PEACE REGION
LIVING LAB

401 114 Avenue
Dawson Creek, BC
V1G 2Z7

780-835-1112
info@peacelivinglab.ca
peacelivinglab.ca

An Alternative Approach to Land Clearing in the Peace Region

By Fred & Madeleine Lehmann, Richard Kabzems & Sandra Burton

Peace Region Forage Seed Association

SARDA AG RESEARCH

MARA

NPARA NORTH PEACE APPLIED RESEARCH ASSOCIATION

PCBFA PEACE COUNTRY BEEF & FORAGE ASSOCIATION APPLIED RESEARCH

BC Grain PRODUCERS ASSOCIATION

Peace River Forage Association of British Columbia

PEACE REGION FOOD ACTION HUB AGRICULTURAL EXTENSION INSTITUTE

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

An Alternative Approach to Land Clearing in the Peace Region

By Fred & Madeleine Lehmann, Richard Kabzems & Sandra Burton

Richard Kabzems & Fred Lehmann looking at the soil layers.

Introduction

The Peace Region Living Lab is a collaboration between producer groups & Agriculture & Agri-Food Canada. It is an innovation project supported by research. The Living Lab approach focusses on testing ideas for beneficial management practices aimed at addressing climate change challenges.

Producers Fred and Madeline Lehmann were trying an innovative method clearing land for agricultural production on their farm. They had questions about the effects of combining woody debris, organic layers and upper mineral soil on their soil properties with this alternative method.

Commercial aspen harvest site after logging is complete, Fort Nelson area. Note debris piles in background & scattered woody material on the harvested area by traditional methods. Source: R. Kabzems.

Traditional Land Clearing

Usually, the first step in land clearing in the Peace is to harvest the merchantable trees. Woody material left after harvesting is commonly piled and burned on site. Then after extensive root picking, the field is plowed, followed by multiple tillage passes to get a suitable seed bed.

Alternative: Chipping & Mulching On Site

In the Lehmann land clearing example, after logging, all the remaining surface woody material was chipped and left on the surface. After surface chipping, the next step on the Lehmann site was to incorporate the surface chips and forest floor (LFH) into the upper mineral soil using a high-speed rotary mulcher. The photos here provide more detail of this method as used on the Ethel Field. *Source: F & M Lehmann.*

These photos show the work on the first pass in the winter/ spring of 2023 / 2024, shredding the residual wood after logging. This was not yet incorporated into the ground. This was a 270 hp hydrostatic mulcher and it took 4 to 5 hours per acre.

Photos show starting & completing the 2nd pass with the Seppi M Supersoil 250 mulcher and Claas Xerion 3800 VC Trac tractor.

Alternative Land Clearing Approach ... *continued*

By Fred & Madeleine Lehmann, Richard Kabzems & Sandra Burton

Chipping & Mulching on Site

The organic carbon (small woody materials and the LFH or forest leaf litter layers) are mixed into the upper mineral soil using this alternative method of land clearing.

The second pass was then done to a depth of 10 to 12 cm with a 2.5 m Seppi M mulcher and a 380 hp Claas Xerion tractor in the fall of 2024. The Lehmanns chose to do a third pass at 12 cm deep in the spring of 25' to grind up the wood fine enough so they could broadcast oats and fertilizer and lightly work it in with the Mandako twister vertical tillage tool.

A 15 pound rock ground up from the Seppi M mulcher. Source: F. & M. Lehmann

Photo to the left: View of the Mando twister, vertical tillage tool, and the results behind it. Source: F. & M Lehmann

Diagram illustrating high-speed rotary mixing of small woody debris, LFH into the upper mineral soil after chipping & mulching. Source: Bedford et al 2008.

The diagram above and the photo to the right both illustrate how the organic carbon (small woody materials and the LFH or forest leaf littler layers) are mixed into the upper mineral soil using this alternative method of land conversion.

The final step is seeding the crop. This field had been seeded to oats in the spring of 2025. Included here are photos from the Ethel Field in the fall of 2025, after using this chipping, mulching and incorporating method of land clearing.

Additional nitrogen may be required in the first couple of cropping years, since the decomposing microbes will be competing with the crop for this nutrient. *(see more detailed discussion on page 4.)*

Photograph taken of the Ethel Field in September 2025. Note that some small chipped wood is visible on soil surface. There was also evidence of good establishment of a canola crop in summer of 2025 following this alternative method of land clearing. Source: R. Kabzems & S. Burton.

Alternative Land Clearing Approach ... *continued*

By Fred & Madeleine Lehmann, Richard Kabzems & Sandra Burton

Effect on Soil Properties

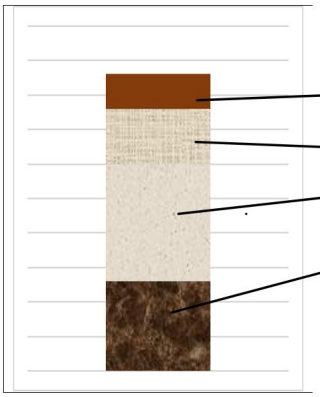
The most common soil type mapped for the Lehmann land clearing areas visited in September 2025 is a Donnelly soil. Soil texture, pH and organic carbon values are shown in the diagram *(upper right)* from Soils of the Peace Region (Lord and Green 1986).

The second diagram *(lower right)* shows what has happened to the Donnelly soil at the Holland recent land clearing location after high speed mixing has created an Ap horizon by mixing the surface woody material, the LFH & the Ahe soil layers.

Soil samples were taken at the New Holland Field in fall of 2025. The data for pH and organic carbon of the Ap layer is from the A and L Canada Laboratory Inc soil test report *(Sample 13, New Land Hollands, 0 to 6 inch sample depth)*. The Ae horizon data is from the A and L Canada Laboratory Inc lab soil test report *(Sample 14, New Land Hollands, 6 to 12 inch sample depth).*

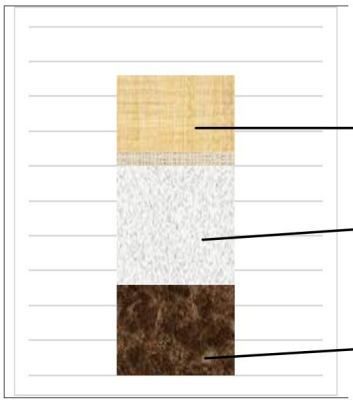
Carbon to nitrogen ratios (C/N Ratios) were calculated with information provided. As shown in the diagrams, the organic matter (i.e. carbon %) is higher in upper soil layers. Therefore C/N ratios will also be higher.

* Please note: Total nitrogen % are needed for this discussion, rather than nitrate test results. Although total nitrogen is not in the commonly used testing packages, it can be requested for an additional fee from most soil testing laboratories.



Horizon	Texture	pH (H2O)	Organic Matter (%)	C/N Ratio
LFH 5 cm	Organic	5.8	77 estimate	21 estimate
Ahe 0 to 8 cm	Silt loam	5.7	4.8	16
Ae 8 to 25 cm	Loam	5.5	0.9	13
Bt 25 to 38 cm	Clay loam	5.0	1.0	11

Diagram of the Donnelly soil before land clearing.
Source: R. Kabzems & S. Burton compiled information from the Soils of the Peace Region report (Lord & Green 1986).



Horizon	Texture	pH (H2O)	Organic Matter (%)	C/ N Ratio
Ap 0 to 12 cm	Silt loam	5.7	10.2	*
Ae 12 to 25 cm	Loam	5.1	1.6	*
Bt 25 to 38 cm	Clay loam	5.0	1.0	11

Diagram of The New Holland Field (i.e. originally Donnelly soil) after clearing, chipping & mulching in the fall of 2025 . Source: R. Kabzems & S. Burton compiled information from Soils of the Peace Region report (Lord & Green 1986) & soil test results from A & L Canada Laboratory Inc (Nov 2025).

Importance of Carbon / Nitrogen (or C/N) Ratios

Why is the C/N ratio important? There are two reasons:

1) there is intense competition among micro-organisms for available nitrogen when materials with high C/N ratios are added to soils, and
2) the C/N ratio helps determine the rate of decay and the rate at which nitrogen is made available to plants (Weil and Brady 2017).

The C/N ratio of cultivated surface horizons (Ap) in the Peace region for productive soils like the Esher series are often around 9 (Lord and Green 1986). If added organic material has a C/N ratio greater than about 21, soil organisms need to 'scavenge' the soil solution to obtain enough nitrogen. In addition, the decay of organic materials is limited if there is not sufficient nitrogen to support the soil organisms, either from plant materials or the soil solution (Weil and Brady 2017). Both of these processes would decrease the amount of available nitrogen for plants.

Woody material has a C/N in the range of 100 or greater (Venner et al 2011) while forest floor or LFH materials are often between 20 and 30. To provide sufficient nitrogen (N) for an annual grain crop, soil testing will be needed to assess fertilization needs. Producers might also be able to apply a variety of soil building practices such as incorporating forage legumes into crop rotations.

The Lehmanns have doubled the organic matter of the ploughed surface layer (Ap) by their alternative method. Over time, the multiple benefits of higher organic matter content in the ploughed surface layer, will increase plant productivity Eventually, it will contribute to a soil with a lower C/N ratio, with improved decomposition and soil nitrogen availability. In the meantime, the organic matter additions to the soil will improve its ability to retain soil moisture and nutrients. This will increase the soils' resilience to extreme weather events and climate change.

Main Points for Discussion

Soil pH:
Incorporating surface LFH and woody material has not made the soil more acidic. Woody debris which is incorporated into the upper mineral soil does not change in pH of the soil significantly, based on studies in other locations. The results from the Lehmanns' land clearing are consistent with other scientific information, (Salomon 1953, Uwituze et al. 2023).

Soil pH of the Ap in the Lehmann first field was between 5.5 and 6 (based on the field test kit) which is similar to the Donnelly soil profile descriptions above. Source: S. Burton.

Carbon and Nutrients:
The upper organic layer on a forest site (LFH) is a store of carbon and nutrients which will benefit the soil if retained during land clearing and incorporated into the new cultivated surface soil layer. Nutrient content and chemical properties of woody chips vary with the species of tree and the particular plant components that make up the chips. Bark and fine branches have higher nutrient content than wood. Comparing high speed mixing versus breaking plow treatments in the upper 10 cm of mineral soil in a forest site preparation experiment showed significantly higher soil carbon (4.1% to 1.8%) for the high speed mixing treatment after 15 years, (Macadam and Kabzems 2006).

Biological Decomposition Activity:
In general, biological breakdown is more rapid for smaller material. When chipped materials are incorporated into the soil, decomposition is much more rapid.

Suitable Seedbed & Adjusting Carbon/Nitrogen (C/N) Ratios:
Producers need to consider if they have achieved a suitable seedbed for their seeding equipment when using this type of land clearing technique. Carbon inputs from incorporating the forest floor layer (LFH) and woody material usually require nitrogen fertilization to meet the needs of future grain crop(s) on the site. Nitrogen needs to be added until C/N ratios approach similar values to productive upper ploughed soil horizons (Ap)in the Peace.

In Summary:
Incorporating all organic matter into the upper mineral soil as done by the Lehmanns' land clearing provides clear benefits to future productivity. Higher organic matter levels in the topsoil of the recently cleared land improve nutrient levels, nutrient holding capacity, soil moisture holding capacity, and internal soil drainage (Fontana et al, 2023). This improvement in these soil properties will increase the soils overall resilience and response to climate change.

References

Bedford, L, Boateng, J. and Kabzems, R. Editors. 2008. Tour Guide. Inga Lake Site. Testing the biological effectiveness of mechanical site preparation and vegetation control methods, 20 year results. Forest Practices Branch, B.C. Ministry of Forests. 84 pages.

Fontana, M., Johannes, A., Zaccone, C., Weisskopf, P., Guillaume, T., Bragazza, L., Elfouki, S., Charles, R., Sinaj, S. 2023. Improving crop nutrition, soil carbon storage and soil physical fertility using ramial wood chips. Environmental Technology & Innovation 31 (2023) 103143 https://doi.org/10.1016/j.eti.2023.103143

Lord, T.M. and Green, A.J. 1986. Soils of the Fort St. John – Dawson Creek area, British Columbia. B.C. Soil Survey, Research Branch, Agric. Can., Vancouver, B.C. Rep 42.

Macadam, A. and Kabzems, R. 2006. Vegetation management improves early growth of white spruce more than mechanical site preparation treatments. Northern Journal of Applied Forestry 23(1): 35-46.

Salomon, M. 1953. The Accumulation of Soil Organic Matter from Wood Chips. Soil Science Society of America Journal 17(2): 114 -118. https://doi.org/10.2136/sssaj1953.03615995001700020008x

Uwituzea, Y., Nyiraneza, J., Jianga, Y., Dessureaut-Rompréb, J., and Frasera, T. 2023. Soil C, N and P bioavailability and cycling following amendment with shrub willow chips. Can. J. Soil Sci. 103: 428–445 (2023) | dx.doi.org/10.1139/cjss-2022-0126

Venner, K. H., Preston, C. M. and Prescott, C. E. 2011. Characteristics of wood wastes in British Columbia and their potential suitability as soil amendments and seedling growth media. Can. J. Soil Sci. 91: 95-106. doi:10.4141/CJSS09109

Weil, R.R. and Brady, N.C. 2016. The nature and properties of soils. 15th Edition.