Digging Into the Costs of Short Rotation Coppice Crops in Canada

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Talk Overview

- Context
- Relevant questions and models
- Some national perspectives with and without carbon, and Ontario examples
- Concluding comments and future directions

Background - some policy context: FAACS, Forest 2020, CBIN & Kyoto

- October 2000 announcement of "Government of Canada Action Plan 2000 on Climate Change"
- $500 million investment over five years on specific measures that reduce greenhouse gases (GHG)
- Targeted key sectors, i.e., Transportation, Energy, Industry, Buildings, **Agricultural and Forestry**
- Included forestry component focusing on advancing carbon sequestration opportunities through FAACS and Forest 2020 PDA initiative
- Led us into the work on the spatial aspects of the economics of fast-growing plantations (wood supply, bioenergy, carbon, etc) … more is forthcoming CFS colleagues and others.

On Costs and Choices….

Our objectives are both normative, from a private investor point of view (is it worth it?) and positive from a policy point of view ...

Surprisingly difficult to ascertain a national perspective on establishment and management costs (why? – practices vary, perceptions of opportunity costs and risks, still primarily in a R&D phase, weather, timing, and other stochastic events, etc)

What types of questions can (should) you ask?

How much carbon might be expected to be sequestered under different price (or subsidy, or tax credit) levels?

How much land-use change pressures might there be under different prices?

What regions appear to have the most investment potential? Why - physical or economic advantage?

What energy price changes could affect forest management decisions; when will woody biomass from forests become an attractive energy source?

What research is required to decrease uncertainty, increase financial attractiveness or adoption possibilities?

Economic Models

Three models developed and being applied to our work:

CFS-AFM (Afforestation Feasibility Model)

- Infinite rotation Faustmann-type model including carbon and fibre benefits
- Extensively used in Forest 2020 Plantation Demonstration and Assessment Initiative (PDA) to assess feasibility of fast-growing plantations, published in peer-reviewed media

CFS-FBM (Forest Bioeconomic Model)

We used this one

- More complex and uses specified time horizons
- Uses improved 18-pool carbon model
- Better addresses more complex forest management and bioenergy scenarios (species rotation, fixed time horizons, multiple thinnings)

SRC-GHM (Greenhouse Bioenergy Cost-Benefit Model)

- Cost-benefit spread-sheet model of joint project options:
  Heating greenhouses with SRC biomass – (also includes break-even metrics of fossil fuel substitution)

Typical Output Metrics from Models

ROI, (%) – real rate of return yielding NPV = 0

Break-even wood prices, ($/ODT or $/$m^3$) – the unit price yielding NPV = 0
(wood price is 0 when NPV is positive)

Physical carbon, (t/ha) – total ecosystem carbon sequestered over a project life (minus carbon in harvested biomass and decay emissions)

Geographical variation of the output metrics
(e.g. helps to identify economically attractive areas for afforestation)

Other metrics include **Present Values, break-even carbon prices, aggregate quantities**

Where do we get our information?

National network of sites – Derek Sidders team NoFC: site suitability modeling, yields, practices, costs

Selected operator experiences

Extrapolation from literature and agriculture costs

Independent private landowner experiences

Cost scenario summary

- All scenarios assume 10 ODT/ha/yr yield before being applied to a spatially explicit site suitability index (bio-geo-climatic).

- Agricultural opportunity costs (spatial) also considered.

- Model runs conducted at 3 discount rates: 2%, 4%, 8%

Variable	Assumption	Description
Sample Area	Best 100,000 hectares in Canada, break-even for whole country	Spatial model out puts of average of NPV & IRR, and, break-even prices per grid cell
Scenario 1	Establishment (yrs 0-1) - $3325/ha	A very localized cost description based on an operator in southern Quebec.
	Maintenance (yrs 2-21) - $640/ha	
	Total (yrs 0-21) - **$3965/ha**	
Scenario 2	Establishment (yrs 0-1) - $3445/ha	Regional costing based on current afforestion costs across Ontario.
	Maintenance (yrs 2-21) - $2815/ha	
	Total (yrs 0-21) - **$6260/ha**	
Scenario 3	Establishment (yrs 0-1) - $7670/ha	"National Level" averaged costing.
	Maintenance (yrs 2-21) - $1400/ha	
	Total (yrs (0-21) - **$9070/ha**	
Harvesting	$25/ODT	This assumes costs for harvesting using a commercial harvester. Includes in-field handling and transportation to farmgate.
Chip Price	$85/ODT	The market price assumed for all scenarios.This price reflects farmgate prices.
Carbon Value	$10/$CO^2e$	Reflects a market value for carbon.

Basic results

Best 100,000 Hectares		Scenario 1	Scenario 2	Scenario 3
	Cost 21yrs ($CDN) >	3965	6260	9070
Real Discount Rate	**Scenario**	**NPV (IRR%)**	**NPV (IRR%)**	**NPV (IRR%)**
2%	Base Scenario	2496	504	-2584
4%	Base Scenario	1454 (8.4)	-292 (3.2)	-3576 (0.0)
8%	Base Scenario	109	-1273	-4790

Sensitivity Analysis Scenario 2 - Base Case example

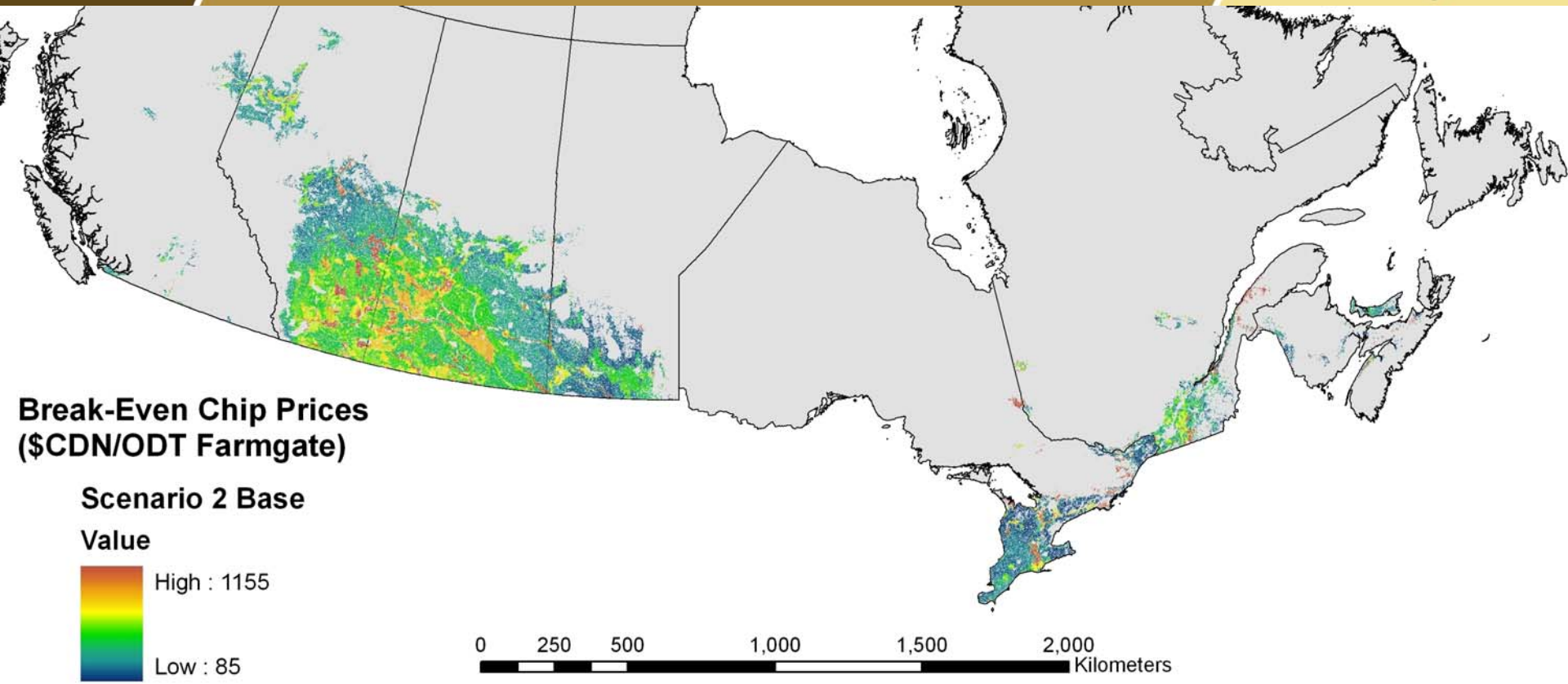
NPV (IRR)

1.5 chip price = 3673 (12.8)

1.5 yield = 2480 (10.2)

Results- spatial examples

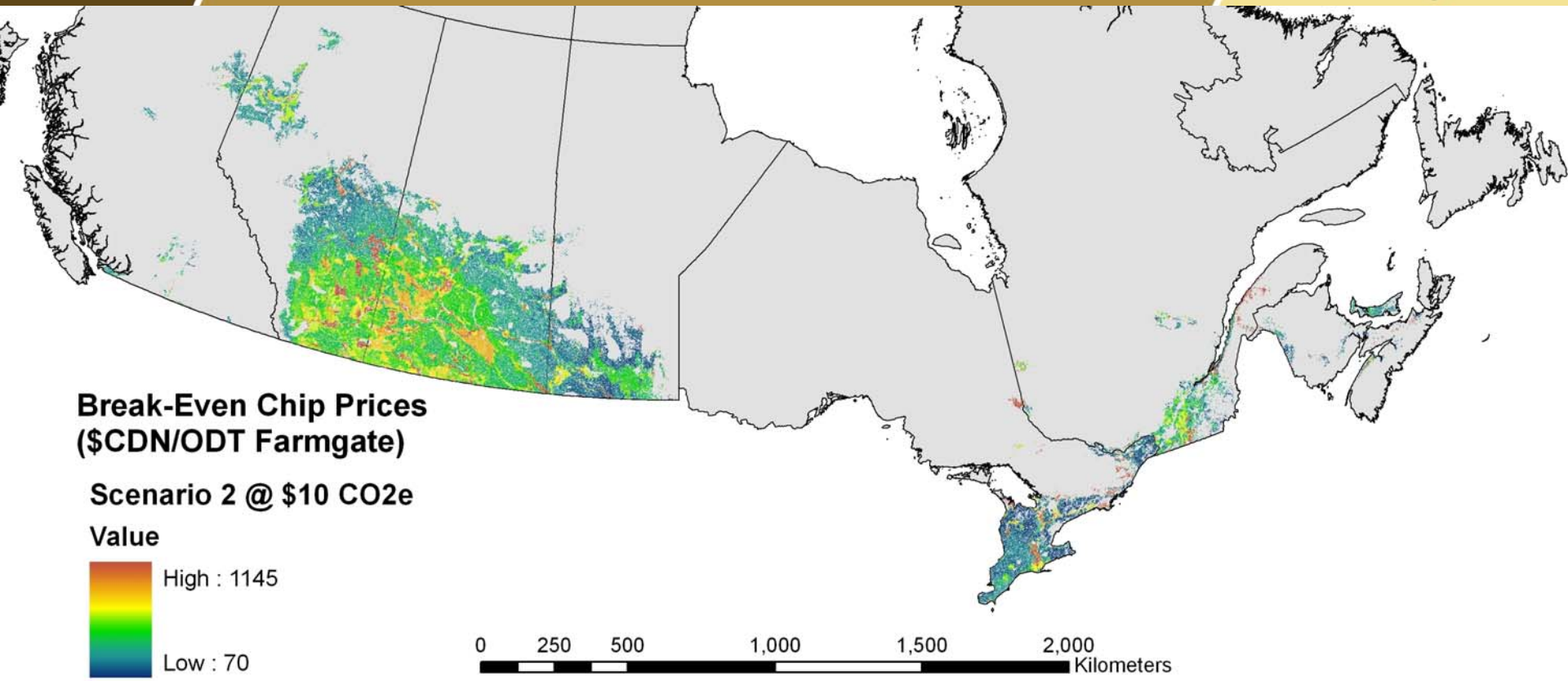
4% discount rate



Scenario 2 base case

Results- spatial examples

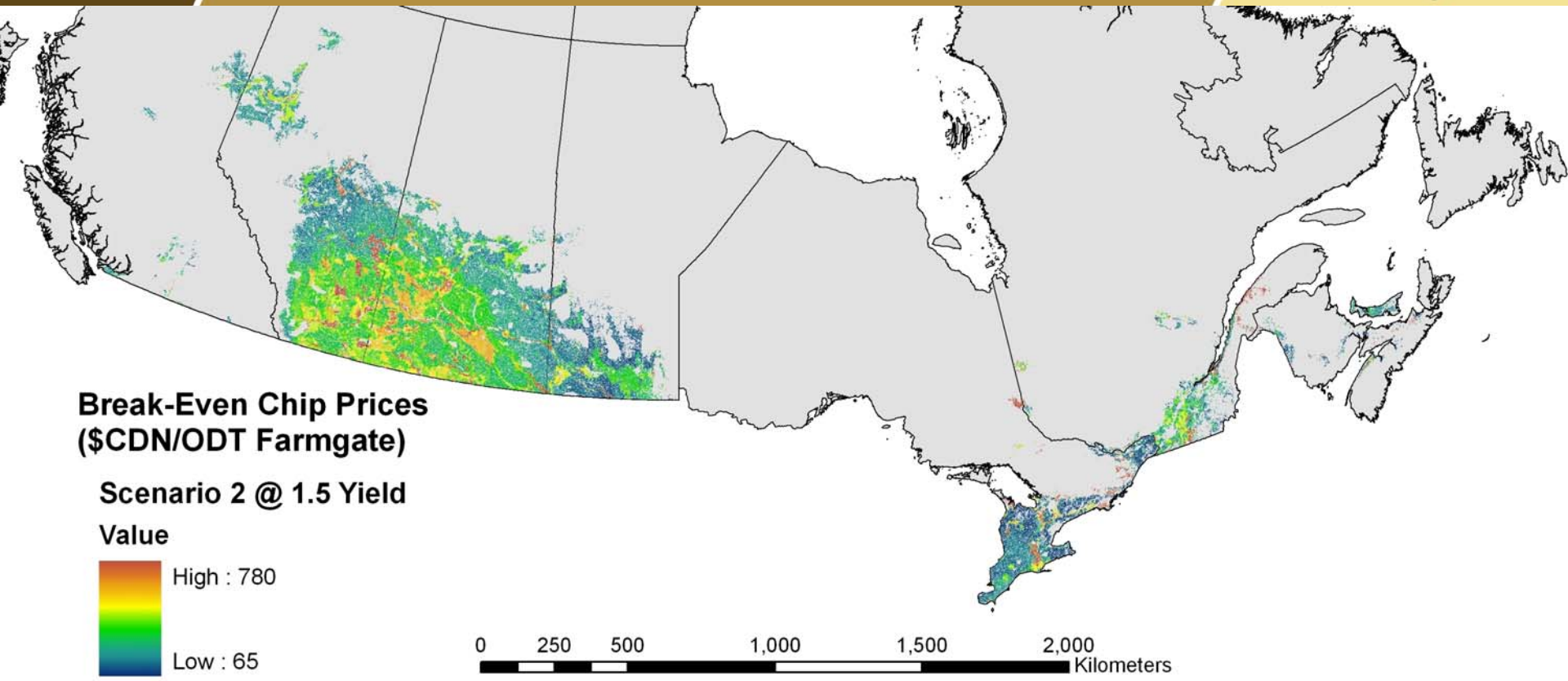
4% discount rate



includes a carbon value

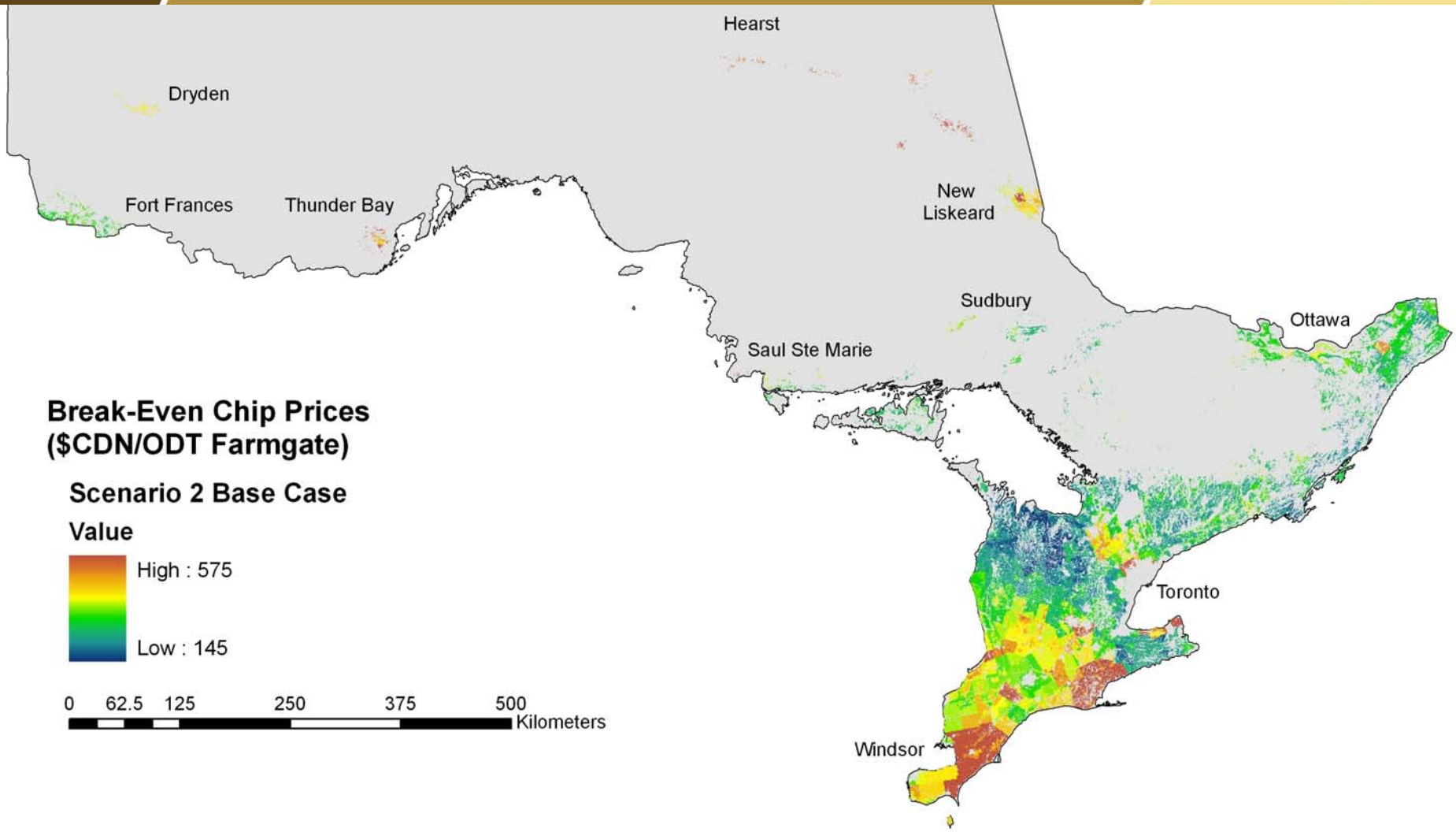
Results- spatial examples

4% discount rate

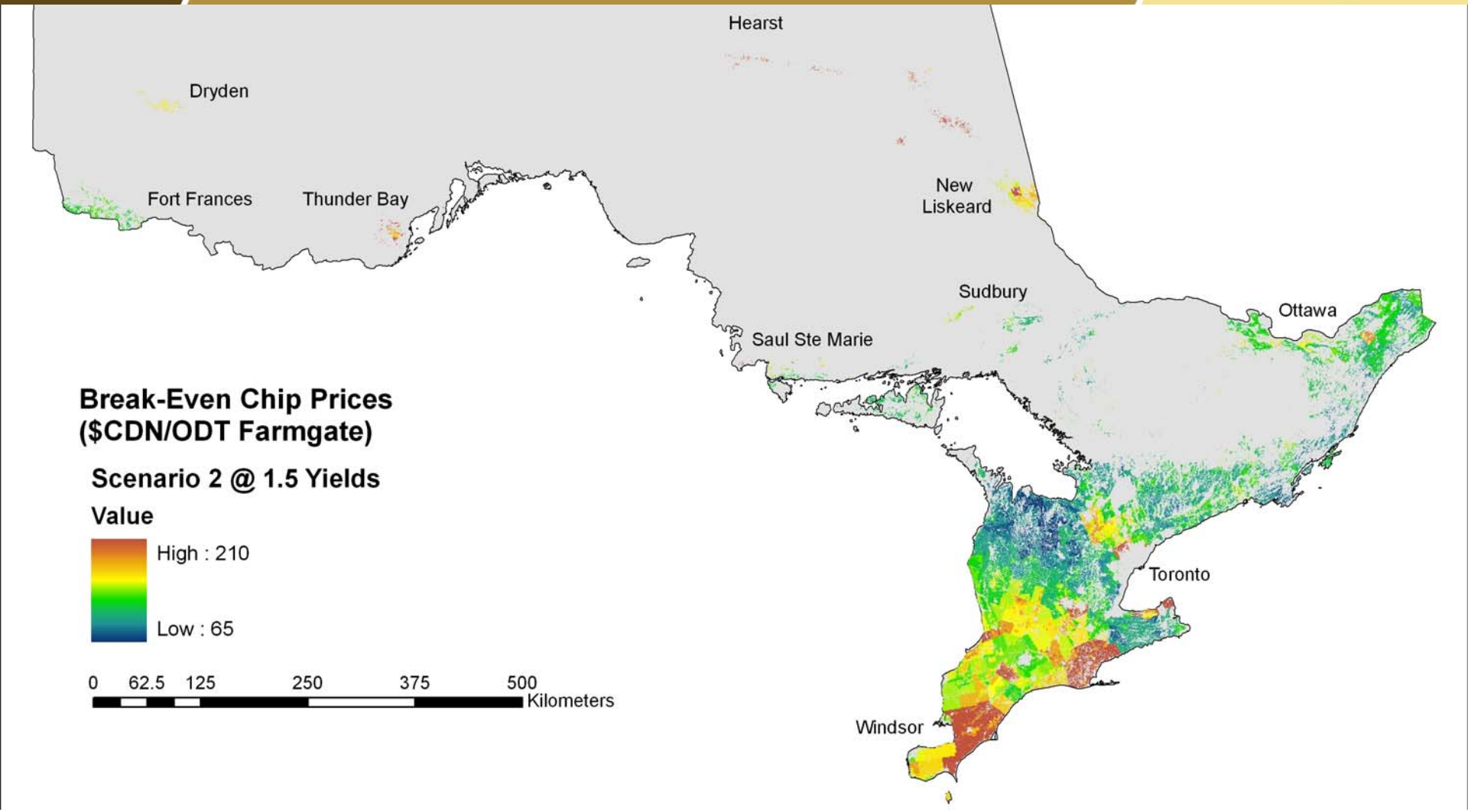


1.5x yield

Ontario example
4% discount rate

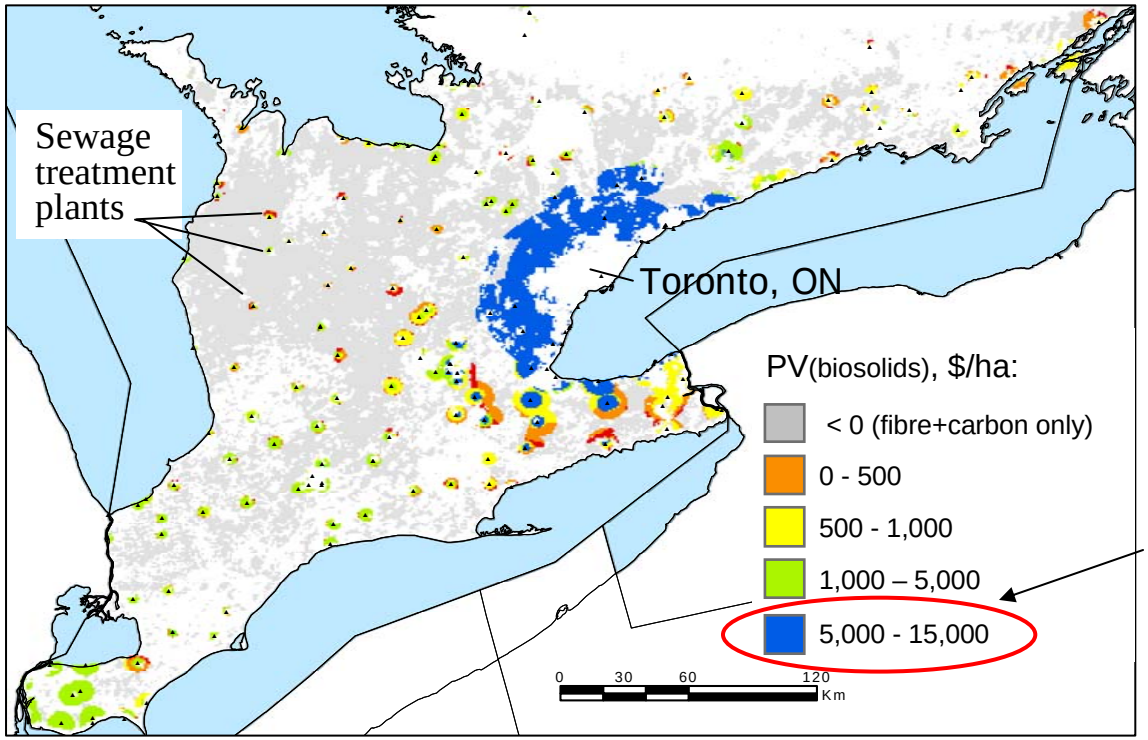


Increased yield assumption



What can be done to make afforestation more attractive?
Joint products: Fibre + Carbon + Biosolids

Present value (PV, $/ha) of biosolids storage benefits



Biosolids application rate = 1wmt/ha/year (4% of regulatory limit)

Apparent high returns in Southern Ontario (reduced landfill disposal and transportation costs – high returns leaves lots of room to increase acceptability)

A way to make plantation forests more relevant to municipalities?

Conclusions and Future Work

- Model / data development quite well advanced – new capacities being developed
- Models have already been used to support policy development
- Incorporating economic aspects very important for policy development
- Some areas appear to be economically attractive based on cost assumptions (best 100,000 ha examples)
- Multiple revenue streams: co-projects and joint products appear to be attractive

Other Needs/Activities

- Make use of finer scale data and more cost scenarios as this type of activity expands in Canada
- “Option” value modeling for land-use change (with University of Alberta)
- Forest crops vs Ag crops (with University of Guelph)

Example references - previous work

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