Introduction

Over the years we have had many requests for an up-to-date "How to Build an EcoNest" book. Since Robert first wrote the original *Mooseprints: A Holistic Home Building Guide* in 1992, our processes have evolved. More than 1,500 students have participated in an EcoNest Natural Building Workshop over the past 25 years, and each has made a contribution—left us "a $50 tip"—that has improved or streamlined the process of crafting a successful nest. Wall framing and stuffing, which once took three weeks is now accomplished with a workshop of 12 in just four days.

In Section II we will give you clear step-by-step, easy-to-follow instructions for building a successful Light Straw Clay (LSC) structure. We have a secret hope, however, that the content of this book will entice you to experience one of our workshops in person, because a workshop is an opportunity for you to bask in the camaraderie, dedication, and craftsmanship that magically develop in the good company of like-minded earth stewards with a passion for building a better future.

This is also a "*Why* to Build an EcoNest" book.

The era of green building is burgeoning. With cutting-edge technologies, ever-more efficient mechanicals, high-performance synthetic wall systems, super-insulating foams, stickier tapes and tighter vapor barriers, why on earth would we choose to build with earth…and straw, timbers, and stone? Why cling to a building system that uses natural, unadulterated materials when state-of-the-art lab-tested synthetic building products are so readily available and convenient?

Our answer lies in the fact that we have repeatedly witnessed something so profound that it has shaped and inspired us to embrace nature in our homes and dedicate our work to helping others do the same. For the past 25 years we have opened our door to countless strangers: building professionals, aspiring builders, eco-home seekers, soon-to-be homeowners, the chemically sensitive, and the curious. We have seen the transformation that occurs over and over again as these people discover, for the first time in their lives, just how good, how strangely familiar and right, a natural home feels. We have also experienced the ongoing enrichment that our nest has

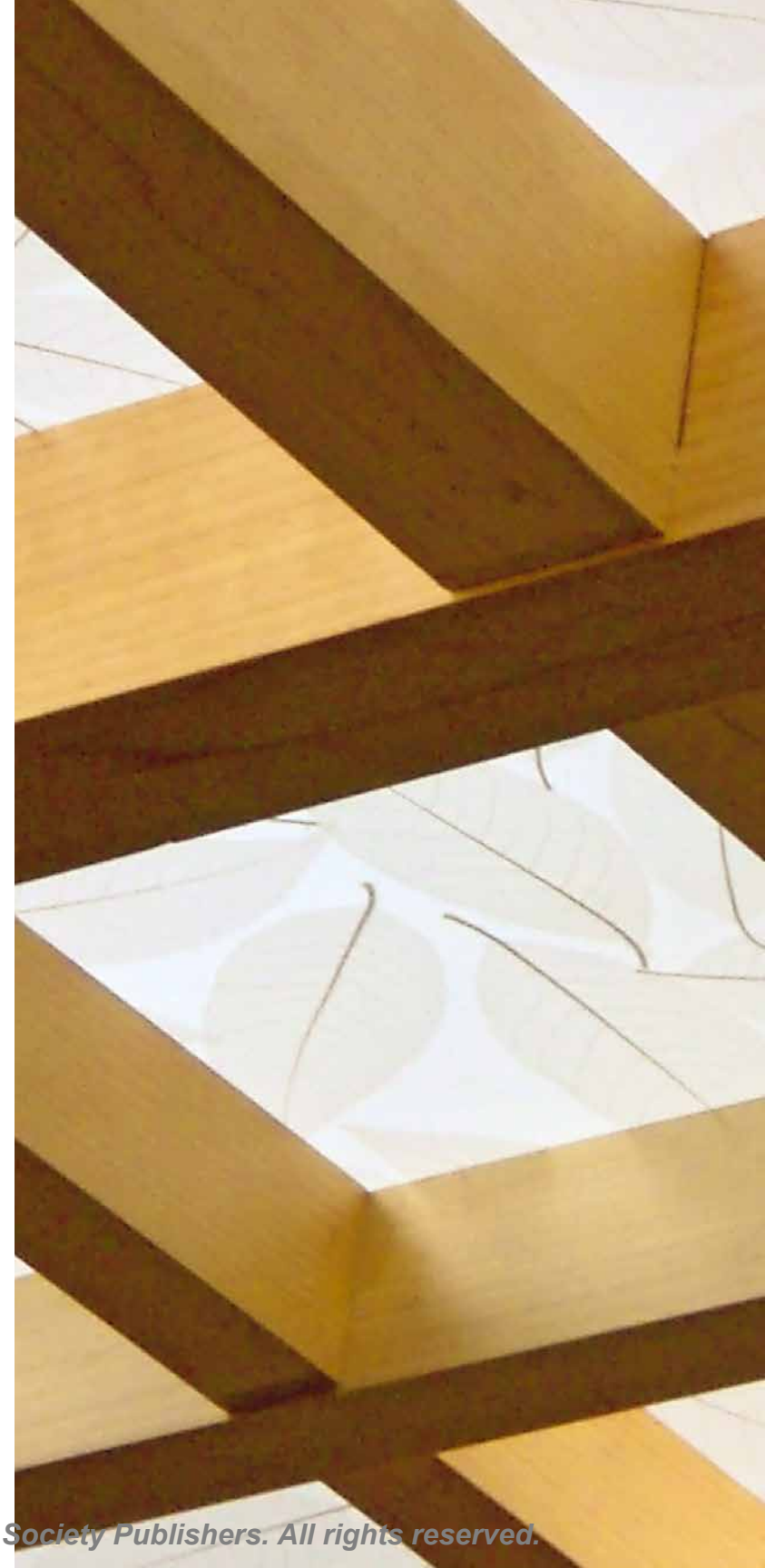
provided us in our own quest to be the best that we can be.

Unlike Europeans or Asians, who grow up in historic settings steeped in time-honored building traditions that are often crafted from nature, most North Americans have never had the opportunity to experience the timeless and nurturing quality of the natural home. All but forgotten, or never really understood, is the fact that we are *a part of nature*—the ultimate model of sustainability and ecological regeneration. When we build with nature's unadulterated materials and a deep understanding of her laws, we can build homes that nurture us and respect her. We call these *biological homes*.

Our mission is to make this kind of home a familiar and mainstream North American alternative to conventional mechanically dependent and petrochemically based construction.

SECTION 1

The EcoNest Philosophy



CREDIT: PAULA BAKER-LAPORTE

Chapter 1

Defining the Biological Home

Biological Food/Biological Home

If your interest in exploring a natural way of building has led you to this book, chances are that you already understand the benefits of investing in local organic food and grasp the relationship between our health and good ecological citizenship. Thinking this way about our shelters is less common but every bit as important for our own well-being and in our quest for a sustainable future.

The story of food and the story of shelter parallel one another. Both underwent a radical break from age-old regionally defined traditions in the post-war petro-chemical era. In the process, our health suffered and the environment suffered. By comparing conventional and natural food side by side with conventional and natural building, we hope to further clarify

why biological building benefits both the occupant and the environment.

For many years there has been a popular and successful movement in North America characterized by a return to natural or biological food. Many have made the informed decision to shun cheap "denatured" processed foods because of the costs—social, environmental, and health. We have witnessed a burgeoning of local farmers markets and community-supported agriculture throughout North America. When Michael Pollan, best-selling author of *The Omnivore's Dilemma* and *In Defense of Food*, was asked about the relationship between health and ecology with regards to food, he stated: "I discovered that

It has been estimated that it takes an average of 10 calories to produce 1 calorie of the Standard America Diet. Our grocery stores are full of food products that are neither healthy nor ecologically sound.

> *It has been our experience that the biological home fills most North Americans with awe and delight and most Europeans with a nostalgic longing for home.*

CREDIT: PATRICK OWEN

in most…cases the best ethical and environmental choices happen to be the best choices for our health." [*In Defense of Food: An Eater's Manifesto*, Penguin Press, New York, 2008, p. 2]

Remarkably, more than 40 years earlier, the founders of Building Biology made a parallel observation about the built environment stating: "There is almost always a direct correlation between the biological compatibility of a given [building] material and its ecological performance." In other words, environments that are deeply nurturing to human health, *by their very nature* excel in ecological performance.

Just as we have discovered that the soil sterilization and chemical fertilizers of factory farming are a very poor substitute for rich, living organic soils, Building Biology notes the failure of industrialized building technology to create vital environments with the synthetic materials and systems that are prevalent in conventional construction today.

Unfortunately, unlike food products, homes do not have labels revealing their ingredients or "nutritional value." If they did, a list far more disturbing than the fine print on a box of junk food would expose the use of carcinogens and neurotoxins. What goes into our homes in the way of chemical additives is virtually unregulated. The EPA lists more than 88,000 chemicals in common use today, and, to quote the Environmental Working Group: "As amazing as it may seem, there are no mandatory pre-market health testing

If homes had mandatory labels like food products do, then a list, far more disturbing than the fine print on a box of junk food, would expose the use of carcinogens and neurotoxins. We would be empowered to ask for better.

CREDIT: PAULA BAKER-LAPORTE

or approval requirements under any federal law for chemicals in cosmetics, toys, clothing, carpets or construction materials, to name just a few obvious sources of chemical exposure in everyday life."[1]

How has this affected us?

- There are an estimated 42.6 million Americans living with hay fever and/or asthma; 87 percent of American homeowners are not aware that pollution may be worse inside their homes than outdoors. [American Lung Association, healthhouse .org/iaq/facts.cfm]

- The rate of asthma doubled from 1980 to 1995 and has remained steady since then, at historically high levels. [cdc.gov/nchs /pressroom/06facts/asthma1980-2005 .htm (2006)]

- Of the 21.8 million people reported to have asthma in the US, approximately 4.6 million cases are estimated to be attributable to dampness and mold exposure in the home. [Berkeley Lab Research News, May 24, 2007, from Berkeley Lab and EPA joint study]

- The US Environmental Protection Agency reported that about one-third of people working in sealed buildings claimed to be sensitive to one or more common chemicals. [my.clevelandclinic.org/health /diseases_conditions/hic_Multiple_Chemical_Sensitivity_Fact_or_Fiction]

Reducing the toxins in the air of a home is a worthwhile goal. It will decrease the number of people, especially children, who suffer from building-related illness. However, absence of illness is not the same as radiant health; absence of toxics is only a first step toward creating a truly nurturing biological home.

Whenever we opt for locally crafted natural materials over the manufactured, denatured assemblage of products that go into the conventionally built home, there are beneficial repercussions for the health of the ecosystem, the health of the occupant, and those involved in all aspects of the construction of our homes.

Imagine a world in which we have regained what was thrown out with the bathwater of industrialization. Imagine a home built by a community of master craftsman to last for centuries. Imagine a home that requires little energy to operate comfortably while reinforcing the occupants' health and connection to nature. This is the promise of the natural building renaissance that we call *the biological home*.

The growing popularity of farmers markets and the authentic food movement is a testimonial to a realized need unmet by the factory farm and conventional food processing industry. While so many of us have rediscovered the value of local, unadulterated foods, why do North Americans so unwittingly settle for so much less in their homes? We look forward to the day when the housing market catches up to the farmers market.

Farmers markets thrive because consumers realize the value of fresh, organic, and local food.

CREDIT: PAULA BAKER-LAPORTE

CREDIT: ROBERT LAPORTE

The door to Dr. Anton Schneider, founding director of Institut fur Bau Biologie und Okologie in Neubeuern, Germany.

Building Biology: Nature as the Gold Standard for Health

We have coined the term *biological home* to describe a home that pays homage to the principles of Building Biology.

Both Robert and Paula, long before they met, were each on a journey of discovery. Paula was looking for ways to design healthier buildings, and Robert was looking for ways to build with natural materials. What they each found separately was the same holistic approach to the design and building of home called *Building Biology.* Building Biology is both a building philosophy and a science that originated in Germany in the early 1960s, as *Baubiologie.* At that time, long before building-related health problems were recognized or understood in North America, it was becoming alarmingly evident in Europe that a growing segment of their population was chronically unwell from being indoors in the mass-produced industrialized housing that went up post World War II. A multidisciplinary gathering of concerned citizens and professionals systematically compared newly constructed "sick buildings" with the solid, often earthen, pre-war building stock. What resulted was the first set of scientific standards for evaluating indoor environmental quality and 25 principles for building new homes, workplaces, and communities. Baubiologie founded the birth of the European healthy home movement.

The main focus of Building Biology is human health—and achieving deep ecology is a corollary of this. In other words, buildings that deeply nurture every aspect of human health in production, occupation, and post-habitation will also excel as models of sustainability.

Principles of Building Biology

We can sense when an environment feels good to us, but it is rare to find indoor environments where we feel the vitality we experience in nature. Why? Because the natural environment embodies a delicate balance of chemical, electrical, and biological energies that has sustained life through the millennia. Humans, along with all living things, thrive in natural

CREDIT: PETER MUSTY, CHARETTE CENTER

The Commons Co-housing, Santa Fe, NM. Dense planned community with landscaped pedestrian pathways give a feeling of being surrounded in nature even at 6+units/acre.

environments with fresh air, temperature variation, humidity range, a complexity of colors and shapes, and the subtle electrical pulse of the planet. The ideal role of our buildings is to shelter us from climatic extremes without sacrificing these life-nurturing qualities. In short, the natural environment *is* the gold standard for human health, *and* it's the ultimate model of sustainability. To the extent that our indoor environments measure up to the natural environment, they will nurture us.

There are 25 principles of Building Biology. Each is multi-faceted and worthy of many books. The sum total is a formula for built environments that promote profound health and ecological balance.

Here are those principles, arranged into the four main categories:

Site and Community Design

1. Verify that the site is free of naturally occurring health hazards.

2. Place dwellings so occupants are undisturbed by sources of man-made air, soil, water, noise, and electro pollution.

CREDIT: PAULA BAKER-LAPORTE

An LSC wall will sprout as it dries, demonstrating synergy to working with natural materials. The sprouts help the water to dry. Their roots bind.

3. Place dwellings in well-planned communities that provide ample access to fresh air, sunshine, and nature.

4. Plan homes and developments considering the needs of community, families, and individuals of all ages.

Occupant Health and Well-Being

5. Use natural and unadulterated building materials.

6. Allow natural self-regulation of indoor air humidity, using hygroscopic (humidity-buffering) building materials.

7. Assure low total moisture content and rapid desiccation of wet-construction processes in new buildings.

8. Design for a climatically appropriate balance between thermal insulation and thermal storage capacity.

9. Plan for climatically appropriate surface and air temperature.

10. Provide for ample ventilation.

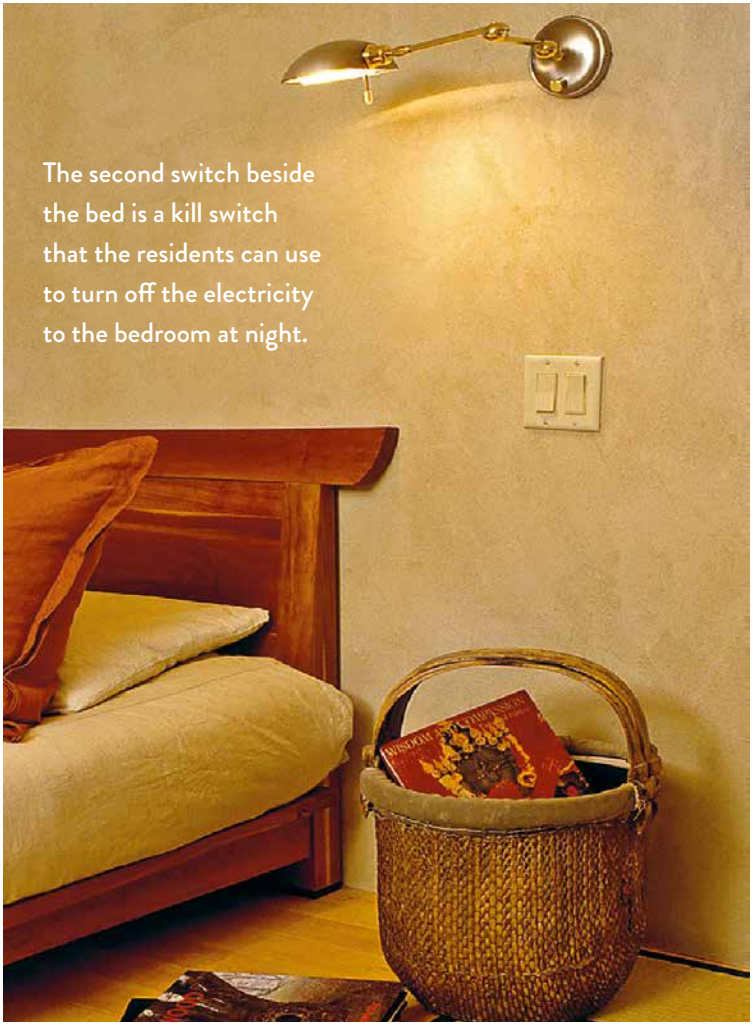
11. Use appropriate thermal radiation strategies for heating buildings, including passive solar wherever viable.

12. Provide an abundance of well-balanced natural light and illumination while using color in accordance with nature.

13. Provide adequate acoustical protection from harmful noise and vibration.

14. Utilize non-toxic building materials that have neutral or pleasant natural scents.

15. Use appropriate water- and moisture-exclusion techniques to prevent interior growth of fungi, bacteria, dust, and allergens.



The second switch beside the bed is a kill switch that the residents can use to turn off the electricity to the bedroom at night.

CREDIT: LAURIE DICKSON

CREDIT: ECONEST CO

Irreplaceable natural resource—the last remaining redwood forests. Building Biology asks us to consider the environmental consequences of our materials choices in building.

16. Assure best possible potable water quality by applying purification technologies, if necessary.

17. Utilize physiological and ergonomic knowledge in interior and furniture design.

18. Consider proportion, harmonic measure, order, and shape in design.

Natural and Man-Made Electro-Magnetic Radiation Safety

19. Minimize indoor interference with vital cosmic and terrestrial radiation.

20. Minimize man-made power system and radio-frequency radiation exposure generated from within the building and from outside sources.

21. Avoid use of building materials that have elevated radioactivity levels.

Environmental Protection, Social Responsibility, and Energy Efficiency

22. Construction materials production and building processes shall provide for health and social well-being in every phase of the building's life-cycle.

23. Avoid the use of building materials that deplete irreplaceable natural resources or that are harvested in an unsustainable manner.

24. Minimize energy consumption throughout the life of the building, utilizing climate-based and energy-efficient design, energy-and water-saving technologies, and renewable energy.

25. Consider the embodied energy and environmental life-cycle costs when choosing all materials used in construction.

When the 25 principles are applied, it has been our experience that the resulting biological home fills most North Americans with awe and delight—and most Europeans with a nostalgic longing for home.

Green Building and Our Health

In North America, our need to build healthier buildings is a more recent concern and has made some headway as a subsection of a green building movement. As awareness of human impact on planetary ecology grows, it has become increasingly evident that we need to consume less. North Americans are notorious for consuming far more than their share of the planet's resources, and the operation of our homes and workplaces are by some accounts the single most important focus for decreasing our impact. The green building movement has become a major force, with a multi-faceted focus on the ecological impact of our buildings, including the negative impact that conventional building has had on our health. Many people in the building industry have worked hard to come up with systems for assessing the "greenness" of a building. Health is one small

subcategory of the green building agenda, but to those who have become chronically ill from their living and work environments, a healthy environment is the single most important and most elusive thing they seek.

The green building movement has developed its own scorecards to evaluate success; there is almost always a section on these scorecards for "indoor environmental quality," which requires or rewards a dependable supply of fresh air and reductions in the use of toxic substances. But is this enough to lead to buildings that deeply nurture us? The main emphasis in the green building movement is to create more energy-efficient homes by making improvements to the light-frame construction techniques that are the product of a uniquely North American building industry. Unfortunately, a "green" home certification is not a guarantee that a home will support the optimal health of its occupants.

CREDIT: REINHARD KANUKA-FUCHS

Building Biology sees the building envelop as our third skin. You wouldn't let your child play in a plastic bag. Why house them in one?

While some of these Building Biology principles parallel and precede criteria used in various green building evaluations, others do not mesh well with our common building practices in North America and demand a re-examination of the core values of conventional light-frame construction. Understanding the Building Biology principles and the emphasis placed on vapor diffusion, safe electro-climate, inclusion of thermal mass, etc., gives insight as to why our light-frame methods of building are so fraught with problems that often lead to envelope degradation from moisture intrusion and (simultaneously) to occupant health issues. They also explain why biological buildings feel so comfortable and peaceful to be in.

The Third Skin Concept of Building Biology

Building Biology considers the envelope of a building to be analogous to our third skin, clothing being the second. Our own skin is our largest organ. This miraculous surface is our interface with the environment and is in constant interaction with it. Our skin is able to shapeshift—creating goosebumps when we are cold in order to form tiny pockets, trapping air for insulation. Skin is permeable, but on its

own terms. We can take a leisurely soak in the tub without gaining an ounce, yet when our bodies are too hot, we freely perspire to create evaporative cooling. Anyone who has seen the James Bond movie *Goldfinger* knows what happens when a body is completely covered with a non-permeable substance. In the case of Goldfinger's young and beautiful but unfortunate victim, it was a thorough seal of gold paint that was her demise. She died because her skin could no longer regulate her body temperature. We can thrive only when our skin is able to mediate conditions between the outer world and our inner metabolism.

Similarly our third skin, the walls of our home, must mediate between the indoor and outdoor climate. Here too permeability is directly related to longevity, and Building Biology advises us to build an interactive and permeable skin free of vapor barriers.