

# **THRESHOLDS TO THE HEARTH: Living With the Natural Environment**

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## **INTRODUCTION**

Henry David Thoreau wrote in Walden, "I went to the woods because I wished to live deliberately, to front only the essential facts of life, and see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived."

My belief is that humankind's psyche and soul are closely tied to the natural environment, and that relationship must be nurtured for a fruitful and holistic existence on this planet. Architecture can aid in providing this relationship.

## **NATURE'S DEVELOPMENT**

This planet, early in its life, was a very hostile place with caustic fumes and toxic ultraviolet rays of the sun. The first life on this planet was probably anaerobic bacteria existing without oxygen. It was in the oceans, which make up three-quarters of the earth's surface, and with its great mass provides stable temperatures and alkalinity with a richness and constancy of chemical composition, where sunlight penetrates but protects against its harmful ultraviolet rays, that life emerged. Life started as simple as algae. Algae could not exist without the sun. The sun is our life force. But it is the plant world that has allowed life on this planet. Life is dependent on photosynthesis. It was the plants that colonized the earth. It is interesting how close the word plant and planet are to each other. This symbiotic relationship between plant and bacteria created a biosphere around the earth that permitted the evolution from the sea of amphibians, reptiles, mammals and man. In Lawrence Henderson's book The Fitness of the Environment he states that "Darwinian fitness is compounded by a mutual relationship between the organism and the environment. Of this, fitness of environment is quite as essential a component as the fitness which arises in the process of organic evolution; and in fundamental characteristics the actual environment is the fittest possible abode of life." And it is not the strongest that survive, but those that can adapt to the continual change in nature.

Nature is the arena of life. Knowledge of her process is indispensable for survival, and more so for existences, health, and delight. Hypocrites' famous

medical work was the first public recognition that man's life, in sickness and in health, is bound up with the forces of nature, and that nature, so far from being opposed and conquered, must rather be treated as an ally and friend, whose ways must be understood, and whose counsel must be respected.

### **EASTERN SOCIETY**

Ian McHarg talks about the traditional society (not necessarily the contemporary society we know today) of Japan in Design With Nature and their integral relationship with the natural environment. "In that culture there was sustained an agriculture at once incredibly productive and beautiful, testimony to an astonishing acuity to nature. This perception is reflected in a language rich in descriptive power in which the nuances of natural processes, the tilth of the soil, the dryness of wind, the burgeoning seed, are all precisely describable. The poetry of this culture is rich and succinct; the graphic arts reveal the landscape as the icon. Architecture, village and town buildings use natural materials directly with stirring power, but it is garden making that is the unequalled art form of this society. The garden is the metaphysical symbol of society in Tao, Shinto and Zen - man in nature."

### **WESTERN SOCIETY**

The oriental harmony of man-nature has been achieved at the expense of the individuality of man. The western assumption of superiority has been achieved at the expense of nature. The western attitude to nature is confirmed in Judaism where nature is to be conquered as the enemy. This attitude is not true for the native Americans - they were in the west before religious man made his presence known here.

### **NATIVE AMERICAN** (First Americans)

The American Indian, like the Orientals (and closely related), is another prime example of a societal fit between man and nature. The hunter and gatherer learned to adapt his take to the capacity of the crop and prey. In this evolution there must have developed a true understanding of creatures and their habitat, and plants and their environment. Hunting has to respond to an understanding of animal life, to breeding seasons, be protective of pregnant females, and cull the surplus males. This is a major step in human evolution.

### **Mississippian Mound Builders**

The debate over which came first, agriculture or settlement is answered at a remote site in northeast Louisiana - Poverty Point. The Poverty Point culture of the Mississippi Moundbuilders who lived there some 5 thousand years ago were hunters and gathers who had a true understanding of the natural environment. Because of this symbiotic relationship, they not only settled and built homes to live in, but built impressive mounds that signify a true community spirit. It is a real misnomer to call these people 'primitive'. They understood, appreciated,

and managed their natural environment to sustain a life style that outlasted most high cultures of this planet. The people of this so-called 'primitive society' could promise their children the inheritance of a physical environment at least as good as had been inherited - a claim few of us could make today. Life and knowledge have developed and become more sophisticated and complicated in the intervening centuries, but, whatever excuses we can concoct, it is clear that we cannot equal this claim.

### **Anasazi**

In Chaco Canyon, Bandolier and Mesa Verde are the ruined habitations of early Americans - the Anasazi, while at Zuni, Acoma and Taos they live today. Acoma is the oldest continuing living community in the Americas. These people built an abode that is truly inspirational. It was like they knew physics before it was developed as a science. At Chaco Canyon, the epicenter of this culture, they not only understood the yearly movement of the sun, but they also understood the movement of the moon which has an 18.6 years repetitive cycle.

This 'primitive' culture developed an architecture that reversed the daily and seasonal ambient temperatures. When it was hot outside the interior of their home was cool, and when it was cold outside the interior was warm. The high specific heat value of earth and/or stone and the thermal lag of heat transferred by conduction were understood. The structures were stepped on the south side to maximize the exposure to the sun, while the north side turned its back to the cold winds. They also had solar zoning in that the next adobe structure was placed at that distance where the winter solstice cast its shadow from the one in front as not to rob their neighbor of the much needed sun exposure to their abode.

It is obvious that these societies of the Americas knew and understood their natural environment, and lived as one with it. And because of this, their lives were richer. Not that they lived the life of luxury, but their life had meaning in that they were forced "to live deliberately". Their life fit into the patterns of the natural environment. And art was part of their everyday celebration of life.

### **COLONIAL LOUISIANA**

Another prime example of how to live more aligned with nature in a harsh hot and humid climate is how the French colonist in south Louisiana went through a climatic adaptation with their provincial architecture. They brought with them to the New World an architecture that their forefathers had developed over centuries for a colder climate in Europe. This worked well for their first colonial settlement on this continent in what is now Nova Scotia (New France -

L'Acadie), but when they built this same design in the lower Louisiana colony, it proved to be a disaster. They picked the buildings up off the ground, added porches around the exterior, provided higher ceilings, located more doors and transoms on the exterior walls, and other design elements that took maximum advantage of shading and ventilation. They adapted their architecture to the natural environment, once they understood it, for human comfort.

### **A CONTEMPORARY HOUSE IN SOUTH LOUISIANA**

Today we have new materials, new construction systems, and new technology to better climatically adapt our architecture to the natural environment. The crux of this situation is how to do it in a sustainable manner. The author designed and built a home for his family that would allow for a closer relationship with the natural environment.

#### **The Site**

This endeavor started with the purchase of an abused 5.5 acres of land. Because of the accumulated junk and trash on the site, the land was purchased at a very reasonable price. An architect friend, Malcolm Wells says “we should purchase ugly property and make it beautiful. However, most of the time we spend good time and money doing just the opposite.”

The property is located in south Louisiana, north Saint Martin Parish on the Bayou Teche (a main means of transportation for the settlement of the Acadians [Cajuns] in the mid eighteenth Century, and the Native Americans before them) some 25 miles (as the crow flies) from the Gulf of Mexico in a bottomland hardwood forest. Much of the land has been cleared in the area for farming, but the area along the bayou has remained forested.

#### **Old House**

An older house was obtained from a client who needed it removed from land that was to be developed for commercial use. Recycling of older architecture is a sustainable start. The roof and porches were dismantled for the move and reconstructed at the new site. The house was oriented for energy efficiency, and renovated for a new family use.

This house was used as the main residence for some 20 years as the site was cleared of refuse and the land allowed to heal itself. During this time the author developed a knowledge and understanding of the natural environment and microclimate of the site, and plans were developed for the use of the property and a new house that would be built on the natural levee of the bayou. Also during this time salvage material was collected, categorized, inventoried and

stored on the land. Once the new house was designed, more specific material was sought for salvage possibilities and reuse.

### **New House**

The house is square with the corners pointing to the cardinal directions. It is built above the ground with an underfloor plenum. The house is designed like a chimney for ventilation with a cupola at the apex of the roof. The roof is well insulated, contains a perforated radiant barrier, and has two vented air spaces. It overhangs the exterior wall by three feet to protect the glazing from the sun along with positioning the house to take advantage of shading from existing trees and the use of porches. The 2X6 exterior walls are filled with damp blown cellulose insulation. Cellulose is recycled newspaper, which is pulverized and treated with borax to prevent it from burning. A major side benefit is that borax is a natural product that kills ants, roaches, mold and termites that are prevalent in this area. A continuous knee-wall, of recycled concrete blocks, encloses the underfloor plenum that has fill insulation in the cores not containing concrete and rebar, cellulose blown on the interior surface, and the exterior surface waterproofed. Recycled closed cell rigid insulation was placed on the ground at the kneewall tapering from about 12" at the kneewall to about 2" eight feet out from the house. This was backfilled with dirt from pond excavation to create a good ground slope away from the house for drainage.

This exterior horizontal ground insulation is to thermally ground the structure pulling the constant underground temperature closer to the floor surface in the plenum. The constant ground temperature in this area is 70°F. You have to go down 30' to reach that, but at 15' there are even better temperatures - warmer in the winter, and cooler in the summer. This is due to the thermal lag of the earth. Not much has to be done with 70°F to be comfortable in either the summer or winter in south Louisiana.

The kneewall supports steel bar joists with recycled metal building siding and roofing for the steel deck which is welded to the joist. This supports a concrete slab with a smooth steel trowel finish, scored and stained as the finish floor.

The geothermal heat pump and water heater are situated in the center of the house, and backs up to the wood-burning fireplace. The fireplace has outside air ducted directly to the firebox with a damper control. The heatpump is connected to a seven-foot run of duct that connects the overhead plenum above the hallway to the underfloor plenum. A simple damper can direct forced air to either plenum and use the other as return air. The heatpump's fan runs constantly at a low speed. In the winter the wood burning convection fireplace produces heat that rises to the top of the house. The heatpump fan returns warm air from the top of the house and supplies it through the floor. The air moves from the center

of the house to the exterior walls while heating the concrete floor. In the summer the cool air is supplied at the higher level, letting the cool air fall to the floor and returned at the exterior walls through the underfloor plenum to cool the concrete floor.

The mean radiant temperature of the floor is important. The human body relates to heat gain and loss much greater through radiation than it does by air temperatures. The more comfortable situation is for the mean radiant temperature to be a few degrees cooler in the summer than the air temperature, and the mean radiant temperature to be a few degrees warmer than the air temperature in the winter. Air is a better insulator than a method of supplying thermal comfort to the human body.

Natural ventilation was designed on the basis of “suckulation”. That is, the design emphasis is on how to create negative pressure openings high in the house to pull air out of the structure. This is what nature wants to do, allowing cooler air to enter low and letting warmer air rise to be exhausted. The movement of air over humans removes heat from the body.

The double-pitched roof is what the earlier French would have had as the first response to this hot-humid climate. The interior 40' square is a steep hip roof without any attic space and open to the great room at the first floor and an architectural studio at the second floor. A lower pitch roof covers the perimeter 8' that includes verandas, screened porches, and some conditioned space. Other colonial French influences are the two major walls in the great room which are colombage (half-timber) framed with recycled cypress and infilled with bousillage (a mixture of earth and retted Spanish moss). A Z-scarf joint joins major exposed beams, and exposed recycled cypress beams in the dining room are beaded at their bottom edges, all in the French style.

The design of the house is like that of a sailboat. It has the flexibility to adapt or change with the seasons and the winds. The house sails on the natural environment for as long as it can. This amounts to over half of the year when the geothermal heatpump is not required for comfort.

### **Sailing With the Seasons/Dancing to the Rhythms of Nature**

Not necessarily the longest, but the harshest time of the year is the winter. Cold fronts come in from the north and northwest with winds and sometimes rain. The sky after a frontal passage is clear. This gives the ability to collect heat from the sun during the day while the clear skies at night can turn to frost or freezing temperatures. Wood is burned as the major heat source. The fire is fed all day long when needed, and loaded up at bedtime. Enough hot coals are left to start a new fire in the morning. The heat pump's fan is used to return warmer air above

to the underfloor plenum. This heat moves from the center of the house to the exterior walls, transmitting its warmth to the concrete floor. Sometimes the combination of geothermal heat pump and the fireplace are required, while there are many days when added heat is not needed at all. The fan continues to run at a low speed during these times. The deciduous trees have lost their leaves and the landscape is more open. The dense vegetation is gone and nature exposes herself to the observant eye. The mosses and lichen are at their best. The camellias are in full bloom. Vegetables from the garden are being harvested. Strawberries and garlic are planted at this time. All the citrus, Kumquats, Satsumas, lemons, lime, and grapefruit, are picked at this time to eat as desired. The fruit will stay on the trees all winter. The migratory ducks and geese fly in formation above. Wood ducks work the wet forested areas, the pond and the bayou. Many types of water birds visit the pond, not far from the house, to fish – heron, ibis, cranes, egrets, carmerands and kingfishers visit the pond all year long. The cardinals work below the small bird feeder to pick of the scrapes of the migratory small birds.

In late winter the days are warm and the nights are cold. Fronts still move in bringing rain and colder temperatures. On nice days the house is open during the day and closed at night. The last of the citrus are being eaten from the trees. Excess citrus are harvested and their juice frozen into citrus cubes to be used during the summer. Japanese magnolias, red buds, blackberries, pears, yellow tops, purple trumpet, wild onions, tear drops, jonquils, Easter lilies, and the wild cherry trees are showing their flowers. The sweet olive is in full bloom and smells wonderful. Robins are everywhere. The male wood ducks sit atop the box nest at the pond as they are jockeying for position to attract a female. As the garden is harvested the compost mulch is tilled into the soil preparing the beds for a spring planting.

Early spring has days that are still warm and nights cold, but sometimes the days are warm and the nights cool. For the latter, the house is open at night and closed during the day with the plenum used for return air. The mass floor is cooled by bringing in cool air at the perimeter of the under-floor plenum and pushing it up and out the cupola at the top. All the fruit trees are in bloom, along with the dogwood, wild cherry and many other trees, and the summer vegetable garden can be planted. A near by rookery is teeming with nesting birds (rosette spoonbills, ibises, cranes, herons, egrets, and ducks) and their baby chicks with the alligators waiting below. Live oaks are evergreens but the new leaves are pushing the older leaves off the tree at this time. Almost all of the deciduous trees are showing new leaves. The wild flowers are in full bloom. The bees are busy working the flowers. The Japanese plums are ready to be eaten. The fish are active and there is good fishing in the pond

In late spring the days are warm and nights are cool. The house is opened at night and closed during the day. The pecan trees are the last to sprout their leaves. The garden needs to be kept weed free and the fruit trees fertilized and mulched. The mother wood duck is pushing her young out of the box to start a new life on the pond. The azaleas are in full bloom. Additional supers are added to the beehives as the hives grow with the honey flow. This will prevent a swarm and give the ability to collect more honey. Bamboo shoots are driving up through the earth - some are harvested for eating and others cut to control its growth. The garden is being thinned and harvested. Spring rains produce chanterelle mushrooms from the ground under trees with low branches, and oyster mushrooms are growing on the dying willow trees. The wild cherries are ready to eat and so are the dewberries and blackberries. Some of the wild cherries are collected to make cherry bounce.

The early summer nights are still cool and the days hot now. The house is open at night and closed during the day. Sometimes the house has to be closed and air-conditioned. All of the trees are heavily leafed and there is an unbelievable claustrophobic density to the landscape. The crepe myrtle, mimosa, wisteria, water hyacinth, and magnolias are in full bloom. The vegetable garden is producing lots of good food now.

Late summer days are very hot and the nights are warm and humid. The house stays closed with the air conditioning returning air from the under-floor plenum and supplying cool air high from the overhead plenum. The garden is still producing, but can only be worked early in the morning and late in the afternoon because of the heat. This is hurricane season and an ideal time to harvest firewood. The wood is split and stacked to face the sun and prevailing breezes, and covered on top with salvaged metal roofing sheets and held down with salvaged concrete blocks. The beehives are robbed of their sweet delight. The pecan trees are hanging with green nuts. The kingfisher is working the pond.

In the early fall there are still times when the air conditioning is needed, but cool fronts start to make their way down with cooler temperatures. This is an opportunity to open the house up at night and cool the mass floor by returning air through the under-floor plenum. It is time to rework the vegetable garden - nonproductive plants are pulled up and the compost mulch tilled into the soil preparing the beds for a winter planting. Cabbage, broccoli, lettuce, onions, celery, spinach, mustard, carrots, radish, chives, cauliflower, shallots, and snow peas can be planted at this time. The French Mulberries have turned from green to purple.

Late fall is a wonderful time when the days are warm and the nights are cool. The house is flushed out at night to cool the concrete floor. Many days are nice



to open the house all day to enjoy the nice weather outside. As the nights get cooler the house is closed at night. The pecans are harvested at this time as the trees start to lose their leaves. The Chinese tallow trees, swamp maples and the poison ivy vines are the only major fall leaf colors, along with many wild flowers like the goldenrod, mist-flower, purple aster and ironweed. The bass are preparing for winter and fishing is good in the pond.

## **CONCLUSION**

Americans spend 80% of their life in buildings. I would say that a great percent of the other time is being in a vehicle. The reality of evolution is that all living things have adapted to their natural environment or perished. Today mankind is realizing that life can be much richer when you stop to smell the roses. As architects we can accommodate this philosophy by designing architecture with the natural environment. The emphasis here is on the preposition WITH. Not only are environmentally responsive buildings more sustainable, but they provide a stage that allows the occupant to dance to the rhythms of changing seasons. A dance that brings mankind a little closer to the wonders of the natural world. A dance that makes life rich, "and not, when (you) come to die, discover that (you) had not lived."

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