TECHNOLOGY TO USE THE BIOMASS OF MEADOW PLANTS AS THERMAL INSULATION MATERIAL AND THEIR THERMAL PROPERTIES

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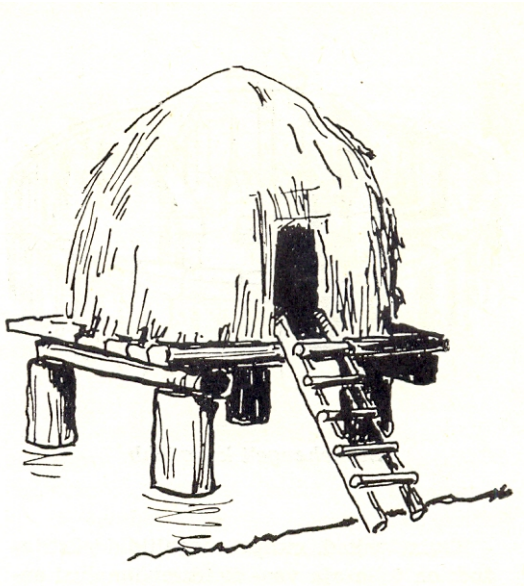
In the history...

…at first our ancestry even built of bio-based materials + reed all the structures,



afterwards they used bio-based materials as hay temporarily for insulation on winter time …

… and to make babies

… but today

The attics/stores are empty or covered with mineral wool…

… and the demographic situation in Estonia goes worsen, maybe of non-comfortable conditions.

The questions...

- If they used hay of meadow plants for insulation in old times, can we do it now?
- What plants are the best for that?
- Where to get them?
- How to avoid the material to set down?
- How to keep the material out of mould and fungi?
- What can be the maximum moisture content for that?
- How to get less consumption of prime energy and cost of construction technologies in total?

... and the idea

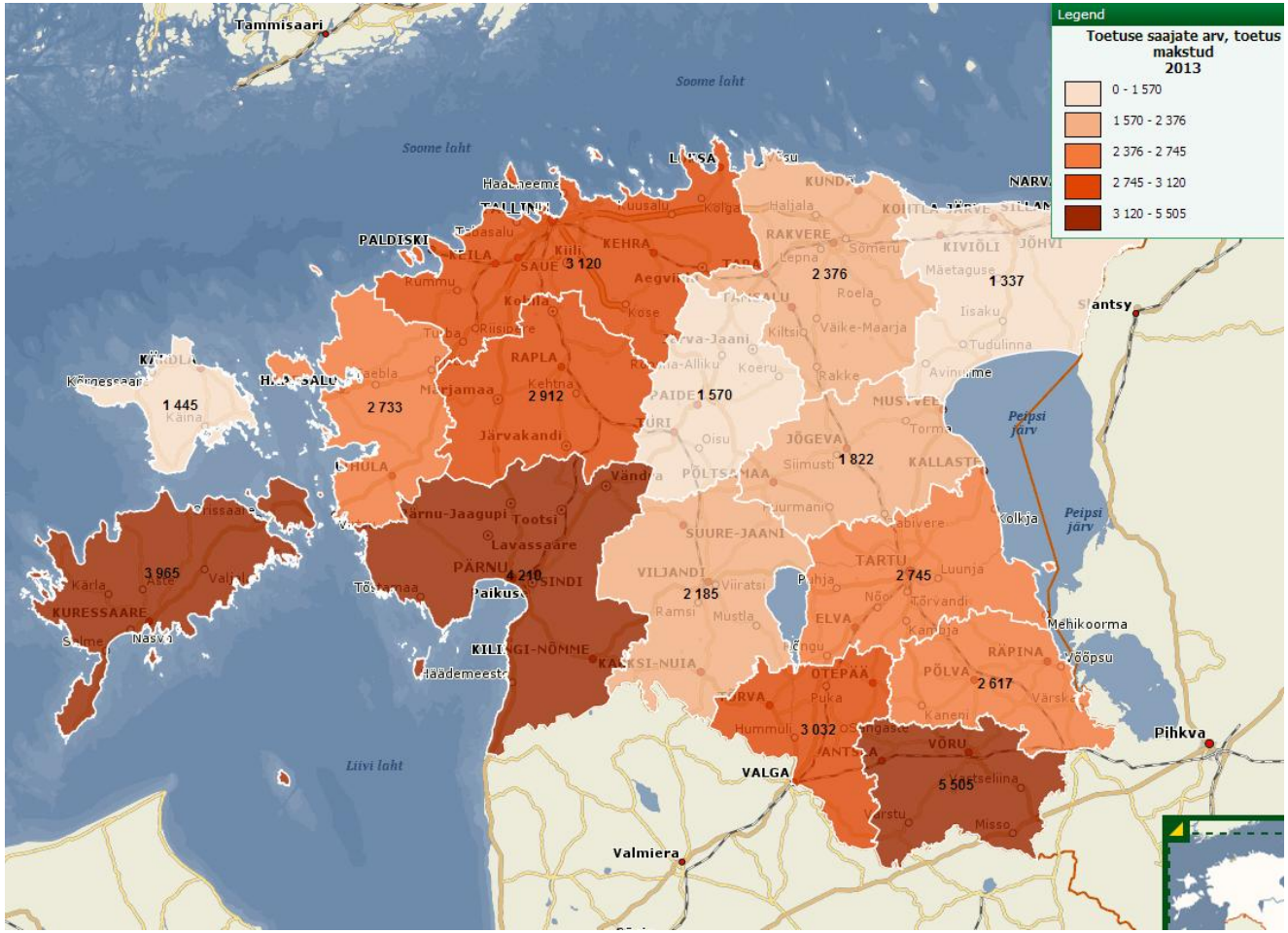
- If we have to use the plants that have vegetative parts similar to timber
- To avoid their drying it have to mow them down in the wood-like conditions
- Where to get them?
- To avoid setting down the material it have to stabilized with something
- The biomass can be used in frame type buildings of timber-based materials in strewing way

The gaps can be filled with glue-mixed biomass…

… and dryed with convectors during the construction time

Where to get? How much does it cost?

The assistance for mowing the meadows not used is from 25 to 238 €/per ha



Amount of farmers in Estonia getting financial assistance from ARIB[1]

1) Estonian Agricultural Registers and Information Board

Without using the mowed biomass we have the problems:

The result of financial assistance is often this

The meadow plants used in experiments

a) From dry habitation

ida kitsehernes - *Galega orientalis*
karvane võõrkakar - *Galinsoga ciliata*
valge hanimalts - *Chenopodium album*
põldohakas - *Cirsium arvense*
valge mesikas - *Melilotus albus*
põdrakanep - *Chamaenerion Spach*
pajulill - *Epilobium*
harilik piimalill - *Euphorbia helioscopia*
põldsinep - *Sinapis arvensis*
keskmine ristik - *Trifolium medium*
kanada kuldvits - *Solidago canadensis*
kesalill - *Matricaria perforata*

a) From humid habitation

päideroog - *Phalaris arundinacea*
villtakjas - *Arctium tomentosum*
laialehine hundinui - *Typha latifolia*
jänesekastik - *Calamagrostis epigejos*
metsvits - *Lysimachia vulgaris*
konnaosi - *Equisetum fluviatile*
metskõrkjas - *Scirpus sylvaticus*
tarnad - *Carex nigra*
angervaks - *Filipendula Mill*
konnaosi - *Equisetum fluviatile*
metskõrkjas - *Scirpus sylvaticus*
päideroog - *Phalaris arundinacea*

The technology:

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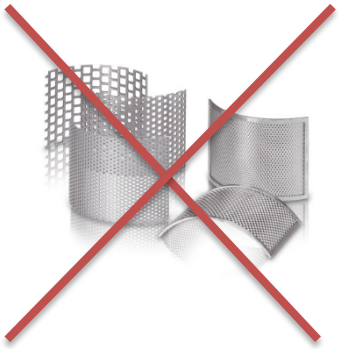

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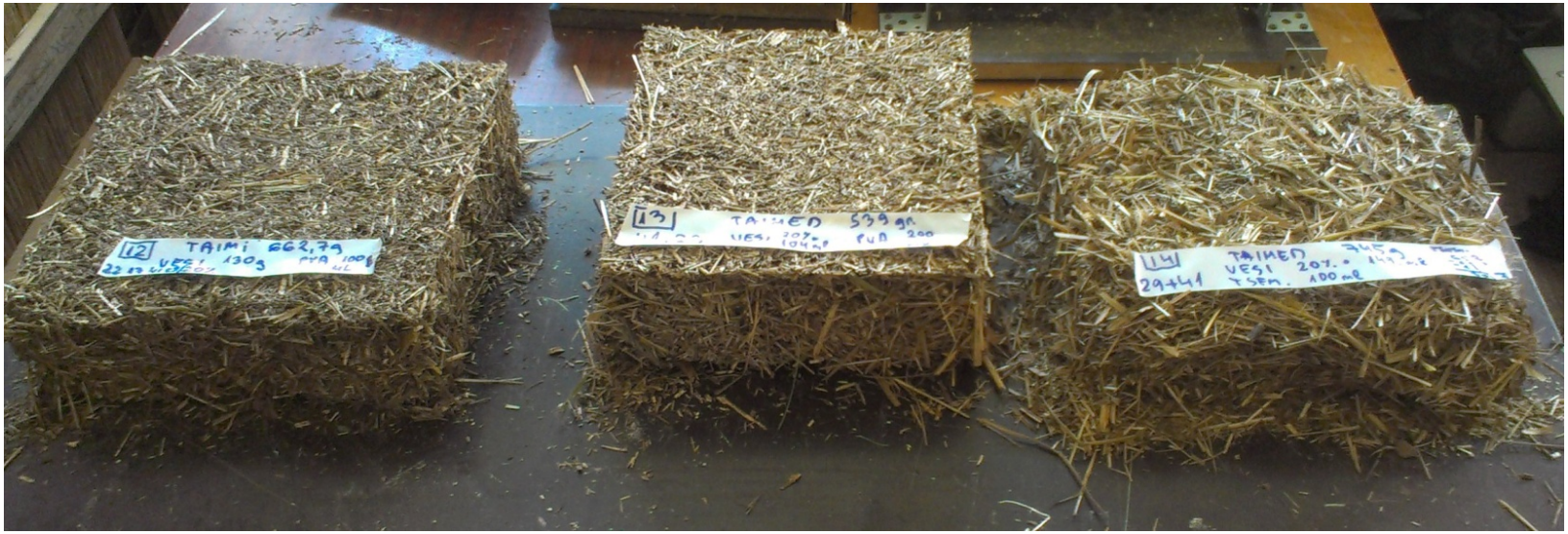


The test specimens after drying

The climate tests results

1. Differences depending on habitat of plants

Habitat	Thermal conductivity λ=(W/m*K)
Meadows	0,04…0,09
Humidity areas	0,05….0,08

2. Biomass of different mixing types

NR	Thermal conductivity λ=(W/m*K)	Density (kg/m³)
1	0,09	86,07
2	0,05	63,68
3	0,08	188,83
4	**0,04**	**70,8**
5	0,05	100,8
6	0,05	112,32
7	0,06	147,22
8	0,06	114,31
9	0,11	312,89
10	0,08	154,79*
11	0,16	460,5
12	**0,05**	**75,3**

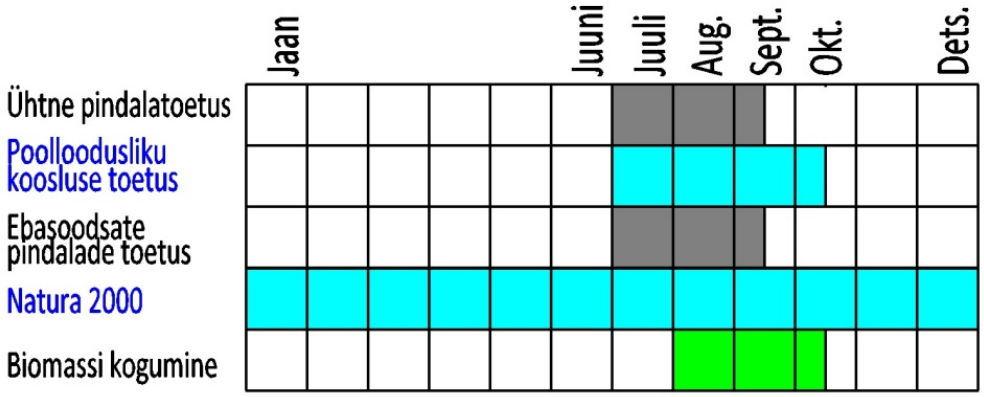
*- PVA glue with too much water

3. Comparison of different insulation materials

Name of insulation material	Thermal conductivity (W/m*K)
Expandable polystyrene	0,033…0,04
Rockwool	0,034….0,05
Glasswool	0,035…0,06
Glasswool as windscreen	0,034
MIX of meadow plants	**0,04…0,09**
Hempwool	0,04
Celluwool	0,041
MIX of meadow plants + hydrosol with PVA-glue	**0,05**
Foamed concrete	0,09

The conclusions

1. Mowing plants



2.Production of insulation material

3.Using the insulation

4. Utilization of insulation

a) composting

b) pluging into the soil

THANK YOU FOR YOUR ATTENTION!

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