Welcome to this week's presentation & conversation hosted by the **Canadian Association for the Club of Rome**, a Club dedicated to intelligent debate & action on global issues.

The views and opinions expressed in this presentation are those of the speaker & do not necessarily reflect the views or positions of CACOR.

The Buy-one-get-one-free of Climate Policy.

Description: Climate change & air pollution share many common drivers & sources. However, policies to address each are often developed independently & without coordination. Further, broad public support for aggressive decarbonization measures has been elusive in Canada, & long-term climate policies remain vulnerable to political fluctuations. This talk explores quantitative linkages between climate mitigation & air pollution & seeks to show the value of an expanded narrative around climate action that incorporates air pollution impacts on population health & environmental justice.

Biography: Amir Hakami is an Associate Professor of Civil & Environmental Engineering at Carleton U. His expertise is in air quality modeling, & his research is on applications of models to inform air pollution decision-making. Much of his work is placed at the interface of various disciplines such as atmospheric modeling, population health, environmental economics, & environmental justice.

The presentation will be followed by a conversation, questions, & observations from the participants.

CACOR acknowledges that we all benefit from sharing the traditional territories of local Indigenous peoples (First Nations, Métis, & Inuit in Canada) and their descendants.

Website: canadiancor.com
Twitter: @cacor1968
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2024 May 15 Zoom #197

Climate Change and Air Pollution

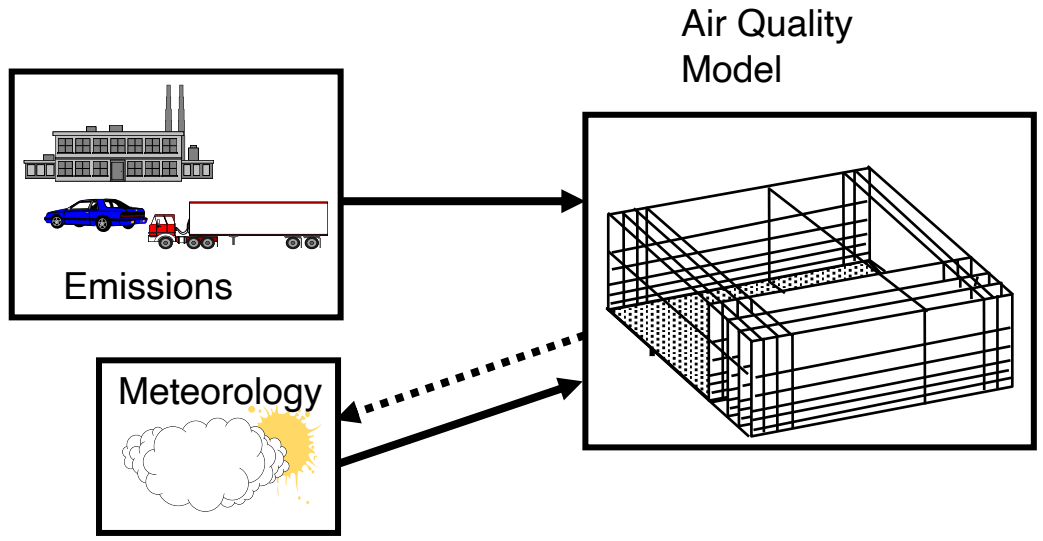
- Somewhat of an arbitrary distinction.

- Air pollution and Climate change share many common drivers.
  - Combustion → emits both GHGs and air pollutants.

- Climate change and air pollution impact each other in different ways
  - Warmer climate → higher ozone → climate penalty
  - Air pollutants also impact climate
    - Ozone and soot → warming effect
    - Sulfate → cooling effect

Air Pollution and Models

- I am an air pollution modeler, and an engineer.
- As an engineer, I am more focused on how we can solve the problem more efficiently.
- Models to inform decision-making
  - Overlap with various disciplines
    - Population health
    - Economics
    - Social Sciences



Air Quality Co-benefits of Climate Mitigation

- Air pollution and climate change share many common drivers. However, climate and air pollution policies are developed(mostly) independently and without coordination.

- Co-benefits: Ancillary benefits of climate mitigation; not limited to air quality.

  - GHG ↓ → less warming → climate penalty ↓ → type-I co-benefit
  - GHG ↓ → co-emitted air pollutants ↓ → health burden ↓ → type-II co-benefit

Valuating the invaluable

- A necessary evil for decision-making and benefit-cost analysis.

- Valuating life → Value of Statistical Life (VSL)
  - A statistical measure of the society's willingness to trade money for reduced risk of mortality.
    - Gray areas and ethical dilemmas abound.
  - While mortality incidence rates are much lower than morbidity, mortality dominates the valuation of population health impacts.

- Valuation of climate impacts → Social Cost of Carbon (SCC)
  - From $50 USD to $190 USD.

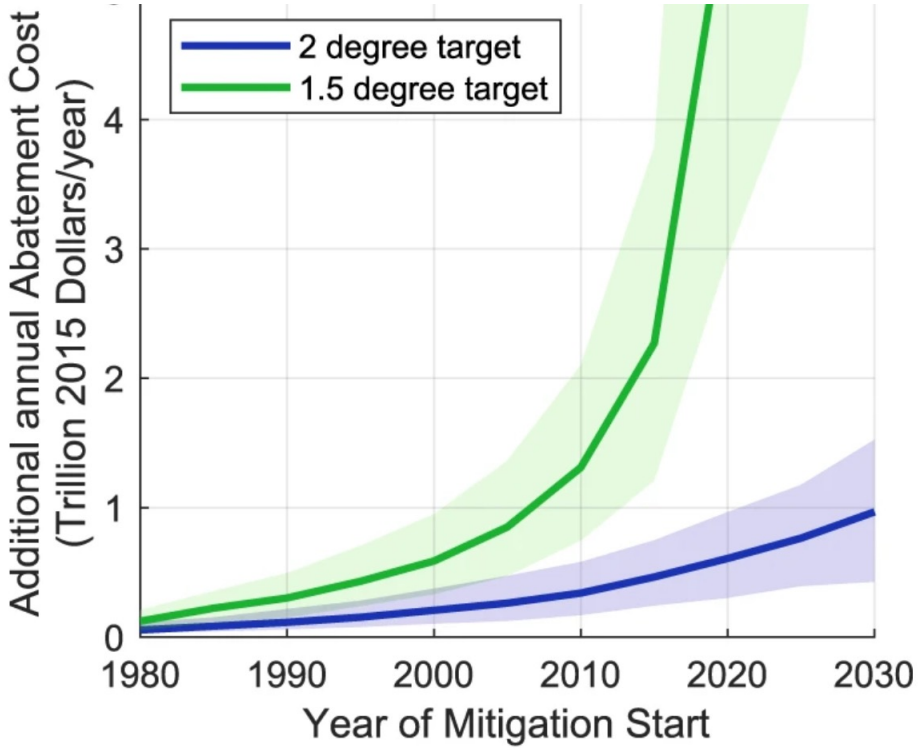
How Expensive is Climate Action

- Many studies, great uncertainty.
- IPCC (2018) → $48 trillion over 20 years.
  - ~ 2.5% of global GDP.

1. Climate action is costly, so is inaction.

2. COVID-19 spending 2021-2022 was approximately $20 trillion.

Annual Additional Cost of Delayed Action

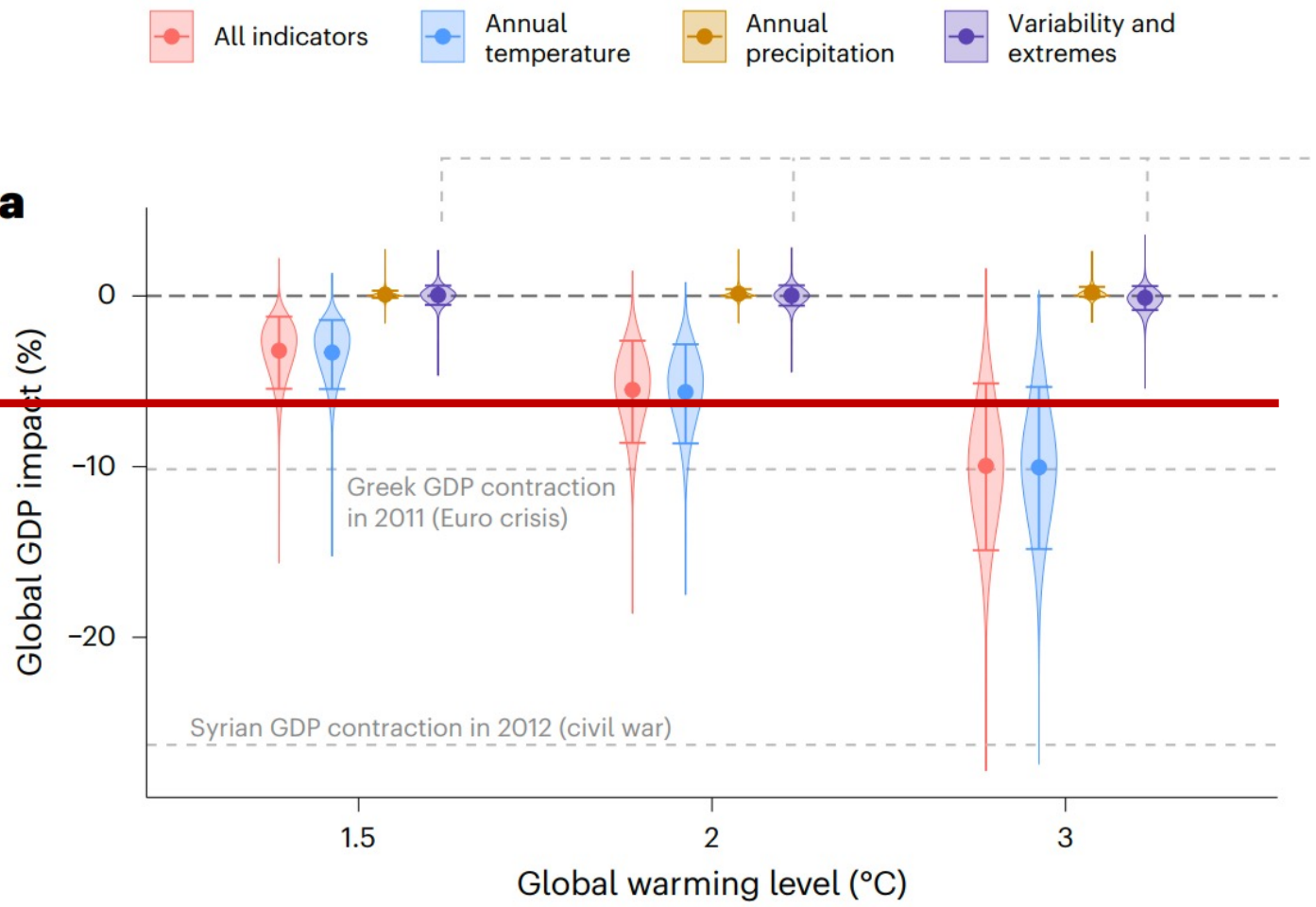


Sanderson and O'Neill, Scientific Reports, 2020

What about Climate Damage – External Costs?

Air pollution Health

World Bank, 2022



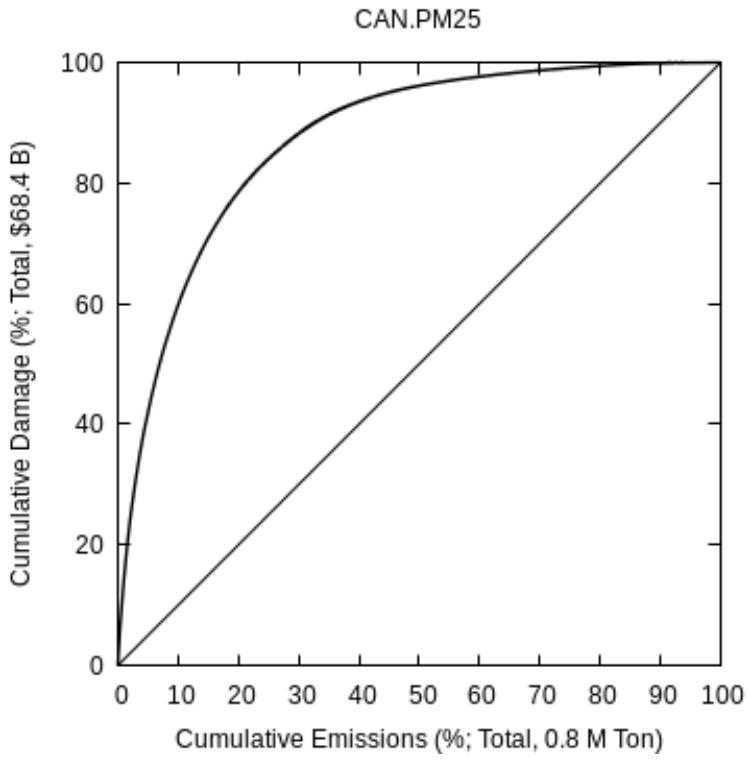
Waidelich et al., Nature Climate Change, 2024

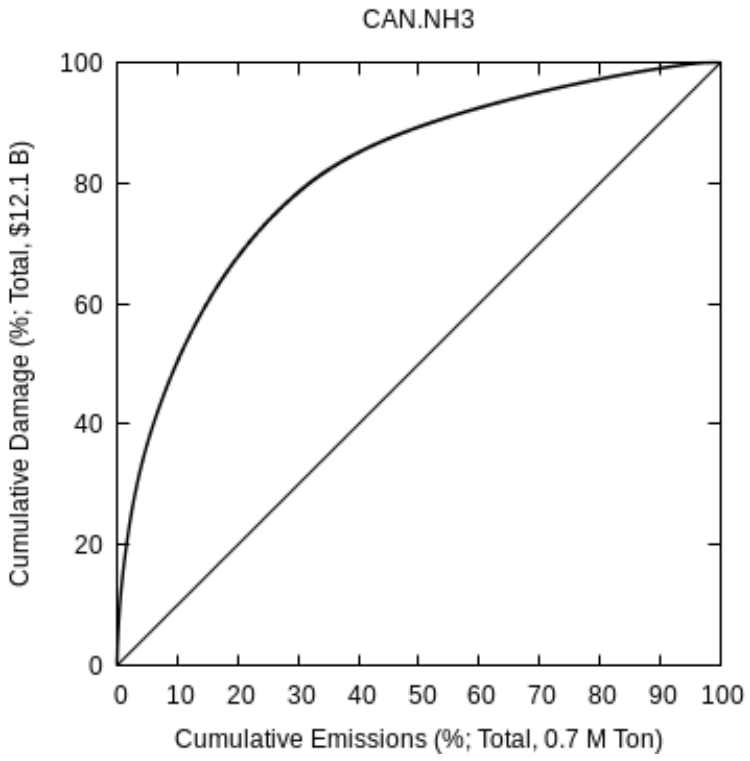
External Costs – Climate vs. Air Pollution, Canada

- Canada's 700Mt GHG emissions @ $57/tonne → $40 billion
  - @ $260/tonne SCC → $180 billion
- Canada's air pollution burden:
  - 17400 Premature deaths (Health Canada, 2024)
  - $146 billion
  - About half of the health burden is from burning fossil fuels (co-benefit).

Climate vs. Health (Co-)Benefits - I

- Air pollutants are not created equal. GHGs are.
  - Location of release is immaterial for GHGs; it is essential for air pollutants.





10% of $PM_{2.5}$ and ammonia emissions are responsible for nearly 60% and 50% of the health burden.

Climate vs. Health (Co-)Benefits - II

1. Climate impacts happen (far) in the future, health impacts happen now.

- Climate benefits are very sensitive to discount rates, health co-benefits are not.

2. Climate impacts are distributed across the globe, health co-benefits.

Lesson From the (First) Trump Administration

- Trump administration reduced SCC from $45 to $3 in 2017. This practically upended the Obama Administration's Clean Power Plan. The arguments for the reduction:
  - Discount rate of 7% (upper bound) instead of 3% (middle range)
    - A climate damage of $1 billion in 2100 has a present value of $6 million in 2024 at 7% discount rate, as opposed to $106 million at 3%.
  - Only accounting for the climate damage to the US as opposed to global damage.

Social Cost of Atmospheric Release (SCAR) Instead of SCC

- Inclusion of health co-benefits into a more general social cost of atmospheric release (SCAR - Shindell, 2015) immunizes climate policies against two important vulnerabilities of SCC with respect to political fluctuations.

- An expanded climate narrative that includes co-benefits can help reach wider audience.

Why Haven’t We Done This Yet?

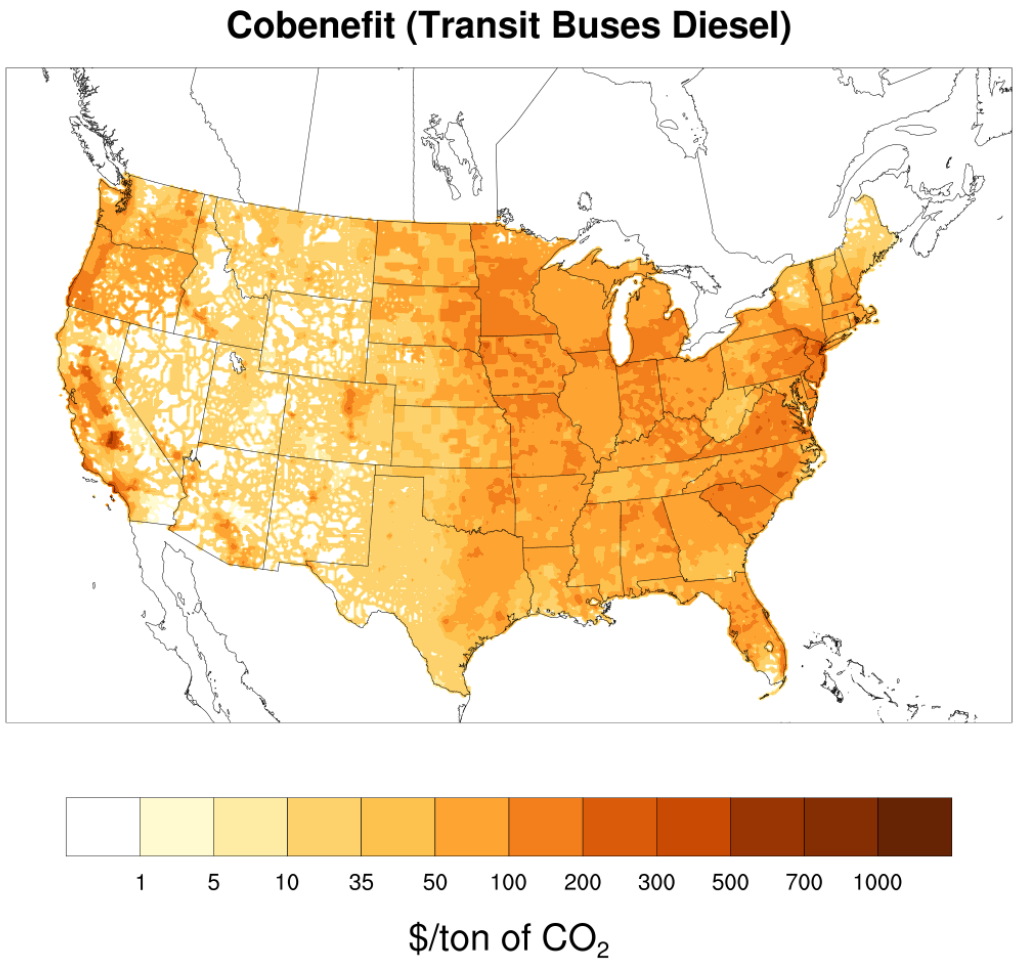
- Researchers have done this, but without location specificity in co-benefits (e.g., Shindell, 2015; Markandya et al., 2018).

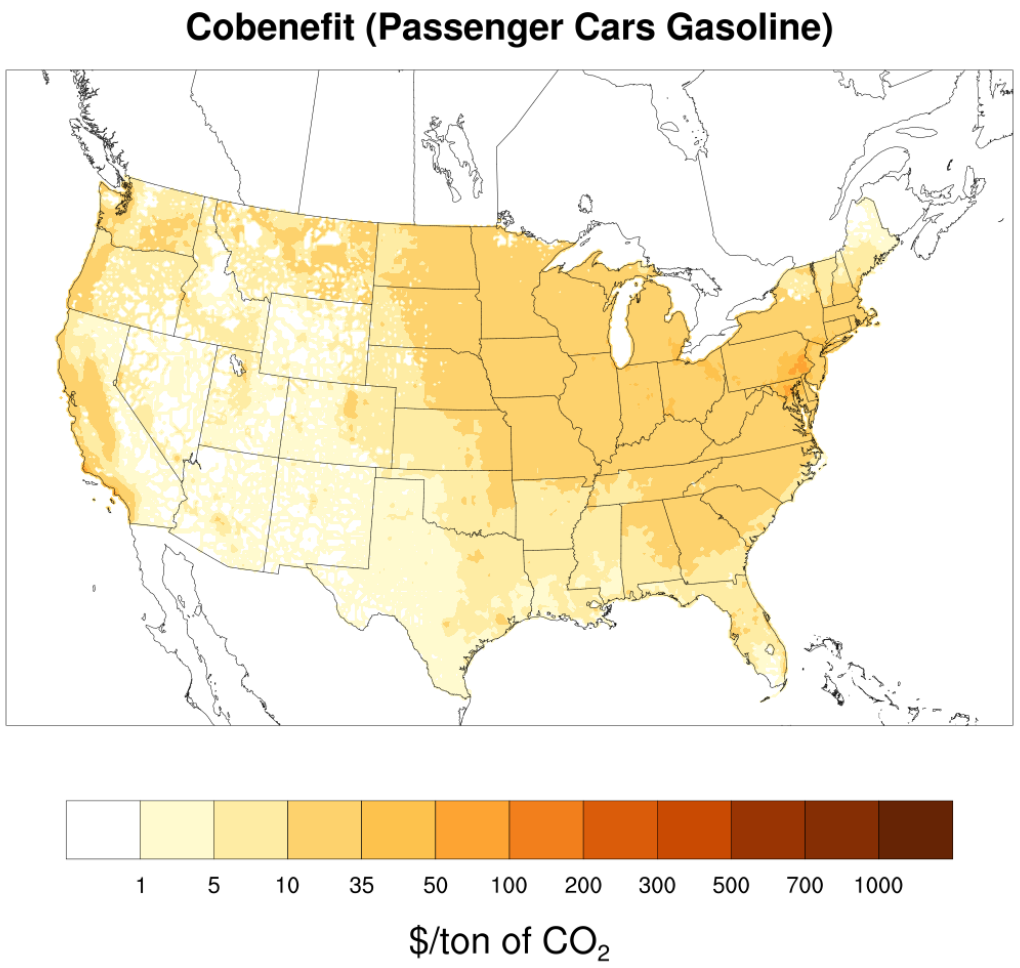
- Estimating location-specific co-benefits is a difficult task.

    - Tools available now (Hakami et al., in press).

Co-benefits – Some Results

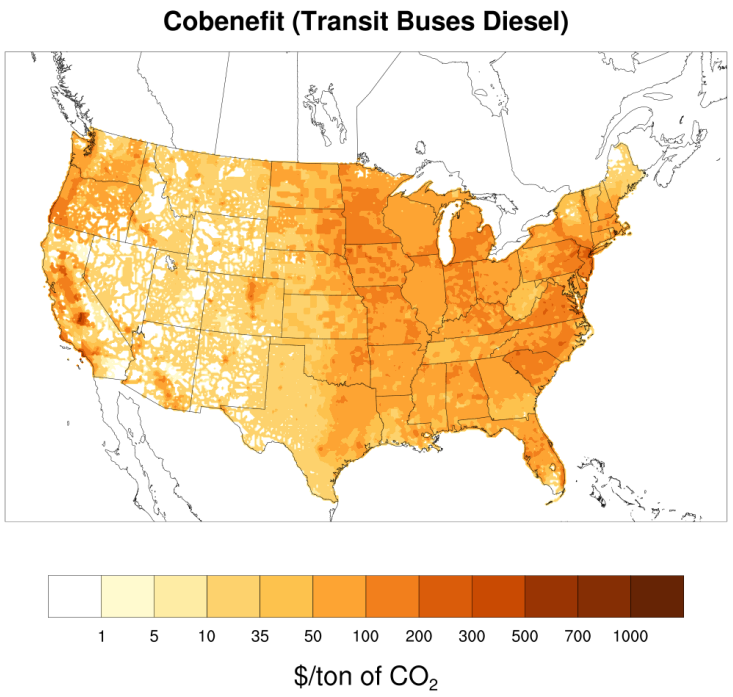
Co-benefits, Diesel HDV vs. Gasoline Passenger Cars

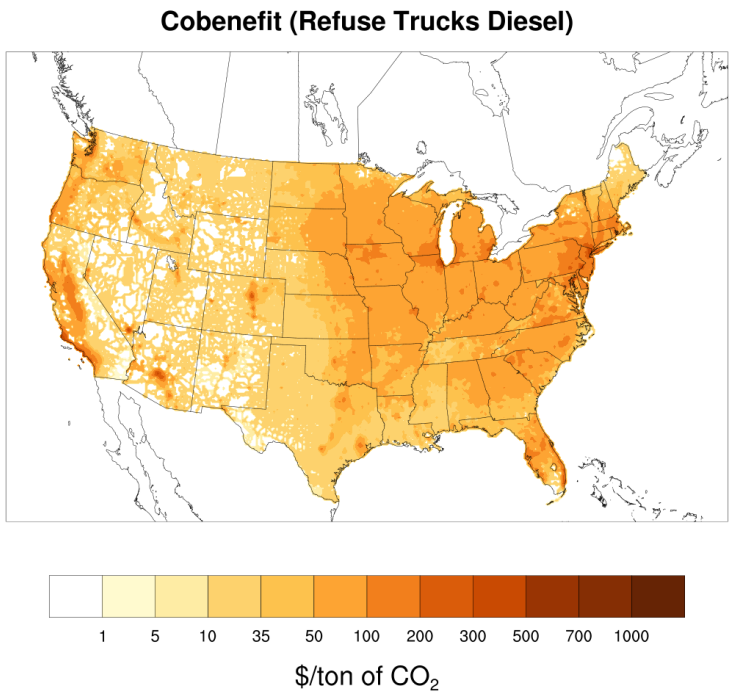


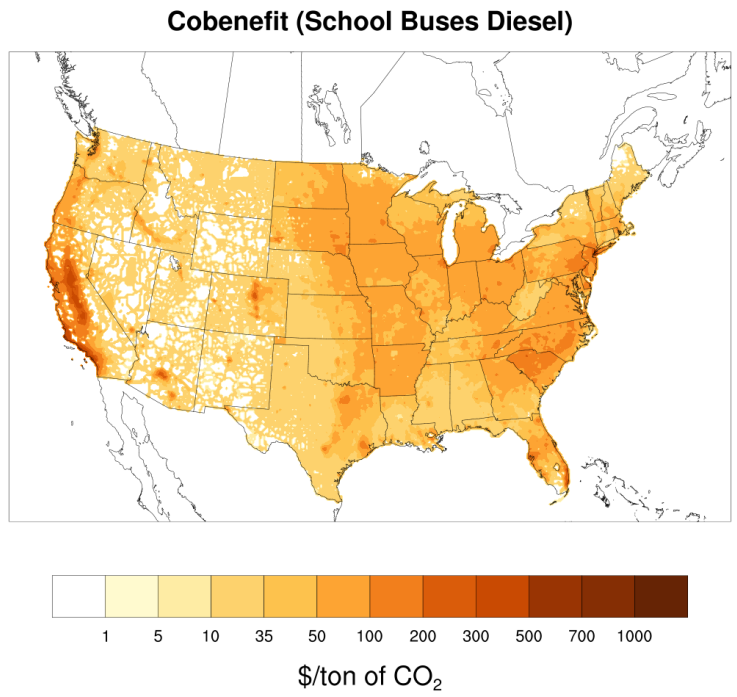


Hakami et al., in press

Co-benefits, Different Diesel HDVs

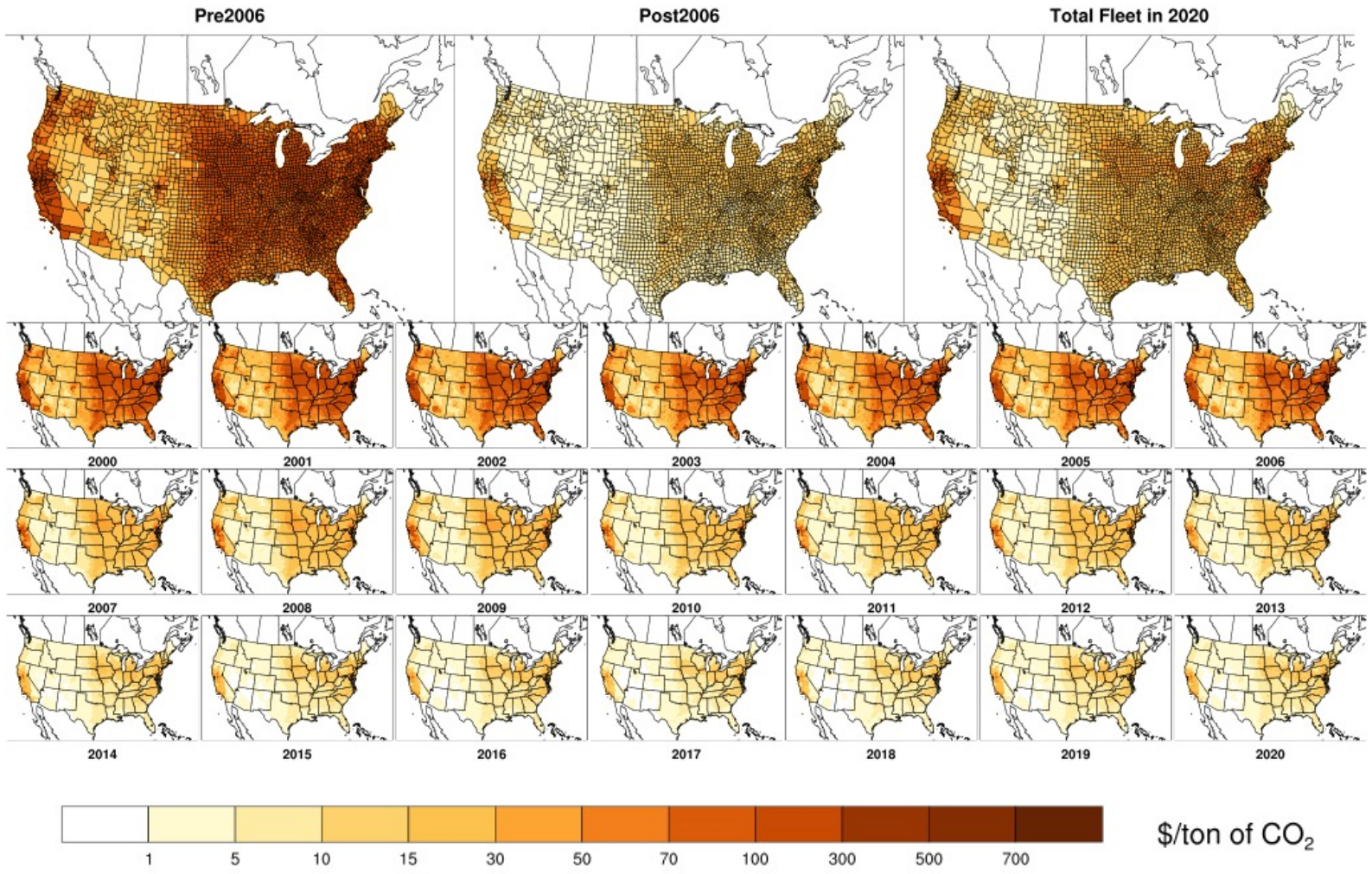






Hakami et al., in press

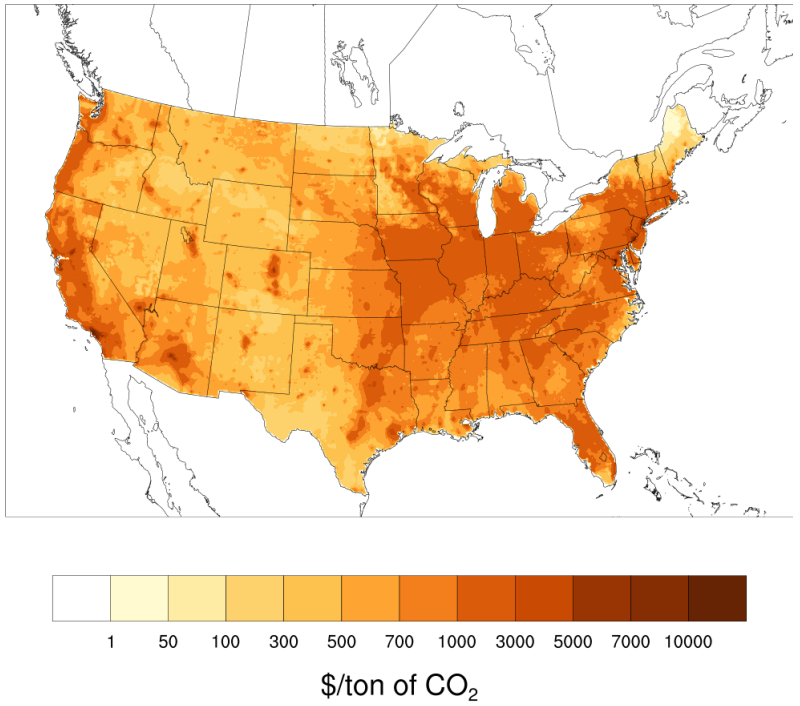
Diesel School Buses, Different Vintages



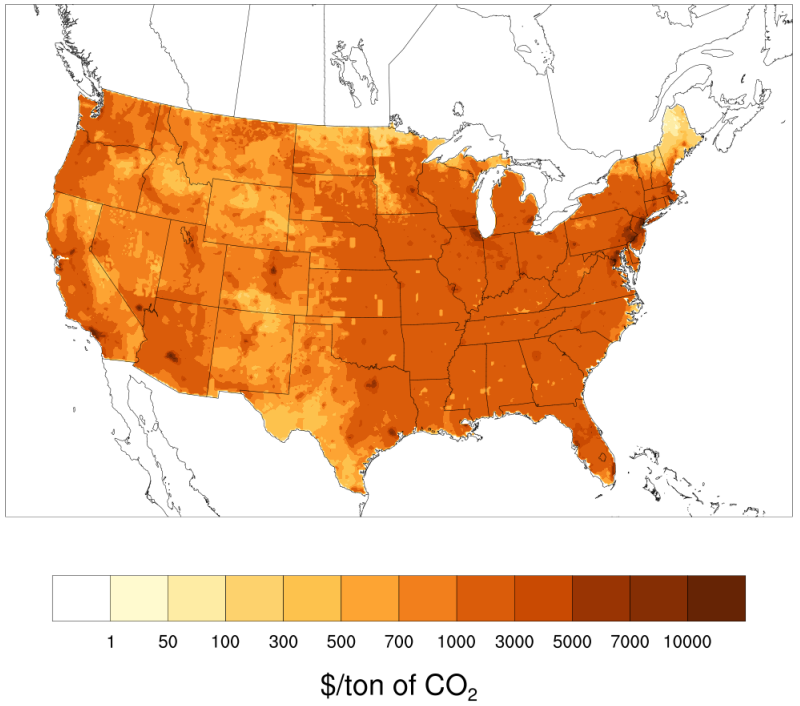
Soltanzadeh et al., in preparation

Co-benefits – Offroad Engines

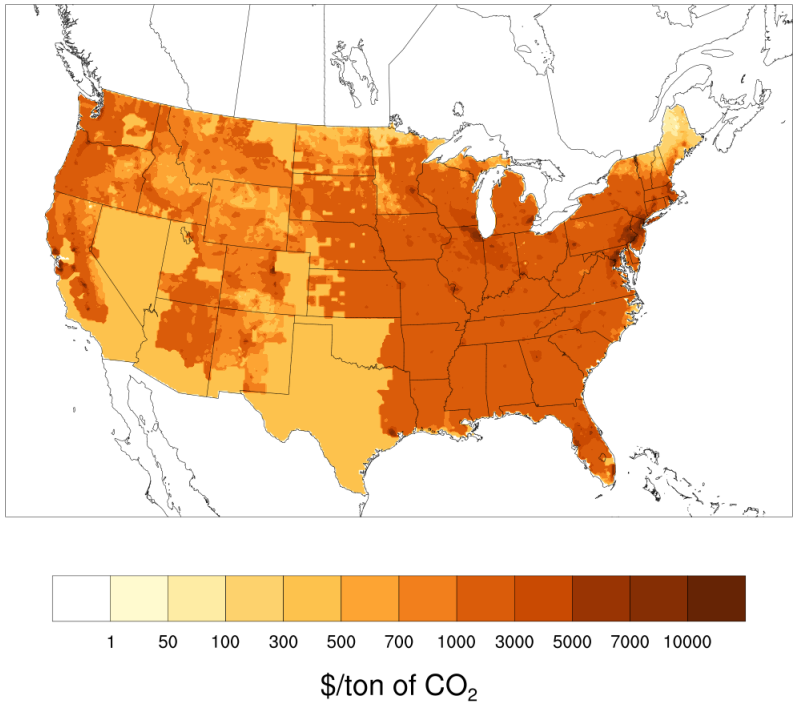
Lawn and garden - gasoline



Construction - gasoline



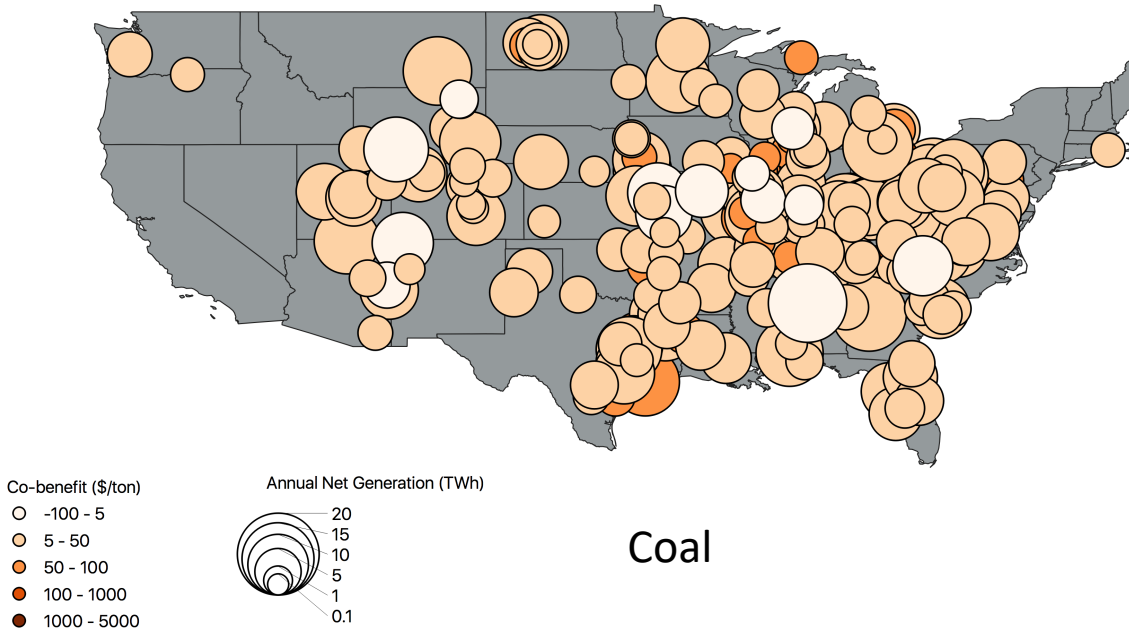
Logging - gasoline



Hakami et al., in press

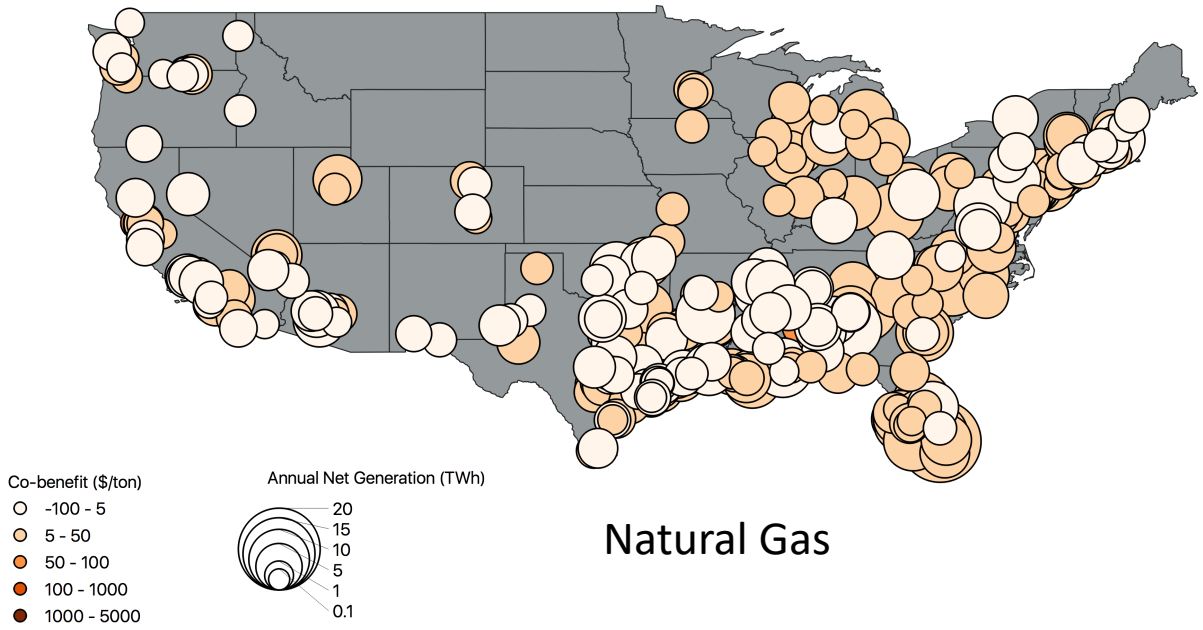
Co-benefits – Thermal Electricity Generation

Coal-burning Electricity Generating Units (EGU)s
Co-benefits ($/ton) Sized by Annual Net Generation (TWh) for Generation > 1 (TWh)



Coal

Natural Gas-burning Electricity Generating Units (EGU)s
Co-benefits ($/ton) Sized by Annual Net Generation (TWh) for Generation > 1 (TWh)

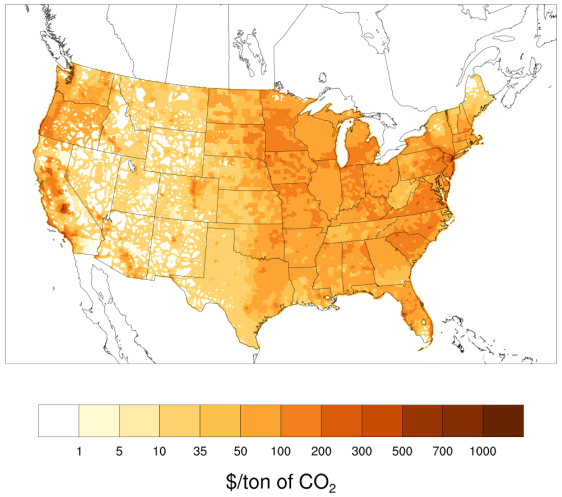


Natural Gas

Hakami et al., in press

Electrification

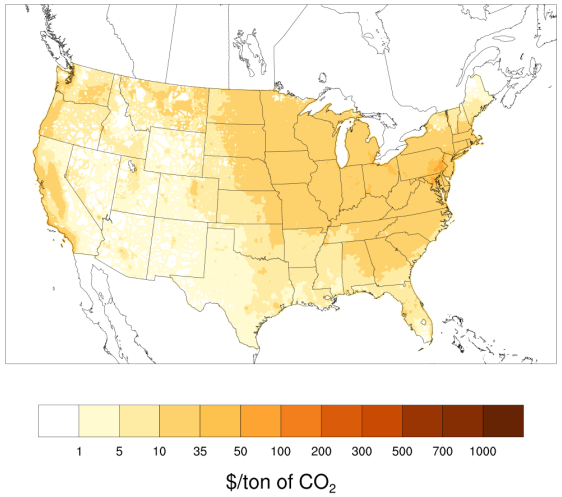
Cobenefit (Transit Buses Diesel)



1 5 10 35 50 100 200 300 500 700 1000

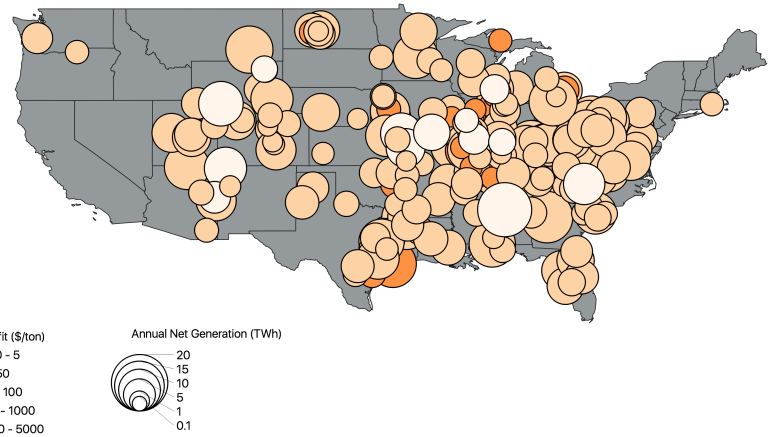
$/ton of CO_2

Cobenefit (Passenger Cars Gasoline)

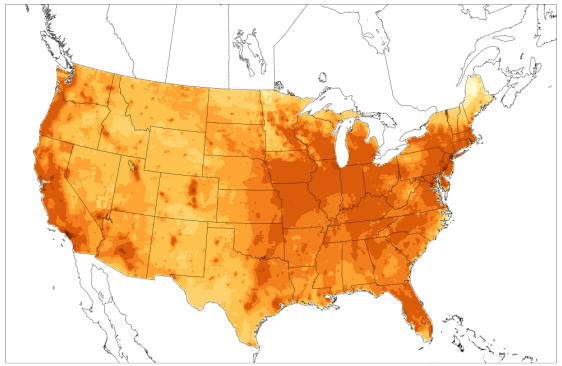


1 5 10 35 50 100 200 300 500 700 1000

$/ton of CO_2



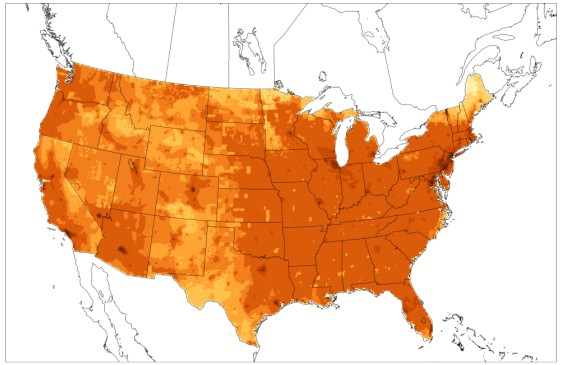
Cobenefit (Offroad Lawn and Garden 2Str)



1 50 100 300 500 700 1000 3000 5000 7000 10000

$/ton of CO_2

Cobenefit (Offroad Construction 2Str)



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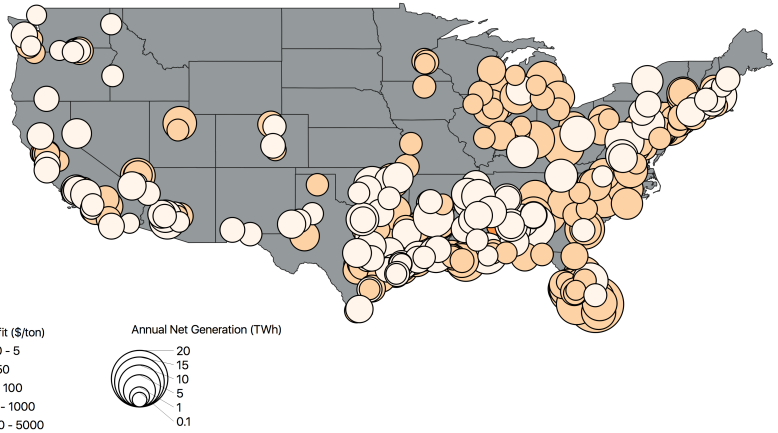
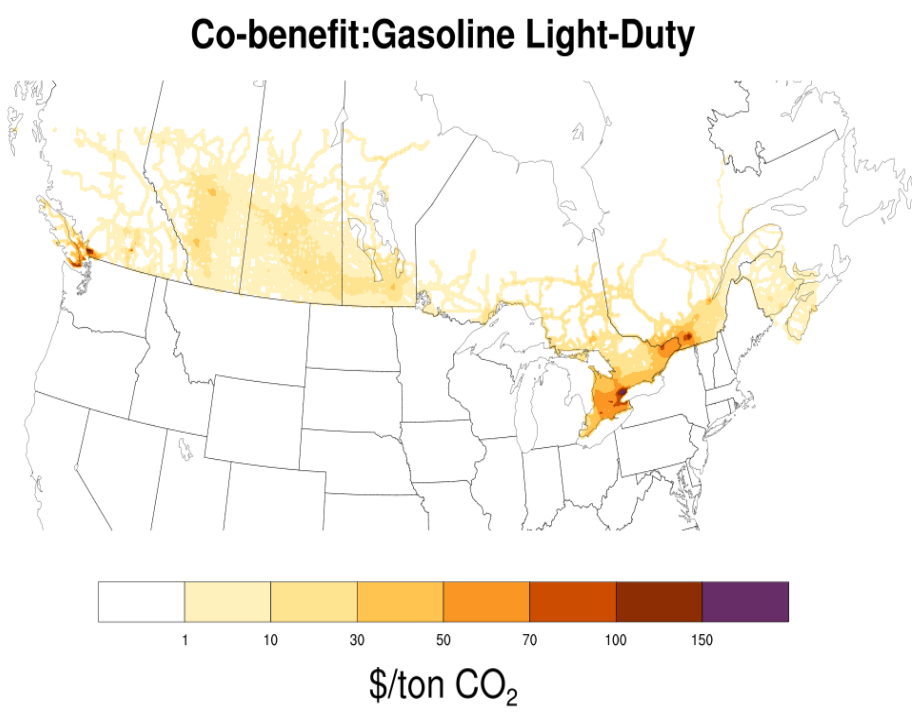
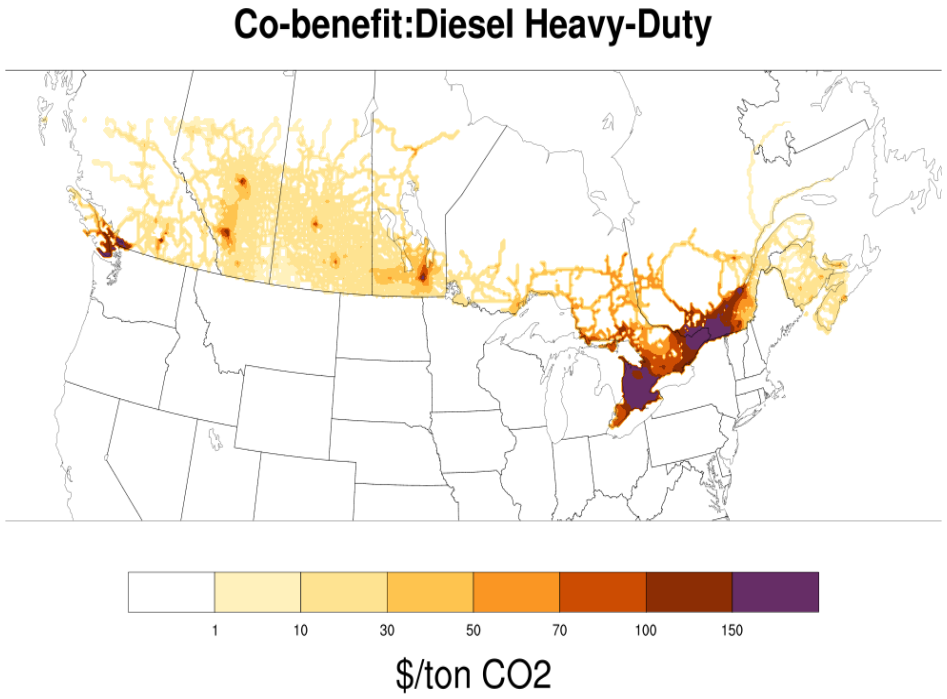
$/ton of CO_2

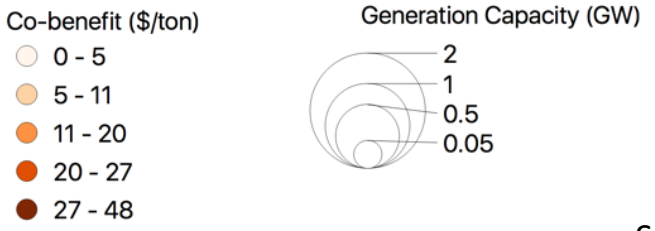


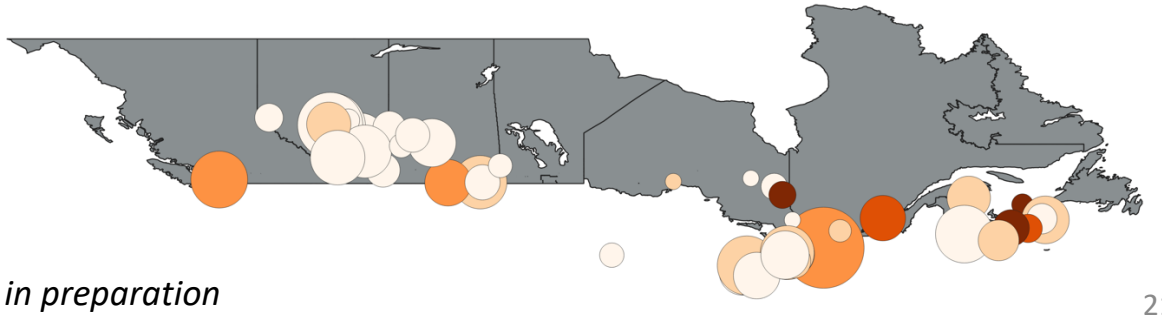
Hakami et al., in press

Co-benefits - Canada



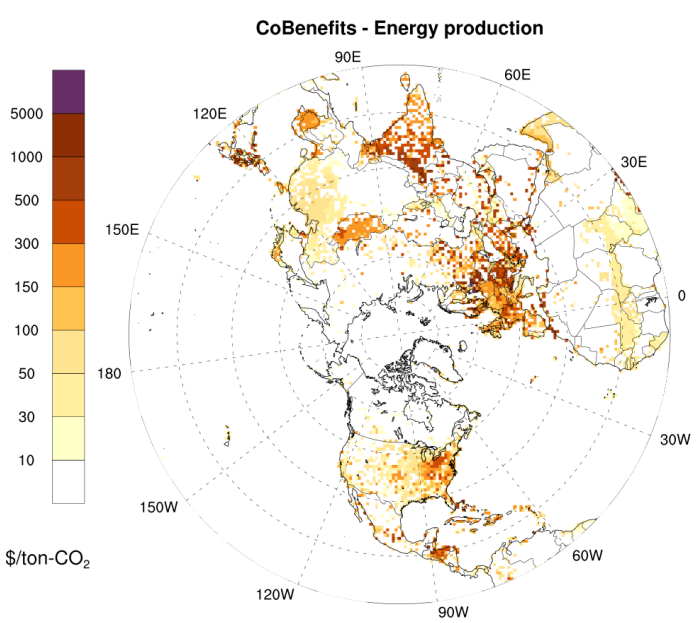


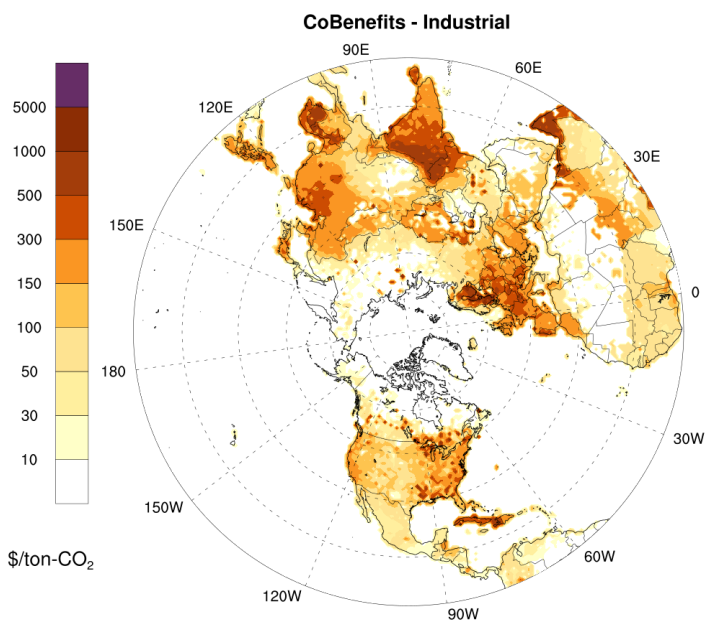


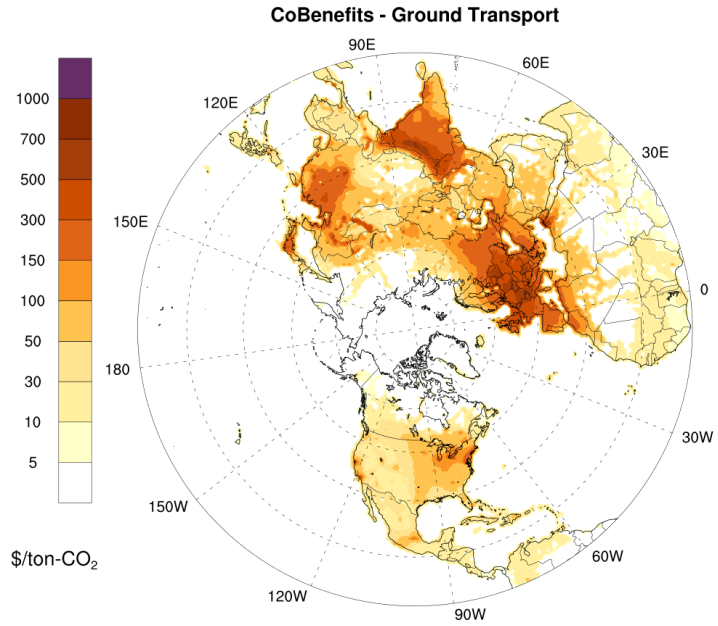


Soltanzadeh et al., in preparation

Co-benefits – Hemispheric







Oztaner et al., in preparation

Co-benefits – Environmental Justice

Decision Priority Hierarchy

- Air Quality co-benefits extend beyond population health.
  - Emerging area, and more difficult to quantify benefits/co-benefits.

Conclusions

- Populations health and climate benefits are two sides of the same coin, and complementary to the case for climate action.
- Health co-benefits are large in magnitude – possibly larger than climate benefits, depending on how you calculate.
- Health co-benefits are local and occur now. This immediacy in time and space makes co-benefits less vulnerable to political fluctuations.
- Expanding the narrative to incorporate co-benefits can help achieve a more inclusive climate discourse and wider acceptance.
- Air quality co-benefits extend beyond population health and carry over to environmental justice domain as well.

Last Word …

Expanding the narrative to incorporate co-benefits can help achieve a more inclusive climate discourse and wider acceptance.

If you have thoughts on this topic beyond this session, or ideas on how to work towards this shift in narrative, I would love to hear your thoughts. Coffee’s on me!

Acknowledgements

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