A Senegalese City Based on Traditional Spatial Planning

Using a Rural Spatial Planning Culture as a Formula for Urban Planning in Expanding Urban Areas of Dakar (Kholpa-Ndiass-Mbour-Thiès-Senegal)

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Abstract

The urban area of Dakar is growing in its extents and population. Necessities to facilitate this growth include social, economic, environmental and governmental planning. Currently, underprivileged groups are not sufficiently included in large scale urban development plans by the public sector (Cissé, 2022 - p. 47). This paper analyses the social dynamics of the spatial fabric in a traditional village setting in Kholpa in the Dakar region. It informs an alternative approach to the western suburb style of urban planning currently aimed to be developed in the greater region of this village. The advantages of the historical settlement typology are mainly attributed in the realm of social cohesion through frequent social interactions in collective spaces. The challenges lie in the provision of building services or permitting adaptability to higher densities of above 300 persons per hectare.

Keywords | Rural area, spatial planning, Social Dynamics, Informal Settlements, Urban Expansion, Daga Kholpa urban Pole.

Introduction

Urban Growth in Dakar | Along with other cities in West Africa, Dakar is growing rapidly (DJIA 2016). The urban population on the African continent increased more than sixteen-fold between 1950 and 2018 with similar urbanization trends expected to continue until 2050 (UNDESA-PD, 2019 - p.24). In the Dakar region specifically, the continued urban growth is being concentrated in the developing Diamniadio & Daga Kholpa urban poles.

Daga Kholpa & Diamniadio | These two urban developments have been identified as new key economic hubs for the region, with Diamniadio serving mainly as a new administrative and financial center, while the Daga Kholpa urban pole serves as a residential, logistical and industrial hub (DUA & JICA, 2016b). The urban expansion is now partly following 'high-modernist' master planned city building principles (Scott, 1998; van Noorloos, 2018). This includes aspects of neo-liberal urbanism such as the privatization of land and air rights which is currently being formed in a footprint of urban square grids. Nevertheless, this approach efficiently facilitates vehicle and pedestrian mobility and building services such as electricity, water and sewerage.

Traditional Irregular Settlements | The planned Urban Poles are situated in a predominantly rural setting (see figure 1). The Daga Kholpa urban pole is being planned in an area where the landscape is inhabited by Sérère communities (DUA & JICA, 2016b - p. 158 Becker et. al, 1999 - p.18). They have been observed to recurringly use an informal compound typology for residential spatial planning (see figure 2). The landscape of the planned Daga Kholpa urban pole contains many of such village compounds. The spatial planning typology is structured by organically

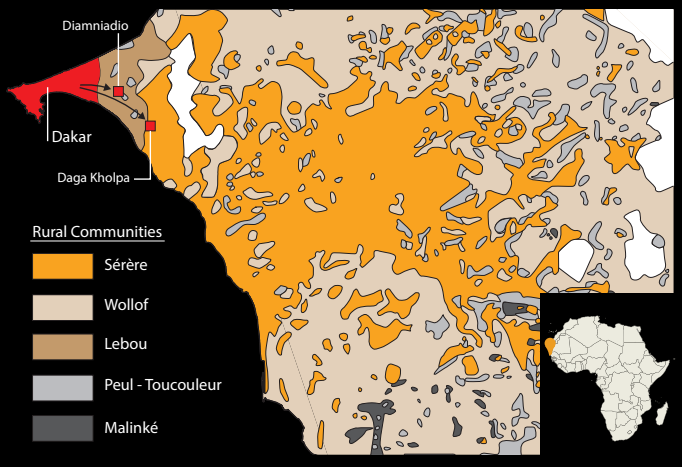

Figure 1. Rural areas in the vecinity of Dakar divided by cultural backgrounds. Modified from source Becker et. al (1999 - p. 18)

organized (multi-) family residential enclaves. These settlements are not structured in the urban grid pattern which is being proposed by the municipalities organizing the regulated allotments of land parcels. Therefore, there is a strong contrast between the spatial planning by the municipality in comparison to the traditional style of spatial planning (see figure 2).

Value of Rural Spatial Planning | The three main aspects in which the traditional spatial planning culture adds value are in its affordability, its social cohesion and its spatial organization to create collective outdoor spaces. The residential real estate currently being planned in the Daga Kholpa urban pole is unaffordable for the average person in Senegal and is therefore targeting the emerging middle class. Informal settlements have allowed low income citizens to maintain a livelihood at an expense which has suited them sufficiently. Due to the sharing of amenities and collective spaces, residents in such compound settlements have lower costs and maintain frequent interaction with neighbors.

Problem Statement | The contrast between the spatial planning concepts of the square grid and the compound has the potential to disrupt a significant social lifestyle. The square grid is being planned around the existing compounds in Kholpa and aims to modernize the residential typology. However, this typology enlarges the distance between families who have culturally lived close to one another for many previous generations. Similar suburb developments have led to fragmented and insecure social relationships between neighbors (Buys et. al, 2007). Interaction is thereby highly dependent on the likes of the people. The current development plans for the urbanization of the village can create insecurity around the social sustainability through the change of spatial planning from compound to a grid style plan. In this paper, the traditional informal settlement typology is explored to extract inspiration for the urban expansion in the Daga Kholpa urban pole.

Literature Review

Public Spatial Planning | The current state of public spatial planning in Dakar is characterized by ongoing efforts to address various urban challenges and promote sustainable development (DUA & JICA, 2016b). Through the formulation of urban development plans, designated zones are made for residential, commercial, and industrial purposes, and the enhancement of transportation systems to alleviate congestion. The Daga Kholpa urban pole mainly addresses the housing deficit of ±160,000 homes in Dakar (World Bank, 2022). In the urban vision for the urban pole, 56% of land is reserved for residential programs. Sixty percent of this land area is thereby allocated for collective housing, while the remaining 40% is destined for high-end housing projects (DUA & JICA, 2016b – p.160). Through the division of land for designated programs, the development is structured in a top-down operation.

Figure 2. Top: Fojn compound in Kholpa. This is a recognizable Sérère type of compound. Bottom: The spatial plan for the expansion in Kholpa.

Informal Settlements | The administrative bodies have historically struggled in managing land allotments to meet growing housing demands, which has led to informal settlements (Attahi et. al, 2009 – p. 18 -19). This phenomena has endured technical, economic, environmental and political problems due to unplanned precautions. Cissé (2022 – p. 40) mentions land rights disputes between administrative and traditional authorities. Mbow (2008 - p. 3) comments on increased flood risks in informal settlements built at low altitude areas. These structures often also receive building services later on through public programs (World Bank, 2002 – p. 12). The rural Sérère compound typology is traditionally an informal settlement and is subjected to many of the mentioned difficulties. Cissé (2022 – p. 46) further argues that due to both the rapid nature of urban sprawl in the history of Dakar and the large housing deficit there is reason to consider "producing serviced and equipped plots of land on a large scale for supervised self-construction".

Literature Review Limits | The literature review did not bear sufficient information regarding the social life in the Sérère compound spatial typology. Therefore, a site visit was conducted from the 6th – 26th of December 2022 to a selected compound in the village Kholpa. The target of the research was to identify and map spaces recognized to have value in the typology's social dynamics. This was done in the largest compound in Kholpa (Fojn compound) consisting of roughly 200 people and was about one hectare in size.

Research Objective | This study aims to inform a different perspective to the current square grid urban model used for the development plans in the inhabited areas of the Daga Kholpa Urban Pole. Kholpa is one of the existing villages in the urban pole area. This research sought to register and reflect on the social dynamics in outdoor spaces of the compound to inform how these features can be of value and be implemented into urban planning. The model will function mainly as a manual for replicating the spatial characteristic of the compound. Solutions for the problem regarding mobility and services are also discussed. The work presented should therefore be of special interest to architects and urban planners seeking to incorporate social sustainability in the development of the Daga Kholpa urban pole area.

Methodology

Due to the limitations of the literature review on the social dynamics in the compound, the research methods for this paper were focused on action research. This was done through satellite imagery, in situ observation, shadowing of individuals, surveys and interviews. The analyses focused on embracing interpretation and meaning in context by the observer to identify and map spaces where people gathered to interact with one another.

Hypothesis | The rural spatial planning typology of residential compounds can be scaled into an urban context and be implemented as a model for urban planning in applicable areas of the Daga Kholpa urban pole.

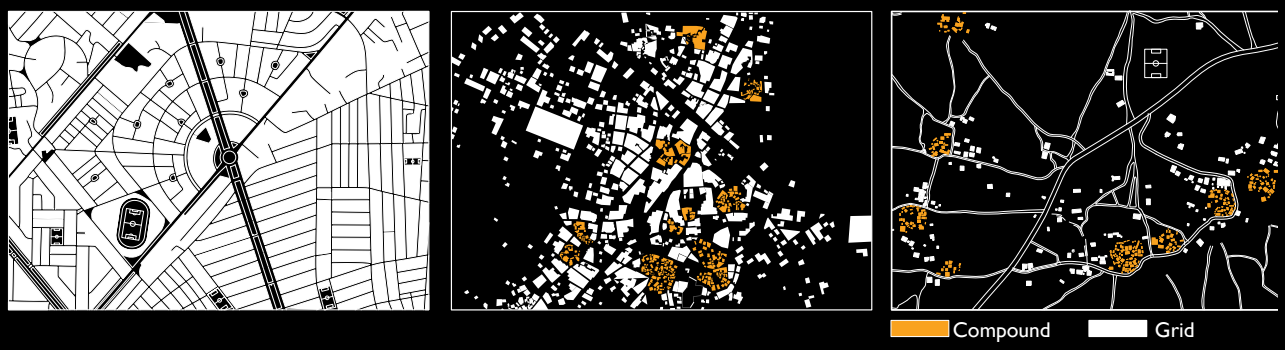

Figure 3. Urban fingerprint comparisons between (left) Grand Dakar, (middle) Diass and (right) Kholpa. Each map is displayed at a the same scale. The Compound typology is shown in orange.

Research Tools | The manner in which interactions took place in the compound was mapped through abstracted digitial and hand sketched 2D and 3D drawings and model making. These drawings and models sought to portray and highlight a generalized view of interactions in such spaces. Aside from the observations, structured and unstructured surveys and interviews assisted in listing the activities which occurred in the collective spaces. The interviews were primarily taken with the chief of the village who is the leader of the community in Kholpa. Casual conversations and participation in informal activities with residents in the Fuyn compound were carried out to experience the social and cultural activities described by the chief of the village. These visits were also used to interview additional persons about activities happening in the compound. All maps are traced from satellite imagery and have a range of precision ranging from 1 - 3 meters.

Limitations of This Research | The insiders' perspectives were interpreted through a Western Architecture student's observations as an outsider. The research was however attempted to be positioned through a non-Western outlook by using a transnational literature source and express objective recordings of what was encountered during the visit. The observations made were of the individuals who were encountered during the observation time-period. Those who live in the compound but had left for work or education during the times of observation were therefore not accounted for in the results. Additionally, the observer was a male adult. In the local culture, time spent during daylight was mostly divided by gender. This meant a greater insight was collected of the social life of the men in the compound than those of the women. Discrepancies may therefore occur in the observed interpretation of meanings in context as well as missed perspectives due to absence. Overall, this is a generalized overview of styles in which interaction took place in the compound. The results are therefore based on similarities which were found in the manners of interactions in space.

Spatial Qualities

Special Features of the Compound | A village compound in Kholpa and its surrounding villages and towns can be characterised by many residential buildings clustered together in an often recognisable circular form in plan view (see figure 4). Constructing this way would maximize the space left for agricultural practices in the surrounding areas, as the constructed environment would not spread out too extensively. On the periphery of the compound, a 2m wall forms a barrier for outsiders not to protrude into the compound. There are several single door openings in this wall and two larger openings without doors. The latter is used for increased mobility as it is large enough for a vehicle to enter (although this rarely occurs). Compound residents predominantly make use of the collective spaces within the peripheral wall of the entire compound. Villagers from different compounds occasionally visit one another in these outdoor spaces as well.

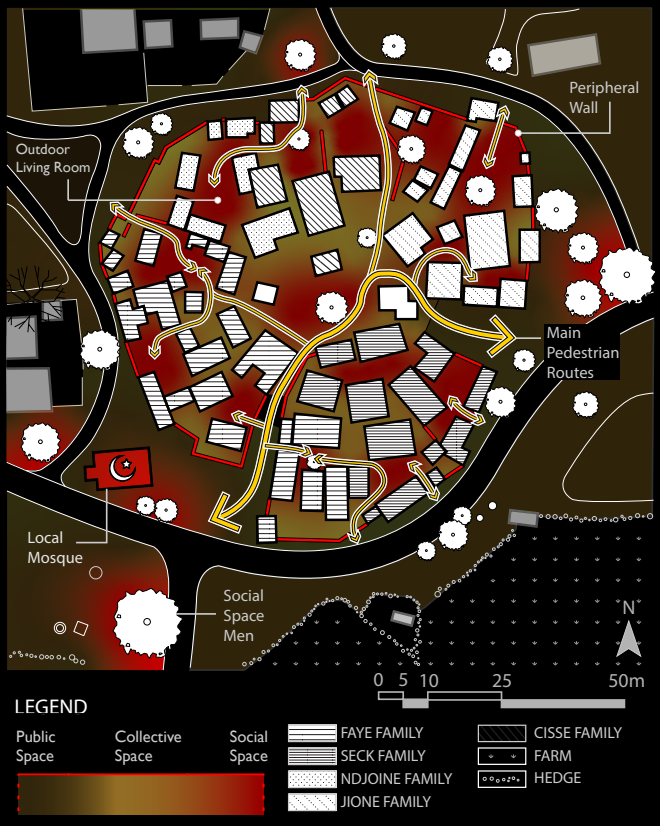

Figure 4. Spatial analysis of the gradient in privacy. Pedestrian routes, the peripheral wall and outdoor collective space are highlighted. The latter is used for social interactions.

Development Process | The entire compound often started with one building and gradually expanded as the family grew over various generations or when additional families joined the compound. New structures are built by the descendants of those who constructed the first structure, often directly next to those of their ancestors (see figure 5 & 7). The birthrate in Senegal is 4.4 which that the country is going by means of natural growth (World Bank, 2022b). In the compounds such large families lived together. They would therefore grow larger as time passed and different generations within a family largely continued to live next to one another. The collective outdoor spaces were generally used by the family who's houses surround it. The outdoor spaces were therefore not surrounded by different families but in fact by one family respectively.

Compound Architecture | The buildings in the compound are often small, housing a single function such as dwellings, shared sanitary facilities, a shared kitchen or a small shop. Interior living rooms are often absent in buildings or kept relatively small. The outdoor spaces between houses are freely accessible by the residents of the compound and are used as pedestrian pathways or as open air living rooms. There are often extrusions used for seating at the base of the buildings when it is facing one of these collective spaces used as outdoor living rooms (see figure 6). Seated on this extrusion, people often have quick conversations with those passing through this space as pedestrians. Those spending long continuous timespans in these areas were mainly groups or individuals who lived in the houses directly facing this collective space or extended family. Lastly, there are often column supported cantilevers attached to the building facing the outdoor living room to provide shade. Due to the hot climate, this shaded space is a highlighted space for socializing. It is significantly cooler and therefore provides better thermal comfort. Similarly, wide spanned trees provide shade and have lower temperatures due to evaporative cooling. This resulted in people often sitting here for conversations both inside and outside the compound.

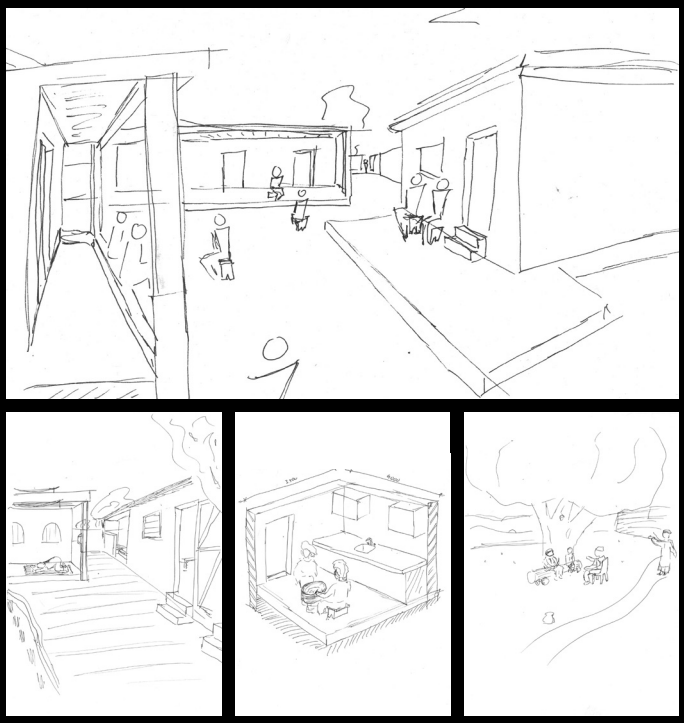

Figure 6. Impressions of life in and around the Fojn compound.

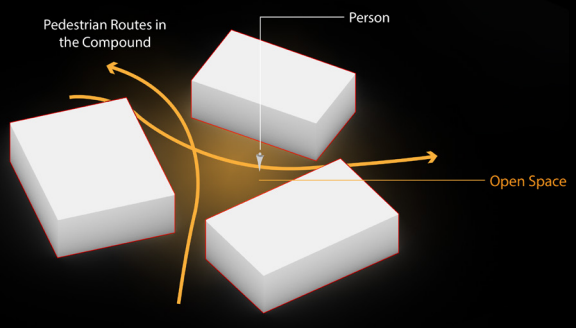

Figure 5. The enclosing effect of open space by buildings clusters to create the recognized outdoor living rooms.

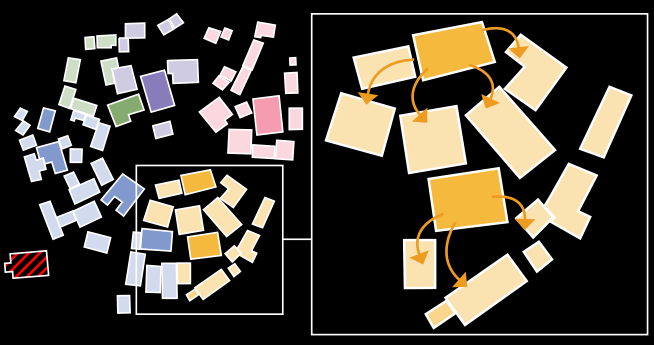

Figure 7. Building clusters often start with one building and expand through future generations who build next to the first building.

Social Activities During the Day

Morning and Early Afternoon Activities | The use of the collective space varied during the course of the day. Men and women often spent time separately during the span of the morning and early afternoon. During this time, the collective outdoor spaces within the compound were used by the women and children of the family. The age difference between women socializing together in the outdoor living rooms would vary largely and could be with women from the same family or diverse families from the compound. The women socialized, rested casually, prepared breakfast in the morning and a heavy lunch after for the entire family. The women worked on large portions of harvested produce intended to be consumed locally or sold for wholesale. During this time, the men in the village were rarely or briefly spotted inside the compound. For most of the morning and early afternoon the (adult) men were found in groups of similar age groups and occasionally from different compounds in the exterior social spaces conversating for short or long periods at a time (see figure 4).

Afternoon Activities | The men would return to the outdoor living room to which their home faced for their prayers and mostly prayed outside. A call for prayer was signaled by the mosque two times (out of the five total daily prayers) every day. The women prayed indoors inside their respective dwellings. When the men were away, the women from the entire compound occasionally met together in the centrally located open outdoor space to socialize under a large tree. When the men and women returned from work halfway through the afternoon, a large plate of traditional Senegalese food prepared by one or two women of the family would be presented to all present family members and to those currently visiting the family's outdoor living room as a gesture of hospitality. The lunch is consumed in large groups sitting together from one large plate. After the meal, men and women sat together in the collective outdoor space and discussions flourished about the passing of the day as one person prepared a traditional tea termed as 'attaya'. This tea would be consumed by the many adults sitting in the collective space through two glasses. Sharing a glass with others symbolized solidarity. After lunch between 2 and 3 pm, children played together in the collective spaces and adults socialized in the outdoor spaces while some sought more privacy inside their dwellings.

Evening Activities | At dusk, the men of the entire compound visited the mosque situated to the southwest of the compound to pray together. Thereafter, the entire family living around one collective outdoor space often regrouped sitting outside in this outdoor living room, socially awaiting the end of the day in one another's company. Young men occasionally continued socializing until after midnight in the collective spaces, drinking attaya tea.

Figure 8. A selection of impressions of daily activities in and around the Fojn compound.

Lessons Learned

Different Levels of Privacy | Privacy is a crucial aspect in the spatial organisation of outdoor space in the compound. The peripheral wall creates a physical barrier with the public space to the exterior of the compound. This wall essentially changes the outdoor space in the compound from public to collective. The collective space is thereby shared by residents in the compound. The social dynamics depend on the privacy created by the enclosing effect of this wall. The locals in the Fojn compound have displayed good capabilities in positioning their dwellings in ways which foster spaces in the form of outdoor living rooms which are used by families for socializing. Creating these spaces is done through the positioning of buildings and walls to create limited accessibility and vision into the outdoor living room. The outdoor spaces are not private to the family but are in fact collective to the compound. However, there is a sense of ownership to certain collective open spaces by groups (families). This is due to the relative close proximity of houses positioned towards this space. Residents in the compound thereby tend to mainly use the collective space facing their own dwellings. Some families have been observed to have a very accessible outdoor living space while other families had made their collective space more private by limiting the vision into their outdoor living room through smaller openings into the space (see figure 9).

Spatial Qualities of the Outdoor Space | At first glance, the buildings in the compound seem to be scattered at random. In reality however, every building has been positioned carefully by the compound residents. The placement of a new building starts with discussions between its future neighbors. This is done in regards to its best possible placement. Some of the aspects which are designed through discussion, include: (i) sightlines and its influence on routing and privacy, (ii) leftover space for its use as an outdoor living room, and (iii) how the privacy of individuals or family clusters are affected by the placement of the new building.

Building Placement Variables | The placement of a new building follows three variables. The first two variables are its placement in a horizontal plane through an X and Y axis. The third is how the building is rotated. These variables directly influence how the three design aspects in "Spatial Qualities of the Outdoor Space" are considered for the placement of a new building (see figure 10).

Sightlines and Privacy | The sightline towards another outdoor space practiced an influence on one's routing through the compound. As the unbuilt outdoor spaces in the compound were used as pathways and outdoor living rooms, the sightlines practice an influence on the choice of routing within the compound. This was the case for the observer, who

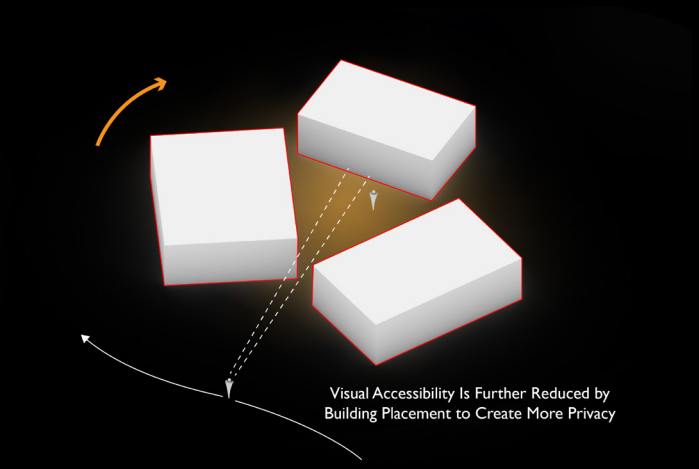

Figure 9. The effects of building placement on the visibility and accessibility of the enclosed outdoor living room.

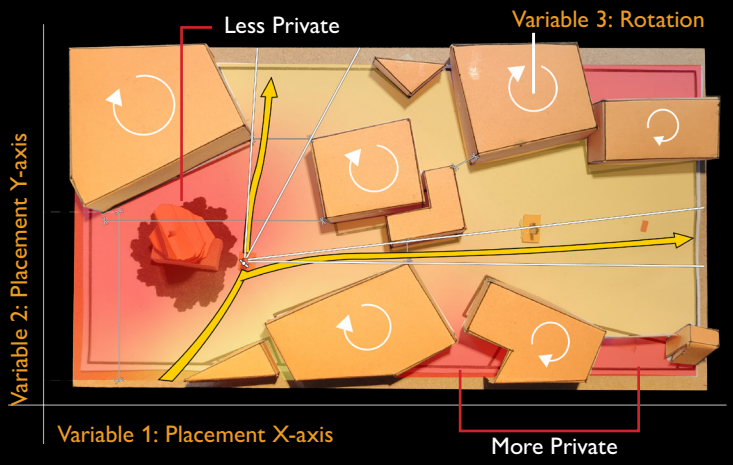

Figure 10. Segment of the Fojn compound in plan view. The three variables govern the privacy in the collective outdoor spaces.

was an outsider and therefore was not familiar with the setting of the compound. Having a view of the space behind the opening you are positioned in gives comfort to continue walking into that direction (see figure 11). This has a direct influence on the privacy of the outdoor living rooms through the aspect of seeing into a more private space. These spaces are not physically closed by a door, but are perceived as a space belonging to the families who use them. By placing buildings in such a manner that it is not possible to see the following space, gives the pedestrian a sense of protruding into a private area and therefore makes the wanderer in the compound seek a different route. In contrast opening the sightline towards the following space in the route creates a natural inclination to continue walking into that direction. (see figure 11).

Collective Use of Outdoor Space | The spatial setting of the compound allows for interactions to naturally occur more often than in a grid style suburban plan. This is firstly due to the fact that the outdoor space in the compound is shared and not privatized as is the case in the suburb grid. To reach a dwelling in the compound, it is unavoidable that residents must encounter one person or more before reaching the dwelling they live in (see figure 12). As the entrances to the compound are all situated on its outskirts in the peripheral wall, individuals must walk past the dwellings of others and often pass through the collective outdoor spaces of other families or their own. In the suburb grid, residents can directly access their home (perhaps by vehicle) and not encounter their neighbors at all without the physical assertion to do so. Through this comparison, it is evident that the urban fabric plays a role in how often one engages in interaction with neighbors.

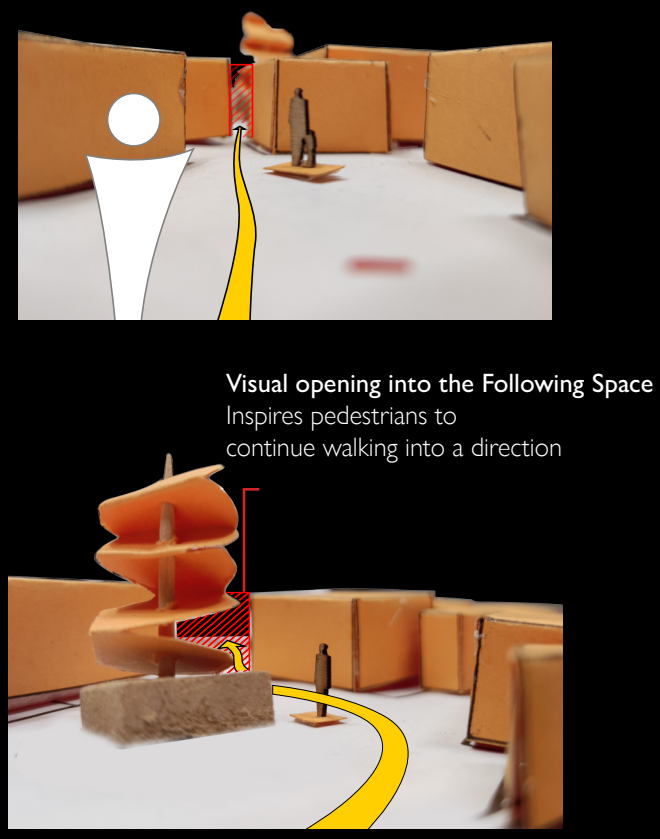

Figure 11. The curiosity window visualised in a red hatch pattern.

Figure 12. The routing in the compound allows for many interactions to take place.

Social Interaction | The spatial setting of the compound allows for interactions to naturally occur more often than in a grid style suburban plan. This is firstly due to the fact that the outdoor space in the compound is shared and not privatized as is the case in the suburb grid. To reach a dwelling in the compound, it is unavoidable that residents must encounter one person or more before reaching the dwelling they live in (see figure 6). As the entrances to the compound are all situated on its outskirts, individuals must walk past the dwellings of others and often pass through the collective outdoor spaces of other families or their own. In the suburb grid, residents can directly access their home (perhaps by vehicle) and not encounter their neighbors at all without the physical assertion to do so. Through this comparison, it is evident that the urban fabric plays a role in how often one engages in interaction with neighbors.

Family Clusters | The sense of familiarity with neighbours is crucial to create the social capital observed in the daily activities of the Fojn compound. This familiarity was catalysed due to the family relations between neighbours. This spatial planning typology has been used by the locals in Kholpa for many generations. Therefore, those living in the compound have grown accustomed to this planning culture thereby often living outside with others. The compound spatial planning is therefore highly applicable for those who are used to living in such a setting. It is uncertain how such a spatial setting

Clustering of Buildings Follows Family Cores | The sense of familiarity with neighbours is crucial to create the social capital observed in the daily activities of the Fojn compound. This familiarity was catalysed due to the family relations between neighbours. This spatial planning typology has been used by the locals in Kholpa for many generations. Therefore, those living in the compound have grown accustomed to this planning culture thereby often living outside with others. The compound spatial planning is therefore highly applicable for those who are accustomed to living in such a setting.

Outdoor Living Rooms | The social activities mainly flourished in the larger outdoor open spaces. These collective spaces were translated as outdoor living rooms. In general, living rooms may differ in function dependent on culture. The outdoor living rooms in the compound are viewed as as such because they are used for: (i) socializing with families or friends (ii) entertainment for kids to play, (iii) relaxation, (iii) reception of guests and (iv) a place for prayers. The dwellings unanimously point the entrance of the house facing this collective space. When residents approach or exit their dwelling, they immediately have a view of the other dwellings surrounding their shared outdoor living room. This creates a short threshold to interact with your neighbors, as there is a high chance of encounerting people upon entering the compound.

Higher Density | The compound typology provides a higher density and more variability in housing typologies when compared to the 15m by 15m grid currently being implemented by the municipality. Roughly 200 residents per hectare live in the single level development of the Fojn compound while the 15m x 15m urban grid can house roughly 100 residents per hectare with repetitive plots. The compound reaches higher densities due to the minimized private space and road network compared to the grid urban fabric. This accounts for the ground floor area. Both the compound and the grid typologies have capacities to enlarge its floor space index by adding more stories. It is not advised to build higher than two stories in the compound however, as it can have negative effects in overcrowding the shared collective spaces used as outdoor living rooms. The urban grid has a better capacity to build higher than 2 stories, as the outdoor space on the periphery of the building (the sidewalk) is not used as a collective space but is in fact public space. The doubled factor in density in the compound per floor means that in a block of one hectare, the same amount of people can live in two story buildings in the compound typology and four story buildings in the urban grid. Keeping the building lower, ultimately results in less materials needed for structural components in the building, which has a minimizing effect on the material, financial and environmental demands of the building.

Anticipated Implications of Applying the Grid System | In Diass we find square plots on the outskirts of existing compounds (see figure 3). The village of Diass is an example of what Kholpa might look like in the future if the urban plans using the grid persist. The changing of the urban fabric from a compound to grid typology will have implications on the dynamics of the social culture tied to the compound typology based on two factors. The first implication is through the privatization of parcels of land. The grid makes it easier for parcels to be sold during financially stressful times by current or future generations. This can fragment families. In the compound however, it is not common for parcels to be sold individually. The land in the compound is not percieved as private and would therefore not be sold unless the entire family core or residents in the compound choose to conclude such a sale of land. Families are therefore likely to continue to live together in clustered buildings. The second implication pertains to the altered privacy in types of space where social interactions are fostered by the spatial planning typology. In the urban grid system, the space delegated for social interaction is centered in a public square. This square is intentially designated as public space and is therefore accessible by everyone and can be used as social space by everyone. Social interactions can also take place on the sidewalk likely between small groups (2-5 people) (observed in the grid typologies in Grand Dakar and Diass). In the compound, the space intended for social interaction is often found as collective space within the compound (between dwellings and the central open outdoor space). Public space is also used for social interactions under trees to the exterior periphery of the compound. The result is that residents need to travel longer distances to use public space for socializing with their neighbors in the grid than in the compound. In the compound there are smaller more accessible collective and public spaces

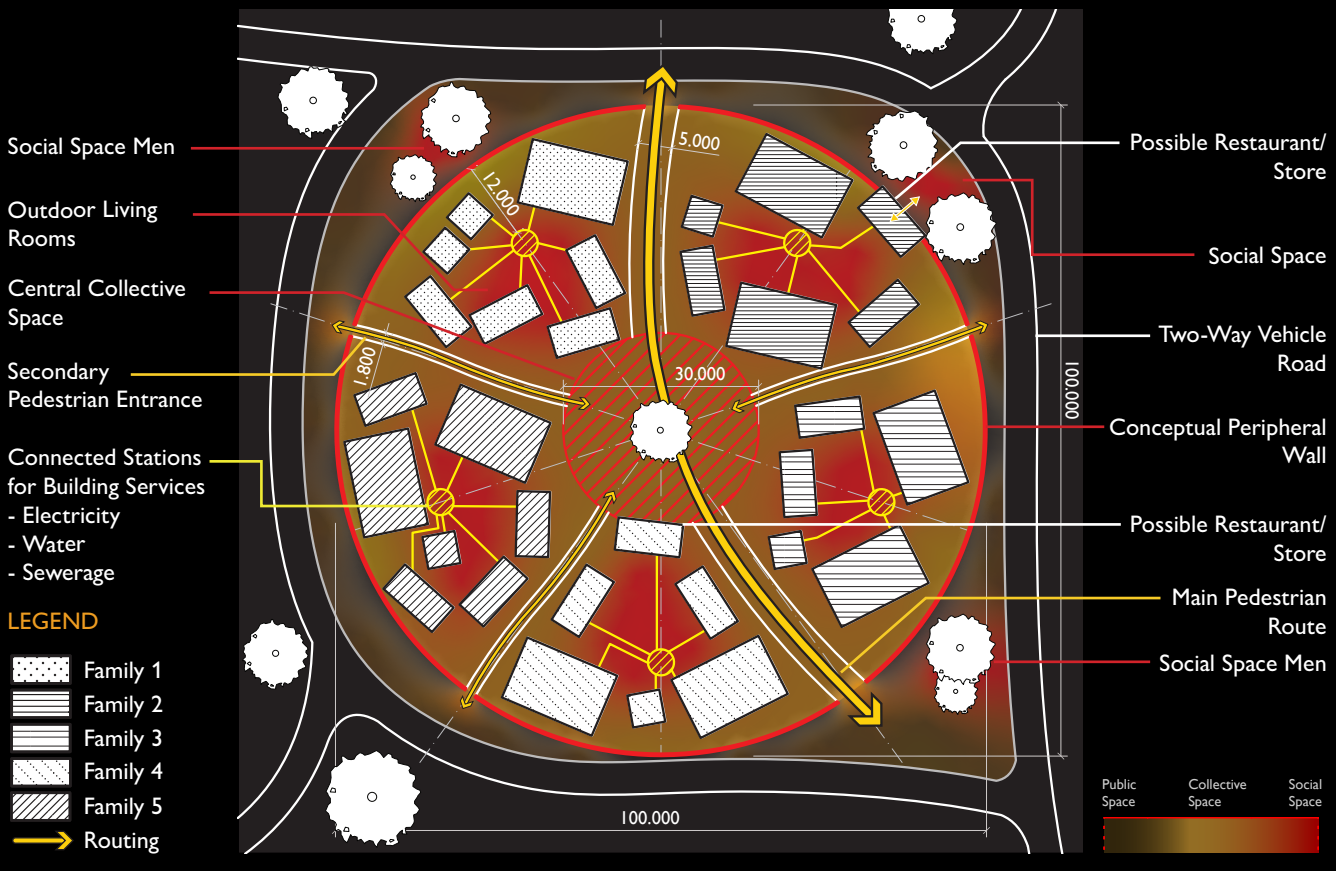

Figure 13. Visualized summary of the recommendations for urban planning using the compound typology.

which can be used for socializing by groups of up to 20 people. In the grid, the public square can foster 100 people yet it is not as accessible as the many smaller outdoor spaces in the compound. Lastly, there is a cultural tendency for men to use the public space (outside the compound) for socializing which women do not use. It can therefore be argued that women will have less open outdoor space to socialize in the grid system unless they adapt to socializing in public spaces like the public square.

Recommendations for Urban Planning

Spatial Planning | The position of this paper is that the social culture embedded in the spatial planning of the compound has valuable insights for the urbanization of the Daga Kholpa urban pole. An urban model which uses the spatial planning of the compound is likely to lead to a continuation of: (i) frequent social interactions, (ii) strong family ties, (iii) higher densities than the grid system and (iv) identity made through the image of the compound. The main issues attributed to the compound typology lay in the lack of building services when built and improper flood management systems. Therefore, a suitable solution should be implemented for these aspects before the compound typology can be integrated into regulation. Furthermore, mobility for pedestrians as well as for vehicles should have predescribed codes in a new building decree which permits the compound typology.
Scope of Spatial Planning | The research in this paper has focused predominantely on the outdoor spaces within the compound and some social spaces in the direct exterior vicinity. Therefore, the recommendations only pertain to this scale. Further research is needed on how the scope of spatial planning is extended on a larger scale. The further research should describe how public space between several compounds function in a social dimension.

Spatial Elements | Some parameters should be used in the urban design if urbanization is expected to happen at a pace where multiple hectares will be developed simultaneously. This pace is i.e. the case in areas of the developing Diamniadio urban pole. Based on the lessons learned, the compound as an urban block for housing could: (i) start with a peripheral wall (ii) build a mobility network as a starting point for dividing space in the compound to house separate families, (iii) build plugin stations for building services and (iv) allow buildings in the compound to be placed freely according to the preferences of the users (see figure 13).

Peripheral wall | The compound typology as one unit can range in size. The peripheral wall is a suitable way to allot residential areas in a greater master plan. If the typology should follow the size of the Fojn compound, the surface area in the compound would have enough space for about 5 families to build clusters of buildings. The diameter of the wall should then be roughly 100 m. It is advised that families starting in the compound are allowed to continue to add building as time passes in their respective family plots. Therefore, the compound could have a surplus of unused space at its conception, but within three generation (roughly 60-70 years), these empty spaces are likely to be occupied by the decendents of the families living in the first buildings built in the compound. In accordance with the users, the permeability of the wall can be changed to allow for openings which can be used for (i) small or large entrances for accessibility and (ii) commercial activities such as stores or restaurants. The permeability of the wall should allow for water to easily escape the compound in times of high rainfall. The openings in the wall can lead to roads which simultaneously divide the space for separate residential family clusters. Lastly, the wall should adjust itself to the landscape of the land not be kept strictly in a circular form. This is beneficial for optimizing the land for water drainage. A less homogenous wall also builds on the character of existing compounds.

Routing | The outdoor space in the compound is mainly used by pedestrians. In the case of emergenies or large deliveries, the compound should be accessible by vehicle. Vehicle parking should however be kept outside the compound to allow more space in the compound to be used for social activities and for children's safety while playing in the outdoor spaces. There should be a vehicle road and pedestrian network for two-way traffic around the exterior of the compounds to allow for regional accessibility.

Land Division | To discourage family fragmentation, it is suggested to allow family cores to continue developing using the compound typology. Freedom can easily be given to the residents in the compound to place buildings according to their preferences. They are therefore able to design their own direct living environment and create collective spaces large enough for their specific family needs. to be transformed into a plot which can be shared by many people but is not privatized. The analyses have shown that the locals have sufficient skill to place buildings in manners which create social spaces used as highly valued outdoor living rooms. This will allow for the existing social use of outdoor space to continue as they have traditionally.

Legal Structure | Existing traditional authorities can be empowered to take up some of the operational tasks in organizing the spaces in new compounds. This has traditionally also been executed through this method. The chief of the village, who is a community leader along with a technical team can thereby lighten the operational demands for certain aspects in spatial planning from the public sector. It is suggested that a legal organization is intiated for this through a foundation. The land in the compound will therefore partially be governed by this foundation who follows predescribed building codes by the Ministry of Urban Renewal, Housing and Living Environment in the Republic of Senegal (DUA). The organization should in fact be legally bound to the administrative governmental body. This changes the legal dynamics of urbanization. It includes efforts for locals in the compound to participate in the development of compounds through an approachable organization. The foundation should be led by the chief of the village, who has great insights into what his people seek in the development. This legal structure is above all intended for the micro management of spatial planning of outdoor open spaces in the compound. It will will (i) save labor costs for the ministry and (ii) create localized spatial plans within the framework of the peripheral wall in the compound.

Density | The national urban vision for the Daga Kholpa urban pole mentions that the residential urban model should target 170 people/ha (DUA & JICA (2016b - p.184). Of the total residential area, 60% is intended for low income groups and 40% of the total residential area is intended for high end residential real estate. DUA & JICA (2016b) also indicate that low rise apartment housing is desirable for the low income groups. The compound typology can be a valid alternative spatial planning typology used for developing low income areas, as it roughly meets the 170 people/ha demands by the policy in a single story development. The compound typology minimizes private space to add collective space which reduces the land used per building. This makes it possible to lower cost of land per building due to having smaller plots. When two story buildings are introduced in the compound the density reaches roughly 300 people/ha. Adding a level will allow families to first expand into the vertical direction, before expanding to additional buildings. Family descendents can therefore first construct their homes above their parents in an additional story. Doing this will slow the pace of the compound becoming full. This is specifically significant if the birthrate is higher than 3 (which is the case in Senegal (World Bank, 2022b) which leads to a point where the compound reaches its population limits. In the Fojn compound this has been calculated to be after three generations in the single story development.

Building Services | Some of the problems previously addressed in connection to informal settlements conform to water, electricity, sewerage and internet supply by the public sector. There is a spatially difficult task to allow significant freedom in building placement and simultaneously providing such building services. Due to the homogenous nature of the spatial organization of plots in the grid, it is easier to supply these building services to individual buildings. In the compound however, it is suggested to build stations which buildings can attach themselves to in order to recieve services. Depending on the size of this installation, it could become part of the outdoor space used as the living room. In this way, new buildings can similarly attach an underground shaft towards their new homes. The engineering and maintenance can thereby be provided by an association of home owners in the compound. The service station should be placed strategically so

that enough space is left for buildings to be placed around it. Sufficient space should also be available for the outdoor living rooms to function the way it does in the compound around this service structure.

Conclusion

The benefits in using the compound typology as an urban model are firstly attributed to the social cohesion observed in the Fojn compound as a case study and secondly in the residential density it can reach. Further research is necessary however to see in what manner such a social cohesion manifests in other similar compounds in Kholpa and other villages in order to conclude if the social dynamics are recognized there as well. If the compound typology should be implemented in an urban setting in the Daga Kholpa urban pole, additional research is necessary to measure how such a spatial planning typology is appreciated by outsiders of the Sérère culture using the family core as a design parameter or through a more diversified demography.

Furthermore, there is an opportunity to empower local Sérère residents by allowing their social culture to continue to be used in spatial planning within their inhabited areas in the Daga Kholpa urban Pole. Beyond the currently inhabited areas, the DUA has the opportunity to develop other currently uninhabited areas in the Daga Kholpa urban pole using this traditional Senegalese spatial planning typology.

Further research is also necessary to analyze the social dynamics in the scenario of the urban grid. Specifically because it is currently favored by urban planners in the region. The social culture in Kholpa is engrained in having social relations with neighbors. It is however necessary to conclude to which degree the social interaction might reduce or not if the spatial planning typology in Kholpa is changed to the urban grid typology. Studies on the social dynamics in towns such as Diass can help quantify the difference between social interactions in the compound setting in relation to the grid. This can be done in Diass because both villages have similar backgrounds in using the compound typology.

All in all the Daga Kholpa urban pole can enrich itself with cultural history if the legal administration allows compounds to be included in the spatial planning of the urbanization in the area. This would result in a an urban setting which is tied to local culture. Less space will be needed to house the growing population using the compound typology, which leads to less agricultural or environmental land to be used for urbanization compared to the grid system. Furthermore, the compound typology has the opportunity to include local authorities in its legal system to further enhance the participatory approach to spatial planning. This will reduce operational planning labor by the ministry of DUA. Locals can continue designing their outdoor spaces through the guidance of a foundation led by the chief of the village and a technical staff. This will lead to contiued social interactions and reduce family fragmentation based on the designs of locals living in the Fojn compound. Lastly, the compound typology is specifically well adapted for residential space for low income groups and will have more social spaces when compared to the urban grid or low rise apartment blocks. Senegalese administrative bodies therefore have the unique opportunity to create the urban pole using this typology as an urban block around which urban facilities can be installed while maintaining valuable identity tied to the image of the traditional Sérère culture using the compound typology.

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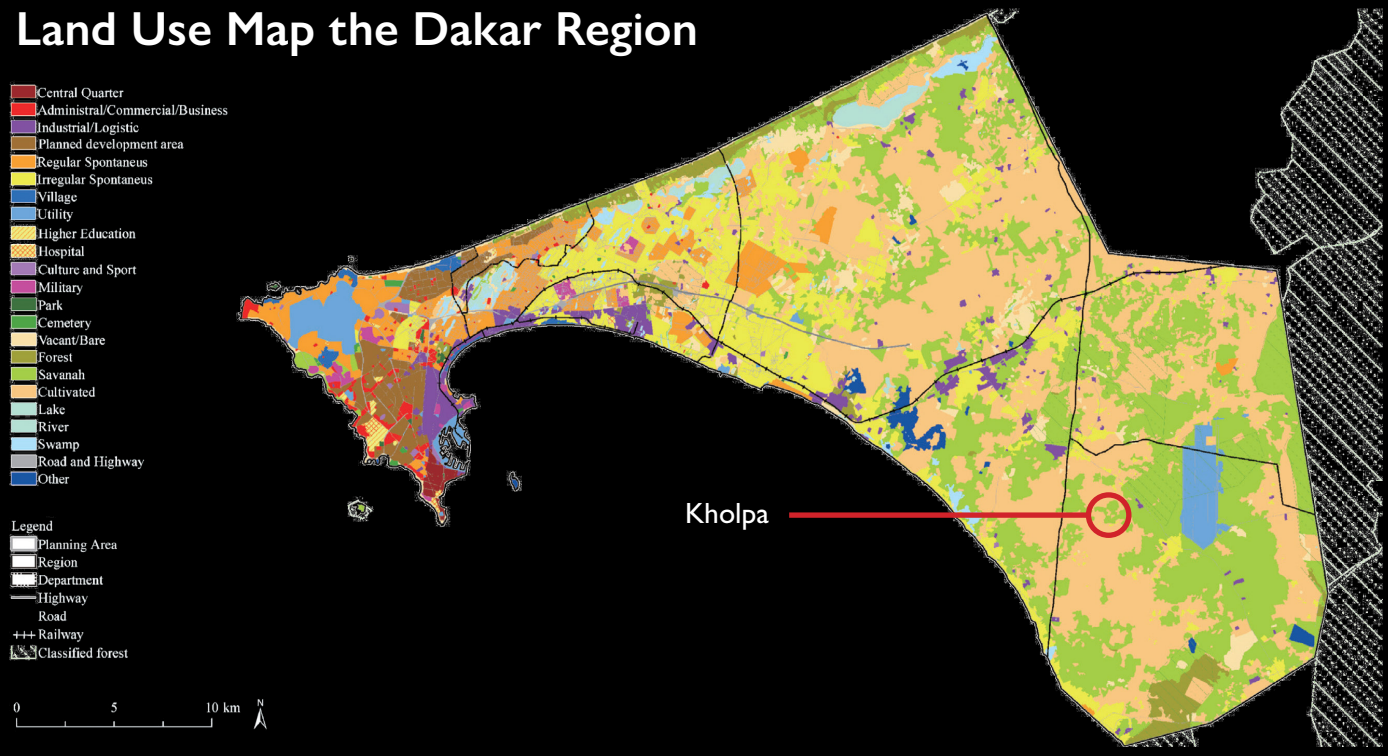
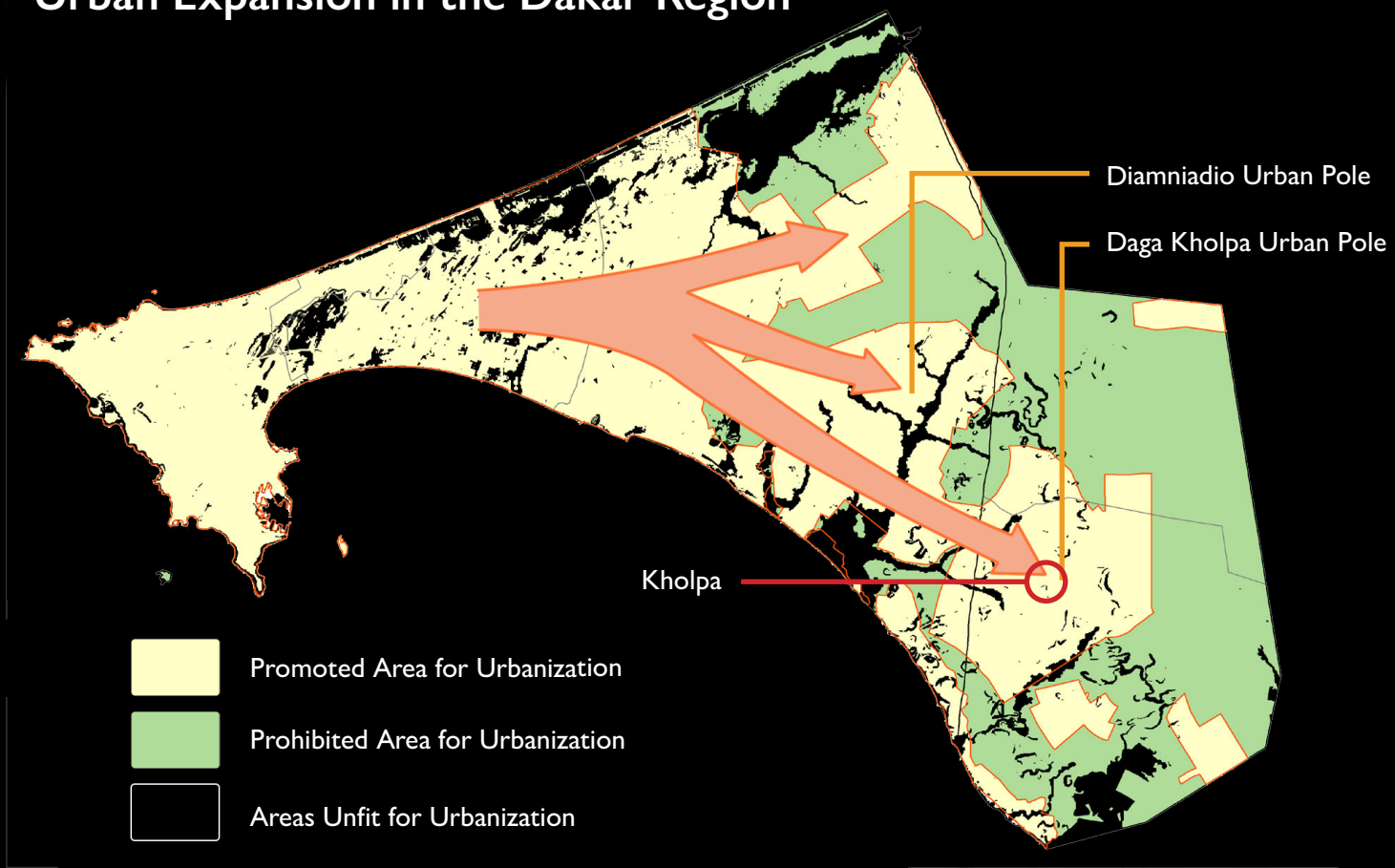
Land Use Map the Dakar Region



Source: DUA & JICA (2016a)

Urban Expansion in the Dakar Region



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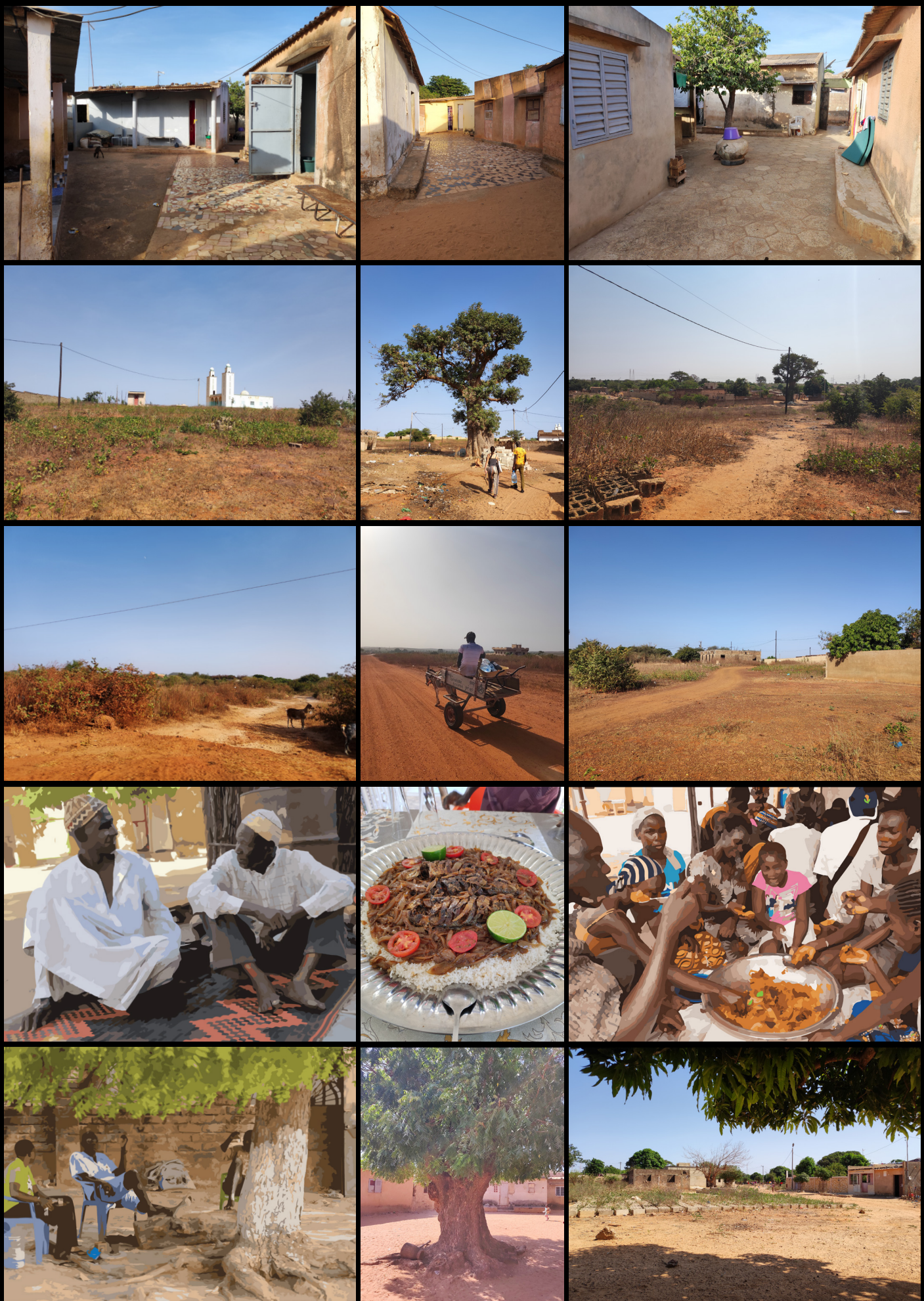
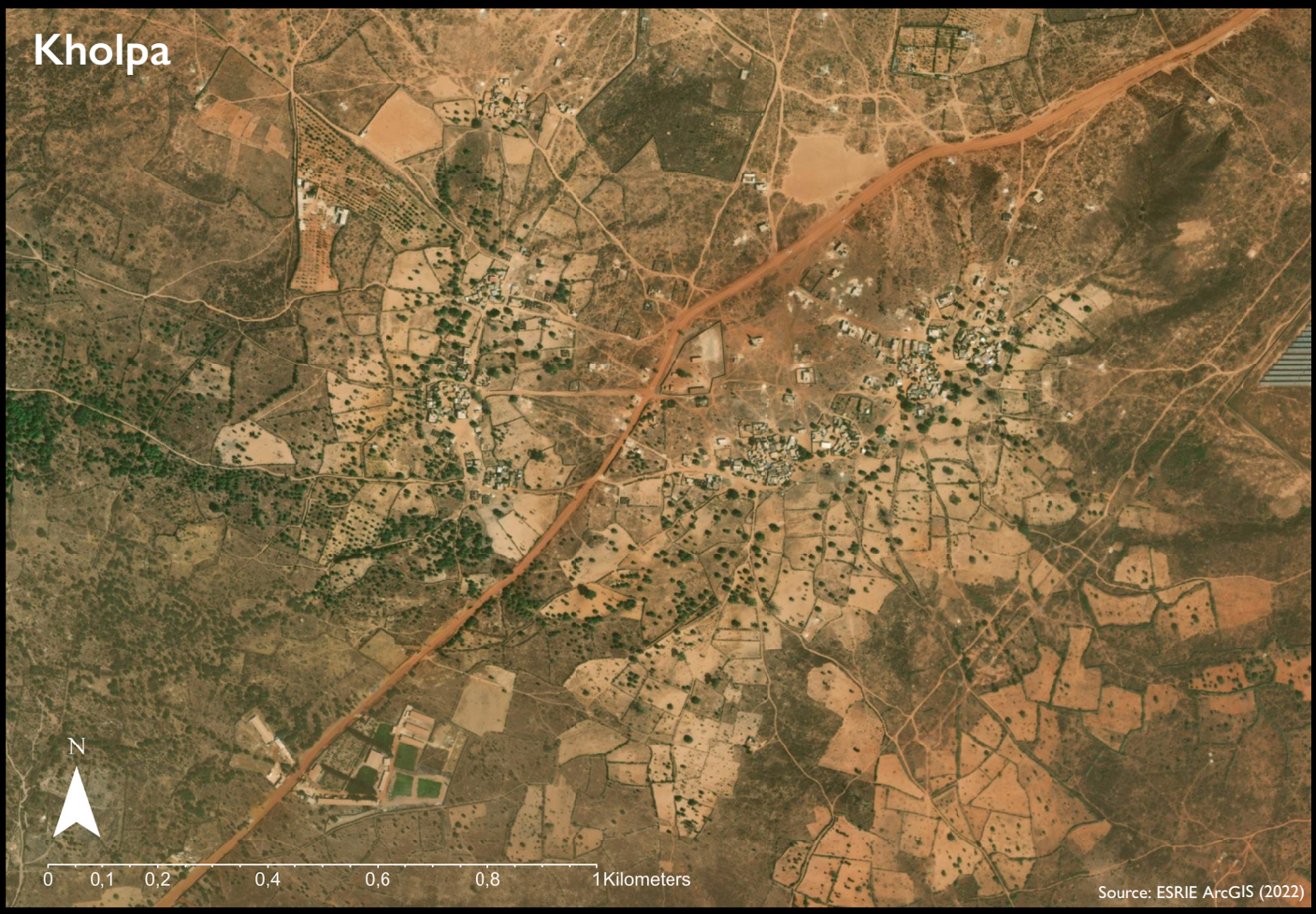
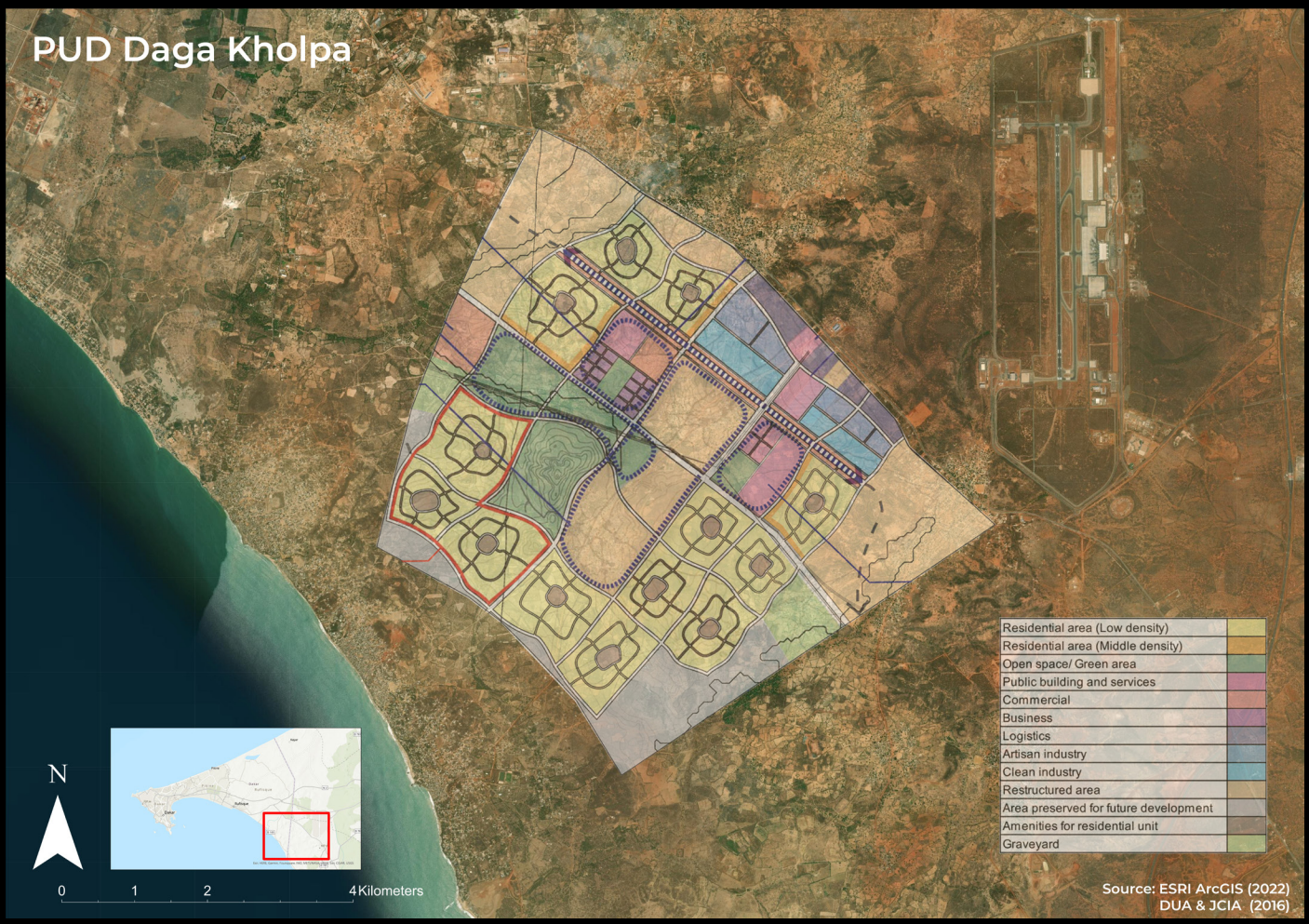
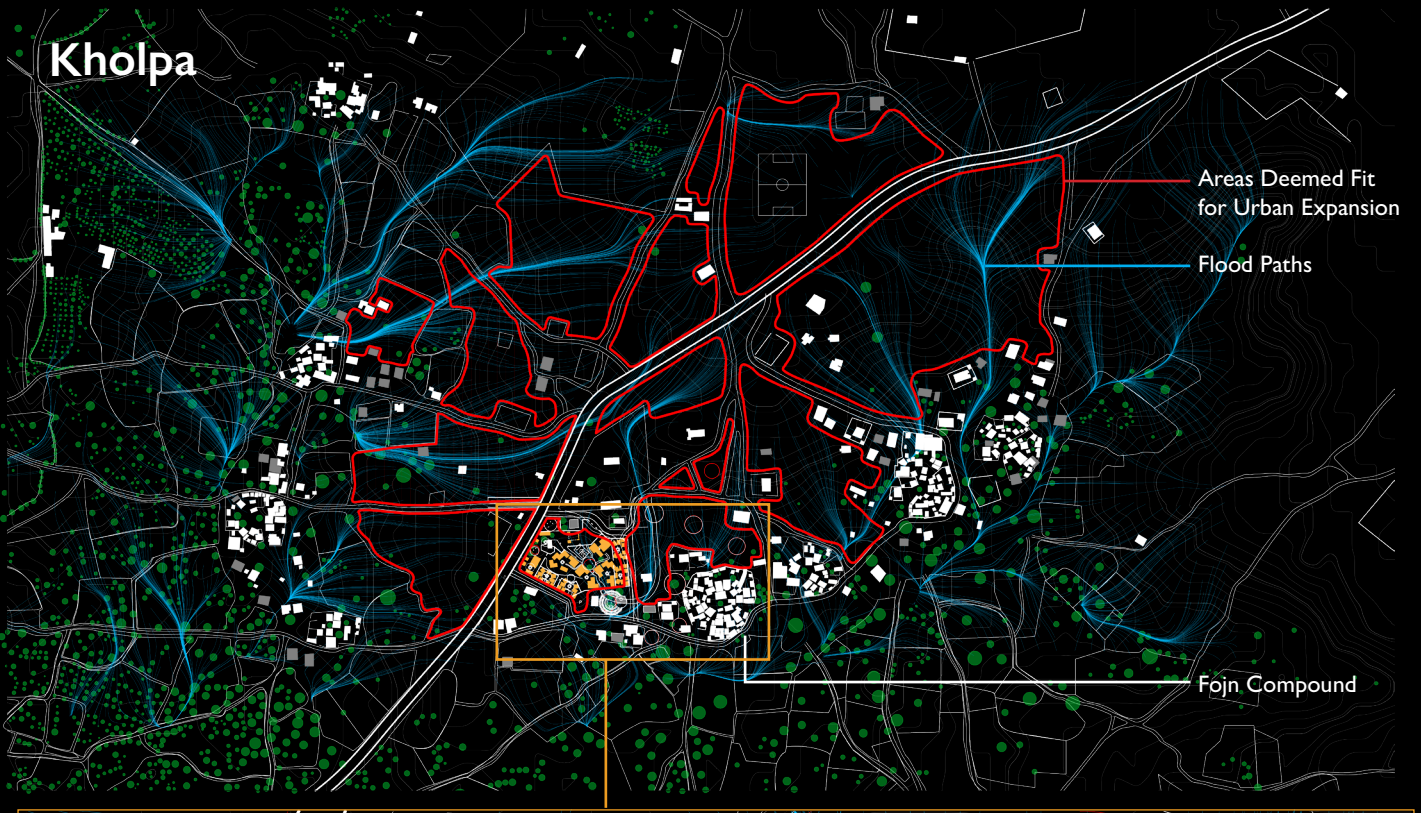


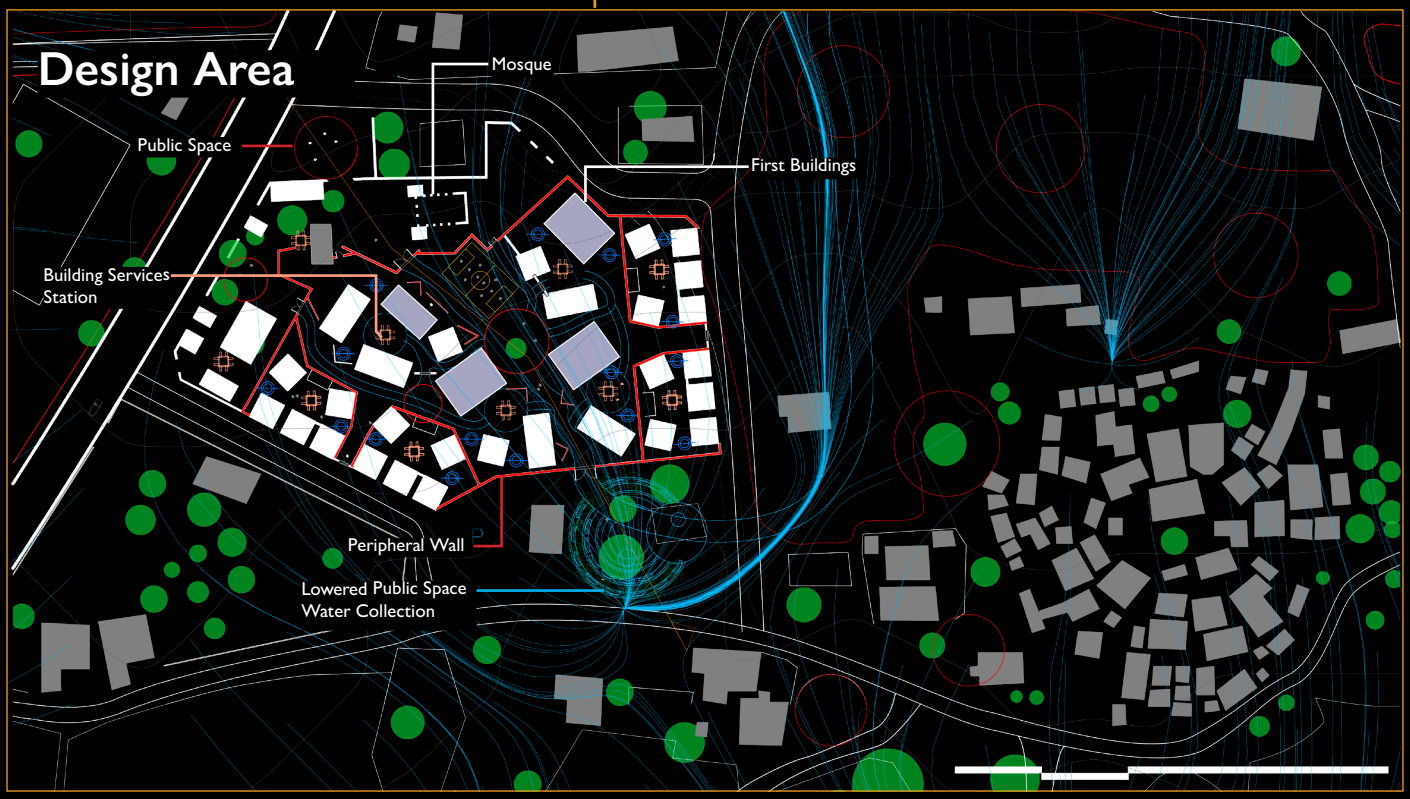

Kholpa
N
0 0,1 0,2 0,4 0,6 0,8 1 Kilometers
Source: ESRIE ArcGIS (2022)

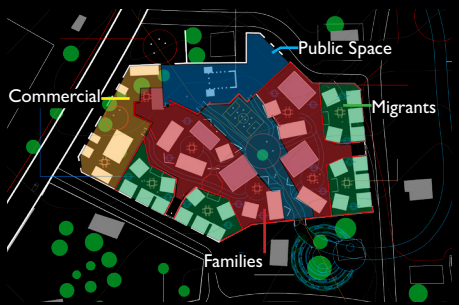

PUD Daga Kholpa
Residential area (Low density)
Residential area (Middle density)
Open space/ Green area
Public building and services
Commercial
Business
Logistics
Artisan industry
Clean industry
Restructured area
Area preserved for future development
Amenities for residential unit
Graveyard
N
0 1 2 4 Kilometers
Source: ESRI ArcGIS (2022)
DUA & JCIA (2016)

le 5 Avril 2019

Source: Department of Urban Planning Commune Ndiass

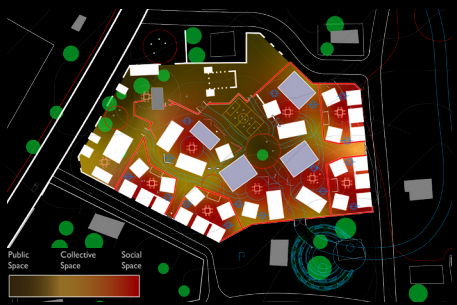






Demographies

Flood Drainage



Public, Collective & Social Space