How accurate do we need to be?

- The need for accuracy depends on the purpose of the analysis



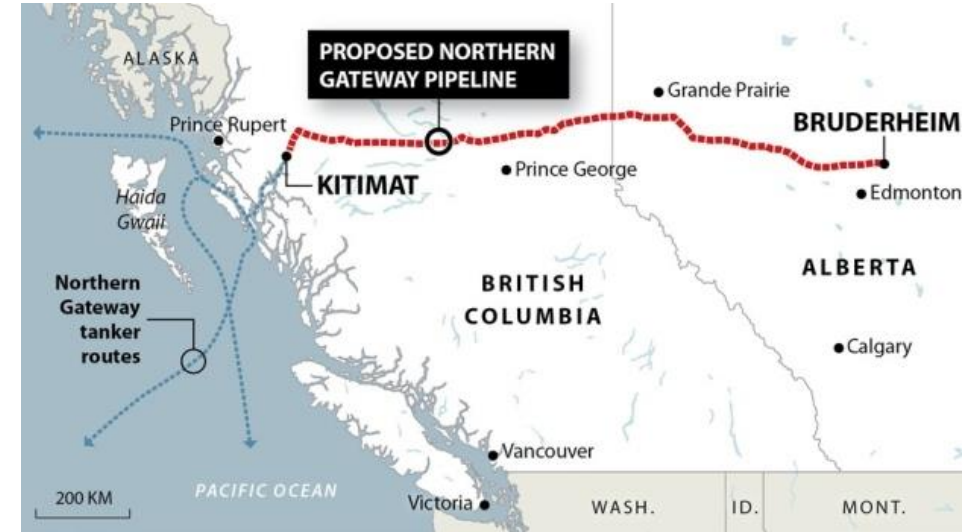
The state of non-market valuation in Canada: Two stories



BP oil spill in 2010

NOAA conducted two large-scale studies

- Recreation use values (\$660 million)
- Non-use values (\$17.8 billion)



Northern Gateway pipeline

- Comprehensive environmental assessment / economic impact analysis
- No formal non-market valuation study
- NEB tossed out a submitted benefit transfer study

Does valuing nonmarket impacts...

- Need to happen for all energy infrastructure projects?
- Replace economic impact analyses?
- Favor easy to quantify impacts?
- Require monetization of all impacts?
- Always change the outcome of a decision?
- Always generate high values?

Does valuing non-market impacts...

- Need to happen for all energy infrastructure projects? No
 - Replace economic impact analyses? No
 - Favor easy to quantify impacts? No
 - Require monetization of all impacts? No
 - Always change the outcome of a decision? No
 - Always generate high values? No
- But when credibly done, can provide useful information on people's preferences/values for a broad range of impacts from energy infrastructure projects

Concluding comments

- Non-market valuation quantifies well-being using economic theory
- We have a flexible set of methods that have been put through ringer
- Still lots of work to do to improve valuation methods
- Lots of opportunities to increase applications of non-market valuation in Canada
- Need to compare against analogous market welfare measures (i.e. not GDP)
- Economic values only one framework to interpret human-nature relationship

The last word

“non-market valuation methods are the worst means of assessing peoples’ economic preferences for goods and services traded outside the market except for all the other methods that have been tried.”

