Pore structure of different biochars and their impacts on physical properties of *Sphagnum* moss growing media

Mika Turunen

Dr. Sc. (Tech.)

Natural Resources Institute Finland (LUKE)

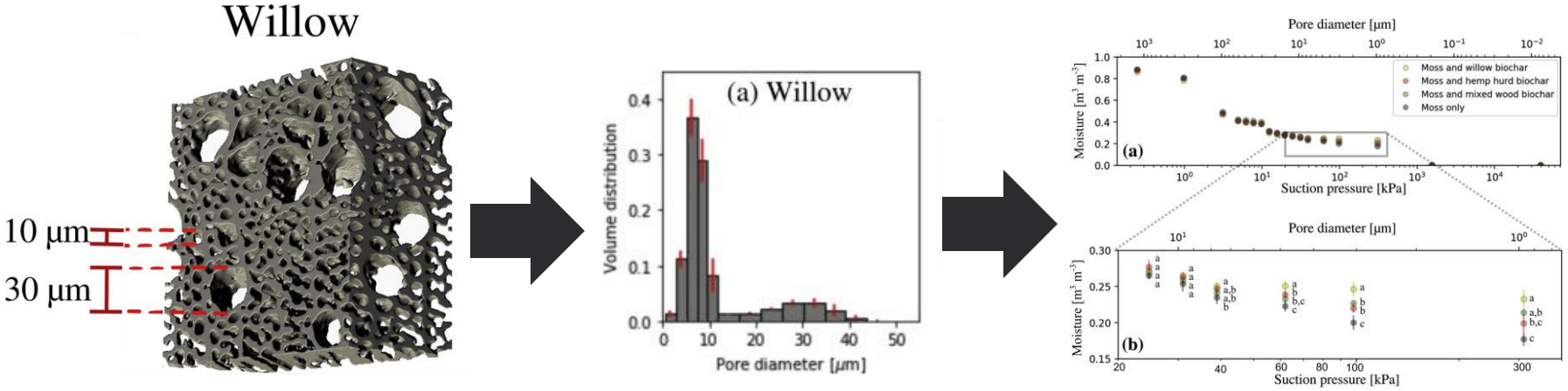


Figure source:
Turunen et al. 2020, Biosystems Engineering, *191*, pp.96-106.
Turunen et al. 2019, Vadose Zone Journal, *18*, 190033.

Luke
LUONNONVARAKESKUS

Introduction

Undecomposed *Sphagnum* moss has been suggested as a relatively sustainable growing media material.

- But moss growing media properties not well known.

Amending the media with biochar could enhance the properties, but biochar impact mechanisms are not fully understood.

This study combined conventional measurements with 3D imaging to mechanistically understand (1) moss growing media physical properties and (2) biochar physical impacts.

Methods

Key physical measurements (samples with and without biochar):

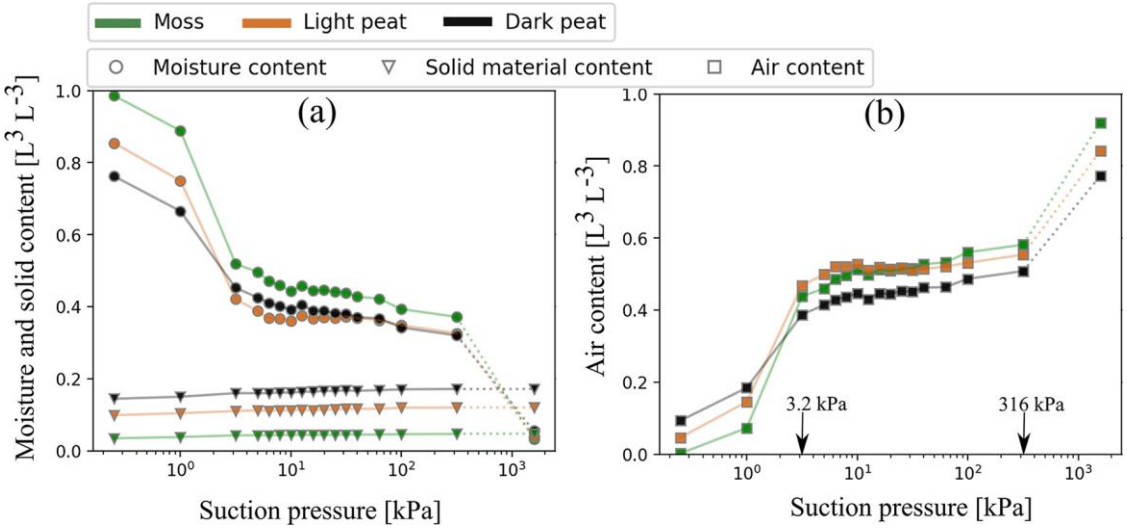
- Retention curves (water and air).
- Shrinkage.

3D imaging (30 images of moss materials and 15 of biochars), to compute:

- Porosities.
- Pore size distributions.
- 3 different wood-based biochar materials.

Imaging results aid in explaining biochar physical impacts.

Results and Discussion (1/3)



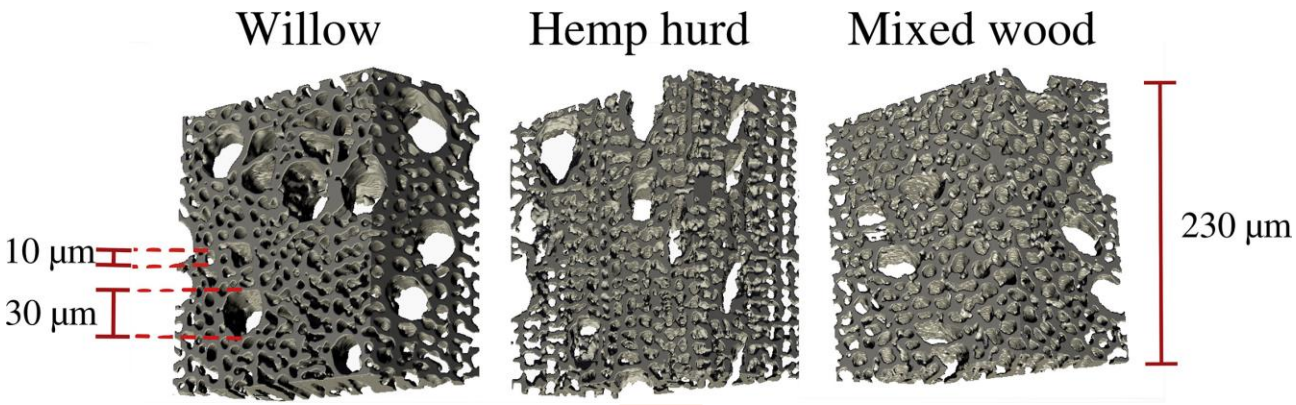
Water and air content in moss comparable to peat.

Suction regions where air content sufficient (≥0.4), amount of easily available water low.

Could the properties be enhanced with biochar?

Figure source: Turunen et al. 2019, Vadose Zone Journal, *18*, 190033

Results and Discussion (2/3)



The biochars consists of pores with sizes relevant for readily plant available water.

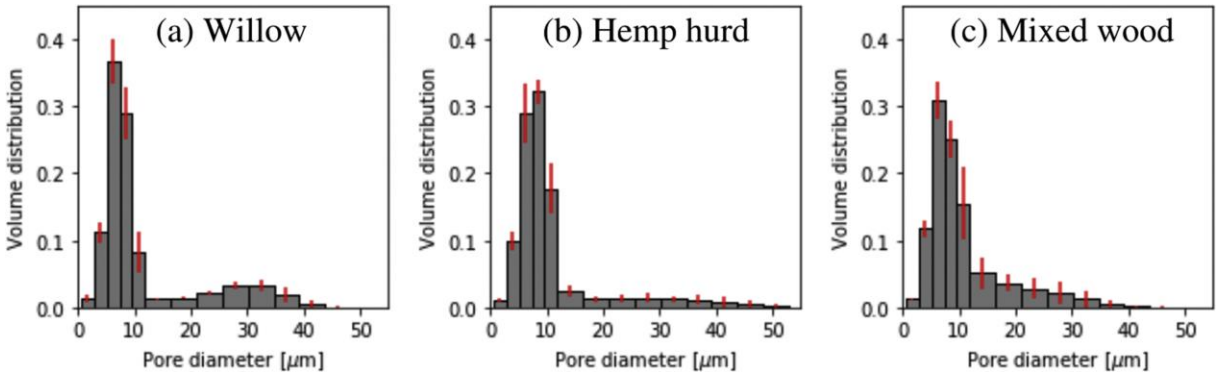
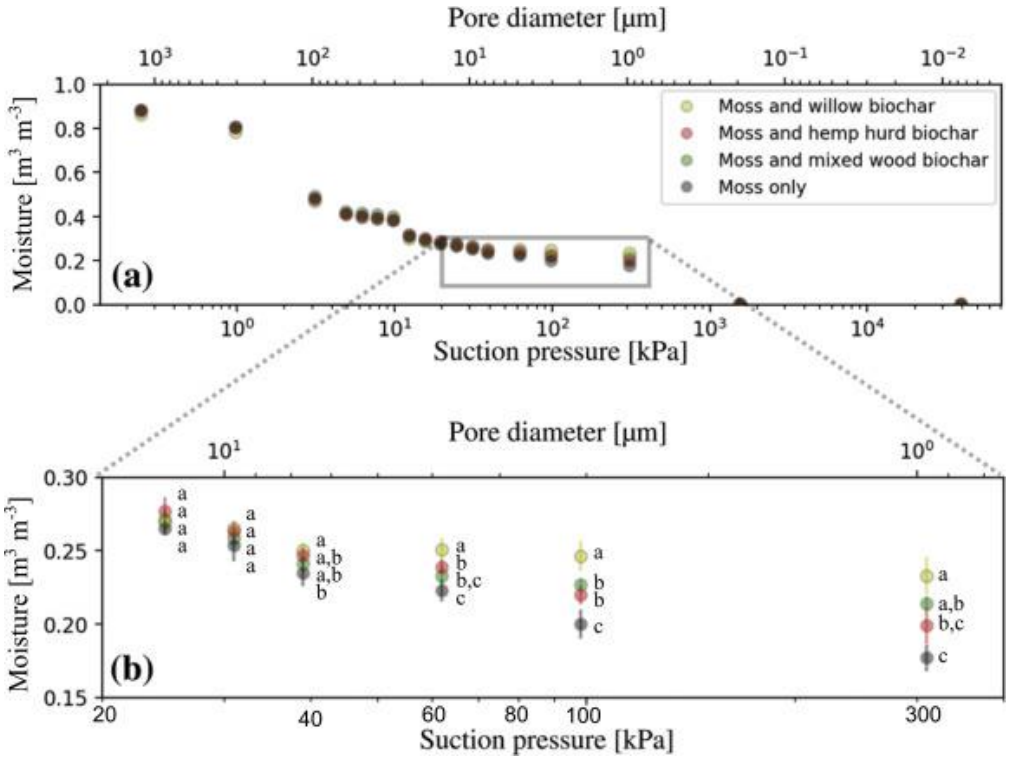


Figure source: Turunen et al. 2020, Biosystems Engineering, 191, pp.96-106

Results and Discussion (3/3)



Biochar impacts were found in the water retention curves in those pores regimes where the char pores were observed to reside.

But why amended samples retain more water?

⇒ Discontinuity of water table between biochar particles and the surrounding material.

⇒ Evaporation- and suction-based drying function differently (evap. experiments not shown here).

Figure source: Turunen et al. 2020, Biosystems Engineering, 191, pp.96-106

Conclusions

- Moss and peat growing media properties comparable.
- Tradeoff between moisture and air content set challenges for organic growing media.
- Pore sizes 2-11 µm dominated in different wood-base biochars due to the plant tissue structure.
- Water retention charateristics of amended media were affected in the corresponding range.
- Effects of water table discontinuity on water retention was shown.
- 3D imaging was needed to understand the water retention impacts.

Thank you!

Those of you interested in 3D imaging feel free to contact me!
mika.turunen@luke.fi

Luke
LUONNONVARAKESKUS

References:

Turunen, M., Hyväluoma, J., Heikkinen, J., Keskinen, R., Kaseva, J., Hannula, M. and Rasa, K., 2020. Quantifying the pore structure of different biochars and their impacts on the water retention properties of Sphagnum moss growing media. *Biosystems Engineering*, *191*, pp.96-106.

Turunen, M., Hyväluoma, J., Heikkinen, J., Keskinen, R., Kaseva, J., Koestel, J. and Rasa, K., 2019. Quantifying Physical Properties of Three Sphagnum-Based Growing Media as Affected by Drying–Wetting Cycles. *Vadose Zone Journal*, *18*, 190033.