Shelterbelts: A Row of Trees or the Next Best Thing to Mitigating GHGs on Prairie Landscapes

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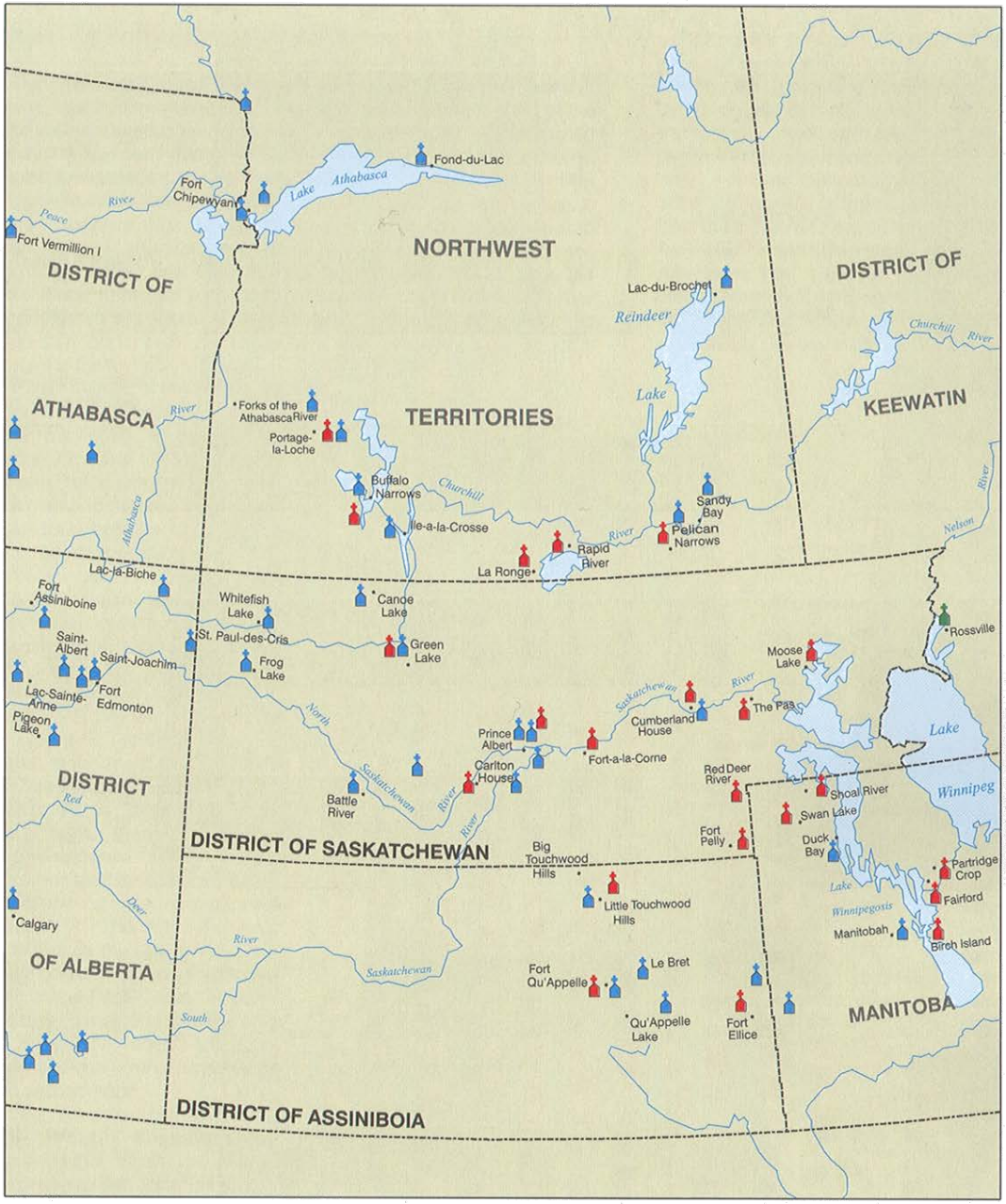
NORTHERN MISSIONS 1820 - 1910



Objective 1. Develop an inventory of shelterbelts systems in Saskatchewan

Objective 2. Quantify the potential for shelterbelts to store carbon

Objective 3. What are the potential impacts of climate change on future shelterbelt growth patterns for C accumulation?

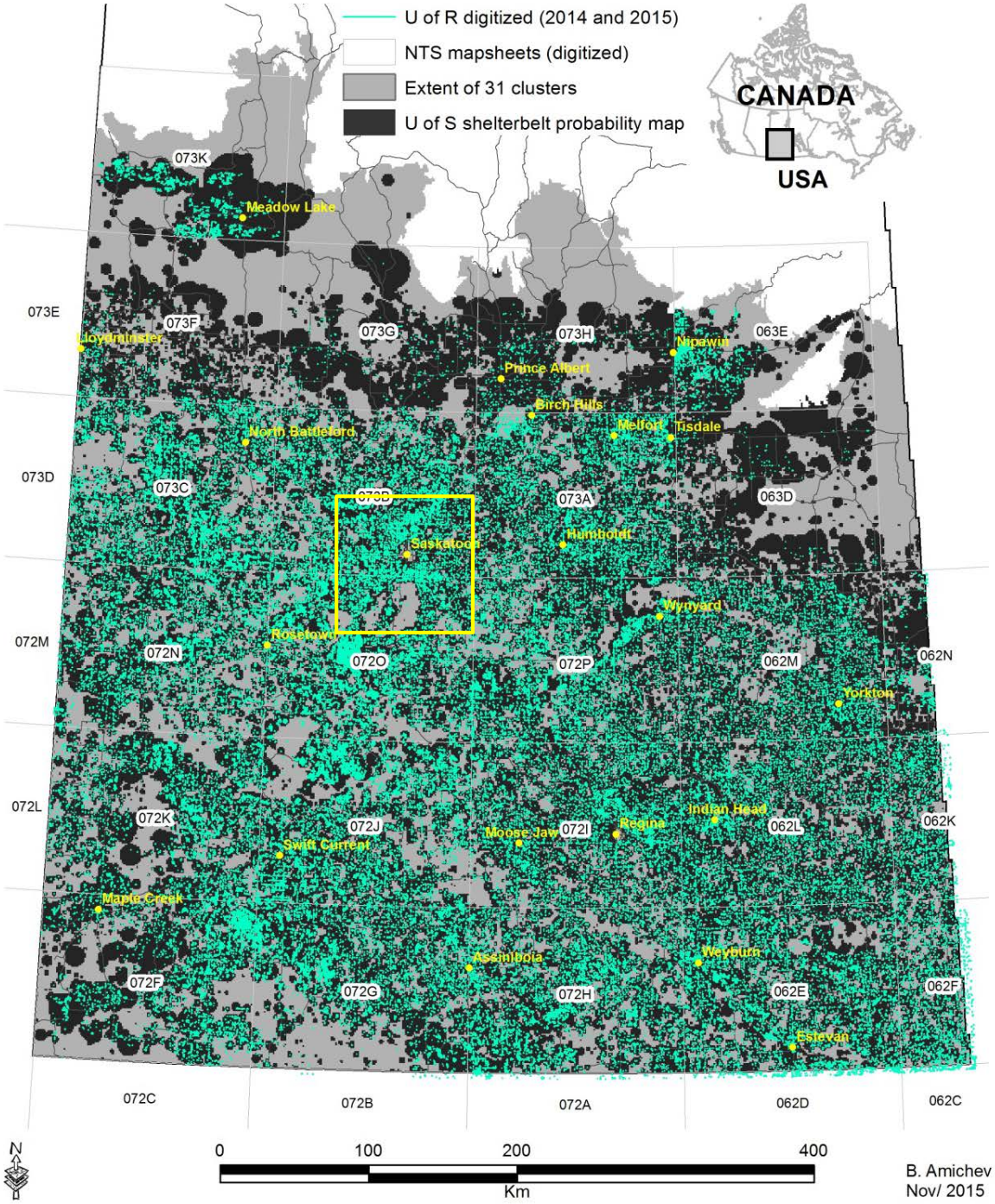
Shelterbelt Species

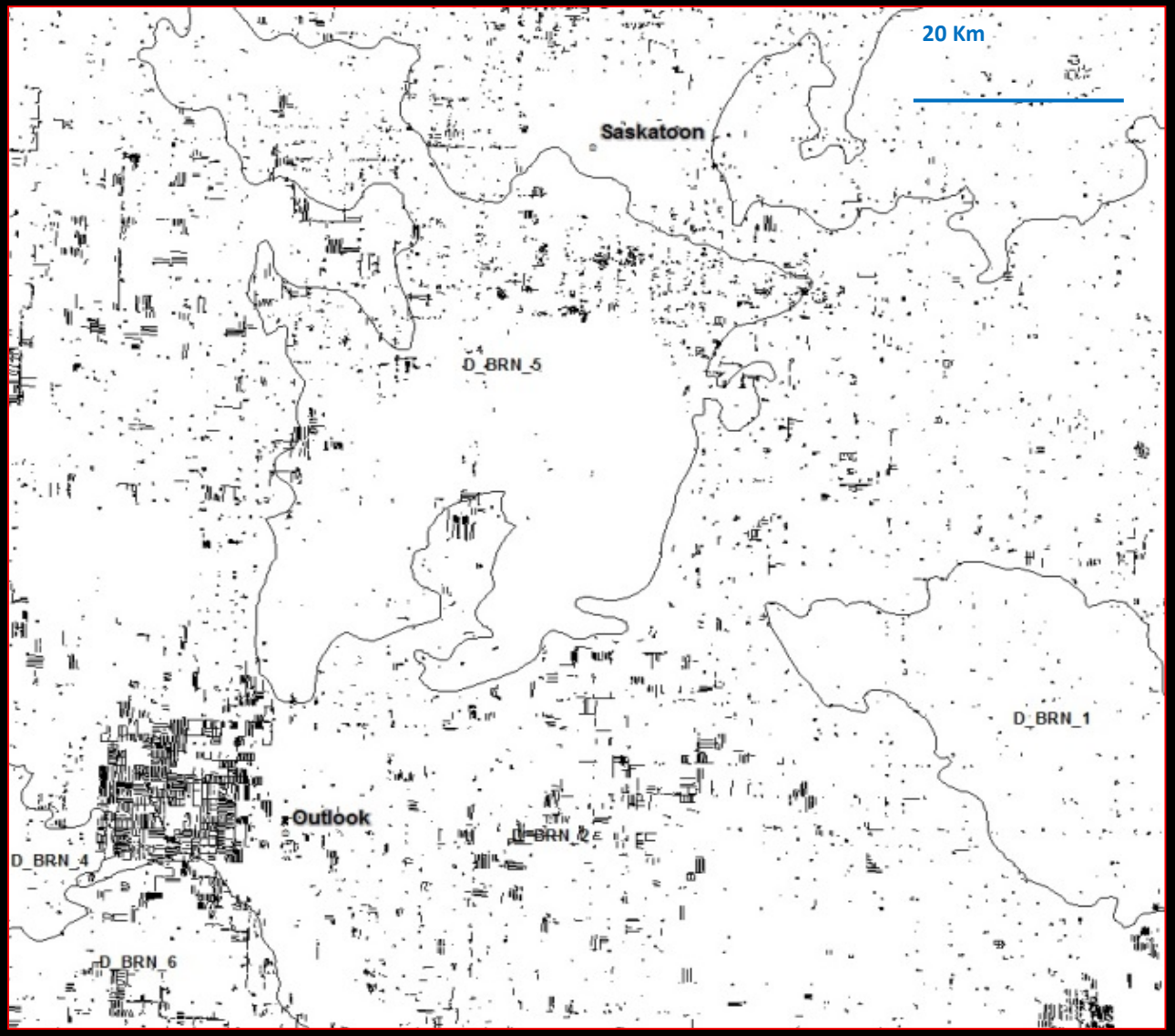
Green ash
Hybrid poplar
Manitoba maple

White spruce
Scots pine

Caragana


Newby
1 Km


U of R digitized (2014 and 2015)
NTS mapsheets (digitized)
Extent of 31 clusters
U of S shelterbelt probability map
CANADA
USA
073K
Meadow Lake
073E
073F
073G
073H
063E
Lloydminster
Nipawin
Prince Albert
Birch Hills
North Battleford
Melfort
Tisdale
073D
073C
073B
073A
063D
Saskatoon
Humboldt
Wynyard
072M
Rosetown
072N
072O
072P
062M
062N
Yorkton
072L
072K
072J
072I
062L
062K
Indian Head
Regina
Moose Jaw
Swift Current
Maple Creek
Weyburn
Assiniboia
072F
072G
072H
062E
062F
Estevan
072C
072B
072A
062D
062C
N
0
100
200
400
Km
B. Amichev
Nov/ 2015

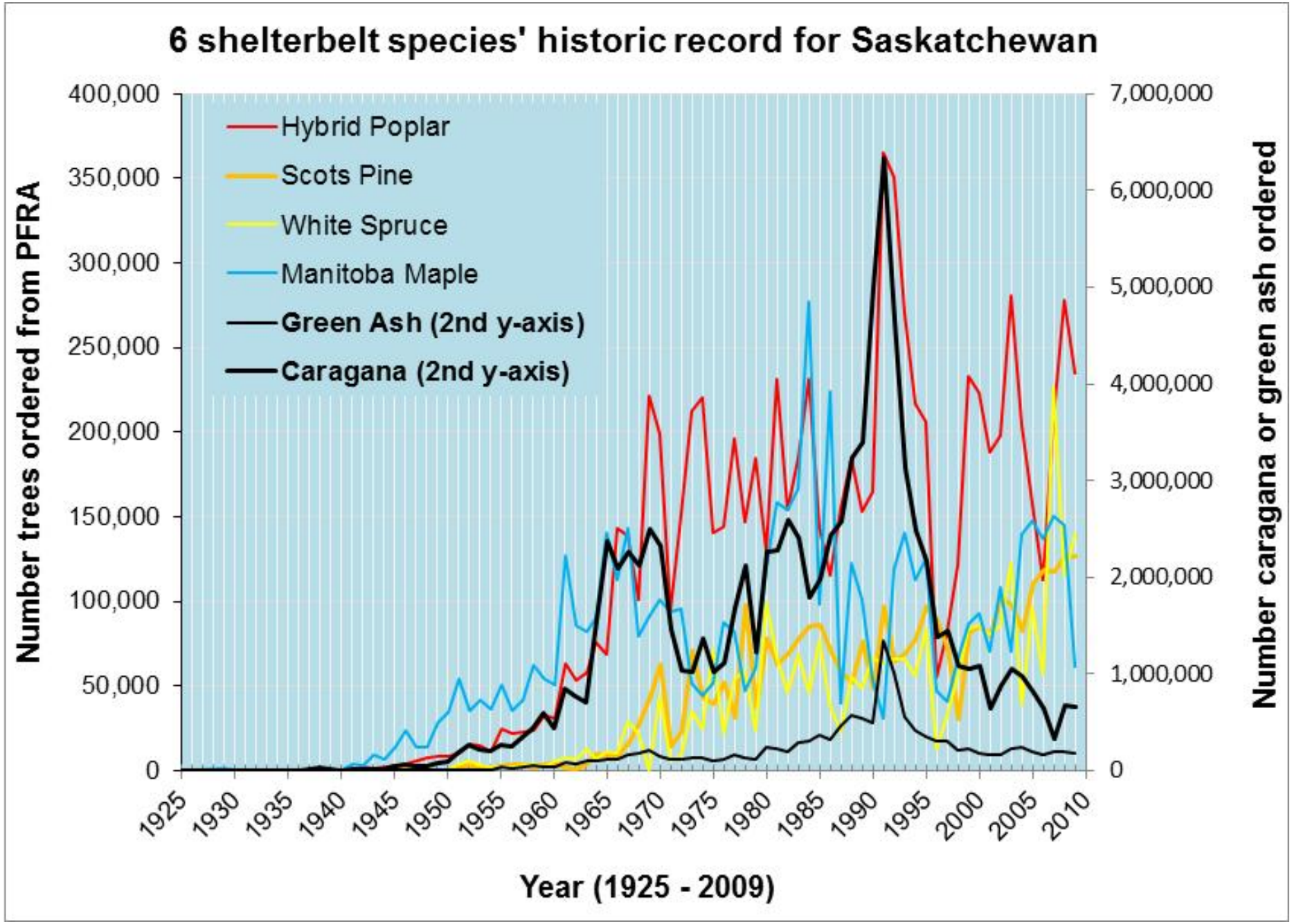

20 Km
Saskatoon
D_BRN_5
D_BRN_1
Outlook
D_BRN_2
D_BRN_4
D_BRN_6

Length of digitized shelterbelts in various soil zones

Type	Brown	Dark Brown	Black	Dark Gray	Gray	Total
	Length of shelterbelt (km)					
Farm	8,488	12,422	8,048	778	19	29,754
Field	7,859	10,852	2,892	293	3	21,899
Total	16,347	23,274	10,940	1,071	21	51,653

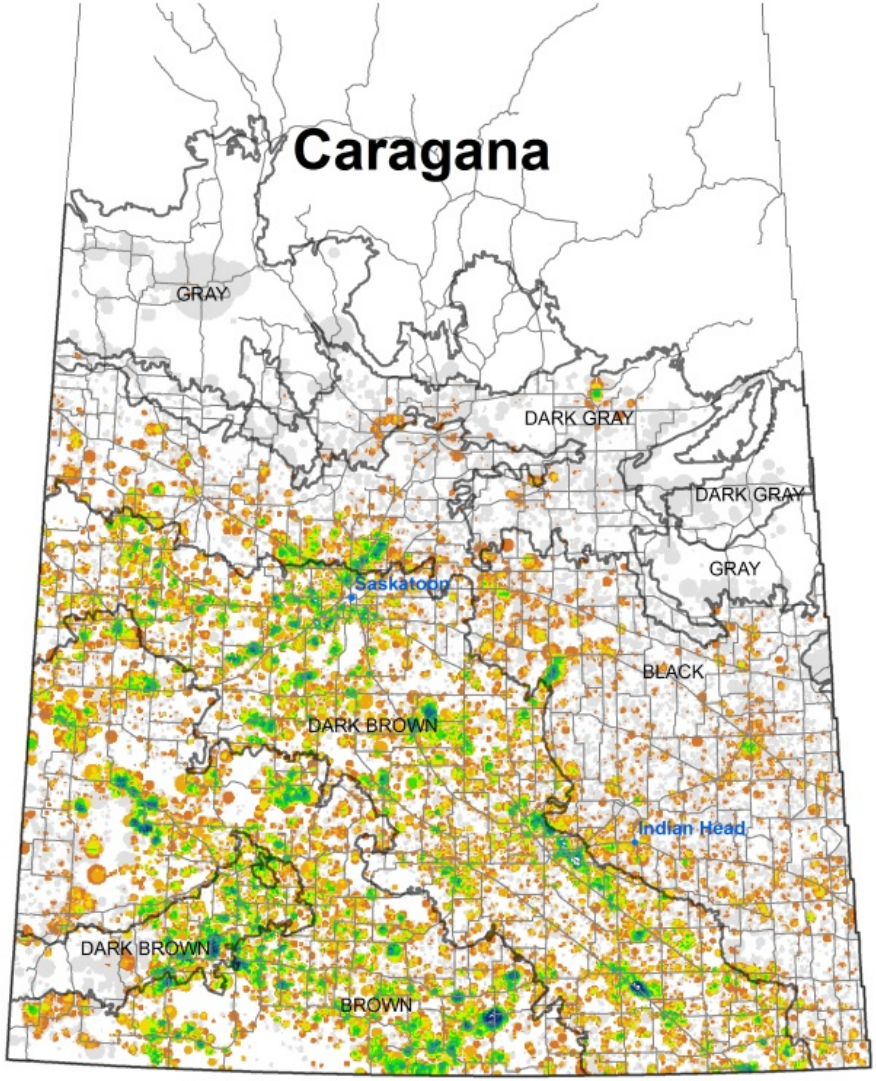
Length of digitized shelterbelts by species grouping

Type	Conifer	Deciduous	Mixed	Shrubs	Total
	Length of shelterbelt (km)				
Farm	4,309	21,876	186	3,384	29,754
Field	286	5,741	400	15,472	21,899
Total	4,595	27,617	586	18,856	51,653


6 shelterbelt species' historic record for Saskatchewan
Number trees ordered from PFRA
Number caragana or green ash ordered
Year (1925 - 2009)
Hybrid Poplar
Scots Pine
White Spruce
Manitoba Maple
Green Ash (2nd y-axis)
Caragana (2nd y-axis)
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010

- Total number CG planted = **64,573,630**;
- Overall CG mapping accuracy = **69%**

Caragana

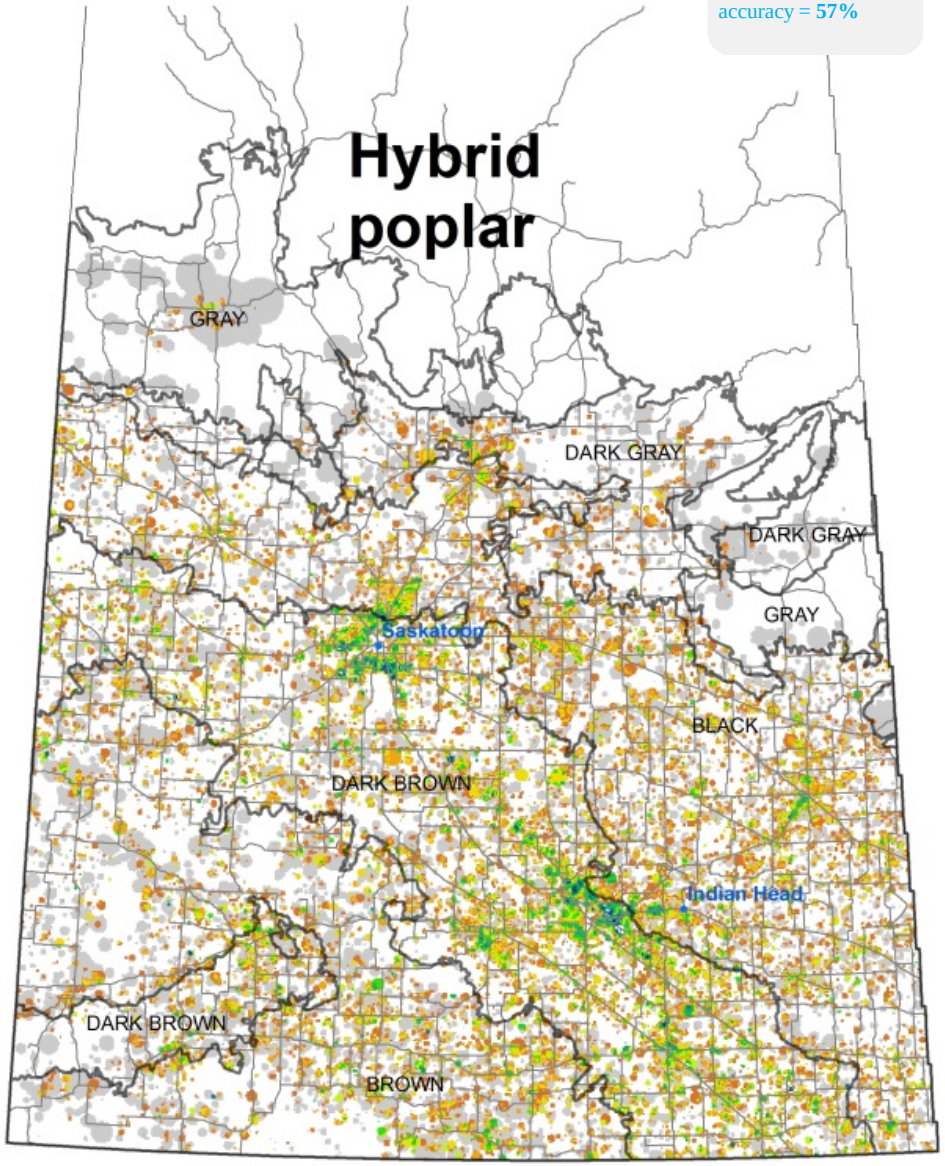


Planted shrubs per 100 ha

No CG in shelterbelt	403 - 581	791 - 1,039	1,341 - 1,721	2,247 - 3,254
< 403 CG planted	581 - 791	1,039 - 1,341	1,721 - 2,247	3,254 - 5,868

- Total number HP planted = **5,684,728**;
- Overall HP mapping accuracy = **57%**

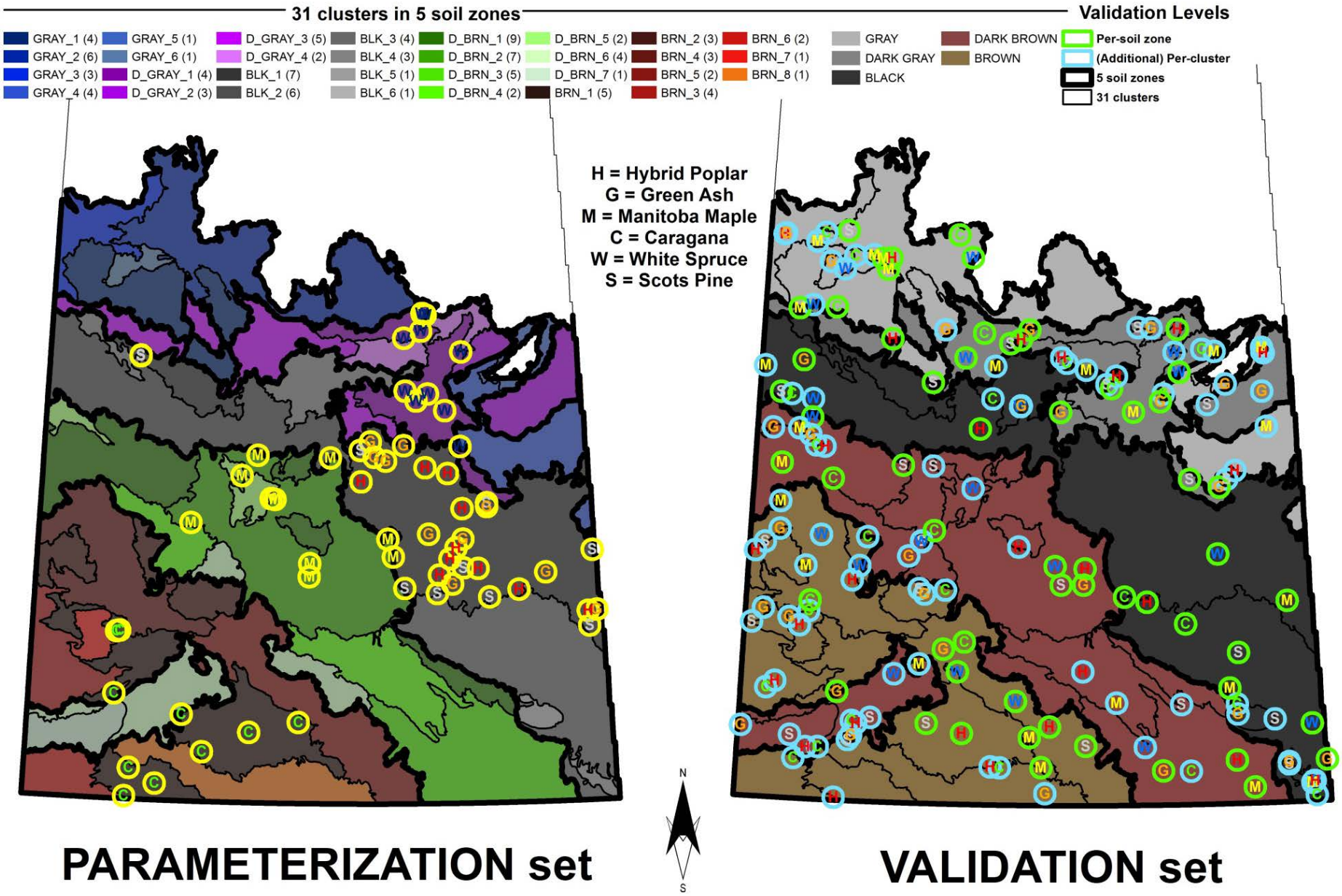
Hybrid poplar

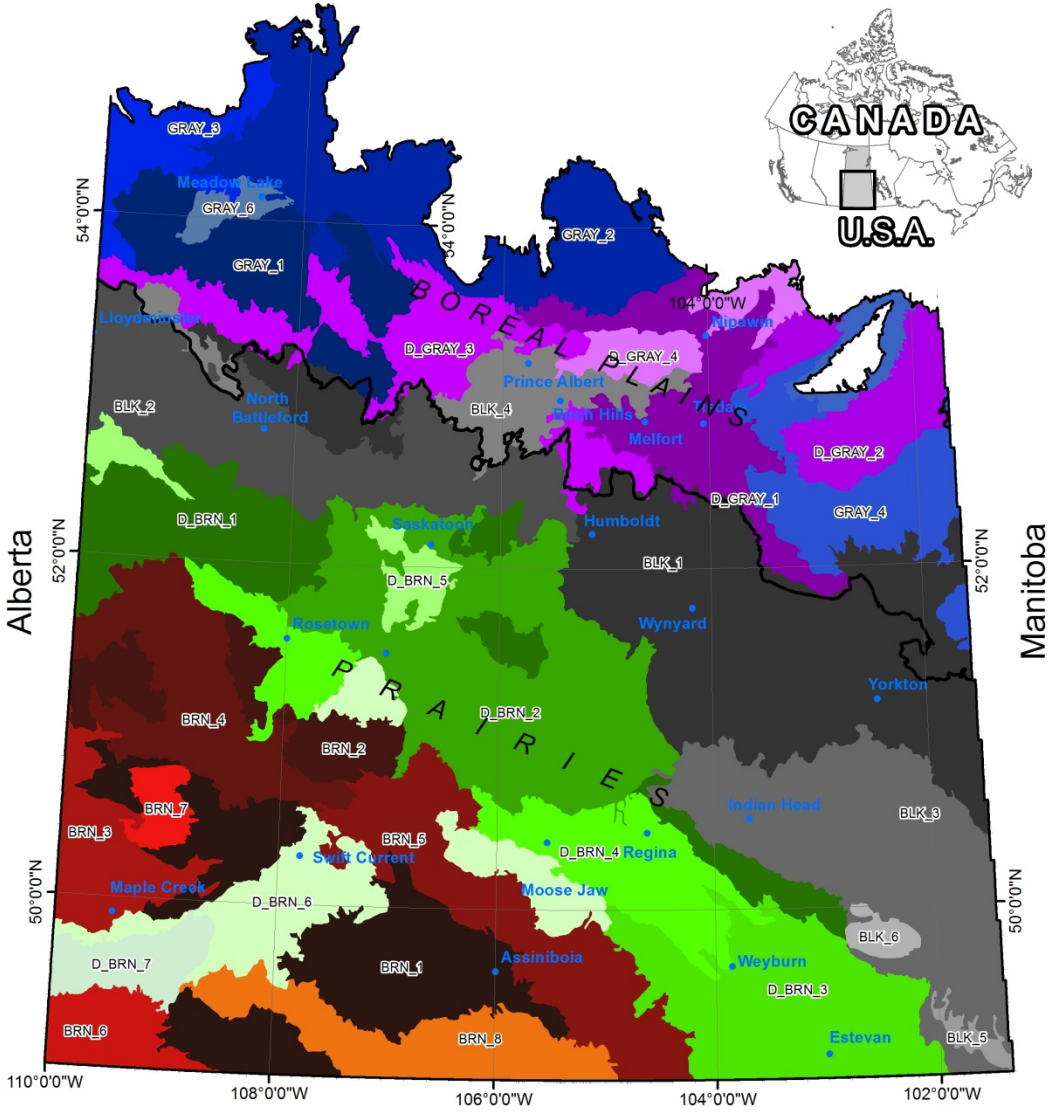


Planted trees per 100 ha

No HP in shelterbelt	51 - 75	104 - 138	180 - 236	312 - 428
< 51 HP planted	75 - 104	138 - 180	236 - 312	428 - 764

Tree sampling locations

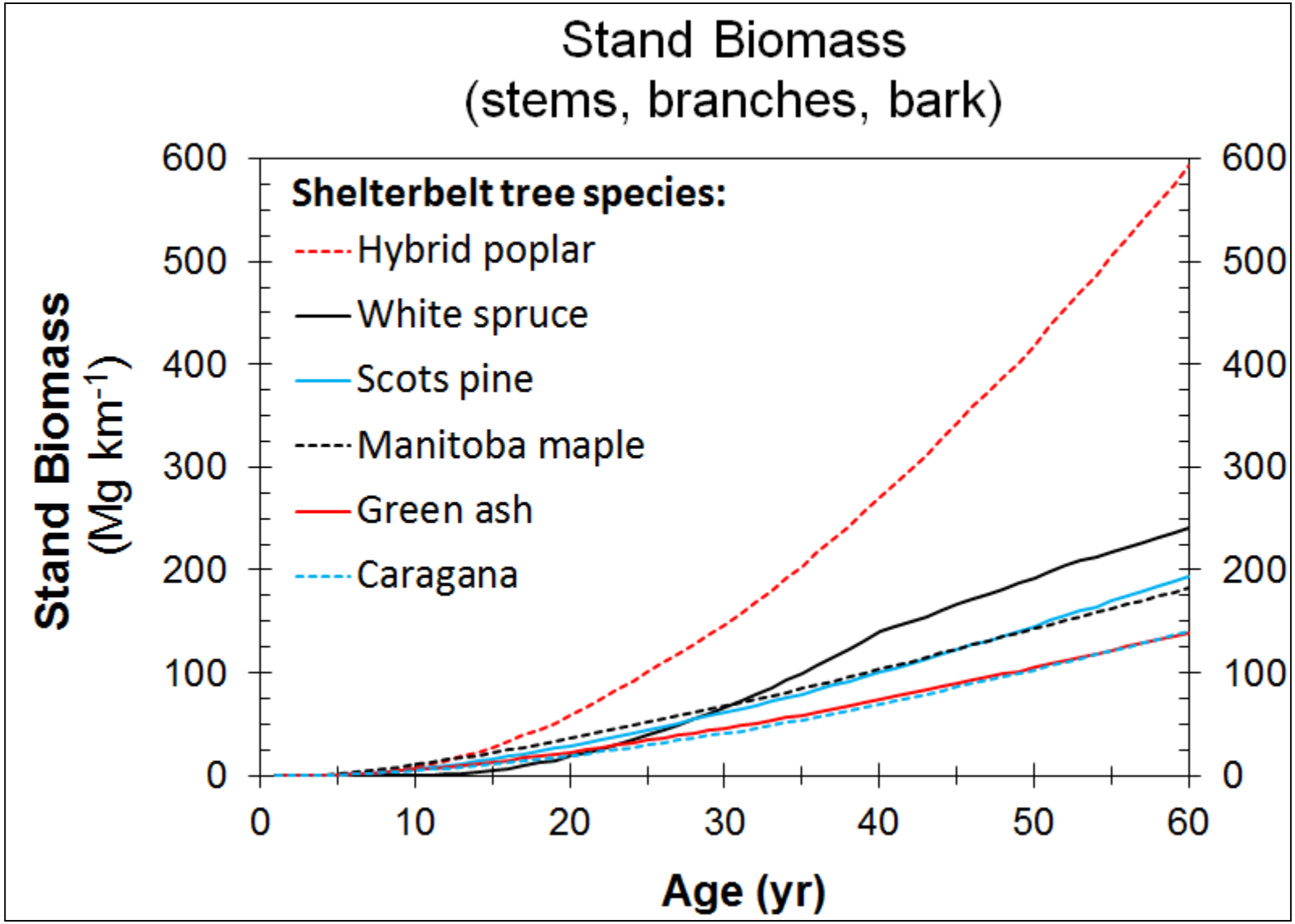




CLUSTERS (No. of ecodistricts)

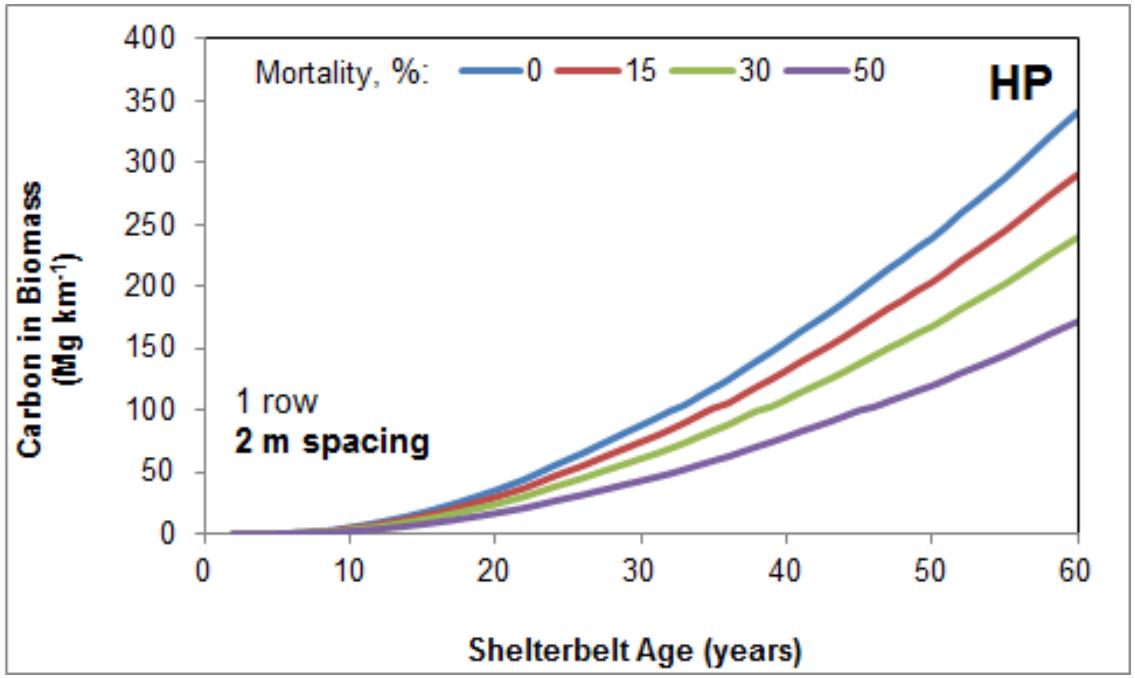
- GRAY_1 (4)
- GRAY_2 (6)
- GRAY_3 (3)
- GRAY_4 (4)
- GRAY_5 (1)
- GRAY_6 (1)
- D_GRAY_1 (4)
- D_GRAY_2 (3)
- D_GRAY_3 (5)
- D_GRAY_4 (2)
- BLK_1 (7)
- BLK_2 (6)
- BLK_3 (4)
- BLK_4 (3)
- BLK_5 (1)
- BLK_6 (1)
- D_BRN_1 (9)
- D_BRN_2 (7)
- D_BRN_3 (5)
- D_BRN_4 (2)
- D_BRN_5 (2)
- D_BRN_6 (4)
- D_BRN_7 (1)
- BRN_1 (5)
- BRN_2 (3)
- BRN_4 (3)
- BRN_5 (2)
- BRN_3 (4)
- BRN_6 (2)
- BRN_7 (1)
- BRN_8 (1)

Six species growth comparison

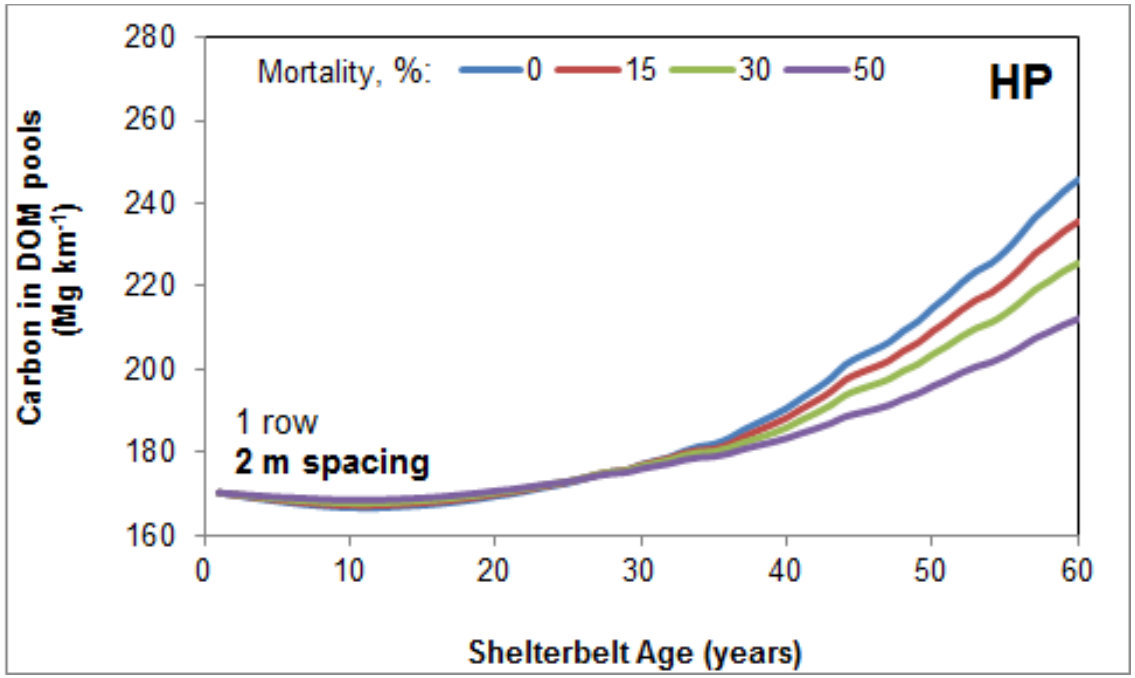


(1 row, 2 m spacing, 0% mortality)

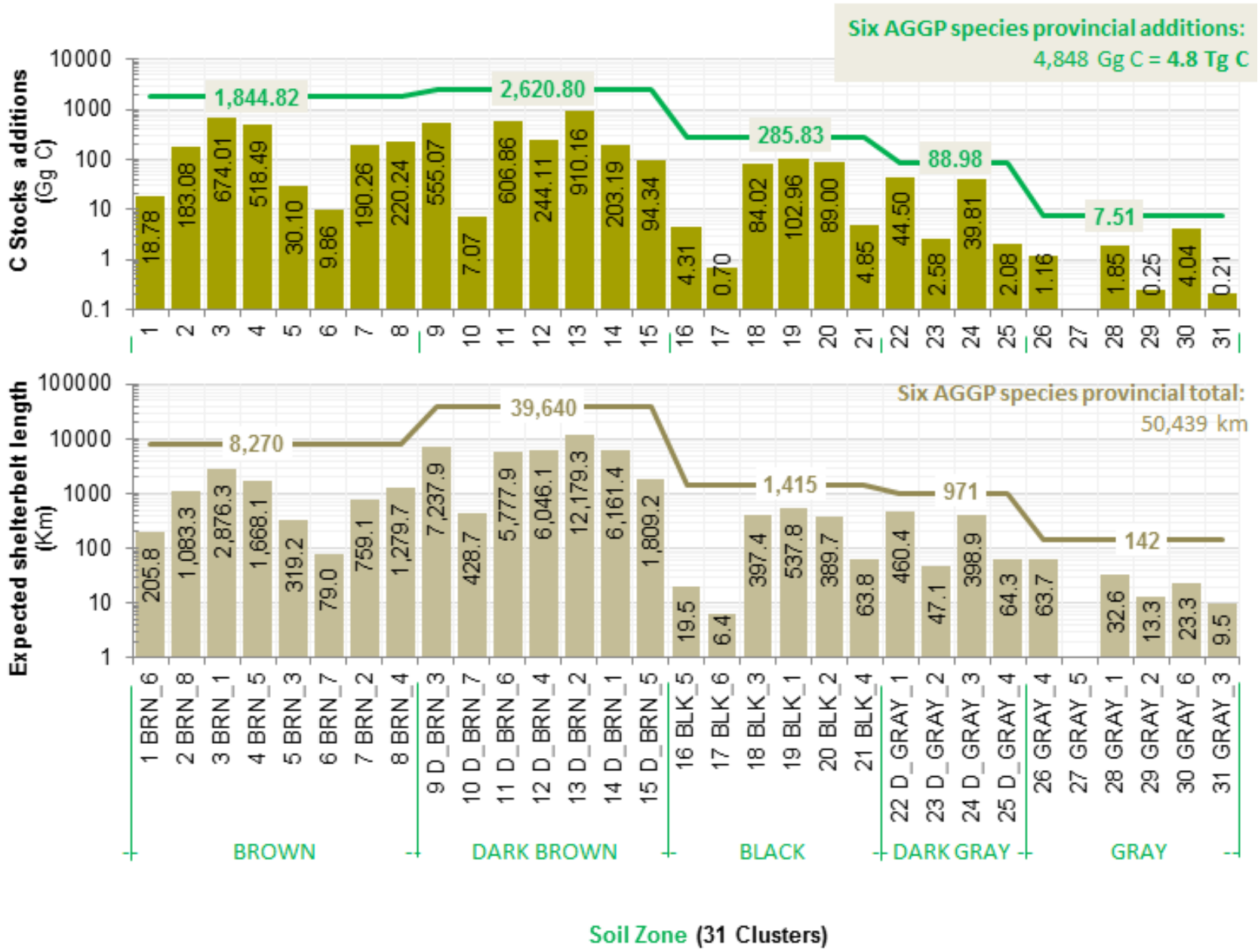
Carbon Budget Model



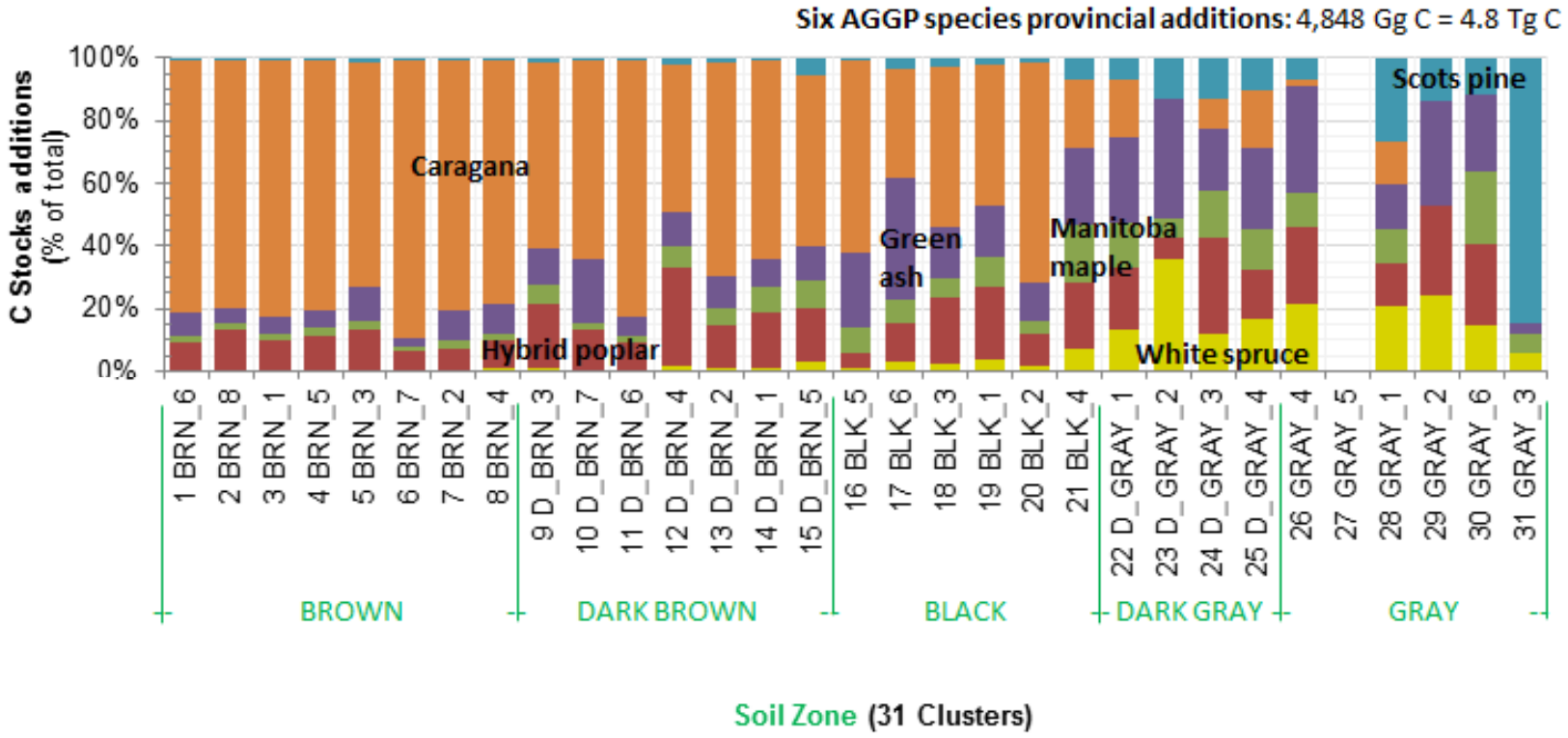
Total biomass C pools



Total dead organic matter (DOM) stocks



(Planted 1925-2009)



(Planted 1925-2009)

Summary of shelterbelt C inventory

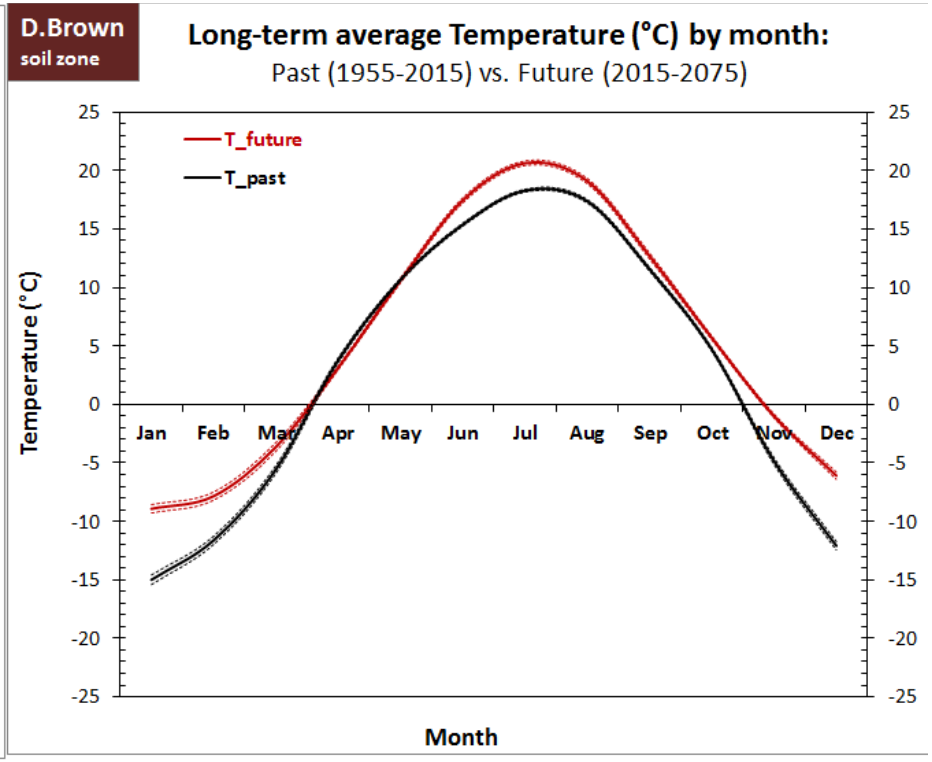
		Shelterbelts planted 1925-2009		Shelterbelts planted since 1990	
Species	Length (km)	Total (Mg C)	Additions (Mg C)	Total (Mg C)	Additions (Mg C)
Caragana	35,245	7,864,038	3,403,911	1,517,700	421,968
Green Ash	5,841	964,207	432,497	329,481	99,988
Hybrid Poplar	4,144	1,303,391	684,186	216,767	50,324
Manitoba Maple	2,646	364,000	212,503	41,894	12,893
Scots Pine	1,573	184,214	64,392	51,095	10,740
White Spruce	991	131,750	50,440	39,709	6,697
Total	50,439	10,811,599	4,847,929	2,196,646	602,701

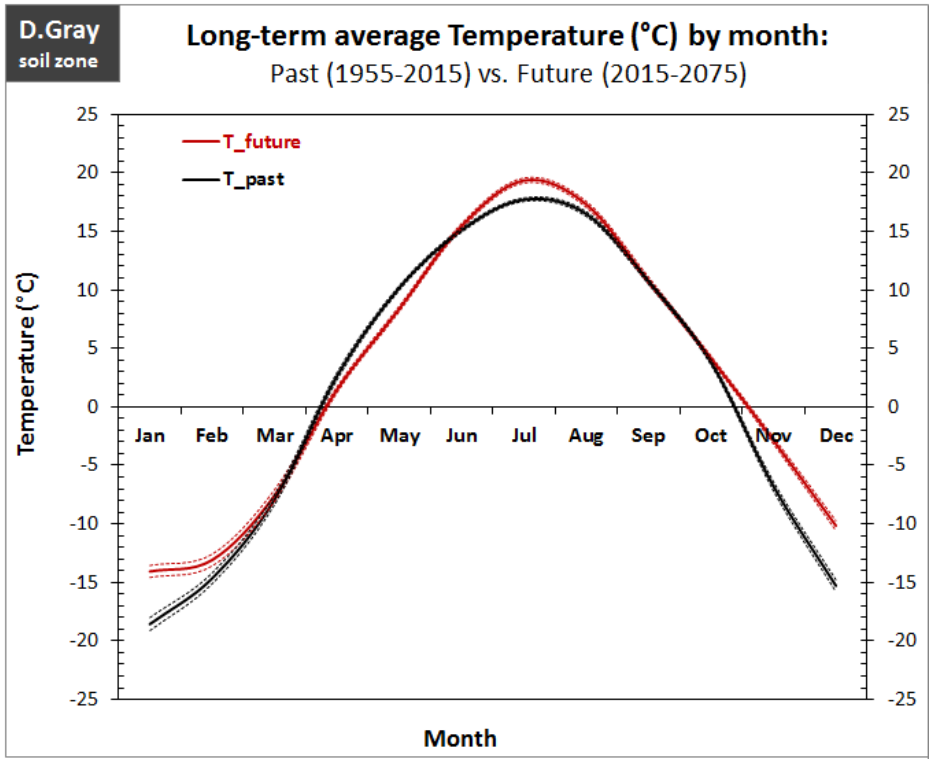
Value of Added C since 1990 assuming $15 per tonne CO_2

	Additions since 1990 for shelterbelts planted 1925-2009	Additions for shelterbelts planted since 1990
Species	($Millions)	
Caragana	144	23
Green Ash	19	5
Hybrid Poplar	31	3
Manitoba Maple	8	0.7
Scots Pine	3	0.6
White Spruce	2	0.4
Total	208	33

Past vs. Future Climate (based om CCCMA-A2 scenario)

Long-term monthly average Temperature (°C), *by soil zone*





Conclusions

- **This represents the first modelling of these types of agroforestry systems in Canada. The 3PG and CBM-CFS3 models were applied successfully to estimate tree growth and carbon sequestration in shelterbelt systems.**

- **These results suggest that planted shelterbelts as a whole could contribute to mitigating greenhouse gas emissions by sequestering C in the biomass, dead organic matter and soil.**

- **However, if shelterbelts are to play a role in mitigating future greenhouse gases emissions then further research is warranted to estimate biomass growth and C sequestration potential in a changing climate to determine which species to plant to maximize carbon sequestration into the future.**

Acknowledgements

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