DETAILED
SHELTER RESPONSE PROFILE

ETHIOPIA

LOCAL BUILDING CULTURES FOR SUSTAINABLE AND RESILIENT HABITATS

1ST EDITION
DECEMBER 2018

Shelter Cluster
ShelterCluster.org
Coordinating Humanitarian Shelter

Cover images (from top to bottom):

Stone houses in Axum, Tigray Region. CC- A. Davey
Round *chikka* houses and elevated granary near Langano lake in Oromia region. CC- Ninara
Dorze houses (Southern Nations, Nationalities and Peoples' Region). CC- Maurits Vs

Chikka constructions with thatched roofs near Gondar (Amhara Region)- © S. Moriset- CRAterre

Konso village of Mecheke with round and rectangular houses both with thatched and CGI sheet roofs in the Southern Nations, Nationalities and Peoples' Region. CC- Richard Mortel

Landscape near Lake Wonchi (Oromia). ©T. Joffroy- CRAterre

Nomads in the Danakil Depression, (Afar Region). CC- Archilli Family Journeys

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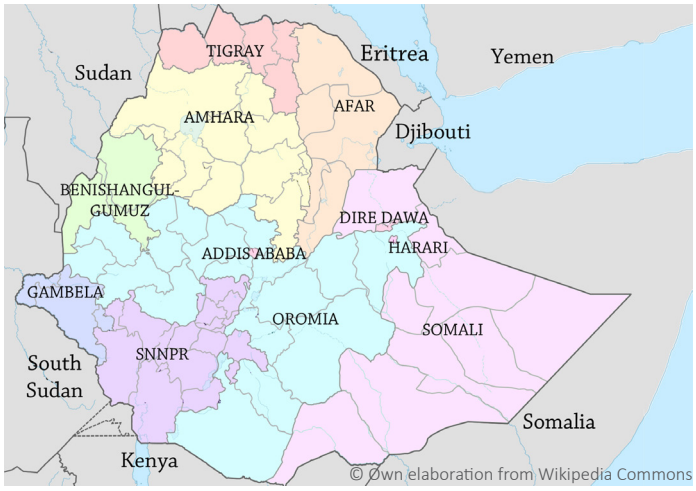
FOREWORD

A COUNTRY OF EXTREMES...

Ethiopia's location gives it strategic dominance as a jumping off point in the Horn of Africa, close to the Middle East and its markets. Landlocked, it borders Somalia, Kenya, South Sudan, Sudan, Eritrea and Djibouti, which is the traditional access point for Ethiopia to the coast. Ethiopia is divided into 9 regions and 2 chartered cities (see map below).



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Ethiopia's huge population of about 105 million makes it the second most populous nation in Africa, after Nigeria. Although it is the fastest growing economy in the region, it is also one of the poorest, with a per capita income of $768. Ethiopia's government aims to reach lower-middle-income status by 2025.

Due to its location spanning the Rift Valley, Ethiopia has some of the most extreme changes in altitude and temperatures in Africa. In Afar, the Danakil Depression is a volcanic region over 100 m below sea level, where temperatures frequently reach 50°C, whereas less than 100 miles away, the residents of Amhara are over 2,000 m above sea level with an average temperature of around 16°C.

There are 5 climatic zones, closely associated with the varied altitude levels throughout the country (see pictures below): There are 5 climatic zones, closely associated with the varied altitude levels throughout the country: *Kolla* (Tropical weather), *Woina Dega* (Subtropical weather) and *Dega* (Cool weather), *Bereha* (Desertic) and *Worch* (afro-alpine areas above 3,200m). Ethiopia has different agricultural seasons according to the climatic regions. During the time of harvest, little construction is possible, as families are focussing on gathering their crops.

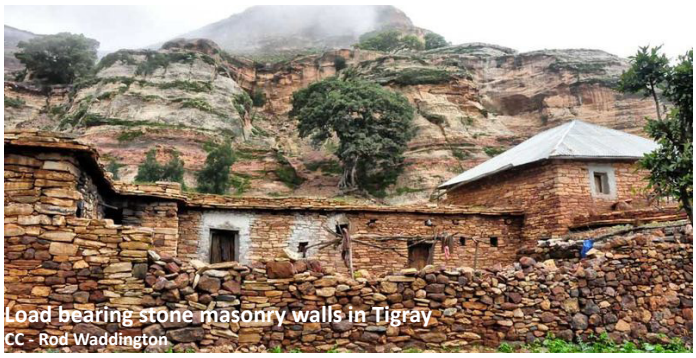
(Main source for "A country of extremes": World Bank)

HIGH VULNERABILITY

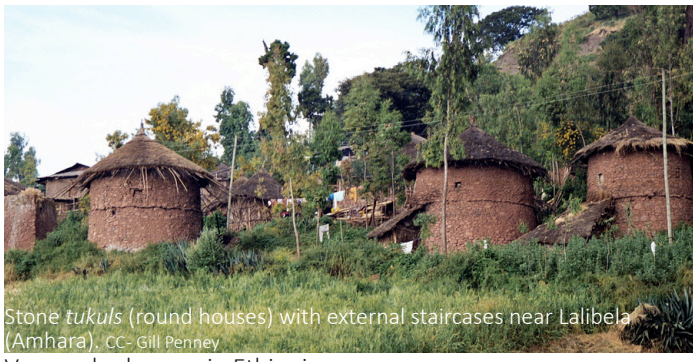
In Ethiopia almost 80% of the population live in rural areas and 72.7% work in agriculture. Low and unpredictable rainfall, frequent droughts, floods, crop and livestock diseases, domestic and international price volatility, environmental degradation, deforestation and also gradual and uncontrolled urbanisation are some of the root causes of increased vulnerability situations.

Risks linked to natural disasters and conflicts are aggravated by high levels of poverty (29.6% of the population below the poverty line) and high population densities, especially in the highlands and the Rift Valley.

The number of internally displaced persons has increased to over 2.5 million by August 2018 due to conflicts, droughts and floods. Moreover, Ethiopia has become the second largest refugee-hosting African country due to the long term conflicts in neighbouring countries. In August 2018, it hosted over 905,000 refugees mainly from South Sudan, Eritrea, Sudan and Somalia. The sheer volume of movement into Ethiopia, and willingness to provide safe haven, has required the support of many international agencies, working in close coordination with the Ethiopian Authorities.


Load bearing stone masonry walls in Tigray
CC - Rod Waddington


Nomads' hut in Awash Valley (Afar)
©T. Joffroy - CRAterre


Stone *tukuls* (round houses) with external staircases near Lalibela (Amhara). CC- Gill Penney


Houses with verandah in Addis Ababa
©T. Joffroy - CRAterre

Vernacular houses in Ethiopia

ADAPTED LOCAL BUILDING CULTURES

Ethiopia boasts a proud history of habitation in the many and varied climates using clever and innovative solutions, with materials sourced from the local environment. Local building cultures in the different territories of Ethiopia show a huge diversity depending on the variation of climates, altitudes, cultures, materials and know-how.

The *chikka* house (wood structure and earth and straw filling) is the most common design and is found almost everywhere in the country. Though, many other building cultures coexist, ranging from load bearing stone masonry walls structures with earthen mortar in the north of the country, to bamboo structures and thatch walls in the south and demountable wood and fibre mats houses of the nomadic peoples in the desert areas of Somali and Afar. Round houses (*tukuls*) and thatch roofs are very common throughout Ethiopia, but CGI sheet roofs are becoming ubiquitous with the shapes of the houses progressively adopting a rectangular plan.

In cities, constructions built with reinforced concrete structure, cement blocks or fired bricks are becoming more and more common. Multi-story condominiums are progressing thanks to public initiatives and are gradually substituting *chikka* and CGI sheets houses.

Local solutions and their associated know-how and knowledge are suppressed of in favour of international building styles and standards. There is also a slow adaptation of local building cultures to new situations. For example: the lack of good quality durable timber and general deforestation creates vulnerability in chikka houses which are more easily attacked by moisture and termites. Likewise, in the cities, where there is a long waiting list for affordable housing, there are many substandard 'shanty dwellings' spread amongst the more durable structures.

USE OF THIS SHELTER RESPONSE PROFILE

This Shelter response profile aims at providing a basic understanding of the context and the relevant key issues for shelter related operations, especially to support humanitarian projects through making the best use of existing good practices offered by Local Building Cultures (LBC) and Building Back Better/Safer activities promoted by emergency and development responders.

In response to the climate, hazards and cultural needs, different local building cultures have been developed and can offer a whole variety of context-specific solutions, including with regard to local coping mechanisms. The information on LBC presented in this document is organised per division where solutions differ, and issues which apply throughout the country have been grouped in a single chapter.

The focus is on the local building practices and materials that support Building Back Better/Safer and leverage people's capacities for self-recovery. At the same time dangerous or inefficient practices are highlighted and recommendations given for sustainable and resilient shelter practices.

In order to concretely illustrate the idea of drawing inspiration from LBC in a successful housing project, examples of housing projects and architectural designs are presented in chapter 6, including basic information on unit costs and on the building techniques used. This chapter shows houses inspired from traditional models that have been studied whithin reverse engineering process to adapt to contemporary constraints and possibilities and suit the evolution of lifestyles.

The information in this booklet is ment to help agencies and their experts to make informed choices for their shelter response projects. Though, to make sure that local specificities are well taken into account, this information will need to be completed with dedicated field missions (see recommendations in p. 58-59).


Konso dwellings (Southern Nations, Nationalities and Peoples Region)
CC- Bernard Gagnon


Chikka house with CGI sheet roof near Awasa (Oromia)
© O. Moles- CRAterre


House near Lake Wonchi (Oromia)
©T. Joffroy- CRAterre


Nomads' hut in Ogaden (Somali)
©G. vant Klooster- FAO

1. Introduction

1.1. Why local building cultures are important today

All over the world, societies have managed to produce, adapt and develop their habitat according to their needs, interests, aspirations, preferences and abilities, making the best use of locally available materials. Strategies developed take advantage of natural resources to protect against the destructive forces of nature and have always generated rich and varied knowledge at local levels.

(Re)discovering the intelligence of local architectures and analysing their associated practices is often very useful in the process of designing disaster resistant architectures in accordance with build back safer principles, but also to adapt to contemporary lifestyles and their evolution, to respect the local environment and culture and to conform to the technical and economic capacities of local populations.

Relying on, or at least getting inspiration from local knowledge, know-how, construction processes and traditional means of organisation has proved very effective, as it favours:

- The implementation of solutions well adapted to local ways of life and the suggestion of viable improvements;
- The possibility to shelter many people quickly and cost-effectively while taking into account seasonality effects as well as factors like religious festivals and livelihood activities;
- Large-scale reproducibility of the improvements designed in continuity with local building cultures and an easy access, both financially and technically, to the promoted solutions for non-beneficiaries.
- A positive impact on local economies as local skills and materials are fully promoted, while also taking into account environmental concerns linked to the construction industry;
- Greater short and long-term ownership by the beneficiaries through their participation in decision-making and project implementation processes;
- Empowerment of local populations through the recognition of the value of their existing capacities for building and the improvement of their resilience.

To develop a disaster resistant architecture adapted to current local ways of life, it is important to involve the beneficiaries and the local professionals and decision makers from the very beginning of the recovery phase. If rebuilding is often necessary and can be very demonstrative and convincing, promoting pertinent repairs when possible may help reaching this goal. This way, the connexion between relief, recovery and development is enabled and so, the long term benefit of a shelter project is ensured. In addition to the provision of shelters, higher levels of resilience within the project area are reached.

1.2. Key concepts

Building cultures

A building culture is the intangible dimension of a construction or a settlement produced by humans to live, work, thrive, etc., and is strongly connected with its environment. It includes assets related to each phase of the building life cycle: design, construction, use(s), maintenance, replacement, extension, adaptation, etc., which are often related to social, economic and environmental aspects as well as cultural aspects, including symbolic and representation systems.

The genesis and evolution of building cultures are closely linked to their environment and to the specific history of each territory. This is the reason why they are so diverse across the world and why several building cultures can co-exist within a single territory.

Vernacular habitat

Vernacular habitat is characterised by the use of local resources to respond to people's needs and to local climatic conditions. It is therefore closely linked to the site where it is built. It often results from reproductions, improvements and on-going adjustments or adaptations over time and may include external inputs and imported solutions, though rather parsimoniously. Such constructions, mainly handmade and outside or on the outskirts of global economic exchanges often rely on strong links between the inhabitants and their families and neighbours and their persistence may facilitate feelings of belonging and pride within the community.

Precarious habitat

The term "precarious habitat" covers different realities depending on the specificities of the places and the factors that generate it: economic difficulties, climate change, natural disasters or armed conflicts. It characterises houses or shelters built by low-income families or by those who, without a land property title, prefer to limit their investment by choosing light structures that are easy to dismantle or repair. These constructions are primarily found within peripheral urban areas where illegality often correlates with a negative perception and with high risk, hazardous (disaster prone areas) and precarious living conditions that expose inhabitants to frequent destruction of their homes. This inherently leads to constantly rebuilding, strengthening and fixing housing structures, which may reinforce people's knowledge on what works and what does not, but also drain their income.

Despite these challenges, their connection to cities and the opportunities they offer (educational, income, recreational, etc.) result in a strong attachment to these habitats. That leads to creative design solutions, including elements of comfort, income generating uses or external spaces of socialisation that do not exist in more formal habitats.

Globalised habitat

Around the world, building is increasingly influenced by "global trends" and a growing interest in the reproduction of international solutions and in industrial materials such as cement, steel and CI Sheets. These are often implemented to replace more traditional materials (such as thatch) without considering that changing one element of the construction can affect the way the structure performs as a whole, possibly compromising structural safety, thermal comfort and other important features of the building. Therefore, one of the challenges of the Local Building Cultures (LBC) approach is to be able to take on board such tendencies and make sure that expectations are met when proposing designs for the construction of shelter projects.

In post-disaster or conflict situations, some shelters are intended to be temporary structures made of short-lasting materials with designs that meet basic needs. But they often become permanent structures for families who lack the possibility to repair or improve them as their shape does not allow it or the materials and skills required are not available.

1.3. Information used for this document and history of the collection

Information and data collection

This document was elaborated after a dedicated literature review (see chapter 7) and thanks to information collected during and after a number of experiences by the authors and their partners in Ethiopia, as well as through exchanges with Ethiopian technicians and academics or Ethiopia-based experts.

History of the series of shelter response profiles

This publication is part of the series of documents: "**Local Building Cultures for sustainable and resilient habitats**". Several documents have been produced after a disaster (Fiji, Ecuador, Haiti) or before a disaster strikes as a preparedness tool (Bangladesh). This profile for Ethiopia is the first document elaborated in a situation of both conflict and disaster context.

1.4. Suggestions for use / Audience

The organisations backing this document have been working for several years on the elaboration and the dissemination of an identification method for local building cultures (LBC), especially in regard to their contribution to Disaster Risk Reduction (DRR). The aim is to facilitate the identification of the strengths and weaknesses of LBC and the opportunities they offer, in order to promote them – in an adapted version if necessary – in housing reconstruction or improvement projects.

To achieve this, it is important to consider that beneficiaries live in environments that are often shifting due to several factors such as climate change, urbanisation processes, globalisation and the evolution of social attitudes as local practices are challenged. Still, it is advised that the solutions proposed are found locally and to keep inovations limited to improve their chances of being adopted and thus to contribute to long term development and increased local resilience capacity.

This document introduces reference data on local building cultures and local sociocultural resilient strategies. These references are to be considered as a basis for the elaboration of project-specific strategies and also as a grid of analysis with a first set of conclusions. Context and details will differ from one place to another and stakeholders will benefit from the collected data in order to make comprehensive and accurate decisions. It is highly recommended to complete them through the organisation of field surveys which will also allow to exchange with local actors on the specificities of each local context.

1.5. Communication style in Ethiopia

Amharic and Oromo are the more widely used of the Ethiopian languages, but it should be appreciated that in the various regional government offices, the local languages, (particularly Somali) will be spoken in meetings. It is important to ensure that a local translator is employed to assist at meetings.

Ethiopians are generally very hospitable and usually offer food and drinks to visitors. Coffee was discovered in Ethiopia and it is one of the more popular drinks, with traditional ceremonies in which green coffee beans are roasted and prepared and small cups of very strong coffee are offered to the guest. When meeting people for the first time, it is considered polite to gently shake hands and look each other in the eye. Once a closer working or personal bond has developed, it is common for friends to shake hands and lean forward with a slight twist, so that the opposing right shoulders touch lightly. If someone offers you their wrist to shake, it is merely that their hands may be dirty, or they have just washed them in anticipation of a meal, so they don't wish to contaminate them as food is eaten with the right hand, which is always washed before a meal. In such cases, simply lightly clasp the forearm just above the wrist instead of the hand.

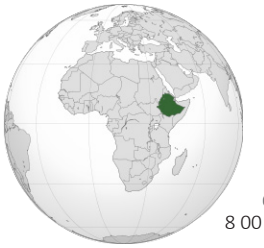
Occasionally, the visitor may become aware of the Ethiopian system of '1 to 5'. (http://www.refworld.org/docid/5a8405244.html). This is a government initiative, in which households are put together in groups of five. This builds on a traditional structure in which groups of villagers would form an informal group to assist each other with planting, building and harvesting. The current system is partially to share government information and recommendations, but also so that any trainings or activities offered to households can have maximum reach, as the group representative is expected to give training and capacity building to their group members. This system could be used for capacity building, particularly for activities such as encouraging safe building practice.

2. Country profile

2.1. General description

Source: CIA World Factbook, FAO, World Bank, Climate portal, Wikimedia, Protected Planet

A. Location



©Wikimedia
8 00 N, 38 00 E

©Ezilon.com
Topography and geography

Ethiopia is a landlocked country that lies on the Horn of Africa. Bordering the country are Sudan and South Sudan to the West, Djibouti and Eritrea to the North, Somalia to the East and Kenya to the South.

B. Physical and topographical data

Area: 1,104,300 sq km. Land: 1 million sq km. Water: 104,300 sq km.

Elevation: mean elevation: 1,330 m. Lowest point: Danakil Depression-125 m. Highest point: Ras Dejen 4,550 m.

Relief: Within Ethiopia is a vast highland complex of mountains and dissected plateaus divided by the Great Rift Valley which runs Southwest to Northeast and is surrounded by lowlands, steppes, or semi-desert. This diversity determines variations in climate, soils, vegetation and settlement patterns.

The altitude range of the country is divided into three zones: *daga* for the highlands, *woina daga* for the midlands and *kolla* for the lowlands.

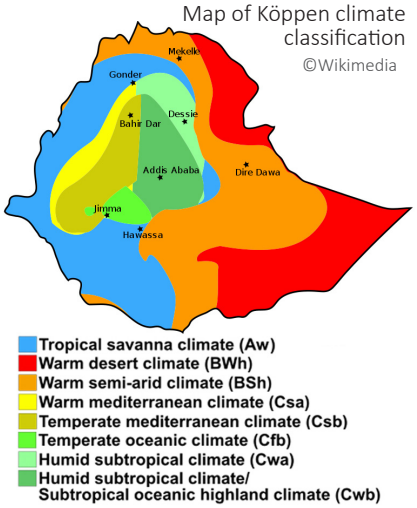
C. Climate

There are 5 climatic zones, closely associated with the varied altitude levels throughout the country: *Kolla* (Tropical weather), *Woina Dega* (Subtropical weather) and *Dega* (Cool weather), *Bereha* (Desertic) and *Worch* (afro-alpine areas above 3,200m).

The Somali Region and the Danakil Depression in Afar have a hot, sunny and dry climate producing fully desert or semi-desert conditions. In the basins of the Sobat, the Tekezé and the Abay rivers the conditions are tropical and diseases such as malaria are prevalent. Over the greater part of Ethiopia as the Amhara and Oromia highlands the climate is healthy and temperate. In the uplands, the air is cool in summer and bleak in winter. On the higher mountains the climate is Alpine.

Rainfall per year: In Afar and Somali regions rainfall ranges from 91 to 500 mm per year, while it is above 1,000 mm in the West of the country, with places reaching 2,500 mm.

Map of Köppen climate classification
©Wikimedia

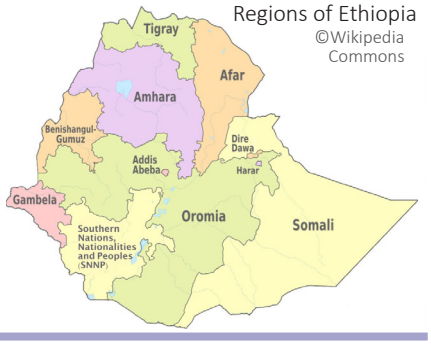


D. Protected areas and world heritage sites

The World Database of Protected Areas (link in page 11) cites 104 Protected areas in Ethiopia. Protected areas are important biodiversity hotspots, as well as being the source of livelihoods and natural resources used for housing for the local communities. There are 58 National Forest Priority Areas, 18 Controlled Hunting Area, 13 national parks, 8 wildlife reserves and 4 sanctuaries. Moreover, there are 2 UNESCO-MAB Biosphere Reserves (Yayu and Kafa) and 1 natural World Heritage Site (Simien National Park).

Ethiopia also has 8 cultural properties inscribed on the World Heritage List (link in page 11): Rock-Hewn Churches, Lalibela (1978); Fasil Ghebbi, Gondar Region (1979); Aksum (1980); Tiya (1980); Lower Valley of the Awash (1980); Lower Valley of the Omo (1980); Harar Jugol, the Fortified Historic Town (2006) and Konso Cultural Landscape (2011).

Regions of Ethiopia
©Wikipedia Commons



E. Administrative data

Ethiopia is a federal state subdivided into 9 ethno-linguistically based regional states (Tigray, Afar, Amhara, Oromia, Somali, Benishangul-Gumuz, Southern Nations, Nationalities and Peoples Region-SNNPR-, Gambella and Harari) and 2 chartered cities (the country's capital Addis Ababa and Dire Dawa). Each state comprises zones, districts (*Woredas*), cities, and neighbourhood administrations (*Kebeles*). (See link in page 11 for more information)

2.2. Demographic, cultural and socioeconomic data

Source: CIA World Factbook, World Bank, UNHCR, Info as Aid, UNICEF, ILO, IDMC, NCR, World Atlas

A. Demographic data

Total population: 105,350,020

Population density: 95,4 people/km²

Human Development Index (HDI): 0.463 (low)

Life expectancy: 62.6 years

Fertility rate: 4.99 children born/woman

Infant mortality rate:
49.6 deaths/1,000 live births

Median age: 17.9 years

Age structure:
0-14 years: 43.47%
15-24 years: 20.11%
25-54 years: 29.58%
55-64 years: 3.91%
65 years and over: 2.94%

Net migration rate:
-0.2 migrant(s)/1,000 population

Urban population: 20.8%

Rural population: 79.2%

Urban population growth:
4.63% annual rate of change

Major urban areas:
Addis Ababa (capital city): 4,567,857
Dire Dawa: 1,274,869
Mek'ele: 480,217
Gondar: 358,257

B. Languages

Amharic (official national language): 29.3%

Oromo (official language in Oromia): 33.8%

Somali (official language in Somali) 6.2%

Tigrinya (official language in Tigray) 5.9%

Other languages: Sidamo 4%, Wolaytta 2.2%, Gurage 2%, Afar 1.7%, Hadiyya 1.7%, Gamo 1.5%, Gedeo 1.3%, Opuuo 1.2%, Kafa 1.1%, others 8.1%.

English (major foreign language taught in schools) and Arabic.

C. Ethnic groups

Oromo 34.4%

Amhara 27%

Somali 6.2%

Tigray 6.1%

Sidama 4%; Gurage 2.5%; Welaita 2.3%; Hadiya 1.7%; Afar 1.7%; Gamo 1.5%; Gedeo 1.3%; Silte 1.3%; Kefficho 1.2%; other 8.8%.

D. Religion

Ethiopian Orthodox 43.5%

Muslim 33.9%

Protestant 18.5%

Traditional 2.7%

Catholic 0.7%

Other 0.6%

E. Education

Literacy rate: 49.1% (age 15 and over)

Youth (15-24 years) **literacy rate** 2008-2012. Male: 63%. Female: 47%

Primary school participation, Net attendance ratio 2008-2012. Male: 64.3%. Female: 65.5%

Secondary school participation, Net attendance ratio 2008-2012. Male: 15.7%. Female: 15.6%

F. Health

Physicians density:
0.03 physicians/1,000 population

Hospital bed density:
0.3 beds/1,000 population

HIV: 610,000 people living with HIV (0,58%)

Major infectious diseases:
Food or waterborne diseases: bacterial and protozoal diarrhea, hepatitis A and E, and typhoid fever
Vectorborne diseases: dengue fever and malaria
Respiratory disease: meningococcal meningitis
Water contact disease: schistosomiasis
Animal contact disease: rabies

G. Economy (2017 est.)

GDP (purchasing power parity): $202.2 billion

GDP - real growth rate: 10.9% (annual average GDP growth of 10.3% a year from 2005/06 to 2015/16)

GDP - per capita: $768

GDP - per capita (PPP): $2,200

GDP - composition, by sector of origin:
agriculture: 35.8%; industry: 22.2%; services: 42%

Labour force - by occupation (2013 est.):
agriculture: 72.7%; industry: 7.4%; services: 19.9%

Child labour 5-17 years-old (2015):
Children working in child labour: 42.7% (15,948,175)
Children working in permitted forms of work: 8.3% (3,096,516)
Children non-working: 49% (18,288,047)

Population below poverty line: 29.6% (2014)

Inflation rate (consumer prices): 9.9%

Distribution of family income - Gini index: 33 (2011)

Other information: according to the CIA World Factbook, Ethiopia is a one-party state with a planned economy. For more than a decade Ethiopia has been one of the fastest growing states, driven by government investment in infrastructure and sustained progress in agriculture and in service sector.

Ethiopia has the lowest level of income-inequality in Africa and one of the lowest in the world. Yet, Ethiopia remains one of the poorest countries in the world, due to rapid population growth and a low starting base.

H. Access to information

Telephones - fixed lines
Total subscriptions: 1.147.000
Subscriptions per 100 inhabitants: 1

Telephones - mobile cellular
Total subscriptions: 51.224.000
Subscriptions per 100 inhabitants: 49

Mobile phones are popular in Ethiopia, and in 2010, the Ethiopian government formed Ethio Telecom, the only phone, internet and mobile phone service provider. (http://www.ethiotelecom.et/).
At the time of writing, the mobile phone network did not cover the entire country, so it is still necessary to use Satellite phones in the more remote areas.

Radio and television access
Radio is the most important source of news and information in Ethiopia. 4/5 Ethiopians use radio as a source of information.

Television in Ethiopia caters mainly for urban audiences. It is the most important source of news and information in the country after radio.

Internet users
Total: 15,731,741
Percent of population: 15.4%

To find out more

On sections 2.1. and 2.2.

CIA World Factbook
https://www.cia.gov/library/publications/the-world-factbook/geos/et.html

FAO
http://www.fao.org/countryprofiles/index/en/?iso3=ETH

World Bank
https://www.worldbank.org/en/country/ethiopia

World Database of Protected Areas
https://protectedplanet.net/country/ET

UNESCO World Heritage Sites
https://whc.unesco.org/en/statesparties/et

Regions of Ethiopia
http://www.worldstatesmen.org/Ethiopia_Regions.html

2.3. Natural hazards, environment and sustained weather pattern changes impacts

A. Natural hazards

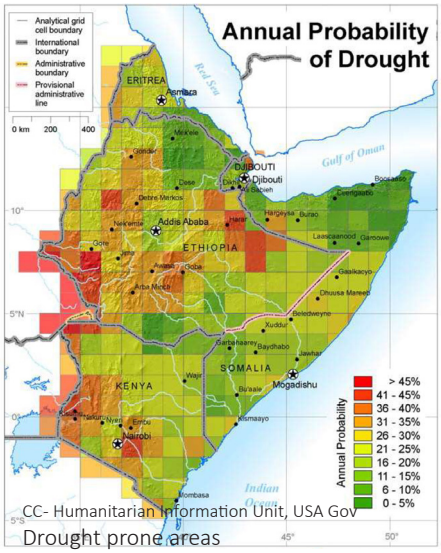
Sources: Reliefweb, IFRC, Preventionweb, CIA World Factbook, ZERGA & GEBEYEHU MENGESHA (2016), NOAA-USA gov, Wikimedia, UNICEF, HURNI et al. (2016), STEENBERGEN et al. (2011)

According to the 2017 World risk report Ethiopia is considered a country with a high degree of risk (ranking as the 65th country most at risk of disaster). This rating of countries identifies key risk elements, different indicators such as exposure, vulnerability, susceptibility, lack of coping capacities and lack of adaptive capacities of the local population. Levels of exposure to risk are low in Ethiopia, but vulnerability is very high according to this report.

Natural hazards are mostly related to frequent droughts and floods, but also to the geologically active Great Rift Valley where earthquakes and volcanic eruptions occur.

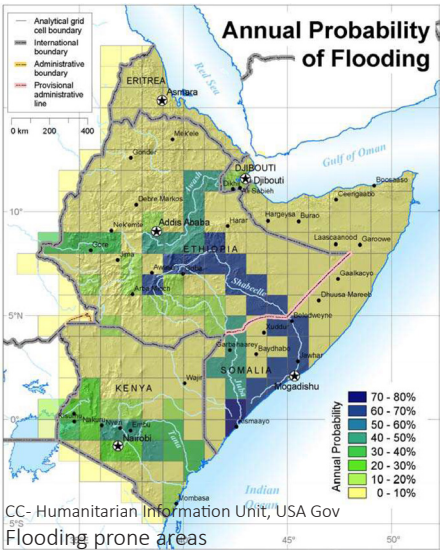
- ☑ Droughts
- ☑ Floods
- ☑ Earthquakes
- ☑ Volcanism
- ☑ Insect infestation
- ☑ Fire
- ☑ Cyclones (very rare, but potential increase)

Drought: Most of Ethiopia is made up of arid, semi-arid or dry sub-humid areas, all of which are vulnerable to localised droughts or major droughts. Eastern and western Ethiopia are the areas most frequently affected by severe drought, with a greater than 40% annual probability of moderate to severe drought during the rainy seasons.

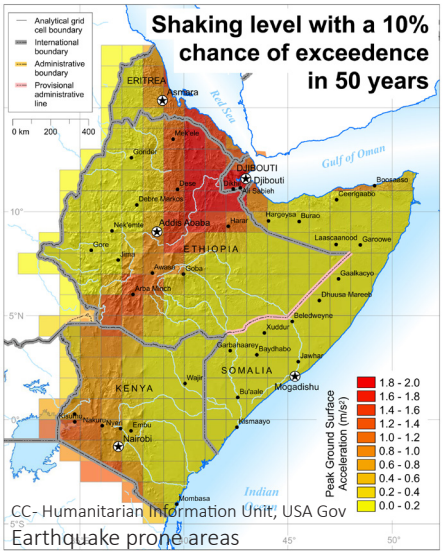


CC- Humanitarian Information Unit, USA Gov
Drought prone areas

Flooding: Floods are becoming increasingly common due largely to deforestation, land degradation, climate variability, and settlement patterns. Whilst large-scale flooding is limited to the lowland areas of the country, flash floods can occur in most parts of the country (especially when rains fall after prolonged dry spells or droughts). Heavy rainfall in the highlands can cause flooding of settlements in a number of river basins, particularly the Awash, the Shabeelle and the Juba River basins. Flooding in urban areas occurs annually. Several NGOs and local authorities started working with some communities to develop terracing and reforestation activities, in an attempt to reverse the impact of deforestation and reduce flash flooding.



CC- Humanitarian Information Unit, USA Gov
Flooding prone areas

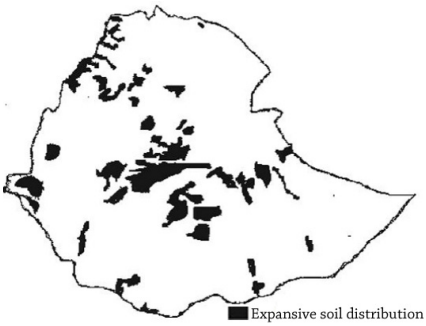


CC- Humanitarian Information Unit, USA Gov
Earthquake prone areas

Seismic activity: The largest earthquakes (greater than M 6.0) are most likely to occur along the Great Rift Valley regions.

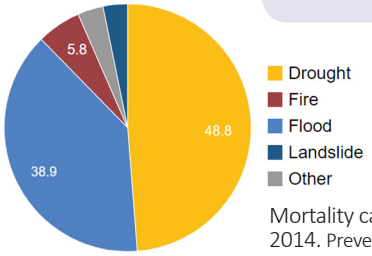
Volcanism: Erta Ale is the country's most active volcano and has caused frequent lava flows in recent years; Dabbahu became active in 2005, forcing evacuations. There are many other active volcanoes in the country.

Black cotton soils (expansive soils): The seasonal expansion/shrinkage rate of these soils can be around 8 % in volume. As a result, they develop cracks up to 8cm thick and 90 to 100 cm deep when they get completely dry. Buildings erected in such soils without any particular precaution invariably develop cracks that can put their stability in danger.



Expansive soils distribution. © Nardos Belete 2015

Insect infestation: In recent years, there have been many issues of damage maize crops, as a result of Fall Army Worm Infestation. Considering that maize is a staple of the popular dish *ugali,* this can have a significant impact on the poorest members of the Ethiopian community.



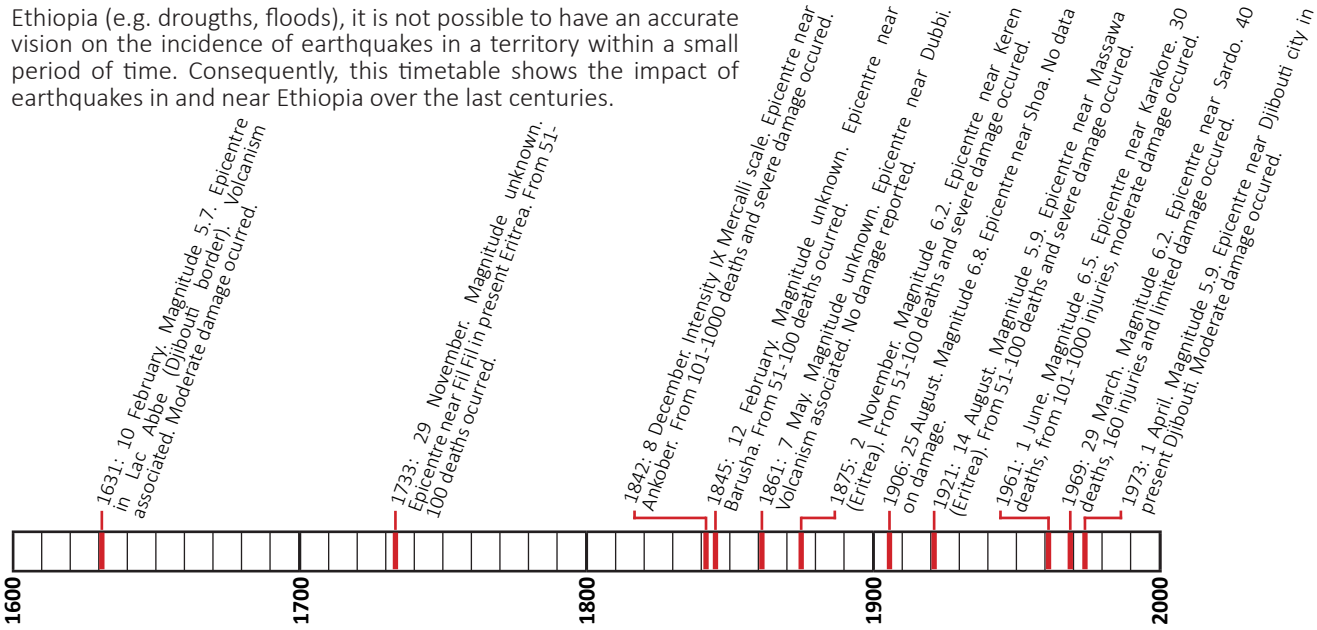
Mortality caused by type of disaster 1990-2014. Preventionweb

To find out more

- Reliefweb
  https://reliefweb.int/disasters?country=31#content
- World risk report 2017
  https://reliefweb.int/sites/reliefweb.int/files/resources/WRR_2017_E2.pdf
- Global risk data platform
  http://preview.grid.unep.ch/

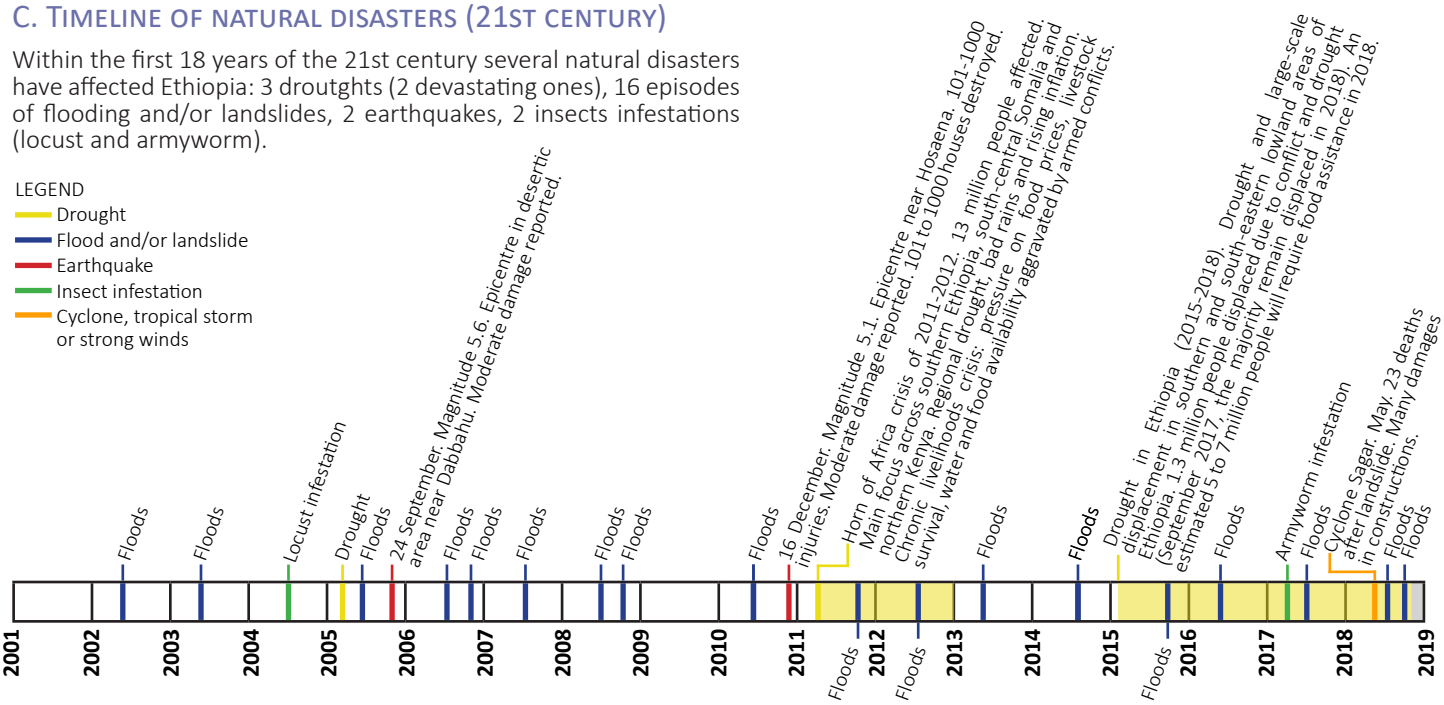
B. Timeline of registered earthquakes (before 21st century)

Unlike other natural disasters which are seasonal and recurrent in Ethiopia (e.g. drougths, floods), it is not possible to have an accurate vision on the incidence of earthquakes in a territory within a small period of time. Consequently, this timetable shows the impact of earthquakes in and near Ethiopia over the last centuries.



C. Timeline of natural disasters (21st century)

Within the first 18 years of the 21st century several natural disasters have affected Ethiopia: 3 droutghts (2 devastating ones), 16 episodes of flooding and/or landslides, 2 earthquakes, 2 insects infestations (locust and armyworm).



D. Sustained weather pattern changes and environmental issues

Ethiopia is not a significant contributor of CO2 and has therefore been rather unfortunate in being one of the countries significantly impacted by worldwide climate changes.

The current and sustained changes in the Ethiopian Climate have led to wide ranging effects on the environment (terrestrial ecosystems and biodiversity) and on socio-economic sectors (water resources, agriculture, food security and human health).

Historical data of temperature and precipitation from 1951 to 2005 for selected stations in Ethiopia showed year-to-year variation of rainfall for the period with both dry and wet years. These changes in the physical environment have an adverse effect on agricultural production, environment and the overall livelihood. Particularly, the Central Rift Valley is environmentally very vulnerable to sustained weather pattern changes .

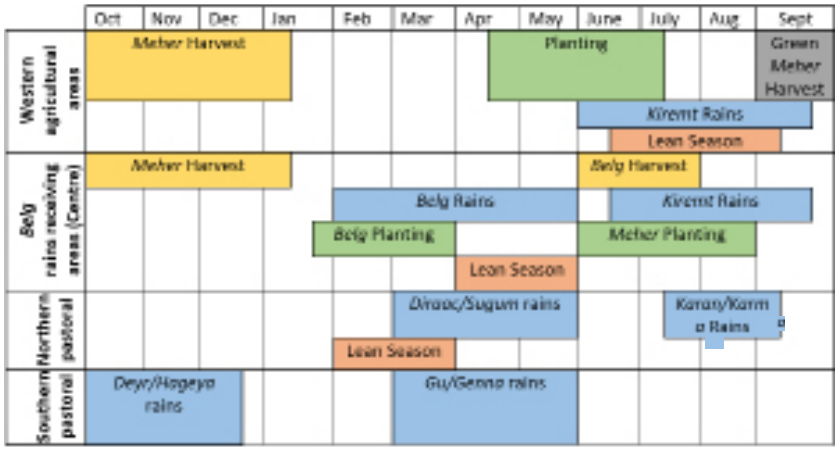
Causes of changes in the weather patterns in the country are very diverse. Deforestation and forest degradation, land use change and agriculture are considered as major drivers. Transport, power, industry and building sector are minor ones.

In addition, the Indian Ocean 'Dipole' effect can disrupt the weather patterns in Ethiopia, causing excessive drought or rainfall.

E. Dams for hydropower and water retention/irrigation

Over the last couple of decades, the Ethiopian Government has worked with the World Bank and foreign investors to implement the construction of a massive number of dams and reservoirs. These are being created for a multitude of reasons, including hydro-power and controlling the rainwater runoff for irrigation of large industrial cotton and sugar cane plantations.

Unfortunately, the creation of these dams, and the loss of prime grazing ground has had a detrimental effect on the movement of the traditional pastoralist population. Many of whom are now having to opt for employment in the industrial farmlands in order to survive, as their usual access to rich pastures for their herds is no longer available.



Calendar for rains and agricultural seasons

Omo river, Gibe III Dam in Wolayita, SNNPR.
CC - Mimi Abebayehu

2.4. Refugees, Internally displaced persons (IDPs) and returnees

Sources: UNHCR, IOM, IDMC, Shelter Cluster Ethiopia

A. Refugees

Ethiopia generated large numbers of refugees and migrants until the early 1990s, but it has since become the second largest refugee-hosting country on the continent. In August 2018, it hosted over 905,000 refugees mainly from South Sudan, Eritrea, Sudan and Somalia. The refugee population continues to rise mainly from South Sudan and Eritrea. More than 400,000 refugees from South Sudan have crossed into Ethiopia's Gambela region since the war broke out in December 2013.

Most refugees are accommodated in 26 camps with limited services and opportunities, and depend largely on international humanitarian assistance, in close coordination with the Ethiopian Authorities.

Transitional shelters for somali refugees. CC UNICEF

B. Internally displaced persons

The confluence of rapid urban expansion, ongoing conflicts within Ethiopia and in the region, and high levels of vulnerability due to the frequent drougths and seasonal floods continue to generate numerous new displacements every year in the country and migratios of rural populations towards urban centers.

The number of internally displaced persons had increased to over 2.5 million by August 2018. Close to a million people were displaced by ethnic conflict in Gedeo and Guji in southern Ethiopia, while many were displaced because of continued conflict along the Somali Regional State border with Oromia. Flooding has also added to the internal displacement, and communities that have been affected by droughts are still partly displaced in eastern parts of the country.

TO FIND OUT MORE

- Shelter cluster Ethiopia
  https://www.sheltercluster.org/response/ethiopia
- Humanitarian response
  https://www.humanitarianresponse.info/operations/ethiopia
- UN OCHA
  https://www.unocha.org/ethiopia
- UNHCR
  http://www.unhcr.org/ethiopia.html
- IOM
  https://ethiopia.iom.int/

C. Returnees

On 29th March 2017, the Government of the Kingdom of Saudi Arabia (GoKSA) issued a *Note Verbale* stating that all irregular migrants in KSA should voluntarily leave within the amnesty period. The GoKSA extended the amnesty period four times, with the last ending in November 2017. The Government of Ethiopia estimated that 500,000 Ethiopians will be affected by the decree

In October 2018, IOM estimated that there were already about 200,000 returnees from the Kingdom of Saudi Arabia.

D. Eritrea Peace Agreement

In April 2018, Ethiopia appointed a new Prime Minister; His Excellency, Prime Minister Abiy Ahmed.

One of his first major acts, (July 2018) was to hold a summit with the Eritrean President Isaias Afwerki in which they signed a peace agreement, ending a 20-years of hostility between the two countries.

As a result of this agreement, the border area is now significantly more secure and there is a resumption of movements between the two countries, meaning that in many cases, long separated families have now been reunited, flights have resumed and transport/trading routes and links between the two countries are beginning to be improved (https://www.aljazeera.com/news/2018/07/ethiopia-eritrea-sign-declaration-peace-friendship-180709101214478.html).

Tsore Refugee camp. Homosha woreda. Benishangul Gumuz. CC UNICEF Ethiopia2018- Mulugeta Ayene

3. Analysis of housing

3.1. Household composition

Source: Central Statistical Agency (CSA) Ethiopia

The variety of sociocultural contexts has led to a number of differences in the composition of households. As a result, only a field survey makes it possible to to precisely take stock of the realities in a given place. That said, some general data exists for the entire country.

Men head the majority of Ethiopian households (75%). The average household size in Ethiopia is 4.6 persons. Urban households (3.5 persons) are smaller than rural households (4.9 persons). The average household size remained the same between 2011 and 2016 (4.6 persons in both surveys). The notable exception being Somali region, where households sizes are average over 6 persons. This is connected to less access to medical facilities and lower educational standards than in other areas of the country, but also to polygamy (Islam is the main religion) and to the fact that traditionally large families are considered a sign of prosperity.

The age distribution of the household population has not changed since 2011. Children under age 15 account for 47% of the population and individuals age 65 and older account for 4%.

The wealthiest households are concentrated in urban areas (89%). In contrast, approximately half of the rural population (46%) falls in the lowest two wealth quintiles. There are regional variations in wealth. The wealthiest households are concentrated in Addis Ababa (100%) and the poorest households in the Afar Region (74%).

To find out more

On section 3

FAO

http://www.fao.org/countryprofiles/index/en/?iso3=ETH

Central Statistical Agency (CSA) [Ethiopia]

Ethiopia Demographic and Health Survey 2016

https://dhsprogram.com/pubs/pdf/FR328/FR328.pdf

UN-Habitat, 2010

Condominium housing in Ethiopia: the integrated housing development programme.

https://unhabitat.org/books/condominium-housing-in-ethiopia/

3.2. Inhabitants' ability to invest in housing

Sources: FAO, UNDP, World Bank, UN-HABITAT (2010), GIORGHIS (2015), BRIDONNEAU et al (2012), Ministry of Urban Development and Construction (2012) and The Economist (2017), Habitat for Humanity

A. Global overview of households economic situation

In 2015, 26.7% of the population lived with 1.90 US dollars (16.8 Ethiopian birr) per day per capita or less. 34.7% people lived with more than 1.90 US dollars and less than 3.20 US dollars (28.3 Ethiopian birr) per day per capita. 23.3% of the population lived with more than 3.20 US dollars and less than 5.5 US dollars (48.7 Ethiopian birr) per day per capita. Only 15.3% of the population lived with more than 5.5 US dollars per day per capita.

In 2017, with a Human Development Index (HDI) of 0.463 (Low human development), the country ranked 173th out of the 189 countries measured. Even though the HDI is still considered as Low, the country has grown from 0.283 in 2000 to the present 0.463, which is one of the most important absolute gains in this period of time.

Inequalities are growing in Ethiopia since 2004. The Gini index was 29.80 by then (being 0 total equality and 100 total inequality). In 2016, the Gini index in the country had risen to 39.10.

B. Housing sector in Ethiopia

According to UN-HABITAT (2008), 80 percent of the housing stock needed either upgrading or replacement in 2008.

Land

- The land is of public ownership. The State controls the lease of urban land (Proclamation No. 172/2002). The land is provided free of lease charge for low-cost housing developments (Proclamation No. 272/2003).

Informal sector

- A substantial part of the construction work takes place in the informal sector. About 80% of the population lives in the rural areas. Their buildings and other small infrastructure facilities are constructed by the informal sector. This sector comprises of unregulated and unprotected individuals engaged in economic activities that include the supply of labour, materials and building components to the formal construction sector directly in response to needs of clients. It also includes works carried out by individuals and groups on a self-help basis.
- Informal housing becomes more and more common in cities as urbanisation rates rise, scarcity of housing widens and high prices of formal housing go up. In Addis Ababa it accounted for 34.1 per cent of total housing supply between 1996 and 2003.

Private housing sector

- The private formal housing sector is not sufficiently engaged to meet the demand. It is mostly involved in the high-income sector.
- Foreign contractors and consultants account for major proportions of the market share in road sector (about 58% in terms of value) but nearly 100% is executed by local contractors as far as building is concerned.
- Since the 1970s, housing cooperatives have provided home ownership in a quite small scale (e.g. 40,539 units from 1975 to 1992) and with limited impact for low-income population. The Government has supported cooperatives with measures from free allocation of land to materials subsidy (up to 60 per cent in the past). Self-management is common in this process.
- NGOs have had very little involvement in the housing sector, and are most engaged in upgrading of sanitation and infrastructure.

Low-cost public rental housing

- The low-cost government owned rental housing system established during the socialist period (1974-1991) continues to be the dominant low-income housing strategy. This modality invlolves two main organisations: the Agency for the Administration of Rental Houses (Government-owned rental units) and the Kebele (neighbourhood level) Administration units (Kebele Housing rental units).

Condominiums under construction in Addis Ababa. © V. Murtagh

Low-cost public housing for private ownership

- The Integrated Housing Development Programme (IHDP) is a public housing programme promoting private ownership for low-and middle-income households. The programme started in 2004 with projects on brown-field sites or slum areas whose residents are re-housed (Proclamation No. 455/2005 establishes amounts of compensation for displacement and land expropriation, a notice period of 90 days as well as the need to provide rental or ownership options at fair prices in the same or nearby location). The type of housing is the condominium: multi-storied buildings for several households where communal areas are jointly owned and managed. From 2004 to 2016 the government built some 250,000 housing units.
- Beneficiaries make a down payment to the government ranging from 10% to 40% of the price of the flat, which is set by the state. Then pay off the rest over a 10 to 20-year period. A state-owned bank holds the mortgage with generous terms. The prices charged by the government were too low so it has had to hike them.
- This system has improved the speed of construction using pre-cast concrete elements and facilitated the development of small and medium enterprises to produce construction elements.
- Unfortunately, the poorest are not benefiting from this experience as they do not have the ability to afford the initial down-payment nor to pay the monthly service payments. Moreover, many poor families opt to rent out the flats and move elsewhere.

C. Notions of costs for low-cost housing

(1USD = 27.95 Ethiopian Birr-September 2018)

It remains very common in Ethiopia to build its house in a self help system with also possibility to mobilise community help, more specifically in rural areas.

Public low-cost rent

The houses administered by the Agency for the Administration of Rental Houses were rented for an average of 100 birr (ETB) per month (3.58 USD) in 2015.

Low-cost public programme for ownership

The Government's Integrated Housing Development Programme (IHDP) has managed to reduce construction costs. In 2010, these housing units costed around birr 1,000 (35.8 USD) per m². On the free market they would cost birr 2,500 (89.4 USD) per m².

Unit type	Floor area (m²)	Monthly income in ETB (USD)	Average price (m2) in ETB (USD)	Selling price in ETB (USD)
Studio	<20	300 (23)	800 (62)	16,000 (1,230)
1 Bedroom	20-30	600 (46)	900 (69)	18-27,000 (1,380-2,070)
2 Bedroom	30-45	1,200 (92)	1,100 (85)	33-50,000 (2,530-16,660)
3 bedroom	>45	1,800 (138)	1,200 (92)	>50,000 (16,660)

IHDP types of units, beneficiary income level and selling price. ©UN-HABITAT (2010)

D. Available budget for housing and availability of loans

It is difficult to estimate the available household budget for housing. However, figures show that the average expenditure in housing is 10% of total consumption expenditure, reaching 15% in urban areas.

According to those figures, an average family of 4.6 persons earning 1.9 USD per capita would spend 319 USD per year (10% of 3190 USD annual income) and in urban areas up to 479 USD per year on their accommodation or housing. For the rural family living in a situation of poverty by income, it would take about 4 years to afford the above mentioned (3.2 C) Studio (surface less than 20 m²) and more than 52 years to afford the 3 bedrooms one (in a hypothetical situation where prices remain constant).

A large majority of Ethiopians cannot afford to buy a formal house (either from the private or the public sectors).

The Government owned Construction and Business Bank (CBB) has long time been the only bank to offer housing construction loans and mortgages for housing. The lack of access to housing finance is a challenge for low-income Ethiopians. From 1991, subsidized interest rates were removed and rates increased from 4.5 per cent for cooperatives and 7.5 per cent for individuals to 16 per cent for both. The low level of savings coupled with the increase of interest rates translate into little capacity of low-income families to own a minimum standard house.

In recent years, there has been largescale overseas investment in housing, particularly in the larger urban areas.

3.3. Tenure security issues

Sources: FAO, UN-HABITAT (2010), ETHIOPIA (1994, 2005, 2011), BRIDONNEAU et al (2012), IFRC (2013), Central Statistical Agency (CSA) Ethiopia

A. Legislation and administration

Constitution of the Federal Democratic Republic of Ethiopia (1994)

Article 40 of the Constitution states that:

- Every citizen has the right to the ownership of private property. Unless prescribed otherwise by law on account of public interest, this right shall include the right to acquire, to use and, in a manner compatible with the rights of other citizens, to dispose of such property by sale or bequest or to transfer it otherwise.
- The right to ownership of rural and urban land, as well as of all natural resources, is exclusively vested in the State and in the peoples of Ethiopia. Land is a common property of the Nations, Nationalities and Peoples of Ethiopia and shall not be subject to sale or to other means of exchange.
- Without prejudice to the right of Ethiopian Nations, Nationalities, and Peoples to the ownership of land, government shall ensure the right of private investors to the use of land on the basis of payment arrangements established by law.

Land Administration and Land Use Proclamation No. 456/2005

- Regional states have autonomy in matters of land without contradicting of the Constitution and the national laws.
- The Rural land use right of peasant farmers, semi-pastoralists and pastoralists shall have no time limit. The duration of rural land use right of other holders shall be determined by the rural land administration laws of regions.
- Women's rights are considered and customary law is not supported. Nevertheless, big farmers and men are usually allocated larger plots than women and smallholders.
- Any holder of rural land shall be given holding certificate to be prepared by the competent authority and that indicates size of the land, land use type and cover, level of fertility and borders, as well as the obligation and right of the holder.

Urban Land Lease Holding Proclamation No. 721/2011

- Urban land may only be held on a leasehold basis with maximum lease periods varying depending on the use.

B. Tenure types and landlessness

Rural land tenure

Proclamation 456/2005 allows for three types of rural land tenure:

- private holdings,
- communal holdings,
- government holdings.

It also states that:

- Peasants have right to obtain land without payment and the protection against eviction from their possession. They also have to lease the land and, while the right remains in effect, to legate it to family members.
- Pastoralists have the right to free land for grazing and cultivation as well as the right not to be displaced from their own lands.
- Holding certificates are issued to the land-holders. The person is using the land that ultimately belongs to the State.

Land is allocated regarding the number of household members. Factors as quality of land, size of family workforce and ownership of farm assets have less weight.

Informal markets exist where officiously land is bought and sold without title. Land is also rented and sharecropping practices are common in rural areas.

Urban land tenure

Proclamation 721/2011 states that urban land may only be held on a leasehold basis with maximum lease periods varying depending on the use. The lease periods can be transferred and renewed.

- Lease for residential housing for a 99 year period (or government offices, charitable organizations, research and study).
- Lease for education, health, culture and sports for a 99 year period (90 in Addis Ababa).
- Lease for industry for an 80 year period (70 in Addis Ababa).
- Lease for commerce and all 'other' uses for a 70 year period (60 in Addis Ababa).

Housing tenure

Rental housing is the dominant tenure mode. Private ownership levels are low (e.g. in 2010 30% of owned houses in Addis Ababa).

C. Gender issues

Gender inequality

The Revised Family Code (2000) recognises equality between women and men.

However, in 2014 Ethiopia was ranked among the countries with high levels of gender discrimination in the SIGI Index (Social Institutions and Gender Index) by the OECD (ranked 73 out of 108 countries studied). This index takes into account discriminatory Family code data, restricted physical integrity values, son bias, restricted resources and assets and restricted civil liberties for women. There is available data on women's access to land, credit, non-land property, and inheritance practices.

Moreover, in 2017 according to the Human Development Index by UNDP it is among the group of countries with very low equality in HDI achievements between women and men (group 5: absolute deviation of more than 10 percent).

A data not relied to tenure issues but important to understand the situation of women is that in 2016, 65% of women age 15-49 are circumcised. The prevalence of female circumcision is highest in Somali (99%) and lowest in Tigray (23%).

In October 2018, the Government of Ethiopia appointed their first female President. In addition, the Prime Minister adjusted his cabinet to ensure that at least 50% of the Ministers were women, including the first female Defence Minister and Minister for Peace.

Property/use rights

Both women and men have use rights to land. The Family Code recognises the equal rights of a married woman to the possession and administration of personal property. It also allows for joint ownership of land and property in marriage. Consent of both spouses is required for property transfers.

Despite the legal frame, rural women do not have effective access to land. In certain areas, such as the south of the country, land reforms have not yet been fully endorsed because of traditional patriarchal practices or beliefs centred on male domination, where women's access to land is not recognised.

Tenure issues are intensified by gender disparities. In 2005, 12 753 000 women were active in agriculture (45% of the agricultural labour force and 77% of all economically active women), but only 19.2% of agricultural holders are women.

In 2010, 50% of the women reported land ownership (sole or joint): agricultural or residential. Nevertheless, just over 1/3 of women who own a house report that there is a title for the house which includes their name. Moreover, 40% of women own land but only one in two of the women who own land say there is a title or deed in their name for the land.

Inheritance

The Civil Code (1960) declare that the children of the deceased are the first to inherit. Each descendant receives equal shares of the succession. "Sex, age and nationality of the heir shall not affect in any way the ascertainment of rights to succession".

D. Public measures to counter landlessness

The land is of public ownership. The land is provided free of lease charge for families. Farm size ranges from zero-landless to 10 ha, although the latter are very few in number and usually are found in the less densely populated regions of Somali and Afar. Despite the distributive nature of current land tenure systems, the mean size of farm holdings is about 1.02 ha per household.

Market in Jinka (SNNPR). CC David Stanley

Sources: Government of Ethiopia, IFRC (2013), UN-HABITAT (2008)

3.4. Organisations involved in shelter, housing and disaster preparedness

National authorities

National Disaster Risk Management Commission

Its mandate is to manage early warning and response measures to natural and manmade disasters. The head of NDRMC is the current Co-Chair of the Shelter Cluster Coordination Team.

Ministry of Agriculture and natural resources. http://www.moa.gov.et/

- Disaster Prevention and Preparedness Commission.

  Its objectives are to prevent disasters by tackling their root causes (i.e Prevention); to build in advance, the capacity to reduce the impact of disasters (i.e. Preparedness); and to ensure the timely arrival of necessary assistance to victims (i.e. Emergency Response).

Administration for Refugee & Returnee Affairs (ARRA). https://arra.et/

Its mandate is to receive and assist refugees. It is the government's counterpart of UNHCR leading the refugee management operations in Ethiopia, that hosts more than 900,000 refugees in 27 refugee camps spread across six regions.

Ministry of Urban Development and Housing. http://www.mudho.gov.et

It is responsible for urban building and construction matters at the federal level, although some of its powers are delegated to other bodies such as the Ethiopian Roads Authority and the Agency for Government House

- Agency for Government Houses. http://www.agh.gov.et/index.php/am

  It is a government appointed agency for the management and administration of houses under the ownership of the government.
- Regional Agencies.

At the regional level, government Bureaus implement policy, with broadly the same remits from state to state. Building officers deal with the ground-level enforcement and implementation, and each urban administration must have a building officer to deal with the assessment of plans.

Ministry of Construction. http://www.moc.gov.et/

It aims to contribute to the country's development by helping develop a standardised and competent construction industry via mobilisation of stakeholders of the sector.

Ministry of Water, Irrigation and Electricity. http://mowie.gov.et/

Play a role in the development of Ethiopia through development and management of its water and energy resources in a sustainable manner, through provision of quality and equitable supplies in the entire country and by contributing = to the food security and foreign currency earning.

International institutions in Ethiopia

- Ethiopia Shelter Cluster. https://www.sheltercluster.org/response/ethiopia
- UNHCR. http://www.unhcr.org/ethiopia.html
- IOM. http://www.iomethiopia.org/
- Ethiopian Red Cross Society. http://www.redcrosseth.org/
- UNDP Ethiopia. http://www.et.undp.org/
- UN-Habitat. https://unhabitat.org/ethiopia/

Civil society

Urban Dweller Associations (UDAs). They are responsible for housing and economic activity within their zones. There are up to three levels of UDAs in each city.

Universities & training centres

- Ethiopian Institute of Architecture, Building Construction and City Development, Addis Ababa University. http://www.eiabc.edu.et/
- Department of Architecture and Urban Planning, Unity University. http://www.uu.edu.et/bsc-in-architecture-and-urban-planning
- Selam David Röschli Technical & Vocational College. http://www.selamchildrenvillage.org/TVET

Main agencies and NGOs with shelter actions

For a full and updated list of active Shelter agencies, see https://www.sheltercluster.org/response/ethiopia

- Care Ethiopia. https://www.care.org/country/ethiopia
- Norwegian Refugee Council. https://www.nrc.no/countries/africa/ethiopia/
- Danish Refugee Council. https://drc.ngo/where-we-work/east-africa/ethiopia
- ShelterBox. https://www.shelterboxusa.org/home-page/news/ethiopia/
- Catholic Relief Services (CRS). https://www.crs.org/our-work-overseas/where-we-work/ethiopia
- Islamic Relief. http://www.islamic-relief.org/category/where-we-work/ethiopia/
- PARDA (Pastrol Relief and Development Association)
- CONCERN. https://www.concern.net/where-we-work/africa/ethiopia
- ZOA. https://www.zoa-international.com/files/ethiopia/
- Save the Children. https://ethiopia.savethechildren.net/
- HelpAge. http://www.helpage.org/where-we-work/africa/ethiopia/
- CST (CAFOD, SCIAF, Trocaire). https://www.trocaire.org/whatwedo/wherewework/ethiopia
- RESCUE. https://www.rescue.org/country/ethiopia
- GOAL. https://www.goalglobal.org/Ethiopia
- Africa Humanitarian Action (AHA). http://africahumanitarian.org/
- Development Expertise Center (DEC). http://www.decethiopia.org/
- Action for the Needy in Ethiopia. http://www.ane-ethiopia.org/
- Habitat for Humanity. http://www.habitatethiopia.org/
- World Vision. https://www.wvi.org/ethiopia

New constructions in Kazanches, Addis Ababa. © V. Murtagh

3.5. Preparedness and post-disaster strategies

Sources: IFRC (2013), Preventionweb

Reduction in vulnerability is made possible through the resilient adaptive behaviour of communities as highlighted throughout this document, but is also the result of national leaded strategies, tools and media (risk awareness, building codes, increased incomes, etc.), which should advantageously be developped towards encouraging and facilitating existing resilience capacities.

These public strategies are essential to reduce vulnerability sustainably. According to the IFRC (2013) the current legal framework in Ethiopia contains many positive aspects regarding Preparedness and Post-Disaster strategies:

To find out more

- International Federation of Red Cross and Red Crescent Societies (2013)
  Ethiopia: country case study report. How Law and Regulation Supports DRR.
  http://drr-law.org/resources/Ethiopia-Case-Study.pdf

- **National Policy and Strategy on Disaster Risk Management** (NPSDRM): it was aproved in 2013 and emphasises on the delegation of powers to regional and local levels, as well as on community involvement. It is not only drought focused and aims to improve information on community vulnerability and flood preparedness. It includes general directions and major implementation strategies, including on a decentralized DRM system, early warning and risk assessment, information management, capacity building, and on integration of disaster risk reduction into development plans.
- **Early Warning System and Risk Mapping**: Ethiopia has one of the most sophisticated EWS in Africa, with an extensive reporting network, together with the use of relatively sophisticated technology, feeding into the Disasters Risk Management and Food Security Sector's (DRMFSS) Early Warning and Response Directorate. It involves local communities and ensures that their input is factored into the system and the risk profiles created.
- **Building Codes**: the existence and implementation of a series of detailed building codes is a clear example of a good practice. Notably, Building Code EBCS-8 deals specifically with the design of structures for earthquake resistance.
- **Local community 'by-laws'**: *kebele* level committees are involved in designing and issuing local 'by-laws' which cover different areas (management of water resources, pastures and fields). This system seems to work well in practice, and not only raises awareness of legal issues in communities but also involves the communities themselves in the design of locally appropriate legislation. They could also be involved in Preparedness and Post-disaster strategies.
- **Environmental Impact Assessments**: the extent of legal regulation of EIA in Ethiopia can be considered a good practice. Environmental protection legislation encourages the involvement of communities, and seeks to involve local communities in all phases of environmental and resource development and management.
- **Community participation reflected in legislation and policy**: important legislation prioritising community involvement and participation, both as important steps in legal processes (e.g. EIA) or as means of resource management (e.g. forest and water resource management).
- **Proclamation 197/2000 on Water resources management**: it contains several provisions of relevance to DRR. The Ministry of Water and Energy (in collaboration with appropriate public bodies) delimits the boundaries of the banks of certain water bodies, and prohibit the clearing of trees/vegetation and the construction of residential houses within the delimited banks.

3.6. Construction sector

Sources: Ministry of Urban Development and Construction (2012), Ethiopia (2009), lawethiopia.com, UN-HABITAT (2010), IFRC (2013), metropolitanaddis.com, World Bank, abyssiniagateway.net, National Meteorology Agency, Central Statistical Agency (CSA) Ethiopia

A. General description

The infrastructure and construction sector is growing in Ethiopia. According to the Ministry of Urban Development and Construction (2012), it registered a remarkable growth from 2001 to 2012 when its contribution to the GDP at constant price increased from Birr 2,853,336,000 to Birr 8,185,747,000 at an average annual growth rate of 12.43%. The percentage share of the construction sector to GDP had increased from 4.5% in 2000/01 to 5.8% by 2009/10. The construction sector includes four main branches (UN-HABITAT, 2010):

Rectangular houses with CGI sheet roofs and round houses with thatched roofs, both with *chikka* walls near Langano lake, Oromia. CC- Ninara

- Civil engineering.
- Professional services: architects, engineers (mechanical, sanitary) and quantity surveyors.
- Building and residential development (construction firms). Companies are classified according to size, expertise and financial capability and must be registered with the Ministry of Urban Development and Housing and licensed. There is little specialisation in contractors work.
- Informal self-building sector. It is not registered but it supplies materials and labour at a very large scale, employing a large number of people. There is little cross-collaboration between the professional sector and the informal sector.

B. Regulations in the construction sector

The Constitution is the supreme law of Ethiopia, which prevails over all other legislation. Proclamations, laws established by the House of Peoples' Representatives, are second in hierarchy. Third are Regulations, enacted by the Council of Ministers. Last are the Directives, legislated by individual government departments in order to implement Proclamations and Regulations. There are several laws concerning construction. The most important ones are:

Ethiopian Building Proclamation 624/2009: It applies to urban centers that have 10,000 or more dwellers; smaller urban centers once the decision of application is made by the Regional State concerned; public buildings, or buildings which could be used for industrial or commercial scale agricultural occupancy or real-estate outside of urban centers.

All residential construction in this areas must adhere to comprehensive building codes and standards governed by local and state laws. There are three categories of buildings:

- Category 'A': one storey buildings with a span of seven meters or any dwelling house not exceeding two storeys. For category 'A', construction permits are issued in 5 working days (except for real estate developments).
- Category 'B': buildings with a span of more than 7 meters or more storeys not covered in category 'C'. For category 'B' (except for real estate developments) or real estate developments of category 'A', construction permits take 7 working days.
- Category 'C': any public building, factory or workshop building or any building with a height of more than 12 meters. For this category and for real estate developments of category 'B', the construction permits are delivered in 21 working days.

Application to carry out construction permit to the urban administration or designed organ:

- The application shall be made on an official application form prepared by the urban administration and shall consist of a design and report according to the category of building in question.
- It shall be accompanied with a reference to main roads and names of prominent places.
- It shall include a proof of possession rights to the land or property on which the construction will take place.
- The documents shall be sufficiently complete to determine compliance with this Proclamation and other laws.

Building Codes: There are 15 building codes for Ethiopia, although not all are in force. Building Code EBCS-8 deals specifically with the design of structures for earthquake resistance. These codes provide a strong legal framework for safe building.

No legislation covering private housing outside urban centres: No legislation exists for the construction of private housing outside of urban centres. Nevertheless, according to IFRC (2013) usually no building can be constructed in a village without permission from the local *kebele* administration and, if necessary, the *woreda* administration.

Building Regulation no. 243/2011 and Building Directives

C. Seasonality effect

Based on temperature and rainfall activity there are three seasons known as *Bega* (October to January), *Belg* (February to May) and *Kiremt* (June to September). During *Bega* dry and cold weather prevails over much of the country. *Belg* is the short rainy season for northeast, east, central and southern highland. *Belg* is the main rainy season for south and southeast portions. *Kiremt* is the main rainy season except for the south and southeast of the country. The majority of construction in the rural areas tends to occur after harvest time, when households have spare cash and time to improve on their living conditions. The cost of materials also tends to rise at this time, due to supply and demand issues.

On the other hand, wooden / bamboo / CGI constructions are quite feasible in the rainy season. That said, it is necessary to enquire about local particularities on construction seasonality.

D. Construction process

As indicated in 3.2. informal shanty style housing is very common in cities (34.1% of total housing supply between 1996 and 2003 in Addis Ababa). Also, most of the constructions of the population living in rural areas (about 80% of the total population in Ethiopia) are built by the informal sector, with limited support from local carpenters who tend to be employed on a casual basis.

According to the Ministry of Urban Development and Construction (2012), the construction industry is male dominated. Efforts have been made by public institutions to involve women in activities like road works, but the level of involvement is still minimal. The prevalent lack of technical skills, tends to confine them to manual unskilled or occasional semi-skilled jobs, such as carrying materials and tying rebar. In the informal rural construction sector, Ethiopian women in particular are usually the most skilled labourers in earth (*chikka*) plastering.

E. Units of measurement

In rural Ethiopia, units of measurements are linked to different parts of the human anatomy, to traditional agricultural issues, etc. These units may vary from one region to another and are sometimes used in construction. It is necessary to make sure about what units are used in the specific zone where a project takes place. For instance, *timad* is one of the most common non-standard units, traditionally defined as the amount of land a pair of oxen can plough in one day. It varies greatly from one region to another.

F. Availability of materials and construction skills

Sources: MENGITSU (2013), HJORT & SENDABO (2011), UN-HABITAT (2010), GIORGHIS (2015), Central Statistical Agency (CSA) Ethiopia

MATERIALS

Local materials shaped the country's built heritage and still shape most of rural houses. Nowadays they continue to be used and industrial building materials are also present, being generally expensive and low quality comparing to neighbouring countries. The government is still active in retailing construction materials and some subsidies remain in place. Nevertheless, material production and supply is moving to market based economy with market prices. The cost of construction materials in 2011 was a high proportion of the total construction cost, around 70 per cent in the formal sector. Raw materials (bamboo, wood, leaves, straw) are not anymore always available close to the communities and they are also becoming costly to purchase.

Wood is a very important material in almost all regions of Ethiopia. It is used as structure, but also making part of walls and for furniture. The supply of wood for building is running short and good quality timber (such as *Thid* and *Kosso)* is becoming scarce. However, Eucalyptus is now farmed and harvested in many locations, with no restrictions, other than recommendations that the trees be spaced apart, as they can have a detrimental effect on the environment, as the leaves are toxic to animals and do not compost well. Timber production varies from region to region, but many Ethiopian households are involved in the production of Eucalyptus. There are many industrial plantations as well across the country. Eucalyptus is also frequently used as scaffolding for large multi-story constructions, as western style metal scaffold is rare, even in Addis Ababa.

Bamboo is very much used in construction, mostly in the south and west portions of the country. Bamboo is used in structural elements, for matting and wall cladding or for furniture. Bamboo is vulnerable to attack by insects such as borers and termites, and by rot fungus, so treatment is required to improve durability (soaked in a body of water for some weeks, soaked for months in mud, smoked on a fire, painted with bitumen), as the high sugar content of bamboo makes it a desirable food source for insects, so treatment that removes or washes out the sugars, can reduce insect attack.

Earth is very important as it makes part of the walls of many vernacular buildings all over the country. Locally, wattle and daub is called *chikka*. Also, earth is used for plastering and in stone masonry mortars. Most highly prized for plastering of huts, is the soil from termite mounds, as it is easy to work and lacks large stones. Flat earthen roofs are also found (e.g. Tigray), where timber joists are placed across the supporting walls, with gaps between packed with natural materials, such as grass and leaves, then mud is packed in and smoothed down to make a reasonably water resistant cover. Compacted earth floors are also very common.

The two most commonly used materials for flooring in Ethiopia are earth or sand (48%) and dung (33%). Earth or sand, vinyl or asphalt strips, and carpet are most often used in urban households (23% each), whereas households in rural areas primarily use earth or sand (55%) and dung (39%). Skim concrete floors are common in middle-income households. In the more expensive urban properties, ceramic tiles, parquet and wooden floors are more common, with high end properties using marble and slate.

Stone masonry is very common in the highlands (notably in Tigray and Amhara regions). In other places, foundations to protect the lowest parts of the walls are built with stone when available.

Gypsum has been traditionally produced in Ethiopia. Its quality varies greatly.

Thatch is used for roofing all around the country with different vegetal species being used (e.g. different kinds of grass, papyrus, cereal straw, etc.). Straw is used for many different purposes: roofing, walls protection, as part of mixtures for wattle and daub or plastering. Fibre from different species of plants is used for manufacturing mats for nomads' huts. Many rural women are highly skilled at basket and cloth weaving, so patterns and designs for mats and screens can be quite intricate and colourful.

CGI sheets are becoming more frequently used for roofing and sometimes for walls. They are usually too costly for most of the rural poor. However, investment in a CGI roof can still be interesting as the sheets can easily be sold in times of dire need (provided that they are not deteriorated due to weathering and fixing holes.). But the lower quality sheets which are affordable to low-income groups corrode and develop rust quite rapidly. This deterioration impacts thermal comfort and safety issues, and induces demoralising effects on their owners. Villages on the main roads are easily accessible for deliveries of CGI sheets, but the more remote households may not have access to suitable transport for delivery of CGI.

Rainwater harvesting has been used for some time in public buildings, such as schools. Initially, the guttering and pipework were made of crudely shaped metal sheeting. Plastic guttering and pipework were only introduced in around 2009, so it may be difficult to source plastic waste-pipe goods and materials in the more rural areas.

In the last decade a Proclamation was signed to allow the importation of cement as the lack of locally available cement caused major construction delays. Concrete is becoming more popular in construction, particularly in urban areas, with concrete ring-beam designed properties being most common. Cement and steel are available in large and medium cities throughout the country. However, concrete is usually mixed by hand, even with high level construction, so quality of the mix and compaction may vary greatly. Fired bricks and cement blocks are generally used for the curtain walls of the ring beam constructions, with cement render applied at a later stage.

CONSTRUCTION SKILLS

Unskilled labour is spread in urban areas. Severe shortages exist in skilled manual, technical and managerial services in construction. There is a need for training of unskilled labour to improve the quality of housing and production. Skilled thatchers become harder to find.

G. Future predictions for pressure on building materials

The projected increase in per capita income is expected to alter the mix of housing types with more and more families being able to afford a house built with industrial materials. Therefore it is predicted that the demand for bricks and concrete will increase dramatically. This may alleviate the deforestation issue (apart from fired bricks being burnt in traditional ovens), but will exacerbate the river bank erosion and sand mining impacts, as well as global environment impact and so climate change.

H. Commonly used materials: impacts, benefits and better practices

MATERIAL	IMPACTS	BENEFITS	BETTER PRACTICES
TIMBER	• Extraction can cause forest destruction, landslides, land degradation, and habitat destruction and can increase flood risk, flash flooding and further droughts and a downward spiral of increased hardship. • In protected areas, gangs are reported to illegally fell trees for great profit, while influential locals also violate laws to collect firewood. • Tree production is not engaged in most refugee hosting areas with wood instead being sourced from natural forest and bushland. The absence of tree production - encompassing the supporting functions of input supply, research, knowledge and skills- means increased pressure on natural assets. • During times of famine or financial hardship, households often harvest local wood for selling as charcoal. This has had great impact on the environment. • Transport can further damage forests and rural roads. • Where processing takes place, poorly managed mills cause solid-waste pollution, noise and air pollution. • Using toxic chemicals for treatment causes environmental and health hazards. • Attempts to control illegal logging have been known to cause conflicts with local forest communities.	• A renewable resource, if well managed. • Encourages community self-reliance as it makes self-building possible. Wood reduces the economic dependence on the construction materials market, preventing indebtedness. It may contribute to local economy, through livelihoods for local communities. • Community forestry projects can reduce human/ wildlife conflict and provide sustainable livelihoods to neighbouring communities. • Environmental Policy in Ethiopia dictates that farmers must have approval from a government forester to cut down their trees. • Forestry has recently emerged as a priority for the Government of Ethiopia from both a commercial and environmental standpoint. Mitigating the impacts of climate change is particularly important in areas such as Gambella where heavy rains cause flooding and topsoil erosion, which deforestation can only exacerbate. • Thinnings from new established forests can be utilised for firewood within two years with construction timber available within 3-4 years of establishment after an initial investment of species development of 4-5 years.	• Do not overdesign/overspecify where possible, conduct proper structural design and calculate timber needs accordingly. • Minimise cutoffs. • Treat timber properly to ensure its long-term durability. There are certainly several recipes to treat timber that may vary locally depending on the availability of products. • Minimise the use of timber for formwork,prefer reusable modular formwork instead. • Encourage timber reuse (e.g., door and window frames, roof members). • Chemically treated timber cutoffs should be considered hazardous and never be used as firewood.
BAMBOO	• The importance of bamboo as a local resource makes it essential to consider the effects of large scale procurement on regional bamboo stocks and set systems to mitigate potential negative impacts. • Bamboo is commonly a community resource and therefore the voice of the community is important at all stages of bamboo and bamboo products' procurement. • Overharvesting means that greener bamboo is being used while it does not meet the standard of dryness required to extend its longevity. • Poor practices that often occur after a major disaster can devastate crop outputs for many years or in some cases permanently. • Given its invasive nature, bamboo can quickly take over nearby forests.	• The high strength, low cost, rapid growth and high availability of bamboo makes this an ideal resource. • Replenishes rapidly and over-extraction can usually be managed, unless there is massive demand due to larger scale destruction. • Good crop management practices can increase bamboo crop yields by up to 400%. • Minimal impact on natural forests. • It encourages community self-reliance as it makes self-building possible. Bamboo reduces the economic dependence on the construction materials market, preventing indebtedness. It may contribute to local economy, through livelihoods for local communities. • The complex root system of bamboo can be used to stabilise unstable embankments and slopes.	• Bamboo harvested during the rainy season will be of better quality for construction. • Encourage reuse (e.g., door and window frames, roof members). • Never dispose of chemically treated bamboo in streams, wetlands, or coastal areas. • Chemically treated offcuts and waste are hazardous and never be used as firewood. • There are certainly several recipes to treat bamboo that may vary locally depending on the availability of products.
THATCH	• Natural or farmed vegetation (e.g., palm leaves, reed, grasses) is used in thatching. Without proper management, negative impact on forests and natural vegetation may ensue. • Household or small-scale industrial material. • Material needs seasoning. • Many types of thatch are a bi-product of agriculture (Maize stalks, banana leaves etc) so would go to waste if not used for thatching or animal feed. • Has a limited lifespan, due to its susceptibility to rot and insect infestation But, if smoked by indoor fire, this lifespan may increase.	• No requirement for quarried materials or clay. • No firewood or energy requirement. • Can support indigenous livelihoods and valorise local knowledge. • Does not harm the environment since it is biodegradable. • It may contribute to local economy, through livelihoods for local communities.	• Use local knowledge where possible. • Use basic building designs. • Support local livelihoods and industries. • Consider fire risk in planning and design since thatch is combustible.
EARTH	• Earth is a healthy material without toxic compounds (unless contaminated with toxic waste). • Possiblility of quarry problems (availability). • The extraction of earth can be done for the benefit of the development of environmental elements (canals, retention basins, plinths...).	• Used for thousands of years in Ethiopia (wattle-and-daub-*chikka*-, earthen floors, plasters...). These building cultures result from knowledge, know-how and a collective intelligence improved over generations, through trials, failures and successes. • Local material, does not need transportation. • Earth does not create pollution and waste. • Recyclable if it is not stabilised. • Great variety of solutions, which allows for high levels of comfort if combined with knowledge on the bioclimatic conditions of each site. • Effective regulator of humidity in indoor spaces, which increases comfort. • Encourages community self-reliance as it makes self-building possible. Earth reduces the economic dependence on the construction materials market, preventing indebtedness. • Stimulates local activity by favouring production, processing and trade at the local level.	• Make use of local knowledge and local building cultures. • Extracted earth can benefit the creation of canals, retention basins, plinths, etc. • Improve wall resistance with plinths built with stone, concrete or other inert materials. • Avoid the implementation of massive earth walls in high flooding prone areas. • Support local livelihoods/ industries. • Only use in areas where earth can be extracted without causing hazards or environmental impacts. • Improve resilience of the surface by smearing with an earth based plaster on an annual basis. • Soil from termite mounds is naturally sieved by the termites, making it a good material for soil blocks and plastering.

Source: Most of the content has been contextualised for Ethiopia adapted from WWF, 2016: Environmental Guide To Selection Of Common Building Materials.

MATERIAL	IMPACTS	BENEFITS	BETTER PRACTICES
STONE	• Extraction of rock from quarries involves blasting. Quarries cause noise, dust, air pollution, habitat destruction and vibration if not properly managed. • Unplanned rock quarrying can cause landslides and hydro-geological impacts. Without planning and protection blasting leads to occupational hazards. • Transport may affect rural roads. • Extraction may leave large pits which can cause health hazards. • Stone construction in zones that are prone to earthquakes, should be carried out with care. Some Ethiopian constructions in such zones use the 'monkey head' timber cross-banding technique to reduce damage during earthquakes.	• Stone has been used for thousands of years in Ethiopia (highlands). These building cultures result from knowledge, know-how and a collective intelligence improved over generations, through trials, failures and successes. • Local stone does not require transportation and does not create pollution and waste. • Recyclable. • Great variety of solutions, which allows for high levels of comfort if combined with knowledge on the bioclimatic conditions of each site. • Effective regulator of temperature (thermal inertia) in indoor spaces, which increases comfort. • Stone construction may encourage community self-reliance as it makes self-building possible when locally available. It reduces the economic dependence on the construction materials market, preventing indebtedness. • Building with stone can stimulate local activity by favouring production, processing and trade at the local level.	• Make use of local knowledge and local building cultures where possible. • Use good packaging/loading practices when transporting. • Design and construct properly to ensure long-term durability. • Only use in areas where stone can be extracted without causing hazards or environmental impacts. • Use as much as possible earth mortars. Use preferably local lime mortars when earth is not suitable.

CONCRETE	• Requires cement, quarried and mined materials (e.g., sand, rock chips and gravel). River sand or river gravel extraction contribute to river bank erosion and displacement.
	• Often illegally extracted. For example, sediments in rivers are legal public property and cannot be extracted and sold by private companies though this is commonplace.
	• Materials to make concrete such as river sand are often controlled by the "sand mafia" of influential local residents and the most vulnerable are subject to coercion and extortion.
	• Extraction of sand erodes channel beds and river banks, increases channel slopes and leads to changes in channel morphology. This may cause:
	  • undercutting and collapse of river banks;
	  • loss of adjacent land and/or structures;
	  • upstream and downstream erosion;
	  • downstream changes in patterns of deposition;
	  • destruction of riverine habitats.
	• Extraction of rock from quarries involves blasting. Quarries cause noise, dust, air pollution, habitat destruction and vibration if not properly managed.
	• Unplanned rock quarrying can cause landslides and hydro-geological impacts. Without planning and protection blasting leads to occupational hazards.
	• CO2 production, impacts on climate change.
	• Revenues concentrated on a few people.
		• More resilient to extreme weather, flooding and earthquakes if correctly designed and implemented.
		• No firewood required, although the construction of many concrete structures requires scaffolding and supports often made with eucalyptus poles and plywood sheeting.
			• Use alternatives to concrete/mortar, e.g., earth walls.
			• Use prefabricated concrete items to control the provenience of gravel and sand.
			• Never dispose of concrete in the environment. It can be:
			  • reused on-site/off-site for construction purposes (e.g., filling),
			  • safely transported to a construction material recycling facility,
			  • safely transported to a sanitary landfill.

FIRED BRICKS	• Brick firing is an energy-intensive process. The brick industry is one of the largest consumers of coal and therefore also a significant air polluter. Air pollution and the use of good quality agricultural soil are the major environmental concerns related to the use of bricks. Brick kilns may emit toxic fumes (suspended particulate matter, carbon monoxides and oxides of sulphur) that are harmful to eyes, lungs, and throat.	• In some areas, the fired brick constructive culture may be alive and may be worth improving. • Fired bricks and tiles have value and do not become waste (when used for stabilisation, or even in concrete instead of gravel).	• Produce bricks on-site (e.g., stabilized earth blocks). • Encourage the reuse of bricks from demolished buildings. • Use standardised, quality controlled bricks for construction. • Reduce waste by accurately estimating brick requirements. • Use standard lengths and optimal wall thicknesses in design to minimise brick waste. • Use by-product, such as badly fired and broken bricks for porous fill in soak-away and road base construction.
CGI SHEETS	• Manufacturing process requires large quantities of steel, zinc and other metals. May contribute to negative mining impacts. • Manufacturing takes place in large scale factories using energy intensive processes. Factories can cause severe air and water pollution, if poorly managed. Manufacturing processes may release toxic heavy metals. • CO2 production, impacts on climate change. • Transport can damage rural roads. • Dangerous in cyclones. The main problem is the potential uplift of CGI sheets due to strong winds and improper fixations that may cause injuries and loss of lives. • Cause discomfort and health issues. • Edges can be very sharp, so carrying and handling sheets of CGI can be dangerous, and thick gloves should be worn to protect the hands. • Revenues concentrated on a few people.	• They are easy to carry and lightweight so no important structures are required to support them. • CGI sheeting is valuable and can be sold if dwellers need to raise funds, for example in a disaster or post-disaster context.	• Use optimum design calculations to minimise cut wastes. • Use certified products and avoid implementing in corrosive environments (e.g. seaside). • Avoid contact with ground or high levels of moisture if using on wall panels. • Encourage reuse of uncorroded sheets from old buildings, unless you suspect they have been stolen during conflict.

4. Description of local habitat

4.1. Local habitat: general description

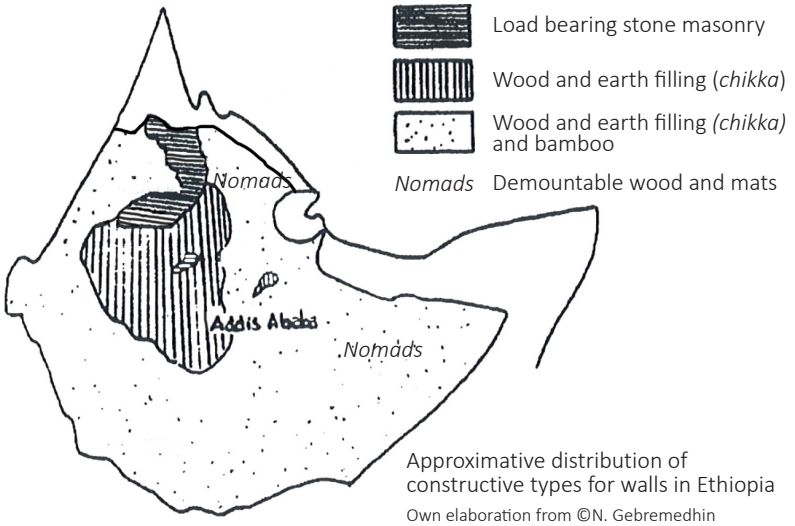
Sources: WOLDE-MARIAM (1996), GIORGHIS (2015), DAVIS & BLOCK (2015), LAST (n. d.), MOGES (2015), UN-HABITAT (2010), BRIDONNEAU et al (2012), Central Statistical Agency (CSA) Ethiopia, shafisaid.wordpress, voicesofyouth.org, UN-HABITAT (2008), RAHMATO & KIDANU (1999)

A. Local affordable or self-built housing

VERNACULAR HOUSING

Regarding the form, all around the country, round houses (*tukul*) with walls built in different materials and thatch roofs are very common. Rectilinear houses are less common, but they are gradually replacing round houses in order to make it easier the use of CGI sheets for roofing. Round houses with thatch roofs are known in the north of the country as *sarbet* (grass hut), while rectilinear houses with CGI sheets roofs are known as *corcorobet* (corrugated hut).

Vernacular housing in Ethiopia can be shallowly classified into four categories depending on wall types:



Approximative distribution of constructive types for walls in Ethiopia
Own elaboration from ©N. Gebremedhin

Timber structure with earth and fibres filling (*chikka*)

Chikka houses are very common throughout the country (72% of houses had their walls in *chikka* in 1984). Their structure is built with wood poles of eucalyptus or other available timber measuring about 8 cm large. Wood is split in half if the diameter is too large. Eucalyptus, which is easily attacked by termites, is smoked and/or soaked in burnt oil. The poles are set vertically about 30 to 40 cm deep into the ground or on a stone or cement foundation. Foundations are then filled with stones and sometimes lime mortar up to 35 cm above the natural terrain. These main poles are then tied in place and diagonally braced when necessary. Wood elements with smaller diameters (about 5cm) are planted in the basement or on the ground and go up to the roof. They are braced by horizontal elements, the assembly being ensured by strings and/or barks of eucalyptus. Thinner eucalyptus elements (*sagha*) are attached to this structure to accommodate the *chikka* mixture, close enough to prevent excessive shrinkage of the *chikka* during drying.

The roof (thatch or CGI sheets) is put before applying the *chikka* mortars. Then, a mixture of earth, straw (usually teff straw, a common cereal in Ethiopian highlands) and water, is used as a filling for the wood structure. It is also used for plastering. The mixture is left to ferment between 3 days and 2 months for better adherence quality. It is stirred every 2-3 days for homogenization. Then the mortar is projected with force on the wood structure, so that it hangs well. Once dry, an extra layer can be applied. The layers on the inner side of the construction are made before those on the outer side. One or two layers are applied in the inner part and two or three in the outer side. The amount of straw in the mixture increases in the final layers. The last layer is usually is give a smooth finish. The walls can get to be protected by a relatively thick earth coating (15 to 20 mm). The final layer can then be coated or not (with lime or cement mortar) with an improvement of the hanging through stones embedded in the layers of *chikka*. To prevent cracking around wooden doors and windows, they are only fixed once the first layer of *chikka* is dry.

Houses in the highlands have thick *chikka* walls in order to get better inertia and control of humidity and so a better temperature inside the houses in this temperate region. On the contrary, these houses have less and less mortar in the walls in the lower tropical climate areas, and they permit ventilation and better comfort inside the houses. In some areas, almost no *chikka* is applied to the wooden structure and the walls are almost only made of wood.

Oromo *chikka tukul* near Langano lake (Oromia). CC- Ninara

Chikka house in Gedeo Zone (SNNPR). © ShelterBox

Decorated *chikka* house in the South Omo Zone (SNNPR).
CC- Rita Willaert

Chikka houses are usually round houses (*tukul*) covered with thatch, but more and more metal roofs are used and houses are becoming rectangular. Corrugated iron is growing as a roofing material as the price of thatching grass rises and skilled thatchers become harder to find. The roofs usually have an overhang to protect the walls. CGI sheets and straw are sometimes combined in the roof to have a better comfort.

Thatched roofs have the disadvantage of being flammable, but they also allow to cook inside the house without a chimney, as smoke can pass through the thatched roof. At the same time, smoke can treat the thatch against insect attacks.

These two typologies are built with the limited building materials and construction skills available in the rural areas. These constructions require regular maintenance. Thermal comfort is very recognized and appreciated.

Stone *tukul* in Lalibela in Amhara region. CC- Beth

Load bearing stone masonry walls with earthen mortar

This is found specially in Tigray and Amhara regions, but also in cities like Harar or Dire-Dawa.

In these regions, stone is an abundant resource. Houses are usually square or round and stone built. There are one single level square or round houses, and also two levels rounded houses.

Basalt is used for foundations. Walls are built with stones (gray trachyte). In square houses large stones well carved are placed at the corners with a filling of smaller stones for the rest of the walls. Mortar is made of earth and straw (*chikka* mortar). The collection of stones can last nearly 3 years, then the construction of the house typically takes 4 to 6 months. Openings and frames are in wood. Stone balconies can be found on the 1st floor, which protects the wall of the 1st level from the rain (chikka mortar).

The wooden posts supporting the roof are positioned all around the house, with no particular symmetry according to their height and section.

Flat roofs of wood covered with sods of earth and wide overhanging eaves are common, but also thatch roofs can be found. Recent houses often have CGI roofs (corcoro) with gable ends as thatching grass becomes scarcer.

Ceilings are usually very decorated. The interior walls are often plastered with a mix of earth, straw and cow dung.

Houses with stone masonry walls in Tigray. CC- Bernard Gagnon

Bamboo and thatch walls

This technique is found in SNNP Region, especially in Dorze and Sidama peoples.

The structure is built with split bamboos sunk into the ground every 10 cm or so following a circle or oval form. The series of vertical bamboos are connected to each other, forming circles or ovals that have a diameter which diminishes as one goes up. The bamboo structure is then covered with bamboo leaves (sometimes also with grass and ensete leaves). Small openings at mid-height are usual to leave the smoke out.

Dorze houses do not have central pole, while Sidamo houses do have one and have a bigger surface

Bamboo and thatch house (Dorze people-SNNPR). CC- David Stanley

Wood and mats huts from nomads

These houses are used by the nomads in Afar and Somali regions. They are erected, dismantled and loaded on to the camels by the women. Huts are owned by women. Men usually gather the materials to build the huts.

Both types are made of an armature of boughs bound with palm fibre and covered with mats. Each group of huts is usually surrounded by a hedge or wall to protect the animals from enemies. The Somali hut is called the *aqal*.

In some cases, there is an outer uncovered verandah.

Afar huts (Afar region). © T. Joffroy- CRAterre

PRECARIOUS HOUSING

People build more and more temporary structures out of cheap materials, whether to live in or to rent out. In cities, self-initiated extensions or houses are constantly being erected because of the acute shortage of affordable housing for low-income households. These constructions are commonly built using reused corrugated iron sheets and earth-plastered wood structures. They help accommodate the changing needs of tenants and generate cheaper alternatives for subtenants.

Data on the national stock of informal housing units is not available. The only data concerning informal housing dates back to the year 2000, when Addis Ababa had an estimated 60,000 informal 'squatter' units representing 20 percent of the city's housing stock.

Moreover, 80 percent of houses in Addis Ababa can be considered a slum according to the UN-HABITAT slum definition. 70 percent of these houses are government owned rental housing.

Precarious habitats in Adama (Oromia). © Compassion International

GLOBALISED HOUSING

More and more, houses are built with reinforced concrete frames and slabs. Cement-sand blocks or fired bricks are used to infill walls.

Large multistorey buildings are being constructed with the same technique all over big cities, and more frequently in Addis Ababa.

Globalised housing project in Addis Ababa. © Habitat for Humanity

B. Access to water, sanitation and electricity

Improved drinking water source:

Urban: 97% of population

Rural: 57% of population

Urban households rely on: water piped into the household's dwelling, yard, or plot (63%); water piped into a public tap/standpipe (13%); and water piped to a neighbour (12%).

Rural households obtain their drinking water mainly from public taps/standpipes (19%), followed by protected springs (14%) and tube wells or boreholes (13%).

Improved sanitation facility access:

Urban: 16% of population

Rural: 4% of population

One in three households in Ethiopia have no toilet facility (39% in rural areas and 7% in urban areas).

More than half (56%) of rural households use unimproved toilet facilities. More than one-third (35%) of toilet facilities are shared in urban households, whereas only 2% of rural households share their toilet facilities with other households.

In recent years, the Ethiopian Government has engaged in a Community Led Total Sanitation (CLTS) type sanitation exercise, in which whole rural villages and *Woredas* are targeted with sanitation awareness trainings and exercises to discourage random defecation.

Access to electricity:

Urban: 93% of population have access to electricity, though this is not always reliable. Many households and modern apartment blocks use automatic back-up generators. In Addis Ababa, the massive programme or construction and expansion in recent years, has put pressure on the electricity supply, causing frequent power-cuts.

Rural: 8% of population have access to electricity, mainly via generator, or solar panels.

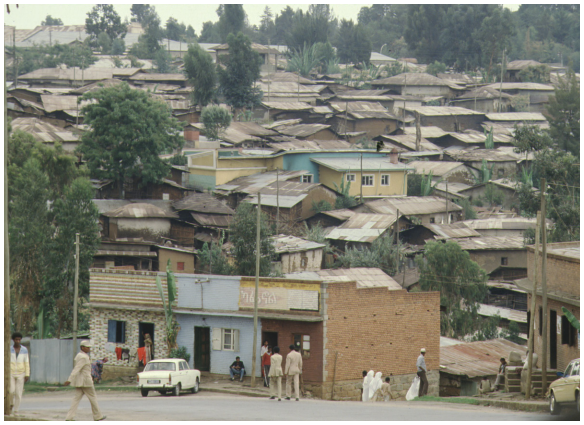
	Households			Population		
Housing characteristic	Urban	Rural	Total	Urban	Rural	Total
Electricity						
Yes	93.3	8.4	25.6	92.2	7.7	20.8
No	6.7	91.6	74.4	7.8	92.3	79.2
Flooring material						
Earth, sand	22.9	54.7	48.2	23.2	55.5	50.5
Dung	9.1	39.1	33.0	9.2	38.2	33.7
Wood/planks	0.3	0.1	0.2	0.3	0.1	0.2
Palm/bamboo	0.8	1.7	1.5	1.1	1.8	1.7
Parquet or polished wood	1.1	0.1	0.3	1.3	0.1	0.3
Vinyl or asphalt strips	22.7	1.2	5.6	21.3	1.0	4.2
Ceramic tiles	4.1	0.1	0.9	4.9	0.1	0.8
Cement	16.1	1.6	4.5	17.3	1.6	4.1
Carpet	22.9	1.4	5.8	21.4	1.4	4.5
Rooms used for sleeping						
One	65.2	71.6	70.3	52.5	66.6	64.4
Two	25.0	23.1	23.5	32.4	26.4	27.3
Three or more	9.4	5.2	6.1	14.9	7.0	8.2
Place for cooking						
In the house	31.2	42.1	39.9	26.4	40.0	37.9
In a separate building	52.4	46.1	47.3	59.8	48.9	50.6
Outdoors	13.6	11.2	11.7	12.8	10.9	11.2
No food cooked in household	2.8	0.5	1.0	0.9	0.1	0.3
Other	0.1	0.2	0.1	0.1	0.1	0.1
Cooking fuel						
Electricity	23.2	0.3	5.0	24.2	0.3	4.0
LPG/natural gas/biogas	1.3	0.3	0.5	1.1	0.3	0.5
Kerosene	2.1	0.0	0.5	1.3	0.0	0.2
Charcoal	30.2	2.1	7.8	27.8	1.5	5.6
Wood	38.7	85.6	76.1	42.5	86.9	80.0
Straw/shrubs/grass	0.0	0.5	0.4	0.0	0.5	0.4
Agricultural crop	0.3	2.2	1.8	0.4	2.1	1.9
Animal dung	1.3	8.3	6.9	1.7	8.2	7.2
No food cooked in household	2.8	0.5	1.0	0.9	0.1	0.3
Percentage using solid fuel for cooking[1]	70.6	98.8	93.0	72.3	99.2	95.0
Frequency of smoking in the home						
Daily	4.4	6.2	5.8	5.2	6.8	6.6
Weekly	4.5	5.8	5.5	4.7	5.9	5.7
Monthly	0.8	0.3	0.4	0.6	0.3	0.4
Less than once a month	1.3	1.3	1.3	1.1	1.3	1.3
Never	89.1	86.4	87.0	88.5	85.7	86.1

Housing characteristics in 2016.
Percent distribution of households by housing characteristics.
© Central Statistical Agency (CSA) [Ethiopia]

C. Habitat organisation and conditions of use

The physical form of Ethiopian housing has been dominated by single-storey construction. In the 1994 census, 98.3% of buildings nationwide were single storied and the remaining 1.7% were multistoried buildings. This has changed ever since, but it shows the characteristics of most vernacular dwellings.

Habitats are further examined later in this chapter region per region. Nevertheless, some general characteristics tend to be shared throughout the country both in urban and rural habitats.



View of Addis Ababa. ©T. Joffroy- CRAterre

URBAN HABITATS

Ethiopia is one of Africa's least urbanised countries. Cities in Ethiopia have traditionally been small. Nevertheless, more and more people live in cities (6.4% in 1960 and 20.8% in 2018) and cities are growing. In 2008, only 10 cities had more than 100 000 inhabitants. In 2018, there are 21 cities with at least this population.

In 1996, four materials were mainly used in urban areas: *chikka*, cement blocks, fired brick and concrete. There was a decrease in stone construction, even where it was abundant. Nevertheless, stone constructions are common in old cities. In urban areas, *chikka* constructions are often of poor quality. *Chikka* was mostly used by low-income households, while other materials were used by those who could afford them. In 1984, 80% of urban housing walls were made of chikka. Even today, behind concrete and glass buildings on the main streets of every city of the country there is a world of earth buildings. These structures can be as old as the cities themselves but they also continue to be built today. There is a very rich complexity of earth buildings and clusters which increases in the city centres.

Roofs are mostly built with CGI sheets. Today, around 23% of urban houses have earth or sand floors. Other 23% have carpets, and almost the same percentage have vinyl or asphalt strips. 16% have cement as flooring material and finally 9% have dung.

In 2008, the government estimated that 35% of urban solid waste was never collected, while only 10% of the population reported using a municipal waste collection system.

Concerning the conditions of use of the houses and their spaces, almost 2/3 of the households in cities have one single room used for sleeping, while 25% have two.

People usually cook in a separate building from the house (almost 60% of the population), while 26% cook inside the house and around 13% outdoors. 70% of the households use solid fuel for cooking, and 23% used electricity.

Security in urban areas has to do with permanent employment and with pension. To cope with their problems women in urban areas engage in construction work.

RURAL HABITATS

Almost 80% of the population of the country live in the rural areas. The structure of Ethiopia's economy largely depends on rainfed agriculture. The countryside in Ethiopia is covered with earth, stone, timber, bamboo and fibre buildings. They are usually round, but also more and more square and oblong. Unlike the urban ones, these units are often generously spaced from each other. Thatch roofs were very common, but they are gradually giving way to CGI roofing sheets. In some regions (e.g. Somali and Afar), people have usually held nomadic lives. In these places traditional houses are demountable.

In rural houses, earth and sand are used today in floors in 55% of the households, and almost 40% also use dung. The rest of materials are almost unknown for flooring purposes throughout rural areas of the country.

The great majority of households only has one room for sleeping (72%).

People in the countryside cook either in a separate building (49%) or inside the house (40%). Around 11% of the population cook outdoors. The vast majority of people uses wood for cooking (80%). A remaining 7% uses animal dung and around 6% charcoal.

In rural areas security has to do with land and cattle. For the rural poor, the priorities are land, agricultural inputs, extension programs, and the problems of food security caused by drought and rainfall variability. To cope with their problems women in rural areas sell fire wood and cow-dung.

Usually, people share the interior of their houses with livestock in order to avoid the loss of animals. Mixed agriculture (crop and livestock production) is the mainstay of most rural population. The majority of rural households have a field associated to their house where they cultivate the necessary to support the family needs and sometimes to make exchanges with. Some industrial species have also rapidly evolved (e.g. coffee).

The conditions of use of the houses and their spaces greatly vary from region to region, as will be determined in the following sections.

4.2. Addis Ababa

A. Hazards affecting the chartered city

Floods and landslides / Black cotton soils / Earthquakes / Conflicts

Sources: WOLDE-MARIAM (1996), GIORGHIS (2015), LAST (n. d.), OUALLET & GIORGHIS (2005)

B. General description of habitat

Multiple techniques: *chikka*, stone, recycled shacks, concrete...

In Addis Ababa (est. 1887) there is a coexistence of multiple architectural styles due to numerous influences. Arabs, Indians or Europeans have brought along their architecture. There exists an Addis Ababa style mostly used by aristocracy in the end of the 19th century and the beginning of the 20th. Constructions used to be rectangular. Ground floors were built with heavy masonry, while a much lighter upper story integrated wooden verandahs, balconies and more openings (windows). Roofs with different shapes were built using most usually metallic sheets or thatch.

In the zone where today lies Addis Ababa the most prevalent architectural form used to be the *tukul* (round buildings) but rectangular houses were not uncommon. These constructions were mainly built with *chikka* walls. These kind of construction (mostly rectangular) is still used throughout the city.

In the city slums, there exist houses built with a wooden structure whose walls and roofs are made of CGI sheets.

Finally, apartment and office western-style constructions built with reinforced concrete structure, cement blocks or fired bricks, etc., are becoming more and more in vogue in the city. Multiple story condominiums are gradually substituting *chikka* and CGI sheets houses.

Addis Ababa itself has been subject to massive increase in infrastructure over the past decade, with overseas investment, low interest loans from the Chinese banks, there is the new light railway crossing the city, with over 100,000 passengers using the cheap (between 2 and 6 ETB per journey) and efficient service every day.

Prior to the launch of the light railway, many workers reported that they were spending up to 5-hours a day in traffic, trying to reach their workplaces. Now, they have reduce their daily commute to about 1-hour.

The expectation is that the improved transport links will have a positive impact on businesses and make the more remote urban settlements more attractive to commuters.

However, on the downside, over 23,000 slum homes have been destroyed and households forced to move to either designated government housing, or simply made homeless. It is believed that by 2020, an area greater than 500 football pitches will be cleared for the light-railway construction. (http://www.spiegel.de/international/tomorrow/addis-ababa-how-light-rail-has-changed-ethiopian-capital-a-1206837.html)

Some of those evicted for this development reported that they also lost their jobs, as the government housing wasn't built near enough to the tramline to make it possible for them to take advantage of the new transport option, so they are reliant now on local buses that are too expensive to use for commuting.

Rental costs for both housing and businesses have also increased massively in locations near to the train stations, with average increases anything from 60 to 100%, putting the possibility of renting in these areas out of reach of the average local person.

Addis Ababa style building with verandah. ©T. Joffroy-CRAterre

Condominiums under construction Addis Ababa. CC- Maguns Franklin

CGI sheet houses in central Addis Ababa. CC- Maguns Franklin

View of the Light Railway of Addis Ababa. ©V. Murtagh

4.3. Afar

A. Hazards affecting the region

Sources: WOLDE-MARIAM (1996), LAST (n. d.), The Hadgi Tour (2018)

Floods and landslides / Earthquakes / Drought /Conflicts

B. General description of habitat

Nomadic fibre shelters

The Afar are mostly nomads living in small isolated groups. A moving camp is made of about 20 huts with livestock and a meeting place. Camps are surrounded by vegetal barricades, which protect them from the attacks of wild animals and from domestic animals theft. Nevertheless, urban population is rising, and today about 1/5 of the population of the Afar region lives in cities.

The Afar nomad huts, called *ari*, are oval-shaped and are erected by women. They are also demounted and loaded on to the camels by the women when the group decides to move. Women are also the owners of the huts. The structure of the hut is erected making an domed armature of branches which is bound with palm fibre. The covering is made with palm mats.

Afar nomadic camp with wooden barricade. ©T. Joffroy- CRAterre

Sedentary or semi-nomadic houses: stone, *chikka*...

Other kind of dwellings exist, often used by sedentary people or by semi-nomadic groups having a fix sedentary place to go back.

One of them is a stone house called *dabou* which is found at the foot of the highlands where the soil is constituted of sandstone or pumice. These houses have thick stone masonry bearing walls and a thorn and rubble roof.

Another kind of sedentary vernacular dwelling are rectangular constructions with wooden structure and wooden walls, sometimes with a *chikka* filling and with a flat earthen roof.

There also exist in some places rectangular houses made with wooden structure whose walls are covered with fibre mats and that have CGI roofing.

More and more buildings are been made with rectangular form and with *chikka* structure (or also with cement blocks) and CGI roofs, mainly in cities.

Afar nomadic hut. CC- Ji Elle

Permanent stone huts (*dabous*) in Erta Ale campement in the Danakil Depression. Afar region. CC- Ji Elle

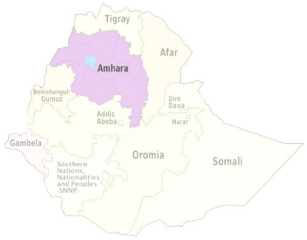
Afar women building a nomadic shelter. © T. Joffroy- CRAterre

Permanent mat houses in Afar. CC- Evelyne

Permanent constructions with wooden structure and earthen roof in Afar region. ©T. Joffroy- CRAterre

Chikka houses in Erebti village. CC- A. Savin

4.4. Amhara



Sources: WOLDE-MARIAM (1996), ODIAUA (2010), LAST (n. d.)

A. Hazards affecting the region

Drought / Earthquakes / Floods and landslides / Black cotton soils / Conflicts

B. General description of habitat

Amhara Region has a rich cultural background, with many historical sites, including Lalibela, an UNESCO registered World Heritage Site, famous for the rock-hewn churches, carved into the mountains in the late 12th Century.

Stone masonry houses

Stone masonry houses are predominant in Amhara and are usually circular or rectangular. Both can have one or two levels. Those with two levels have external staircases. In two story buildings the family usually live in the upper floor and the livestock are stabled below, what serves as heating system in the cold weather of the mountains.

In both cases walls are built with stone masonry and earth mortar. Interior walls are usually plastered with a mix of earth, straw (usually teff straw for binding) with a high percentage of cow dung. Exterior walls are often unplastered, but when they are, the mix also contains high levels of cow dung which makes it more workable and more flexible and water resistant, due to the high fibre content. Plastering is done in different layers.

These houses have thatched roofs. The conical roof is supported by four or five poles, commonly eucalyptus. There are small storage areas for cooking utensils, and the main area serves as sleeping and living spaces. There are usually few windows and no chimneys, the smoke escapes through the thatch.

These construction technique is becoming less common, as the construction is costly, complicated and time consuming with time and skill required to prepare the stone.

Stone and/or *chikka* houses

Chikka houses are more and more common in the region. Round chikka tukuls with thatch roofs used to be very numerous, though the proportion of rectangular *chikka* houses with CGI sheet roofing is rapidly increasing.

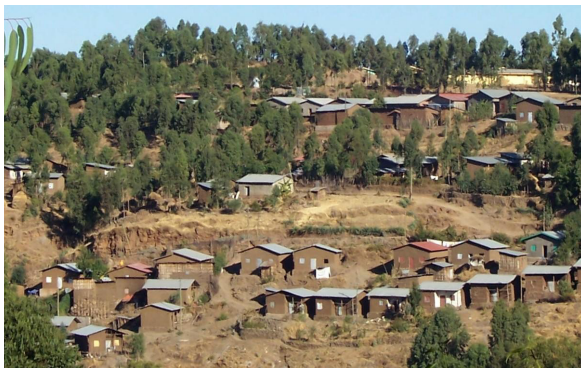
In this region with stone resources, many chikka houses have stone foundations and plinths, or even low stone walls surrounding the houses to protect *chikka* from rain. Anyway, there are also *chikka* houses whose wooden poles are directly buried on the ground. The wooden poles used for the *chikka* structure are very usually from eucalyptus. The same plastering as for the stone houses applies for the *chikka* ones.

Balconies are common and two story buildings too.

A small *chikka* building (10 m²) can be raised in only two weeks. Unskilled labour can be used to fill the structure with the mix of earth, straw and cow dung. Farmers do this work in between the planting seasons.

Stone tukul in Lalibela with two levels and exterior staircase. CC- Martijn Munneke

Two story house with stone plinth, *chikka* walls and balcony in Gobgob village, Amhara region. CC- Kelley Lynch USAID



Chikka square houses in Lalibela. CC- Beth

Round and square stone *tukuls* with thatched roofs near Lalibela. CC- Gordontour

Chikka rectangular house with CGI sheet roofing in Felasha village, near Gondar. CC- Beth

New *chikka* houses under construction in Amhara region. CC- Canned Muffins

4.5. Benishangul-Gumuz

A. Hazards affecting the region

Sources: GONZÁLEZ-RUIBAL (2006), GONZÁLEZ-RUIBAL et al (2009), Wikipedia

Drought / Conflicts

B. General description of habitat

Berta houses

Berta are the prevailing ethnic group in the Benishangul-Gumuz region. They are commonly slash-and-burn agriculturalists who live in villages of a few hundred people. Working parties are culturally substantial: to build a house or cultivate a field, people will ask neighbours for help in exchange of food and traditional beer.

Family compounds (*khosh*) only have bamboo fences in cities and are formed by several constructions: one or a few round houses (*shuli*) built with an interwoven bamboo structure and thatched roofs, a granary, a raised platform to dry sorghum, a stockyard for sheep and goats and sometimes raised hen coops. Grain can also be stored inside houses on a raised platform. Houses are not plastered, what allows cross ventilation, what is important in this hot humid climate region. Among the constructions that may appear in the compound there is a house for guests and houses for adolescent boys.

Different uses of interior spaces coexist in the Berta society, but externally all houses present similar external attributes: round interwoven bamboo walls with conic thatched roofs crowned by four wooden poles.

Gumuz houses

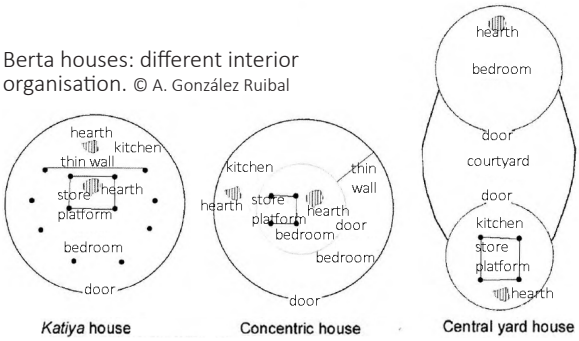
The Gumuz are the third ethnic group in number in the region after the Berta and the Amhara. They are mainly cultivators and traditionally live in small villages with less than 200 people that tend to be more stable, even though some of them continue to be displaced when soil losses fertility. Inside villages, extended families live in fenced compounds, which have a main house (*mes'a*), one or more youngsters' houses, goat pens and granaries. Nearby compounds are occupied by close relatives. The history of slavery of part of the Gumuz people has an effect on settlements through fences and labyrinth-like pathways. This helped dwellers to escape and better defend the villages.

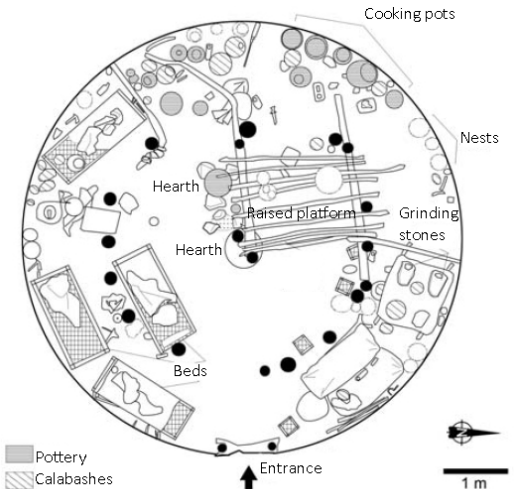
Houses are round. They are built with a bamboo structure and a conical thatched roof. They only may have earth in the walls around the doors, what permits cross ventilation through the bamboo structure. The main house measures 8 m in diameter. Houses also present a defence mechanism through double doors, one in the front and one in the back.

The Gumuz people keep cereal crops either in clay granaries which may be decorated with clay bas-reliefs imitating female breasts or male sexual attributes or in raised platforms inside the houses.

Berta houses in Asosa Zone. CC- Ben Rohrs

Berta houses: different interior organisation. © A. González Ruibal





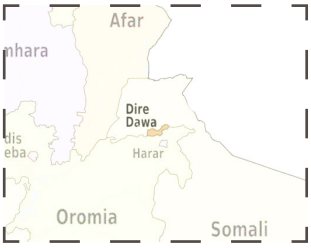
Gumuz house plan schema. © A. González Ruibal et al.

View of a Gumuz village with fences demarcating pathways and compounds. Settlement of Manjäri. © A. González Ruibal et al.

Back door in a bamboo Gumuz house. Settlement of Manjäri. © A. González Ruibal et al.

Raised Gumuz clay granary on a platform of branches placed on top of stones or directly on stilts. Manjari, Metekel Zone. CC- González Ruibal

4.6. Dire dawa



Sources: UNHABITAT (2008), (2005) Politique Africaine

A. Hazards affecting the chartered city

Drought / Earthquakes / Floods and landslides / Conflicts

B. General description of habitat

The city of Dire Dawa was founded in 1902 when the train Addis-Ababa-Djibouti was about to be built as a station between those cities. It was found technically very difficult for topographic reasons to make the train pass through Harar.

Almost half of the population lived in 2008 in substandard housing, half of which lived either in simple earth and wood houses or in shacks. Vulnerability to floods and landslides is important within the city. The Dechatu River is dry during most part of the year and becomes a torrent when it rains.

View of the city of Dire Dawa in 1934.
Public domain- W. Mittelholzer

Multiple techniques within the city: Arab style, stone, recycled shacks, concrete...

The city was divided into two different zones when it was founded: to the west of Dechatu River, a planned and very regularly constructed city with European style and concrete and stone buildings arose. The market and the Arab style city would rise to the east, where most local people (oromo and somali) started dwelling. Most houses were then built with stone walls and flat earthen roofs.

***Chikka* houses**

In 2008, most of the existing houses inside the city were of wood and earth (*chikka*). All qualities of *chikka* houses could be found. CGI sheets were very common in roofing.

The chartered city has an important rural territory in which rounded or rectangular plan *chikka* houses arise. Rounded houses have usually thatch roofs, and square or rectangular houses are mostly covered by CGI sheets.

View of *chikka* houses with vegetal fences to protect the courtyard and the house in rural Dire Dawa. CC- Petr Kosina

Square chikka house with CGI sheet roof and round chikka house with thatch roof in rural Dire Dawa. CC- Petr Kosina

4.7. Gambela

Sources: LAST (n. d.), encyclopedia.com, EVANS-PRITCHARD (2010)

A. Hazards affecting the region

Drought / Floods and landslides / Black cotton soils / Conflicts

B. General description of habitat

Nuer houses

The Nuer are the most numerous ethnic group in Gambela. They are mostly pastoralists and their cattle is central in their lives. The Nuer are usually transhumant and most of them live in villages during the rainy season and move to cattle camps in the dry season. Villages are commonly situated in higher zones as most of the territory is flooded in the rainy season. In villages they grow cereals.

Houses in villages are usually round, with *chikka* walls and thatched roofs. Some roofs are multi-tiered, what allows better protection against heavy rains and provides better isolation from the sun. The entrance may have a porch and is more decorated than the rest of the house. Houses are windowless and doors are small so that visitors are forced to crawl in order to enter. In villages they also build byres for the cattle. During the rainy season doors are tightly closed at sunset and fires are made with cow dung inside byres and houses so that mosquitoes are kept away. The smoke escapes through the thatched roof.

When they move to the cattle camps in the dry season, they build shelters with local grasses. These shelters are more transitory and do not need to be water-proof.

Anuak houses

Anuak people are mostly farmers and herders. As the Nuer, they move to drier sites when the rivers flood.

Anuak houses are similar to those of the Nuer: chikka houses with thatched roofs which are often multi-tiered. One main difference is that they are commonly built on top of an earthen platform or mound, to help avoid the impact of average floods and to avoid being affected by humidity inside the houses. Another great difference is that decoration is important to Anuak people and thus some houses have bold murals. Doorways are little and low as the houses are used mainly for sleeping, all other activities taking place out of doors. Verandahs circling houses are not uncommon, what protects the chikka walls from the effects of the rain.

Nuer houses in Gambela. CC-Frans Devriese- foto_morgana

A nuer house. ©Tabata Fioretto

Anuak houses in Gambela. CC- Gill Penney

Anuak house on an earthen mound, with verandah and mural paintings in Gambela. CC- Gill Penney

4.8. Harari

Sources: LAST (n. d.), BOSREDON (2008)

A. Hazards affecting the region

Drought / Earthquakes / Conflicts

B. General description of habitat

The ancient city of Harar, founded in the 13th Centruary is also a UNESCO World Heritage Site. As a historical trading centre, many buildings are quite unique to Ethiopia, with Indian and Islamic architectural details being quite noticeable within the fortified walls at the centre of the city. In the surroundings of the city, some rural territory makes also part of the current Harari region.

Two kinds of houses are found in vernacular architecture in Harar: *chikka* houses and stone flat-roofed houses (in the historic city centre). The latter are less usual in Ethiopia, being a reminiscence of the coastal Arab architecture. Men build both kinds of houses and repair wall and roofs when necessary. Women are in charge of the day to day maintenance.

Besides these two types of constructions, increasing numbers of concrete buildings are being constructed in the city, raising concerns that this may change the look of the city beyond recognition.

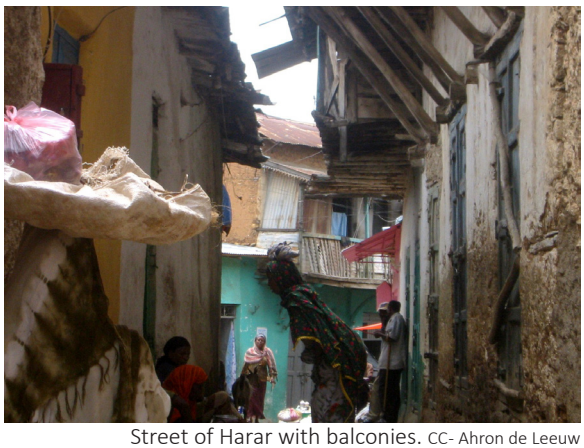
View of Harar and its countriside. CC- Ahron de Leeuw

Stone and flat-roofed houses

The ancient city (*Jugol*) is very dense in terms of buildings and population, with narrow streets, dead ends and stone-built courtyards isolated from the public space by high walls.

In this part of the city, the predominant kind of house is called *gegar*. These buildings are rectangular, built of stone masonry walls and flat-roofed. They are often two-storied and are surrounded by an about 2 m high wall. They have a white-washed or pastel colour exterior which is painted twice a year. Flat roofs are made with wooden planks and covered with earth and dry grass. More and more houses have CGI sheet roofs even in the city centre.

The interior of the houses has different rooms, one of which is used to receive guests. Raised platforms in different levels determine the status of the guest. The walls are painted with ochre or red earth and covered with cotton cloths or carpets and decorated with handcrafts. Several niches in the walls contain ceramics. Many houses have balconies.



Street of Harar with balconies. CC- Ahron de Leeuw

***Chikka* houses**

Chikka (wattle and daub) round houses with a thatch roof are very common in the outskirts of the city and in the countryside of the Harar region. They have a central pillar to support the conical roof. There are also more and more rectangular houses with *chikka* walls and CGI sheet roofs.

Within the city, these houses lay in neighborhoods where streets and houses are made of earth and houses are grouped together in compounds protected by vegetal fences.

Market at Asmaddin gate. CC- Ahron de Leeuw

Market of Harar. CC- Ahron de Leeuw

Balconies in the city centre. CC- Ahron de Leeuw

4.9. Oromia

A. Hazards affecting the region

Drought / Earthquakes / Floods and landslides / Black cotton soils / Conflicts

Sources: LAST (n. d.), WOLDE-MARIAM (1996), Wikipedia

B. General description of habitat

The Oromo people are the largest ethnic group in Ethiopia and are mainly concentrated in the Oromia region, which is the largest of the country. Oromo people are very diverse: Barentu and Borana are the major groups, and are subdivided into subgroups. Nevertheless, some general housing features prevail among these different groups.

Circular *chikka* houses

The main house of the family is surrounded by other houses and often by thatch roofed granaries. In some rural areas, the different constructions of a homestead are surrounded by fences, (e.g. a living euphorbia in the Oromo from Jimma or acacia thorn fence in the Borana Macha Oromo).

Houses are circular, with (e.g. Macha Oromo) or without a verandah (e.g. Oromo in Borana Zone). Walls are usually built of *chikka* by the owners. There are frequently no windows, only doors. A space of 20 cm is often left unplastered above the doors to facilitate ventilation and evacuation of smoke. Cow-dung is used for floors and walls along with earth and fibre.

In some groups, once the walls are finished, neighbours are called for the construction of the roof structure. Junipers, eucalyptus and acacias are easily found in the region. The best plant for thatching is the *sembelet*, but many others are used depending on the zone. Thatching is sometimes completed by an expert, mainly in areas with heavy rain. The roof edge is placed firstly and bouquets of herbs are hung with ropes on the wooden frame towards the top of the roof. This part may be protected by a decorated pot of clay placed upside down, the *gulilat*, or by an ostrich egg. Roofs usually have large overhangs in the rainy zones.

The interior of the house has sometimes partitions with the sleeping platforms and kitchen being separated. The fireplace is generally placed in the central part. Storage is done inside the houses.

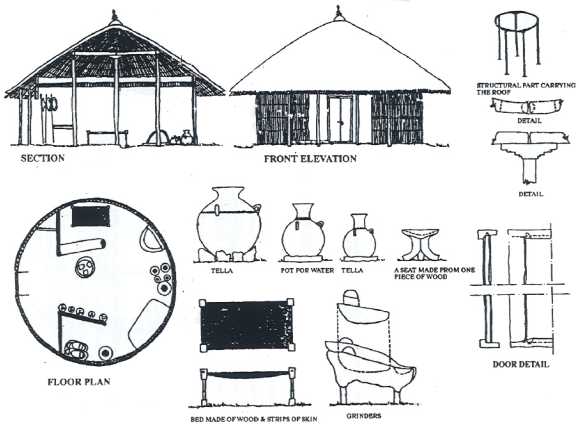
Some Oromo grow vegetables and spices in a garden surrounding the house. Some groups as the Macha Oromo move the enclosure of cattle from time to time to permit better distribution of fertiliser on the land.

Rectangular *chikka* houses

Rectangular houses or constructions also exist in the Oromo culture. Traditionally, in zones with little rain, *chikka* constructions with flat earthen roofs were built. Today, many *chikka* houses are being built with rectangular form and a CGI sheet roofs.

"Bird's nest" houses and nomadic houses

Some groups (e.g. Barentu Kereyu Oromo or Borana near Yabelo) build round or elliptic houses whose rafters are planted in the ground forming both the walls and the roof (as a bird's nest).



Floor plan, section, elevation and details of an oromo house. © N. Gebremedhin

Oromo dwelling. CC- Bernard Gagnon

Oromo dwelling in Sof Omer (Bale Zone). CC- Rod Waddington

Construction of a Borana «bird's nest» house.
CC- National Museum of World Cultures

Square house with flat earthen roof (left), round *chikka* house (centre) and granaries (right) near Langano Lake (Arsi Zone). CC- Ninara

4.10. Somali

Sources:
issaabdull.wordpress.com,
shafisaid.wordpress.com,
everyculture.com

A. Hazards affecting the region

Drought / Floods and landslides / Earthquakes / Black cotton soils / Conflicts

B. General description of habitat

The nomadic hut (*aqal*)

Somalis are mostly pastoralist nomads moving in search of pasture and water whose shelters are portable huts called *aqal*. These huts are dome-shaped and usually have an elliptic base. They are built by women with varying materials usually gathered by themselves depending on the availability in each zone: branches, wooden poles, reeds, grass, roots, woven mats, animal skins and lately also plastics and CGI sheets. Once the group decides to move away, women dismantle the huts and carry them on camel backs.

An *aqal* is separated into two areas: one at the back, which helds the sleeping area, and one at the front, which is used like living area. There might also be an outer uncovered veranda (*gabbaad*). Somali nomadics usually have few possessions which have practical uses. A bed made from wooden sticks covered with hides is the only furniture in the *aqal*. Cooking utensils, storage boxes, stools, woven mats and water bags are among the family's goods and constitute part of the Somali crafts.

The structure of the hut may have from three to seven arched branches (*dhigo*). In intersection with the first ones, other arched branches are placed to form a round or elliptical hut (*lool*). These arches are held by either one or two (depending on the number of *dhigo*) long pieces of wood with a V-shaped head placed in the long axe of the hut. Two pillars are erected on the sides of the door as jambs. Right after, the woven hand-made mats are fastened to the structure. There are different kinds of mats with specific positions in the *aqal*.

Once finished, the huts are fastened to the ground diagonally and horizontally with ropes so that they are not blown away by storms. During rainy seasons waterproof plastic sheets called *shiraac* are used to protect the huts on top of the mats.

Agro-pastoralist *chikka* houses (*mundal*)

Agro-pastoralists and riverine communities usually live in more permanent structures similar to *chikka* round houses with thatched roofs and palm fronds knotted together. This kind of house is called *mundal*. Plastering is made with earth, animal dung, and ashes.

Sedentary houses

Sedentary people in Somali may also live in rectangular *chikka*, stone, brick or cement houses with CGI sheets roofs (*arish*) or concrete roofs in new buildings in cities. In cities, people also live in Arab-style whitewashed houses made of stone or brick coated with lime or cement mortars.

Somali *aqal*. © Shafi Said

Women building an *aqal*. © Shafi Said

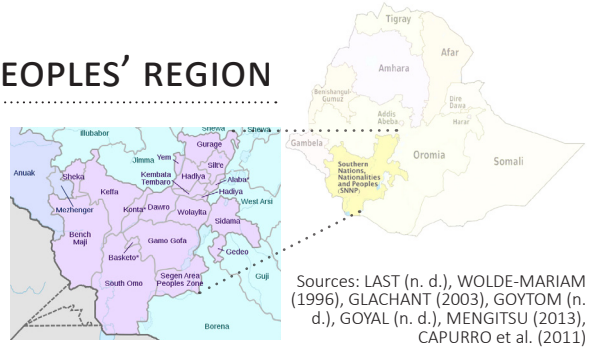
Interior of Somali *aqal*. © Shafi Said

Nomadic huts in Somali region built with mats and recovery materials and with *shiraacs*, plastics for protection from rain. CC- Global Finland

Chikka houses of Somali agro-pastoralists. © everyculture.com

Rectangular chikka house in Gode, Somali. CC- Robert Sauers USAID

4.11. Southern nations, nationalities and peoples' region



Sources: LAST (n. d.), WOLDE-MARIAM (1996), GLACHANT (2003), GOYTOM (n. d.), GOYAL (n. d.), MENGITSU (2013), CAPURRO et al. (2011)

A. Hazards affecting the region

Drought / Floods and landslides / Earthquakes / Black cotton soils / Conflicts

B. General description of habitat

The SNNPR is the main homelands of 45 ethnicities. The most numerous are de Sidama, Welayta, Hadiya, Gurage and Gamo. Other minoritary ethnicities like Alaba, Konso, Dorze or Bench have important building cultures. Their houses and types of dwelling greatly vary.

Sidama houses

The Sidama live in beehive-shaped round *tukuls*. There might be several tukuls and a vegetable garden in one compound. Compounds may be circled by a fence of woven bamboo or euphorbia. The framework is built with bamboo. Walls and roof are covered with grass and *ensete* leaves. This is strengthened before the rainy season. The waterproofing leaves are sandwiched between two bamboo panels. There is usually a small front porch at the entrance. The space inside the house is shared by people (to the right) and calves (to the left). Furniture consists of beds and seats.

Sidama people house built with a bamboo structure and a vegetal covering for walls and roof. CC- Maurits Vs.

Welayta houses

Welayta houses are large round or eliptic in plan and they are usually built in the middle of cultivated gardens. Their structure is made of bamboo and they are covered with thatch in both roof and walls. The structure of the roof is plaited and made with concentric rings of framework. One of more ostrich eggs are placed at the top of the roof as fertility symbols.

Screens of bamboo serve to divide the interior space. Families share this space with cattle, what helps keep the cattle safe from predators but also to provide the family some heating for the cold nights.

Welayta people house built with a bamboo structure and a vegetal covering. © Todd McGowan

Gamo houses

Gamo houses may vary depending on their location. They may have round or elliptic plan. When they are elliptic, they may have two central pillars or even more (which shows the economic situation of the owner).

Most of the people use bamboo for vertical structure, for roofing structure and for covering. Different trees as *miththa* may also be used for structure. Also, other vegetal species can be used for covering (as barley and wheat straw in the hilly areas and grass in the middle and low land areas). Ropes are used to tie the different parts of the structure to the covering materials. Some houses are covered with a *chikka* mortar (earth and straw) and others have only vegetal covering.

Gamo compound with round house, gardening zones and fence. © Ashley Tindall

Dorze houses

Dorze people live in vertical houses that reach a height from 6 to 12 m. Around their houses, they have gardens. The structure of the house is made of split bamboos driven into the ground along a circle, approximately every 10 cm. A series of horizontal bamboos are woven between these elements, forming ever decreasing circles as they rise to a gently curved arch shape. The bamboo structure is then covered with bamboo leaves. Small openings at mid-height allow the smoke to vent, but keep the upper area filled with smoke to reduce sparks from igniting the roof. The interior is divided into: fireplace, bedroom, brewery and cattle sector.

The lower part of the walls is not protected and is therefore attacked by termites and affected by damp and humidity, so houses tend to sag about 20 cm every 4 years. The family continues to live there as long as the house is not too low, then they rebuild. The age of the hut can be gauged by the height.

Dorze houses. CC- Richard Mortel

Alaba houses

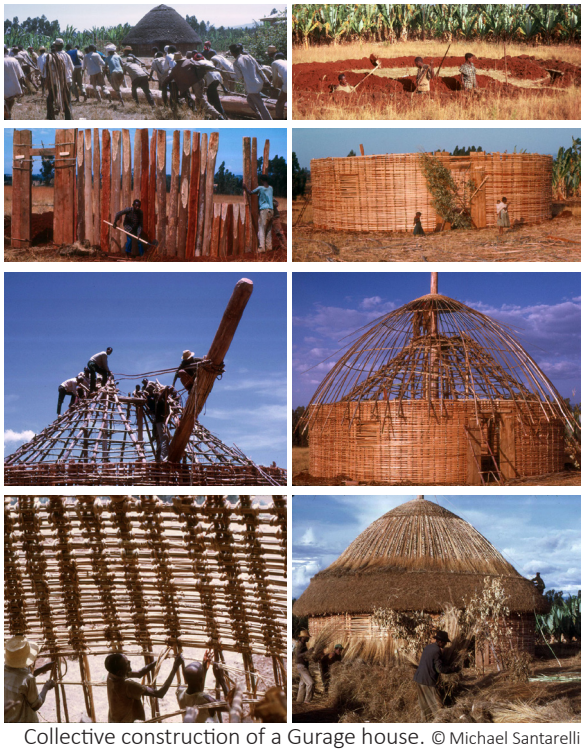
These round *chikka tukuls* have three-dimensional earth plasters on the external face of the walls. They also have a sit all around the house, what is useful to increase the thermic mass of the building and to protect from moisture. Decorations often represent open doors, symbol of hospitality. Some coins, symbol of prosperity that is the blessing given by the local Imam to all the new families that build a house, are also found. Under the roof, the top of the wall (40-50cm) is left without plaster. This provides ventilation in the house, making it fresher.

Alaba house with three-dimensional decoration. © Lorenzo Fontana

Gurage houses

The Gurage live in compounds with cultivation gardens and constructions for different uses. The entrance to the property is a lawn area surrounded by a palisade. Houses are round with a diameter of 6 to 8 m and thatched roofs. The structure is made of wood with a *chikka* filling. These houses are built thanks to collective work, which is carried out in parallel on the vertical structure and on the framework of the roof. Specialist expertise if required for setting door frames, placing the central post (which is done with the help of up to 30 men), and for the thatching of the roof.

Roof elements and walls are connected by ropes. The slope of the roof is structurally very effective. The doors are the only openings and no spaces are left for ventilation. The high roof and thick thatch ensures that the smoke from the fire fills the roof space; working as both a natural insecticide, and also ensuring that any sparks from the fire are extinguished due to lack of oxygen.



Collective construction of a Gurage house. © Michael Santarelli

Konso houses

The Konso live in stone fortified settlements on hillsides that provided protection from wild animals and enemies. Defensive dry stone walls built using uncut basalt rocks are formed in concentric rings. Within the settlements houses are densely packed in and public spaces include narrow walkways and ritual public areas called *mooras*.

Men build the framework and roof of houses, while women do stone walling. Juniper wood is used for the beams and the roof structure. They are experts on wood construction, and many of their houses last for 80 years or more. They have three types of houses:

- The *Pafta* or cave houses are excavated to obtain a rectangular shape cut into the mountainside; logs are placed horizontally spanning the roof area. A front stone wall is erected across the gap with a low door in its centre that forces people entering to stoop down. This type of house is rare today.
- The *Maana*, or all-roofing house, is a circular hut consisting of a straw roof from the ground up to the top, with no differentiation in between (basement elevation-unification-roofing). A small door is the only entrance.
- The most common house has a double roof and a round wooden structure of poles sunk quite far into the ground and carefully covered with *chikka*. There is usually only one entrance. Stone benches are placed outside and *chikka* benches for both sitting and sleeping inside. The roof of straw thatch bundles is supported by a central pole of 2.5 m high.

Most common Konso house with double roof. CC- Jens Klinzing

Bench houses

The Bench people live mainly in the Bench Maji Zone. They are mostly agriculturalist. Pathways and compounds are contained using euphobia as boundary hedge. This wood is also used for the structure of the houses, which are not big and have quite a low entrance. Roofs are thatched and have a very prominent slope. The walls are filled with chikka with the exterior plastered. These houses usually have a veranda and an important overhang.

These houses have very often mural decoration which is made flattening the surface, covering with mortar and modelling in light a relief with simple pargetting designs. The walls are also decorated, with popular colours being orange, vermillion, charcoal and cinders.

Bench house. CC- Frans Devriese- photo_morgana

4.12. Tigray

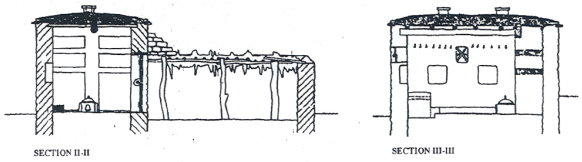
A. Hazards affecting the region

Drought / Earthquakes / Black cotton soils / Conflicts

Sources: LAST (n. d.), WOLDE-MARIAM (1996), GOYTOM (n. d.), LEPAGE (1973)

B. General description of habitat

Tigray is a historic region of the country with a very rich cultural heritage such as the archaeological site of the ancient city of Axum, an UNESCO World Heritage Site, strongly influenced by the Ethiopian Orthodox Church. The original capital of the Kingdom of Aksum is one of the oldest continuously inhabited places in Africa. Axum was a naval and trading power that ruled the region from about 400 BC into the 10th century.



Sections of a rectangular house in Tigray. © N. Gebremedhin

Stone masonry houses

The Tigray region is mainly mountainous and has massive stone resources that have been historically used by its inhabitants to build their houses. Terrace farming is common and deforestation is an important issue.

There are both rectangular and round houses. In some areas, dense villages can be found, but the most common are scattered houses forming parishes. Usually, livestock is kept safe in a courtyard with a high stone wall. Dung from cattle is used as fuel for cooking and for heat. When the family has several buildings, they usually build stone boundary walls to confine their compound. Some houses also have wooden covered verandas.

Good quality basalt is quarried in Northern Ethiopia and is used for solid foundations. Walls are usually built from easily cut and carved stone masonry (graytrachyte) with earth and straw mortar. In some cases, the technique of "monkey heads" is used in the walls: stone and earthen mortar masonry walls and timber ladder-like horizontal bands with short round cross-pieces whose end is visible. This technique is believed to make the construction more seismically resilient in this earthquake prone area.

Stone house with two levels in Axum. CC- A. Davey

Roofs are often flat with wide overhanging eaves that help protect the earth and straw mortar rendered walls from the heavy rains. Beams are covered with wood planks and an earthen mortar. *Acacia etbatica* wood (*Seraw* in Tigrigna language) is usually used for the pillars and beams to support the heavy earthen roofs of these houses.

Thatch roofs can also be found, usually in round houses, when they take a cone shape. CGI sheet roofing is becoming more common.

Exterior stone staircases are common. They lead either to the roof, that is used for many purposes, or to the upper floor, which may be used as bedroom, living room or guest room.

Stone house with one level in Axum. CC- A. Davey

The interior space is usually a single room with a fireplace dug in the earth floor. The smoke from the fireplace escapes through a chimney that is usually made with a broken water-pot. There are some windows and a main door. Timber is used for lintels. Interior walls are usually painted in white. Local limestone is used for this finishing.

Stone and *chikka* houses

Chikka houses are common down in the warmer areas of the region. The proportion of rectangular *chikka* houses with CGI sheet roofing is rapidly increasing.

In this region with stone resources, many *chikka* houses have stone foundations and plinths.

The *chikka* found in these warm areas has not much filling, so that there is free circulation of air.

Church of Abba Afse with «monkey heads» technique in the walls. Yeha, Tigray. CC- A. Davey

5. Learning from local habitat

5.1. Hazard-resistant practices

A. Floods

[ALL ETHIOPIA]

- Elevated granaries to protect crops against moisture are found in some regions.
- The roof structure is sometimes borne by an independent timber or bamboo frame while the inside space is fenced by load bearing *chikka* or stone walls. In case of damage to the walls during floods or earthquakes, the frame can withstand autonomously, hence preserving the roof which is often the most expensive part of the construction. Moreover, the space under the withstanding roof can be used as an emergency shelter.
- Some constructions in flood prone areas (e.g. Amhara, Anuak in Gambela or Aari in SNNPR) start with the creation of an earthen platform. This is done by raising up an earthen mound whose edges work as a sacrificial mass. This solution is very effective and it can be done at minor cost with earth from the site. However, regular maintenance is required to ensure its effectiveness.
- Vegetation cover around the houses, protect them from strong winds but also from floods effects thanks to the roots system.

[GAMBELA]

- The Nuer and Anuak peoples move from grassy flood-prone zones to higher places during the rainy season. Their villages are built in these higher zones. They have two kinds of houses, one made of grass for the dry season and *chikka* houses for the rainy season in villages.

[BENISHANGUL-GUMUZ]

- Raised platforms to store the grains and crops are common inside the houses in Berta and Gumuz societies.
- There also exist raised platforms to dry cereals outdoors (e.g. Berta people) which may reduce vermin attack.

[SOUTHERN NATIONS, NATIONALITIES AND PEOPLES' REGION]

- The Gurage have different spaces inside their houses that serve for storage of goods. The zones above the animal living areas in houses space (inside the main house) is covered by a mezzanine to store the firewood during the rainy season. Food is also kept inside from one year to the next as well as the tools for harvesting.
- The Alaba houses (SNNPR) have an earthen plinth with a step shape forming a circular bench around the house. This step serves to avoid damages from ordinary rains and even from ordinary floods.

B. Earthquakes

- The roof structure is sometimes borne by an independent timber or bamboo frame while the inside space is fenced by *chikka* or stone walls. In case of damage to the walls during floods or earthquakes, the supportive frame can survive autonomously, hence preserving the roof which is often the most expensive part of the construction. Moreover, the space under the resilient roof can be used as an emergency shelter.
- Some double story buildings in cities have the ground floor built with heavy materials such as stones and the upper floor built with lighter materials such as wood. Thanks to these greater lightness and flexibility, the upper portion is able to endure the movements produced by earthquakes without cracking. In case of partial collapse of the wall, the risk of serious injuries is considerably less, thanks to the reduced weight of the materials used.
- The round forms of *tukuls* provide better resistance to earthquakes.

Aari houses built on a mound with a round verandah protecting the walls from the rain. (Debub Omo Zone in SNNPR). CC- Richard Mortel

Karo people food storage on stilts (Debub Omo Zone in SNNPR). CC- Richard Mortel

Earthen plinth in an Alaba house (SNNPR). © Lorenzo Fontana

Heavy ground floor and light upper floor in Harar. The upper parts of the walls have a decreased thickness and/or are built with materials lighter and more flexible than those used for the lower parts. CC- Beth

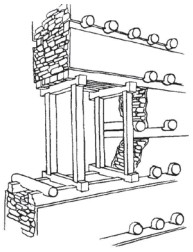
Church with horizontal «seismic» timber bands or «monkey heads» in Debre Damo monastery in Tigray. CC- Travel Aficionado

- Wooden structures have a good flexibility. They are more seismically resilient and rarely collapse in the event of an earthquake. Therefore they are also less likely to cause the loss of life of the inhabitants.

[AMHARA AND TIGRAY]

- In Tigray and Amhara regions, there are some examples of horizontal ladder-like timber bands. This technique called «monkey heads» is typical from the Axumite period, and has later been used in vernacular architecture. This technique consists of stone and earthen mortar masonry walls where timber ladder-like horizontal bands are integrated with a varying distance depending on the buildings. Long squared timbers tie the entire building and are held by short round cross-pieces whose end is visible (the "monkey heads"). The horizontal beams tightly hold perpendicular walls together and bind the whole building at different levels, avoiding dissociation and strengthening of walls towards out of-plane lateral forces during earthquakes.

Church of Yemrehanna Kristos with horizontal timber bands or «monkey heads» near Lalibela in Amhara. CC- Travel Aficionado



«Monkey heads» technique. © N. Gebremedhin

C. Erosion, landslides and riverbank erosion

- In many locations around Ethiopia, it has become common to implement terracing and reforestation activities so as to reduce erosion and landslides. This also helps to retain rainfall and replenish the underground aquifers.
- Surface drainage systems are usual. They are executed with simple means and contribute to the reduction of landslides by ensuring that water flows are managed and directed away from unstable areas.

Surface drainage system to prevent from erosion and flooding near Bahir Dar, Amhara. © O. Moles

TO FIND OUT MORE

- World Vision (2014)
  Trip Report and Recommendations. Regreening Tigray
  http://fmnrhub.com.au/wp-content/uploads/2014/02/Tigray-Regreening-Report.pdf

Stone barriers protecting plants against strong winds, improving water retention and infiltration and preventing soil erosion in Western Hararghe (Oromia). Project developed with USAID. CC- USAID

Stone terraces preventing soil erosion and landslides near Dire Dawa. CC- Petr Kosina

D. Insect infestation

[ALL ETHIOPIA]

- Farmers attempt a number of traditional control methods to control termite infestation, mostly plastic sheets and painting with used engine oil, but they were usually ineffective. (Debelo & Degaga, 2014).
- Eucalyptus, which is easily attacked by termites, is usually smoked and / or soaked in burnt oil.
- Termites are controlled by destroying their nests. When a termite nest is too close to habitation, it is common for the community to dig the queen out of the nest so that the whole colony moves away from the houses.
- Species such as *Thid* (*Juniperus procera hochst*) and *Kosso* (*Hagenia abyssinica*) have been traditionally used for the walls as they are very resistant to moisture and termites. Now they are very scarce. Also, in central Ethiopia, different kinds of wood species used in construction are more resistant to termites (people prefer them if available): *Dichrostachys cinerea* (Ader or Ergett-dimmo in amhara language, Adesa in oromo language, Dhigdar or Galool-sur in somali language), *Acacia etbaica* (Seraw in Tigringa language), *Flueggea virosa* (no local names available) or *Acacia Senegal* (Gum arabic tree). However, care should be taken when purchasing timber, as native species are carefully monitored and licenced by the authorities.
- As mentioned before in the text, smoke acts as a treatment of thatch against insect attacks.

[SOUTHERN NATIONS, NATIONALITIES AND PEOPLES' REGION]

- The Gamo people (SNNPR) leave slight gaps between the ground and the vegetation covering of their houses in order to reduce the termite attack on these materials.
- Weevils are a beetle which consume bamboo. The Gamo people (SNNPR) traditionally cut bamboo depending on moon cycles (no specific information found on what particular moments are preferred). The Gamo people (SNNPR) smoke the bamboo firing different leaves in order to avoid the attack of weevils.

E. Storms and strong winds

[ALL ETHIOPIA]

- Trees planted all around the house reduce the winds velocity and impact on shelters, as do all other kinds of vegetation. However, high and rigid trees must be located far enough from the buildings to avoid danger in case of fall. It is therefore common to favour lower vegetation close to the house (bamboo, banana trees...) and to keep high trees at sufficient distance. Other advantages brought by vegetation are the regulation of temperature and humidity around the house as well as the provision of fruits, vegetables and livelihood for families.
- Stones and other heavy materials are placed on top of CGI sheet roofs in order to reduce the risk of wrenching under strong wind pressure.

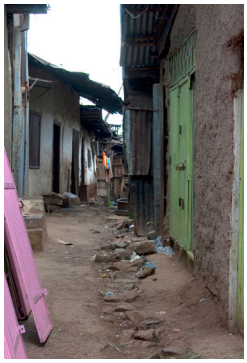
[HIGHLANDS]

- Hipped roofs are common in the Ethiopian highlands as they are far less impacted by high winds.

[AFAR AND SOMALI]

- Once finished, Somali and Afar huts are fastened and tied down with ropes so that they are not blown away by storms.
- During rainy seasons, a waterproof plastic sheet (*shiraac*) covering the entire hut is placed on top of the mats.

Hipped roofs with better resistance to strong winds in the Ethiopian highlands. CC- Beth



Stones forming a gutter to avoid soil erosion when water falls from roofs. Addis Ababa. CC- PicturesFromWords

Bamboo fence and vegetation around houses in Gamo-Gofa Zone (SNNPR). CC- Wac12 Wikimedia

F. Black cotton soils

- Bulding on black cotton soils is to be avoided if possible.
- Avoiding any risk of water content change in the soil that supports the building is a good strategy. In some buildings, the corridor space between the interior earth wall and the wooden exterior wall avoids the risk that the moisture changes associated with rain affect the soil under the hard walls. This soil will remain drier, and consequently this design will prevent the cracking of the rigid structure.
- Wooden structures have a good flexibility and are suited to soils with a significant risk of shrinkage and swelling. They do not crack easilty and do not tend to collapse without warning.
- Constructions built with elements disconnected from each other adapt easier to soil movements and so crack less due to soil expansion and retraction.
- Site selection for building erection must avoid risk of water stagnation around the building. Special care will also be taken to slope the ground surrounding the building to drive the water far from the building site.

Flexible wooden construction in a black cotton soils area in Bahir Dar (Amhara). © O. Moles- CRAterre

Black cotton soil in the dry season in Bura, Amhara. © L. Davis

Contemporary construction made of elements disconnected from each other is a good practice for the building not to crack due to black cotton soil expansion and retraction. Near Bahir Dar, Amhara. © O. Moles- CRAterre

This church (Bura, Amhara) lies on an earthen mound to protect against floods. There is a corridor between the interior earth wall and the wooden exterior wall. These two elements prevent from the effects of black cotton soils expansion if the platform is built with inert earth, and so cracking of walls is avoided. © L. Davis

5.2. Prevailing dangerous construction practices

LOCATION, SOIL, FOUNDATIONS AND SURROUNDINGS OF THE BUILDING

- In recent years, due to the adjustment of riverbeds and instances of flash flooding, many houses have been adversely affected by flooding. Overcrowding in cities has also led to the locating of houses closer to rivers that flood in times of high rainfall and overwhelmed drainage systems.
- Swelling clay soils or black cotton soils are common in Ethiopia. These soils are highly vulnerable to shrinkage and expansion. Black cotton soil is easily recognisable as it is usually dark in colour, shows deep cracks and is soft and fibrous in texture. It is of common knowledge that this type of soil is unstable, so it is often found in clear open areas that have been previously rejected for construction. So, if an open area has been selected for creation of camps or settlements, it is worth double checking for black cotton at an early stage, so as to avoid long term problems.
- If the wooden poles of the housing structure are in direct contact with the ground, (without a barrier such as a stone plinth), then they are vulnerable to rising damp and decomposition. This can lead to the collapse of the building. In addition, if the walls are made of *chikka*, wood or fibres, they can be vulnerable to rain and water damage, especially if close to a tap-stand or laundry area.
- If there is no superficial drainage at the base of the walls moisture and stagnant water can become a problem, especially if the rain falling from the roof has created a natural dip in the ground.
- Lack of drainage creates breeding ground for mosquitoes and other water-borne diseases. This should be monitored and remedied on a regular basis.
- Heavy rains, flooding and rising damp may compromise the integrity of the walls.

Houses settled precariously close to the flooding Akaki river in central Addis Ababa. CC- Magnus Franklin

LACK OF KNOW-HOW

- Using concrete for structural elements is challenging due to scarcity of good quality aggregates and clean water.
- Knowledge and skills to produce good concrete as well as necessary tools (e.g. for vibrating and compacting) are rather limited, especially in rural communities.
- There is sometimes a poor quality of the *chikka* mixture that depends on the season, the earth, the time of fermentation of the earth with the *teff* straw. There is also a general lack of know how to make and apply good and durable *chikka*. Badly mixed and applied *chikka* plastering quickly degrades, cracks or it gets washed out.

Stability problems due to black cotton soil expansion and contraction near lake Tana (Amhara). © L. Davis

BUILDING PRACTICES

- Unethical building practices using illegal timber or sand are common and often exacerbated in post-disaster situations. Practitioners should be very aware that the local authorities have strict rules about the exploitation of indigenous trees, which are protected by law. People caught felling or transporting these trees can face large fines.
- Wooden structures require large quantities of wood (one to two trees per m2). As a consequence of the fast degradation of wooden structures due to termites and to rotting, they need to be rebuilt fairly regularly (every 10 to 20 years). These two factors have a significant impact on local deforestation problems.
- Cracks and damage should be remedied quickly, as they can allow water penetration and rapid degradation of the core structure if left unrepaired.
- The nature of the materials used for rural constructions can leave them vulnerable to attack by rodents and termites, so there is a need of regular maintenance and repair.
- Lack of connections at the corners between walls of square houses leads to separation and collapse of walls as a result of erosion and subsidence, frequently in case of floods.
- A lack of perpendicular corner bracing and a lack of vertical-pole support for heavy roofs leads to walls twisting or bending and then collapsing.

Rectangular house damaged by frontal undermining caused by standing flood water. © IOM- James Kennedy

TERMITES

- The wood and straw thatch roofings of farmer communities are susceptible to termite damage, particularly in the tropical savanna areas. Thatching can be expected to last 5 to 6 years. Where the termite problem is very accentuated, thatched roof huts are destroyed in less than five years and corrugated iron roof houses in less than eight years (e.g. in western Ethiopia). (Debelo & Degaga, 2014).
- Once the termites have reached the roof, especially in CGI roof houses, which contain only a few roof supporting timbers, termites ring-cut the timbers at their junction with the wall leaving the roof with no fixation to the wall. As the damage is not visible, the homeowners do not take action timely, and thus the whole roof may be removed completely even by a slight wind. (Debelo & Degaga, 2014).

Termite infested house supported by poles.
© D. Debelo & E. Degaga

5.3. Lifespan and maintenance

[ALL ETHIOPIA]

- In most constructions with wooden or bamboo superstructure, the stability is ensured by the fact that the poles are planted in the ground. However, the downside of this is that it can cause the poles to rot due to moisture penetration. This can be reduced by the placing of the poles on a stone foundation plinth and also by a surface peripherical drainage.
- Wooden or bamboo posts often stand on waterproof elements (e.g. stones or more recently concrete). It increases the structure durability by preventing posts rotting.
- Bamboo may be soaked in a body of water for some weeks, soaked for months in mud or smoked on a fire. Painting bamboo with bitumen is also a common practice. When soaked in water, it helps washing the bamboo of its sugars (that attract termites).
- *Chikka* houses usually have roofs with a large overhang to protect the walls. Two or more *chikka* layers are applied for better durability. The first one is applied on both sides and the following ones more often only on the exterior side. With the roof overhang and a good *chikka* mortar, these walls may lasts for many years without major repair.
- Verandahs circling houses are common in different zones (e.g. Anuak in Gambela, Amhara) and protect the base of *chikka* walls from the effects of the rain and from the stagnation of water and consequent moisture in the walls..
- To prevent the cracking of *chikka* around wooden doors and windows, they are only fixed in place once the first layer of *chikka* is dry.

Church in Bura (Amhara) with an inner block built with *chikka* protected by a roofing with a very large overhang that creates a verandah surrounding the entire building. An eucaliptus screen helps proctect the chikka mortar and the foundations of the inner block from black cotton soils cracking. © L. Davis

This enclosed verandah around the church is the area for menstruating women to stand and be able to listen to the religious service, as they are not allowed in the main area of worship at that time.

[AMHARA]

- In areas of the Amhara region, some houses are built with wooden palisade load bearing walls on the ground floor, protected by stone masonry walls. These stone walls ensure the stability of the overall structure (by bracing the wall) and allow the vertical load transfer from the upper part of the building to its base.

[SOUTHERN NATIONS, NATIONALITIES AND PEOPLES' REGION]

- When a bamboo structure is damaged (usually rotten in the bottom), bamboo builders can repair it and save the upper part by adding new bamboo in the bottom and after they re-plant the structure on the ground.
- Slight gaps are sometimes left in SNNPR (e.g. Gamo people) between the ground and the vegetal covering of houses to partially avoid the attack of termites and rising damp coming from the soil, what increases the durability of fibres.

Stone masonry wall built to protect the lower part of the chikka walls in Bahir Dar. (Amhara). CC- A. Davey

- As mentioned in chapter 4, the lower part of the bamboo walls of the Dorze house is unprotected and is therefore attacked by termites and humidity. When lower parts of the bamboo structure start to get too rotten, the base of the housed is trimmed and woven to hold it in place, then the structure is reduced in height. Each time this happens, (approximately every 4-years), the height of the building is reduced by about 20 cm. Each house will begin life at about 6m in height, and it can take about 40-years before the house is too short for habitation, at which point it will be demolished and rebuilt. If the termites are a local problem, the entire community may be called upon to lift the house and move it to a new location away from the termites.
- Termites can be also considered as a resource: the earth extracted from their nests has good quality for constructions. For instance, this is the material that Alaba people use for their plasters. It is also used by researchers in several projects throughout the country (e.g. building of the ATRTC: Appropriate Technologies Research and Training Centre, in the village of Ropi -border between Oromia and SNNPR-, funded by Centro Italiano Aiuto all'Infanzia; or a family house built by students from Genova University).

Round verandah and stone plinth protecting a *chikka* house. CC- Beth

Constructions with stone plinths for protection of the wood and chikka walls from moisture and water splashing on the walls. (Amhara).
Left: © L. Davis; Right: CC- Beth

Earth from termites nests is used by the Alaba people for good quality durable plasters. The house in the right has been built with earth from termites nests. (Oromia-SNNPR). © Lorenzo Fontana

[ALL ETHIOPIA]

- Frequent repairing and even more the need to rebuild houses within a few years is uneconomical for subsistence farmers. It also has negative environmental impacts as trees are the major source for building materials while deforestation is a huge issue, as it is a major contributing factor in erosion of topsoil, loss of retention of water in the aquifers and subsequent flash flooding and drought.
- Thatch is a local material that can provide good insulation, ventilation and protection from rains, and can be a very adequate technique to promote local skills when available. Nevertheless, thatch may be a nesting place for insects and thatch roofs require frequent maintenance moreover if they are not properly executed. Thatched roofs also have the disadvantage of being flammable.
- Earth plaster needs regular maintenance, more specifically when roof overhang is limited on the wind side direction when it rains.
- Sometimes, roofs in papyrus are found. They are less durable than grass, but much faster to build as papyrus grows faster.

[AMHARA]

- In some areas of the Amhara region as mentioned before in this section, stone masonry foundation walls rise up a few feet from the ground level in order to protect the wooden palisade walls. This building system is slightly less flexible than the one only made of wood and not suitable for areas with expanding soil (black cotton soils) problems or earthquakes.

[SOUTHERN NATIONS, NATIONALITIES AND PEOPLES' REGION]

- Bamboo leaves used for covering the houses of Dorze and Sidamo are becoming rare and expensive.

Rectangular *chikka* house with a papyrus roof in Oromia. Papyrus is less durable but easier to build with as it grows faster than grass. © Lorenzo Fontana

5.4. Green design, comfort and health features and beauty

[ALL ETHIOPIA]

- Ceilings appear in some zones of the country (e.g. made from reed mats or made of bamboo). They have two main advantages, one is aesthetic, and the second is to improve comfort by insulating against the heat and the cold.
- The open weave screens of the bamboo, wood or fibre mats allow adequate ventilation in the interior of the buildings in the hot humid parts of the country.
- Thatch is a good material for roofing, as apart from protecting from rain it offers great insulation, good ventilation. Also, it is a traditional craft- whereas CGI sheeting is imported and expensive to replace when needed. Nonetheless, CGI sheeting is valuable and can become useful if the householder needs to raise funds as these sheets can be sold (e.g. in a moment of crisis). However, in conflict situations, the CGI sheets can be easily stolen and sold.
- Many houses with thatched roofs do not have a chimney. Smoke can pass through thatched roofs offering some level of treatment of the thatch against insect attacks and suppress sparks, due to lack of oxygen.
- Houses are richly decorated in different zones of Ethiopia. Interior decorated ceilings appear in the north of the country, while exterior mural paintings appear in the south and west.
- In many cultures (e.g. Welayta, Sidamo, Gurage in SNNPR, Nuer in Gambela, Ahmara, etc.), cattle are bought into partitioned areas in the house at night, so as to keep them secure from predators and thieves, whilst also providing welcome warmth for the household.

[AMHARA]

- Two storey stone houses are built in the mountains, where nights are cold. The cows heat the air so the hot air rises, passing through the wooden floor of the upper floor. This is a biomass heating system.
- The community of Awra Amba, near Bahir Dar is using energy efficient stoves, made of *chikka*. It saves wood, provides healthier conditions (thanks to the chimney) and contributes to keep the house warm.

[SOUTHERN NATIONS, NATIONALITIES AND PEOPLES' REGION]

- In the Alaba house, the top of the wall under the roof is left without plaster for 40-50 cm. This provides ventilation in the house, making it fresher.
- In the Alaba culture (SNNPR), decoration appears in a three-dimensional way through earthen plasters in the exterior walls of the buildings. These bas-reliefs represent symbolic aspects of the Alaba culture.
- In the Konso houses the smoke helps preserving meats as there is no chimney.

Interior ventilated space in a Gumuz house made of bamboo structure without chikka mortar and with a thatched roof. © A. González Ruibal et al.

Ventilation is made possible thanks to the absence of plaster in the upper part of the walls in the Alaba houses (SNNPR). © Lorenzo Fontana

Energy efficient stove made of *chikka* in the village of Awra Amba (Amhara). It improves the quality of the air inside the house. © Lorenzo Fontana

Decorated house, South Omo Zone (SNNPR). CC- Rita Willaert

Decorated house in Gambela. © Muse Mohammed - IOM

Bamboo ceiling near Bura (Amhara). Ceilings improve the house's comfort. © O. Moles- CRAterre

- The use of CGI sheets causes discomfort for inhabitants and may induce health issues. When a shiny CGI sheet is installed, it reflects some solar radiation, but heats up and radiates the heat inside the house. When CGI sheets rust, they become darker in colour and consequently reflect less radiation. Thus, the interior of buildings become hotter as the CGI sheets rust.
- Apart from their thermal disadvantage, CGI sheet roofs are noisy during rainy periods. Though, false ceilings reduce the noise and create thermal buffer zones.
- The floor may suffer from rising humidity.
- Thatch, bamboo or timber need to be treated against insects.
- Exposure to smoke inside the home, either from cooking with solid fuels or smoking tobacco, has potential harmful health effects and is often blamed for upper respiratory tract infections. Ninety-three percent of households in Ethiopia use some type of solid fuel for cooking, with virtually all of these households using wood. Exposure to cooking smoke is greater when cooking takes place inside the house rather than in a separate building or outdoors. In Ethiopia, cooking is done in a separate building in 47% of households, a figure that has increased since 2011 (36%).
- In urban areas, Liquid propane gas (LPG) is generally used for cooking. Nevertheless, Ethiopian households will still burn charcoal and incense indoors for hosting of the traditional coffee ceremony during which the green beans are roasted in an open pan over a traditional clay built charcoal cooking fire/grill. Such a pan is also used for cooking meat for roasted 'tibs', one of the traditional Ethiopian foods consisting of lamb pieces cooked on the grill.

Cattle is kept inside the houses in many zones of Ethiopia. Cooking is also usually an indoor activity, what can cause health problems. (South Omo Zone, SNNPR). CC- Rita Willaert

5.5. Sociocultural practices fostering resilience

[ALL ETHIOPIA]

- Traditional spaces of conviviality are important for establishing and maintaining community links. These public places appear in several cultures such as the Konso (SNNPR). The term *moora*, in the local language, indicates a well-defined typology of public space, and, for each village there are many of them, from ten to twenty, with different functions, shapes and attributes. It's the place of social and spiritual life, where children play, youngsters sleep and spend their time, the elders meet and discuss, women pass and can participate in some of the happenings. (Capurro et al., 2011).
- Economically, most of the materials necessary to produce vernacular habitats are taken directly from the local environment, and the money invested in these technical solutions is directly injected into the local economy.
- Environmentally, vernacular habitats involve the use of renewable materials, provided that adequate programmes to manage wood resources are in place.
- CGI sheets have the advantage of not being heavy, and thus, to require lighter supporting structures. This can help save wood.
- It is not uncommon to make "investments" by purchasing CGI sheets (in small quantities), which can later be used to the cover a house that will be built in the future, or, if necessary, be resold in case funds are needed. Nevertheless, the sums invested in such a way have very little impact in local economies (dealer profit margins, some transportation and implementation).
- The increased cost of the metal roofing compared to thatch roofing is usually offset by its benefits to rural inhabitants. These sheets are commonly collected and used as covering material or as capital to be resold in case of need (informal rural banking).
- Immediately after a disaster, affected households depend on bonding networks (relationships with immediate family members and relatives) and bridging networks (relationships with neighbours and friends) to cope with crises. Neighbours and relatives can play an important role during times of crisis. They are providers of food, clothes, and money. Moreover, they often are a source of emotional support, which is very important in bad times.
- Before heavy rains and floods, people store seeds and crops into dry place.

Public covered space in a Konso village (SNNPR) called *moora*. These traditional places are very important for coviviality and are common throughout the country. CC- Rod Waddington

- The Ethiopian Government has long fostered a system known as 1 to 5, in which five households are grouped together to provide mutual support and guidance in a community. This group is also the source of transmission of information, with a type of 'communication tree' between these five households and the local leaders. This information sharing network can be useful for implementing agencies, if they wish to give or receive information and verification of potential beneficiary households.
- Usually, even the poorest households can be sure that they will receive help by neighbours and relatives—and they also know that they will be obliged to help others in return.
- Gardens are cultivated in many zones of the country, so that there is always a certain amount of food available in stock or on the ground.

[BENISHANGUL-GUMUZ]

- Working parties play an important role in Berta society. When somebody wants to build a house or cultivate a field, they call their neighbours for help and provides beer and food as a form of payment.

[GAMBELA]

- Anuak and Nuer people usually live in areas that are flooded during the rainy seasons. Their villages are placed in higher places and they create seasonal camps in the lowlands during the dry season.

[OROMIA]

- In some Oromo groups the families build the *chikka* walls of their houses, and neighbours are the called for the construction of the roof structure. Mutual aid is so deployed.
- There is a deal of cooperation between members of communities who commit to share the workload (e.g. Oromo in the Jimma Zone).

[SOUTHERN NATIONS, NATIONALITIES AND PEOPLES' REGION]

- As mentioned in a previous section, when a Dorze house starts to rot or gets eaten by termites, the house is dug up. Bamboo is sewn round it to keep it in shape, and everyone helps carry it: men with poles poked horizontally through it, women with their backs against the wall grasping the lower edges, and the children holding poles to prevent it toppling. It is moved to its new site a little less tall than before (Last, n.d.).
- The Konso communities manage the forests around their settlements, and particularly value the Maringa Tree, which they grow close to their settlements as a source of food. It can also be used for medication and water treatment.

Dorze house being moved by the whole community in SNNPR. Bamboo structure is visible. © H. Mengitsu

5.6. Evolution of local building cultures

Sources: PETERSSON & STRÖM (2015), MOLES (2004), Lorenzo Fontana

ADOBE

Even though adobe is not a vernacular technique in Ethiopia, in some places it has become popular during the last decades, usually after development programmes or thanks to market based diffusion. If maintained and constructed correctly, an adobe house can be very durable. Thus, the development of this technique must rely on pilot projects and trainings, as people still need to understand its particularities. Bad examples could fast ride to a lack of confidence in this technique.

Deforestation originates scarcity of timber for construction and subsequent rise of timber prices. In some zones, this is the main factor why adobe technique is growing. Adobe walls are more resistant to termites than those of *chikka*, moreover when the latter are built with Eucalyptus (more resistant wood species being far less common). Adobe walls will not be damaged by termites unlike the wooden posts of *chikka* walls.

Culturally, people in most regions of Ethiopia are used to build with earth in the *chikka* buildings. Adobe can consequently be a suitable technique in several areas as the mixture used for *chikka* plasterings (earth, straw and sometimes cowdung) is not very different from the one used to produce adobe blocks and earthen mortar production. This technique that uses the same materials is then easier to learn and apply.

Adobe construction in Aira (Oromia). © Petersson & Strom

To find out more

- Petersson & Ström (2015)
  Sustainable housing in Ethiopia. A diffusion analysis of the Adobe technique.
  http://www.diva-portal.org/smash/get/diva2:825582/FULLTEXT01.pdf

Some zones stand out regarding the use of adobe technique in construction:

- Harari region and surroundings. In the area of Babile (East Hararghe Zone, Oromia), adobe has become widespread and has been around for several generations due to the lack of wood to build chikka houses. This zone is locally known as specialised in adobe construction.
- Central Rift Valley. Between Awassa (SNNPR) and Lake Zway (SNNPR and Oromia) adobe technology is more and more common. In this zone, observations show local adobe-block production sites, used both for traditional circular houses and rectangular ones. In the area of Adama (Oromia), adobe construction is also becoming common as it has already been used by local farmers for a long time.
- Other areas were the adobe technique is not anymore completely foreign are: Kembata Tembaro Zone (SNNPR) or Ambo, Nekemte and Idajii in East Wollega and West Shewa (Oromia); West Wollega (Oromia); or Gambela.
- A good example of project of 2012 built with adobe is a training centre for an integrated project by CIAI in the village of Ropi, Siraro Woreda, West Arsi Zone, in a rural area of Oromia Region. The traditional Oromo hut is scaled up in order to host five training rooms and a library. The Centre was built by local unskilled people trained on the worksite, using exclusively local materials: termite nest adobe blocks for the walls and the foundations and the traditional wooden structure with straw for the roof. The building consists in 2 concentric cylinders connected by 5 radial walls, giving solidity to the masonry. 40x40x15cm blocks have been used for the foundations, 16x32x11cm for the outer cylinder and the upper part of the inner one, 20x40x11cm for the radial walls and the lower part of the inner cylinder. The cost is 1500 birr/m². Materials used for the construction include: 3 termite nests, 80 eucalyptus poles, 1 isuzu of marsh reed, 2 km sisal string and 1 ha of straw.

Adobe round house in the Ethiopian Rift Valley (20 years since construction). © Petersson & Strom

Adobe production site in Aira (Oromia). © Petersson & Strom

Ropi Rural Training Centre. Project by: Arch. Lorenzo Fontana, CIAI (Italian Centre for Children Aid), University of Genova, 2012. © Lorenzo Fontana

CEB (COMPRESSED EARTH BLOCKS) AND HYDRAFORM

Both CEB and Hydraform blocks are already part of the building industry of Ethiopia. These materials are considered as modern. Most of customers using these technologies are high income people.

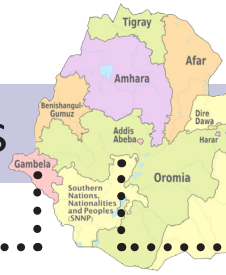
Ethiopia is one of the countries where Hydraform solutions are developed with good technical results. The market for Hydraform blocks in 2004 was much higher than the CEB one (an average of more than 3 000 000 blocks per year against around 500 000 standard CEB). Producers explain that customer save some cement due to the fact that Hydraform blocs are interlocking and so masonry out of this technology does not require mortar. Calculations show that in fact, Hydraform blocks, even if they are used in a load bearing walls do consume more cement than even infill Hollow concrete blocks technology. The main reason for people to choose this technology against other ones is the fact that when you have been able to buy the blocks themselves, you can achieve the construction very quickly with a good quality level without employing numerous skilled people.

School built with CEB (Compressed Earth Blocks) in Addis Ababa. © O. Moles- CRAterre

Some development institutions are involved in the promotion of these techniques, as the Selam David Röschli Technical & Vocational College develops trainings in CEB (http://www.selamchildrenvillage.org/TVET) in Addis Ababa. Projects of collective housing using the Hydraform technique have also been developed in the country with the support of the GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit GmbH). Small producers work in different parts of the country on the promotion of these techniques.

Comparison per m2 of wall (Birr)	HCB Hollow Concrete Blocks	Hydraform	CEB standard Compressed Earth Blocks	Adobe	Wood local house
Total cost	78,86	87,64	76,39	52,91	46,53
Cement cost included	22,87	24,31	12,70	4,05	4,05
Money locally invested	36,35	49,73	60,75	39,39	32,88
%	46%	57%	80%	74%	71%
Money going out of Ethiopia	42,52	37,9	15,63	13,52	13,65
%	54%	43%	20%	26%	29%

Comparison of different construction systems regarding cost, cement cost, money locally invested and money being invested outside Ethiopia. Case study for Awasa (Sidama Zone, SNNPR) in 2004. This kind of study must be undertaken and updated in every single context before taking any decision concerning shelter or habitat development projects. © O. Moles-CRAterre (2004)



TRANSITIONAL SHELTERS FOR SOUTH SUDANESE REFUGEES IN GAMBELA

Project by: IOM, Administration for Refugees and Returnees Affairs (ARRA), United Nations Higher Commissioner for refugees (UNHCR).

Contextual Information:

Location:

- Region: Gambela
- Zone: Anuak
- Woreda: Itang special woreda
- Kebele: Pulkot Tharpam sub kebele
- Town: Terpam

Geographic information:

- Topography: mainly plain but hilly for the specific refugee camp
- Altitude: 450 m

Main ethnic groups: Nuer and Anuak

Climatic profile:

Description: The climate is tropical. The summers are much rainier than the winters. The average annual temperature °C.

- Average temp.: 27.4 °C
- Avg. Max. temp.: 29.7 °C
- Avg. Min. temp.: 19 °C
- Average rainfall: 933 mm

Project principles and scope:

The Gambela region is located in the Western of Ethiopia and next to the border with South Sudan. After the conflict erupted in South Sudan in December 2013 and caused massive displacement both internally and into neighboring countries.

The region received the largest number of refugees fleeing the conflict in the eastern parts of South Sudan. Several number of camps were set up to receive a high influx of people seeking Protection and adequate shelter, along with access to food, water and basic services. The country lead actors are the Administration for Refugees and Returnees Affairs (ARRA) and the United Nations Higher Commissioner for refugees (UNHCR). IOM as one of the partners in the implementation of transitional shelters and refugee transportation from the border to the camps, has been active in the region since 2011.

The project had reached about 6,645 refugee households from the year 2012 to 2017 in the region. IOM also expands its shelter programming towards host community assistance in order to avoid any tensions between refugees and host community. In 2017, IOM has reached about 214 households in three different refugee camp neighboring *kebeles* through construction of shelters.

Design Considerations:

Design: the main actors have an engagement to the provision of transitional shelter to South Sudanese refugees. The decision was to provide it with harmonized houses based on vernacular designs. The design was adopted through the Shelter Working Group (SWG) with the inclusion of the Refugee Committee Council (RCC) which considered of the cultural and environmental acceptability.

The transitional shelter project promotes beneficiary's engagement towards the construction through cash for work that became more essential and involves active participation of refugee beneficiaries through mud plastering and thatching of their own homes thus increasing ownership of the process. The project is also a way to creating job opportunities through carpentry trainings to refugees as well as host communities.

Cost: able bodied - between 333 USD and 366 USD for the vulnerable homesteads.

Materials:

- Foundation: eucalyptus poles 10 cm diametre sunk to a minimum of 60 cm depth and stabilized with rubble stone and earth filling.
- Plinth: well compacted earth floor to an effective height of 150 mm above ground level
- Central post: eucalyptus pole
- Walls: *chikka* walls (wood and earth and straw plasterings).
- Openings: Wood frame + CGI sheet door.
- Roof Type: Four pitched thatched roof
- Roof structure: wood.
- Bracings: Eucalyptus poles thickness of 8 cm diametres for rafters and tie beam. 6 cm diametres for wall pass
- Treatment (wood): eucalyptus poles are treated
- Roof cover: thatch. grass thatching

Transitional shelter for South Sudanese refugees. © Muse Mohammed - IOM

Active participation of beneficiaries through mud plastering and thatching. © Muse Mohammed - IOM

Sources: YITBAREK ALEMAYEHU (2011), YITBAREK ALEMAYEHU (2012) KELLET & YITBAREK ALEMAYEHU (2013), SEWNET (2015)

SUSTAINABLE RURAL DWELLING UNIT (SRDU)

Project by: Ethiopian Institute of Architecture, Building construction and City development (EiABC); Arthur Waser Foundation of Switzerland and ETH-Zurich North-South Centre

Contextual Information:

Location:

- Region: SNNPR
- Zone: Gurage
- Woreda: Welkite
- Town: Gubre

Geographic information:

- Topography: hilly
- Altitude: 2 044 m

Main ethnic group: Gurage

Climatic profile:

Warm and temperate. Rainy summers and dry winters.

- Average temp.: 18.5 °C.
- Avg. Max. temp.: 27.9°C
- Avg. Min. temp.: 9.1°C
- Average rainfall: 1,221 mm.

A Gurage village near Gubre. © SRDU documentation team

SRDU I prototype. © Yitbarek Alemayehu

SRDU II prototype. © SRDU documentation team

Project principles and scope:

Draw lessons from the vernacular architecture of a rural area (Gurage). Implementation of housing types including the advantages of the traditional Gurage house and improving the aspects worth evolving, while maintaining the Gurage identity.

Capacity building through hands-on training on a one-to-one construction of housing units.

Phase- 1: documentation and study of the existing vernacular architecture and local building materials. Phase-2: construction of a single proto-typology (SRDU) including the use of renewable energy. Phase-3: replication.

Design Considerations:

Design: SRDU I prototype is a house with dimensions of 7.51 m per 7.51 m each side and a height of 8.69 m. Ground floor with living room, kitchen and an indepentend barn. Mezzanine including two rooms. The house is square instead of the traditional round ones. It also has openings apart from the main door. WC and storage spaces are accessible from the exterior.

SRDU II has a round plan, like the vernacular Gurage constructions.

Cost: between 600 birr/m² (21.5 USD) if built by a local resident and 2,000 birr/m² (71.6 USD) if built by an outsider.

Materials (SRDU I):

- Foundation: stone gravel
- Plinth: stone gravel
- Central post: wooden pole
- Walls: sun-dried earth and straw blocks (adobe).
- Openings: Wood. SRDU I: 1 main door + 2 back doors + 2 windows in the ground floor. 4 horizontal windows in the upper floor.
- Mezzanine floor: light weight earth fill graded on a adobe block vault
- Roof Type: Four pitched thatched roof
- Roof structure: umbrella type structure
- Bracings: bamboo studs which connect the foundation with the wall
- Treatment (bamboo & wood): ?
- Roof cover: bamboo leaves

Interior of SRDU I prototype. © Mulugeta Gebrekidan

7. Additional resources and bibliography

7.1. For further information

General


A

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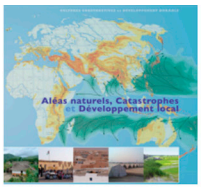

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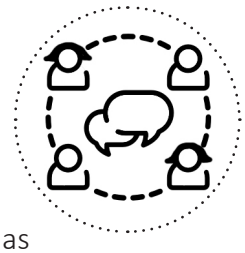
7.4. Series of detailed shelter response profiles

Country/territory	Language	First edition	Available online
Fiji	English	March 2016 (after Cyclone Winston)	https://www.sheltercluster.org/fiji-cyclone-winston-2016/documents/fiji-baseline-data-local-building-culture-coping-strategies
Ecuador (Coastal area)	Spanish	May 2016 (after April 16 earthquake in Coastal area)	https://www.sheltercluster.org/sites/default/files/docs/ecuador_costa_habitat_local_y_estrategias_de_respuesta_craterre310516_1.pdf
Haiti	French	October 2016 (after Cyclone Matthew)	https://craterre.hypotheses.org/1803
Bangladesh	English	September 2018 (preparedness tool)	https://www.sheltercluster.org/bangladesh/documents/detailed-shelter-response-profile-bangladesh
Ethiopia	English	December 2018	
Democratic Republic of the Congo (East)	French	December 2018	

Key issues for initial diagnosis and project implementation



PROJECT MANAGEMENT

- Identify regulatory and social requirements.
- Identify and meet the different authorities.
- Involve representatives of the community (stakeholder groups) and local professionals as much as possible in the decision-making process for the project.
- Coordinate the project with other ones to develop yours in a comprehensive and integrated approach.
- Carry out a field survey as soon as possible to identify the strengths and weaknesses of local building practices and the local market, as well as actual capacities and training needs.

SOCIOCULTURAL PRACTICES FOSTERING RESILIENCE

- Analyse local practices regarding community cooperation in the building sector and other sectors (e.g. agricultural activities).
- Identify local practices regarding risk preparedness and recovery.

SITING

- Carefully select the construction site to avoid risky areas, comply with business activity area requirements and grant access to basic services.
- Plan for an easy access to drinking water and sanitation services.
- Take into account land tenure issues.

LOCAL HABITAT ASSESSMENT

- Identify local building practices and know-how and valorise the ones fostering the inhabitants' resilience. Appreciate and adapt to local practices, including in the informal sector.
- Identify local practices that contribute to an ecological and comfortable habitat.
- Identify weaknesses so as to give focus to the technical reflection (reverse-engineering process).
- Include building maintenance and repair related issues in the reflection.
- Collect feedback from previous projects.
- Consider different scales: materials, elements, construction systems, building, neighbourhood, environment, territory.

ARCHITECTURAL DESIGN AND CONDITIONS OF USE

- Make sure that the solutions and practices you promote are financially and technically accessible for most people so as to ensure the long term impact of the project.
- Identify the composition of the household and local practices in terms of cohabitation and uses of indoor and outdoor areas.
- Question the concepts of durability, dismantling and reuse related to local customs.
- Allow for a flexibility of the building system so that inhabitants can develop appropriation processes and make it evolve all along its lifespan according to their needs and abilities.
- Carefully define the orientation and position of buildings and public/private outdoor spaces into the compound, and the landscaping of the latter.
- Ensure that the building design provides a sense of pride among beneficiaries.

CONSTRUCTION AND BUILDING LIFESPAN

- Select materials according to their availability and accessibility and check their quality. Select materials in order to facilitate their reuse or recycling.
- Carefully design and build the crucial elements related to risk reduction: the anchorage of the roof and the walls to the foundations, the structure bracing devices, the water-resistant plinth and/or the post ends protection systems, the protection of walls (plastering, grouting), the seismic bands, etc.
- Sensitise people about the importance of regular maintenance in DRR.
- Assess material sourcing and reuse options to ensure environmental sustainability.

BUILDING PROCESS

- Develop and insist on the potential pedagogical value of the project and on the importance of its replicability.
- When possible, build a prototype that will allow to make any necessary adjustments.
- Beware of climate and seasonal constraints affecting the availability of people and materials.
- Analyse the social aspects of the building processes and their impacts on the community cohesion and the efficiency of works. Ensure that traditional mutual help systems are valorised.
- Give priority to local populations and artisans in the building process to ensure a positive impact for the community.
- Pay attention to supervision, training and communication needs.

THE FIELD SURVEY

CAÏMI (2015)

ASSESSMENT CONTENTS & MAIN INFORMATION SOURCES

● main source
○ complementary source

	COMMUNITY MEMBERS	INHABITANTS / TENANTS / HOUSE AND LAND OWNERS	SELF BUILDERS / CONSTRUCTION ARTISANS	MATERIALS PRODUCERS / SUPPLIERS /CARRIERS / CONTRACTORS	TECHNICIANS / EXPERTS CONSTRUCTION SPECIALISTS	LOCAL AUTHORITIES / GOVERNMENTAL DEPARTMENTS	FORMAL & INFORMAL COMMUNITY LEADERS	GOS & NGOS / COORDINATION BODIES	VOCATIONAL / ACADEMIC / RESEARCH / TRAINING CENTRES	OBSERVATION IN THE FIELD	DOCUMENT REVIEW
SITE											
Natural environment	●									●	●
Socio-economic profile	●					●	●	○			●
Infrastructures	●					●	●	○		○	●
HABITAT											
Settlements	●					●	●			●	○
Housing/building typologies	●	●	●		○				○	●	○
Building construction	●	●	●		○	○			○	●	○
CONSTRUCTION PROCESS											
Activities & roles	●	●	●			●	●			○	○
Maintenance	●	●	●							○	
Training		○	●	●	●			○	●		
RESOURCES											
Materials	●	●	●	●	○				●	○	○
Skills & know-how	○		●	●	●			○	○		
Costs	●	●	●	●	○	○					
RISK REDUCTION											
Natural hazards & risks	●	●	●			●	●	○		○	○
Adaptation & coping strategies	●	●	●			●	●	○	○	●	
CAPACITIES											
Organizations & networks	●		○		○	●	●	○			
Cooperation systems	●	●	●	○	○	○	●	○	●		
Key persons & groups	●	●	●		●	●	●	○			

TO FIND OUT MORE

ON PROJECT MANAGEMENT AND FIELD SURVEYS:

- Assessing local building cultures, a practical guide for community-based assessment (Caïmi, 2015)
  https://hal.archives-ouvertes.fr/hal-01493386/file/16059_Caimi_Assessing_local_building.pdf

SELF-ASSESSMENT SUSTAINABILITY TOOL FOCUSED ON SHELTER AND SETTLEMENT RECONSTRUCTION IN THE AFTERMATH OF NATURAL DISASTERS:

- QSAND Tool
  http://www.qsand.org/

SUSTAINABLE HOUSING DESIGN TOOL TO ASSIST HOUSING PRACTITIONERS IN DESIGNING EXEMPLARY SOCIALLY AND CULTURALLY RESPONSIVE, CLIMATE-RESILIENT AND ECONOMICALLY SUSTAINABLE HOUSING PROJECTS:

- Sherpa Tool
  https://unhabitat.org/sherpa/

ONLINE REFERENCE GUIDE WITH TOPICS (POLICY, PROGRAM AND OPERATIONAL FRAMEWORK) TO BE MANAGED IN EMERGENCY SITUATIONS:

- Care Emergency Toolkit
  https://www.careemergencytoolkit.org/

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Victoria Murtagh
Eugénie Crété

With contributions by:

Dawit Abraham
Christèle Chauvin
Lara Davis
Lorenzo Fontana
Amanda George
Thierry Joffroy
James Kennedy
Muse Mohammed
Olivier Moles
Mohamud Omer
Addishiwot Samuel
Murielle Serlet
Beth Simons
Marina Trappeniers
David Zimmerman

Language review:

Victoria Murtagh

Institutions

National Disaster Risk Management Commission (NDRMC) of the Government of Ethiopia

Global shelter cluster
Website: https://www.sheltercluster.org/

Shelter cluster Ethiopia
Website: https://www.sheltercluster.org/response/ethiopia

CRAterre
Maison Levrat, Parc Fallavier. 2 rue de la Buthière – BP 53. 38092 Villefontaine, France.
Website: http://craterre.org
Email : craterre@grenoble.archi.fr
Tel: +33 (0)4 74 95 43 91

LabEx AE&CC / ENSAG / Université Grenoble-Alpes
Unité de recherche Architecture, Environnement et Cultures Constructives
ENSAG- École Nationale Supérieure d'Architecture de Grenoble. 60 Avenue de Constantine- CS 12 636. 38036 Grenoble, France.
Website: http://aecc.hypotheses.org

International Organisation for Migration (IOM)
17 Route des Morillons. 1218 Grand-Saconnex. Switzerland
Website: https://www.iom.int/

International Federation of Red Cross and Red Crescent societies
International Federation of Red Cross and Red Crescent Societies. P.O. Box 303 CH-1211 Genève 19, Suisse.
Website: http://www.ifrc.org/

CARE International UK
9th Floor, 89 Albert Embankment, London, SE1 7TP United Kingdom.
Website: https://www.careinternational.org.uk/

Shelter Cluster
ShelterCluster.org
Coordinating Humanitarian Shelter

European Union
Civil Protection and
Humanitarian Aid

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ENSAG
Communauté
UNIVERSITÉ Grenoble Alpes

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