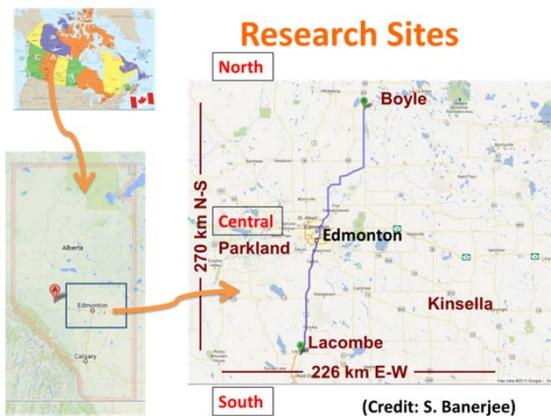


### Perennial Vegetation Increases Soil Organic Carbon Storage in Agroforestry Systems

Scott Chang, Sangsun Lim, Mark Baah-Acheamfour, Woo-Jung Choi, Muhammad (Charlie) Arshad, Cameron Carlyle, Edward Bork, Farrah Fatemi, and Samiran Banerjee

#### The Motivation

Most past research on soil carbon (C) in agroforestry systems is limited to sampling the surface soil (to about 20-30 cm depth). However, one of the potential benefits of including trees in the agricultural landscape is the contribution of the deep roots of trees to soil organic C accumulation in the deeper soil layers. In this study we determined the impact of agroforestry system and land use type on soil organic C distribution to 75 cm depth.



#### Methods

We selected 36 sites for three agroforestry systems: 12 each of hedgerow, shelterbelt (white spruce dominated) and silvopasture (aspen dominated) sites. The sites were distributed across a 250 x 300 km area centered around Edmonton, spanning from the Dark Brown Chernozemic to the Dark Gray Chernozemic soil zones. In each site, plots were set up in the forested area and in the agriculture production area (herbland, including grazed pasture and annual crop production areas). Soil samples were collected from the 0-10, 10-30, 30-50 and 50-75 cm depths and analyzed for total organic C concentrations and content.

#### The Result

The soil organic C content in the mineral soil (0–75 cm) was not affected by agroforestry system but was greater in treed areas (25.5 kg C m<sup>-2</sup>) than in the herbland (19.4 kg C m<sup>-2</sup>) (Fig. 1), driven by greater ( $P < 0.001$ ) soil organic C levels in the top 0–30 cm of the soil, but no contribution from deeper layers (30–75 cm) was found with land-cover types, indicating that litter fall, rather than root turnover in the deeper soil, was most likely the key factor in soil C accumulation.

The forest floor (organic horizons that sit on the surface of mineral soil) made a very important contribution to soil organic C storage in the forested area of agroforestry systems.



Fig. 1. Soil C storage in the 0-75 cm layer



#### Implications

Determination of soil organic C storage to 75 cm depth confirms that including trees in the agricultural landscape in the form of agroforestry benefits soil organic C storage. Planting of trees should be encouraged to enhance soil organic C sequestration and mitigate GHG emissions.

#### Acknowledgements

Agriculture and Agri-Food Canada (the AGGP program) funded this research. We thank QT Chen and SJ Ren for help and the participating landowners for site access.