

Introduction: An Open Door

MICHAEL G. SMITH

*He who dedicates himself to the duration of his life, to the house he builds,
to the dignity of mankind, dedicates himself to the earth and reaps from it the harvest
that sows its seed and sustains the world again and again.*

« Albert Camus, *The Rebel* »

Natural building is nothing new. It is as old as the paper wasps who construct insulated hives out of chewed wood fiber, the aquatic caddis fly larvae who make protective shells by cementing together grains of sand, the prairie dogs who excavate enormous towns of interconnecting tunnels, and the chimpanzees who build temporary rain shelters out of sticks and leaves. For thousands of years, our own species followed this same path, building our shelters out of locally available materials.

Each group to settle in a new

area developed a unique culture with its own architectural style, which evolved through small improvements from generation to generation, becoming increasingly better suited to local needs and opportunities. But always the basic materials stayed the same: the earth and stones beneath our feet, the trees and grasses that grew nearby. Building was a necessary skill shared by most people, a part of the traditional knowledge of how to live wisely and comfortably in a place, passed down through the centuries.

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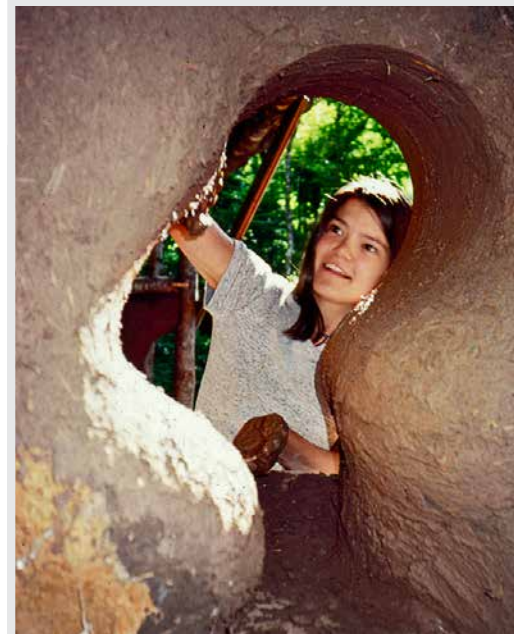


FIGURE I.1. People the world over are rediscovering the many advantages of building their own homes from natural materials.

[Credit: Joseph F. Kennedy]

Only in the last few generations has our relationship to building begun to change. The Industrial Revolution came like a big splash in a small pond. It started in Western Europe and is still spreading into less-developed parts of the globe. This wave has carried changes into nearly every aspect of our



FIGURE I.2. Natural building emphasizes the use of inexpensive tools and simple, easy-to-learn techniques. Here, a mallet fashioned from a log is being used to tap straw bales into place. This building was the first straw bale demonstration project organized by the American Indian Housing Initiative at the Crow Indian Reservation in Montana in 1999. [Credit: Michael Rosenberg]

lives, not least the way we shelter ourselves. New materials appear on the market every year, promising more strength and speed than the old ones. The new building techniques are often more complicated and require specialized training and equipment, so most people in industrialized cultures no longer build their own homes.

The industrialization of building has made possible an enormous increase in the amount of construction that takes place every year. But not all of the consequences are positive. The energy expended in extracting, manufacturing and transporting building materials is a major contributor to the looming climate crisis and other environmental problems, too numerous to list here. Manufactured products can be toxic to the workers in the factories where they are made, the builders on the construction sites where they are employed and the families who live in the houses where these materials end up. They also create enormous waste disposal problems. Industrial building tends to be expensive: manufactured materials are transported great distances and specialized labor is often involved. What results is high-cost housing and increasing homelessness in industrialized countries.

Some individuals have always challenged the industrial building paradigm, preferring to build for themselves using local materials and traditional techniques. During the back-to-the-land movement of the 1960s and 1970s, thousands of people in the United States chose to build their own homes from available resources, without professional assistance, much training or money. Some were inspired and aided by contemporary pioneers like Helen and Scott Nearing (authors of *Living the Good Life* and other classics) and Ken Kern (whose book, *The Owner-Built Home*, was the bible for a generation).

The energy crisis of the mid-1970s focused public attention on our use of natural resources and the energy efficiency of our buildings. Around that time, a great deal of research and writing was done on passive solar building, alternative energy systems and sustainable resource use. But much of that knowledge was swept under the carpet by government policy and public apathy during the '80s. Some of the responses to the new interest in energy efficiency actually turned out to be detrimental to human health, as airtight buildings made of synthetic materials contrib-

uted to environmental illness and other health problems.

Although it was no longer receiving much popular press, the experimental work of conservation-minded builders continued. In the late 1980s, a flurry of activity surrounded the rediscovery in the southwestern United States of straw bale building, a technique that had gained brief popularity in Nebraska in the early part of the 20th century. In Tucson, Matts Myrhman and Judy Knox started Out On Bale, (Un) Ltd., an organization devoted to popularizing this elegant and inexpensive construction system.

Around the same time, Ianto Evans and Linda Smiley, inspired by the centuries-old earthen homes in Britain, built their first cob cottage in Western Oregon. The interest generated by this wood-free wall building technique, which had proven itself well-suited to cool, rainy climates, led them to found the Cob Cottage Company. Meanwhile, Iowa-based Robert Laporte was teaching natural house building workshops that combined traditional timber-framing techniques from Japan and Europe, light-clay (a German infill of clay-coated straw) and earthen floors and plasters. In upstate New York, Rob and Jaki Roy taught

cordwood masonry and earth-sheltered housing at their Earthwood Building School. Persian architect Nader Khalili established CalEarth, a center in Southern California devoted to developing, educating about and gaining code acceptance for earthbag construction. Also in California, David Easton was breaking into the contract-building market, first with monolithic rammed earth walls, and then with a sprayed-on soil-cement technique he dubbed PISE.

By the mid-1990s, there were dozens of individuals and small

organizations in the United States researching, adapting and promoting traditional building systems. These visionaries proceeded with their work independently, each largely unaware of the existence of the others. Then the straw bale boom in the Southwest began to attract the interest of the mainstream national media. When movie star Dennis Weaver moved into a passive solar earth-bermed house made of recycled tires and soda cans, he brought instant fame to New Mexico architect Michael Reynolds, developer of the



FIGURE 1.3. Natural Building Colloquia have inspired a great deal of collaboration and cross-pollination between practitioners of different building techniques. When the “straw bale people” met the “cob people” at the 1995 Colloquium, this hybrid dome was the result. [Credit: Catherine Wanek]

“Earthship” concept. As increasing numbers of hands-on workshops were offered around the country, the isolated teachers and innovators began to hear about one another.

In 1994, Ianto Evans, Linda Smiley and myself, directors of the Cob Cottage Company, organized the first Alternative Building Colloquium, inviting natural builders and teachers from around the country to spend a week together on a farm in Oregon. The idea was for these leaders to meet each other, share

the building techniques each knew best and begin to join our various philosophies and experiences into a more cohesive system of knowledge.

The following year, Catherine Wanek hosted a follow-up gathering at her lodge in New Mexico. When publicizing that event, she coined the term “natural building” to define the commonality among these varied building materials and methods without limiting their potential with the marginalizing term “alternative.” Joseph Kennedy,

representing CalEarth, was one of nearly a hundred participants at that event, as were at least a dozen other authors represented in this book. We had all stumbled together through a doorway that we had glimpsed but had not been able to see clearly until that moment, into a world where decisions about the built environment are informed by traditions of the past yet rooted in a deep concern for the future of humanity and of the planet itself.

Since then, during the annual Natural Building Colloquia that followed on various sites around North America, thousands of people from diverse backgrounds (including students, architects and builders, code officials, artists, entrepreneurs and urban squatters) have attended workshops on wall building systems ranging from adobe to wattle and daub; roofing techniques including sod and thatch; and foundation systems including the rubble trench, dry stone and rammed earthbags. Through lectures, slides and demonstrations, innovators have presented their work with structural testing and building codes; composting toilets and grey water systems; designing with sacred geometry and natural forces; ecovillages and co-housing; and a hundred other topics.



FIGURE I.4. Kaki Hunter and Doni Kiffmeyer lead an earthbag building project at a Natural Building Colloquium at the Black Range Lodge in New Mexico. These gatherings combine hands-on building, skill-sharing, lectures and slide presentations and networking among natural builders. [Credit: Mark Mazziotti]

The energy and enthusiasm of these groups have been expressed physically in the construction of ornate timber frames, experimental straw bale vaults and multi-colored lime fresco murals. Ideas and techniques have collided and merged, coalescing into hybrid structures including a straw bale/cob dome and a straw bale/cob/light-clay/wattle and daub cottage on a stone and earthbag foundation. From the seed of these colloquia, a new movement has been born. The many disparate efforts to relearn ways of building with local materials and adapt them to modern needs have been brought together into a single conceptual basket with an easily understood name: natural building.

In the early years of the movement, authoritative written information was scarce, and in some cases there was substantial disagreement about best building practices. Terminology was divergent, as practitioners in different areas developed their own language to describe aspects of their work. The exceptions were stone masonry, adobe in the Southwest and timber framing, especially in the Northeast, since these techniques had never been “lost.” In the 1990s, a new wave of practical guidebooks started to appear,

starting with *The Straw Bale House* by Athena and Bill Steen, David Eisenberg and David Bainbridge in 1994. By the turn of the century, new how-to manuals had been published on cob, rammed earth, cordwood and Earthships, among other techniques. But there were still many critical gaps in the natural building literature.

Following the 1997 Colloquium, again hosted at Catherine’s Black Range Lodge, Joseph and Catherine put together a booklet of information culled from the presentations. A great deal of technical information was put down in writing for the first time. Joseph and I had begun teaching two-week workshops on natural building and design, and compiled a large packet of Xeroxed handouts for our students. The packet was getting unwieldy and expensive to produce, and it still had some significant omissions. The three of us decided to join forces on a book aimed at introducing the emerging field of natural building in a comprehensive fashion to newcomers, while filling in gaps in the knowledge of readers already familiar with some pieces of the puzzle. We brainstormed our dream team of authors, selecting those who not only knew their material intimately but were clear

and experienced presenters, and asked them to write chapters on their areas of expertise. Nearly all of them agreed, and that collaboration became the first edition of this book.

Representing every major natural building technique, and written by some of the most prominent innovators and advocates in the field, the first edition strove to document the current state of the art of the movement circa the year 2000. In addition to a survey of techniques, it provided a philosophical framework for the entire natural building movement, as well as a set of design principles broadly applicable to ecological design projects everywhere. In mapping out such a broad territory, we necessarily sacrificed some depth; we made up for that by including a comprehensive up-to-date list of resources for further information.

The book was a success, but time passes and things change. So many new resources have become available in the last decade, both in print and electronic form, that the first edition is no longer current. And the natural building movement is still young enough that a lot of new understanding can develop in a decade. By 2014, it was clearly time for a second edition.



FIGURE I.5. Natural building projects like this cob bench can provide an empowering creative outlet for urban youth, while teaching technical concepts and teamwork skills. [Credit: Joseph F. Kennedy]

When the three of us sat down to discuss our visions for the new edition, we were surprised to note that in the intervening decade and a half there had been almost no additions of major building techniques to the natural building palette. What had occurred instead was a significant fine-tuning and professionalization of the field. Whereas the natural builders of the 1990s have been characterized as a collection of mavericks, misfits and mad scientists, developing new techniques on desert lots and deep in the

woods, often removed from public scrutiny, the latest generation of practitioners is more focused on gaining mainstream legitimacy for natural building techniques. This latest wave of natural builders has been examining traditional building systems through the new lens of building science, resulting in a much better understanding of how natural materials interact with each other and with their environments. They have also been evaluating the performance of early natural buildings in order to develop more effective

designs and details. These trends have allowed a recent proliferation of high-performance natural buildings in challenging settings such as cold, wet climates and urban contexts. We wanted the present edition to reflect this sea change.

As both the knowledge base for natural building techniques and the public's acceptance of them increase, and as worsening climate and economic crises create disillusionment with industrial models of building and development, many organizations have begun to apply natural building methods to the housing needs of populations around the world. For this edition, we created an all-new section called "Building the Global Village," which showcases some of these successful efforts.

From the introduction of ancient Egyptian and Iraqi techniques for building earthen domes and vaults in sub-Saharan Africa, to empowering a social movement in Thailand with adobe and cob, to the increasing acceptance of straw bale buildings in China and Pakistan, each of these stories offers valuable lessons about how new and old techniques need to be adapted for best results in different contexts. We also wanted to feature some of the groundbreaking work eco-

villages around the world are doing, as laboratories for both social and physical reorganization. As a planetary “village,” we may be entering a new era of reinventing ourselves, our cultures, our settlement patterns and construction techniques to be more harmonious with the laws of nature. No corner of the Earth will be unaffected by the changes to come, so the time is ripe to learn successful resource-management strategies, both ancient and contemporary, wherever they can be found.

Our aspirations in this book go beyond just informing our readers of what other people are doing. Our greatest desire is that this book will be a doorway through which many of you will step in order to join the natural building movement. We hope that the profiled projects and the photographs throughout will help get you excited about handcrafting your own personalized structure.

The chapters describing construction techniques should give you a good basis for determining which ones appeal to you and make the most sense under specific circumstances, but they will



FIGURE 1.6. Come on in—the door is open! This family home in British Columbia, built by Cobworks in collaboration with the homeowners, combines cob walls, local stone foundations, milled and unmilled wood and natural plasters. [Credit: Misha Rauchwerger]

not give you all the details you need to start building. Therefore, at the end of each chapter, we have once again listed a selection of the best books, periodicals and websites where you can find more information about that technique, as well as providers of workshops and other hands-on learning opportunities. We strongly encourage you to take advantage of the latter; a few days spent practicing

a natural building technique with a skilled instructor will give you more confidence and ability than all the volumes ever written.

So come on in; the door is open. We’re very pleased to take you on a tour of the rambling, varied and often surprising world of natural building, and to introduce you to some of our friends, colleagues and teachers along the way.

PART ONE

The Context for Natural Building

*There is some of the fitness in a man's building his own house
that there is in a bird's building its own nest. Who knows
but if men constructed dwellings with their own hands,
and provided food for themselves and their families simply and
honestly enough, the poetic faculty would be universally developed,
as birds universally sing when so engaged.*

« Henry David Thoreau, *Walden*, 1854 »



The Case for Natural Building

MICHAEL G. SMITH

1

Natural building is any building system that places the highest value on social and environmental sustainability. It assumes the need to minimize the environmental impact of our housing and other building needs, while providing healthy, beautiful, comfortable and spiritually uplifting homes for everyone. Natural builders emphasize simple, easy-to-learn techniques using locally available, renewable resources. These systems rely heavily on human labor and creativity instead of capital, high technology and specialized skills.

Natural building is necessarily regional and idiosyncratic. There are no universally appropriate materials and no standardized designs. Everything depends on local ecology, geology and climate; on the character of the particular building site and on

the needs and personalities of the builders and users. This process works best when the designers, the builders, the owners and the inhabitants are the same people. Natural building is personally empowering because it teaches that everyone has, or can easily acquire, the skills they need to build their own home.

Natural building is not a new idea. In many parts of the world, almost all building still conforms to these criteria. Until the Industrial Revolution, the advent of cheap transportation and the professionalization of building and architecture, the same was true throughout Europe and America. Pioneer families in the United States built their own homes out of local materials, as First Peoples here and everywhere have always done. Our modern building industry with its

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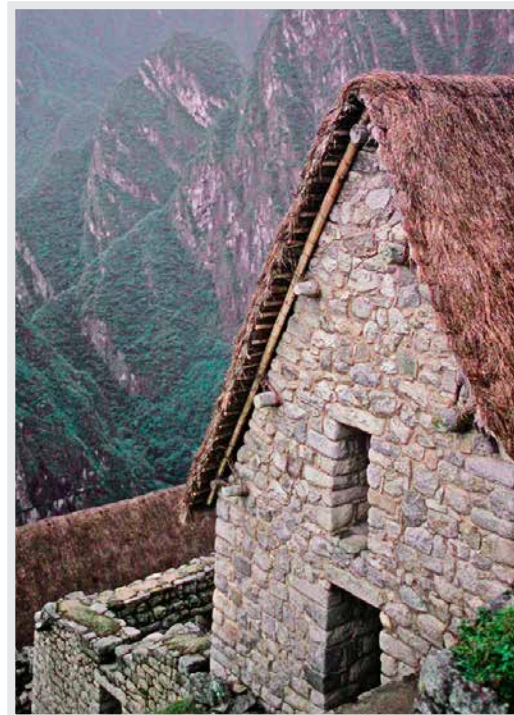


FIGURE 1.1. Everywhere on Earth, vernacular building traditions evolved that used local resources to their best advantage to meet local climatic and cultural conditions. These reconstructed Inca homes at Machu Picchu borrowed both their materials and their forms from the immediate environment. [Credit: Michael G. Smith]

resource-extractive, energy- and capital-intensive, polluting and often toxic practices must be seen as a temporary deviation from this norm. Let's look at some of natural building's many advantages over conventional modern building practices.

Environmental Impact

It's no secret that the global ecosystem is ill. The housing industry is a major contributor to the problem. We in the Pacific Northwest see the evidence all around us: the trail from clearcut to sawmill to building site is easy

to follow. Other major modern building components depend on destructive mining: gypsum for plasterboard; limestone for cement; iron ore for hardware, rebar and roofing, to name just a few. Every material used in a typical modern building is the product of energy-intensive processing. The mills that saw our lumber, the factories that make plywood and oriented strand board, the foundries that make steel, the plants that turn minerals into cement by subjecting them to enormous heat—all consume vast quantities of power, supplied either by the combustion of coal and oil, the damming of rivers or the splitting of atoms.

Manufacturing processes also release toxic effluent into the water and hazardous chemicals into the air. The manufacture of Portland cement, for example, is responsible for approximately five percent of global greenhouse gas emissions. And even after our building materials are made, modern construction depends on an endless stream of polluting trucks to deliver them to us, usually from hundreds of miles away. Now that human-induced climate change is an accepted reality, we urgently need to find ways to reduce our carbon footprint. Building with less-processed nat-

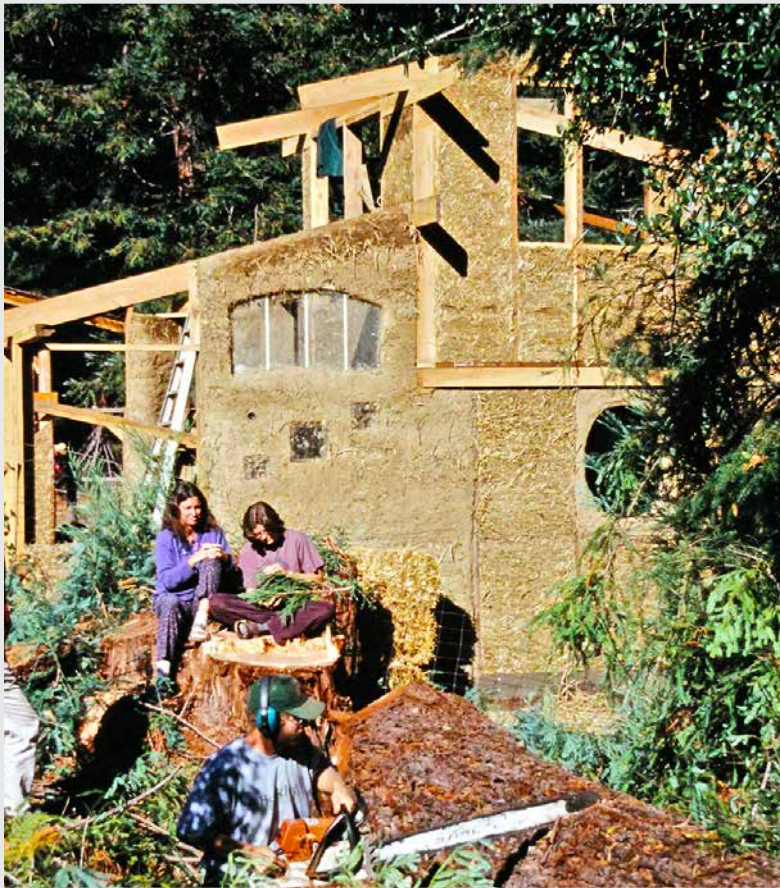


FIGURE 1.2. Natural building offers the best environmental advantages when on-site materials are used as much as possible. At Emerald Earth Sanctuary in California all lumber for construction is harvested on the land, often within sight of the building project. This allows residents to micromanage the forest for health and productivity and also to increase solar gain for the buildings. [Credit: Michael G. Smith]

ural materials from close by our sites is an important step in the right direction.

In some cases, we can choose to build with materials that are the by-products of other industries and would otherwise create a disposal problem. Until the end of the 20th century, nearly all the straw produced in California—enough to build tens of thousands of family homes every year—was burned in the fields. But clean-air legislation passed in the early 1990s has outlawed that practice. Faced with the problem of what to do with all the straw that they can no longer burn, California rice growers supported legitimizing straw bale building, with the result that in 1996 California became the second state to adopt a straw bale building code.

It's impossible to build a house with no environmental impact, but it's our responsibility to minimize and localize the damage. Many of us religiously protect the trees on our property, then go to the lumberyard to purchase the products of wholesale clear-cutting. If we choose to build with wood, it seems less hypocritical to take down a few select trees near our home sites and run them through a small portable mill, or to thin overcrowded woodlands of small-diameter poles and build

with those. Digging a hole in your yard for clay to make a cob house may look ugly at first, but it's a lot less ugly than strip mines, giant factories and superhighways.

Nature has an enormous capacity for healing small wounds—and that hole in your yard can be turned into a frog pond that supports many kinds of animals and plants. Building with natural, local materials also reduces our dependence on the polluting and energy-intensive manufacturing and transport industries. When our environmental footprint is

under our very noses, it helps ensure that we will minimize its impact. Since we see and walk through our local ecosystems every day, we are more likely to protect their health.

Human Health

Some of the most fervent supporters of natural building are people with acquired chemical sensitivities and other environmental illnesses. These people are particularly aware of how modern buildings can make us sick, but we all know it. In 1984, a World



FIGURE 1.3. At the Permaculture Institute of Northern California, designers pride themselves on “closing loops”—filling needs with local resources while minimizing waste and environmental impacts. For example, the clay for this cob and straw-clay hybrid office was dug from a hole (right front) that later served as a duck pond and part of the site’s greywater recycling and rainwater collection system. [Credit: Michael G. Smith]

Health Organization report found that, globally, 30 percent of new and remodeled buildings led to health complaints. These problems result from inadequate ventilation, mold and volatile organic compounds (VOCs) released from formaldehyde-based adhesives, carpets, paints and manufactured wood products.

Other industrial materials like fiberglass, plastics and insulating foams have a larger impact on the

health of factory employees and construction workers. Natural materials like stone, wood, straw and earth, on the other hand, are not only non-toxic, they are life-enhancing. Clay, one of the most useful natural building materials, is also prized for its ability to manage moisture, absorb toxins and restore health. (It's also true that some people find straw irritating to their skin, and that inhaling fine particles of clay, straw or wood can cause respiratory illness, so use appropriate protection.)

There is increasing evidence that modern buildings can compromise our psychological and emotional health. Right angles, flat surfaces that are all one color and constant uniformity don't exist in the natural world where our ancestors evolved. Most modern homes certainly don't stimulate our senses with the variety of patterns, shapes, textures, smells and sounds that our pre-industrial ancestors experienced. The uniformity of our environments may contribute to our addiction to sensory stimulation through drugs and electronic media.

In contrast, people seem to get a good feeling from natural buildings that is difficult to describe. Even though conditioned to prefer the new, the shiny and

the flawless, we respond at a deep level to unprocessed materials, to idiosyncrasy and to the personal care expressed in craftsmanship. Nearly all the natural buildings I have seen, regardless of the builders' level of expertise, are remarkably beautiful. When I lived in a hand-crafted cob house, I grew to expect the looks of mesmerized awe I saw on the faces of first-time visitors, and the difficulty they had prying themselves from the fire-warmed earthen bench when it was time for them to leave.

Empowerment

We grow up being told you can't build a house unless you're a professional builder. If we want a house, we have to work full-time at a job we often dislike to make enough money to pay a builder who may not like his or her job, either. But it doesn't have to be that way. By using local, unprocessed materials like earth and straw, building smaller than the conventional house and providing much of the labor yourself, you can create a home that is almost unbelievably affordable.

As the price tag drops from the hundreds of thousands to the tens of thousands or even a few thousands of dollars, it becomes easier to shrug off the yoke of



FIGURE 1.4. Natural building techniques allow people with minimal training to work together to build an inexpensive home. These systems often require a lot of labor but little cost in materials and tools. Here, workshop participants apply a base coat of clay plaster to a straw bale wall. [Credit: Catherine Wanek]

loans and mortgages. Save yourself money with a more efficient house that uses simple passive-solar technology for heating and cooling. You may find your cash needs dropping. You can cut down the hours you work and spend more time with the kids or grow a big vegetable garden that will save you even more money while increasing your happiness and health.

Techniques that rely on human labor and creativity produce a different social dynamic than those that depend on premanufactured building components, expensive machines and specialized skills. When you build with straw bales, cob or adobe, the whole family can get involved. A building site free of power tools is a safe and supportive environment for children to

learn valuable skills. Or invite your friends and neighbors for an old-fashioned barn-raising. Offer them food and an education in exchange for their time and energy. It's a good deal for everyone and a lot of fun. While building your home, you're also building a different kind of social structure where people depend upon themselves and each other—instead of on governments, corporations

RESOURCES

Books

- Chiras, Daniel. *The Natural House: A Complete Guide to Healthy, Energy-Efficient, Environmental Homes*, Chelsea Green, 2000. A homeowner's guide to a wide range of natural building systems, comparing the advantages and disadvantages of each. Contains excellent chapters on energy independence, sustainable water systems and site considerations.
- Elizabeth, Lynne and Cassandra Adams, eds. *Alternative Construction: Contemporary Natural Building Methods*, John Wiley and Sons, 2000. A thorough and scholarly treatment of the contemporary natural building revival, with good introductory material, as well as in-depth descriptions of specific techniques. Excellent bibliography and resource list.
- Snell, Clarke and Tim Callahan. *Building Green: A Complete How-To Guide to Alternative Building Methods*, Lark Books, 2nd Edition, 2009. Excellent practical overview of natural building for the owner-builder, with emphasis on straw bale, cob and cordwood. Amazing photos in full color throughout.

Periodicals

- The Last Straw: thelaststraw.org. This journal of straw bale and natural building, available in both print and electronic editions, features the latest technical developments and case studies from all over the world.

The website includes a comprehensive listing of workshops and events.

Videos

- *A Sampler of Alternative Homes: Approaching Sustainable Architecture*. Produced by Kelly Hart, Hartworks, Inc., 1998, 120 minutes. Available from hartworks.com. This two-hour video features a number of different natural building alternatives, including adobe, earthbags, Earthships, papercrete, rammed earth, straw bale and more.
- *Mud, Hands, a House (El barro, las manos, la casa)*, 2007, 116 minutes. A collaboration between Argentine natural builder/instructor Jorge Belanko and director Gustavo Marangoni, this well-organized, beautifully shot and professionally produced documentary starts with a convincing introduction to natural building and why it is important and moves on to clearly introduce nearly a dozen earth-building techniques. In Spanish with English subtitles. Available from handprintpress.com/mud-hands-a-house.

Organizations

- The Natural Building Network: nbnetwork.org. Membership organization for natural builders with links to websites and a calendar of events.

and professionals—to meet their basic needs.

From the many gatherings and collaborations of people in-

terested in natural building, a few things have become clear. One is that we are all working together. Even though we may have chosen

to focus on different techniques or aspects of natural building, we are all motivated by the same concerns, and our personal experience makes up part of a larger body of collective knowledge. Two, we are not alone. As word gets out to the greater public, we find enormous interest and support from a growing community of owner-builders, professional builders and designers, activists, educators, writers and conservationists.

And lastly, together we hold a great deal of power. The power in our ideas and collective action can influence the way our society thinks, talks and acts regarding building and resource use. We are helping to create a society where, someday, natural building will again be the norm in the United States, as it still is in some parts of the world, and where a new cob house with a thatched roof in any American town will draw only an appreciative nod.



FIGURE 1.5. What kind of world do we want to leave for our children? Natural building empowers children and youth to participate in the creation of their own homes and to envision a more healthy, creative and democratic future. [Credit: Michael G. Smith]