



RECOMMENDATIONS AT BIO CARIBE

The following recommendations should be used as a guideline to achieve a sustainable development at Bio Caribe. The management encourage all property owners to respect the following recommendations at all time.

ARCHITECTURE AT BIO CARIBE

- Bio Caribe recommends the integration and restoration of the architectural structures with the natural ecosystem, lowering the impact of the buildings on the natural views and ecosystem.
- Bio Caribe recommends keeping, encouraging, celebrating and making use of designs that explore the vernacular vocabulary of our architecture.
- Bio Caribe encourages owners to take advantage of environmental design, with its typical flora and fauna.
- Bio Caribe's community design promotes a wide variety of building sizes and shapes to add character and diversity to our community and its surroundings.
- Bio Caribe's ecological design promotes a variety of terrain uses, compatible to enhance walking trails and areas, as well as other features that enhance the vitality of the entire community. These include gardens, groves, parks, resting areas, path areas and bird watching areas.
- Bio caribe encourages the concept of a very compact building footprint. Homes do not need to be wide to be appealing. A small and very well lit place, with natural ventilation, good views to vegetation areas can be better or more comfortable than a big space.
- Bio caribe promotes the use of local construction techniques and shapes throughout building design.
- Bio caribe promotes the use of local cultural images in building design.

ARCHITECTURAL CONTEXT (SPACES)

- Buildings should be designed in order to improve their energetic efficiency. For example, north and south faces should be longer than east and west sides, keeping a 1:1.3 to 1:3 proportion.
- Bio Caribe encourages the incorporation of inner gardens to every building (the more centered the garden is, the more benefits you get from a better ventilation and natural lighting, reducing energetic expenses)
- Bio Caribe promotes protected spaces and/or paths, using gazebos, wide roofings and other constructive strategies to reduce solar heating during summer and water heating during rainy seasons.

ARCHITECTURAL CONTEXT (ARCHITECTURAL ELEMENTS)

- Bio Caribe recommends not to build blind walls towards public areas or natural scenery.
- Bio Caribe promotes the use of natural ceilings in at least 50% of the concrete flat roofs, to reduce heat load in the buildings.
- Bio Caribe encourages the addition of natural materials to at least 50% of concrete walls, to reduce heat load in the buildings (walls can be naturally lined using creeper plants, climbers, land slopes, among others).
- Bio Caribe recommends avoiding constructing fixed glass areas, due to their relation with increasing glare and heat gain, as well as increased danger to occupants and bird species.

ARCHITECTURAL CONTEXT (ROOF COVER)

We make the following recommendations for roof cover:

- Galvanized steel, zinc or corrugated aluminum
- Recycled banana bags tiles
- Palm leaves or a synthetic variety.
- Recycled tetra pack for roof panels
- Other environmentally safe and properly documented materials.

ARCHITECTURAL CONTEXT (STRUCTURE)

- Permanent housing structures must be earthquake and hurricane wind resistant.

ARCHITECTURAL CONTEXT (LIGHTING)

- Bio Caribe maximizes natural interior lighting using large windows (minimum 40% of the exterior wall surface), mainly on the north façade or on windows with panoramic view access and those protected with sun breakers.
- Bio Caribe encourages the use of skylights to maximize natural interior lighting (Preferably heading north). Skylights should cover a minimum 3% net area in compared to the total floor net area.
- Building's width should not be longer than 30 feet (length can be higher). Windows should be placed on long walls.
- Sunlight trays are used to improve natural lightning on the interior of the buildings.

- In order to promote natural lightning, bright colors are to be used, according to the next Percentages and usages:
 1. Interior panels: minimum 80% reflectivity.
 2. Interior walls: minimum 60% reflectivity.

This strategy does not eliminate the possible use of darker or lower reflectivity color accents, as long as the reflection average is among the pointed ones. To facilitate color selection, the next table presents an approximate reflectivity percentage:

Color or material	Reflectivity %
Dark colors	0 to 39%
Intermediate colors	40 to 60%
Aluminum, zinc or galvanized steel (no paint)	61 to 100%
Aluminum, zinc or galvanized steel (no paint)	90%
Mylar reflective plastic for glass	76%

Color	reflectivity %
white	80%
marfil	77%
yellow	74%
pink	70%
beige	68%
gray	64%
lemon	62%
gold	53%
orange	34%
café	27%
red	20%
brown	14%
dark blue	8%

Better reflectivity on interior surfaces means a reduced need to use lamps to light the space.

ARCHITECTURAL CONTEXT (VENTILATION, AIR CONDITIONING AND HUMIDITY CONTROL)

- Design must utilize natural crossed ventilation techniques to improve comfort and control humidity on the interior. Windows should be located in 2 opposite walls in every habitable room.
- In places where crossed ventilation is minimum or nonviable, natural ventilation will be supplemented by using convection or electric fans and/or plafond or wall fans.
- Landscape features are located to facilitate natural ventilation on the buildings and to avoid unnecessary energy consumption.
- Building design suggests open spaces without intermediate walls (except for bathrooms and kitchens) to avoid the obstruction of breeze flow.
- Interior walls should not get to the ceiling to avoid the obstruction of natural breeze flowing to the buildings.
- Stair and elevator boxes or holes are used to induce natural ventilation and hot air removal.
- Openings such as movable lattices on upper and lower walls are placed to promote air movement.
- Full floor to ceiling windows are used to ease crossed ventilation.
- Separation of heat or humidity producing spaces (kitchens, bathrooms, laundry rooms) from the rest of the rooms is recommended.
- Buildings should be lifted from the ground to allow air flowing underneath them, reduce humidity and lower the impact on topography.
- Breezes are directed towards shadows before entering any structure.

ENVIRONMENTAL CONTEXT (VIEWS AND SCENIC VALUE)

- Bio Caribe promotes the conservation of highly scenic value areas and the creation and conservation of natural panoramic views.
- Bio Caribe recommends to place maintenance areas out of sight and covers them with natural resources such as vegetation.
- Compost piles, recycle centers, photovoltaic control systems, etc will not be covered.

ENVIRONMENTAL CONTEXT (NATURAL LANDSCAPING ELEMENTS, FLORA AND FAUNA)

- Landscaping design will favor local ecological communities of species to increase biodiversity and to be attractive to all flora and wildlife.
- Installations are designed and placed to avoid dense vegetation areas and grown trees from being removed, and to avoid damaging tree's roots or any other natural features.
- Local natural groundcovers are recommended instead of using exotic grass or groundcovers.
- All the trails, paths and roads are designed to respect wildlife and its movement patterns and habitats.
- Preexistent paths, trails and roads are incorporated into the design.
- Separate buildings or building sets are properly separated (or grouped) to allow natural vegetation growth and fauna movement.

- Bio Caribe recommends low maintenance landscaping, adequate to the weather.
- Bio Caribe recommends planting 10 shadow trees (not shorter than 10 feet height when planted and with a treetop bigger than 20 diameter feet) for every 12,000 Btuh of artificial conditioning.
- Tree planting can be done inside the community or in outside roads if it can't be done in the same place.
- Natural resources, such as "lemongrass" can be used as repel insects around public domestic areas. Most artificial insecticides or pesticides can be harmful to humans.
- Agronomists and arborists have recommended specific tree pruning and fertilizers around Bio caribe.
- Bushes and low vegetation are placed away from buildings to avoid air movement obstruction and to reduce solar heating early in the morning and in the afternoon.

ENVIRONMENTAL CONTEXT (TOPOGRAPHY, EROSION AND OVERFLOWS)

- Autochthonous vegetation will be used to protect exposed grounds due to leveling or any other ground movement work, as recommended by a landscaping architect, an agronomist or licensed arborist.
- Preexistent vegetation will not be removed of sloped grounds (roots contribute to stabilize ground, reduce erosion and/or slip potential)
- Buildings can make use of ground slopes to the east to help topography protect them from solar radiation from the west.
- Bio Caribe protects natural overflows, including rain water.

ENVIRONMENTAL CONTEXT (CORPORAL SENSES)

- Bio Caribe promotes the conservation and/or creation of fragrant spaces using natural native resources.
- Areas of night darkness are planned to provide a space to appreciate the beauty of the starry nights and full moons.

CONSTRUCTION MATERIALS (GENERAL)

- Bio Caribe recommends the use of low maintenance materials produced through reduced environmental pollution techniques.
- Facilities are ecologically designed to preserve all resources and minimize waste on the construction site.
- Standard equipment and materials are used to optimize the construction process. For example, a 21' wall requires more material than a 20' wall, which can be built using 5 standard size panels)
- Bio Caribe recommends avoiding the use of limited, hard to find or foreign material.
- Bio Caribe recommends the reutilization of local material to minimize the use of planet resources and preserve energy throughout the construction process.
- It is recommended to use Costa Rican products or, better yet, locally produced material.

- Bio Caribe proposes the construction contracts to specify the use of locally produced materials over outside products, whenever possible.
- Low energetic material are recommended (see appendix).
- We recommend hiring suppliers that can provide sustainable, low toxic or non-toxic products.
- Rustic materials are preferred over processed ones in construction.
- Bright painting and material with reflectivity higher than 80% is used on the outside of the buildings to reduce solar heating.

The following table indicates the incorporate energy value for construction materials:

low incorporate energy value	Btuh/lb
wood	185
brick work with sand	730
concrete (light)	940

Middle incorporate energy value	Btuh/lb
lime	2,800
cement	4,100
isolation minerals	7,200
glass	11,200
porcelain	11,300

high incorporate energy value	Btuh/lb
lead	25,900
zinc	27,800
copper	29,600
aluminum	103,500

CONSTRUCTION MATERIALS (CHEMICALS)

- Sprays or other products used should not contain chlorofluorocarbons (CFC), hydrocarbons or hydro fluorocarbons.
- All measures to avoid oils from motor engines to be filtered on the ground must be taken.
- Bio Caribe forbids the use of thermal or acoustic insulation products that damage the ozone layer.
- Contractors must not use chemicals that can be filtered through the subsoil.

ALTERNATIVE ENERGY

- Building structures and/or trees can not shadow any solar equipment.
- Solar equipment and panels are placed on roofs with an inclination between 18° and 20° in relation to the horizon and facing south to improve solar energy uptake.

- Photovoltaic systems are recommended to generate at least 30% of the total electricity in the project. The goal is to supply Bio Caribe 100% with solar energy.
- Wind generators are recommended, if possible, to generate 15% of the total electricity in the project.
- Appropriate techniques, such as biogas tanks are recommended to be used to treat and reutilize organic waste.

EQUIPMENT AND FURNITURE

- High efficiency and low power consumption equipment is required.
- It is recommended to use gas stoves and microwaves over electric ones.
- It is recommended to use high energetic efficiency lamps, such as compact fluorescent or led.
- Dehumidifiers and air conditioning equipment must have a minimum of 12 EER (Energy Efficiency Ratio) and will be used only when imperative.
- The alternate use of gas or solar air conditioning equipment is recommended.
- It is recommended to use long life products.
- The use of low power consumption laptops is recommended over desktop computers.
- Lamps must be certified and low consumption.
- The use of stand or ceiling fans is recommended over air conditioning machines.
- Fluorescent compact yellow lamps are specifically recommended in order to avoid the use of chemical insecticides on places with insect abundance.