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SCIENZE E MATERIALI DEL PATRIMONIO CULTURALE

CULTURAL HERITAGE FACING CLIMATE CHANGE: EXPERIENCES AND IDEAS FOR RESILIENCE AND ADAPTATION

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Cultural Environment as a Resource in Climate Change Mitigation and Adaption

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Abstract: One of the main goals of Finland's Cultural Environment Strategy (2014-2020) is how to recognize the ways the cultural environment helps in mitigation of climate change and in adaptation to it. The strategy underlines the importance of good management of the cultural environment to support climate change mitigation. If we systematically take care of our built heritage and landscape according to the principles of sustainable development it can help us in mitigation of climate change.

In 2013-2014, a Nordic research group carried out a project about the interaction between climate change and cultural environment. The participants of the project came from Finland, Sweden, Norway, Iceland and Denmark. The project was called Cultural Environment as Resource in Climate Change Mitigation and Adaption (CERCMA), and it focused on the positive influence of cultural environment protection on climate change mitigation and adaptation. The project dealt with building conservation, planning of built heritage areas and management of cultural landscape.

Résumé: L'un des objectifs principaux de la stratégie 2014-2020 de la Finlande pour un environnement culturel consiste à identifier dans quelles conditions l'environnement culturel est en mesure de contribuer à atténuer le changement climatique et à permettre aux Etats de s'y adapter. Cette stratégie souligne l'importance de la bonne gestion de l'environnement culturel dans l'atténuation du changement climatique. Si nous veillons systématiquement à préserver notre environnement culturel et nos paysages culturels existants dans le respect des principes du développement durable, il nous sera possible de favoriser l'atténuation du changement climatique.

Une équipe de chercheurs des pays nordiques a mis en œuvre en 2013-2014 un projet dans lequel elle s'est attachée à examiner la relation entre changement climatique et environnement culturel. L'équipe en charge de ce projet réunissait des acteurs finlandais, suédois, norvégiens, islandais et danois. Intitulé Cultural Environment as Resource in Climate Change Mitigation and Adaptation (CERCMA), le projet visait à étudier les conditions dans lesquelles la protection de l'environnement culturel peut influer favorablement sur l'atténuation du changement climatique et sur la capacité des Etats à s'adapter à celui-ci. Les thèmes traités dans ce projet étaient la conservation architecturale, la planification de zones de protection du patrimoine bâti et la gestion du paysage culturel.

Key words: cultural environment, cultural heritage, landscape, sustainable development, climate change, mitigation, adaptation.

Mots clés: environnement culturel, patrimoine culturel, paysage, développement durable, changement climatique, atténuation, adaptation.

1. Finland's Cultural Environment Strategy

In 2014, the Finnish Government issued a resolution concerning the first national Cultural Environment Strategy. The strategy was prepared through widespread cooperation coordinated by the Ministry of the Environment and the Ministry of Education and Culture. In the strategy, the cultural environment refers to a whole formed by human activity, an interaction between humans and the natural environment that includes different kinds of elements of different ages. Some parts of it have been defined as targets for protection, or otherwise as particularly important monuments or

objects of value. A big part of it is our everyday human environment surrounding us wherever we go. The cultural environment includes the cultural landscape, the built cultural environment, and archaeological sites. It includes both whole areas and individual sites.

After the government resolution was issued, an implementation plan was carried out in cooperation with various interest groups, and the implementation measures, parties responsible, schedules and their monitoring were set out.

The strategy envisions the cultural environment as a source of well-being and vitality, where people value the cultural environment and work



1. - The suburb of Herttoniemi in Helsinki is an example of 1950s urban structure. Photo: Rautjoki, Ministry of the Environment.

La banlieue de Herttoniemi à Helsinki est un exemple de structure urbaine des années 1950.

actively for it. A well-tended cultural environment evolves over time, while its unique characteristics are preserved. The changes should, however, be controlled. The strategy also points out that the resources of the public administration should be directed to guiding the orderly change of the cultural environment. Furthermore, according to the vision of the strategy, the diversity of the cultural environment opens up opportunities for success for the business sector.

2. The goals of the strategy

The Cultural Environment Strategy has three main goals for the year 2020. Firstly, that the cultural environment is an important resource and a catalyst. Secondly, that management of the cultural environment is a part of sustainable development, and, finally, that good administration makes it possible to have a comprehensive cultural environment policy.

The cultural environment is an important cultural, financial, social and ecological resource, and a catalyst for new activities. The goal of the strategy is to increase understanding of these opportunities. The strategy aims to strengthen the cooperation between different parties and reinforce the prerequisites for acting for the benefit of the cultural environment, whilst also emphasising the importance of civic activity in reaching the goals of the strategy.

Another goal of the strategy is to strengthen sustainable development and the related

ecological, financial, social and cultural values with the help of good management and responsible enhancement of the cultural environment. The basic view of the strategy is that the cultural environment can be renewed and adapted to the changes taking place over time while the central features of different ages are preserved.

The strategy lays out the prerequisites for comprehensive cultural environment policies. The state administration is responsible for implementing the strategy. The goal is to ensure the cultural environment administration's national, regional and local capacity to serve and function, to clarify the division of responsibilities and sectorspecific responsibilities in the administration, and to increase the cooperation between various administrative branches. The actions proposed in the strategy will promote the implementation of international agreements related to the cultural environment signed by Finland and the protection of the cultural environment.

3. Good management of the cultural environment supports sustainable development

One of the focal points of the strategy is how to recognize the ways the cultural environment helps in mitigation of climate change and in adaptation to it. The strategy underlines the importance of good management of the cultural environment as a tool in climate change mitigation.

Good management of the existing building stock, infrastructure and cultural landscapes is the basis for sustainable development. Renovation work and the new use of buildings that fall into disuse are important ways of preserving the buildings, employment, and sustainable development. Utilising existing cultural environments instead of pulling them down and building new ones can be an important competitive factor in developing business activities. In global competition, environmental responsibility and social responsibility in general are becoming increasingly important success factors. Cultural environments can support these goals, for example, by acting as symbols of companies' environmental responsibility and by forming an attractive interface between companies, the society and individual citizens.

Climate change and its consequences pose new challenges for the management of the cultural environment. The political choices related to climate change are also reflected in the cultural environment, such as new requirements for the energy efficiency of buildings. There is some research data available on improving energy efficiency at culturally and historically valuable sites, but not all of the aspects of the issue have been sufficiently investigated.

In growth centres in particular, infill and complementary building are used to implement a more ecologically efficient urban structure. It is, however, important that the special historical characteristics of the cultural environment are identified and respected in complementary building.

Landscapes and their natural and cultural heritage values are assets for recreation and tourism. According to the Roadmap for Growth and Renewal in Finnish Tourism for 2015–2025, cultural tourism to Finland emphasises, among other things, the local cultural environments, individual cultural sites and routes, as well as regional, individual cultural features, such as the Sámi indigenous culture in the most northern parts of Finland. In this way, the comprehensive maintenance of the cultural environment is also important for sustainable tourism.

4. How should climate change mitigation and adaptation be promoted?

It is important to recognise the different ways the cultural environment helps in mitigation of climate change and in adaptation to it. Owners should understand the importance of the cultural environment and they should be committed to managing it systematically. The overall costeffectiveness of repairing buildings should be better understood. It is also necessary to develop models and find best practices for new uses for buildings that become empty. Information on the ways of adapting renovation norms, taking into account the special conditions for protecting the built heritage, must be collected and offered to designers, planners, owners and the local authorities.

How should this be done? According to the strategy, the authorities should support and

develop solutions which help the mitigation of climate change and adaptation to it through the sustainable use and management of the cultural environment. The Ministry of the Environment will be supporting this by conducting a survey of existing research on the field. The Ministry has also started a project to make a guide book on how energy efficiency regulations could be applied in the repair works carried out on historically valuable buildings. The guide book should be ready in 2018. Furthermore, the cultural environment is observed in the Action Plan for the Adaptation to Climate Change of the Environmental Administration 2022 (2016).

Secondly, conditions for the temporary use of buildings and environments that have fallen into disuse should be improved and innovative reuse of the building stock should be supported. One means of promoting this action is the commitment by RAKLI, the Finnish Association of Building Owners and Construction Clients, to build models on how empty spaces can be taken into new use in an adaptive way.

One way to promote these kinds of actions is to make a cultural environment commitment on the website of the Society's Commitment to Sustainable Development (commitment2050. fi), which is Finnish initiative to achieve sustainable development. A cultural environment commitment is a promise made by a company, organization or individual to commit to changing their operations according to the objectives of the Cultural Environment Strategy and the principles of sustainable development. Each commitment includes objectives, indicators and a schedule for the work that are defined by the party making the commitment. The commitment is a good way to tell others about the planned actions and to build up a network.

5. The Nordic project Cultural Environment as Resource in Climate Change Mitigation and Adaptation (CERCMA)

CERCMA is a project by five Nordic countries that dealt with cultural environment and climate change in 2013-2014. The project was led by Maunu Häyrynen, a Finnish professor from the University of Turku. Other partners came from Sweden, Norway, Iceland and Denmark.



2. - A heavy load of snow places a strain on roof structures. Photo: Malinen, Ministry of the Environment. *Une lourde charge de neige met la pression sur les toits.*

The project joined the cultural heritage administrations of the Nordic countries, and the universities Aalto, Turku, Tampere and Lund, the Finnish Meteorological Institute, the Institute of Archaeology Iceland, Gaia Arkitekter Oslo, the Alvar Aalto Foundation, Realdania and the Norwegian Institute for Cultural Heritage Research.

The focus of the project was on finding positive influences of cultural environment protection for climate change mitigation and adaptation. The project dealt with building conservation, planning of built heritage areas and management of cultural landscape. It was primarily financed by the Nordic Council of Ministers through the Terrestrial Ecosystem Group (TEG). The project received additional funding from Finland's Ministry of the Environment, the National Board of Antiquities Finland, the Finnish Meteorological Institute, the University of Turku, the Directorate for Cultural Heritage in Norway and the Swedish National Heritage Board.

The aim of the project was to provide information for Nordic decision-makers about the need to harmonise climate change mitigation and adaptation measures with the protection of the cultural environment. The main questions in the project were:

- How can heritage solutions help in adaptation to climate change and future risks?
- How can traditional planning density and scale as well as the preservation of historic green areas contribute to sustainable community planning?
- How can existing buildings be resources in climate change mitigation?

These topics were discussed at a Nordic expert meeting in Helsinki that assessed the friction points between cultural environment protection and mitigation and adaptation measures and evaluated possible or imminent damage to cultural environments by climate policies as well as the effectiveness of mitigation involving cultural environments.

6. How does climate change affect cultural heritage in the Nordic countries?

The temperature rise caused by climate change will lead to a rise in sea level, increased annual downpour, storm damage, flooding of coastal areas and watercourses, and changes in vegetation. All this may have a dramatic impact on archaeological sites, built heritage and landscape.

Nordic cultural environments are particularly susceptible to climate change for a number of reasons. Wood is a common building material in the Nordic countries and will be exposed to an increased risk of rotting and pests. Multiplying zero point passes and salt crystallisation will place additional stress upon all building exteriors. Flood risk most acutely concerns cities and structures, especially those located by the coast or watercourses. From the mitigation point of view, a cause of concern is the application of the European Union Energy Performance of Buildings Directive (EPBD 2003) to historic buildings. The directive does not cover protected historic buildings, as minimum energy performance requirements could result in unacceptable changes to them, but historic buildings without official designation must comply with the directive.

In addition to built heritage, archaeological remains are threatened in various ways by increasing overgrowth and erosion, salt damage, loss of permafrost and the possible introduction of pile worm to the Baltic Sea. Cultural landscapes will be altered by the changing seasonal patterns, shifting vegetation zones, disappearing or invading species, loss of pastureland and forest blowdown occurring more frequently. In addition, both afforestation and wind power construction as mitigation measures may have an impact on the cultural landscape. Increasing downpour and extreme weather have already proven problematic in cities with plentiful hard surfaces.

The temperature in the Nordic region is to rise more than the global mean temperature rise. For example, with a two-degree global mean temperature rise, the temperature rise in the Nordic would be higher, perhaps around 2.5°C for the annual mean (Vautard et al., 2014) - or even more. A further typical result for the Nordic region is that the regional rise will be higher in winter than in summer. Also, the spring will start earlier and the autumn later, which implies a longer growing season and larger temperature sums, which will affect the natural vegetation as well as the conditions for managed ecosystems. Precipitation is projected to increase especially in winter, with consequent changes to groundwater levels, river runoff and soil moisture. Summertime precipitation changes will be less obvious. Milder winters will also imply milder snow conditions over time, with both a shorter snow season and smaller maximum snowpack thicknesses. The results of the scenario studies so far do not indicate significant changes to the regional wind climate or major alterations to the regional storminess. Heavy precipitation is, however, projected to increase.



3. - Floods threaten an Ostrobothnian house with cultural historical value. Photo: Heikkilä, Ministry of the Environment. *Des inondations menacent une maison ostrobothnienne de valeur culturelle historique.*

The regional sea level will also rise, which in parts of the Nordic region will, to some extent, be counteracted by the land uplift that has been ongoing since the last glacial maximum. In Southern Scandinavia, land uplift is insignificant, but it increases towards the region around the northern Bay of Bothnia. Regional sea level rise will for most regions differ from the global mean sea level rise. Emerging patterns suggest that, for the Nordic region, the seasonal sea level rise will be lower than the global mean around Iceland, but more than the global mean in the North Sea region (e.g. Slangen et al., 2012). The basic Nordic patterns of regional scale climate change are thus milder winters and warmer summers, higher wintertime precipitation, effective sea level rise, at least in the southern parts of the region, and for a higher level of global warming in the north. What happens with the global emissions is of major importance not only for the global mean, but also for the Nordic region.

7. How can cultural environment reduce climate change?

The influences of climate change to the cultural environment have been studied quite a lot. But less known are the possibilities for limiting climate change by means of good management of our cultural environment. The CERCMA project examined these possibilities.

In the project, four questions were presented to justify the interaction between cultural environment and climate change.

- How are cultural environments differentiated by climate change and its mitigation?
- What kind of roles could cultural environments play in climate change mitigation?
- How do cultural environments relate to the general political discourse on climate change?
- What new value models, priorities and strategic choices are expected from the cultural heritage sector?

The project group arranged an expert workshop to study the questions mentioned above. One workgroup was dedicated to the adaptation solutions. The discussions witnessed the emerging of a new narrative among the Nordic heritage sector. There was a relative consensus among the participants on the need to integrate cultural heritage values in climate policies and on the importance of built heritage as a resource for mitigation. However, opinions were more divided on how to proceed with the modern built heritage. Research on the relationship between cultural heritage and climate measures was deemed inconclusive at this stage. The promoting of certain cultural environment categories as positive models also seemed to profile other categories as unsustainable.

The workgroup set out from the fact that the effects of climate change and the connected risks divide Nordic cultural environments into different categories. Sites that are already popular and well visited will be at less risk than those that are less frequently visited and monitored. The need for risk assessment of cultural environments will rise in general. The Nordic societies are relatively well equipped to deal with the risks. Adaptation measures as well as changing patterns of tourism may have both positive and negative impacts on cultural environments. Preservation of built heritage may, however, be the best option from the mitigation point of view as well.

8. Adaptation solutions

The workshop considered adaptation solutions and future risks from five directions. The first was the need for more collaboration between agencies, administrative sectors, disciplines and NGO bodies, and the second was the development of Nordic cultural heritage databases into a more uniform whole and their combination with climate data. In order to meet the challenges of climate change there is a need for increased multidisciplinary collaboration. National high-level actions, such as Finland's Cultural Environment Strategy, can help to motivate more collaboration work within a country.

There is a large need for research and development of the methods that will digitalize and make cultural heritage databases accessible for climate change modulation and adaptation research. The increased use of GIS would be important also in view of qualitative data, and the power of cultural heritage visualisations ought to be harnessed for concretising the effects of climate change.

A third solution would be offered by the wide promotion of a long-term risk assessment, followed by the re-evaluation of cultural environments



4. - A downburst causes significant damage to several summer villas in North Karelia. Photo: Pihlatie, Ministry of the Environment. *Une tornade cause des dommages significatifs à plusieurs villas d'été dans la Karélie du Nord.*

and new protection and management priorities. It is very difficult to communicate the value and significance of cultural heritage. Therefore, there is a priority to develop methods for communicating cultural heritage values using monetary value.

The two last points suggest the need to learn from the past, since few of the adaptation issues would be genuinely new, and the use of traditional building methods as a source of innovation.

9. Urban heritage as resource in mitigation

The second workgroup observed the diversity of urban heritage, which means that cities and cultural environments will be exposed to climate change and its mitigation in a variety of ways. It is necessary to strive for scale- and contextsensitive solutions and overall flexibility of planning. Urban heritage could offer both good and bad examples of resource use. In general, the preservation and re-adaptation of historic structure with minimal intervention could be recommended, which would require a more relaxed application of legislation and building regulations. Human scale in planning, which enables walkability and liveable public spaces, would be crucial also for the sake of mitigation. Urban heritage was seen as an enabling structure that is adaptable for current needs and as an archive of traditional planning tools that could serve contemporary planning. This would require a better understanding of how historic cities of different ages really perform in terms of energy consumption.

The workgroup found out that different periods each have their specific advantages in terms of sustainability. For instance, the premodern cities offered starting points for the planning of relatively small carless areas with adaptable small-to-medium plans and smallsized, intensively designed open space. Moving into a large scale, the densely built, compact city ideal, together with more extensive green areas might prove more useful.

In the workshop, three main topics were identified. First, enhancing the mixed use of areas promotes living within walking distance from public services, culture services, nature and commercial services. Secondly, planning in human scale would highlight the value of cultural environments as such and pay attention to human spatial qualities and space management. Thirdly, the importance of green and blue infrastructure should be recognised in urban planning. In general, the workgroup saw that it is possible to learn from historical urban patterns and apply this knowledge to modern sustainable planning. Historical towns are often originally based on mixed use. All the key functions of a sustainable town can be found in them, for example active streets with public functions, which promotes walking.

The use of existing infrastructure instead of building new for current functions, promotion of new uses of old buildings and retrofitting of old infrastructures may be beneficial also from the economic and socio-cultural point of view. Encouraging adaptation and facilitating positive flexibility in regulations and legislation is essential for this objective.

The workgroup reiterated that the cultural environment has a value in itself. It is a living document of both human and environmental history. Built environment entails regional characteristics that are adaptations of human life into the changing local climate and resources. Maximal preservation of the existing urban fabric and minimizing of intervention would constitute a resource-wise approach.

Green areas form an integral part of historic cities and shape their identities. At the same time, they provide several sustainable functions and ecosystem services – for example, storage for downpours, urban gardening, reduction of pollution, increased biodiversity and groundwater protection.

Dense town structures with integrated green areas in historical parts of cities and old towns,



5. - Regular maintenance lengthens the life of a building. Photo: Heikkilä, Ministry of the Environment. *La maintenance continue allonge la vie d'un bâtiment.*

and in new urban areas enable connection and engagement with nature in the city. The green areas serve to channel and filter runoff water and mitigate the heat island effect, while they also provide room for socio-cultural-ecological functions such as urban gardening. Street planting helps to keep evaporation at bay.

Cultural environment issues and research related to cultural environments need to be fitted into the bigger picture of climate change data. In the context of ecosystem services, the natural values have achieved an economic interpretation. In a similar way, a valuation model of climate change policies should be developed that takes into full account the cultural environment values. A multidisciplinary research framework needs to be established for supporting policies. There is a demand for a more experimental study on the relations and interaction between historic cities and climate change.

Disseminating this information to a wider audience requires a key message: how does climate change affect *my* cultural environment? What can I do in *my* personal choices to mitigate or adapt to it?

10. The greenest building is the one already built

The third workgroup approached existing buildings as mitigation resources from two directions, as already constructed buildings embodying energy and as a knowledge base for sustainable development.

Historic buildings and environments can be a valuable resource for sustainability and climate change mitigation; both in a limited sense, as a valuable resource, and in a wider sense, as a historical document, representing traditional knowledge and examples of how today's society may cope with resource depletion. The goal of claiming existing buildings as an asset in climate change mitigation is to promote greater understanding of this fact and to discuss and suggest the implementation and policy adjustments needed to achieve synergy between policy to reduce climate change and cultural environment protection.

There were two main hypotheses:

• Historic buildings represent resources as already constructed buildings.

• Historic buildings represent knowledge that we can use as a base for sustainable development.

The workgroup noted the complexity of modelling the values of an historic building. This contrasts to the simple calculation modes that are used for energy performance, which in turn may lead to the lack of adjustment of historic buildings and the risk of losing their values due to energy repairs. User behaviour was seen as a central factor.

Within policies for climate change mitigation there is currently a strong focus on energy use in the operational phase of buildings. Energy saving is not the only solution, because energy performance must be seen in a broader context of the sustainable management of buildings. This requires balancing between the four dimensions of sustainability.

- Environmental sustainability: Resources used in the construction of the building, operational energy use, maintenance, recycling, disposal and other on-going processes that have a carbon footprint.
- Economic sustainability: Operating costs, revenues and market value of the building.
- Social sustainability: Functional values and contribution of the building or complex to the amenity of the local area.
- Cultural sustainability: Documentary and experiential values.

To be truly sustainable in the management of buildings, it is necessary to take all four dimensions into account, and an appropriate balance should be sought between them, understanding that they are complementary and mutually dependent rather than isolated quantities.

The proposals of the group were to create a properly working tool for calculating carbon dioxide emissions for old buildings, to study the links between user behaviour and energy consumption and to map out the traditional knowledge incorporated in historic buildings.

There is a lack of understanding that the reduction of greenhouse gas emissions is the main goal, not energy saving. Acceptance of the use of environmentally friendly energy sources instead of higher energy use, can be a more environmentally friendly solution than very extensive upgrading. The economic price label of building materials and constructions today does not include greenhouse gas emissions and pollution from cradle to grave. The economic price label should include greenhouse gas emissions and pollution during the whole life cycle.

Old buildings already exist, and start as zeroemission buildings, and even if these buildings require a larger amount of energy while in use, it will take decades before they can exceed new buildings regarding greenhouse gas emissions.

The materials of the old buildings were usually lightly processed and they were locally produced. The production has required little energy and caused little climate impact. Emphasis on the material properties, i.e. the right property and quality at the right place and function, gives good resource utilization. The materials and building components have long life and are often easy to maintain and repair. Reuse of materials and building parts is a tradition that we should be inspired by. Flexibility is important for sustainable development, giving options when situations change. Many historic buildings have this type of flexibility.

11. Conclusions of the workshop

The workshop and its three workgroups produced a couple of interesting outcomes and recommendations for future work. Firstly, energy performance must be seen in a broader context of the sustainable management of buildings. The building policy including legislation must move towards the goal of sustainable development. Secondly, historic buildings must be given the credit they deserve in energy calculations, energy labelling and other analyses of how historic buildings perform. Thirdly, the economic price label does not include greenhouse gas emissions although it is obvious that it should be included. As long as we are not prepared to change this, we must try to visualize these effects in other ways. It is essential that users are made aware of the correlation between their actions and the impact on climate gas emissions. The user's possibility and probability to make the right decisions must be facilitated. Finally, the knowledge linked to traditional buildings must be activated, the similarities of modern eco-buildings and the solutions used in historical buildings should be considered as well as other qualities of old buildings which may promote climate mitigation.

At least some Nordic cultural environments can play a crucial part in climate change mitigation. Conservation of built heritage offers an example for contemporary building and planning, treating existing building stock as embodied energy and minimizing interventions. Traditional building and planning methods may be regarded as a toolbox for low-tech construction using locallyobtained, cheap and lightly processed materials. The large-scale applicability of such methods would, however, need more investigation, as would the user skills required for living in traditionally built environments. Without this, the actual effectiveness of cultural environments in mitigation is hard to estimate or prove.

A central outcome of the CERCMA expert meeting was the importance of sectorial cooperation. This was seen as a two-way process, in which the cultural heritage sector needs to fully acknowledge the climate policy goals and the protection of cultural heritage should be mainstreamed into them at the same time. New kinds of evaluation models, tools and indicators would be needed to develop a strategic response to climate change within the Nordic cultural heritage sector.

A practical goal for Nordic co-operation in the cultural heritage sector is the comparison of methods, datasets and good practices that relate to cultural environments and climate change in each country and the transfer of research knowledge. The next step should consist of joint studies on energy performance in historic buildings and the built environment, on the applicability of traditional building and planning methods in contemporary construction, on cultural heritage evaluation models as well as on comparative user studies in different cultural environment types.

The Nordic project Cultural Environment as Resource in Climate Change Mitigation and Adaption (CERCMA) made some important observations of how the cultural environment can play an active role in climate change mitigation and adaptation. These observations will be taken into account in the implementation of Finland's Cultural Environment Strategy and in future actions in the Nordic co-operation.

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