

ROCKY MOUNTAIN ECO-DWELLINGS: INTERSECTIONS OF NATURE, ART AND COMMUNITY

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Topic: Tectonic strategies in ecological and sustainable design

In the Rocky Mountains outside of Boulder, Colorado, small networked communities of innovative, ecologically and socially aware individuals are suggesting the framework for a re-conceptualized vision of the American Dream - one based on principles of sustainability, personal expression and community collaboration. The five case studies described in this paper are rooted in a desire to pay close attention to human impact and make a mark that fits. They empower the people who build them and strengthen the fabric of community. Each of these residences is as different as their makers, yet all share similar values, techniques and processes in terms of their construction and intended dialogue with the landscape. Detroit, Michigan is located in a radically different cultural and geographical context, but there are strategies taking place on a small, cooperatively-based local scale that can be adapted to conditions in physically ravaged inner city neighborhoods.

Sustainable construction

Sustainability is about the human footprint – how we mark the earth in our inhabitation of it. It is also about not using more than you need or creating more waste than the earth can digest. Sustainable construction has been defined as “the creation and responsible management of a healthy built environment based on resource efficient and ecological principles” (Kibert, 1994). Sustainable construction is about changing both the physical structures and the hearts and minds of the people that populate the built environment (Kibert, 2005). It addresses ecological, social, and economic issues of a building within its community and incorporates human habitation into a comprehensive living system.

To the people living in Jamestown, CO, sustainability is personal, incorporates human emotion, and is a lifestyle choice. Glen Kalen, a custom furniture maker, had been commuting to Boulder to work every day. For years he had been researching how to build and run a woodshop off the electrical grid and he felt lucky to find this property formerly owned by an 83-year-old woman who had lived there for twenty years. When Glen first moved up the mountain the 500 sq ft (46.5 sq meters) log cabin was surrounded by a dense forest of 150-year-old ponderosa pines. Only 10 months after his first shop was built the fire destroyed everything. Instead

of letting this break his spirit, Glen decided to use the natural fire ecology as a metaphor for his life and re-build himself—and his home—from the nutrient-rich ashes. To Glen, this was a personal reconstruction, and a means to create a physical environment that mirrored his philosophical beliefs. He lives a low-consumption lifestyle, builds furniture, and spends much of his time hiking in the mountains and playing music with friends. His goal was to build something healing – something



that would fit the land and contribute to its regeneration (Kalen, 2007).

Integration of Building & Site

One of the primary principles of sustainable construction is sustainable land use: “the ability of an ecosystem to maintain a defined / desired state of ecological integrity over time” (Balmori, 2007, p. 5). Passive design strategies that employ the building’s geometry, orientation, and mass to condition the structure, use natural features and climatic conditions to build a symbiotic relationship between architecture and landscape.

The Maddux House at Spring Gulch was the first to bring my attention to this small, but tightly networked and collaborative community of artist-builders. The pristine south-facing

property on the edge of protected Boulder County Open Space is tucked into a granite canyon with a mountain creek of pure drinkable water running through it.

The siting of the house begins a dialogue of response between human needs and the unique characteristics of the environment. This area of the country is known for its prevalent sunshine (on average 300 days a year) and extremely high winds (between 40-70 miles or 64-112 km per hour). In



order to block out cold and wind coming from the North, the house is tucked into the hillside with a three foot space between the north wall and the granite cliff.

No blasting was needed to accommodate the house – instead the house was designed to fit snugly into the hillside. Minimal grading was done with even cut and fill to build a level platform and bring the house out of the floodplain and to take maximum advantage of the southern exposure for passive solar gain and light. The 6-12 slope of the surrounding mountainscape has



been echoed in the 6-12 pitch of the roof – resulting in a harmonious feeling of “belonging.” The house is built as an integrated part of the mountain.

Oak Chezar and Joy Boston are artist / activists and direct a feminist performance troupe in Boulder called Vox Feminista. Neither of them possessed any building skills but both were committed to solar and alternative technologies and sustainable construction. They knew of several couples building with straw bale all during the same time period and were able to build their house from their friends’ leftover building materials. In order to create the least amount of disturbance on the steeply sloping hillside, the house was built



tall – a three-tiered stack of 22 x 22 foot (6.7 x 6.7 meter) boxes. This was intended to make the smallest possible footprint and achieve maximum solar gain from the southern exposure.

Recycled and Sustainably-Harvested Materials

Material selection and resource-conscious design is one of the central principles of sustainable construction (Kibert, 2005). In a consumer-based economy with an excess of manufactured materials, sustainability means taking time to find and reuse things that have been used before, not wasting precious resources to produce and transport new building materials. Residents of the Jamestown community utilized a variety of resource-conscious design strategies into their low-cost housing projects. These included the incorporation of straw bale construction, recycled building materials and green technologies. All the straw bales came from a nearby farmer in the San Louis Valley who was known for having the tightest, densest, most consistent-sized bales – compact enough to drive nails into and dense enough so they will not burn through. The smaller houses were built from bales leftover from the larger projects.

All five of the case studies use straw bale construction with either earth-based or concrete plaster finishes. It is the plaster element which transforms the tightly compacted straw bales into a formidable thermal mass providing optimal insulation that’s never too hot or too cold. This is in a climate which can range from over a 100 degrees Fahrenheit (38 degrees Celsius) in the summer to 20-below (- 29 degrees Celsius) in the winter. While non-renewable energy costs can be prohibitively expensive and environmentally destructive, in this region coming primarily from coal and nuclear power, straw bale construction takes minimal amounts of energy for heating and cooling.

Walls made of loose compacted straw coated with clay had been built for centuries in Europe and Asia, but it was the development of stationary horse-powered and steam-

powered balers in the late 1800s, that made it possible to compress straw into regular-sized units. Straw can be sculpted



and shaped into a variety of forms but for maximum efficiency in construction, everything must be designed around the 18" x 36" (45.7 x 91.4 cm) bale in 3, 6 and 9 ft (.91, 1.8 and 2.7 meter) dimensions.

For the foundation walls, a material called Rostra – made of 90% recycled Styrofoam and 10% cement was used rather than concrete. According to the 2005 National Construction Estimator, concrete costs over \$100 to pour a 14 x 14 foot or 4 x 4 meter slab and causes 12% of current US CO2 emissions (Hanle 2005). Blue jeans and blown cellulose made from recycled newspapers were used as insulation for ceilings and walls. Materials were transported from as short a distance as possible and much of it came directly from the surrounding canyon. All the houses have solar-voltaic panels – which have been partially subsidized through CO state law – and are so well insulated that heating and cooling costs are minimal. Even in blizzard conditions and scorching heat, the interiors are always temperate.

Sixty percent of the Maddux house is made from recycled construction materials. All of the wood timbers – posts and



beams – were dead-standing ponderosa pine gathered from the nearby mountains by owners Rick and Naomi. The blue striations in the wood are actually the mark of pine beetles – the reason for the trees' death.

The two main supporting beams carved to resemble a pair of blue whales are both from a single 60 foot (18 meter) tree. The railing on the staircase is made of aspen and river birch – all hand selected from the surrounding forests. Other framing materials came from a reclaimed log cabin, an abandoned farmhouse, and Resource – the local building salvage yard. The dry stack stone foundation is constructed from loose



rock gathered on the mountain.

The roof is made up of concrete tiles obtained second-hand, which were leftover from their neighbors' straw bale construction. The corrugated blue metal used as siding was found in a heap on the side of the road. Lighting and plumbing fixtures, hardware and appliances were all reused. Even the components of the adobe plaster – the clay and lama excrement – were from local sources (Maddux, 2007).

Likewise, almost the entire structure of Oak and Joy's home is made from recycled materials. The giant circular window found at the Resource salvage yard set the tone for the design of the whole house. All the windows, doors, posts and beams are reused as are the appliances and the greenhouse. The straw, adobe, roofing and insulation materials were leftovers from friends' larger constructions. Most of the cost of the house was spent on hiring local skilled labor for the foundation, framing, roofing, road grading and plumbing (Boston & Chezar, 2007).

Glen and his wife JoAnna harvested all their framing timber from the burnt ponderosa pine on his property. They had to peel the logs twice because they were charred so badly. Dead-standing aspen – also from the property – were cut and milled for railings and stair treads. There is not as much recycled lumber used as in other case studies because the Kalens were racing against the approaching winter during a critical construction phase and recycled materials take time to track down and acquire (Kalen, 2007).

A fourth home in the area owned by Justine and Roman Sanchez – whose footprint is merely 200 sq ft (18.6 sq meters) – stands up to the harshest elements and stays warm, snug and remarkably quiet despite its diminutive stature. The house was designed by a female engineer who wanted to build a small low-income straw bale house as an experiment – something anyone would be able to do. It is a simple square with a rectangle roof – the easiest form to build.



The Sanchez House is a load-bearing straw bale construction as opposed to the more typical post and beam. Bales sit directly on top of the foundation – which uses considerably less lumber than if framed. The doors and window sills are all floating in straw. The only wood needed was for the floors and roof rafters. The main floor is made of sustainably harvested bamboo (Sanchez, 2007).

Green Technologies

As the political and environmental costs of fossil fuels become impossible to ignore, it has become imperative to find renewable sources of energy for heating, lighting, electronics and machinery. Colorado has both sun and wind in great abundance and those who are connected to the electrical grid are given rebates for adding power to the system through solar-photovoltaic panels and wind turbines.

The dirt road up to Glen's house is narrow and rocky and hugs the side of a very steep cliff – so materials had to be off-loaded onto smaller trucks before they could be hauled up the mountain. Over 140 thousand pounds (63,503 kg) of materials had to be moved by hand. The top priority in this project has been minimal energy consumption. A two-kilowatt solar photovoltaic panel with sixteen batteries runs all the shop machinery and provides heat and electricity. This will soon be augmented by a vertical access wind generator which spins horizontally and doesn't kill birds because it appears solid from every direction. It's also significantly quieter than typical wind turbines - only 5 decibels; the wind itself is actually louder.

Oak and Joy's home also runs on active and passive solar energy. But there is no running water and they are acutely aware of what it feels like carrying a gallon (3.8 liters) of water up the mountain from the nearest creek. They catch rainwater in barrels and, as a general rule, use water three times before feeding it to the garden. They are looking into grey water

systems but these are currently illegal because of the difficulty in regulating them. By consuming less resources and living off the grid Oak and Joy are not obligated to work within the system. Together they make between \$12 and \$14,000 a year – what is considered to be well below the poverty line – and they still manage to save money.

Community Participation

One of the key components to the Jamestown community's interpretation of sustainable construction is community participation. Straw and plaster are time-consuming, labor-intensive undertakings. Machinery and the fuel needed to run it is minimal. The plastering techniques are so simple that children can be taught to do them. However considerable human labor is needed – it is impossible for a few rugged individuals to do it for themselves. The only way this type of construction can be accomplished by low-income households, is with what Americans call a “good old-fashioned barn raising”. Sustainability refers to a system that is local – having a mutually supportive community within an easily accessible distance. Sharing tools, knowledge, skills and resources helps form a collaborative network whose combined experience benefits the whole. Physically building each others homes creates an investment in place which goes beyond mere social connections to establishing a true sense of belonging. People feel intrinsically part of each others' worlds. They have put themselves in the stone and straw and clay and lama excrement and now they feel a part of it. There's a little bit of everyone in every house. In Oak's words, “It is a tribal effort” (Chezar, 2007).

The fifth case study, the home of Cindy and Norman Skarstad is a formally ambitious structure just up the ridge from Rick and Naomi. The Skarstads had been researching straw bale housing for years and when this old 1870s mill site came up for sale, they felt it was a great opportunity to take their skills and build something enduring which would fit in with the mountain landscape. They wanted a round house to echo the vernacular architecture of the indigenous people so it was designed to resemble a very large yurt.



The outer bales were shaved to make the nine-sided structure look round from the outside, a form particularly resistant to high winds as well as earthquakes. The big open central room was intended for parties and social gatherings. With the furniture pushed back – the floor was made for dancing, intentionally designed as a space for community celebration and ritual (Skarstad, 2007).

Personal Expression and Creative Dialogue

Finally, the role of personal expression and creative dialogue is intrinsic to this community's understanding of sustainable construction. The ability to shape one's physical surroundings and to structure them according to unique needs and personal visions is incredibly empowering. It infuses a dwelling with the spirit of its inhabitants.

What Oak and Joy lacked in building skills, they made up for in art. Cob and adobe allow sensuous forms and elements to emerge – the whole house is a living creation.



Because earth-based plasters need to be renewed and maintained, the surface can be changed, re-ornamented and remolded over time and made to express the personal and creative lives of its inhabitants. Oak and Joy's house goes behind the concept of dwelling to a dynamic expression of inhabitation. The house itself inhabits the landscape and becomes a part of its ecological fabric.

Both Rick and Naomi believe that natural materials embody their own art and their creative process revolves around accentuating the beauty that already exists in these elements. Rick, a carpenter by trade put many of his signature forms into the custom woodwork and metal fixtures. Seeing every step along the way as an opportunity to do something "artistic" Naomi taught herself stained glass techniques in order to make her own windows (Maddux, 2007). The house is the transitional edge where human creativity and the physical environment meet.

Detroit: Re-making the Motor City

Detroit, Michigan, perhaps more than anywhere, illustrates the devastating effects of deindustrialization on a city formatted to fit around the automobile. In the late 19th century, Detroit was a thriving metropolis at a critical juncture between the Great Lakes. The great irony is that what became the

automobile capital of the world started out as a paradise for cyclists. In 1890 bicycles were as thick in the streets as cars at rush hour in Los Angeles today with 80% of the population getting around on bikes. It was the bicycle and carriage shops, but especially the excellent paved roads – lobbied for by cyclists - that made Detroit an attractive location to develop and test automobiles (Baulch, 2007).

When the American auto industry fell into economic decline, Detroit went with it. The deindustrialization of the city led to financial disinvestment and the so-called White Flight to the suburbs. Devastating socio-economic conditions intensified by racial conflict and social inequity led to the Riots of 1967 from which the city has never recovered. Among the primary reasons stated for the riots based on interviews with neighborhood residents, were the lack of affordable housing and the way urban renewal projects had torn through vital neighborhood fabric. In Detroit sustainability is an issue of personal investment and empowerment. The citizens need to rebuild the city for themselves on a much different scale than it has previously existed.

According to 2005 United States' Census figures, Detroit's Heidelberg Community is the most economically depressed neighborhood in the entire country with a 75% unemployment rate and 90% living below the poverty line. Once home to more than 300 African-American owned businesses, this area was virtually destroyed by the riots. In 1986 artist Tyree Guyton began cleaning up vacant, burned out and abandoned lots and using the garbage he collected to transform the street into a massive environmental artwork.



There is a psychological resonance between these discarded objects and discarded communities and people. Their evolution from garbage to art inspires hope and vision to rebuild the neighborhood from within. The Heidelberg Project has empowered neighborhood residents to believe that they themselves can rebuild the structure and fabric

of their own communities and create a way of living that is economically viable and culturally nourishing. Personal artistic expression is a catalyst for re-framing community identity and reversing neighborhood decline.



In a city ranked the 2nd most dangerous in the US (Morgan, 2006), there have been no crimes reported on Heidelberg Street in the twenty-one years that the Project has been in existence. The ultimate goal of the Heidelberg Project is to transform this neighborhood into a cultural village – what they are calling their own “Ghetto Guggenheim” – with community renovations of decaying houses and the conversion of abandoned lots to urban agriculture and art gardens.

The incorporation of green building practices including straw bale construction and alternative energy technologies such as vertical access wind turbines and solar photo-voltaics, would not only contribute to physical durability and energy efficiency, but they also provide an ideal medium for personal artistic expression and community collaboration. Construction skills such as framing, roofing, plumbing and electrical wiring could be provided by local businesses and taught to younger generations through apprenticeship programs. Residents could then offer these skills to neighboring communities as a marketable trade.

The swaths of vacant and abandoned lots running throughout the inner city provide a unique opportunity for a networked system of open space which can cut across the limiting boundaries of the oversized traffic grid and serve as bicycle and pedestrian links to the river, downtown and neighborhood mixed-use commercial areas. Re-weaving the urban fabric in this particular context means forming tighter structural relationships between housing, commercial activity and the physical environment.

Although the native ecosystems were stripped of natural resources such as wood and stone in the early 1800s, Detroit is virtually one big salvage yard of abandoned buildings – valuable construction materials that can be reused in housing and commercial structures. Straw bales and earth-based plasters can easily be procured in nearby rural parts of the state.

Urban eco-dwellings can be a model for an alternative, culturally nourishing community independent of the global marketplace and corporate economies and focused instead on the art of living. If the neighborhoods of Detroit are to re-build themselves from the ashes of the riots, this type of sustainable construction which incorporates community participation, personal expression and social ritual is essential to creating a real sense of place and belonging – to getting people to invest in each other as they invest in their neighborhood and the future.

The communal act of adobe plastering could become a social ritual of working together and celebration. The techniques are so simple they can be taught to grade school children who would be encouraged to leave their personal marks and imprints in the walls they have helped to form. In this way investment in the community could be literally embedded in the fabric of the urban environment. The future of Detroit cannot be determined by outside economic forces if it is to survive; it must be remade from within. The unique spirit of the people combined with the physical realities of the landscape will contribute to a way of life that is custom-made – not mass produced – and authentically sustainable for the lives of its inhabitants.

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