AGGP-Agroforestry

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

No. SASK-37

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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 Dark Gray soil zone of Saskatchewan. C 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 Dark Gray soil zone for the period 2008–2016 were 13 Gg C (146 km total removed shelterbelt length). The carbon stocks ranged from 0.1 to 10 Gg C across four clusters of homogenous ecodistricts in the Dark Gray 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) D_GRAY_1 (10 Gg C in 91 km total removed length) > D_GRAY_4 (2 Gg C in 43 km) > D_GRAY_3 (0.8 Gg C in 9 km) > D_GRAY_2 (0.1 Gg C in 2 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.

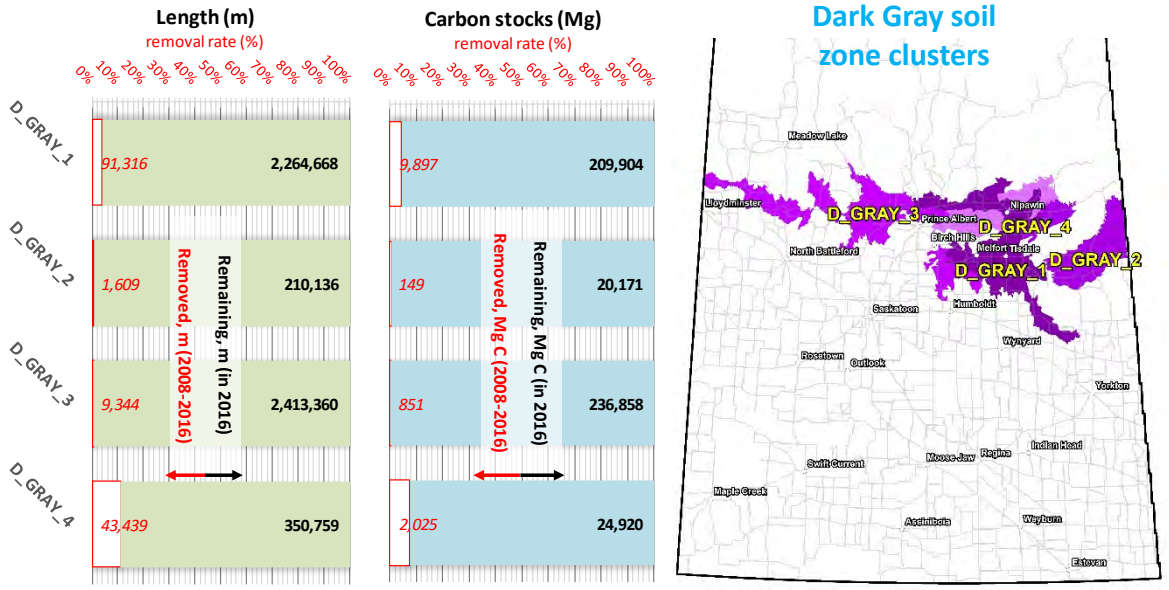

Figure 1. Cumulative carbon stocks (Mg C) and length (m) of shelterbelts removed in the 2008–2016 period across four clusters in the Dark Gray soil zone of Saskatchewan. Removal rates (%) and remaining shelterbelts (in 2016) are also shown.

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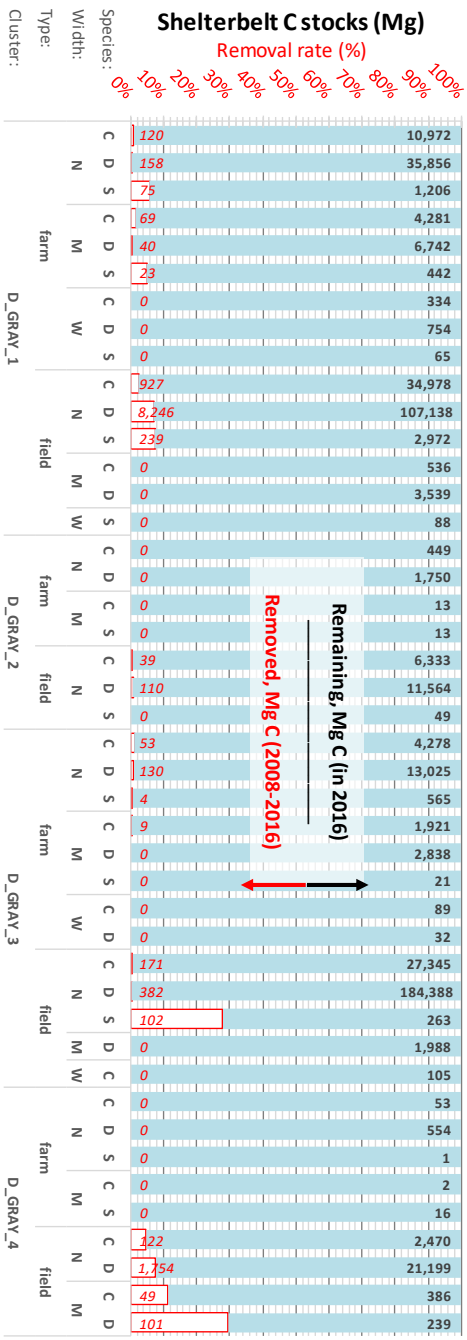
REMOVALS BY SHELTERBELT SPECIES, DESIGN, AND TYPE

- **Species**: Shelterbelt removal was highest for deciduous shelterbelts (11 Gg C total) in all clusters ranging from 0.1 – 8 Gg C (in descending order) for the D_GRAY_1 > D_GRAY_4 > D_GRAY_3 > D_GRAY_2, and ranged from <0.1 to 1 Gg C per cluster for coniferous shelterbelts (2 Gg C total), and was 0.1 – 0.3 Gg C per cluster for shrub shelterbelts (0.4 Gg C total)
- **Design**: Shelterbelt removal was highest for narrow, 1-row shelterbelt designs (13 Gg C total) ranging 0.1 – 10 Gg C per cluster, followed by medium width, 2-3-row designs (0.3 Gg C total) at <0.15 Gg C per cluster; there were no removals for wide shelterbelts, planted in >3-row designs (Fig. 2)
- **Type**: Shelterbelt removal was higher in crop production fields (12 Gg C total) ranging 0.1 – 9 Gg C per cluster, compared to farmyard shelterbelts (0.7 Gg C total) ranging 0.2 – 0.5 Gg C per cluster

- The top three highest total C stocks of removed shelterbelts by design category in the Dark Gray soil zone were narrow field deciduous shelterbelts (10 Gg C), followed by narrow field coniferous (1 Gg C), and narrow field shrub (0.3 Gg C) shelterbelt
- Removal carbon stocks and removal rates by design category varied largely between clusters, and were highest in the D_GRAY_1 cluster where 8 Gg C in narrow field deciduous shelterbelts were removed at 7% rate (Fig. 2)



➔ Figure 2. Carbon stocks (Mg C) of shelterbelts removed in the 2008-2016 period in four clusters in the Dark Gray 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-36, and SASK-38, and -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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