Soil properties and greenhouse gas emissions with distance from a shelterbelt

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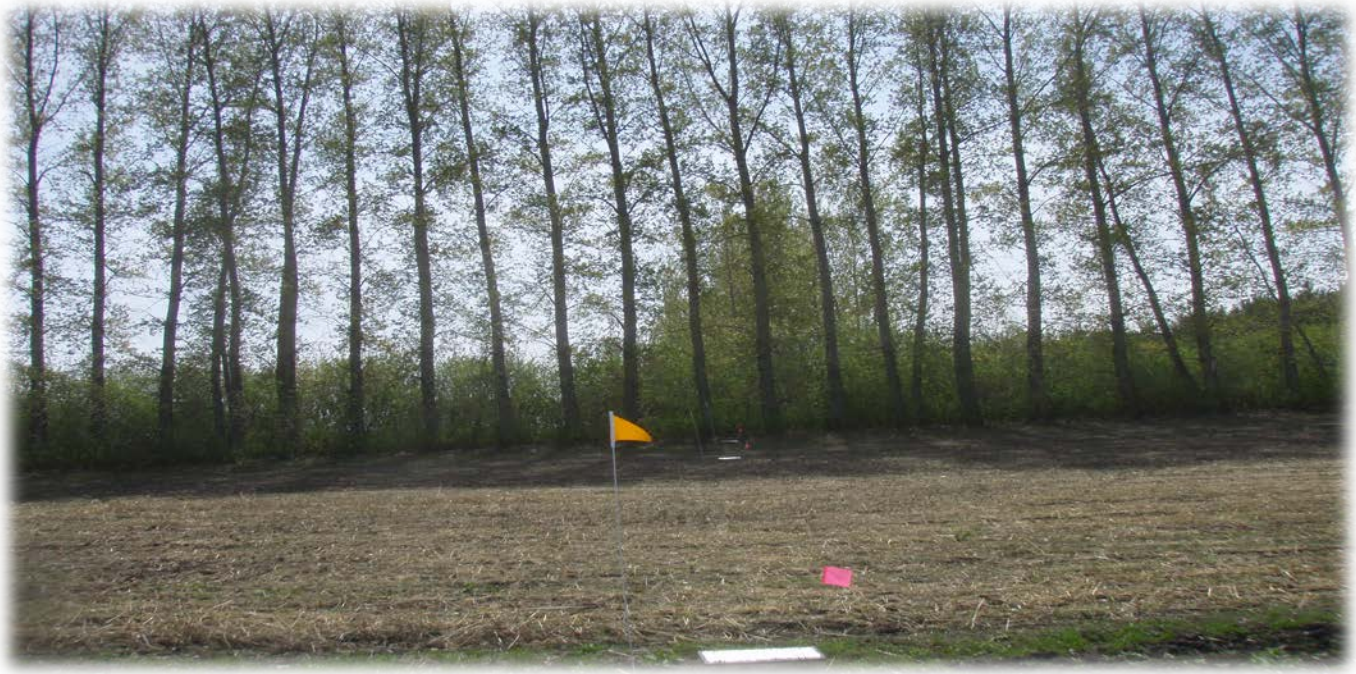

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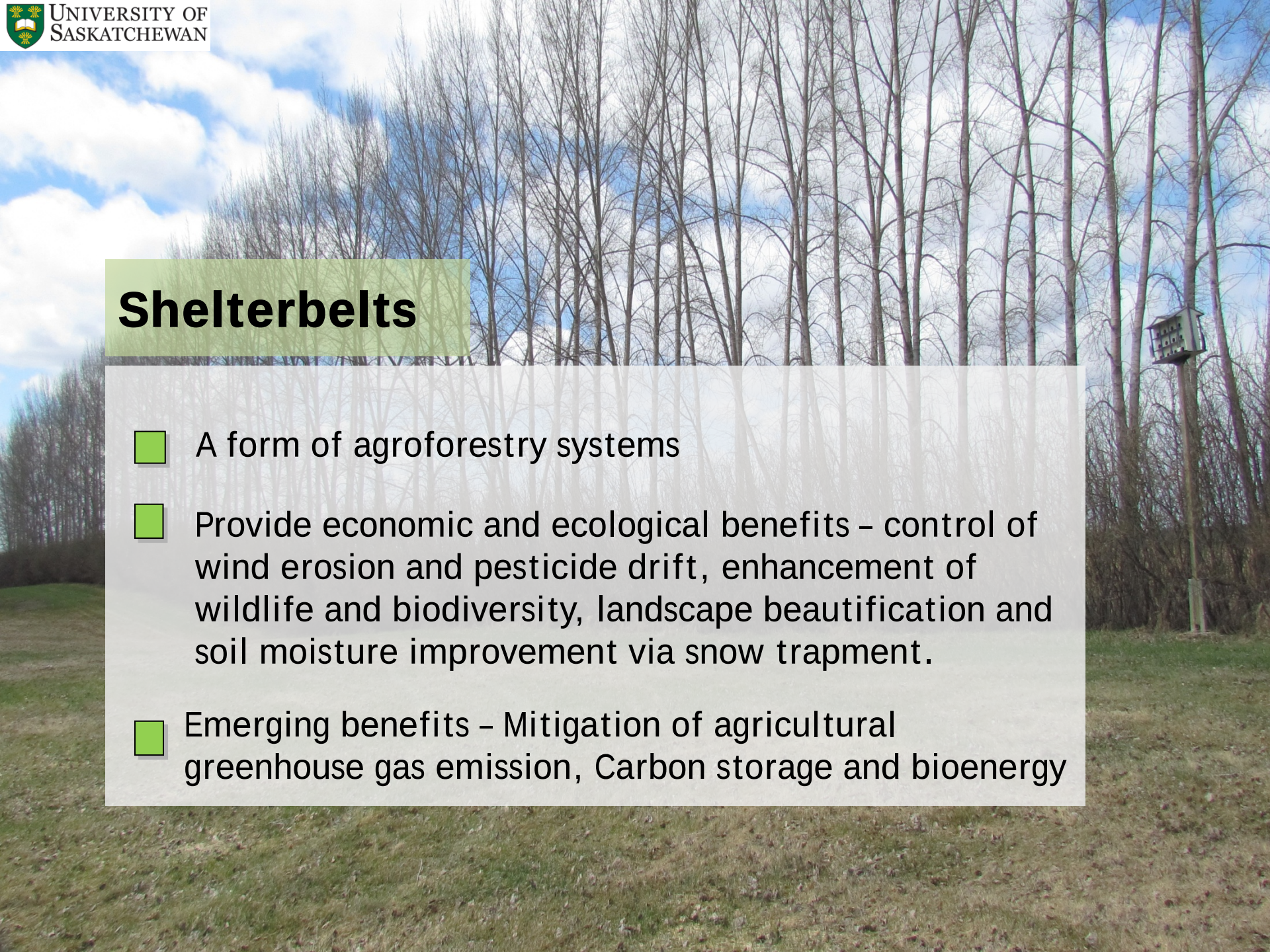


Shelterbelts

- A form of agroforestry systems
- Provide economic and ecological benefits – control of wind erosion and pesticide drift, enhancement of wildlife and biodiversity, landscape beautification and soil moisture improvement via snow trapment.
- Emerging benefits – Mitigation of agricultural greenhouse gas emission, Carbon storage and bioenergy

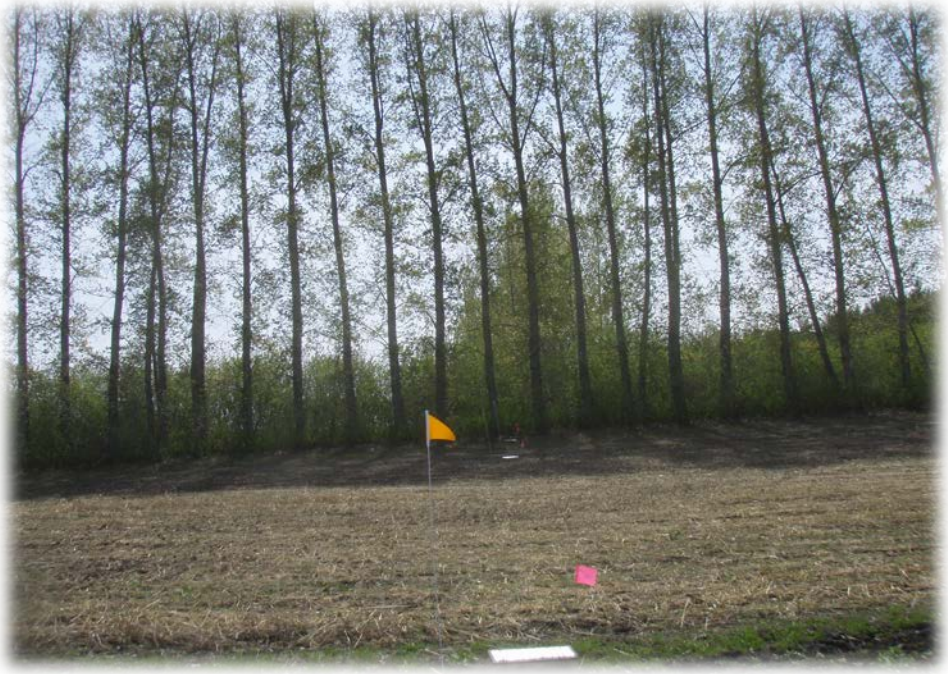
Why study shelterbelts for GHG reduction?

Improve understanding, identify inefficiencies, sustain ecosystem health, modelling

- Microclimate on the leeside is modified (Interactions of soil microbial communities with modified climate)
- High organic matter input due to tree litter deposits and wind-blown sediment trapment. Organic carbon in tree biomass is about 24 Mg km^{-1} to 104 Mg C km^{-1} (depending on species and age)
- Trees are deep rooting and can reduce denitrification and N leaching
- Over 600 million shelterbelt tree seedlings distributed around the prairies by PFRA
- The impact of shelterbelts on greenhouse gas flux in the Prairies has been less studied - **knowledge gap** (Impact on greenhouse gas models and inventories)

Objective

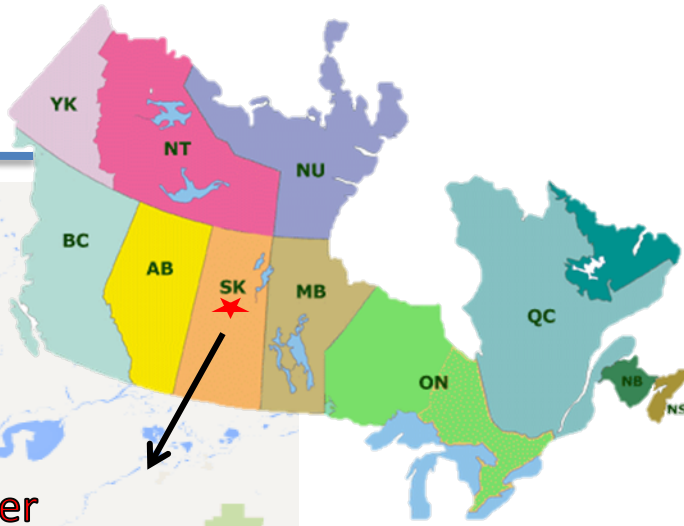
- Determine the changes in soil properties with distance from shelterbelts
- Investigate dynamics in GHG fluxes with distance from shelterbelts

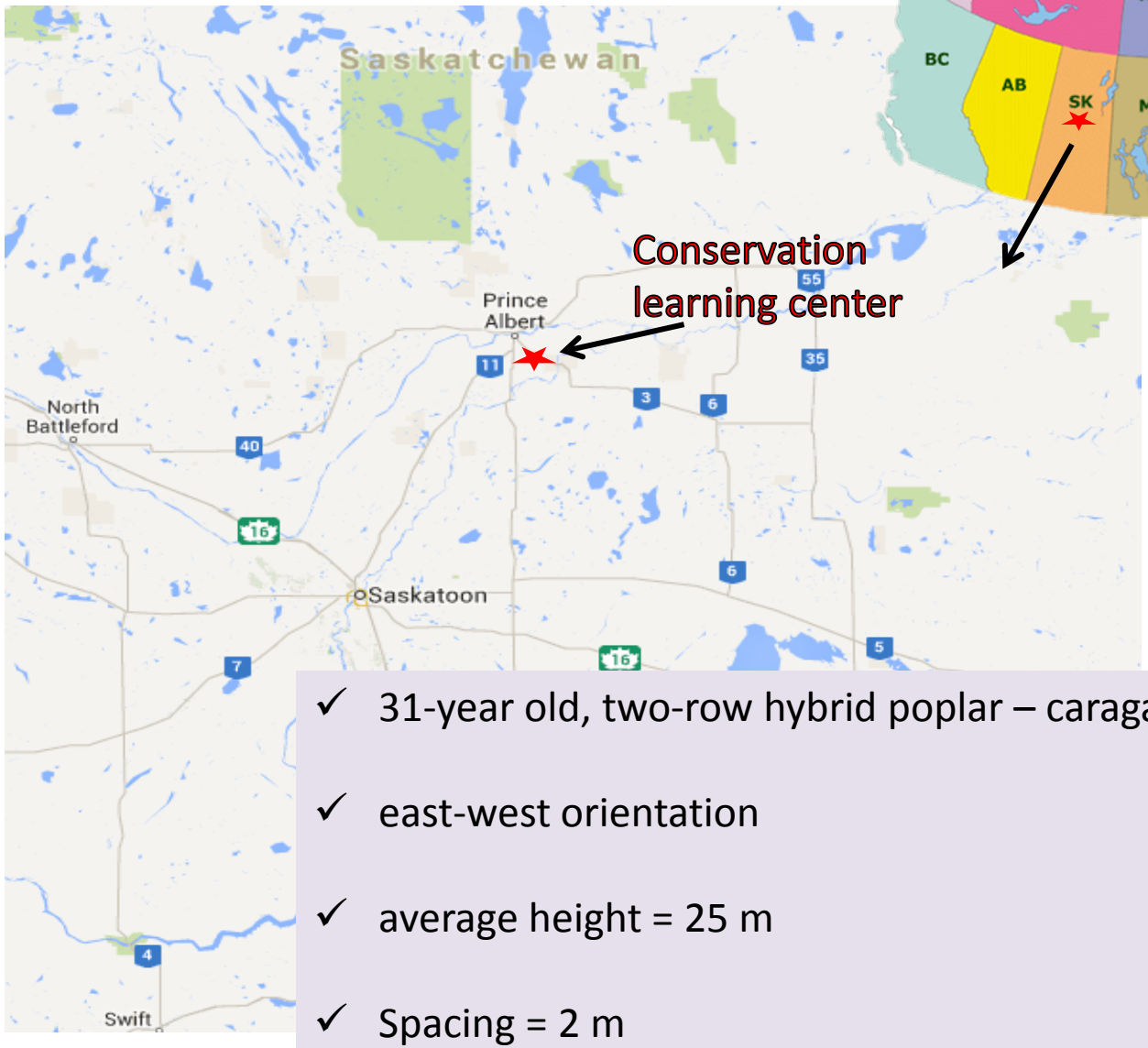


Hypothesis

Sheltering effect and root activity of shelterbelts will have varying degrees of effect on GHG emissions at different distances away from shelterbelts

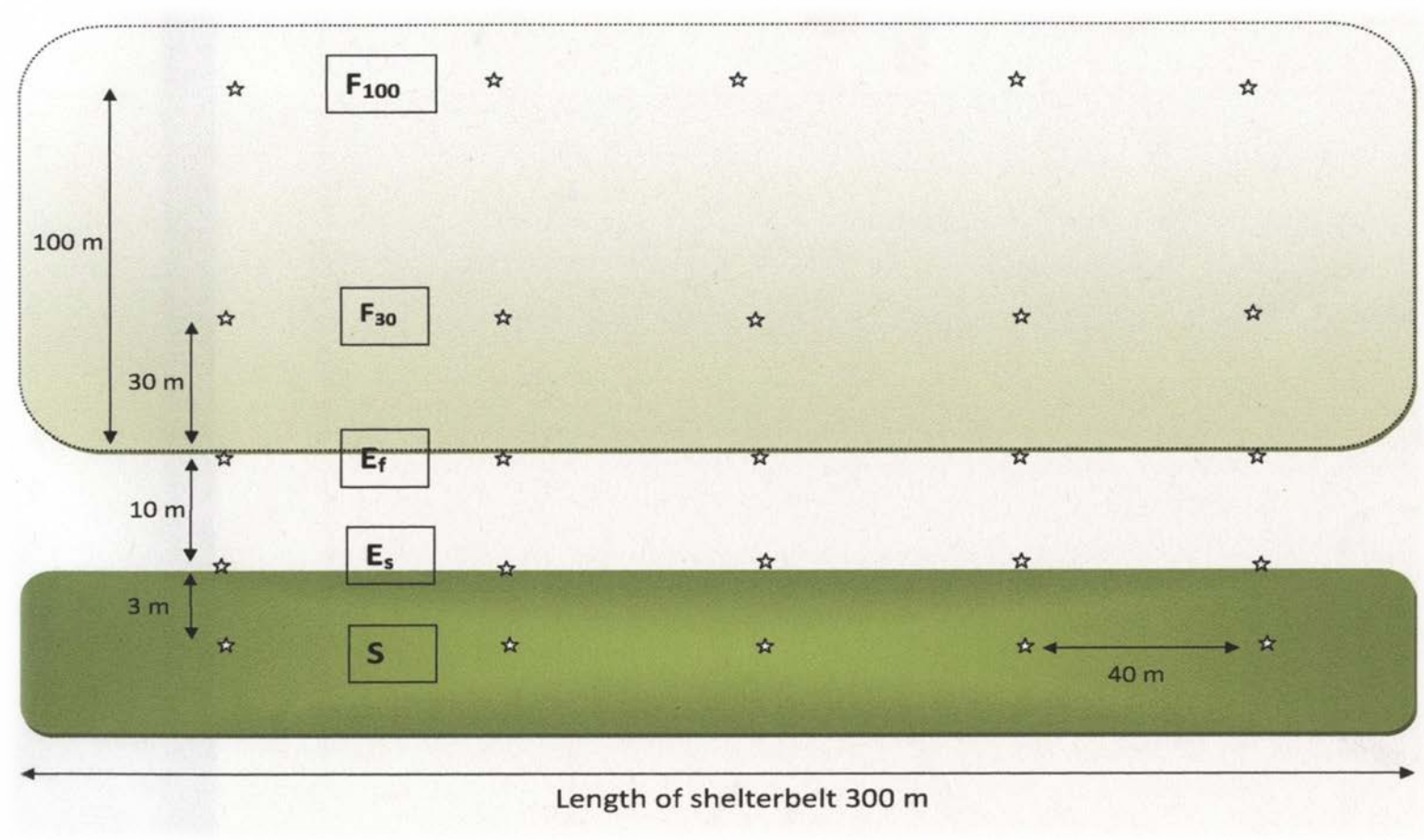
Study Site





- ✓ 31-year old, two-row hybrid poplar – caragana shelterbelt
- ✓ east-west orientation
- ✓ average height = 25 m
- ✓ Spacing = 2 m

Experimental layout



Gas, soil and ancillary data

- Static state vented chambers

- Sampling intensity: - (guided by weather events)

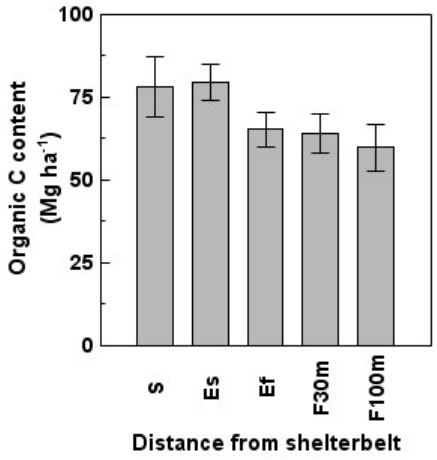
  - 4 time points (T_0, T_1, T_2 and T_3)

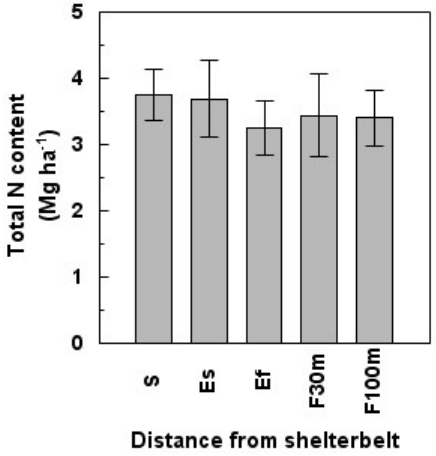
- Gas samples measured using a gas chromatograph (Bruker 450-GC)

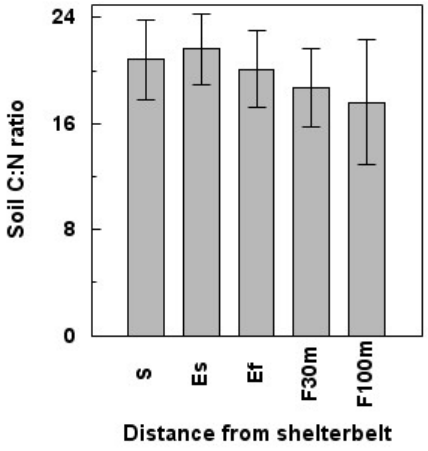
- Soil temperature and moisture at 5 cm depth

- Soil sampling: 15 cm depth

Soil Properties

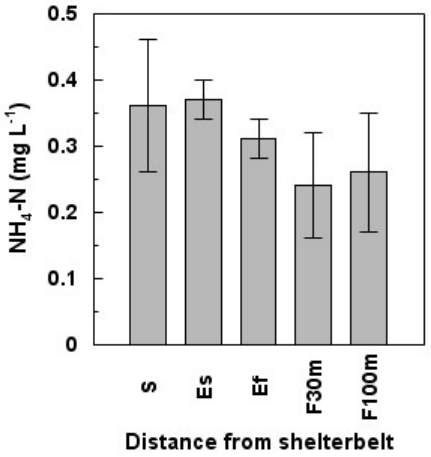


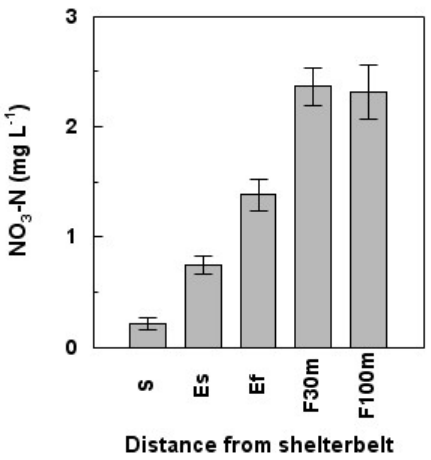


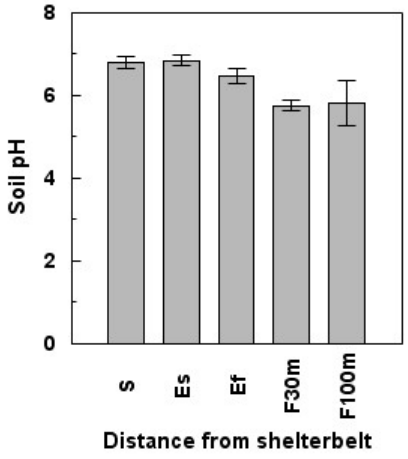


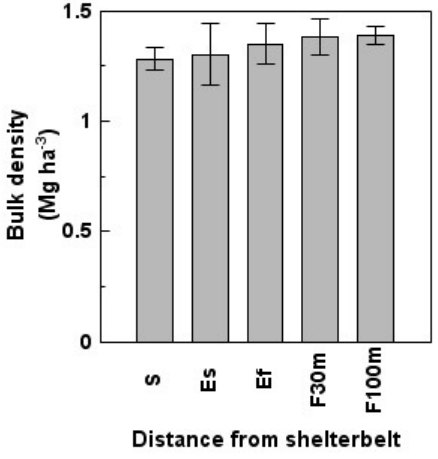
Soil texture: Sandy loam

Soil Properties









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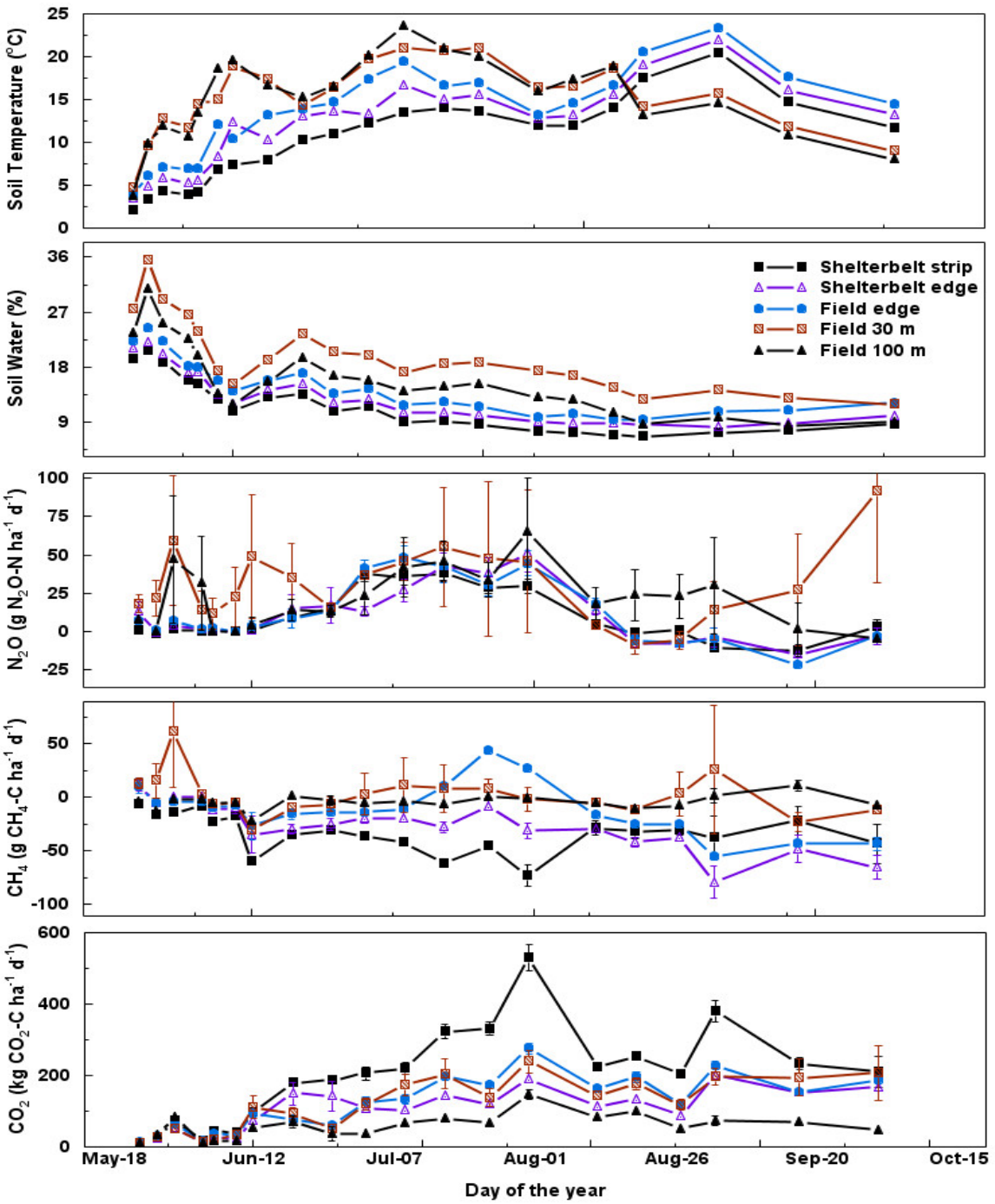
Results

2013 field season

Daily CO_2, CH_4 and N_2O flux from soils with distance from shelterbelts



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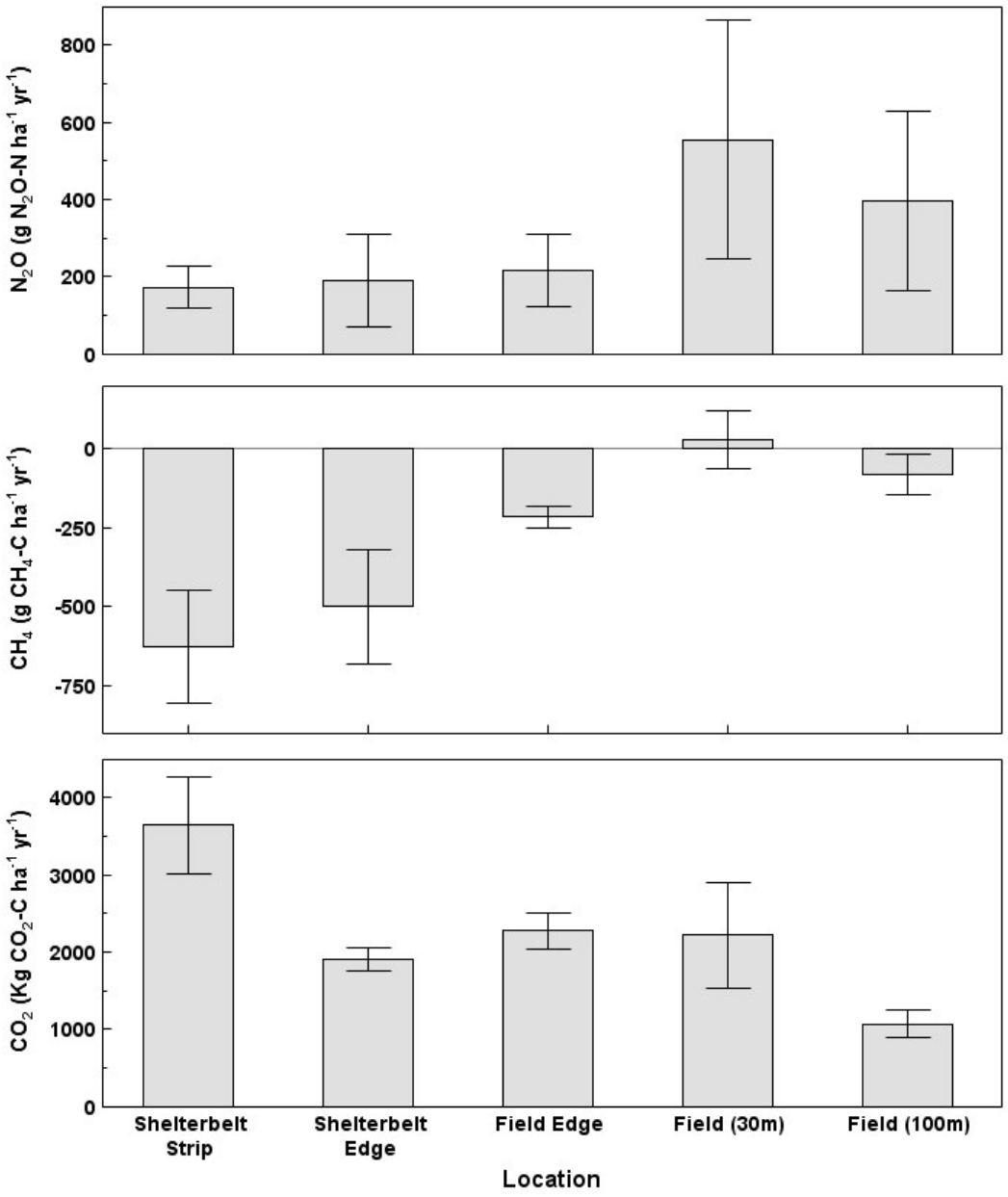
Results

2013 field season

Cumulative flux

Cumulative CO_2, CH_4 and N_2O flux from soils with distance from shelterbelts



Summary

- Fluxes of N_2O and CH_4 were lowest in shelterbelts but increased with increasing distance from shelterbelts
- CO_2 fluxes (soil respiration) decreased with increasing distance from shelterbelts due to improved biological activity and greater SOM content
- Tree roots can take up excess mineral N and soil water thereby reducing CH_4 and N losses via denitrification and leaching
- Shelterbelts provide opportunities for reducing agricultural GHG footprint

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Questions?

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