# HEMP LIME CONSTRUCTION

## A guide to building with hemp lime composites

Rachel Bevan and Tom Woolley

With contributions by Ian Pritchett, Ralph Carpenter, Peter Walker and Mike Duckett

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# LIST OF ILLUSTRATIONS

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# FOREWORD

For far too long, ‘eco’ building has focussed on energy efficiency in use, with super insulated structures, renewable energy and rainwater collection. This is all very well, but such structures have continued to be built from materials with high-embodied energy or toxic production processes such as concrete, steel and plastic. This book sets out a form of building that offers a real alternative to standard cavity wall construction, providing a carbon neutral option that is easy to use, diverse in its application and cost competitive.

I was introduced to hemp lime construction when searching for an alternative to wattle and daub in the repair of my own timber-framed house. Hemp lime was breathable, and therefore compatible with the ancient timber frame, and could be sculpted to shape. It was also far more thermally efficient than the daub, and did not shrink to create gaps around the edge of the panel. I was so impressed by the material, I went on to use hemp lime for a contemporary extension on the same building. In both instances, the material has proved a roaring success.

Whether you require practical information for building in hemp lime, scientific data for further research or simply want to understand the material better, this book is packed full of all the information you could need. I only wish it had been available before I embarked on my own hemp lime building projects.

**Marianne Suhr**
**MRICS, SPAB Lethaby Scholar**

# ABOUT THE NATIONAL NON-FOOD CROPS CENTRE (NNFCC)

The National Non-Food Crops Centre (NNFCC) is the UK's national centre for renewable materials and technologies. *It uses its extensive market knowledge and technical expertise to build supply chains for plant-derived renewable materials so that good ideas become products that people buy. It establishes and explains the economic, environmental and social benefits of non-food crop materials. And it provides evidence and advice to support the development of policy.*

*The NNFCC is a not-for-profit company which receives grant funding from Defra but is independent of government and of industry. The Centre acts on the evidence and takes care not to promote non-food crop solutions that do not provide real benefits.*

*The NNFCC is very interested in crop-derived construction materials, which can contribute to sustainable construction issues including: embodied carbon, energy consumption, waste, and providing greater occupier comfort, for example through buffering moisture content. The Centre is working with several companies developing renewable construction materials. It also publishes information including newsletters and factsheets as well as more detailed studies including a recent life cycle analysis of natural fibre insulation materials.*

*For more information about the NNFCC's work in the construction field, contact them by:*
*Email: enquiries@nnfcc.co.uk*
*Tel: 01904 435182*
*or visit their website* **www.nnfcc.co.uk**

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Aston Clinton, Buckinghamshire

# 1 INTRODUCTION

In 2006 we were commissioned by the National Non-Food Crops Centre (NNFCC) to investigate building construction using hemp lime composites and to write a guide to assist those who want to use and specify the materials. A year-long study funded by the Department for Environment, Food and Rural Affairs (Defra) has led to this guide.

In the UK, Europe and globally there is a general acceptance of the need to reduce carbon emissions and energy consumption. Over the past few years there has been growing interest in the concept of low- and zero-carbon buildings and methods of construction that can facilitate this. Even those who deny that climate change is the result of human activities accept that fossil fuels are increasingly scarce and costly and that the impact of using non-renewable resources is unsustainable and likely to damage the environment. To safeguard both people and planet we have to develop alternative strategies for meeting our needs in building construction, transport, infrastructure, food and so on.

## 1.1 WHAT ARE ZERO-CARBON BUILDINGS?

The general understanding of zero-carbon buildings is that they involve 'micro-generation', adding renewable energy equipment like solar panels and wind turbines to buildings. Certainly, UK government policy has focussed strongly on this and on reducing waste and water consumption. These ideas can be found in the *Code for Sustainable Homes* (Department for Communities and Local Government, 2008) and other sustainable building standards that are being applied by public sector bodies. Energy efficiency, in terms of increasing insulation, is a very important part of these policies but there has, until recently, been little concern about the methods and materials that are used to achieve this, as long as energy consumption is reduced.

Recently, greater awareness has developed in which the nature of the materials and methods of building construction are seen as equally important. It seems foolish to use fossil-fuel-based materials to manufacture insulation when we are trying to reduce our consumption of fossil fuels, yet the insulation industry is dominated by products that are petrochemical-based or require a lot of energy to produce. Many of these synthetic products also use highly toxic additives in the form of glues, binders and flame-retardants that can cause pollution.

Brominated flame-retardants are widespread in the natural environment owing to pollution and emissions from manufacturing and buildings. They have been found in worryingly high levels in the blood of volunteers tested by WWF (WWF-UK, 2003) and are causing concern among Inuit communities near the North Pole, who rely on fish that are now contaminated with toxic chemicals associated with synthetic building materials (*The Guardian*, 2007 [French LCA, 2005]). Demand for natural and non-toxic materials, as an alternative to synthetic products, is growing rapidly as public awareness of green issues has grown.

## 1.2 SEARCHING FOR ALTERNATIVES

Petrochemical-based synthetic materials do not biodegrade easily and create worrying problems for the future if they end up in landfill. Thus society has begun to look for natural materials that are renewable (ie materials that can be replaced without doing any damage to the environment), consuming minimal fossil fuel energy, and have minimal pollution and health risks. Crop materials like hemp and flax have become significant in the search for such alternatives.

## ABOUT THIS BOOK

Hemp lime is a composite construction material that can be used for walls, insulation of roofs and floors and as part of timber-framed buildings. It provides very good thermal and acoustic performance, and offers a genuinely zero-carbon contribution to sustainable construction. Hemp masonry is breathable and is able to absorb and emit moisture, leading to much healthier buildings. Comprehensive guidance on using this novel material for housing and low-rise buildings is given for the first time in this book, which is full of practical information on materials, design and construction. It is fully illustrated and includes case studies and design details, and explains how the use of hemp based material can capture and store carbon dioxide in the fabric of buildings. The guide is the output from a Defra-funded study commissioned by the National Non-Food Crops Centre.

**From the Foreword by Marianne Suhr:**

"This book is packed full of all the information you could need. I only wish it had been available before I embarked on my own hemp lime building projects"

## THE AUTHORS

RACHEL BEVAN is principal architect at Rachel Bevan Architects, based in County Down, Northern Ireland. Her work includes the specification of ecological building materials and the practice has won awards from the Royal Institute of Architects of Ireland and the Royal Society of Ulster Architects.

TOM WOOLLEY is professor of architecture at the Graduate School of the Environment at the Centre for Alternative Technology and an acknowledged expert on natural building and related environmental issues. He is also professor of Sustainable Rural Architecture at the Countryside and Community Research Institute, University of Gloucestershire. He is chairman of the UK Hemp Lime Construction Products Association.

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