

# The Northwestern Amazon malocas: Craft now and then

Journal of Material Culture

1–33

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DOI: 10.1177/1359183519836141

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## Abstract

In the Northwestern Amazon, resilience in construction has been traditionally conceived as a capacity for social, climatic, and spatial adaptability. Through methods of seasonal reconstruction based on lightweight enclosures made mainly from palms, vernacular housing, or malocas, in the region have proven efficient from environmental, human comfort, and cultural perspectives. Intricately woven palms, layered to shape roofs and walls, form enclosures that repel water, insulate heat, and reflect light while embodying specific projections of the body in space as the basis of unique cosmological perspectives of spatial organization. The palm-weave is the very root of the construction ethos of Northwestern Amazon housing. In the last few decades, these complex woven enclosures have been progressively replaced with industrial panels made of materials such as galvanized steel or cement, simply because of their low economic cost and availability. The loss of the palm-weave in roof-walls is not a mere replacement but a supplantation of material culture and has profound environmental, human comfort, and social implications. In a context where resilience has been shaped cognitively and physically through a plant-based material culture of adaptability, what is the extent of a potential craft disruption? The supplantation of the palm-weave technical practice implies a loss of social engagement in a craft that has defined an understanding of belonging and inhabitation. This article addresses how the geometric, scale, and spatial characteristics originating from the distinctive palm-weave craft of the Western Amazon malocas of the Bora, Miraña, Muiname (Witoto), Murui (Witoto), Yukuna, Tikuna, and Makuna groups perform as a living entity. By questioning the differences between craft preservation vis-à-vis reclamation, the author explores the specific architectural and social characteristics that are locally valued in the inherited craft to create a path for discussing future generations of palm-weave in the Northwestern Amazon.

## Keywords

Amazon, craft, housing: weaving, material, palm, resilience

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The maloca is the world and the world is the maloca. (Hugh-Jones, 1985: 78)

## Introduction

In 1867, Albert Frisch braved a journey into the then mostly-unknown inner core of the Amazon (Kohl, 2015: 175–193). For one year, Frisch documented, through 98 photographs, the built environment of indigenous communities from the eastern end of the river, the town of Manaus, up to the heart of the Amazon – Leticia/Tabatinga. Arguably, many of Frisch’s architectural images could appear more as a theatrical depiction of life rather than a view into modes of habitation – for instance, the plate of the temporary maloca structure in Tabatinga (Figure 1, left). However, by displaying a series of distinctive architecture patterns, including the early development of future urban enclaves such as Leticia, Frisch provides a possible reading of the material culture of the longhouses in the region (Figure 1, right). Frisch’s views into inhabitation patterns, where construction technology is manifested through an economy of natural material reuse, present a wealth of typological diversity and resilience in riverine flood cultures.

Vernacular housing construction in the Amazon is widely diverse in shape, size, and spatial organization. These structures are locally known as malocas, or longhouses. Traditionally, malocas have been constructed with natural fibers, mainly palm in the Western Amazon. In some areas in the Eastern region, malocas have also been built with soil, as Frisch documented in 1867 (Kohl, 2015: 175–193). From a linguistic view, the term maloca bears various interpretations that refer to the building component and building type, as well as the dwelling. Stradelli (1929) discusses in the *nheêngatú-portugues* vocabulary the term *Mará* = ‘Vara’ (p. 514), which means beam or stick, *Maróca*, *Maráoca* = ‘Casa de varas, casa de estacas’, which means house of posts (p. 517), and also *óca* = ‘casa’ (p. 579), which means house (pp. 514, 517). Architectural expressions of Northwestern Amazon malocas embody a material culture that combines the symbolic entity of the maloca with the geometric expressions of varying planimetric and vertical sections of space. These spatial traits are firmly rooted in the palm-leaf cladding.

Amerindians and settler populations have used the palm leaf as a key resource for subsistence strategies across various applications, from medicine to construction (Belcher et al., 2005; Coomes, 2004; Plotkin and Balick, 1984; Stagegaard et al., 2002; Zambrana et al., 2007). The most used species have often been vested with local cultural values, which in turn means that usage and conservation of palms may be complementary (Denevan and Padoch, 1987; Kahn, 2012; Lawrence et al., 2005; Balick and Micheal, 1988; Zambrana et al., 2007). The palm-weave has played a critical role in the material culture as a primal constituent of the symbolic corpus of the longhouse and as a craft unique to a cosmological vision in the Western Amazon. Matapi and Matapi (2010: 19–20), discuss this palm-weave cosmological cohesion in the Yukuna-Matapi culture:

The ornamented world is given by the creators. To enable its operability it was necessary to provide spirits to assist. In this manner the coca, tobacco, the thinking seat, the sifter, and the maloca as the center of interaction of the various spirits and the world’s organization and healing. The maloca has its own ornamentation to endow it meaning. When the first construction of the maloca took place the elder understood that the maloca had to have appropriate ornaments,



**Figure 1.** Left: Temporary maloca structure by Albert Frisch, *La Cuisine de la Malocca*, Tabatinga, about 1867, Albumen silver print, The J Paul Getty Museum, Los Angeles; Right: Early development of Leticia with various maloca typologies, Albert Frisch, Leticia, 1869, Albumen silver print, The J Paul Getty Museum, Los Angeles.

each endowed with specific meaning. After the structure of the maloca was built, the weave of the ‘puis’ [the palm stems], its ornamental symbol was formed. It took time to pursue the various weaving types. Later on, through dialogues with the owner of the maloca, the shaman

was shown how to structure its organization and perfect form. It is through this process that the maloca was built. (my translation)

Unlike the traceable differences in overall geometries, the palm-weave that makes the cladding of these houses is significantly more challenging to define as a group-specific palm-leaf craft rather than a shared regional palm-leaf craft. The term group-specific palm-leaf craft is here implemented to refer to weaving typologies that are particular to an indigenous group. The term regional palm-leaf craft refers to palm-weaving systems that are shared by various groups in the Northwestern Amazon. The role of palm-weave craft as a group-specific craft that expresses a singular cosmological vision rather than a more extensive regional craft has been addressed by Hugh Jones and also by C Hugh-Jones (Carsten and Hugh-Jones, 1995: 226–253; C Hugh-Jones, 1979: 40–49). However, a comparative study of the construction system specificity, including proportional and geometric traits as an expression of material culture across the various communities in the region, has not been carried out up to date. The comparative architectural scope of this study focuses on the predominant urban indigenous groups in the enclave of Leticia-Tabatinga-Santa Rosa and the convergence of shared social, organizational and construction typologies of the malocas of these Amerindian groups. The scope stems specifically from recent fieldwork with representatives of these groups in current urban indigenous organizations in the region. The selected groups are: Bora, Miraña, Murui (Witoto), Muiname (Witoto), Yukuna, Tikuna, and Makuna.

In 1992, Jacopin raised the question of whether the purpose of the maloca depended on its material construct or if it had a function beyond its physical nature. He argued that the maloca is articulated as a multifamilial cluster – an abstract unit that operates as a political, legal, social, and economic commune that is more than its material body (Jacopin, 1992: 123). The original multifamilial use of the maloca has been largely lost. However, as Franky and Mahecha Rubio (2018: 82–83) denote for groups including the Yukuna and the Makuna, the maloca continues to perform as an essential basis for social, ritual, and political exchange. While the inherited complex history and recent urban migrations have led to significant blurring of the original architectural distinctions between and within (status-rank connotations) the ethnic groups here under discussion, understanding these shared and unique original characteristics and expressions opens paths to understanding the processes and transformations of current and future malocas in the region in their ritual and political roles. Cayón (2010: 343) refers to how the Makuna groups of the Pirá-paraná and lower Apaporis have differing conceptions regarding transformation processes of how they relate to territory when compared to the Eastern Tukano groups of the Tiquié, Papurí e Uaupés rivers. The conception of transformation processes of locale and possibly of architectural specificity can thus express varying frameworks of social and political organization in the transnational border of the Northwestern Amazon. This text probes this argument by exploring the cultural agency of the group-specific craft versus the wider regional craft applied to the maloca. It does so by exploring whether the palm-weave cladding has been critical for shaping the plural agency of the multifamily unit and the expression of unique cosmological visions of each community and political role of each ethnic group or whether these are rather outside assumptions of a given architectural culture. This inquiry is situated within the context

of a growing loss of the core material ethos of the palm-weave craft in the region since the latter half of the 20th century (Barclay et al., 2014: 343; Franky and Mahecha Rubio, 2018: 82–83; Martín Brañas and Torres, 2014; Riaño Umbarila, 2003: 202).

The material construction culture addressed in this article focuses on case studies of the housing of the Bora, Miraña Tikuna, Murui (Witoto), Muiname (Witoto), and Yukuna. These are the predominant communities that have migrated to Leticia, Tabatinga, and Santa Rosa and its surroundings, a region where Peru, Colombia, and Brazil converge along the Western Amazon River basin. These groups make up a large cohort of urban indigenous communities that have quite distinct original architectural expressions of their cosmological visions of the maloca. The social implications of the architecture are discussed within the framework that the geometry, scale, and spatial characteristics of the housing and its palm-based weaving typologies bear in the material culture of the transnational region of Leticia/Tabatinga/Santa Rosa.

The article aims to evaluate how group-specific architectural differences of the NW malocas are real in pre-20th-century typologies or rather constructed by external perceptions as raised in recent literature. Through the architectural analysis of scale, geometry, and thatch-palm systems, this exploration can point to an understanding of the recent and potential forthcoming transformations and craft conservation aims. Without doubt, there are shared architectural traces in the ethnic groups here in discussion and the tectonic make-up is not fixed and interdependent. Yet, the degree of fixation and interdependency, and its complementary nature to the extensive literature on social and cosmological nature of the maloca are the primary aims of this study.

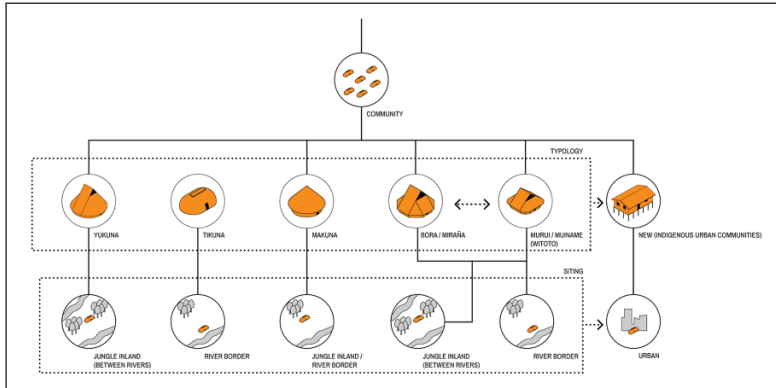
## **The Western Amazon maloca function: The house-world**

Traditional constructions in the Western Amazon have been shaped as permanent and transient spaces tailored to multi-familial functions and the demands of riverine border inundation patterns marked by a dry and a wet season. The malocas of the regions are composed by a wide range of geometries, sizes, wall systems, and roofs. The distinctive architectural components of these constructions have been addressed in literature mostly for single groups rather than as a wider comparative study. Likewise, the new urban malocas have not been discussed from the specific architectural permutations or lack thereof and its potential bearing and correlation with sociocultural transformations.

The longhouse typologies of the primary groups that have migrated into the urban enclaves in the Leticia/Tabatinga/Santa Rosa area comprise a wide range of dimensions, forms, and geometries (Figure 2). In part, it can be argued that such differentiations are culturally tied to their understanding of locale and habitat. Arhem argues that, in the context of the Tukano of the Vaupes, exogamic groups that speak the Makuna language compose the Makuna group. Based on this view, the Makuna comprise two inter-matrimonial clans related as ‘big brothers’ and ‘small brothers’. The ‘big brothers’ include the Ide Masa or ‘water people’, subdivided into multiple subgroups and the ‘small brothers’ include the Yuba Masa or ‘land people’ and the Hemoa Masa as ‘ant people’ (Arhem et al., 2004: 23).

Jacopin refers to the traditional definition of the Yukuna as ‘people of the interior or of the forest’, since they have inhabited the surroundings of small streams rather than





**Figure 2.** Diagram of chosen Northwestern Amazon groups of this study with predominant location types. © Maria Paz Gutierrez.

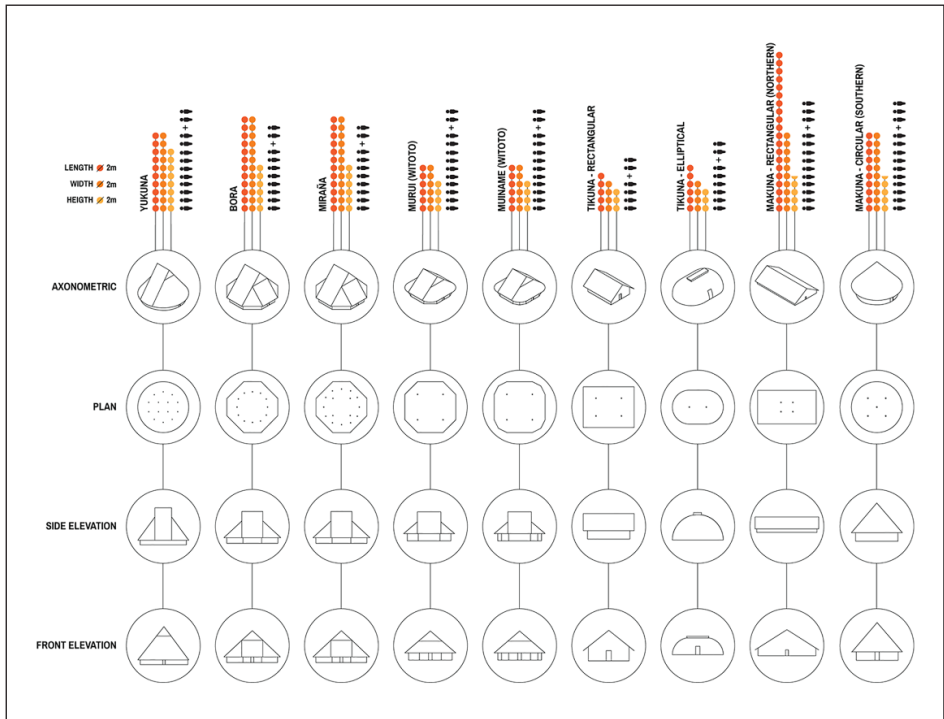
major rivers unlike other Tukano groups of the west that are defined as ‘river people’. Nevertheless, Jacopin argues that a definition of ‘horticultural people’ would be more appropriate since, while being excellent hunters, the Yukuna are much more devoted to agriculture (Jacopin, 1992; 3, 124). Likewise, the Bora define themselves as people of the middle – *piinemúnaa*, with *pine* referring to middle or center space and *múnaa* as people or humans (Lucas, 2018: 193).

The varying definitions of the conception of locale and the connection to the habitat and the technique of construction and architectural constituents of the maloca are directly related. In Matapi and Matapi (2010: 19) we see the narrative of the origin of the maloca:

The ornamented world is given by the creators. To enable its operability it was necessary to provide spirits to assist. In this manner the coca, tobacco, the thinking seat, the sifter, and the maloca as the center of interaction of the various spirits and the world’s organization and healing. The maloca has its own ornamentation to endow it with meaning. When the first construction of the maloca took place the elder understood that the maloca had to have appropriate ornaments, each endowed with specific meaning. After the structure of the maloca was built, the weave of the puis [the palm stems], its ornamental symbol was formed. It took time to pursue the various weaving types. Later on, through dialogues with the owner of the maloca, the chaman was shown how to structure its organization and perfect form. It is through this process that the maloca was built.

The specific structure and organization of the maloca are the result of iterations through dialogues with the creators from the overall form to the type of palm-weave. Consequently, it can be argued that, at least in principle, the maloca’s form, size, and palm-weave system is specific to a group and that the clans present in the Western Amazon area discussed here have had particular definitions related to its locale and identity whether as interior or jungle, riverine or water, or combinations.

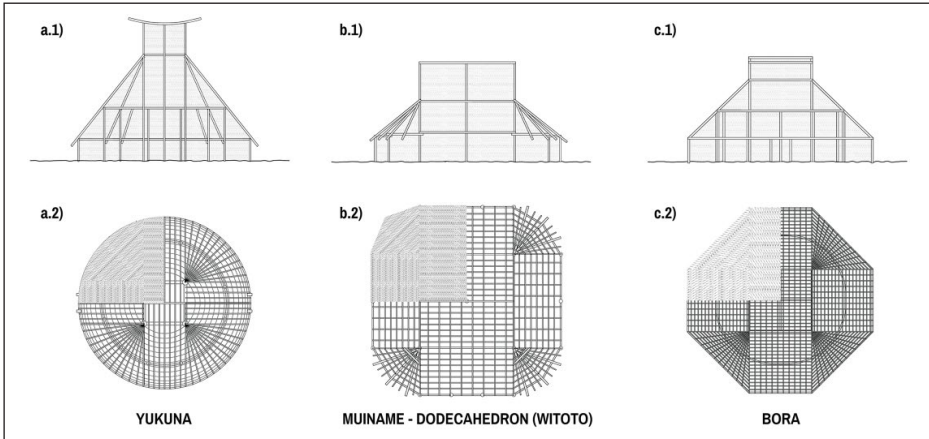
Each community in the region typically contains housing composed of one or two primary geometric figures in plan and vertical sections. As summarized in Figure 3, the geometries in plan sections are comprised of circular, octagonal, rectangular (rounded



**Figure 3.** Diagram of typologies based on dimension, volumetric form, plan and vertical section of Yukuna, Bora, Miraña, Murui (Witoto), Muiname (Witoto), Tikuna, and Makuna. © Maria Paz Gutierrez.

corners), rectangular, square (rounded corners), and elliptical forms for the Yukuna, Miraña, Bora, Tikuna, Murui (Witoto), Muiname (Witoto), and Makuna groups (Cayón and Cliche, 2012: 68–69; Correa Rubio, 1996: 246–297; Gasché, 1972: 197–201; Guyot, 1972: 150–168; Hugh-Jones, 1985: 79–93; Jacopin, 1992: 130–145; Miranda, 2012: 136–139; Riaño Umbarila, 2003: 49–54). In the vertical section, the variations of the roof are as follows: a point convergence, two partial-sided centered planes, two planes along the extent of the house, and the dome. The full dimensions and geometry vary significantly from small clusters that house approximately six people to traditional structures that traditionally housed up to 200 inhabitants (Århem and Samper, 1998: 48). For some groups, there are regional variations (e.g. Makuna northern-rectangular versus southern-circular), as well as variations that are not regionally based, as in the case of the Tikunoan malocas.

Housing morphologies are for the most part directly related to the internal organization of function. Apertures in the traditional malocas of the Western Amazon are typically positioned in two directions: locating openings in this axial manner is a method of situating the maloca as a cosmos (Hugh-Jones, 1985: 79–93). The predominant east and west axis apertures function to set the center of the house at the geometric midpoint at the



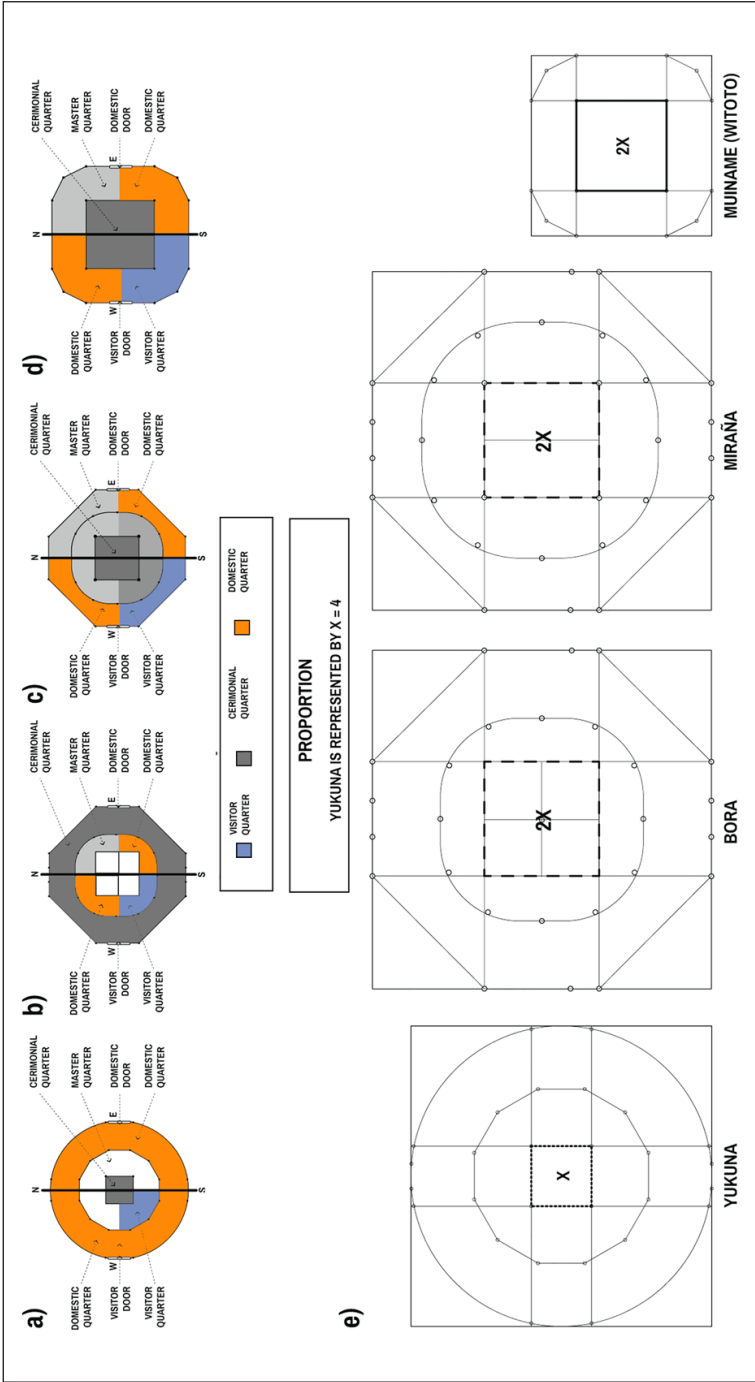
**Figure 4.** Diagram of the primary structural components in section and plan views of the traditional maloca of the Yukuna, Muiname (Witoto) and Bora groups. © Maria Paz Gutierrez.

midday sun angle. Throughout the day, the sun travels through the ‘sky’ of the maloca’s roof, with space and time brought together as one. What remains unclear is the extent to which the geometric variations play a role in the function of the house, which functions as a cosmos.

The universe embodied by the maloca structures its spatial division and orientation with the territory, and its diverse internal logic associated with its structural system. In the vertical axis, we can observe a clear variation in not only the height but also the sectional difference of the roof structure. The maloca of the Yukuna flattens on its peak (Figure 4a.1), while the Murui (Witoto) and Muiname (Witoto) roof is a two-part gable (Figure 4b.1). Conversely, the Bora and Miraña’s longhouses are composed of a high pitch in two opposing directions, with one folded into the other (Figure 4c.1). Likewise, differences in plans span from a circular base (Yukuna: Figure 4a.2), to an octagonal (Witoto: Figure 4b.2), and a dodecahedral form (Bora and Miraña: Figure 4c.2).

The variations in the internal logic of the maloca of the Bora, Miraña, Yukuna, Murui (Witoto) and Muiname (Witoto) are primarily derivative of geometric differences rather than functional variations. Figure 5 (a, b, c) presents the four primary subdivisions of function common to all these housing systems. Typically, the internal subdivision encompasses one door for the visitor, usually situated to the west, and another entry to the east, which is the domestic door. This partition divides the malocas into quadrants occupied based on the family structure. The master of the maloca is situated to the right of the domestic gate; the other quadrants are inhabited accordingly by age group. The quadrant to the right is the visitor corner. Whereas the quadrant system exists predominantly independently of the plan geometry, the distances and forms of these quadrants are directly affected by the overall form, extension, and height of the maloca for the Yukuna, Bora, Miraña, and Murui (Witoto) malocas (Figure 5 a, b, c, d). The internal core or ceremonial space presented in Figure 5d changes dramatically in proportion when compared to the other typologies. The Yukuna maloca is larger in extension than the Murui (Witoto) and





**Figure 5.** Diagram of the variations in the internal logic of the traditional maloca of the: (a) Yukuna – circular base; (b) Muiname (Witoto) – dodecahedral base; (c) Bora octagonal base; (d) proportional analysis of the ratio of the predominant dimensional differences between the core unit represented as ‘x’ in the maloca Yukuna, Muiname (Witoto), and Bora.

Muiname (Witoto), which is typically of a maximum of 20m diameter versus 20m width; however, the core is twice the size in the latter (Hugh-Jones, 1985: 78–93; Jacopin, 1992: 7–8; Miranda, 2012). An important distinction discussed by Karadimas (2004) is the variation of the Bora and the Miraña spatial occupation. For the Miraña, the ceremonial quarter is located in the central square. Conversely, for the Bora it is housed in the perimeter of the 12 posts (Figure 5b; Karadimas, 2004: 371–373).

The Bora and Miraña malocas have an internal core corresponding to 8m (referred to as '2x' in Figure 4) and a typical maximum width of 24m–25m (Karadimas, 2004: 371–373). This is typically the same size core as that of the Murui (Witoto), whereas the Bora and Miraña units are three times its size. Hugh-Jones (1985: 78–93) discussed orientation and internal distributions comparatively for most of the groups in question here. Likewise, Miranda (2012: 136–140) and Marussi (2004: 18) have compared overall dimensions and structural systems for the Bora, Miraña, Murui (Witoto) and Muiname (Witoto). But these have not linked wider regional groups or the potential complementary nature of proportional and geometric differences with cosmological and social organizations

Whereas, for the most part, the multifamily structure operates as a single maloca unit, in some communities (e.g. the Yukuna) the dual maloca structure is typical as a reciprocal multifamily structure. The master of the maloca (usually the eldest son) tends to marry his cousin and become the future master of the neighboring maloca. This reciprocity is established between the two houses such that the two malocas can be considered a local residential group (Jacopin, 1992).

The Makuna are one of the 15 or more Amerindian groups that speak the Eastern Tukano language of the Colombian Vaupes region (Århem and Samper, 1998: 12). Whiffen (1915: 44) refers to the Makuna longhouse as invariably fortified and lighter than a 'Boro' dwelling. Whiffen notes that as with a few 'Witoto' malocas, the Makuna's longhouses have thatched roofs that do not extend to the ground. Rather, these groups have malocas formed by closed palisades that stem up to 3 ft above ground. Arango Ochoa and Sánchez Gutiérrez (2004) argue that the Makuna housing was typically formed on pilotis and was of a shorter lifespan than the rest of the structures in the area. However, this is arguable since there is insufficient evidence that pilotis were specific to this group in pre-colonization periods (Riaño Umbarila, 2003). Makuna housing sits in the forested interfluvial areas between the main rivers, with periods of residence in base villages of 8 to 10 units (Cayón, 2010: 195).

Århem and Samper (1998: 70) refer to Makuna malocas in the past that housed almost 150 people, comprising a whole lineage or clan. However, in recent years, these longhouses have an average of 15 inhabitants. These units are typically smaller single-family clusters and are of a more temporary nature. They are usually situated as interacting settlements organized around co-residing affines related by marriage. Among the Makuna, adjacent longhouses tend to be connected through multiple marriages, forming alliance-ordered localities and territorial groups of intermarrying sub-segments (p. 17). Thus, although the longhouse is in itself strictly exogamous, the local clusters of malocas as adjacent longhouses tend to be highly endogamous.

Each maloca extends its network of cultures and clearing for sky visibility. Often, inhabitants decide to construct another maloca as their gardens become less productive

and their palm roofs begin to fail. The time of these rotating cycles depends on social and physical factors of which the longevity of the palm is the primary driver.

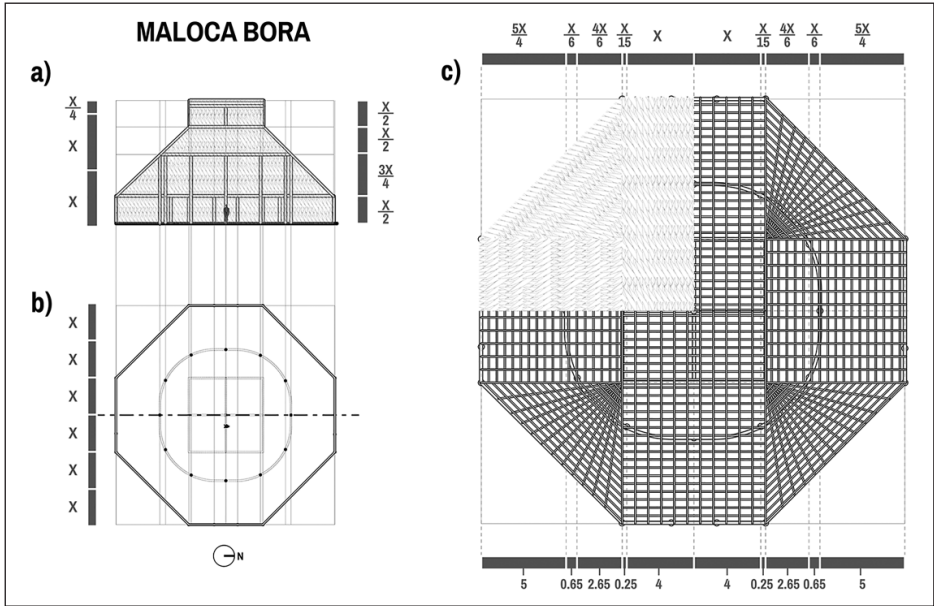
Hugh-Jones argued in *The Maloca: A World in a House* (1985: 78) that each architectural tribe has its architectural typology, and even small variations in such things as the way in which the leaves are woven serve to mark subdivisions in a group. The role of the palm roof as a material artifact that embodies particular conceptions of the cosmos regarding its alignment and orientation has been widely documented for the Tukano, Bora, Miraña, Murui (Witoto), Muiname (Witoto), Makuna, Maku, Yukuna, and other groups in the Northwestern Amazon (Beksta, 1988: 17–43; Cabalzar, 2000; Cayón, 2010: 197–199; Correa Rubio, 1996: 286–297; Guyot, 1972: 150–9; Hildebrand, 1983: 12–31; Hugh-Jones, 1979: 40–49, 1985: 78–83, 1995: 233–247; Jacopin, 1992; Karadimas, 2004: 370–373; Nimuendaju, 1952: 11; Reichel, 1999: 213–249). This text explores complementary aspects of the maloca, particularly pertaining to the palm-weave, assemblage, and geometric proportions to the past discussions of the cosmological and social constituents of the maloca.

The significant overall morphological variations between the maloca of the Bora, Miraña, Murui (Witoto), Muiname (Witoto), and Yukuna create very different spatial qualities despite the common internal subdivision of space and function, as previously discussed in Figure 4. Although they share the same division of direction regarding the allocation of family compartments, visitor compartments, and cooking area, the circular, octagonal, and dodecahedron-based plans create different spatial qualities related to scale, extension, and light quality. Some maloca typologies are variants for each community, as is the case of the Murui (Witoto) and Muiname (Witoto) systems presented in Figure 3. Others have, in turn, gone through extensive transformations from their original forms. Consequently, careful evaluation is needed to argue whether the primary form is itself comparatively critical for all people in the region, or whether the transformations have been more related to the influence of migration patterns mainly due to recent urbanization. The constancy of the form, whether variant or not in traditional units, is observed in all of these communities. However, the relationship between the cosmological order and the overall predominant geometry is less explicit in most cases.

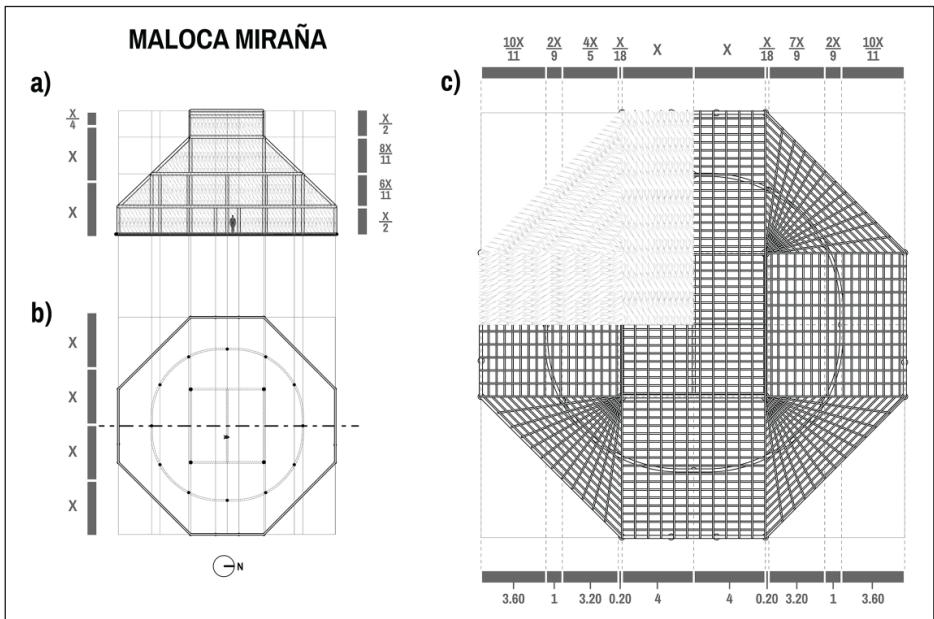
A predominant example of the non-varying model is the traditional maloca of the Yukuna (Figure 6). The system follows a particular order of construction with the constant dimensions of a 10m radius and 10m height measured on a cubit-based system (Jacopin, 1992: 127). For this community, housing follows a specific model for which a strict order with a radius based on cubits sets the proportional system of the whole set (Jacopin, 1992: 128). The Yukuna ‘modulor’ enables the repetition of identical models across settings. While circular, the plan of the Yukuna maloca has an internal division describing a cross, which creates an axial distinction in the vertical section (Figure 6a). The plan follows a unit ratio of 3:2:3:5:3:2:3 across its diameter, with the internal cross measuring 5 units. This cross composes the gable of the east–west axis, which is one  $\frac{1}{4}$  unit higher than the northeast axis.

The Yukuna longhouses have central pillars supporting the roof, which define the structural and symbolic core (Figure 6b). A square with four posts comprises the center. This area is surrounded by the first internal ring, which houses the craft, cooking, and preparation activities and related artifacts (cassava press, coca ashes, etc.). The third



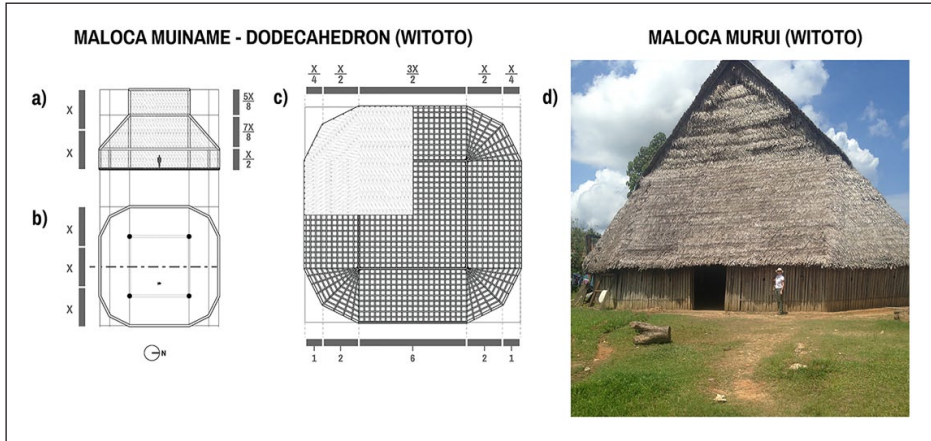


**Figure 7-A.** Geometric proportions of the maloca Bora: (a) section of the ratios in height; (b) plan with the corresponding units (meters); (c) roof structure plan. © Maria Paz Gutierrez.



**Figure 7-B.** Geometric proportions of the maloca Miraña: (a) section of the ratios in height; (b) plan with the corresponding units (meters); (c) roof structure plan. © Maria Paz Gutierrez.





**Figure 8.** Left: Geometric proportions of the maloca Muiname (Witoto): (a) section of the ratios in height; (b) plan with the corresponding units (meters); (c) roof structure plan. Right: Maloca Murui (Witoto): (d) photo of a contemporary maloca in Leticia. © Maria Paz Gutierrez.

the master of the maloca and inherited by his sons (p. 18). The maloca of the Witoto is variant in dimension and in form in plan and vertical section (p. 26; Gasché, 1972: 206). Tagliani (1992: 26) and Gasché (1972: 207) discuss two primary distinctions of the Witotan malocas: the Murui (male) located along the Cara-panná and Putumayo rivers and the Muiname (female) situated along the Igaraparná and Caquetá rivers. The fundamental conceptual differences between the Murui (Witoto) and Muiname (Witoto) maloca is manifested in the corners. The Muiname forms triangles in the corners shaping a lighter frame (Figure 8a-c) while the Murui is chamfered in the corners producing a heavier appearance (Figure 8d).

The Witotoan rectangular homes are mostly squares and 12-sided polygons constructed on the ground or on pilotis of 10m in height and 10m x 20m in the base on average (Guyot, 1972; (Tagliani, 1992: 17). Initially, the Witoto malocas were built in interfluvial spaces but, during the last century, housing was moved to riverbanks. These have rounded corners in some cases; in others, they form polygons with sides of different lengths (Figure 8a-b). However, they share the commonality of a square at the center, typically of 4.5 x 4.5m frames and four posts approximately 8m high (p. 18). The sides of the polygon with the square center are generally set in a ratio of 1:2:1 units as seen in the Muiname (Witoto) diagram (Figure 8c). This proportion sets up a system of a footprint of 4 x 4 units with radial ribs in each corner. The planimetric symmetry is contrasted by the sectional differentiation of each axis, where the slanted roof of one axis folds under the planar vertical pitch of the other gable – Muiname (Witoto) (Figure 8a).

The gable of the Murui (Witoto) and Muiname (Witoto) house consists of rafters forming the two lateral slopes of the roof aligned in the north–south and east–west axes. The rafters intersect on an X-shaped ridge. Two poles with two perches hold each ridge, one passing on top of the other. All structural members are joined with lianas tied in a cross shape. The four central pillars, through a herringbone-shaped compression joint locally

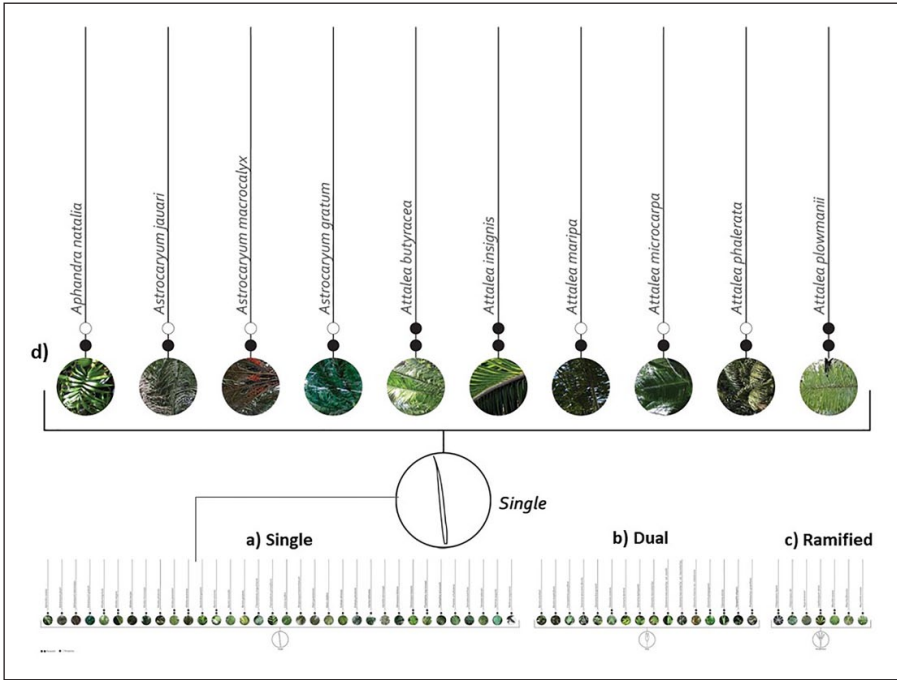
called ‘trample underfoot’, hold up the primary beams forming the center square. The connection system for the thatch-palm is also a liana-based tie. In the Murui (Witoto) maloca, we observe a typical ratio of 1:5 of the wall: roof (Figure 7c). Palm leaves fully covered the traditional Murui (Witoto) and Muiname (Witoto), maloca. However, during the 20th century, a transformation to walls made of split poles of palm took place, setting them apart from the full roof-wall extension in the Yukuna, Bora, and Miraña typologies (Figure 8d).

## The palm leaf weave

There were other houses called ‘jacueco’ (rectangular base palm-thatched longhouse) and ‘namoco’ (elliptical base palm-thatched longhouse). Those houses were covered with leaves. All the thatched palms have a name: of crab, worm, trumpeter bird, bat, heron, certain birds, of deer and another class of animal but of thatched palm. To weave the thatched palm faster, one swallows a cricket that is in the leaf. (Ministerio de Educación pública, 1964: 44–45)

The use of multiple parts of the palm in the construction of the malocas in the Western Amazon is common to most communities. The wide range of species provided a material basis for multiple palm uses in construction in the region (Wallace, 1853: 3–7). From an ecological palm diversity and distribution in the territory there is rising research on the impact of nomadism by hunter gatherers versus agricultural harvesting for diversity in the pre-ceramic and post-colonization in the Amazon, see Guardiola-Rivera, 2017). Castellanos M and Isabel L (2011) has documented that for construction in the Colombian Western Amazon, on average, at least five components of the palm are used. Over 50 species are used for temporary and longer-term housing in the region (Lopez-Parodi, 1988: 119–122; Martin Brañas, 2015: 34–60; Pintaud et al., 2016). These species have been used primarily based on a combination of local availability and structural characteristics for varying applications in vernacular housing constructions. Zambrana et al. (2014) reported at least 18 species used in construction in a group of only seven villages in Madre de Dios in the Peruvian Amazon. Figure 9 shows a field study classification in a region with a wide range of palms used in construction in the Western Amazon. Three leaf types make up a range of species used locally in construction: single (35 species; Figure 9a); split (16 species; Figure 9b); and ramified (7 species; Figure 9c).

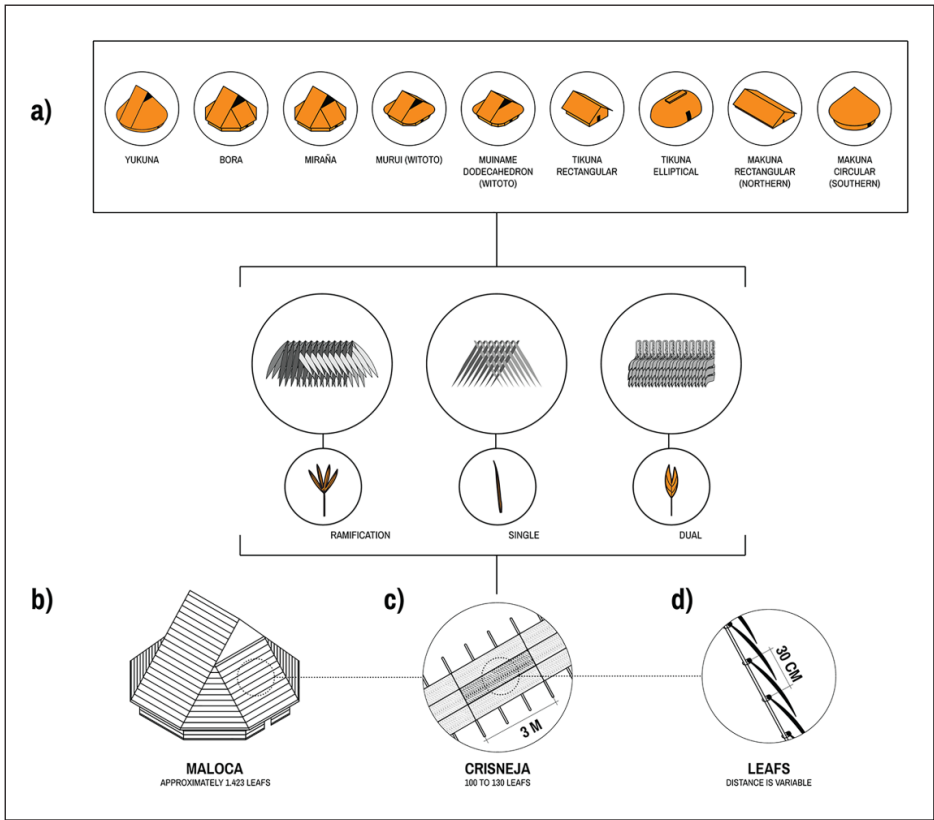
So far, the literature has primarily focused on the technique of constructing structural elements and the weaving system of a certain group in the region of the Western Amazon rather than a comparative analysis (e.g. Gasché, 1972: 200–211; Jacopin, 1992: 130–135; Marussi, 2004: 18–24; Tagliani, 1992: 15–33). Alternatively, Lopez-Parodi (1988: 119–129) and Kahn (Kahn and Mejia, 1987: 130–136) presented documentation of a collection of villages along the Peruvian Amazon and the Ucayali river, respectively, discussing the use of specific palms and a few construction traits. Martin Brañas (2015: 22–45) addressed the correlation of three specific species with regard to palm-weaving systems as non ethnic-groups based in the Peruvian Amazon. However, whether a specific correlation per species, weaving, and construction typology is particularly tied to the cosmological vision of a given community is yet to be ascertained. Whereas some typologies of weaving are specific to certain communities (e.g. the ‘comb’ style for the Witoto, see Gasché, 1972: 202–204), often particular types are found in the malocas of various communities in the region (Figure 10).



**Figure 9.** Diagram of palm types used in construction in the Western Amazon: (a) single leaf; (b) dual/split leaf; (c) ramified leaf; and (d) detailed view of single species. © Maria Paz Gutierrez.

Mesa Castellanos (2011) reported the following in her study of the palm species used on the Colombian side of the Western Amazon: 84 uses and 47 species by the Tikuna; 69 uses and 37 species by the Witoto; 30 uses and 25 species by the Bora and Miraña; and 49 uses and 18 species by the Yukuna. The primary species used for medicinal, material, and construction purposes include the *Bactris gasipaes*, *Euterpe preclatoria*, *Lepidocaryum tenue*, *Oenocarpus bataua*, *Mauritia flexuosa*, *Iriarte deltoidea*, *Astrocaryum chambira*, *Manicaria sacciferay*, and *Socratea exorrhiza*. The report accounts for a total of 34 species used in the Colombian Amazon alone in construction. The primary species used for the roof consists of the caraná (*Lepidocaryum tenue*), la canangucha (*Mauritia flexuosa*) and milpesos (*Oenocarpus bataua*) (Mesa Castellanos, 2011). The walls and structural members are typically built with zancona (*Socratea exorrhiza*) and pona barrigona (*Iriarte deltoidea*) (pp. 351–369; see also Cadena-Vargas et al., 2007: 97–116; Sánchez Sáenz, 2005; Schultes, 1974: 13–21).

Housing located in primarily flooded terrain is typically made with leaves of palms found in these areas because they have intrinsic resistance to and resilience for humidity. Such species as *Scheelea* or *Attalea cephalotes* and *Phytelephas microcarpa* – locally known as shapaja and yarina, respectively – are some of the most commonly used palm types in the region (Mejia, 1988: 130–136). Typically, roofs made from these species use



**Figure 10.** (a) Diagram of the thatched-palm strip locally known as ‘crisneja’ in the Northwestern Amazon; (b) direction of the crisnejas position on a maloca as horizontal strips; (c) diagram of a single crisneja; (d) schematic section of a crisneja enclosure system. © Maria Paz Gutierrez.

leaves folded double and tied. Another reason for relocation of a maloca is for sociopolitical purposes – after the death of the master of the maloca.

The most common use of palms in housing is as roofing material. Irapay (*Lepidocaryum tessmannii*) is the most used palm type in roofing because it is deemed the most durable and abundant in the Western Amazon Region. In the Department of Loreto, along the Ucayali River, Kahn and Mejia (1987: 130–136) reported a natural density of irapay at 2500 stems/ha. Whereas irapay is arguably the most used palm type in the Western Amazon, other species, including the palmiche (*Geonoma diversa*), shapaja (*Attalea phalerata*), yarina (*Phytelephas macrocarpa*), pona (*Iriartea deltoidea*), ponilla (*Wettinia augusta*), shebón (*Attalea butyracea*), and aguaje (*Mauritia flexuosa*), are also widely used in the region (see also Lopez-Parodi, 1988: 120–122; Zambrana et al., 2014). The second most commonly used roofing palm in the Western Amazon is the *Phytelephas macrocarpa*, commonly known as yarina. Roofs made of woven yarina have been reported

to last between five and eight years, depending on the spacing of the overlap of the woven palms and the roof pitch. Whereas the irapay and yarina are the most predominant species, other types of palms are used to make up the roof cover unit of thatched-palm locally known as the *crisneja* (Figure 10a–d). The shebón or *Attalea butyracea* fronds are wider and last longer than *Attalea phalerata*. For this reason, even today, these palm types are transported hundreds of kilometers to supply villages and towns in the Peruvian Amazon (Smith, 2015). In Amazonian urban enclaves such as Iquitos, until the 20th century, the thatched-palm was sold as a construction component (Mejia, 1988: 132).

The thatched-palm strip is laid onto the roof-wall in varying directions depending on the overall form of the maloca (Figure 10). The strips can be formed by ramified, single, or double palm types. The thatched palms have been reported to be approximately 3m in length, 30cm in height and 3–5cm in width (Burga, 2010: 120–138; Mejia, 1988: 133) (Figure 10c–d).

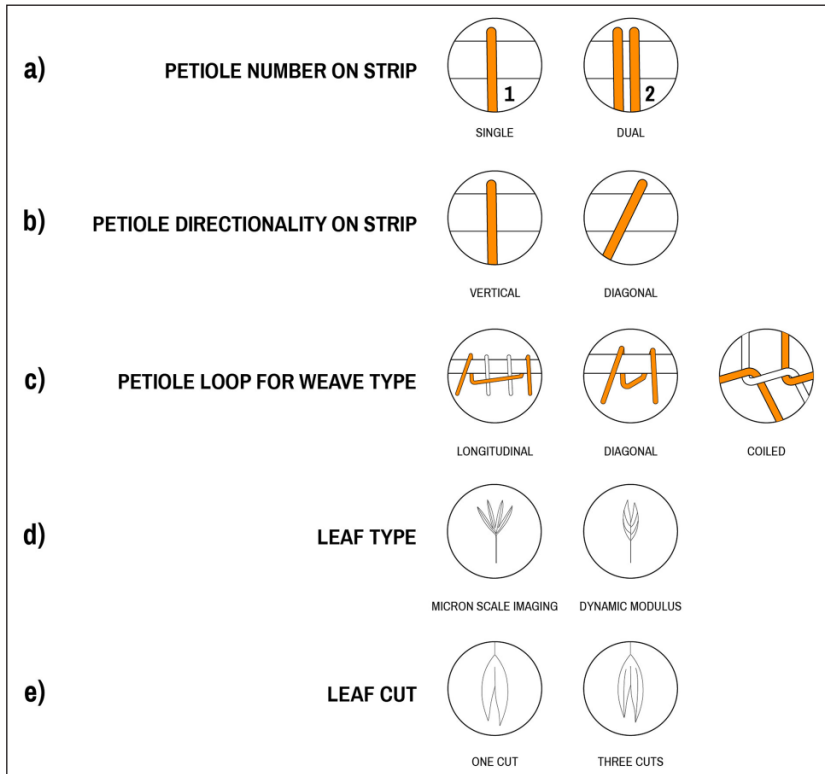
The density of the leaves varies based on each species and weaving method. In the case of the irapay, arguably the most frequent palm type system accounts for approximately a range of 80–150 leaves per thatch-palm (Martin Brañas and Torres, 2014; Mejia, 1988). For a maloca of 6 x 9m, a total of 300 thatch-palms are implemented, totaling 39,000 irapay leaves (Lopez-Parodi, 1988: 126). Lopez-Parodi reported that gables of a 60-degree pitch with a 10cm overlap and composed of 150 leaves last an average of eight years (p. 127).

Ultimately, the type of palm used for a given function varies based on availability and tradition passed on from generation to generation, leading to a complex and wide array of weaving typologies. These variations depend on multiple factors ranging from the leaf morphology and the number of cuts that divide the leaf to how the petiole is interlaced on the horizontal strip that supports the full thatched-palm strip. Martin-Brañas (2015) has discussed the thatch palm weaving typologies for the Peruvian Amazon housing, presenting a first discussion on geometric progression of the palm (p. 22). Martin-Brañas' analysis focuses on four thatched-palm types in the area known as 'Pata de Grillo' (cricket leg) made from *Irapay*, 'Shiruy Cara', 'Shebón', and 'Palmiche' (pp. 31–37). The cricket leg denomination alludes to a relation between a gesture and an animal form. However, more specificity of the gesture and symbolism is not addressed. The three latter names are associated to the local denomination of palm species. Nor does the study address specific ethnic groups and symbolism, but it does investigate a wide range of shared weaving typologies as construction techniques in the Peruvian Amazon.

To discuss the predominant typologies in Bora, Miraña, Murui (Witoto), and Muiname (Witoto) housing, the following classification is used: (a) number of petioles per weave on the longitudinal strip (Figure 11a: *single or double*); (b) direction of the loop on the strip (Figure 11b: *vertical or diagonal*); (c) type of loop (*longitudinal, diagonal, or coiled*); (d) leaf type (Figure 11 d); and (e) cut applied to partition the leaf (Figure 11e: *one cut; three cuts*).

According to Gasché (1972: 200–203, the Murui (Witoto) and Muiname (Witoto) had at least eight basic weaving types made from the same palm. This argument is reinforced by the dictionary for alphabetization of the Murui (Witoto) and Muiname (Witoto) children created in Peru in 1964. The document mentions varying thatched-palm strips with the names of animals (e.g. crab or heron, Ministerio de Educación pública, 1964: 44–45).

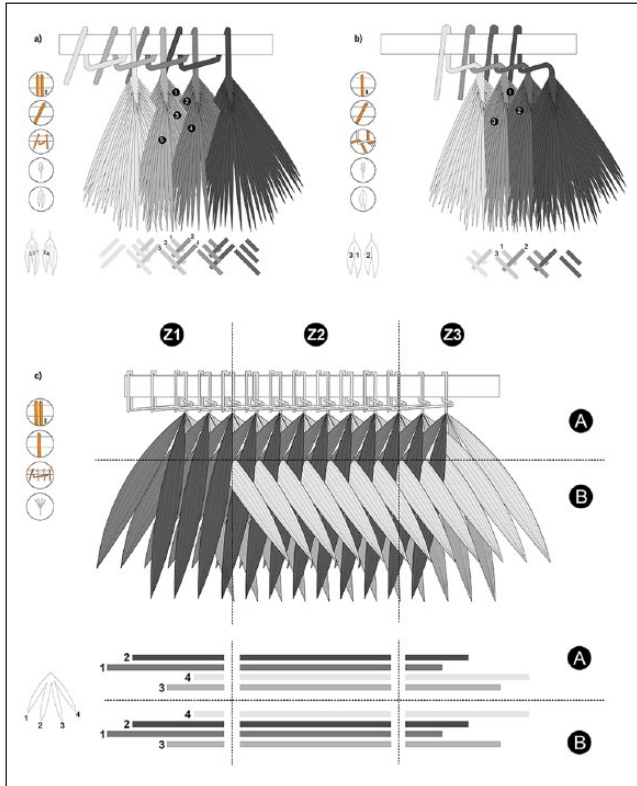




**Figure 11.** Glossary by author for a palm-weave classification system based on the geometries and symbols of the indigenous groups (Witoto, Yukuna, Bora): (a) petiole number on strip; (b) petiole directionality on strip; (c) the direction of the loop on the strip; (d) leaf type used in the weave; and (e) cut applied to the palm leaf. © Maria Paz Gutierrez.

These were also reported by Gasché (1972: 208), who used seed names such as ‘peanut comb’ or ‘black peanut comb’. Figure 12a articulates what Gasché described as *mazákarai*. This term comes from the root *mazaka* that means ‘peanut’ and a ‘comb’: ‘peanut comb’, or ‘black peanut’ and ‘black peanut comb’ weave (p. 202). Made of a dual-palm leaf type cut into two segments, this system interposes two vertical petioles, one vertical and one angled, creating a triangle that is interlaced into a diagonal hook. The lower planimetric diagram presents the progression of segments 1 and 3 interwoven with segment 2 in one of the simplest weaving forms present in the region.

A second Murui (Witoto) and Muiname (Witoto) weaving system, also made of a dual-palm leaf type but cut into four segments, comprises a *single diagonal petiole* that is interlaced forming a *coiled* loop (Figure 12b). The lower planimetric diagram displays the progression of segments 1, 3, and 5 interwoven with segments 2, and 4. Gasché (1972) explains that this weave’s name has no direct interpretation, but the closest is the ‘maraca nucleus comb’, because the laces imitate the form of this organism.



**Figure 12.** Diagrams by the author of the weaving typologies of the Witotos: (a) the 'black peanut comb' made with a series of dual leaf cut into four segments; (b) the 'maraca nucleus comb' made with a series of dual leaf; (c) 'cricket leg' created with ramified leaves most typically the 'Irapay'. Drawing: adapted from Martín Brañas (2015), Gasché (1972) and fieldwork by the author.

The third type found in the Murui (Witoto) and Muiname (Witoto) housing is composed of the intercalation of the four segments of a ramified leaf palm (typically irapay), with one palm in each direction. Each branch is woven in opposing directions forming *dual vertical* petioles and interlaced *longitudinally*. Gasché (1972: 202) referred to this as a *uárai*, from *ua*, meaning 'true, clean, authentic', and *-rai*, 'the true comb'. Figure 12c shows the progression from the vertical view and plan section. The four segments of the leaf are woven in the dual horizontal geometric progression 4, 3, 1, 2, 1, forming a *dual diagonal petiole* that is interlaced, forming a *longitudinal* loop. This predominant typology is repeated extensively even today. Figure 13 presents a detailed view of this weaving type in a contemporary maloca of a shared Bora, Miraña, Murui (Witoto), and Muiname (Witoto) urban community in Leticia, Colombia, made of irapay.

Palm fibers are used also for tying joints to structural members and thatched-palm strips to structural members. The palm species used for this purpose include the *Attalea butyracea*. Also, in the Northwestern Amazon Basin, caqueta (*Heteropsis flexuosa*), an



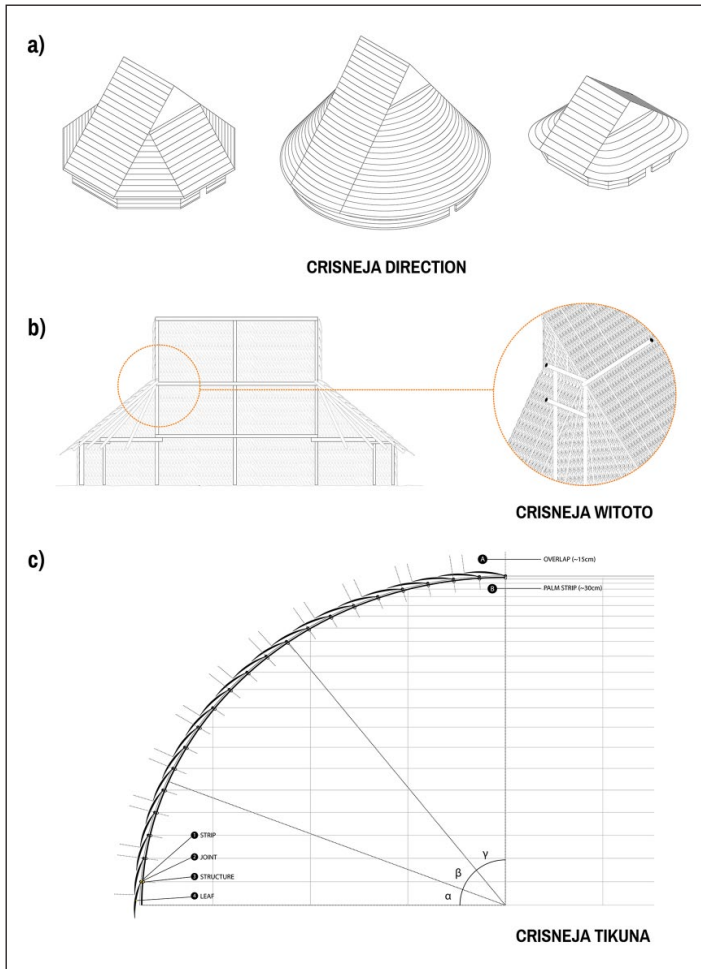
**Figure 13.** Detailed view of a cricket leg weave – contemporary Witoto maloca, Leticia, Colombia. © Maria Paz Gutierrez.

aerial root vine, is largely used as a construction fiber for tying posts (Cadena-Vargas et al., 2007: 97–116, Vargas and Van Andel, 2005: 248).

Typically, the Northwestern Amazon communities abandon their houses when the palm roof decays, which occurs every seven to eight years (Jacopin, 1992). The palm-weave roof is a material construct that is the primary driver for relocation. Consequently, it can be argued that the physical properties of the palm and the craft used to construct the roof – the predominant architectural trait – are the fundamental determinants of sociopolitical and spatial conditions. However, the extent to which current weaving typologies are dynamic processes shared by various groups as implicitly argued by Martin Brañas' (2015) study of wider regional spans rather than group-specific ones is essential to understanding how palm-weave craft transformations are taking place in the Northwestern Amazon.

## The roof-wall

The construction of the great house is not complicated, but the workmanship is dexterous, and will bear the closest inspection. Four great poles, 20 to 30 feet high, form the main supports of the roof, which slopes down on either side tent-wise almost to the ground from the central ridge-pole. More posts and cross-beams support it, and the whole is most adroitly lashed together. The forest supplies all the needed material. It is there ready to hand, growing where the house is to be erected. The straightest tree-trunks provide the posts and cross-beams; the creeping lianas serve to splice and bind the framework together; Bussu palm-leaves make the



**Figure 14.** (a) Schematic drawing of the roof-wall based on the angles of the roof and the directionality of the placement of the woven-palm strips onto planes or curves for varying geometries; (b) interior view of the sectional complexity of an arrangement of the woven-palm strips, in a Witoto house; (c) typical section of the continuous radial disposition of the woven-palm strips in the Tikuna longhouse.

thatch, which, as the actual wall is but some three feet in height, is practically roof and wall in one. (Whiffen, 1915: 43)

Whiffen argued in the early 20th century that the roof and wall in Amazon housing are practically one (pp. 43–46). This distinctive architectural feature is called the ‘roof-wall’. The wide range of morphologies for malocas provides a diverse canvas for the accommodation of the thatch-palms in varying directions (Figure 14a). The thatch-palms are usually attached to poles of varying sections, creating the particularities of the roof-wall

in varying directions ranging from radial to cross-and-radial combinations (Figure 14b). The distinctive features of the roof-wall are largely dependent on the angles of the roof and the directionality of the placement of the thatch-palms on the planes or curves. Figure 14b shows an interior view of the sectional complexity of an arrangement of thatch-palms in a Murui (Witoto) house. In Figure 14c, we see the clear difference between a typical section of a continuous radial disposition of a thatch-palm in a Tikuna longhouse.

The Makuna house also often embodies images of the social identity of each group and of geometries of visions stemming from the consumption of yaje, a hallucinogenic drink (Århem et al., 2004). The painted walls are not exclusive to the Makuna group in the region (Århem and Samper, 1998: 23; Carsten and Hugh-Jones, 1995: 226–253, 228–229; Cayón, 2010: 343). Hugh-Jones refers specifically to the fact that Tukanoan malocas have a palm thatch gabled roof coming almost to the ground with external walls often painted with human figures (Carsten and Hugh-Jones, 1995: 228–229; Hugh-Jones, 1993: 98).

The maloca Makuna is composed of two basic typologies. One type is the rectangular longhouse common in the Pirá Paraná River typically measuring up to 40m in length and 10m in height. The other is the circular base originally common in the Araporis River with a diameter of 20m and a thatched roof of palms almost to the ground (Århem and Samper, 1998: 64). Århem et al. (2004) referred to the circular-based maloca as truly embodying the spatial distribution of the anaconda of the water essential to the Makuna's cosmological vision. However, this claim could be argued by the counterpoint that the geometric differences pertain more to geographic variations than one form being more representative of the Makuna cosmological conception than the other.

Tagliani's (1992: 24–29) documentation of Witoto housing of the Murui (Witoto) and Muiname (Witoto) shows a continuum of indistinguishable roof-wall fully clad in woven palm. This cladding system differs from frequent vertical wall made of flat wood planks seen in the contemporary Murui maloca in Figure 8d. Tagliani refers to the highly specific conceptual differentiation of strata in the maloca from top to bottom: roof pitch and triangular opening (fourth realm-superior); animal world of thatched-palm strips (third realm); manioc and fruits (second realm); earth (first realm) (pp. 24, 33). The earth or first realm encompasses the ground up to the vertical wall portion. However, in Tagliani (1992) and Gasché (1972), there are various documentations of this segment being fully clad in thatched-palm, creating a continuum of roof and wall in the Murui and Muiname malocas. By making openings in a wattle made of central nerves of the leaf of *Mauritia flexuosa*, the Witotos created opportunities to let out smoke and let in light (Gasché, 1972: 208). However, the thatched palm extensions could be observed in other ethnic groups in the Northwestern Amazon and Eastern Amazon (e.g. Xingu) during the 19th century (Kohl, 2015: 175–193). For the same groups, including the Xingu, recent archaeological evidence is showing unexpected architectural traits for local longhouses, including pilotis (Navarro, 2018).

The specific architectural characteristics of early ethnic groups in the Northwestern Amazon are typically through descriptions in early documents such as for the Tukano (Carvajal, 2014: 75; Chaumeil et al., 1988: 175; Porro, 1996: 66; Santos Granero and Barclay, 1994: 341). The study of early forms of urban settlements in the Eastern Amazon by Heckenberger et al. (2008) support claims that ancient civilizations in broadly forested



regions, such as the Amazon basin where Xingu groups have lived continuously for over 2000 years, are generally dispersed rather than centralized (pp. 1214–1216). Heckenberger et al. have specifically analyzed the geometric traits from an urban perspective.

Although the traditional maloca in the region can arguably be characteristically defined as a continuous roof-wall or wall-less house, this cannot be a sweeping generalization. The diffusion and shared commonalities of the architecture of the longhouse in a wider range in the Amazon in pre-Colombian period is just beginning to resurface in recent archeological studies (Navarro, 2018). This is also the case for the use of the palm in ancient construction in other areas of South America (Acosta and Ríos Román, 2013; Bonomo and Enrique Capeletti, 2014). Also, local migration processes in the Northwestern Amazon region in the 20th and 21st centuries led to a cross-pollination of the forms and of individual community roof-wall traits, rendering malocas such as the Murui (Witoto) seen in Figure 8d with distinctive wood planks in the vertical plane.

Of all the group-specific and intertwined variations and transformations of the Western Amazon malocas discussed here, one fact is a constant – the progressive loss of the palm roof-wall. Zinc sheets provided by government-supported projects in the Western Amazon and, more recently, by economic pressures to achieve low costs have made it the primary roof material (Martin Brañas and Torres, 2014). Further, the direct and indirect consequences of such material replacement in the region have barely been examined.

## **The loss of the palm-weave roof-wall: Material supplantation**

I bring a load of leaves to repair my roof. When the rain comes, it always drips. I want to fix that part well. So today, I went to get leaves. Tomorrow, I will weave the leaves that I brought today. If I weave this house alone, it would be a lot of work. So I'm going to tell people to help me. If I do it alone it will never end. (Ministerio de Educación pública, 1964: 18)

Over 30 years ago, Mejia was already reporting how, in villages along the Ucayali, palm use in constructions was being replaced by industrial boards in floors and walls (Society for Economic Botany [US] et al., 1988). Although this cladding material replacement has taken place in rural settings, the role that the urbanization has played in this process cannot be overlooked. It is a popular misconception that the Amazon is still predominantly rural; in fact, the vast majority of people, including indigenous groups, live in urban settings for at least part of the year. A series of shifts in subsidies, policies, and trade in the region, particularly since 1980, have contributed to the reorganization of the economic household in the rural Amazon (Alexiades and Peluso, 2015).

Indigenous urbanization most frequently entails interconnecting and transforming contexts and people. The urbanization of rural communities creates all sorts of hybrid, peri-urban, and suburban spaces in between (Brondizio et al., 2013; Cleary, 1993; WinklerPrins, 2002). The spatial, material, aesthetic, and social transformations arising from the urbanization process in the Amazon challenge the normative dichotomous conception of urban–rural life. Growing dependency on municipal health and education systems, along with revolutionary change in the transport, communications,



**Figure 15.** Photo of a house in Tabatinga, Brazil, clad with a combination of industrial materials including the predominant *calamina* (galvanized steel). © Maria Paz Gutierrez.

agricultural, and forest sectors, all played a crucial role in the urbanization trend in the Amazon (McSweeney and Arps, 2005). In particular, the progressive decrease of agrarianization and increased involvement by local indigenous groups in the mining and service sectors with a predominantly informal submerged economy spurred and supported the rapid urbanization processes and intensified rural–urban links for indigenous groups in the Amazon (Peluso and Alexiades, 2005; Pinedo-Vasquez et al., 2001). A critical aspect of the indigenous migration in the Amazon is that it is a phenomenon that is still poorly understood only in its infrastructural, environmental, economic, and political complexities but also with regard to issues of identity and the aesthetic implications of transformations in material culture. Such has been the case in the palm-weave cladding, geometries, and functions of the *maloca*.

The introduction of foreign building technologies from urban areas has disrupted the use of palm since the first quarter of the 20th century (Martin-Branas and Torres, 2014). The most common material to be introduced in the region was galvanized steel, known locally as *calamina* (Figure 15), which has become widespread as the primary roofing material in entire neighborhoods in the region. Figure 16 depicts a recent settlement in Fantasy Island. This is a new marginal neighborhood in Leticia with urban–rural activities.

Although zinc panels are particularly unsuited for use in the Amazon, the influence of rapid urbanization in the region has led to an unprecedented level of loss of material culture. As in many other regions, the use of industrial materials often indicates higher status of the house owner. In the Amazon, this has led to a progressive rejection of native technology and materials, including the palm-weave (Lopez-Parodi, 1988). Housing in villages and urban enclaves in the Western Amazon zones in Peruvian, Colombian, and Brazilian territories are living examples of industrial material gradations. The short lifespan of these houses testifies to the climatic and resilience inefficacy of the material technologies they use (Riaño Umbarila, 2003: 135, 190, 202).



**Figure 16.** Photo of the main frontal view of the newly formed neighborhood Fantasy Island housing, Leticia, Colombia. Houses are developed onto pilotis clad with wood planks and galvanized steel/zinc plates on walls and roofs. © Maria Paz Gutierrez.

Martin Branas and Torres (2014) reported a thermal analysis of roofing with traditionally predominant palm species (*Lepidocaryum tenue*) and local galvanized steel zinc-coated panels (*calamina*). The results showed that between May and June, housing with *calamina* roofing is, on average, 6 degrees hotter than with a traditional palm-woven roof. Díaz and Isalgue (2012) reported that galvanized steel zinc coated panels in the Dominican Republic housing produced an increase in surface temperature from 3°C (31°F) up to 15°C (43°F) at a peak ambient temperature of 28°C from 30° to 0° inclination. A few recent weather reports also account for the expected ventilation benefits of double-height constructions characteristic of the traditional malocas with cross ventilation. In Leticia, ventilation averages between 0.3 m/s and 0.8 m/s throughout the year without significant seasonal variation, showing the clear benefits for cross-ventilation. This climatic strategy was applied to traditional Western Amazon malocas for centuries through precise cross-facing apertures, and double and triple heights. Additionally, some studies also point to the negative impact of corrosion for thermal radiation and how it is affected by rain (Baboian et al., 1990; Kabre, 2010).

The impact of the loss of palm-weave culture on the environment, although not quantified for the region, has been extensively evaluated in the life-cycle analysis in the literature (Bolin and Smith, 2011; Chau et al., 2007; Cruz, 2010; Su and Zhang, 2016). However, the inefficacy of *calamina* in other factors of human comfort, including acoustics and corrosion, is yet to be quantified or addressed in the literature. A comprehensive evaluation of the loss of the traditional material culture pertaining to its sociological, aesthetic, and environmental components is essential for local communities and external agents that participate indirectly in the process. Opportunities for social engagement around the role of preservation versus reclamation of palm-weave material culture are critical.

The lack of agreement on how to measure resilience has been discussed by various researchers in recent literature (Barrett and Constanas, 2014; Béné, 2013: 8–18; Gall,

2013: 21–23; Winderl, 2014: 12–17). Part of this challenge pertains to the variable opinions on how to measure the conceptual linkages among vulnerability, resilience, and adaptive capacity (Cutter et al., 2008: 598–606). Cutter argues that resilience is the ability of a social system to respond and recover from disasters and includes the intrinsic conditions that allow a given system to absorb impacts and cope with an event, as well as to cope post-event through adaptive processes of reorganization, change and learning (p. 601). Resilience has also been defined as a tiered capacity, which is absorptive, adaptive, and transformative (Béné et al., 2012: 20–23). In the scope of the thatched-palm craft transformations and material supplantation in the Northwestern Amazon, resilience can be defined for a purely physical perspective, e.g. thermal comfort. However, in a broader sense resilience is intrinsically related to a capacity of a social system to respond to a disaster. Hence, the implications of the loss of the palm-weave culture in the region are substantially more complex than purely physical climate comfort implications.

The division between rural and urban sectors of the landscape in various peripheral settings of the urban enclaves in the Amazon is increasingly blurred. Most homes incorporate areas for minor agricultural productions or ‘home-lots gardens’, a term used by WrinklerPrins (2002: 44). These act as urban and rural continuums. The fieldwork for this research was conducted in Fantasy Island, Leticia, in the translational border of the Western Amazon. During the fieldwork, which involved female and male community leadership of the Witoto, Bora, and Yukuna groups, a constant theme (besides the need for better infrastructure) was the desire to ‘conserve’ group-specific craft. Conservation was defined not simply as a perpetual repetition of the weaving typologies or forms of the malocas, but as a reclamation of the traditional craft which maintains the use of the thatched-palm and some of the traditional geometric traits, while incorporating other functions, including higher durability, less strenuous labor of production, and lower cost. This position bears interrogation of what the next generation of craft is in Western Amazon housing.

## Conclusion

Urbanization in the Western Amazon region is occurring at rapid and unprecedented rates. Which are the craft values and building characteristics of local traditional malocas that still exist, and why? And which architectural traits of the traditional malocas are being negotiated? This research argues that some characteristics of scale, geometry, and weaving typologies of the Bora, Yukuna, Ticunas, Makunas, and Murui (Witoto) malocas are distinctive, but other traits express the shared specifics of the thatched-palm craft resultant of dynamic processes of exchange in the region. How are these processes of social interchange being influenced by new spatial structures in the ‘urban indigenous communities’ as in Leticia? What is their relation to the surrounding territory? How is the incorporation of new technology, including electricity, transforming the physical structure and possibly social occupation?

Withdrawing from Latour’s (1993, 2005) conception of sociality as a set of ‘actor-networks’ that is forged within fields of relations between actants (such as humans) and objects, which role does the preservation of a craft play? In Latour’s model, ‘reality’ is

the constitution of inter-objectivity of human objects (see also McGonigle, 2012). Then, what role can alternative modes of production play in this inter-objectivity? My argument is that the craft involved in weaving the palm demands intertwined creative, social, aesthetic, and complex technical processes where inserting individual, and collective presence and interaction into a material form is critical to the indigenous cultures of the Northwestern Amazon. This human–matter interaction is both individual and collective. It is also a means to provide a quality of life that is becoming lost because of purely climatic perspectives. The diverse weaving typologies considered as sequences of gestures forming a plethora of geometries in thatched-palms, combined with a diverse array of overall morphologies, articulate that overall environments are a means for relational growth. Thus, the complete eradication of the woven palm construction process and the traditional housing morphologies by industrial panels represents more than a loss of large- and small-scale architectural artifacts; it represents the loss of social interaction in the form of the weaving craft of the roof-wall.

In *The Savage Mind* (1968), Levi-Strauss argued that experiential knowledge of primitive societies relies on similar classificatory structuralist systems to those present in Western society. The engineer and bricoleur represent the link between the empirical and aesthetic, as experiential and phenomenological knowledge sets a framework to address the role that the woven-palm roof-wall bears as material culture. As such, the positioning of craft reclamation as material culture is not an act of preservation. Rather, a future path lies in the transformation of characteristics that are locally valued into a generation of new crafts that preserve aesthetic, cultural, and climatic values.

### Acknowledgements

The fieldwork took place during two periods in 2013 and 2015. It involved participants of the Cabildo Indígenas Urbanos de Leticia and female and male representatives of the Bora, Miraña, Murui (Witoto), Muiname (Witoto), Yukuna, Tikuna, and Makuna groups. The support from Alexander Rodriguez, President of the Colombian Institute of Architects, Amazon Region; Olga Fajardo and Dr Carlos Franky of the Universidad Nacional Colombia, Sede Leticia, Amazonia; Dean Edgar Arroyo Department of Architecture Universidad Nacional de Colombia-Medellin; and Dr. Michael Ramage and Dr. Emily So (University of Cambridge) is greatly appreciated.

### Funding

I acknowledge the support of the Cambridge University International Trust and the Energy Climate Partnership of the Americas- US Department of State for fieldwork in Peru, Brazil, and Colombia. There is no conflict of interest.

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## Author biography

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