Spectroscopic Characterization of Soil Organic Carbon under Shelterbelts

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Shelterbelt –
An agroforestry practice that consists of one or more rows of trees planted across crop fields

Helps in reducing wind speed, enhancing micro climate for crop production.

Carbon Sequestration under Shelterbelts

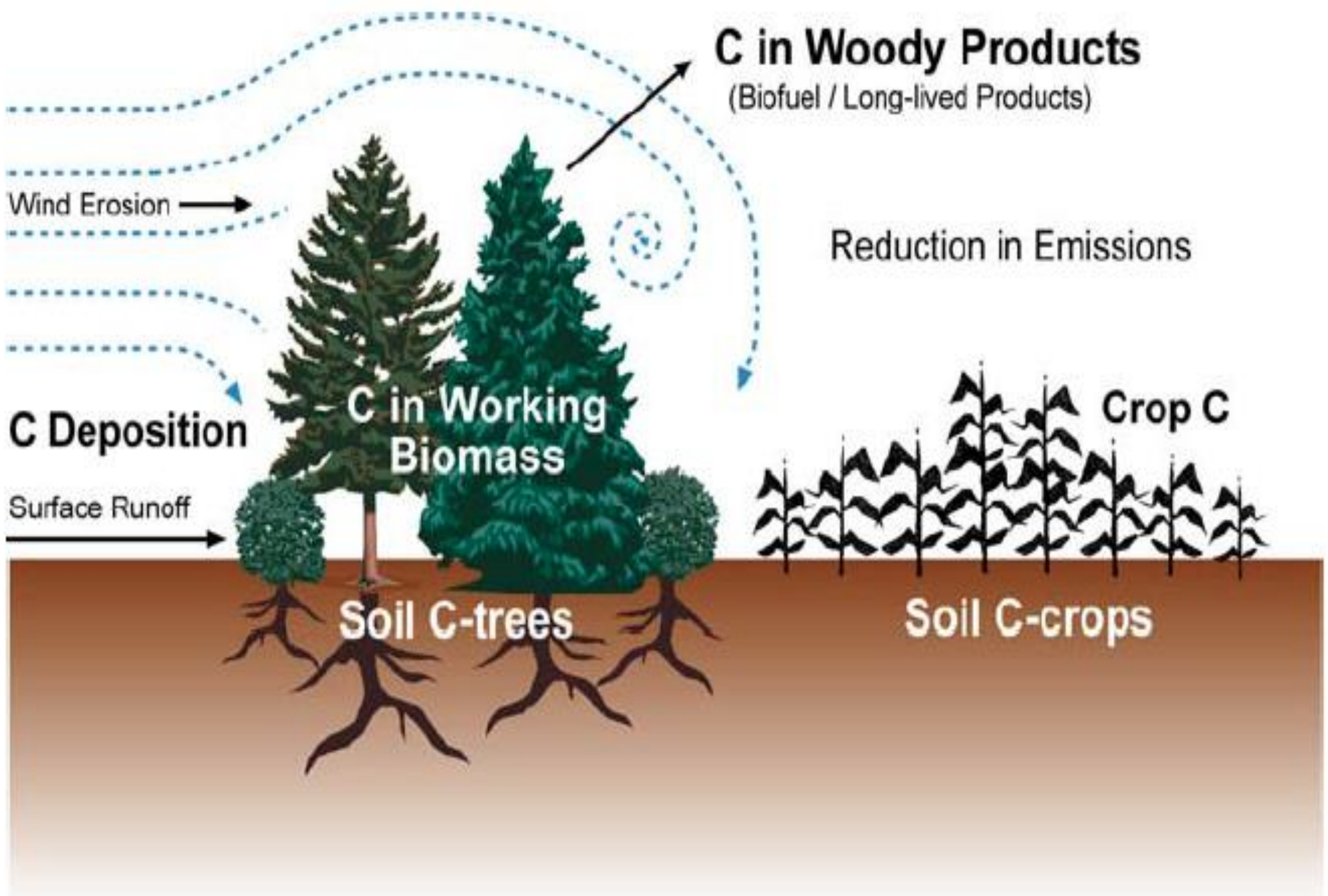


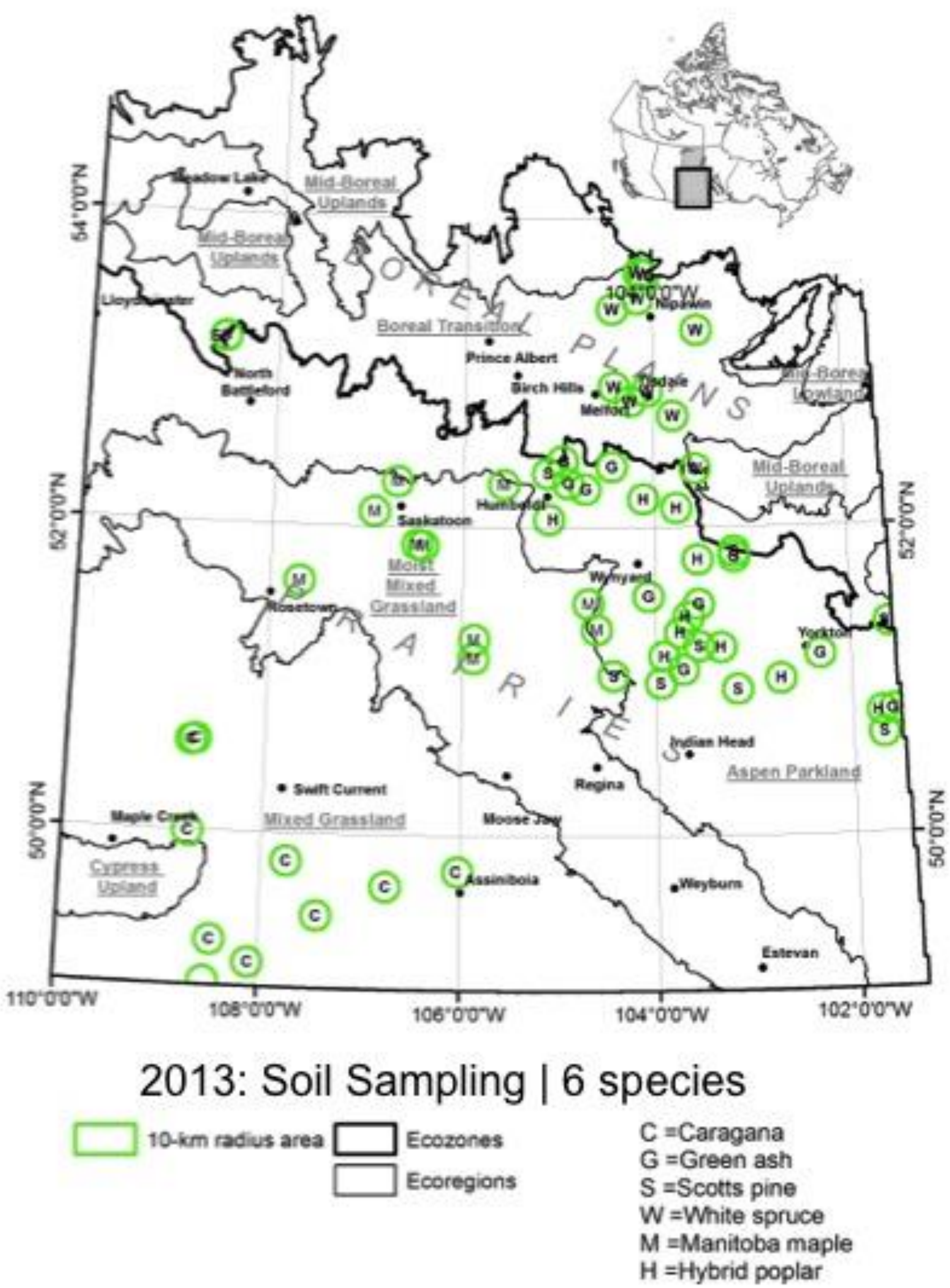
Figure 1: Field shelterbelt showing major carbon sinks (from Schoeneberger, (2009)

Objectives

To quantify the C stored in the soils underneath the shelterbelts and in the adjacent agricultural fields

To study the change in the composition of soil organic carbon underneath the shelterbelt compared to the agricultural fields

Sampling



Tree species –

Hybrid poplar (*Populus spp.*)

Manitoba maple(*Acer negundo*)

White spruce(*Picea glauca*)

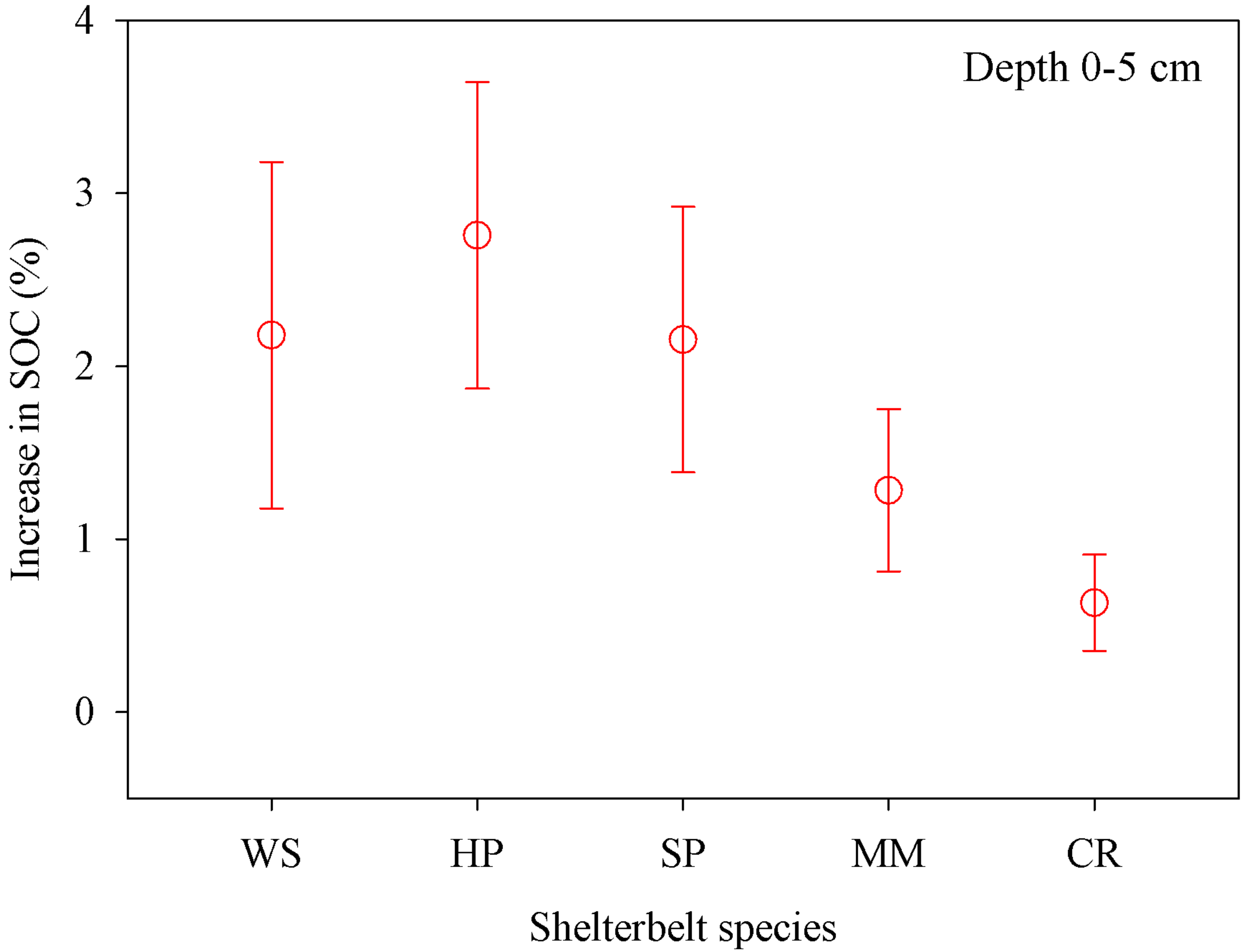
Scots pine(*Pinus sylvestris*)

Green ash (*Fraxinus pennsylvanica*)

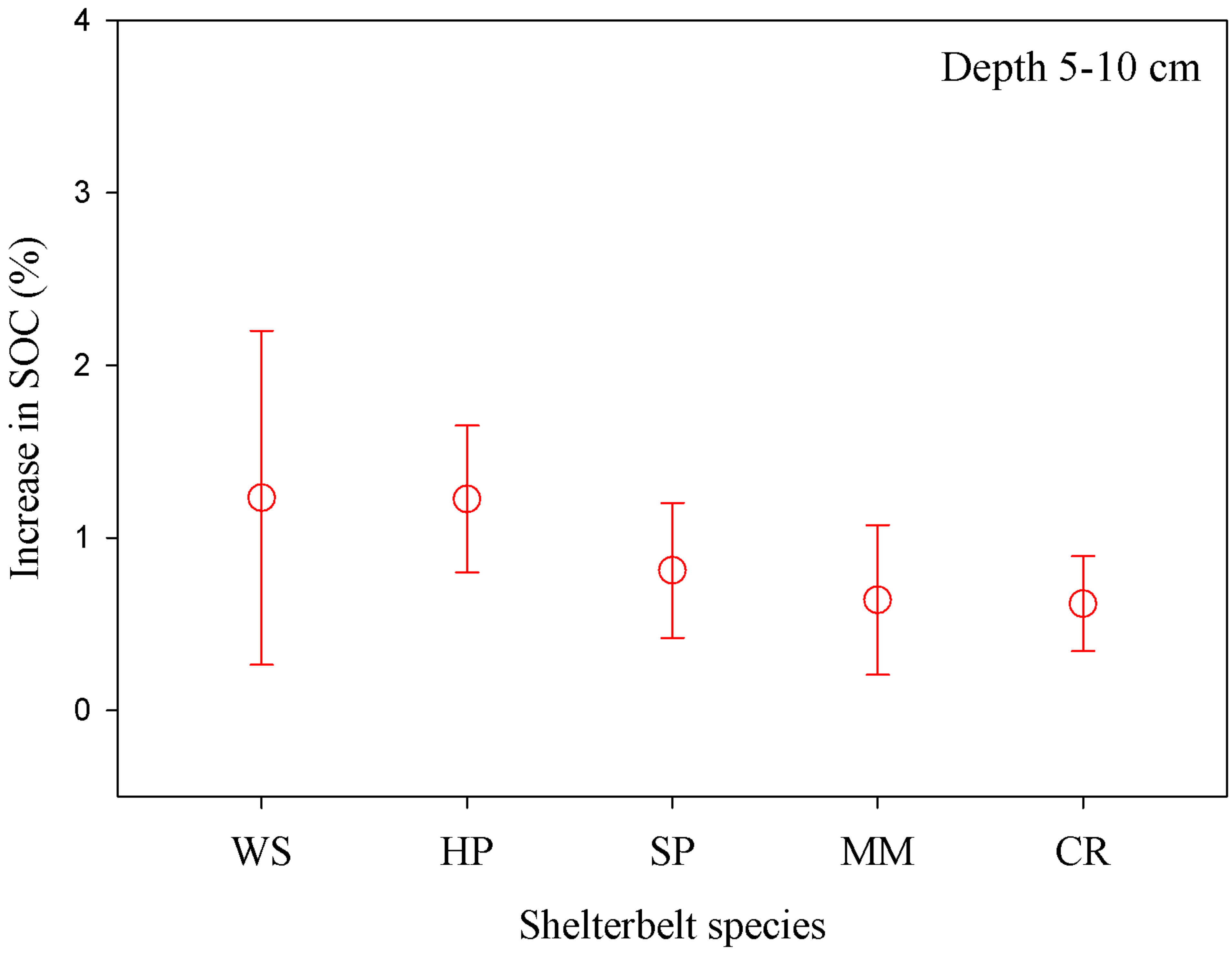
Caragana (*Caragana arborescens*)

Sampling

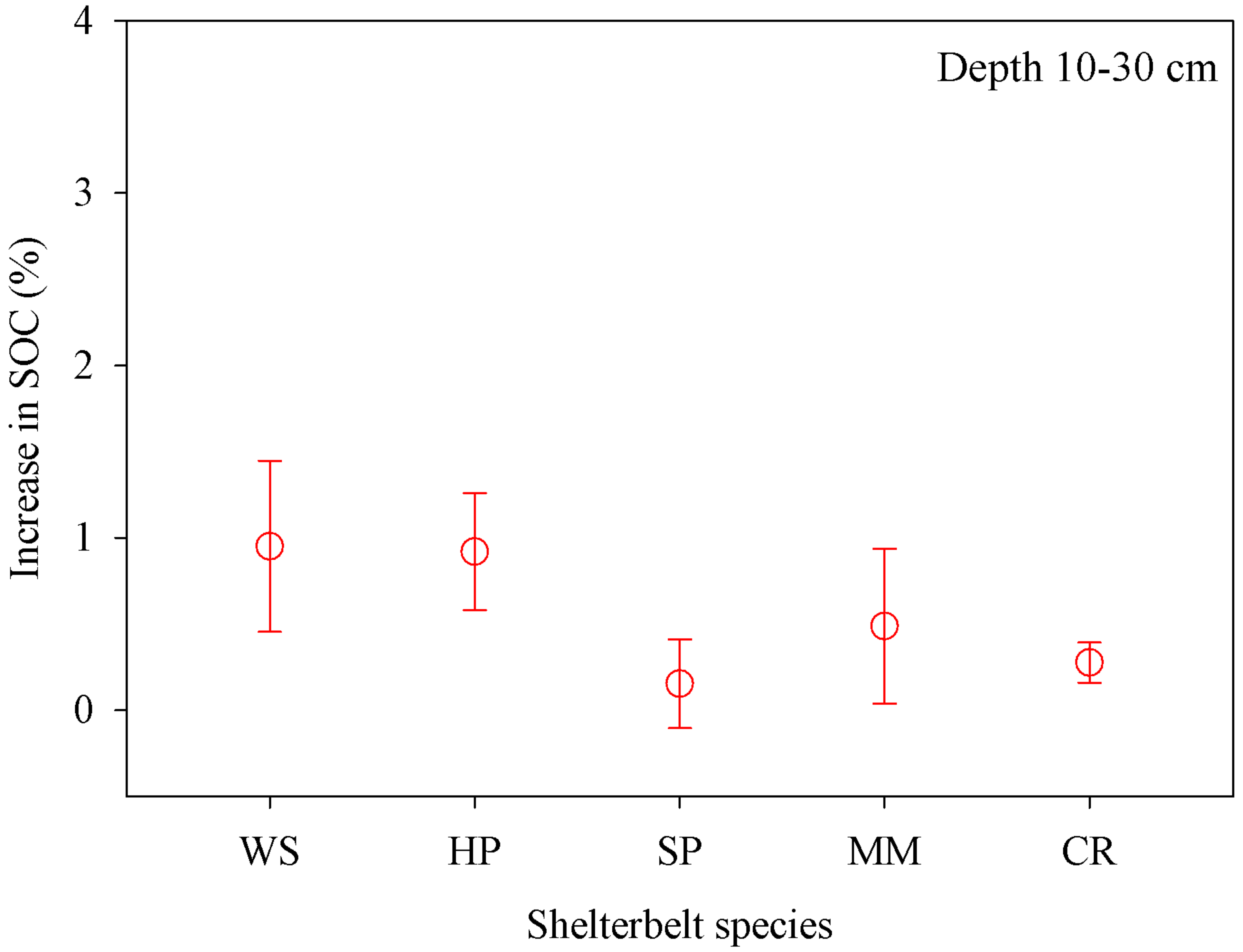
Increase in C concentration



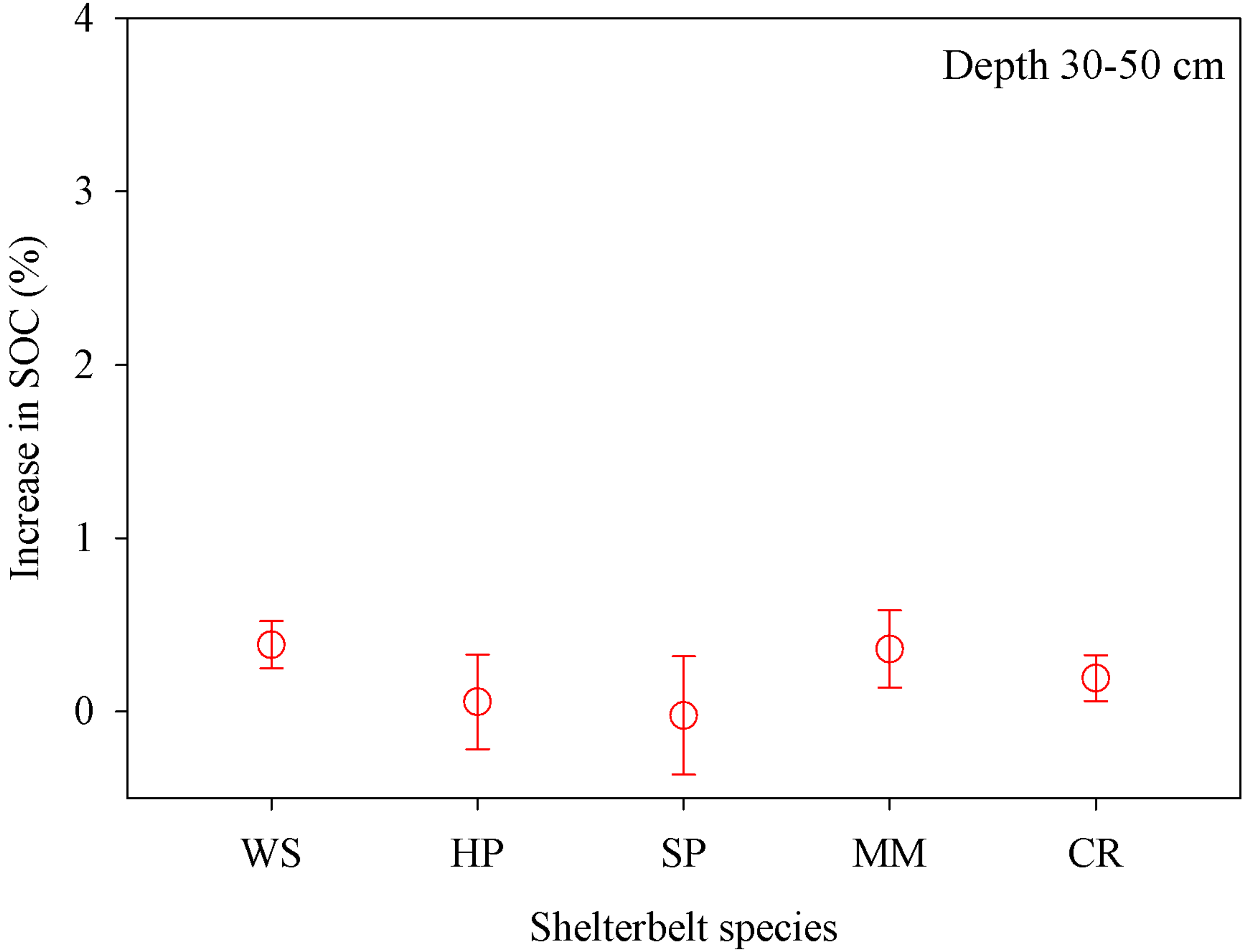
Increase in C concentration



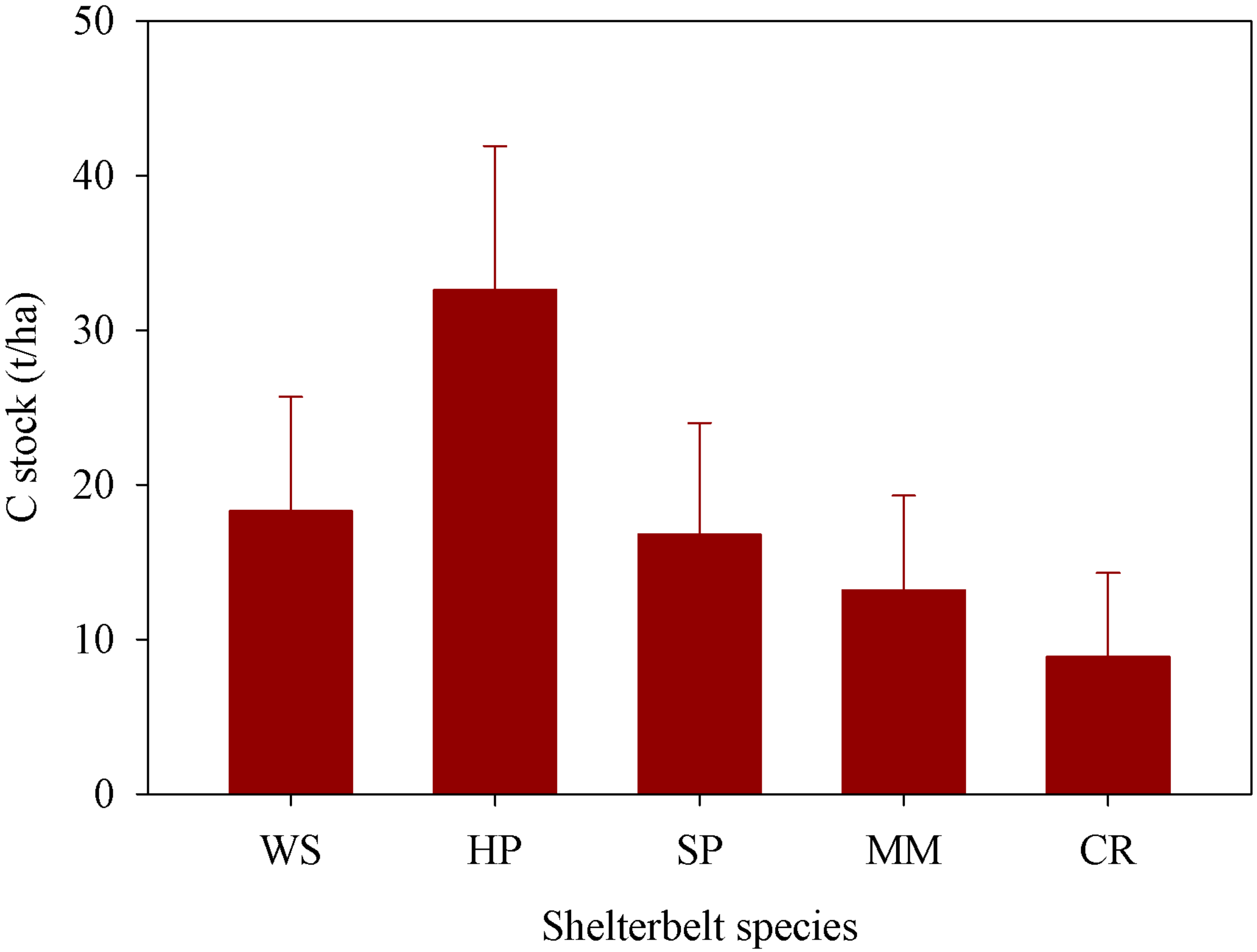
Increase in C concentration



Increase in C concentration



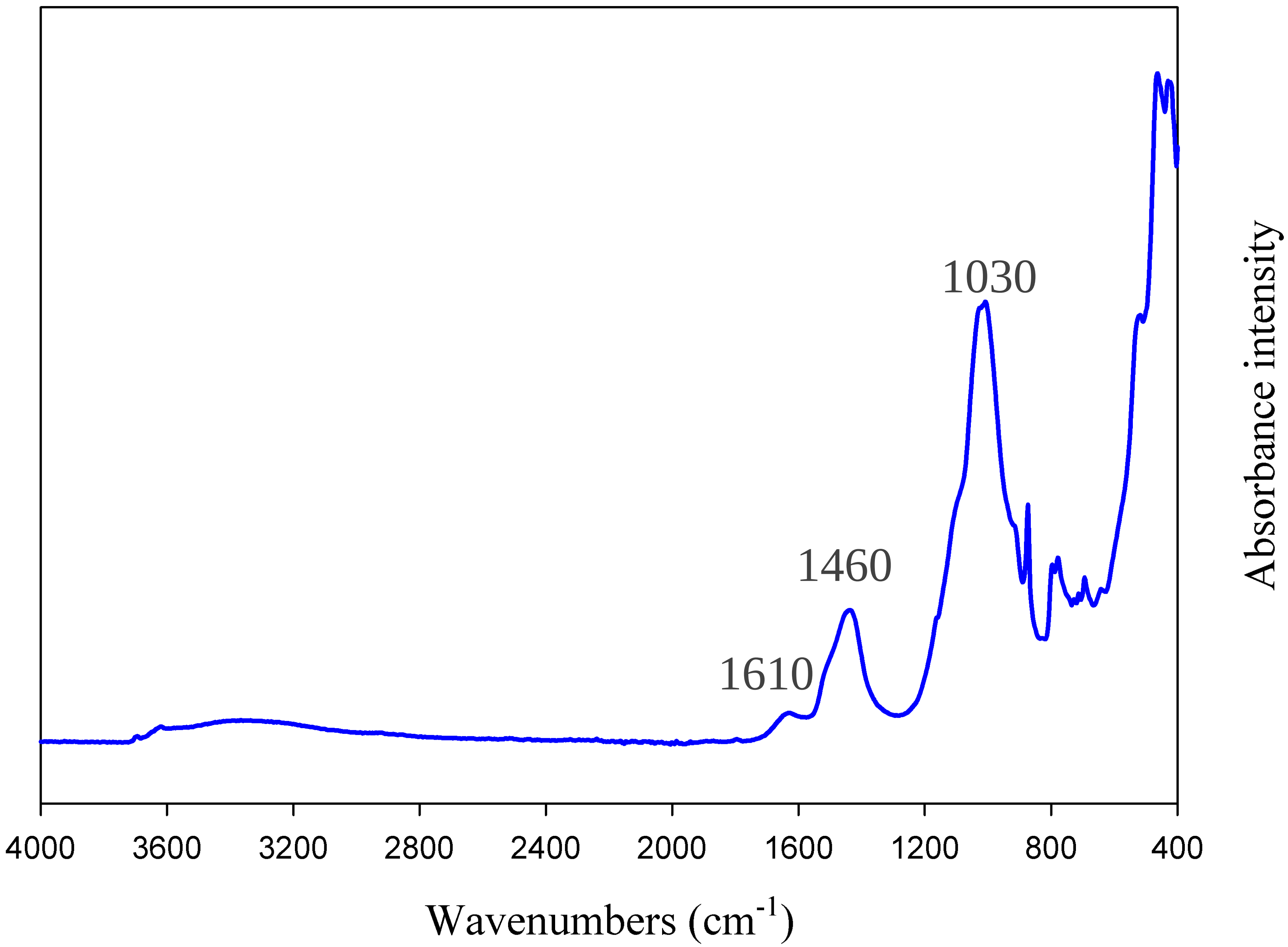
Amount of C sequestered



Amount of C sequestered under the shelterbelts varied from 9-33 t/ha

Significant contribution to the C sequestration potential of the agroforestry systems

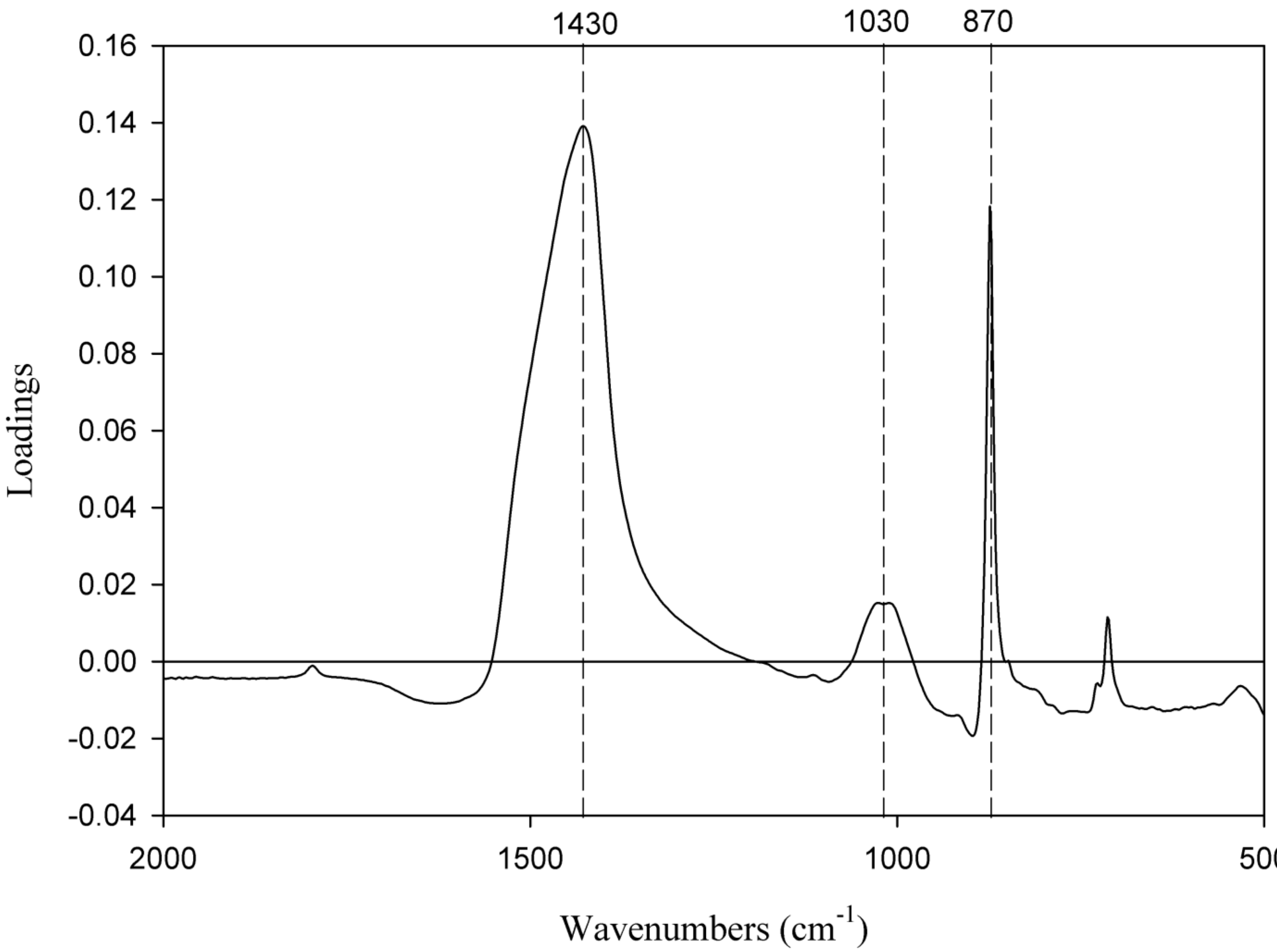
ATR-FTIR spectra

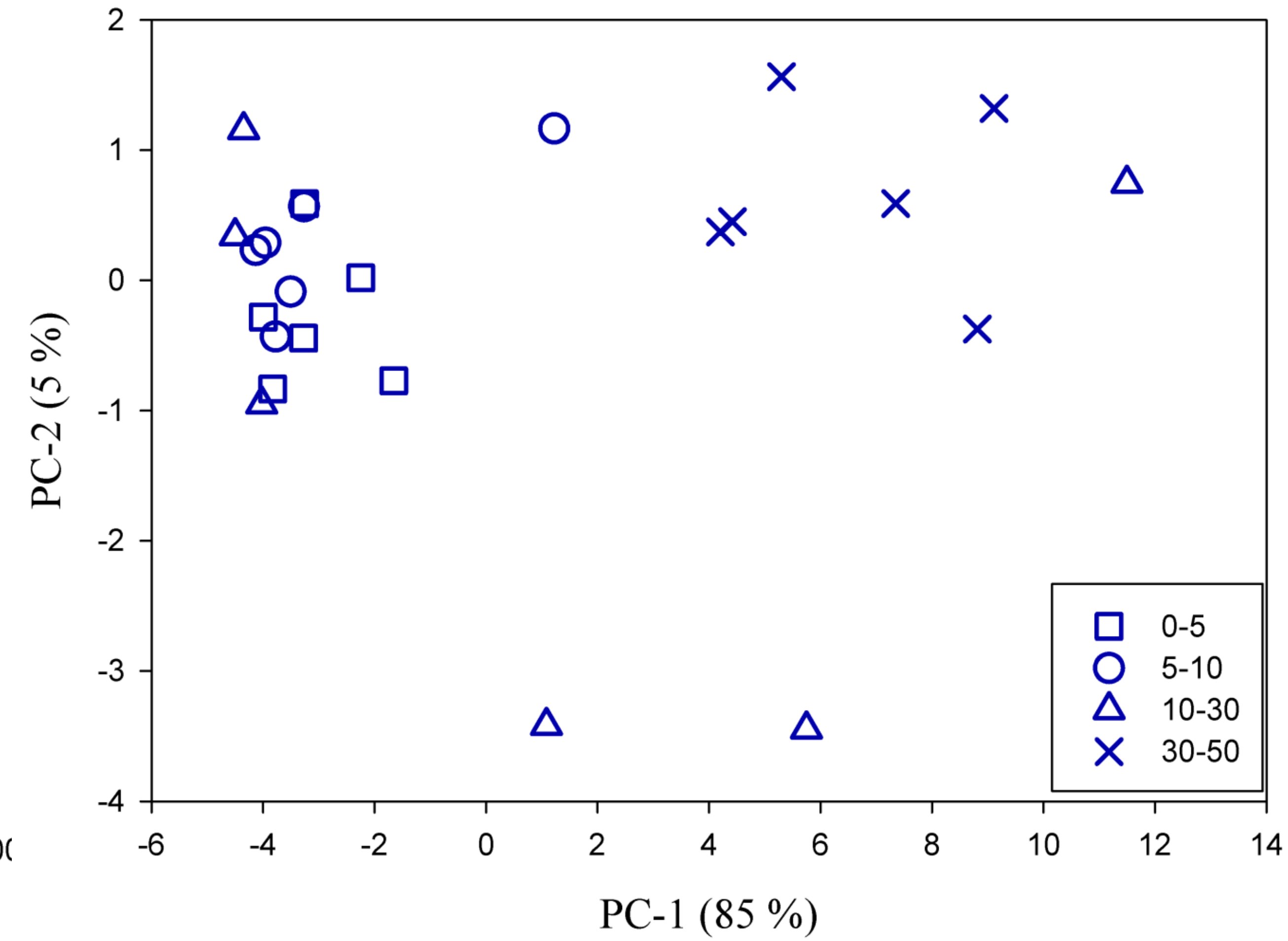


Several distinctive peaks between the spectral range of 500-1700 cm^{-1}

Peaks correspond to specific C bands such as, C-O stretching of carbohydrates (1030 cm^{-1}), aliphatic C-H stretching (1460 cm^{-1}) and aromatic C=C stretching (1610 cm^{-1})

Changes in SOC composition





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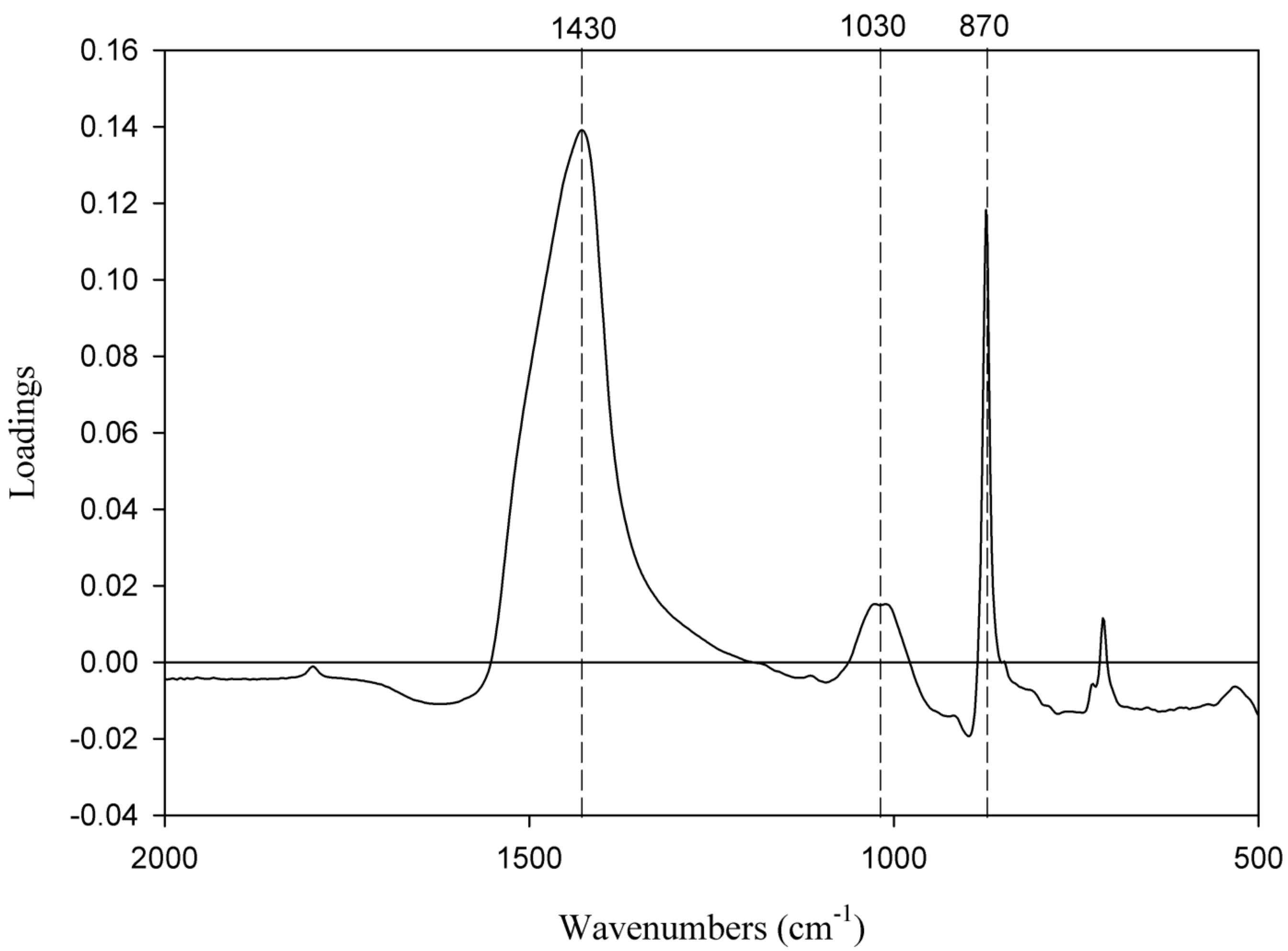

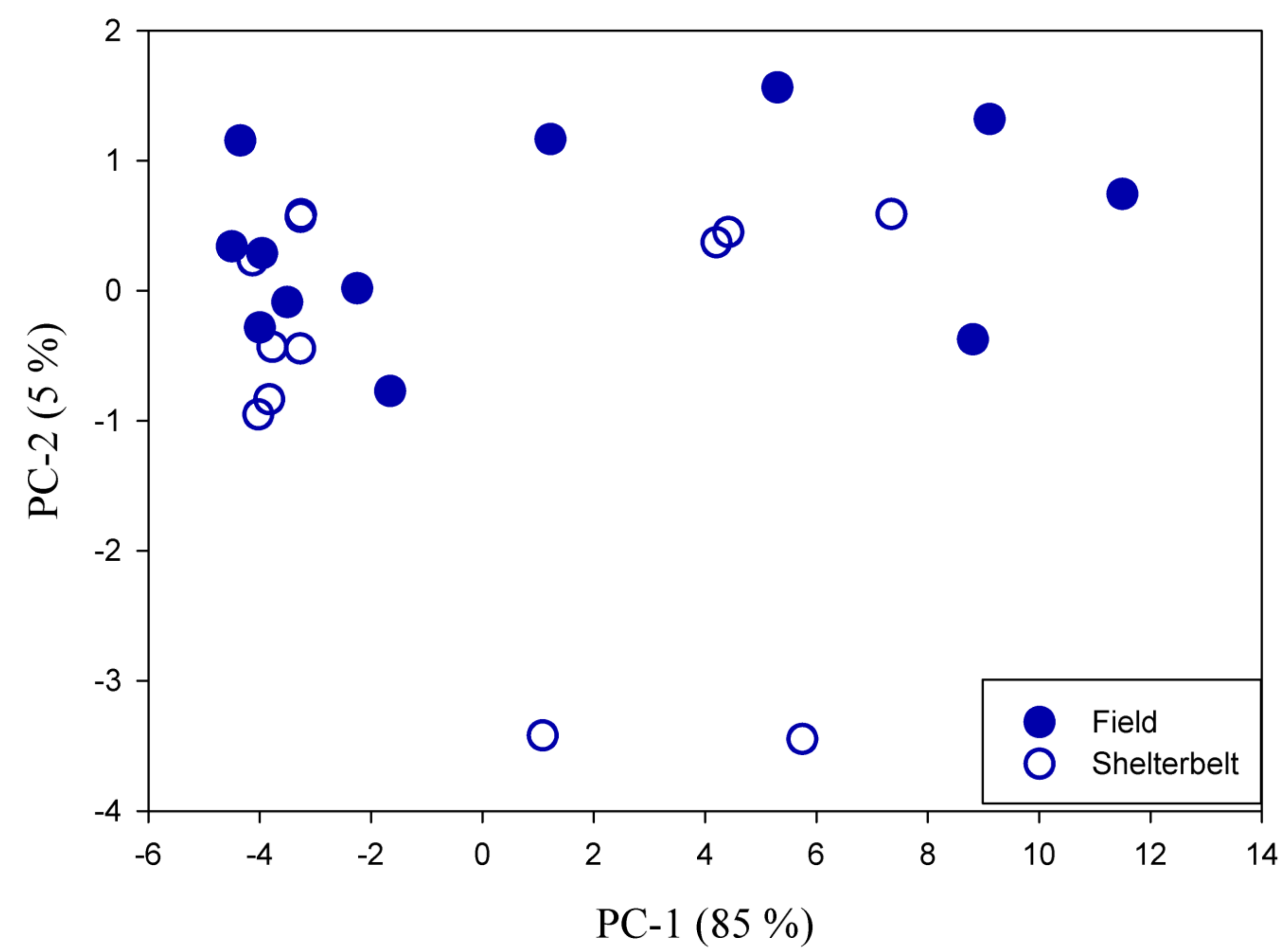

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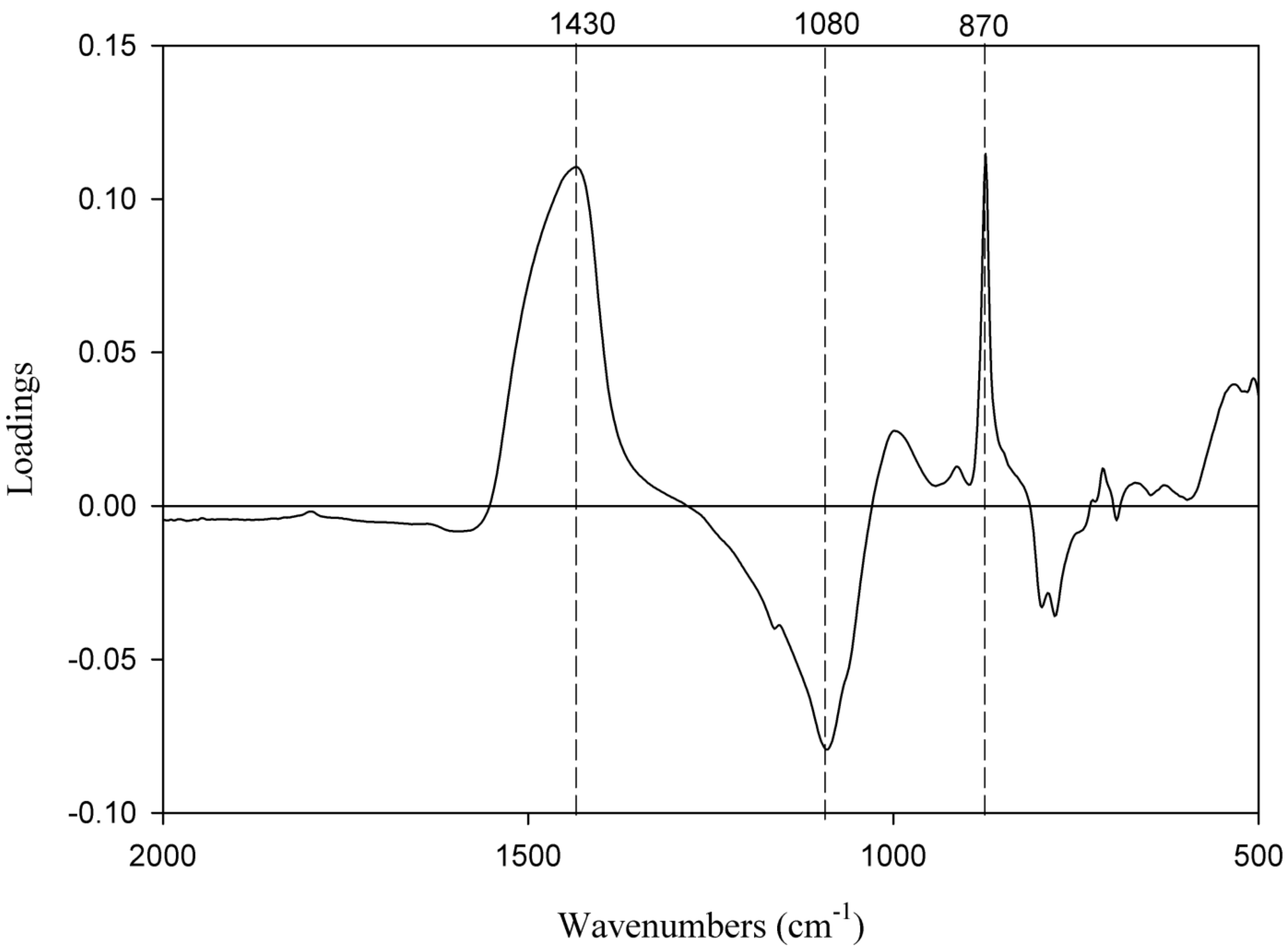

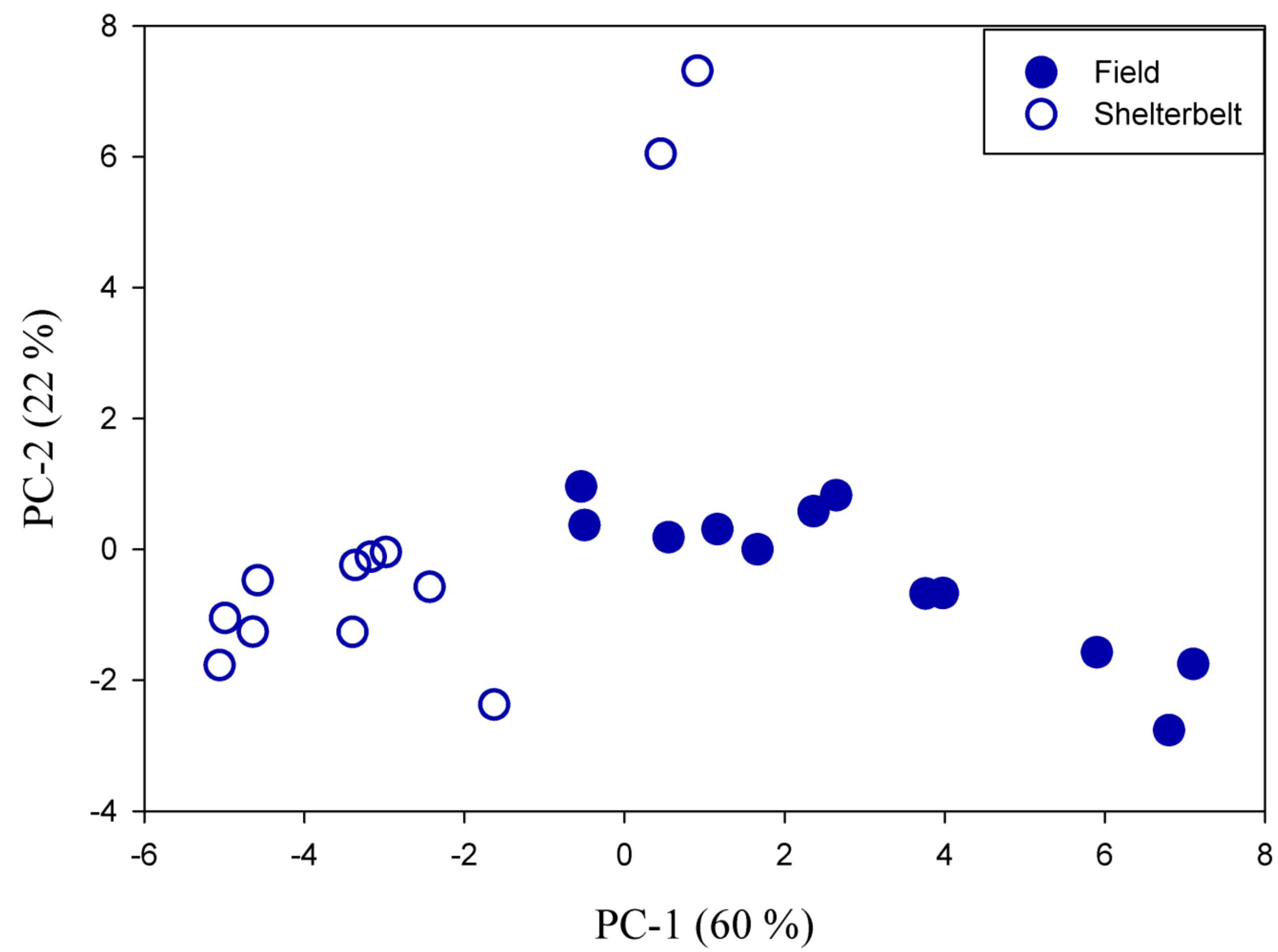

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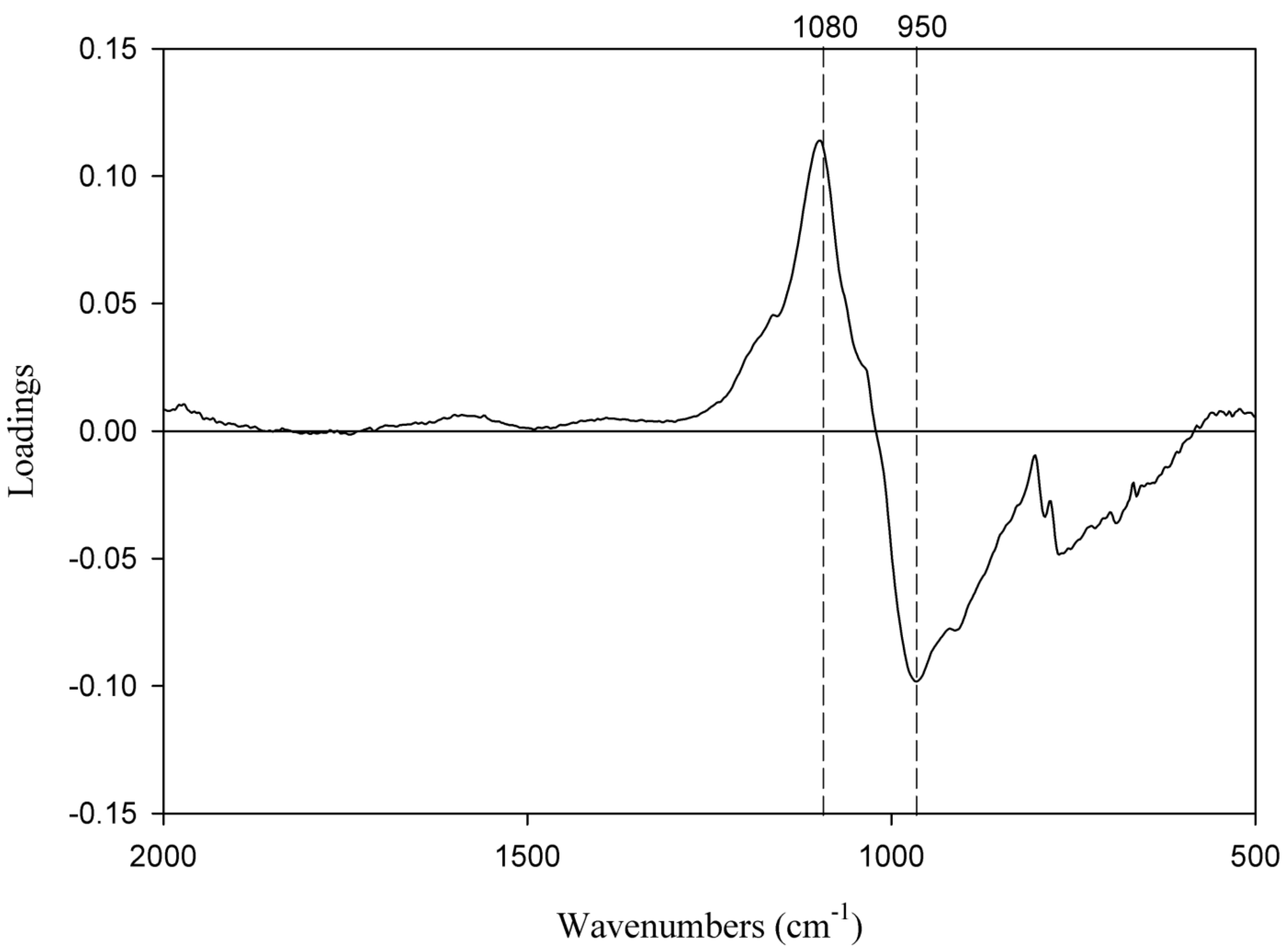

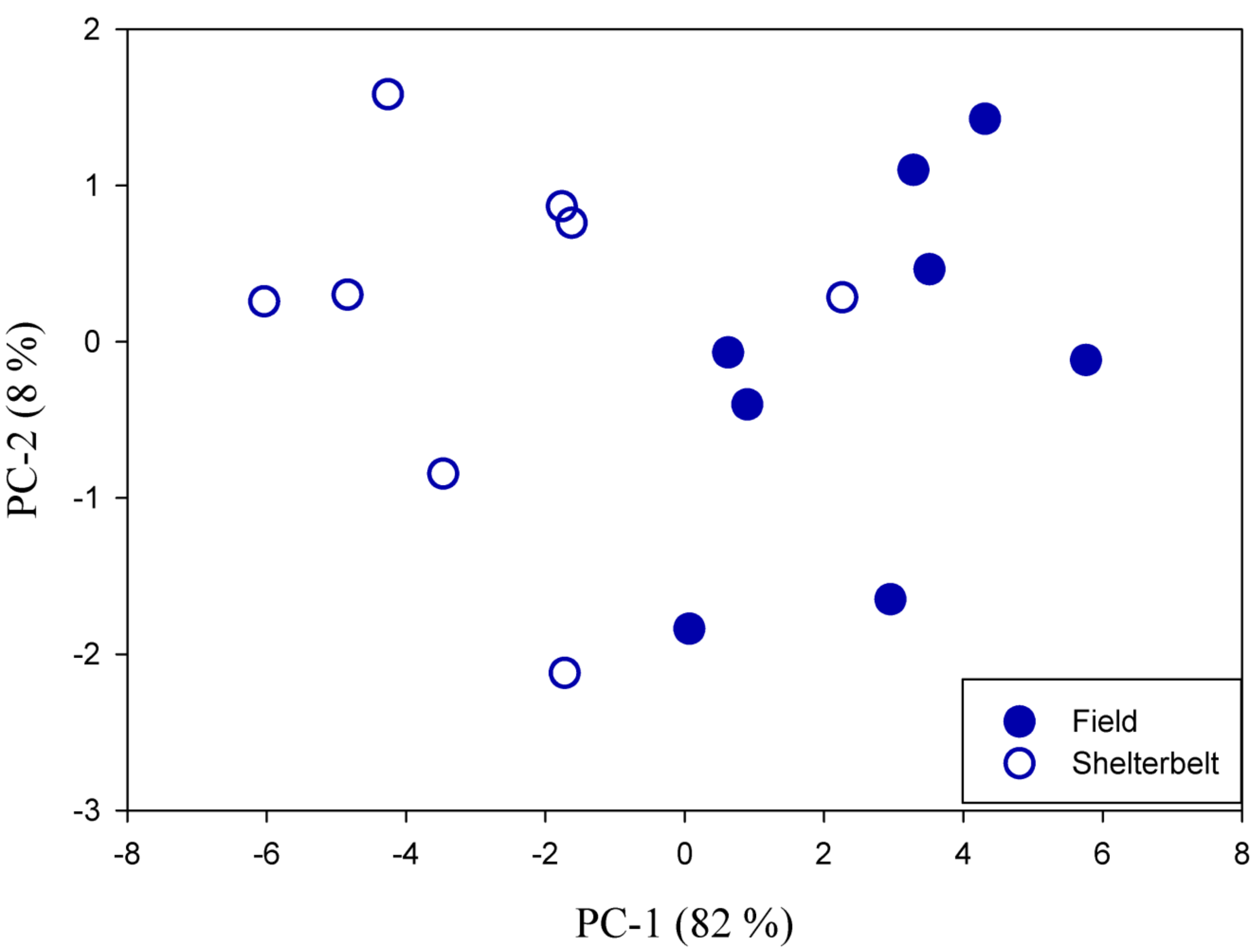

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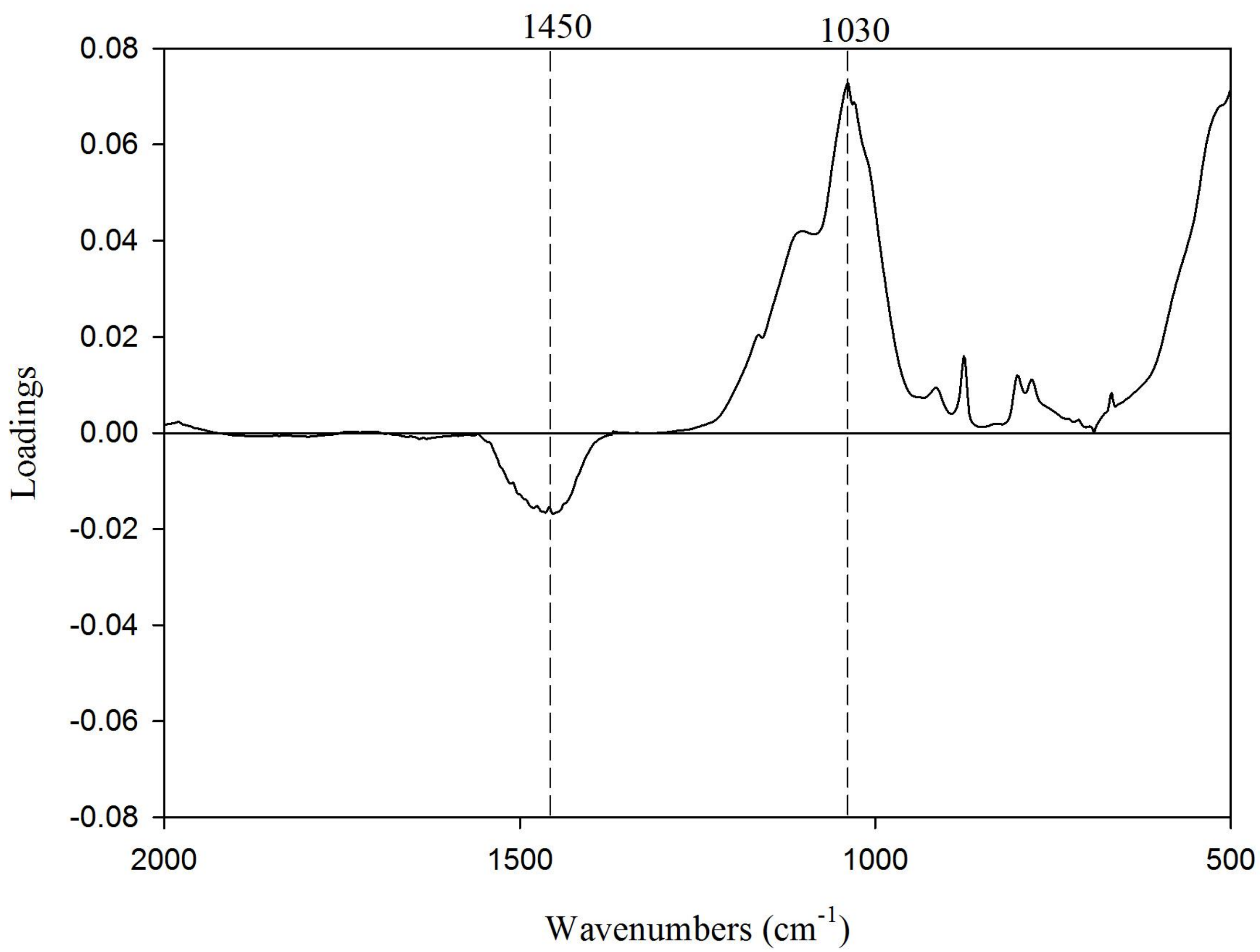

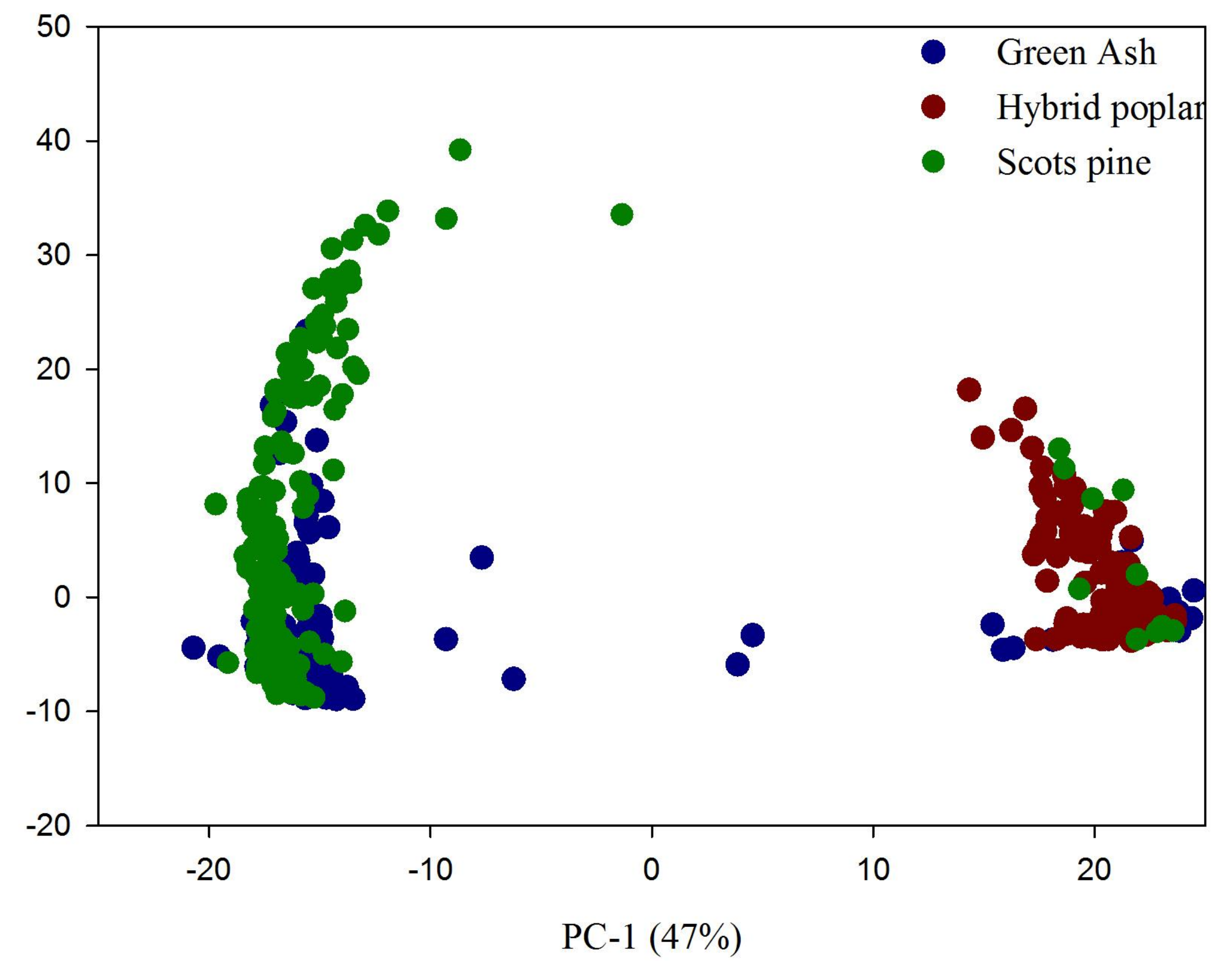

Summary

- SOC amount was significantly higher under the shelterbelts compared to the agricultural fields especially in the surface soil layers.

- Effect of shelterbelts on SOC composition was not consistent and controlled by the site conditions.

- Litter biochemistry impacted the composition of SOC under shelterbelts.

Acknowledgements

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