The Power of Sustainability in Old Architecture of West South Saudi Arabia & Yemen

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Abstract: Spirit of place is the power that is manifested in sacred space. People who enter the space, and are aware of the spirit, experience it in various ways: often as healing, meaning, transformation, strength, or connectedness with nature; though sometimes as threat, risk, or ordeal. That some places are different from others in very special respects was evident to our earliest human ancestors; indeed many of our non-human evolutionary progenitors; sensed it, too. To understand how early humans responded to place, one can remember the deep caver chambers of Altamira and Lascaux, where Cro-Magnon hunters let the shapes of the walls suggest the sacred animal forms they painted there, or the earlier cave of basua where Neanderthals found a zoomorphic stalagmite that became the body of a bear in their shamanic ceremonies, a cave has numinosity; it resembles the womb of Mother Earth, and the space inside is sacred. Symbolically, what is placed as a seed within, whether it is an enactment of hunting, a call for healing, the transformative ritual of initiation, or the burial of a dead relative in the fetal position, will come to birth or rebirth in the outer world. A cave is a place of power a place of spirit. Environmental issues are finally at the forefront, guiding our lives and choices in new and sustainable directions. Fighting the urge to consume without thought of the consequences is a struggle, but one that increasing numbers of people are finding is necessary. Changing to green makes sense from both economic and personal points of view. Perhaps you're inspired by champions who give voice to the issues, like celebrities and activists, or real people making changes in their communities, you can take their stories and begin to make them your own. Nowadays the world become aware and more environmentally savvy and demand ecological choices, a new generation of architects and builders is emerging, intent on creating warm and inviting homes that cause only a fraction of the environmental impact of conventional building methods. The New Ecological Home provides an overview of green building techniques, materials, products and technologies that are either currently available or promise to be in the near future. There are too many research works around the world on green building materials, earth-sheltered architecture, passive solar heating and cooling, sustainable approaches to water and waste, energy efficiency, and environmental landscaping. The result sets the record straight on the vast potential for passive heating and cooling and provides a resource guide, recommendations, and a green-building checklist. And provide a wealth of up-to-date, practical information for homebuyers, owner-builders, and anyone interested in building for a sustainable future. As one of those architects interested in designing building for a sustainable future, I found here in West south Saudi Arabia & Yemen an open museum for huge numbers of buildings in very vast residential areas, this absolutely groundbreaking example doesn't just talk about eco-friendly building techniques, but actually *shows* every step! More than thousands close-up photographs, along with in-depth descriptions, follow the real construction of an alternative house from site selection to the addition of final-touch interior details. These research papers provide thorough discussions of the fundamental concepts of construction, substitutes for conventional approaches, and planning a home that's not only comfortable and beautiful, but environmentally responsible. **And finally answering the question are those building realize the sustainability of architecture?** Before the world crises of energy, pollution, weather changes, modern researches by hundreds of years.

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1- Problem statement

We have here an old human settlement in residential villages in west south Saudi Arabia & Yemen built by Spontaneous and soul craft according to their needs, weather and avilable natural materials. Cool in summer, warm in winter; These conventional building and methods... Can we take their stories and begin to reconsider them for our own? Are those considered sustainable buildings and eco-friendly houses for today?

2- Introduction:-

While there are perhaps many ways to define a green home for the purposes of this paper I define a

green home as one that meets at least a few of the following criteria[7]

1. Made with generally non-toxic building materials.
2. Energy efficient - a generally tight house with energy efficient appliances and windows and HVAC and ventilation systems.
3. Solar home - derives most of its space and water heating from the sun.
4. Recycled content materials.
5. Resource efficient materials.
6. Materials from renewable resources.
7. Sensitive to its neighbors and context.
8. Use of locally manufactured building materials.

While people with environmental sensitivities differ greatly, and their needs vary wildly, generally, a healthy home has been built or remodeled with low or non-toxic materials. In addition they specially designed ventilation, filtration, and HVAC systems. Often older homes, which have not been remodeled recently, are a good beginning for a healthy home, because previously toxic materials have out gassed most or all unhealthy constituents.

Healthy Home as one that meets at least a few of the following criteria: [5]

1. Made or remodeled with generally non-toxic building materials.
2. No pesticide use in or around the home - this is essential.
3. Home is maintained with non-toxic cleaning supplies - this is essential.
4. HVAC, ventilation and filtration systems - designed for optimum health.

To achieve our goals and testing those building and their urban setting I have to applying sustainable and green building criteria on the above architecture. There are more than ten sustainable architecture criteria to examine the selected architecture to see if it meets those criteria or not:

2-1-Small is enough & beautiful.

The trend lately has been toward huge mansion-style houses. While these might fit the egos of those who purchase them, they don't fit with a sustainable life style. Large houses generally use a tremendous amount of energy to heat and cool. This energy usually comes from the combustion of fossil fuels, depleting these resources and emitting greenhouse gases and pollutants into the air. Also, the larger the house, the more materials go into its construction; materials which may have their own environmental consequences. A home should be just the right size for its occupants and their activities. The key to this is efficient use of space, good organization, and keeping possessions to a manageable level.

As we see the building is well scaled to fit the need for its residence in a beautiful and comfortable manner

2-2- Heat naturally with the sun.

Nothing can be more comfortable for body and mind than living in a good solar-heated house. I say "good", because proper design is crucial to the comfort of such a house. Good passive solar design will provide just enough sunlight into the rooms to be absorbed by the surrounding thermal mass (usually masonry materials), so that the heat will be given back into the room when the sun goes down. The thermal mass is a kind of "heat battery" that stores the warmth, absorbing it to keep the room from getting too hot during the day. Equally important to thermal mass is insulation (such as straw bales or crushed volcanic rock) that will keep that heat inside. Thermal mass materials need to be insulated from the outside, or else they will just bleed that warmth right back out. A rock house might have tons of mass, but be uncomfortably cold because of this energy bleed. So a good solar design will utilize materials of the right type in the right places, blending thermal dynamics with utilitarian design.

2-3-Use natural non toxic materials.

Again, naturally occurring materials often "feel" better to live with. When you step onto an adobe floor, for instance, you feel the resilient mother earth beneath your feet. A major reason for choosing natural materials over industrial ones is that the pollution often associated with their manufacture is minimized. For every ton of Portland cement that is manufactured, an equal amount of carbon dioxide is released into the air. And then there is the matter of your health; natural materials are much less likely to adversely affect your health.

2-4- Use locally available materials.

There are several benefits to using local, indigenous materials. For one, they naturally fit into the "feeling" of the place. For another, they don't burn as much fossil fuel to transport them, and they are likely to be less processed by industry. An example of building materials found in West south Saudi Arabia & Yemen Would be rocks, sand, adobe and scoria (crushed volcanic rock).

2-5- Recycled content materials.

If the materials already exist, we might as well use them, because by doing so we are not promoting the creation of more of them. We might also be keeping them out of the landfill, or keeping them from being transported for further processing. Stone, timber joist that is kept dry does not degrade much, nor does glass. All kinds of things can be used in another house.

2-6- Build to last.

There is an attitude in this throw-away society that an old house might as well be replaced by a new one. Unfortunately this is often true, because of shoddy construction or poor choice of materials, or lack of maintenance. A well made house can last for centuries, and it should. Moisture getting into a

building can lead to ruin, and it is hard to avoid this, whether from the outside environment or from condensation from within. For this reason I am partial to the use of materials that are not degraded by moisture.

2-7- Keep your cool.

As I suggested above, a well designed solar house is both warm when you want it, and cool when you want it; that is to say, the temperature tends to stay fairly even. A good way to keep your cool is to dig into the earth. If you dig about six feet into the earth, you will find that the temperature there varies by only a few degrees year round. While this temperature (about 50-55 degrees F.) might be too cool for general living comfort, you can use the stability of the earth's temperature to moderate the thermal fluctuations of the house. If you dig into a south-facing hillside to build, or berm the north part of the house with soil, you can take advantage of this. The part of the house that is underground needs to be well insulated, or the earth will continually suck warmth out of the house.

2-8-Save the forests.

Unlike houses in the Pacific Northwest, I can attest to the appalling degradation of national and private forests. While wood is ostensibly a renewable resource, they have gone way beyond sustainable harvesting and have ruined enormous ecosystems. Use wood as decoration. Cull dead trees for structural supports. Use masonry, straw bales, papercrete, cob, adobe, rocks, bags of volcanic rock, etc., instead of wood. Unfortunately it is difficult to get away from lumber in making a roof, so consider making a dome from materials that can be stacked. Domes are also more energy efficient and use less material for the same space as a box. A conventional stone & flat roof house only diminishes the amount of wood used by about 30%!

2-9- Share Facilities.

A basic tenet of sustainability is to share what you have with others. Doing this can diminish the need for unnecessary duplication of facilities. In this way a group of people can not only have fewer tools or appliances or functional areas, but at the same time they can have available a greater variety of these facilities. This benefits both the environment (through less industrial activity) and the individual (by providing more options for living.) all buildings in the study area living in group inside the single family houses the ground floor common for all and unmarried men in on floor and unmarried women in one floor and room for each married couple all sharing the facilities.

2-10-Materials efficiency.

Building materials typically considered to be 'green' include rapidly renewable plant materials like bamboo (because bamboo grows quickly) and straw, lumber from forests certified to be sustainably managed, ecology blocks, dimension stone, recycled stone, recycled metal, and other products that are non-toxic, reusable, renewable, and/or recyclable. Dimension stone is one of the most sustainable of the industrial minerals since it is created by separating it from the natural bedrock underlying all land on every continent .Dimension stone rates very well in terms of the criteria on the ASTM checklist for sustainability of building products: there are no toxic materials used in its processing, there are no direct greenhouse gas emissions during processing, the dust created is controlled, the water used is almost completely recycled (per OSHA/MSHA regulation), and it is a perpetual resource) virtually inexhaustible in a human time scale .(Dimension stone in use can last many generations, even centuries, so the dimension stone manufacturers haven't needed a product.

Recycling program. [13] However, there are practical qualifications to and constraints on that sustainability. It's clear from the picture that the main building material in the area is dimension stone it's clear also they used recycled stone from demolished building in most sustainable way by well designed powerful and beautiful architecture.

2-11- Water efficiency.

Reducing water consumption and protecting water quality are key objectives in sustainable building. One critical issue of water consumption is that in many areas of the country, the demands on the supplying aquifer exceed its ability to replenish itself. To the maximum extent feasible, facilities should increase their dependence on water that is collected, used, purified, and reused on-site. The protection and conservation of water throughout the life of a building may be accomplished by designing for dual plumbing that recycles water in toilet flushing. Waste-water may be minimized by utilizing it in agriculture irrigation that commonly exists in each residential area.

2-12- Indoor environmental quality enhancement.

The Indoor Environmental Quality (IEQ) category in LEED standards, one of the five environmental categories, was created to provide comfort, well-being, and productivity of occupants. The LEED IEQ category addresses design and construction guidelines especially: indoor air quality (IAQ), thermal quality, and lighting quality. [13]

Indoor Air Quality seeks to reduce volatile organic compounds, or VOC's, and other air impurities such as microbial contaminants. Buildings rely on a properly designed HVAC system to provide adequate ventilation and air filtration as well as isolate operations (kitchens, dry cleaners, etc.) from other occupancies. During the design and construction process choosing construction materials and interior

finish products with zero or low emissions will improve IAQ. Many building materials and cleaning/maintenance products emit toxic gases, such as VOC's and formaldehyde. These gases can have a detrimental impact on occupants' health and productivity as well. Avoiding these products will increase a building's IEQ.Personal temperature and airflow control over the HVAC system coupled with a properly designed building envelope will also aid in increasing a building's thermal quality. Creating a high performance luminous environment through the careful integration of natural and artificial light sources will improve on the lighting quality of a structure. [7][14]

2-13- Be energy efficient.[8]

There are many ways to conserve the use of fossil fuel. Reducing energy consumption in such types of building by having a standard natural indoor air quality and good thermal quality with adequate natural day lighting quality therefore these of buildings considered energy efficient houses which is an important factor in sustainable buildings for this rezone we have here a green architecture, environmental responsive buildings with high degree of sustainability.

2-14-Let nature cools your food.

In the old days people relied on pantries and root cellars to help keep produce and other provisions fresh. Ice boxes made way for refrigerators, which are obviously much more convenient, but somehow the use of cool pantries and root cellars also fell by the wayside. This is too bad because these spaces have functions that a refrigerator simply can't replace. Root cellars can store large quantities of produce from the time of harvest until the next summer. Cool pantries can store some produce, but also all manner of other foodstuffs and kitchen supplies can be kept there. Cool, dry storage is the best way to preserve most food. The cool of the earth can keep a totally thick walls pantry or root cellar cool; the night air can also be used to cool a storage room. The convenience and security of having ample provisions at your finger tips cannot be beat.

2-15- Grow your food.

From sustainability point of view that each residential cluster should have small agricultural area for dally needs of vegetables Herbs and salad greens which can be grown year round. What a pleasure! Saving transportation, pollution and people can get it fresh every day these green areas not only supplying residence with food products but also increasing healthy environment and beautiful view as well as providing open spaces between each group of building which is necessary for clean fresh air therefore the ventilation and filtration systems through these building - designed for optimum health.

2-16-Reducing environmental impact. [7]

Green building practices aim to reduce the environmental impact of buildings. Buildings account for a large amount of land use, energy and water consumption, and air and atmosphere alteration. Considering the statistics, reducing the amount of natural resources buildings consume and the amount of pollution given off is seen as crucial for future sustainability, according to EPA. The environmental impact of buildings is often underestimated, while the perceived costs of green buildings are overestimated.

On the aesthetic side of green architecture or sustainable design is the philosophy of designing a building that is in harmony with the natural features and resources surrounding the site. There are several key steps in designing sustainable buildings: specify 'green' building materials from local sources, reduce loads, optimize systems, and generate on-site renewable energy. [7]

Finally green building, also known as green construction or sustainable building, is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from sitting to design, construction, operation, maintenance, renovation, and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. [1]

Although new technologies are constantly being developed to complement current practices in creating greener structures, the common objective is that green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation[1]

A similar concept is natural building, which is usually on a smaller scale and tends to focus on the use of natural materials that are available locally. [2]

sustainable, green, eco-friendly and environmentally responsible architecture in west south Saudi Arabia and Yemen to my delight all of them worked very well with all buildings and we found ourselves in front of great sustainable healthy architecture for people and environment these discoveries and realization should led us learn very well the stories of these architecture and use them to set out the principles and guidelines for planning and construction sustainable buildings its more advanced than modern searches and the results are significant and real case studies in real field as an architect we

encourage all architects, builders, home owners in west south Saudi Arabia &Yemen to built all their homes and building by the same way.

3- Conclusion and Recommendation:

Shelter like many elements of human existence, comes at an extraordinary cost to our planet and its inhabitants. Nearly 60 percent of all timber cut in the United States is used to build 1.2 million new houses per year. Construction wastes—and the staggering amounts of electricity, water, and nonrenewable produces consumed in the day-to-day operation of the "modern" household—add to this massive drain on Earth's natural resource base. In addition to environmental costs, there are personal economic costs—the thousands of dollars homeowners spend each year to heat, cool, and power their homes. Today, a new generation of architects and builders is emerging, intent on constructing homes that cause a fraction of the environmental impact of conventional housing. Green building not only helps heal the planet, but also meets human needs more fully than standard building practices, creating healthier, less costly, more beautiful living spaces. *The New Ecological Home* contains a wealth of up-to-date, practical information on green building techniques, materials, products, and technologies, including:

1- Energy-efficient design.
2- Wood-wise construction.
3- Passive solar heating and cooling.
4- Earth-sheltered architecture.
5- Environmental landscaping.
6- Nontoxic and natural building materials.

Architecture in west south Saudi Arabia and Yemen Provides an invaluable resource for architects home buyers, owner-builders, and anyone interested in building for a sustainable future with complete guidelines how to chose designs for their sustainable, green, Ecological Homes to conserve their area and help to conserve the world.

Our recommendation for each of Saudi Arabia & Yemen is to establish : **National Office of Community Development and Environmental Protection** to organize and supervise all planning departments which control the processing of building industry by giving authorized Built Green Communities Checklist for new and restoration of buildings to ensure they flowing the same types of existing architecture which we prove that all the old buildings in the their communities not only environmentally responsive and eco-friendly green and healthy but also beautiful, comfortable, economical very suitable for future sustainability and world protection for human and all living species around us.

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Appendix

Figure1: above old houses in the foreground near Al Baha Saudi Arabia. (21)

Figure 2: left Thy Aein village. Al Baha KSA old stone houses. (21)

Figure 3- one small building for each family-saana-Yemen. (21)

Figure 4 – the spaces inside comfortable, suitable and economical. (21)

Figure 5: all the building well oriented to the sun and plastered from inside by sand, adobe and scoria (crushed volcanic rock) they are good insulation materials keep the heat inside and make the stone wall very suitable thermal mass . (21)

Figure 6: all buildings from natural stone non toxic material. (21)

Figure 7: non manufactured local materials minimizing pollution and exit with enough amounts in our area. [21]

Figure 8: dry stacked stone can be used to built anther building after demolishing. [21]

Figure 9: the use of materials that are not degraded by moisture. Stand in good condition a well made house can last for centuries. [21]

Figure 10: they keep lower level well connected to the earth and have good ventilation it's always cool & comfortable. [21]

Figure 11: minim use of wood only for ceiling and walls support elements decoration from stone to save forests . [21]

Figure 12: besides sharing the internal facilities inside the building by the family members in all floors the community also creates a common entertainment facilities sharing by all the building around. [21]

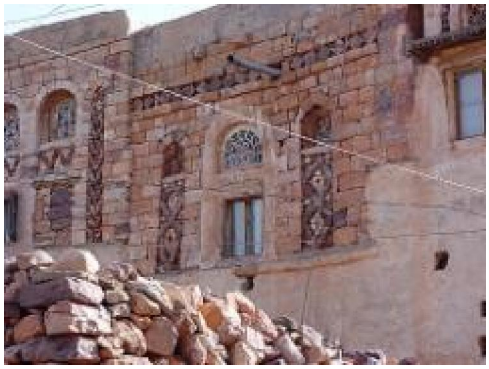

Figure 13: all the buildings in the selected area are from natural dimension stone including decoration and architectural details. [21]

Figure 15: in most building there is underground water well supply the family by drinking water and sharing the water between two buildings or more for the same families are common by high sustainability way . [21]

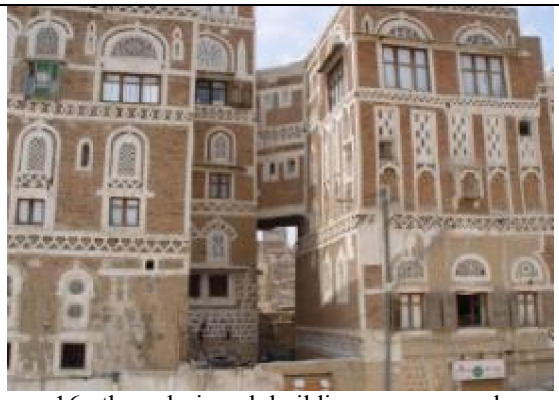

Figure 16: they designed building masses, volumes and orientations as well as the opening to ensure maximum cross ventilation also the kitchens and service rooms located on the top for good indoor air quality. [21]

Figure 17: openings studied very well to get maximum ventilation and good quality for indoor air, thermal and lighting quality. [21]

Figure 18: indoor construction materials and interior finish products natural with zero or low emissions will improve IAQ with inside opining. [21]

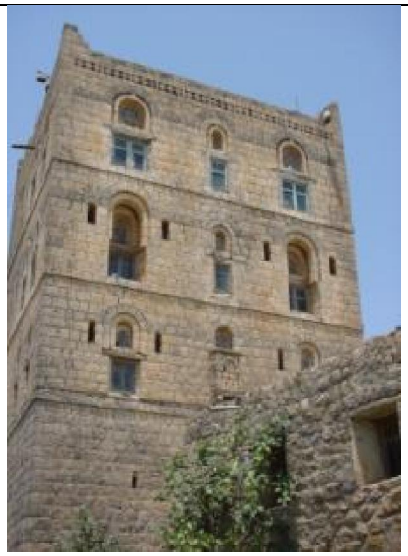

Figure 19: the lower floor of the building solid thick walls with very small opening for ventilation as natural pantries and root cellars to help keep produce and other provisions fresh. [21]

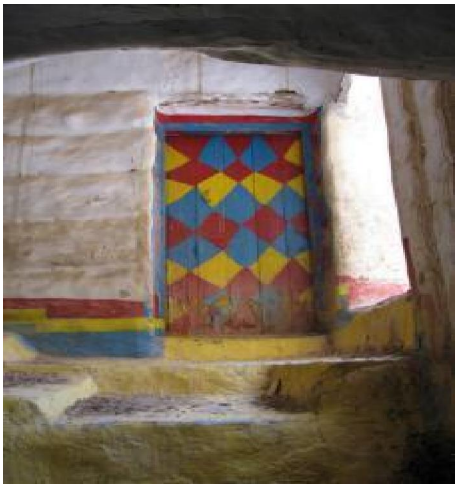

Figure 20: the entrance to food products stores in the building showing its walls and floors keeping them naturally cool all around the year without any energy consumption. [21]

Figure 21: the green areas between buildings. [21]

Figure 22: the green areas between buildings. [21]

Figure 23: almost all the buildings are harmony with natural features and resources surrounding the site. [21]

Figure 24: the aesthetic side by local materials in wonderful architecture elements. [21]

Figure: 25 up and Left almost all the buildings are harmony with each other using surrounding natural materials specify 'green' building materials from local sources. [21]

Figure: 26 open spaces are designed to reduce the overall impact of the built environment on human health. (21)

Figure: 27 open spaces not only for human health but also to produce food stuff for surrounding buildings occupants in very sustainable manner. (21)

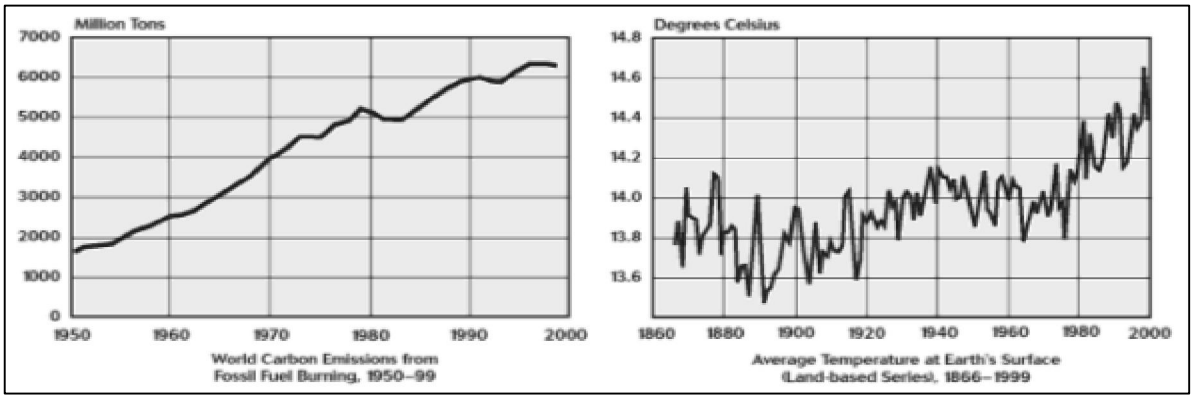

Figure 28: Rising fossil fuel use over the past 100 years has increased carbon dioxide levels In the atmosphere by around 30 percent and resulted In a small but significant Increase In average global temperature (global warming) that is having dramatic and costly Impacts on our climate, our lives, our economy, and the lives of millions of species that share this planet with us. (Source: World watch Institute)

Figure 29: eco friendly beautiful environmentally buildings in Yemen. (21)