Vaga-Lume Small Farm – Rancho Queimado – Santa Catarina – Brazil: a frame of reference for perma-culture and eco-villages (Poster Presentation)

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ABSTRACT: This academic project studies the construction of a property around the principals of a perma-cultural unit, its use for educational purposes and its degree of environmental sustainability as well as its role as a place of intra and inter-development experiences for the local community and people from neighboring cities. The methodology used for this research was based on a study of the literature. Following this we introduce the conceptual basis for sustainable human settlements called eco-villages. The resulting project encompasses different construction techniques, from the traditional to the more innovative, using low to medium technology, as well as landscape regeneration systems and alternative infrastructure that utilize ecological design techniques referred to as perma-culture, bio-construction and bioclimatic architecture. Different aspects of the relationship between man (user) and landscape (surrounding) are also contemplated through a discussion of the architecture. We also consider the cultural and anthropological aspects of architecture as a mediator between Man and the land.

Theme: low energy architecture
Keywords: permaculture, bio-climatic architecture, bio-construction, bamboo, eco-villages.

"Our most important task is to redirect our present collision course (...) We must carefully understand the problem and start to see the possibilities of evolution towards a new lifestyle, with new modes of production and new means of consumption: a lifestyle designed for permanence."

(SCHUMACHER, 1973)[1]

1.INTRODUCTION

This article stems from a Final Project for the Under-Graduate Course in Architecture and Urbanism at the Federal University of Santa Catarina in which we looked for alternative models for permanent and sustainable human occupation in the context of a small homestead in Santa Catarina.

Figure 1 shows the inverse relationship between natural resources and the world population which is the main concern behind this article.

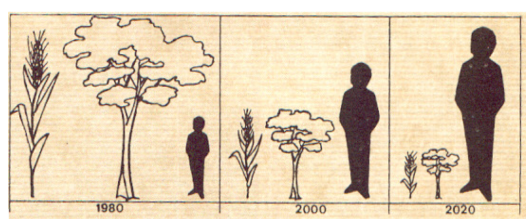

Figure 1: World Population versus Natural Resources Source: Revista Projeto, n. 38, p. 65.

2. THE FOCUS

The construction industry is charged with a special responsibility for the environmental impact and energy consumption which result from the procurement, manufacture, use and disposal of its product. It is the greatest consumer of raw material in any country. In Latin America this can be more than 50% of all natural resources extracted. Buildings use about 25% of all energy produced in Latin America, while only 10% of their sewage is treated.

In the rural areas of Latin-American countries, there is a real decline in fertility of agricultural land due to the overuse of agro-toxins, just as there is also a reduction in the number of farms for which the family provides the labor force, leading to flight from rural communities, hardship and unemployment and the resulting exodus to the cities.

The context of this article falls within the realm of these two themes. Our proposal also studies the issue of human interaction between the city and country and the educational potential of the countryside.

3. THE PROJECT

The main objective of the project studied is the construction of accommodation for teaching sustainable agriculture, environmentally-friendly construction, training in sustainable economic practices and environmental education. It would also act as a social center supplementing reflection and personal interaction with knowledge based around the eco-village idea of settlements.

4. THE REGION: RANCHO QUEIMADO

The site is located in the south of Brazil, in the state of Santa Catarina, 70 km to the west of the state capital, Florianópolis and the Atlantic Ocean (see fig. 2).

Figure 2: Brazil → Santa Catarina → Rancho Queimado.

There are approximately 2,500 inhabitants mainly of German and Portuguese origin whose livelihood is based on arable farming and cattle ranching.

The rough terrain contains many rivers and is located between 800 and 1,200m above sea level. The climate is humid and temperate, with an average temperature range of 18 to 22°C in the Summer and 10 to 12°C in the Winter. Annual rainfall is 2,115 mm mostly falling in the Summer, less in the Autumn and Winter. The relative humidity of the air has an annual average of 80 to 85%.

5. THE VAGA-LUME SMALLHOLDING

The area was originally a large agricultural property. It is in a concave valley with about 80% of its area (12.5 hectares) being forested slopes (see fig. 3). In the valley floor a stream, fed by smaller tributaries, divides the smallholding. There is a plantation with about 300 clumps of bamboo, mainly of species good for construction like *Dendrocalamus Giganteus* and *Guadua Angustifólia.*

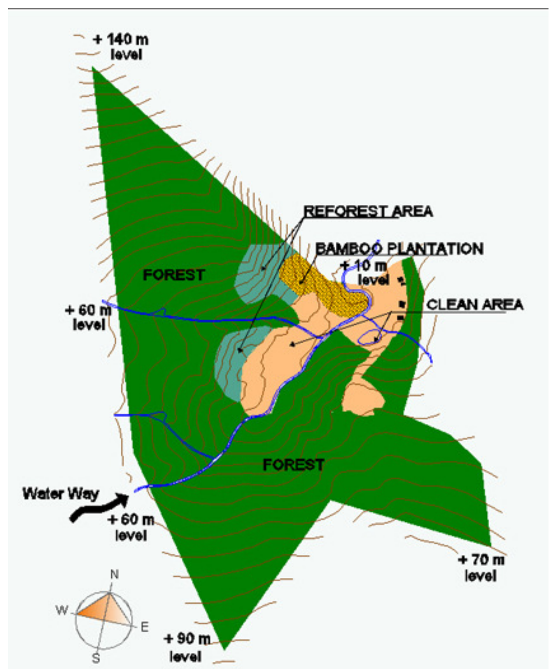

Figure 3: Vegetation Cover, Hydrology and Annotations. (Author´s design)

In addition to the architectural intervention the plan for the smallholding dealt with issues such as:

• zoning of future crops in accordance with perma-culture principals,

• perma-culture techniques to regain the landscape and original soil fertility,

• creation of tracks and paths within the smallholding.

The strategic positioning of equipment was also considered, such as:

• a waterwheel as an alternative source of electricity,

• elevated reservoirs and water storage for gravity-feeding,

• a viewpoint and wind turbine at the highest point as a further alternative electricity source.

This article will be limited, however, to the principles that guided the architectural proposal to be used as a key frame of reference for perma-culture and eco-village installations

6. MATERIALS AND METHODS

The project covers different construction methods: from the traditional to the innovative, using low and medium technology whose main feature is its repeatability, in other words, the ability to be easily assimilated and reproduced.

We agree with George McRobie of the Intermediate Technology Development Group (ITDG), when he says, "the most urgent task, as much for the rich countries as the poor ones, is to discover and use sustainable technologies that respect the human need for useful and satisfying work, which cause minimum damage to the environment and conserve natural resources." [2]

6.1. Appropriate Technology

McRobie continues, "to be appropriate the technology should be used, maintained and produced locally (...) It should maximize the use of local and renewable energy. It should be easily transferable by self-contained means and through local markets." [2]

In our work we bring together:

• Locally obtained materials: soil, sand from the streams (coming from the erosion of land above the smallholding), stone, natural fiber and bamboo.

• Locally worked materials: planed wood, eucalyptus logs, metal fabrications and carpentry products.

• Industrialized materials: cement, ironmongery, PVC piping, tar-macadam surfacing and geo-textiles.

• Recycled materials: polyethylene bottles, aluminum cans, long-life milk cartons.

Figure 4: Soil Samples after the Sedimentation Tests. (Author´s archive)

7. THE BUILDINGS

In presenting the building projects we hope to show how the fundamental architectural concepts were applied. In addition to positioning the context and fundamental concepts of the project, this article will be limited to a presentation of only one building within the overall scheme, leaving the others for subsequent articles.

Besides the inherent aesthetic impact of the materials and methods adopted, the intention was to look for an architectural language that symbolized the ethical force behind the campaign for eco-villages and perma-culture.

Each building was conceived with its role as an "*eco-building*" in mind. According to Adam, "Eco-building is a dynamic, forward-looking concept that brings together: individual, building and eco-system, harmonically helping to assimilate them all." [3] In order to abide by the concept described above, knowledge from construction science was employed such as: Bio-construction, Eco-technology and Bio-climatic Architecture.

7.1. The Community Center: Schoolhouse and Lodgings.

This poly-functional building, located in a clearing 35 meters above the valley floor (see fig. 5) was conceived as lodgings for students of the perma-culture and bio-construction courses - 4 students per dormitory on the upper floor, and for the course leaders - 1 for each class, who stay on the lower floor (see figs. 7 e. 8).

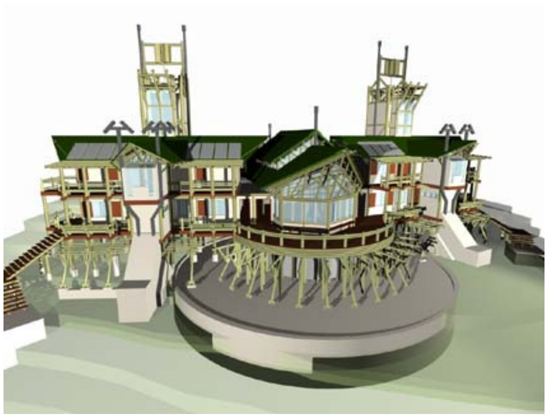

Figure 5: Community Center. (Author´s design)

Figure 6: Photograph of the Site. (Author´s archive)

It also serves as accommodation for eco-tourists when there are no courses programmed, and can be used as autonomous housing.

7.1.1. Description of Spaces

The central module holds the classroom and refectory. The tables have places to put away the teaching materials for when lunch is being served.

At the back of this block and with separate access is the kitchen, fitted with wood-burning stove and a hob also using bio-gas. The large windows allow the excess heat of the Summer to escape while at the same time using this to heat the main room. For this reason the clear ceiling height of the kitchen is lower than that of the main room.

The rear walls of the kitchen are protected by a retaining wall made of old tires filled with earth and planted with herbs and spices, within easy reach of the kitchen staff. The placing of the kitchen at the rear reflects the traditional architecture of the region, which sometimes will even use a separate building for this purpose.

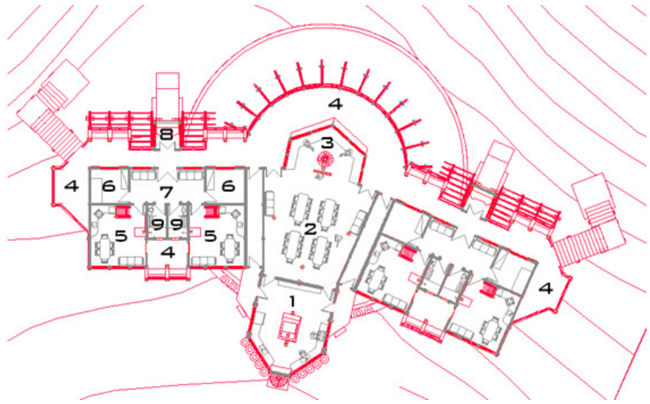

Figure 7: Plan View of Lower Floor. (Author´s design)

Key to figures 7 and 8: 1. kitchen, 2. main room, 3. solarium, 4. sun deck, 5. living/kitchen, 6. single bedroom, 7. alpendre (veranda), 8. dry restroom, 9. shower, 10. bedroom for four people.

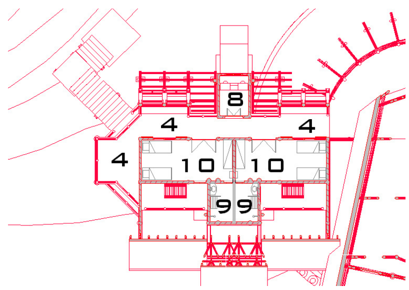

Figure 8: Plan View of Upper Floor. (Author´s design)

Over the entrance to each block is a glass porch, very important in colder climates where the transition from inside to outside shouldn't be made suddenly. Visitors may sit in this space, sheltered from the weather, while waiting for those inside, just as it can be used for removing dirty boots and overcoats.

7.1.2. Eco-techniques and Bio-climatic Principles

From conception through to architectural detailing, this building was defined by bio-climatic issues.

Starting with the location in a north-west-facing clearing, and the restriction to not remove any trees from the area, the shape of the building achieves the greatest wall area exposed to the sun during the Winter when it is most needed.

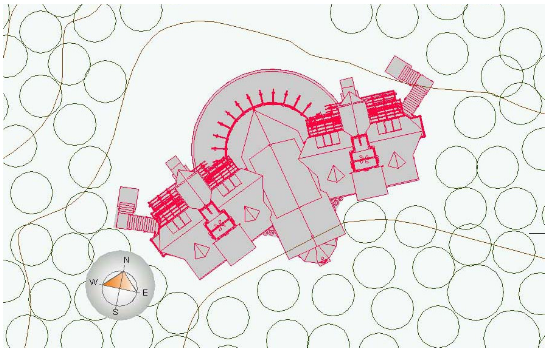

Figure 9: The Site and its Undergrowth: A Building Exposed to the Sun. (Author´s design)

As a way of taking advantage of the sunshine for warming the inhabited spaces a “sun-deck” was built in front of the central module. This patio, with its panoramic view, allows the solar energy to warm up the external wattle and daub wall (holding the school blackboard) and the floor covered with a locally abundant lightweight black stone (see fig. 10).

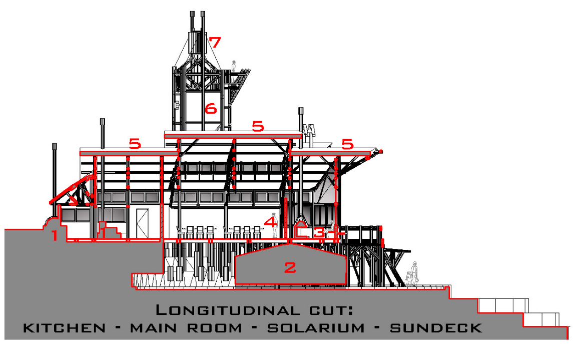

Figure 10: Main Room Section and any energy-saving features used. (Author´s design) Key: 1. Wood-stove, 2. Rainwater tank (100.000 l), 3 –Stone-floor Solarium, 4. Trombe wall, 5. Roof-lawn, 6. Tower for water tank, 7. hot-air flue, viewing platform and wind turbine for water pumping.

The walls, being made from earth, have a high thermal capacity, which retains the heat inside the building. To protect these walls from the effects of rain, overhanging bamboo eaves were added (see fig. 11) which can carry transparent tiling made from polyethylene bottles in the Winter (see fig. 12) and plant fiber matting to protect from the hot sun in the Summer.

In a manner analogous to plant-life, the building can be adapted interactively by the user to react to the heat intensity of the sun. Since this would be a place for teaching bio-architecture, user-involvement was encouraged for creating comfortable conditions, as exemplified by this statement from DENT e SCHADE when they say that, "There is generally a correlation between independence from fossil fuels and a greater personal involvement in the creation of comfortable conditions. Since we have become so dependent on our mechanical servants to create thermal comfort, it may be difficult to change to lower consumption and greater involvement. However, solutions are being developed using high and low technology. The choice for the user will be between greater involvement and lower cost or greater convenience and higher cost." [4]

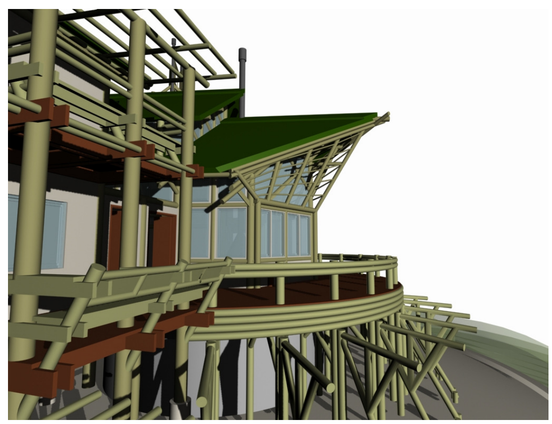

Figure 11: Overhanging Eaves on the North Facade. (Author´s design)

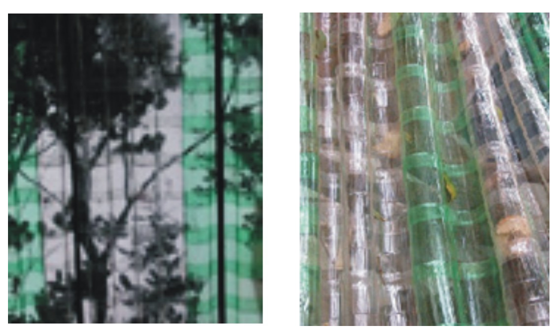

Figure 12: Eaves Coverings using Polyethylene Bottles. (Author´s design)

The building walls will be made from wattle and daub, a typical colonial Brazilian technique (see fig. 13) which consists of a wooden frame with interlaced panels formed in bamboo, this being covered with a mud and vegetable fiber mortar (see fig. 14).

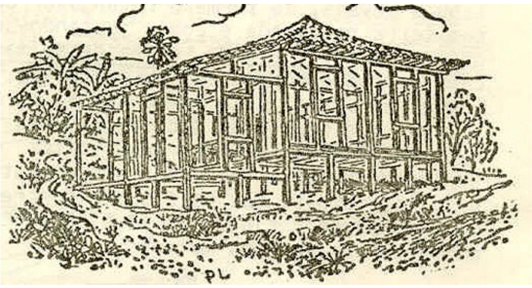

Figure 13: Frame for a Colonial House made ready to receive Wattle and Daub. Source: Revista Projeto, n. 28. p.75.

Figure 14: Wattle and Daub Construction. Source: www.ipemabrasil.org.br

Another main aspect of the technology used in this building that deserves as much special attention as the solar orientation is that of the dry composting restrooms (see fig. 15). Without the heat generated by the sunshine on the metal roofs it could prove difficult to reach the temperature required to remove the disease-carrying germs.

Figure 15: Dry Restroom. (Author´s archive)

One final example of eco-techniques used here was that of the roof lawn (see fig. 16). With its excellent thermal insulation and very good integration into the landscape, it also obviates the need for the kiln-cured clay tiles common to the region.

Figure 16: Roof Lawn. (Author´s archive)

7. CONCLUSION

The use of permaculture in planning and architectural design achieves its goal of making social and technological advances that improve the environment

We believe, with Giannetti [5], that a *co*untry does not need to be very rich in order to achieve high standards of well-being for its citizens using sustainable technology.

This study can be continued by researching the sustainable construction techniques in greater detail, considering changeable human and environmental needs.

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