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GREEN ASH GROWTH AND CARBON STOCKS IN SHELTERBELTS IN SASKATCHEWAN

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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 green ash shelterbelts in Saskatchewan. Our growth curves and biomass prediction values (Figure 1) were limited to age 60 years. All older-than-60 years shelterbelts were assigned a conservative, 60-year biomass estimate. Differences in climatic and soil conditions caused the wide ranges of green ash growth in shelterbelts: mean aboveground biomass (stems, branches, bark), at age 60 years, was 93-148 Mg Km^{-1}, diameter at breast height (DBH) was 25-31 cm, and height was 10-12 m (Figure 1). The growth curves were used in the CBM-CFS3 model to produce an inventory of the carbon stocks (Table 1) in all green ash shelterbelts planted from 1925 to 2009.

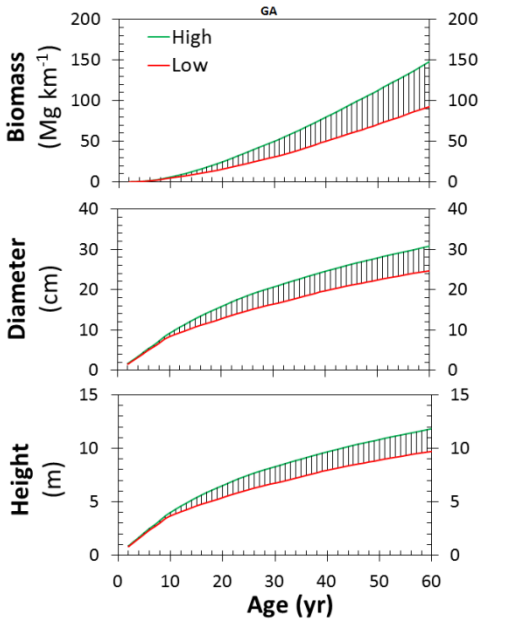

Figure 1. Green ash growth in shelterbelts: range of biomass, DBH diameter, and height.

CARBON STOCKS INVENTORY

- TEC stocks and C stocks additions in green ash shelterbelts were 0.96 and 0.43 Tg (1 Tg = 1 million Mg), respectively. About 80% of these C stocks additions (0.35 Tg) occurred since 1990, regardless of tree planting period, and have an estimated value of $19 million, at $15 per Mg CO_2-eq (Table 1).
- 42% (2,482 Km) of all green ash shelterbelts (5,841 Km) were planted in the last 25 years.
- For six common shelterbelt species in Saskatchewan, the total length of green ash shelterbelts is 12%, and the TEC stocks stored in them is 8.9%, of the cumulative length and TEC stocks, respectively.
- Although 83% are in the Dark Brown soil zone (Table 1), green ash shelterbelts represent about 10%, or greater, spatial occurrence in the Black, Dark Gray and Gray soil zones. In the Dark Gray soil zone, they represent up to 36% of the cumulative TEC stocks in some clusters (Figure 2).

Table 1. Total ecosystem C and C additions stocks in green ash shelterbelts in Saskatchewan.

Green ash shelterbelts planted 1925-2009						
	Total Ecosystem C		C Additions		Length	
Soil zone	Since 1925	**Since 1990**	Since 1925	**Since 1990**	Km	
	---------- Mg C ----------		---------- Mg C ----------			
Gray	4,131	2,725	1,753	1,639	25	
Dark Gray	49,377	34,621	21,408	18,339	165	
Black	103,588	64,305	43,401	35,625	179	
Dark Brown	571,980	337,816	244,236	194,885	4,856	
Brown	235,132	136,631	121,700	96,117	615	
Totals (Mg C):	964,207	576,098	432,497	346,605	5,841	
(Tg C =)	0.964	**0.576**	0.432	**0.347**		
North ← South						

GA: 2015 C stocks and estimated length

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Relative occurrence and C sequestration rate

- Green ash growth and its C sequestration potential make it a very desirable species for shelterbelt establishment (Figure 2).
- The average C sequestration rate was 1.78–1.98 Mg C Km^{-1} yr^{-1}, the highest being in the Gray soil zone.
- Green ash relative spatial occurrence and estimated rate of C sequestration (Figure 2) could be used as a guideline for identifying best locations for future planting.

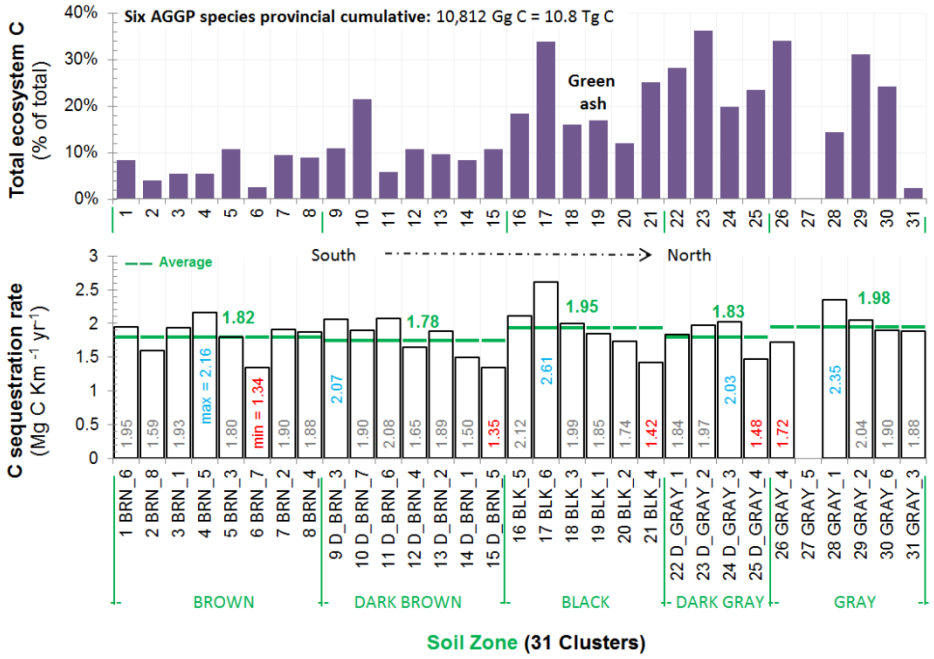

Figure 2. Relative spatial occurrence (top) and C sequestration rate of green ash shelterbelts across 31 clusters and 5 soil zones in Saskatchewan.

- Best predicted areas for future planting are the Black and Gray soil zones, where on the majority of the clusters, the C sequestration rate is estimated >1.85 Mg C Km^{-1} yr^{-1}, ranging 1.42–2.61 Mg C Km^{-1} yr^{-1}.
- Planting green ash shelterbelt trees on agricultural landscapes is an important strategy for mitigating greenhouse gasses.

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, SASK-2, SASK-7, SASK-10**

Contact for more information: SASKAGROFORESTRY.CA/

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