

**Goal of David's Project:**

- To create a sustainable system that will feed a family of five and fifteen guests with most of their dietary, social, and economical needs fulfilled.
- To create a permaculture demonstration site.

**Technical Data:**

- Location: Beach of Galveston Island, TX, U.S.A., about 29 degrees North and 94 degrees West
- Site size: 0.52 acres (22,651ft<sup>2</sup>)
- Home size: 4,993ft<sup>2</sup>
- Planned Structures:
  - Biogas converter: 20m<sup>3</sup>
  - Biogas overflow tank: 10m<sup>3</sup>
  - Primary biogas cleaning/remediation pond: 21.2m<sup>3</sup>
  - Secondary biogas cleaning/remediation pond: 3.54m<sup>3</sup>
  - Greenhouse: 11.4m<sup>2</sup>
  - Workshop: 3m<sup>2</sup>
- Elevations:
  - 6 ft high at house foundation and 5ft at pond and sand dunes
  - a gentle slope downward from all sides of the house
- Wind:
  - mostly from the South and Southeast in the summer
  - wind from every direction except West, Southwest, and Northwest in the winter
  - wind speeds average 13 miles per hour
- Solar Access: (sun rises in East and sets in West)
  - 14 hours daylight in June (highest); 10 hours daylight in December (lowest)
  - highest median cloud cover is 67% in January
  - lowest median cloud cover is 10% in August
  - summer sun declination: 86 degrees with the ground
  - winter sun declination: 36 degrees from ground
- Weather Data:
  - highest is 89.3 degrees Fahrenheit (31.83 degrees Celsius) in August
  - lowest is 49.7 degrees Fahrenheit (9.83 degrees Celsius) in January; occasional freezes
  - average annual precipitation: 43.85 inches (111.38cm)
  - highest rainfall is 6.03 in. (15.3cm) in September with the lowest rainfall being 2.57 in. (6.53cm) in February, and hurricane season is from June to November

**Building Strategies:**

- Structures will be made from natural and recycled materials as much as possible or obtained within 15 miles of the site.
- All utilities to the site will be shut down and severed before any construction begins.
- All ponds, visible and stealth, will be sealed using the Sepp Holzer method (i.e. anaerobic bacteria seal) unless otherwise stated.
- An organic wood sealant/protector will be placed on all wooden porches and beams.

**Precaution:**

- This site will be certified by the National Wildlife Federation as a wildlife habitat as soon as possible for protection and to draw in people's interest.

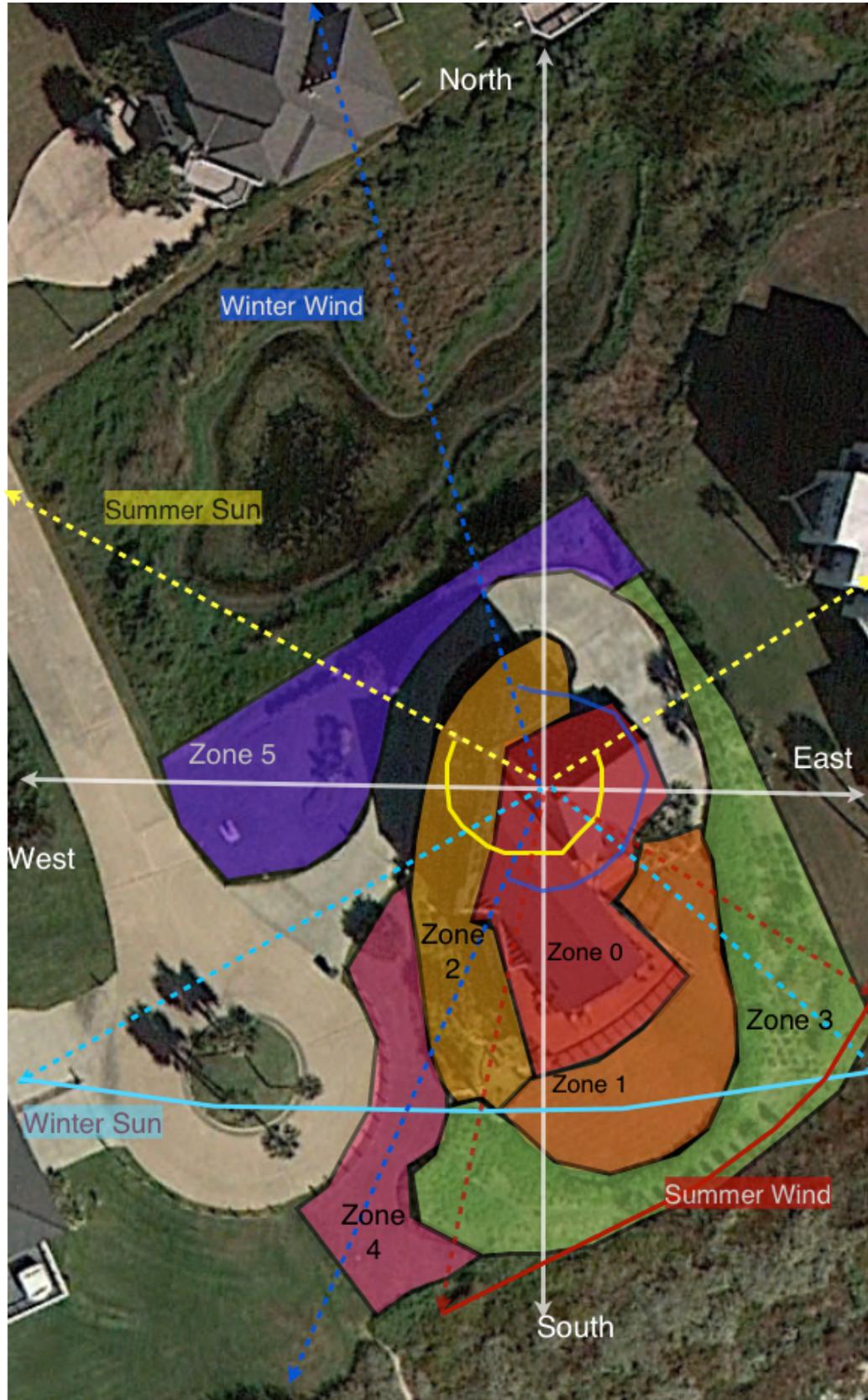
**Site Dimensions:**



Contour Map:



**Zone and Sector Map:**



**Sector Analysis:**

- Summer Wind: This generally comes from the South and Southeast, and this will be moderated with windbreaks.
- Winter Wind: This usually comes from all directions except the West, Northwest, and Southwest; this wind will be moderated with a windbreak.
- Summer Sun: This generally comes from everywhere except the North, Northeast, and Northwest; the summer sun will be moderated with tree and vine cover.
- Winter Sun: This mostly comes from the South, Southwest, and Southeast; it will be moderated a little less than the summer sun.
- Beach View: This view, as lovely as it is, will be blocked from the site because if one feels the need to visit the beach, it is located only a short walk off of the site.
- Beach-goers: These usually appear along the South to Southeast border of the site from early June to late August, and their curious glances will be blocked with tall plants.
- Neighbors: These are found on all sides of the site, and their view will be blocked with tall plants.

**Zone Analysis:**

- Zone 0: This is the home, and it will be visited the most often because the occupants live here. The home has many opportunities for usefulness and function stacking because it has large windows, three sitting areas (e.g. ground floor porch, second floor balcony, third floor balcony), tall poles, and a large roof. Inside the home, aquaponics systems, living walls, composting toilets, and workshops/labs could be installed.
- Zone 1: This area is directly in front of the first and second floor porches (ontop of each other), and it will receive the second most amount of attention. Here, annual, needy, or regularly consumed organisms will be grown; this area may also include things that require daily maintenance. The majority of all human efforts will be devoted to zones 0 and 1, and there will be a lot less effort spent on zones 2 to 5.
- Zone 2: This area is in view of the kitchen and will be regularly walked by when going to the beach, driving the car, getting the mail, riding bikes, or any other activity that requires a sidewalk. In here, slightly less needy elements will be placed.
- Zone 3: This area is just behind Zone 1, but it will be visited less often because of its distance from the house. Over here, perennial plants and trees will be prominent features.
- Zone 4: This area is beside Zones 2 and 3, and since it is farther down the sidewalk and blocked by what will be grown in Zone 2, this area is going to be partially unmanaged. Therefore, timber, wild food, and foragers will be grown here.
- Zone 5: This area is along the back of the site, and it will be completely unmanaged; this zone will be randomly planted with an array of native plant seeds and inoculated with a spectrum of microflora and microfauna. Afterwards, it will have to take care of itself. It will serve as a quiet place of meditation, observation, and learning.

David's Design Image:



## David's Site Design:

(The number of each element listed corresponds to the physical features on the diagram above)

### 1) Biogas converter system: (*handles up to twenty people's toilet business*)

(1a) The biogas converter will be placed directly on and under the northern most portion of the porch. It will have a radius of 1.78m and go 2m deep.

For the installation, the biogas converter will be connected to the house's sewage line and receive direct deposits of waste from the home's toilets; the connection to the city sewage grid will be blocked and sealed off. A nozzle and hose will be located on the top of the converter so that one can manually decide where they would like the gas to go. In addition, the home's natural gas receiving line will be routed to the surface and capped with a receiving nozzle- to match up with the converter's natural gas output nozzle; the natural gas line's end that is connected to the grid will be dug up completely and permanently closed. An animal waste inlet will be provided in the middle of the ground floor porch. In case the water and sewage lines fail, a curtain will be placed around the animal waste inlet with a movable pseudo-toilet nearby so that people can urinate and have bowel movements in privacy. The biogas converter chamber tank will be built using superadobe and sealed inside and outside. A mobile natural gas powered electricity generator will be provided, and a passive geothermal heating and cooling system will be placed under the converter to harvest its heat.

(1b) The biogas converter's overflow/collecting tank will be located just northeast of the converter, and it will have a radius of 1.78m and have a depth of 1m. This will be built in a similar manner to the biogas converter. A small controllable drainage marsh will connect this to the primary cleaning and remediation pond.

(1c) The biogas converter system's primary cleaning and remediation pond will be south of the overflow tank, and it will have a radius of about 1.5m and go 3m deep. Its sides will be irregular sides to optimize edge. Fish, shellfish, and wildlife can make their homes in the ponds. Another drainage marsh will connect this pond to the secondary pond. Furthermore, a Sepp Holzer style monk with a Geoff Lawton twist will be installed. The monk will be used to vary the water level as necessary, and the tubing will become smaller until it becomes small enough for a spigot to be attached. This way water can be drained and attached to a hose for watering.

(1d) The biogas converter system's secondary cleaning and remediation pond will be south of the primary cleaning pond, and it will have a radius of 0.75m and go 2m deep.

Some native plants to attract wildlife at the ponds:

- trees: eastern redbud, common paw paw, elderberry
- shrubs: huckleberry, hydrangeas, annabelle, winterthur
- vines: trumpet vine, virginia creeper, American wysteria
- ground cover: nodding wild onion, purple prairie clover, leadplant

Functions of this element:

- produces methane for heating, cooking, boiling water, electricity, and for sale
- purifies water and upcycles wastes into food, medicine, and supplies
- attracts wildlife and manages mosquito populations
- aesthetically pleasing
- generates waste heat which can warm the home and provide hot showers

## **2) Solar Panels:**

Solar panels will be installed to cover as much of the roof as possible, and enough nickel-iron 'Edison' batteries for a 1-month backup will be provided. They will also work as regular usage batteries when the solar panels are running on a day-to-day basis. The batteries will be stored in the garage.

Functions of this element:

- converts sunlight into electricity
- provides electricity for heating, cooking, and other activities
- can be used to boil water for purification
- provides money when excess electricity that the backups cannot handle is diverted to the grid

## **3) Rainwater Catchment System:**

A rainwater catchment system will be installed around every edge of the roof and second and third floor balconies. There will be 14 one hundred gallon (or more) ceramic barrels placed aboveground around the house- the white dots on the diagram. Each tank will be protected from the weather with a superadobe structure.

Functions of this element:

- saves money
- provides water for household use and in times of drought
- provides a thermal mass to protect cold-sensitive plants

## **4) Parabolic Solar Cooker:**

A parabolic solar cooker will be placed at the southwestern corner of the second floor balcony.

Functions of this element:

- cooks food
- boils water
- signals people

## **5) Clothesline:**

A clothesline will be placed on the eastern side of the second floor of the house.

Functions of this element:

- dries clothes and linens
- perch for birds

- hanging garden

## **6) Balcony Gardens:**

A mixture of hanging, standing, and self-watering containers of various sizes, shapes, and colors will be placed along the edges of the balconies.

Functions of this element:

- provides food and medicine
- enhances the aesthetics of the balconies
- cycles oxygen, water, and carbon dioxide

## **7) Fishing Net Trellises:**

Fishing nets will hang off of both balconies and extend to the ground. These can be cut and shaped into whatever designs one desires. As the fishing nets decay, the vines will create their own netting.

Functions of this element:

- allows more vines to grow on the house
- creates shade from the summer sun
- quick escape route from the balconies
- fun object for people to play on

## **8) Double Chamber Cob Oven:**

A double chamber cob oven will be installed on the southwestern corner of the porch, and its deconstructable exhaust pipe will go straight through the second floor balcony.

Functions of this element:

- cooks food
- very clean burning
- brings people together
- looks pretty
- exhaust pipe makes for a good place to warm hands and food on the second floor
- exhaust pipe could also be routed to the greenhouse for heating

## **9) Rocket Mass Heater:**

A rocket mass heater will be built southeast of the double chamber cob oven.

Functions of this element:

- provides warmth in the winter
- cooks food and boils water
- looks pretty
- brings people together
- can function as a kiln
- very clean burning

## **10) Open-Air Studio/Workshop:**

This area south of the northern most segment of the house will be left untouched and designated as a workshop, studio, and social gathering place.

Functions of this element:

- place for people to eat together and socialize
- area for tinkering and construction
- place to work outdoors

## **11) Greenhouse:**

A triangular greenhouse will be constructed on the northern side of the second floor balcony, and the lowest 10cm of the greenhouse along, with the parts of the balcony covered by the greenhouse, will be painted black to encourage the heat to rise and force the cooler air out. The greenhouse sides will be 9.7m (SW side), 9.4m (N side), and 2.4m (SE side), and it will be 3-3.5m tall.

Functions of this element:

- protects cold-sensitive plants
- nursery and propagation center
- animal shelter

## **12) Backup Toilets:**

A total of seven self-contained nonelectric composting toilets and seven humanure toilets will be distributed inside and outside the house to decompose any wastes that the biogas converter cannot handle.

Functions of this element:

- decomposes human wastes
- creates useful fertilizer
- keeps biogas converter from malfunctioning at times of peak capacity

## **13) Passive Solar & Heating System:**

A series of eight vents will be installed along the roofs and outside walls of the building to allow the air to circulate. In addition, the house will be given a new paint job with darker colors on the bottom and progressively lighter towards the top. Screens and protectors will be placed on the vents to prevent organisms and water from entering.

Functions of the element:

- circulates the air
- decreases electricity usage
- increases beauty of the house

#### **14) Leaf Vein Garden:**

A leaf vein garden is located south of the porch; the branched design of the walkways mimics the efficient pattern of leaf veins. Three main walkways are large enough for wheelbarrows to move through, and as it branches out, the walkways become smaller and smaller until only one person can walk through. The walkways will be made of wood chips and mulch- possible mushroom cultivation area. Everything in the garden will be planted according to what needs the most attention, what their life cycle is, how often they are eaten, and how well they behave with others. Crops to be grown: anything and everything that tastes good and tolerates the climate. In the hardest to reach parts of the garden, fruit and nut trees will be planted; some nitrogen fixing species will be interspersed throughout the garden as permanent living mulches. As time progresses, the garden will be phased into a nine-layered food forest.

Functions of this element:

- provides food and medicine
- beautiful and aromatic
- wildlife habitat
- good demonstration site
- pollinator food source
- possible income stream

#### **15) Solar Dryer:**

A solar dryer will be installed south of the open air workshop to dehydrate food.

Functions of this element:

- saves food for emergencies
- reduces food waste
- free food drying and possible income stream

#### **16) Herb Spiral:**

An herb spiral will be located southeast of the solar dryer, and it will grow a variety of medicinal and culinary herbs.

Functions of this element:

- possible income stream
- attracts wildlife
- provides food and medicine

#### **17) Four-Way Food Waste Management System:**

This system will be located south of the kitchen and will be connected with a kitchen/food waste chute. The waste will first enter the hot composting section where black soldier fly larvae consume the food; then, it will go onto phase two where the chickens devour the black soldier fly larvae; after the chickens eat the black soldier fly larvae, their feces have two possible paths: worm processing or pond processing. The worm processing area is immediately south of the chickens, and the pond (i.e. mega-pond) is immediately west. Both pond and worm processing will receive direct deposits of chicken waste. The worm processing area will have red wigglers

closer to the surface and night crawlers near the bottom. This area will be built with the some of the soil removed to build the biogas converter system. A roof will be placed onto of the system to protect the chickens, black soldier fly larvae, and worms from the weather. There will also be a mulched path connecting this system to the leaf vein garden so that the chickens can tend the garden.

Functions of this element:

- upcycles kitchen waste into terrestrial and aquatic food supplies
- grows black soldier fly larvae which can be another source of income
- provides a ready supply of worms to be added into the garden's soil or sold to the public

### **18) Mega-Pond:**

A giant pond will cover all of zone two. It will begin shallow at the northern end and progressively increase in depth until it is 4.5m deep at the southern end. Everything above the water table will be sealed manually with the Sepp Holzer method. Since it would require a lot of effort to manually seal the rest of the pond hidden by the water table, organisms (e.g. plants, fish, shellfish, frogs) will be introduced around and inside the pond to encourage water fowl to visit the pond, eat there, and defecate in it. Cattails, definitively, will be included because of their variety of uses. Overtime, feces will accumulate at the bottom of the pond and encourage anaerobic bacteria to seal the pond. In the meantime, it will be a seasonal pond. In addition, stone hills will be built at the far northern and southern edges of the ponds to provide amphibian and reptile habitat. Some water loving trees- like mangroves and willows- will be planted along the western edges of the pond to reduce evaporation and provide habitat for more animals and plants.

Functions of this element:

- increases biodiversity of the site
- provides aquatic food to eat
- recycles some of the chicken feces
- attracts migratory birds

### **19) Bee Hotel:**

A bee hotel will be located in the area covered by the kitchen overhang, and it will have niches for a variety of bee species to make their homes.

Functions of this element:

- protects bees with a pleasant environment
- pollinates the garden
- provides honey and wax
- educational area to promote awareness and encourage micro-beekeeping

### **20) Flower Garden:**

A variety of native and nonnative flower seeds will be strewn behind the herb spiral and biogas overflow tank and left to their own devices.

Functions of this element:

- provides insect and pollinator habitat
- aromatic and beautiful
- yummy insects for people and birds to munch on

### **21) Bog:**

This area receives the least amount of sunlight and minimal wind, and likewise, it will receive less attention. This will host plants like venus flytraps, pitcher plants, sundews, and the water-wheel plant. Some pitcher plants- especially *Nepenthes rafflesiana* var. *elongata*- will be allowed to grow beneath the third floor balcony and on its corresponding fish net trellis.

Functions of this element:

- controls insect populations
- provides bat habitat with the pitcher plants
- beautiful, increases biodiversity, and educational

### **22) Ducks:**

Some ducks will be hatched and raised from eggs onsite to imprint them with an acceptance of humans. Wild ducks will be encouraged at the mega-pond with duck specific plants like wild rice, arrow arum, duck potato, pondweed, wild celery, bulrush, water plantain, blue iris, white water lily, swamp milkweed, burreed, boneset, beggar ticks, smart weed, coontail, duckweed, and map millet. Along the very edge of the mega-pond, pin oaks and hawthorns will be planted to provide habitat and more food.

Functions of this element:

- manages and controls the mega-pond plant life
- controls pests when they visit the leaf vein garden
- protects the chickens
- provides feathers, meat, eggs, and companionship

### **23) Chickens (4-7):**

The primary chicken coop and home will be part of the four-way food waste management system, and their home will have a detachable coop that can be moved around the garden to manage their efforts in the leaf vein garden. Placing the chickens where they are is beneficial because they will have a constant food supply from the four-way waste management system and have access to water from the mega-pond and rainwater catchment system. During the day, they will be allowed to roam free through the leaf vein garden and four-way waste management system. At night and the hottest parts of the day, they will be sheltered in the four-way waste management system. Their coop will have several horizontal poles which they can fly onto.

Functions of this element:

- recycles food waste

- tends to the leaf vein garden
- provides meat, feathers, eggs, and companionship

#### **24) Goats (1-2):**

Goats will be housed in the open spaces beneath the second floor of the house. They will be allowed to munch and nibble on anything in zones 1, 3, and 4. They will primarily use the leaf vein garden's middle path to access the food forest.

Functions of this element:

- provides meat, hair, and milk
- provides companionship
- manages the food forest
- compacts soil as it walks (not bad, can increase biodiversity)
- fertile feces

#### **25) Hugelkultur Berm and Swale:**

(25a) The hugelkultur berm is located along the edges of the site, and it will be built using all the vegetation and soil that was removed and cleared for the creation of other elements in the design.

(25b) A swale will be located along the inner edge of the hugelkultur berm, and the soil removed for building it will also be used in creating the hugelkultur berm.

As the site is observed during rains, the places where the water moves too quickly will have check-hugelkultur-dams installed. At about the same heights, the hugelkultur berm will have tiny dips in the top for overflow water to escape, if too much water becomes trapped inside the site.

Functions of this element:

- varies the landscape which creates several microclimates to increase biodiversity
- swale retains water and berm stops water from leaving and entering the site
- hugelkultur berm stores water and slowly releases it back

#### **26) Privacy Screen and Windbreak:**

A privacy screen and windbreak will cover all sides of the site except for the bamboo grove. Within the summer and winter sun sectors, it will be composed of the following deciduous trees: serviceberry trees (*Amelanchier canadensis*), american smoke trees (*Cotinus obovatus*), eastern hornbeam trees (*Ostrya virginiana*), and sassafras trees (*Sassafras albidum*). The rest of the site's border not covered by the summer or winter sun sector will be planted with: paw paw (*Asimina triloba*), blue elderberry (*Sambucus caerulea*), and elderberry (*Sambucus canadensis*).

Functions of this element:

- attracts wildlife and beneficial insects
- looks beautiful

- produces aromatic flowers and tasty fruits and nuts
- appeals to conservation organizations since they are all native plants (except for serviceberry which is native to the USA but not Texas)

### **27) Initial Food Forest:**

This covers all of zone 3 along with the hugelkultur and swale that are in zone 3, and it will have nine layers: canopy layer, sub-canopy layer, shrub layer, herbaceous layer, ground cover layer, underground layer, vertical layer, aquatic layer, and a mycelial layer. If all the fruit and nut trees desired cannot fit into the food forest, as many as possible or desired- some people have grafted 40 or more on- will be grafted onto scions. It will be composed of a mix of native and nonnative organisms. As this matures and begins to produce, the leaf vein garden will fade out along its outer edges, and the food forest will be allowed to conduct natural succession into the leaf vein garden. There will be a list of species and resources at near the end.

Functions of this element:

- produces a variety of food year-round
- attracts wildlife
- looks beautiful and smells nice
- revitalizes the soil

### **28) Mycology Operation:**

This is going to be a low-cost moderately intentional operation; the hugelkultur berm will be inoculated with the spores of pearl oyster, pink oyster, reishi, shaggy mane, king stropharia, mai-take, lion's mane, garden giant, chicken of the woods, and *hypsizygus ulmarius* fungi. Some nonedible types of fungi may also be included for their usefulness in recycling nutrients and caring for aboveground and belowground life. What grows, grows, and what does not, did not. The primary goal is to make sure nutrients are cycling and the soil life is doing well; the secondary goal will be getting food and selling produce. As a rule of thumb, it would be advisable to take spore-prints of all mushrooms harvested to make sure that as many spores as possible return to inoculate the soil again.

Functions of this element:

- recycles nutrients
- tends to and protects the food forest
- produces food and is educational

### **29) Bamboo Grove:**

This will cover all of zone 4. The layout will be as follows: giant bamboo species will be located along the western edge; the tall to medium bamboos will be located in the middle, and the shortest and clumping bamboos will be along the eastern, southern, and northern boundaries of zone 4 to control the spread of any running bamboos. It will be planted with a variety of bamboo species: some tall, some small, some cold-hardy, and some not.

Functions of this element:

- provides beauty and meditation space

- provides wood and building materials
- moderates windspeeds and temperatures

### **30) Rock Garden**

This will cover a small portion of the driveway that is located at the southeastern corner of the northern portion of the house. It will be constructed by breaking up the concrete and turning it into gravelly urbanite rocks. Here, partial shade plants, mosses, lichens, epiphytes, and pioneer species can thrive.

Functions of this element:

- varies the landscape which increases biodiversity
- looks pretty
- attracts wildlife

### **31) Driveway Arched Trellis**

White willow or ficus trees will be grown from seed or sapling along the edges of the driveway and gently arbor sculpted to fuse together with each other and form a living arch. It will require a lot of attention early on but will stabilize in later years. Alternatively, rot-resistant woods like black locust, yew, osage orange, red mulberry, cedar, cypress, redwood, or white oak can be used to create an abiotic trellis for vines and epiphytes to grow on. Eventually, wood will be sourced from the site itself.

Functions of this element:

- extends growing space on top of the concrete
- shades and protects people and vehicles from overheating, sunlight, and the weather
- looks beautiful and attracts wildlife

### **32) Driveway Space:**

The driveway's concrete, except for where the rock garden and espaliered trees will be, will be untouched.

Functions of this element:

- gathering space and demonstration area
- possible sleeping and camping area
- concrete's high thermal mass retains heat and stores it for later

### **33) Espaliered Trees:**

Along the southeastern and northeastern sides of the northern half of the house, the concrete will be smashed and broken until the soil is reached. Fruit and nut trees will be planted and espaliered to cover all of these two sides of the house.

Functions of this element:

- increases growing space
- shades the house which decreases energy used on cooling

- produces year-round food
- looks beautiful

### **34) Native Plant Zone:**

The only intentionally placed plant in zone 5 will be a southern live oak seed grown at the center of zone 5's northwest segment. This tree will become the mother tree that protects and nurtures zone 5 for hundreds and hundreds of years to come, and it will be given a few years head start before other trees seeds are introduced. A variety of native trees, succulents, grasses, perennials, annuals, vines, and bulbs will be strewn evenly across zone 5. A light layer of compost and soil will be added on top to prevent the seeds from blowing away in the wind and washing away in the rains. After the mother tree has been given its headstart, all of zone 5 will be left alone to manage itself.

Functions of this element:

- provides a chance to observe nature and how it works
- inspiration and beauty
- place for meditation and rest
- wildlife sanctuary

### **35) Occupants, Guests, and Visitors:**

The site is designed to care for and house five permanent occupants and fifteen guests. The reasoning for this is that five people will be necessary to maintain a long-term vision for the site and bounce ideas off of each other in the long-run. Room for fifteen guests of varying stays will be allowed at any one time –kind of like a maximum number of WWOOFers. These people will be important for bringing new ideas onto the site, spreading good news about the site, and contributing their time and effort to the site's development. This project would be too big for just five people alone. In addition, workshops can be taught on site throughout the many stages of incremental development to help spread the word and offset the cost of development. Tours may be hosted by one or two of the guests throughout development to also spread the news and offset the cost.

Functions of this element:

- manages and develops the site
- produces feces, urine, and carbon dioxide
- manages plant and animal growth through consumption

### **Some Cool Resources to Look At:**

-Educational Resources:

- Permie ( <http://www.permies.com/> )
- Bill Mollison Online Lectures ( <http://www.networkearth.org/perma/culture.html> )
- Permaculture Research Institute ( <http://permaculturenews.org/> )
- Geoff Lawton ( <http://www.geofflawton.com/sq/15449-geoff-lawton> )
- Open Permaculture ( <http://www.openpermaculture.com/> )
- Grow Organic ( <http://www.groworganic.com/organic-gardening/> )
- Garden Web ( <http://www.gardenweb.com/> )

- Watershed Academy ( <http://water.epa.gov/learn/training/wacademy/index.cfm> )
- EdX ( <https://www.edx.org/> )
- Crown Bees ( <http://crownbees.com/> )
- Free Stuff and Exchanges:
  - Freecycle ( <https://www.freecycle.org/> )
  - Cuttings and Scion Exchange ( <http://www.homeorchardsociety.org/events/> )
  - Free Seed Exchange ( <http://www.heirloomseedswap.com/> )
  - Seed Savers Exchange ( <http://www.seedsavers.org/> )
  - Listia ( <https://www.listia.com/> )
  - Craigslist (search 'curb alerts' and use free stuff filter) ( <http://www.craigslist.org> )
- Native Plant Databases::
  - Lady Bird Johnson Native Plant Database ( <https://www.wildflower.org/plants/> )
  - American Beauties Native Plant Database ( <http://www.abnativeplants.com/index.cfm> )
- Large Plant Databases:
  - Plants For a Future ( <http://pfaf.org/user/default.aspx> )
  - Tropical Plant Database ( <http://www.rain-tree.com/indicate.htm#.U-ftBIBdXDV> )
  - Missouri Botanical Garden Plant Finder ( <http://www.missouribotanicalgarden.org/plantfinder/plantfindersearch.aspx> )
  - Royal Horticultural Society Database ( <http://apps.rhs.org.uk/horticulturaldatabase/> )
- Places to Buy Soil Inoculant:
  - Fungi Perfecti ( <http://www.fungi.com/> )
  - John and Bob's Solutions ( <https://www.johnandbobs.com/> )
- Places to Buy Seeds and More:
  - Bountiful Gardens ( <http://www.bountifulgardens.org/> )
  - Horizon Herbs ( <https://www.horizonherbs.com/> )
  - Oikos Tree Crops ( <http://www.oikostreecrops.com/default.asp?> )
  - Nature Hills Nursery ( <http://www.naturehills.com/> )
  - Arbor Day Foundation ( <http://shop.arborday.org/content.aspx?page=tree-nursery> )
  - Bamboo HQ ( <http://www.bamboohq.com/> )
  - Moss Acres ( <http://mossacres.com/> )
  - Moore Water Gardens ( <http://www.moorewatergardens.com/catalog.html> )

**Native Texas Plant List** (this is not a comprehensive listing, some things are mentioned elsewhere in the design and some not mentioned at all, so please check the databases, too):

1. Cacti:
  - a. Red yucca
  - b. Santa Rita purple prickly pear
2. Conifers:
  - a. Coneflower
  - b. Silver Eastern Redcedar
  - c. Burkii Red Cedar
3. Ferns:
  - a. Lady fern
  - b. Hairy lipfern
  - c. Cinnamon fern
  - d. Christmas fern

- e. Male fern
- 4. Grasses:
  - a. Indian Grass
  - b. Little Bluestem
  - c. Switchgrass
  - d. Deer grass
  - e. Regal Mist Grass
  - f. Pink Muhlygrass
  - g. Big Bluestem
  - h. Northern Sea Oats
  - i. Grama Grass
- 5. Perennials:
  - a. Wild Onion
  - b. Swamp Milkweed
  - c. Butterfly Weed
  - d. Wild Onion
  - e. Wild Columbine
  - f. False Indigo Bush
  - g. Dwarf Wild Indigo
  - h. Sky Blue Aster
- 6. Shrubs:
  - a. Yellow Bells
  - b. Highbush blueberry
  - c. Witherod
  - d. Winterberry
  - e. Fairy Duster
  - f. Arrowwood
  - g. Inkberry
  - h. Trumpet Honeysuckle
- 7. Trees:
  - a. Paw Paw
  - b. Elderberry
  - c. River Birch
  - d. Black Gum
  - e. Flowering Dogwood
  - f. Black Gum
  - g. White Fringetree
- 8. Vines:
  - a. Trumpet creeper
  - b. American Wisteria
  - c. Virginia Creeper
  - d. American Bittersweet

**Additional Organisms Based on Usage** (long list, but not exhaustive):

-Saponin Producing Plants (Soap):

Mojave Yucca leaves	Soap Lily	Horse Chestnuts	Grated Soaproot
Mountain Lilac	Snowberries	Buffalo Gourd leaves	
Bracken roots	Buckbrush leaves	Soybean	Soapwort

-Food:

- animals: pigs, oysters, crabs, lobsters, shrimps, krill, crabs,
- trees: common lime, black walnut, common peach, Chinese haw, sassafras, monkey puzzle tree, quince, blue hawthorn, Oregon crab apple, quince, azarole, Asian pear
- shrub: Chinese hawthorn, smooth, sumach, common juniper, pineapple, goumi, bastard oleaster, Carolina allspice, western redbud, Chinese hollygrape, gooseberry currant, bitter orange, Mexican barberry
- annual: rat-tail radish, dwarf mallow, wild tomatillo, common sunflower, rocket
- biennial: savoy cabbage, weld
- perennial: sweet flag calamus, agave, horseradish, cardoon, globe artichoke, lovage, sweet fennel, clustered belliflower, common day lily, earthnut pea, century plant, hollyhock, sweet woodruff, rainbow plant, perennial lettuce
- bulb: golden garlic, wild chives, German garlic, prairie onion
- corm: saffron
- climber: passionflower, maypops, banana passion fruit

-Medicine:

- trees: black walnut, sassafras, Chinese haw, common lime, common peach, red sweet gum, black walnut, English walnut, Formosa sweet gum
- shrub: Chinese hawthorn, wild hydrangea, juniper, tree peony, Chinese privet, smooth sumach
- annual: thorn apple, German chamomile, rat-tail radish
- perennial: horseradish, agave, sweet flag calamus, cardoon, globe artichoke, meadowsweet, fumewort, watercress, cardinal flower, pennyroyal, orris, ground ivy, wild geranium, oregano, primrose, lungwort, balloon flower, ribwort plantain, mandrake
- bulb: meadow saffron
- corm: saffron
- climber: ivy, maypops

-Water Cleaning:

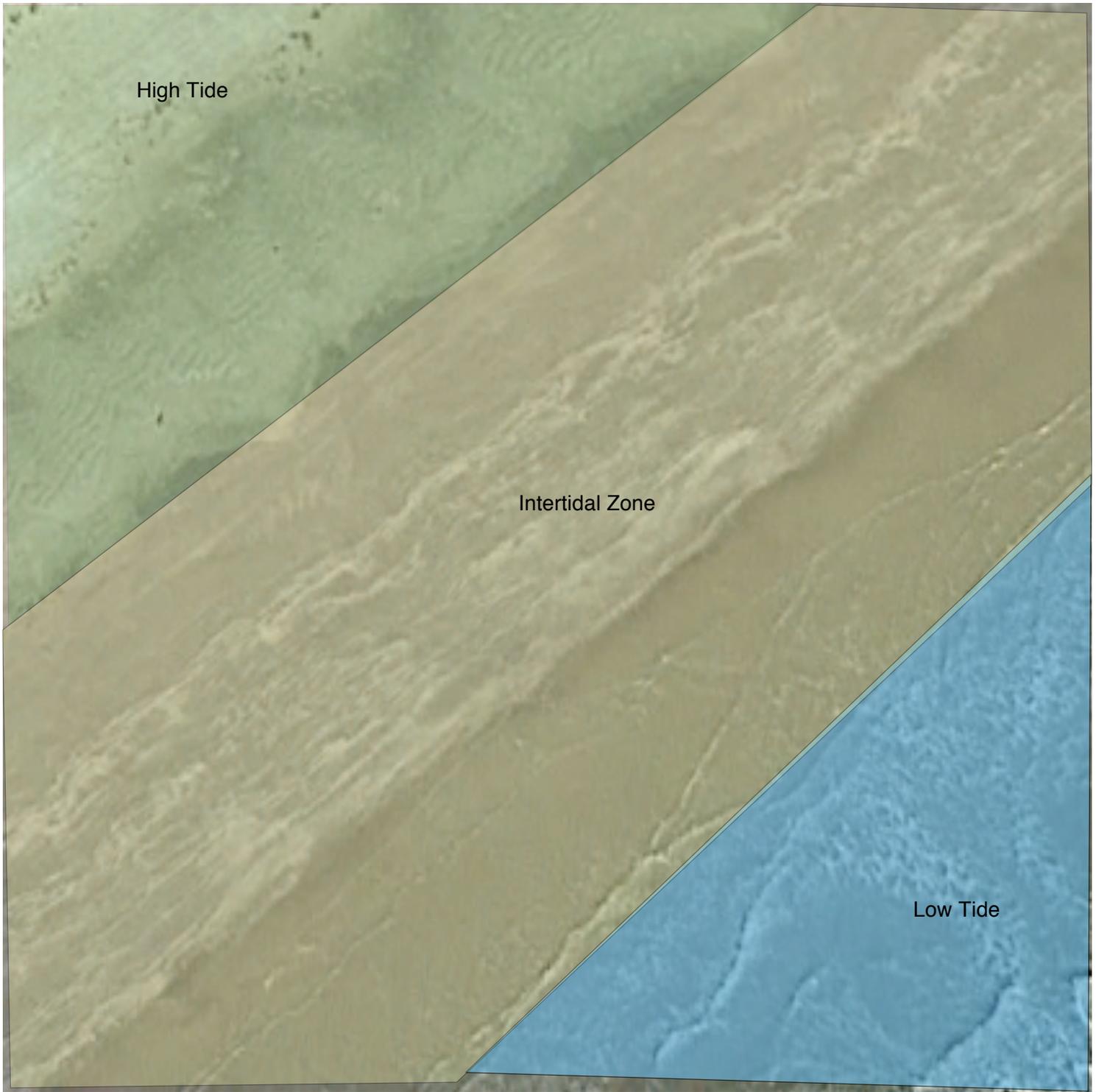
Mangroves	Oysters	Mussels	Gurami	Tilapia	Shrimp	Crabs
Barnacles	Scallops	Sponges	Krill	calamus		

\*More can be found by changing settings on different databases

\*Final note: The lists of plants were provided because the designer likes Masanobu Fukuoka's techniques and would prefer for the plants to figure out their density, locations, and spacing on their own. This will also save time and money.

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**Storm Surge and Erosion Protection System:**



**Plan of Action:**

Design will be implemented using as many local, natural, recycled, reused, or repurposed materials as possible.

**Low Tide Zone:**

This area is frequently soaked in water and is constantly battered by winds and waves. Black mangroves and shellfish (e.g. oysters, clams, mussels) would be ideal species for defending the low tide zone and buffering the area from storm surges. Cuttings and seeds can be sourced from already existing black mangroves.

Functions of this element:

- protects the coast from erosion and storm surges
- purifies the water
- provides seafood, building materials, fodder
- attracts wildlife and looks beautiful

**Intertidal Zone:**

The intertidal zone is submerged in water through about half of the day; it is frequently pounded with waves and wind. Species like American hornbeam, goldenrod, little bluestem, sweet pepper bush, blue elderberry, Mexican hat plant, downy scullcap, and blue-eyed grass are some good native plants to protect the coast. A few nonnatives that are also useful include seabuckthorn, sea berries, sea almonds, and bastard oleaster.

Functions of this element:

- protects the coast from storm surges and erosion
- attracts wildlife
- provides food, medicine, and supplies
- aesthetically pleasing

**High Tide:**

The high tide zone is submerged in water for a short portion of the day and is constantly battered with waves and winds. Willows and the Silver Eastern Redcedar are two good trees for this zone. Around them, Mexican evening primrose, pink muhlygrass, rattlesnake master, and star tickseed could be planted as groundcover.

Functions of this element:

- sequesters and degrades toxins leaving urban areas
  - protects the coast from storm surges and erosions
  - looks pretty
  - attracts wildlife
  - provides supplies
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