



AGGP-Agroforestry

## No. SASK-15

# SCOTS PINE 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 Scots pine 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 Scots pine growth in shelterbelts: mean aboveground biomass (stems, branches, bark), at age 60 years, was 119–201 Mg Km<sup>-1</sup>, diameter at breast height (DBH) was 28–37 cm, and height was 11–13 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 Scots pine shelterbelts planted from 1925 to 2009.

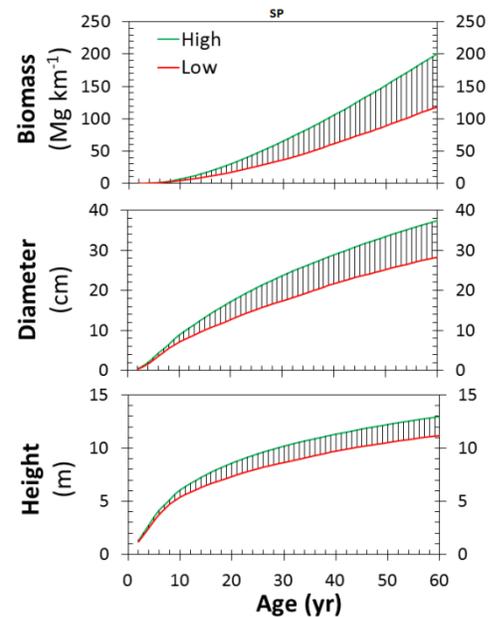


Figure 1. Scots pine growth in shelterbelts: range of biomass, DBH diameter, and height.

### CARBON STOCKS INVENTORY

- TEC stocks and C stocks additions in Scots pine shelterbelts were 0.18 and 0.064 Tg (1 Tg = 1 million Mg), respectively. About 87% of these C stocks additions (0.056 Tg) occurred since 1990, regardless of tree planting period, and have an estimated value of \$3.1 million, at \$15 per Mg CO<sub>2</sub>-eq (Table 1).
- 30% (479 Km) of all Scots pine shelterbelts (1,573 Km) were planted in the last 25 years.
- For six common shelterbelt species in Saskatchewan, the total length of Scots pine shelterbelts is 3.1%, and the TEC stocks stored in them is 1.7%, of the cumulative length and TEC stocks, respectively.
- Although 86% are in the Dark Brown soil zone (Table 1), Scots pine shelterbelts represent about 10%, or greater, spatial occurrence in the Dark Gray and Gray soil zones. In the Gray soil zone, they represent up to 90% of the cumulative TEC stocks in some clusters (Figure 2).

Table 1. Total ecosystem C and C additions stocks in Scots pine shelterbelts in Saskatchewan.

Soil zone	Scots pine shelterbelts planted 1925-2009				Length Km
	Total Ecosystem C		C Additions		
	Since 1925	Since 1990	Since 1925	Since 1990	
Gray	3,077	1,989	1,251	1,169	19
Dark Gray	22,542	12,321	8,942	7,471	70
Black	17,996	9,228	6,456	5,435	33
Dark Brown	113,610	59,176	35,454	31,281	1,352
Brown	26,988	13,576	12,289	10,580	99
<b>Totals (Mg C):</b>	<b>184,214</b>	<b>96,290</b>	<b>64,392</b>	<b>55,936</b>	<b>1,573</b>
(Tg C =)	0.184	0.096	0.064	0.056	

SP: 2015 C stocks and estimated length

North ← South



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## RELATIVE OCCURRENCE AND C SEQUESTRATION RATE

- Scots pine growth and its C sequestration potential make it a valuable species for shelterbelt establishment (Figure 2).
- The average C sequestration rate was 1.90–2.17 Mg C Km<sup>-1</sup> yr<sup>-1</sup>, the highest being in the Gray soil zone.
- Scots pine relative spatial occurrence and estimated rate of C sequestration (Figure 2) could be used as a guideline for identifying best locations for future planting.
- 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 >2.05 Mg C Km<sup>-1</sup> yr<sup>-1</sup>, ranging 1.44–2.67 Mg C Km<sup>-1</sup> yr<sup>-1</sup>.
- Planting Scots pine shelterbelt trees on agricultural landscapes is an important strategy for mitigating greenhouse gasses.

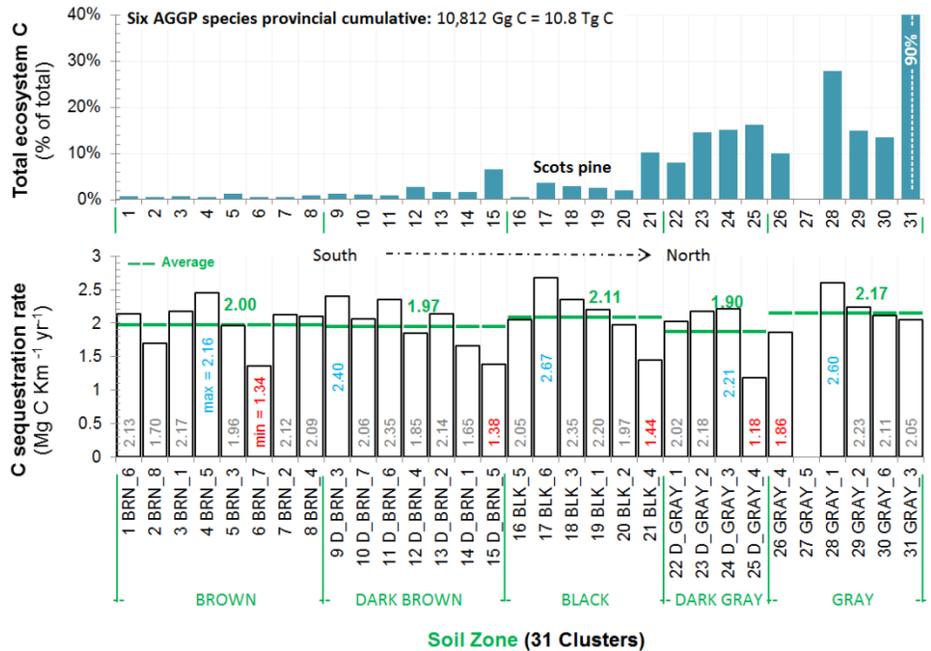


Figure 2. Relative spatial occurrence (top) and C sequestration rate of Scots pine shelterbelts across 31 clusters and 5 soil zones in Saskatchewan.

### 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, SASK-2, SASK-8, SASK-10

CONTACT FOR MORE INFORMATION: [SASKAGROFORESTRY.CA/](http://SASKAGROFORESTRY.CA/)

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