GreenContainer – dual innovative: Lightweight construction using *Typha* from rewetted peatlands

- **Paludiculture**: agricultural use of wet peatlands preventing peat loss.
- ***Typha* as construction material:** tensile fibre structures ensure stability and load-bearing capacity, sponge tissue provides excellent insulation properties.
- **GreenContainer**: modular frame elements that can be assembled to form a room.

Paludiculture: biomass from wet peatlands

Typha cultivation

The cultivation of *Typha* (cattail, bulrush or reed mace) in paludiculture creates alternatives to conventional, drainage-based peatland use. This new approach to work with the water represents a return to the original ecosystem functions of near-natural fens. The *Typha* biomass used in the project comes from a 10-hectare pilot site near Neukalen in Mecklenburg-Western Pomerania, which is located in north-east Germany. The site was established by planting *Typha* in a drained fen grassland and rewetting it in 2019 (further information: Paludi-PRIMA and Paludi-PROGRESS). A GIS-based landscape analysis of *Typha* cultivation in Mecklenburg-Western Pomerania (GreenContainer project) identified a high cultivation potential for an area of 7,600 hectares and a medium potential for a further 46,500 hectares.

Harvesting – sorting – drying

To make full use of the unique properties of *Typha* biomass, it is necessary to use non-fruiting plants with thick, unbent leaf bundles. However, adapted machinery is so far only available for harvesting *Typha* as chopped material. Although reed bundles for thatching roofs are already harvested mechanically, further development of the bundling technology is needed for *Typha*. To be used in the project, the plants were cut in November and December with a single-axle mower, a brush cutter, or by hand and loaded into a canoe to be transported to the edge of the field. There, they were sorted and bundled and finally loaded into big bags for road transport. Consequently, the harvesting process still requires a significant amount of manual labour and cannot be scaled up in its current form. The spongy tissue of the biomass retains a high water content even after the plants have matured, so that drying is necessary for storage and further processing. This can be done passively (in airy storage) or actively (with ventilation using cold or warm air).

Seed head formation influences biomass quality

Plants with seed heads (fruiting plants) have firm stems with pithy cores, which makes cutting the biomass more difficult during processing. In contrast, plants without seed heads (non-fruiting) consist only of leaf material with a lot of spongy tissue (aerenchyma). This makes them particularly suitable for use in building materials due to their superior insulating properties. Despite various studies on what influences seed head formation and whether it can be controlled, further research is needed in this area.

Cross-section of fruiting (left) and non-fruiting (right) *Typha* plants

Typha* cultivation near Neukalen, dominated by *Typha latifolia

Manual harvesting and transport by canoe and winch

Sorting and bundling at the edge of the field

Loading into big bags

Photos: Dr. Sabine Wichmann, Uni Greifswald

Typha: Building with air

Further processing into frame elements

The dry whole plants were split first and then mixed with a natural binding agent. Preliminary studies involving over 100 test specimens were conducted to develop the appropriate formula and quantity of binding agent. A formwork measuring 2.40 m × 2.60 m × 0.5 m was constructed for producing frames of the required size. The glued raw material was filled into the formwork, pressed and then the bonded frame element was removed from the formwork and left to dry. Since these steps also involved a great deal of effort and manual labour in the project, mechanisation is necessary to scale up production. Broadleaf cattail (*Typha latifolia*) from Mecklenburg-Western Pomerania proved to be a suitable raw material. However, it is softer and easier to press than narrowleaf cattail (*Typha angustifolia*) from Romania, which has mainly been processed into building materials to date.

Successful 1:1 project

The result was a successful 1:1 project: nine frame modules were made from cattails and assembled into a demonstrator for a single-room building 4.5 metres long. In the future, the GreenContainer could be used, for example, in modular construction for emergency shelters as an ecological alternative to metal containers or for vertical extensions of buildings.

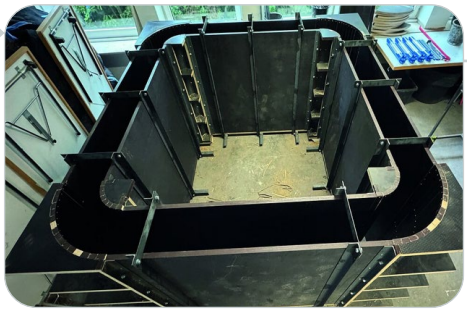
Peatland plants create space

In Germany, 550 million tonnes of building materials are consumed annually, of which only 10–15% are renewable raw materials. Currently, 1,200 kg of conventional building materials such as concrete, stone and steel are used for every square metre of living space. The fibre composite material made from cattails is set to change this: it is load-bearing and highly insulating at the same time – and at approximately 100 kg/m³, it is very light. Previous product developments have been in the field of cavity wall insulation and construction boards – the GreenContainer project has now taken the first step from the board to the room.

Split *Typha* leaves

Natural binding agent

Gluing



Frame formwork (1:1)

Evenly filled formwork

First frame removed from the formwork

Photos: Prof. Manfred Lux, TH OWL

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Photo: Prof. Manfred Lux, TH OWL