AGGP-Agroforestry

ABOVE- AND BELOW-GROUND CARBON SEQUESTRATION IN SHELTERBELT TREES IN CANADA: A REVIEW

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Shelterbelts provide several important environmental services, especially carbon sequestration. From 1935 to 2013, shelterbelts were donated to farmers by the Prairie Farm Rehabilitation Program (PFRA), chiefly to protect crops against wind erosion. After the development of no-till techniques, wind erosion was less of an issue for farming, so landowners started to remove shelterbelts to increase cropped area, to better maneuver large equipment, and to overcome maintenance costs. However, research has shown that shelterbelts are an important ally against climate change. For example in Saskatchewan alone, shelterbelt trees sequestered 4.85 Tg of carbon in the last century. If farmers are granted with incentives, for example tax reduction or tax credits in a carbon market, they would be more motivated to keep and plant more shelterbelt trees on their land, which would help global warming mitigation (Figure 1). Thinking about the means of helping to motivate farmers to keep their shelterbelts and the government to implement reward policies, a literature review that evidenced the benefits provided by the shelterbelts was written, focusing on their carbon sequestration potential.

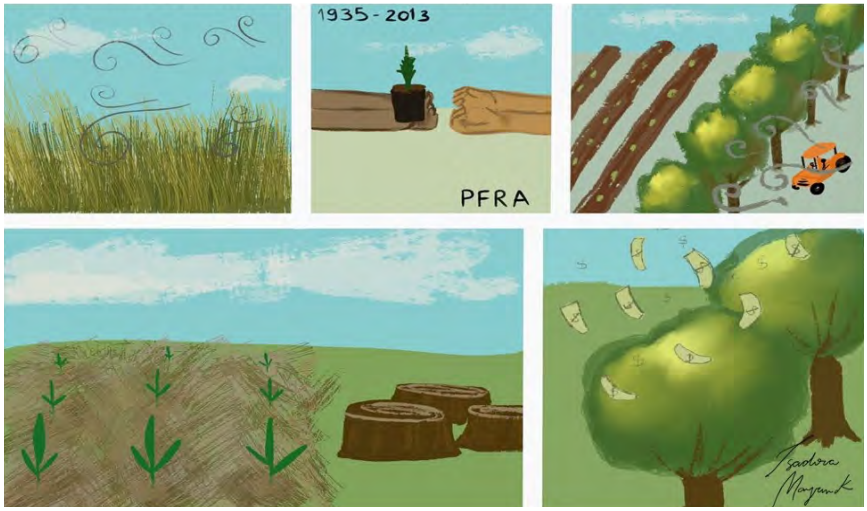

Figure 1 – Sequence of scenarios explaining shelterbelt use throughout the Prairies. First, wind erosion was an issue for farming in the Prairies. The Prairie Farm Rehabilitation Program started to donate seedlings to the farmers to protect their crops. Eventually farmers started to use no-till systems, and so shelterbelts were thought to no longer be needed. Farmers started to remove them, without considering the additional benefits that they might lose. Monetarily the environment benefits that they provide were not calculated, with the sequestering of carbon to mitigate climate change being one of the most prominant.

SHELTERBELT BENEFITS

Shelterbelts protect soil, homes, farm infrastructure, and livestock from the elements; reduce animal odor from livestock systems; lower the risk of crop damage from pesticide spray-drift; reduce noise and heating costs for households and livestock operations; reduce soil runoff into rivers, streams and creeks; enhance and protect animal and plant diversity, including pollinators; improve water quality, sequester carbon from the atmosphere; and increase crop yield in many cases, chiefly due to mechanical crop protection and reduced evapotranspiration (Figure 2).

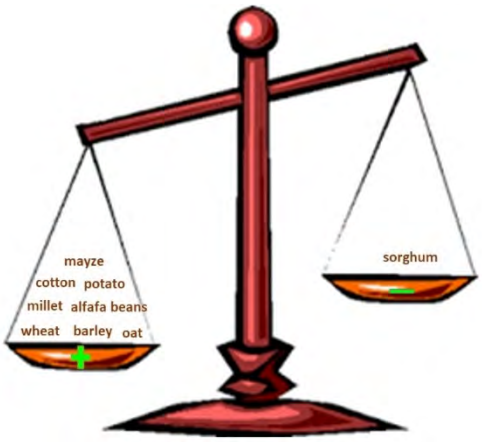

Figure 2 – Crops affected positively and negatively by shelterbelts, according to the literature review.

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CARBON SEQUESTRATION

The carbon sequestration potential of shelterbelts are considerable when compared to other land uses, even using a small amount of area. Table 1 illustrates some of the potential uses of shelterbelts to combat climate change.

Table 1– Maximum and minimum carbon sequestration potential for diverse land uses and species around the world. Note: for shelterbelts, carbon stock was calculated considering it occupied only 5% of the area.

Land use	Total Mg C (ha^{-1} $year^{-1}$)	Location
Shelterbelt	1.3 - 5.3	Canada
Woodlots for firewood, fodder, land reclamation	2.0 - 11	Africa
Coffee monoculture	2.14	Brazil
Improved fallow	11.2 - 31.25	Kenya
Silvipasture	6.1	USA
Alley crop	3.4	USA
Soybeans culture	0.3	Brazil
Intercropping	12.3	Malawi

SHELTERBELT RESEARCH

Fortunately, research on shelterbelts is growing globally, in a similar pace with agriculture and forestry research. The main leading countries are China, U.S., and Canada. More research means that shelterbelt systems will be more understood, and their use can be better optimized to mitigate global warming and to optimize more sustainable food production chains.

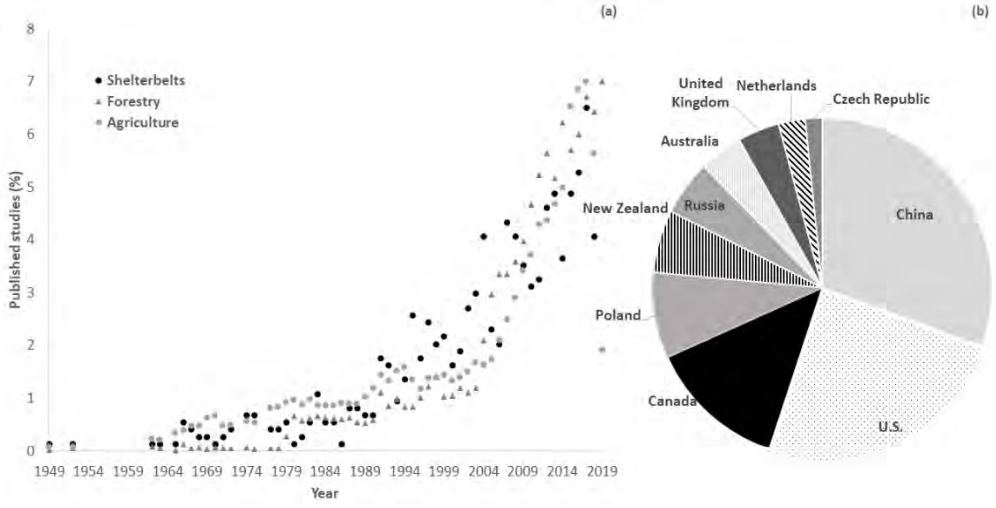

Figure 3 - Number of journal publications on shelterbelt agroforestry systems found on theWeb of Science (a), and the relative contribution by country (b).

FURTHER READING: Mayrinck et al. 2019. Forests. https://doi.org/10.3390/f10100922

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