MITIGATING CLIMATE CHANGE IMPACTS IN NUTRIENT-RICH ORGANIC SOILS WITH THE APPLICATION OF WOOD ASH AFTER COMMERCIAL THINNING IN SPRUCE STANDS

One of the climate change mitigation (CCM) measures applied in the project LIFE OrgBalt relates to the application of ash on soils. This method is applied in the demonstration site on a forest stand in Mežole, Latvia. The goal of the demonstration site is to demonstrate greenhouse gas (GHG) emissions reduction in spruce stand by using genetically selected planting material and improving hydrological regime – furrows to ensure excess water runoff to the relief lows.

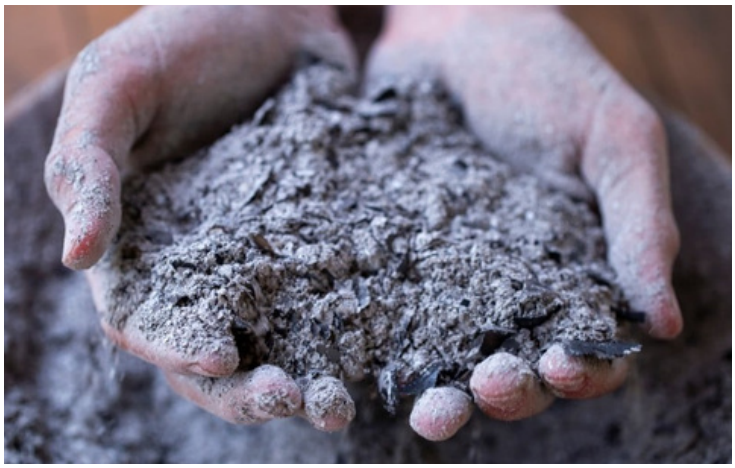

Figure 1. Wood ash..*

It is expected that, after applying this CCM measure, a reduction of GHG emissions will be achieved due to groundwater level stabilizing during forest regeneration phase and better growth conditions and increased CO2 removals in forest biomass and other carbon stocks. Moreover, stabilized groundwater levels are anticipated to decrease CH4 emissions, but mounds will ensure better growth conditions for forest regeneration during the first decades after planting.

The practice of applying wood ash after commercial thinning has shown admirable results elsewhere. For example, in a study of wood application on different soils, mitigation of N2O emissions was observed for solis with low pH and high soil organic matter (Bornø et al., 2020).

In a review of the environmental impacts of using wood ash in forestry, it was concluded that the effects of wood ash application depend on the soil type and application rate of ash, and in shallow peats the impact of applying wood ash is long lasting and positive (Pitman, 2006).

Studies in Latvia demonstrated no increase of GHG emissions after application of different dosages of wood ash on peat in controlled conditions, while in short term CO2 emissions significantly decreased, most probably due to suppression of microbiological activity in soil. Further studies in field conditions demonstrated increase of CO2 emissions in case of application of wood ash (5-15 tons ha-1); while it is associated with significantly higher input of forest litter in fertilized plots.

We asked Andis Lazdiņš, Senior researcher of the Latvian State Forest Research Institute “Silava”, about the details of wood ash application in cases like these.

Why is ash so valuable especially on nutrient-rich organic soils?

Management of organic soil is usually associated with shortage of nutrients at some point, either due to increase of groundwater level limiting access to reserves of nutrients in deeper soil layers or increasing consumption of nutrients, e.g., due to growth of forest stand. In our climate conditions, the most common issue is shortage of potassium (P), phosphorus (P), boron (B) and other micro-nutrients. Wood ash provides

complex of micro- and macro-nutrients ensuring improvement of growth conditions in most of the cases. Wood ash is applied at topsoil; therefore, it is acting positively always, and delivery of nutrients is gradual ensuring long lasting effect. Wood ash is also reducing risk of natural disturbances because trees are not suffering from nutrients significant for the plant protection.

How is the ash produced?

Wood ash applied at an industrial scale is usually produced in district heating plants or industrial facilities consuming biofuel. In Latvia small scale facilities using moving furnace bars technology are dominating resulting in diverse variety of wood ash with melted inclusions and partially burned biomass. Wood ash produced in liquidized bad boilers are more even in terms of quality. Dusty particles are dominating in both types of wood ash, therefore pre-processing to improve the quality is necessary. It is not recommended to use pure fly ash in forest lands due to high content of cadmium (Cd). This material should be mixed with bottom ash or other material diluting heavy metals.

Would this CCM method be scalable to larger territories and soil types?

Yes, it can be used in about 0.6 mill. ha area in Latvia; however, due to management restrictions actual applicable area may be significantly smaller. It may be limited also by accessibility of an area, since existing strip roads and sufficient bearing ground capacity are key factors limiting technical potential of wood ash application. Current production of wood ash in Latvia is sufficient to fertilize gradually all forest with peat soils in Latvia.

When would the first results be expected after applying the ash?

Depending on the current condition, the effect of wood ash may appear during the next vegetation season or in longer time as a reduction of natural disturbances or avoided growth reduction. Short term impact is associated with already existing shortage of certain nutrients, which can be detected as reduced growth, defoliation or increasing disturbances.

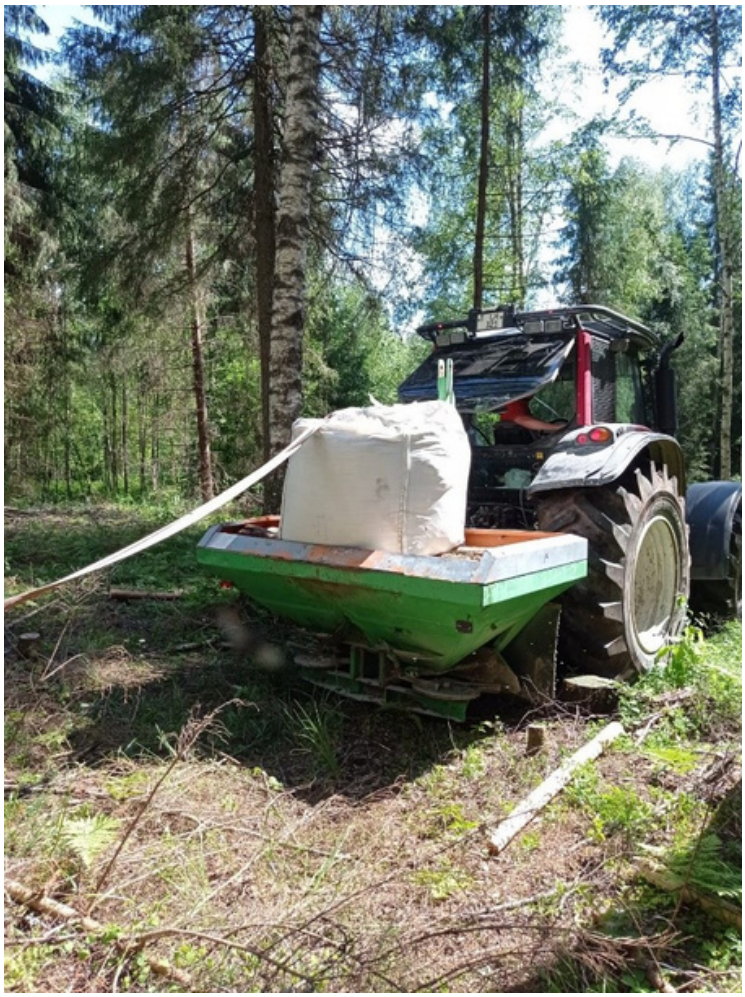

Figure 2. Wood ash spreading in Mežole.

Are there any limitations to this method?

Actually no! Besides the above-mentioned technical limitations or nature conservation related restrictions. If economic benefits are prioritized, fertilization with wood ash should be done 7-15 years before regenerative felling, prioritizing forest stands with visible signs of nutrients' shortage.

Could and should owners of forest lands apply wood ash by their own initiative?

As everything, the application of wood ash costs money. Normally these costs should be covered by producer of wood ash since the producer is saving on transport and landfilling of wood ash.

If properly done (no additional soil and stem damages during the wood ash application) wood ash will not do any harm even if no additional increment will be acquired in short term.

In the case if ash application costs are not covered by the producer and short-term economic outputs are important, the decision can be done after commercial thinning depending on stand parameters and the recent increment trends of extracted trees. If they are reducing gradually, the stand is more suitable for application of wood ash.

LIFE ORGBALT TEAM

References

Bornø, M. L., Rønn, R., & Ekelund, F. (2020). Is wood ash amendment a suitable mitigation strategy for N2O emissions from soil?. Science of the Total Environment, 713, 136581.

Pitman, R. M. (2006). Wood ash use in forestry–a review of the environmental impacts. Forestry: An International Journal of Forest Research, 79(5), 563-588.

*Figure 1 retrieved from: https://www.diyncrafts.com/101312/home/gardening/15-clever-ways-to-use-wood-ash-in-the-garden

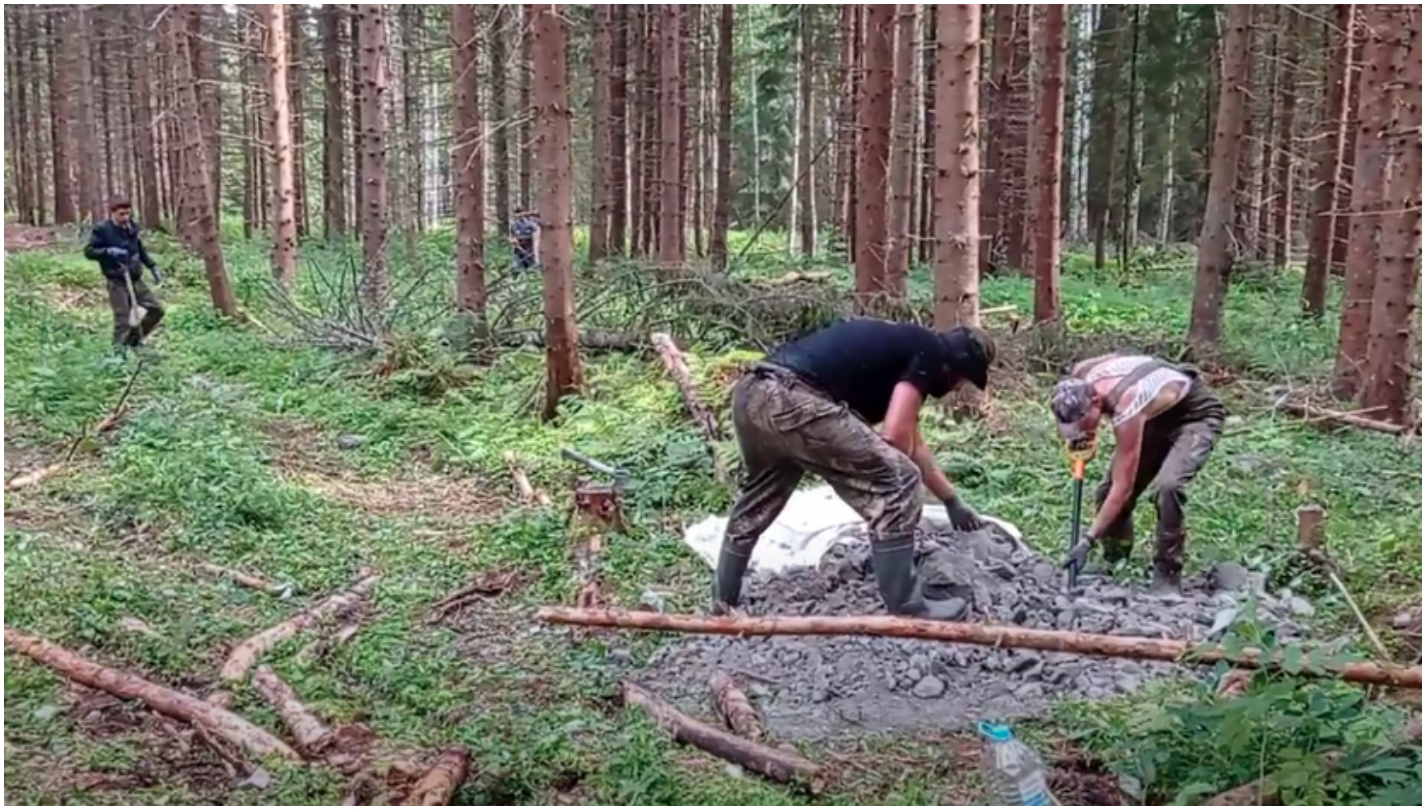

Figure 3. Wood ash spreading in Mežole

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