AGGP-Agroforestry

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CARBON STOCKS IN SHELTERBELTS IN SASKATCHEWAN

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The carbon (C) sequestration potential of six common shelterbelt species in Saskatchewan was 1.3–5.3 Mg C ha^{-1} yr^{-1} (Figure 1), which was similar to other regions in the world. Saskatchewan shelterbelts sequester C at rates that are also comparable to intensively managed shrub willow plantations (15,000 shrubs ha^{-1}) in the province at 4.9–6.6 Mg C ha^{-1} yr^{-1} (Figure 1), and to higher density (1,600 trees ha^{-1}) hybrid poplar plantations in western Canada at 1.7–6.1 Mg C ha^{-1} yr^{-1}. Globally, shelterbelts sequester 0.7–2.0 and 1.5–2.0 Mg C ha^{-1} yr^{-1} in aboveground biomass, and 0.4–1.0 and 0.8–1.5 Mg C ha^{-1} yr^{-1} in the soils, in Asia and Europe, respectively. Much lower C sequestration rates have been reported elsewhere in North America at 0.37–0.73 Mg C ha^{-1} yr^{-1}.

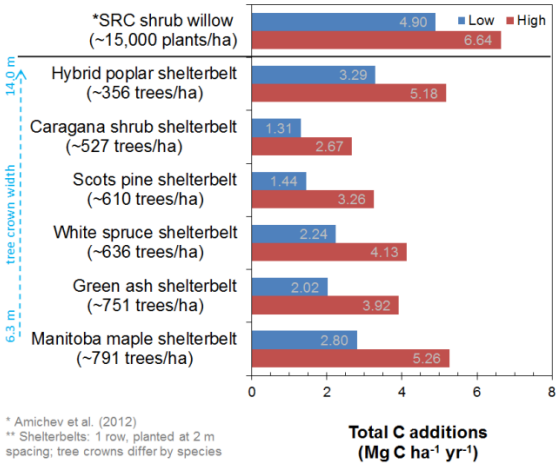

Figure 1. Annual C stocks additions in biomass, litter, and the soil in planted shelterbelts in Saskatchewan for six common shelterbelt tree and shrub species.

CARBON STOCKS INVENTORY

- Tree growth (3PG model) and C dynamics (CBM-CFS3 model) modelling approaches were used to determine the total ecosystem C (TEC) stocks and C stocks additions in shelterbelts of different ages, species, and planting locations in five soil zones.
- The total length of six commonly planted shelterbelt species in Saskatchewan, of any planting period, was estimated to be 50,439 Km, and ranged from 991 (white spruce) to 35,245 Km (caragana) (Table 1).
- TEC stocks and C stocks additions produced by shelterbelt planting during the course of eight decades were 10.8 and 4.8 Tg C (1 Tg = 1 million Mg), respectively. About 78% of these C stocks additions (3.77 Tg C) occurred since 1990 (Table 1).
- About 69% of the C stocks additions occurring since 1990 were in caragana shelterbelts, mainly because of the very large number of planted caragana shelterbelts, followed by hybrid poplar (15%) and green ash (9%) (Table 1). The estimated value of 3.77 Tg C additions = $208 mill., at $15 per Mg CO_2-eq.

Table 1. Carbon stocks inventory for six common shelterbelts species in Saskatchewan.

2015 C stocks and shelterbelt length		Shelterbelts planted 1925-2009					
		Total Ecosystem C		C Additions		Length	
		Since 1925	**Since 1990**	Since 1925	**Since 1990**		
No	Species	---------- Mg C ----------		---------- Mg C ----------		Km	
1	Caragana	7,864,038	3,712,920	3,403,911	2,617,188	35,245	
2	Green ash	964,207	576,098	432,497	346,605	5,841	
3	Hybrid poplar	1,303,391	734,540	684,186	568,097	4,144	
4	Manitoba maple	364,000	170,453	212,503	141,542	2,646	
5	Scots pine	184,214	96,290	64,392	55,936	1,573	
6	White spruce	131,750	78,359	50,440	45,348	991	
	Totals (Mg C):	10,811,599	5,368,660	4,847,929	3,774,715	50,439	
	(Tg C =)	10.81	**5.37**	4.85	**3.77**		

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SHELTERBELT SPECIES PREVALENCE

- Distribution analysis of six common shelterbelt species from south to north showed a caragana majority in all of the Brown, Dark Brown, and half of the Black soil zone clusters, followed by green ash and hybrid poplar trees (Figure 2)
- Mainly in the Gray and Dark Gray zone clusters (latitude > 52°), conifer shelterbelt species were preferred, and caragana distribution was relatively minimal.
- The length of planted shelterbelts in the province is >3 round-trips from Saskatoon to Paris, France. This legacy of the Prairie Shelterbelt Program (PSP) is deeply rooted in the minds and hearts of farmers, directly benefiting Saskatchewan's agricultural land, as well as indirectly benefiting the local and global climate.
- Planting shelterbelt trees and shrubs on agricultural landscapes is an important strategy for mitigating greenhouse gasses.

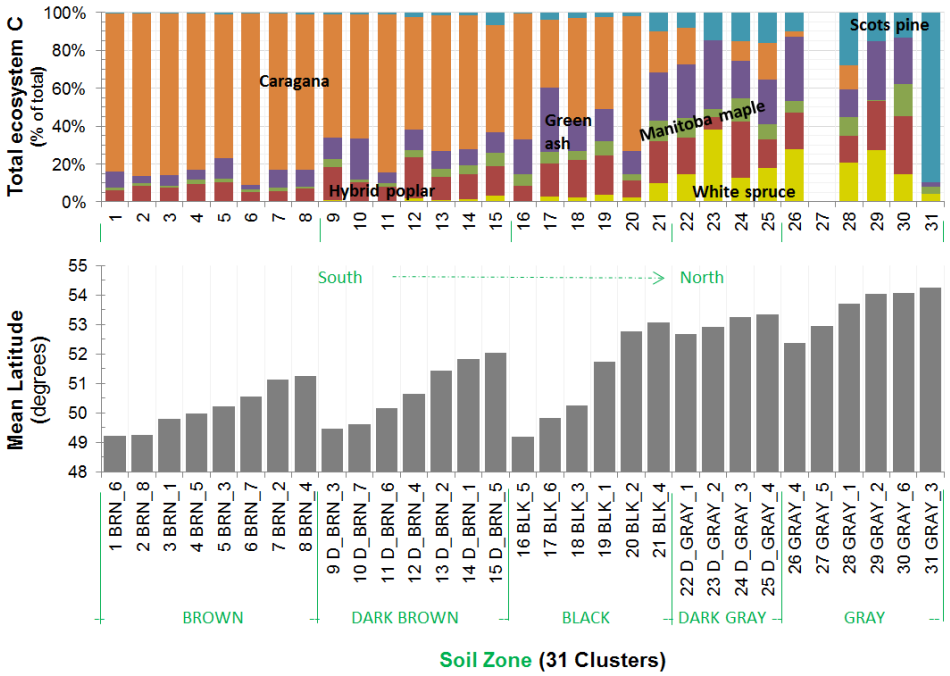

Figure 2. Prevalence of six common shelterbelt species in Saskatchewan.

FURTHER READING

Amichev, B.Y., et al. 2016. **Carbon sequestration by planted shelterbelts in Saskatchewan: 3PG and CBM-CFS3 model simulations.** *Ecological Modelling* 325:35-46

AGGP Fact Sheet(s): **SASK-1 through SASK-3, SASK-11 through SASK-16**

CONTACT FOR MORE INFORMATION: SASKAGROFORESTRY.CA/

ACKNOWLEDGEMENTS & COPYRIGHT

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