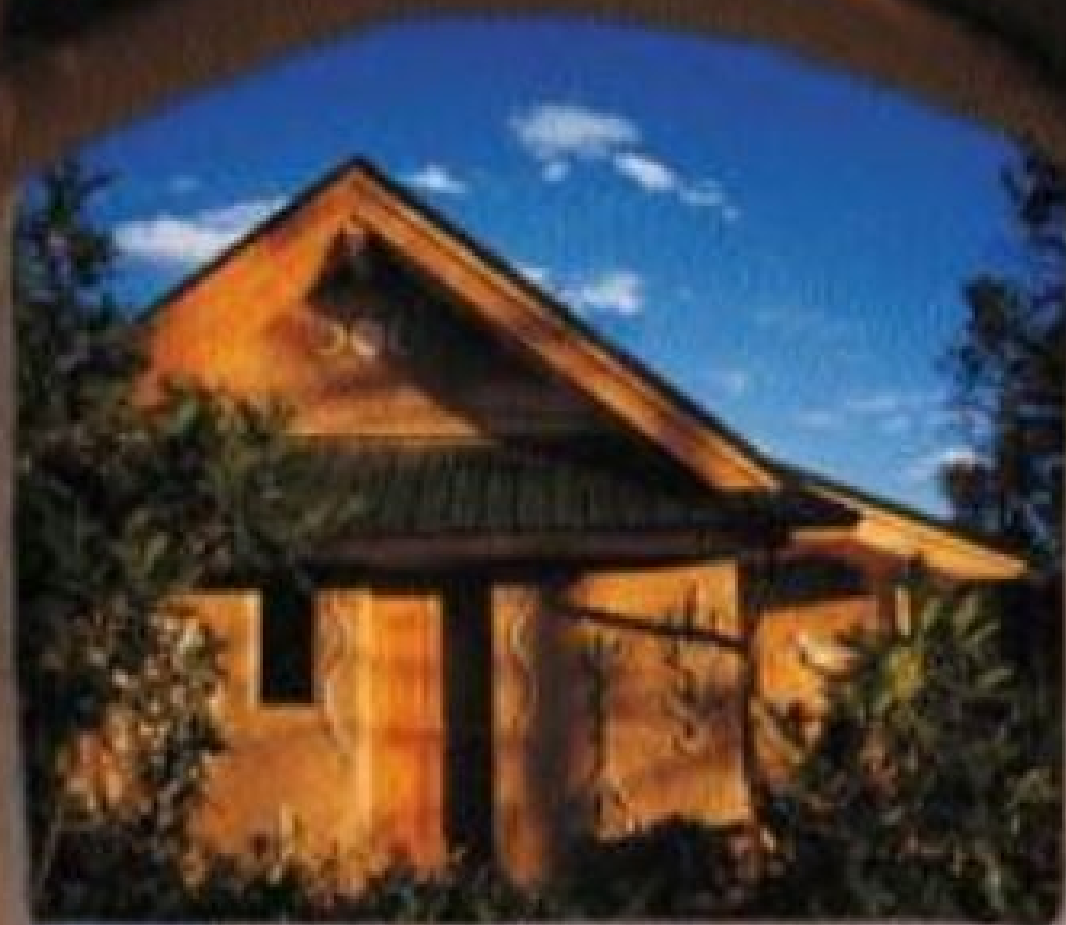


# The Natural Plaster

Book *earth, lime and  
gypsum plasters for  
natural homes*

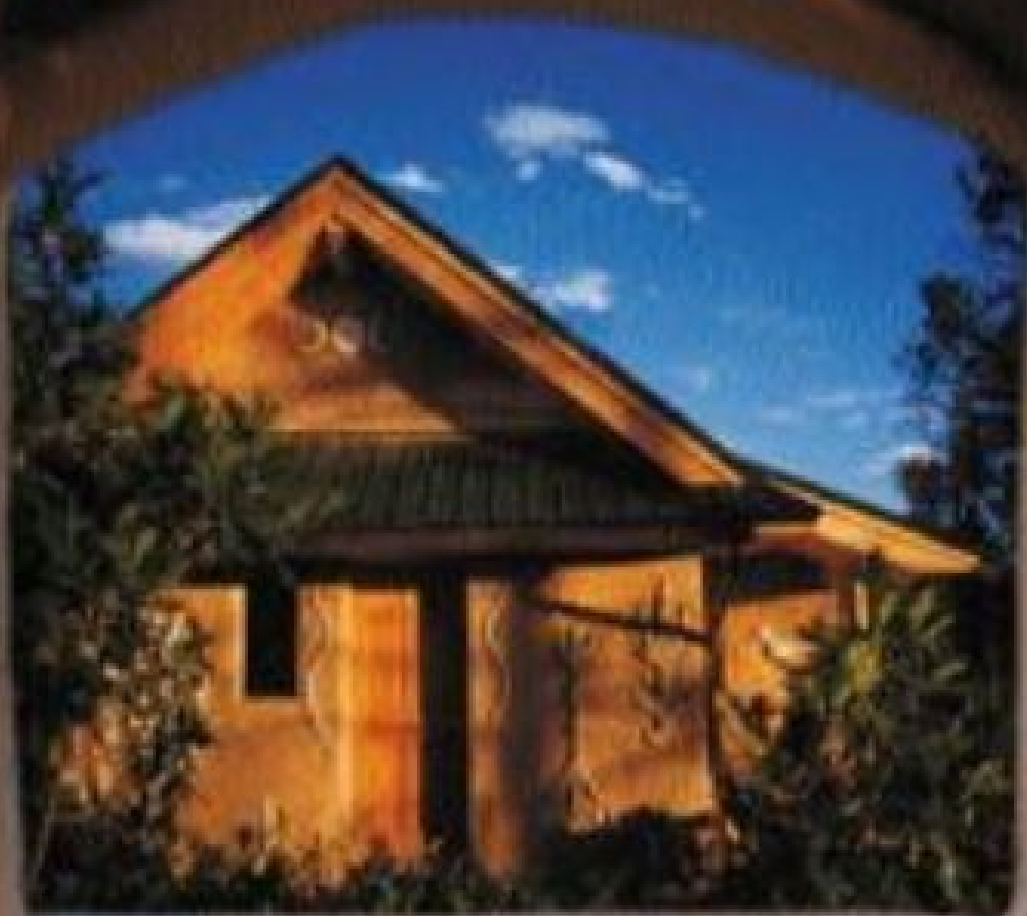


CEDAR ROSE GUELBERTH & DAN CHIRAS



# The Natural Plaster

Book *earth, lime and  
gypsum plasters for  
natural homes*



CEDAR ROSE GUELBERTH & DAN CHIRAS



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## **The Natural Plaster Book**

*The Natural Plaster Book* is to mud what the *Kama Sutra* is to sex. Filled with interesting tips and techniques, good attention to detail, well-illustrated

— it just plain makes you want to do it! An excellent resource for the novice as well as the professional.

— Kaki Hunter & Doni Kiffmeyer, authors of *Earthbag Construction*

This is the comprehensive book on plasters that natural builders have been waiting for. *The Natural Plaster Book* is not only an excellent overview of earth, lime, gypsum and other ecologically sound plastering options, but also provides an introduction to different ecological building techniques, design advice for plastered buildings, and resources for further research. Filled with useful tips and evocative photos and drawings, *The Natural Plaster Book* should prove to be an essential addition to any natural builder's library.

— Joseph F. Kennedy, Co-editor of *The Art of Natural Building*, Director of Builders Without Borders, and faculty member in New College of California's EcoDwelling program.

*The Natural Plaster Book* makes the ancient art and science of natural plastering accessible-to the professional plasterer and to the owner-builder. It provides step by step instructions for creating beautiful, healthy, and enduring interior and exterior wall finishes. As an architect, the book has the resources I need to specify natural plaster finishes in my homes.

— Paula Baker-Laporte A.I.A., co-author of *Prescriptions for a Healthy House*

“At long last, a book that effectively unravels the mysteries of natural plasters for all builders interested in creating their own beautiful, non-toxic, earth-friendly homes. Cedar and Dan have compiled this hard-to-find,



practical information into a single source that speaks from their life's work  
experience and focus on healthy building alternatives. This book will expand  
the consciousness of everyone who likes to 'play in the mud'!"

— Steve Kemble, Co-producer of  
“How To Build Your Elegant Home with Straw Bales”

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*The*  
**Natural Plaster**  
*Book* *earth, lime and  
gypsum plasters for  
natural homes*

CEDAR ROSE GUELBERTH & DAN CHIRAS

Foreword by Matts Myhrman & Judy Knox

Illustrations by Deanne Bednar



NEW SOCIETY PUBLISHERS

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## DEDICATION

*To our children:  
Cedar's daughter and son, April and Summer,  
and Dan's two sons, Forrest and Skyler.*

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## Acknowledgments

MANY PEOPLE HAVE HELPED US throughout this project, answering questions over the phone or via e-mails, or through their written materials or interviews. Many thanks to all of them, including Matts Myhrman, Judy Knox, Steve Kemble, Carol Escott, Chris Magwood, Bob Campbell, Kaki Hunter, Doni Kiffmeyer, David Eisenberg, Bill and Athena Steen, Carole Crews, Shay Salomon, Catherine Wanek, Linda Smiley, Ianto Evans, Robert Laporte, Paula Baker-LaPorte, Kai Stapelfeldt, Charmaine Taylor, Niko Horster, Michael Smith, Kiko Denzer, Frank Andersen, Carmen Velarde, Albert Andrews, Jr., Dorothy Andrews, and Reto Messmer. We'd like to thank Keith Lindauer, Johnny Weiss, Linda Smiley, Catherine Wanek, Doni Kiffmeyer, Kaki Hunter, Jean-Louis Bourgeois, and Edith and Alex Forrester for the photos they've provided. If we have forgotten anyone, we apologize profusely.

A world of thanks to our families for their love and support through the many months of writing and rewriting. And, of course, we'd be remiss if we didn't acknowledge the folks at New Society Publishers. At the helm of this splendid ship is Chris Plant, whose patience, guidance, and unwavering support have been nothing short of phenomenal, for which we are eternally grateful. Many thanks to Deanne Bednar for her delightfully skillful drawings which grace the pages of this book. We would like to acknowledge with tremendous gratitude the rest of the staff at New Society, especially Greg Green, production manager and art director, and Sue Custance, production coordinator, for their assistance in the preparation of this book.

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## Foreword

THERE IS AN OLD CHINESE SAYING, “If we don’t change direction, we will surely end up where we are headed.” The world we inhabit and are irreversibly interconnected with is in deep trouble. Every natural system on earth is in decline, some precipitously. We, as human beings, must choose to claim responsibility for the cumulative results of the choices that have brought us to this critical point in the history of our planet. It will take enormous effort and courage to move beyond our ordinary ways of doing things; it will take each and every one of us, acting on choices that arise from our deepest inclinations to affirm life. What’s at the heart of our human existence is that there is an essential part of us that yearns — even clamors — to champion the breakthroughs necessary to restore and sustain life.

There is no area of life needing dramatic change more than the way we in the “developed” world go about housing ourselves — housing that is often toxic to both the planet and its inhabitants. In the United States, our buildings account for 40% of all material and energy use, 35% of greenhouse gas production, and 28% of municipal solid waste. Since the 1940s, floor space per person in new homes has nearly tripled. Our houses demonstrate many unhealthy habits: use of energy-consumptive, unhealthy, manmade materials; ecologically destructive misuse of natural materials; decades of mortgage loan debt, the payment of which requires excessive amounts of time and energy — energy needed for ourselves, our families, our communities; the family’s almost complete disconnection from the design/building process of their homeplace; and, overarching all, our seemingly insatiable need for way more than enough to meet our basic needs.

As leaders of the straw-bale construction revival, we constantly asked ourselves how we could best demonstrate and inspire a move from egocentric to ecocentric buildings. As champions of natural building, the transformative power of our work together resides in developing our ability to inform and inspire others — to build our technologies and workplaces into bridges of learning and demonstration for the legions of people who can’t imagine how we can get from here (serving the imperatives of a consumer-driven, growth-oriented, anthropocentric world) to there (creating just, sustainable societies that bring the human species into balance with itself and the planet). Real champions dedicate themselves to reflecting hope out into a distressed world — not blind hope, but hope that rises out of developing and teaching real and do-able ways to meet our basic human needs within a restorative and sustainable framework.

Our hats are off to champions Dan Chiras and Cedar Rose Guelberth, who have spent years gathering information, learning, teaching, trying out new ways of doing things, discarding what doesn’t work, improving those things that do work, collaborating with others in the natural building community, and, most impressively, making the effort to turn their knowledge into usable and available tools for all of us.

*The Natural Plaster Book* is an open invitation to the champion in all of us; to add its hard-earned information to our tool kits, try it out in our homes and communities, modify, add, detract, collaborate with others, teach, learn, share — to join in the step-by-step, conscious, choice-filled, joyful, and hopeful journey from here to there.

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Judy Knox and Matts Myhrman

Out On Bale

Tucson, Arizona

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# Introduction

CEDAR AND I MET IN JUNE OF 1999 at a workshop on natural building in the mountains of Colorado in a largely defunct mining town known as Rico. She was teaching, as usual, and I was attending workshops and lectures, hungrily gathering information for a new book, *The Natural House*, slated for publication the following year. The sun shone bright, unabashed. The air was warm and inviting, and the Colorado sky was a flawless blue dome above our heads, free of the haze and pollution you see most everywhere else in this country. I was heading into town to hear Cedar speak at the local theater which was our meeting place. She asked for a ride, and off we went.

In the mile or two from our campground to the funky theater where the slide shows and lectures were given, we talked up a storm. In that short distance, it became apparent that she was a rather special person, full of enthusiasm, kindness, and an expanse of knowledge on natural plasters that could fill a book or two. Before we had parked in town, a couple of miles from the site where we had camped and engaged in the hands-on portion of the three-day workshop, we'd broached the subject of working on a natural plasters book together. I liked the idea, as I'm always on the lookout for new and exciting topics to research and write about, but I must say I also felt some trepidation. To say I didn't know much about plasters at the time would be the understatement of the year. I had worked with unnatural wall finishes — cement and synthetic stucco — and had read a little bit about earthen plasters, but at the time I would have had trouble writing a coherent paragraph on earthen plasters, let alone lime and gypsum plasters.

With some trepidation, I suggested “Maybe we should work on a book together.” When we left the workshop, the idea still swirled in my head. A year later, when we had time to hammer out the details, we embarked on this project. You're holding proof that we managed to forge a fruitful partnership that melded Cedar's vast knowledge on the subject with my modest skills at research and writing.

This book is a labor of love — the first comprehensive book on natural plasters for natural buildings. It took much longer to write than either of us had ever imagined, but the process — even though grueling at times — was ultimately successful. I am thankful for the opportunity to translate Cedar's gained knowledge — along with knowledge of a great many others who communicated with us through written and spoken word — into a book that offers insight, guidance, and enthusiasm for a subject that ranks among the top that I've had the privilege to tackle since the 1980s when I left my full-time university position to pursue a life of independent research and writing.

As you will soon see, this book describes natural plasters on natural buildings. Although much of our attention focuses on earthen plasters on straw bale homes, there is a great deal of information on lime and gypsum plaster, and on making and applying plasters to a wide range of natural buildings. Our goal throughout the book is to provide you with a firm conceptual understanding of natural plasters, one that allows you to tackle virtually any project with confidence, and to give you important details that will make any plaster job more rewarding, safer, and more successful.

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## How This Book is Organized

We begin our book with an overview of natural building. Chapter 1 is designed to help the reader understand the various building systems we will refer to in the book. This discussion is followed by a useful overview of natural plasters in Chapter 2, which provides a little background information on plasters that's essential to your understanding of traditional plasters. In Chapter 3, we discuss important details of the planning, design, and construction of natural homes, especially straw bale homes — details required for a successful plaster job. Be sure to read this chapter: it is vital to your success.

In Chapter 4, we begin our in-depth look at earthen plasters. We'll explore each of its components — sand, clay, silt, and fiber — and the role each plays in an earthen plaster. You will learn how to test soil — usually subsoil — to see if it is appropriate for making earthen plaster or how it needs to be altered. Next, we examine plaster additives — substances you can add to an earthen plaster to make it easier to work with and more durable and water-resistant.

In Chapter 5, we turn our attention to site preparation and mixing plasters. We'll provide guidelines for making your job site clean, efficient, and safe; explain how to prepare materials and mix plasters; and provide an overview of the function of the various plaster coats.

In Chapter 6, we look at the application of earthen plasters on straw bale homes, starting with the prep coats, then proceeding to the layers of plaster itself. You'll learn more about mixing plasters and the techniques used to apply each coat. As in other chapters, we'll describe the tools you will need.

Next, in Chapter 7, we will focus our attention on wall finishes. You will see how you can add color to earthen plaster walls via alises, litema, clay finish coats, and natural paints.

In Chapter 8, we'll explore the world of lime plasters and in Chapter 9, gypsum plasters. Then, in Chapter 10, we will discuss what you need to know and do to successfully plaster walls made of cob, adobe, rammed earth, straw-clay, rammed earth tire, and earthbags. Even though only one of these methods of construction may be the type of building you are interested in, we urge you to read the book from cover to cover. Much of what you learn early on, while focused primarily on straw bale homes, does carry over to other natural homes.

Finally, in the Resource Guide at the end of the book we provide a comprehensive listing of publications (books, articles, newsletters), videos, organizations, suppliers, and workshops.

We welcome newcomers to the natural building movement and hope this book helps in many ways, providing a solid conceptual background in addition to details on processes and materials that will help you to become a successful natural plasterer — or will improve the knowledge and skills of those of you who have already begun to dabble in this wonderful craft.

In closing, we would like to point out that slopping around in the mud may not seem like the most civilized thing a human could do. However, if that mud is an earthen plaster destined to adorn the walls of a natural home, this pursuit may just turn out to be one of the most enlightened acts of civilization you can engage in...that is, if you care about the future of our planet, our children, and the many species that share this planet with us. You will see why shortly.



Dan Chiras  
Evergreen, Colorado

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Cedar Rose Guelberth  
Carbondale, Colorado

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# CHAPTER 1

## Welcome to the World of Natural Building

FOR VIRTUALLY ALL OF HUMAN HISTORY, our ancestors have lived in shelter fashioned from locally available materials. Earthen materials were one of the most popular. Even today, approximately half of the world's people inhabit shelters fashioned from clay-rich dirt harvested from the Earth's crust. Such shelter not only protects people from the elements, it can provide extraordinary comfort, even in rather harsh climates. Earthen building materials also create a close connection to the Earth with calming and healing effects.

Today, however, an increasing number of homes are being built from synthetic or highly processed natural materials. Many modern materials release toxic substances into our homes, inadvertently poisoning the very people these homes were designed to protect. Their harvest and production also damage the environment.

Most contemporary shelter is also less than optimal for maximum human comfort. For one, most new homes tend to create a sterile, straight-edge environment — so unlike the natural world and devoid of soul. Placed in cities and suburbs, our homes also tend to isolate us from nature. The closest most people get to nature anymore is a romp on the pesticide-sprayed lawn or in a local park with the family dog. Coming from generations of people who were connected to nature, many of us respond poorly to the isolation from our environment.



ALBERT M. ANDREWS, JR.

*1-1: Locally available materials have been used throughout the world for virtually all of human history to build homes and other structures like these stone and earthen buildings in old Jerusalem.*

There is a far more healthful way to create shelter. It is called natural building. With thick protective walls fashioned from earth and fiber, natural homes typically offer soft lines and delightfully curved, even sensuous, walls. Finished with a sumptuous earthen plaster, these homes often evoke feelings of security, harmony, and peace. Built with features likely to be found in the natural environment, these homes help to connect us to the Earth, the source of life.

Natural homes provide a nurturing and supportive environment for people. They are a kind of mental salve to battered senses in a high-stress world. Natural homes provide us an opportunity to relax and rejuvenate after a hard day's work. For those who work in a natural home or in a natural office building, immersion in this setting provides a daily nurturing environment — far more productive than most contemporary buildings. As many readers know, prolonged stress can impair the human immune system and endanger our health. By reducing stress, natural homes may help our immune systems function at their peak and thus protect our health.

Natural building is good for our bodies and our minds, but the list of benefits does not end here: it also pays huge environmental dividends. Most are made from locally available materials transported to the building site using far less fossil fuel energy than those needed to build a modern stick-frame structure. Less energy means less pollution. Although locally harvested materials can create small isolated pockets of damage, these can be repaired quite easily. The small hole dug to extract clay for an earthen plaster, for instance, may be converted to a frog pond, or filled in with topsoil and replanted, leaving no evidence of earlier disturbance. By building with locally available natural materials, you can reduce the use of highly manufactured materials whose production often causes extraordinary environmental damage. The list of benefits goes on, but the point should be clearly evident: by building a home that nourishes body and mind, we protect and replenish our environment. Planet care, we must not forget, is the ultimate form of self-care.



CEDAR ROSE GUELBERTH

1-2: *The earthen plastered walls of this straw bale home are inviting and soothing to the soul, in part because they connect us to the Earth.*

## **The Rising Popularity of Natural Building**

Although natural home building has declined sharply in modern times, it is making a strong comeback. Straw bale building has been a pivotal player in this resurgence. The revival of straw bale building, in turn, can be traced in large part to an article written by Roger Welsch which was published in a fairly obscure publication, *Shelter Magazine*, in the 1970s. Penned primarily for the back-to-the-land folks, this article provided an overview of indigenous and off-beat ways of constructing shelter. Although few would have predicted it, the article also inspired a dramatic resurgence in straw bale construction, a technique that originated nearly 100 years earlier in the windswept grasslands of the Sand Hills of western Nebraska. The resurgence began in the early 1980s, slowly at first. Then, in the 1990s, it gained a momentum which continues today in North America, Europe, Australia, Russia, Japan — all over the world!

Straw bale building offers numerous benefits and attracts a wide spectrum of people. Most people are attracted to straw bale building's promise of reduced energy bills. Energy efficiency, combined with passive solar heating and passive cooling, can result in dwellings that use little, if any, outside energy — and thus contribute mightily to cleaner air. In most parts of the world, straw is locally available. Far less energy is required to ship a truck load of straw from a farm 20 miles (32 kilometers) away than to ship wood from distant forests 1,000 - 2,000 miles (600 – 1200 km) away. This, too, adds to its appeal.

Straw bale construction helps reduce air pollution in other ways as well. In many parts of the world, after grains are harvested, the straw is burned off to make cultivation easier and to return nutrients to the soil. So, advocates point out, building houses out of straw is a great way to put an agricultural waste product to good use and to reduce air pollution.

Straw bale construction also provides a way of reducing wood use. For those interested in helping protect our vanishing forests, this is a major plus. In addition, straw bale replaces potentially toxic earth-unfriendly insulation materials — for example, fiberglass containing formaldehyde or foam made from ozone-depleting chemicals. It is, therefore, a more healthful way of creating shelter.

Straw bale building is appealing to people who want to construct their own homes. That's because building walls from straw bales is relatively easy. Straw bale construction can also reduce the cost of building a home, although this is not always the case. If designed and built well, straw bale homes can save money in energy bills and thus dramatically reduce living expenses.

Over time, we've discovered another benefit of straw bale construction: straw bale homes can be exceedingly beautiful. The adjectives elegant, graceful, and breathtaking describe many well-crafted straw bale homes.



*1-3: The Martin/Monhart home, built in Arthur, Nebraska in 1925, demonstrates the elegant simplicity and endurance of straw bale construction.*

## THE ECONOMICS OF STRAW BALE CONSTRUCTION

Straw bale homes range in price, depending on how much work an owner does and how much he or she must contract out. Cost also depends on the complexity of the design. The more complex, the more costly the home. In addition, cost depends on details — for example, the type of tile and cabinetry and the amount of finish work. Straw bale homes can range from as little as \$50 to \$150 per square foot.

Straw bale building can be fun, too, and is often carried out communally with wall-raising parties or workshops that build personal relationships as well as shelter.

Despite what critics say, straw bale walls, if designed and built well, rarely have problems and are extremely durable. Straw bale walls are also pest- and fire-resistant, because finished walls are coated with a thick layer of plaster that prevents pests and fire from reaching the bales. Even if fire penetrates the plaster, straw bales are tightly compacted and burn poorly due to a lack of oxygen.

With thick walls of straw, these homes are quiet. In addition, straw bale building is an approved form of construction in many jurisdictions. Mortgages and insurance are also readily available in many locales. Resale values appear to be quite good, too. If the energy supplies dwindle, the value of a highly energy-efficient straw bale home could easily exceed a comparably sized structure made from conventional materials.



DAN CHIRAS

*1-4: Straw bale raisings like this one promote community, reminiscent of the barn raisings of days past. They also help to teach building skills to others.*

Despite its many benefits, straw bale building does have a few shortcomings — but then so do every other form of construction. Straw is the shaft of cereal crops, such as wheat. Many farmers who grow wheat and other cereal grains use lots of irrigation water and pesticides. (Use pesticide-free bales if possible.) Using straw, rather than plowing it under, reduces the return of nutrients to the soil. (Buying bales from farmers who manage their farms well can lessen this impact.) Straw bale building is not always as inexpensive as some would have you believe. (Walls are only a small portion of the total cost of building a home; many other factors determine the total cost.) If not designed well (especially with regard to protection from water), straw bale walls can mold and deteriorate, as in any construction system.

In closing, straw bale construction provides many benefits. While there are some things to be aware of, straw bale construction offers a wonderful way to build sustainable homes and has a bright future.

## **Natural Building: Creating Homes from Earth and Fiber**

Although many readers may be familiar with straw bale, numerous other natural building materials are gaining in popularity in recent years. In fact, there are currently over a dozen different natural alternative building systems, among them rammed earth, adobe, straw-clay, earthbags, and cob. Although there are many earth-friendly building alternatives, walls are generally built from two materials, earth and fiber (for example, straw). Stone and wood are often used as structural components (foundations in the case of stone, framework in the case of the wood). In many homes, natural builders are using a combination of natural materials. For instance, they may build exterior walls out of straw bales and interior mass walls for passive solar heating from adobe blocks, rammed earth, or cob. Interior divider walls may be built from straw-clay. (We'll describe each of these options shortly.) Many natural homes are finished with natural plasters, too.

No matter what natural building material is used, they all share two common features: they're produced by natural processes and they're locally available. Because they're made by natural processes, they're renewable. Straw and soil, for instance, are both renewable resources — although soil formation takes a long time.

Using such materials allows us to build homes that tread lightly on the Earth. Moreover, many natural building materials are conducive to highly energy-efficient design. They're also ideal for passive solar heating and cooling. Natural building therefore is gentle on the environment during construction and during the life span of the house. Once its useful life is over, the materials used in building a natural home can easily revert back to their former state.

Because we'll be talking about natural plasters for earthen homes as well as straw bale structures, we begin with a survey of the major natural building systems to which plasters are applied.





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sample content of The Natural Plaster Book: Earth, Lime, and Gypsum Plasters for Natural Homes  
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