AGGP-Agroforestry

SHELTERBELT REMOVAL IN THE BLACK SOIL ZONE OF SASKATCHEWAN (2008–2016)

No. SASK-36

by BEYHAN Y. AMICHEV

Shelterbelt agroforestry systems play a vital role in agricultural sustainability by providing a variety of benefits to producers. Shelterbelts also sequester atmospheric CO_2 at rates ranging from 1.78 – 6.54 Mg C km^{-1} yr^{-1}, which emphasizes their high importance for balancing carbon emissions in the agricultural sectors. The ability to create up-to-date shelterbelt inventory maps is important to detect changes in these systems, including the retention or removal of existing shelterbelts, or planting of new ones. A new method was developed to map removal of planted shelterbelts using satellite imagery. This method was effective in mapping shelterbelts, cropland, and mixed cover types across the Black soil zone of Saskatchewan. Carbon stocks removed from planted shelterbelts in the period 2008–2016 in farm yards or crop production fields were estimated using the map-derived removed shelterbelt lengths, approximate shelterbelt age, and estimated C sequestration rates (Fig. 1).

CARBON STOCKS OF REMOVED SHELTERBELTS

The total carbon stocks in removed shelterbelts in the Black soil zone for the period 2008–2016 were 36 Gg C (479 km total removed shelterbelt length). The carbon stocks ranged from 0.2 to 16 Gg C across six clusters of homogenous ecodistricts in the Black soil zone, equivalent to an average of 3% (ranging from 1–8%) rate of removal, relative to all existing shelterbelts per cluster. These clusters were used for shelterbelt inventory and analysis in the AGGP project (Fig. 1). The removal carbon stocks ranged by cluster as follows: (in descending order) BLK_2 (16 Gg C in 218 km total removed length) > BLK_3 (10 Gg C in 121 km) > BLK_1 (10 Gg C in 119 km) > BLK_4 (0.7 Gg C in 13 km) > BLK_5 (0.2 Gg C in 7 km) > BLK_6 (0.2 Gg C in 1 km) (Figs. 1,2).

The shelterbelt analysis results reported here can be used to develop a new leading-edge shelterbelt management support toolbox for researchers and farmers, directing emphasis to the use of different shelterbelt species, designs, and types. This toolbox can also facilitate a more focused understanding of the rates and extent of the shelterbelt removal phenomenon in the Canadian Prairies, which can lead to new socioeconomic policies aimed at addressing future shelterbelt removal, and the planting of new shelterbelts. Separate fact sheets were created for each of the five soil zones of Saskatchewan.

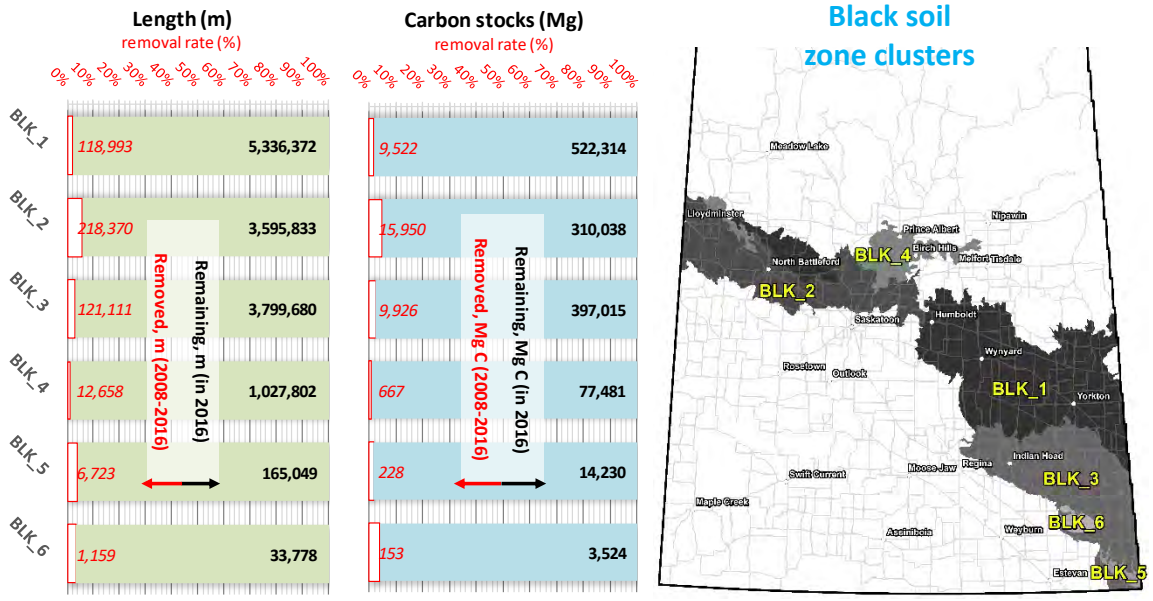

Figure 1. Cumulative carbon stocks (Mg C) and length (m) of shelterbelts removed in the 2008–2016 period across six clusters in the Black soil zone of Saskatchewan. Removal rates (%) and remaining shelterbelts (in 2016) are also shown.

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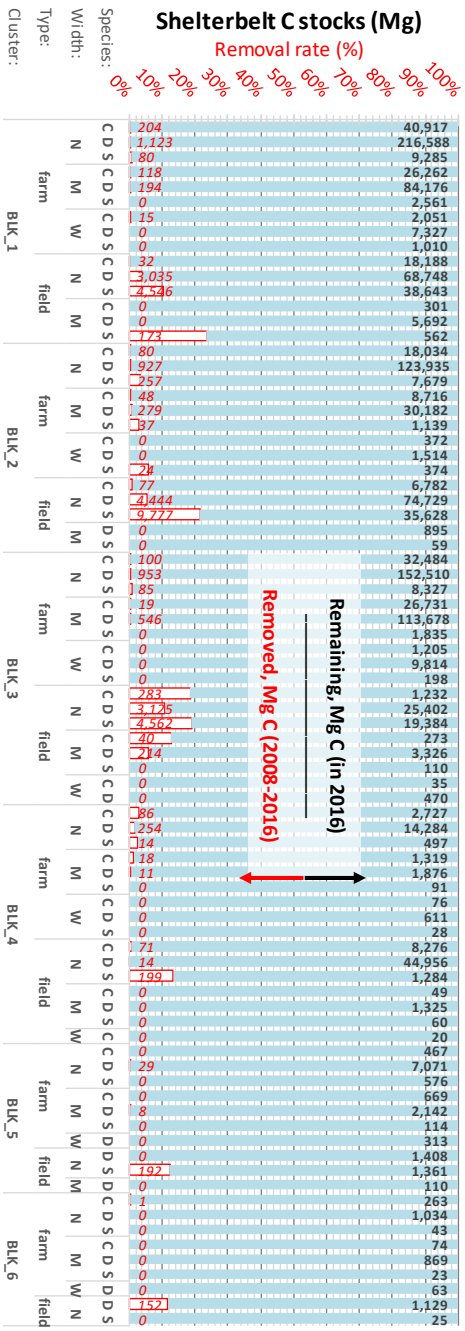
REMOVALS BY SHELTERBELT SPECIES, DESIGN, AND TYPE

- **Species:** Shelterbelt removal was similarly high for shrub (20 Gg C total) and deciduous (15 Gg C total) shelterbelts, while it was low for coniferous shelterbelts (1 Gg C total). Shrub shelterbelt removal was dominant in half of the clusters and ranged from 0 to 10 Gg C (in descending order) for the BLK_2 (shrub dominant) > BLK_1 (shrub dominant) > BLK_3 > BLK_4 > BLK_5 (shrub dominant) > BLK_6 clusters.
- Deciduous shelterbelt removal was dominant in the remaining clusters and ranged from <0.1 to 6 Gg C (in descending order) for the BLK_2 > BLK_3 (deciduous dominant) > BLK_1 > BLK_4 (deciduous dominant) > BLK_6 (deciduous dominant) > BLK_5 clusters. Coniferous shelterbelt removal was <0.4 Gg C per cluster
- **Design:** Shelterbelt removal was highest for narrow, 1-row shelterbelt designs (35 Gg C total) ranging 0.2 – 16 Gg C per cluster, followed by medium width, 2-3-row designs (2 Gg C total) ranging from <0.1 to 0.7 Gg C per cluster, and was lowest for wide shelterbelts, planted in >3-row designs (<0.1 Gg C total) (Fig. 2)
- **Type:** Shelterbelt removal was higher in crop production fields (31 Gg C total) ranging 0.2 – 14 Gg C per cluster, compared to farmyard shelterbelts (6 Gg C total) ranging from <0.01 to 2 Gg C per cluster
- The top three highest total C stocks of removed shelterbelts by design category in the Black soil zone were narrow field shrub shelterbelts (19 Gg C), followed by narrow field (11 Gg C) and narrow farm (3 Gg C) deciduous shelterbelts
- Removal carbon stocks were highest in the BLK_2 cluster where 10 Gg C in narrow field shrub shelterbelts were removed at 22% rate (Fig. 2)



➔ Figure 2. Carbon stocks (Mg C) of shelterbelts removed in the 2008-2016 period in six clusters in the Black soil zone shown by shelterbelt species group (C=coniferous; D=deciduous; S=shrub), planting design (N=narrow, 1-row; M=medium, 2-3 rows; W=wide, >3 rows), and type (farm= located in farm yards; field=planted in crop production fields). Removal rates (%) and remaining shelterbelts (in 2016) are also shown for each scenario. ➔

FURTHER READING: Fact sheets SASK-33 through SASK-35 and SASK-37 through SASK-39

CONTACT FOR MORE INFORMATION: SASKAGROFORESTRY.CA/

ACKNOWLEDGEMENTS & COPYRIGHT: This research was done by a team of collaborators from the Centre for Northern Agroforestry and Afforestation at the University of Saskatchewan, under the leadership of Dr. Colin Laroque. Funding was provided by Agriculture and Agri-Food Canada (AAFC)'s Agricultural Greenhouse Gases Program (AGGP). This fact sheet was updated in Jan 2020.

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