The Effect of Layering Soil Over Degraded Peatlands on Carbon Dioxide Emissions

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A layer of mineral soil over disturbed peat reduced soil respiration.

INTRODUCTION

- Drainage, cultivation, and amendment of peatlands for agriculture creates conditions for the rapid oxidation of soil organic carbon, resulting in carbon dioxide emissions
- A large portion of Richmond's agricultural land is on former peatlands
- Previous research suggests that a potential management strategy for lowering carbon dioxide emissions is to cover peatlands with a layer of mineral soil and farm on top of it
- The Agricultural Land Commission (ALC) has approved applications for farmers in Richmond to place soil fill to raise fields and improve poor drainage
- In such cases, the ALC and City of Richmond requires the salvage of topsoil by stripping it, storing it, distributing fill soil, and then redistributing the topsoil over the fill soil
- This research is to assess whether an alternative management strategy, leaving native peat beneath fill soil, could reduce carbon dioxide emissions

OBJECTIVE

- Assess the effect soil fill placement on carbon dioxide emissions from peatland

METHODS

- The study site was on the northwest side of Garden City Lands in Richmond
- Randomized complete block factorial design with four replicates and four treatments (Fig. 1)
- Respiration measurements taken seven times from August to September (SRC-2 Soil Respiration Chamber with CIRAS-3 Portable Photosynthesis System)

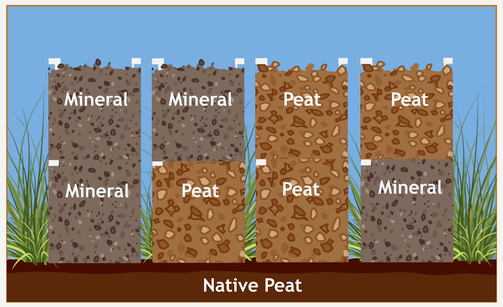

Figure 1. Cross section of the four soil layering treatments. Bucket bottoms were removed to allow contact with soil below.

RESULTS

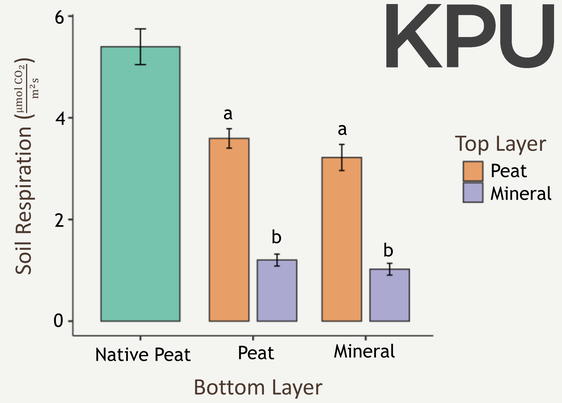

Figure 2. Mean soil respiration rates for native peat and treatment combinations. Error bars denote standard error. Bars labelled with the same letter do not differ significantly (Tukey test, $\alpha = 0.05$)

- No significant difference observed between:
  - Peat over peat & peat over mineral (a)
  - Mineral over peat & mineral over mineral (b)
- Significant difference ($p<0.001$) observed between:
  - Peat over peat & mineral over peat
  - Peat over peat & mineral over mineral
  - Mineral over peat & peat over mineral
  - Peat over mineral & mineral over mineral
- Soil respiration was highest on native peat
- Soil respiration was higher for treatments with peat as the top layer than treatments with mineral soil as a top layer
- There was no difference between treatments with the same top layer

DISCUSSION AND CONCLUSION

- The native peat had the highest soil respiration, suggesting that disturbed peatlands are more vulnerable to oxidation than peatlands covered by imported soil
- Soil respiration was lowest when imported mineral soil was the top layer, supporting the previous research that found a layer of mineral soil can protect the native peat
- Soil respiration was higher when peat was the top layer, suggesting that it provides some protection to the native peat, but it is not the most effective for reducing carbon dioxide emissions
- The results suggest that placing soil fill over native peat reduces carbon emissions associated with farming on peatlands

ACKNOWLEDGEMENTS

The respiration chamber was purchased with funding from a KPU Student Research and Innovation Grant.