

## Supplementary Materials

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Table S1. Characteristics of the four soil provinces in Quebec included in the study.

| Properties                                  | Soil Province                                                     |                                                                               |                                                                                                          |                                                                  |
|---------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
|                                             | B (Appalachians)                                                  | C (Laurentians)                                                               | D (Abitibi Lowlands)                                                                                     | E (Mistassini Highlands)                                         |
| Main parent material                        | Glacial till or regolith made of sedimentary and metamorphic rock | Glacial till composed of igneous and metamorphic rocks of the Canadian Shield | Extensive glaciolacustrine clay deposit, glaciofluvial sand, and gravel deposits over interlayered clays | Glacial till composed of igneous, metamorphic, and volcanic rock |
| Geology                                     | Sandstone, siltstone, shale, slate                                | Granite, gneiss                                                               | Interlayered clays                                                                                       | Granite, gneiss                                                  |
| Soils *                                     | Brunisols to Podzols                                              | Podzols                                                                       | Gleysoils, Gleyic Podzols to Podzols                                                                     | Podzols                                                          |
| Soil texture                                | Medium (loam)                                                     | Coarse (sand to sandy loam)                                                   | Fine (clay or silt)                                                                                      | Coarse (sand to sandy loam)                                      |
| Altitude (m)                                | 180–1300                                                          | 180–1200                                                                      | 30–525                                                                                                   | 300–600                                                          |
| Topography                                  | Alternating ridgelines and valleys                                | Rounded mountains, overgrown valleys                                          | Low-shield terrane                                                                                       | Rounded hills and valleys                                        |
| January temperature <sup>†</sup> (IQR, °C)  | –2.9—14.1                                                         | –16.0—18.4                                                                    | –17.3—18.6                                                                                               | –17.8—18.5                                                       |
| July temperature <sup>†</sup> (IQR, °C)     | 16.1–17.2                                                         | 15.8–16.8                                                                     | 16.3–16.8                                                                                                | 16.2–16.5                                                        |
| Annual precipitation <sup>†</sup> (IQR, mm) | 1054–1113                                                         | 964–1067                                                                      | 891–919                                                                                                  | 913–952                                                          |
| Degree days <sup>†</sup> (IQR)              | 1180–1350                                                         | 950–1290                                                                      | 1030–1190                                                                                                | 990–1110                                                         |
| Aridity index <sup>‡</sup> (IQR)            | 1.41–1.64                                                         | 1.34–1.52                                                                     | 1.19–1.26                                                                                                | 1.27–1.33                                                        |
| Nb. frost-free days <sup>†</sup> (d)        | 150                                                               | 140                                                                           | 140                                                                                                      | 142                                                              |
| Vegetation                                  | Mixed forest to balsam fir–white birch forest                     | Balsam fir–white birch to black spruce–feather moss forest                    | Balsam fir–white birch to black spruce–feather moss forest                                               | Black spruce–feather moss forest                                 |

\* Soil orders according to the Canadian System of Soil Classification [30]. <sup>†</sup>1961–1990 annual interquartile range (IQR) or average between 47° and 50° of latitude computed from New et al. [31]. <sup>‡</sup> 1970–2000 aridity index interquartile range (IQR) between 47° and 50° of latitude computed from Trabucco and Zomer [32].



Table S2. Parameter estimates of the relationship between soil bulk density (Db) and organic matter (OM) concentrations according to broad soil texture groups. No significant difference was found between the sand and the loam model ( $F = -1.34$ ,  $p = 1$ ), so these data were combined.

| Parameter                                                 | Estimate | SE    | t value | $p$    |
|-----------------------------------------------------------|----------|-------|---------|--------|
| Sand and loam                                             |          |       |         |        |
| $D_{bm}$                                                  | 1.532    | 0.049 | 31.2    | <0.001 |
| $D_{bo}$                                                  | 0.111    | 0.006 | 18.6    | <0.001 |
| Residual standard error: 0.2335 on 522 d.f.; $R^2 = 0.38$ |          |       |         |        |
| Clay                                                      |          |       |         |        |
| $D_{bm}$                                                  | 2.152    | 0.253 | 8.5     | <0.001 |
| $D_{bo}$                                                  | 0.109    | 0.011 | 10.2    | <0.001 |
| Residual standard error: 0.1438 on 39 d.f.; $R^2 = 0.66$  |          |       |         |        |

NOTE: The modeled relationships are represented by the following equation (Federer *et al.*, 1993):

$$Db = \frac{D_{bm} \times D_{bo}}{F_o \times D_{bm} + (1 - F_o) \times D_{bo}}$$

where  $D_b$ : observed bulk density ( $\text{g cm}^{-3}$ )

$D_{bm}$ : Constant: bulk density of “pure” mineral soil (without organic matter) ( $\text{g cm}^{-3}$ )

$D_{bo}$ : Constant: bulk density of “pure” organic matter (without mineral matter) ( $\text{g cm}^{-3}$ )

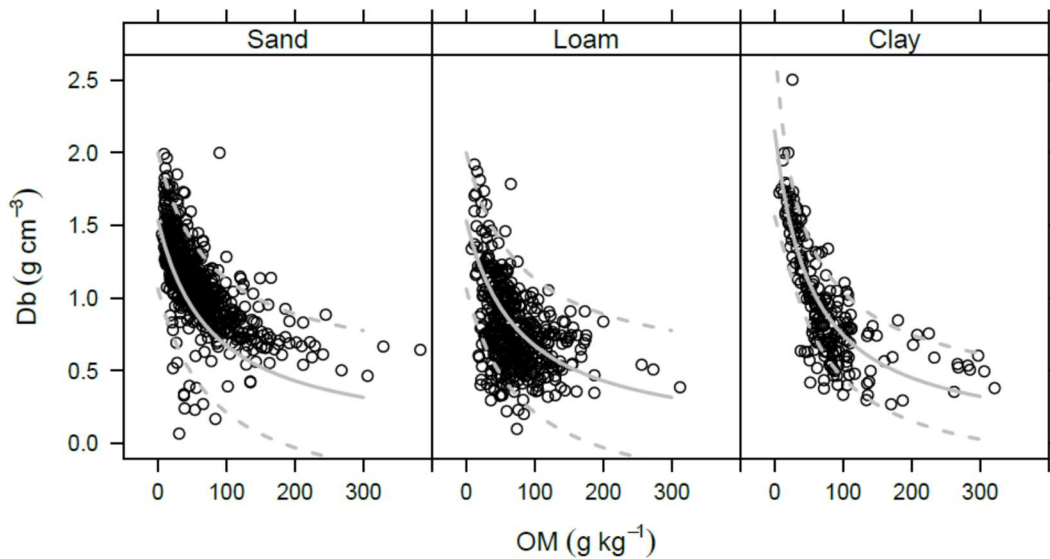


Figure S2. Relationship between soil bulk density (Db) and organic matter (OM) concentrations according to broad soil texture groups. Lines show model predicted values and 95% CI predictions.

Table S3. Total carbon (C) and total nitrogen (N) stocks in the first 60 cm of soil (forest floor excluded) as a function of harvesting treatment (stem-only harvesting (SOH) and whole-tree harvesting (WTH)) in four soil provinces in Quebec: B = Appalachians; C = Laurentians; D = Abitibi Lowlands; E = Mistassini Highlands. Data presented are model-adjusted means  $\pm$  SE.

| Variable                        | Harvesting intensity | Soil province    |                  |                 |                 |
|---------------------------------|----------------------|------------------|------------------|-----------------|-----------------|
|                                 |                      | B                | C                | D               | E               |
| C stocks (Mg ha <sup>-1</sup> ) | SOH                  | 63.7 $\pm$ 4.4   | 148.3 $\pm$ 9.8  | 86.4 $\pm$ 6.7  | 99.8 $\pm$ 15.3 |
|                                 | WTH                  | 71.3 $\pm$ 9.7   | 107.0 $\pm$ 12.3 | 82.9 $\pm$ 11.2 | 55.8 $\pm$ 12.8 |
|                                 | Difference           | -7.6 $\pm$ 9.1   | 41.3 $\pm$ 14.3  | 3.6 $\pm$ 13.4  | 43.9 $\pm$ 12.0 |
|                                 | p-value              | 0.407            | 0.004            | 0.791           | <0.001          |
| N stocks (Mg ha <sup>-1</sup> ) | SOH                  | 5.25 $\pm$ 0.28  | 6.23 $\pm$ 0.42  | 4.03 $\pm$ 0.38 | 4.81 $\pm$ 0.57 |
|                                 | WTH                  | 5.49 $\pm$ 0.46  | 4.63 $\pm$ 0.53  | 3.88 $\pm$ 0.57 | 2.58 $\pm$ 0.44 |
|                                 | Difference           | -0.23 $\pm$ 0.42 | 1.60 $\pm$ 0.58  | 0.15 $\pm$ 0.66 | 2.24 $\pm$ 0.53 |
|                                 | p-value              | 0.582            | 0.006            | 0.824           | <0.001          |

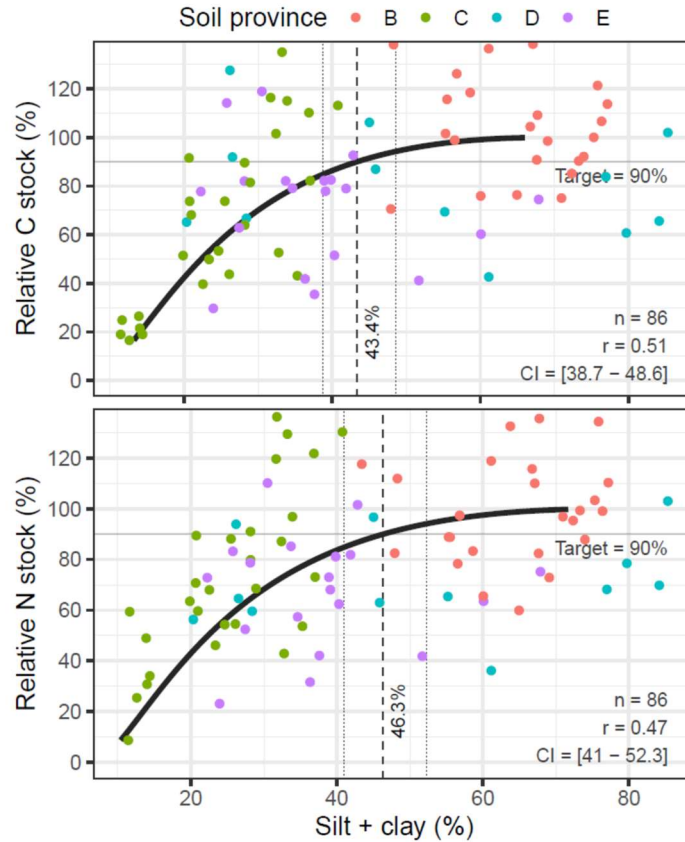


Figure S3. Relationship between the soil fine particle content (silt+clay) and the relative average soil C and N stocks (0-60 cm soil depth) after whole-tree harvesting (WTH) (relative to stem-only harvesting, SOH) by soil province. The dashed line represents the silt + clay content (and 95% confidence intervals (CI)) required to reach 90% of the soil C and N stocks after SOH with the arcsine–log calibration curve (Correndo *et al.*, 2017);  $r$  is the square root of the proportion of variation explained by the curve. Curves: relative soil C stocks =  $100(\sin(-1.384 + 0.698 \ln(x))^2)$ ; relative soil N stocks =  $100(\sin(-1.191 + 0.636 \ln(x))^2)$ .

## References

- Correndo, A., A., Salvagiotti, F., García, F., O., Gutiérrez, Boem, F., H., 2017. A modification of the arcsine–log calibration curve for analysing soil test value–relative yield relationships. *Crop and Pasture Science* 68, 297-304.
- Federer, C.A., Turcotte, D.E., Smith, C.T., 1993. The organic fraction–bulk density relationship and the expression of nutrient content in forest soils. *Can. J. For. Res.* 23, 1026-1032.