

**TROPICAL ARCHITECTURE: THE ANALYSIS OF THREE WORKS BY
ARCHITECT BRUNO STAGNO**

**ARQUITETURA TROPICAL: A ANÁLISE DE TRÊS OBRAS DO ARQUITETO
BRUNO STAGNO**

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ARQUITECTO BRUNO STAGNO**

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ABSTRACT

This work analyzes three buildings by architect Bruno Stagno: the BATCCA with the headquarters of the offices of the Bat tobacco company in Central America, built in 2006, the Casa LOUMAY in 2012 and the hotel to receive students from the Instituto Centroamericano de Administración de Empresas INCAE in 2016. The objective of this article is to understand the work of the Costa Rican in the context of sustainable tropical architecture applied to different typologies: business, residential and student hospitality. The methodological procedures are based on literature review and qualitative analysis, comparing bioclimatic strategies in the use of materials, the project, the elements of the envelope and the landscape, without leaving aside the emblematic meaning of the works. The results demonstrate conceptual consistency through the adaptation of sustainability premises in different contexts. BATCCA's work has a business nature; Casa LOUMAY contemplates everyday family life; and at INCAE. Hospitality to receive students. In the three works analyzed, it is observed that he intertwines technical solutions with environmental ones, incorporating the cultural context of tropical architecture. This expands the debate on sustainable architecture, seeking user comfort and lower energy expenditure.

Keywords: Bruno Stagno. Tropical Architecture. Sustainability. Latin America. Bioclimatic Architecture.

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RESUMO

Este trabalho analisa três edifícios do arquiteto Bruno Stagno: o BATCCA com a sede dos escritórios da empresa Bat de tabaco na América Central, construído em 2006, a Casa LOUMAY em 2012 e o hotel para receber os estudantes do Instituto Centroamericano de Administración de Empresas INCAE em 2016. O objetivo deste artigo é compreender a obra do costa-riquenho no contexto de arquitetura tropical sustentável aplicada a diferentes tipologias: empresarial, residencial e hotelaria estudantil. Os procedimentos metodológicos partem da revisão da literatura e da análise qualitativa, comparando as estratégias bioclimáticas no uso de materiais, o projeto, os elementos da envoltória e a paisagem, sem deixar de lado o significado emblemático das obras. Os resultados demonstram uma consistência conceitual pela adaptação das premissas da sustentabilidade em diferentes contextos. A obra do BATCCA tem caráter empresarial; já a Casa LOUMAY contempla o cotidiano familiar; e no INCAE. Hotelaria para receber estudantes. Nas três obras analisadas, observa-se que ele entrelaça as soluções técnicas com as ambientais, incorporando o contexto cultural da arquitetura tropical. Este amplia o debate da arquitetura sustentável, buscando o conforto dos usuários, buscando menor gasto energético.

Palavras-chave: Bruno Stagno. Arquitetura Tropical. Sustentabilidade. América Latina. Arquitetura Bioclimática.

RESUMEN

Este trabajo analiza tres edificios del arquitecto Bruno Stagno: el BATCCA con sede de las oficinas de la tabacalera Bat en Centroamérica, construido en 2006, la Casa LOUMAY en 2012 y el hotel para recibir a estudiantes del Instituto Centroamericano de Administración de Empresas INCAE en 2016. El objetivo de este artículo es comprender el trabajo del costarricense en el contexto de la sostenibilidad tropical. arquitectura aplicada a diferentes tipologías: empresarial, residencial y hostelería estudiantil. Los procedimientos metodológicos se basan en la revisión bibliográfica y el análisis cualitativo, comparando estrategias bioclimáticas en el uso de los materiales, el proyecto, los elementos de la envolvente y el paisaje, sin dejar de lado el significado emblemático de las obras. Los resultados demuestran consistencia conceptual a través de la adaptación de premisas de sostenibilidad en diferentes contextos. El trabajo de BATCCA tiene un carácter empresarial; Casa LOUMAY contempla la vida familiar cotidiana; y en INCAE. Hospitalidad para recibir estudiantes. En las tres obras analizadas se observa que entrelaza soluciones técnicas con ambientales, incorporando el contexto cultural de la arquitectura tropical. Se amplía así el debate sobre la arquitectura sostenible, buscando el confort del usuario y un menor gasto energético.

Palabras clave: Bruno Stagno. Arquitectura Tropical. Sostenibilidad. América Latina. Arquitectura Bioclimática.

1 INTRODUCTION

Global warming has been causing damage to several sectors "in recent human history." Risks are uncertain, in cities and infrastructure, in buildings, and in society. The authors Adger *et al.* (2003) observed that parts of society are more vulnerable. that depend directly on "government resources", especially developing countries.

The reflections of architectural production in Brazil and in the world have been undergoing changes due to the concern with the impact of the built building on the environment, with the mode of production of materials and their exhaustion, as well as with energy expenditure during the useful life of the building, and the disposal of materials after the end of their useful life. Society and architecture have been looking for buildings with "green certifications and standards that emphasize the rational use of resources, energy efficiency, water management, and sustainable materials" (Araújo *et al.*, 2023). According to Kowaltowski *et al.* (2011), we are looking for new methods and processes, design, materials and a broader approach to "architecture in its social, environmental and constructive context".

Araújo et al. (2023) highlight that the growing incorporation of renewable energies, such as solar and wind, in residential and public projects is evident. Like "rainwater harvesting systems" and green walls, these "elements promote urban biodiversity and reduce the environmental impact of buildings." "Legislation and public policies" must integrate and value "sustainable constructions, supporting bioclimatic reflections in architectural production."

In this sense, since the end of the last century, Costa Rican architecture has drawn our attention, as a cultural expression and response to the country's specific environmental conditions, standing out for its integration with the environment, the adoption of sustainable principles and adaptation to tropical climatic conditions. The constructive and design aspects in contemporary Costa Rican architecture contemplate sustainability, but without leaving aside tradition. Therefore, this work seeks to understand the production of Bruno Stagno, in the panorama of contemporary Costa Rican architecture, recognized for his significant contribution to architecture in general in the country. In this context, the work stands out for its technical-evolutionary rigor, an aesthetic sensibility and a commitment to sustainability. (STAGNO, 2004)

Stagno was born in Santiago, Chile, and is a Costa Rican citizen. He graduated from the Pontifical Catholic University of Chile in Santiago and the École des Beaux Arts in Paris. His trajectory is marked by the search for a dialogue between the natural environment and construction. His works reflect a search for and understanding of the tropical climate. It

applies passive solutions that promote energy efficiency by spending less energy in its buildings, as well as valuing parameters to minimize user discomfort. He values the "use of local materials and traditional construction techniques, combined with contemporary solutions", revealing the "commitment to cultural identity and sustainability" (STAGNO, 2004)(STAGNO, 2019).

To analyze three representative works of the most recent phase of Bruno Stagno's production: the BATCCA in 2006, which is the headquarters of the offices of the Bat tobacco company in Central America, the LOUMAY House in 2012 and the INCAE – Instituto Centroamericano de Administración de Empresas, a hotel space for graduated students, built in 2016. The selection includes different scales and typologies — business, residential and institutional hospitality — allowing the identification of both the common principles that structure its architecture and the variations introduced depending on the program and context.

2 THEORETICAL FRAMEWORK

The relevance of the theme of tropical and bioclimatic architecture arises from the need to think of architectural solutions capable of responding to specific environmental conditions in humid and hot climates. This theme gained international prominence at the end of the twentieth century, with the consolidation of approaches that articulate parameters such as human comfort and climate adaptation, with the foundations of architectural design. Among other pertinent authors, the studies of Victor Olgyay and Baruch Givoni stand out. Victor Olgyay (1963), with the book *Design with Climate*, created a methodology that related the bioclimatic map to the 12-month needs chart and a solar diagram. The card interpolates the "Dry Bulb Temperature (Tbs) and Relative Humidity (RH)" (FERNANDES, 2019). This shows a region in thermal comfort and areas without comfort, therefore, in these there is a need for strategies to have well-being, associating corrective measures, depending on the climate. Different works have pointed out that Olgyay's graphics did not consider the envelopes of buildings, and it was considered for outdoor environments. This methodology has been taken up again in urban microclimate analyses (ANDRADE, 1996) (PIJPERS-VAN ESCH, 2015).

Baruch Givoni has great relevance for bioclimatic architecture, as a researcher and professor, he dedicated his career to the study of environmental comfort and heat exchange mechanisms. He published several books, including *Man, Climate, and Architecture*,

considered a reference whose first publication was in 1969, republished in 1976. Andrade (1996, p.21) points out that one of Givoni's main contributions was to study the biophysical model

[...] describes the mechanisms of heat exchange between the body and the environment, the Thermal Index (ITS). This index uses air temperature, humidity (vapor pressure), air movement, solar radiation, metabolic rate, and clothing as variables included in the calculation.

Givoni also proposed bioclimatic maps, but different from those proposed by Olgyay, as he associated "the external climatic conditions of the building with the properties of its envelope." Givoni's letters have also undergone revisions. . The maps underwent revision over time, the tropical climate map was revised by Milne and Givoni (1979) (ANDRADE, 1996, p. 21).

Another aspect observed in the field by Givoni is that "people who lived and worked in cities in developing countries, located in humid and hot regions, were acclimatized to values above the temperature of the norms." Due to this field study, he adjusted the thermal comfort limits, creating two charts.

Givoni (1998) highlights in his articles and book that, in regions with a hot and humid climate, it is difficult to control thermal stress, and recommends that buildings and urban environments located in hot and humid zones avoid overheating through shading strategy, natural ventilation, vegetation, use of light-colored coating, and the orientation of the building. He highlights the use of balconies, brises, eaves and pergolas.

Gupta et al. (2021), with support from the United Nations Environment Programme, have prepared a guide: *A Practical Guide to Climate-resilient Buildings & Communities*. This one was addressed to the communities of Nairobi, it addresses strategies to improve the construction process and comfort in hot and humid tropical climates. The text shows that, in a hot and humid zone, natural ventilation is very important in the comfort of the inhabitants, therefore, the implantation of the building in the project can improve its performance if the openings are designed in the prevailing winds. "The higher ceiling height promotes the chimney effect with air convection". Houses on stilts have the advantage of being isolated from soil moisture, and the higher the height of the openings, the higher the wind speed.

Gupta et al. (2021) describe that roofs, in general, are responsible for up to "70% of the total heat gain" of a building. Therefore, strategies should be sought to improve the

performance of buildings, applying roof coatings "with high solar reflectance index (SRI), with cool roof paints", these can reduce "internal temperatures from 1 ° to 4 °C"; use of two layers of protection on the roof, so as to create an air gap between the outer and inner surface, allowing air flow, this will reduce the temperature, known as fly roof; the use of large eaves "to shade walls and protect the openings from direct sun and heavy rain", or the use of horizontal louvers; use of ventilated attics.

Feng et al. (2020) evaluate 34 case studies of NZEB – Zero Energy Buildings. These projects and constructions value passive strategies and minimize active ones, in the search for zero energy costs. In this study, the authors note that in a hot and humid climate, one should work with a high-performance envelope. They point out that they count on the envelope, "walls, roof and fenestration surfaces (windows and glass). These systems have to be designed and built to minimize heat transfer and solar heat gain, aiming for energy efficiency superior to traditional building codes and standards."

In the search for architectural references by architect Bruno Stagno that integrate climate and nature, for hot and humid climates, the works of Geoffrey Bawa and Ken Yeang stand out. Bawa lived between 1919 and 2003 in Sri Lanka, consolidated the term "Tropical Modernism ", which combines principles of international modernism with vernacular strategies adapted to the tropical climate (AMPERSAND, 2024). His work demonstrates how architecture can dissolve into the landscape, integrating vegetation, topography, and natural ventilation into solutions that reconcile environmental efficiency and cultural identity. (Chiu, 2025). Bawa's work has received two important awards, including the Aga Khan Architecture Award, being nominated for membership in RIBA - "Royal Institute of British Architects", becoming a fundamental reference for the practice and reflection on tropical architecture. MOMa exhibited SAW's projects in the exhibition "The Project of Independence Architectures of Decolonization in South Asia", which ran from February to July 2022.

Figure 1

Hotel Kandalama - Sri Lanka Year 1992 - 1995



Source: © Courtesy of The Heritance Hotel

One of the architects cited in terms of concepts that integrate bioclimatic architecture and biophilic concepts is Ken Yeang (1995). In his projects, he seeks to transform the "built environment into ecosystems", especially in the context of skyscrapers, which values passive strategies associated with climate, such as natural light, natural ventilation, vertical gardens in the search for energy efficiency. Yeang expands the notion of sustainability by considering buildings as an ecosystem, "valuing natural systems, including biotic and abiotic ones" (NORMAN FOSTER FOUNDATION, 2023). Ken Yeang defines that critical infrastructures must be integrated into the whole "Nature, People, Built Environment, Energy Systems and Hydrology" to have an ecosystem and sustainable project.

Figure 2

Kandalama Hotel - Sri Lanka Year 1992 Figure 3 - Editt Tower, Singapore, 1998



Source: T. R. Hamzah & Yeang

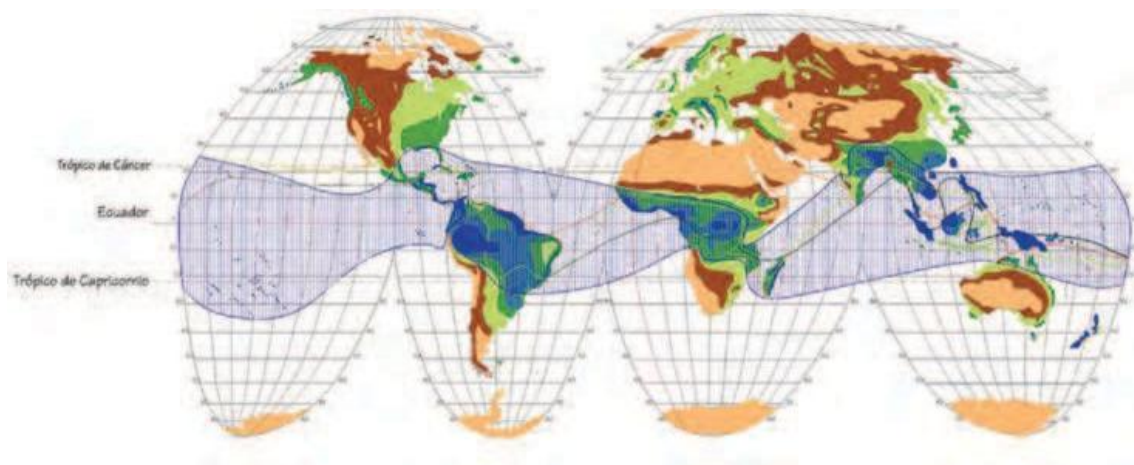
In the context of sustainable architecture in Latin America, Bruno Stagno's work has a significant contribution, as shown in the book on his work by Mignucci (2019) entitled *"Sustainable Tropical Architecture"*. The author points out that the Costa Rican architect argues that "sustainability should not be restricted to energy performance, but should integrate environmental, social and cultural values". He values the concept of "more design than technology" for developing countries. His work and writings present a synthesis between bioclimatic efficiency — through strategies, among others, such as shading, cross ventilation, large eaves, and the use of local materials. Cultural values, on the other hand, are understood as an expression of identity and belonging of the population that lives in the place. In addition, Stagno understands architecture as a pedagogical tool, capable of transmitting to users and society the importance of living responsibly. His work in this perspective projects Central America as a laboratory of architectural innovation, inserting the region in the international debate on sustainability.

The works of Yeang, Bawa and Stagno allow us to understand tropical bioclimatic architecture as a multidimensional field, which articulates technique, ecology and culture. Olgyay and Givoni establish the conceptual and methodological bases, Bawa and Stagno resignify these premises in specific tropical contexts, expanding the reach of sustainability as a global architectural paradigm.

From the dialogue between Yeang's and Bawa's contributions, one can understand sustainability in architecture as a multidimensional concept: while Bawa highlights territorial understanding in the dimension of architectural practice, Yeang delves into the technological and ecological aspect. Both point to the need to rethink the role of architecture in the face of contemporary environmental challenges, going beyond merely formal or aesthetic solutions.

Figure 4

Map of the planet's tropical regions



Source: Institute of Tropical Architecture.

In this sense, the work of Latin American architects such as Bruno Stagno is part of a critical tradition that adapts and resignifies these concepts to the tropical context of Central America. By articulating bioclimatic principles with cultural and identity values, Stagno contributes to the development of a sustainable tropical architecture, which combines technology, environmental ethics and cultural belonging.

3 METHODOLOGY

This article investigates the actions of the effects of climate change that play a leading role in the design process of architecture, analyzing the architecture produced in Costa Rica by Bruno Stagno. His work theorizes a specific architecture for the latitude range 10° N, considering climatic aspects, but also the human lifestyle. The strip demarcated on the map below has architectural characteristics based on climatic and territorial conditions.

The investigation brings a selection of three buildings developed in the period of ten years (2006 to 2016) to analyze through texts, photographs, plans, etc., among these: design processes, construction systems, materiality, in addition to the relationships inherent to a

good architectural project. This selected theme, with an emphasis on the work of Architect Bruno Stagno Levi and his studio BSAA, is due to the important commitment to climate issues related to geographical latitude in architecture and the reverberation of architectural forms over time in a specific place and its territory. The primary sources were sent by the architect Bruno Stagno himself, from contact by e-mails.

3.1 WORK ANALYSIS 1 - BATCCA BRITISH AMERICAN TOBACCO WORKSHOPS

Figure 5

BATCCA – Corporate space



Source: BSAA
Year: 2007

BaTCCA is the headquarters of Bat de Tabaco's Central American corporate offices in the Caribbean. It was built in 2006 in the Llorente Flores district of San José, Costa Rica, and has 6,396 m².

The project for the administrative offices of BATCCA was built on a plot of land that contained the remains of the foundations of an industrial warehouse. These are preserved. Another aspect is that the existing cedars on the site have been preserved. "Moving away from the corporate office model with compartmentalized spaces and cubicles, the project prioritizes coexistence, visual relationships between employees and contact with nature and fresh air." (MIGNUCCI, 2019).

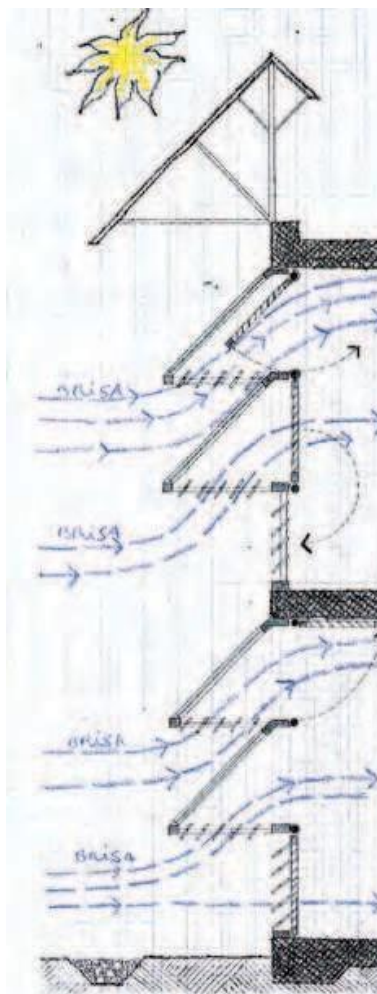
It is observed in the project that induced ventilation, as well as shading of the facades with curved panels away from the shaded walls and natural lighting, are applied to reduce energy consumption, while the implementation values the topography and local vegetation. Bruno Stagno observes the strategies applied in the BaTCCA Project

"Tropical architecture requires shading on facades to keep them cool. To this end, the huge existing cedars were preserved, keeping much of the building in shade. The work with materiality and the construction system creates elements on the facades through the overlapping of layers to meet the needs of watertightness and thermal comfort. These elements protect the building from rain, keeping the windows apart and the soft, differentiated natural lighting that protects and softens the intense sunlight. Energy savings are achieved by keeping the building shaded and elevated from the ground, allowing air to circulate, cooling it, and reducing humidity. This allows for smaller and cheaper air conditioning equipment, in addition to minimizing maintenance" (MIGNUCCI, 2019, 209).

In the sketch on the left, it can be seen that the ventilation is moved to the interior of the building. In the sketch on the right, areas of greater insolation, shaded windows and vegetation. Recommended strategies for hot and humid weather, by Givoni (1998), and Gupta et al. (2021).

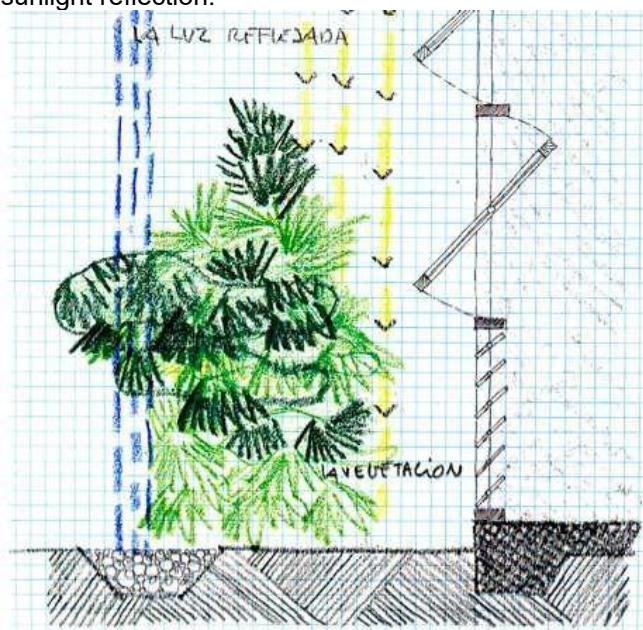
Figure 6

Ventilation scheme, Bruno Stagno



Source: BATCCA, San José
Costa Rica, 2007.

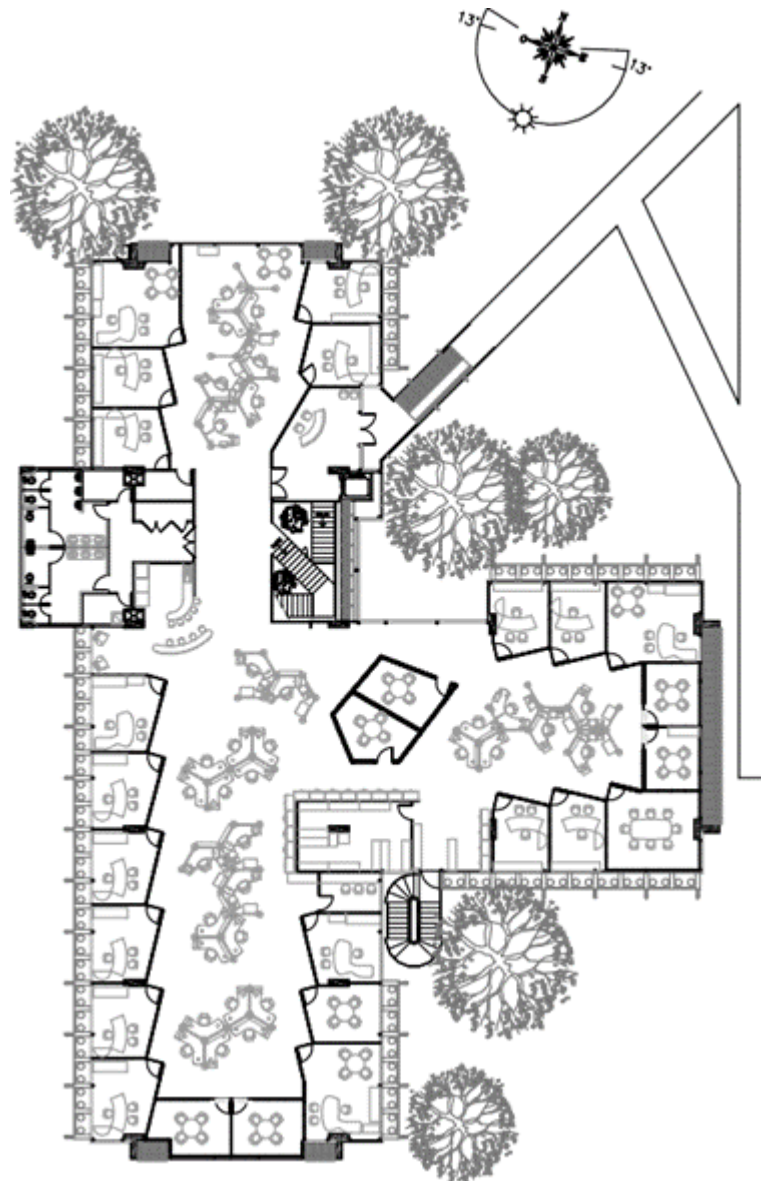
Figure 9: Project sketches with ventilation scheme and sunlight reflection.



Source: Bruno Stagno Notebook.

Figure 7

BATCCA Plant



Source: Bruno Stagno, *BATCCA*, San José, Costa Rica, 2007.

In the sketches above, we note the concern with comfort systems expressed in design thinking. In this sense, the energy performance of buildings adapted to the climatic characteristics of the tropics is observed in the use of local materials, with emphasis on tropical biodiversity and landscaping. The project can be considered a sustainable ecosystem, as it was designed and built involving the five dimensions of sustainability: "Nature, People, Built Environment, Energy Systems, and Hydrology" (NORMAN FOSTER FOUNDATION, 2023).

3.2 ANALYSIS OF WORK 2 – CASA LOMAY

Figure 8

Lomay House



Source: BSAA
Year: 2012

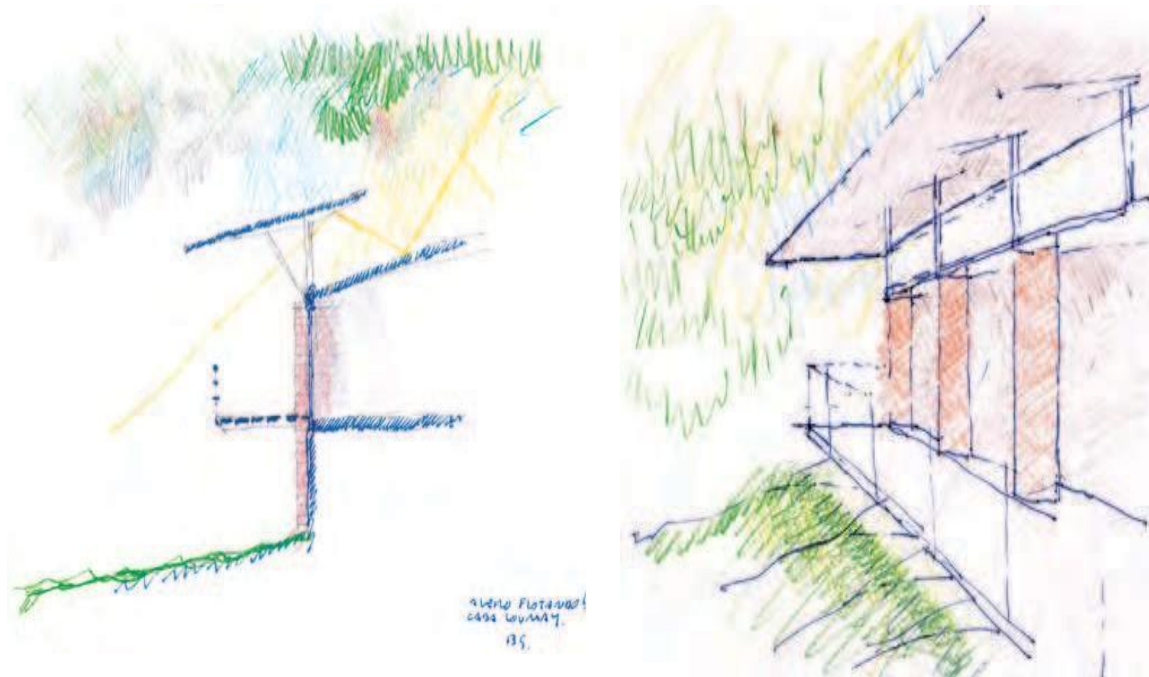
Casa LOUMAY is a single-family residence in Escazú, San José, Costa Rica, with 430 m². It was built in 2012. The architect incorporated in this project "large eaves, natural materials such as wood and baked clay brick, as well as generous openings that promote integration between interior and exterior." The brick was chosen for its low maintenance and durability, it adds warmth to the house and helps the construction to respectfully integrate with the surroundings.

In the sketches and sections, the large eaves can be seen creating a transition space between the exterior and interior, the double roof valuing cross ventilation. The author indicates that this design allows natural air circulation, maintaining a cool climate without the need for artificial air conditioning. Strategies recommended by Givoni (1998) and Gupta et al. (2021).

The house has terraces, protected, allowing the view of the "imposing hills, where the tropical rains, far from being an obstacle, become a natural spectacle, providing a unique experience" (MIGNUCCI, 2019).

Figure 9

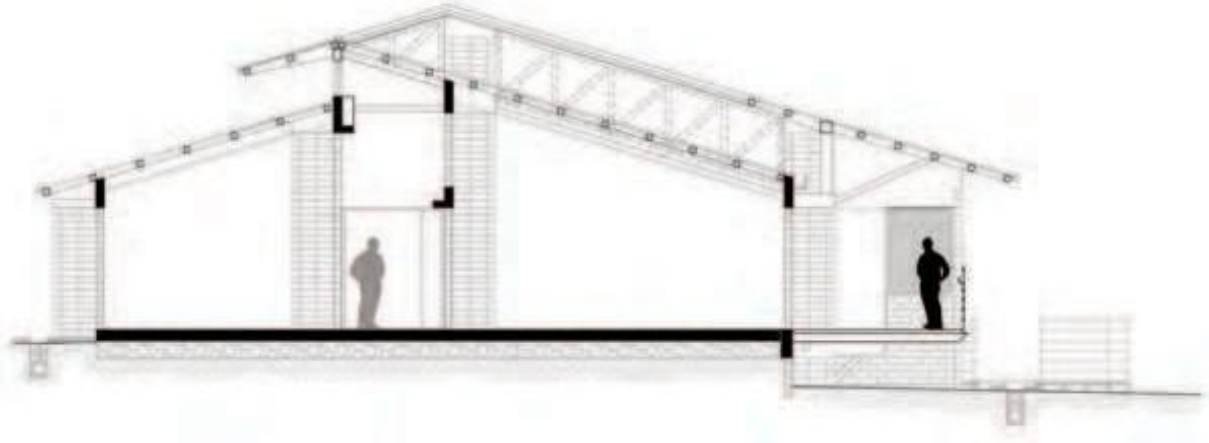
Sketches for Casa Lomay



Source:BSAa
Year: 2012

Figure 10

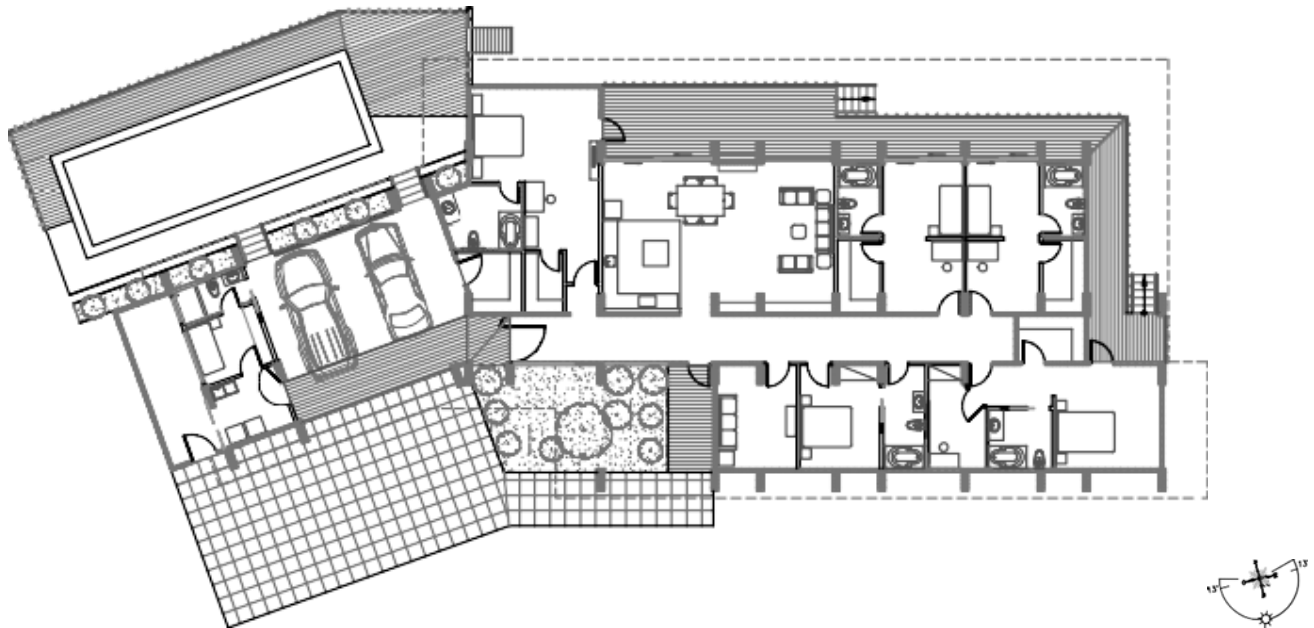
Cross-section of the Lomay House



Source: BSAA
Year: 2012

Figure 11

Plan of Casa Lomay



Source: BSAA
Year: 2012

Analyzing the section and the floor plan above, the double cover is clearly noticeable, creating a thermal layer that protects against the incidence of heat, but preserves clarity. With a design of peculiar simplicity, this residence seeks comfort through layered protections and materiality suitable for the tropical climate. It is observed that the project applied several strategies pointed out by FENG et al. (2020) with the goal of minimizing heat gains in the

envelope, especially in the covering and shading of windows, can be considered with sustainable bioclimatic strategies.

3.3 WORK ANALYSIS 3 – INCAE - ACCOMMODATION FOR GRADUATED STUDENTS INSTITUTO CENTROAMERICANO DE ADMINISTRACIÓN DE EMPRESAS: ACCOMMODATION FOR GRADUATED STUDENTS

Figure 12

Central American Institute Of Business Administration



Source:BSAa
Year: 2016

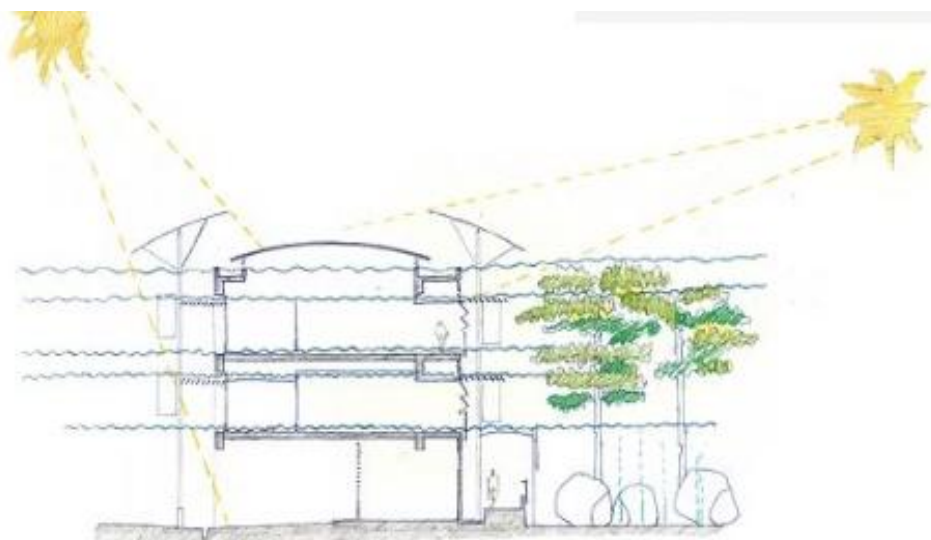
The accommodation for students graduated from INCAE - INSTITUTO CENTROAMERICANO DE ADMINISTRACIÓN DE EMPRESAS was built in 2016, demonstrates the maturity of the architect on an institutional scale. It is located in Alajuela, Costa Rica. Its area is 2000 m². The project integrates reception, bedrooms, meeting room, administrative spaces, restaurant, living areas.

Thinking about preserving the rest of his users, the architect applied large windows with views to the outside, but to preserve comfort, he applied shading to the windows with woven wooden panels, both horizontal and vertical (MIGNUCCI, 2019). Another aspect highlighted by the architect is that a double layer of tile was applied, allowing air to enter and exit. Gupta et al. (2021) advocate this type of system for tropical climate, as it improves the efficiency of the cover. Another aspect is that the work applied the cover with a high index of solar reflectance. Therefore, it is an example of tropical architecture applied to the hotel industry, associating innovation, identity and environmental responsibility.

It is observed that the project applied several strategies pointed out by FENG et al. (2020) with the goal of minimizing heat gains in the envelope, especially in the covering and shading of the windows, In this sense, it can be considered sustainable by valuing passive strategies.

Figure 13

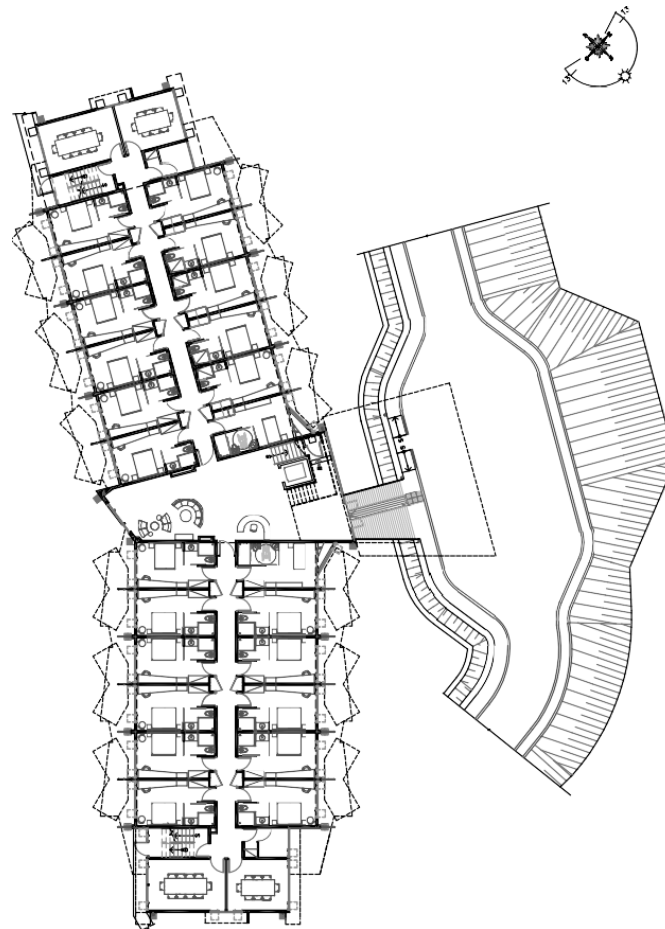
Generalist sketch of bioclimatic architecture



Source: BSAa

Figure 14

Plan of the INCAE dormitories



Source: BSAA

It is observed that, in the design process, special care was taken to apply sustainability criteria, achieving solutions adapted to the budget, functions and climate without losing the quality of the construction.

4 FINAL CONSIDERATIONS

The ten-year cut of the production of the Bruno Stagno Arquitectos Asociados office brings the following considerations. The analysis of BATCCA (2006), Casa LOUMAY (2012) and INCAE (2016) demonstrates how Bruno Stagno consolidated a trajectory marked by conceptual coherence and the adaptation of bioclimatic principles to different projects. These projects confirm the architect's vision that sustainability is not limited to a set of technical solutions, considering the tropical climate, without leaving aside beauty and creativity.

While BATCCA stands out for its corporate space, Casa LOUMAY exemplifies sustainable living, and INCAE extends these principles to the institutional and educational,

with hotel space for students. Together, the three works reveal Stagno's versatility in responding to different programs, maintaining a consistent architectural language, in the search for a bioclimatic architecture adapted to the tropical climate that values passive strategies, with the use of natural ventilation, shading elements, use of local materials and integration with the landscape become central elements.

Bruno Stagno reaffirms himself as one of the leading exponents of contemporary Latin American architecture, offering significant contributions to the international debate on sustainability. His work shows that it is possible to articulate cultural identity, environmental responsibility and innovation in projects that respond to the challenges of the twenty-first century. With carefully thought-out artifices to maintain the sustainability of his projects that prioritize the tropical bioclimatization of his architecture, Bruno Stagno contrasts economic issues with long-term benefits.

It is worth highlighting the expression of latitude in architecture; in the reverberation of architectural forms over time in a specific place, which evidences the responsive relationship of architecture in relation to the place, how it makes it the main articulating element of the architectural language of a given geographical position. In this sense, the work developed by Estúdio Stagno BSAA can be defined as an experimental laboratory of this architecture in the tropics - both through design and research.

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