Promoting Natural Materials

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Päivi Simi & Outi Tuomela (eds.)

ProNatMat

CENTRAL BALTIC
INTERREG IV A
PROGRAMME
2007–2013

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND
INVESTING IN YOUR FUTURE

TURUN AMMATTIKORKEAKOULU
TURKU UNIVERSITY OF APPLIED SCIENCES

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www.pronatmat.eu

Reports from Turku University of Applied Sciences 141

Turku University of Applied Sciences
Turku 2012

Graphic design by Ulriikka Lipasti

ISBN 978-952-216-301-1 (printed)
ISSN 1457-7925 (printed)
Printed by Saarijärven Offset Oy, Saarijärvi 2012

ISBN 978-952-216-302-8 (pdf)
ISSN 1459-7764 (electronic)

Distribution: loki.turkuamk.fi

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Part 1

ProNatMat

ProNatMat

Promoting Natural Material Know-How

ProNatMat 2009–2012 is an adventure to the world of natural materials in Southern-Finland and Estonia. A wide spectrum of views and thoughts on natural materials is opened through these articles. All things could not possibly be fitted within these covers, but these examples should help you, the reader, to start your own expeditions.

Take a Stand!

Fundamentally natural materials are a philosophical issue. What are natural materials? Basically, every material is originally natural. Even humans are composed of pure natural materials. We need better definitions: ecological materials, local materials, renewable resources, organic materials, recyclability, etc. We cannot forget that everything we do or consume locally also affects globally. We must not forget that we have options. ProNatMat implies working with the knowledge that touches our roots through the millennia. It can also become a way of life, a deliberate alternative to consumer society. By rising up for natural materials – our future – you take a stand for improving your environment and well-being. All the possibilities are just around the corner.

Principles of Permaculture

Even in the beginning of our natural material adventure we noticed that all of the various themes of the ProNatMat project (ecological construction, sharing of cultural heritage, art, design and handicrafts) would merge with the principles of permaculture: taking care of one another (people care), respecting nature (earth care) and fair distribution of resources (fair shares). The concept of "permaculture" originates from the words "permanent agriculture", but it has also reached other fields and is currently interpreted as "permanent culture". This is linked with a great environmental and social responsibility and it emphasises the significance of design and know-how. You are what you do and eat.

The Art of New'n'Trad

ProNatMat is a symbiosis of traditional, economical and recyclable old knowledge and materials with constantly developing know-how and creativity. Collaboration is a strength and many different kinds of people are required to succeed in projects in the future. Natural material filled thanks to all those who participated in the success of the ProNatMat project. We would also like to thank Central Baltic Interreg IV A programme 2007–2013 and the Regional Council of Southwest Finland / Ministry of Employment and Economy for financing this project. Special thanks to the Degree Programme in Sustainable Development at Turku University of Applied Sciences for the wisdom with regard to sustainable things!

Projects begin and end, ways of life and attitudes remain! •

Turku, August 15, 2012
Päivi Simi & Outi Tuomela


ProNatMat
Promoting Natural Materials Know-how
CENTRAL BALTIC INTERREG IV A PROGRAMME 2007-2013
INVESTING IN YOUR FUTURE

Park Trees Are a Noble Local Source

Outi Tuomela & Hannu Parkkamäki, Turku University of Applied Sciences

There are awe-inspiring piles of valuable trunks resting in the wasteland of Koroinen that were brought from the parks of central Turku. The material bank of the LUMO Centre in Turku began with marvelling why old hardwood was being brought to the landfill and cut to firewood. The park trees that are cut down may be old and sick, but are there no other uses for them?

Is it trash or valuable?

People have strong feelings towards trees, especially when the plan is to cut them down. In pursuance of the park renovations in Turku, tall trees were cut down. The events caused change resistance in the city dwellers. Trees are an essential part of the cityscape and a great deal of memories are related to them. In our mental imageries, they are our silent listeners and objects of our admiration. When the trees were cut down, the new life of the trees in the material bank was reported in media. A lot of people were joyed by the thought that our shared asset – park trees – can return to parks in due course as benches or sculptures.

In the time of modern recycling what is one person's trash can be another person's treasure. We are talking about the surplus of trees from which anything can be redesigned. The material bank makes it possible to store, process and recycle all kinds of trees. Elders, cherry trees, plum trees, apple trees and other so called 'trash trees' are suitable materials for specialised carpenters, archaeological technicians and musical instrument builders. Shepherd musician **Minna Hokka** likes to make

Hannu Parkkamäki at work. Photo: Outi Tuomela.

Hannu Parkkamäki: "The Turku Pods". Photo: Hannu Parkkamäki.

whistles from red elderberry, because it is hollow inside. In the language of common people, one could say that it is easy to obtain materials when anything goes.

The recycling of sturdier park trees has been realised in a diverse way in product design at Turku University of Applied Sciences. Design teacher **Hannu Parkkamäki** has planned and realised the reuse of elm logs as visual and functional elements in the parks of Turku. "Nature must be allowed to leave its mark on design", says Parkkamäki. 'The Turku Pods' made from elm trees are used in playgrounds.

Non-fiction writer and artist **Markus Tuormaa**, who is our partner in cooperation in the ProNatMat project, carves items out of yew, guelder rose, buckthorn, hazel, rowan tree and sea buckthorn among others. Nowadays it is quite an unknown form of utilisation. Tuormaa writes in his book *Veistotöitä*: "Working with wood is about experiencing the wood, just like walking, staying and working in a forest is about experiencing the forest." Different trees and bushes can be experienced in different ways. Patterns, gentle and steep curves in annual rings, branches left inside a tree are the inner landscape of a tree for Tuormaa.

The utilisation of park trees and tree species that are in the marginal has been part of the design education at Turku University of Applied Sciences. Every year, various kinds of usable wood are cut down in Turku and in its immediate surroundings. Trees usually end up in the landfill or become firewood. It is respectful towards trees to use them deliberately and utilise them in diverse ways.

We have investigated the chain of further processing for park trees, e.g. how information flows between those interested in park trees and the park division of the city. Information should be given to park divisions on the potential uses of different tree species. For example, they should be informed how to cut trees after their fall so that the wood can be exploited in further processing. Also, information is needed on how to transport wood to a suitable storage so that it can be sheltered from the sun and sawn to billets at the same location. There already is knowledge on storing billets and planks, orthodox drying methods and how to exploit wood as a material bank. The wood stored in the material bank can be used by crafters and designers.

The goal is to achieve a functioning and flowing chain of utilisation for park trees. It would be beneficial to the city as well to show a spot where wood can be transported to, thus shortening the distances and reducing the working hours (ecological viewpoints). The practice would become routine and therefore a level of continuity would be achieved. Deciding who would take care of contacts, wood handling and further processing has been the deal-breaker.

The most usable park trees

The Wych elm

The Wych elm is a common sight in city parks, where one can spot even 200-year-old specimens. Age comes with certain harmful outcomes (cracks, fissures and various diseases)

Timo Takala finishing work with sculpture "Nuorena vitsa väännettävä". Photo: Outi Tuomela.

which are why trees have to be trimmed and cut down from time to time.

The Wych elm and its wood are dense, hard and tough. It is dark-coloured and it endures moisture quite well, just like oak does.

The Wych elm, due to its toughness, is good for bending and carving. In addition, the Wych elm is suitable for a wide range of purposes: furniture, tools, decoration and it is popular wood for woodturning due to its structure.

Trunks and around 20 cm thick branches can be exploited from the elms that are cut down in parks. The trunk is often so robust that it is difficult to handle it without machines. That is why a band saw has been designed especially for trunks. With the band saw even larger trunks can be cut to planks which are easier to handle.

The planks sawn from trunks are usually 50 mm thick. Smaller branches can be split down the middle to speed up the drying process. If the idea is to turn wood and leave it round, it is worthwhile to apply paint or glue on the wood to prevent it from cracking. In addition, wood can be barked here and there so that it will not dry.

The best kind of storage is an airy and shady shelter where the rays of sunshine cannot reach. The elm dries quite slowly and it is a relative compact species.

The lime tree

The Finnish common lime is suitable for woodwork and woodturning. Also, it can be used in the shanks of brushes, toys and miniatures among other things.

Long pieces of good quality cannot be obtained from the lime tree because it is cut often. That is why the trunk is not usually of uniform quality. It is relatively easy to dry wood from a lime tree because the lime tree is quite porous.

The poplar and the aspen

The poplar and the aspen belong to the same family (Populus) and they are similar in their properties. They are excellent for structures that are bended and as raw material for miniatures, among other things. The aspen is also good material for decorative panels. The poplar and the aspen are easy to dry because their structure is also porous.

The oak

The oak is the most versatile tree species because it bends well and it endures moisture and use. In addition, its colour and surface patterning are beautiful. The oak is treated in the same way as the elm is.

Trees that grow in parks are often crooked, forked and other natural forms are also represented. These forms can become sources of inspiration when designing products of trees.

You do not always have to think like a standard carpenter, you may also give room for inspiration. It would be good to have examples of these sorts of 'unique products' so that the objectives would be understood.

Artists utilise park trees

Sculptor **Simo Helenius** received his first delivery of wood from Turku in 1978. The cooperation lasted until 2005. Helenius started woodworking already in the 1960s and his favourite trees were the Wych elm, the common alder and the birch. In addition, he used the poplar for its softness.

The artist looks at the tree and its own qualities first, and after that a three-dimensional work is carved on it. When treating wood, one must take into consideration that it takes a long time for wood to dry. When working with younger trees, Helenius cut them open or he made a dent on the other side

Simo Helenius: Hair fluttering in the wind (made from the base of a birch). Photo: Simo Helenius.

of the tree when it was still fresh. By doing so, the wood did not bend as it dried. Then he closed the dent.

Sometimes Helenius used the whole tree in his works including roots, bases, branches and tree tops so that over 30 works could be made from a single tree.

Sculptor **Miika Karttunen** takes his wood sculptures called *Come una Grande Famiglia* (Like one big family) all over the county. In 2009, the sculptures came from the yard of the main library in Turku to Koroinen for a year. In 2010, they continued their journey to the botanical garden in Ruissalo. Next, they will be on display near St. Henry's Church in Turku.

It is a changing monument where the surfaces of the sculptures which resemble raw wood gain a patina due to the influence of nature and seasons. Inner tensions cause cracks – the tree is alive! At the same time, the family of sculptures travels to ever-changing destinations, whose atmosphere and architecture allow free dialogue with the work. *Come una Grande Famiglia* changes over the years. "We do not know the destination – the journey and the change are the most important matters", says Karttunen.

Come una Grande Famiglia is a silver willow installation consisting of three parts. It a continuation of life to one abandoned and cut tree that was found and worked at a landfill: it is a reconstruction as a family. The parts are called *una bimba* (a girl), *una donna* (a woman) and *un uomo* (a man). The fact that the sculpture is touchable and its authenticity in

Miika Karttunen: "Come una Grande Famiglia". Photo: Outi Tuomela.

terms of natural forms and surfaces are characteristic of the sculpture series. The wood has not been saturated or treated with any artificial additives.

"Wood is an important material in my own works", says carpenter and sculpture student **Kim Jotuni**. "Wood is ecological, beautiful, and diverse but also a challenging material. The challenges are related to working with wood, drying and acquisition. When sculpting wood, one must respect its natural qualities. It is these natural qualities that make wood beautiful and every work unique. It is challenging to get logs that are of good quality and large enough to sculpt. You cannot buy these logs from shops but they must be obtained from other sources. There are good trees growing in the parks that are suitable for sculptures. However, they are in danger of ending up in a landfill, because sawmills no do not usually accept them. The project in Koroinen is crucial, because its goal is to take advantage of these trees and create such a culture in Finland that makes good use of park trees."

Carpentry workshops at LUMO Centre 2009-2011

The ProNatMat project and the Devepark project both operate in the LUMO Centre. They have been using the wood of their material banks as course material. Park trees in Turku have provided materials for clogs, sculptures and Viking chairs. The valuable wood has even served as a building material in outhouses.

The silver willow, being soft and easy to work with, is good material for clogs. In Markus Tuormaa's course shoes were carved from wood. Shoes, that are also very light, are easily put together from fresh and soft wood. "It was like slicing cheese, sensual and fun", said **Kristiina Annala** about her feelings after the course had ended.

Miika Karttunen, the instructor of the "From park trees to sculptures" course, said that the material basis for the whole course was park trees or parts of them, which transformed to a work of art through the creator. It was about a metamorphosis that can be found in form and matter, and then thought and

Kim Jotuni: "The Past". Material: aspen. Measures: height 30 cm and width 20 cm. Photo: Kim Jotuni.

Kristiina Annala: Wooden shoes. Photo: Outi Tuomela.

Sculpture workshop in Koroinen 2010. Photo: Outi Tuomela.

work gave birth to it. This is how the eight sculptures were made from park wood. They ended up in their old habitats in an exhibition in the park of the Turku Cathedral.

"Cloven hoof" fences

In the workshop called "*Cloven hoof" fences* (sorkka-aita in Finnish), led by **Markus Tuormaa**, they used so-called trash wood collected in the city. In other words, it was young spruce that was removed during a thinning in Hirvensalo. Traditional fences (without the binding twigs) were built in the field of Koroinen to landscape and crop annual farming and perennial farming from each other. The structure of this fence is very simple: the fencing is placed so that the two poles that are set across support it and then another pair of poles is propped on the fencing. A double number of poles were needed in comparison with the fencing.

Planks of elm were suitable materials for the Viking chair course. Two planks were joined by placing the carved head of one plank to the other. And so a nice and comfortable chair was made.

Markus Tuormaa taught to make "cloven hoof" fences in Koroinen. Photo: Outi Tuomela.

Vikings with the Viking chairs. Photo: Outi Tuomela.

Bourgeois Gotskalt's better plate

For instance plates can be made from park trees. Objects that were turned became more common in Finland in the 14th century and the tradition is continued in **Toni Saikkonen**'s workshop. His motto is that materials should not cause problems. He crafts objects using all kinds of local and natural materials. Saikkonen has studied medieval methods and he likes to make wooden dishes that were common during the period. *Bourgeois Gotskalt's better plate* is reconstructed from an authentic medieval plate which was used at feasts. The plate was found near the Turku Cathedral.

Toni Saikkonen: "Bourgeois Gotskalt's better plate". Photo: Toni Saikkonen.

Artist **Merja Markkula's** *Independent Love* was made from wood which was collected in her own yard and it was sawn at a sawing event in Koroinen.

The 'Independent Art' series was part of the Turku 2011 Culture & Exercise Central Park project. In the work *Independent Love* Markkula used decayed goat willow and birch that were cut down from her own yard. The wood was red-coloured because it was treated with a mixture known as "the Roslagen mahogany", which consists of linseed oil, turpentine and tar.

Speculating the future of the material bank

Both Devepark and ProNatMat projects end in 2012. The plan is to continue the material bank in Koroinen through entrepreneurs, a cooperative and the design education at Turku University of Applied Sciences. There is plenty of old material to be removed in the future in the parks of Turku for the diverse material bank of the LUMO Centre.

The trip of park trees to LUMO Centre has included several meetings and agreements since 2008. Cooperation has continued between different projects as Lumo, ProNatMat and Devepark projects. Turku City Council has ordered some sculptures for public places. For example, two pieces of art made out of a park tree from the Old Great Square have already been placed in the Dream Park in Turku. Five pieces are going to the beach of Saaronniemi and one is going to Turku University's entrance hall at the Brahea Centre for Training and Development. Also the Cathedral School of Åbo wanted their own sculpture made out of elm tree from the Porthan Park. In the future, the idea is to continue the same way and deliver pieces of furniture and sculptures in cooperation with Turku City Council as long as the financing is worked out. •

Merja Markkula: "Independent Love". Photo: Vilppu Piirola.

Project Work Skills

for Students with Innovation Pedagogy

Tanja Hallenberg, Turku University of Applied Sciences

The ProNatMat project is carried out in the faculty of Technology, Environment and Business (TEB) at Turku University of Applied Sciences (TUAS). TEB is a multi-disciplinary faculty where teaching, research and development are interwoven. Innovation pedagogy plays an important role in the operations of TUAS. Project hatchery is one of the educational and learning methods based on innovation pedagogy. Project hatcheries have been organised since 2008 and they are usually linked with R&D projects at TEB.

Project hatchery studies are a compulsory part of first year studies at TEB. The students participating in the hatchery comprehensively learn the theory of project work by participating in projects. The goals of the project hatchery are that students:

- explore research oriented working and studying methods
- learn self-directed working methods
- learn to work in a multi-disciplinary group
- get to know other subjects that are studied at TEB
- practise networking
- learn project work
- improve performance, interaction and teamwork skills.

The project hatchery of the ProNatMat project was carried out in the autumn of 2010 concurrently with 30 other hatcheries. In all the hatcheries students worked under the guidance of a teacher and a student instructor. Because there was a shortage of student instructors, some hatcheries, including the ProNatMat hatchery, shared the student instructor with another hatchery. Student instructors are senior students and get 3 credits and salary for their work. Students in the research hatchery get 3 credits.

Students of TUAS built a stall for the Christmas Market and hold Christmas crafting activities for children. Photos: Outi Tuomela.

General objectives and measures have been defined for the project hatchery. In addition to the general objectives, each hatchery draws specific objectives and commits to them. In addition to carrying out the specific project, the project hatchery includes a set of mandatory tasks. A project plan and a final report must be compiled. In addition, each hatchery creates a poster on their project, and it is enrolled into an inter-hatchery poster competition. Each hatchery will also compose a hatchery presentation that will be ranked likewise.

In many ways, the ProNatMat project hatchery was a novel experience. For most first-year students, the project work in general, and the project hatchery in particular, were first of their kind. Also for the ProNatMat project, the hatchery was the first of its kind, although there had already been several sub-projects within the project. The project hatchery was also the instructor's first.

There were 16 students in the ProNatMat project hatchery, 11 of which were engineering students. The remaining five students represented degree programmes in sustainable development, design and fisheries and environmental care. The gender ratio was not even, either, with four women to 12 men. The project hatchery course was completed by 15 students, as one of the students dropped out early on during the course.

Scheduled hatchery meetings were held at 8.15–11.45 on Friday mornings. The time was rather challenging, because informal student events are usually organised on Thursday evenings. Especially during the first meetings the attendance was high, but as the course progressed, punctuality degraded.

There were in total 11 ProNatMat hatchery meetings during the course. During the first few meetings some practical issues and the theory of project management were covered with the lead of the teacher and student instructor. After the basics, students gathered mostly among themselves, but occasionally general meetings were held to analyse progress and the phases of the hatchery.

The first hatchery meetings proceeded with the lead of the instructors, but as the theory and practical issues were covered, the students managed to handle meetings themselves. In the beginning of the hatchery work, the students divided into groups and chose their personal roles according to what they wanted to do. There were some notable issues in the role differentiation. Two women rose to lead the male dominated group as the conscientious women were elected or chose themselves the most arduous roles of chairperson and secretary. The choices were also somewhat affected by the field of education: e.g. civil engineering students took the task of designing and building a construction related to the project and an automotive and transportation engineering student took the task of transporting stuff.

Highlighting natural materials and the ProNatMat project

The project manager and coordinator of the ProNatMat project briefed the students about their project which was natural material related and designed to bring ProNatMat project out to the traditional Christmas Market at the Old Great Square. The project leaders gave the students a chance to expand and modify the subject, but the students preferred adhering to the client's wishes.

After the assignment was given, the students compiled a project plan. The goals of the project were laid out as the advancement of natural material know-how and the use of local natural materials and natural material know-how. The project plan acted as the guiding principle throughout the project hatchery.

In addition to the target objective of participating in the Christmas Market, the students outlined the design and construction of the lean-to stall, organised crafting sessions and created a survey.

Students devised a lean-to stall for the Christmas Market that was used to hold Christmas crafting activities for children. They also planned natural material related fact sheets for the stall and a survey for market visitors. To encourage people to answer the survey, one of the hatchery students had participated in a ProNatMat straw workshop and created a big yule goat that was given as a lottery prize for those that had given their contact details along the survey.

The Christmas Market at the Old Great Square is held annually during the four Advent weekends. The ProNatMat project hatchery participated in the market during two weekends (27–28 November and 4–5 December 2010). The weather in Turku was wintry and cold. The market held outside required some resiliency of the hatchery students as they were on duty at the stall each in turn. Pointed hats thought up in the hatchery and sewn by one of the students finalised the presenters' outfits.

Survey

People's interest in natural materials was clarified with a survey. One of the goals in the survey was to get people to the stall and give adults something to do while the children crafted.

In addition to the basic background questions (age, gender) there were five natural material related questions. Students also helped in doing a preliminary analysis of the results. There were a total of 190 responses collected. Two thirds of the respondents were women and almost half of them were between the ages of 45 and 64.

Based on the survey the students analysed that a typical participant in a natural material course is a 55–64 year old woman. The course format could be workshop and subject wool or flax. Other possible materials could be willow, clay, birch bark or straw. Also informing the people of natural material know-how and related courses e.g. at the Christmas Market was considered an efficient channel.

Survey data remained at the hands of ProNatMat project and it will be possible to utilise them later on. However, the students did not realise that the utilisation of the survey data would be considerably easier, had the information been entered into a spreadsheet instead of a text document.

The particular benefits of the survey were the collection of the data for the project and accumulation of experience for the students. The designing, compiling, realising and analysing of the survey trained the students in research oriented data collection.

Final remarks

The students had an opportunity to practice project work as part of their studies, get to know students from different fields and research activities right at the beginning of their studies. All students might not appreciate facing the problems related to project work in a safe environment. The uncertainty related to the beginning of the project hatchery made them somewhat nervous. In the future, the students will hopefully notice that before setting targets and goals and before committing to them there are always all kinds of uncertainties in projects.

Some of the students were not interested in the subject of the project. However, the goal of the project hatchery studies is to teach basics on how to realise project work and how many different sets of skills are needed to carry out a project. When a student has learned the basics of project work, it is in the future easier to concentrate on the substance of the project.

The feedback system for project hatchery studies still needs development. The feedback given by the students on each other and themselves suggests that the evaluation methods are not appreciated or capitalised on. The evaluation seems as a necessary evil that exists only for gaining the pass grade. •

Jonna Pohjonen: Colour Pencils / Flux Aura - Fluxations 2009.

The Story of the Sounding Reed Bales

Sonic Seascape Terrace in Turku 2011

Outi Tuomela, Marianne Decoster-Taivalkoski & Hanna Haaslahti

The Curated Expedition to the Baltic Sea is an art project organised by Capsula in the framework of Turku 2011 European Capital of Culture programme. It comprised five new art works, all related with the natural phenomena and the state of the Baltic Sea.

One of the artworks produced was *Sonic Seascape Terrace* by three artists, **Marianne Decoster-Taivalkoski**, **Hanna Haaslahti** and **Alejandro Montes de Oca**. In this work hydrophones transmit natural and man-made underwater sounds, composed in real time, to be listened on two waterfront terraces in Koroinen and Ruissalo.

The common reed as a material of an environmental artwork

As a result of eutrophication the common reed has become a serious problem along the sea shores. During winters, dry reed is harvested in areas where perennial material is chosen to be cut to improve water quality and currents or as a nature conservation action. This reduces the annual methane output produced by renewable and decomposing reed mass. Reed harvested during winter from the top of ice is well suited as construction material.

Winter 2010 was snowy in southern Finland and suitable harvesting equipment was not found in Finland. Estonian Rooexpert Ltd. came to harvest reed e.g. from Mietoistenlahti as part of conservation work on the Natura 2000 area. The harvester is built from the body of a Swedish Armed Forces caterpillar and

Winter of 2010 was snowy in southern Finland and suitable harvesting equipment was not found from Finland. Estonian Rooexpert Ltd. came to harvest reed from Mietoistenlahti as part of conservation work on Natura 2000 area. This reed was used in the Sonic Seascape Terrace. Photo: Outi Tuomela.

an Italian cutting head. This machine allows the harvesting of reed even when there is plenty of snow on top of ice.

The ProNatMat project sored the reed harvested in the winter of 2010 in Koroinen. Part of the harvested reed was baled with a Welger baler for various future construction experiments. The reed bales were also used for the Sonic Seascape Terrace in Koroinen.

The reed bales were made with help of local farmer Mr. Hartikainen and his Welger bale machine. Photo: Outi Tuomela.

Application of clay begins with the mixing of clay and water. A certain amount of water is put into the mixer and crushed clay is added. The solution is mixed at high revolutions until all the clay has been dissolved. Photo: Outi Tuomela.

Local reed loves local clay

The clay needed to coat the reed bales was dug up the previous year from Villa Höyrylinna estate in Parainen. Winter frost causes the clay to crumble and become more soluble. Clay can be crushed also with a sledgehammer. Fresh clay can also be used as long as it is sliced into thin slices that dissolve faster in the mixer.

A horizontal mixer is best for making clay plaster. First the clay is mixed with water until it becomes slurry. Then fibrous material, such as horse manure, paper or reed chaff, or wood chips, is added to get the final composition. The mixing order can be changed according to the qualities of the materials used. Wood chips, for example, harden the plaster strongly so it is better to add it last. Clay plastering was performed by an international group of volunteers.

The Sonic Seascape Terrace

Sonic Seascape Terrace is a site-specific project, which explores the connections between the waterscape and sounds emanating beneath its surface. Two terraces, belvederes, constructed on the shorelines of the City of Turku, are accompanied with a real time soundscape composition, distributed on the terrace from the hydrophones hidden in a nearby body of water. The view over the waterscape is framed from the terrace to the place where a number of hydrophones are located, so that a viewer/listener standing on the terrace can link the seascape and soundscape to each other. The terraces form an exploration into the interaction between the sea and the land, how the sea is reflecting human activities and how city sounds merge into the underwater soundscape. At the same time, it should sharpen our senses to make observations about our surrounding environment not only with our eyes, but also with our ears. The streaming sound signals question the beauty of "vista mare" opening from the terraces by revealing processes invisible to the eyes. In Koroinen the soundscape emerges from Halistenkoski and its fish road.

Common reed has excellent acoustic qualities, thus making it a suitable material for sonic structures. It is also a local material in Koroinen. Both walls of the terrace have 20 minispeakers immersed inside the common reed bales to diffuse the soundscape composition. The walls are plastered over with clay and little holes punctured in the inner walls for the sound to reach the listeners. All the technology is hidden from view. The clay wall is a comfortable surface to lean on and listen to the sounds moving and vibrating inside the terrace. Media artist Hanna Haaslahti was responsible for the design of the pavilions, while sound artist Marianne Decoster-Taivalkoski designed and realised the sonic concept of the installation and composer Alejandro Montes de Oca created the realtime composition system. **Outi Tuomela** consulted the artists in the reed and clay construction, and the general coordination and production was directed by **Merja Markkula**.

Underwater soundscapes

What is the correlation between the underwater soundscape and the way the sea looks on the surface? Sound can travel many kilometres under water, so it is noisy down there though on a sunny day the surface of the sea appears as a calm and peaceful entity. When we talk about the sea, we tend to refer only to what is happening on the surface level. However, underneath there is a secret world, of which we know very little of. The project investigates that world with the aid of sound, which is the best communication method in water.

Contemporary western lifestyle produces huge amounts of waste in various forms. The most intangible ones are noise and light pollution. While not producing anything concrete to deal with they have a direct impact on human senses and our behaviour. Our daily soundscape is filled with different kinds of electrical devices humming and beeping, machines producing a constant background noise, which our hearing blocks out to be able to distinguish sounds that matter. Normally we are not aware of this, but some people show strong physical symptoms, coined as electric allergy. Noise pollution causes stress and fatigue, and its source is difficult trace.

Soundscape studies and acoustic ecology form the scientific background of the project. Acoustic ecology is a rather new field of research dedicated to the study of the sound-based social interactions of living organisms. The composer and researcher **R. Murray Schafer** created the term 'soundscape' in the 60's in parallel to the term 'landscape'. Soundscape refers to an acoustic environment in which listeners are immersed; it includes natural acoustic elements as well as those caused by human activities in a specific place in the landscape. In our project the contradiction between the soundscape and the landscape should raise thoughts about the invisible changes happening under a naturally serene surface. Even if the seascape still looks harmonious and beautiful, its polluted and industrial soundscape prefigures something really different.

Soundscape composition usually implies that the original sound sources remain recognisable to the listener. Underwater sounds are not, however, so well known by the audience and it is sometimes difficult to relate the sound to its cause while it is not visible on the surface of the water. Also some sounds very typical to the location can emanate during a very limited period of time. Our approach as composers is to emphasise the specificity of the soundscape of each location. To do so, we select the sound material through the choice of precise points of hearing where the hydrophones were set. Real time composition reinforces the chosen acoustic qualities of the sound to reveal its originality and the zones where sounds overlap with each other. A parallel timeline is created to the real time transmission of sound events occurring in the water – an imaginary timeline which resonates sound memories of the location. •

Marianne Decoster-Taivalkoski and Alejandro Montes de Oca are installing the hydrophones in the fish ladder at Halistenkoski, Koroinen. Photo: Thomas Söderström.

The clay plastering was made by the Finnish branch of Service Civil international, KVT Finland. Photo: Thomas Söderström.

The grey clay-covered walls of the structures are constructed from bales of common reed and are perforated by small holes through which the sounds escape. When you stand inside a pavilion, you can hear what is going on beneath the surface of the water. Speakers embedded inside the walls of two structures transmit the real time recordings of underwater microphones, hydrophones, positioned in the river. Photo: Thomas Söderström.

Project Team:

Sound concept: Marianne Decoster-Taivalkoski
Visual concept: Hanna Haaslahti
Real time composition and application design: Alejandro Montes de Oca with Alejandro Olarte
Reed and clay expertise: Outi Tuomela/ProNatMat project
Curating and mediating: Merja Markkula and Ulla Taipale
Produced by Capsula as a part of the programme European Capital of Culture, Turku 2011
In collaboration with the Centre for Music & Technology at Sibelius Academy, Turku University of Applied Sciences, ProNatMat project, LUMO Centre Koroinen, Turku, BalticSeaNow.info, AVEK (The Promotion Centre for Audiovisual Culture in Finland), the Arts Council of Finland and Villa SteamCastle.

Location: Turku, Finland
Duration: 28. May - 1. September 2011

www.capsulaexpeditions.com

Special thanks to Jorma Lehtelä, Matias Kuttila, Aurajokisäätiö, Hartela Oy, The Finnish branch of Service Civil international, KVT Finland, and many others.

Aquatrio; Marianne Decoster-Taivalkoski, Alejandro Olarte and Alejandro Montes De Oca performing in live concert during Koroinen Village festival in 2011. Photo: Outi Tuomela.

The Sonic Seascape Terrace in Koroinen offered an audiovisual scenery for river´s underwater soundscape. Photo: Ulla Taipale.

ProNatMat Summer Camp

Saaremaa Lime Days 24 to 27 August 2010

Ave Timberg, Information Center for Sustainable Renovation – SRIK

The study trip of the ProNatMat project to the largest Estonian island, Saaremaa, took place in August 2010. The goal of the trip was to learn about the traditional methods of lime-making and the production of other natural materials in Saaremaa.

On 25 August, we organized a public seminar for local people and heritage protection officials. The name of the seminar was *Traditional Local Materials of Saaremaa and Restoration*. We held the seminar in the Kaali Visitor Centre near the famous Kaali Meteorite Crater Field.

The speakers at the seminar were Saaremaa heritage protection and city officials, as well as local businessmen and builders. The representative of non-profit association Väinamere Uisk delivered a very interesting presentation. Local lime producer and expert **Priit Penu** introduced the history and technology of lime production on the island. His

Photos: Sanna Andberg.

dream was to create a theme park about lime on the historical lime production site in Lümanda Municipality, Saaremaa. After the seminar we took a look at the Kaali meteorite lake and the meteorite and lime museum.

The Kaali Meteorite Crater Field in Saaremaa is the most unique natural object in Estonia and also known as the most interesting crater field in Europe. Kaali meteorite is the last giant meteorite to hit a densely populated area of the world. The approximate time of the impact of the meteorite – 7,500 to 7,600 years ago – was determined according to the sedimentation of soil and rock particles in the surrounding lakes and fens. The place is a well-known sight and people from all over the world come to see it. It has even been thought that there is a connection between the Kaali meteorite and Saaremaa, and the travels and writings of the Greek geographer and explorer Pytheas from the 4th century BC, where he talks about Phaeton, the son of the Sun who fell down to earth. There was probably an ancient sacred place on the shores of the bank later, and it is likely that the lake was also used as a place of sacrifice. The Kaali Meteorite Crater Field is also the reason why Saaremaa became an important destination for Christian pilgrims of the world in the 13th and 14th centuries. A visitor centre with a museum can now be found on the lakeshore. It is a place definitely worth visiting.

The seminar was followed by a tour: we visited the traditional Saaremaa windmills in Angla. The historical local and Dutch-style windmills from the 19th century can now be admired as museum exhibits. Local businessmen and craftsmen have used European Union support to restore the old windmills and to build a Cultural Heritage Centre, where everyone can learn traditional methods used in various handicrafts. For us, the most interesting thing was the building of the Cultural Heritage Centre, as it was built using recycled dolomite and limestone as local natural building materials.

At the end of the tour, we saw how organic soap is made on Good Kaarma Farm in Kuke Village, Kaarma Municipality. This is a small family business, which uses traditional and environmentally friendly materials and methods to make soaps and other organic cosmetics.

The third day of the trip, 26 August, was the day of practice or lime day.

In the morning we went on a tour of Tagamõisa peninsula: Undva cliff and Suuriku cliff. We took a look at limestone as

it appears in the landscape and limestone washed by the sea. Thousands of years of nature preserved in limestone is breathtaking and beautiful.

The tour was followed by an excursion, where we learned about the local limestone theme park project. It is a very interesting and brave venture. The roof of the old dilapidated wooden prayer house of the Brothers Congregation was in bad shape. The abandoned building had stood in the forest for many years and the idea of renovating it was truly amazing. The man behind the idea, Priit Penu, explained that the building would become the training and seminar centre of the limestone park in the future. The building looks really nice now and something that we thought was impossible has actually happened. The house has been restored and several training and education activities will soon be available there.

It was equally interesting to see the historical lime burning kilns and quarries in Lümanda. Many lime manufacturers and their families were exiled as a result of the Soviet occupation. The kilns were abandoned and most of them fell into ruin. AS Limex started manufacturing lime by the traditional method at the beginning of the 1990s. The company is now the best lime manufacturer in Estonia and the quality of its products is better than the quality of competing foreign products thanks to the traditional methods used.

At the end of the tour we were shown how to use lime plaster and make lime paint. We also compared the usages of cement plaster and lime plaster, and building traditions, and we learnt about the most common building mistakes.

In addition to lime production and lime products we were also able to see how tar is burned using traditional methods, as local family company Saare Tõrv OÜ showed us different technologies and products. Tar burning is also partly a form of recycling, as the pine stumps left in the forest after felling are used to make the tar. The stumps "sweat out" the resin, which is actually wood tar. Tar is used in building to cover boats, wooden houses, ropes and roofs. Wood tar is absorbed by the wood, which protects it against moisture, rot, mould and dry rot. In older times tar was also used for medical purposes. Several skin problems (rashes, frostbite, infection, infected wounds, scabies, etc.) were treated with a mixture of tar and fat, and it also helped people suffering from joint pain. Some tar was also put in the water used to create steam in the sauna, as it made it easier to breathe and helped get rid of respiratory diseases. Pine tar was even dripped on an aching tooth. Pine tar contains natural turpentine, which is still used to treat lung diseases. However, contemporary research has shown that inhaling large quantities of tar is harmful rather than good, and this is why tar is no longer used indoors. However, when used in small quantities and diluted, it is still an effective ingredient in cosmetic products and shampoos. The people on our study trip all appreciated the qualities of tar and many of them bought a little pot of tar as a souvenir from the elderly tar-maker.

Late in the evening we took part in practical lime burning training in the Lümanda lime quarry under the instruction of Priit Penu. We started with a brief training session, where we were given some important practical knowledge that is needed to mine, burn and slake lime. At the same time we took part in an eight-hour shift in the burning cycle that lasts for several days. It was the night shift, because the instructor told us that an August night with a full moon is the right time to learn how this is done. And she was right. At times it felt like being on top of a volcano. The kilns are located in the middle of a pine forest and the beautiful silver blue light shining through the pieces of limestone made us feel like we were sitting by a witch's cauldron. The gatherings of witches described in fairy tales look so much like ancient lime burning. The heat was immense and the view was beautiful, so we thought about a possible documentary, which would help us show this to people and share it on a broader scale. The picture of heavy limestone turning into a light ashy powder and then forming a paste as it comes in contact with water is worth seeing. The documentary has now been made and also translated into Finnish. The film can be viewed via our project partners;

information is available on the project's website and can also be obtained from the Information Centre for Sustainable Renovation in Tallinn, Estonia, and the LUMO Centre in Turku, Finland. One of the dreams of lime experts and our project is to have the film shown and presented on both Estonian and Finnish television.

On the last day of the study trip we went on a tour of Saaremaa and Muhu Island. We saw how reed material was produced in Suur-Rahula Village, Orissaare Municipality. The company is Roomaja OÜ, one of the best-known natural insulation material producers in Estonia. Different production technologies and methods were demonstrated to us, as well as how to recycle reed waste in agriculture and gardening.

We also visited the company Väinamere Uisk MTÜ in

Koguva Village, Muhu Island. The same company had made an interesting presentation on the seminar day of the study trip and we therefore wanted to pay them a visit. We could observe the traditional process of local shipbuilding, where the building practices of our ancestors and manual work are still used. The cultural heritage programmes and project of Väinamere were also introduced to us.

The last destination of the trip was the old smithy farm in Ridaküla, Muhu. The current owner of the farm is interior architect **Inara Tõugjas**, who has renovated the farm in a traditional and environmentally friendly manner. Clay has been used in the restoration of the old smithy and sauna, which is unusual in the region. At the same time, it is a traditional Muhu farm, where you can see a local interpretation of the traditions of various countries across the sea. The traces of the building traditions of various eras and the interesting details of the barn were really exciting to see. The use of national colours and patterns in landscaping and building was also very interesting. Stone fences are a unique sight in the "street architecture" of Muhu Island.

This trip was truly educational and we learned a lot about the use of natural and traditional building materials in just a couple of days. Keeping old traditions alive is not important for building alone, but it also reflects a nation's cultural history in addition to the history of building.

These materials and using them have been a significant source of income for the islanders. Using local materials on the island is also important, because transport, i.e. ferry traffic, depends on the weather and is also an expensive method of importing goods. •

Soup Town Goes Port Arthur and Vice Versa

Supilinn in Tartu and Port Arthur in Turku agree upon cooperation to advocate for wooden houses

Kirsi Äyräs, South-Western Finland's Estonia Center

Port Arthur, alias "Portsa", is a district in Turku known for its old urban wooden houses and cosy courtyards. Supilinn, which is "Soup Town" in Estonian, is "a village inside a city". Supilinn is a green corner of wooden houses and gardens in Tartu. Both places are close to city centres, yet they are apart from the hustle and bustle of the cities. In fact, they are located in the best spots in order to preserve old wooden house culture in the cityscape. The residents of both areas want to defend their own blocks, and they hope that the old houses will remain there in the future as well. They want to preserve the blocks in their original use, as living parts of the city.

The ProNatMat Project joins Port Arthur in Turku and Supilinn in Tartu together. One of the goals of the project is to advance the use of natural materials in construction. The Turku Info Point in Tartu serves as an agent for the cooperation between the cities. Jaava Masing, the manager of the Info and head of the ProNatMat Project in Tartu, sees many opportunities for the future in the cooperation:

ProNatMat has participated in Supilinna Days twice and in Portsa Days three times. Restorers have repaired old windows and taught people to repair themselves. Photo: Jaana Oikarinen.

"Port Arthur and Supilinn share some challenges. Restoration of old buildings is a topical and important matter for both. The same applies to many questions regarding city planning. The originality of the neighbourhoods is a value itself, and both neighbourhood associations are working hard to preserve the spirit of their neighbourhoods", she says.

"The best kind of cooperation begins with personal contacts, and the idea is to create them between Tartu and Turku through the ProNatMat Project", says Masing.

The building of apartment houses menaced Port Arthur

Established in 1972, The Port Arthur Association is already celebrating its 40th anniversary, whereas the Supilinn Selts have been operating for ten years.

The Port Arthur Association was founded during a time when the area and its old wooden houses were in danger of demolition and new buildings. A new city plan was already being planned when the residents woke up to defend their blocks and wooden houses. Petitions and campaigns proved fruitful and Port Arthur was given a protective status in urban planning.

Many of the housing cooperatives in Port Arthur have celebrated their 100th anniversaries recently. Histories and stories told by the residents have been collected and colourful narratives have been published in both books and on the website of Port Arthur Association.

Port Arthur Association is also an active organiser of neighbourhood events. Street markets, flea markets and concerts are held in May. Yard sales are in August. The idea of the yard sale is that residents organise sales and events in their yards using their imagination. The week named after Port Arthur takes place at the end of August, when there are guided tours, a concert, and a movie night in the park. A children's flower carnival has entered the festivities as a new idea.

Port Arthur's Olohuone, translated living room, is a company owned by **Sirpa Huntsala**, the secretary of Port Arthur Association. It offers property management services and accounting. Huntsala has specialised in managing wooden house properties in Port Arthur. Wooden houses are a unique form of urban residency. Many consider wooden houses to be the idyllic way of residency and it has even become fashionable. In reality, residents have a lot of responsibility for their environment. Sirpa Huntsala hopes that the residents of the wooden houses would remember to respect the house and the environment. "Some have hurried to tear down the old and valuable milieu, even without proper permissions! People have been rushing to modernise everything and by doing so they may cause invaluable damage", Huntsala depicts. She has a recommendation for new owners:

Photo: Outi Tuomela.

"As an alternative, owners could settle first and think through what they want. They could familiarise themselves with the house and move on to planning with caution. There was a time when builders knew their profession, so there is no point to destroy something that is good and functioning. One should always remember to find out about things and ask for advice before acting. Almost all kinds of building and renovating are subject to license these days", Huntsala reminds.

The property manager is also worried about the fading of "talkoot" (work parties/voluntary neighbourhood work). For decades the cleansing of shared yard spaces, annual checks on drainpipes and small repairs in the housing companies were taken care of on work party days.

"Nowadays, there are still housing companies where the tradition of work parties exists. However, unfortunately, many housing companies share the attitude that these matters are best to deal with bought services. By doing so, residents lose an opportunity to create a communal spirit and to introduce newcomers. At the same time, this leads to a sort of isolation to compartments that is common in apartment houses and that is when you lose a great deal of the social traits of a wooden house neighbourhood. It is not the walls that guarantee the idyllic living in wooden houses, it is the whole package!"

"Remember that you are the housing company together with other residents! Let's look after our wooden houses with care and respect, so that they will remain with us for at least another 100 years."

The board of Port Arthur Association decided to begin cooperation with Supilinn through the ProNatMat Project. Visits on both sides were made in the spring of 2012 during the festivities of the districts.

Supilinn is colourful soup

Supilinn is a soup city; its street names would be good ingredients for rather tasty soup. The long main street of Supilinn is called "Pea". Side streets are named "Potato", "Bean" and "Celery". What could be better than "Melon" or "Berry" for dessert after the soup?

This corner of the city has preserved quite well as a whole, but some of the houses are in bad condition. As wooden houses are menaced by the ravages of time, another threat exists: investors who are buying plots and properties see the value of the plots in proximity of city centres in a different way than the local residents do. That is when the pressure to demolish old houses and to replace them with new larger ones starts to build up.

"I consider the pressure to build detached houses in place of traditional wooden houses to be a threat to Supilinn also because it would influence the social life of the district. I wouldn't like to see Supilinn's communal yards to change to one-family gardens. On the other hand, I wouldn't want to have the parking spaces of apartment houses in place of the green yards", ponders an activist of Supilinn Association and

Photo: Markku Hyvönen.

a founding member, **Aliis Liin**. In her opinion, Supilinn is splendid just the way is, as socially diverse home for all kinds of people.

There are around 130 members in the district association of Supilinn and twenty or so of them are active. The common goal of the members of the association is to protect original urban culture. Many things have changed over the last the years already. The attitudes in the city towards wooden houses have improved and awareness and the sense of pride in the originality of Supilinn have increased. "As long as we manage to increase the awareness of proper renovation methods, owners will positively respond to perpetuating renovation. Nobody wants to harm their own houses."

The people of Supilinn have not had a lot of contact with Turku before. Instead Käpylä in Helsinki and Pispala in Tampere are familiar to them. "Port Arthur is a completely new partner, we are looking forward to getting to know them", says Aliis Liin. Cooperation with Turku is not entirely new to Supilinn. Last year, Turku University of Applied Sciences and the ProNatMat Project participated in the Supilinn Days with an info car which presented the restoration of windows and doors. The info car is a tuned motor home which tours various events in Finland and Estonia. "The info car is welcome to come back. Next time we could take advantage of the experts even more efficiently. Maybe it could be possible to book the car so that the renovation experts would come to your own yard, and you could get specific advice regarding your own house", plans Aliis Liin. The Supilinn Days are held in April. It is the association's largest annual event. The festivities begin with a traditional soup meal served at the City Hall Market. The programme offers many things to do, the principle being that there would be as many as possible open and free happenings. After the market, the concert continues until late in the evening.

Recently, the Supilinn Association has conducted a questionnaire survey to residents, where it was found out that the residents value community spirit and the lively street scene in Supilinn. Residents sitting on stairs, people leaning on fences and catching up, children playing outdoors and wandering cats with outstretched tails are no longer a familiar sight anywhere else in Tartu, but they do belong to the setting in Supilinn.

The most novel idea in Supilinn that fits pretty well with the results of the questionnaire is to make Supilinn "teretamise tsoon", a zone of greeting. It is not common in Tartu to greet unfamiliar passers-by; city dwellers usually pass each other in urban manner. Supilinn wants to be different; in its streets people are noticed and greeted. After all, a stranger is a stranger only because no one has had the chance to say hello to him or her yet.

The twin cities in the ProNatMat Project

"Tartu and Turku are twin cities, and from there the idea of cooperation started to develop. Port Arthur and Supilinn both have ready and active associations, so they have good prerequisites for cooperation. There is a will to boost the twin city cooperation between Tartu and Turku on many levels, including the cities, the universities and the districts", says the project manager of ProNatMat, **Päivi Simi**, at Turku University of Applied Sciences. The Estonia Centre of south-western Finland takes part in the project. The mission of the centre is to advance the cooperation between wooden house associations in Turku and Tartu and to help them exchange ideas regarding wooden house renovations.

"As an example of work in progress, we have a short dictionary, which would be useful to builders in both countries. Many trainings and visits have been organised. For instance, when I was visiting the Eco-revolt event in Estonia, I noticed that the interest toward natural materials was really vast", tells the executive director of the Estonia Centre, **Anna-Liisa Ossipova**.

She has a vantage point to the cooperation between Turku and Tartu in the Estonia Centre at the Old Great Square in Turku. The cooperation contracts, signed by the two cities, date from 1996 and 2010–2011. Collaboration and visits on both sides are happening on an official level between the cities, but also private people often come to the Estonia Centre for tourist information.

"Tallinn, Tartu, Pärnu and Saaremaa are always interesting", says Ossipova.

"In Turku, there is quite a large group of people who are crazy about Estonia. Estonian language courses are constantly popular. We even have a travel club which meets to exchange experiences in Estonia." •

Recycle, Reuse and Repurpose

in Sustainable Thinking

Ave Timberg, Information Center for Sustainable Renovation – SRIK

Recycling and its history

Recycling-reusing-repurposing are regarded as notions that have become popular in the last decade. It is a natural way of thinking that has come close to disappearing due to the extensive urbanisation of the last centuries. Wasting and overconsumption are possible only in the so-called developed civilisations, where human and environmentally friendly values degenerate in the wake of technological and economic development. The reality is that people with a practical way of thinking have practiced recycling for thousands, if not millions of years. As far back as the primeval era, people tried to use up all the materials they could find and this is why there was often nothing left. In addition to food, the animals caught by hunters could also be used for building, clothing, everyday items, weapons, jewellery, etc. The stones and logs found on the ruins of perished buildings and cities have always been used to erect new buildings and cities. This is evidenced by the fragments of ancient monuments discovered in the foundations of buildings. The use of natural materials has made it possible for people to reuse and repurpose them later. Anything left over that has no value is used for heating or buried in the ground, where they provide food for new life. The growing production of artificial materials led to the beginning of a new era where people focussed on cheap things used just once and constant production.

"It is so easy to buy shallowness for money, but true simplicity can be found by giving up the things you don't need and by repairing, adapting and recycling the old things that you already have and love. This inventive and often also environmentally friendly approach is refreshing at the time when we consume and are ready to consume more than ever before."

– "Simply Contemporary" by ***Solvi dos Santos***

Estonia is in a fortunate position in terms of the environment. We have a lot of pure, untouched nature and important natural phenomena for a small country, and nature reserves cover a large part of our area. Recycling also has a history here, and the Soviet era still has an influence on the modern day. During the Soviet occupation, we had to follow this way of thinking: "use and repair, until the victorious end". People repaired and mended their clothes and rags were used as floor and dust cloths. Jam jars were used year after year, only the contents changed. People had to be smart and find new uses for things. Repair shops were treated with the same respect that is given to dental surgeries today. Women had to run their homes as responsibly and smartly as possible. Magazines taught people how to recycle and mend, and often provided patterns and drawings alongside theoretical advice. Every second man was skilled enough for the wood, electrical and repair works that had to be done in their homes. People sometimes took frugality and excessive repairing to such extremes that it became dangerous both for the repairmen as well as the people around them, especially in electrical and construction works.

Then came freedom, and with it the welfare society, which

The old windows and doors have often good quality wooden material and they can easily be restored. You can find ideas from Old Materials Warehouses in Estonia, in Finland and also in other countries. Photos: Ave Timberg.

instilled a way of thinking that focused on excessive consumption and throwing things away without second thought. Everything new was accepted in a rush. Maybe shaking off the Soviet shackles and the bitter taste left by the way of thinking prevailing in those days also contributed to this. There are still people who despise preserving and mending things. Even household electronics, which people used to repair some twenty-odd years ago, have now become something that is only used once. The prevailing trend, especially among young people, is that communications devices cannot be used for more than a year, as both their appearance and software become outdated by then. Something that is functional and often in good order is thrown away, because it is not fashionable and does not meet the latest needs. This lifestyle, which is driven by consumption, is reminiscent of the Russian fairy-tale about the goldfish and the greedy woman.

Old tea cans and used candles are crafted together for a new romantic kit.

Global reality forces us to take a better look at ourselves and the approaching environmental crisis shows that it is high time to create some order in the world and in the way we think. Taking a more sustainable approach to our economy and the way we act cannot be avoided, as otherwise we will soon have nothing left except sky-high towers of rubbish and we will be forced to leave the Earth. The fairy-tale about the waste robot Wall-E may turn into a sad reality.

The new generation have understood this and a new trend is appearing: reusing and recycling, giving a new life to old things and materials. The natural and reusable origin of the materials is also very important. The use of artificial materials may be innovative and we also need a vision of how they can be recycled in the future, but the situation cannot be improved, if they continue polluting the environment and having an adverse impact on nature and people's health.

Recycling or reuse

The best recyclable materials are natural and organic, as they are easy to utilise if necessary. It is also important to think about our resources when we use natural materials – materials that are not easily renewable can be replaced with equivalent alternatives that are renewable. Natural materials that are unusable can support the birth and growth of new materials, including the nature. They do not pollute the environment or take too much room.

Restoration

The first option is recycling as repairing, which is also known as restoration. Restored buildings, doors, windows, building and interior decoration details as well as furniture are often beautiful and usable. Items and objects that are considered materially or culturally valuable are restored. These are objects and items that can prove their history. Things often have an ethical value as well – we need to preserve and respect the skills and intricate handicraft of old masters. We all feel bad when something that we worked hard to create is disregarded and not valued.

Many restorers claim that the materials used to make old things are better than modern ones. In the old days, people followed the rhythms of nature to improve the quality of raw material, and craftsmen passed their experience and skills from generation to generation. There is also the feeling of harmony that is often reflected in the beauty and quality of old things. The things that no longer meet their purpose can be used as 'spare parts' for filling, batching and replacement. For example, finding similar material when restoring doors and windows is extremely important, because old and new wood behave differently, meaning that uniform quality cannot be guaranteed. It is always best to ask a craftsman for help, if you are not sure about your own skills. The work is not cheap, but the result is worth it. Sometimes we do underestimate ourselves and we only need some training to be able to restore something ourselves. The internet offers a lot of help in the format of instructional videos and other materials.

Antiques

Antiques represent the most exclusive area of recycling. People often do not think of it as recycling, but that is exactly what it is as old items are restored and reused, again and again. A well-restored item of furniture may be passed from generation to generation as a family relic, and it can tell stories about the history of families, generations, sometimes also the society. Signs of wear are parts of the stories and do not always have to be hidden. The main thing is to keep the item in good order and functional, as deterioration starts from negligence and indifference. Every item hides some history and things that tell you stories are always cosier and warmer than the mass produced items found in shops. A home only becomes a home after you have lived there and had some adventures. However, there are situations where preserving the heritage left to us by our ancestors feels like a tedious obligation, as the items have lost their practical value, become useless and simply clutter our sheds or lofts. Recycling would definitely help here. A smart and creative idea can give an old item a new purpose and a new life. The topic should be approached delicately, though, and people should think twice before they throw something away that can still be used. Maybe someone you know needs this item, or maybe you could lend it to a museum.

Reuse and repurpose

"It is amazing what can be made from waste – rubbish. Instead of just throwing things away without second thought, we should be creative and find the item a simple, unique and original solution in the interior, the household or building details." **Moira** and **Nicholas Hankinson** write this in their book *Recycle!*

Most traditional natural building materials and details can be reused and repurposed. The same applies to household appliances – a creative person can find a new purpose for almost anything. Reusing is possible in various areas of life: building, interior decoration, household, gardening, even cookery. The borders of these areas become blurred or disappear altogether in recycling or so called repurposing by making room for creativity and smart ideas. One man's rubbish can be another man's treasure. This is why we should circulate the materials and items we really do not need ourselves and give them to those who need them and have more ideas. It is also better to not bury yourself in things, but to go for quality over quantity. Before you throw anything away, think whether some of its details or parts, or the entire thing could be used for another purpose. For example, an old door makes a beautiful headboard, sofa or bookshelf after some work. Old windows can be rebuilt into a greenhouse for the garden or a mirror in the bathroom. An old decorative detail may find new life as a design element in the lounge, etc.

Modern minimalist households often lack storage space and containers to hide any bric-a-brac. You can find inspiration by going to a flea market or having a rummage in your grandparents' loft, and you can also use any containers you can find around the house. This way, you can give metal tins new lives as lamps or pencil pots, and turn the drum of an old washing machine into a modern ottoman with some storage space. If you struggle for ideas, go surfing on the internet as there is an abundance of inspiration, including ideas illustrated with photos. There are also many inspiring and educational books, which contain detailed instructions on how to make different things.

ProNatMat and recycling

The Information Centre for Sustainable Renovation has focussed on recycling since its establishment in 2000. The main focus area is building: valuing what we have, a sustainable attitude and repairing or restoring the things that we have or replacing them with equivalent alternatives. We believe that it is important to broaden the knowledge of people by offering them advice and training. We have organised training in the format of lectures and practical activities, e.g. restoration of doors and windows, restoration of furniture.

Old Material Warehouse, where details and materials from demolished houses are stored, plays an important role in our activities. The quality of the materials is generally good and they are used again in restored buildings, homes. Although the main focus used to be on heritage protection and listed buildings, there are now many people who live in new buildings and modern homes, but want to use and expose old and traditional materials and details. They do it to make their homes cosier by combining the new with the old. Recycling and reusing is simply IN.

The project ProNatMat (Promoting Natural Materials and Know-how) also focuses on the subject of recycling. The theme of the project in 2012 is innovation. For us, it means reusing something old and long-forgotten or reviving the topic of Old Material as ReValuable Material. We have added some elements of recycling to our training and reuse materials like clay, paper, plants, wood, etc.

Paper plaster, which has figured in our training schedule for almost ten years, has become one of the most popular areas of training. It is a particularly sustainable and simple method mainly used in insulation, interior decoration and product design, which in certain conditions can also be used as an affordable alternative to gypsum plaster in restoring stucco décor.

An experimental green house was built in the yard of the Information Centre for Sustainable Renovation in 2011.

The Old Material Warehouse contains doors, windows, staircase details and decorative building details from wooden lace to window cornices and parts of old glazed tile stoves. They can all be reused or repurposed as new items in interior decoration and applied art.

Our activities

In spring 2010 we organised the recycling exhibition “Old is New” as part of the ProNatMat project. We exhibited the items given a new purpose during the training offered to the unemployed in the course of a cooperation project. The items were made from old construction waste and details of demolished buildings. With this exhibition we invited people to appreciate the valuable materials and details found among construction waste and to be creative in preserving them. The exhibition also attracted the attention of media and several articles about it were published in important interior design magazines. We chose the cultural centre of a small Estonian town, Põltsamaa, as the venue of the exhibition. One of the reasons for promoting the materials was the idea to go to the ordinary people, to the countryside where people have less work and where creative thinking and recycling could also reduce unemployment. Also, many country homes in Estonia have lots of construction waste laying around behind sheds and barns, including several things or details that are valuable materials for reusing.

An experimental greenhouse was built in the yard of the Information Centre for Sustainable Renovation in 2011 by reusing old windows and limestone steps from demolished houses. We also built an experimental rainwater system, where water is collected in an old fuel tank. The experiment was carried out in cooperation with the Estonian Native Construction students of the Viljandi Culture Academy.

The earlier activities were the introduction to a bigger and more public event, which took place in September 2011 in Tallinn – the Ecomess held in Telliskivi Creative Campus. It consisted of a number of activities that lasted several days and were aimed at promoting the use of natural materials in construction and design as well as raising children and therapies. The installation that was the base for the exhibition of building materials, the café furniture and bar, and the advertising and information boards used in the streets of Tallinn were made of old doors. It had a symbolic meaning: a door as something that leads to the next room or level of development; broken doors mean that there is no way back, which is why it is necessary to analyse the sustainable development of one's actions before entering the next room. In addition to the doors the topic of recycling was also evident in the activities of the flea market and antiques fair, and in reused fashion design training. The main topic of the training offered to children was recyclable natural materials. Ecomess turned into an international event and was enjoyed by many foreign visitors in addition to Tallinners.

Training days about recycling and reuse are included in the plans of the project for 2012. Old building details, such as old door panels, are used to teach finishing and restoration methods. Another Ecomess will take place in September 2012 and the topic of recycling will again be an important part of the event, as will our cooperation with the Old Materials Warehouse. We are also planning to create and design a permanent exhibition of old materials and valuable materials in the yard of the Information Centre for Sustainable Restoration in order to keep the topic alive and allow it to continue after the end of the project. •

References to books that inspired the author:

Compendium: Architectural Antiques by Wim Pauwels (Beta-Plus, 2009).

Easy Flea Market Style by Alan Caudle (Leisure Arts, 2003).

Eco Chic Home: Rethink, Reuse, and Remake Your Way to Sustainable Style by Emily Anderson (Skipstone Press, 2010).

Eco Craft: Recycle, Recraft, Restyle by Susan Wasinger (Lark Books, 2011).

Eco Deco: Chic, Ecological Design Using Recycled by Stewart Walton and Sally Walton (Aquamarine, 2000).

ECO House Book by Terence Conran (Conran Octopus Ltd, 2012).

Flea Market Style by Emily Chalmers (Ryland Peters & Small, 2005).

Flea Market Style by Jerri Farris and Tim Himsel (Creative Publishing International, 2001).

Recycle! Make Your Own Eco-friendly and Creative Designs by Moira Hankinson, Nicholas Hankinson (Kyle Cathie Limited, 2006).

Recycle This Book by Dan Gutman (Yearling, 2009).

Recycled Home by Sally Bailey and Ryland Peters & Small (Ryland, Peters & Small Ltd, 2007).

Rediscovered Treasures: A New Life for Old Objects by Ellen Dyrop and Hanna Kristinsdottir (New Holland Publishers Ltd, 2011).

Restore. Recycle. Repurpose: Create a Beautiful Home (A Country Living Book) by Randy Florke and Nancy J. Becker.

This Old House Salvage-Style Projects: 22 Ideas for Turning Old House Parts Into New Treasures for Your Home by Amy R. Hughes.

Interesting links and hints:

www.ceebee.it
www.craftingagreenworld.com
www.en.espritcabane.com
www.inspirationgreen.com
www.instructables.com
www.reducereuserecycle.co.uk
www.robomargo.com
www.treehugger.com


SRIR
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Part 2

Natural Materials

Landscape Painted with Resin

Markus Tuormaa

Paint is composed of pigment, adhesive and often solvent. When I work as an artist the materials are not just tools to enable the creation of the painting. Also the substance and origin of the materials matter.

I paint with spruce resin. Resin contains all the required ingredients of paint. It has its own colour, it is adhesive and it contains turpentine as a solvent. Pigment and adhesive of the resin cannot be separated, but the solvent – turpentine – can be distilled separately. Turpentine distilled from resins of various trees belongs to standard painting supplies. Resin is also used as an adhesive – for example dammar gum, which is used in paintings, is manufactured from the resin of various Asian trees belonging to the Dipterocarpacae family.

However, personally I do not mix different ingredients to my paints. I use raw resin. To me it is both paint and a runny, fragrant substance that heals the wounds on the trunks of spruces.

Landscapes are usually painted by creating an illusion of the scenery as believably as possible. Western landscape painting is usually perceived to originate from late 18th century romantic art. Landscape paintings of the romantic period are usually painstakingly detailed illusions of scenery. They are based on sketches created outdoors. Respectively modern nature photography aims at delivering as accurate as possible representation of the scenery to the viewer.

This kind of landscape art is executed far from the subject, the depicted nature. A landscape painter requires a large selection of pigments that are not possible to manufacture from the materials found in the depicted forest. A nature photographer uses equipment that is manufactured from materials mined from the earth and produced in factories all over the world. Creating the illusion that depicts nature accurately, or "naturally," is not technically that natural.

Another possibility to depict nature is to do it with the materials and possibilities found from the landscape itself.

While working I seek a relationship with the resin similar to the pre-industrial relationship with nature. Therefore I have familiarised myself with the old resin tradition.

When painting the artist is in a closer relationship with materials than when photographing. Brush strokes are concrete matter, unlike the pixels in a photo. Thus painting is a befitting way of illustration to familiarise oneself with natural materials, such as resin. While working I seek a relationship with the resin similar to the pre-industrial relationship with nature. Therefore I have familiarised myself with the old resin tradition. Old knowledge is useful while looking for suitable methods to harvest resin, processing it and when pondering the relationship with resin brought forth through working with it.

Finnish resin harvesting can be divided historically into two groups. There is the old resin usage tradition based on old natural economy and 20th century harvesting to industrial raw material mainly during the world wars.[1] In contrast modern industrial resin harvesting occurs during pulping by collecting it from the residual liquor, black liquor, generated during the process.

Fresh and runny resin trail on the spruce trunk is light and colourless. Photos: Markus Tuormaa.

The history of harvesting and using resin is really a story about the transformation of our views towards natural materials due to industrialisation. During natural economy people felt resin through their works, touch of their hands and even mouths. Resin was chewed as gum and it was generally known that hardened resin tasted and felt different in the mouth when compared with fresh and runny resin. When harvesting of resin for industry began, the knowledge of that experience turned into literary knowledge disseminated in the harvesting instructions: turpentine content of hardened resin is less than that of runny resin.[2] In the end resin started to move without human touch into a raw material: from forest harvester by log truck into pulp mill to be processed into black liquor.

However this is not quite a one-way story. When a modern pharmaceutical was developed from old resin ointment recipes, old-style resin harvesting reminiscent of the past natural economy has partially re-emerged in the 21st century.[3]

When aging the spruce resin hardens into brown or golden lumps.

In the forest

Creating a resin painting begins with harvesting resin from the forest. Resin exuding from wounds on trees trickles in a fresh sticky trail. When the turpentine dissipates from the resin, and because of the air-induced chemical reactions, the resin hardens and creates a hard protective layer on top of the wounds.

Large resin lumps form more easily on spruce trunks than on pine. Swifter hardening of spruce resin when compared with pine resin is one of the reasons for their different use purposes and values. If turpentine is to be extracted from resin, runny resin is superior. Pine resin is therefore valued more in industrial use in particular.[4] However, at least in some regions spruce resin particularly has been preferred as chewing resin.[5]

I had chosen spruce resin for my paint material. I was especially fascinated by the simultaneous gloominess, taciturnity and luscious coniferousness, protectiveness. Spruce evokes a somewhat deeper image than pine.

I geared up for my resin harvesting expedition with a knife and a collector made from a forked stick. A cloth bound between the forks could be handily pressed against the trunk. Scraped resin lumps fell on the cloth from which it was easy to pick out larger twigs and bark chunks.

There are also other instruments developed for this. In 1918, **Emil Vesterinen** recommended in his resin harvesting manual using a wide apron that you could tie around the trunk. Another option is a resin pouch with a mouth circled by a spruce twig so that one edge is left free. The free edge can be tightly pressed against the trunk.[6]

The colour of resin differs significantly on the spruce trunk. Fresh runny resin is pale, often almost white. Its shade is more cold than warm; sometimes I have seen even blue resin runs on trunks. Dried resin is much darker, more yellow and browner. I tried to collect different kinds of resins separately – they have their own character here in the woods and also later on in my painting.

Alongside work I enjoyed an age-old substance by

When boiling the resin dissolves from within the gauze bundle and accumulates on the surface. Cleaned resin is spooned.

chewing a hard lump of resin. At first it crumbled to bits in my mouth and tasted bitter, but eventually the taste became weaker and refreshing while the resin softened pleasantly.

In my opinion using chewing resin reflects well the relationship of a person living in natural economy using natural materials. According to a description written by ethnologist **Kustaa Vilkuna**, it is essential to know the different aspects of resin on tree trunks when chewing resin. Likewise it is essential to feel the change of the composition of resin due to saliva and chewing.[7] As an artist I strive to a similar empirical relationship with this natural material, although I use a brush instead of teeth.

Detailed instructions on how to harvest resin were published in the 18th century.[8] These instructions differ from the ones published later on in the 20th century especially in terms of dealing also with the cleaning of resin. Back then resin was not taken to industrial plants for further processing but it was cleaned small-scale.

I cleaned the resin applying a method described in the 1762 almanac. I wrapped resin lumps in a gauze patch and closed the bundle with iron wire. I sank the resin bundle into boiling water so that the resin dissolved through the gauze into hot water leaving residue inside the gauze. Then I collected the clean resin accumulating on the surface with a spoon.

While working I was surrounded by the warmth and aroma rising from the kettle. The atmosphere was heartfelt and calm. I feel that this is particular stage where the resin enters from the forest to my palette, to my paint. Resin is cleansed of needles and bark bits and the resins from various trunks are mixed into a uniform mass.

Although the resin passes from the forest to my palette it still maintains some of its wooden origin. It diverges from the forest just enough to enable painting an image that represents the forest.

I use resin to paint windows of rooms so that light filtering through the windows is tinted by the resin. My real painting is light inside the room, how the yellow light falls upon the walls, the floor and the furniture. Although my aspiration is the etherealness of light my paint is still tangible, hard, tacky, flaky and elastic resin.

After cleaning, the resin solute is pale and opaque, but when it is re-melted in the kettle without water, it becomes translucent again. I do this work stage while painting, because the resin has to be melted into runny liquid anyways. When heated, the turpentine in resin evaporates and resin becomes more solid, transforming into what is often called rosin or colophony. However, I call my material resin during all the work stages, because it includes the woody origin of resin better.

Fresher resin gives a fresh lemon yellow colour. At its thinnest and clearest the resin is almost as clear as glass and colourless. Resin that has hardened for years on the tree trunk gives a golden, ochre and brown colour. Varying shades of resin have been visible in the forest, but now the scale is slightly different: colours become brighter and extremes are closer to the characteristic yellow. Cold blues become cold yellows, dark browns brighten into red yellow.

Usually an artist has a large selection of shades on his palette that are made out of different soils and other natural materials gathered from all over the world, and even some synthetically manufactured colours. Natural pigments from all over the world free the artist from the limitations of his own environment. Synthetic pigments free the artist from the limitations set by the nature.

To me painting with resin signifies the acceptance of the limitations set by the nature; depicting a landscape within the limitations set by the landscape itself.

Forest interior

I have created my resin paintings for two exhibitions, in two different spaces, but using the same resin. It is possible to scrape the resin from windows after the exhibition is over and use it to paint later again. For the first time a resin painting was on view in Kluuvi Gallery during the autumn of 2006.

I will now tell you about a painting I created for the ”Puun taju” (Sense of Wood) exhibition held at Promenade Gallery in Hyvinkää during the summer of 2011. Back then I used resin that I had used once before. Fresh and old resin was partially mixed and apparently the fresh resin itself was slightly aged due to the earlier painting occasion – after all it had been in the window exposed to sunlight and air for several weeks. My pigments were now quite dark, rather warm than cold yellow.

I paint with spruce resin into the windows of an old wooden house that has been somebody's home before. My painting location is a first storey glazed porch with small windowpanes.

When painting I aspire for the resin tinted light surrounding the individual just like a forest or a bushy topped spruce would. There are several 19th century paintings called "metsänsisus" or "metsänsisusta" (forest interior) that convey a feeling of being under trees. I named my resin painting *Forest Interior,* because I feel the name contains the emotion of being surrounded by the forest.

I paint the same subject as 19th century landscape painters but my paint is different. I do not take my paint to the forest to make

Forest Interior (Metsänsisus). Spruce resin, natural light. On view in Promenade Gallery in Hyvinkää 2011.

sketches that I could bring to my atelier, but rather harvest my paint from the forest and bring it to the house, in to the room, inside.

While in the forest I often feel that the forest itself is a painting. I can wander in the forest just like my gaze wanders on the surface of a painting. By harvesting resin and painting it on the windows I bring the forest as a painting inside, forest interior to the interior of the room.

It is hard to be satisfied with the resin painting in its entirety. When one pane is pleasing the light shifts and the pane no longer looks the same. When painting another pane the previous painting has already gone out. Only after veiling all the panes I can experience my painting more as a whole. The natural light radiating into the room is tinted warm yellow and the aroma of resin surrounds the viewer.

My goal is to let the light paint the room, its walls, skirtings and floors. However, in these my painting meets another painting; the painted walls, skirtings and floors of the room. The walls of the porch are painted with turquoise tinted white. I felt the location challenging for resin painting because turquoise is almost the complementary colour for resin yellow. I was afraid that it would conceal the colour of resin. Only the window frames and covering boards of the door were white. At least the adjacent room has white walls.

Before finalising the work I could not even imagine how the resin tinted light would look like in this room. Now that is possible.

I sit down on a chair on the porch and look at the white covering boards of the door. They are warm yellow, bluish shadows on the decorations. Also the lower parts of the covering boards are bluer as the light from the windows does not reach them that well. Gazing amidst resin tinted light the adjacent room, which has natural light as such, looks cool blue, like it was lightly painted with ultramarine.

The light turquoise on the porch walls now looks yellowish blue in the lightest spots, not exactly green, rather so that both the blue and yellow light can be seen simultaneously. It pleases me.

I write these notes into my sketchbook with its white pages tinted resin yellow. •

References:

[1] Vesterinen 1918a; KM:K33. There are descriptions of both industrial harvesting of resin during the World War II and domestic use of resin in the Ethnological Archive of National Museum of Finland. Metsälä briefly introduces the domestic use of resin based mainly on this material, Metsälä 2001, pp. 62–68.

[2] Vesterinen 1918b, pp. 3 and 7.

[3] Saraja, Antti 2009.

[4] Vesterinen 1918b, p. 3; Vesterinen 1918a, pp. 6–7

[5] Vilkuna 1963, pp. 78 and 79.

[6] Vesterinen 1918a, pp. 8–11; Vesterinen 1918b, p. 29.

[7] Vilkuna 1963, pp. 79–80.

[8] Anonymous 1756; Anonymous [1761].

Literature:

Anonymous 1756. *Neuwo pihan cocomisesta ja sen walmijxitekemisestä hartsixi*. Stockholmisa, präntätty, directeurildä ja cuningalliselda kirjan präntäjäldä, Jacob Merckellildä, wuonna 1756.

Anonymous [1761]. *Almanach eli ajan tieto, meidän Wapahtajam Christuxen syndymän jälkeen wuonna 1762. Turun horizontin jälke en, joca on 60 grad. 27 min. pohjan puolella aeqvatoria, ja 17 ajan min. idän puolella Upsalan observatoriumia. Ulosannettu, Hänen Cuning:sen Maij:tins armollisen asettamisen jälkeen hänen Tieto-academialdans*. Stockholmisa, prändätty directeurildä ja cuning:da kirjan pränt. suuresa-ruhtinan-maasa Suomesa, Jacob Merckellildä.

Metsälä, Harri 2001. *Pihka*. Rakennusalan kustantajat, Helsinki.

Saraja, Antti 2009. *Pihka on kuusikon kultaa*. Metsälehti 11/2009, pp. 14–15.

Vesterinen, Emil 1918a. *Kuivan pihkan kokoominen*. Kauppa- ja Teollisuuskomissioni, Pihka- ja Tervakonttorin julkaisuja N:o 1.

Vesterinen, Emil 1918b. *Pihkan juoksuttaminen männystä ja kuusesta*. Kauppa- ja Teollisuuskomissioni, Pihka- ja Tervakonttorin julkaisuja N:o 3.

Vilkuna, Kustaa 1963. *Purupihka, vanhin nautintoaineemme.* Kotiseutu 4/1963, pp. 76–84.

Archives:

Ethnological Archive of National Museum of Finland, Request 33, pihkan keruu, 1987 (KM:K33).

From Peatland to Textile

Papu Marjatta Pirtola

Cotton grass peat fibres. Photos: Papu Pirtola.

The history of peat fibre utilisation

In Finland the use of peat, harvested from peatlands, as horticultural peat and fuel, is well known, along with its use as an animal bedding material and as an oil spill response aid. It has also been widely used as a construction material for dwellings thousands of years ago, and later as an insulation material. Even as late as the beginning of the 20th century it was used as a cover material for house roofs, especially with outbuildings. Peat can also be used with dry toilets due to its odour and moisture binding properties.

The peat fibre that is formed out of the sheath of Hare's Tail Cottongrass (Eriophorum vaginatum), which grows in raised bogs, has been known in Finland as a textile raw material only since the 1990s. In Europe, for example in Germany, England, Ireland, Holland and Austria, the use of this fibre had begun already in the mid-19th century. As peat was harvested from the bogs to be used as fuel and animal bedding, there was a hard, fibrous material within the peat, which actually served to hinder the manual peat extraction. This fibrous material could not be used for the same purposes as the other peat material, and was isolated from the peat. It was then when people started thinking about how this available unutilised raw material could be put to use.

Bog-derived peat was comprehensively researched in the 19th century, because it was considered as a universal raw material available in unlimited quantities, as was the consensus at the time. Also, the research of peat fibre began at those times. Peat fibre was found to consist of the remains of one plant species only, and this was namely Hare’s Tail Cottongrass. When the plant dies, it gets buried inside the slowly accumulating peatland, and over time, humic acid from humus transforms the hard sheath of the plant into a brown, fibrous material. It was found that Hare’s Tail Cottongrass fibre has bad thermal conductivity, which is due to the hollow, air-containing cells. For this reason, the material was found to be excellent insulation material. In addition to this, the material has a great absorption capacity, it dries quickly, is light in weight, spongy and elastic. When it is freshly harvested from the bog, it has also antiseptic and aseptic properties. The long and narrow, hollow cells of the Hare’s Tail Cottongrass sheath have a special characteristic of being wavy, which is due to their three-dimensional folds. Due to this reason, the fibres do not break down with the other plant materials inside the peatland, and can last for thousands of years. However, despite the strength of the material, when it is harvested and dried, it is fragile and dusting.

The textile industry has always been looking for new materials for the increasing demands. Even as early as in the 1890s there were some companies that utilised peat fibre. They also patented their invention. All of them had different ways of processing the fibre either mechanically or chemically so that it could be made into paper, packaging material or a cottonous material, peat wadding, available for carding and spinning.

Peat fibre is a delicate fibre, and therefore other natural fibres were used as binding materials.

Peat fibre is a delicate fibre, and therefore other natural fibres were used as binding materials. From such combined material different products were made, such as absorbent peat wadding, carpets, covers, clothing, etc. Eventually, an Austrian called **Zschorner** patented a method where he, utilising a machine that he developed, was able to card and spin the peat fibre material without any external binding fibres.

However, at one point, all the companies processing peat fibre went bankrupt and closed down. This was arguably due to the complexity of the manufacturing process, and the high price of the products.

Peat fibre found its use again in the First World War. In Germany, due to the lack of raw materials, it was used, for example, in soldiers' clothing, warps of war-horses and wound dressings. It was also noticed that peat material had healing properties. This is why it was used in the mattresses of chronically ill patients. This was also known in Finland according to the tradition. However, after the war, peat material was forgotten again, as other materials were available.

Peat fibre could have possibly been completely forgotten, if Austrian doctor **Rudolf Steiner** would have not paid attention to the good qualities of the material as clothing material. According to him it was light, warm and protective. Therefore, in the 1920s, Steiner initiated the research of peat fibres in Germany, Stuttgart. In the laboratory experiments, it was strengthening the fibres was attempted, using liquids derived from various plants and minerals so that the fibre could be used without external binding fibres. This research ceased due to the economic recession.

It was only in the 1970s when a German-born Swedish resident, **Johannes Kloss,** started again the research and use of peat fibre. He founded a company called Älma Torvtextil in Rydöbruk, Sweden, where he industrially cleansed the fibre and sent it to Germany to be carded and spun, mixed with wool, with a 50 per cent concentration of each. This combined

Felting process.

material was processed into thread, fabrics, knitting, bed linen, etc. This company worked until the 21st century, and through this company, the information about peat textiles spread all over the world. Additionally, Kloss has researched the use of peat fibre clothing to protect people who are oversensitive to electricity.

Peat fibre textiles in Finland

The information about the use of peat as textile material was acknowledged in Finland rather late, despite the fact that two thirds of Finland''s surface area is originally peatland. In 1985 a company called Ruskovilla Oy started importing Kloss peat products, such as thread and knittings, but the sales were not great. In 1993 a small Finnish group visited Sweden to familiarise themselves with the work of Johannes Kloss, and this initiated the interest and activity around peat fibre materials in Finland. A trial batch of peat material, mixed with Finnsheep wool, was manufactured, and a company called Kultaturve Oy (1993–2005) was founded. The company produced industrially carded peat wool wadding, blankets, insoles and clothing. The material was also widely sold to small-time entrepreneurs who manufactured clothing and accessories. An interest in products containing peat fibres grew along with the new eco-friendly trend in the 90s. Along with

Felting process.

the industrial manufacturing, peat fibre textiles were hand-made as well. Due to the growing interest, the education of such handicraft skills started in the form of different courses within various educational institutes. For example, in the Vihti Institute of Crafts and Design, a three-month course about the subject was held for unemployed textile workers. In the course, the participants visited peatlands to collect peat fibres accompanied by a peat geologist **Riitta Korhonen** from the Geological Survey of Finland (GSF) and learned how to dye Finnsheep wool with natural dyes, card, spin, and felt by hand.

The new natural fibre as a textile material rose interest. Along with the GSF's peat research, a research into peat fibre began. Its age, availability and properties were researched. According to a study conducted in 1993, there are 91.28 million cubic meters of the fibre residing in Finnish peatlands.

Among the horticultural peat there is always some peat fibre that is sifted out, and this material accumulates to great amounts every year. This fibre can be bought from the peat factories, although it contains plenty of other plant-derived materials, such as twigs, wood etc. A company called Vapo sells so-called opened peat fibre, which is industrially cleansed and thus easier to process manually.

It is said that within the central European sources, the peat fibre applicable for textile use occurs in the depth of 50 to 300 centimetres. According to geology, this would mean that the fibre is roughly 3 000 years old. In Finland, the fibre can be even older, however. According to the research of GFS, the oldest fibres in Finland that are still applicable for processing turned out to be over 4 000 years old in radiocarbon analysis.

Various different peat fibre textile research projects existed in the 1990s in Finland, for example the "Elantoa suosta" ("Living off the peatlands") project in Southern Ostrobothnia, and a project in Central Ostrobothnia, during which the longest and strongest fibres so far were found. Also in Juva, in Leivonmäki of Joutsa, in Kolari and in Rantsila there were projects that familiarised participants with the use of Hare's Tail Cottongrass peat. In the 1990s, the use of peat as a therapeutic agent, and as a bath peat, was also as a strong theme, present in these projects as well.

In various Finnish educational institutes, theses that pertain to the use of peat fibre textiles have been made since the 1990s. A thesis submitted to the University of Helsinki in 1999 with

Venla making a color circle.

the topic of "Teollisesti valmistettujen tupasvillatekstiilien käyttöominaisuudet" ("The usage qualities of industrially produced cottongrass") states that according to studies, Hare's Tail Cottongrass fibre is absorbent, anti-static and insulating, it has a property of binding and neutralising skin secretions, its odour retention qualities are good, and it can also provide protection against UV radiation.

The Finnish peat fibre studies inspired a corresponding line of studies in Estonia. In the beginning of the 2000s, students from the Estonian Academy of Arts came to Finland to familiarise themselves with the possibilities of peat fibre processing. This lead to a course in Estonia, aimed at students and teachers, where peat fibre searching and processing was taught. An Estonian peat geologist was present on this course as well.

At this moment (as of 2012), it is difficult to acquire industrially manufactured peat products in Finland. The Ainofelt felt factory, which provided facilities for companies and private entrepreneurs to industrially card peat and wool, and to make peat wool felt, went bankrupt years ago, and a

Felting process.

new manufacturer is not on the horizon. The difficulties are due to the dusting properties of the material when it is carded; the dust clogs the machines, which have to be thoroughly cleansed before carding other materials. One spinning mill has produced some peat wool deposit discs and a test batch of peat wool thread for felting, with the peat fibre percentage of 20%. However, currently there is no information of peat fibre product availability in the future. The felt factories also do not willingly produce felt that contains peat fibres, due to their perception of it as a problematic material. Manually processing the material, however, is easily done.

Peat fibre felt as a construction material - Ugric sauna in Turku 2011

The producer of the Alkumeri festival, which was one of the events in the Turku 2011 European Capital of Culture celebrations, contacted me and proposed that I build a sauna, similar to my earlier sauna project, to be built near the Samppalinna's outdoor pool. In 2003 I designed and built with a team a peat material sauna in Töölönlahti, Helsinki. The sauna was built of heavy blocks of peat and was a sturdy construction. The sauna attracted lots of visitors, and was maintained until 2007. However, the proposed schedule was not sufficient to build an exactly similar sauna construction, which led me to suggest that a different type of sauna, a tent sauna, would be constructed, this time of Finnsheep wool and Hare's Tail Cottongrass fibre. I designed the sauna together with **Janne Inkeroinen**, who also built a supporting frame out of aspen. The roof and the walls of the sauna were felted in Koroinen, Turku, during a period of two weeks, a task in which about twenty people from the voluntary workers of the Turku2011 ECC also participated. Most of them had never done felting before.

As the materials for the sauna, there were about 100 kilograms of Finnsheep wool with colours of white, black, semi-brown and some of it dyed with natural dyes. The wool was bought from Haltiala manor in Helsinki. Part of the wool was carded in Musta Lammas mill, part of it was carded with a manually operated carding machine, and part of it was used uncarded. There were about 20 kilogrammes of Hare's Tail Cottongrass fibre, half of which was provided by Vapo, and half was hand-picked from Central Ostrobothnia. The peat fibre was carded together with the wool so that in each piece to be felted there was around 10 to 20 per cent of peat fibre. It has to be noted that the peat fibre cannot be felted by itself, but as the wool gets felted, it will contain the peat fibres inside it. Finnsheep wool felts very easily, and other properties, such as its flexibility, softness, shininess and curliness make its processing easy and enjoyable. Unwashed wool also contains natural fats, which makes the felting process even easier. Additionally, wool and peat fibre together insulate and repel water effectively. As felting aides we had drainpipes of 2 to 3 meters in length, tarpaulins, plastic bags, round sticks, gauze fabrics, rope, water buckets, olive oil soap, and liquid pine soap.

As the weather allowed, we could work outside. We spread a tarpaulin to the ground, and placed a large gauze fabric on top of it. The wool and peat fibres were spread on top of this in layers. There were from four to five thick layers. With a diagram cut out of plastic bags we shaped out the wall rugs into about 2 x 1.5 m sized pieces, where the upper part was narrower. The layers were covered with gauze fabric and wrapped around a drain pipe, and attached to it with a string to form a firm roll, which was then first rolled as dry, and then as moistened with soapy water. The rolling took place on a flat yard on top of a tarpaulin, and as an aide, two ropes were wrapped around the roll, which were pulled by two to four persons back and forth in turns, with the roll moving steadily in between. This technique proved to be very easy, light and fast compared to the rolling performed using hands or feet only. At times the roll was opened, the felted material was checked, creases were straightened, and water and soap was added. When the rug was firm enough, it was lifted to the rinsing area, where it was rinsed with cold water until all the soap was washed out. After this, the rug was placed on a string to dry.

Twelve wall rugs in total were needed for the tent sauna. The first ones were the most difficult ones, and it took one or two days to make them. As the process got familiar, the rest could be prepared even with the rate of two pieces a day.

The materials shrink during felting. For example, the size of the roof rug was four meters in diameter in the beginning of the felting process, and after the process it was three meters in diameter. The roof rug was also the most challenging of all of the rugs. It was circle shaped, and there was a black spiral on a white base, with a yellow solar cross on a black base outside. Its manufacturing took the longest.

The sauna was built on the hill of the Samppalinna outdoor pool area in two days' time, of which the most was used on putting the wooden parts in place and on creating the stove. The stove was built with the help of the volunteers with the process led by Janne Inkeroinen. When the framework and the stove were finally ready, the wall rugs were sewn to place, but the roof rug was left detached, because it is a piece that has to be removed during the heating of the sauna. The sewing took a few hours, after which the sauna was finally ready, and a test heating was made.

The official heating of the sauna took place in the morning, and it took approximately four hours. The rainy weather hindered the bathing a little. During two days, the sauna was heated up a few times, and over 100 people took a bath in there. It attracted much admiration and wonder, and people enjoyed the bathing.

After the festival the sauna was taken down in a couple of hours. The rugs were taken off, dried and stored along with the wooden parts to wait for the next instalment. •

Ugric sauna in Alkumeri festival in Turku 2011.

Additional readings:

Kloss, J. 1987. Die Herstellung von Textilprodukten aus Torffasern. Telma 17: 299–301.

Korhonen, R., Pirtola, M. 1998. Research and Use of Cottongrass Peat Fibers in Finland. In Sopo, R. (ed.) The Spirit of Peatlands. IPS.

Lappalainen, E. & Hänninen, P. 1993. Suomen turvevarat. Tutkimusraportti 117. GTK, Espoo.

Pirtola, Marjatta. 1998. Turvetekstiilit. In Vasander, H. (Toim.) Suomen suot. Suoseura ry.

Schliehe, Beate. 1994. Die Textilfaser Torf im Moor- und Fehnmuseum Elisabethfehn - eine textildidaktische Untersuchung.

Schriftliche Hausarbeit Zur Prüfung für das Lehramt an Realschulen Oldenburg, Deutschland.

Finnsheep Wool - Characteristics and Possibilities

Marja-Leena Puntila

Background

The Finnsheep is widely known for outstanding fecundity and for that reason the breed has been used in crosses and in developing synthetic multi-breed populations. Relatively little information is available on wool production and the fleece characteristics of the breed, especially with regard to lambs.

Sheep farmers have not received any subsidy for wool since 1995 when Finland joined the European Union. The wool prices are ruled by the spinning mills (half a dozen). Prices hardly cover the cost of shearing; therefore the interest of sheep producers in wool and its development is minor. Wool is even burned which is a waste of natural resources.

National wool production is about 80 000 kg a year, which is spun as carded and combed yarn, or processed pre-yarn or felting wool. Lack of a co-ordinated wool chain from farm to finished products makes the advancement of the Finnish wool sector difficult.

When EU subsidies were introduced for raising endangered colour types of Finnsheep, the numbers of black, brown and grey sheep increased considerably and this trend still continues. Another motive has been the consumer demand for "naturally coloured wool". In the Finnish Sheep Recording Scheme of all recorded ewes, nearly 70% are pure Finnsheep (9 000 ewes) About 60% of born lambs in the recorded Finnsheep flocks are white, 30% black and 10% brown. Originally the so-called Kainuunharmas was considered a grey-type Finnsheep, until with DNA analyses it was discovered to be a separate sheep population.

Coloured wool is in general denser than white wool of Finnsheep. Photos: Marja-Leena Puntila.

Good staple formation in white Finnsheep wool, medium-fine, curly, lustrous.

Early Finnish and foreign studies have shown that the wool characteristics of Finnsheep are special. Finnsheep's wool is lustrous, soft, medium-fine, light, elastic and it also has good felting characteristics and the fibre is highly crimped. Disadvantages are uneven quality and a tendency for felting on the backs of the animals.

Finnsheep wool in general can be considered as a bottom wool type. Therefore it differs from the double-coated Ahvenanmaan lammas (Ålands får, Åland sheep) and Icelandic sheep having fine undercoat fibres and long, coarse outercoat fibres.

Wool research

Selection schemes for different uses of Finnsheep were started in 1986 at the state-owned farm of Pelso. One part of the selection objectives of this nucleus flock consisted of wool traits in lambs. The breeding flock Pelso is now the national gene bank for all colour types of Finnsheep.

The wider data for the genetic evaluation of wool traits consisted of the records from this nucleus flock and 17 flocks from the Fine Finnwool project (EU 5 b framework programme for regional development) in 1997–99 and from a private-owned breeding flock with white Finnsheep. The flocks in the Fine Finnwool project included both white and coloured Finnsheep. Most of these flocks were small handicraft flocks with increasing interest in coloured Finnsheep.

Criteria for assessment of wool characteristics

The following wool characteristics (with respective scoring) were assessed and included in the analyses: fleece uniformity, density, staple formation, lustre, crimp frequency, fineness grade and staple length (detailed description by Puntila et al., 2007). Assessment was carried out by a trained team at about five months of age. Nearly 600 wool samples were taken to Macaulay Land Use Research Institute (Scotland) where the fibre diameter was determined by the OFDA method (Optical Fibre Diameter Analyser). The OFDA instrument is based on automatic image analysis technology.

This work was carried out in the contemporary European Fine Fibre Network (EFFN). The network had a goal to develop European standards used in the selection of the quantity and quality of fibre traits in speciality fibre animals, fine wool sheep, mohair and cashmere goats and angora rabbits[1]. The OFDA measures the mean fibre diameter showing SD and CV and specific medullation results. The fibre diameter is the main factor determining the world market price for wool.

Measurable wool traits tend to be strongly inherited

The genes only are transmitted from generation to another therefore the differences between animals are of interest to breeders. Heritability estimates (h^2) of the characteristics are expressed in terms between 0 and 1. The main effects sex, birth/rearing type, lamb age and colour had an influence on wool traits; therefore they have been taken into consideration in the statistical analyses.

Heritability estimates	h^2
Fleece uniformity	0.28
Density	0.38
Staple formation	0.32
Lustre	0.23
Fineness grade	0.43
Crimp frequency	0.45
Staple length	0.62
Fibre diameter, μm	0.62

Crimp frequency is based on the number of crimps per 3 cm and measured by a ruler on the butt portion of the staples. This measure to assess crimps showed to be highly heritable (0.45) as was fineness grade (0.43). The fineness grade assessment has been in use a long time and is based mainly on the size of the curl. Fineness is classified by grades from 46 to 60 and assessed visually on the chest, side and britch. Both of these traits characterise wool fineness. Staple length, measured in the same three locations as fineness grade,

All colours of Finnsheep. Photo: Juha Kantanen.

is even more strongly inherited than the fineness traits (0.62).

Visually assessed wool traits were assessed according to the points between 1 and 5. Heritability estimates were as expected somewhat smaller in the range from 0.23 to 0.38.

A mean fibre diameter measured by OFDA was 23.8 and 25.6 µm (micron) for white and coloured Finnsheep lambs, respectively. The finest fibres were even under 20 microns, quite on the level of the Merino. On the other hand the coarsest fibres exceeded 30 microns. Figure 1 presents an example on the OFDA histogram printout for a wool sample, showing the mean fibre diameter, SD, CV and sample size of fibre snippets. The OFDA measures also the distribution of fibre opacity and the printout gives specific medullation results. The trait of the fibre diameter is well-inherited. The results indicate that on the planned selection, Finnsheep even has prerequisites for fine wool production.

Increasing awareness of different wool characteristics is important in order to use the right wool for the right purpose at the right price.

This study pointed out for the first time the genetic differences in wool characteristics between Finnsheep lambs. The coloured lambs had denser fleece, while the white ones had more uniform fleece, more lustrous and finer wool. Genetic parameters indicated that simultaneous improvement of growth and fleece characteristics can be achieved. The genetic progress through selection based on these traits would be relatively easy. The average fleece weight of lambs in this study was 1.1 kg. In the wool line at Pelso nucleus flock the average wool weight was 3.1 kg in adult ewes.

Finer wool is not better wool unless it is also less variable

The use of objective measurements in animal selection is now gaining more interest everywhere. We know that wool suffers from large variation within the individual fibre, on a sheep, and between sheep in a single flock. Wool fineness is not discovered by hand. The Thematic Fine Fibre Network encouraged the use of OFDA for increased competitiveness of high quality European animal fibres by improving fibre quality. OFDA is already used in the Swedish Finewool breeding programme. Finnish Alpaca breeders are selecting the males for breeding according to fibre microns.

Fibre analyses have shown that there are good possibilities to improve fibre fineness in Finnsheep by selection and thus to produce finer wool. Therefore there are possibilities for innovative, exclusive end products such as very soft fabrics suitable for underwear or therapeutic uses, providing that the wool quality is uniform and the processed yarns are of high quality.

All wool for utilisation

Sheep production is growing in Finland and the flocks are getting larger. That means also an increase in the total wool production. The role of cross-breeding is expanding as meat breeds are crossed with Finnsheep. How can we utilise all wool and improve wool quality?

A national wool strategy is needed to achieve the desired increase in sheep production. First of all, a co-ordinated wool chain from a farm producing greasy wool to the end product should be organised. A clear set of guidelines is needed for the shearing, handling of wool, local wool collection and grading system of wool in spinning mills. Increasing awareness of different wool characteristics is important in order to use the right wool for the right purpose at the right price. When wool production is invested in, it results in the improvement of raw wool and yarns. Spinning mills will benefit from the better quality of wool, and wool producers will be better paid. Besides, the overall handicraft sector will benefit from the improved wool quality.

Attention has to be paid to sustainable development also in sheep production. There is a growing demand for eco-friendly woollen products among consumers.

Uniform grading of wool quality in the flocks and measurement criteria have been created, which has given clear guidelines how the achieved information can be incorporated in the new Web sheep database program of the Finnish recording scheme, and further in the selection programme to improve the wool traits in Finnsheep.

Norwegians have been able to create a brand image for their traditional sweaters a long time ago. Icelanders have their unique sheep breed with its colour combinations. Icelandic quality wool is internationally known. Finnsheep wool has its recognised speciality characteristics. Many-sided product development of Finnsheep wool has been carried out with several projects and handicraft institutes. It is high time to seek innovation for specialised fabrics and new wool products utilising all available information studied. Knitting has gained a great popularity among consumers. This trend gives encouraging challenges for wool production, the promotion of innovation and the registered brand-name.

The number of the elderly is growing fast. The health care sector seems to be a potential field of application for wool in future. Lately the usability of felted woollen products in treating properties has been investigated at the University of Lapland. Recent Australian studies show medical sheep wool as an example to be effective in preventing and treating bed sores.

All produced wool should be stored up and utilised. Finn wool is used to produce a variety of yarns for knitwear, felt, socks, carpets, etc. However, there is insufficient information on the relationship between fleece and yarn characteristics to determine which fleece types are best suited for these different yarns. Some kind of use should be discovered for "waste" wool, which is not acceptable for processing.

Finnsheep wool as a value-added opportunity for small-scale businesses in rural areas has not been properly investigated; neither have the identification of wool with its natural colours and the final products on niche markets.

Lapland is visited by large numbers of tourists, particularly in the skiing season. They should be the real target group. •

Wool is a natural, renewable and sustainable fibre.

Good staple formation in Finnsheep wool, dense, curly, lustrous. Photos: Marja-Leena Puntila.

The measurements of staple length on three locations: 1. shoulder, 2. midside, 3. britch. The average of the three measurements is used in the analyses. The crimp frequency and fineness grade is assessed on the same three locations.

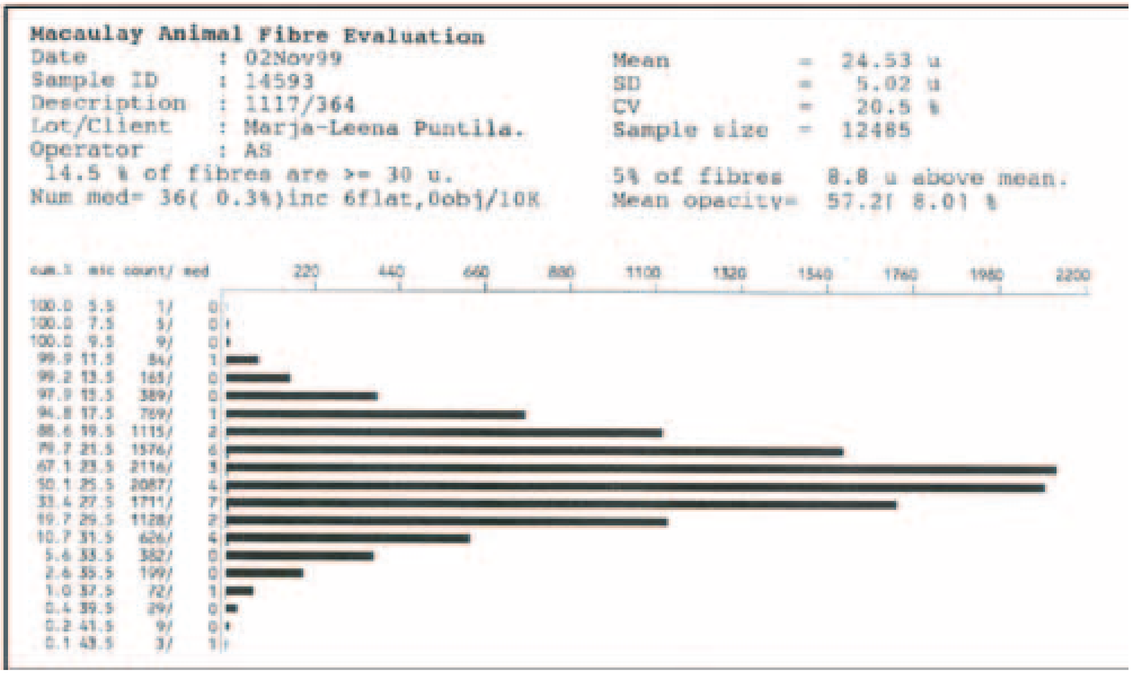


Figure 1: The OFDA histogram showing the fibre diameter ditribution in a typical sample of wool from a white Finnsheep lamb.

References:

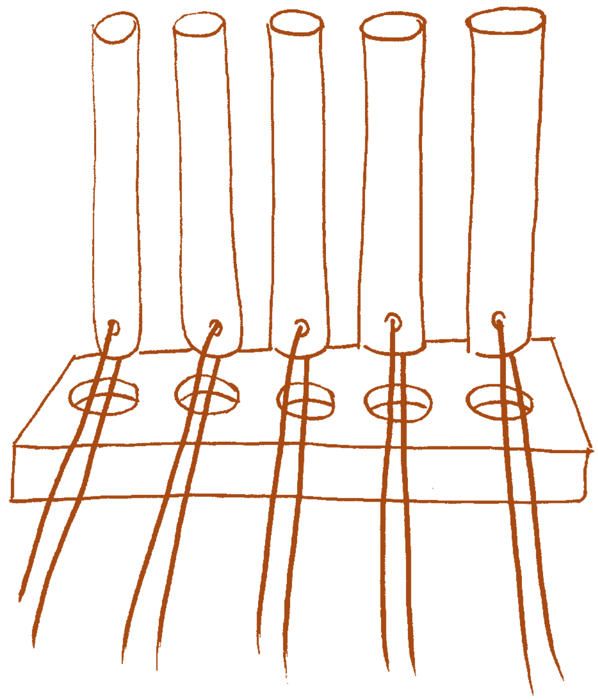
[1] Laker, J. 1999. Aiming for increased competitiveness of high quality European animal fibres by improving fibre quality. Newsletter of the European Fine Fibre Network Issue 6. Dec. 1999.

[2] Puntila, M-L., Mäki, K., Nylander, A Rintala, O. 2007. Genetic parameters for wool traits in Finnsheep lambs. Agricultural and Food Science Vol. 16, No 2.

[3] Tuovinen, H. Hoivihanke, 2007. Lapin yliopisto. http://www.ulapland.fi/?deptid=4335.

Peg Loom

Sinikka Korhonen

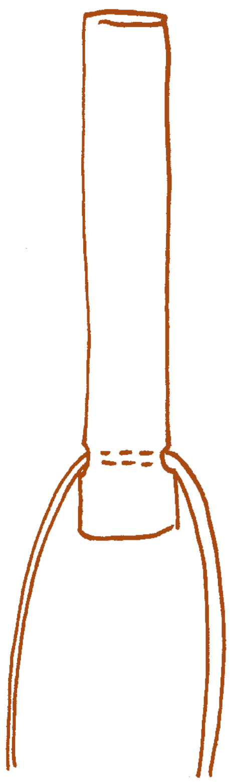


Drawings: Sinikka Korhonen.

Peg loom is a simple tool for weaving, with which for example rugs, tapestry, beddings or duvets can be made. Peg loom is an affordable and easy tool to use, and thus it suits all those who enjoy handicrafts regardless of their age. Due to its small size, this weaving tool is easy to store when not in use, unlike its larger relatives.

In practice, the peg loom has two different parts: the pegs, which hold the warp and the bottom part that holds the pegs standing.

The pegs can be made for example from brush handle or round lath. Their length should be about 20 cm. By changing the thickness and density of the pegs one can make different looms to produce different products. It is recommended to sand the pegs, and possibly also varnish them before use, so they are as smooth as possible. This way the weft does not get stuck to an uneven surface and it makes the weaving go smoothly. A hole is drilled in the lower part of each peg, through which the warp is threaded. One can also add ordinal numbers at the end of each peg; this makes it easier to keep them in the correct order when working.



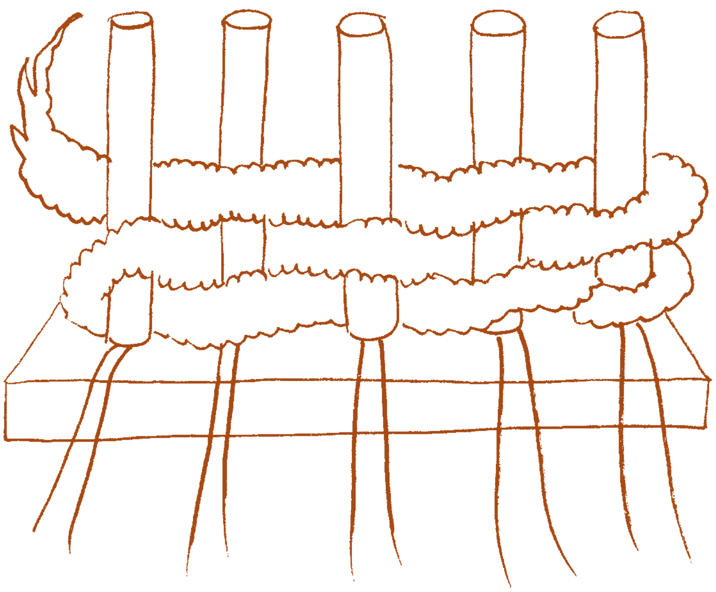
As the lower part one can use whatever sturdy, flat-bottomed lumber is available. Slots for each peg are drilled into this piece. The slots should be as tight as possible, about 1–2 mm larger than the diameter of the pegs, so the pegs stay firmly in their place.

When starting the work, its final measure must be decided. If the desired length is about one meter, a warp must be about 2.4 m long. Cut one yarn and take the first peg of your loom. Thread the yarn through the hole and pull until the middle point of the yarn is placed in the middle of the peg, or in other words, pull until there is an equal amount of on both sides of the peg. Continue to do this with each peg until the width fits your work. It is not necessary to use all the pegs in one loom but, on the other hand, you can also use two peg looms side by side to form a wider loom for extra wide products, for example duvets.

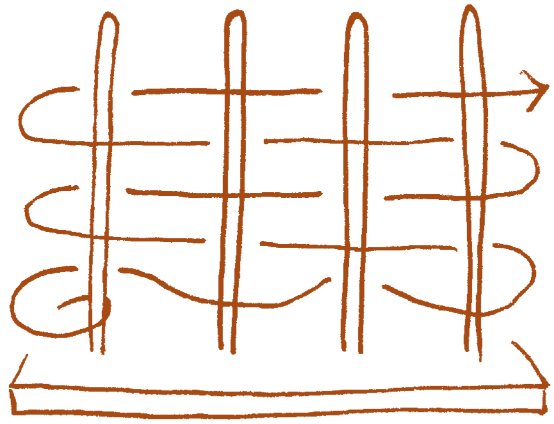
All kinds of material can be used for weaving: waste wool, combed wool, carpet yarn or even willow branches. The imagination is the only limit in testing different materials. It is still worthwhile to take the density of the loom into account. For a looser loom, a thick material is better and for a thinner loom, a thinner and lighter material could work better. It is worthwhile to try mixing different materials, for example cotton weft and raw wool.

The material used for the warp should be quite durable, because it is under bigger stress than the weft. For example tightly spun woollen yarn, linen yarn or something similar would be suitable. If you want to felt the finished work, it might be the wisest to use wool yarn, as it felts together with the weft. If the warp is very long, it is practical to tie a knot at the end of the warp or attach the end of the warp to a brush handle, because this makes handling it easier and the warp threads will not get mixed up so easily.

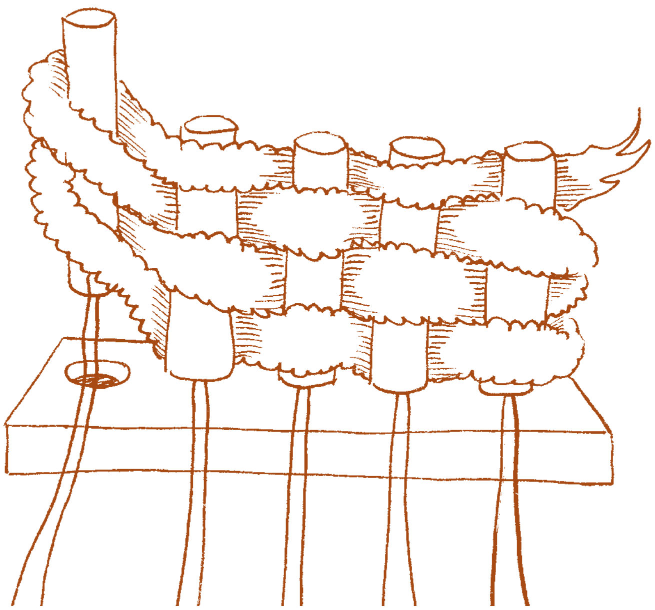
Start weaving from the side of the loom. Wrap the weft a couple of times round the first peg and "hide" the beginning, so the work will not unravel. Begin to weave by placing the weft under and then over every second peg. This is basic weave, plain weave. When you reach the other side of the loom, just turn around and start to weave under one and over the other again. Follow the diagram below.

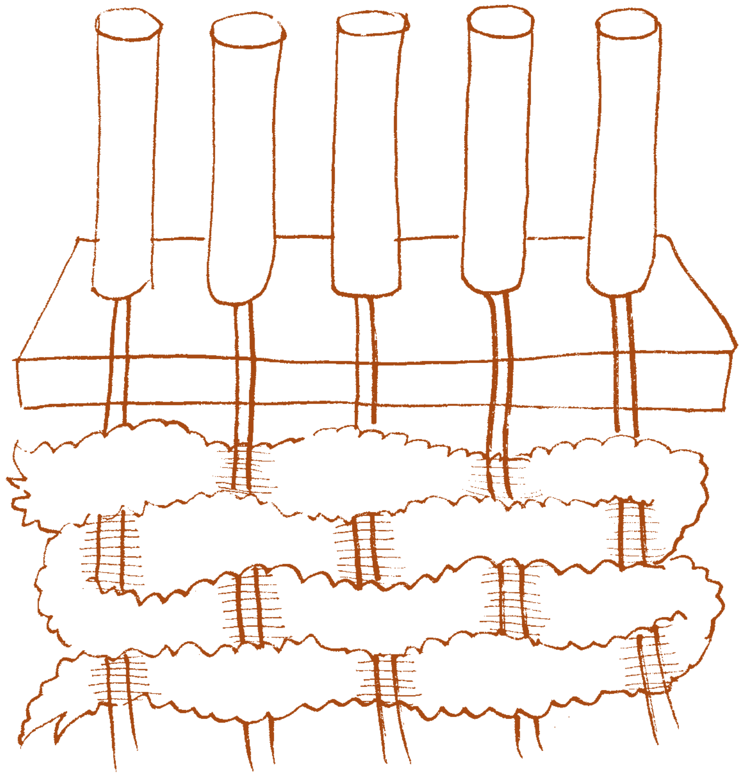


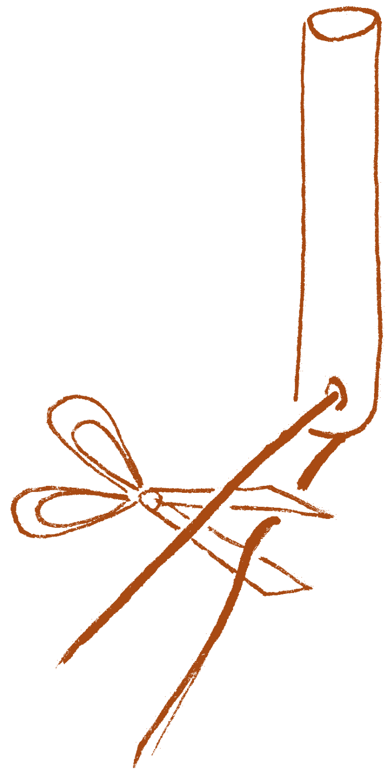
If you use unprocessed wool, you can spin it a little while weaving. When your piece of weft runs out, place the end between the former layers. Take more material, hide the beginning like you did with the ending and start to weave from where you were. It also pays to compress the work once in a while by pressing it tighter.



When you have reached the end of the pegs and there is no more room for weft, the time has come to move it onto the warp. Take a hold of the first peg and pull it out from its slot. Slide the weft over the peg and into the warp. Put the peg back into the slot. You can also lift several pegs at once to move the weft. When all the wefts are placed on the warp, continue to weave normally. Remember to check that you have placed the pegs in the right order. The benefit of marking the ordinal numbers in the pegs is obvious in this phase of the work, especially if there are several thin pegs.





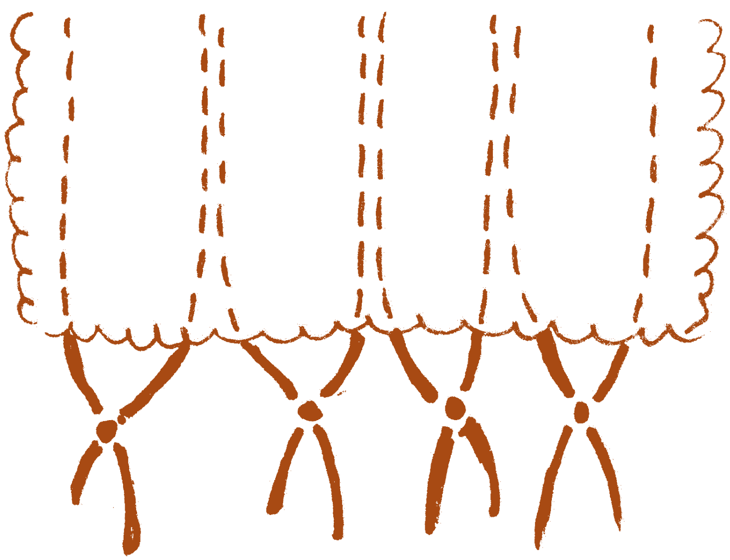


Continue to weave until you have covered the whole warp. After this, the time has come to cut the warp and fasten off the work. Pull each peg separately out from its slot and cut the warp in the middle. Continue until the warp is cut loose.

Roll the work out into an even surface. In this phase you can still adjust the density and tightness. If the work is asymmetric, you can tighten the warp from the looser side. If the work is too loose, pull the weft tighter and tighten the warp thoroughly. If the weft is unevenly on the warp, you can arrange it to be more even.

When you are happy with the work, it is time to tie the warp ends, so that the work will not unravel. Take adjacent warp yarns and tie them together. The outermost yarns can be tied together three at a time.

Depending on the material, the work can be post-processed for example by felting it lightly. Raw wool can be washed and felted at the same time. For this purpose Marseille soap or tall oil soap, "mäntysuopa", are the best choices. If the fabric is very dirty, you can also soak it for a while in soapy water or as an alternative wash and felt it several times. •



Hemp fibre with raw wool. Photo: Outi Tuomela.

Dyeing with Natural Ingredients

Sinikka Korhonen

Papu Pirtola at Medieval Market in Turku. Photo: Outi Tuomela.

History of dyeing

Domestic sheep has been held as a domestic animal for over 10 000 years[1] and wool dyeing has also been practiced about the same time. Iron and oak bark have been used already in the Bronze Age to get a black colour[2]. In India and Egypt, madder has been used to get bright red colours as early as 2000 BCE[3]. In Greece and Egypt, people invented the use of certain sea snails (Murex brandaris) to have a much wanted purple colour 2000 BCE. These animals were almost consumed to extinction, when people craved to have purple-coloured clothes. To have one ounce (about 30 grams) of Thyatirian purple over 20 000 shells are needed.

Aphids were also used for dyeing. For example the Coccus icilis (a Kermes insect) were used around year zero in Persia and Cochineal aphids in Mexico about 1 000 years later. Both give out an intense red colour[3]. One of the oldest plants used for dyeing is also indigo from the indigo plant, and here in the North also from woad (Isatis tinctoria). Indigo is a blue colour. In the North, woad has been used since the year 860, since findings from the Oseberg burial ship have revealed pieces of woad plant and seeds[4].

Dyers were appreciated due to their professional abilities and skills, but foul odours and the hardship of dyeing also awoke a different kind of reception. An Egyptian papyrus from the year 236 BCE mentions that "dyers have tired eyes, they smell of fish and their hands are ever working."[5]

Queen Elisabeth I (1558–1603) prohibited with a regulation the enrichment of woad within five miles of royal property. Using putrefied urine when working with woad was common, so the sour attitude was quite understandable.

In the beginning, dyeing was knowledge that was tightly held within guilds' walls, and different ways to dye and dyeing recipes were guarded as great secrets, especially with regard to the colours red and violet. When printing was invented, also dyers' secrets started to slowly spread among common people[5].

New trade routes and the time of voyages brought new dyeing plants to Europe, first from the Middle East, from the year 1400 from America and soon after also from India. **Carl Von Linne** as well took into account if some plant was mainly used for dyeing and named it "tinctoria", meaning dyer, "tinctor", in Latin[3].

Along the industrialising and development of chemistry, more powerful chemicals were introduced. These polluting chemicals were then carelessly released into rivers and lakes. In 1830, **Ferdinand Runge** managed to filter aniline from coal tar and **William Perkin** succeeded to separate the first usable tar dye around 1850. Year 1856 is considered as the birth year of tar dyes. These pigments endured both light and washing poorly, for which they were also criticised[6].

Natural dyes started to became popular again in the beginning of the 20th century, for example several newspapers published articles, plant dyeing classes and other information about it[7].

Chemistry of dyeing

The idea of dyeing is to extract pigment from a plant, animal or mushroom and then attach it again into yarn or cloth. In some dyes the chemical structure is such that the colour attaches easily without any help, whereas in some dyes it has to be bound with chemicals. Wool and silk as protein fibres are most easily dyed, cotton and linen as cellulose fibres are more difficult. Dyeing synthetic fibres is also worth testing, some mixed-yarns might even dye better than those of pure wool[8].

There are also many different methods of dyeing. Using mordant means a method where the dye is chemically bound to a material with a metal salt. In vat dyeing the pigment has to be modified into a form that is attached to fibres, through several chemical treatments[9]. In days of yore, dyers commonly used iron or copper cauldrons when working, and so the mordant came naturally from these metals[3]. Some also threw, for example, iron nails, old horse shoes or other similar things into the mix[5].

The mordants used when dyeing wool

One of the most common mordants is alum, hydrated potassium aluminium sulphate that does not affect colours. The amount of alum used in dyeing is 10 g / 100 g wool yarn[8].

Alum creates a thin "glue layer" between the fibre and the pigment. The cream of tartar (Potassium bitartrate) is used often with alum mordanting to equalise the colour. The amount is about half of the alum amount[3]. Using tin salt – tin chloride – as a mordant brings about brighter colours, because it can attach more pigment molecules to itself. This mordanting is however more difficult to make than alum mordanting, because tin salt has to be soaked into acidic water and the life span of this solution is very short. The suitable amount of tin salt is 3 g / 100 g wool yarn, and to have proper acidity, 20 g of Potassium bitartrate must be added as well[3].

Iron mordanting with iron vitriol makes colours appear darker, because the "glue" between the fibre and dye has a brownish hue. One can also do after-mordanting with an iron if a darker shade of colour is desired.

A good amount of iron salt is 1–5g / 100 g yarn. Glauber salt as addition increases the attaching of iron salt[8]. A too large amount of mordant may cause the yarn to become fragile.

In many, especially in older "how-to-dye books" you can find instructions how to use chromium, ferrocyanide or copper in dyeing, but all these should be left out because they are either poisonous, may cause cancer and/or pollute

Photo: Niko Korhonen.

the environment[3]. Tannic acid is used when dyeing cellulose fibres[8]. Vat colours that were mentioned earlier are dissolved into water by reducing them in alkaline liquid. Earlier rotten urine, ergo ammonia, was used for this purpose[4], but today one can use for example washing soda. There are several instructions how to do this[4], but basically vat dying works in the following way: woad or indigo plant leaves are boiled or fermented, which causes the precursors of indigo to detach themselves in the dye solution. After this the liquid is filtered and the pH is lifted to very alkaline with ammonia and at the same time the liquid is oxygenated by whisking the solution forcefully. When the liquid is oxidised enough, the reducing agent is added. Nowadays one can use either sodium hydrosulphite or what they used in the olden days, flour or fruits[4]. Damp yarn or cloth is added to the solution. When it is lifted from the solution, the oxygen in the air oxidises it and the colour turns indigo blue[9].

Indigo dye is moderately fadeless but not very rub resistant. This is the reason that jeans dyed with indigo usually start to fade in certain places.

Plants and fungi used for dyeing

Originally plants used for dyeing were those that were inedible, for example the Arctostaphylos (bearberry) and carrot tops. Plants are dried in an airy place to make them keep longer. If not enough fungi or plant is found at once, can it be collected in stock for a longer period of time. The amount of dye needed in ratio to yarn is usually about 2:1, in semi-strong dye solution about 1:13.

Yellow colours

A yellow colour is derived from several plants, e.g. mountain ash (Sorbus) and birch leaves, tansy (Tanacetum vulgare), especially tansy flowers, onion peel, heather and many different mushrooms, for example from peppery boletus[10].

Green colours

A green colour is traditionally achieved by dyeing the material twice. First with indigo to get a blue colour and after this with a yellow dye[3]. With iron mordanting, many yellow colours can be tinted to green, for instance with velvet-footed pax and common reed.

Red colours

A bright red colour is traditionally derived from cochineal and its carmine acid[3]. Carmine acid is still used in Campari and also in sweets, ice cream and other foodstuff as well.

A red dye is derived from madder and especially from a certain mushroom, Cortinarius sanguineus (blood webcap) and Cortinarius semisanguineus (surprise webcap/red-gilled webcap) that both contain lots of red pigment[3]. The amount of webcaps needed for dyeing is 0.5–1:1 regarding the yarn or cloth[8]. Also bird cherry berries and chokeberries are used to get a lasting red[10].

Blue colours

A blue is traditionally received through vat dyeing with indigo or woat. The pigment is called indoxyl[3]. Some mushrooms also give out blue hues, but they are not as bright as indigo blue[3]. E.g. certain hydnum can be used to get a greyish blue dye. Many instructions also mention Sarcodon imbricatus although they should be from the previous autumn and preferably mummified.

How to dye?

Take a big kettle and fill it with water. Add 100 g dried birch leaves. Soak overnight. Boil the leaves for an hour. Cool the solution and sieve the leaves from water. Add 10 g of alum (can be found e.g. from a pharmacy) to the water. Add 50–100 g of woollen, coiled yarn into the solution. Slowly and carefully lift the water temperature to 80–90 degrees, but do not let it boil! Keep the temperature high for an hour. Take the kettle away from the heat and let it cool till the next day. Rinse the yarn thoroughly and hang to dry. If the dye solution still contains colour, it can be re-used. •

Sources:

1 http://www.sheep101.info/history.html
3 Sundström E. 2003. Värjäämme yrteillä, sienillä ja jäkälillä. Translated into finnish by Ilona Sevelius. Mäkelä.
4 Hannusas S.; Raitio S. 1997. Morsinkovärjäys - historiaa ja kokeiluja. Turun Maakuntamuseo Monisteita 12. Saarijärvi: Gummerus kirjapaino Oy.
5 http://www.coloria.net/historia/varjays.htm
6 Sisefsky J.; Sandberg G. 1984. Värjärin kirja. Translated into finnish by Eeva-Liisa Nisula. Helsinki: Otava.
7 http://www.kansalliskirjasto.fi/kokoelmatjapalvelut/digitaalisetkokoelmat/historiallinensanomalehtikirjasto17711890.html
8 Tetri A. 2010. Luonnonvärjäys. Vantaa, Kustannusosakeyhtiö Moreeni.
9 Aalto T. 2009, Värjäripäivät, http://www.varjarikilta.fi/tiedotteet/09_vp/morsinko.pdf
10 Aitomäki R.; Colliander H.; Kotiranta H. 2000. Väriä luonnosta. 3. edition. Helsinki: Tammi.

Birch Bark

Information on qualities and potential uses

Riikka Kivimäki

A brief history of birch bark utilisation

Birch bark has been used both in folk medicine and everyday items since the Stone Age. Birch-bark items have been located all around the world in areas where birch trees have existed after the Ice Age. Items made of birch bark have been found the most in northern areas such as northern Russia, Scandinavia and North America. However, there have been some findings in the south as well, in Pakistan and Afghanistan[1].

Birch-bark items have been found in tombs and in the remnants of mummified people. The findings that were made in Sweden and Denmark have proven that during the Bronze Age the dead were buried wrapped in birch bark. In 1991, a mummified man carrying two boxes made of birch bark was discovered in a glacier on the border between Italy and Austria[2].

Birch bark was an important commodity during the Middle Ages and it was possible among other things to pay taxes with it. Birch bark was used the most in the 18th and 19th centuries, when birch bark was such key merchandise that markets were named after it. The Turku Birch Bark Market was held in June to coincide with the time of harvest for birch bark[3].

Birch bark findings have been abundant, because items made of birch bark have preserved better than items made of wood or textiles, due to the more proficient resistance in birch bark against rot[4]. The thread used in the stitches of the birch-bark purse, presented in the picture, has rotten. Thus, the birch bark endured rot much better than the thread did.

All the drawings and photos: Riikka Kivimäki.

A handmade and sewn birch-bark purse from the 11th or 12th century has been found in the tombs of Kirkkomäki in Turku. Finnish traditions in birch bark weaving can be found in Karelia, because from there it is possible to obtain the best birch bark for weaving, in terms of thickness and flexibility. Finnish birch bark weaving has drawn influences from the kindred nations of Otyaks and Votyaks[5].

North Karelia is a traditional area of woven birch-bark products. In North Karelia and Central Finland, birch-bark traditions are becoming increasingly cherished. The Ilomantsi-Tuupovaara region has been developing a birch-bark crafts centre, where birch-bark production, sales and education are researched and developed[6].

Making birch-bark items

Birch-bark items have been produced particularly by weaving, sewing and gluing. Clothes and equipment have been made of birch bark using the same methods as with leather and textiles[7]. Especially in the countryside, birch bark was taken into broad use as a raw material for various household utensils[8]. Many containers were repaired with birch bark. For instance, broken ceramic containers were repaired by wrapping birch-bark string around them[9]. Birch-bark items have been decorated with stitches and cuts. Plants and geometric formations have been popular patterns.

Backpacks, bast shoes, vests, headwear, jewellery, decorative items, knife sheaths, casks, water skins, birch-bark bottles, shepherd horns and various containers woven of birch-bark strings are still popular birch-bark products. In addition, durable ropes were woven from birch-bark strings in the olden days. Fishermen preferred birch bark because it was light, it floated and it did not get wet. By boiling birch-bark strings in water, sponges, floats and net weights were made from it, because birch bark curled up in tight rolls due to the influence of warmth. Various disposable plates and cups were made from birch-bark sheets, such as small baskets and drinking vessels; accessories were also sewn from them. Hunters did not have to carry containers or sleeping paddings on their hunting trips, because they were made on the spot from waterproof birch bark. Even cookware was made from birch bark. Although birch-bark containers did not endure open flame, they could be placed in the middle of warm ashes. The best known container made from birch bark is probably the basket for Finnish Easter pudding “mämmituokkonen”, which was still used popularly in the 1930s to prepare Finnish Easter pudding. If needed, birch-bark sheets were bent to work as a rain coat or as protection against the sun and birch-bark insoles were slipped inside shoes. Birch bark was also used to decorate homes, for flower pots were made from it. Sometimes birch bark was even used to bind wounds[10].

The birch bark that was used in sheet works was often thicker than that in woven products. In these items, the white outer surface of birch bark was often left to the object’s outer surface and it was not removed like in woven works. With sheet products, it did not matter if the item was somewhat rough, as long as the rough spots were not on folds. In case stitches were not wanted on a box, the joint was put together by a joggle. It requires hardier birch bark, which is often softened before bending; otherwise the birch bark might split when assembling the box[11].

Boxes made of birch-bark sheets have often been sewn with thin pine roots or flax thread. It is easier to sew with flax thread and it is possible to sting it right to the surface of birch bark. If wanted, stitches can also be hidden in seams or they can be highlighted by using thread the colour of which differs from that of birch bark. Roots tend to push up from the surface and they stand out more clearly. That is why roots have been used in ornamental seams. Especially box lids are often decorated with different ornamental stitches. Roots from spruce and juniper have also been used to sew seams on birch-bark boxes. The easiest way to make stitches is to use fresh roots. However, even previously harvested roots can be used if they are softened first. Hoops of thicker roots or sprouts could be made into boxes that were shaped oval or round. Roots can be replaced with rattan. The lids and bottoms of the boxes are often sawn from timber[12].

Seamless containers are made from birch-bark tubes, which can be obtained by hollowing out wood from a log or by removing the birch-bark layer, detached from the phloem, of a sawn block of wood. A container made from birch-bark tubes may be so compact that it is suitable for storing milk or sour milk[13].

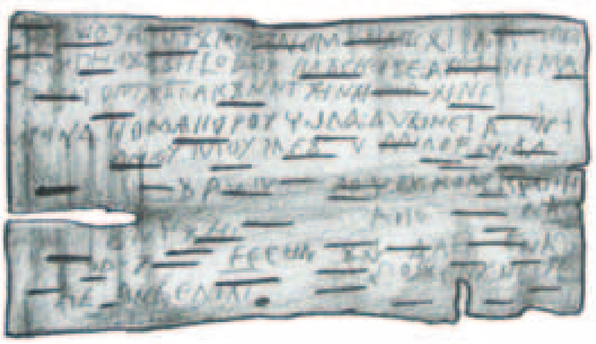
Native people in North America made canoes from birch bark by spreading fresh birch bark on the ground and then the framework of the canoe was built on it. The edges of birch bark were bent to the edges of the framework by wetting the birch bark with hot water. Lastly, the birch bark was attached to the edges of the canoe with root strings, both holes

and seams were sealed with spruce resin or birch-bark tar[14].

Birch-bark items in Shemogsa and Veliky Novgorod areas (north-western Russia) are internationally the most famous products made from birch bark[15]. As can be seen in the picture above, these items were made from birch-bark sheets and they were patterned by cutting different ornamental strings from birch bark. The product also demonstrates the proficiency in using different shades of birch bark.

Birch-bark documents

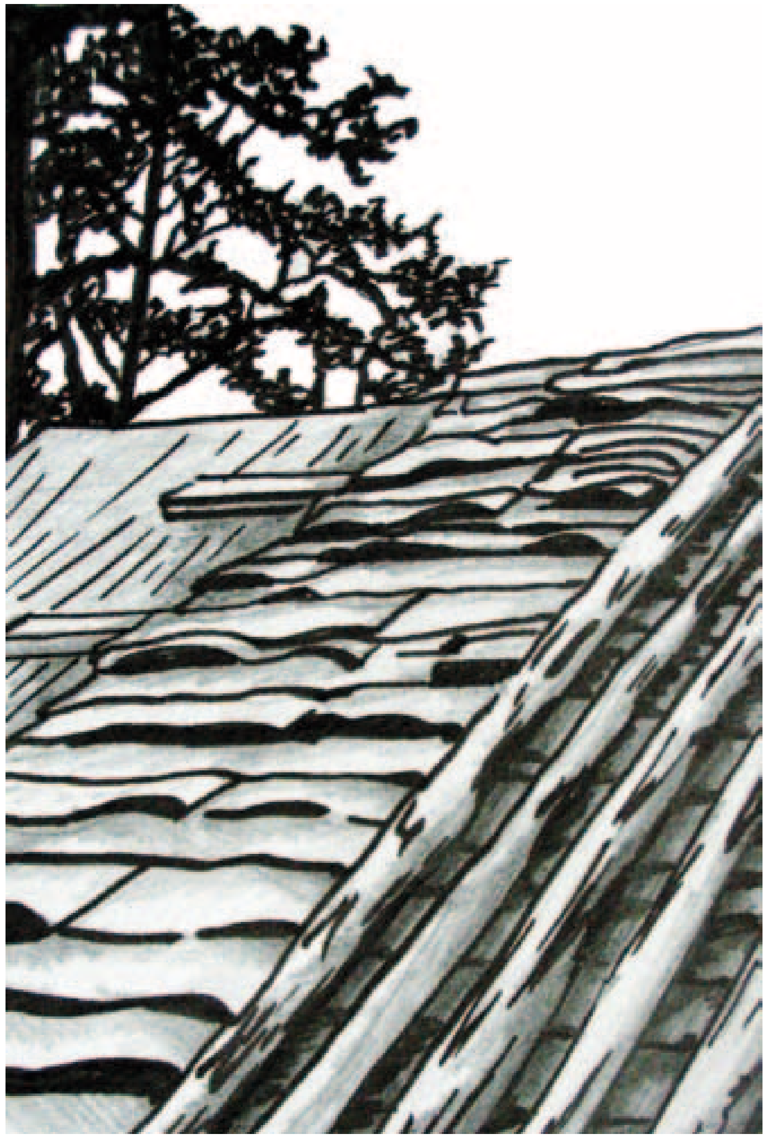
Birch-bark sheets were also used in the same manner as paper. Messages, documents, contracts and tax information were written on them. Sometimes birch bark was allowed to roll into a scroll so that the text remained hidden. Birch-bark documents on the history of Buddhism, dating from the fourth century, have been found in Afghanistan. Hundreds of birch-bark documents dating from the 11th century to the 12th century have been found in Russia, especially in Veliky Novgorod. The writing instrument used in birch-bark documents was either ink or a stylus with which marks were scratched on the surface of birch bark[16].



The birch-bark document in the picture, dating from the 13th century, is the oldest known document written in a Finnish language. Picture: Gramoty 2009. Birchbark Literacy from Medieval Rus. http://gramoty.ru [17.8.2012]

Using birch bark in construction

Due to its traits, birch bark is an excellent material for insulation and it has been used in birch-bark roofs as roofing material and



as insulation inside walls. Birch-bark roofs have endured even longer than shingle roofs. Birch-bark roofs were built in night-time or in a cloudy weather, because sunshine made birch-bark sheets to curl[17].

Birch-bark roofs were one of the most popular roofing types in Finland until the 1860s. The role of birch bark is to serve as roofing material against natural elements. Depending on the quality of birch bark, birch-bark sheets are stacked into three to six layers. Birch-bark sheets that are in good condition on old birch-bark roofs can be left underneath new layers of birch bark. One must take the direction of the fibres in birch bark into account when stacking birch-bark sheets. Birch bark endures stress from supportive timber better without splitting if its fibres are directed sidewards[18].

Supportive timber, stretching from the ridge to the eaves, is placed on birch-bark sheets. In some cases, birch-bark sheets could be covered with turf. The functions of turf and supportive timber are to keep the birch-bark sheets in place and to cover them from sunlight. Spruce has been a popular material for supportive timber and formerly they were attached to the roof with twigs from junipers. Natural drip edges were made by carving sharp the tips of the supportive timber that stretch above eaves[19].

Birch bark was used in many structures in addition to its use as an insulation material. Birch bark was rolled around poles and timber, also between footing and timber in houses, to serve as insulation against moisture and rot[20].

Birch-bark tar and birch-bark extract

Birch bark can be used to make tar by burning pieces of birch bark in oxygen-free space. Birch-bark tar is tough and rubbery. It has been used to wax leather footwear, as an adhesive and as a seal in birch-bark works[21]. Also, different kinds of extracts and oils can be made from birch bark. Birch-bark oil can be used in the raw to tan leather and various adhesives can be refined from it[22].

The composition of birch bark

Birch bark is like what skin is in human beings. It is dead tissue which has turned into cork-like material. Birch bark grows from the inside, in other words the oldest layers are on the outer surface of birch bark and they flake off as they get old. Every year a new layer grows. The older the birch is, the thicker its bark layer is[23]. Birch bark covers the trunk from weather conditions such as rain and sunshine.

Birch bark can be harvested from both downy birches and silver birches. Downy birches are whiter and their branches grow more upright than those of extensively branched silver birches. In addition, silver birch bark is rougher. Silver birches grow in drier soil, whereas downy birches are more comfortable in moist habitats. Many consider the bark of downy birches to be of better quality and easier to work with. The bark of silver birch is regarded sturdier. This is worth keeping in mind if the purpose of use for birch bark is known before harvest. However, both varieties have almost equally suitable qualities for birch-bark works[24].

Betulinol is one of the earliest found compounds that have been isolated from birch bark and it was scientifically discovered already in 1788. Almost a third of birch bark is betulinol ($C_{30}H_{50}O_2$) which has anti-septic qualities. Furthermore, there are silver compounds in birch bark. These compounds purify air by dissipating fungi and they improve the quality of air in buildings damaged by mould. Betulinol intrigues researches especially in cosmetics, pharmacies and chemistries[25].

The antiseptic qualities of betulinol were recognised before the development of medicine, because birch bark was widely used in folk medicine. In addition, it was noticed that containers made from birch bark preserved the freshness of pastries longer and people who wore birch-bark shoes did not suffer from Athlete's foot. Also, pieces of jewellery that were preserved in birch-bark boxes kept their shine longer[26].

The properties of birch bark

Lecturer **Jan Gustafsson** in Åbo Akademi told during his class about the chemical constitution of natural materials and microscope level research “Chemical and microscopic research on natural materials”, on 3rd February 2010, that natural materials are not homogeneous. Specimen belonging to the same variety may vary in structure, thus their properties differ as well. This is influenced by soil and the substances in it, among other things. For instance, iron assimilates according to the iron content of soil, which may change the properties of plants.

Birch bark is also influenced by the tree's age, growth position, fertilisation, thinning and climate. Also, samples of birch bark harvested from the same tree can differ in their properties. Birch bark harvested from the base of the tree can be different from the birch bark harvested from the top of the tree. In addition to this, timing, storing and refining influence the properties of birch bark[27]. Especially the tree's age, trunk diameter and the thickness of birch bark matter. Birch bark is thinner in younger and smaller trees. It is also more difficult to detach from the trunk than it is from older trees which have thicker and more durable bark.

Birch bark is light, sturdy, flexible, durable, watertight and it has good thermal conductivity. Birch bark feels a little bit like silk. Birch bark preserves well without rotting even for hundreds of years[28]. The colour of birch bark varies due to the influence of several factors. The light colour of the surface alternates between different shades of grey. There are black stripes of different sizes on the surface which are the largest at the base. It is possible for birch bark to turn black and jagged, and that is when it starts to resemble the bark on other trees. The reason for this has not been proven, but pollution, habitat and weather conditions are presumed to cause jaggedness.

The timing of birch-bark harvest influences not only how easily birch bark is removed but also the colour of it. Birch bark may turn multi-coloured and darker as it gets older. Generally in the spring and early summer the phloem side of birch bark is light-coloured and yellowish. As autumn approaches, the colour of birch bark gets darker. Birch bark becomes more strongly attached to the phloem and when it is removed, fibres from the phloem get caught on the birch bark easily. The phloem is darker in the autumn and winter. Furthermore, birch bark harvested in the autumn is tougher and more durable than birch bark harvested in the spring. Tougher birch bark is more fit for demanding weaving and sheet works. It is a lot easier to handle tougher birch bark and it is suitable for a wider range of products and techniques. Fresh birch bark may darken if it is exposed to sunlight. The colour of older birch bark fades if it remains in the sunlight for a long time[29].

There is also birch bark that is reddish on the surface. It gets sheet-like and splits easily; that is why it cannot endure processing very well. This is why you should consider before using it in birch-bark works[30]. This kind of birch bark is very difficult to remove from the trunk in one piece. It tends to break into sheets when removed.

Betulinol concentration influences the colour of birch bark. Birch bark has been used as a kindling as well[31]. It is because of betulinol that birch bark ignites easily from sparks or direct contact with flames. It continues to burn after contact. According to **Seija Laaksonen**, who weaves rugs from birch bark, the area where the birch lives affects the rich shades of the bark: "You can find lighter birch bark in damp areas and darker in dry areas[32]."

Birch bark turned black and jagged.

The colour of birch bark darkens as it ages[33]. Birch bark that is exposed to weather effects turns light grey and fluffy the same way that an untreated tree does[34]. Even though birch bark endures well in the outdoors, the appearances of untreated products may change over time. One can try different treatments, for example varnishing, to prevent the product from turning grey.

Exploiting the properties of birch bark

The quality of birch bark affects the weaving. The quality of birch bark determines which products can be made from the birch bark in question. Thinner and more flexible birch bark bends more easily, but you can also create many kinds of products from thicker and sturdier birch bark[35]. Birch bark that is too thick can be made thinner by removing layers from its underside. Hard spots are also worth removing if they hinder the making of the product[36]. I have noticed that when you bend or especially when you weave birch bark it tends to break from these hard spots and larger black stripes.

Because there are differences in the quality of birch bark, it is worthwhile to choose pieces of birch bark that are as similar as possible to ensure that the product is of uniform quality. It may take some time to sort birch bark material, so it pays off to sort them immediately in the pursuance of harvest. **Raimo Toivonen** recommends marking the date of harvest and the serial number according to the tree that has been barked. This way, it is easier to make birch-bark products from the same tree[37]. Birch bark can be harvested in different seasons and places. This is how you get material in different shades. By doing so, you can get a broader selection of colours without using dyes.

Often in woven birch-bark products the phloem is visible and the outer surface of birch bark is inside the weavings, because this way the product endures use better. There are clear differences, but not that big, in longevity between the sides of birch bark. The phloem is hardier and it is easier to cut marks in it with a knife. On the other hand, the outer surface is softer and more flexible.

Birch bark processing

Thinning

Birch bark consists of multiple layers so thinning it is easy[40]. Birch bark grown in dry habitats is more prone to become sheet-like. In other words, the layers of birch bark growing in dry habitats are easier to detach from one another than they are in birches grown in damper areas[41]. Birch bark can be thinned immediately when it is fresh, or later if the purpose of use is not known at the time of harvest. It is easier to make fresh birch bark thinner, because when birch bark dries, the different layers lodge tighter together[42]. Stiffer products can be made from thick birch bark and softer products from thinner birch bark.

Heat treatment

As birch bark dries, it curls and heat accelerates the process[43]. Birch bark always curls in the same direction, that is horizontally in relation to the growth direction of the tree, so that that the outer surface of birch bark remains inside the roll. Curled birch bark can be straightened by dipping it in boiling water and then straightening it. Birch bark can be treated the same way with cold water, but then the straightening process is slower. Adding salt to the water enhances the straightening and softening processes[44]. Straightening birch bark with the help of water makes using curled birch-bark strings easier. Traditionally, birch-bark shoes were first softened in a hot oven, in water or in a sauna stove and after that they were shaped according to the user's feet. Worn out birch-bark shoes were recycled. After their initial purpose as shoes, they were transformed to serve as brushes[45].

Making birch bark more flexible

Birch bark can be softened by soaking it in tepid or warm water if it has dried or it has become too hard to work with[46]. **Sulo Määttä** has softened hard birch bark with paraffin oil and steam. The softening can be done in boiling water as well, but it may be too harsh a method because then birch bark starts to curl easily. Birch bark can also be made more flexible by treating it with chloride[47]. After the treatment, even products that have been made from thicker birch bark are more flexible.

Finishing birch-bark products

Birch bark properties can be modified with the help of finishing and birch bark can be made to suit different products better. For instance, birch bark that is exposed to rigorous friction in its environment can be modified to endure drying and use better. Birch bark can also be treated to repel dirt. Finishing should be used with caution, because it can easily have a negative impact on the appearance of a product and ruin the natural feel of birch bark. Also, in the course of time, untreated birch-bark products acquire a beautiful patina.

The most used finishing in birch-bark products is coating. Birch-bark products that have to bend in use are often covered with floor wax or vaseline. Paraffin oil, linseed oil or different lacquers can be used to get a shine on the surface of birch bark; the products also endure use better after the treatment. In addition, the colour of birch bark remains unchanged longer and the surface repels dirt better. Extra oil that has not been absorbed can be wiped off after 24 hours from the treatment[48]. The appearance of birch bark can easily turn plastic if the lacquering is not successful. The use of lacquer requires testing with different levels of shine. Matt lacquer is better suited for birch-bark products than shiny lacquer if it is important that the original level of shine on the surface is preserved.


Coatings affect the level of shine on birch bark.

1. thick paste
2. thin paste
3. carpenter's glue '(borax + casein)'
4. thin alcohol-based lacquer (shellac + Sinol (ethanol-based fuel), 2–3 hours after dissolution)
5. alcohol-based lacquer (shellac + Sinol [ethanol-based fuel], 18 hours after dissolution)
6. wood glue
7. wood glue + water
8. wood wax
9. dim lacquer

The amount of paste affects the level of shine; the thicker the paste and the more of it is applied on birch bark, the shinier the surface will be. The same effect applies to alcohol-based lacquer. The more shellac is dissolved in alcohol, the shinier the surface becomes. Alcohol-based lacquer also changes the colour of birch bark into yellowish. Wood glue turns considerably dimmer when water is added. The levels of shine in the wood wax and dim lacquer I tried were not as high. However, they clearly make the surface of birch bark shinier. The best way to preserve the original shine on birch bark is to use thin paste and carpenter's glue.

Patterning & dyeing

Birch-bark products can be patterned with various methods. Birch bark can be coloured with different pigment colours, lacquers, waxes and soot. Furthermore, different patterns can be pressed and cut on the surface of birch bark. Ornaments that respect the spirit of the times have been preferred as patterns in birch-bark products.

Because the surface of birch bark is soft, different patterns can be drawn on it by pressing lightly with an awl or a sting. Even a sharp stick can work as a drawing tool. A more demanding ornament can be carefully drafted with a pencil on the surface of birch bark. Also, the surface can be scratched off with a chisel. It is advised to consider thoroughly before using dense or detailed patterns, because they may cause the birch bark to split. Perforation has been a popular patterning technique as well[49].

Harvesting birch bark

Birch bark that is whole and of uniform quality can be obtained from lumpless birches with straight trunks, which have as few branches as possible or the branches are high in the top[50]. The harvesting of birch bark should take place as soon as possible once the tree is fallen, because birch bark starts to dry and curl shortly after the fall[51].

The proper time for birch bark harvest is in the early summer at the end of sap season. Approximately a week before Midsummer and a month from it is when birch bark is easiest to remove from fresh birches. Soon after "the month of birch bark", bark starts to lodge tighter on the vascular cambium, and becomes harder to remove[52].The best time of harvest varies slightly with habitats and weather conditions. Especially the timing of spring, rain and fair weather fluctuations affect the timing of the birch bark month each year. Birch bark that grows in shadowy groves may be harvested at different times than those which grow in sunny heaths[53]. Birch bark can also be harvested in other times but it requires more work.

Birch bark can be detached as strings or sheets from the trunk, depending on the purpose of use and the harvester's

Where birch bark has been removed, phloem starts to become harder. (Nuuksio 10 Oct. 2010)

preferences. Detaching birch-bark sheets is faster and easier, but weaving often requires longer strings than it is possible to cut from birch-bark sheets. The more tenacious the birch bark is, the narrower are the strings that can be harvested from it. It is recommended to harvest birch bark in dry weather because rain makes birch bark curl. Too much sunshine should be avoided because it also makes birch bark curl. To harvest birch bark, a permission from the landowner is required. Harvesting birch bark is not included in Everyman's Rights: it is prohibited to harvest parts of fallen or growing trees. By the Swedish legislation, it was prohibited to harvest birch bark without permission already in the Middle Ages, which was probably so because of the economic value of birch bark[54].

Birches suffer if the birch bark is removed and they cannot recover very well, but the process does not necessarily kill them. Especially the tree's ability to fight off cold and pest insects weakens. In addition, the wood may be damaged so badly that it has an effect on the growth of the tree. New birch bark will not grow, but the phloem, that is now the outermost layer, becomes harder. The process can take up to ten years[55].

Storing

The right method of storing birch bark is important for the product unless it is processed immediately. Birch-bark strings can be stored by curling them into airy rings, tangles or coils against the natural rotation direction of birch bark and by binding them with narrow birch-bark strings. By doing so, the lighter coloured outer surface of birch bark remains on the outer surface of the ring. In case the purpose of use for the bark is known before storing, it is wise to cut the strings in fitting lengths already before putting them into storage, because it is easier to cut fresh birch bark than stored birch bark. Birch-bark sheets are stacked by placing them one after another the other way around, in other words the outer surfaces facing each other. A weight is put on the top of the stack to keep the sheets straight so that they cannot curl. Birch-bark sheets can be stored also by curling them into rings and binding them with twigs or birch-bark strings. If birch bark is washed up or it is otherwise moist after harvest, it is worthwhile to let it dry for some time before it is stored. The best place for storing birch bark is an outdoor storage that is slightly moist and where air can circulate. Moist birch bark that is stored right after harvest and packed too tight may mildew. If birch bark is stored correctly, it will not dry or mildew and it can be stored for quite a long period of time before further processing. As with other natural materials, it is wise to avoid plastics when storing birch bark. It is also advisable to cover birch bark from direct sunlight, which can make it brittle and dry[56]. •

References:

[1] North House Folk School 2007, 1–4.
[2] Hall ym. 1997, 6; North House Folk School 2007, 2.
[3] Lindqvist 1987, 12.
[4] Arponen 1982, 6; Hall ym. 1997, 6; Toivonen 2003, 13; Suomen luontoyrittäjyysverkosto ry 2005; Pielisen museo 2006; Wikipedia 2009.
[5] Nadia Shop 2010.
[6] Suomen luontoyrittäjyysverkosto ry 2005.
[7] Savolainen 2006, 56; Wikipedia 2009.
[8] Lehtonen 2009.
[9] Hall ym. 1997; 6.
[10] Arponen 1982, 6; Lindqvist 1987, 10–12; Hall ym. 1997, 6; Sepän koulu 1998; Pielisen museo 2006; Savolainen 2006, 56; Tapio 2007; Auer 2008, 33; Laine 2008; Virtanen 2008; Lehtonen 2009; Wikikko 2009; Wikipedia 2009.
[11] Lindqvist 1987, 86, 91.
[12] Lindqvist 1987, 86, 91.
[13] Lindqvist 1987, 10-–11, 88.
[14] Hall ym. 1997, 6; Wikikko 2009.
[15] Tapio 2007; Nadia Shop 2010.
[16] Lindqvist 1987, 11; North House Folk School 2007, 3–4.
[17] (Sepän koulu 1998; Mattsson 2003; Suomen luontoyrittäjyysverkosto ry 2005; Pielisen museo 2006; Laine 2008; Virtanen 2008; Lehtonen 2009; Wikipedia 2009; Nadia Shop 2010; Restaurointikuvasto 2010.
[18] Lindqvist 1987, 10; Mattsson 2003.
[19] Hall ym. 1997, 6; Mattsson 2003.
[20] Lindqvist 1987, 10; Hall ym. 1997, 6
[21] Sepän koulu 1998; Wikikko 2009.
[22] Hall ym. 1997, 6.
[23] Lindgvist 1987, 13; Toivonen 2003, 15; Suomen luontoyrittäjyysverkosto ry 2005; Pekkarinen 2009.
[24] Lindgvist 1987, 13; Hall ym. 1997, 4.
[25] Suomen luontoyrittäjyysverkosto ry 2005; Krasutsky 2006; Losoi 2009; STT 2009; Wikikko 2009; Wikpedia 2009; Nadia Shop 2010.
[26] Nadia Shop 2010.
[27] Virtanen 2008.
[28] Lindqvist 1987, 13.
[29] Arponen 1982, 7; Lindqvist 1987, 15; Toivonen 2003, 14–15; Laine 2008.
[30] Lindqvist 1987, 15.
[31] Suomen luontoyrittäjyysverkosto ry 2005; Tapio 2007; Wikpedia 2009.
[32] Heikkinen 2009.
[33] Savolainen 2006, 62.
[34] Toivonen 2003, 13.
[35] Paunonen 2009.
[36] Laine 2008.
[37] Toivonen 2003, 12–13.
[38] Nadia Shop 2010.
[39] Toivonen 2003, 13.
[40] Savolainen 2006, 65.
[41] Arponen 1982, 6.
[42] Lindqvist 1987, 16.
[43] Toivonen 2003, 14; Savolainen 2006, 65; Wikipedia 2009.
[44] Wikikko 2009.
[45] Lindqvist 1987, 12; Sepän koulu 1998.
[46] Arponen 1982, 14.
[47] Toivonen 2003, 14.
[48] Arponen 1982, 14; Lindqvist 1987, 23; Hall ym. 1997, 26; Nadia Shop 2010.
[49] Hall ym. 1997, 26.
[50] Arponen 1982, 7.
[51] Laine 2008.
[52] Arponen 1982, 7; Lindqvist 1987, 13, 15; Hall ym. 1997, 8; Toivonen 2003, 11; Suomen luontoyrittäjyysverkosto ry 2005; Savolainen 2006, 62; Laine 2008; Wikipedia 2009; Nadia Shop 2010.
[53] Lindqvist 1987, 13; Hall ym. 1997, 8.
[54] Arponen 1982, 7; Lindqvist 1987, 12, 15; Hall ym. 1997, 8; Toivonen 2003, 11; Mattsson 2003; Saarikoski 2004, 90; Suomen luontoyrittäjyysverkosto ry 2005; Laine 2008; Ympäristöministeriö 2008; Wikipedia 2009.
[55] Arponen 1982, 7; Lindqvist 1987, 15: Hall ym. 1997, 8; Toivonen 2003, 11; Mattsson 2003; Saarikoski 2008, 90; Suomen luontoyrittäjyysverkosto ry 2005; Laine 2008; Ympäristöministeriö 2008; Wikipedia 2009.
[56] Lindqvist 1987, 15–16; Hall ym. 1997, 10; Sepän koulu 1998; Suomen luontoyrittäjyysverkosto ry 2005; Laine 2008; Arponen 1982, 9.

Sources:

Literature:

Arponen, O. 1982. Opimme punomaan. Tuohi-, lastu- ja päretyöt. Espoo: Weilin+Göös.

Auer, L. 2008. Luonnonmateriaalit rakentamisessa ja dekoraatiokulttuurissa, Markkinatutkimus Varsinais-Suomen näkökulmasta. Opinnäytetyö. Kestävän kehityksen

koulutusohjelma. Turku: Turun ammattikorkeakoulu.
Hall, L.-G.; Ljungberg, G. & Ljungberg, I.-A. 1997. Harrasteena tuohityöt. Karkkila: Kustannus-Mäkelä Oy.
Lindqvist. S. 1987. Miten tehdään tuohitöitä. Helsinki: Tammi.
North House Folk School. 2007. Celebrating Birch. The lore, art, and craft of an ancient tree. East Petersburg: Fox Chapel Publishing.
Saarikoski S. 2004. Kaislakranssista heinähelmeen. Jyväskylä: Atena.
Toivonen, R. 2003. Tuohitaitaja. Jämsä: Raimo Toivonen.

Articles:
Heikkinen, P. 2009. Materiaalit luonnollisesti luonnosta. Turun Sanomat 10.12.2009 23.
Palm, P. 2009. Pilke johtaa puun ytimeen. Turun Sanomat, 25.11.2009, 21.
Savolainen, A. 2006. Minun korini. In Koskinen, M.; Savolainen, A. & Väätäinen A.-M. Muistiin punottua.
Woven into memory. Jyväskylä: Atena Kustannus Oy. 56–73.

Internet:
Krasutsky P. 2006. Birch bark research and development. Natural Product Reports. Accessed 14.6.2010.
http://www.rsc.org/delivery/_ArticleLinking/DisplayArticleForFree.cfm?doi=b606816b&JournalCode=NP
Laine, M. 2008. Tuohityöt. Museovirasto, Opetushallitus ja ympäristöministeriö. Accessed 1.2.2010. http://www.edu.fi > Hankkeita > Suomen Tammi -verkosto > Yhdessä oppimaan – Opas monikulttuurisen kulttuuriperinnön opettamiseen > Tuohityöt. (http://www.edu.fi/projektit/tammi/yhdessaoppimaan/019_Tuohityot.pdf)
Lehtonen, S. 2009. Tuohi taipuu moneksi mestarin käsissä. YLE Tampere. Accessed 1.2.2010.
http://yle.fi/alueet/tampere/2009/09/tuohi_taipuu_moneksi_mestarin_kasissa_1041234.html
Losoi, T.; Anne Varsamäki, A. & Ilari Pirttilahti, I. 2009. Sauna Concept Sydän. Accessed 1.3.2010. http://tuohisauna.wordpress.com/
Mattsson, U. 2003. Tuohi tiivistää savusaunan malkakaton. Turun Sanomat. Accessed 14.2 2010.
http://www.ts.fi/ajassa/?ts=1,3:1007:0:0,4:7:0:1:2003-08-17,104:7:170611,1:0:0:0:0:0
Nadia Shop 2010. Koivu ja Tuohi. Accessed 1.2.2010. http://www.nadiashop.com/fi/tuohi.php
Paunonen, R. 2009. Taipuisa tuohi kutsuu töihin. Länsi-Savo. Accessed 1.2.2010. http://www.lansi-savo.fi/Uutiset/8274232.html
Pekkarinen, E. 2006. Maailman suurimmat tuohivirsut. Maahenki Oy 2006. Kaikilla mausteilla – ite: Suomalaista nykykansantaidetta Juuassa Suomen Kivikeskuksessa 19.5.- 31.10.2006. Accessed 1.2.2010. http://joyx.joensuu.fi/helio/pitkospuut/kaikilla%20mausteilla/pages/IMG_2380.htm
Pielisen museo 2006. Tuohityöt. Accessed 1.2.2010. http://www.lieksa.fi/Resource.phx/sivut/sivut-lieksa-pielisen-museo/index.htx > Asuminen > Koti > Kodin työt ja askareet > Tuohityöt. http://www.lieksa.fi/Resource.phx/sivut/sivut-lieksa-pielisen-museo/asuminen/koti/tuohi.htx
Rakennusperinto.fi. Päivitetty 16.2.2009. Rakennusmateriaaleja. Palveluntuottajat ympäristöministeriö ja Museovirasto. Accessed 9.2.2010. http://www.rakennusperinto.fi/Hoito/Rakennusmateriaaleja/fi_FI/Rakennusmateriaaleja
Restaurointikuvasto. 2010. Malkakatto. Accessed 1.2.2010. http://restaurointikuvasto.nba.fi/restkuvasto/asp/rakosakuvahaku.asp?kuvaus_id=497
Sepän koulu 1998. Käden taidot. Accessed 1.2.2010. http://www.sepankoulu.fi > Projektit > Suomen kansankulttuuri > Käden taidot. http://www.sepankoulu.fi/kansa/kansa07.htm
STT 2009. Sinilevästä ja koivun tuohesta voi kehittää lääkettä. Turun Sanomat. Accessed 1.2.2010. http://www.ts.fi/online/kotimaa/58205.html
Suomen luontoyrittäjyysverkosto ry. 2005. Tuohi ja kaarna. Accessed 1.2.2010. http://www.luontoyrittaja.net > Toimialat > Erikoisluonnontuotteet > Tuohi ja Kaarna. http://www.luontoyrittaja.net/219.html
Tapio, J. 2007. Suomalaisesta koivusta on moneksi. Apu -lehti. Accessed 1.2.2010 http://www.apureportteri.fi/node/457
Virtanen, P. 2008. Metsästä moneen. Opetushallitus. Accessed 1.2.2010. http://www.edu.fi > Hankkeita > Suomen Tammi -verkosto > Aineistot > Verkkomateriaalit > Kasvit – elävää kulttuuriamme > Tiedon lähteeksi > Metsästä moneen.
http://www.edu.fi/oppimateriaalit/kasvikulttuuri/artikkelit/15_metsa.htm
Wikipedia 2009. Tuohi. Accessed 1.2.2010. http://fi.wikipedia.org/wiki/Tuohi
Wikikko 2009. Tuohi. Accessed 1.2.2010. http://wikikko.info/wiki/Tuohi
Ympäristöministeriö. 2008. Jokamiehenoikeudet. Accessed 14.6.2010. http://www.ymparisto.fi/default.asp?contentid=48853&lan=fi

Natural Clay in Climate Change

Jari Holopainen

This article is a continuation to the presentation *Ilmaston eletty muutos ja kestävä rakentaminen* (The Lived Change of Climate and Sustainable Construction) held at the ProNatMat Opening Seminar in Turku on 3 February 2010. The presentation suggested a new point of view for the definition of sustainable construction in the middle of climate change.

Challenging concepts

I have been interested in natural construction and clay as a building material for quite a while. In 1998–99 I had a chance to participate in the orientation phase of Arenas of Work and Know-How. Labour-Training Program[1]. In the final study that was part of the course I started to reflect on the conceptual issues of natural construction; what makes construction natural? Is it about nothing more than the materials used in construction or is it also about something else?

In over ten years, the conceptual issues have not disappeared; rather there are more of them. Also the interest towards natural construction has increased due to climate change. The climate change theme issue of *Arkkitehti* magazine 1/2008, for example, goes through the connection between sustainable construction and climate change and states that the concepts can be misleading[2]. For example the concepts of ecological, eco-efficient and sustainable construction should be replaced by a common concept of sustainable building. In this context, no position was taken regarding natural construction, but it is a concept that has been and is used to reflect the health and material choices (i.a. Helsinki University of Technology, Research Unit of Natural Construction that has been discontinued since). In future I will use both terms, natural construction and sustainable building, together. They are not necessarily synonymous; rather I would see them as the opposite sides of the coin and thus supplementing each other.

The concepts used are not always self-explanatory. What should sustainable construction be like? On the other hand is natural construction not as sustainable as sustainable construction? In relation to climate change, the issue can be even more complex, as the definition of climate change itself is ambiguous. At present the term climate change is in itself used in connection with more and more subjects, but the nature of its definition is often unheeded. Some think that climate change is about the increased carbon dioxide levels in the atmosphere while to others it means global warming. To some it is a new, more fuel efficient car, while others change their windows or acquire more efficient ventilation systems.

In practice the most remarkable definition of climate change for societal policy making has been presented by the Intergovernmental Panel on Climate Change[3] in its reports. In these, climate change is used to refer to any long term changes in climate either through natural variation or human activity[a]. However, in the terminology of the same report, climate change is used to refer to statistically significant variance in either the average state of the climate or its variance during decades or longer time scales[b]. Further, both references differentiate from the definitions used in the UN Framework Convention on Climate Change, where climate change is used only for changes caused by either the direct or indirect influence of mankind, e.g. altering the composition of atmosphere[c].

Towards better definition of natural construction

There are not yet any standards for either natural construction or sustainable building. Thus, any product can be marketed as either sustainable or natural. 'Eco' or 'organic' prefixes are also used widely, often without cause as part of a brand name[2]. Perhaps the word is considered to summon a certain obvious sense to the listener, thus influencing his/her purchase decision.

In Finland, housing construction is regulated by zoning, legislation and municipal building supervision, which have the role of guaranteeing the necessary safety, health and habitability standards. Zoning regulates the placing, height, shape and materials used in façades, for example. Respectively the legislation, where the Building Code of Finland has a central place, regulates the required construction methods and quality. As the municipal building supervision also inspects that the plans and construction work are properly executed, this should be a guarantee of natural and sustainable construction. In practice this is not that simple.

Norms and standards are rules of the society and they are binding directives for its members. Many subjects and topics such as quality, good construction conventions, manners, traditions, prohibitions and even morale, are covered by them. However, for some subjects, norms and standards give no directives and two of those are hopes and dreams. What is your dream house like? Another topic is definitions: if my dream house is constructed in a natural way, can I build one, if the law does not define the concept of a naturally constructed house? Norms and standards can also be characterised by that they do not to tell what is behind the dreams, desires and hopes of people, let alone fears and anxieties, which can make people lose their strength or will to talk and act, to live.

Neglecting the idea of man in the conversation can be a huge deficiency. The idea of man does not develop if it is not developed. The subject is far from insignificant, because exploring the idea of man can also give a completely new viewpoint to natural construction. There are different ideas of man and thus different conclusions can be reached. It is also common not to present the idea of man separately within a report or an article. This can be contradictory, because both construction and climate change, if any, contain the question about human influence in change and life in that change.

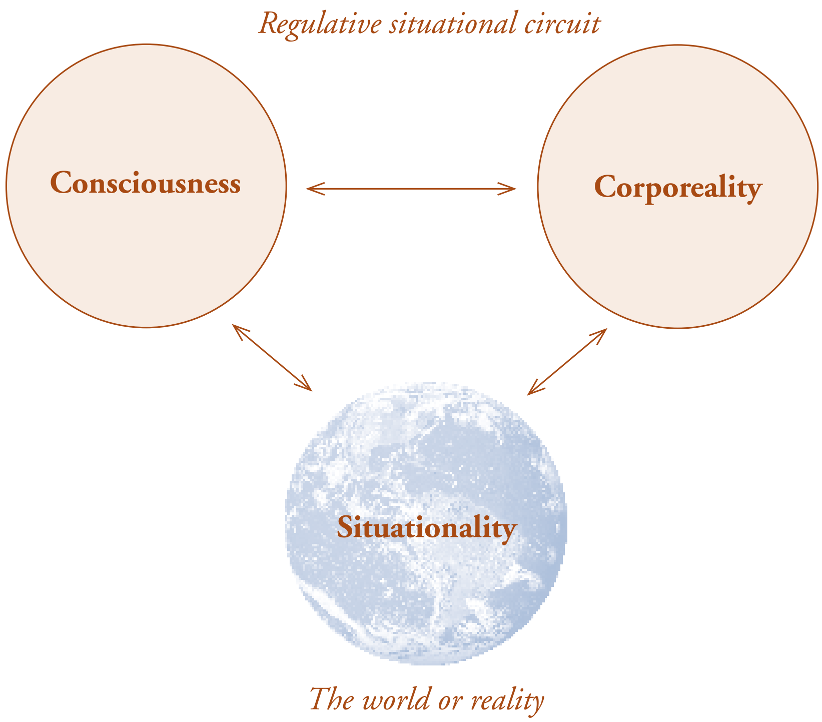


Figure 1: The basic dimensions the holistic concept of man metaphor by Lauri Rauhala.

In this article I will continue to use **Lauri Rauhala**'s holistic idea of man[3] used already in the "Ilmaston eletty muutos" (The Lived Change of Climate) research. Rauhala[4] has in his analysis settled on the following basic forms of human existence: corporeality (existence as an organic process – as a body), consciousness (existence as grades and degrees of experiencing), and situationality (existence in relation to reality or personal situation). The intertwining of the human essences at topic, human has been described by Rauhala as a regulative situational circuit. The term suggests that the different essences of human existence define what the other essences are and thus a person's life situation can be affected both negatively and positively.

According to the holistic concept of man, questions about corporeality are linked to healthy and safe construction solutions and building materials. Situation is the part of the world where an individual gets into relationships. The situation of an individual consists of concrete or ideal components. The former includes all physical factors while the latter is comprised of values and norms. In the context of natural construction, issues about the quality and ways of construction, equipment standards , heating systems, ventilation, wastewater treatment and waste management are components in one's situationality. Financial resources and work are also included in a person's life situation, as well as family relations and the main topic of this paper, climate change. In general, this means everything that is around us. Similarly, consciousness stands for experiences and perceptions as well as the experiential. In natural construction it may therefore relate to the choices made by the builder in general – what values he or she attaches to building. What are the basics of making choices or does the builder transfer the responsibility to the professionals and order the building as a turnkey house to the plot? Happiness and images also belong under the questions of consciousness. For example, advertising and marketing can use intensive images and dreams to create positive experiences for builders. One can ask, does a person

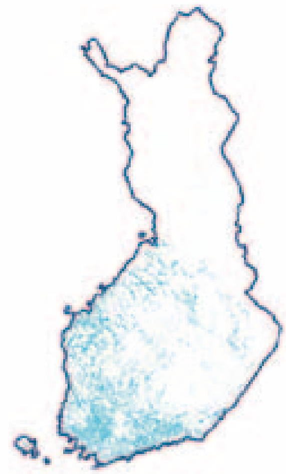
Local clay is taken from the field nearby. Photos: Outi Tuomela.

build the kind of house, where the happiest families are said to live?

Today in building, acquiring residences and in housing more broadly, there are different options which can make decision making challenging. There is not a single right way to build a natural house. Besides, not everyone wants to commit to building a house, but rather buy an apartment or rent a residence. Based on the aforementioned, a new kind of definition for sustainable/natural construction can be pieced together. It is not just about the materials or technology used, but rather about affecting the situation in life: when the life situation is seen as an essential part of human well-being, natural/sustainable construction can affect the situation of both a single human or the entire society in a positive way. The definition is based on dialogue or exchange of ideas.

Time for clay building is now

Clay building is not yet mainstream. In the Western world, clay has been associated with poverty and bad times[5]. However, it can be contemplated why clay building is not (yet) a cultural phenomenon on the scale of wood and especially timber building? The abundance of wood can for one explain this for the past. Instead, the changes in climate over centuries have gotten less attention in the reasoning. Based on the historical documents we can tell that Europe was warmer in the late Middle Ages and cooled when entering the Modern Era. This colder period is known as Little Ice Age[6]. The much discussed Little Ice Age concept was first introduced by glaciologist **F. E. Matthes**[7] in 1939, referring to the new mountain glaciation following the warm period after the last glacial period. A much shorter definition was introduced by **C.E.P. Brooks**[8] in 1949, referring to the colder period of 1600–1850. **Hubert Lamb**[9] places the beginning of the cold period as early as the 13th century and extends it to the mid-19th century. According to him, the beginning of Little Ice Age could as well be in 1190 or 1420 and the end in 1850 or 1900, depending on the continent. Swiss climate historian **Christian Pfister**[10] has dated that period to 1565–1895 in Swiss climate history. In Finland **Matleena Tornberg**[11] has studied the climate during the Little Ice Age and their effect on the harvests in the crown farms of south-western Finland. Based on data on grain figures he dates the Little Ice Age to 1580–1710.



Clay areas in Finland.
Source: www.geologia.fi

It is quite likely that during the coldest and rainiest years of Little Ice Age there were no premises for a clay building to dry. Clay hardens only through air-drying, not chemically as lime or cement[5]. Methods might have been known, but building with timber might have been the safest and most practical due to the typical weather conditions of the climate era. In the course of time (during centuries), when a construction method becomes mainstream, its effects are wide-ranging and long-lived. It is not easy to change course, especially when the building infrastructure has slowly developed due to certain conventions into its current state, not to mention the long tradition of price and value formation.

The origin of our soil as the origin of our clay is a direct echo from global climate change. Today we live in the so-called Quaternary, which began circa 2.5 million years ago. Intense climate changes have been a typical feature of the era that has included several glacial and interglacial periods[12]. The last glacial period ended circa 11 500 years ago. Clay soil formed when large amounts of water flowed from melting glaciers. In consequence, fine-grained material migrated from the immediate vicinity of the glacial edge and finally stratified into the bottom of water as clay, silt and fine sand. Clay soil was formed and has been forming also after the glacial period. Their substance derives from older clay soils that were eroded by running water and flushed again to the sea where they re-stratified into clay. A detailed description of the origin of clay soil and the geological process has been presented by **Matti Sauramo**[13].

Clay soils in Finland are presented in Figure 2. The above mentioned hinted that clay is not uniform. Colour, granularity, plasticity, stiffness and other qualities of clay vary greatly. Therefore it is good to determine the exact qualities of clay before using it as building material.

Due to anthropogenic or human derived climate change, this era is better suited for clay building. If the temperatures continue to rise in Finland during the next decades as predicted[14], clay building can be deemed as a natural construction material when considering the changing climate. Adaptation to climate change would thus be partially fulfilled by using raw materials produced by climate change. As the growing season is also predicted to lengthen and spring comes earlier, clay as a carbon neutral and often local material would be a most natural choice for building. •

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[a] Climate change in IPCC usage refers to any change in climate over time, whether due to natural variability or as a result of human activity.

[b] Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

[c] Climate change in the United Nations Framework Convention on Climate Change usage refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.

Literature:

[1] Leo, O. 2000: ESR-projektin loppuraportti. http://esrlomake.mol.fi/esrprojekti/loppurap/lr980520.html [Accessed 22.12.2011].

[2] Hänninen, P. 2008: Mitä maapallolla tapahtuu? Arkkitehti 1/2008, 18–23.

[3] Intergovernmental Panel on Climate Change (IPCC) (2007): The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. http://www.ipcc-wg1.unibe.ch/publications/wg1-ar4/wg1-ar4.html [Accessed 22.12.2011]

[3] Holopainen, J. & Helama, S. 2009: Ilmaston eletty muutos. Ajatus 66, 197–214.

[4] Rauhala, L. 1977: Ihmiskäsitys arkkitehtuurin kannalta. Arkkitehti 8/1977, 49–51.

[4] Rauhala, Lauri (1988): Holistinen ihmiskäsitys. Sosiaalilääketieteellinen aikakauslehti 25, 190–201.

[5] Volhard, F. & Westermarck, M. 1994: Savirakentaminen – kevytsavitekniikka. Rakennusalan kustantajat, Helsinki.

[6] Grove, J. 1988: The Little Ice Age. Methuen, London.

[7] Matthes, F. 1939: Report of Committee on Glaciers. Transactions American Geophysical Union 20, 518–523.

[8] Brooks, C.E.P. 1949: Climate through the Ages. Ernest Benn, London.

[9] Lamb, H.H. 1982: Climate, History and the Modern World, London, Methuen.

[10] Pfister, C. 1984: Klimageschichte der Schweiz 1525–1860. Das Klima der Schweiz von 1525–1860 und seine Bedeutung in der Geschichte von Bevölkerund und Landwirtschaft I-II, Academica Helvetica 6, Bern.

[11] Tornberg, M.1989: Ilmaston- ja sadonvaihtelut Lounais-Suomessa 1550-luvulta 1860-luvulle. Turun Historiallinen Arkisto 44, 58–87.

[12] Salonen, V-P, Eronen, M. & Saarnisto, M. 2002: Käytännön maaperägeologia. Kirja-Aurora. Turku.

[13] Sauramo, M. (1924) Lounais-Suomen savista. Talonpoika I, Lounais-Suomi, 8–22.

[14] Jylhä, K., Ruosteenoja, K., Räisänen, J., Venäläinen, A., Tuomenvirta, H., Ruokolainen, L, Saku, S., Seitola, T. 2009: Arvioita Suomen muuttuvasta ilmastosta sopeutumistutkimuksia varten. ACCLIM-project report 2009. Finnish Meteorological Institute, Reports 2009:4. Helsinki University Print, Helsinki.

Different kinds of clay workshops are social happenings and fun.

Natural Building and Environment

Sven Aluste

Your choices of action may be limited – but your choices of thought are not.
- Daily quote from Abraham Hicks Publications

Living in harmony with nature and using natural building materials have both played an important role in my life since childhood. During the last 10 years I have actively studied and practiced building with natural materials, reusing old materials and creating healthy living environments. This article will describe the main aspects of my practice.

Traditional building methods and materials have been one of my starting points when giving workshops on natural building and designing my own dwelling. Over the centuries Estonians have used several traditional building materials – there is a lot to learn about the durability of these materials over a longer period of time. How do these materials influence our health and the house itself? In our country, stone, timber and clay are the most commonly used building materials.

Natural building workshop for gymnasium students in Paide, February 2012. Photo: Sven Aluste.

Sven Aluste. MEng, trainer, natural builder. Photo: Helle Aluste.

Today we can examine how these materials have lasted over time and what we can learn from this kind of a construction process. For example, when building using stones, it is good to explore how the foundation has been made and how it lasts under high walls. Natural plasters on stone walls or on wood are also worth considering: what kind of plaster mixtures have been used and how these mixtures have preserved over time. Also discussed are the regions and types of mixtures that are better preserved, and how to protect buildings against weather conditions in a more efficient way.

Building clay houses has been very time-consuming but the results can be very durable and beautiful. For example we can use techniques used in building clay houses to build an inside wall in the new building and, through that, add an inner environment which comes with an important thermal mass

Recycled wooden hay barn 300 m², finished 2011. Photo: Sven Aluste.

helping to store the warmth over cold seasons and keep the rooms cool during hot seasons.

Artificial environments also enable the use of ideas from traditional buildings. However, we can still use clay and lime plasters in the interior design of apartment houses or office buildings, and natural paints which do not cause allergies or other illnesses deriving from an artificial environment. By using clay plaster in living rooms we can provide a normal air humidity level without placing buckets of water next to heaters. We also want to avoid mould in bathrooms which often tend to be too damp. In that case, in addition to a good ventilation system and heating, it would be useful to consider lime plaster and lime paints. Natural materials are easily sourced and we have background knowledge on their origin and authenticity, and information on energy spent on handling or creating them.

Due to energy efficiency policy demands on buildings, the energy spent on materials is becoming an increasingly significant issue.

Recycling and reusing materials

For building new houses or creating new interiors I have firstly searched for old material removed from use but can still be used in the building process. For example, when I needed to build a small sauna house, I found an old log house which was for sale. I dismantled it and rebuilt it on my own territory. This resulted in a building we needed that looked like it had been standing there for a century. I have also rebuilt a wood and tool shed which originates from 1930. Furthermore, I built the hay barn on my property from material originating from a schoolhouse built in the beginning of the last century. All the houses were fitted with new roofs but old and authentic wood was used for walls and the roof construction.

One way to use old materials is inside the house. I have built beds, cupboards and frames for mirrors and windows out of old logs. I have also reused several old doors and windows in my practice.

I really enjoy the sense of old materials: knowing that somebody has shaped the wood with their own hands and put their effort in the work. The material, proven to be solid for years, with its rigid shape and wears and tears and worn-outs is a wonderful finding for the interior and for building construction.

Creating healthy living environments

The most influential factors for human health are thought patterns and eating and exercise habits; however, we cannot disregard the environment where a person spends most of his/her time.

A closed environment, e.g. a building, is increasingly becoming a place where people tend to spend most of their time. Decades ago most of the day time was spent outside, but nowadays people from North Europe spend up to 90% of their time in closed rooms. Thus the inner climate of our rooms has become very important for both the building itself and for our own health.

While considering our health issues and saving energy it is essential to remember the principles of natural building where the cardinal points, major winds and aquifers have a significant importance in creating the building. We must consider the energy movement in the specific spot where we want to integrate our construction.

If natural sunlight shines reaches your rooms during a cold winter day it will heat up both the room and your own energy reserve. In the cold darkness only the needs for light and warmth will prevail: creativity and other essential aspects surrender to basic needs.

While talking about the quality of life, people mainly concentrate on healthy food, pure water and stress issues but fresh air is often neglected as one of the most important needs in our life. This may be due to the ignorance of our building and siding material salesmen, or the minimal knowledge salesmen and customers have on the matter.

However, usually the information on a safe inner climate includes the remark that it has been approved by the Health Protection Inspectorate. The question still remains: are information and price good enough aspects in order to be preferred in the building process?

There are several cases where using artificial building materials has caused mould to develop in damp rooms or has caused the inner climate of the living environment to become too dry. Environments where extremely drastic variations in air humidity levels occur or which are too dry or damp are a significant danger for our health and have resulted in respiratory problems. It also often affects the weakest among us: our children. That knowledge should force us to seriously consider the materials we use in creating our homes and environments.

As mentioned before, natural building materials are the safest choice whether it is inside of an old log house or in a modern block house.

Conclusion

The world is a whole in itself and everything around us is tightly connected. However, we can only see the world through our own eyes, which makes us filter information such as the way we sense our lives. That is why it is essential to be aware of our real potential, needs and knowledge for creating a better environment for our children.

There is a saying that our land is not a heritage from our ancestors but a loan from our grandchildren. It is our responsibility to create the kind of environment where nature is minimally affected and the life span thoroughly considered.

Using natural materials in a building process wherever possible, and correctly combining them with recycled materials and traditional knowledge, enables us to create a healthy living environment with an inner climate where the temperature, air humidity and quality are easily regulated and safe for our health both for yourself and your family.

Since 2006 I have organised and taught practical trainings and seminars in natural building both for adults and children. Today we are creating a training centre next to our home in Central Estonia which will be the place where people can learn and practice building using natural materials and living in harmony with nature. The other branch of our centre is Equine Assisted Therapy and Learning which is a wonderful tool to help people reach an inner balance. •

More information: www.equilibre.ee.

The ProNatMat workshop by Sven's clay house for donkeys. Photos: Outi Tuomela.

Pioneering of Straw-Bale Building in Finland

Kati Juola & Paul Lynch

Use of straw bales as a building material is commonplace in many European countries. There are many methods to building with straw bales, such as the original load bearing Nebraska method. There is also infill and timber frame, hybrid and lightweight framing and now even industrialised prefabricated walls can be built in factories and transported to the site.

In central Europe in the last 20 years there has been an upsurge in straw bale building and houses as well as some bigger buildings i.e. factories, have been constructed using the above mentioned methods, mainly because of the ease in which they can be built, the strength of the walls and the high insulation value. On top of the energy characteristics, these houses include better indoor air quality and aesthetics and they appeal to a growing number of subscribers, designers and builders. The Natural Building Company Oy (a Finnish company, despite its name) wants to bring this building method within the reach of the Finnish people, and has built a demonstration load bearing house at the offices of Kasper Järnefelt Architects Ltd Inkoo.

Straw from grain crops is actually a byproduct. Some of the straw is used for animal bedding on farms, but most of it is chopped up already during threshing and ploughed back into arable land. Previously, straw was burned in the fields, but the smoke damage and carbon emissions due to combustion are no longer recommended. So there is now an abundance of straw ready to use for construction. In England it is calculated that you could build 250 000 3-bedroom houses every year with the waste straw.

Roof / frame construction. Photo: Kasper Järnefelt.

Straw as a building material

Straw consists mainly of the same ingredients as a tree. For example, wheat straw contains 37% cellulose, 23–30% hemicellulose, lignin 20%, 7–9% ash, 1.5 to 2% silicate, as well as small amounts of protein and starch[1]. Left in the field for a few days, dry straw reaches about 25% relative humidity, when it is baled using an ordinary tractor-baler. The end product is a "building block" with the cross-section for example of approximately 50 x 80 cm and a length of about 190 cm; these are called mini big bales. There are also big bales and a smaller more standard size, all can be used. The bale density and moisture content varies in a straw bale depending on the baling machines settings, but a good "building block" weighs over 100 kg/m^3 and has a load bearing capacity of 3 tons per m^2, and the thermal conductivity of 0.05 to 0.07 W/mK. A typical bale has a sound insulation barrier of 50 dB, and fits to the fire classification of E90.

Mortar

When plastering straw bales it is very important that the material used is breathable. It is recommended therefore to use either lime or clay. Cement should not be used; it becomes too hard and is an inflexible mortar.

After bales are in place and compression is finished. Photo: Kasper Järnefelt.

Lime mortar

Plastering work with lime could be done in 3 layers. The mortar is preferably made from conventional quarry lime, which makes it very flexible to work with, and allows it to be easily applied to the straw bales.

Clay plaster

Clay is very fine-grained mineral powder the size of which is less than 0.075 mm. Clay can be found in most parts of our country under the earth's surface, and much of it is suitable for plastering with. The clay is first dissolved for long enough and other plaster ingredients such as sand, water, or small fibres are added to get the proportions adjusted correctly for the different coats. It is also possible to buy ready-made clay powders from the brick industry. These can be found in many beautiful natural pigments and are readily available. Clay and lime plasters are also needed for their fire resistance properties. If the clay is burned more than 950 degrees centigrade, it becomes like ceramic or tile.

Som ler och långhalm

The title is a Swedish-speaking Finnish phrase 'as thick as thieves'. (If people are thick as thieves, they are very close friends who have no secrets from each other). It is known

First layer of clay and panels on sides. Photo: Kasper Järnefelt.

from experience that clay and straw are very compatible and therefore are committed to each other. Wall structure of clay plaster and straw bales are mutually supportive. Tightly packed straw bales (each bale compressed 100–120 kg per m^3) are a good base for the clay plastering; clay and straw together protect against mechanical abrasion, moisture and fire. Together, they form a sort of federal structure.

The design principles

As with every building technique, good design is extremely important. All good building principles should be followed to make sure that the building will last for generations to come. When a straw bale building is designed and constructed properly it is a long lasting, healthy building method. The oldest known straw bale house to date is a load bearing straw bale building in Nebraska dating back to 1904. This house is still being lived in today and is open for visitors to see.

ESSENTIAL POINTS TO CONSIDER IN PLANNING ARE:

- The protective eaves / roof water system.
- Straw bale walls' centre line to take the central roof load especially important in loadbearing construction.
- Splash-protective plaster.
- High foundations to prevent splash back.
- Tilted topsoil which is far enough from the walls.
- Moisture-permeable foundation wall.
- Drip edge.
- Good anti freezing gravels placed around the foundation.
- Rain and all other running water is lead away from the building.

Straw bale houses are CO^2 negative as the energy is stored within the walls. The primary energy content of a straw bale house is very small. When comparing the wall structures of different building methods, where the U-values are in the same class, you will see that a straw bale wall has used about 17 kWh / m^2, concrete-and SPU walls about 280 kWh / m^2 and a brick wall 560 kWh / m^2. Straw bales are locally produced; the raw material is a byproduct of agriculture. A straw bale wall's thermal insulation is good, and they achieve passive house classification easily.

It is a healthy structure. Clay plastered straw bale walls are open to diffusion, and a breathable design. It does not release toxic substances. It does not generate hazardous waste during construction and after construction the walls can be composted, or ploughed back into the ground. Indoor air quality is exceptionally good in a house of clay, because of clay's ability to absorb moisture and impurities. As an extra bonus, a straw bale house has excellent sound insulation and indoor acoustics.

It is easy to construct, alter, and repair. The simple design does not require any special tools. Clay hardens when it dries, and returns to a reusable format when it gets wet. Straw is fun to work with and is a sympathetic material, which most people will be happy to work with. The bales are comfortable to sit on, they smell great, and the golden yellow colour is a pleasant one. Overall in our construction sites there is an enthusiastic and cheerful atmosphere. Professional builders have come up with happy faces and with improvements in work practices. For example, for bale bindings we use ”a baling needle”, which was improved by creating a motorised version by the professional builders who attended our last Straw bale building workshop.

Drawbacks and limitations

Like in most building techniques there are certain things we must look out for. Moisture in the bales during straw bale building is one. It is important to check each bale with a moisture reading needle before using them. This can be done first when buying them and then again during construction. Bales must be covered well and not be allowed to get wet from above or by driving rain. If so they should be discarded. Once

FREQUENTLY ASKED QUESTIONS

How long will a straw bale building last?
The oldest still in use straw bale house was built in 1904, so the maximum age cannot yet be defined.

Does straw rot / mould / spoil?
Yes, if the building has not been built well and the bales were inserted in the walls while wet. However, clay plastering the straw keeps moisture so low that the wall does not provide a suitable living environment for fungi and mould spores.

What about rats / mice / pests?
The straw is tightly packed and therefore there are no spaces for rats / mice / pests to move or build homes. In addition, clay is not a pleasing material for rodents. In straw there is no food, so it does not in itself interest insects.

Does it burn easily?
No, again the bales are compressed so tightly that there is limited supply of combustion air, and the clay/lime plastered acts as a fire retardant. As mentioned before clay hardens and turns to ceramic if burned.

Possible benefits of straw bale building in Finland and the Nordic countries:
- High insulation value which easily meets and surpasses the standards needed in Finland today.
- Straw bale houses are CO^2 negative.
- Good for the environment, even after the lifecycle of the house the materials will not harm the nature.
- Extremely fire resistant.
- Good indoor aesthetics and acoustics.
- Healthy indoor air which can help those with allergies.
- Benefits farmers who now have another income from baling of waste straw.

the building is standing it is important to get the first layers of plaster on as soon as possible. We also recommend setting panels on the outer walls which are most likely to get weather beaten. Good covering with eaves and high foundations and baseboards are prerequisites for a long-term structure. It is good to be familiar with local conditions, design and construction regulations. Bale shape, capacity and nature of the plans must be taken into account, complex shapes are more complicated to implement.

The availability of straw bales depends a lot on having favourable weather conditions during the baling season. •

Assisted in writing:

DI **Anders Westerlund** and construction carpenter Charlie Jespergaard.

References:

Master's thesis, **Markus Vanninen**, University of Jyväskylä, Department of Chemistry, 2009

Links:

www.naturalbuilding.fi
www.jakubwihan.com/projects/Waddington.html
www.baubiologie.at/europe, www.baubiologie.at/download/zertifikate/F90.html
www.atelierwernerschmidt.ch
www.baubiologie.at/download/zertifikate/F90.html
www.amazonails.org.uk

Finished with clay/lime plasters and 100% Rheinzinc metal roof. Photo: Kasper Järnefelt.

Experimental Doghouse

Ilkka Lempinen

Ilkka Lempinen is a craftsman, a natural builder and a clay plasterer from Loimaa, Finland. Ilkka was almost blinded after having brain tumour surgery in 2005. Nowadays, he works as a subcontractor for Sokeva Handicraft and he is also a member of The Finnish Federation of the Visually Impaired. With the help of designer ***Markku Hollo****, Mr. Lempinen created a doghouse made of clay and reed for the Luomura TerveTalo fair in Luopioinen.*

The materials used in the doghouse included local wood, clay from a company called Seppälän Tiili, sand from Kauniston Sora, reed from ProNatMat's LUMO Centre in Koroinen and some extra articles from a hardware store.

Once the materials had been obtained, it was time to start the project. Markku Hollo began to prepare shapes for the elements, on which we had to assemble the frame element. I had prepared a mass consisting of clay and sand for the casting, using hemp as a binder.

When the panel had been assembled, we started to cast the first element. First, a thin layer of clay mass was applied on the wooden frame, and then came common reed, then more clay mass, and then common reed was placed across the other way around – then clay mass again, then a plaster net, and finally the last layer of clay mass. It became the outer side of the wall and I levelled it with a straight board. I did not make it completely smooth. I left the surface jagged, so that we could coat the walls with plaster of a different colour. Once the cast was ready, we had to stop and wait with excitement for the plaster to dry, because clay plaster does not dry very quickly.

Then came the day when we got to unbuild the element and look at how well we had done and the element held together. With minor changes, we were able to start the casting of a new element. There are five elements in total, a base and four walls. When the elements had dried up, we got to build the hut.

The walls were built on the base and joined together with woodscrews. Millimetre scale precision was required in the sizing of the walls. Finally, they fitted accurately. Elements were tightened with the help of a screw clamp and strings of flax were put into the seams for insulation. The corners were finished with boards which were painted with clay paint.

The roof had been finished and it was raised into its place. The result was good. The roof is covered with a felt, which makes the roof less noisy when it rains.

The last layer of plaster applied on the walls is coloured like berry porridge. The plaster was dyed throughout. The plaster came from the Netherlands, and it is a ready-mixed combination of clay, sand and dye. It is a pleasure to use, and not too strong. In addition, I intend to build a ceiling to the roof using straws saturated with clay. It would prevent the patter of rain and serve as insulation against sunlight and cold in winter. A building made of clay stays dry and cool in summer. When the weather is damp, it binds moist into its walls and gives out moist when the weather is dry again, so that the air in the dog house would remain as even as possible. •

A nice doghouse built with clay. Photo: Erika Sillander.

Fresco Painting Workshop

Natasa Bulatovic Trygg

The fresco workshop at LUMO Centre was held by Natasa Bulatovic Trygg, graduated M.A. artist from University of Art Belgrade, Faculty of Applied Arts, Department of Wall Painting. The aim of the workshop was to offer fundamental knowledge of making traditional Roman fresco paintings. The professional fresco painting technique requires time in preparations and careful planning; as a technique it is not suitable for improvisations and change of technical aspects during the process. Therefore the workshop of three days had no possibility to give acquaintance for fresco painting profession in itself.

Introduction to fresco painting

Wall painting techniques include mural, fresco painting, mosaic, encaustic, sgraffito and stained glass. All of them have their own beauty but at the same time face many challenges and technical disadvantages to overcome.

For all wall painting techniques, the wall and its preparation is the most important thing. Without properly prepared wall itself, no matter how well technically done painting would be, the art piece will get ruined. Besides wall as a problem, wall painting techniques require attention on the technical approach which would make art, as a result, more permanent. Knowing **Leonardo Da Vinci's** masterpiece *The Last Supper*, because of poor preparation and no attention on actual technique, the painting is near disappearing nowadays.

Wall painting techniques are emphasised during Hellenistic and Roman period between two eras (1st century BC – 1st and 2nd century AD). Typical examples of fresco painting from that time are paintings from Pompeii, saved by eruption of Vesuvius in 79 AD. The early Christian paintings in catacombs (made in 3rd and 4th century) in Rome used different technology in preparing walls. They used more porcelain clay (known as "red concrete") because of the humidity of catacombs. In the other development in Byzantine time, they did not use sand in preparing concrete; instead they used different types of fibres, such as oakum. The most known technique to us, using hydrated lime with sand, dates to Renaissance.

Traditional fresco painting is made on fresh concrete, known as "fresco buono". First thing is to make sure that final layer of concrete (on which we paint) is correctly made so it would take colour properly. Next step is to make colour in right proportion of pigment and lime milk. The quality of fresco paintings depends on quality of lime as a binder, type and rudeness of the sand, the process of making plaster, the thickness of the layers as well as density ratio between a binder and aggregate (plaster and colour).

When concrete is drying it makes the colour paler by the influence of calcium hydrate that it contains. Lime can accept and bind the pigment of the colour only 10%. That is why the colour must be transparent and added in many layers. The lime milk that is used in making of the colour is the most important ingredient. The lime milk that is used in making of the colour is the most important ingredient. It is made by extracting the lime water whose pH value is over 12 due to $Ca(OH)^2$. The surface of still lime water is covered by the thin layer of calcium carbonate that is of great importance in fresco painting.

Fresco secco painting is made on dry plaster with pigments mixed with some other kind of binder than lime water. The best way of making colour is using casein, which makes painting looking as close as possible to actual fresco painting. Besides casein, very used technique on dry plaster is egg-tempera especially in the Middle Ages and now days are present acryl based binders.

Techniques and methods

Fresco painting workshop at LUMO Centre focused on technology of fresco art. The attention was on properly prepared base for applying concrete and the methods of making fresco concrete layers. The demonstrations of preparing base, concrete layers and usage of the lime based colour was held by Natasa Bulatovic Trygg. Each participant was working on own fresco design with focusing on technological aspect of traditional Roman fresco technique.

Each participant worked on 50x60 cm size fresco. Because of the working conditions, instead working on the wall, the base was wooden OSB board. After preparing the base, the participants prepared the concrete for colour testing. Next step was to make concrete layers, apply the sketch on the final fresco layer and paint the individual fresco design. After painting was finished it needed to be polished and framed to be cleaned and coloured.

Timetable

Workshop of fresco painting was planned to last three days, from 21st till 23rd of January 2011. Each day had 4–5 working hours. Some working day might have had 5–7 working hours due to the needs of realisation of the individual fresco projects by each participant and drying of the fresco concrete. Workshop was planned for 10 participants.

Day 1: Preparing the materials for fresco painting. Building the frame and preparing base for application of concrete layers. Making the lime-water for colour mixing. Making the first two layers of the concrete. Preparing the small amount of concrete layers for colour testing.

Day 2: Preparing the sketch for applying on the fresco concrete. Applying the third layer of the concrete and finalising the frescos.

Day 3: Finalising the work. Conclusions and discussion about the process of fresco painting.

Materials

The following table contains list of needed materials for realisation of the workshop. The amount of material is based on the plan for having ten participants of the workshop.

Material	Amount
Hard sand	3 sacks
Fine sand	3 sacks
Lime	3 sacks
Wooden spatula	10
Trowel	10
Ladle	10
OSB boards	2
Wooden boards for framing (2 x10 cm)	30 m
Wire (2 mm), roll of wire net	roll
Spray-bottles	10
Mortar tub	10
Pigments	
Hay	2 kg

Pallets for mixing the colours, fine straight and rounded brushes were provided by participants.

Fresco painting workshop

The workshop started with introduction to the fresco painting methods and lecture of technical aspects of creating fresco painting. In addition to different approach in fresco preparation due to the conditions of work and aim of the workshop, the actual process of making fresco painting on the wall is different and requires years of practice and experience. Therefore, this workshop within three days was meant to offer an introduction in technique and its possibilities for those who find it useful in their own artistic work.

The process of fresco painting starts with preparation of the wall. It is very important that the wall on which concrete should be applied is healthy and has no damages, e.g. cracklings or humidity. If so, the wall needs to be treated and fixed before any further work because no matter how good the fresco, it will be effected by the wall base from beneath. In our workshop we used OSB boards which we framed with thick wooden panels in addition to get a type of box in which the fresco painting would be placed. This is a very common way of artistic practice in which fresco paintings can be easier exhibited afterwards in various environments.

When the wall is clean and ready, the next step is to make first layer of the concrete. The fresco painting usually has two-three layers of the different structure of concrete. The lower levels (the ones which we attach directly to the brick) consist primarily of sand while in the upper layers the concrete has more lime. In Roman fresco paintings there were usually three layers, afterwards it was more practical and useful to have two during the Middle Ages and Renaissance. In our workshop the wooden "boxes" housed an OSB board to which a coated wire net was attached as an armature for the concrete, which we were planned to apply in two layers.

In first layer of the concrete we used hard sand (approximately 2 mm grounds) and lime in relation 3:1 (with chosen measure-cup such as ladle, the 3 measures of sand mix with 1 measure of lime). For easier mixing a little bit of lime water was added.

Photos: Natasa Bulatovic Trygg.

(NOTE: Do not add any other water or liquid except lime-water which is present in lime that you are using). In each concrete mixture about a handful of small hay pieces should be added for the improvement in strength of the concrete. When the concrete is equally mixed and there is no presence of small white spots regarding the unmixed lime, the layer is ready to be applied to the wall. Each concrete layer should be 1–2 cm thick. For the application of another layer, the first one needs to be a little bit scratched on the surface (do not scratch the concrete deeper than 1–2 mm).

When applying the first layer make sure that all concrete is pushed underneath the wire or, if applying to the brick wall, that all of it enters the bricks and its joints firmly. Then it is time to prepare another layer which needs to have more lime and less sand than previous one. The time between the application of the layers is about 20–30 min. Also the layers of the concrete can go even up to four – the only thing to make sure is that lower layers have more sand and less lime, while upper layers that will hold the pigment and fresco painting need to have more lime and less sand.

The second layer consists of 3 measures of less hard sand and 2 measures of lime. It is important that with application of the second layer it is firmly pushed on the top of the first layer so there would be no air bubbles that will lead to future crackling of the fresco painting. The same thin scratches should be made regarding the application of the final layer. The third layer is made with 3 measures of very fine sand (approximately 0.50–1 mm grounds) with 1 measure of lime. When the layer

Photo: Natasa Bulatovic Trygg.

The brushes for fresco painting should be soft, sizes and shapes varying due to the needs of the work. The process of painting is very similar to the watercolour painting since there is no use of white pigment, for white tone it is used wall itself and then painting is building up with thin layers of paint. Final details can be applied with thinner brushes and darker colours.

Active time for painting is about 6–8 hours, as long as the concrete is fresh, when it starts drying it is time to stop. The signs of drying concrete are showing as whiter areas at the wall. When painting is finished, fresco needs to dry for few weeks if possible in a place with constant room temperature. After the fresco is dry, it can be polished with glass bottle while wooden frame can be cleaned and painted for needs of further exhibiting.

is applied, wait about 30 minutes before painting.

The first step of the painting process is to apply the sketch. That can be done precisely by drawing the sketch over a transparent plastic folio and then carefully tracing over the concrete or by free hand, depending on the individual idea for final fresco painting.

Paint for fresco painting is made with lime-water and pigments. It is very important to use the same lime-water through the whole process. Pigments have different characteristics; therefore it is possible that some colours like yellow or certain reds can disappear in the process of drying, because of the chemical reaction with lime. Also black pigment is very hard to work with, because it is a strong type of pigment that is hard to attach to the concrete and sometimes it can be blown off the wall when the fresco is ready. For avoiding such mistakes, previously made colour tests as well as tests of concrete layers are recommended.

Results

The workshop gave unique designed, high quality fresco paintings that can be exhibited to the public afterwards. The size of the frescoes makes it suitable to move and exhibit art pieces in different environments.

The workshop closed with presenting the works, sharing experience and summarising the process of creating the fresco art. •

References:

Brkic, N., Tehnologija slikarstva, vajarstva i ikonografija (Technology of Painting, Sculpturing and Iconography), University of Art Belgrade, Serbia 1983.

Turinski, Z., Slikarska tehnologija (Technology of Painting) University of Art Belgrade, Serbia 1987.

Thompson, D. V., The Materials and Techniques of Medieval Painting, Dover Publications, NY, 1956.

Photo: Outi Tuomela.

Part 3

Cultural Heritage

First Steps With Folky Wind Instruments

Minna Hokka

The world of traditional wind instruments opened to me by doing; by learning to remove the bark from birch as long strips and by making simple instruments such as reed pipes. I felt lucky because I got guidance from an old master, **Jarkko Aallonloiske**.

Removing bark from a birch. Photo: Tauno Nordman.

Continuous tradition

As an artisan and adventure leader I got acquainted with Finnish and Karelian shepherd instruments in Turku in the late 1990s. The years passed and I kept on visiting my master's workshop every now and then, learning how to make folky pipes. We made trips to nature and collected useful material for different kinds of instruments.

During the last 50 years, Jarkko Aallonloiske has built dozens of different shepherd instruments which he has presented at various happenings. He has also made and sold thousands of simple flutes and clarinets and taught thousands of children how to make willow pipe.

Jarkko got his first lesson in Helsinki in 1960 from a native Ingrian man, **Teppo Repo**, who had a background of fifteen summers as a shepherd in the end of the 19th century. Later Teppo Repo was known not only in Finland but also abroad as an original folk musician and talented instrument builder. Repo got guidance for making horns and flutes from his uncle. From man to man, this is how the skills of making musical instruments have been inherited under centuries.

A truba, cowhorn. Photo: Minna Hokka.

120 instruments as a goal

When I was awarded a one-year grant by the Finnish Cultural Foundation in 2007 I finally got the chance to devote myself to the tradition of shepherd instruments. The project, which I had chosen for myself in order to learn the subject thoroughly, was to build every instrument that was presented on a holistic doctoral thesis. This book of **Timo Leisiö** was published in 1983, and it gives precise information about size and build of altogether 120 different pipe and horn instruments in Finland and Karelia. The oldest models are estimated to be from the Stone Age and the youngest instruments of this research have been collected in the 1950s.

The first buzy months of the project I spent at my master's workshop making instruments and discussing about Teppo Repo and other things dealing with tradition. During the summer, I travelled with Aallonloiske from a fair to another, learning how to present these folky instruments to the audience. In the autumn, I continued instrument building independently on the basis of the book. Other things, such as renovating an old wooden house, happened in my life, but I always returned to my workshop. In autumn 2009, after building some 90 instruments, I thought it would be possible to get all the 120 ready by the next summer.

I had opportunity to get a place for my first exhibition at the LUMO Centre in Koroinen. The place was perfect for traditional instruments refined delicately of organic material. At the same time I had an idea to organise the Pipedays III event to introduce my works for the professionals of the line. The gathering of people interested in folky wind instruments had earlier taken place at Sibelius Academy and at the University of Tampere. I invited various professionals to lecture and present their skills in the exhibition room with walls full of fresh, but traditional instruments.

One of the most difficult instruments of Leisiö's doctoral thesis is the wolf horn, a tuba-formed trumpet instrument, whose tube was supposed to be intact. For that, I had to make several parts and join them together. By the way, I made the echo funnel of a piece of an old flagpole. Because the model of this instrument was black, I painted the horn with tar. After waiting for it to dry in sunlight for some days with no results, I finally flamed the horn.

Demonstrating my instruments at the Hungarian bazaar in Turku 2007. Photo: Anja Hokka.

It turned out that there would be more than 120 instruments in the exhibition, for of course, I also wanted to present the Ingrian shepherd instruments and some other pipes and horns I had copied from Jarkko Aallonloiske's collection. The

A wolfhorn. Photo: Minna Hokka.

preparation of the exhibition meant a lot of work besides instrument building: building showcases, writing introduction texts about the instruments and marketing.

Dedication gives results and happenings

Finally the ambitious goal was achieved and I opened the exhibition of almost 130 different wind instruments on the 2nd of May 2010. The instruments were categorised into a few main groups according to the way of producing sounds: flutes, clarinets, oboes, trumpets, free aerophones and mirlitons. The collection of variations was anyway some kind of proof of a folky imagination, which is a great thing. The decoration of the surroundings was natural and odorous: balloons made of urinary bladders and serpentine of birch bark strips. Fresh spring water and Karelian pastries of blueberry and lingonberry were served for the guests in addition to all kinds of chirps, noises of the instruments. I also played improvisations, old runesongs, Karelian folk songs and modern pieces of music.

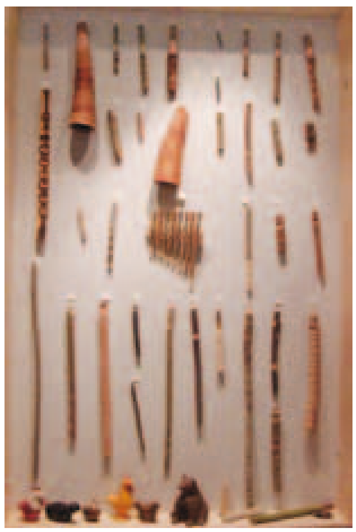
In the middle of May some 30 professionals, students and others interested in traditional wind instruments gathered at the Koroinen LUMO Centre in Turku. After I had introduced the exhibition, people were welcomed to move outside to make reed pipes. After lunch, professor Timo Leisiö lectured about the history of flutes. Instrument-builder, musician, teacher and researcher Rauno Nieminen told in his turn about his project of developing a flute. After him, librarian **Riitta-Liisa Joutsenlahti** from Sibelius Academy talked about a deceased folk artist who also made flutes and other instruments. After this official programme, people were invited to see a remarkable private collection of brass instruments. For the evening, I had organised a party which began with guided folkdance. I played some music with fresh instruments and sang my own songs inspired by nature. The big star of the evening was the multi-instrumentalist **Kristiina Ilmonen** with twenty years' experience of wind instruments. On the next day I taught the participants to build instruments in a folky way. In the afternoon there were several archaic instruments playing with the birds.

Building an instrument. Photos: Minna Hokka.

About the exhibition

The first showcase included various flutes made of different materials like willow bark, feather of swan, tin, birch bark, solid wood, clay and clam. By the way, according to the last scientific news, a flute of Mammoth bone, which is 35 000–40 000 years old, has just been found in Germany!

The next two showcases presented three kinds of clarinets. The difference is in the leaflet; on the oldest and the most wide-spread models from the Iron Age it is an inseparable part of the stem, whereas on the youngest models from the 19th century, the leaflet of juniper or birch bark is fastened with thread. The third model from the 13th century is an interesting combination of the first-mentioned two. In the first showcase there were mainly instruments from western Finland and in



Dozens of flutes.

Clarinets, old models.

the other, more Karelian models are represented.

The trumpets of birch and alder bark, many birch bark covered wooden trumpets and an uncovered hoop trumpet are placed in the first of the four showcases. In one showcase there were folky wooden imitations of the rich people's metallic trumpets: a trumpet, a tuba and a round trumpet imitating an old Russian military instrument. A unique "mutkaluikku" is a trumpet made of naturally curved tree branch and birch bark. Smaller wooden trumpets of eastern origin and buck, cow and bull horn trumpets complement the collection of Finnish-Karelian trumpets.

There was still one showcase which presented archaic wind instruments without a tube in a significant role. On the basis of a few basic principles there are again several innovative variations. In addition I placed in the same showcase examples on different ways to fasten the end of the birch bark trumpet.

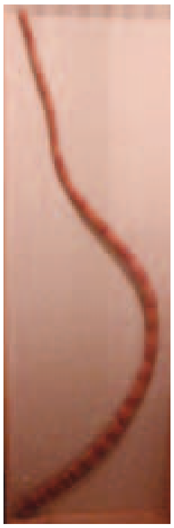
The last showcase presented Ingrian shepherd instruments and some copies of the models Jarkko has copied from museums.

The first exhibition of my folk instruments was deconstructed on the 17th of September 2010, and the next one took place in Loimaa, in Sarka – the Finnish Museum of Agriculture in summer 2011. During the same summer I took the exhibition to the folk music festival in North-East Finland for two weeks.

I want to thank my master Jarkko Aallonloiske, Teppo Repo and Timo Leisiö and all others who have collected and preserved the information of these instruments and helped me on my way as an instrument builder. •

Master Jarkko Aallonloiske and the transmission of the tradition. Photo: Outi Tuomela.

Various trumpets and brassinstruments. Photos: Minna Hokka.



A Mutkaluikku.

Minna Hokka and her folky wind instruments in 2010. Photo: Outi Tuomela.

Shingle Roof

Markku Hyvönen, Turku University of Applied Sciences

For centuries, shingles manufactured by splitting wood by knife or axe, have been used for illumination and shingle baskets. For roofing they have apparently been used for a couple of centuries. These first shingle roofs were extremely durable, because the wood fibres did not break when chipped. The lifetime of these shingle roofs could be over fifty years and even after that they were usable as roof-covering sheeting for later roofing materials. Even today these historically valuable building elements can be found under tile and tin roofs. Knife shingles can be distinguished from plane shingles by bending. If the fibres stay intact it is most likely a knife shingle. They are usually longer and narrower than plane shingles. In the early days knife shingles were anchored to the roof with the aid of transversal binding shingles using wrought nails.

Students of restoration renew a shingle roof in Toijainen in 2010. Photos: Markku Hyvönen.

After the mid-19th century, plane shingles started to displace hand-made knife shingles. In the early 20th century, shingle roof was the most common roofing in Finland. There were several reasons for this. For one, a large amount of new roofs were needed rapidly. Due to general parcelling out, the buildings were moved from place to place, so the need for roofing increased, birch bark used for roofs started to be in short supply and affordable factory-made shingle roofing nails came into use. Soon there were also domestic nails available, in addition to Swedish nails. Regional newspaper “Hämäläinen” wrote about this in 1859:

New iron tool factory in Turku. This new factory is handsomely built by the Aura River, over the city, in a field formerly owned by the bishopric. Shingle roof nails cheaper than ones imported from Sweden are of particular interest. Shingle roofs are the future of roofing in Finland, for it certainly is so that no one, who has once resorted to them, will give up on them.

Shingle roof nails are either chisel pointed sheathing nails that will not split the shingle when hit across the grain, or thin enough wire nails. Even today, 1.7 mm thick and 50 mm long wire nails designed specifically for shingle roofs are available. The nails have to be non-zinced so that they last as long as the roof. Rusted nails are easy to remove when renewing the roof. If the roof is made of more durable block shingles, more durable zinced nails are recommended. When nailing it is important to be gentle – the attachment should remain slightly loose so that the nail will not split the shingle when the wood swells up.

Shingles were carved with various planning devices operating with either human, horse, water, wind or machine power. In more advanced models the machine power was transmitted with a belt into a large wheel that moved the carving plane back and forth with a crank. The wood needs to be fed to the machine manually. That is the most demanding phase in making a shingle roof – a phase where a sensitive touch is required. Shingle planes are still used across Finland and shingles manufactured with them are sold with a reasonable price.

Spruce, pine and aspen have been used for shingles. There are certain advantages to using each of these. Aspen tends to curl up and is thus the most demanding. When using aspen, it is recommended to make shingles with a shorter advance. On the other hand it has a beautiful silver grey colour and when made correctly it is considered the most durable. However, it is important with all wood species to choose the right individual tree from the forest. The tree has to be straight, uniformly thick, have straight and dense fibres, and few branches. The diameter of the tree should be around twenty centimetres.

Coniferous trees used for shingles are usually cut down in late winter and planed in early summer, when the tensions within the tree have settled. Roofing is usually done during the summer, often in one day bees with a large number of people participating.

Olavi Mäkinen guiding Anna Pichetto Fratin on how to make thin shingles.

Maria Lumo and Enni Ellä nail shingles. Rows are kept straight with "riialauta" and comb board.

As shingles are made out of wood they have some weaknesses too. Wood is flammable and it is prone to rotting. There have been attempts to eliminate these issues throughout the ages with various tricks. Shingles have been treated with various

Planing shingles in "Puufoorumi" in Kyrö.

oils, tar, vitriol, red ochre, lime milk, etc. However, these have not significantly increased the longevity of shingles. Some treatments have even caused the iron nails on the roofs to corrode through within a few years.

One advantage of wood is that it is a renewable natural resource that also binds carbon. The longer it stays on the roof, the better. One suggestion for making roofs last longer was reported by "Mikkelin Sanomat" in 1898, quoting a Gotlander innovation:

In 1894 a new way to cover rooms came into use: shingles were set aslant over the rib, nailed in place from the lowest left corner and otherwise attached as usual. Thus the shingles slant slightly sideways leaving no gaps but stay dense and smooth from all directions becoming less flammable, hindering the advance of fire. Because the shingles are on a slant to the course of water, this cannot penetrate beneath them. The roof dries easily from the outside and the visible nails will not rust. There are three striking advantages to this new shingle roof: compactness, less flammable and greater durability.

As already mentioned, the life span of roofs made from knife shingles can be over fifty years, while it is probably as little as twenty years with plane shingles. Would it be possible to develop a machine that would make block shingles with the speed of a shingle plane? While waiting for that we have to settle with making knife shingles with a bee. The following announcement appeared in newspaper "Koitare" in 1905:

> *Shingle chipping is carried out by the Hamina branch of Friends of Sobriety amongst its members.*
> *Programme: Bee, ripping shingles, nailing shingles, a cup of coffee.*
> *Note! Everybody to work, take your long knives.*

There are new methods in development for flammable roof materials. In the Netherlands, reed roofs are common also in the urban areas and there are unnoticeable fire sensors and sprinkler systems installed on the apex of the roofs.

In the ProNatMat project, shingle roof building experiments were carried out in cooperation with the Puufoorumi association from Kyrö. The selection of trees and shaving of shingles were explored in Puufoorumi premises at the former Rahkio school.

In Toijainen, Turku, the roof of an old outhouse was renewed with shingles. The substructure of the roof had here and there significant roughness, where shingle demonstrated its flexibility when compared with other roofing materials. Pine, spruce and aspen were all used in different areas of the roof. The goal was to follow how they behave differently along the years. Some colour differences are already apparent after a couple of years.

Planing shingles in Rahkio during the spring of 2010. Blade planes shingles from the wood leaving a triangular log.

At the Koroinen farm in Turku, test roofs were made out of elements built on the ground. In the spring of 2012, experiments will be carried out on making shingles out of hardwood by either splitting or planning. Trees cut down from parks would thus get a new life on the roofs of yard or doorway roofs, for example.

In shingle roof bees, the spirit of good old competition and collective making is still present. There is also a good reason to celebrate achieving a common goal. It is good to get an experienced shingle roof builder to act as the master in a roof bee. New shingle roof builders are also educated in the degree programmes of traditional building and restoration at various schools.

For most, a shingle roof is familiar from local museums. However, it should not be left to roof only museums, but should rather be further developed. There could be a future for traditional shingle roofs especially in summer residences without a fireplace, various garden shelters and huts. The webpages and renovation files of Finland's National Bureau of Antiquities offers good advice to shingle roof builders. (www.nba.fi/fi/File/134/korjauskortti-19.pdf) •

Natural Materials

in Recreational Activities for the Elderly

Sanna-Mari Rivasto

Natural materials offer many possibilities for recreational activities, for various usable materials are available in the surrounding environment throughout the year and they offer an ecological, abundant and often even economical option for synthetic materials. There is also a cultural and historical dimension to the use of natural materials: before industrialisation all utility items and ornaments were made out of natural materials, because synthetic materials were not available. Also the skill, time and trouble required when collecting and processing natural materials add to their value.

Recreational activities support the solving of the challenges emerging due to ageing. Statistics Finland estimates that the percentage of those over 65 years old will increase from the current 17% up to 27% by 2040. Ageing citizens are a significant group that requires recreational services in particular. The challenge is how both the quality and quantity of services can be guaranteed while keeping the costs in hand. Recreational activities help sustain the elderly's capacity to act, thus shortening the time that they are dependent of welfare and health services. The basic idea of recreational activities is to support the physical, mental and intellectual capabilities of the elderly so that the activities themselves are pleasing and improve the quality of life. Recreational activities activate memory and place strain on the brain and thus improve their functionality. The more the brain is activated the better the capability to learn and remember will be. Recreational activities also increase the general activity of the elderly and at the same time the elderly become more aware of their capabilities and resources.

At its best, recreational activities give the ageing important social contacts and long-standing social networks.

Natural materials themselves can be sources of pleasure. The touch with nature that comes with them is experienced as very important. In turn, when crafting, the union of many senses evokes a variety of bodily experiences. Stone is often experienced as cold, heavy and valuable, representing stability; wood as warm, safe and cosy. Woven wool is generally considered as functional, practical and multidimensional; warmth, softness, beauty and familiarity are often connected with it. On the other hand, these characteristics are less apparent in industrially produced products. Knowing the origin of the material and the work required in crafting increase the appreciation.

If the physical, mental and intellectual capabilities of the elderly are taken into account when planning recreational activities, they offer multifunctional activities to the ageing. At its best, recreational activities give the ageing important social contacts and long-standing social networks. The communities that are formed in recreational activities give a sense of security and empowerment in everyday life. Doing together and sharing experiences and knowledge have an important role. Coordinated activities create possibilities to maintain social networks and to meet peers. Socialising is an essential part of recreational activities, as important as e.g. completing handicrafts. In groups, support is given to one another and there is an awareness of the limitations of the others that enables encouraging and supporting them. In addition to these benefits, recreational activities improve and maintain memory, muscle strength and motor function as well as create sensations of joy and success. All of these are linked with maintaining the capacity to act and experiencing happy ageing.

Challenges related to ageing

The challenges must be taken into account when working with the ageing. The role of the instructor is to give ideas and advice and enable various activities. For that reason there must be enough workforce to give personal assistance to those who need it. The instructor must also take care of the acquisition of materials or organising the acquisition trips.

The challenges related with the physical capacity of ageing must be acknowledged especially in craft activities, for they limit the working methods and choice of materials. Physical restrictions must be taken into account already when planning the activities so that each participant gets the chance to participate in them. Typical restrictions related to ageing include decreased muscular strength, poor motor function and impaired vision and hearing. These can be taken into account in practical work by focusing attention on providing guidance, material choices, accessibility and illumination.

The special needs of the weak-sighted must be taken into account. The instructions must be written with a large font and a good contrast. They must also be read aloud. Illumination is an important factor in that the weak-sighted should be able to use their eyesight as efficiently as possible. The weak-sighted can also be easily dazzled. This can be taken into account by avoiding high contrasts in illumination and using lamp shades. Also a magnifying glass can be used when precision is required. When combined with poor motor function, impaired vision is a significant limitation. Accessible space enables more independent and safer operation for the visually impaired. Routes must be free and thus the materials must be kept on tables or close to walls, away from the routes.

To avoid dangerous situations, the space and condition of participants must be observed. Activities requiring good hand-eye coordination or dangerous equipment should be avoided. However, the recreational activities should support coordination abilities, because practice also affects the maintenance and development of skills. If motor capabilities have already deteriorated so much that crafting is impossible, even touching the natural materials alone can give positive experiences.

The choice and collection of materials

The environmental impact, availability and ease of use must be taken into account when choosing the materials. In addition their health effects, such as purity and suitability for people, must be taken into account. Some natural materials can be poisonous or allergenic.

The search for materials itself can offer experiences of well-being to the ageing. When working with the ageing, the physical disabilities that may play a role in the acquisition of materials must be taken into account in particular. Because of this, some basic materials should be acquired in advance, but also a possibility for harvesting the materials from nature should be given. Although the harvesting of materials from nature may be arduous to organise, self-harvested materials add to the value of the work. With self-harvested materials handicrafts become unique and personal. It is also worthwhile to suggest that people bring useable materials from home.

The search for materials itself can offer experiences of well-being to the ageing.

Guided excursions and detailed instructions are required when harvesting materials. It is prudent to delimit the areas where materials can be harvested and the areas which should be left untouched. Also, participants must be told which materials can and should be harvested and which are forbidden to collect. Rare and poisonous plants could be listed as forbidden for example. It is also good to remind of the right of public access that forbids harvesting of twigs, lichen and cones without permission from the landowner. In the table below some natural materials are shown that you are allowed or forbidden to harvest without the landowner's permission. The list is not exhaustive.

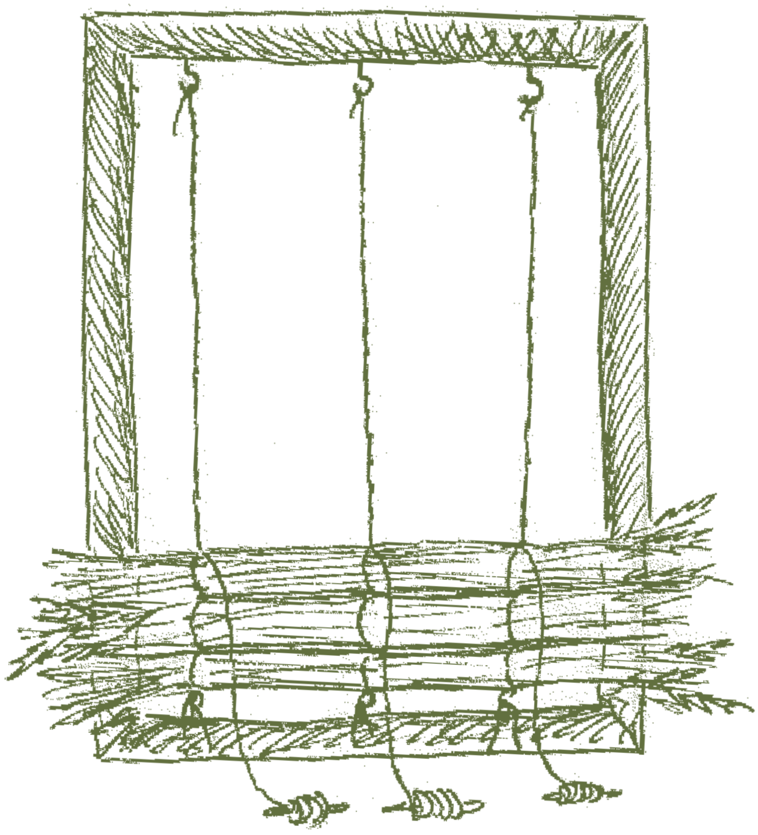
May be harvested without permission	Subject to permission
• Wildflowers that are not protected under Nature Conservation (1997/160) • Berries • Mushrooms • Materials that have fallen on the ground, such as cones, dry twigs and nuts	• Materials from growing or fallen trees: willow, coniferous litter, birch bark, roots, leaves, resin, bast, acorns, cones, nuts • Moss, lichen • Sprigs • Protected plants • Logging waste

Reed seat cushion

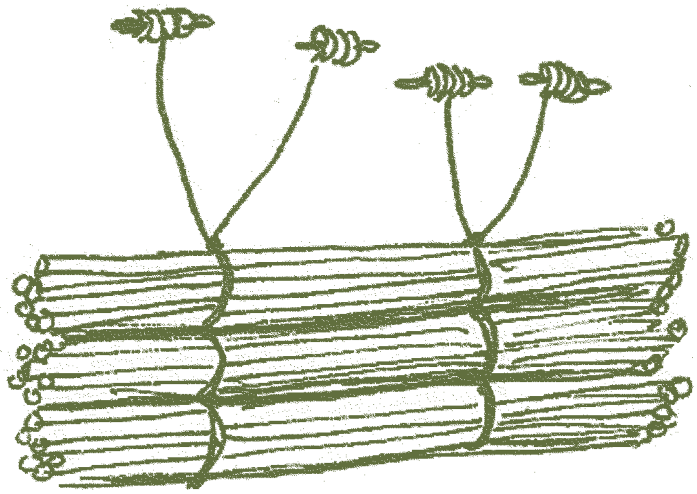
Supplies: reed, cutters, natural string
Working instructions:

1. When harvesting, cut off the inflorescence. Common reed is at its best when harvested during winter or spring.
2. Measure two pieces of string in length approximately three times the height of the seat cushion.
3. Find the middle of the string. You may roll both halves of the string around a stick.
4. Take a bundle of reed and place them in the middle of the strings. Tie a firm overhand knot.
5. Place the next bundle and tie it to the cushion. Continue until the cushion is wide enough.
6. In the end level the sides of the cushion with a cutter.

Tip: You can use this technique also to make carpets. You may also use other kinds of grass, willow or birch twigs as material.



Drawings: Sanna-Mari Rivasto.



Weaving with a weave frame

To ease weaving you may build a frame from old window frames for example.
Working instructions:

1. Make the frame yourself or use an old wooden frame. Your imagination is the only limit !
2. To the bottom of the frame screw hooks evenly for warp threads. When working with reed, the warp threads should be 10–40 cm apart.
3. On the top of the frame screw hooks as on the bottom.
4. Bind the warp threads from the bottom to the top. They should be tight.
5. Bind another thread, twice the length of the intended work, to the bottom hooks and roll the rest of the thread around a stick.
6. Start weaving by putting a bundle of weave material to the bottom of the frame, on top of another warp thread and bind it with the rolled thread.
7. Set a new bundle and bind it. Continue until the work is of desirable size or until warp thread runs out. •

Literature:

Eloranta, Tuija & Punkanen, Tiina 2008. Vireään vanhuuteen (Way to the energetic old ages). Otavan kirjapaino Oy, Keuruu.

Joenpolvi, Martti; Kälviäinen, Mira; Mähönen, Raili & Junnila-Savolainen, Riitta, 2003. Luonnonmateriaalien kokeminen tuotteissa (Experiments with Natural materials in products). Research report, Kuopio Academy of Design. Kuopio.

Kupiainen Tarja (edit.) 2004. Käsillä tehty (hand made). Edita Prima Oy, Helsinki.

Kälviäinen, Mirja (edit.) 2005. Käsityö – yrittäjyys – hyvinvointi. (Handicraft, Entreprise, Well being) KTM Publications 9/2005.

Manninen, Heikki (edit.) 2003. Kuntouttavaa kotielämää. Kuntoa arjen toimista ja apuvälineistä ikäihmisille. Loimaan Kirjapaino Oy.

Tuunanen, Pekka (edit.) 2007. The public right of access, Finland's environmental administration. Edita Prima Oy, Helsinki.

Vähälä, Eija, 2003. Luovan käsityöprosessin yhteydet psyykkiseen hyvinvointiin, University of Joensuu. Kirjakas Ky, Nurmijärvi

Virtual databank www.lumoverkosto.fi.

Rivasto, Sanna-Mari 2009. Luonnonmateriaalit ikääntyvien viriketoiminnassa (Natural materials in stimulus activities for the aged). Thesis: Turku University of Applied Sciences, Degree Programme in Sustainable Development.

Permaculture Design

Mari Korhonen

Could our cities, homes and farmlands function like nature does, not polluting but improving the air, water and soil; not exhausting but generating more natural resources, better soil and rivers full of fresh water? From greening the deserts in the Middle East to creating edible forest gardens all over the world a design method called permaculture is doing just that. It draws its models from observing how natural ecosystems function in a balanced, healthy and increasingly productive way. Permaculture is an ecosystemic way of designing our human environments so that they become more resilient if disturbed, stable in their functions, and more healthy and productive as they are used. This is quite opposite to the conventional industrial and agricultural systems that tend to deplete and degrade their surroundings while requiring big external inputs like fossil fuels or synthetic fertilisers to function. Permaculture is a word derived from the words permanent (agri)culture, and was established as a concept in the early 1970s by two Australian academics, **Bill Mollison** and **David Holmgren**.

In a nutshell, permaculture means a holistic design system for creating sustainable, even regenerative human habitats. This means that we learn to know our living environment and how it functions, and learn to work and cooperate with those patterns to achieve what we need: comfortable shelter, clean water, nourishing food and other materials using local resources and energy. Practical examples of this could include buildings using passive solar design for heating and cooling, rainwater harvesting for domestic or garden use and diverse gardens containing herbs, vegetables and trees that themselves supply the functions that are needed to keep them healthy and productive. Guided by the principle of "problem is the solution", even negative things can be transformed into more resources and put to beneficial use. Cold winds can power a windmill and wet swampy soil in the garden might be the perfect place for a duck pond.

The method of permaculture design has a foundation of ethics: care for the earth, care for the people and a fair share of resources.

The method of permaculture design has a foundation of ethics: care for the Earth, care for the people and a fair share of resources. The design process is guided by principles of permaculture, and the actual design is implemented by using techniques that vary depending on the local climate and other circumstances. That is why the practical examples from its homeland Australia are not necessarily appropriate in Finland while the design method is still as useful as ever. As Bill Mollison said, permaculture does not really offer us anything new – it just arranges the things we already know in a different way.

The permaculture systems are efficient: as one of the principles goes, every element in the system should serve multiple functions and all the important functions should be provided from multiple sources. This saves energy and effort while providing more yields at once. A great innovation by the Central Rocky Mountain Permaculture Institute in Colorado includes a sauna built on the North wall of a greenhouse

Permacultural Design course (PDC) in Koroinen 2011 gathered participants from 12 different countries. Photo: Outi Tuomela.

to provide extra heat for the plants in the winter as a by-product of bathing, in addition to heat storing rock walls, water tanks and a "subterranean heating and cooling system" that stores excess heat from the sun into the ground under the greenhouse. This kind of system allows the institute to maintain a subtropical food forest with bananas and papayas in the altitude of 2 200 m without any use of oil or natural gas normally used for heating greenhouses. The footpaths also serve as worm composts providing fertiliser for the plants, and the water storage tanks are planned to grow fish in addition to irrigating the vegetables. It is stacking of functions at its best – another permaculture principle – showing that the

Permaculture Ethics and Design Principles by permacultureprinciples.com

opportunities and products of these systems are limited only by our imagination! Speaking of imagination, the greenhouse also has an archery range on one corridor and a cosy subtropical sleeping loft in the north-west corner!

Learning permaculture

The basic introduction to permaculture design is the 72 hour Permaculture Design Certificate course (also known as the PDC), most often taught as an intensive residential course over 10–14 days. The course syllabus was originally developed by Bill Mollison and is still taught as the standard curriculum all over the world. In August 2011, a PDC course was organised in Turku, supported by funding from the EU Grundtvig programme.

A PDC course contains a wide range of topics, beginning from the basics of permaculture and continuing to improving soils, managing water, growing trees, using ecological construction methods, social permaculture and alternative economics etc. On the course the students also learn many design and analysis tools and mapping skills that can be utilised in any project. The content on the course is delivered in both theory as well as through many practical and participatory exercises. On the PDC course organised at Koroinen, one day was spent sampling the soil in various locations on the site and recording the observations, and on another day students were calculating rainwater catching roof surfaces on buildings and surveying contour lines on the slopes for designing erosion control structures on the land. A very interesting exercise was planting edible trees, shrubs and herbs of the cold climate in perennial polycultures – the opposite of annual monocultures of conventional agriculture.

Permaculture started in a climate very different from our cold temperate conditions and although it has been used successfully especially in the warmer climate zones, so far there are not so many tried and tested solutions for places such as Finland. However, some do exist. One of the closest famous examples of cold temperate permaculture can be found in the Austrian Alps where a rebel farmer, **Sepp Holzer** has developed a diverse farm oasis of livestock, fruits, vegetables and wildlife called Krameterhof, using the same kind of design – working together, not against nature. Courses such as the one held at Koroinen are wonderful opportunities for networking, training practitioners and sharing practical experiences among the inhabitants of colder climates. We need to look back to the traditional knowledge about our land and in the same time use our own observation skills and creativity to discover the best practices in these challenging conditions. For many it is a life changing experience.

Ecosystem in the garden

Some of the most common examples of permaculture design in practice can be found right outside, in your front yard! The home garden that applies the principles of permaculture includes a wide diversity of plants for human use or for other services for the garden. Herbs, vegetables and fruit trees are mixed together in just like they would do in the wild. That is called perennial polyculture, many plants grow back year after year. Plants grown in polycultures give many benefits to the garden. Their roots occupy different niches in the soil, some growing deep down for nutrients and water, others growing near the soil surface, and others find their spaces in between. No competition, but cooperation. Many different shapes, colours and smells of plants distract pest insects from your crops so chemical pesticides are not needed. Some plants serve as mulch makers and nutrient accumulators. Plants like comfrey do that and when you “chop'n'drop” them on the ground, it makes a rich mulch that helps to build healthy fertile soil. A classic example of a perennial polyculture is a forest garden that imitates a natural forest but is designed for human use, containing mostly edible or otherwise useful plants and trees. There the plants grow in layers from low ground covers to herbs, bushes, climbers and finally tall climax trees. In a forest garden plants are arranged together in guilds – combinations, which especially support to each other.

A guild around an apple tree could include for example yarrow, dandelion, comfrey and clover. A recent discovery from the past winter was that trees surrounded by raspberries were better saved from the damage of hungry hares in Finland. So there is another good companion for the guild. More details about guilds and permaculture design can be found in many books and online resources. Anyone can try it, do it, and as **Geoff Lawton** says, “you can solve all the world's problems in a garden”. •

Part 4

Research

"Natural Materials" within Universities

in the Central Baltic INTERREG IV A Programme 2007–2013 Area

Johanna Aaltonen, University of Turku, Brahea Centre for Training and Development

Introduction

There are some 50 public Universities that offer the highest education in the Central Baltic INTERREG IV A Programme 2007–2013 area in Estonia, Finland, Latvia and Sweden. What kind of research, education, and cooperation with the outside world there is on natural materials? What do they have to offer for the ProNatMat project's fields of interests? In this case, an experimental web search for "natural materials" was carried out.

The Central Baltic INTERREG IV A Programme 2007–2013 area was chosen as the area for this short study. It includes the following areas from Estonia, Finland, Latvia and Sweden[1].

- Kirde-Eesti, Kesk-Eesti, Põhja-Eesti, Lääne-Eesti, and Lõuna-Eesti
- Varsinais-Suomi, Helsinki-Uusimaa, Kymenlaakso, Åland, Kanta-Häme, Päijät-Häme, and Etelä-Karjala
- Kurzeme, Riga, Pieriga, Vidzeme, and Zemgale
- Gävleborgs län, Uppsala län, Stockholms län, Södermanlands län, Östergötlands län, Gotlands län, Västmanlands län, and Örebro.

Universities are in this context defined as public universities or university colleges (Latvia and Sweden) that give education in Master's level or higher. The programme area includes all the capital cities (Helsinki, Riga, Stockholm, and Tallinn), and the studied institutes are mainly centred in the capital city regions. This is most obvious in Latvia. In the study area, the universities are the following:

- 6 in Estonia, of which 4 in the capital city Tallinn
- 11 in Finland, of which 7 in the capital city Helsinki
- 17 in Latvia, of which 14 in the capital city Riga
- 14 in Sweden, of which 9 in the capital city Stockholm.

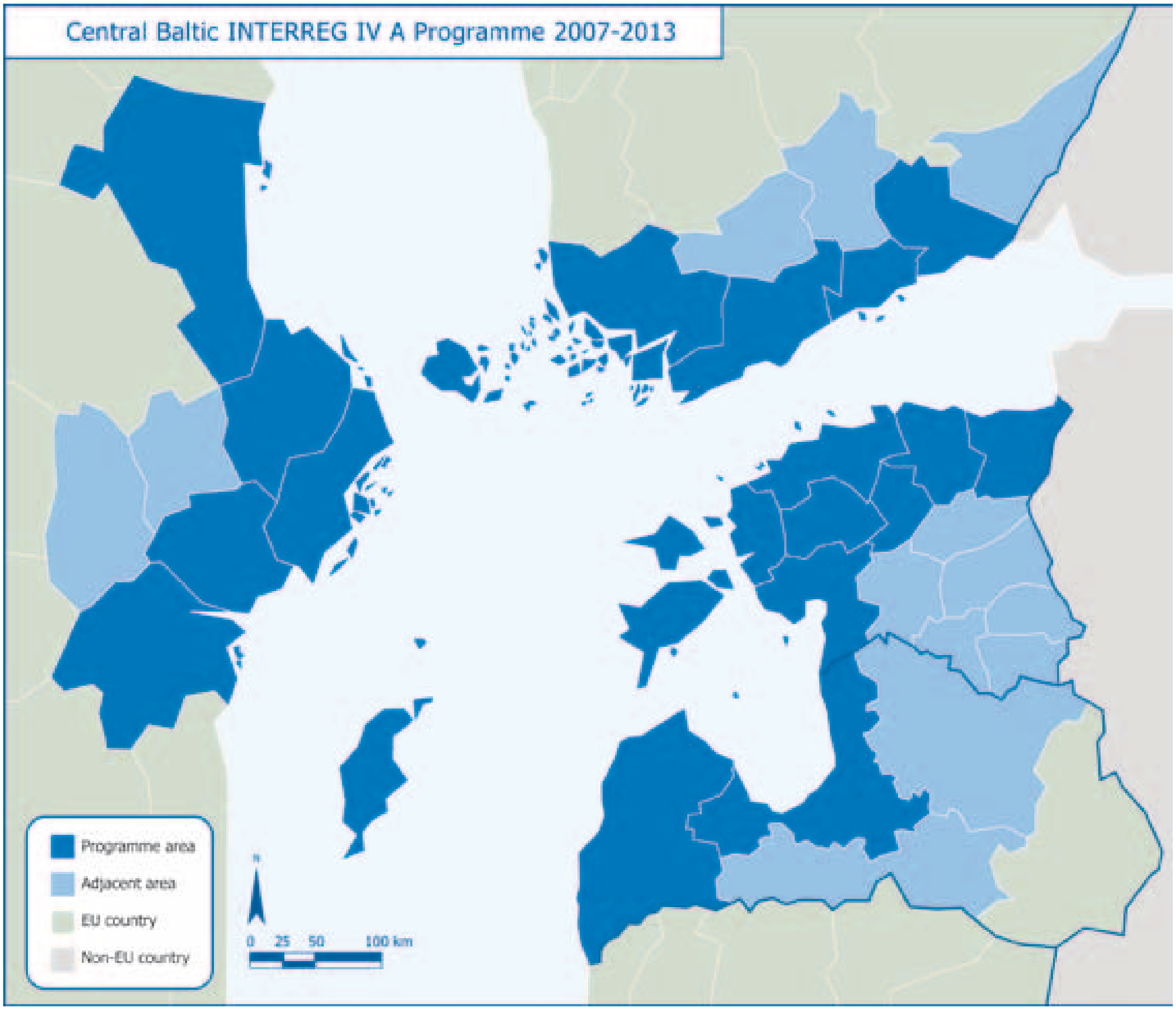
In total, there are 48 universities, plus many other Institutes of Higher Education (HEIs) like private universities. Thus, the total number of HEIs in the programme area is higher than within this study. The classification of universities differs a bit by country, and this made it more difficult to define which institutes should be included. The list of included universities is available in the end[2].

Search for "natural materials"

The actual data was collected from the official websites of the universities, and by using web search engines of the websites. It was necessary to limit the study, as there were 48 websites to search, and it was not realistic to go through all the material on the websites manually. Of course this method has its limitations, and it does not catch all the possible and promising cases. For example, three of the universities' websites did not feature a search at all, and they were excluded from the very beginning (the University College of Opera, Stockholm; the National Academy of Defence of the Republic of Latvia, and the Riga Teacher Training and Educational Management Academy).

The next search words were used:

- "natural materials"
- "looduslikud materjalid"



- “luonnonmateriaalit”
- “naturmaterial”
- “dabīgs materials”.

Native terms were used in Finnish, Estonian, Swedish and Latvian websites, the English term in the English versions of the websites. In thirty of all the universities, there were no entries at all with any of the search words.

In total, and without elimination, there were (consists of 18 universities):

- 562 entries for “natural materials”
- 610 entries for “dabīgs materials”.
- 92 entries for “luonnonmateriaalit”
- 86 entries for “naturmaterial” (including the Åbo Akademi University)
- 27 entries for “looduslikud materjalid”.

The Art Academy of Latvia had a somehow different search, and the results did not necessary carry the actual term “natural materials” or “dabīgs materials”; most often only the term “material” was found. It has a great effect on the final numbers, as there were 182 English and 594 Latvian entries in all for the Art Academy of Latvia (Latvia would have almost zero without the results of the Art Academy of Latvia). In Finland and Latvia, there were more entries in the state languages than in English, and in Estonia and Sweden, there were more entries in English than in the state languages. The study continued with the entries for "natural materials", so that it was easier to compare the results, and study them more carefully.

By entries for "natural materials", the total number of entries by country was:

- SE: 258 entries (consists of 8 universities)
- LV: 185 entries (including the Art Academy of Latvia, consists of 3 universities)
- FI: 86 entries (consists of 4 universities)
- EE: 33 entries (consists of 3 universities).

Sweden clearly stands out from the search in the total number of entries. By entries for "natural materials", the top universities were:

- LV: Art Academy of Latvia, 182 entries
- SE: KTH Royal Institute of Technology, 126 entries
- FI: University of Helsinki, 63 entries
- SE: Uppsala University, 44 entries
- EE: Estonian University of Life Sciences, 29 entries
- SE: University College of Arts, Crafts and Design, 28 entries.

Natural materials' structure and composition, properties, and functionality can boost scientific solutions. New field of science called biomimetics imitates nature's solutions to various problems. (Cost 2012, LiU 2012).

Disciplines and materials of "natural materials"

The study continued with the entries within the most successful universities by countries (see above). Only the thirty first entries (except the Estonian University of Life Sciences with all the 29 entries) were included, checked, and listed by each institution.

As mentioned earlier, Art Academy of Latvia's website[3] search did not catch the actual term "natural materials". "Natural" or "materials" were included in most of the cases, or none of them. Anyhow, the search pointed out, with its undefined logic, some units like Institute for Art History, projects like the *Baltic-Caucasus – Signs of Identity/Signs of Diversity* in cooperation with UNESCO National Committee of Latvia, many student exhibitions, and some academic staff data. The only indirect connections with "natural materials" as actual materials were glass, ceramics, wood, silver and amber. The content included mainly internal data and really short insights into the Academy, even if quite many cases included international connections. Any research papers or special Master's programmes did not pop up. In all, the information was very general, and did not reveal for example any detailed course descriptions for "natural materials".

The website search of KTH Royal Institute of Technology[4] did catch the term "natural materials" as such. Two units dominated the results: School of Architecture and Built Environment, and its department of Land and water resources engineering. Almost all the findings were different research papers by the KTH. By change, many of the researches were implemented abroad, and the research themes and teams seemed to be quite multicultural. The most obvious connection with actual materials was the use of them in different water treatment researches. Materials like seeds, opoka, polonite, limestone, peat, wollastonite, sand etc. were mentioned. There were also a few entries with construction materials like natural fibre composites, stone, bamboo, wool, etc. Any special Master's programmes did not pop up; neither was there too much information on the Institute.

The website search of the University of Helsinki[5] did catch, too, the term "natural materials" as such. Involved units and fields were multiple: chemistry, pharmacy, anatomy, agriculture and forestry, physics, orthopaedics and traumatology, media technology, environmental and social sciences etc. The entries included information about the research in the university, education programmes and courses like the international and interdisciplinary Master's Degree Programme in Biotechnology at the university, and also about international connections like different congresses. Connections to natural materials were scattered because of the many fields involved, but different composites, biomaterials, renewables, and polymers, and functional food could be picked up; also architectural materials and wool.

The search on Estonian University of Life Sciences' website[6] did not catch the term "natural materials", but included in most of the cases of either "natural" or "materials". Involved units or fields were quite many, for example landscape architecture, engineering sciences, agricultural and environmental sciences, forestry, etc. Approximately in one third of the cases the context was strategic, and underlined the sustainability of the entire university. An English Master's programme called Biodiversity and Landscape Management partly stood out. Connections with natural materials were mainly natural and ecological building materials, and wood. Only a few entries were connected to the research, and mostly the cases introduced in addition to strategic lines, different study programmes and courses in the university. The cases also introduced mainly internal data, and not too many connections with the outside world.

All four universities had somehow different profiles of "natural materials", and also different kinds of websites, and the findings started already to be repeated inside the 30 first entries. The Art Academy of Latvia had mainly information about its different activities, projects and the Academy itself. The Estonian University of Life Sciences was also merely introducing its own education, but came across really strongly as the "Green University" with multidisciplinary education. The KTH Royal Institute of Technology was profiled as a technical research institute, especially within water treatment. The University of Helsinki had the most multidisciplinary profile, and the findings included diversified data and materials, about education, research and activities outside the university.

Did you know that

- at Åbo Akademi University, the Department of Chemical Engineering offers studies within a new major subject Natural Materials Technology [7]
- the multidisciplinary Molecular Materials top research group of Aalto University is aiming at functional materials based on self-assembly and its hierarchies, inspired by natural strong materials like silk[8]
- the Swedish Center for Biomimetic Fiber Engineering is a multidisciplinary Centre of Excellence with expertise at every level of the formation, modification and industrial utilisation of wood, fibres and their constituent polymers[9]
- in the TUT Centre for Biorobotics at Tallinn University, and in its Art projects, for example, active and interactive smart textiles are examined: the form, function and aesthetics are designed mimicking a biological element[10]
- at Aalto University, a doctoral thesis about the ATUMICS model by Adhi Nughara is introduced. ATUMICS is a model for promoting traditions in art and design, and comes from the words: Artefact, Technique, Utility, Material, Icon, Concept and Shape; the basic elements of a product[11]
- in 2011, the Nordic-Baltic Designers Event was held in Riga to boost innovations within the part of the creative industry that deals with cross disciplinary design and sustainable development; like applying natural materials in light design[12].

Discussion

The study was not too deep but suggestive, and it is based on Internet sources. Still, the search was done in a systematic manner, and the universities were studied alike. You could consider this as a lead-in to the subject.

The high number of universities in the Central Baltic

INTERREG IV A Programme 2007–2013 area was a little surprising. What a great potential it is! Anyway, in 30 out of 48 universities, there were no hits at all for "natural materials".

The more detailed part of the study consisted of a fifth of all the found entries for "natural materials". It is promising that results for "natural materials" hit multidisciplinary and various fields of science in the Central Baltic INTERREG IV A Programme 2007–2013 area, and also many kinds of materials from natural to bio-inspired materials. The thesis that Sweden would have the strongest scientific understanding of natural materials of the four countries should of course be examined more, and the profiles of the universities cannot be generalised as country profiles.

Nevertheless, it seemed like the technical development frame dominated in general, and was also stronger than for example the more sound cultural and design based frame. The latter frame might carry underused but promising new expectations within the universities. It also seemed that scientific understanding of "natural materials" is not yet widely turned into industrial applications and commercial exploitation. Still, for example material choice is trade-off between different properties like mechanical,

UNIVERSITIES WITHIN THE STUDY	
2 March 2012; No entries at all (number of entries for "natural materials"):	
Estonian Academy of Arts	Liepaja University
Estonian Academy of Music and Theatre	National Academy of Defence of the Republic of Latvia
Estonian University of Life Sciences (29)	Riga Graduate School of Law
Tallinn University	Riga Stradins University
Tallinn University of Technology (2)	Riga Teacher Training and Educational Management Academy
University of Tartu (2)	Riga Technical University (1)
Aalto University (4)	Stockholm School of Economics in Riga
Finnish Academy of Fine Arts	University of Latvia (2)
Hanken School of Economics	Ventspils College
Lahti University Consortium	Vidzeme University College
Lappeenranta University of Technology	Karolinska Institutet (8)
Sibelius Academy	KTH Royal Institute of Technology (126)
The Finnish Defence Forces	Linköping University (12)
Theatre Academy Helsinki	Mälardalen University (15)
University of Helsinki (63)	Örebro University
University of Turku (10)	Royal College of Music
Åbo Akademi University (9)	Royal Institute of Art
Art Academy of Latvia (182)	Stockholm Academy of Dramatic Arts
BA School of Business and Finance	Stockholm University (21)
J.Vitols Latvian Academy of Music	Swedish University of Agricultural Sciences (4)
Latvian Academy of Culture	The University College of Opera, Stockholm
Latvian Academy of Sports Education	University College of Arts, Crafts and Design (28)
Latvian Maritime Academy	University of Dance and Circus
Latvian University of Agriculture	Uppsala University (44)

environmental, and economical properties[13]. Then, one scientific frame is not enough to promote the choice of natural materials between natural and other materials. Multidisciplinary approach should reach from physics to business economics to facilitate positive impacts of science on society, and on nature. •

Sources:

[1] Central Baltic… (2012). The Programme Document. 1.3.2012. <http://centralbaltic.eu/documents/doc_download/4-the-programme-document->

[2] Estonian Ministry of Education and Research 2012, HEQEC 2012, Swedish National Agency for Higher Education 2012, Finnish Ministry of Education and Culture 2012.

[3] 5.3.2012. Art Academy of Latvia (2012). 4.3.2012. <http://www.lma.lv/eng/index.php>

[4] KTH Royal Institute of Technology (2012). 4.3.2012. <http://www.kth.se/en?l=en_UK>

[5] University of Helsinki (2012). 4.3.2012. http://www.helsinki.fi/university/index.html

[6] Estonian University of Life Sciences (2012). 4.3.2012. <https://www.emu.ee/en/>

[7] Åbo Akademi University (2012). 6.3.2012. <http://www.abo.fi/student/Content/Document/document/20148>

[8] Aalto University (2012). Molecular Materials. 6.3.2012. <http://tfy.tkk.fi/molmat/>

[9] Biomime (2012). The Swedish Center for Biomimetic Fiber Engineering. 6.3.2012. <http://www.biomime.org/>

[10] TUT Centre for Biorobotics of Tallinn University (2012). 6.3.2012. <http://www.biorobotics.ttu.ee/tikiwiki/tiki-index.php>

[11] ATUMICS model (2012). ATUMICS-malli rakentaa siltaa perinteen ja modernin välille. 6.3.2012. <http://media.aalto.fi/fi/current/news/view/2012-01-27/>

[12] Nordic-Baltic Designers Event (2012). 6.3.2012. <http://www.nbde.lv/>

[13] Wennberg, David (2011). Light-Weighting Methodology in Rail Vehicle. Design through Introduction of Load Carrying Sandwich Panels. Royal Institute of Technology (KTH). 29 p. <http://www.ave.kth.se/polopoly_fs/1.179981!/Menu/general/columncontent/attachment/David%20Wennberg%20Literature%20study1.pdf>

Cost (2012). European cooperation in science and techonology. 1.3.2012. <http://www.cost.eu/events/biomat>

Estonian Ministry of Education and Research (2012). 1.3.2012. Institutions of higher education. <http://www.hm.ee/index.php?1511854>

HEQEC (2012). Higher Education Quality Evaluation Centre. 1.3.2012. <http://www.aiknc.lv/en/list.php>

LiU (2012). Research at Linköping University. <http://www.liu.se/forskning/reportage/Biosensors?l=en>

Ministry of Education and Culture (2012). Universities and University Networks1.3.2012. <http://www.minedu.fi/OPM/Koulutus/yliopistokoulutus/yliopistot/>

Swedish National Agency for Higher Education (2012). List of higher education institutions. 1.3.2012. <http://www.hsv.se/highereducationinsweden/highereducationinstitutionsheis/listofhighereducationinstitutions.4.28afa2dc11bdcdc557480002332.html#hUniversitiesandInstitutionsofHigherEducation>

Lightweight Clay as a Building Material

Kristina Akermann & Jaan Miljan, Estonian University of Life Sciences

Even though the most common building material in Estonia has been timber throughout history, there are thousands of buildings, which are made of earth.

Earth as building material and earth architecture has a centuries-old but, unfortunately, fading tradition in Estonia. There are still hundreds of remaining historical earthen buildings, but many of them are not maintained and are therefore in ruins.

Earth buildings are particularly common in South-Estonia, where the suitable soil is widely spread and available. In Central and North Estonia the most prominent local building material next to timber is limestone. This is the reason why earth did not develop as significant role in construction as it did in South Estonia. In Estonia, there were various techniques and constructional forms to build earthen buildings. The simplest, oldest and also the most widely occurring technique was so called cob technique, there the earth walls were directly formed with wet earth. Also, a significant number of rammed earth buildings have been built with movable formworks and buildings made of unfired earth bricks or so-called adobe blocks are also presented in Estonia.

Since environmental concern has become increasingly important in every aspect of life, the solution to minimize negative environmental impact of the building industry is to find an alternative to materials with high embodied energy and made of non-renewable resources. Therefore, earth has been rediscovered as a local sustainable building material and old earth building techniques are currently enjoying a revival. More and more old historical buildings are conservated or repaired and new methods to use earth as building material are developed. Most recent earth buildings in Estonia are built with lightweight clay, as the thermal insulation properties of massive earth walls are not sufficient enough to keep the levels of thermal insulation required in Estonian climate.

Picture 1: Single-family house in Ihamaru with timber-framed walls in filled with lightweight clay with wood chips built in 2006 Photos: Marko Kikas.

Lightweight clay consists of clayey soil mixed with light additives such as wood shavings and chips, flax or hemp shieves, chopped reed or straw with a specific weight of 300–1200 kg/m³. Lightweight clay is poured and slightly damped into formwork and used as infill to timber-framed structures. The width of the lightweight clay walls should be at least 300 mm. Sometimes lightweight clay blocks are used instead. Lightweight clay blocks are made by filling moulds with a mixture of wet earth and light additives or shaped by hand. Unbaked blocks are left to dry in the sun. One of the advantages to build walls with lightweight clay blocks is that they are already dried and therefore it does not take as much time as to build monolithic lightweight clay walls.

Density, thermal and mechanical properties of the blocks depend upon the consistent of mixture-type of applied additives and the proportion of clay and light additives. As walls made of lightweight clay have a small compression strength, they are used as non-bearing partition walls and insulation or infill in timber-framed walls. Lightweight clay blocks are laid as any masonry work and bound together with earth or lime mortar. Regardless of increasing popularity of ecological building technology in Estonia, remarkably few lightweight clay houses is built. One of the reasons seems to be a lack of knowledge about the methods and techniques and the impression that it cost more than other conventional building materials.

Unfortunately, not many researches have done in Estonia in order to investigate the properties of lightweight clay and thus oppose those false beliefs.

The experiments were done in the framework of Central Baltic Interreg IV A programme project ProNatMat which promotes, increases and strengthens the use of local natural material and know-how in Finland and Estonia and the exchange of research and knowledge between these countries.

Material and methods

Different mixtures of lightweight clay were produced for this study, consisting of various porous substances such as flax shieves, wood shavings, chopped reed and wood chips as well as varying amount of clay and sand. Local, natural and easily supplied materials were preferred, for example reddish clay was from Joosu quarry, sands with different grain size distribution from Kolleri (sand I and II) and Sõreste (sand III) quarry of South Estonia.

Earth is not a standardised building material. It is a combination of clay, silt, sand, gravel and stones. Its structure and properties are depending on the parent rock and the location where it is dug out. Therefore, it is particularly relevant to understand some of its characteristics – grain size distribution, chemical and mineralogical composition, cohesion and plasticity – before using it for construction.

In order to use earth as building material it is necessary to know what kind of clay minerals it contains (kaolinite, illite or montmorillonite) and the proportion of fine aggregates (clay acting as a binder) and coarse aggregates (silt and sand acting as filler). For example, addition of sand and silt to an earth reduces the relative clay content and therefore earth expansiveness, but in the other hand it also reduces cohesion. Earth containing a high percentage of clay is suitable for lightweight clay walling, but is not suitable for rammed earth walling.

Picture 2: Sand from Sõreste and Kolleri quarry and clay from Joosu quarry was used to make lightweight clay and rammed earth blocks. Photos: Kristina Akermann.

The grain size distribution, average shrinkage, chemical and mineralogical composition of clay derived from Joosu quarry was determined in this study. Mineralogical composition of clay was determined with a help of **Kalle Kirsimäe** from the Department of Geology of the University of Tartu. Chemical analyses were done by one of the partners of ProNatMat – Laboratory of Fiber and Cellulose technology of Åbo Academy. The chemical and mineralogical composition of the clay from Joosu quarry is shown in Table 1.

Mineral	Weight (wt %)
silicon dioxide	40
Potassium-Feldspar	2,6
Plagioclase	3
Calcite	traces of ....
Hematite	1,6
Illite -Smectite	11,9
Mica, Illite	17,9
Kaolinite	20,5
Anatase	1,9
Apatite	traces of ....
Chemical elements	**Weight (wt%)**
O	59,28
Na	0,14
Mg	0,72
Al	9,36
Si	22,56
P	0,06
S	0,03
Cl	0,04
K	2,59
Ca	0,2
Ti	0,65
Fe	4,37

Table 1: The chemical and mineralogical composition of the clay from Joosu quarry.

The clay from Joosu quarry is rich in minerals. All the commonly found groups of clay minerals are represented in studied clay – kaolinit, illite and smectite. The biggest percentage of unweathered minerals found in Joosu clay is silicon dioxide or so-called quartz. Also, there are some traces of other minerals for example hematite and potassium-feldspar.

The light additives such as chopped reed, wood chips or shavings originated also from South Estonia. Reed is a quickly renewable natural material growing in abundance on the coasts of the lakes and rivers in South-Estonia, and wood chips and shavings are by-products from sawmills.

Most lightweight clay buildings in Estonia are built using lightweight clay with wood chips. Sometimes wood shavings or saw dust is added to create more rigid and stabilized mixture or blocks. In Finland and many historical buildings in Estonia, straw is preferred rather. Flax and hemp sieves and chopped reed would be also a reasonable alternative to increase thermal properties and reduce shrinkage of lightweight clay. Although there are a number of historical buildings built by using lightweight clay blocks with flax shieves, it is not particularly common in Estonia nowadays. One of the reasons is the unavailability of flax shieves. Just the opposite, the reed is widely spread and available for everyone, but it is still having not found much of use. Chopping the reed manually might be very labor-intensive and it is difficult to get mixture rigid enough to make unbreakable blocks. Also, one must be aware of possibility of fungus growth and rotting in case of lightweight clay with straw, chopped reed and flax shieves.

Picture 3: Light addivities such as chopped reed, flax shieves, wood shavings and chips were added to lightweight clay blocks to increase thermal properties. Photos: Kristina Akermann.

The aim of the study was to examine the mechanical and the thermal properties of different lightweight clay blocks and the possibility to use lightweight clay as building material. The thermal conductivity in a steady state condition and compressive stress in 10% strain was determined in different mixtures of lightweight clay consisting of various porous substances and different proportion of clay and sand. The consistent and designation of lightweight clay blocks are shown in Table 2.

Sample identification	Composition of Mixture (clay : porous addivites)	Content of Mixture	% (vol)	Dry unit weight, kg/m³
FSB-1	1:4	clay	19	640
		flax-shieves	74	
		water	7	
FSB-2	1:4	clay	14	546
		flax-shieves	74	
		sand	5	
		water	7	
FSB-3	1:3	clay	23	776
		flax-shieves	68	
		water	9	
FSB-4	1:3	clay	17	818
		flax-shieves	68	
		sand	6	
		water	9	
FSB-5	1:1	clay	29	1694
		flax-shieves	29	
		sand	29	
		water	12	

Table 2a: Designation of lightweight clay blocks with flax shieves.

Sample identification	Composition of Mixture (clay : porous addivites)	Content of Mixture	% (vol)	Dry unit weight, kg/m³
WCB-1	1:4	clay	18	621
		wood-chips	72	
		water	10	
WCB-2	1:4	clay	14	568
		wood-chips	72	
		sand	5	
		water	10	
WCB-3	1:3	clay	22	705
		wood-chips	67	
		water	11	
WCB-4	1:3	clay	17	653
		wood-chips	67	
		sand	6	
		water	11	
WCB-5	1:4	clay	13	599
		wood-chips	51	
		wood-shavings	25	
		water	11	

Table 2b: Designation of lightweight clay blocks with wood chips.

Sample identification	Composition of Mixture (clay : porous additives)	Content of Mixture	% (vol)	Dry unit weight, kg/m³
CRB-1	1:2	clay	25	788
		chopped reed	50	
		water	25	
CRB-2	1:3	clay	20	605
		chopped reed	60	
		water	20	
CRB-3	1:4	clay	16,7	558
		chopped reed	66,7	
		water	16,7	
CRB-4	1:2:1	clay	20	651
		chopped reed	40	
		flax-shieves	20	
		water	20	
CRB-5	1:2:2	clay	16,7	699
		chopped reed	33,3	
		flax-shieves	33,3	
		water	16,7	

Table 2c: Designation of lightweight clay blocks with chopped reed.

Also a compressive strength of rammed earth blocks with different proportion of sand and clay were determined. The consistent and designation of rammed earth blocks are shown in Table 3.

Sample identification	Composition of Mixture (clay : sand:sand)	Content of Mixture	% (vol)	Dry unit weight, kg/m³
REB-1	1:1	clay	43,5	2076
		sand III (from Sõreste quarry)	43,5	
		water	13	
REB-2	2:1:3	clay	30	2082
		sand III (from Sõreste quarry)	15	
		sand II (from Kolleri quarry)	45	
		water	10	
REB-3	2:1:3	clay	30	2091
		sand III (from Sõreste quarry)	15	
		sand I (from Kolleri quarry)	45	
		water	10	
REB-4	1:1	clay	44,5	1808
		sand I (from Kolleri quarry)	44,5	
		water	11	

Table 3: Designation of rammed earth blocks.

The compression strength analysis of lightweight clay blocks was carried out on samples of 150x150x150 mm, 3-4 specimens for each mixture and thermal conductivity test in a steady state condition were carried out on samples of dimensions 300x300x100 mm, one specimen for each mixture.

Picture 4: Compressive strength specimens after preparation. Photos: K. Karja and D. Mesteljainen.

The mixture for lightweight clay blocks was placed in the mould made of plywood and compacted by hand with the wooden rammer. The blocks were taken out from the moulds after the compaction and left to dry out in a laboratory condition at +20 ºC and RH 45% for 6 weeks.

Picture 5: Thermal conductivity specimens after preparation. Photos: D. Mesteljainen and K.Karja.

Thermal properties of lightweight clay

Thermal properties of lightweight clay were measured in a steady-state condition in a laboratory. To determine the thermal conductivity the following factors were measured:

- heat flow density through the specimen [W/m²]
- temperature of inner surface of material and outer surface of material [C°]
- moisture content of the specimens during the experiment [%].

The thermal conductivity of different lightweight clay blocks and their specific weight are shown in Figure 1.

Stagnant air does not conduct heat very well. The thermal properties of materials depend on how much pores with trapped air it contains. In theory, the more porous the material is, the greater its thermal insulation is.

This relationship is clearly represented in the results of lightweight clay blocks with flax-shieves and with some irregularity of lightweight clay with chopped reed. The results from lightweight clay blocks with wood chips indicate the opposite. It seems that the more the light additives is added to the mixture, the smaller its specific weight is but at the same time its thermal conductivity is bigger, which means this material transmit more heat. There must be some gaps between wood chips or reed chips, where the air is able to move through and thus increase the heat transmittance. This argument can be proved by adding flax-shieves to the mixture. As a result of adding flax-shieves to the mixture, the specific weight of the blocks was increased (see

Figure 1. WSB-5, CRB-4 and CRB-5) but the thermal conductivity was decreased. The gaps are filled with flax shieves and therefore the air is unable to move through the gaps.

The thermal conductivity of insulation materials should be less than 0, 29 W/(m*K). The lower the thermal conductivity value of a material is, the better the insulating properties are.

In the case of this study, all the mixtures are suitable for thermal insulating products for building applications. The only exception is FSB-5, which properties are more like rammed earth blocks.

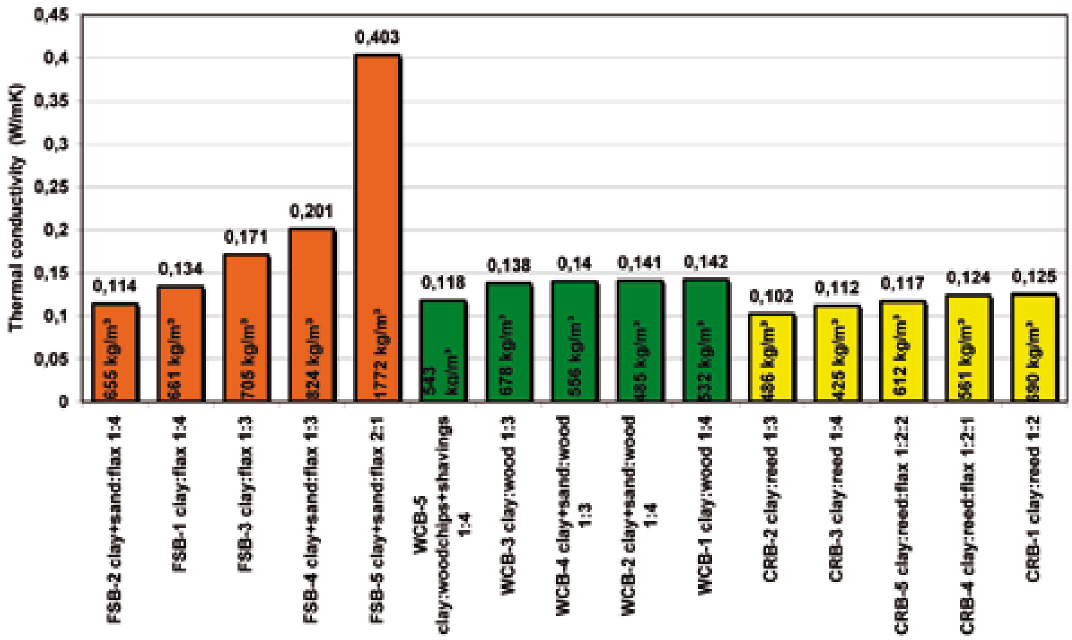


Figure 1: Thermal conductivity of different lightweight clay blocks.

Mechanical properties of lightweight clay

The compressive stress at 10% strain and compressive strength of lightweight clay blocks were determined according to Estonian standard EVS-EN 826:1999.

Picture 6: Centrally placed specimen between the two platens of the compression testing machine. Photos: D. Mesteljainen and K.Karja.

The specimens were placed centrally between the two platens of the compression testing machine and were preloaded with a pressure of 250 Pa. The compression was continued until the specimen yielded or until a strain of 10% was reached. The compression strength of different lightweight clay blocks and their specific weight are shown in Figure 2 and Table 4.

Sample	Compressive strength (N/mm²)	Compressive strength (kPa)	Dry unit weight, kg/m³
FSB-1	0,7	703,5	640
FSB-2	0,3	261,0	546
FSB-3	0,8	768,5	776
FSB-4	1,0	960,5	848
FSB-5	1,0	994,9	1694
WCB-1	0,3	267,3	621
WCB-2	0,3	255,3	568
WCB-3	0,3	342,9	705
WCB-4	0,3	347,9	653
WCB-5	0,4	434,2	590
CRB-1	0,4	357,7	788
CRB-2	0,4	347,4	605
CRB-3	0,3	307,52	558
CRB-4	0,5	528,8	651
CRB-5	0,5	467	699

Table 4: The compressive strength of lightweight clay blocks.

Generally, the bigger the dry unit weight of the material is, the greater the load bearing capacity is. Comparing the result of the study, it is clear that compression strength and dry unit weight of lightweight clay with wood chips are almost the same as the compression strength and dry unit weight of lightweight clay with chopped reed. At the same time, lightweight clay blocks with flax-shieves and rammed earth blocks have greater compressive strength, as well as the dry unit weight of the material.

The results revealed that adding the flax shieves and wood shavings to the mixture, increased the load bearing capacity of lightweight clay blocks, because the empty gaps between wood chips or chopped reed were filled with flax shieves and wood shavings.

At the same time, the load bearing capacity of lightweight clay blocks were reduced by adding the sand to the mixture. Also, the experiments with rammed earth blocks showed that the greater the number of coarse aggregate the mixture is, the smaller its compression strength will be.

As a result of the experiments we can say that the compressive strength of lightweight clay blocks depends not only on the amount and type of clay and light additives, but also on the particle size distribution of silt, sand and gravel, and as well as the method of preparation and compaction of blocks. The more compact the blocks are, the greater the compressive strength will be.

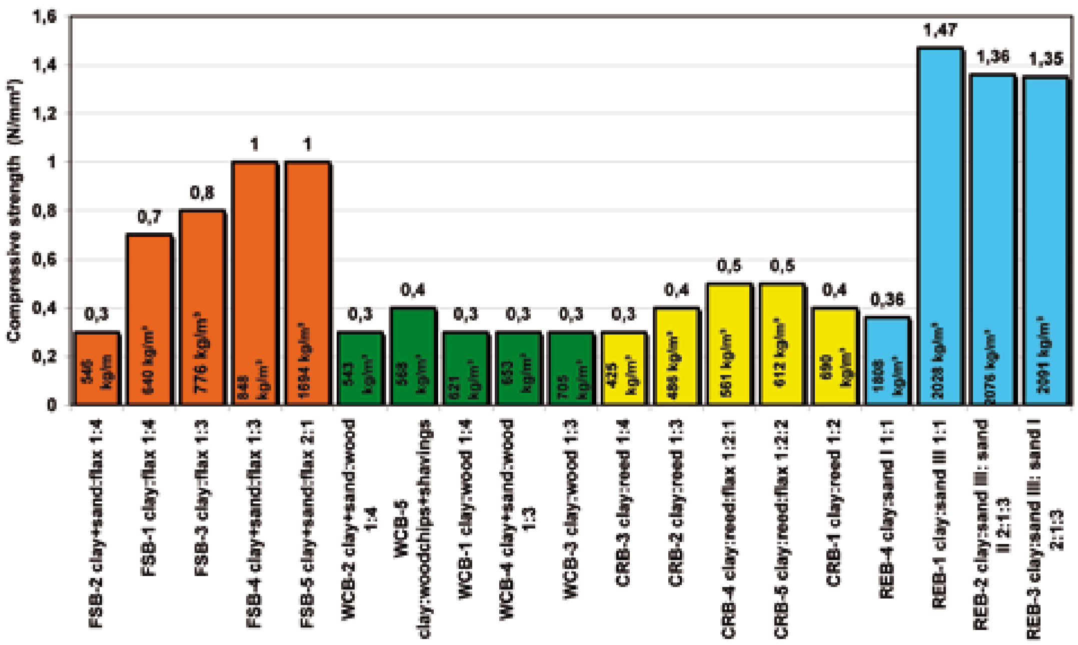


Figure 2: Compressive strength of different lightweight clay and rammed earth mixtures.

Conclusions

The results of the experiments indicate that the most suitable lightweight clay mixture for insulation is made of reed or wood chips. The more light additives the mixture consists, the greater its thermal insulation is. However, it is usually quite difficult to make blocks with reed and wood chips rigid and sure enough for transporting and masonry work. This material is more appropriate to use as infill poured into timber frame.

As a result of the study, it appeared that the examined materials have good thermal properties but not better than synthetic insulation materials. Based on the results we can conclude that in practice it is possible to use lightweight clay as insulation or infill material. If we are comparing lightweight clay with conventional synthetic insulation material – glass wool for example – we can assume that 100 mm of glass wool equals to 250 mm of lightweight clay. In other words constructions have to be made thicker (at least 350), but the materials are less expensive and environmentally friendly. •

What Do We Know about Birch Bark?

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Introduction

Birch (outer) bark (Fin: tuohi, Swe: näver, Est: kasetoht) is the thin layer of dead corkified cells in the outer bark of birch. Birch bark is tough, water-resistant and preserves well. Since it can also be easily cut, bent and sewn, it has been used to make various items during history, of which there is lots of evidence from different places in the world, including Scandinavia, Russia, North America, India and Afghanistan. Examples of traditional uses of birch bark are containers, clothing, music instruments, fishing implements such as a container for fishing net weights, tinder, toys and writing material such as books and maps. The oldest known written document in Finnish is the so-called Birch bark letter No. 292, which is dated to the beginning of the thirteenth century. Birch bark has also been used in construction such as waterproof roof coverings, where it is always underneath a layer of stronger roof materials. Northern-American Indians were famous for their tents and canoes made from birch bark[1].

Birch bark is not only interesting as a material; it also contains a lot of chemicals of which a few are or can be utilised for medical applications. Already at pre-historic times birch bark is assumed to have been used as medicine. An iceman, found in the Tyrolean Alps and dated to be 5 300 years old, wore bags made from birch bark and they contained birch fungi, which is assumed to have been his medical kit, since the fungus contained triterpenes. Triterpenes (one of the extractives in birch bark), of which betulin and its derivatives are the most important, have been found to possess anti-cancer, anti-HIV, anti-fungal and anti-viral properties[2].

Figure 1: Toy slippers made of birch bark. Photos: Jan Gustafsson.

Due to its unique look, feel and processability, birch bark is still used in different handicrafts and arts today; an example is shown in Figure 1. By trial-and-error methods our ancestors developed an empirical understanding of birch bark as material, by which they were able to utilise it in many various products and applications, probably even noticing a healing effect when they chewed on it. But do we know the secrets of why birch bark, very oppositely to birch wood, is flexible, durable, water repellent and contains useful chemicals?

Birch bark as material

Bark in general is the outermost layer of tissue in the stems, branches and roots of woody plants, like trees and shrubs. Bark covers the wood in the tree and is defined as the tissue that is found from the cambium outwards. Cambium is the layer of living cells which extends the diameter of the tree. Bark is chemically and structurally (morphologically) a very heterogeneous material. Bark is divided into two separate parts, inner bark and outer bark. The inner bark, which in older stems consists of living tissue, has the task of water transport and nutrients for the growing tree. The outer bark mostly consists of dead tissue, which protects the wood from drying and also protects the living wood of the tree from external threats like fungi, insects and mechanical damage. In other words, the bark needs to be able to hinder water from escaping from the tree, i.e. it must be water-resistant. At the same time, bark should also protect the tree from pathogens (disease-causing bacteria, viruses and fungi), i.e. have antiseptic properties, as well as act as a shield towards mechanical impact[3].

Bark can constitute a substantial proportion of the tree's weight, about 10–15%[3]. The outer bark constitutes about 3–5% of the weight of the tree[4]. The bark of a cut-down birch is easily recognised as the brown inner bark and white outer bark and is clearly distinguishable from the lightly coloured fibrous wood. The bark and wood in the cross-cut of a relatively young birch can be seen in Figure 2.

Figure 2: (a) Cross-cut of a ca. 30 year old birch and (b) close-up of the border between the thin white outer bark and thicker brown inner bark.

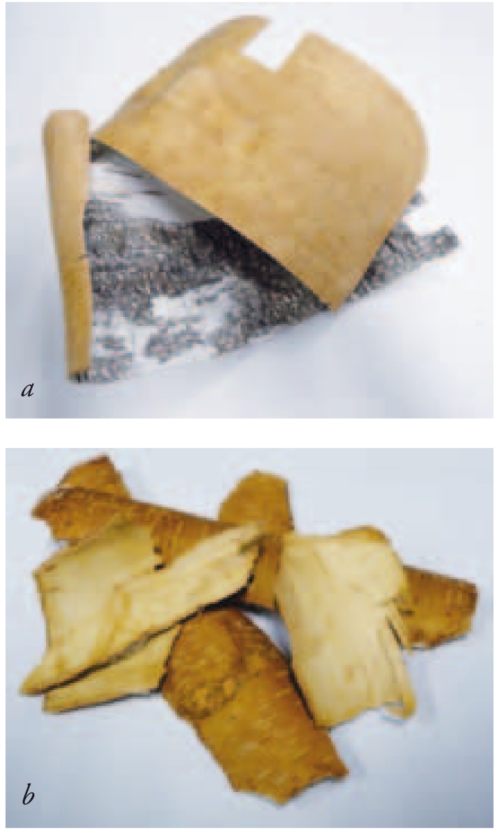

Figure 3: Birch bark (a) – outer bark of birch, (b) – inner bark.

Prior to most industrial usages of wood, bark is mechanically removed before the wood is used as timber in the saw mills or as raw material for fibres in pulp mills. This bark is mostly burned in order to diminish the content of waste and utilise the heat energy obtained. In order to utilise the birch bark as material, it needs to be removed as fresh as possible, which mostly means it needs to be cut from living trees or from recently cut-down trees. If the birch bark is removed carelessly from a living tree, deep cuts may lead to that the tree dies. In the cases when the living tree does not die from the removal of birch bark, they are still often weakened, which makes the trees more prone to different infections. If the inner bark is removed, the tree will most probably die due to loss of sap through the wound[1]. Therefore, most birches from which birch bark has been cut are not valuable for the forest-based industries, since the quality of the wood may be too deteriorated.

Pictures of pieces of removed outer bark and inner bark of birch are seen in Figure 3 (a) and (b), respectively.

Both bark and wood consist of a variety of different cells, whose structure and chemistry are designed to fulfil specific tasks in the tree. The purpose of wood is to give the tree rigid properties, and therefore one of the most important cells in wood are the long reinforcement fibres. The purpose of bark, on the other hand, is to be the cover of the wood. Therefore bark need to be thin, but also flexible, since the three grows in diameter. From a chemical point of view, bark needs to contain water repellent and antiseptic chemicals; see the discussion above. Bark is often too simplistically considered as a single material when subjected to research. When studying bark, the inner and outer bark should be analysed differently, since they differ both anatomically and chemically[3].

The inner bark consists of several types of living cells, which should transport water and nutrients to the growing wood. The inner bark also functions as a place for storage of nutrients. In the inner bark there are cells specialised for outward growth by division. However, the most common cells are only providing strength, since these cells arrange themselves in rows in the tangential direction[3].

The main part of the outer bark consists of corkified cells that protect the tree from mechanical damages, drying and big variations in temperature. Cork cells are usually a dead material, they die shortly after being formed and are then filled with air. The cork cells mostly consist of a polymer, suberin, and by an extractive called betulin[3].

The outer bark can be examined with microscope by peeling off a flake from the surface. Figure 4 (a) displays the cells of birch bark seen from the radial plane, which is the direction from the core to the outer surface of the tree. Figure 4 (a) shows the typical year rings due to quicker growth of cells during spring (lighter part) and the thicker more compact cells that are more slowly grown during summer[3]. The year rings grow from the core of the tree towards the surface of the tree. This can be observed as the diameter (width) of the tree increases with age. Figure 4 (b) shows a microscopy picture of the tangential plane, which is the outermost surface of the bark. It reveals that the cells are oriented in a horizontal direction. This is not like in the wood, where the majority of the cells are located in a vertical position, i.e. from root towards top[4]. As a consequence of the cell orientation, the tensile strength is higher in a horizontal (tangential) direction than in vertical, which can be explained by the horizontal orientation of the cells[4].

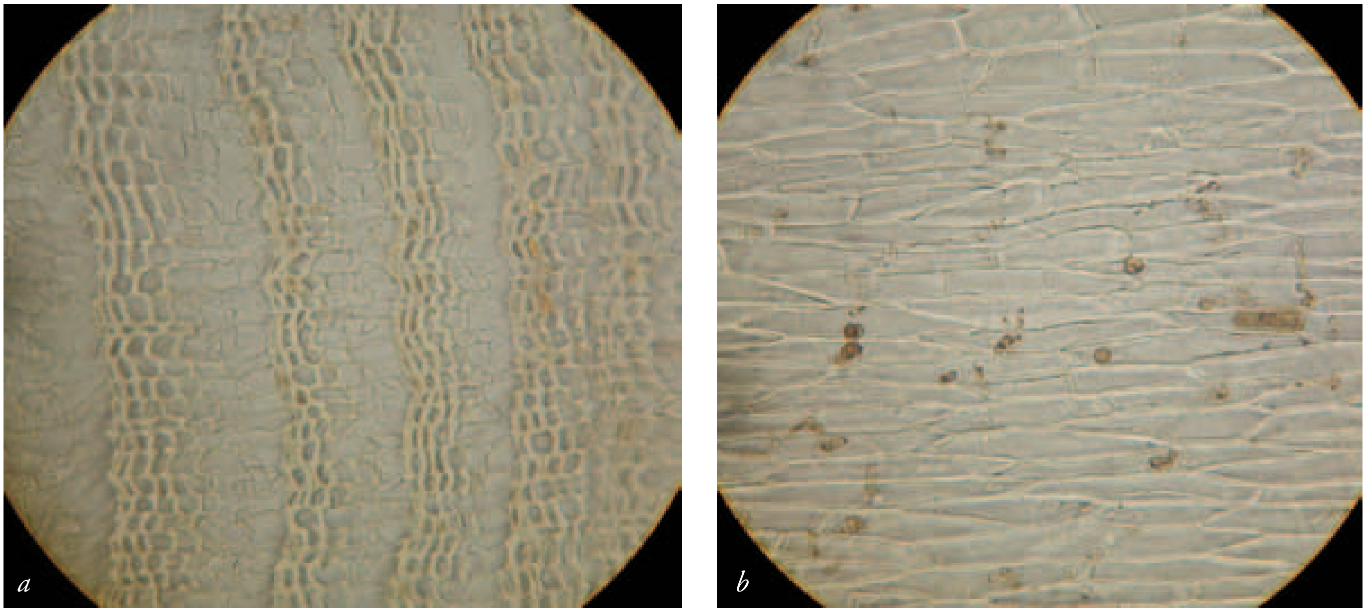

Figure 4: Optical microscopy (approx. 500 x magnification) of birch bark cells in the (a) radial plane (b) tangential plane.

In wood, the fibres are glued together by a stiff polymer called lignin, which makes the wood stiff and brittle. Compared to wood, birch bark is a much more flexible material. The explanation of the flexibility is due to two main differences between wood and birch bark. The first is due to the low content of lignin in birch bark. The other difference is due to the polymeric material suberin, which comprises 85% of the cell walls in birch bark (total 20–40% of the dry bark). Suberin does not exist at all in wood. Suberin is described as an elastic polymeric material[4].

There are also other special material features except of flexibility of birch bark that can be subscribed to the chemical composition of bark. Birch bark is an excellent material in building as moist insulation in walls, roofs and foundations. Birch bark is in other words able to prevent water from entering and the material does not decay very easily, either. These phenomena are supported by the fact that old bark materials that have been used for many purposes have survived periods of several hundred years[4]. The reason for both resistance against water and against micro-organisms can be found in the two chemicals suberin and betulin, which comprise the greater part of birch bark. Neither of them is found in wood. Suberin and betulin are both hydrophobic, which means that they behave like an oily surface. Therefore there is almost no water or moist attached to birch bark, but it drains off very easily. The moisture content reaches its highest value of only 8.9% in a growing tree in winter time[4]. In comparison, fresh wood consists of ca. 60% water.

Most bacteria and fungi need relatively high moisture content to be able to optimally survive and only then they can actively break down the material of which the cells in the birch bark consist of, i.e. carbohydrates such as cellulose and hemicelluloses. In other words, birch bark preserves well due to its low moisture content, and also due to the anti-fungal properties of the extractives, e.g. betulin, which will be discussed below.

Birch bark is also used as tinder, the easily burning material utilised to start a fire, although it is not a very high-value product. Birch bark (and bark in general) quite easily catch fire and possess a higher heating value than wood. The heating value of outer bark is 34.8 MJ/kg, which can be compared to the heating value of wood ca. 20 MJ/kg[5]. A second positive feature of outer birch bark during burning is the high flammability (how easy it is to get to catch fire), which is affected by the low moisture content. Both the heating value and flammability are well explained by the chemical composition standpoint. Birch wood, unlike outer bark, is rich in carbohydrates (70–80%), which are the main source of oxygen in plants. When a material burns it reacts with oxygen, which is then added to the material. Therefore, materials with lower oxygen to carbon relationship usually have a higher heating value. For birch bark, the dominant components of the outer bark, suberin and water insoluble extractives are carbon-rich substances with a low content of oxygen[4]. Also, as discussed above, it does not adsorb water due to the high amount of water insoluble extractives. Water and moist would hinder the material from catch fire (low flammability) and it also lowers the effective heating value.

Another consequence of the low water adsorption and anti-fungicidal properties of birch bark is the ability of containers made from birch bark to preserve food and other products for a long time without decaying because of mould, which flourishes in moist environments. Therefore birch bark can be regarded as a forerunner to plastic food containers[6].

The chemical composition of birch bark

Betulin is an ether extractable compound and it was isolated and scientifically described already in 1788[2]. The ether soluble extractives, which take up 12% of the whole weight of birch bark, and suberin, a polymer composed of aliphatic and aromatic organic molecules, provide hydrophobicity (water repellent properties).

When both the ether soluble and water soluble extractives are included they can comprise above 30–40% of the weight of the bark. The birch bark extractives from all 38 birch species have very similar constitution. Birch has more ether soluble extractives than softwood barks. Of the extractives in birch bark, betulin and its derivatives are the most common ones and they are regarded as the “anti-dote” against pathogens (viruses, bacteria) for the birch if it gets an open wound[2].

Suberin is a complex cross-linked polymer, which has both long chained fatty acids and an aromatic acid. It should be noted that suberin is a compound mostly privileged for birch bark with up to 20–40%, which is the most of all plants[2]. Neither pine nor spruce barks contain more suberin than only 2–3% by weight.

Nowadays the chemical map of the constituents in birch bark is quite well established, see Table 1. However, there are some differences in the chemistry of extractives in birches from Eurasia, North America and especially Alaska[2].

Compounds	Amount, %			
	In outer bark	In inner bark	Total in bark	In wood
Extractives, ether soluble (including triterpenes like betulin)	38.1	1.7	12	1.3
Extractives, water soluble			15	
Colouring matter, including tannins	5.6	13.7		1.8
Suberin	38.7	1.2		-
Lignin	>1.3	20.3		19.5
Pentosans (mostly hemicelluloses)	1.1	20.2		25.2
Hexosans (mostly cellulose)	> 3.4	18.5		43.4
Ash	0.4	1.8	1.0	0.3

Table 1: The chemical composition of outer bark, inner bark and wood of Betula verrucosa[5].

Place of growth	Description	Picture of barks
Forssa (inland-grown)	Smooth; whitecoloured, flexible	
Merijärvi (coastal area)	"Unhealthy" looking; brittle	
Rymättylä (coastal area)	Thin; reddish, covered with green matter; brittle	
Liperi (inland-grown)	Smooth; whitecoloured, flexible	

Table 2: Four different birch bark samples for chemical and microscopic investigation.

Birch bark research in ProNatMat

One of the research subjects on birch bark in the ProNatMat project was to find correlations between basic physical and visual properties with some measured chemical data and microscope pictures. Handicraft experts know that birch barks from inland areas of Finland are more appreciated than those from coastal areas of Western Finland due to higher flexibility, lighter colour and smoother surface.

The aim of the work was to find possible chemical or microscopic reasons why East-Finnish birch barks have more favourable material properties and are more sought for among birch bark users.

Bark samples

In order to perform this investigation, four birch bark samples that were different in place of growth, colour and feel were collected, see Table 2. They were analysed with microscopy and their chemical composition regarding extractives, betulin, suberin and ash content were determined.

Microscopy and chemical composition

Thin slices from the bark surface were prepared for microscopy. The samples were placed on a microscope slide and a few drops of ethanol were added to remove extractives. After a short time the ethanol was substituted with glycerol and the specimens were covered with a cover slip[4].

A flowchart of the sequence of the chemical composition analyses for bark is shown in Figure 5. The preparation of the samples for the analyses was done according to reference[7]. The birch bark samples were ground employing a 1 mm screen (Figure 6 (a)) and sieved to different fractions (Figure 6 (b)). A fraction containing particles from 250–500 μm was used for extraction and other chemical analyses, whereas other (oversized) fractions were

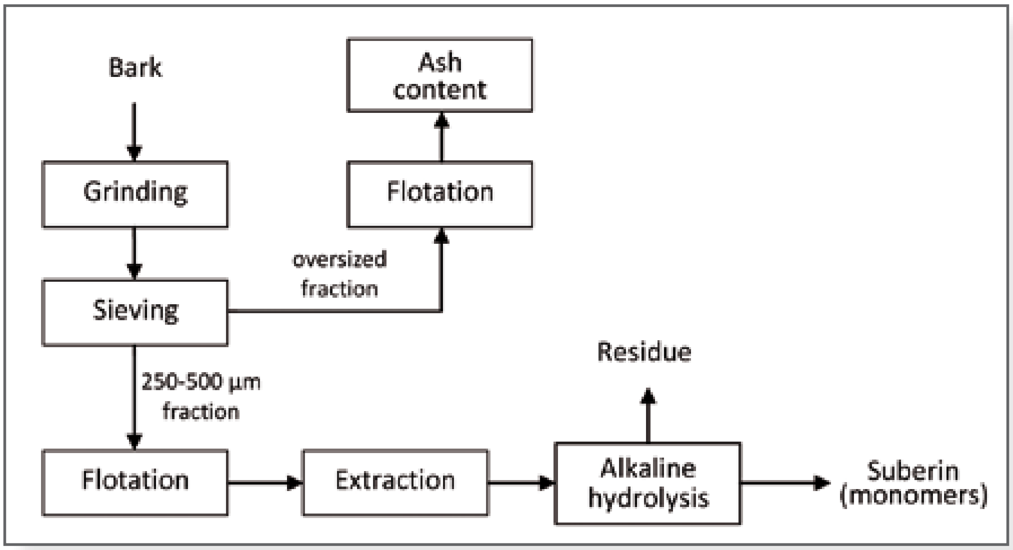

Figure 5: A sequence of bark analyses.

combined together and used for ash content determination.

First both the accepted and oversized fractions were washed by placing them in a container containing a lot of water (Figure 6 (c)). Here sand and other heavy material sink to the bottom and light weight bark normally floats. The floating bark was collected and dried at 40°C.

The dried samples after the flotation were extracted with ethanol during 24 hours[7]. The suberin depolymerisation was done as described in reference[8]. Ash content was determined using the standard procedure Tappi T 211 om-02. All analyses were carried out in duplicates.

Figure 6: Preparation of the bark samples for the chemical analyses: a) grinding, b) sieving, c) flotation.

Results

Analysing the cross section and tangential plane of several birch barks, it could be concluded that there were no essential differences between the bark samples. Microscopy images of the tangential plane are shown in Figure 7. Therefore it was concluded that the differences of the birch bark appearance were not due to morphology (cell structure) reasons.

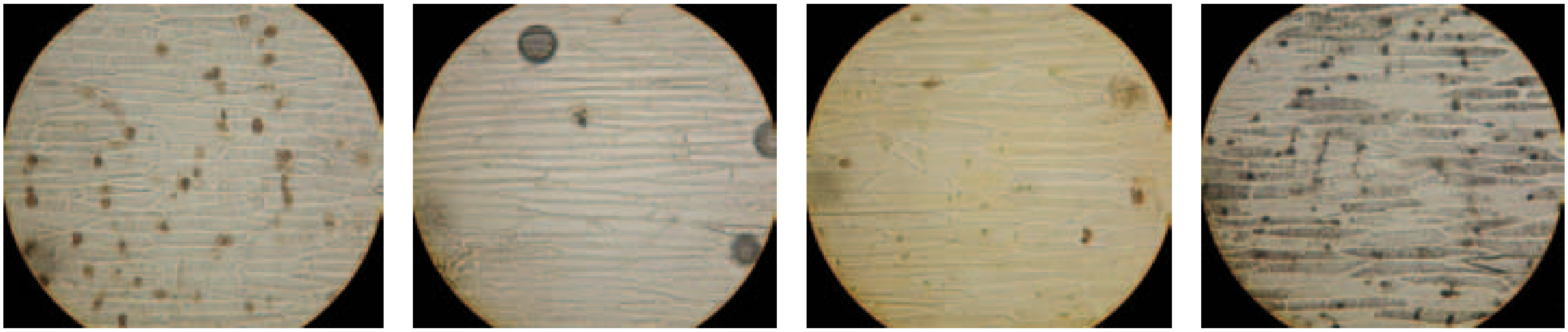

Figure 7: Microscopy images of bark samples. Tangential plain.

Already during the flotation a notable difference was found between the birch barks. A great amount of material from the birch bark from reddishly coloured "Rymättylä" was found to sink. This was a quite surprising discovery, but it was thought that it was due to that the "Rymättylä" birch bark may contain less extractives that makes bark less hydrophobic and consequently less water-repellent. This was proved later on by the results from the ethanol extraction (Figure 8). The "Rymättylä" bark sample had the lowest amount of extractives, 28.23%, in comparison with other barks, especially the "Forssa" and "Liperi" samples. Thus, "Rymättylä" birch bark adsorbed more water and sank during flotation.

The reddish colour can probably be explained by the low content of betulin (the main extractive compound), which is regarded as a white substance. A lower amount of betulin would increase the visual colour of the rest of the material. In addition, the green matter on the surface of the "Rymättylä" bark (probably some type of micro-organism) could develop due to low microbial resistance of the bark. This could also be a result of low content of betulin, which acts as an antiseptic[4], preventing growth of micro-organisms. However, more detailed studies are necessary to prove these hypotheses.

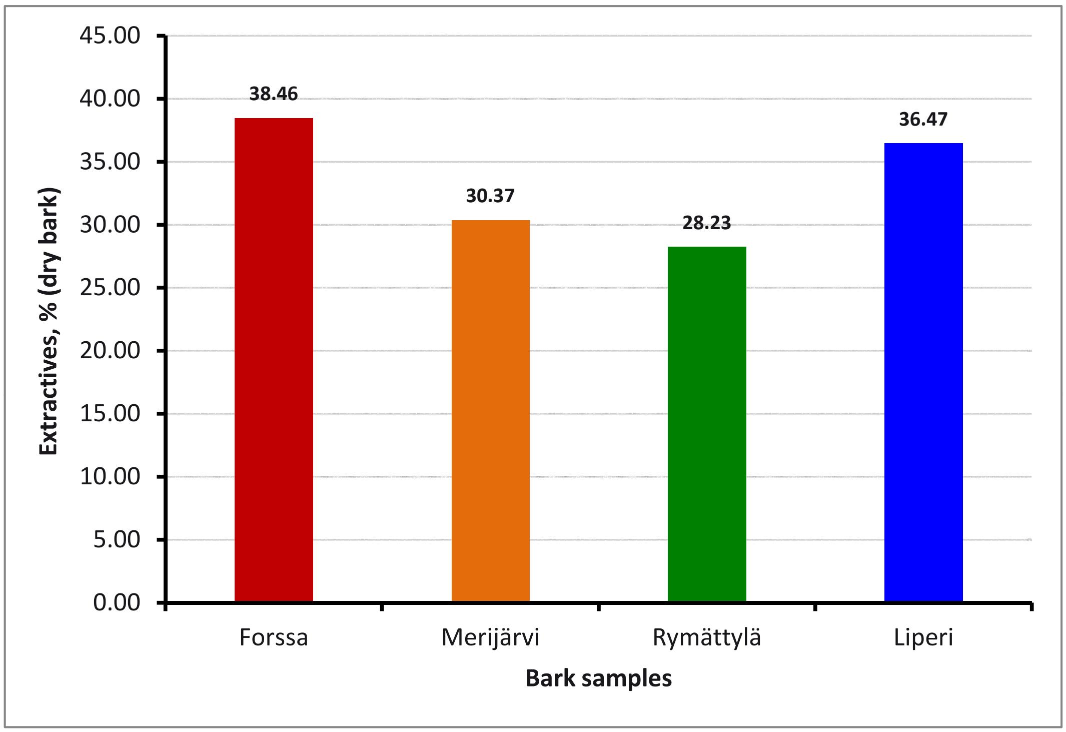

Figure 8: Amount of extractives in dry bark.

Mechanical properties, as was mentioned before, depend on the amount of lignin and suberin in barks. Lignin makes the material rigid, contrariwise suberin is characterised as an elastic substance[4]. The bark samples (extractive free) showed some difference in the amount of suberin (Figure 9). The values were higher for the "Forssa" and "Liperi" samples (79.47 % and 80.38 %) and lower for the "Merijärvi" and "Rymättylä" samples (68.02 % and 71.84 %, correspondingly) The opposite situation could be observed for a lignin-carbohydrate residue that was calculated by subtracting suberin from

100 % (Figure 10). Interestingly, the “Forssa” and “Liperi” samples were described as flexible and the other two barks as brittle materials. This observation is well consistent with the suberin values. Additionally, the results for the lignin-carbohydrate part along with the mechanical properties suggest that the “Merijärvi” and “Rymättylä” barks probably have higher amount of lignin.

The inorganic part constitutes less than 1% of the total weight of the bark samples (Figure 11). It is worth to mention that the “Forssa” ash had white colour, whereas the other three ashes were grey. Unfortunately, there is no explanation for this phenomenon and additional tests are required to understand it.

Conclusions

The study described in this report has shown that the differences between the light and smooth inland-grown birch barks and the reddish and rough birch barks from coastal Finland were due to different chemical compositions. Birch barks from inland areas of Finland had more extractives, less ash and probably also less lignin than the ones from the coastal areas of Finland. The suberin levels were almost the same for all tested samples. The main conclusions were that the lower amount of extractives (e.g. betulin) led to a damaged surface probably due to low microbial resistance. A higher amount of betulin helped to cover the dark colour of suberin and lignin. A lower amount of lignin produces a less brittle (a more flexible) material. At the same time a less lignin means a lighter colour. The microscopy did not show any visible differences in the cell structure.

Future perspective of birch bark

Nordic forests consist of only ca. 15% birch wood. Softwood trees, spruce and pine, are the most common species found in Nordic forests, with ca. 80%. The short-fibred birch pulp for paper cannot for very long compete with the gigantic volumes of the cheap short-fibred eucalyptus entering the Nordic pulp markets from South America. Therefore, the future of birch as a big volume raw material seems not to be very bright, at least not in the Nordic countries. The largest future uses of

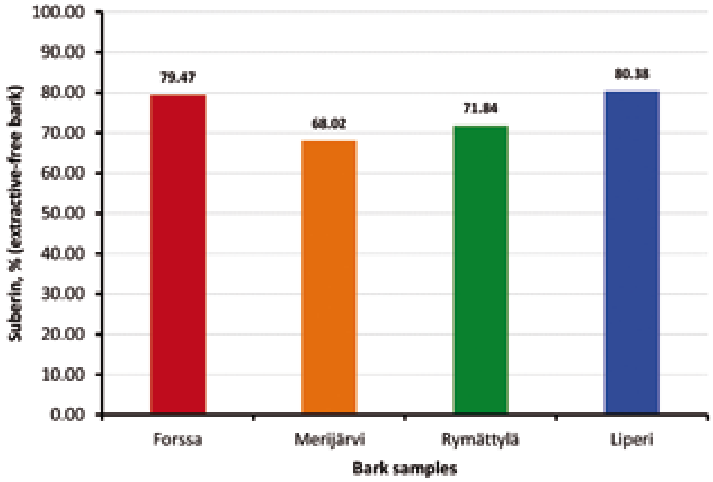

Figure 9: Amount of suberin in extractive-free bark .

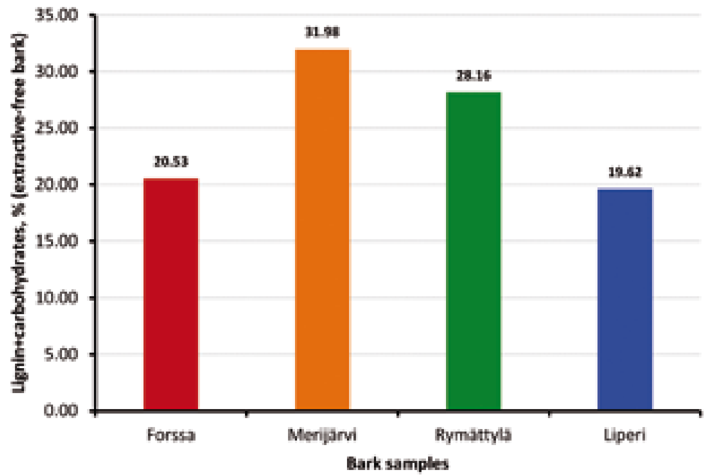

Figure 10: Lignin and carbohydrates in extractive-free bark.

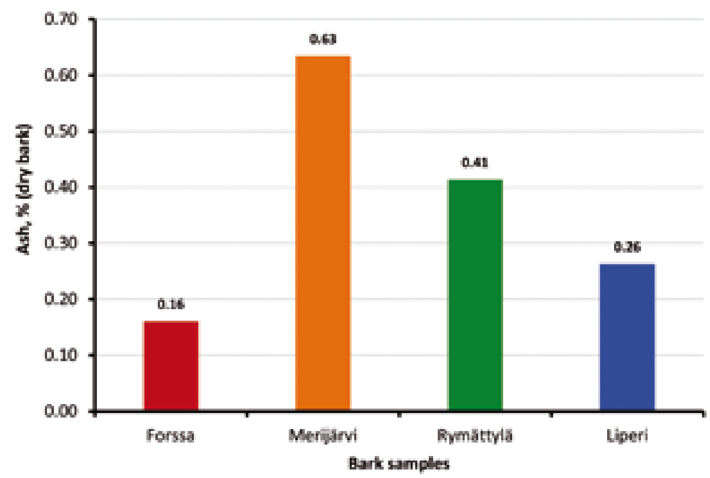

Figure 11: Ash content in dry bark.

(debarked) birch wood are probably as timber for veneer and furniture. Bark is most often overlooked as a raw material and after debarking processes and almost exclusively considered only for burning (where it actually has a higher heating value than wood). That means there is a lot of fresh bark available in debarking stations. Obtaining birch bark from living trees should be considered only after detailed planning, due to the long recovery time of the tree after removal of the bark. The risk of death of the tree is always substantial when bark is removed.

Birch bark has several opportunities as material, due to its smooth, flexible, water repellent and anti-fungal properties. One of the positive features of birch is that, on the Nordic scale, it grows more quickly that its local softwood "competitors", spruce and pine. Therefore there should be substantial amounts of birch bark available per hectare and year of birch forests.

Also the fact that birch bark's material and chemical usages are expected to be low volume - high price products, especially compared to paper pulp, reflects another positive future scenario for Nordic birch (Figure 12). •

Figure 12: Birch – the future white gold mine for Nordic countries?

Acknowledgements:

Christer Eckerman is acknowledged for valuable discussions about the chemical analysis of birch bark.

References:

[1] Wikipedia (www.wikipedia.org) (5.12.2011).

[2] Krasutsky, P.A., Birch bark research and development, Natural Product Reports, 23 (2006) pp. 919–942.

[3] Norin, T., and Fremer, K.-E. ”Kuoren Rakenne ja kemiallinen koostumus” in Jensen, W.,(ed.) Puukemia, 2nd ed., Suomen Paperi-insinöörien yhdistys (1977), pp. 83–96.

[4] Jensen, W., The connection between the anatomical structure and chemical composition and the properties of outer bark of white birch, Pappers och Trävarutidskrift för Finland, 7 (1949) pp. 113–119.

[5] Jensen, W., On surface waste in the production of birch plywood, Pappers och Trävarutidskrift för Finland, 23 (1948) pp. 425–429.

[6] Non-Timber Forest Products and Implications for Forest Managers. (http://www.extension.umn.edu/specializations/environment/components/birchbark1.html) (5.12.2011)

[7] Pinto, P.C.R.O., Sousa, A.F., Silvestre, A.J.D., Neto, C.P., Gandini, A., Eckerman, C. and Holmbom, B. Quercus suber and Betula pendula outer barks as renewable sources of oleochemicals: a comparative study, Industrial crops and products, 29 (2009) pp. 126–132.

[8] Ekman, R., The suberin monomers and triterpenoids from the outer bark of Betula verrucosa Ehrh, Holzforschung, 37 (1983) pp. 205–211.

Materials and Natural Materials in Art Therapy

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What is art therapy

Art therapy combines means and techniques of visual art with the psychotherapeutic approach. Creative work makes it possible to express the things that are difficult or impossible to express in words or the things that people do not want to talk about. Methods of art therapy help people to communicate even if there is no speech. The creative process activates fantasy and feelings; this is a physical and intellectual process, which is often experienced as stress relieving and supporting self-realisation. The goals of the therapy depend on the client's needs, condition and age, and they may be connected to managing with a health problem or life crisis, supporting general development, improving social skills or to better utilisation of one's potential and resources. Art therapy is applied as individual, family or group therapy and it is suitable for different clients from small children to the elderly. This form of therapy is applied in hospitals, nursing homes and day care centres, support systems of kindergartens and schools and in other institutions.

Materials in art therapy – quantity, quality and effect of a material

Art therapists prefer non-structured and easily handled means of art, such as gouache, clay, pastels or pencils, which can be

Photos: Sandra Urvak.

used by most of the people irrespective of their age, and which are applicable during the limited session period[1]. Natural materials, collage materials (different papers, magazine cuttings) are popular as well; postcards and photos are used for inspiration. In addition to traditional means, photo and video techniques are being increasingly used; installations are created by combining different materials and techniques. The selection of materials depends a lot on the preparation and personal preferences of the therapist, but also on very practical things, such as budget, time and room[1]. The art therapist's conception of the use of materials is an extremely important part of professional identity[2].

Contact with the material creates memories, feelings and ideas. Materials play their own role in the formation of a piece of art by guiding our touching and movement. The interaction between body and materials is important as the movement of the body is a dynamic expression of a psychological feeling and it helps to interpret a subjective feeling by means of room application and materials, choice of tools and means. During the therapy, the client's self-expression potential is pointed out[3].

The materials have different potential, application limits and conditions and potential outcome. The therapeutic potential depends on 1) the physical qualities of the material, such as complexity of handling it, number of completion stages of the product, application requirements and restrictions, safety[4] as well as on 2) the psychological nature of the material, such as compulsive, regressive, aggressive, expressive[5] and on 3) cognitive qualities, such as consistency, liquid content, plasticity, possibility to handle it, and how graphical it is[6].

If you pay attention only to the creative process, then you may be in a situation where the material's role in art therapy is underestimated[7]. The quality of materials is significant as the aesthetic process is also important in art therapy[8]. The quality of the material may affect the outcome of the work and the work, which failed due to the material (e.g. bad-quality glue, constantly breaking lead), may create in the client a negative attitude both to his or her work and art therapy[9]. Working with good-quality materials is pleasant and helps to have higher self-esteem[7]. The therapist's attitude to materials transfers also to the client[10]. The amount of the materials used may also be essential as it may affect the client's choice of materials and make him or her worried about "wasting" the materials[11]. The abundance of materials may have an over-stimulating effect. A therapist can help a client to choose materials. A client's reaction to the material is not directly connected with his or her ability to use them[12].

Natural materials in art therapy

Identity, personal satisfaction and personal feeling of perfection of a person depend on his or her contact with nature[13]. Eco-therapy and eco-theory describe a person as a whole and help a person to reconnect with the natural environment. Eco-theory focuses on development and healing[14]. People's need to be connected with nature includes several aspects: practical (the need to study nature in real world), emotional, cognitive, perceptive and mental. The important aspects of ecopsychology are sustainability and people's mutual relations with nature[15]. Eco-therapy creates parallels between a person's inner self-scenery and the external natural environment. Natural resources can be used very well for activating the senses[16]. Taking therapy into the natural environment allows people to learn to care about their living environment, take care of it, and thus respect himself or herself and his or her environment.

Natural materials are not part of traditional means of art; they have their own history and environmental background. Different environments can successfully be rendered by means of natural materials as they enable to create a three-dimensional work of art, a mini model of the environment. These materials are specific, tangible, preservable in time and combinable with each other. They can be selected, put in order, processed (just like situations in life and feelings), and by doing this you gain self-confidence for making choices and decisions important to you[17]. Natural materials contain certain qualities, e.g. a twig of a birch is delicate and a stone is durable. In other words, if a person wishes to express fragility, a twig of a birch is chosen, and so on. Each natural material is unique as there are no repetitions in nature. This imitates and reflects the essence and uniqueness of a person as there are no two identical people in the world. Usage of natural materials requires creativity and inventiveness, and it challenges a client to express his or her ideas in a comprehensible way. Natural materials are also cheap and environment-friendly and using them does not produce waste. Gathering natural materials requires being active, i.e. materials are gathered, not bought. Clients may have more courage for using natural materials as they do not associate with any special skills or targets. Natural materials can be used with people at different ages, but they might not be suitable for everybody. It would be good to offer a client a diverse selection of materials. Natural materials are often used with very young children and with children who suffer from retardation. Natural materials are good tools also for elderly people in order to generate nature-related memories, and thus support memory. •

Summary:

The quality and quantity of the material are important factors in art therapy, affecting the process of therapy as they create specific psychic, physical and emotional conditions in clients. Natural materials make it possible for a client to have an active and exploratory contact with nature and his or her environment during the therapy, and thus reach balance, reduce fears, work on the self-image and increase autonomy and independence.

An educational film "Materials in Art Therapy" will be ready within the project ProNatMat at Tallinn University in 2012. Further information: www.pronatmat.eu

References:

[1] Rubin, J. A. (2011). The Art of Art Therapy. What Every Art Therapist Need to Know. New York, London: Ruotledge Taylor & Francis Group.
[2] Moon, C. H. (2010). Materials & Media in Art Therapy. Critical Underestandings of Diverse Artistic Vocabularies. New York, London: Ruotledge Taylor & Francis Group.
[3] Whitaker, P. (2004). Art moves: Exploring the implications of the body and movement within art therapy. The Canadian Art Therapy association Journal, 17, pp. 3–9.
[4] White, L. M. (2002). Printmaking as therapy: Frameworks for freedom. London: Jessika Kingsley
[5] Nathan, A. A. & Mirviss, S. (1998). Therapy techniques: Using the creative arts. Ravensdale, Wa: Idyll Arbor.
[6] Aach-Feldman, S. & Kunkle-Miller, C. (1987). A Developmental Approarch to Art Therapy. Rubin, J. A. (Ed). Approaches to Art Therapy. Theory and Technique. New york: Brunner/ Mazel Publishers, p. 251–274
[7] Schaverien, J. (1992). The revealing image: Analytical art psychotherapy in thepry and practice. London: Routledge.
[8] Henley, D. R. (1991). Facilitating the development of object relation through the use of clay in art therapy. American Journal of Art Therapy, 29 (3), pp. 69–76.
[9] McNiff, S. (1998). Trust the process: An artist´s guide to letting go. Boston. Shambhala.
[10a] Dudley, J., Gilroy, A. & Skaife, S. (2000). Teachers, students, Clients, therapists, researchers: Changing gear in experiental art therapy groups. In A. Gilroy & G. McNelly (Eds.). The changing shape of art therapy: New developments in theory and practice. London: Jessika Kingsley, pp. 172–199.
[10b] Tartes-Babkina, H. (2010). Kunst abiks lapse ja noore mõistmisel. Kunstiteraapia põhimõtted abiks lapsevanemale ja lastega töötavale spetsialistile. Tallinn: Stella Borialis OÜ.
[11] Hinz, L. . (2006). Drawing from within: Using art to treat eating disorders. London: Jessika Kingsley.
[12] Schnetz. M. (2005). The healing flow: Artistic expression in therapy. London: Jessika Kingsley.
[13] Wilson, E.O. (1984). Biophilia: The human bond with other species. Cambridge: Harvard University Press.
[14a] Barrows, A. (1995). The Ecopsychology of Child Development. In Roszak, Gomes & Kanner (eds). Ecopsychology. San Francisco: Sierra Club Books.
[14b] Pedretti-Burls, A. (2007). Ecotherapy: a therapeutic and educative model. Journal of Mediterranean Ecology. Vol. 8, pp. 19–25.
[15] Kellen-Taylor, M. (1998). Imagination and the World: A Call for Ecological Expressive Therapies. The Arts in Psychotherapy, 25(5), pp. 303–311.
[16] Henley, D. R. (1992). Exceptional children exceptional art: Teaching art to special needs. Worcester, MA: Davis.
[17] Seiden, D. (2001). Mind over matter: The uses of materials in art, education and therapy. Chicago: Magnolia Street.

Natural Materials for Small Children

in the Activities with Hands and Ecological Art Education

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Introduction

A child needs positive contact with nature for emotional development[1]. If he or she has been connected with nature in the childhood, he or she will probably have better relationships with others and his or her environment[2]. From the earliest moments of a child's life, he or she is aware of not only human touch but also of the breath of air, which touches his or her skin, of light, temperature, materials and sounds[3]. Our living environment has changed drastically during the centuries, but we are still constructed to live in the changing and varied environment and use our creativity and thinking in order to cope with life. Unfortunately, the modern city environment is to a large extent static, monotonous and full of limits. The internal need to be connected with nature and a conflict with real isolation may be expressed in psychological, physical or behavioural problems, which are described by **Richard Louv**[4] as a phenomenon called "nature deficit disorder". Creative activities and the possibility to be in contact with nature and explore it actively help children to regain balance, reduce fears, work on the self-image, and increase autonomy and independence[5].

Activities with hands during the first three years of life

The aim of the activities with hands is to offer children positive self-expression experiences, joy, friskiness and new impulses for development. The knowledge, technical methods, abilities and skills obtained during the process offer a child a possibility for independent action. Such activities involve a child fully – the child develops simultaneously physically, intellectually, ethically and aesthetically. A child's fine motor skills (accuracy, finger skills, strength, speed), self-expression skills (using materials for communicating ideas), creativity and imagination develop. A cheerful mood accompanying a game contributes to positive physiological changes in the organism. As a result of solving the problems, which arise during the activities, a child has more courage, he or she is more capable of making decisions, and more responsible, active, independent. As to a small child, the result is not as important as the process itself. A child can perform a lot of activities together with a parent. Doing things together helps a parent to improve his or her contact with the child, follow the child's development and needs, and spend meaningful time together. Recognition and praise of a parent are essential for the development of the child's self-esteem and self-confidence. As to the activities with hands, activating different senses could be focused on during the first year of life. During the second year, when a child's speech starts to develop, conceptions and notions could be paid attention to in their activities with hands. In the third year, the development of I, creativity and imaginary game play an important role.

A game with seed helicopters. Photos: Sandra Urvak.

Natural materials for small children in their activities with hands

Application of natural resources in creative activities is promoted by the fact that children prefer natural resources in their games[2, 6]. Everything that is found in nature can be used. Natural materials include also food products and self-made paints and masses. Natural materials are skin- and contact-friendly and they stimulate a child's fantasy and creativity more than the ready-made toys bought from shops, which do not offer enough challenges for the creative thinking of a child. Toys from shops are ready-made, often a child can only touch certain buttons, and he or she learns fast what is going to happen after pushing the button[7].

The choice of the materials depends on the wishes, preferences, the age-specific development level of the maker and availability of the materials. The common quality of the means of art is that they are so-called error-safe, which means that a child may use them just like he or she wishes. A child learns to know his or her needs, feelings and thoughts by using creative activities and various materials; how much is "much", "enough" and "little" for him or her. It is important to offer children materials which suit their intellectual, physical and cognitive level of development so that the child would not experience frustration and too high demands but his or her experience would be enriching and stimulating. A child's cognitive, perceptive and motor awareness of himself or herself and the environment is tried to be increased by means of activities with hands. The child is provoked to use all his or her senses in order to increase his or her involvement and contact with everything around him or her[8]. Several so-called pre-art materials, such as flour, shaving foam, feathers or food products are used with small children. In activities with the involvement of both a child and a parent, the materials are chosen according to the child's level of development. Children's natural joy of discovering and experimenting with materials is used for improving the child-parent relationship[9]. At first, the child is offered materials in small quantities and with a small number of choices. The choices and quantities are increased during the process. Thus, the susceptibility of a child increases and little by little, art in its more traditional meaning is being dealt with. Together with the progress of the process, classic means of art are changed over to[8].

Nature-friendly art education

The starting point of ecological art education is the way of thinking according to which a person is part of the living nature, and he or she values the versatility of the ecosystem and respects life in all of its forms[10]. According to the ecological way of thinking, as few materials as possible are used and time is spent instead of that[11]. A teacher creates a learning environment where children can concentrate[12]. The art educational process may be at least as important as the result of the activity – a potential piece of work. Not always a material, visible piece of work should be accomplished. The ecological art educational way of thinking expects the child to have as much direct contact with nature as possible. Environmental sensitivity is developed by activating different senses[10]. Instead of common watching, children learn to see. In the natural environment, children can concentrate, for example, on experiences passed on by certain senses and they can experience a so-called journey of senses[13].

They try to use materials economically and smartly. As many natural materials as possible are used and the children create new meanings for things by playing together. A teacher should rather buy few and quality means than put up with the cheap and quickly breaking ones. The means should be well taken care of in order to extend their service life. Non-decaying (e.g. plastic) and toxic means are avoided. Materials are also tried to be used several times. Thus, it is recommended to combine natural and reusable materials with each other. Work with the parents is significant. Ecological education allows us to create community responsibility for the environment and the surroundings. •

Summary:

Small children are very much interested in cones, stones, wooden sticks, leaves and all other things offered to us by nature. Contact with nature is needed for a harmonious development of a child, and activities with hands and natural

materials offer a possibility for this. Ecological art education could be described as thinking training, the aim of which is additionally to art education, promoting a nature-friendly approach.

A manual for the teachers of babies and small children *Natural Materials for Small Children in Their Activities with Hands* was completed in 2012 at Tallinn University within the ProNatMat project. Further information: www.pronatmat.eu

References:

[1] Louv, R. (1991). Childhood's Future. New York: Doubleday.
[2] Moore, R. (1996). Compact Nature: The Role of Playing and Learning Gardens on Children's Lives. Journal of Therapeutic Horticulture, Vol. VIII.
[3] Barrows, A. (1995). The Ecopsychology of Child Development. In Theodore Roszak, Mary E. Gomes & Allen D. Kanner (Eds). Ecopsychology. San Francisco: Sierra Club Books.
[4] Louv, R. (2005). Last Child in the Woods Saving Our Children from Nature-Deficit Disorder. New York: Algonquin Books of Chapel Hill.
[5a] Ferrini, F. (2003). Horticultural therapy and its effect on people health. In Advances in Horticultural Science. Chapter 1 Conference International Society of Arboricolture.
[5b] Winnicott, D.W. (1971). Therapeutic Consulations in Child Psychiatry. London: Hogarth Press.
[5c] Kellert, S. & Derr, V. (1998). National study of outdoor wilderness experience. Washington, DC: Island Press.
[5d] Berger, R. (2004). Nature Therapy. Integratine Therapy, Education and Ecology pub: The Israeli Ministry of Environment (web-site).
[6] White, R. & Stoecklin, V. L. (1998). Children's Outdoor Play & Learning Environments: Returning to Nature. Magazine of Child Care and Children's Learning & Play Environments: Issue of Early Childhood New. March/April.. White Hutchinson: Leisure & Learning Group.
[7] Moore, R. & Wong, H. (1997). Natural Learning: Rediscovering Nature's Way of Teaching. Berkeley, CA: MIG Communications.
[8] Aach-Feldman, S. & Kunkle-Miller, C. (2001). A Developmental Approach to Art Therapy. In Judith A. Rubin (Ed.). Approaches to Art Therapy. Theory and Technique. (2nd ed.). Philadelphia: Brunner-Routledge, pp. 226–240.
[9] Moon, C. H. (2010). Materials & Media in Art Therapy. Critical Underestandings of Diverse Artistic Vocabularies. New York, London: Ruotledge Taylor & Francis Group.
[10] Matikainen, E. (2008). Lasten orientoituminen luonnonympäristöön. In Aili Helenius & Riitta Korhonen (eds.). Pedagogiikan palikat. Johdatus varhaiskasvatukseen ja -kehitykseen. Helsinki: WSOY Oppimateriaalit, s. 154–163.
[11] Wolff, L. – A. (2004). Ympäristökasvatus ja kestävä kehitys: 1960-luvulta nykypäivään. In Hannele Cantell (ed.). Ympäristökasvatuksen käsikirja. Jyväskylä: PS-kustannus, s. 18–29.
[12] Rusanen, S. (2009). Lasten kuvista kulttuurin kuviin. In Inkeri Ruokonen, Sinikka Rusanen ja Anna-Leena Välimäki (eds.). Taidekasvatus varhaiskasvatuksessa. Iloa, ihmettelyä ja tekemistä. Helsinki: Yliopistopaino, s. 48–54.
[13] Keskitalo, A. K. (2006). Tien päällä ja leirissä. Matkanteon kokemuksesta taideteokseksi. Acta Universitatis Lapponiensis 108. Rovaniemi: Lapland University Press.

A game with willow catkins.

Natural Granite Stone as a Construction Material

Observations and Experiences

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Use of natural stone as a construction material began at the dawn of human history. Nearly all older monuments are made of stone – probably because only stone structures have withstood wars and the attritional effects of the elements over the millennia[1].

Estonian nature is rich in fieldstones, and these can also be used for construction purposes. Fieldstones vary, as their formation and subsequent "lifetime" passed in very different fashion. Some of the rocks formed deep in the bowels of the earth under great pressure, while others have already been to the surface as igneous rock, then were buried in the course of tectonic movements and underwent metamorphosis under higher pressure and temperature. This article deals with erratic rocks, also called fieldstones, which were transported to Estonia from southern Finland on continental ice sheets[2.]

There are certainly many different kinds of stones, but relatively few of them are suited for use as construction stones. In addition to ease of access, such stones would have to conform to a number of other requirements to be viewed as good construction stones. They must meet strength, hardness, workability and durability criteria as well as requirements having to do with visual appearance. The qualities of the materials determine their function in construction. As minerals generally withstand pressure well, they are used in conditions where such stressors exist: in foundations, walls, columns, archways, etc. Fieldstones are primarily used to build animal sheds, outbuildings, mills, cellars, houses, etc. Many courtyards have stone cellars which are the oldest structures, as they were not destroyed in fires and there was no need to renovate these in the manner of residences[3.]

A building constructed of fieldstone will likely end up being extremely long-lived and picturesque even if the builder is DIY and relatively inexperienced. A store cellar on Hiiumaa Island near Kalana port. Photo: Urmas Volmer.

The following article describes fieldstones from the standpoint of their use in construction, the tools needed for shaping them and the ethical, aesthetic and cultural aspects of the use of stone.

Availability of fieldstone

Granite is not exposed in Estonia, as the stratum that contains granite lies about 200 m deep. There are however plenty of erratic granite boulders on the surface. They are pieces that broke off of larger formations transported here by the continental ice sheets. Historically, fieldstones have been gathered from all arable plots of land where such stones occur. **A. Juske** estimates that 42 million cubic metres of stones were cleared from fields in the period after the last World War alone. By multiplying these figures by the average density of these stones (2.7 t/m^3), we get a total mass of over 100 million tons, which shows the immense amount of work and energy expended to rid Estonian soils of these vexing mineral "companions"[4]. A large share of this mineral matter found its way into stone walls, but in Soviet times, stones were also heaped into piles at the edge of the fields[2,5]. Thus fieldstones are a relatively easily obtained material, with differences only in the quality of the rocks.

Construction using fieldstones is not inexpensive, as obtaining quality construction stone presupposes sorted material and an experienced expert. Stones are sold by various farmers and companies, with prices ranging up to 70 euros per ton depending on availability and quality. The hourly rate for labour for the person splitting the stones is about 10 euros and the bricklayer's labour costs about 60–110 euros per cubic metre of wall. That does not include the price of mortar and various costs (oral interviews conducted with various masons from 2008–2011).

Tools and techniques

Arvo Veski says wedges are best for splitting granite to be used in construction. A score-mark (or a row of holes 10–30 cm apart) is hewn into the rock where it is to be split, a steel wedge is inserted and the rock is then split by blows of a hammer. The depth of the holes or the score-mark is 3–6 cm and the width at the top 2–5 cm. The natural grain of the rock must be considered when using a wedge to split the rock. Using explosives or fire to split rock for construction stone is not advisable, as this causes micro-cracks that reduce the rock's strength and ability to withstand the elements[6]. Smooth surfaces are created mechanically by way of sawing the construction stones. Granites are polished with picks, pick axes, hard alloy chisel bits, etc. Various hewing methods are distinguished – coarse hewing where larger imperfections are broken off, semi-finished hewing and clean hewing. Clean hewing is accomplished with various chisels, and the blows of the hammer become progressively weaker. Often just one strip of rock along the margins of the stone is hewn out. This is called the rustic style. A cleaner, more finished hewing generally dictated from a sense of aesthetics, but the smoother external surface does also contribute to a better ability to withstand the elements.

Photo 2: Splitting granite using wedges – (www.wikipedia.org 2012).

Photo 3: Various wedges and chisels (Granitecitytool 2012).

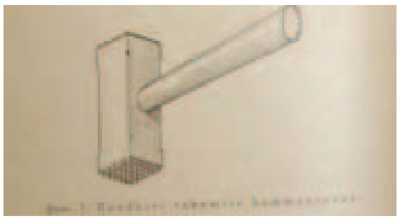


Photo 4: Hammer for hewing granite (A. Veski Müüritööd (Masonry) p. 34).

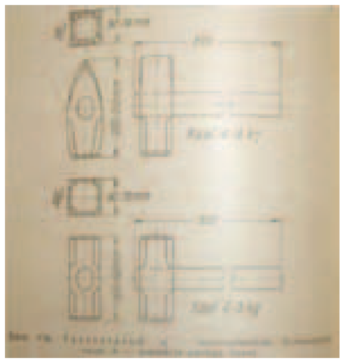


Photo 5: Sledgehammers (A. Veski Müüritööd (Masonry) p. 34).

Photo 6: Motorised stone drilling machine. Field technique from the early 20th century (ERM Fk 2133:6642).

There are significant differences in the oral and written descriptions provided by different masters regarding use of wedges for splitting stone.

Rein Karus writes the following in his instructional materials from 2009, *"Maakivist küttekolded ja müürid"* ("Fieldstone hearths and walls"). A large, 5–6 kg hammer is used, with a pick at both ends, both of them running lengthwise to the handle. The stone is split by hitting the rock with the special axe 'klompimiskirves'. The blows begin on the edge of the rock, pass through the centre of the stone until the opposite edge. The blows on the surface of the rock are spaced more than a blade's width apart, about 5–6 cm between every two strikes. Less force is used to strike the edges of the rock. In a lucky instance, the stone can be split in two with one blow, but this is not advisable. Halving the stone with more than one blow is more precise and small corrections can be made to guide the line in the desired direction. The site of the strike must be as smooth as possible so that all points of the blade of the axe come into contact with the stone's surface. One should also make sure that not only the front or the back of the axe blade strikes the rock. Otherwise the force of the blow will be absorbed by the crystalline structure of the rock, breaking it.

Stone splitter **Riho Lenk** demonstrated his splitting technique in the course of an interview conducted 19 January 2012. Different to the recommendations from Rein Karus, he uses the flat side of the sledgehammer to split stones, even though the hammer contacts the stone at only one corner of the flat side. There is no doubt that in practice, rocks can be split using this technique as well. (A. Peebo interview with R. Lenk, conversation memo in the possession of A. Peebo).

Rein Karus writes of stone splitting: if stones are too large for the 'klompimiskirves', wedges will also suffice. To do so, wedge holes are made in the stone. Using hand-hewing, 6–7 cm long, 2–3 cm wide, 5–6 cm holes are made lengthwise, along the split line. The optimum space between two holes is the length of 1–2 wedge holes.

An example of technically demanding fieldstone masonry. A bridge over the River Mustjõgi near Saru in Valga County, on the former Valga-Ape narrow-gauge railway, thought to be built in 1919. Now in use as a road bridge. Photos: Urmas Volmer.

For many future masons, a stone wall has often been the first source of experience. A restored wall built from limestone at the Estonian Open Air Museum. Many walls in northern Estonia were extended with large vertical slabs of limestone.

Riho Lenk noted in connection with use of wedges that he uses as few of them as possible, no more than five wedges, and the distance of the wedges can vary in the case of different stonemasons. The stone wedges are made of steel so that they could be tempered. The tempering must be so hard that the wedges do not deform when used. And they must be soft enough so that they do not chip or break in half. The wedges are struck in sequence, from one edge to the opposite edge. The wedges are struck with moderate force, erring on the side of too soft instead of too hard. The stone must be given time to split. The work pauses from time to time to allow the stone to rest. During the pauses, the stone is influenced by static tension and little by little it starts to split.

Photo 9: A used hammer compared to a new hammer.

Photo 10: Example of a regular wall in Riho Leng's courtyard.

Laying a wall of fieldstone is rendered technically more complicated by the complicated nature of lifting and processing the material. As the wall becomes higher, substantial scaffolding and platforms are needed as it takes at least two men to lift the larger stones and they must be placed on the wall very carefully so as not to knock the lower stones out of place. Moreover, minor corrections must often be made in accordance with the pattern of the wall – such follow-up hewing requires a sturdy supporting surface. (Interview with **Urmas Anton** 2008)

Historically, transport of the stones has also been complicated and labour-intensive. The various stone-hauling sledges and wagons with raisable bottoms are still remembered by older village inhabitants in stony areas. (Interview with **Helmut Polberg** 2005, see also Viires 1980)

Ethical and aesthetic perspectives on fieldstone

Aesthetics have their own infinite variations – quite a number of researchers have shown that the abundance of different-looking tools is no less than the variations in intangible culture[2].

Visually, each fieldstone is different from the rest; colours and structures vary. This results in different kinds of fieldstone walls. Most outbuildings were laid of unsplit stones or split stones that did not undergo any more processing after the straight surface was attained. There are a number of opinions regarding the appearance of the stones. There are people who want their fieldstone walls to be as rustic as possible. That is, walls are laid of unsplit stones or split stones that do not undergo any more faceting. In such a case, one can see traces of drilling or wedges having been used in the wall. The experienced eye of a master can distinguish different methods of shaping the cornerstones. A preference was shown for stones where only one side needed to be hewn and where the other side already had a naturally level facet. Drills and wedges were used for obtaining the rectangular forms. There are also masters who prefer stones with a refined level of finishing. The traces of drill and wedge work are removed by use of a chisel, and the cornerstones are selected so that both sides of the wall can be shaped with a hammer. (A. Peebo interview with R. Lenk.)

How to sum up the ethics of using fieldstone as a material, including possibilities for reusing it? Fieldstone itself is a completely eco-friendly material, as it does not have to be

Smithy and distillery at Olustvere manor in Viljandi County. Photos: Urmas Volmer.

A fieldstone wall with lime mortar is easily the most common building material solution seen in the cellars and foundations of a century ago. The cellar space of the Pärimusmuusika Ait (Traditional Music Barn) in Viljandi in summer 2007. Photo: Urmas Volmer.

quarried or produced for obtaining the small quantity necessary in Estonian conditions. Fieldstones are found on the surface, with a noteworthy number of them having been heaped into piles from cropland. Due to their qualities (mass and hardness) processing these stones into construction material or a part of a finished structure does leave some ecological footprint. Due to its large mass, transporting fieldstone from nature to the site does generate certain expenses and burden on the environment. The materials that demand the most resources in the masonry building process are the binders, cement production and lime production. One should note however that fieldstone buildings require significantly more heating than buildings made of synthetic materials. For this reason it is not reasonable to use buildings with large stone walls as residences but rather for the functions that evolved in stone structures over centuries.

The special character of recycling possibilities is the fact that fieldstones are not a renewable resource but are recoverable. Stones from walls can be cleaned off and used again if a lime compound was used as the mortar. Of course, recoverable stones involve a little more labour than new stones, as is the case with other recyclables. In addition, granite can always be turned into crushed stone.

Now, a little about the cultural dimension of the use of fieldstone

The cultural dimension of the use of fieldstone has parallels to a few similar disciplines. Fieldstone structures have historically been distinctive landmarks, an integral part of the natural culture, where people's behavioural models are viewed as an integral part of natural culture were the models of people operating in a specific landscape model and its potential products are viewed (Parts 2003). Also clear is the tie-in to heritage culture, which investigates the material artefacts integrally connected with the landscape (Tarang 2001). In addition, cultural preservationism has a role – a movement that tries to find suitable solutions in the contemporary world for preservation of indigenous culture (Rikoon, etc., 1994).

Building from fieldstones has always been and will remain much more costly than just building from more simply processed materials. Due to this fact, fieldstone has never been used in great quantities, but there are periods that gave us more stone structures. Vivid examples of construction in Estonia include the façades of stone granaries and cellars built by Muhu islanders[12] and Taagepera palace. This is likely the finest stone structure located in southern Estonia, demonstrating the very different ways in which granite stones were used in the early 20th century. The massive porch columns, regular and irregular façade stones, split pavement stones are just some of the elements made of granite.

Photograph 13: The façade of the historical Taagepera palace located in the southern part of Viljandi county (www.wikipedia.org 2012).

Photograph 14: Fisherman's outbuilding, Muhu, Rootsivere k., Mihkä farm, (ERM Fk 1562:321).

Although there are no reliable statistics, there are a significant number of fieldstone buildings in Viljandi County, as the material resources were present there. The Western Estonian archipelago is another such area; here the landscape is stony and human settlement had a high density[11,17]. It is also likely that the relevant skills spread from the islands to south-central Estonia, due to the fact that many inhabitants of larger Saaremaa islanders went to work on the wealthy Viljandi County farms and manors. Saaremaa islanders often worked as stonemasons and bricklayers[17]. This fact explains the fact that many Viljandi County stone walls bear similarities to those of the Western Estonian islands[9].

Today, the stone structures are built and restored above all by those who already are in possession of either stones or old buildings built from the stones. New stone buildings with massive stone walls are practically speaking not built anymore; people confine themselves to lining existing façades and smaller forms such as fireplaces and retaining walls. There are some practicing masons still working, but not many, as it is arduous work and splitting stones requires experience and knowledge. There are autodidacts, but their knowledge is the product of hard work, while in the early 20th century stone-working expertise was still extant. Practical skills started fading away in the latter part of the 1930s, more larger-scale production of artificial stones began to be used. Practically no fieldstone buildings were built in the Soviet era and the master masons are no longer among the living as of the early 21st century. Thus aficionados of the medium have no other option than to try to learn the techniques themselves. •

Literature:

1. Beall 1987 = Beall, C. 1987. Masonary design and detailing, 2nd edition, New York: McGraw-Hill.
2. Geertz 2003 = Geertz, C. Interpretation of Cultures: selected essays. New York: Basic Books.
3. Juske 2000 = Juske, A. 2000. Kaks joonist (Two drawings). – Eesti Maaparandajate Selts. Toimetised, 4, Tallinn: Eesti Maaparandajate Selts, 11–19.
4. Karus 2009 = Karus, R. 2009. Maakivist küttekolded ja müürid (Hearths and masonry made of fieldstone). Õppematerjal.
5. Kask, Tõnisson 2000 = Kask, R; Tõnisson, H. 1987, Mullateadus (Soil science), Tallinn, Valgus.
6. Markson 2009 = Markson, E. 2009. Kurepesa talu maakeldri renoveerimine (Renovation of Kurepesa farm's root cellar). Diploma thesis. Viljandi: TÜ Viljandi Kultuuriakadeemia rahvusliku käsitöö osakond.
7. Pirrus 2009 = Pirrus, E. 2009. Eestimaa suured kivid. Suurte rändrahnude lugu (Boulders of Estonia. The story of large erratic rocks). Tallinn: TTÜ Geoloogia Instituut.
8. Rennu 2006 = Rennu, M. 2006. Kiviaed, ühtaegu moodne ja argine (Drywall stone fences: simultaneously modern and quotidian). – Eesti Loodus, 10, 20–23.
9. Rennu 2007 = Rennu, M. 2007. Eesti traditsioonilised kiviaiad: etnograafia ja kultuurirollid (Estonia's traditional stone drywall fences: ethnography and cultural roles). Master's degree thesis. Tartu: Tartu Ülikooli etnoloogia õppetool.
10. Rikoon etc 1994 = Rikoon, J.S., Heffernan, W.D., Heffernan, J.B. Cultural Conservation and the Family Farm Movement: Integrating Visions and Actions. Conserving Culture – A New Discourse on Heritage. Urbana and Chicago: University of Illinois Press.
11. Rullingo 2001 = Rullingo, A. 2001. Muhumaa: loodus, aeg, inimene (Muhu Island: nature, time, humankind). Tallinn: Eesti Entsüklopeediakirjastus.
12. Saron 1988 = Saron, J. 1988. Raudkiviehitus Muhu saarel 20. sajandi algupoolel (Granite construction on Muhu Island in the first half of the 20th century) - Etnograafiamuuseumi aastaraamat. 36. Tartu: Eesti TA, 43–61.
13. Saron 2007 = Saron, J. 2007 [1990]. Saaremaa ja Muhu talude ajaloolisest tarastusest (Historical walls and fences on farms in Saaremaa and Muhu Islands). - Kaheaastaraamat 2005–2006. Kuressaare: Saaremaa Muuseum.
14. Tarang 2001 = Tarang, L. Pärandkultuuri kaitsest metsas. (Protection of heritage culture in forests) – Eesti mets, 4–6, 16–17 ja 24–25.

15. Veski 1984 = Veski, A. 1948 Müüritööd: õpik tööstuskoolidele ja tehnikumidele. (Masonry: textbook for industrial and technical schools) Tallinn: Pedagoogiline Kirjandus.
16. Viires 1980 = Viires, A. 1980. Talurahva veovahendid. Baltimaade rahvapäraste põllumajanduslike veokite ajalugu (Conveyances of the peasantry: history of traditional transport devices used in agriculture in the Baltic States). Tallinn: Valgus.
17. Viires 2001 = Viires, A. 2001 [1967] Kodutööndus ja ulgtööd Eesti saarlaste elus. (Home industry and seasonal work away from home in the lives of Estonia's islanders) – Kultuur ja traditsioon. Tartu: Ilmamaa, 147–157.
18. Kaila 1999 = Kaila, P. 1999 Majatohter I osa, Kiviehituse ajalugu 1: Muinaslinnustest Suomenlinnani. (House doctor, part I. History of stone construction 1: From ancient citadels to Suomenlinna.) Tallinn: Viplala.

Internet materials:

1. PEPK 2012 = Information about fire resistance of construction materials, from the website of the Northern Estonian Rescue Centre.(http://www.pkpk.ee/pages/files/ehitusfyysika/Konspekt_tuleohutus.pdf) accessed 15 January 2012, 17:43.
2. Granitecitytool 2012 = Graniidi töötlemis tööriistade internetikaubamaja. Online store selling tools for working granite)(http://www.granitecitytool.com/stone-splitting-wedges-and-shims) Accessed 15 January 2012, 18:01.
3. Website about stone. Describes, among other things, various means and techniques for working stone (http://stoneplanet.com/Machineryoverview.aspx) Accessed 16 January 2012, 07:30.
4. Online encyclopaedia (http://en.wikipedia.org/wiki/File:Taagepera_loss.jpg) Accessed 31 January 2012, 8:00.
5. Online encyclopaedia (http://en.wikipedia.org/wiki/File:Plug_and_feathers_001.jpg) Accessed 8 February 2012, 20:30.

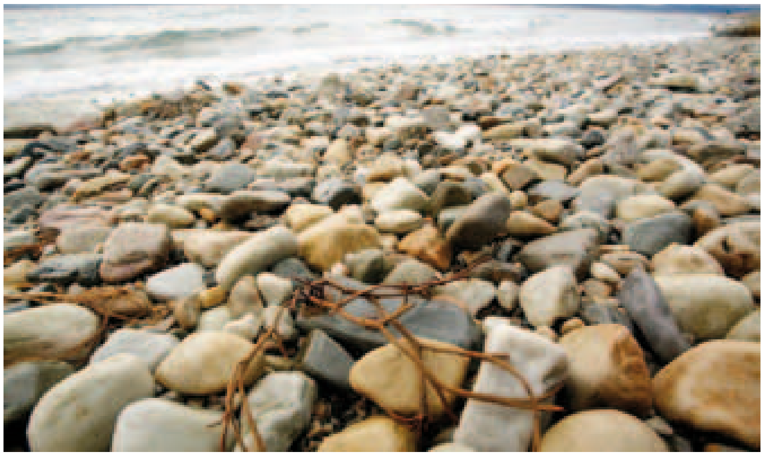
Interviews:

Interview with Urmas Anton 2008 – Interview with national construction university student **Urmas Volmer** with bricklayer Urmas Anton in spring 2008 in Viiratsi. The interview audio file is located in the electronic archive of the native crafts department of the University of Tartu Viljandi Culture Academy.

Interview with Riho Lenk – A. Peebo's interview with stone splitter Riho Lenk in winter 2012 in Viiratsi municipality and the city of Viljandi. The conversation transcript is in the possession of A. Peebo.

Interview with Helmut Polberg – M. Rennu's interview with artist Helmut Polberg in summer 2005 in Hanila municipality, Rame village. The interview audio file is in the possession of M. Rennu.

Field stone at monumental art - Polar Circle pyramid -landmark in Rovaniemi, northern Finland. Photos: Urmas Volmer.



Field stones in Estonia originate from Scandinavia, therefore is the site in our beaches similar. The beach in Northern Norway, Finnmark, Porsangerfjorden.

The former Viljandi manor barn, the current Estonian Traditional Music Center. Construction.

Õisu estate winery from the 19th century - the historicistic building from field stones and bricks.

Fieldstones have been used in construction in southern Estonia for a long period of time. The Viljandi castle of Teutonic Order that was mainly erected in the 13th and 14th century was the second largest after Riga in the historic Livonia. Picture from the ruins of the convent house.

Kolga-Jaani Orthodox Church in the village Lalsi, 1871-1873. a.

Estonian Open Air Museum, Islands Farms, Jüri-Jaagu farm, a kitchen-sauna-cellar.

Petra Giacomelli's *Day and night books exhibition in Koroinen presented works classified as waste paper, mixed technique works, collages and "sculptures" executed with books glued shut. Their wordless stories are recollections and dream images, sometimes messages from past generations. Brittle paper monument preserves time and gives the story a chance to continue…*

Book, like a man, can become a refugee, a stranger with unknown origin,
eerie language,
incomprehensible stories,
pictures faded and behind the times…

Solitude pasting the pages together,
book shutting in its shell leaving only a silent shadow.

– Petra Giacomelli

ProNatMat

CENTRAL BALTIC INTERREG IV A PROGRAMME 2007–2013

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INVESTING IN YOUR FUTURE

TURUN AMMATTIKORKEAKOULU
TURKU UNIVERSITY OF APPLIED SCIENCES

What are natural materials? Basically, every material is originally natural. Even humans are composed of pure natural materials. We need better definitions like ecological materials, local materials, renewable resources, organic materials, and so on. We also need recyclability as well as a free flow of information. Everything we do or consume locally also affects globally. We must not forget that we have options.

This book **Pro**moting **Nat**ural **Mat**erial is a symbiosis of traditional, economical and recyclable old knowledge and materials with constantly developing know-how and creativity. As a project, **ProNatMat** is also an adventure to the world of natural materials in Southern Finland and Estonia in 2009–2012. A wide spectrum of views and thoughts on natural materials becomes available through these 27 articles from experts in the field.

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ISBN 978-952-216-301-1