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Adapting to the Heat: Integrating Healthcare, Communities +
The Built Environment in Gao, Mali

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ADAPTING TO THE HEAT: INTEGRATING
HEALTHCARE, COMMUNITIES + THE BUILT
ENVIRONMENT IN GAO, MALI

ERYN GAUL

with
BRIAN MCLAREN, CO-CHAIR
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After three consecutive years of insufficient rainfall and a decade of higher temperatures, West Africa is facing high urbanization rates due to lack of food and water, the result from the extreme climate. The Tamasheq, a nomadic tribe that spreads through the Saharan countries of Mauritania, Mali, Niger and Tchad, are exchanging nomadic lifestyles for small jobs in villages and towns, where the security of food and structure outweigh the diminishing thrill of following water through the desert. These floating populations are growing rapidly in cities such as Gao, Mali, which lies at the edge of the Niger River and Sahara desert. The Tamasheq, as well as other Sonrai and Fulani herders, are wary of permanent structures and their adaptation to the climate. However, Mali, as in many developing countries, feels a need for "modern" built environment that compares with changes worldwide.

This thesis explores solutions that consider the transition from nomadic to sedentary architecture and culture, as well as how a community and its activities can interact within the built environment in relation to the heat. Instead of imposing a new and foreign architectural style, this thesis utilizes local materials, building techniques and an extensive knowledge of Northern Malian culture and daily activities to design a healthcare, educational and community space for the Tamasheq and Sonrai people.

As the Centre de Communauté (CSCOM or community health center) serves as a meeting and educational center for the quartier of Boulgoundie,

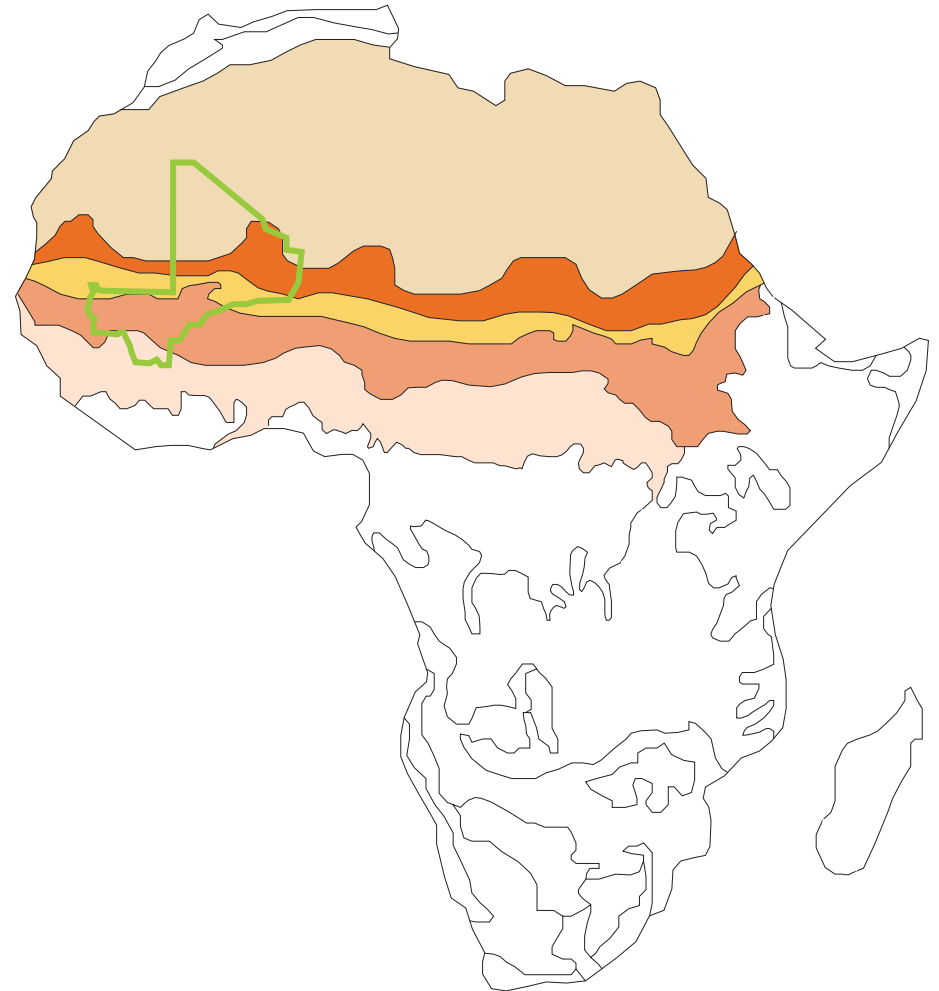


FIGURE 1: Gao lies at the edge of the Sahara desert in the orange semi-desert zone. Four climate zones are seen in Mali, with the cooler temperatures and higher rainfall found to the south.

this program of a clinic, maternity, mosque, market and health education facilities formalizes activities already taking place in and around an existing clinic while focusing on the personal adaptation of spaces throughout the day in relation to the climate, activities and materials.

RESPONSES TO HEAT IN THE 21ST CENTURY

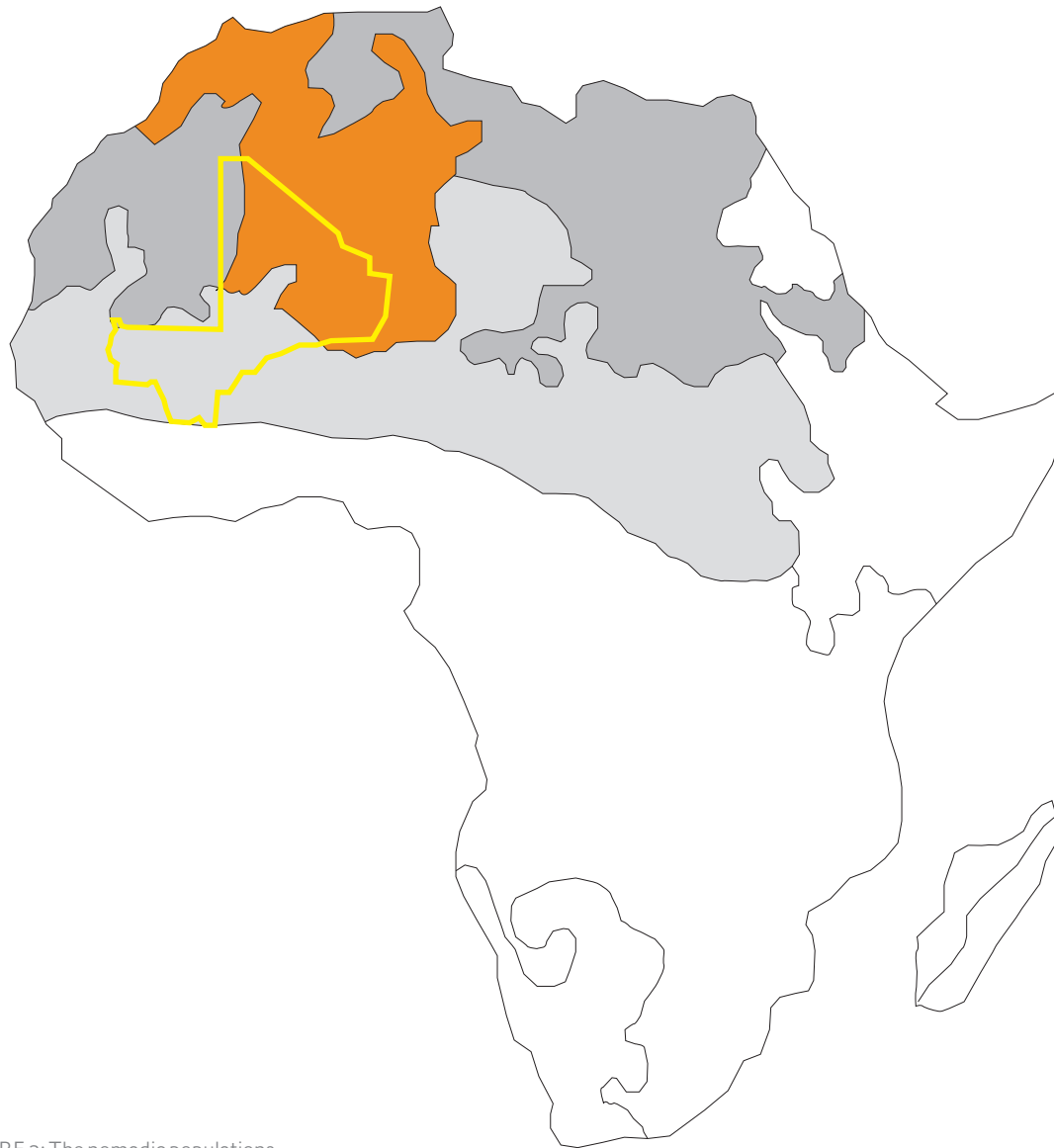
Like many African countries in the 21st century, Mali is developing quickly with an ever-growing availability to media and other cultures. Within a very short time, mobile phones, plastic bags, American hip-hop clothing and construction materials, such as concrete, have changed the landscape and attitude of city dwellers and villagers throughout this vast country. Access to new technologies brings a “want” which may or may not be appropriate for the “need.”

Concrete, as part of the Malian built environment, has gained popularity in Northern Mali primarily in the last ten years. While concrete block architecture has the appearance and idea of permanence, Gao’s extreme climate especially during the months of April and May, causes high interior temperatures. The current mud brick structures are already avoided during the day because of poor ventilation and heat retention. Instead, people search for the shaded spots given from the buildings and small trees.

Other than environmental issues, concrete gives a sense of permanence that Mali has not experienced in the past. Traditional mud brick (or banco) houses must be re-rendered at least once and repaired many times throughout the year. Cement is expensive but is durable and marks a connection with the majority of the “developed” world.

Rather than continuing the approach of building in concrete structures that are foreign to Northern Mali in scale, material and building strategies, this thesis addresses both the “want” for modern architecture, as well as the “need” for a built environment that adapts throughout the day and seasons.





The Tamasheq, shown here in orange, are an nomadic tribe that spans through Mauritania, Mali, Niger and Tchad.

FIGURE 2: The Tamasheq and their nomadic tents of stretched goat skin and large branches.

FIGURE 3: The nomadic populations of West Africa: Tamasheq (orange), Berber (dark grey) and Fulani (light grey).

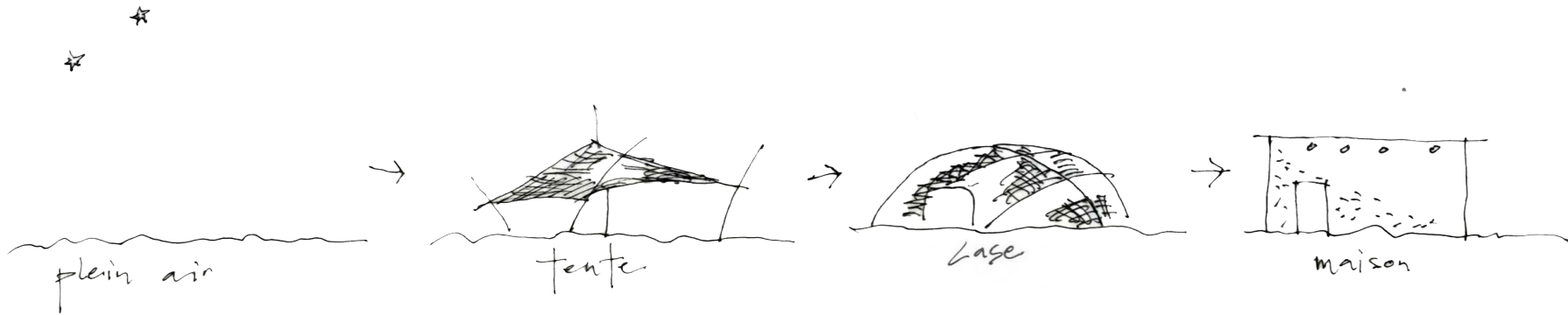


FIGURE 4: The transition of the built environment in Northern Mali.

CURRENT BUILT ENVIRONMENT

As the Tamasheq and other nomadic tribes are settling on the periphery of existing cities, towns and villages, their lives are changing dramatically. Living amongst the few trees and water holes of the Sahara desert is a lifestyle of the past. Lack of water and other economic incentives are outweighing the nomadic culture and families are rapidly making the transition from the open air (*plein air*) to tent to hut (*case*) and lastly to the mud brick or concrete block house. This transition may take place within a few years or an entire life span. In some cases, there may be advancement from one phase to another, but for many, the built environment in Northern Mali includes each of these within a small compound. For example, a family may live in a courtyard surrounded by permanent buildings, but choose to spend most of their nights in a woven hut or under the stars because, simply, it is what they are used to.

The original point in this transition from nomadic to permanent lies simply in the desert alone. Many Tamasheq men and boys spend weeks wandering from one well or water source to another with their herds of cattle,



FIGURE 5: Plein air, in the desert.

donkeys, camels or goats. Their bags are light, with water canister, knife turban, and mosquito net and nights are spent under small bush trees or the stars. As there is very little rainfall in Northern Mali, the experience between man and nature in the desert is stable and comfortable.



FIGURE 6: Traditional Tamasheq tent.



FIGURE 7: Interior of *case*, or woven hut.

The second point, or traditional Tamasheq tent, marks a sense of temporary permanence. While husbands and sons may be out with their herds of cattle or goats in the bush (*en brusse*), the women set up a tent of large tree branches with a stretched goat skin tensile roof. Days are spent maneuvering the tent to create shade and ventilation in an otherwise barren landscape. These tents are extremely simple but provide protection from the heat, sand storms and animals. With the change of the seasons, Tamasheq families will remove the goat skin tent from the large branches and move to the next central location within a days journey from a water resource.

If a family will be staying in one location for an extended amount of time (2-3 months or more), or does not have the funding to build a permanent structure, they will construct a *case*, or woven hut. Instead of using large tree branches like the Tamasheq tents, small bunches of small branches are bound to create a larger curved beam. The skeleton uses the ground to anchor the curves and is typically built in 1-2 days. Depending on the season and the financial abilities of the family, the skeleton is then covered with woven mats in two to three layers. At times, other materials are used when available (plastic sheeting, cardboard boxes, other textiles).

The last step in this transition is the mud-brick house. Families aspire to have their own permanent spaces within a courtyard shared with other family members. Courtyards vary in size and population, but include several small 1-level mud structures with temporary shade structures or woven huts placed strategically for safety and shade. The process of building and re-mudding a house relies heavily on the family members and community and in most cases, becomes a gathering of friends, families and neighbors. Earth and manure are

gathered from surrounding areas and mixed with water in the street next to the building site. Male family members and friends use their feet to mix the earth and then, with a mason, spend many days hand molding the bricks. The entire process may last months or years, as incomes vary throughout the year. Despite many compounds or courtyards being entirely built of mud structures, houses are primarily used for storage of bedding, clothing and cooking utensils. Daily life is centered in the courtyard, most times around a few small trees.

As mentioned earlier, concrete construction is also becoming more prevalent in Northern Mali, primarily in educational or government facilities as the maintenance is low. Architecturally, the concrete block houses emulate construction techniques found in North Africa (Algeria, Libya, Morocco) as Mali does not have an “architectural style” of its own. Only the wealthiest of families are able to afford a complete concrete structure, but middle-class families do use concrete sparingly for latrine covers, soak pits and ground coverings.

By acknowledging the many phases of transition in the built environment and a single person’s life, the community health center seeks to provide spaces for gathering at different stages of the day.



FIGURE 8: Mud brick housing.

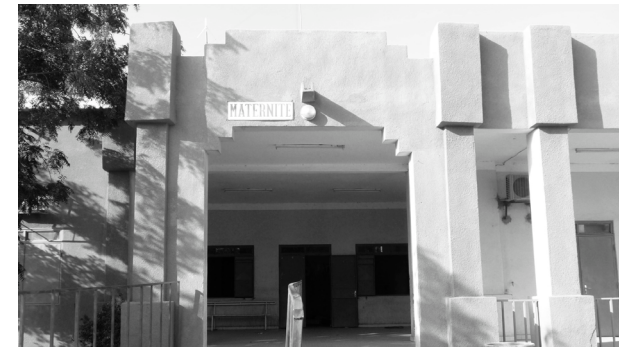


FIGURE 9: Concrete block government office.

FIGURE 10: Many times, families live in a combination of vernacular building types. Here, there is a permanent courtyard of mud brick houses with a woven hut used for sleeping and socializing, primarily in the cold season.



THESIS GOALS

Rather than implement a foreign concept from a foreign country and designer, this thesis aims to use past experiences and knowledge on the community level in Northern Mali to propose a CSCOM relevant to the 21st century. I do not intend to introduce new technologies and high-maintenance attachments, but instead hope to develop a design that is realistic, simple and responsive to the Northern Malian culture (structures, materials, spaces) to a high level of detail, in hopes of realizing this new CSCOM in the future. In order to do so, the following goals and parameters have been set:

To incorporate and address the transition between nomadic and permanent architecture and culture.

To provide a welcoming place protected from the heat.

To design a place of healing which incorporates community needs and the interactions between people throughout the day.

To use only materials that respond well to the Northern Mali environment and be reasonable when choosing materials for the new structures (ie. local materials vs. concrete imported from South America).

To encourage community interaction and health education through providing free classrooms, flexible covered spaces and a community market.

To provide shelter, cooking facilities, prayer areas and community gathering space for visiting families of patients.

By providing a reliable and flexible CSCOM complex with various program elements, Boulgoundie, in Gao, Mali, will have access to facilities that are not found currently in the quartier.

FIGURE 11: Community gatherings, such as these pop-up markets found under a few trees, move throughout the day.



CHAPTER TWO: THEORETICAL FRAMEWORK : OVERVIEW

An increasing number of architecture, design and non-profit organizations and competitions, such as Architecture for Humanity, Engineers without Borders, and OMA, are working in Africa to contribute to technical and cultural exchanges. At the same time, nomadic architecture is appearing in the United States as traveling markets and homes and throughout the world, especially in response to disaster relief. Concrete and steel, replacing mud and straw, are becoming common construction material choices throughout Africa. Traditional materials are also the new trend amongst sustainable architects in "developed" countries. Without knowing it, African architecture is quickly becoming Western and Western architecture is becoming African. Globalization is blurring the boundaries, but in most cases-these new materials and methods are not adapted to the local conditions and climate in Northern Mali.

Research has been divided into three primary topics: (1) Nomadic Architecture, (2) Healthcare Design in Developing Countries and (3) Building Materials and Methods. Through examining these subjects, with consideration given to other development projects and organizations in Africa as well as case studies, a framework for a contemporary design will be created.

FIGURE 12: The Parc Nationale du Mali, finished in 2010 and designed Francis Kéré, Burkinabae architect, has become an example for fellow West African architects in search of "modern architecture."



ANALYSIS OF PRECEDENTS

Schools and clinics in Africa seem to be the most common humanitarian projects for architects worldwide. There is a fine split between very simple structures (built entirely in traditional methods with a small addition of concrete) and modern structures that you might see in Europe or America. Finding the balance, while relating to the community, is important in designing a successful health clinic.

NOMADIC ARCHITECTURE

Settling Tamasheq and other nomadic people of Northern Mali have developed several phases of semi-permanent to permanent structures. Tensile structures remain practical in ventilation, versatility and should be integrated into the building design.

TRADITIONAL TAMASHEQ TENTS

Tamasheq families typically travel through the Sahara and Sahel with their own tensile structures built of wood and stretched goat skins. After settling on a location near the herd or water source, the women will set the posts made from small desert trees/branches then stretch the skins between the posts. There are also typically a few larger posts within the tent area that supports a central space that is typically high enough for a small adult to stand.



FIGURE 13: Traditional Tamasheq tent.

ECO-PAVILION 2011, MEXICO CITY

Each year, architects and artists are invited to participate in a competition in Mexico City that incorporates a pavilion into the ECO Experimental Museum, designed by Matthais Goeritz in 1953. The 2011 winning entry, by the architects MMX, uses the existing building as a frame to “strengthen the key assets of the original museum, [by] creating an extension of the architectural experiment.” With simple materials of steel chain and rope, MMX uses the interior spatial patterns of the museum to link to new patterns of movement within the courtyard.

The tensile structure uses simple materials to create a compelling and inspirational space that also gives shade to the visitor. “The courtyard becomes an ever changing stage that responds to both, the movement of the visitor and the changing patterns of light through the day.”



FIGURE 14: Eco-pavilion 2011, Mexico City.

FOLDED BAMBOO + PAPER HOUSE, CHINA

In response to the May 2008 7.9 magnitude earthquake in central China, Ming Tang designed this paper and bamboo house that would serve as emergency housing. The form originates from the folding of paper, much like an origami paper fan. Simply by folding the large stiff geometric shapes, which are in-filled with smaller pieces of bamboo and paper to allow for some flexibility, hundreds of different structures can be made. The flexibility of the bamboo structures to move and adapt to the climate and landscape is very similar to that of the traditional Tamasheq tents, but uses a fixed geometry for efficiency

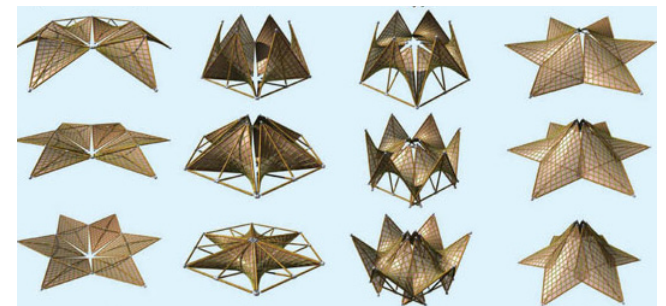


FIGURE 15: Folded Bamboo + Paper House, China.

HEALTHCARE DESIGN IN DEVELOPING COUNTRIES

Studies of existing healthcare facilities in Mali will give a better understanding of the use and needs of the people now. For example, which aspects are used the most? How can the program be adjusted to better serve the community? What treatments are most common?

CENTRE POUR LE BIEN ETRE DES FEMMES / WOMEN'S CENTRE FOR WELL-BEING, BURKINA FASO

Burkina Faso, just to the south of Mali, is home to 16 million. Landlocked without access to ports, Burkinabees suffer from a high unemployment rate and low life expectancy. Expectedly, non-profit organizations have flocked to West Africa with full wallets and, like FARE studio, technological exchanges in terms in architecture, sanitation, and education. FARE studio, with AIDOS, wanted an integrated approach to the interaction of built space, community, and environmental conditions. Much attention was spent in designing a center that would use building orientation, parti, natural vegetation, and local building technologies. The CBF provides educational services to the community of Sector 27, a neighborhood of capital Ouagadougou. Non-profit organization, AIDOS, provides information on women's sexual and reproductive rights as well as medical facilities for nurses and midwives, psychologists, and lawyer's offices.

While designed by FARE studio, local builders completed the project in 15 months. The CBF has a parti based on the separation of two primary activities. The training center (located on the northern building) is home to the consultancy center. This is home to the medical, legal, and psychological offices. The southern building houses workspace and conference areas for awareness programs, management and administrative offices. Bright colors are used for locating the center and the phrase "I have rights" is printed in four languages along the exterior walls.



FIGURE 16: Centre Pour le Bien-Etre des Femmes, Burkina Faso

SALAM CENTRE FOR CARDIAC SURGERY, SUDAN

The Salam Centre, named for 'Peace,' promotes the cooperation and solidarity of medical and cultural institutions of Northeast Africa. Completed in 2007, the Centre serves as an exchange of international medical staff organized by Emergency NGO. The Salam Centre for Cardiac Surgery marks the first of many healthcare complexes in Sudan, as well as surrounding countries. Studio Tam Associati and Emergency NGO designated three main guiding principles for the design of the surgery center. (1). Hollow space and Pavilion-based system, (2). Choice of best technology given the context and (3) Continue the ethical search for this type of architecture. The Surgery Centre uses a pavilion-based plan centered around two existing mango trees. This plant life, as well as the form, represent traditional housing where life is configured around a central space. The perspectives within this area are always changing and the wings provide a protection from the hostile and scorched environment outside the Centre's compound. The compound includes the Centre, technical and service buildings, solar panels, a prayer and meditation pavilion and relative's housing. Two layers of bricks, made locally, are separated by an insulating air cavity and then rendered with a cement mixture. In order to use air conditioning as little as possible, outside air passes through a labyrinth and is cooled by a small spray of water at the end of the tunnel. Therefore, the air can cool up to 9 degrees Celsius. Air conditioning and solar panels were added after construction. Temperatures in Khartoum range from 40-50 degrees Celsius. The heat and dust led to studies for the best insulation, cooling and filtering systems for this extreme climate. Shading devices, woven by local artists, are used here to create sheltered circulation spaces.

In addition to the Salam Centre for Cardiac Surgery, this Medical Housing Compound was designed by Studio Tam as well. By using existing shipping containers, modular and comfortable housing is available for recovering patients and their families.



FIGURE 17, 18: Salam Centre, Sudan.

AFGHANISTAN CLINIC

As part of the I% program, Bob Hull at the Miller|Hull Partnership is working with the Afghan Amity Society in a similar sized (and programmed) health centre. Materials, such as mud brick, challenge traditional forms with new techniques incorporating concrete and steel. Building forms mimic the courtyard allowing for ventilation and communal spaces protected from the elements and intruders.

Despite being in very different geographical locations, this clinic and community face many of the same climate issues as the people in Boulgoundie. As Hull's second project in Afghanistan, he has experimented with different building technologies and decided upon a mud brick vaulting system to allow for ventilation and structural integrity. Programmatically, the clinic includes a sterile conditioned surgery space as well as community activity space, which includes a classroom/immunization room, craft room, prayer rooms and a tea room.

BUILDING MATERIALS + METHODS

As alternatives to concrete and sheet metal being imported from various locations throughout West Africa and the world, focus will be given to local materials with little or no foreign products. Current vernacular architecture in Gao is primarily mud brick with mud rendering and mud roofs supported by limited amounts of wood. Research is focusing on new interpretations of existing methods.

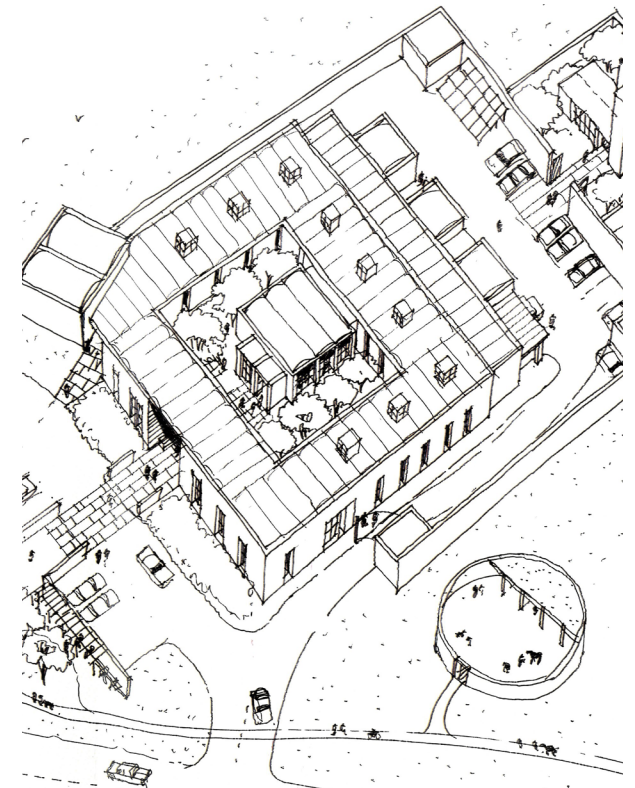


FIGURE 19: Afghanistan Clinic



FIGURE 20: Mosque building type, Mali.

THE HANDMADE SCHOOL, BANGLADESH

As an initiative in Bangladesh, village infrastructures are being improved to deter (or lessen) the large movement to urbanization. Architects Anna Heringer and Eike Roswag's "main strategy [was] to communicate and develop knowledge and skills within the local population so that they can make the best possible use of their available resources." By revitalizing and integrating the use of earth block and bamboo in a structurally sound school building, the community of Rudrapur was able to contribute directly to the design and construction.

The design of this 3498 square foot school is directly influenced by the concept of learning already in place by the non-governmental agency, METI. The classroom spaces, both within the first floor earth structure and the open bamboo second floor, are easily adaptable to each children's learning abilities and activities for "touching, for nestling up against, for retreating into for exploration or concentration."

The architects' "help for self-help" mission has made this relatively small project quite successful. Instead of designing something fancy and disconnected from the community in which it was placed, the school utilizes existing materials, local labor and concepts to promote an holistic and technical education for children and young adults.



FIGURE 21: The Handmade School, Bangladesh.

PRIMARY SCHOOL, BURKINA FASO

Francis Kere, Burkinabae architect living and working in Berlin, Germany, has become the front-runner in African architects. His projects began as a way to give back to his village and have expanded to various public works primarily in West Africa. Kere is well-known for his use of compressed earth block and a raised roof structure, supported by rebar trusses. By simply adapting the traditional mud-brick building with new ventilation strategies, the interior spaces are much more enjoyable to the user.



FIGURE 22: Primary School, Burkina Faso

CHAPTER THREE : PROBLEM DESCRIPTION : OVERVIEW

In a now extremely warm and dry climate, the city of Gao has a beautiful history, full of great empires, lush rivers and traders in West Africa. Today, the growing opportunities found in cities brings growing needs, which the city is addressing slowly. Within these needs, lies that for healthcare and education facilities and an opportunity to join infrastructure with other amenities typically found within a community : markets, mosques, and play areas.

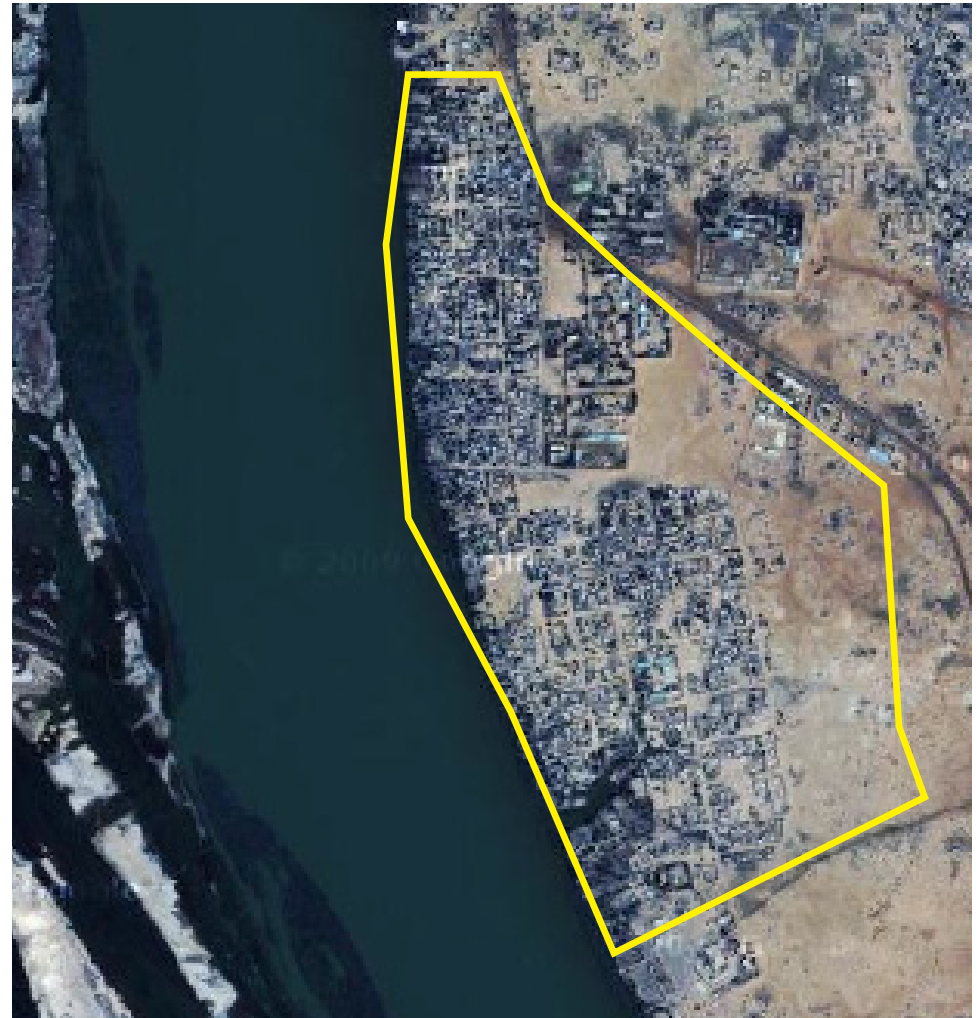


FIGURE 23 (above): The quartier of Boulgoundie.

FIGURE 24: The city of Gao lies 750 miles from Mali's capital of Bamako on the Niger River. Other than two months of rain each year and some flooding of the river, the region has suffered from drought for the last three years.



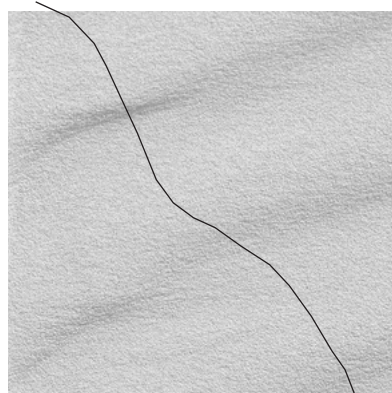
NIGER

GAO

■ SITE

HISTORY

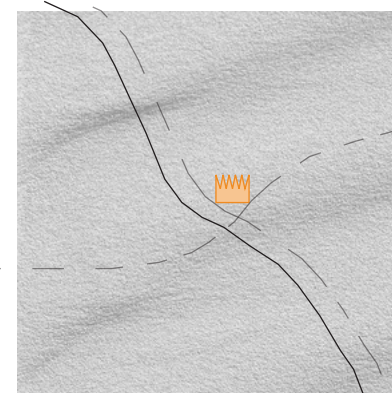
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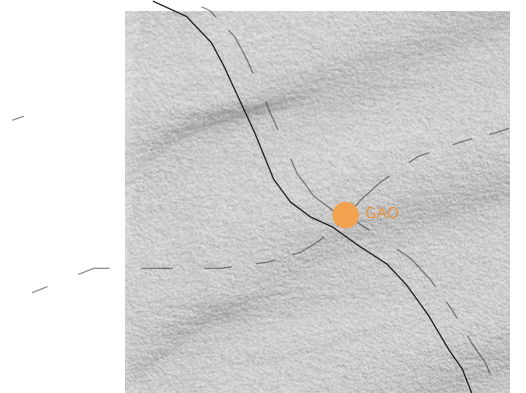
DESERT + RIVER



CENTER OF TRADE
9TH + 10TH CENTURIES

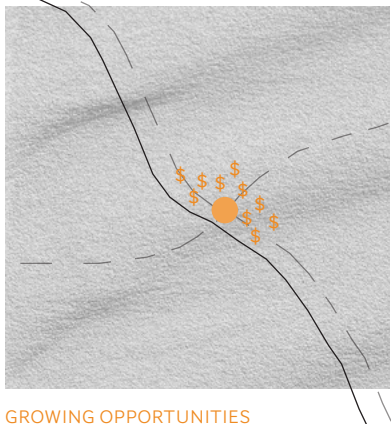


THE SONGHAI EMPIRE
EARLY 15TH - LATE 16TH CENTURY



TOWN
EARLY 20TH CENTURY

FIGURE 25: The city and region of Gao has had many growths and depressions throughout the last 10 centuries, beginning with the village becoming a center of trade, to the great Songhai Empire (conquered by the Moroccans in the late 16th century, and to a regional capital instilled with the colonization of Mali by France in the early 20th century. Today's issues revolve primarily around the change in climate and lack of water.

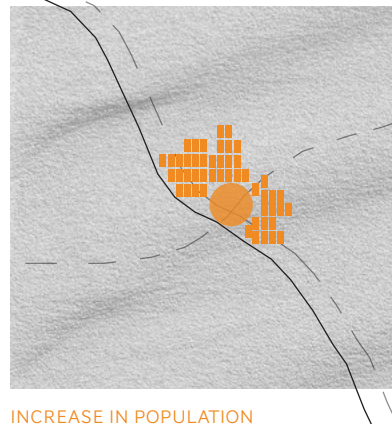


GROWING OPPORTUNITIES
20TH CENTURY

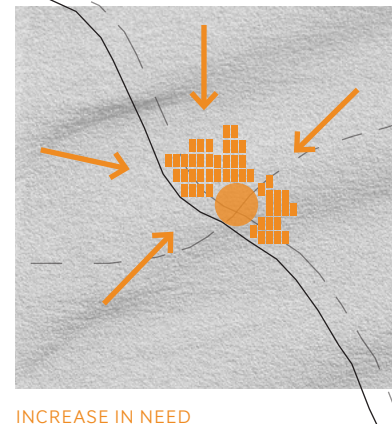
CLIMATE CHANGE

DECREASE IN WATER

DECREASE IN NOMADIC POPULATIONS

A vertical stack of three panels illustrating environmental and demographic changes. The top panel shows a sun icon and the text 'CLIMATE CHANGE'. The middle panel shows a river with a dam and the text 'DECREASE IN WATER'. The bottom panel shows a nomadic tent and the text 'DECREASE IN NOMADIC POPULATIONS'.

INCREASE IN POPULATION
TODAY



INCREASE IN NEED
TODAY

FOOD

INFRASTRUCTURE

EDUCATION

HEALTH

A vertical stack of four panels illustrating social and economic needs. The top panel shows a plant icon and the text 'FOOD'. The second panel shows a cross icon and the text 'INFRASTRUCTURE'. The third panel shows the letters 'abc' and the text 'EDUCATION'. The bottom panel shows a plus sign icon and the text 'HEALTH'.

CONTEXT

The city of Gao, in Northern Mali, is a regional capitol and transit hub for West African overland trade through the Sahara desert. People of all races, ethnic groups and trades mingle in the dry, sandy streets amongst single story mud structures, donkeys, camels, and heat. Outlying villages feed the cities vegetable markets and nomadic herders bring their animals to Gao daily. Men, women and children, all brightly clothed, gather in the streets at all times of the day, greeting friends and strangers and sharing family news, blessings and the latest in weather reports. Despite the fact that water is scarce, food prices are high and the sand and heat are discouraging, Gao-borey (or the people of Gao) are tough, yet joyous and moving quickly into the age of globalization.

SITE SELECTION RATIONALE

After two years living amongst the Songhai and Tamasheq people of Gao, it was apparent that people everywhere are warm, friendly and kind. Gao-borey are determined to make the best for themselves and encourage their families to grow, interact and learn about the world through reading and newer technologies such as internet and television. While certain aspects of daily life are changing quickly and drastically, healthcare facility development still remains low in priority for the government. CSCOMs or Community Health Centres have been constructed in most quartier's of Gao, but many lack adequate resources, trained staff, and recovery areas.

The Boulgoundie CSCOM has potential to become the heart of the quartier, with proximity to football fields, boutiques, the river, and the school. My relationship with Gao, and this quartier in particular, has lead me to choose the existing Boulgoundie CSCOM site as a foundation for ameliorated community centers with the potential to encompass community activities and the process of healing, along with nomadic and traditional building materials and methods.



FIGURE 26: The city of Gao is located 1200 km, or 750 miles, from the Malian capital of Bamako, along the Niger River. Travel times range from 24-36+ hours on a single lane highway.

SITE ANALYSIS

While it is natural for architects and designers to feel the need to support humanitarian efforts for those lacking infrastructure, healthcare and education systems, most executed projects and initiatives have little connection with the culture, climate and local building technologies. Instead of aiding the community, projects are designed and constructed from afar and lack community involvement and ownership.

Schools and clinics in Africa seem to be the most common humanitarian projects for architects worldwide. There is a fine split between very simple structures (built entirely in traditional methods with a small addition of concrete) and modern structures that you might see in Europe or America. Finding the balance, while relating to the community, is important in designing a successful health clinic.



GAO

SITE

BOULGOUNDIE



FIGURE 28: The site, in orange, lies at the center of existing activities in Boulgoundie.

OPEN SPACE / TERRAIN DES SPORTS
 MARKET + TEA SHOP / BOUTIQUE
 GOVERNMENT OFFICES - VET
 SCHOOL / ECOLE
 NOMADIC SETTLEMENTS

FIGURE 27: The city of Gao and site location, in the quartier of Boulgoundie.

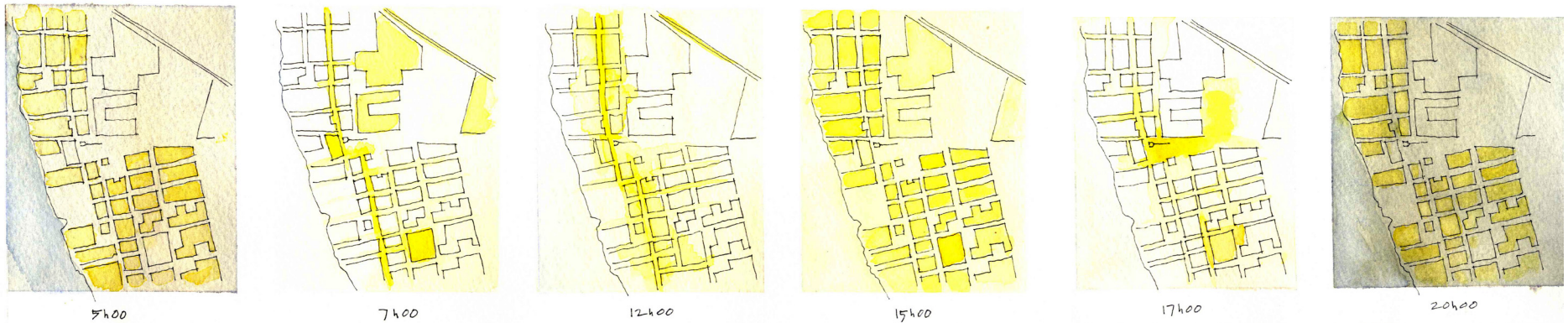


FIGURE 29: The daily lives of Boulgoundie heavily relies on the temperature and amount of daylight. At 5am, people are in their homes preparing food after the first mosque call. At 7am, they are on their way to work, market and school. At 12pm, they are making their way home along the major paths. At 3pm, when the temperature is the highest, people are resting in their own courtyards. At 5pm, the streets are alive once again and activities include soccer and socializing with neighbors. By 8pm, the sun has set and families are turning in.

CLIMATE

Mali spans two drastically different climate zones, the Sahel and the Sahara. Southern Mali, including the capital city of Bamako is lush and receives large amounts of rain. Northern Mali is the opposite, with cool and dry winters (November – February), hot and dry springs (February – June) and rainy, humid and mild summers (June – November). In this Saharan city, heat dramatically governs daily activities as well as Songhai and Tamasheq cultures. In Gao, temperature highs throughout the year range from 87 to 108 degrees Fahrenheit.

ENVIRONMENTAL ISSUES

Throughout Northern Mali and West Africa, the sand dunes are quickly moving into developed area. Desertification continues to be an extreme concern amongst environmental activists and Malian agencies. Because of the recurring droughts, trees and plants are scarce. Boulgoundie is just north of the fields and many villagers have small gardens within their courtyards, or participate in gardening shares not far from their homes. The Neem tree is the most prominent tree, but other small shrubbery and desert fruits are native to the banks of the Niger.

FIGURE 30: Sand storms arrive during the months of July and August in the late afternoons.



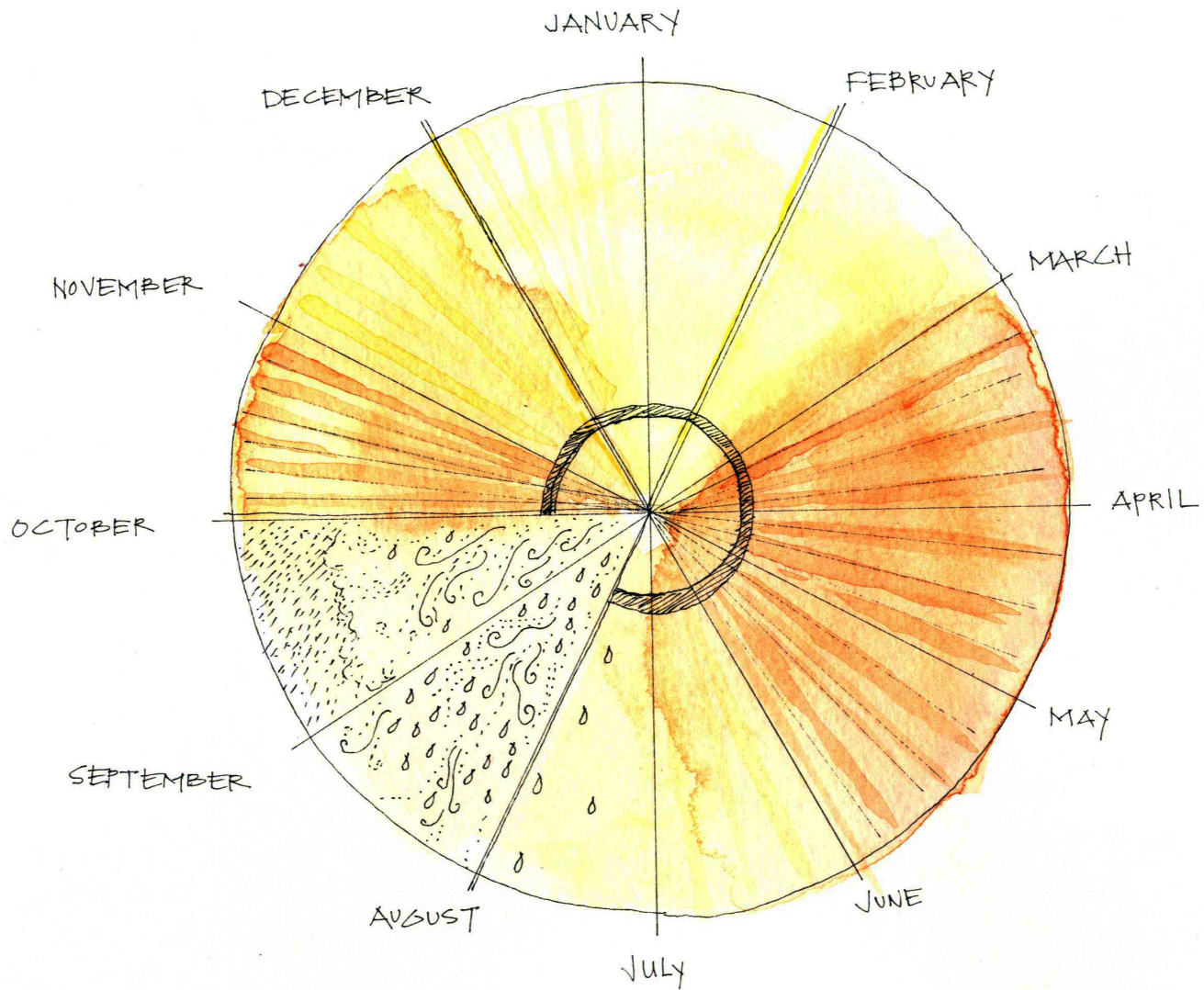
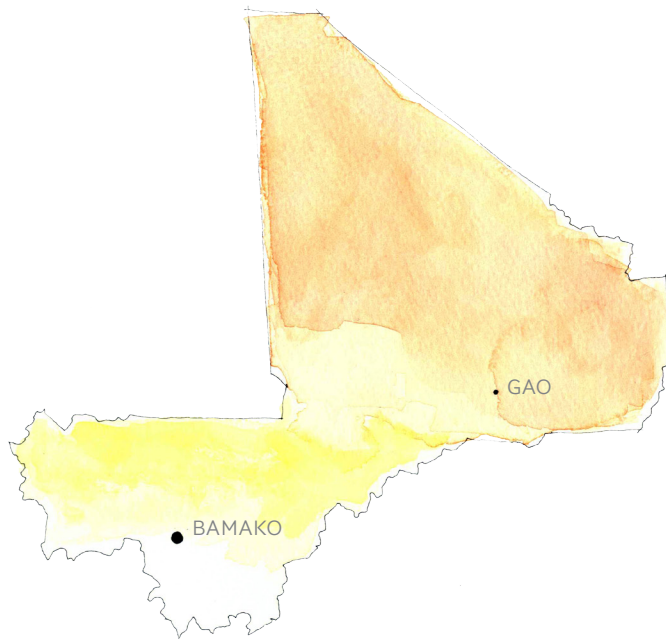
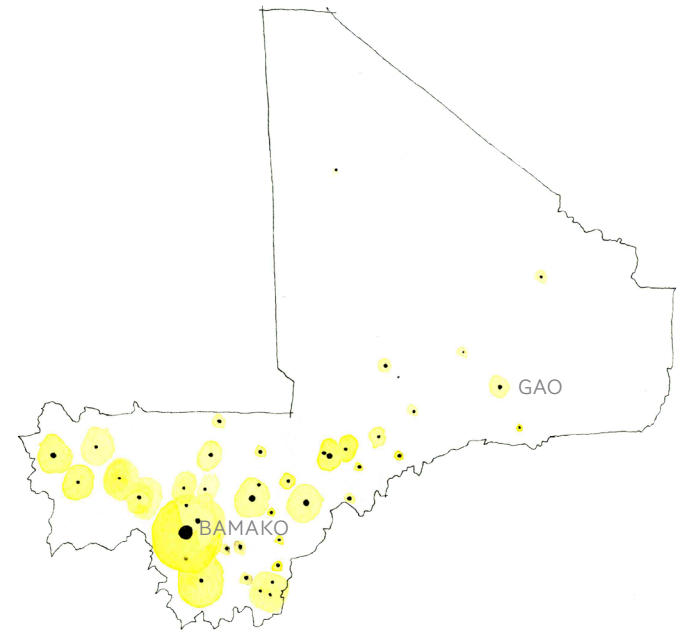


FIGURE 31: With the annual average high in Gao at 100 degrees, the heat is always a concern. The cold, dry season occurs from December to February; very hot season from March to June; "rainy" season from July to August; and a mini-hot season from September to November.



TEMPERATURE

FIGURE 32: Temperatures in Mali vary greatly from the North to South. Higher temperatures are shown here in orange.



CITY POPULATIONS

FIGURE 33: The population in Mali is centered primarily in the south, where temperatures are cooler. Like many cities throughout the world, urbanization rates are rising quickly and in Mali, this is due to climate as well as opportunities.

TOPOGRAPHY

The Niger River lies to the west of the proposed site, but with an ever-changing course and surrounding sandy terrain, Gao's topography is rather flat. The city lies 870 feet above sea level with sand dunes outside the city rising another 100 feet. Specifically to the proposed site in Boulgoundie, there is a slight slope (approximately 2 feet) over 160 feet (0.15 inch per foot) toward the west and riverfront.

SENSORY

Located approximately two minutes from the Niger River (by foot) to the west, the proposed CSCOM site is surrounded on three sides by small sand and dirt roads with widths ranging from twenty to forty feet. The fourth side and main entrance to the CSCOM faces the northeast to an open space used for soccer and socializing in the early mornings and late afternoons. Built as an entire city block, the centre has great access to sunlight and ventilation from all sides. Because most buildings are flat roofed and single story and a flat landscape, views to the river are only seen from the roof or second story.

NEIGHBORHOOD CONTEXT

The existing Boulgoundie CSCOM is approximately 290 feet by 180 feet, totaling approximately 47,395 square feet. While most surrounding houses are one story-mud structures, there have been recent additions of cement amounting for larger spans and higher (maximum two stories) walls. Offices and other bureaucratic buildings are generally placed along "high traffic" roads, but many are also dispersed within the quarters, which leads to a balanced integration of community and residential activity spaces. Despite being a city, most people spend time in their own quartier, neighborhood or village.



FIGURE 34: The Niger riverbank, used for bathing and laundry, is located one block from the proposed site.



FIGURE 35: View to existing site from east.

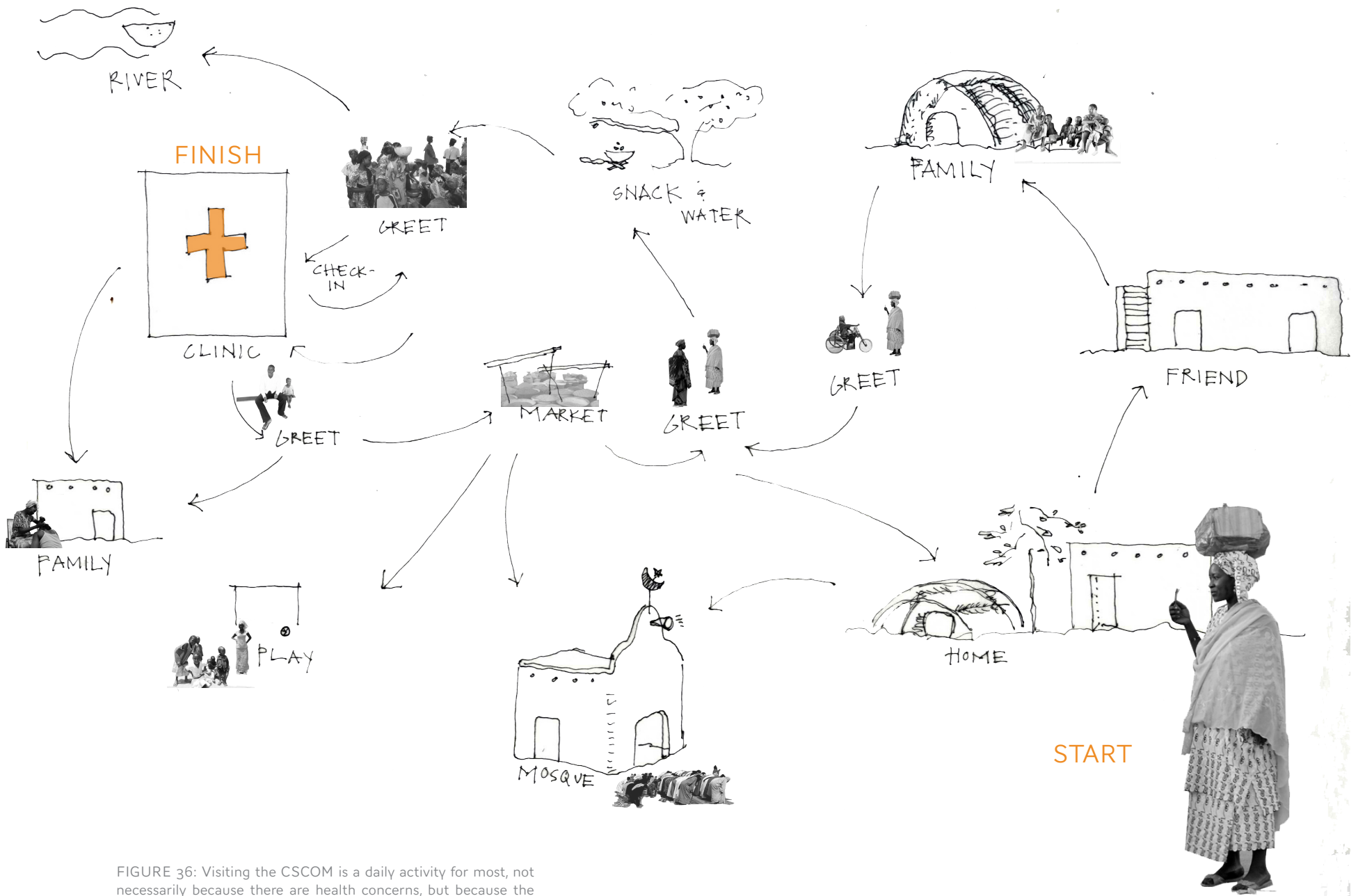


FIGURE 36: Visiting the CSCOM is a daily activity for most, not necessarily because there are health concerns, but because the center serves as a social outlet, primarily for women and children. The path to the CSCOM may be long, filled with stops at the market, mosque and friends' homes, but most arrive between the hours of 7am and 12pm.



EARLY CONCEPTS

Following the local courtyard design in West Africa, it seems natural to develop the community health centre around the edges of the site, leaving the center area for community activities. While the building structure will primarily be of one story mud brick or compressed earth block, the design will also encompass techniques of nomadic architecture such as the Tamasheq tent and tensile structures. For proper responses to the climate and culture, materials and methods of cooling, ventilation and power will be explored and integrated into each building design.

FIGURE 37: Initial concepts included a waiting area that served as a link between the clinic and market and street life with a large tensile structure as shade.



FIGURE 38: The CSCOM as a neighborhood beacon of activity.

HEALTHCARE IN MALI

With the decentralization of government and government facilities in Mali, there are three levels of health facilities, each focusing on specific uses and severity of health issues; the hospital, CSREF and CSCOM.

The public hospital oversees all serious illnesses and accidents, such as cancer, appendicitis, dental and infectious diseases. The hospital in Gao is staffed by government health workers and is funded largely through foreign aid agencies. Patient fees are high which means that only those without significant amounts of money (steady income) are forced to seek other forms of care or none at all. Recently, private hospitals, which cater to the wealthiest of Malians, have become popular. There is currently one in the city of Gao.

The CSREF (Centre de Sante de Reference or Health Center of Reference) is slightly smaller than a hospital and is placed within each cercle or circle/sub-region. With many circles, there are numerous CSREF's in the region of Gao and "accessible" to most people. These centers of references also serve as a central storage area of vaccinations, medications, and supplies for clinics in the area. However, the CSREF is still heavily influenced by government health workers and the community tends to seek out other health resources.



FIGURE 39: CSCOM staff, director and interns.

THE CSCOM:

CENTRE DE SANTE DE LA COMMUNAUTE
COMMUNITY HEALTH CENTRE

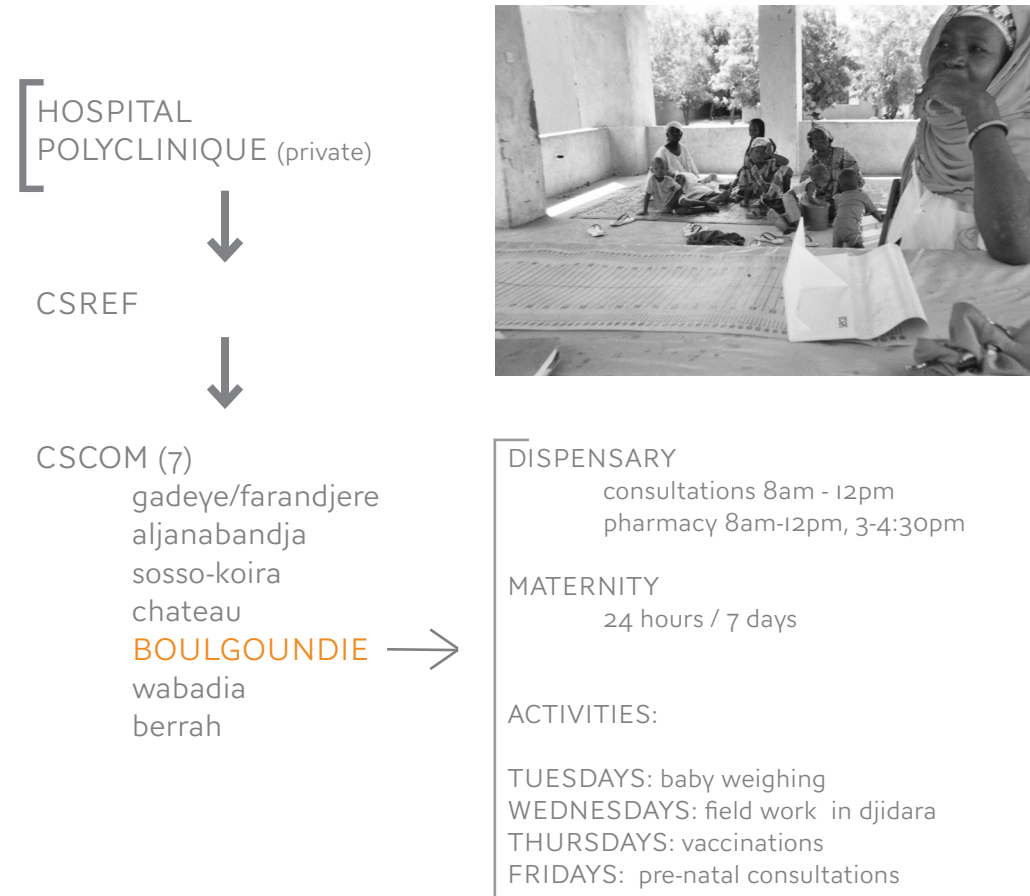


FIGURE 40: The structure of a CSCOM.

THE CSCOM

The CSCOM or Community Health Center is a health clinic and education facility that concentrates on a small community or village level. Five CSCOMs exist within the city limits of Gao, with another two nearby. Primary functions include a consultation or dispensary area for common ailments, a maternity, a health education hangar, a small residence for a guard and his family and storage for health education activities.

While the center is technically staffed by government health workers, these employees tend to be young interns, volunteers or adult technicians or doctors that are dedicated to helping others without the security of a higher level paycheck. The community itself pays for all activities and medications found in the pharmacy with small fees charged for consultations and daily visits. Exceptions are made for children under the age of five and pregnant women. The small fees are still expensive to most and patients seek

Despite this, the CSCOM is the center of a village or in this case, the quartier of Boulgoundie. With three days each week reserved for health education activities for women and children, the clinic is much more than a place to visit solely for the purpose of a doctor's advice. Arriving at, waiting at and the descent from the CSCOM can easily become a daily adventure. To arrive before the heat, women may leave their house just after the morning prayer and preparing duties. Most patients and visitors arrive by foot well before 8am to assure a "quick" visit (3-4 hours) and time to return home before lunch. The importance of a clinic in Gao could be related to an American coffee shop, barber or church, where despite not needing healthcare, a person may stop by several times each day. The clinic becomes a social center throughout the morning, a place where women come to share stories and catch up with their friends while their children receive vaccinations or other medical care.



FIGURE 41: Current uses and users in Boulgoundie, information from questionnaire given in September 2011.

FIGURE 42: Existing consultation/dispensary structure.



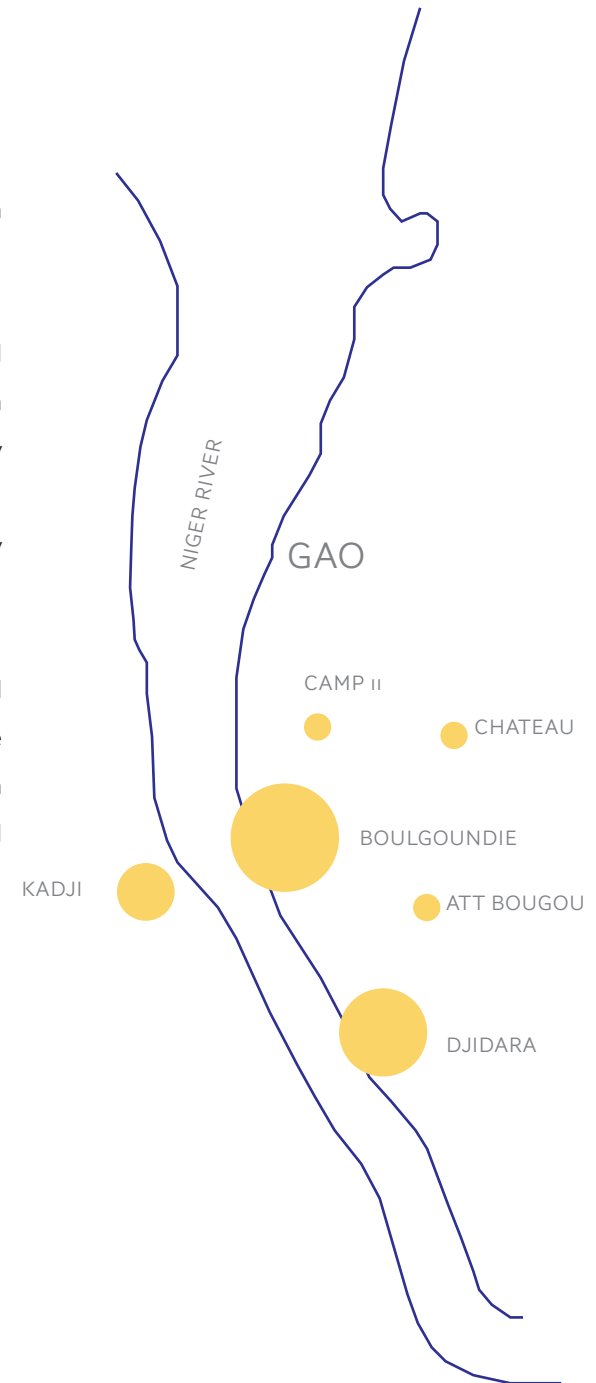
CHOOSING AN EXISTING SITE

With the decentralization of government and government facilities in Mali, there are three levels of health facilities, each focusing on specific uses and severity of health issues; the hospital, CSREF and CSCOM.

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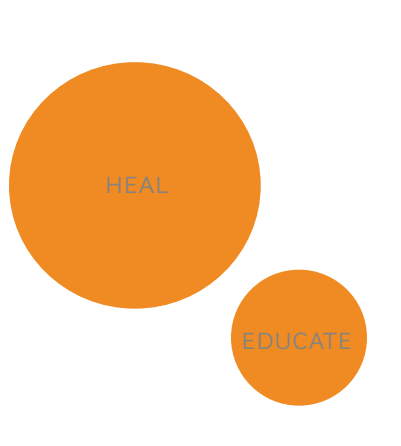


FIGURE 44: Current structure of CSCOM.

THE FUTURE OF A CSCOM

While in an excellent location, the current CSCOM has potential to become a center of not only health, but other community functions, and a place of refuge from the climate throughout the day. Rather than stay as a small one room clinic and maternity, the CSCOM should include more functions that are already so important in daily life. The center of health can become the center of Boulgoundie simply by catering to other activities such as daily market shopping, prayer, and health education.

FIGURE 43: (left) Currently, patients travel primarily from Boulgoundie, Kadji and Djidara to the CSCOM of Boulgoundie.

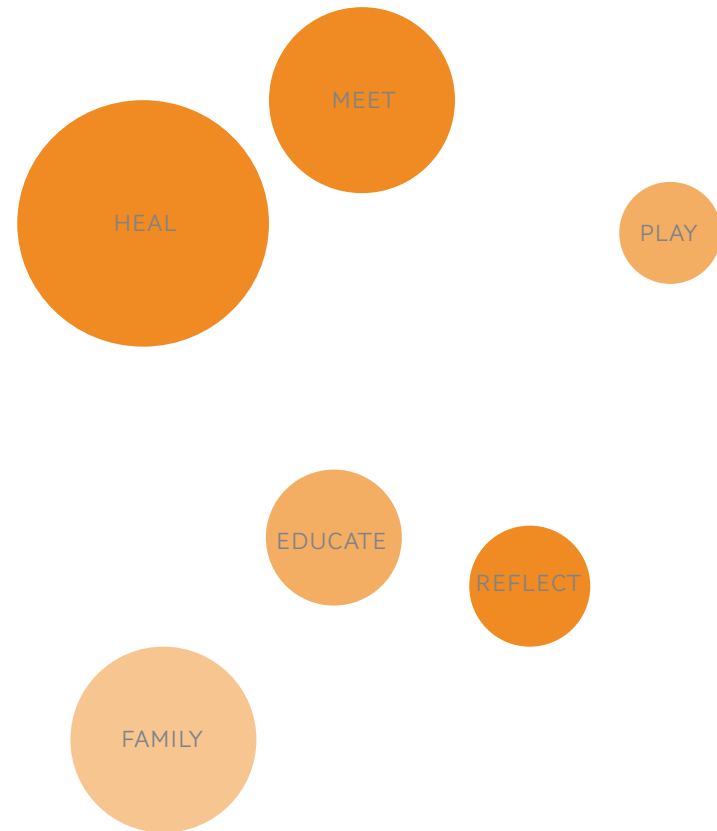


FIGURE 45: Proposed structure of CSCOM, integrating meeting, family, education, reflection and play areas.

PROGRAM

The chosen site and program have been divided into three elements: Clinic/Maternity, Family and Community/Education Spaces. The community spaces ideally will serve as a connection between the village of Boulgoundie (outside the walls) and patients and families being cared for in the health centre.

For a total of 19,673 square feet on an approximately one acre site, the new community health centre will become a multi-functional facility, serving the nomadic population as well as that of existing Boulgoundie residents. Instead of solid walls, the village will be able to permeate the eastern boundaries through the market, mosque and community classroom and gathering areas.

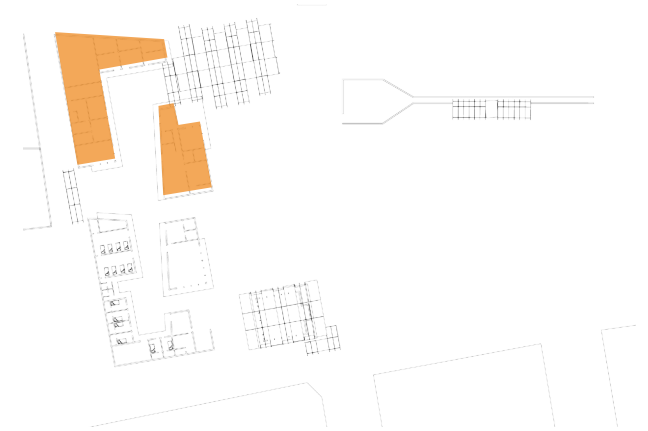


FIGURE 46: The Clinic and Maternity, placed in the northwest corner of the site.

HEALTH CENTER

WAITING AREA

Villagers and Tamasheq nomads traveling to the new CSCOM should feel welcome and comfortable in the waiting area for the health centre. Most likely, this will be a covered structure allowing for good ventilation and seat at least 20 people. A tent-like structure may be appropriate for this area.

ADMINISTRATION / DIRECTOR'S OFFICES + PHARMACY

One office should be allocated for administration purposes for the clinic and maternity. This includes one secretary and adjoining office for the director. Ample storage should be provided nearby for records, medications/immunizations and medical equipment/necessities.

NURSES' OFFICES

Two offices that include examination rooms should be situated closest to the administration offices and waiting area. While they can be simply furnished, they should provide a sense of comfort for the patients through ventilation, shade and education materials (ie murals and other diagrammatic teaching methods).

DOCTORS' OFFICES

Two doctors' office should be located adjacent to the waiting area and patient ward. At least one should be slightly larger in size so as to accommodate any emergency surgeries or other procedures that may not be appropriate for a smaller examination room.



FIGURE 47: Younoussa, pharmacist and administrator.

WARD

Two larger wards should be provided for male and female patients with approximately four beds each. This ward may be used by patients suffering from malaria, household or vehicle accidents or water-borne illnesses. Approximate stays for patients should not surpass 3 days.

MATRONE / MIDWIFE OFFICE + BIRTHING ROOM

Mid-wives, nurses and health technicians rotate through the maternity ward throughout the week, with approximately four people on staff at all times. An office and records area should be provided, along with a birthing room. With births relatively low (approximately three per day), this room is large enough for one birth at a time. Water and preparation areas should be included in the room.

MATERNITY WARD

One large ward should be provided for newborns and mothers who may need to stay overnight. This ward can also serve as a pediatrics wing.



FIGURE 48: Currently, patients rest on mattresses in the courtyard.

CANTINE

If this CSCOM does become a magnet for nomadic populations and the villagers of Boulgoundie, it will be appropriate to include a canteen or kitchen. While families traditionally cook for their friends or family members, there may be special instances where the centre may need to cook for the patients. The canteen could also be used for any training events where the participants may need lunch or coffee. A permanent structure (4-walls) should store grains and cooking utensils, but the cooking itself will occur outside.

LATRINES

An appropriate balance of open-air pit latrines, improved latrines, and western toilets should be provided for daily usage by patients and CSCOM staff, as well as long-term patients. While toilets do not need to be located in individual rooms, they should be placed conveniently throughout the centre. Western style toilets may be placed in doctors' offices, maternity and one ward.

INCINERATOR

Appropriate methods for disposing of medical waste should be provided near the health centre.

FAMILY / DORMITORY AREA

GUARDHOUSE

Housing for a CSCOM guard/groundskeeper should be provided near the entry and nearby the health centre. Two rooms at 100 sq ft each, plus exterior cooking, gathering space and latrine should be included for the guard and his family.

SINGLE OCCUPANCY ROOM FOR RECOVERING PATIENTS AND FAMILY

Currently, the Boulgoundie CSCOM does not accommodate for any overnight patients or the large families that may be traveling to Gao. Unlike western precedents, Malians generally travel with their family members seeking medical care. For example, one child may be ill and in the process of being treated for malaria at the CSCOM, but the entire family will come along (via donkey cart) and set up camp within the courtyard until the child is better. In some cases, the child may also stay with his/her family and have check-ups daily in the nurse's office. Adequate camping and/or permanent structures should be provided to allow for recovering patients or those seeking long-term care, as well as their families.

Current CSCOM staff may also live within the courtyard or with extended family in outlying villages or quarters, making them difficult to contact in emergencies. Housing should be provided for 1-4 clinic staff (one female room, one male room).

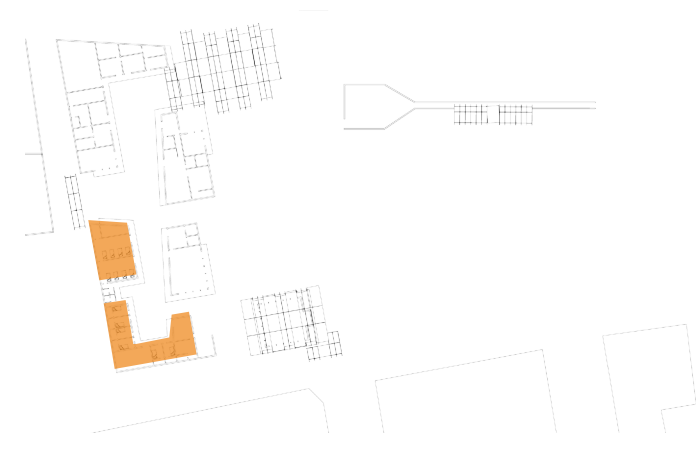


FIGURE 49: The Family, dormitory, and guardhouse are located in the southwest corner of the site.

COMMUNAL COOKING AREA

Because CSCOMs do not generally provide meals for their patients, families are required to cook for the patient (as well as themselves if they are also staying within the complex). Traditionally, cooking occurs on a portable stove outside, so only a small structure should be provided to store grains, large cooking utensils, stoves and fuel (charcoal or wood). Exterior space, preferably with some shade, should be provided for at least one person per patient.

LATRINES / BATHING AREA

Pit latrines are most common and easy to construct in Gao. While western toilets may be provided within the wards for patients, latrines or improved latrines (with a roof) are appropriate for the family or staff housing. Approximately six people can use one latrine. Oftentimes, bathing occurs in the same area as a pit latrine via bucket baths. For hygienic reasons, separate bathing areas should be provided. The design of the structure is similar but does not include the pit. Both latrines and bathing areas should be located near a clean water source and properly dispose of human waste (via compostable pits or soak pits for gray water).



FIGURE 50: Current water and washing conditions.

COMMUNITY EDUCATION

MOSQUE / PRAYER PAVILION

Mosques and markets are the heart of Malian villages and cities. While mosques do exist nearby, this area of Boulgoundie is dense enough to warrant a small parish. CSCOM staff and patients will also require a simple prayer space while working or undergoing treatment. A mosque that is located as an intermediary between the private functions of the CSCOM and public interaction of Boulgoundie seems an ideal way to integrate transient and permanent populations. This mosque should be able to accommodate 50 people (interior) and have adjoining exterior space for overflow or prayers during holidays or the hot season. Water sources (ablutions space) also needs to be nearby.

MARKET

Currently, the closest market is approximately 3 miles from Boulgoundie. As most gardens are, in fact, just south of Boulgoundie, the CSCOM road is directly on the route from the gardens to the market. By providing space for a Boulgoundie market, villagers will be able to buy and sell their daily wares here without spending a few hours walking through the heat to Gao. Existing boutique and vendors (who gather here each evening) will be accommodated with permanent or semi-permanent structures. The market activity will also serve as communal integration between newly settled Tamasheq and the residents of Boulgoundie. The allotted square footage does not include uncovered exterior stalls, which may be allowed as the market

PLEIN AIR GATHERING SPACE

Weddings, baptisms and various holidays bring neighborhoods and villages to the streets. Chairs, tarps and sound systems are rented for large parties where everyone is invited. For such holidays as Women's Day (8 March) and World Aids Day, large events are held in various places throughout the city but are often limited in size due to the width of the street. This CSCOM should include a large enough (and paved) space to influence and promote interaction of Boulgoundie residents and newly settled Tamasheq. Rather than charging for use of the space, residents of Boulgoundie will be able to "rent" (or reserve) the space for free.



FIGURE 51: Temporary market in Gao.

HEALTH EDUCATION SPACE - LARGE

A large covered space should be provided for community use. Activities and uses may include : community celebrations for Womens' Day, World AIDs day, Malian Independence Day and other large events which typically include an education component as well as dancing and other large gatherings.

HEALTH EDUCATION SPACE - MEDIUM

A medium covered space should be provided within the interior courtyard of the CSCOM. Activities and uses may include : nutrition and woman's sex education seminars and mid-sized association meetings.

HEALTH EDUCATION SPACE - SMALL

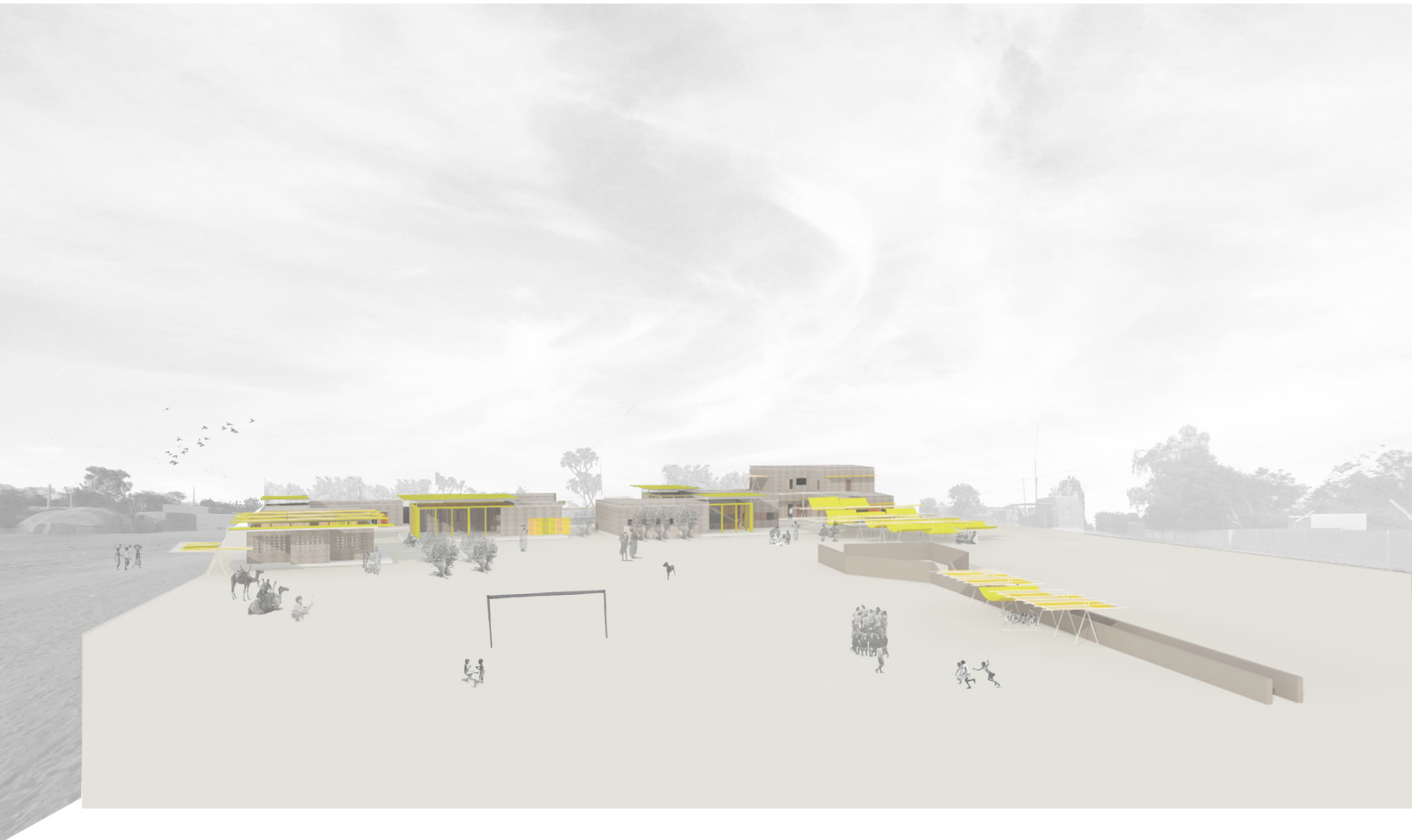
A small covered space should be provided at the entrance to the CSCOM. Activities and uses will be related primarily to the maternity, where many women and children come weekly for vaccinations, baby-weighings and pre-natal care.



FIGURE 52: A wedding in Boulgoundie.

The design of a new CSCOM in the quartier of Boulgoundie relies heavily on three aspects, (1) The transition of space and culture from nomadic to permanent architecture, (2) interactions throughout the day in relation to the climate and (3) materials and methods which are responsible to the climate and culture. By concentrating on six key spaces, Heal, Meet, Education, Family, Reflect and Play, the CSCOM becomes truly a Community health center.

FIGURE 53 (right): The proposed CSCOM, a modern place of refuge from the heat that also fits the neighborhood context.





TRANSITION OF SPACE

Following the transition of built environment from nomadic to permanent, the site itself reflects a change in building types from the open space on the east to the residential compounds to the west. Beginning with the open space (representing the *plein air*), the user moves west through the market structure (representing the *Tamasheq tent*) to an education space (representing the woven hut) and finally, into the permanent buildings of the clinic and family areas (representing the mud houses). The spaces between are designed to support the transition and movement amongst the program features of the CSCOM.

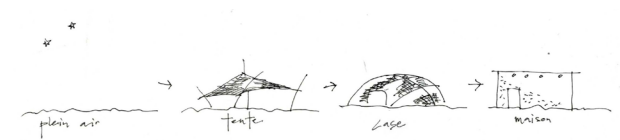


FIGURE 54/55: Proposed site in relation to the transition of spaces and structures in Northern Mali.

SHADE STRUCTURES



FIGURE 56: Market and Education shade structures shown as a green canvas. Of course, this is expected to change with time.

The design of the new CSCOM begins with the shade structures, which represent the flexible nomadic structures throughout Northern Mali. The shade structures are placed over the spaces where the community spends the most time, and have been divided into three types: market, education and a hybrid of the two.

The first shade structure type is found in the market and outside waiting areas for the clinic. Set at 20' o.c., the permanent steel shade structures are triangular in shape and emulate the angles found in a Tamasheq tent. The roof is of canvas stretched over 3" steel column, and below, traditional mats are placed to create a continuous movement of air. The double layer roof system is found throughout the CSCOM, with a few variations. The height of the structures is dependent on the program spaces, which have been separated into three types: market (8'), waiting area (10') and entrance to the health clinic (12').

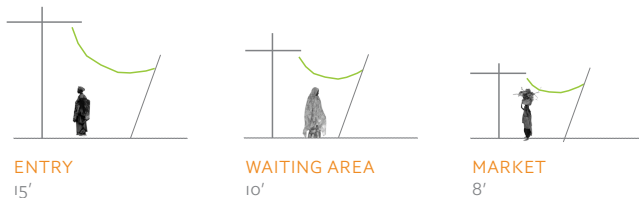


FIGURE 57: Three heights of shade structure.

The permanent market and waiting area shade structures serve as an armature or skeleton for flexible shading areas between. The permanent structure has a hook placed regularly along the north-south direction that can be attached to drape tents and moved throughout the day in relation to the temperature and sun angles using a pulley system of simple rope. These are represented with a green canvas, but it is understood that the materials will change over time to reflect the vendors' needs in the market. For example, other materials may be used such as woven textile fabrics, plastic tarps, or the same woven mat that appears on the underside of other shade structures.

The second shade structure type is found above the education spaces within the CSCOM. While these program spaces are included in the built form of the center, a lifted roof and open walls invite villagers to participate in health education activities throughout the seasons. Here, a canvas roof is lifted three feet above the compressed earth block wall and ring beam on a steel frame. Like the market shade structures, a ceiling of traditional mats is hung below the canvas roof (yet still above the wall). This provides a path of allowable air movement and cooler temperatures for users in these areas.

The last shade structure, found in the prayer pavilion or mosque, is a hybrid of both market and education roof types. While the mosque becomes a pavilion, with only one solid compressed earth block wall and three open walls of columns, this shade structure or roof provides the largest single shaded area in the CSCOM. The Gao-borey (people of Gao) spend most prayers at mosques outside of the building itself because of high temperatures and instead, choose to pray in the street or near small trees. The prayer pavilion roof uses both the permanent shade system found in the market and waiting area, as well as the education roof (as a mosque is also an education center). The roofs are placed at varying levels and overlap slightly to provide protection from the sun throughout the day. The stacking also allows for heat to rise and escape, much like the education shade structures.

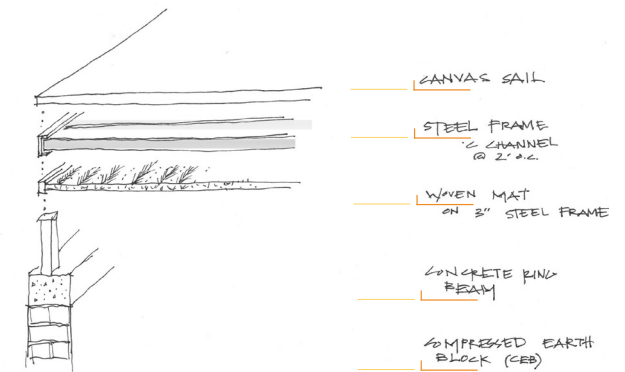
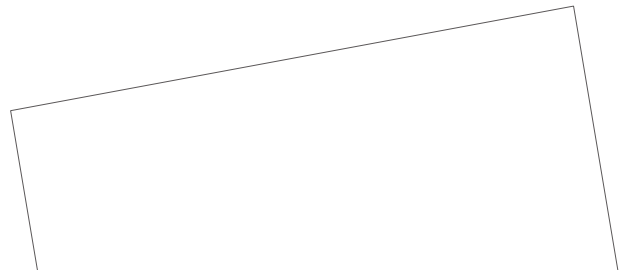
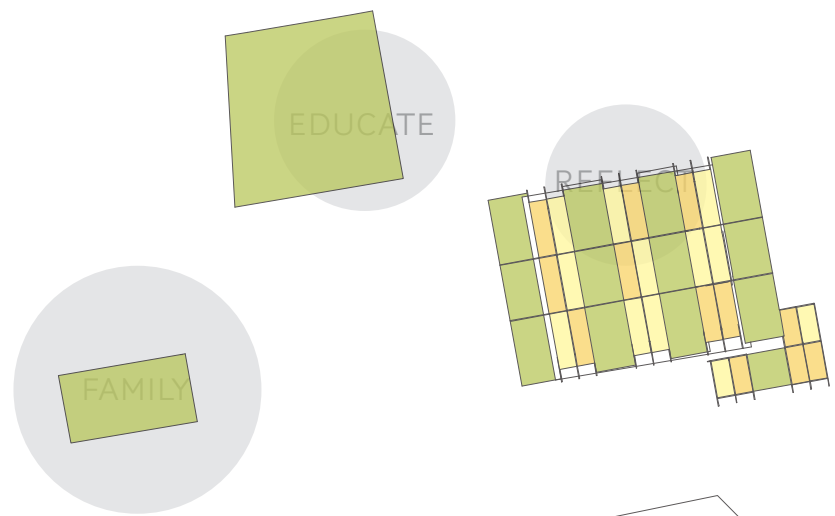
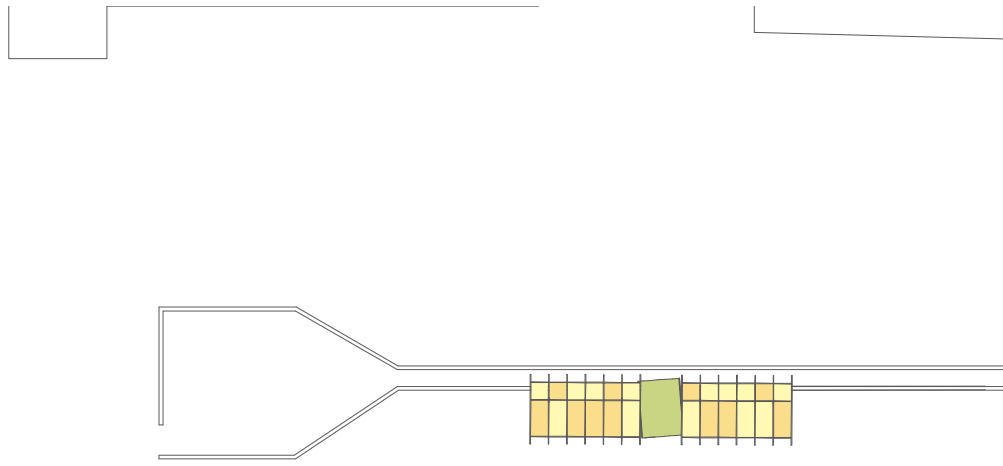
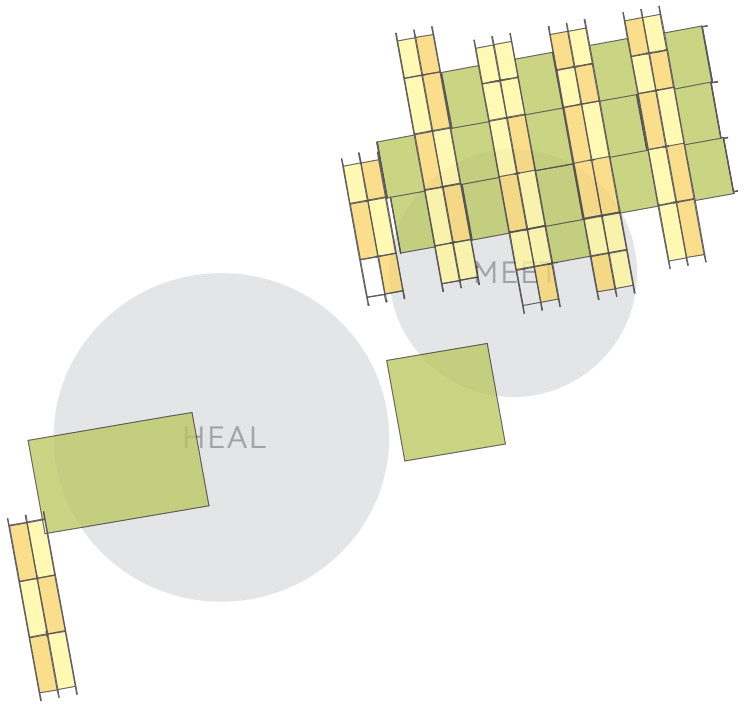
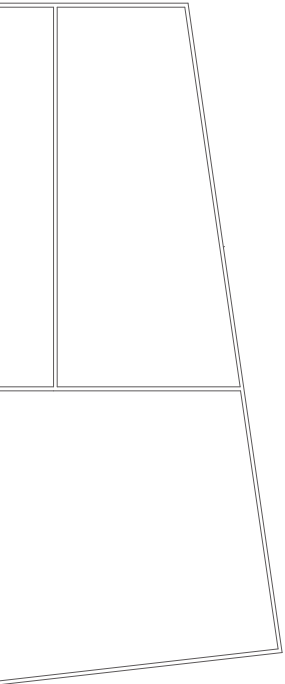


FIGURE 58: Detail of Education space roof structure.

FIGURE 59 (right): Proposed shade structures. Market in yellows/greens and education spaces in green.

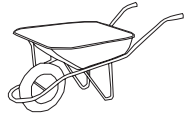




=



80 - 100 BRICKS (approx. 8" x 6" x 12")



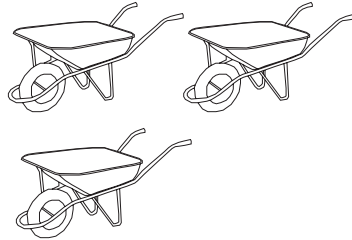
GRAVEL

+



SAND

+



NON-SILTY
SOIL

+



CEMENT

ONE BAG = 7500 CFA
or \$16

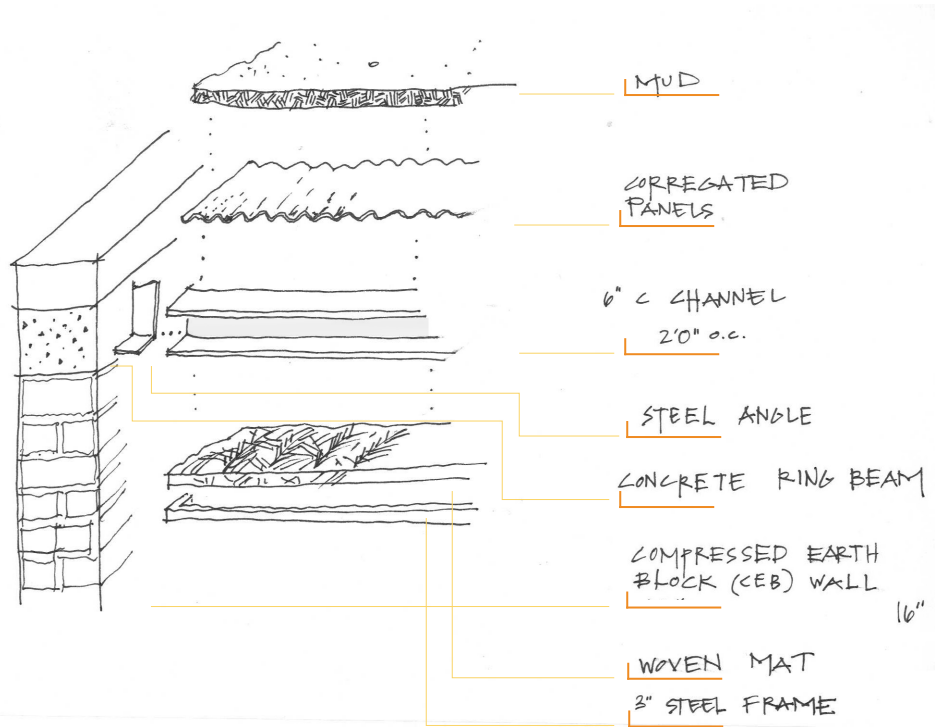
IN USA, ONE BAG =
LESS THAN \$3

PERMANENT STRUCTURES

The last translation in the transition from open air to the built environment lies here, in the clinic, maternity and family areas. The need to create something permanent structure with low maintenance costs and responsibilities is a high priority for sustainability. With high costs for concrete and wood, the decision was made to use compressed earth block (CEB), which can be made by local masons with materials that exist in the region. While a small amount of cement is used for structural integrity, the price is not significantly more expensive than a mud-brick structure that will need repair each year. Also, CEB buildings are much cooler than both mud brick and concrete block buildings.

The wall and roof structure used here is common amongst CEB buildings. Placed upon a concrete and rubble-filled foundation, the CEB bricks are stacked to a height of 10' (family spaces) or 12' (clinic and others), then capped with a concrete ring beam. Concrete lintels also provide support for penetrations such as doors and

FIGURE 60: Compressed Earth Block construction and proportions.



windows. Within the concrete ring beam, steel C channels are placed at 2' o.c., which creates the structure for a corrugated metal and mud roof. Below the roof, the traditional mats are used once again to create a drop ceiling and provide the user with a recognizable material.

FIGURE 6i: Compressed Earth Block wall with metal deck/mud roofing combination.

Placing the permanent program within the existing site began with an overlay of a grid of 20' x 20'. With two grids of Boulgoundie converging within the site, the spaces created (in plan) reflect the relationship between the river and residences to the west and the grid of newer developments to the east. Consideration was given to the clinic and maternity first and placed on the northwest corner of the site for privacy and access to a larger (sand) road. The inner courtyard links the program elements as well as provides a path of movement through the clinic and its amenities. Circulation is primarily external, which reflects the use of space within a traditional residential courtyard. From one point, the patient is able to see their path from checking in, to consultation, wards, health education facilities and the family areas, which lie to the south.

EXPERIENCE OF THE COMMUNITY

From afar, the CSCOM becomes a community icon for the village of Boulgoundie, as well as for the nomadic Tamasheq. It is clear where the village is gathering for the market, health clinic and mosque by the use of color and structural way-finding. While the design goals are to stay within the boundaries of local building materials and methods, I still believe that this facility should be clearly the center of Boulgoundie - a place that people are drawn to because of the activities surrounding and within the walls.

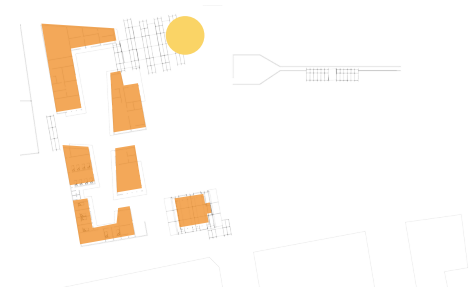
Moving closer toward to CSCOM, Gao-borey and travelers will be drawn to the interaction amongst the health centre and the village. Women and children gather on the northeast corner with tables and mats covered in neatly organized piles of vegetables and fried snacks, while gossiping about neighbors' spoiled children, the newest motorcycle and upcoming baptisms and marriages. Young men and boys play pick up games of football nearby, close enough to grab a frozen ginger drink after scoring a goal. Older men gather in circles of makeshift chairs around the shop and entrance, mastering the art of tea making and smoking out of their wives' sight. Friends and families of patients come and go, buying staples at the market and walking slowly around the neighborhood at dusk, singing hellos through open doors and courtyards. Then, the buzz of a speaker's 'on' switch sounds and the imam begins his 'Allahhu Akhbar.' Women gather their children and head back to their homes while the men begin their ablutions, rise solemnly and walk briskly toward the mosque as the sun sets.

Within the CSCOM, villagers and nomads come and go throughout the day. Donkey carts arrive with thin women riding upon stacks of belongings and gas jugs, now containing desert water. Young boys approach behind with a small herd of camels and an even larger herd of malnourished cattle. Men wander away from their 'grands' and into the market, greeting the women and directing the animals to a nearby post with water. A young girl runs into the health centre's courtyard to be met by a midwife and nurse who gently lead the



woman from the cart to the maternity ward. A few hours later, the young girl reappears and announces to her father and other family members that there is a new healthy baby girl. The men thank Allah. The young girl visits the market for clean water, fresh mangoes and a rice dish prepared by a village woman. Together, family members go in small groups to welcome the new baby. Blessings are given at the mosque for the child, while even more village women bring their babies, chubby and thin, to the weekly baby-weighing station hanging from the maternity's health education space. Other men, from near and far, are learning about small business development in the community classroom. This afternoon, en plein air, there will be a wedding celebration from the young midwife and her husband. Tonight, the Milky Way shines to a new life.

FIGURE 62: Market Entrance



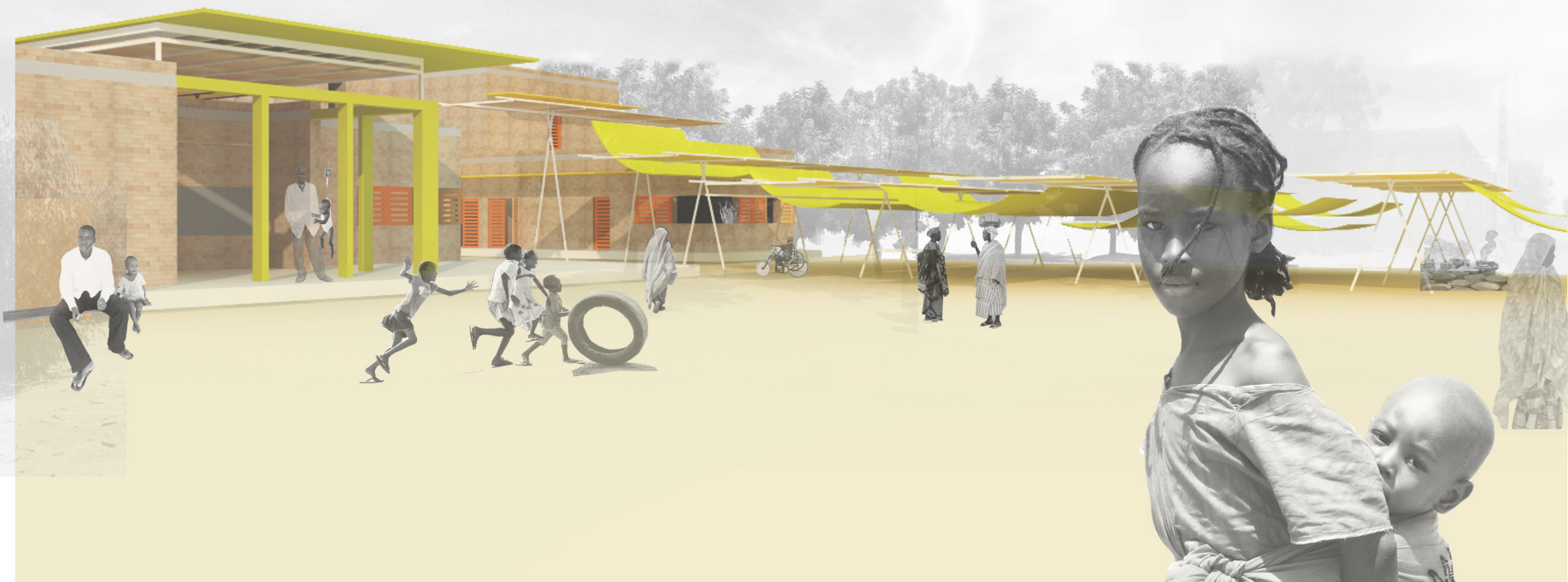


FIGURE 63: CSCOM Entrance

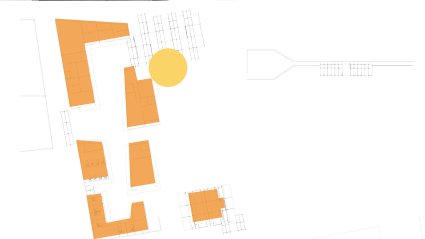




FIGURE 64: Interior CSCOM Courtyard

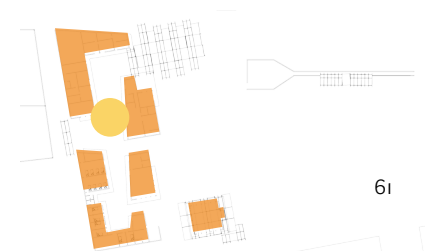




FIGURE 65: Family courtyard

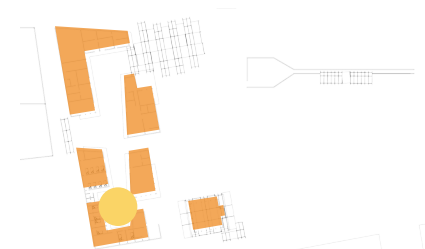
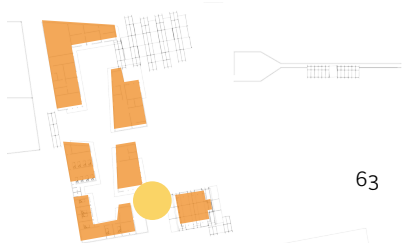




FIGURE 66: South entrance with large Health Education Space.



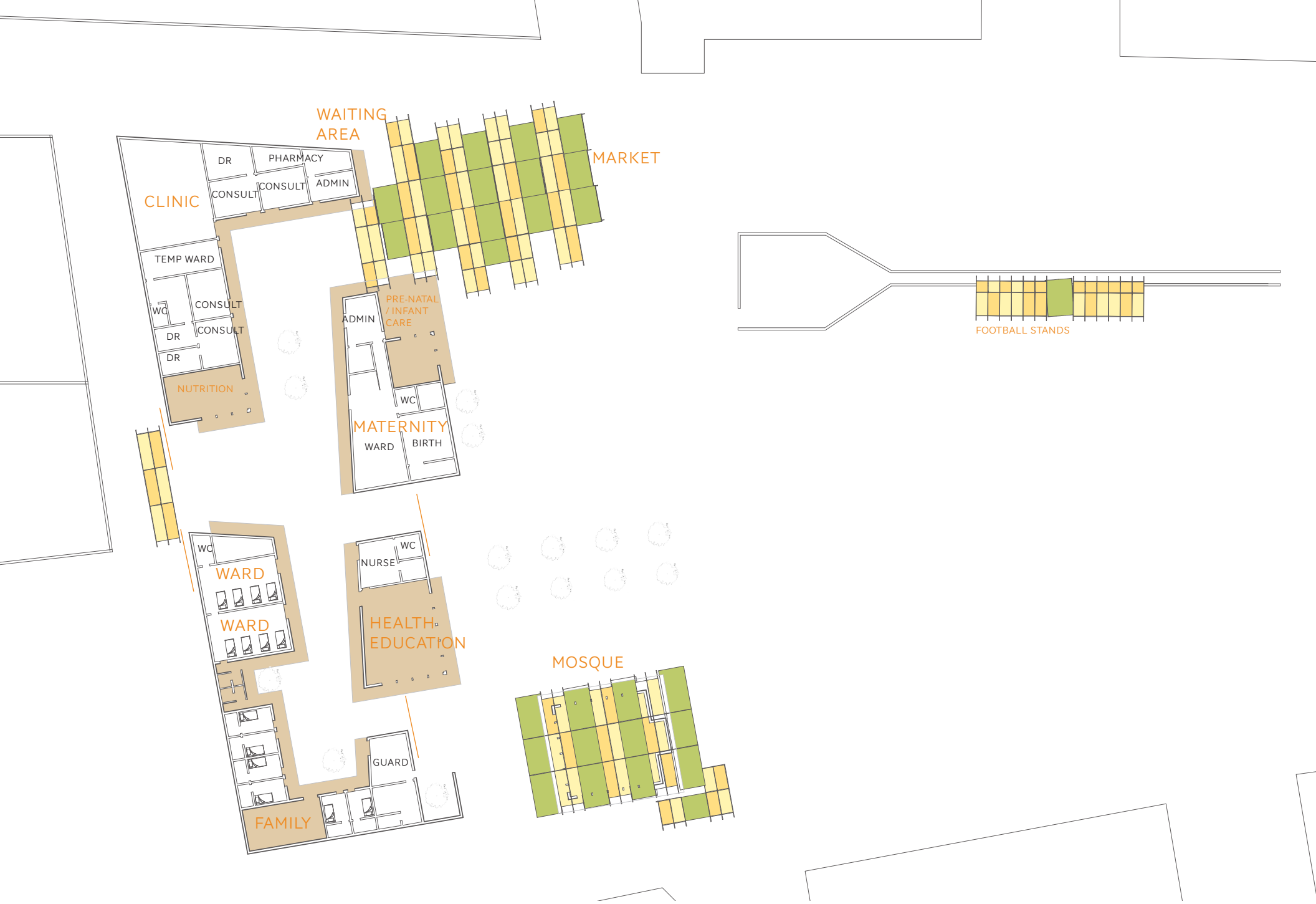
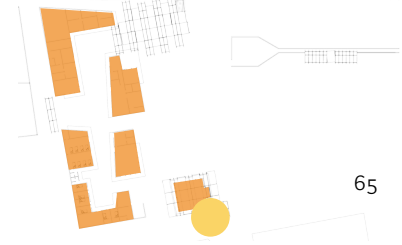




FIGURE 68: Prayer pavilion and southeast corner community space.

FIGURE 67 (left): Plan



Throughout the thesis experience, the project and design were extremely rewarding. Having a specific “client” and need in place, as well as a personal connection with the people of Boulgoundie, Gao and Mali lead to a practical, yet innovative, design.

DESIGN REVIEW

In front of a panel of accomplished architects, the proposal for a new CSCOM for the quartier of Boulgoundie was presented on December 5, 2011. The overall response was good, but foreign projects take slightly longer to understand, especially here in Northern Mali, where the climate and culture are so different from those in Seattle. The critics proposed a future development of:

- The inner clinic and maternity courtyard, suggesting a porch-like shade structure instead of an attached canvas shade device.
- Materials studies and the effect of cooling throughout the day.
- The influence of wind and precautions needed for the market and waiting areas.

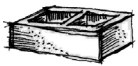





FUTURE ASPIRATIONS

With such a strong connection to the quartier of Boulgoundie and the culture in Northern Mali, this thesis is intended to be built in the future. There may be some adaptations (of course), but the ideas that integrate programs of clinic, market, and prayer pavilion are strong. This typology for a future CSCOM is necessary for adapting to the climate, as well as inherent changes in the 21st century.



FIGURE 6g: Proposed thesis design.



| MATERIAL | SOURCE |
|--|------------------------------------|
|  CONCRETE | BAMAKO ALGERIA CÔTE D'IVOIRE |
|  EARTH | LOCAL |
|  STEEL | BAMAKO NIGER |
|  TEXTILES | BAMAKO GAO |
|  TRASH | LOCAL |
|  WOOD | REGION |

APPENDIX A: Materials and distance to supplies

THE HEALTH CENTRE(7935 sq ft)

DISPENSARY:

| | |
|-------------------------------------|------------|
| waiting area: | 300 sq ft |
| administration/director's offices : | 200 sq ft. |
| nurses' offices : | 300 sq ft |
| doctors' offices : | 250 sq ft |
| exam rooms: | 200 sq ft |
| ward : | 1750 sq ft |
| latrines/shower : | 480 sq ft |
| storage : | 200 sq ft |

TOTAL: 3680 sq ft.

MATERNITY:

| | |
|-------------------|------------|
| midwife offices : | 300 sq ft |
| on-call room: | 100 sq ft |
| maternity ward : | 1000 sq ft |
| latrines/shower: | 480 sq ft |
| storage: | 200 sq ft |

TOTAL: 2080 sq ft

HANGARS:

| | |
|---------------------|-----------|
| cscm activity area: | 400 sq ft |
|---------------------|-----------|

STORAGE:

| | |
|------------------------------------|------------|
| food and other supplies (2 @ 500): | 1000 sq ft |
|------------------------------------|------------|

OTHER:

| | |
|-----------------------|------------|
| cantine : | 475 sq ft |
| incinerator : | 100 sq ft. |
| laundry / wash Area : | 200 sq ft |

APPENDIX B: Program

PATIENT + STAFF HOUSING (3244 sq ft)

PATIENT:

| | |
|-----------------------------|-----------|
| recovery rooms (4): | 600 sq ft |
| exterior/covered space (4): | 800 sq ft |
| communal cooking area : | 200 sq ft |
| latrines / showers : | 144 sq ft |
| laundry / wash area : | 200 sq ft |

TOTAL: 1944 sq ft

STAFF:

| | |
|--------------------|-----------|
| nurses' residence: | 500 sq ft |
| latrine/shower: | 100 sq ft |
| cooking area: | 50 sq ft |

TOTAL: 650 sq ft

GUARDHOUSE:

| | |
|-----------------|-----------|
| residence: | 500 sq ft |
| latrine/shower: | 100 sq ft |
| cooking ara: | 50 sq ft |

TOTAL: 650 sq ft

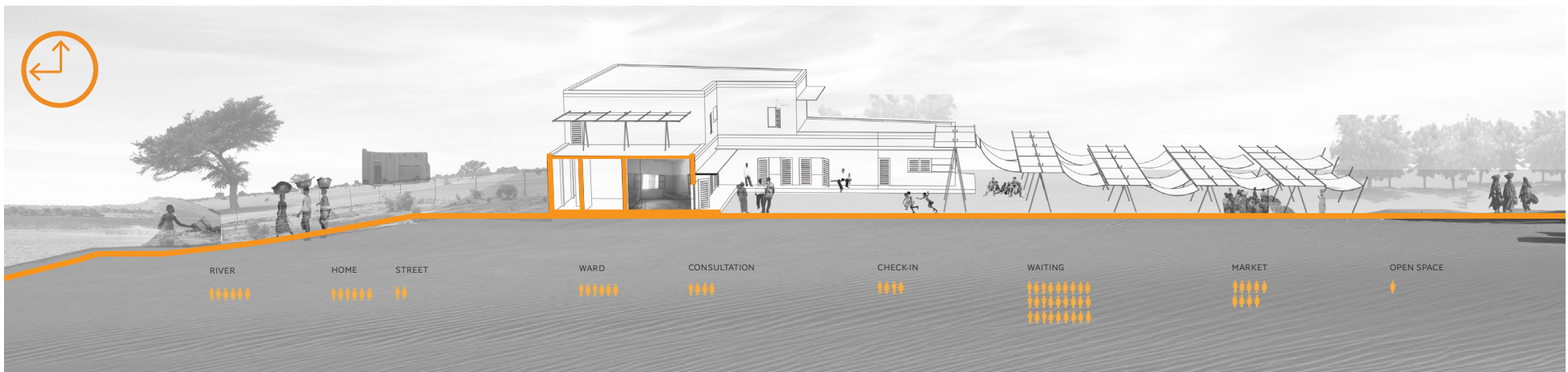
MARKET (1600 sq ft)

| | |
|---------------------|------------|
| market stalls (10): | 1000 sq ft |
| storage: | 200 sq ft |
| circulation: | 400 sq ft |

COMMUNITY SPACES (6894 sq ft)

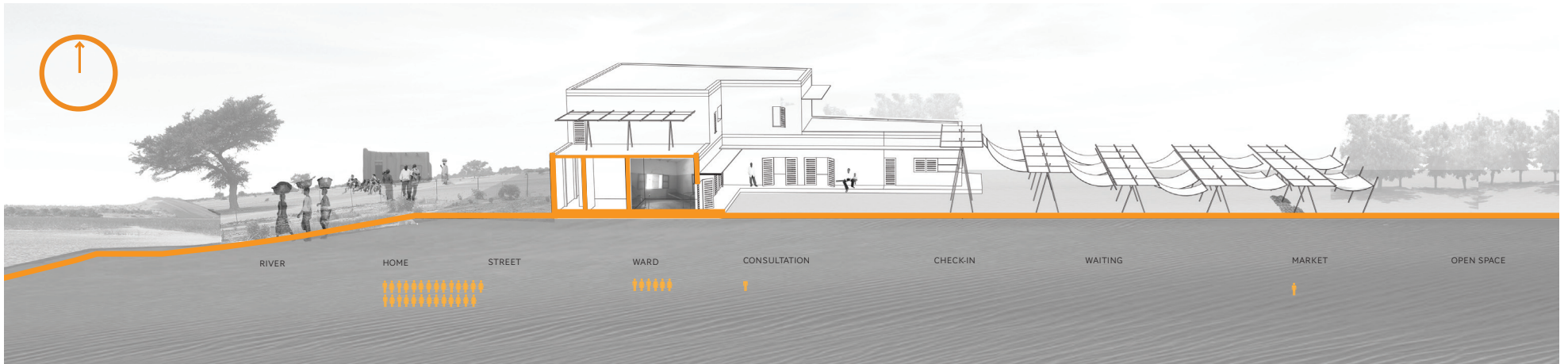
| | |
|---------------------|------------|
| mosque/prayer area: | 750 sq ft |
| classroom: | 300 sq ft |
| storage: | 200 sq ft |
| basketball court: | 4700 sq ft |
| garden: | 800 sq ft |
| latrines: | 144 sq ft |

SITE: 47,395 sq ft

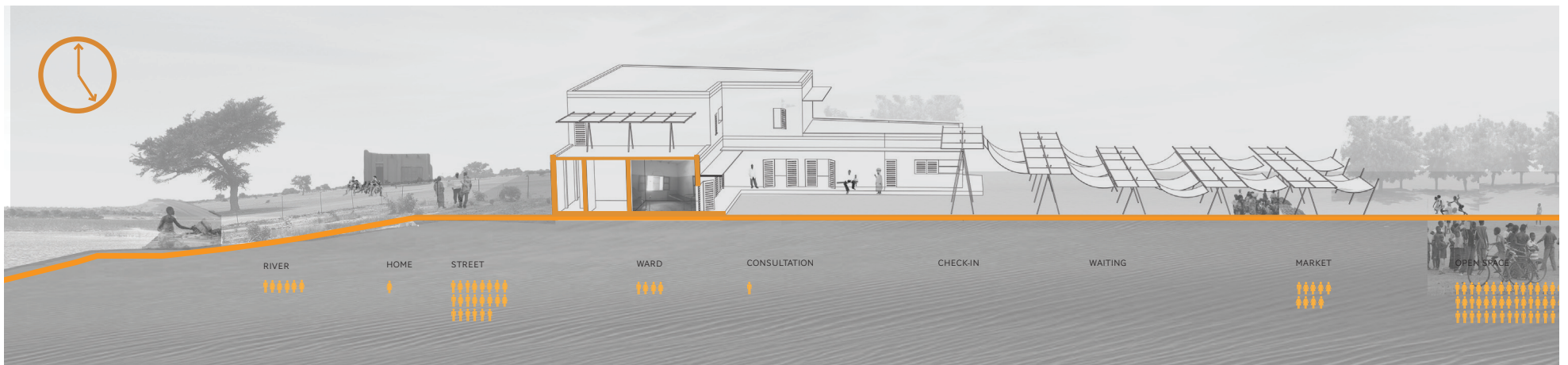


At gam, people are in the streets, on their way to Gao, markets, clinics, work and school.

APPENDIX C: Activities in and around the site in relation to the temperature and time of day.



At 12pm, most people are rushing home before the sun is its hottest at 3pm.



At 5pm, the streets come alive with friends and families meeting in the street and open space to the east of the CSCOM.

EXHIBIT

AN IMAGE OF GAO: PHOTOGRAPHS THROUGH THE EYES OF BOULGOUNDIE, MALI + THE QUARTIER'S GOAL TO BRING HEALTHCARE TO ALL

"Ay ga wa na!"

In Sonrai, the phrase "I know how!" is an amazing exclamation of empowerment and joy. Malians are capable of so many things, but when given the opportunity to take a photo, they question themselves. With a simple explanation and with the first click, eyes open wide and a smile breaks through, and instantly, you can see the young girl brainstorming how she can portray her life in 27 exposures.

As a part of my current MArch thesis research to design a new Centre de Sante Communautaire (CSCOM, or Community Health Center) for the quartier of Boulgoundie, I had the opportunity to return to Mali in September 2011. - a place that I was lucky to call home for two years. While life in Northern Mali is one of sun, sand and drought, the CSCOM is the center of daily activities, especially for women and children. People travel miles by foot, boat and donkey cart to seek the advice of a small health professional staff and to catch up with children, new marriages, market prices, and of course, the weather. In a generally calm quartier, the Boulgoundie CSCOM is an amazing collection of life despite an ever-present malaria, threats of typhoid and high medicine prices.

In exchange for the staff's patience and willingness to help, we launched a short photo project focusing on the healthcare staff and volunteers, as well as shop owners, farmers, market women and students. With 12 cameras, 14 villagers were given the opportunity to share with you the most important things in their lives, whether it be the CSCOM, their children, or simply a cup of tea.



An exhibition of the photos was on display in Gould Hall, University of Washington, during October 2011.

APPENDIX D: Photo project conducted during site visit to Gao, September 2011.

FIGURE CREDITS

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All images were created by or are property of the author, unless otherwise noted.

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