Assessing the effect of climate change on Canadian farmland values: A Ricardian Approach

UNIVERSITY of GUELPH
IMPROVE LIFE.

Nicholas Bannon, Christopher Kimmerer, B. James Deaton
Department of Food, Agriculture, and Resource Economics, University of Guelph

Introduction:

- This study uses a sample of Canadian parcel level farmland values to estimate Ricardian impacts of climate change on agriculture.
- The Ricardian approach was first proposed by Mendelson, Nordhaus, and Shaw (1994) as an alternative to crop-specific approaches.
- The Ricardian approach applies a hedonic property model to farmland values and includes climate measures as key explanatory variables.

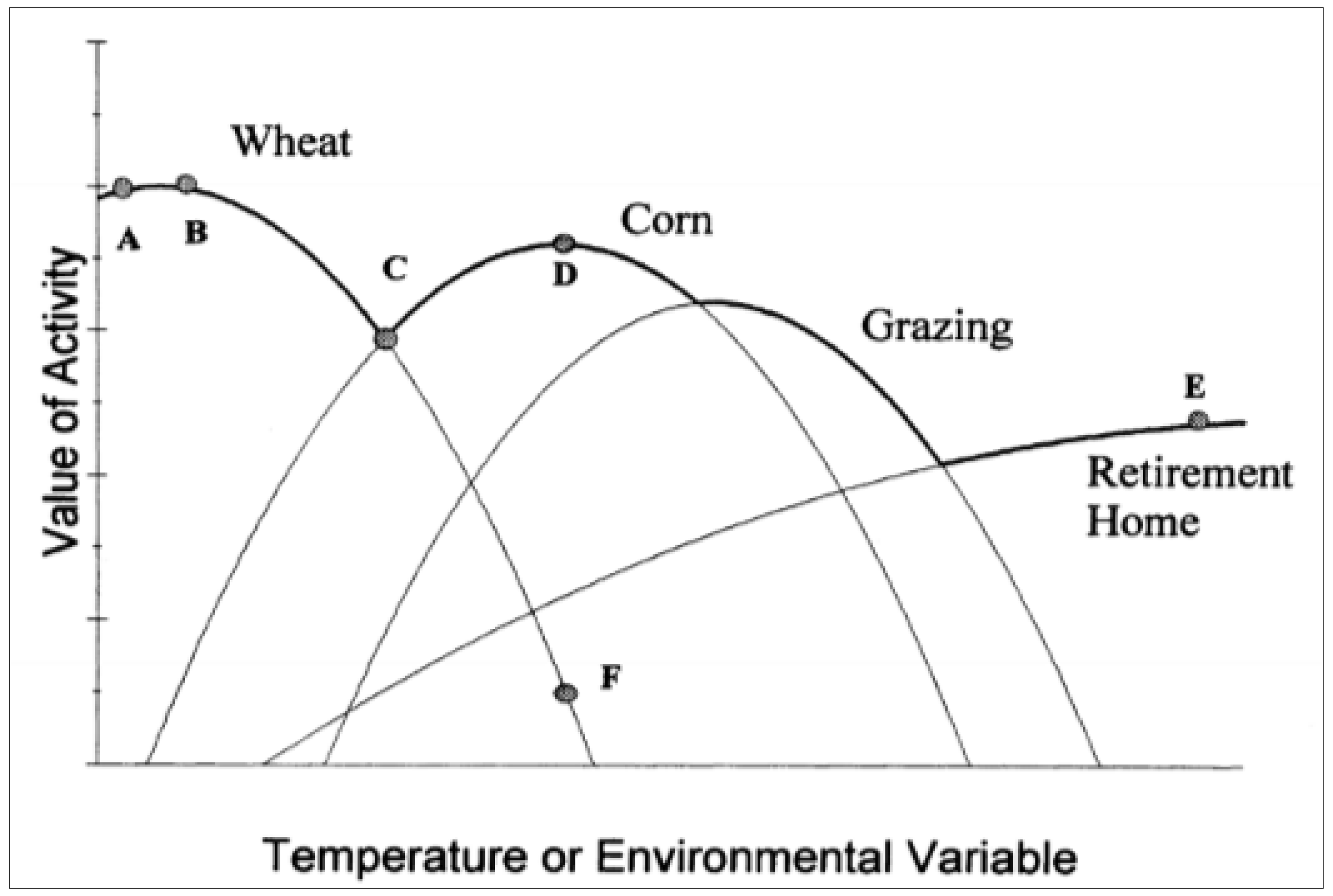


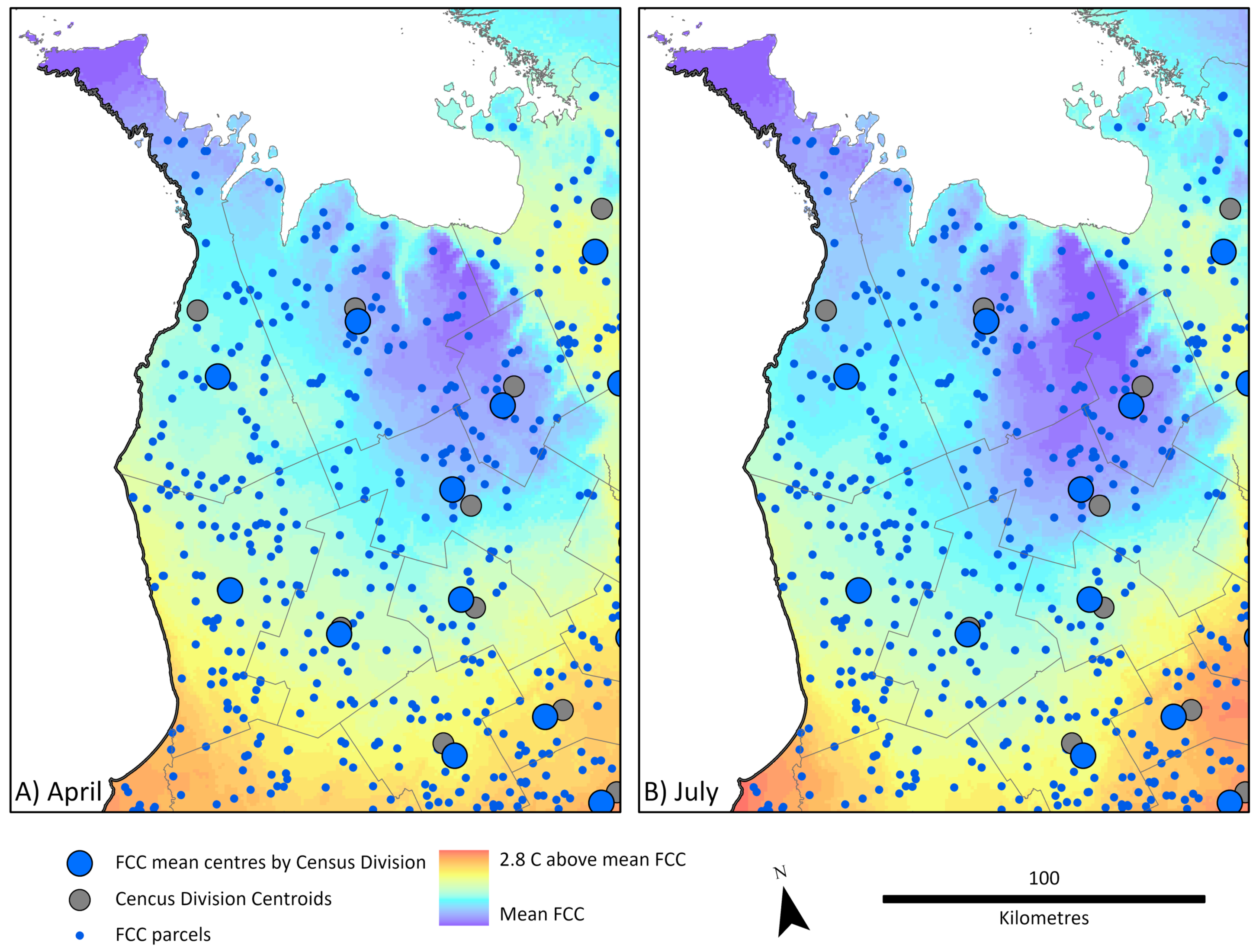
Image adapted from Mendelsohn et al (1994).

Research Contributions:

1. **Publish the first Canadian Ricardian estimates using a pooled county-fixed effects model.**
   - Almost all previous Ricardian studies have used a single year cross section of aggregated county level data.
   - Few studies have used granular spatial data on farmland values (Barielle & Chakir, 2023; Fezzi & Bateman, 2015; Schlenker et al. 2006; Weber & Hauer 2003).
2. **Control for potential omitted variable bias that occurs when climate is correlated with future urban development.**
   - Future urban development influences the price of farmland today.
   - Dataset includes parcels where urban conversion is eminent and parcels where conversion is distant, potentially biasing the estimates (Ortiz-Bobea, 2020).

Data:

- Most studies have used county level averages for farmland values and all explanatory variables – including climate.



- This study uses parcel level farmland values provided by Farm Credit Canada (FCC) - each datapoint is composed of real market transactions between 2017-2022.
- Historic and forecasted climate data were accessed from Adapt West and matched to the centroid location of each parcel
- Other control variables include soil quality, surrounding area population density and median total income.

Empirical Approach

- The first stage estimates the marginal effect of climate on farmland values using a hedonic property model.
- A spatial error model is used to allow for spatial correlation between observations (Conley, 1999).

$$\ln(LV_{i,m,p}) = \beta' C_{i,m,p} + \theta' F_{i,m,p} + \tau' N_{m,p} + P_{FE} + M_{FE} + u_{i,m,p}$$

- The second stage calculates the average predicted change in farmland values resulting from climate change for each observation and corrects for bias in log predictions (Newman, 1993; Wooldridge 2009).

$$\Delta LV_i = (\textit{Predicted Future Value}_i - \textit{Predicted Current Value}_i)$$

Marginal Effects of Climate on Farmland Values:

	Census Division FE	
	(1)	(2)
Temperature (◦C)		
January	-0.28%	0.49%
April	22.68%	23.97%
July	5.48%	0.78%
October	-11.93%	-6.93%
Aggregate	**15.96%**	**18.31%**
Precipitation (mm)		
January	0.15%	0.21%
April	1.10%	1.22%
July	-0.29%	-0.01%
October	-0.57%	-1.12%
Aggregate	**0.38%**	**0.29%**
Proximity Variable		Yes

Aggregate Impact (SSP2.4-5 2041-2070)

	Census Division FE	
	(1)	(2)
Per Acre Price	$11,951	$11,951
Predicted Per Acre Price	$12,756	$12,811
95% Confidence Interval	($12,380, $13,133)	($12,430, $13,192)
Predicted Future Price	$22,489	$23,413
95% Confidence Interval	($21,934, $23,044)	($22,821, $24,005)
Per Acre Change (2041-2070)	**$9,732**	**$10,602**
Annualized Impacts (5%)	**$487**	**$530**
Percent Change	**76%**	**83%**
Proximity Variable		Yes

Conclusions:

- Climate change is expected to have a large positive impact on Canadian farmland values.
- The inclusion of a proximity variable increases the positive impacts.
- These results can help inform climate related risk management decisions.