NATURAL RESOURCES CANADA - INVENTIVE BY NATURE

THE POTENTIAL CONTRIBUTION OF CANADA'S FOREST SECTOR TO CLIMATE CHANGE MITIGATION

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Natural Resources Canada

NACP PIM5

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Motivation and Outline

Can changes in forest management or the use of harvested wood contribute to emission reductions relative to a baseline, and help meet GHG reduction targets?

- Background
- Tools and Scenarios
- Analysis of mitigation potential
- Key messages
- Next steps

CFS Synthesis Papers

Environmental Reviews 21: 293-321 (2013)

293

NRC Research Press

REVIEW

Canadian boreal forests and climate change mitigation[1]

T.C. Lemprière, W.A. Kurz, E.H. Hogg, C. Schmoll, G.J. Rampley, D. Yemshanov, D.W. McKenney, R. Gilsenan, A. Beatch, D. Blain, J.S. Bhatti, and E. Krcmar

http://www.nrcresearchpress.com/doi/abs/10.1139/er-2013-0039

Environmental Reviews 21: 260-292 (2013)

260

NRC Research Press

REVIEW

Carbon in Canada's boreal forest — A synthesis[1]

W.A. Kurz, C.H. Shaw, C. Boisvenue, G. Stinson, J. Metsaranta, D. Leckie, A. Dyk, C. Smyth, and E.T. Neilson

http://www.nrcresearchpress.com/doi/abs/10.1139/er-2013-0041

Mitigation analyses

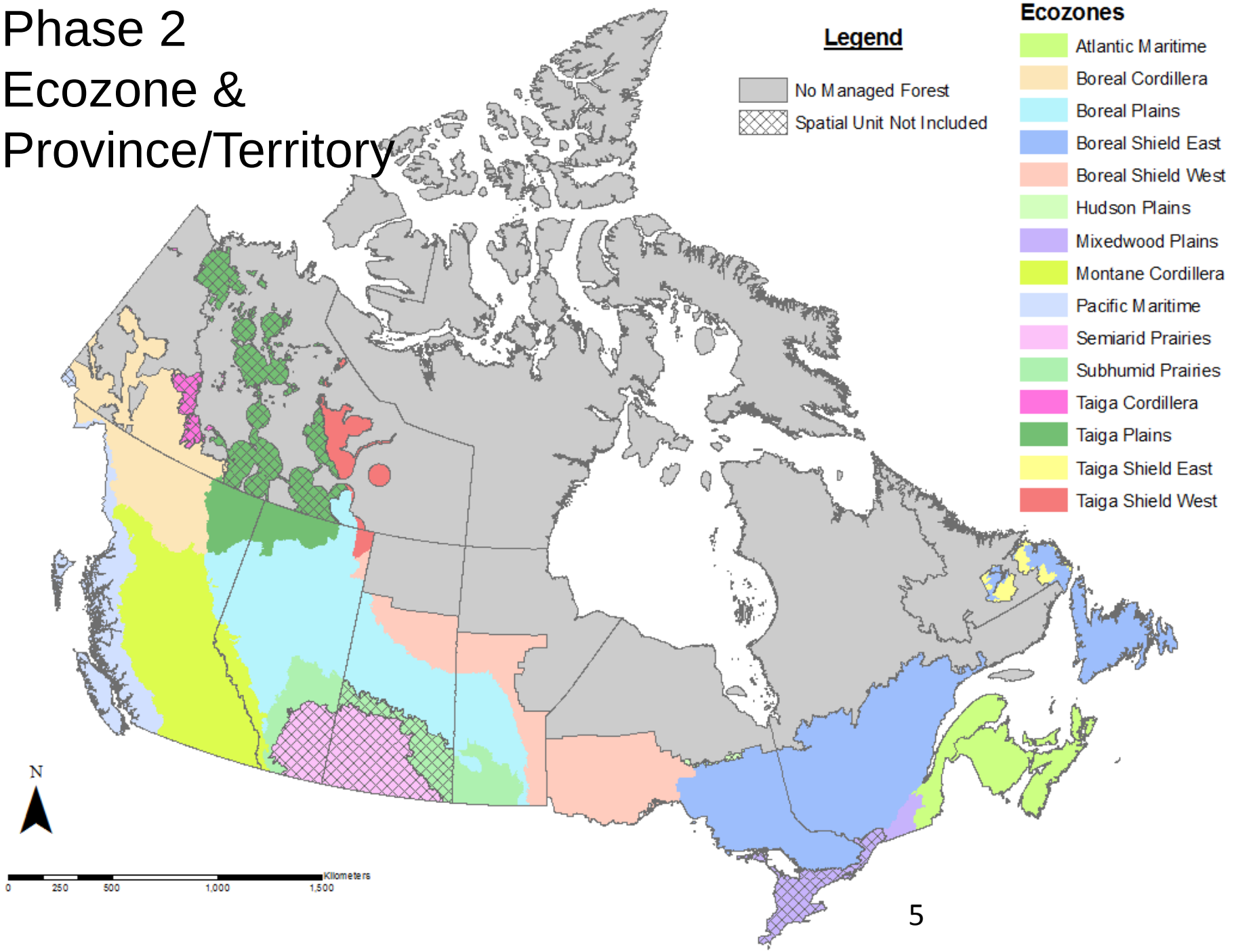
Determine the mitigation potential of Canada's forest sector

Time-series from GHG reporting (1990 – 2011) extended by projecting activity data (harvest, fires, planting, etc.) to 2050

Coarse spatial scale (39 spatial units, ~3 million stands, representing 230 Mha)

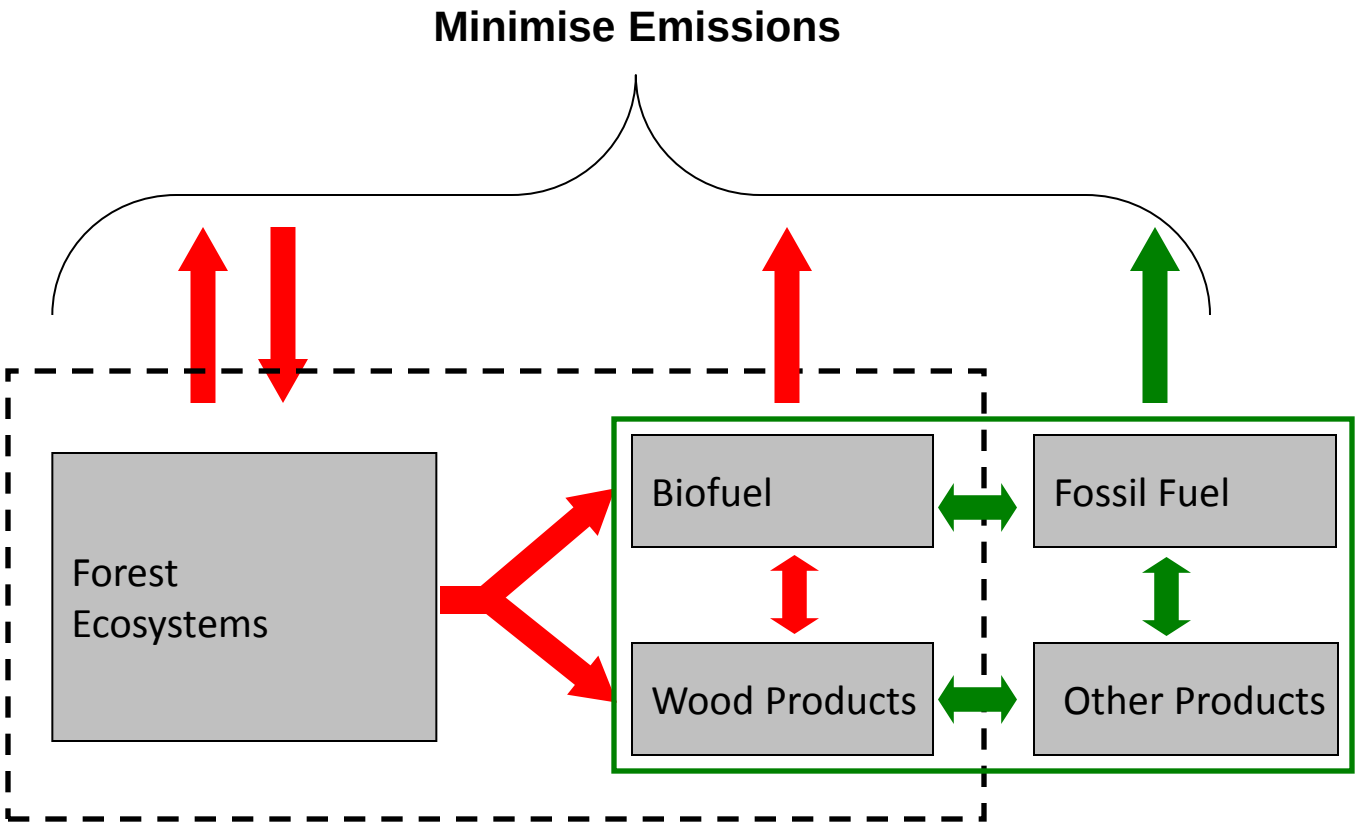
Mitigation is defined as the reduction of emissions from incremental activities, relative to a base line

Phase 2 Ecozone & Province/Territory



Systems' approach to emission reductions

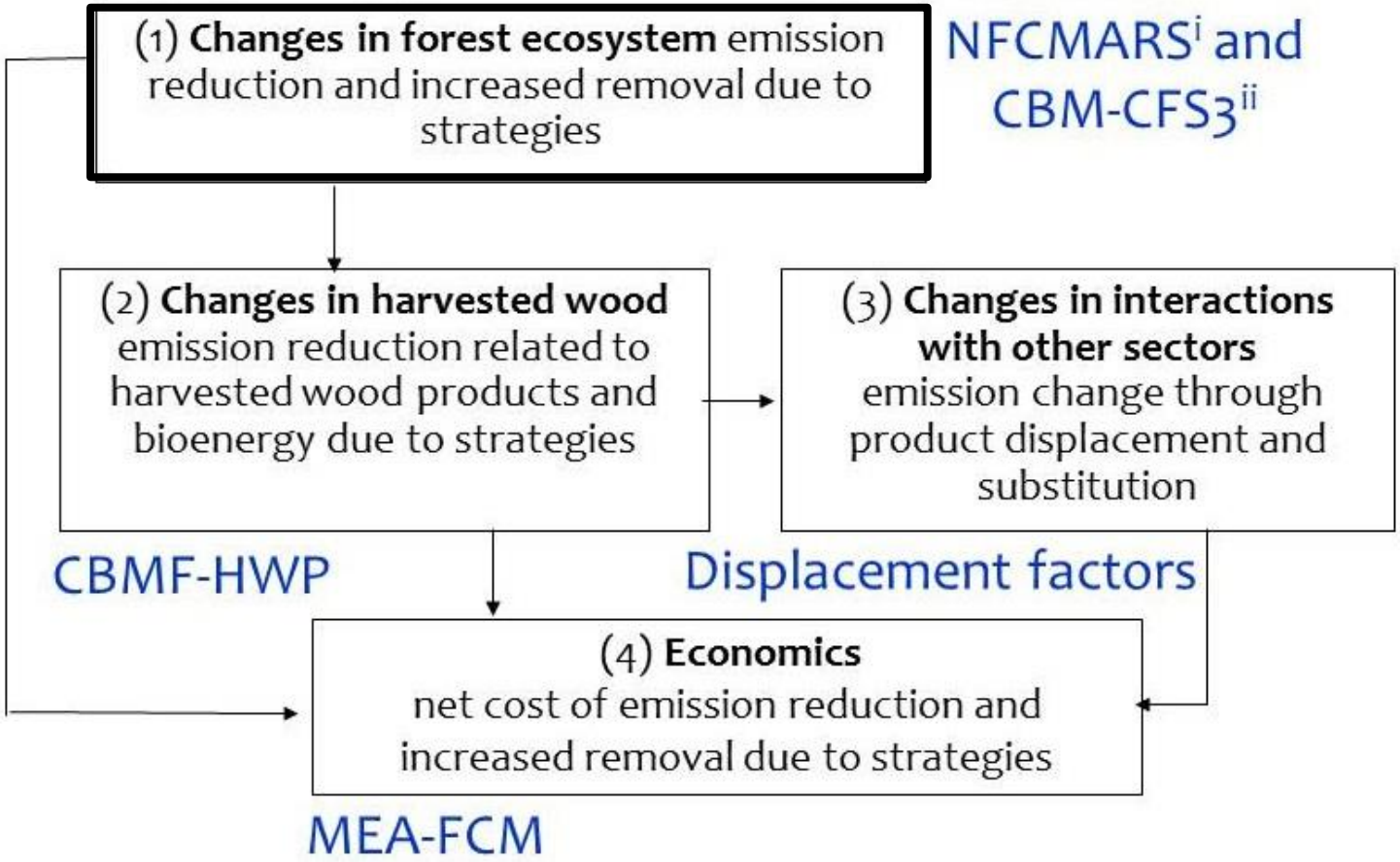
Increased harvest reduces need for other products (and vice versa) with the associated changes in emissions.



Forest Sector **Services used by Society**

After Nabuurs et al. 2007 IPCC , AR4 WG III, Forestry

Mitigation analyses: Analytical framework

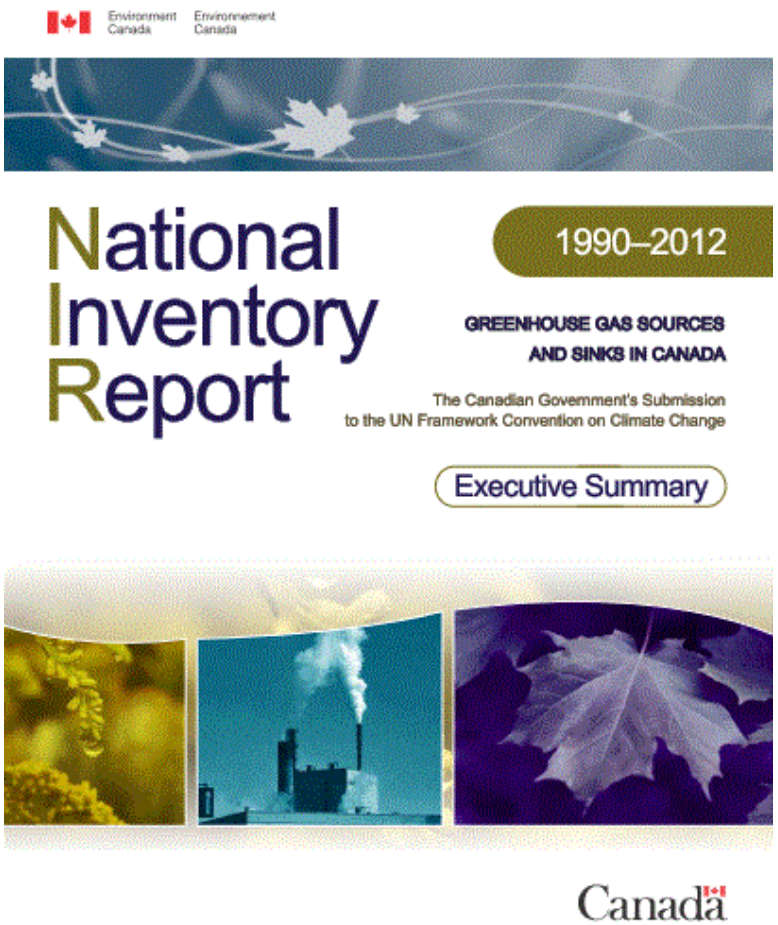


[i] Stinson et al. (2011) *Global Change Biology* 17, 2227-2244
[ii] Kurz et al. (2009) *Ecological Modelling* 220, 480-504

National Forest Carbon Monitoring, Accounting and Reporting System

One national system, many uses:

- Reporting past C dynamics
  - National GHG Inventory
  - State of Canada's Forests
- Projecting future C dynamics
  - Scientific research
  - Policy development
  - International negotiations
- Develop climate mitigation and adaptation strategies
- Add projections to 2050 of mitigation activities and wildfire



http://www.ec.gc.ca/ges-ghg/

National-scale integration of forest C cycle data

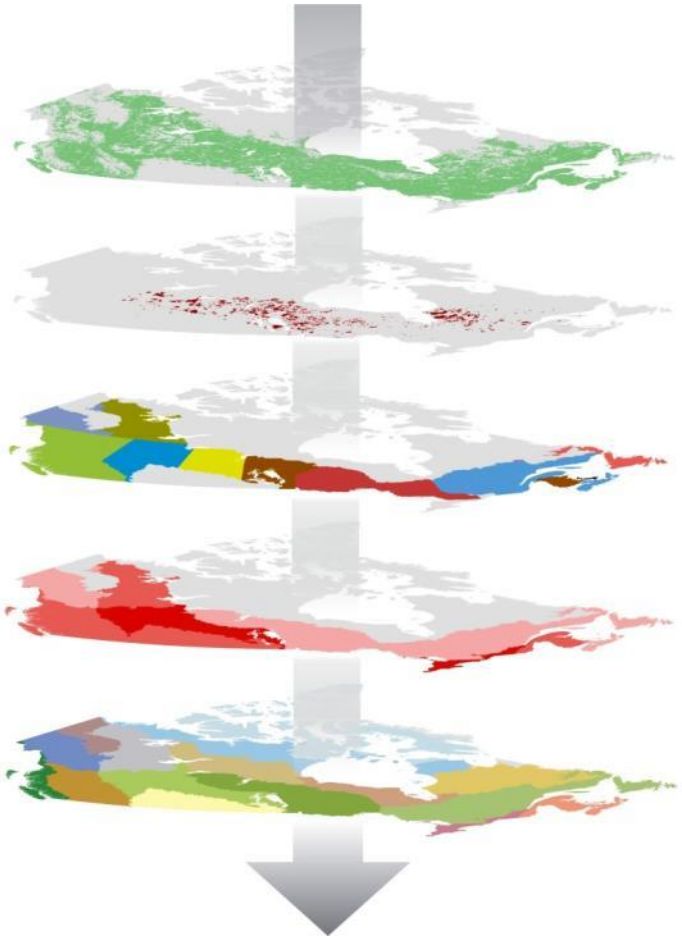
Forest inventory and growth & yield data

Natural disturbance monitoring data

Forest management activity data

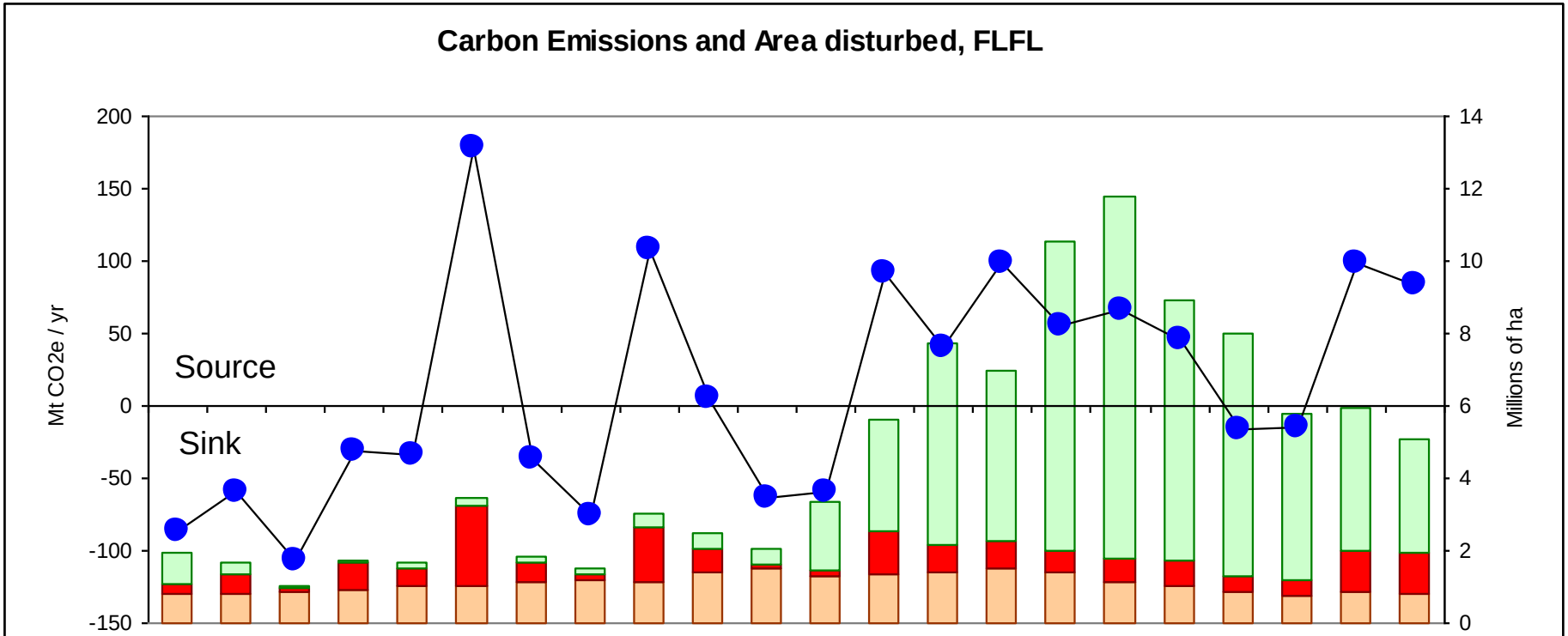
Land-use change data

Ecological modelling parameters



CBM-CFS3

Canada's managed forest emissions

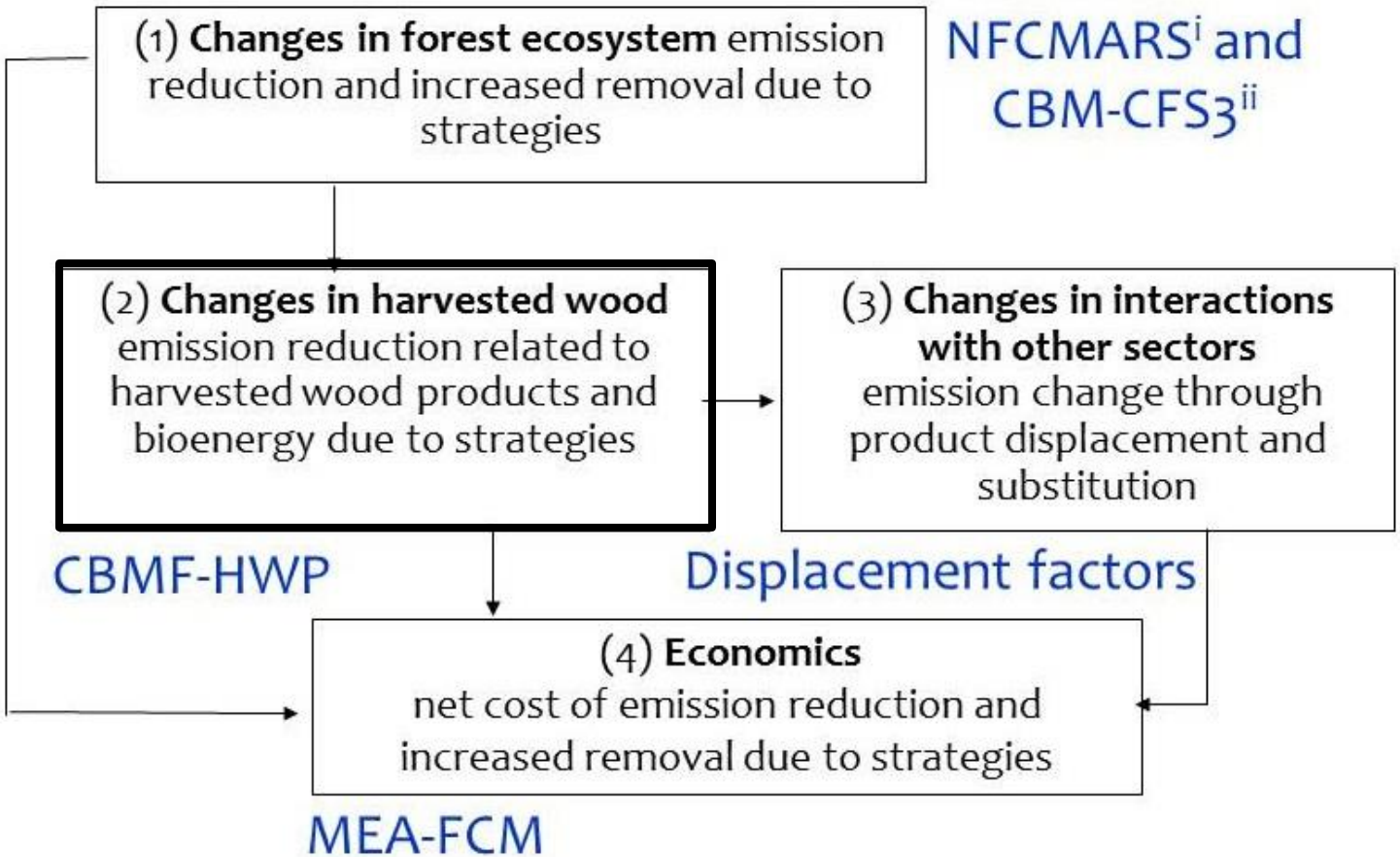


Annual harvest 45 Mt C (165 Mt CO_2)
Assuming instantaneous oxidation of wood moved out of forest

Insects (Mha, right scale)
Fire (Mha, right scale)
Harvest (Mha, right scale)
Emissions (Mt CO_2e, left scale)

Source: Updated after Stinson et al. 2011, NRCan 2012

Mitigation analyses: Analytical framework



[i] Stinson et al. (2011) *Global Change Biology* 17, 2227-2244
[ii] Kurz et al. (2009) *Ecological Modelling* 220, 480-504

Harvested Wood Products

Production approach

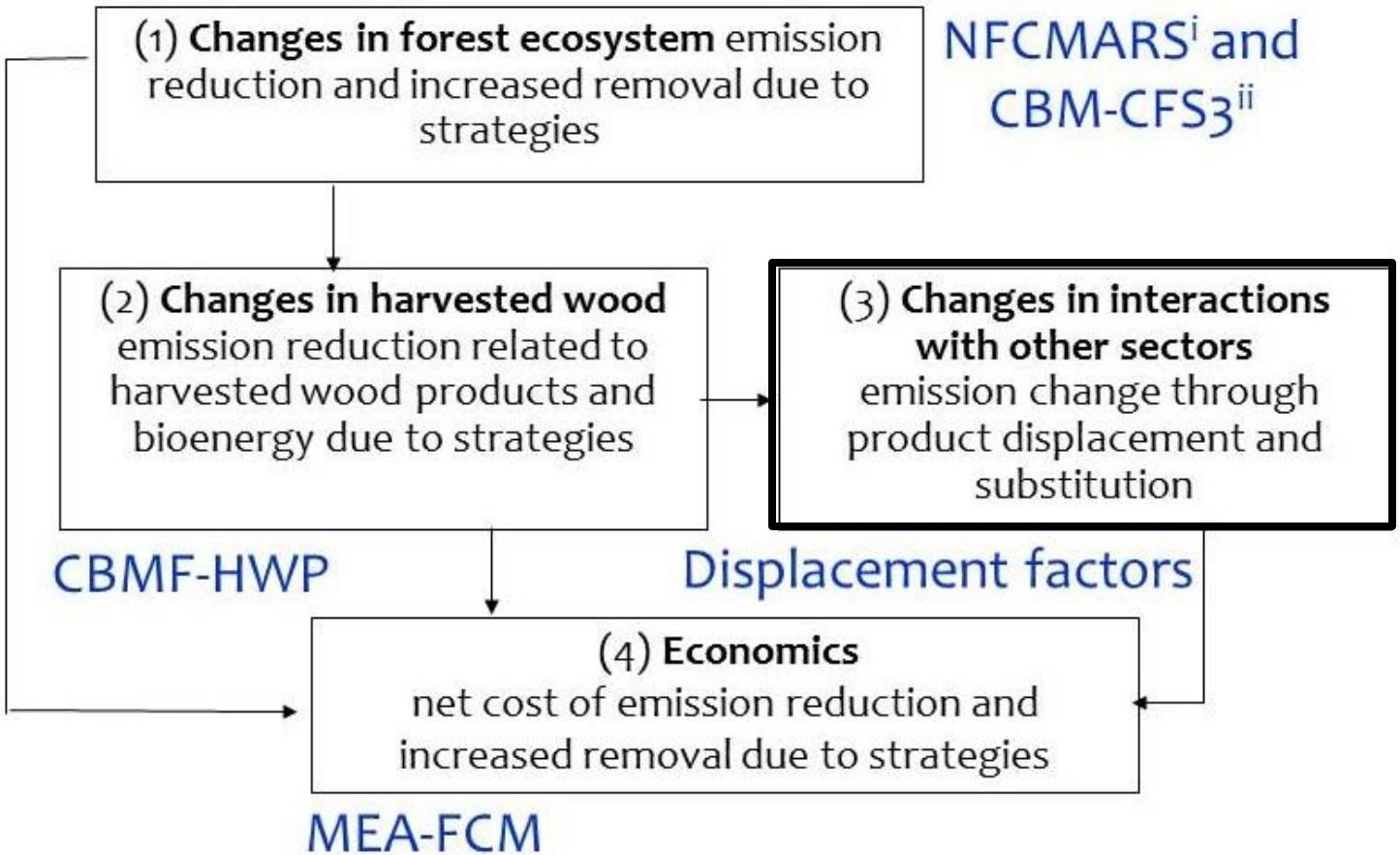
Commodities based on national statistics reported in FAO:

- Sawnwood (35 years)
- Other solid wood (35 years)
- Panels (25 years)
- Pulp and paper (2 years)
- Bioenergy (instant oxidation)

End-of-life (bioenergy, landfill)

Landfill (CO_2/CH_4 emissions)

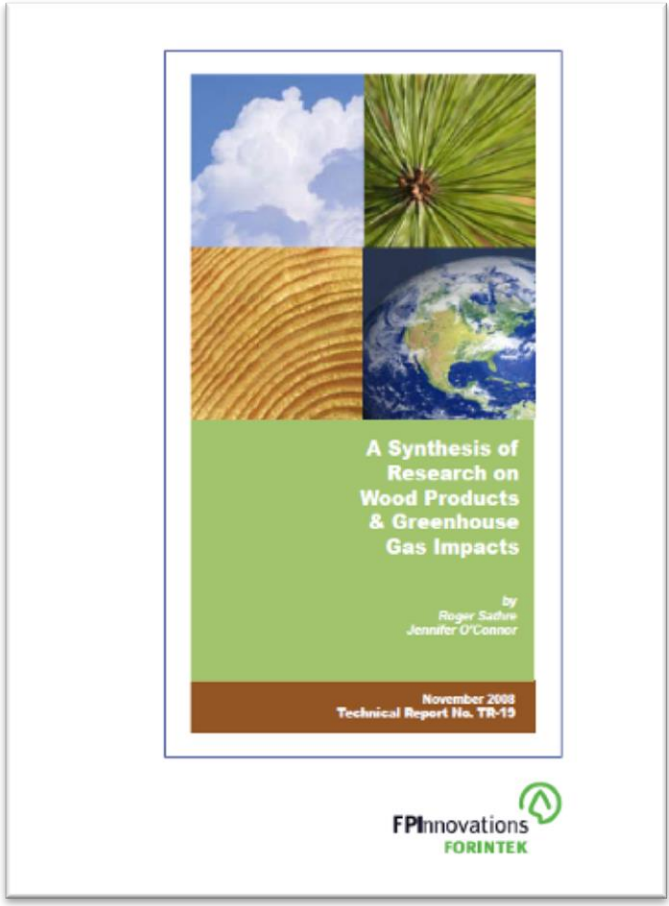
Mitigation analyses: Analytical framework



[i] Stinson et al. (2011) *Global Change Biology* 17, 2227-2244
[ii] Kurz et al. (2009) *Ecological Modelling* 220, 480-504

Substitution Benefits from Wood Use

- Displacement factor (DF) quantifies the amount of emission reduction achieved per unit of wood <u>used</u> in products (i.e. substitution)
- On average, we avoid 2 tons of C emissions for every 1 ton of C used in wood products.
- Substitution benefits of wood use for bioenergy typically < 1.
- Calculated DF for product categories used in this study



Source: Sathre, R. and J. O'Connor 2008 and 2010

Phase 2 Mitigation Analysis

Biogeosciences, 11, 3515–3529, 2014
www.biogeosciences.net/11/3515/2014/
doi:10.5194/bg-11-3515-2014
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Biogeosciences
Open Access

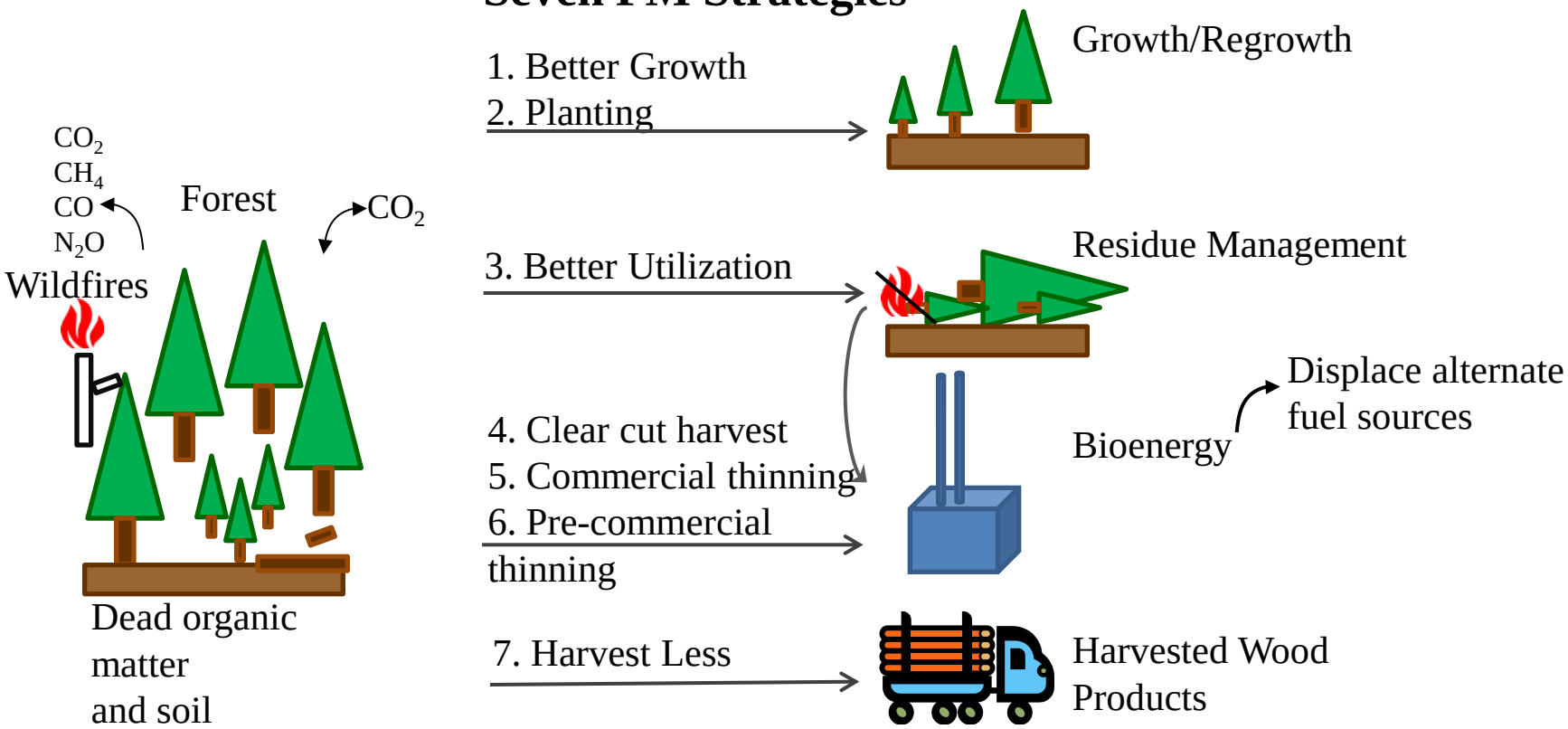
Quantifying the biophysical climate change mitigation potential of Canada's forest sector

C. E. Smyth[1], G. Stinson[1], E. Neilson[1], T. C. Lemprière[2], M. Hafer[1], G. J. Rampley[3], and W. A. Kurz[1]

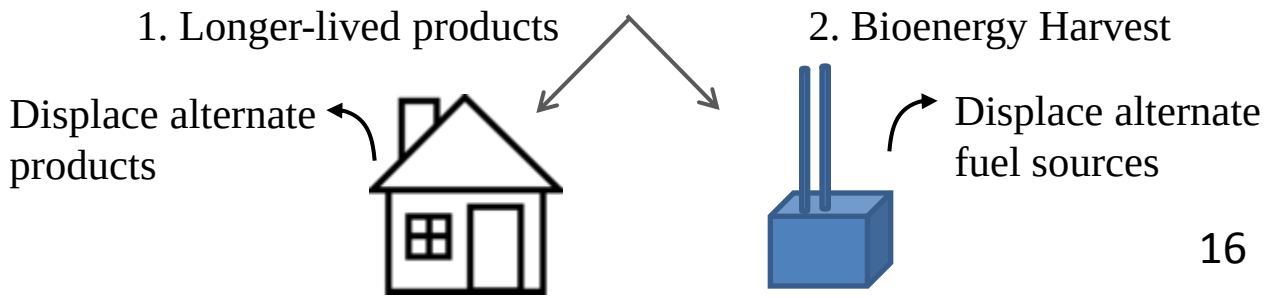
http://www.biogeosciences.net/11/3515/2014/bg-11-3515-2014.pdf

Mitigation Analysis

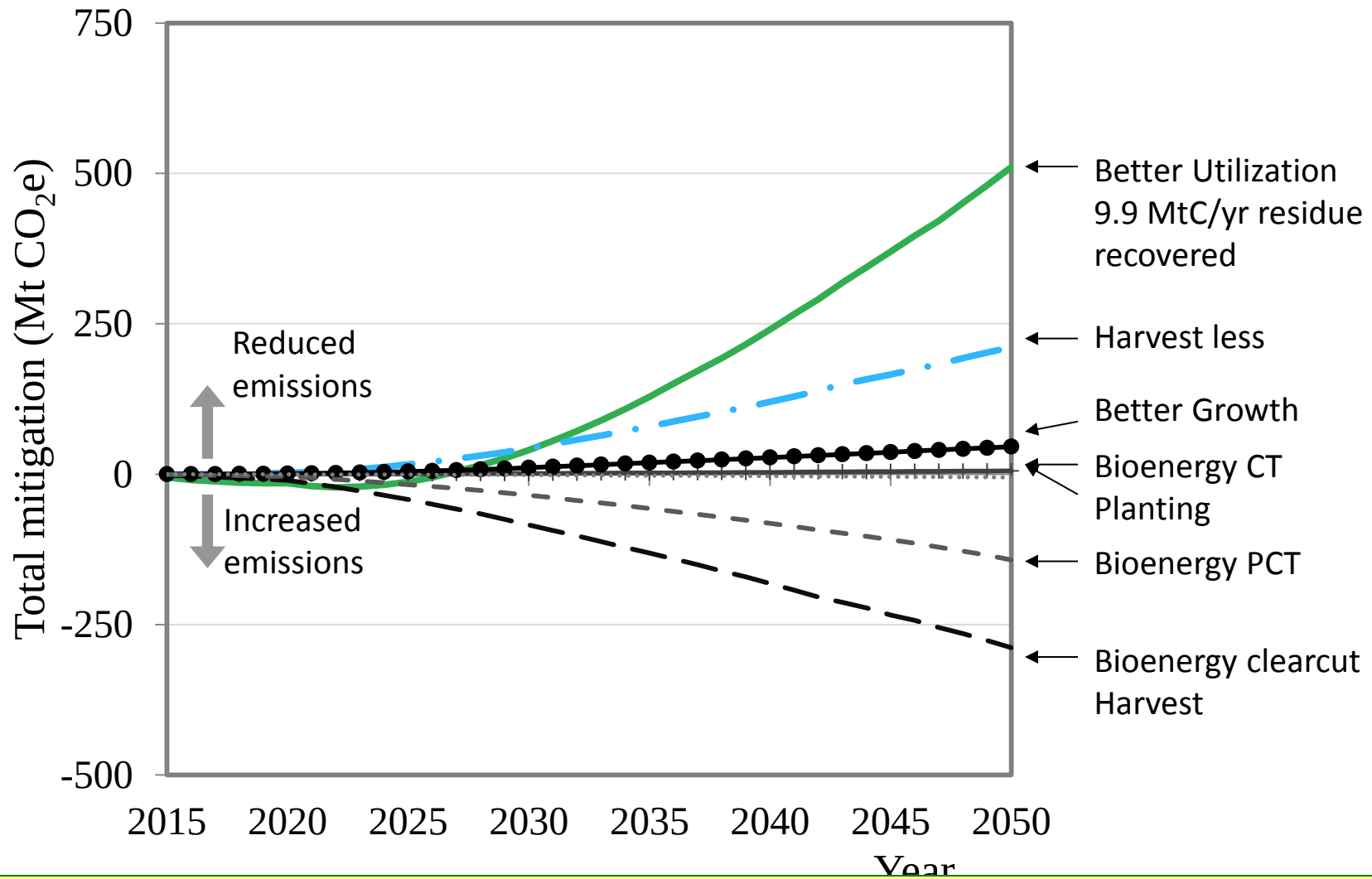
Seven FM Strategies



Two HWP Strategies



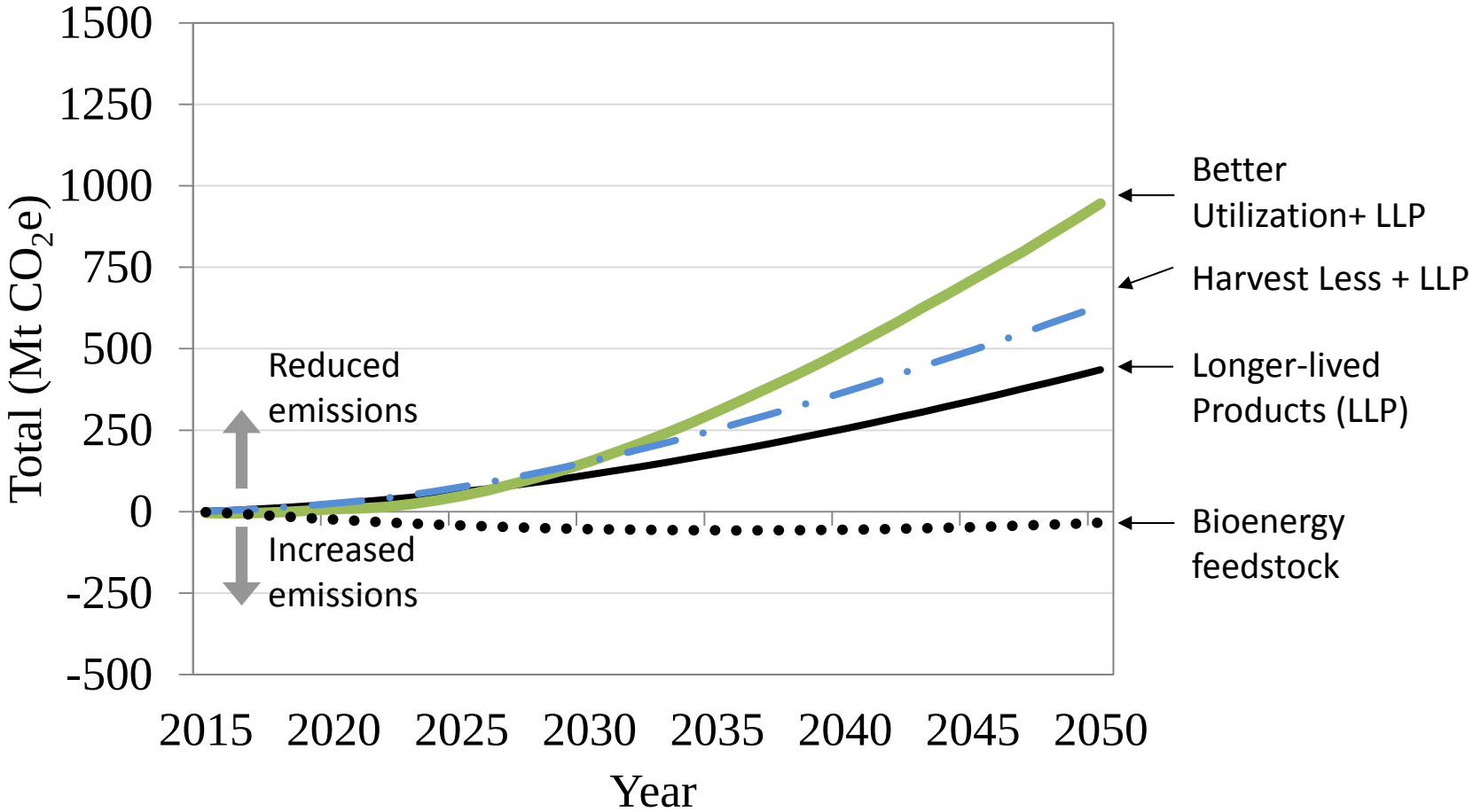
Forest Management cumulative mitigation



Key findings:

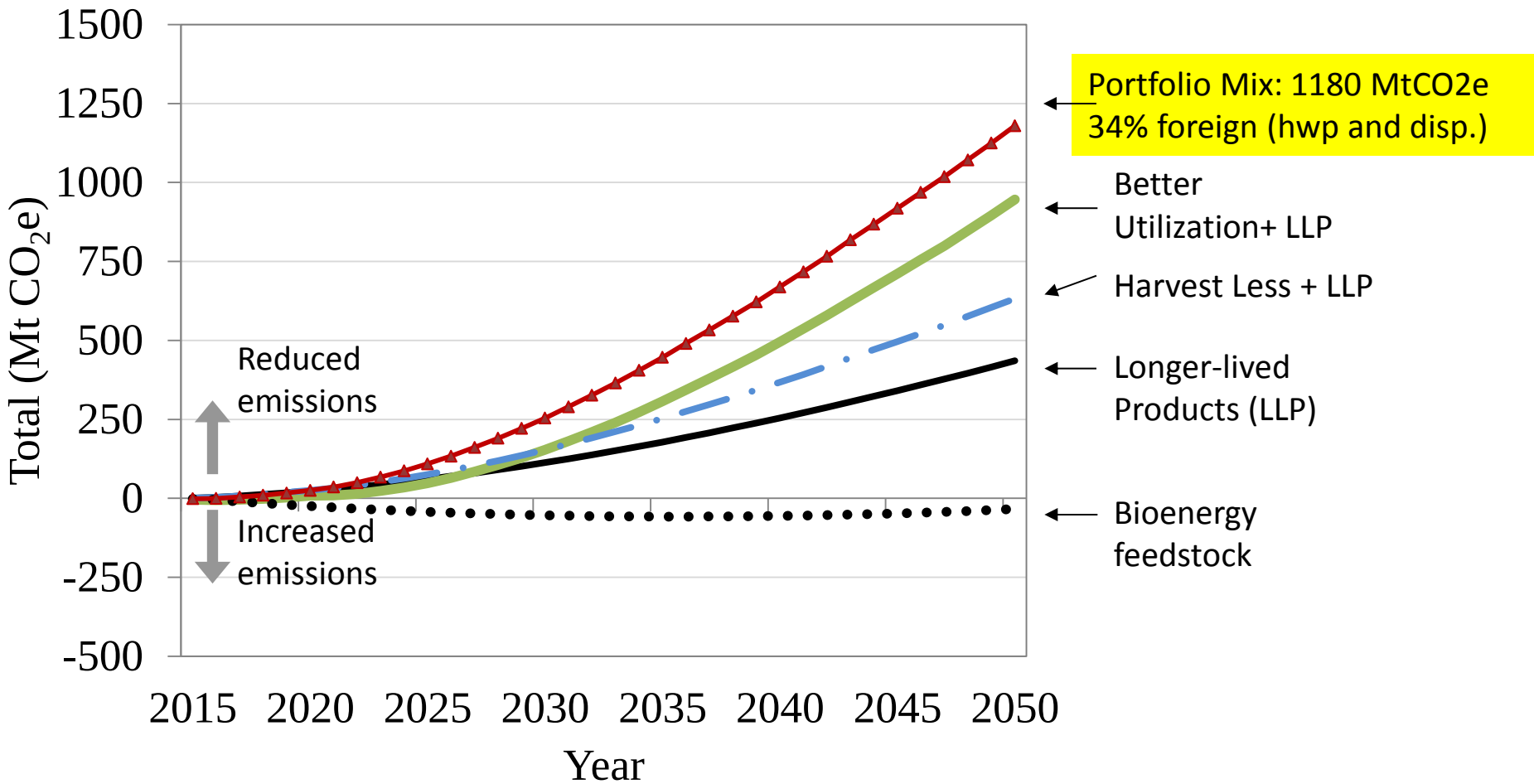
Some strategies result in more positive mitigation (or lessen the negative mitigation) when displacement is included

FM and HWP mitigation



Key findings:
Combining FM and HWP strategies can result in higher mitigation potential.

Maximize FM and HWP mitigation



Key findings:

The best mitigation strategy varies by region: a portfolio derived by choosing the strategy in each region that maximizes mitigation will be best nationally

Key messages

- Design of climate change mitigation portfolios in the forest sector should be based on systems approach that accounts for changes in forest ecosystem C, C in HWP, and substitution benefits, relative to a base case.
- Some proposed mitigation activities are more beneficial than others, and no one strategy is best everywhere - the best strategy varies by region.
- Forest managers do not control use of wood – effective mitigation portfolios need to integrate forest management with wood use strategies.
- Substantial mitigation potential by 2050 if implementation of strategies starts soon.

Next Steps

- Conduct analyses with higher spatial differentiation (600 management units for 230 Mha)
- Identify most favourable forest management regions for forest-based bioenergy from harvest residues
- Explore the interaction of mitigation strategies with climate change impacts
- Quantify financial costs of mitigation options
- Explore institutional and financial arrangements to support forest sector mitigation

Thank-you!

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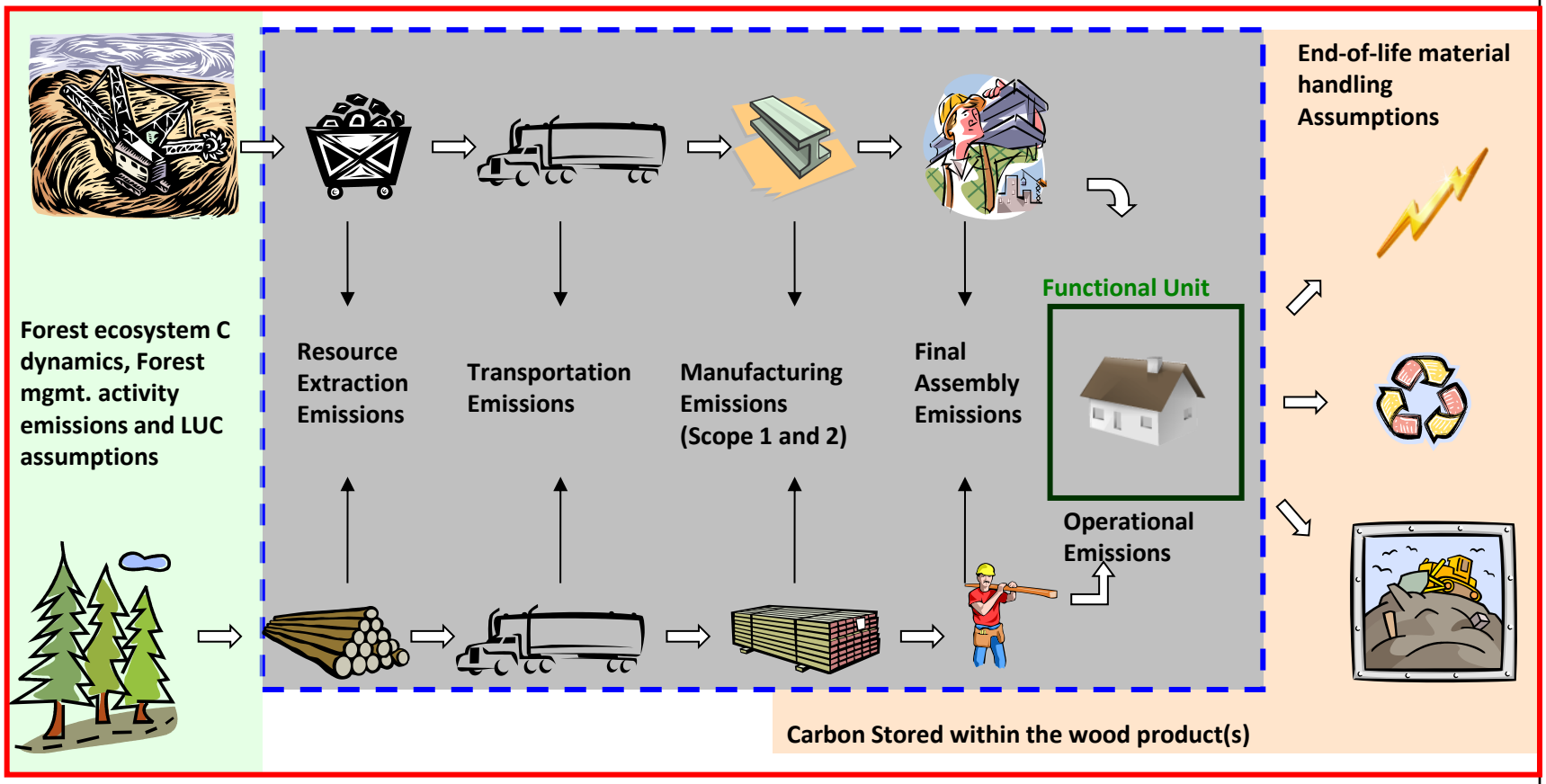
Displacement