



Introduction guide to the preservation of

Traditional thatching

of the
Buganda community in Uganda



United Nations
Educational, Scientific and
Cultural Organization



World
Heritage
Convention

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BUGANDA THATCHING GUIDE

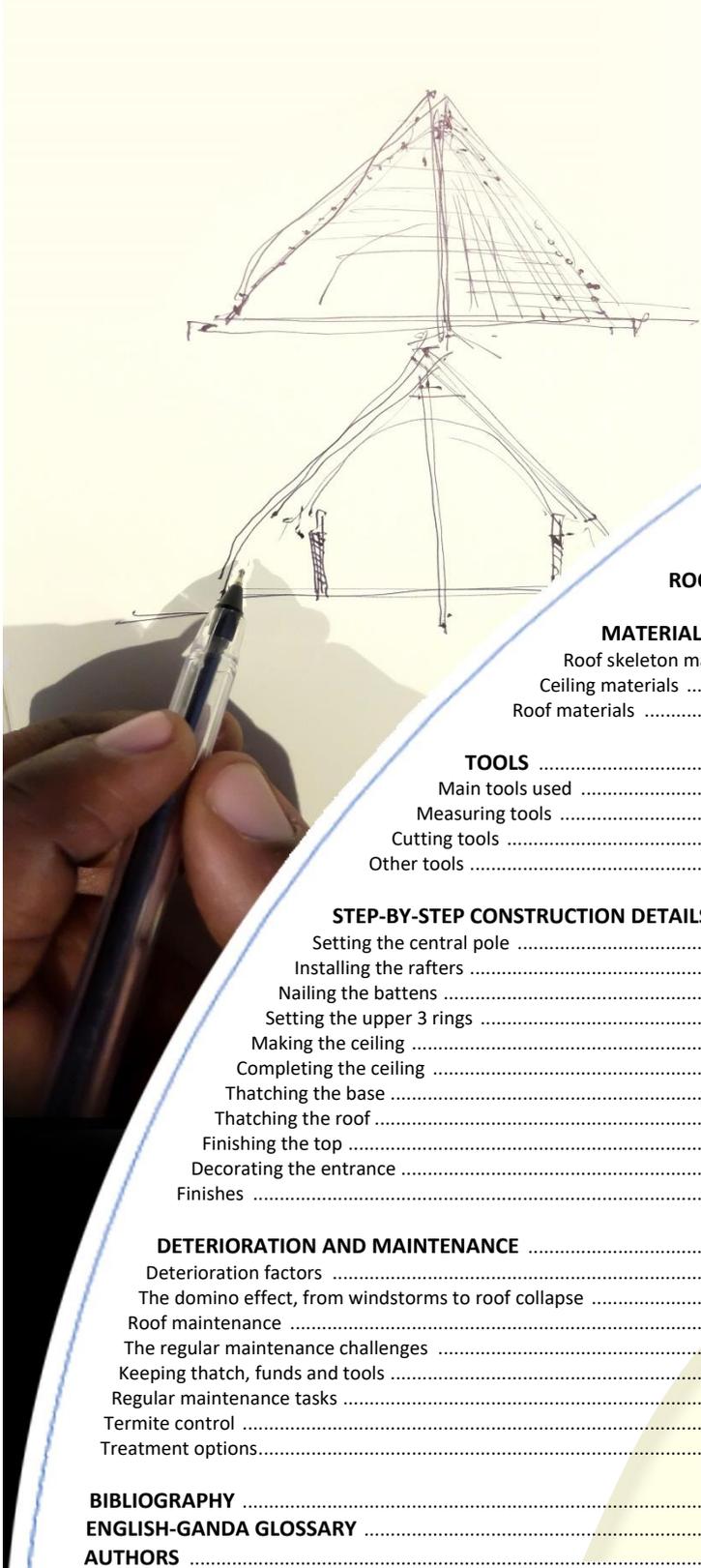


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FOREWORDS



Ssabasajja Kabaka Ronald Muwenda Kimeru Mutebi II
King of Buganda



The Tombs of Buganda Kings at Kasubi are the pride of our Kingdom, by its international stature and by the splendour of the main building, the Muzibu-Azaala-Mpanga, an unequalled architectural achievement for vegetal architecture. Its destruction by flames ten years ago shocked us all. No one could have imagined experiencing this one day in their lives. Its loss erased a strong landmark of our culture, a sacred mausoleum where the souls of my 4 predecessors rest, but also a proof of the greatness of our kingdom.

As the Kabaka,

It was my duty to resurrect this building, to seal the wounds inflicted by its loss,

It was my duty to once again offer a prestigious shelter to the souls of my forefathers,

It was also my duty to show the world that our culture is still vibrant and that our craftsmen are capable of reproducing the deeds of the past.

The reconstruction, which is moving forward at a fast pace, was a real challenge mobilizing hundreds of people. The kingdom, with the support of the Ugandan government, has made every effort to achieve this. The best engineers and architects have invested in the project. The World Heritage site status acquired in 2001 also helped us to mobilize international resources. Indeed, we have benefited from very significant support from UNESCO and the Government of Japan, which has made it possible to mobilize international experts to enrich the debate on the reconstruction strategies to be adopted. The Japanese expertise on thatching and that of CRAterre on issues of authenticity have been very useful to us.

The reconstruction could have made use of contemporary industrial materials. Many proposals were made to me in this regard: Why not take advantage of the destruction of this old architecture to build something modern? But that would have definitely distorted the site and erased a page from the history book of our great kingdom. If the site has acquired its status as a World Heritage Site, it is among other things thanks to the know-how it demonstrates. It is indeed a "masterpiece of human creative genius" as designated by UNESCO.

This is why we wanted to take advantage of this reconstruction to give the craftsmen the chance to practice their art and revitalize it. A new generation of thatchers has emerged from this tragedy and is already showing great talent. We wish them all the best in bringing to life the knowledge they have inherited and we thank them for committing themselves to this professional path. This guide to which they have greatly contributed pays tribute to their achievements and marks a further step in the recognition of a unique technique.



Mechtild Rössler
Director of the UNESCO World Heritage Centre

The international community joined the Buganda Kingdom and local communities in mourning the destruction of the Muzibu-Azaala-Mpanga, which housed the tombs of the four previous Buganda Kings and is considered a masterpiece of Ganda architecture, during a devastating fire at the Tombs of Buganda Kings at Kasubi World Heritage property in Uganda in 2010.

In response to this disaster, the UNESCO World Heritage Committee inscribed the site on the List of World Heritage in Danger in order to mobilize international support for its reconstruction. In 2013, UNESCO received a generous contribution from the Government of Japan to support a 650,000 USD project entitled ‘Technical and financial assistance for the reconstruction of Muzibu-Azaala-Mpanga, architectural masterpiece of the Tombs of Buganda Kings at Kasubi, Uganda, World Heritage property in Danger’.

The project was designed to offer Emergency Assistance to Uganda and accompany them in rehabilitating the property in view of its removal from the List of World Heritage in Danger. It aims to set up an efficient risk prevention scheme at the site with all the equipment needed and support the cost of qualified supervision for the reconstruction of the destroyed roof. In addition, the project is providing scientific support to the team in charge of reconstruction to ensure that the ‘outstanding universal values’ of the site, both tangible and intangible, are maintained.

This thatching guide is one of the results of this project, and was developed through close and wide collaborations with the Buganda Kingdom, its craftspeople team, Mr. Jonathan Nsubuga (the site architect), Japanese experts on thatched structures who visited the site during the course of the project as well as a CRAterre (International Centre for Earthen Architecture) expert.

I am confident that it will prove to be a cherished reference for the continued maintenance of the Kasubi Tombs site, which will reinforce respect for the unique know-how of the Buganda Kingdom craftspeople and for other cultural sites around the world.



Takio Yamada, Former Permanent Delegate and
Ambassador Extraordinary and Plenipotentiary of Japan to UNESCO

Following the devastating fire in 2010 that ravaged the Tombs of Buganda Kings at Kasubi World Heritage property in Uganda, the Government of Japan through the Japanese Funds-in-Trust to UNESCO offered emergency assistance to Uganda with the project ‘Technical and financial assistance for the reconstruction of Muzibu-Azaala-Mpanga, architectural masterpiece of the Tombs of Buganda Kings at Kasubi, Uganda, World Heritage property in Danger’ in the hopes of removing the site from the List of World Heritage in Danger.

As part of the project, we sent a team of experts from Japan on four missions from 2011 to 2016 to work with the reconstruction team at the site on the thatching work required for the roof structure of the Muzibu-Azaala-Mpanga. They shared experiences from thatching projects in Japan as well as insights and advice on fire prevention methods. These exchanges of expertise between Japan and Uganda are reflected in this Thatching Guide, which provides a valuable reference not only for the Kasubi site but also for other similar structures around the world.

We are honoured that Japan could help bring solutions and much-needed support to this tragic situation, and hope that this project will help the Tombs of Buganda Kings at Kasubi World Heritage property to be successfully removed from the List of World Heritage in Danger.



Christopher Kawoya

Wabulakayole (Senior thatcher of the Buganda Kingdom)



I was born in 1932 and I started thatching in 1955 at the age of 23, following the steps of my father who was himself the *Wabulakayole* (senior thatcher) of the Kingdom. By that time, we were many thatchers in Buganda. Each sacred site had its own thatchers team. Work was easier because materials were easily available everywhere. We were living comfortably although nobody was paying us. We were receiving gifts in kind for our work and we also had our small farms to sustain our families.

I built and maintained roofs constantly for the past 64 years, at Kasubi, Wamala, Naggalabi-Buddo, Kyebando, Kanzizi, Banda, Bwanika... I am proud of my achievements and proud of my skills. I have trained many thatchers, some of them already died.

I built my first roof on my own at the age of 35, after 12 years of work under my father's supervision. A year later, in 1968, I was made *Wabulakayole*, because my father had become too weak to handle the work. My father wrote a letter to the *Ngeye* clan (Colobus monkey) elders to announce his resignation as *Wabulakayole* and suggested to transfer the responsibility to me, which the elders accepted. This was a discreet nomination, without ceremony or rituals performed because by that time the Kingdom was abolished. One day, one of my sons will take over my responsibilities.

Today, only one group of 18 thatchers remain and we have to maintain all the sites in the Buganda Kingdom ourselves. Getting the raw materials has become a challenge, because forests and bushes have disappeared. But I am confident for the future. Our skills can not disappear because they have been recognised by UNESCO, and because we will always be called by the Kingdom to maintain thatched roofs. The sad days when we had lost recognition and respect are now behind us.

At the age of 87, I keep going to Kasubi every day to transfer my skills to the young thatchers. I also keep working despite my age because I want to see *Muzibu-Azaala-Mpanga*, the great hut which got destroyed in 2010 rebuilt.

I encourage the young thatchers to keep working hard and to never give up. There is enough work for many thatchers in the country. Our thatching technique is the most difficult one in Uganda. Buganda thatchers can therefore keep themselves busy with other techniques when they are not mobilised on Buganda sacred sites. This is what I have done throughout my life, I have practised other techniques in various Kingdoms within Uganda, but our technique remains my favourite.

INTRODUCTION



Thatched roofs are becoming scarce on all continents. They are generally reserved for modest homes in rural areas. Outstanding exceptions in the design and construction of thatched roofs however exist. UNESCO's World Heritage List presents several of these extraordinary architectures, which prove that it is possible to build huge monuments just from dry grass and a few reeds, an unthinkable concept for a contemporary engineer or architect trained in reinforced concrete.

At a time when humanity is trying to reinvent architecture to return to more environmentally friendly practices, thatch is once again becoming popular. The ecotourism industry and the heritage sector are embracing thatch as a warm and welcoming material which enhances the visitors experience. But these practices remain marginal and some techniques such as the one described in this guide, which are totally unknown and undocumented, could disappear.

The examples on the next page show some of the human achievements in the production of straw roofs. Each region has its own technique, linked to the natural resources available, the climate and maintenance needs. The technique described in this guide differs from others in that the straw is not tightly attached to the roof structure. Only a few bundles at the base and those hidden below the surface are tied. Most grass bundles are held in place by the upper ones, by compression. The great advantage of this concept is that it makes it easier to maintain roofs, replacing straw only in places where it is damaged, without dismantling large portions of the roof. This partly reduces the maintenance work that these roofs require.

Another curiosity that makes this technique very different from the others is that the grass is placed "upside down", stem inside and leaves at the bottom, exposed. In most thatching techniques, the thicker and more resistant base of the stem is exposed to the elements. The grass is normally laid in the same direction it grows, leaves up and stem down. Buganda craftsmen have shown that the opposite is also possible.

It took centuries of practice for Ugandan craftsmen to achieve such excellence in terms of knowledge, to move from basketry to house roofs and then to giant palaces and tomb roofs. The largest roof in the Kingdom, covering *Muzibu-Azaala-Mpanga* on Kasubi Hill is 31 m in diameter, making it one of the largest straw roofs in the world. This masterpiece contributed greatly to the inscription of the Kasubi tombs on UNESCO's World Heritage List in 2001. These architectures represent one facet only of the immense creativity of the Kingdom's craftsmen. Even today, Buganda men and women impress us with the finesse of their work and the constant renewal of the decorative motifs, especially in the production of mats and baskets. This cultural richness is internationally recognized.

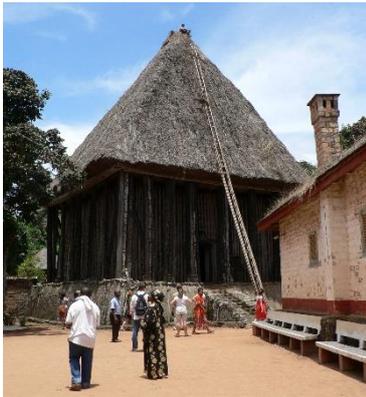
Yet this heritage is fragile. The loss of knowledge, the scarcity of materials and fires are wreaking havoc. We must remain vigilant to celebrate artisans in their art, and encourage young people to join them. We need to let them know that what they are doing is truly exceptional and unique. This book is a first step in recording the knowledge of the last craftsmen in order to prevent it from being lost. It has been written on the basis of information accumulated by CRAterre over 25 years of collaboration with the craftsmen and several institutions that showed interest in their work, within Uganda and at the international level. This guide aims to transmit technical information only. It should be noted that many rituals punctuate each construction phase of these roofs. These rituals, most of which are kept secret, are unfortunately not described here, but they should be respected as they are an integral part of this exceptional heritage.



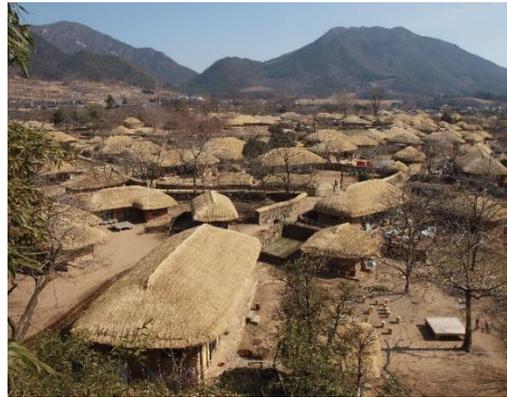
Kasubi Tombs, World Heritage Site, Uganda
(Largest thatched structure in Buganda known as "Muzibu Azaala Mpanga")



Tomb of King Suuna II, Wamala, Uganda



Bafut Chief Palace, Cameroon
Photo David Gandreau CRAterre



Haohe Village, World Heritage Site, Korea
Photo David Gandreau CRAterre



Gokayama, World Heritage Site, Japan
Photo Jun'ichi Hasegawa



Shirakawa-go, World Heritage Site, Japan
Photo Jun'ichi Hasegawa



Louisias Barn, Charavines, France



Tourist restaurant in Nangurukuru, Tanzania

SKILLS

Eighteen skilled thatchers belonging to the Buganda Kingdom are currently available. Five of them belong to the *Ngeye* (colobus monkey) clan. The others belong to 10 other clans, namely *Ngo* (leopard), *Nte* (cow), *Mamba* (lung fish), *Mpologoma* (Lion), *Nkima* (Monkey), *Essenene* (Grasshopper), *Ekooobe* (Wild yam), *Embogo* (Buffalo), *Engabi* (Antelope), *Envubu* (Hippopotamus). Practicing thatching is therefore not only reserved for members of the *Ngeye* clan, even on sacred royal sites. On the other hand, only members of this clan can access the supreme title of *Wabulakayole* (Senior thatcher of the Buganda Kingdom). Their names and contact are available at the end of this guide. They are all men. Tradition unfortunately does not allow women to work on roofs or even to enter buildings during the construction process.

All the thatchers have chosen this profession voluntarily. They have followed very different paths before embracing this vocation. All of them have acquired their knowledge through practice, working with Christopher Kawoya and his son Steven Lumbuye, particularly at the Wamala and Kasubi sites. It easily takes ten years of practice before one can master the construction of a new roof without the help of a more experienced thatcher.

They all believe that their skills will go through a revival process thanks to the respect that their profession has earned and thanks also to the flourishing tourism industry in Uganda. However, the future of their profession remains fragile, and depends on the contracts they will be given to maintain existing roofs or build new ones. Competition from other technologies is also a threat to their knowledge. Thatch roofs of the English or South African type that bloom on tourist sites (ecolodges) are faster to erect and more durable over time (chemically treated reeds), but their maintenance remains complicated.

Even if the ganda thatching technique is fascinating, its long-term preservation remains a challenge requiring a permanent struggle on the part of thatchers who must maintain the excellence of their know-how to attract potential customers who will offer them the opportunity to practice their art.

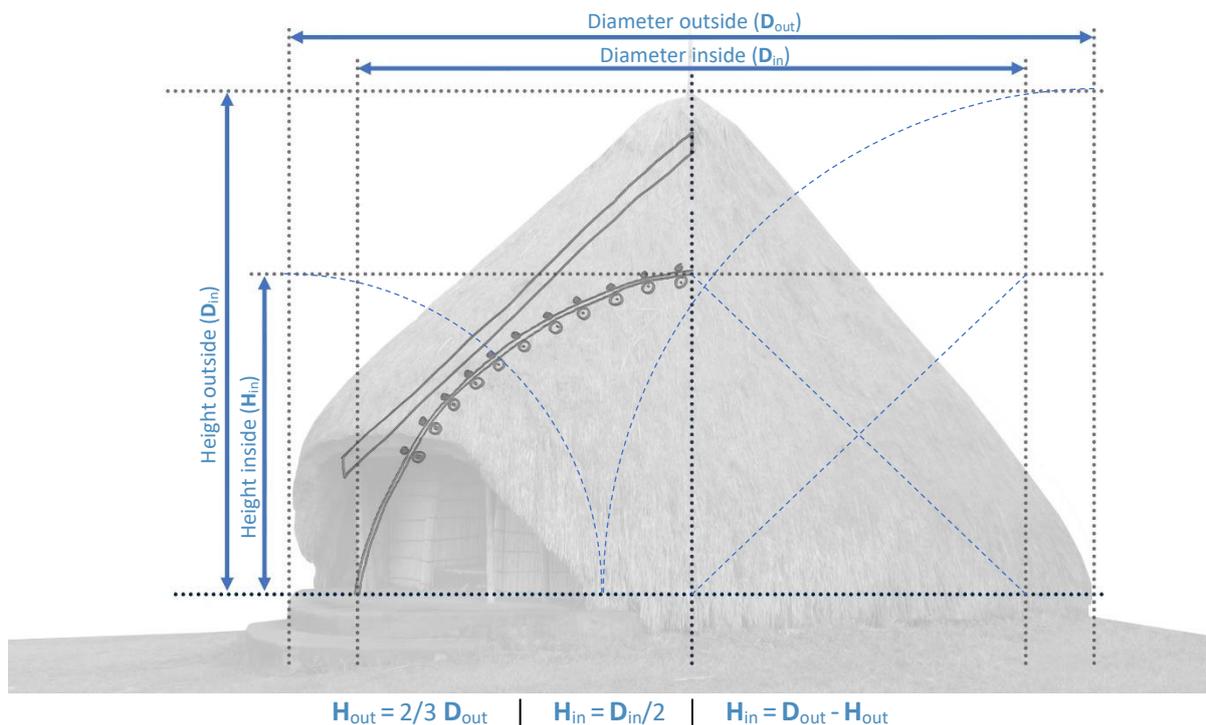


ROOF DESIGN

DIMENSIONS

The Buganda thatched roofs are all conical in shape. Their standard diameter ranges from 6 to 10 metres, but as we have seen on page 6, they can reach 31 m for the largest. Concerning the design of the structures, the craftsmen were not able to provide us with precise design rules. Diameters, heights, proportions are not calculated or written down before construction. There are no construction drawings made. Dimensions are defined by the eye when building, by the most experienced thatcher who gives his guidance by observing the site from a distance.

The sketch below shows the common proportions observed on existing roofs.



THATCH VENTILATION

Doubling the thatch with another material to ensure the long-term waterproofing of the roof is tempting. Many builders have tried to lay thatch on corrugated iron sheets, as shown below. These attempts usually give disastrous results because the iron sheets block natural ventilation and accelerate the natural decomposition process of the thatch.

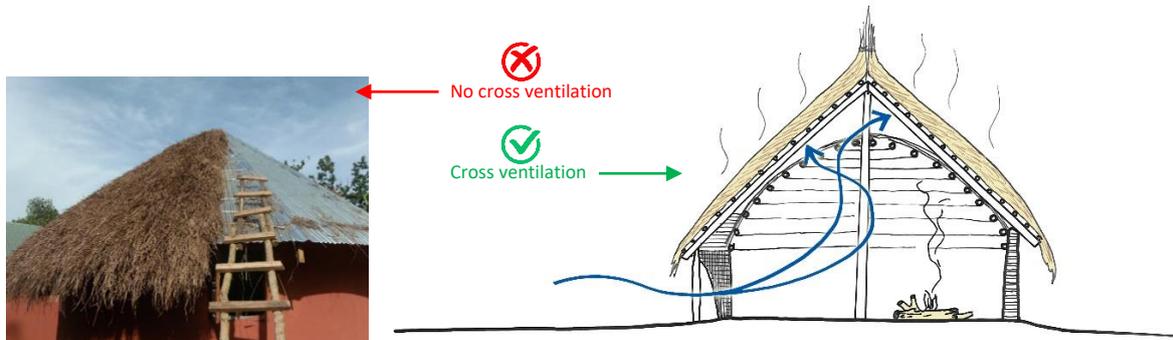
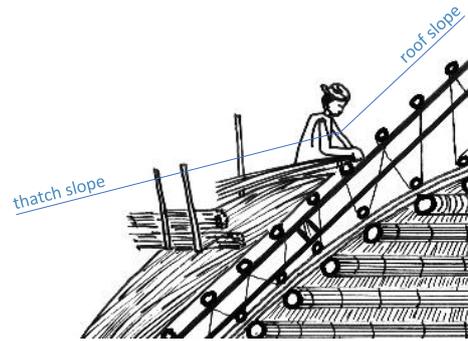


Photo Remigious Kigongo

SHAPE AND SLOPE

The roof slope has a direct impact on durability and maintenance needs. It should be noted that thatch bundles are positioned with a lower gradient than the final roof slope, as shown in the drawing on the right. If you want the roof to last for long with the lowest possible maintenance, then you should aim for the steepest possible slope.



In financial terms, while it is true that a shallow slope will require less material and cost less to build, it will be ruinous to maintain, because the straw will not be able to dry between rains and serious deterioration will appear very quickly.

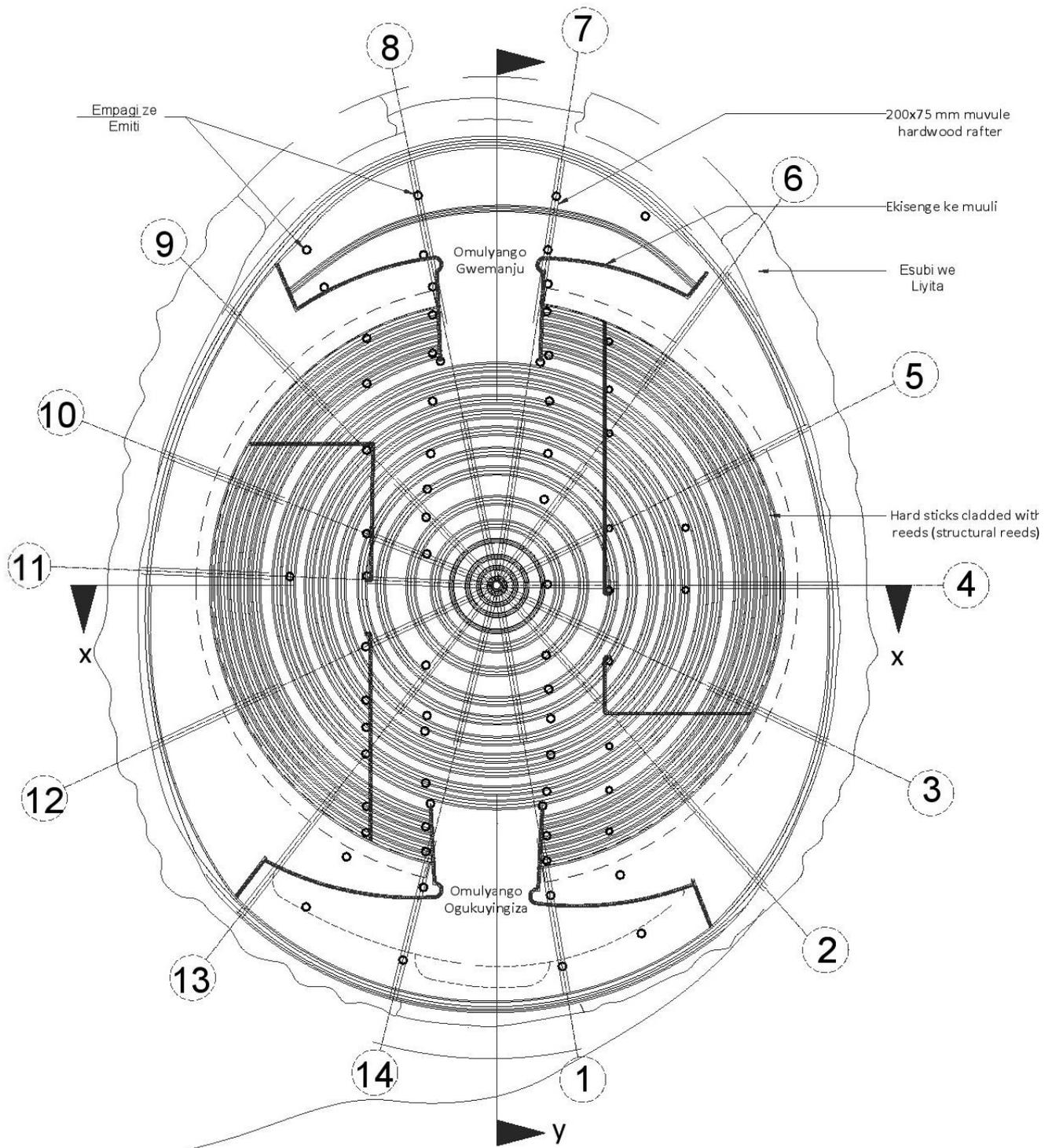
50°	40°	30°
Durability ++	+/-	-
This is the ideal and most durable pitch, because water can hardly penetrate deep into the thatch	This is the most commonly seen slope, but it requires yearly maintenance	This shape is also common because it requires less materials, but it does not last
Cost		
More expensive to build but cheaper to maintain	Expensive to build and expensive to maintain	Cheaper to build but ruinous to maintain
Examples		
Muzibu-Azaala-Mpanga 1891 <i>(Museum archives)</i>	National Museum, Kampala 2010	Muzibu-Azaala-Mpanga 2006
Traditional hut, Makole 2014	Wamala 2011	Bujjabukula 2015
Abalongo Abasimbiri Kasubi 2011	Naggalabi Buddo 2006	National Museum, Kampala 2010

DRAWING EXAMPLE

Plan

Bujjabukula restoration drawings by Jonathan Nsubuga & Associates

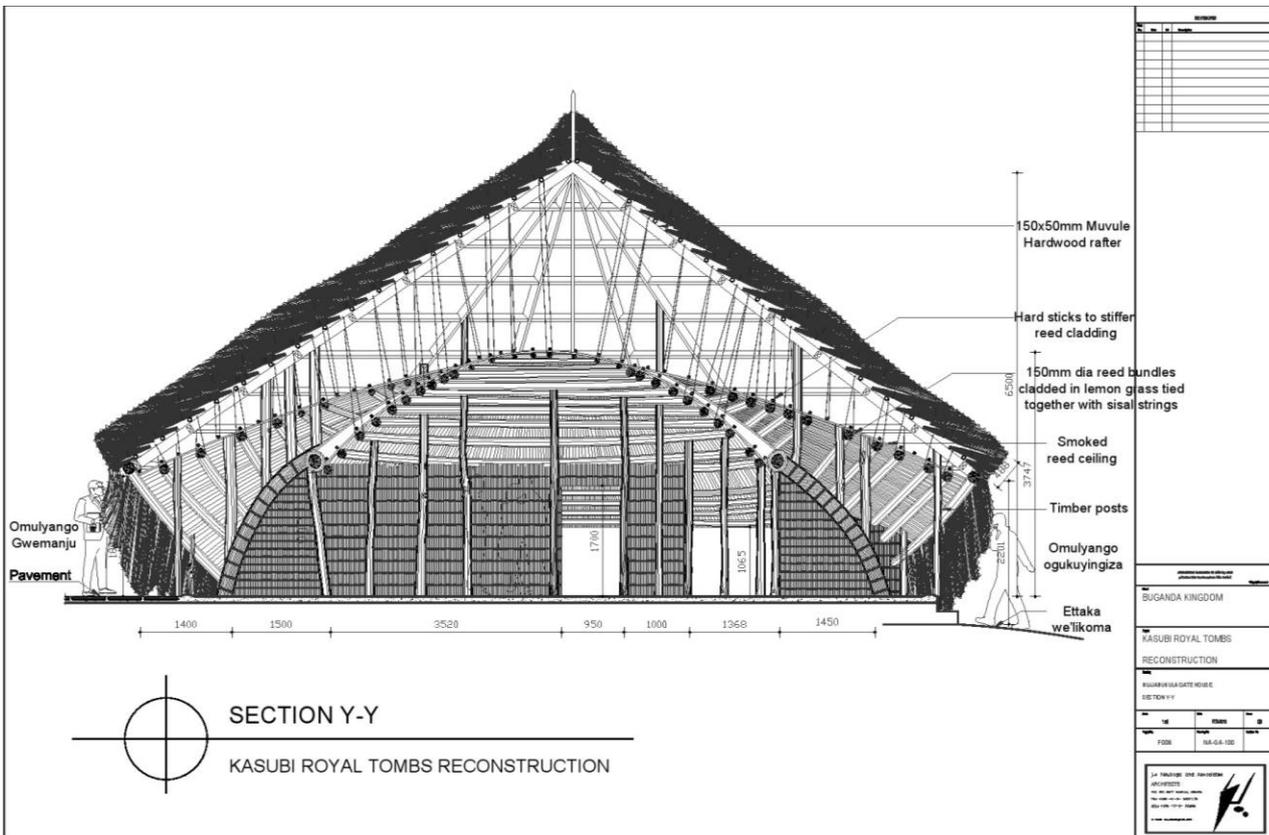
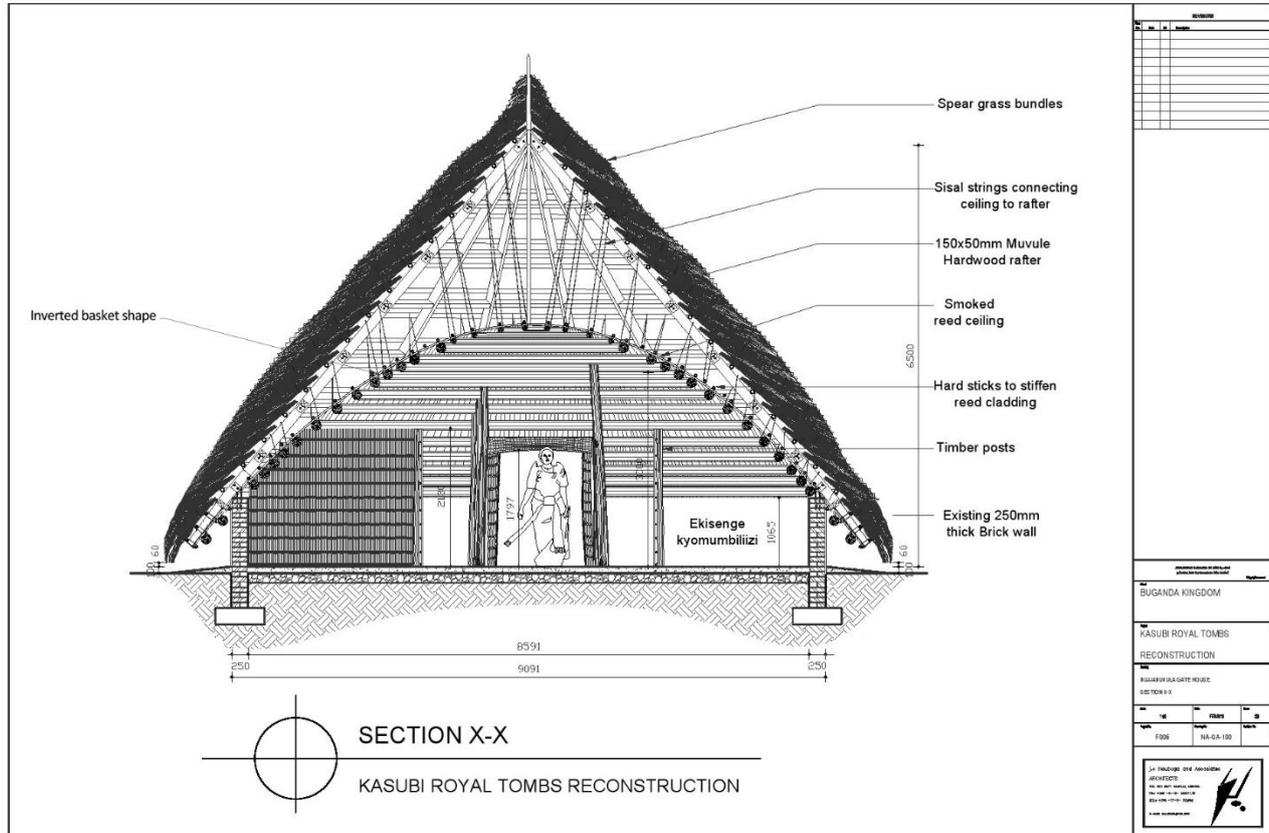
The numbers (1 to 14) refer to the rafters.



DRAWING EXAMPLE

Sections

Bujjabukula restoration drawings by Jonathan Nsubuga & Associates



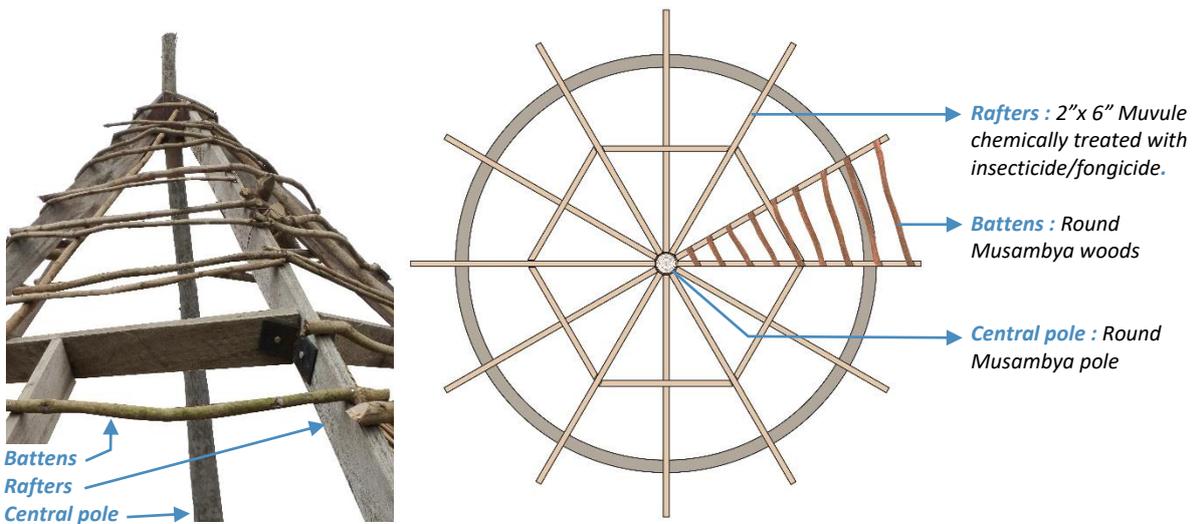
MATERIALS

ROOF SKELETON MATERIALS

The initial skeleton of the roof is composed of long rafters resting at the base on the peripheral walls and at the top on a central pole. In the past, rafters were made of round *Emikomba* woods, but today it is generally 2"x 6" or 2"x 5" sawn *Muvule* that is used. The rafters are then covered with round *Musambya* battens. For an average structure of about 8 m in diameter, the coverage is done with 12 rafters according to the diagram below.

Rafters are assembled with 6" nails and sometimes also with brackets screwed into the wood with lag screws, as shown in the picture on the left.

The battens are fixed with 5" nails, but also with binding wires for those that are difficult to bend.



CEILING MATERIALS

The main ceiling material are the reeds. Reeds are delivered in bundles. They are needed in huge quantities and should be stored in a dry place, without any contact with the ground. Keeping the reeds bundles standing up against a tree, for example, is not a good solution, as they will quickly be damaged by moisture and termites. The reeds used at Kasubi were sourced from Masaka region.

Once the bundles are opened, the reeds are selected to eliminate fragile and partially rotten ones. Then, the reeds are smoothed with a knife blade to remove the remaining leaves attached to the stem but also to smoothen the knots. For the reeds that remain visible (for ceilings or fences), they are polished with sand using a cloth, which makes them smooth and shiny.



Unsmoothed reeds



Smoothing the reeds with a knife



Second smoothing with sand



Smooth reeds

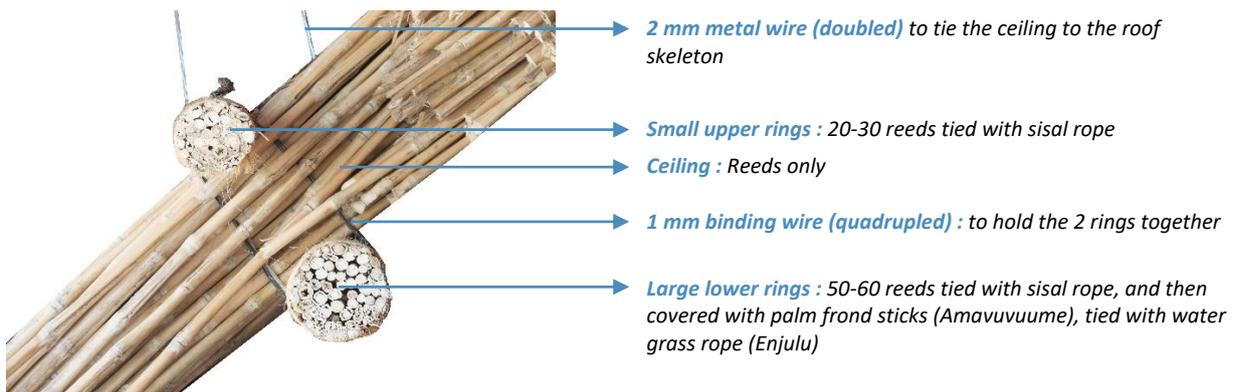
To make the rings, the reeds are tied together with sisal rope. For the visible inner rings, they are covered, once the ceiling is finished, with palm frond sticks (*Amavuvuume*), themselves tied against the rings with water grass rope (*Enjulu*).



Tying the reeds with sisal rope to prefabricate rings

Inner rings covered with palm frond sticks (*Amavuvuume*) tied with water grass rope (*Enjulu*)

The large lower rings (visible ones) and the smaller upper rings (hidden ones above the ceiling) are tied together to hold the ceiling reeds firmly in place with quadrupled metal binding wires (1 mm). The ceiling itself is held to the roof skeleton with strong metal wires (2 mm).



ROOF MATERIALS

Spear grass

The main roof material is spear grass, which is prepared in bundles before being installed on the roof. Spear grass grows naturally all year round. Mature grass ranges between 120 and 140 cm in height. When ready, the spear grass is cut at the base, very close to the earth, and stacked on the ground in small heaps. It is then tied in big bundles without any specific cleaning (contains a few other plant species), and kept on the ground until it is taken away. (Moriset, 2006). As with reeds, very large quantities of grass are required because sorting the grass on site to remove broken or damaged pieces results in 50% of loss. We noticed a huge loss between cutting the grass in the field and using it on site, as the fresh stems are tied together in bundles at the harvest site. This makes it easy for them to rot. Ideally, the grass should be dried and sorted at the cutting field to deliver only good quality dry bundles.

Once on site, the big bundles are sorted out and the good quality spear grass stems are kept to manufacture smaller bundles with a diameter of 5-6 cm. Bigger bundles with a 10-15 cm diameter are also prepared for the base of the roof. The bundles are tied to the battens either with tree bark fibre (*Ebinsambwe*) or with sisal rope. The bundles are then attached to the roof using the same ropes/fibres: sisal or *Ebinsambwe*.



Spear grass field



Spear grass field



Cutting spear grass at the base



Bundling spear grass in the field
Photo Kazuhiko Nitto



Laying spear grass on the ground for drying and removing unsuitable elements (other plants and broken stems)



Combing a bundle with a stick to remove unwanted elements and tying the bundle in a conical shape with a sisal rope
4 photos by Brian Kalema

TOOLS (May 2014 work doc)

HAND AND FEET

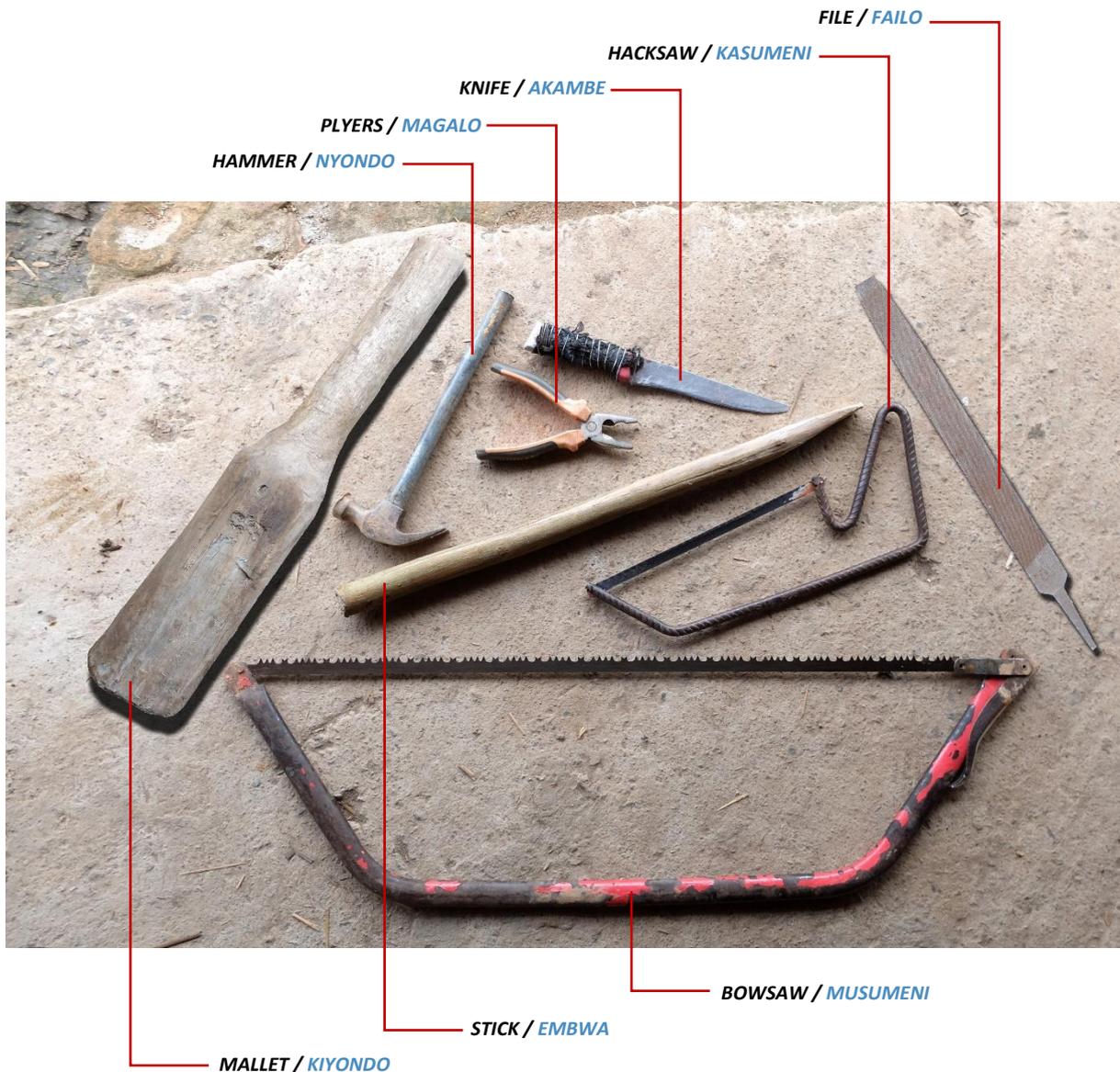


Braiding sisal rope at Kasubi

The tools necessary for the construction of these roofs are very simple, and reflect the sobriety of the materials used. The complete set of tools can fit in a small bag and weigh less than 5kg. Eyes and hands are the main tool, they do almost everything. The feet are also used sometimes to hold elements and the legs to push the reeds in place... Basically, the entire body is used to stretch, weave and shape the fibres to create these perfect basket-like curved shapes.

Two striking elements on the sites are: the silence (no electric tools are used) and the appealing smell of the natural materials.

MAIN TOOLS USED



MEASURING TOOLS

The craftsmen do not use measuring tapes, although they constantly measure elements during the construction process, such as the spacing between the rings to ensure that the circles are perfectly round. According to the thatchers, the eyes play an essential role. The senior thatcher spends most of his time observing the roof from a distance, to ensure that the curves, the spacing between the rings and other details are perfect. Reeds also serve as measuring tools, using the gap between 2 knots as a unit. In that case, all measurements are made with the same reed.



Reeds are used as measuring tools, using the knots as a unit



Measuring the space with the forearm

CUTTING TOOLS

Knives

Various knives can be seen on site. These are generally handmade knives with a wooden handle or industrial kitchen knives with plastic handles. In that case, the weak plastic handle is reinforced by surrounding it with bicycle tubes to make it last longer. The blade ranges from 10 to 20 cm in length.

The blades are sharpened several times daily with a metal file or sometimes also on stones.



Various knives used to cut and sharpen the reeds

Blade sharpening with a file

Bowsaws

Bowsaws are used to cut the roof purlins and battens, the wooden poles and the rings (*Ebizizi*).



Photo Kazuhiko Nitto



Hacksaws

Hacksaws serve to cut the reeds and sometimes the rings (*Ebizizi*) as well.



Cutting single reeds and full rings with the hacksaw. The picture on the right shows the neat cut obtained.

OTHER TOOLS

Wood stick (*Embwa*)

This stick called "*Embwa*", about 70 cm long and 4 to 5 cm in diameter, bevelled at one end, is used by the thatchers for many actions. They make it themselves by pruning a branch of the *Musambya* tree. The tool is used as a lever to adjust the reeds or spread the reeds to pass binding wires. It also serves as a wedge to hold the thatch bundles on the roof slope before installing them or as a grip to climb the roof. They also use the stick to beat the thatch bundles and remove the loose elements such as dead leaves.



Preparing an *Embwa*



Spreading the reeds



Adjusting the position of the reeds

Wooden Mallet & Hammer

The wooden mallet is used to bend the rings which are prefabricated straight. The metal hammer serves to pull the rings, to build the scaffoldings and build the roof skeleton (rafters and battens).



Curving a ring with the wooden mallet



pulling a ring with a hammer

Rags

Rags filled with sand are used to smoothen the reeds.



Smoothening reeds with a rag filled with sand

Ladder

Ladders are key to build and maintain roofs

Plyers

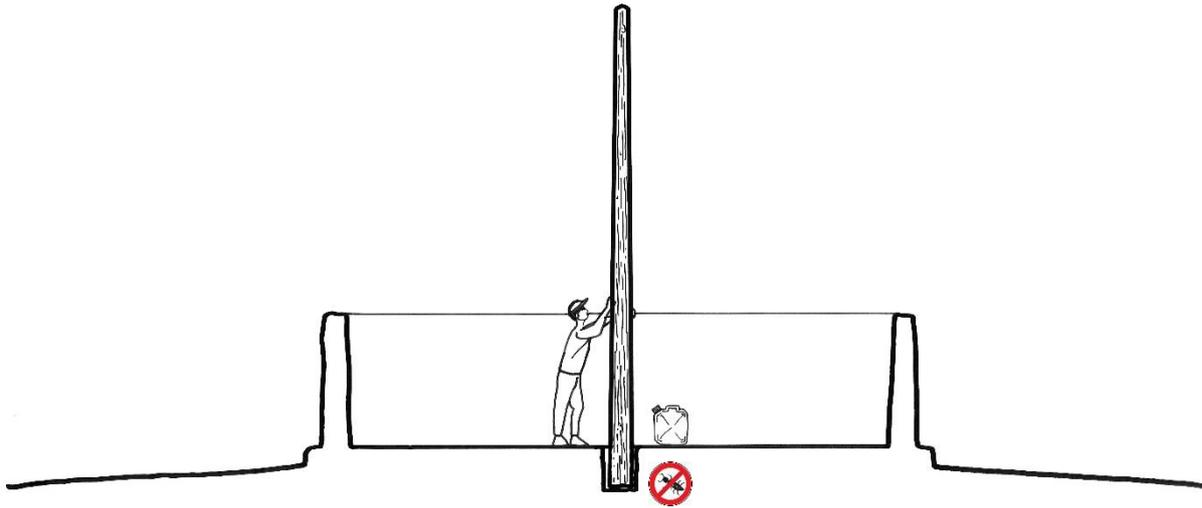
Plyers are used to tie and cut the binding wires.



STEP-BY-STEP CONSTRUCTION DETAILS

1 SETTING THE CENTRAL POLE

The central pole, made of *musambya* wood is set in a prefabricated hole, sealed in concrete. The hidden base should be treated with insecticide. The installation of the central pole is a strong symbolic act that involves rituals.



2 INSTALLING THE RAFTERS

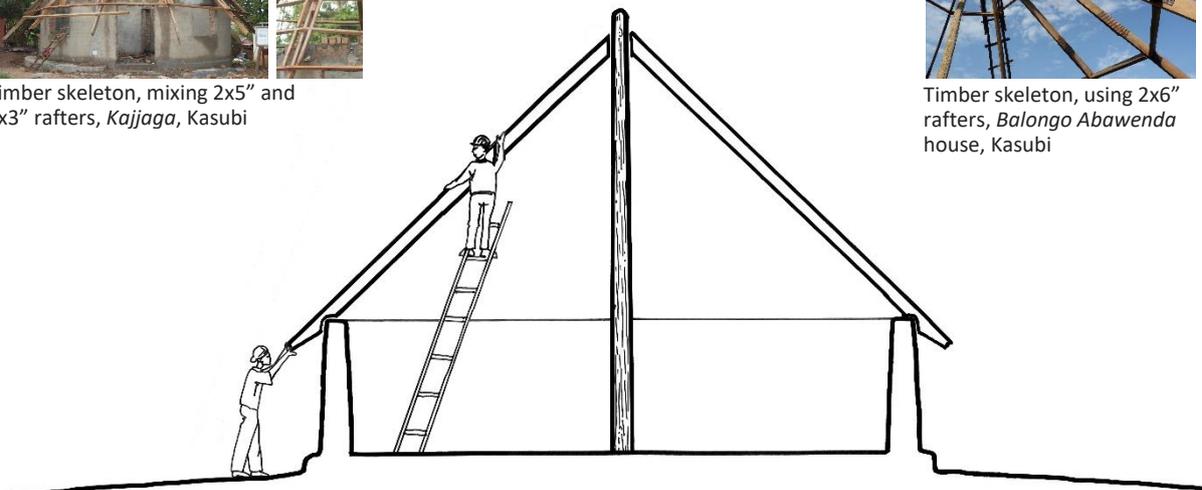
The number and size of the rafters depends on the roof span. The rafters should be resistant enough to carry both the weight of the thatch and the weight of the ceiling. Small structures (6-10 meters diameter) can use ordinary *Muvule* rafters. All wooden rafters are pre-treated against humidity and insects before being assembled.



Timber skeleton, mixing 2x5" and 2x3" rafters, *Kajjaga*, Kasubi



Timber skeleton, using 2x6" rafters, *Balongo Abawenda* house, Kasubi



3 NAILING THE BATTENS

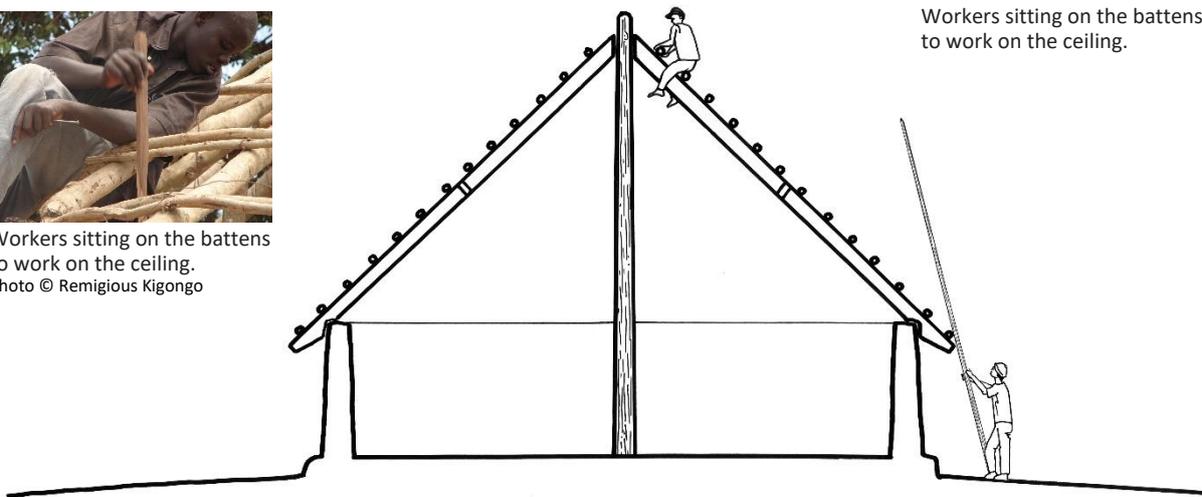
The round *Musambia* battens are nailed onto the rafters with a spacing ranging between 1½-2' (40-50 cm). The spacing should not be too small because the workers on the roof must be able to easily pass the arms to install the suspended ceiling and then install the reeds. They must also be able to pass their legs to sit easily on the battens while working.



Workers sitting on the battens to work on the ceiling.
Photo © Remigious Kigongo



Workers sitting on the battens to work on the ceiling.



4 SETTING THE 3 UPPER RINGS

The rings are installed starting from the top moving downwards. The upper rings are full of intangible significance and even have names (*Nkata* for the smallest, *Katumyo* and *Bugwe* afterwards). As with the central pole, their preparation and their installation require that rituals be performed. In most of the roofs, differences can be seen in the aesthetic finishes of these rings. The rings are made of palm frond sticks (*Amavuvuume*) because the curve of the small rings is too sharp for bending reeds.

There are two options for the rings:

- Option 1: Preparing them on the ground and installing them to the central pole before nailing the rafters.
- Option 2: Manufacturing the rings directly around the central pole once the rafters are in place.



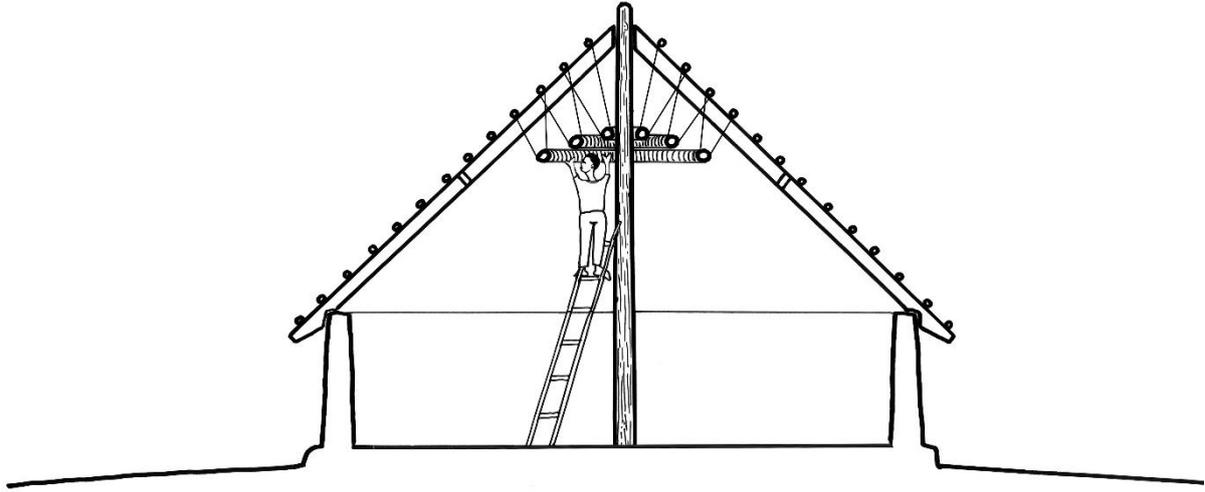
Prefabricating the rings.



Upper rings examples Balongo Abawenda house and BujjaBukula, Kasubi.



Manufacturing the first ring around the pole.



Manufacturing the top rings around the central pole



The first rings are generally fabricated around the central pole. This is an uncomfortable activity, especially for the smallest ring because the pole disturbs hand movements.

Manufacturing the top rings on the ground

This more comfortable option allows the manufacture of high-quality rings.



Bent palm frond sticks (*Amavuvuume*) are held together with palm leaves fibres



Palm leaves fibres (*Obuso*)



The ring is then wrapped with hand-braided sisal rope



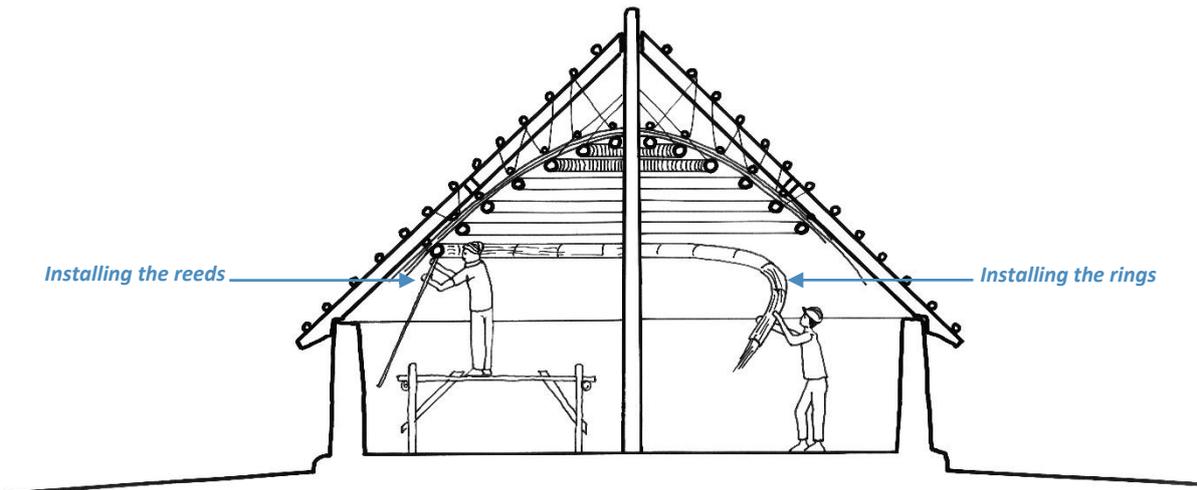
Braiding the sisal rope used to wrap the rings



The spacing between subsequent rings is always the same

5 MAKING THE CEILING

The ceiling is built from the top. Long rings are pre-constructed on the ground before being bent with mallets (see images page 17), cut to the right length and then installed in the right position by tying them to the battens with binding wires. There are two series of rings, those visible from inside, which measure 12 to 14 cm in diameter (requiring 50-60 reeds), and those above the ceiling, which are only 7 to 8 cm in diameter (requiring 20-30 reeds). The upper and lower rings are linked in pairs using binding wires or sisal rope. Between the rings is the reed ceiling itself, which thickness varies depending on the roof span and the desired level of finishing. The following thicknesses can be seen at Kasubi: 4, 7, 12, 15" (10, 18, 30, 38 cm).



Sorting the reeds

Reeds are delivered in bundles and sorted. The good ones (those that are straight and 3 m long) are set aside for the ceiling. Imperfect ones (not straight, shorter than 3 m) are used to make the rings.

Manufacturing the rings

The rings are prefabricated on the ground in long lengths, linking reeds together with sisal rope at about 20 cm intervals. The bundles are tightened as much as possible to give them rigidity. Each reed is sharpened at the end to facilitate its insertion into the bundle.



Inserting a new reed in the bundle



Tying with sisal rope every 20 cm



Tightening the bundle

Installing the large rings and inserting the reeds

The rings are installed from the top moving downwards, as the ceiling is being built. For each new ring inserted, reeds are inserted to form the ceiling. The two operations are inseparable. The reeds are forced in from below. Once pushed in, their position is adjusted using the work stick (*Embwa*). Once all the reeds are placed, the connection between the large lower rings and the smaller upper rings is reinforced with quadrupled binding wires. In order to be able to pass the binding wires through the very dense ceiling, the reeds are spread using the stick (*Embwa*).



Sharpening the reeds end



Inserting the reeds by force from below



Adjusting the reeds position to avoid overlaps



Team work: one pushes the reeds and the other adjusts the position
photo Remigious Kigongo



Upper part of the ceiling done



Cutting a prefabricated ring to the right size



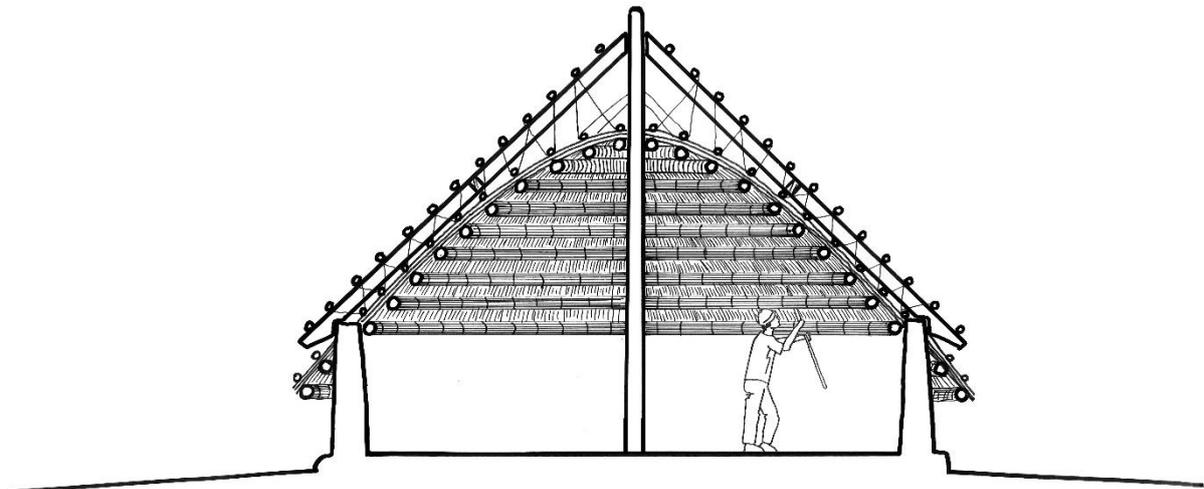
Lower and upper rings attached with a sisal rope



Section on the ceiling at the door level. Lower and upper rings are attached with binding wire

6 COMPLETING THE CEILING

The work continues in the same way down to the bottom. The reeds that protrude below are cut off at the last moment, when the work is finished.





2 mm steel wires connecting the ceiling to the battens



The reeds are not cut at the bottom until the work is finished



Example of ceiling edge neatly cut



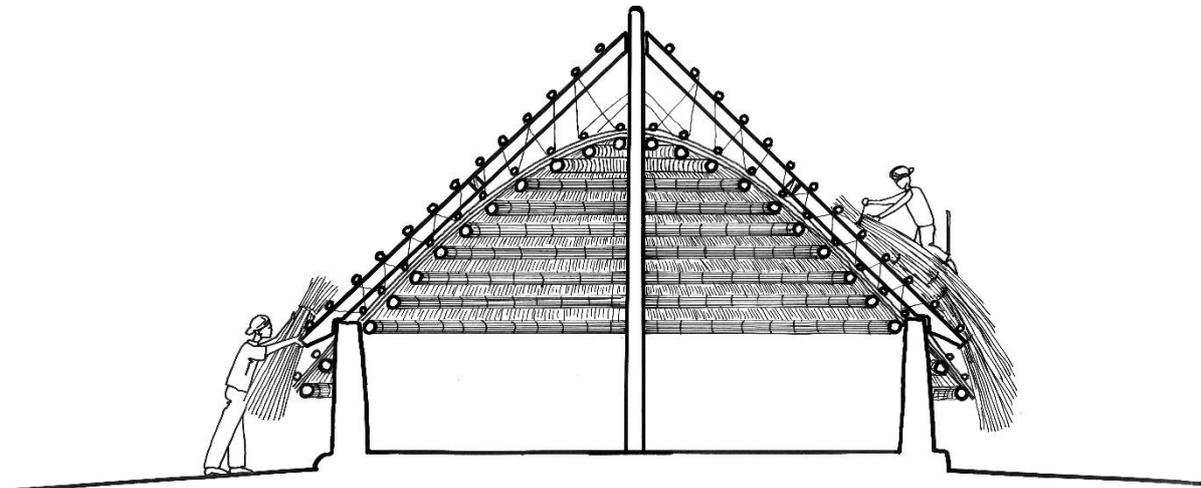
The rings are wrapped at the end with palm frond sticks and water grass



The ceiling must be protected from rain with a tarpaulin during the work

7 THATCHING THE BASE

Thatch bundles are attached starting from bottom moving upwards. They are linked to the battens using tree bark fibre (Ebinsambwe) or sisal rope. An additional battens structure is sometimes added to the roof, as shown in the pictures below. The lower eaves are neatly trimmed with a knife at the end.



Tying thatch bundles to the battens
3 photos by Remigious Kigongo



Example of neatly cut eaves

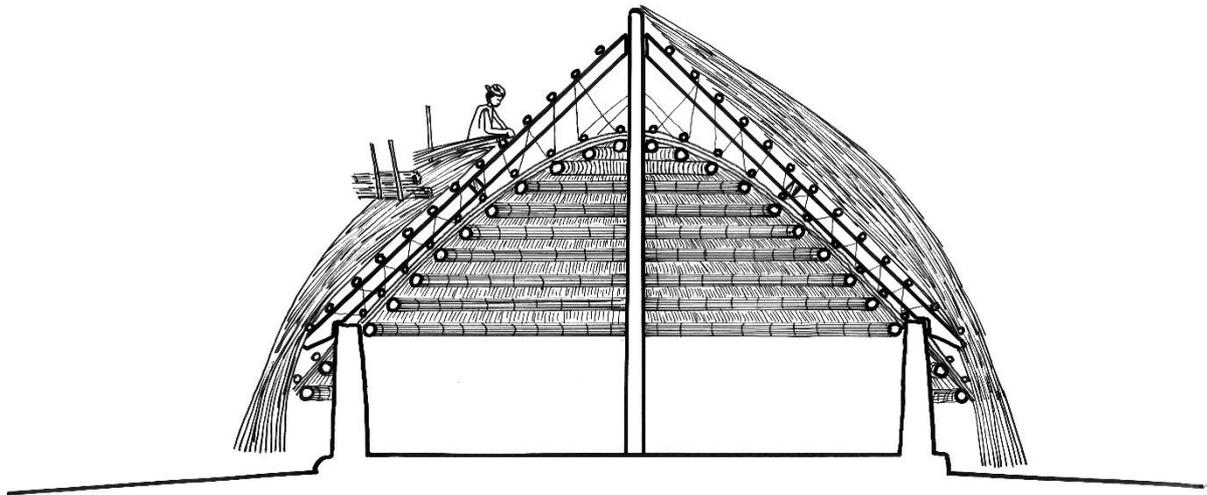


The thatch should not touch the ground



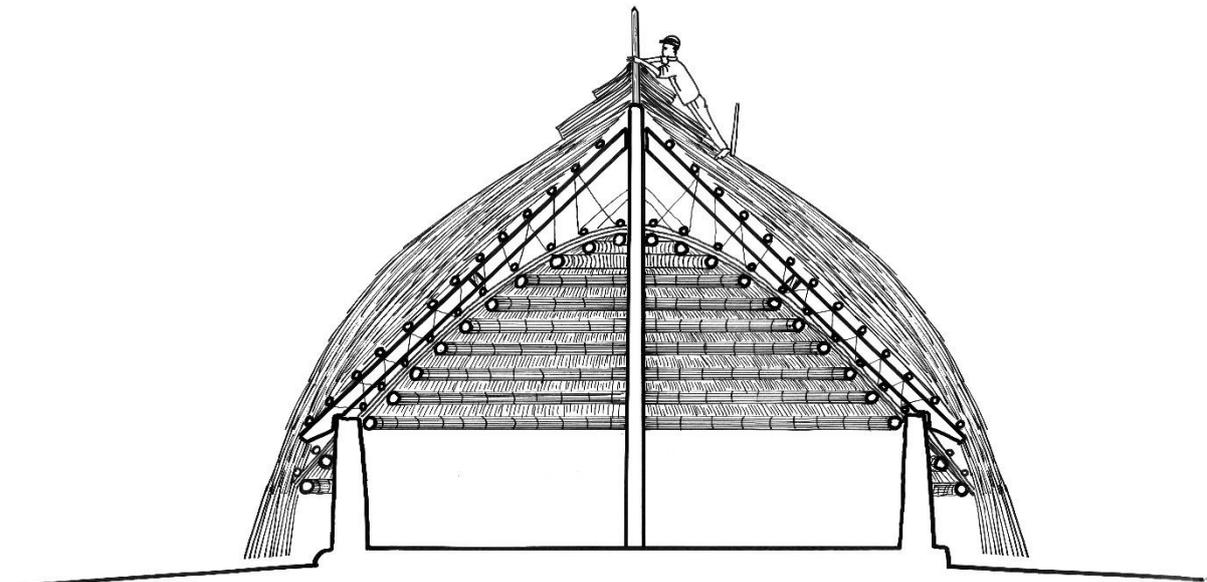
8 THATCHING THE ROOF

The construction process continues in the same way up to the top.



9 FINISHING THE TOP

Particular care is taken with the hat that covers the top of the roof. This straw hat is attached to a Musambya stick planted in the straw.

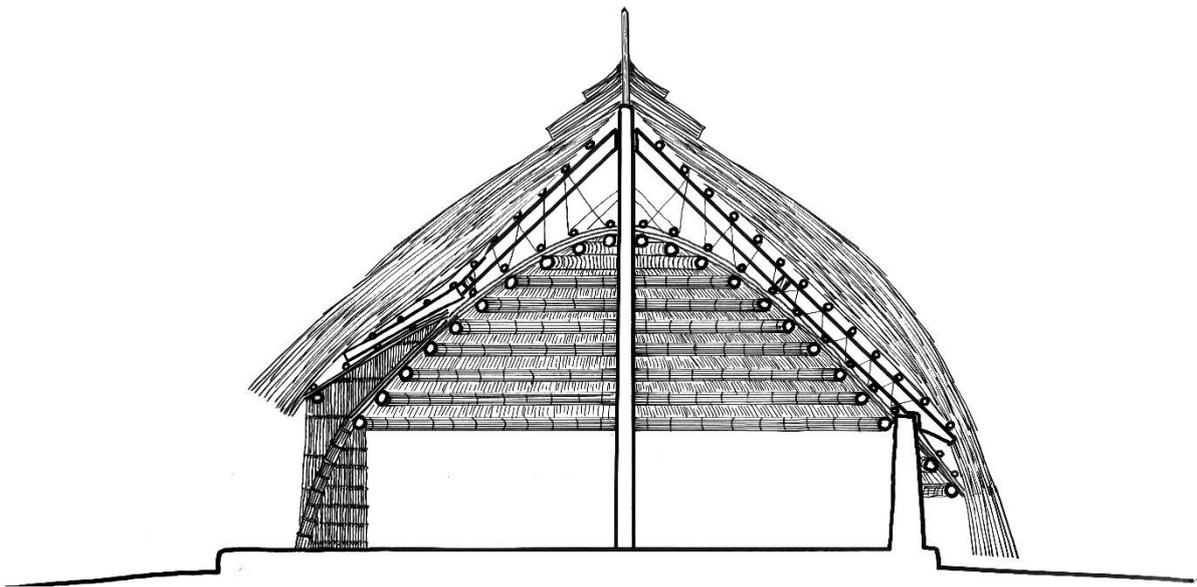




Examples of top finishes
2 photos on the left by Remigious Kigongo

10 DECORATING THE ENTRANCE

Entrances are the trademark of these meticulous architectures. It is here that the craftsmen show the quality of their know-how through extremely well cared-for finishes.



Details on the extra ceiling covering the entrance
2 photos by Remigious Kigongo

Ndoga-Obukaba entrance, Kasubi



Muzibu-Azaala-Mpanga side entrance, Kasubi



Bujjabukula entrance, Kasubi



Muzibu-Azaala-Mpanga side entrance, Kasubi

11 FINISHES

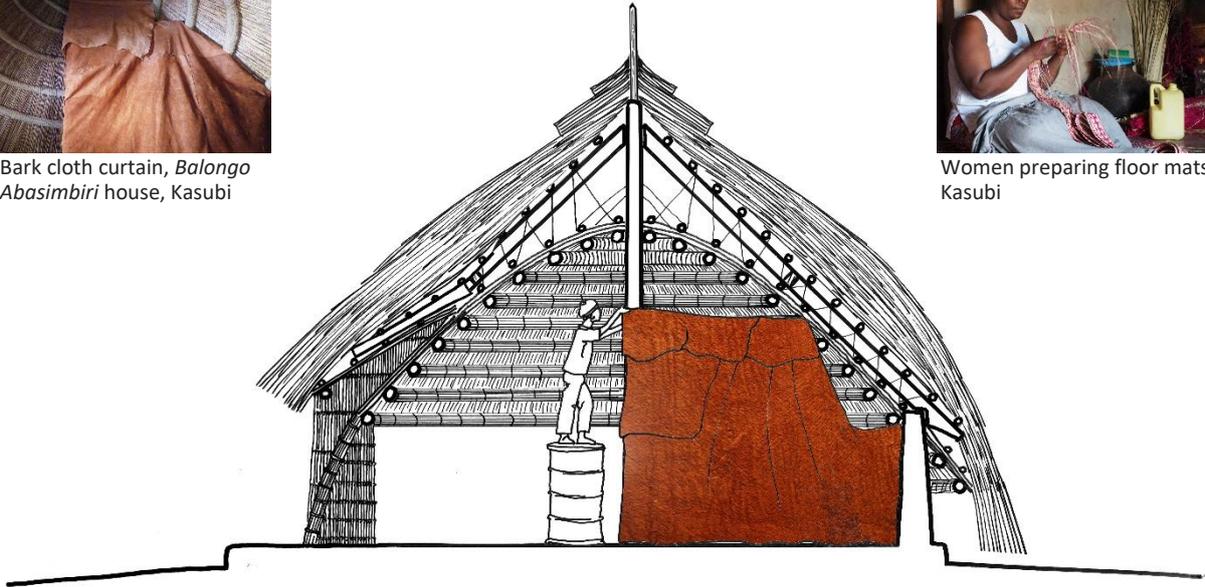
Once the roof is finished, there are still some decorations and interior fittings to be done, tasks that fall under the responsibility of the Leopard Clan (Ngo clan) members. This work includes the installation of the bark cloth curtain and the dressing of the floor with mats laid on a dry lemon grass layer. This final step in the entire construction process also includes cleansing rituals.



Bark cloth curtain, *Balongo Abasimbiri* house, Kasubi

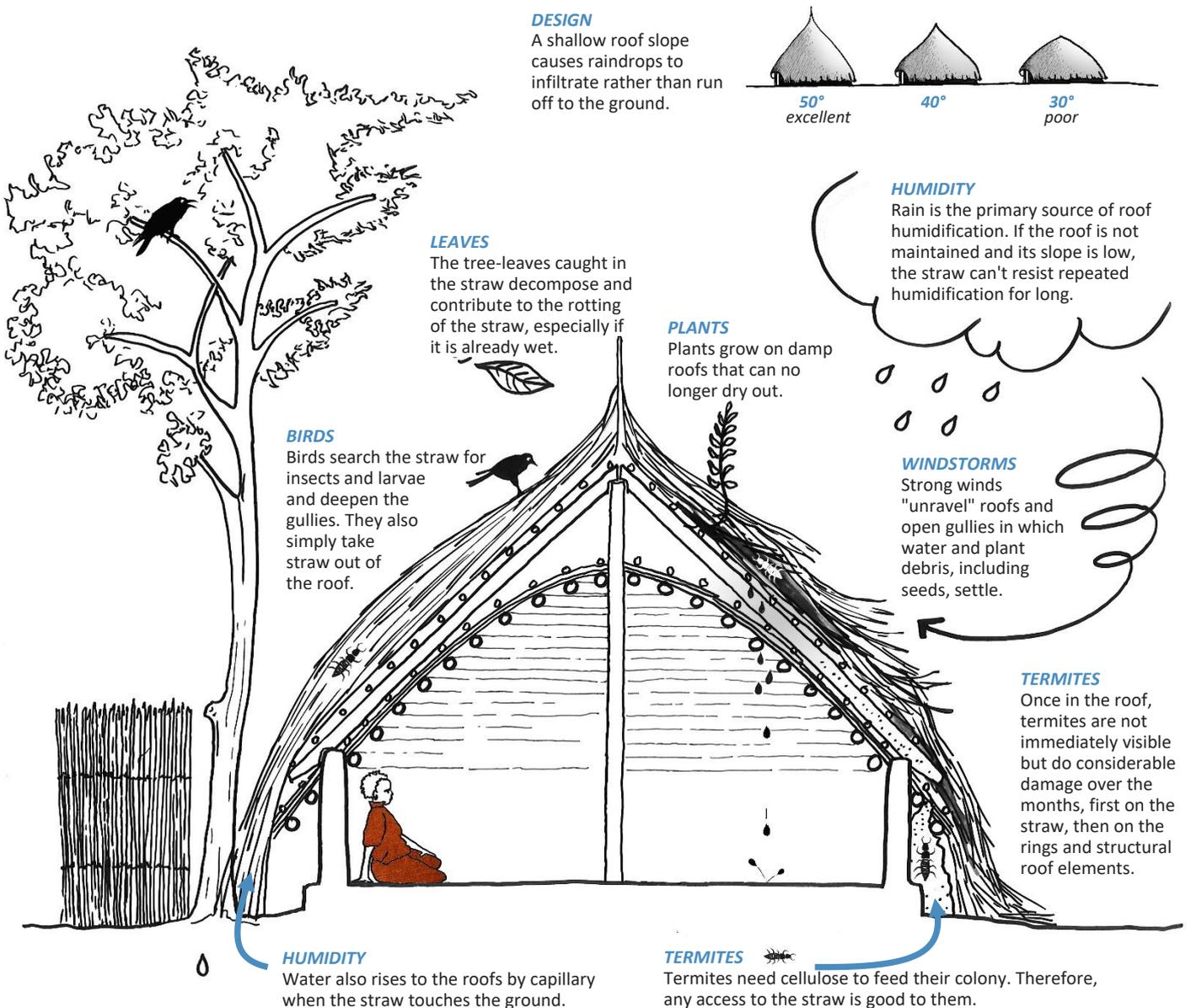


Women preparing floor mats, Kasubi



DETERIORATION AND MAINTENANCE

Deterioration factors



The deterioration of roofs is linked to many factors. Climatic conditions play an important role. Thatched roofs are generally built on hilltops that are highly exposed to heavy rains and wind. Tall trees can also be a damaging factor as they increase the risk of dead leaves mixing with the straw. Branches scratching the thatch during storms have also been witnessed.

An essential factor in the resistance of a roof is its ability to get rid of moisture as quickly as possible, so that the straw can dry as soon as the sun appears. For this, two parameters are essential: first, the slope of the roof, which must be as steep as possible, to accelerate the water flow and prevent deep penetration of moisture. Secondly, the separation of the straw from the soil. If a gap is not maintained between the ground and the straw, the roof acts like a sponge sucking moisture from below. Direct contact also facilitates the ascent of termites, which are another major deterioration factor.

The domino effect, from windstorms to collapse

WINDSTORMS, LEAVES, SEEDS

Strong windstorms move the straw and create gullies in which dead leaves and seeds penetrate.



HUMIDITY, PLANTS

the shifting of straw by the wind facilitates rainwater infiltration, especially when roofs do not have sufficient slope. Moisture can also rise from below when the straw is in contact with the ground. The wet straw sags and gullies open up. The decomposed straw becomes fertile ground for plants to grow and roots to develop deep into the thatch.

TERMITES

Termites can easily climb into the thatch, especially when it touches the ground. Termites need a very humid environment to develop. The deteriorating wet straw offers them a conducive environment and a perfect source of cellulose that they can easily digest.



BIRDS

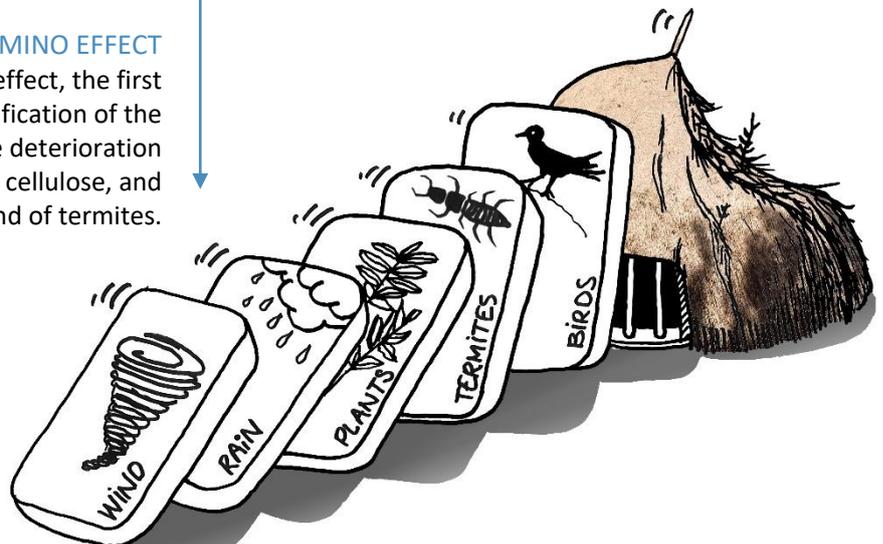
Once installed in the straw, termites attract some birds such as crows who come to search the straw with their beaks to eat them, which causes significant damage, and also increases infiltration. Birds also bring new seeds through their faeces, favouring the development of additional vegetation.



DOMINO EFFECT

We therefore observe a domino effect, the first infiltrations leading to the humidification of the straw and therefore its progressive deterioration which attracts termites, fond of cellulose, and birds, fond of termites.

If infiltration problems are not addressed by regular replacement of damaged straw, the process can go as far as partial or collapse of the roof.



ROOF MAINTENANCE

THE REGULAR MAINTENANCE CHALLENGE

The main challenge is to break this cascade of destructive effects on the roof by providing regular maintenance. If the damaged straw is replaced in time and the bundles shifted by the wind are readjusted, the roof can be considered safe. Regular roof maintenance also helps to maintain the craftsmen's knowledge alive.

In reality, this requires a real organization to ensure that both manpower and materials are available when repairs are needed. Carrying out small, inexpensive repairs once or twice a year is much more cost-effective than waiting for a significant sagging to occur. Two to three years without maintenance can lead to significant damage requiring both very large quantities of materials and highly skilled labour.

This need for permanent maintenance is part of the technology itself, as explained in the introduction and in the previous chapter on construction. If the thatch bundles are not all tied to the roof, it is precisely to enable an easy replacement in case of damage. It is also interesting to note that the replacement of a few decayed thatch bundles can be done by a junior craftsman.



Removal of decayed thatch at Kasubi



Insertion of new bundles at the base of BujjaBukula, Kasubi

KEEPING THATCH, FUNDS AND TOOLS

Regular maintenance is easily delayed by a lack of funds or materials. Efficient site management requires that a regular budget be dedicated to labour and straw. The quality of storage of these spare materials is important, because straw kept on the ground does not last. Straw, loose or in spindles, should be kept in a dry and ventilated place as shown in the examples below. In addition to this, a set of tools including a ladder should always be available to easily climb on the roof.



Shed for keeping spare dry grass at Kasubi



Shed for keeping spare dry grass at Wamala

REGULAR MAINTENANCE TASKS

Keeping the thatch dry

The deterioration speed of a roof is directly linked to its moisture content. The drier a straw roof is, the more resistant it is over time. To achieve durability, roofs must be regularly inspected to fill up gullies through which water infiltrates. The inspection should be done at regular intervals and after severe storms.

Removing dead leaves and trimming trees

Dead leaves tend to cling to the ends of the straw bundles and then decompose in the roof. To avoid this, trees with branches developing too close to the roofs should be trimmed. As a general rule, no tree should grow within 5 metres of the roofs, to avoid shading the thatch or cutting off the wind, which is necessary for drying the straw. If, despite everything, leaves settle on the roof in quantity, they must be removed.

Removing plants

Plants growing in the gullies should be removed as soon as possible. The longer we wait, the deeper the roots penetrate into the straw, creating waterways that are extremely damaging to the roof. Once the plants are removed, the decayed wet straw must be replaced by dry one.

Replacing thatch bundles

Once the dead leaves and plants have been eliminated, the decomposing straw can be removed and replaced with dry bundles. It is advisable to check the weather forecasts so that this replacement can be done in sunny weather, to allow the roof to dry. The new straw must be perfectly dry when it is laid. The straw removed should not be thrown away. It should be given to farmers for mulching vegetable crops.

Drainage: keeping the site dry

The drainage of the site also limits the presence of humidity and termites, by diminishing the amount of water absorbed by the ground. Slopes should be provided to drain runoff rainwaters from the buildings towards farmland areas.



Cleaning and readjusting the thatch with a stick



Bringing new spear grass bundles on the roof to fill gullies



Inserting new bundles in a gully after removing decayed grass



Drainage slopes made of compacted laterite

TERMITE CONTROL

How to discourage termites?

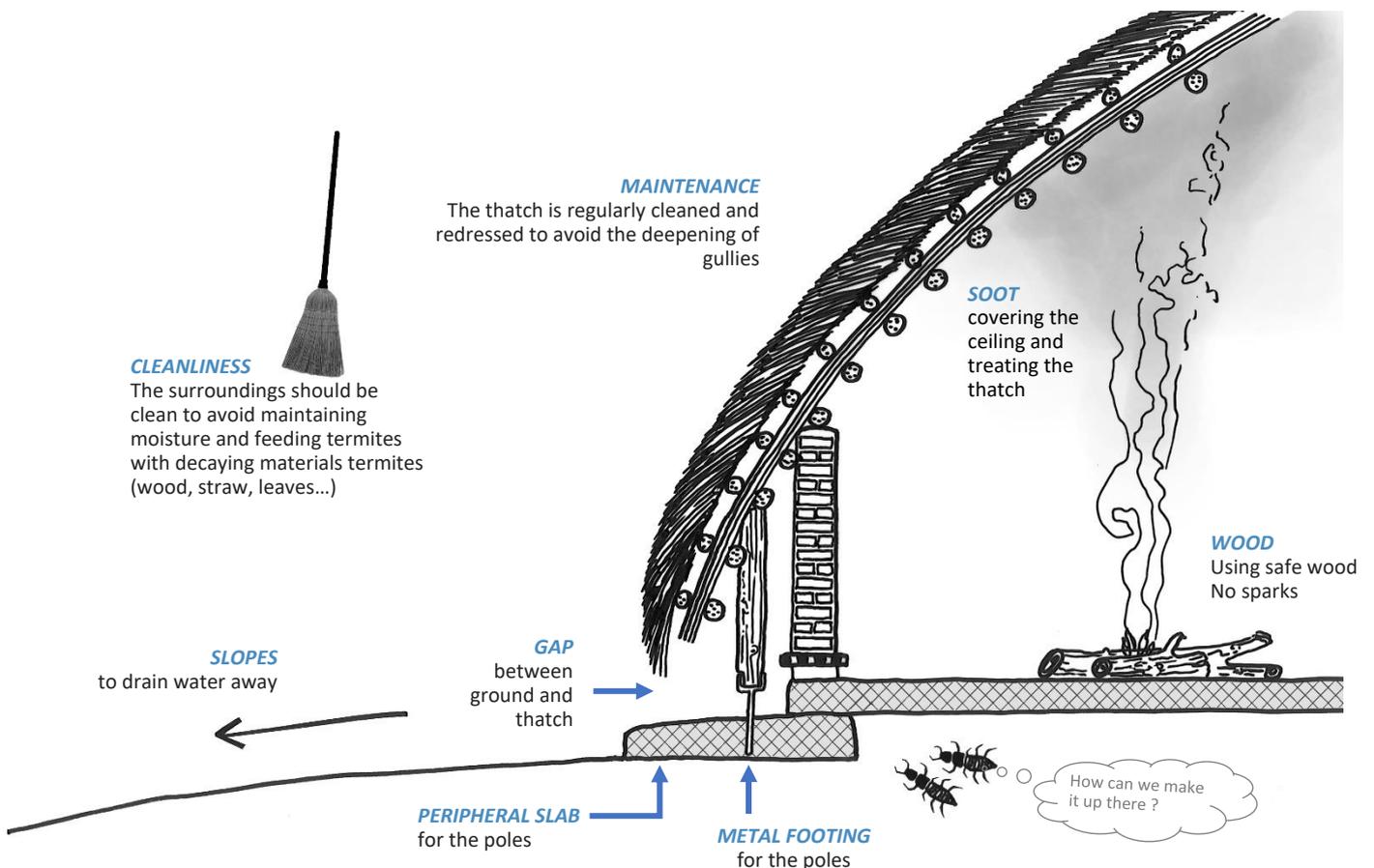
Termites are omnipresent underground. Eliminating them is an impossible fight. However, it is possible to curb roof colonization by termites in different ways:



- By regularly trimming the lower part, i.e. cutting the end of the straw to maintain a space of at least 10 cm between the ground and the roof. Thus termites do not have a direct bridge between their natural habitat and the straw.
- By regularly maintaining the roof, to remove gullies as they appear and thus avoid any risk of moistening the straw. We remind you that termites feed on rotting wet straw, not healthy dry straw.
- By replacing rotten straw by fresh one as quickly as possible.
- By inspecting the walls regularly to destroy any earth tunnels built by termites.
- By working the slopes around the building to ensure that runoff water is quickly drained as far as possible, thus avoiding soil moisture that is favourable to termites.
- By not attracting them with food. Wood or straw stored on the ground are invitations for termites to proliferate.

Contemporary improvements for new thatched structures

- For a new construction, it is advisable to multiply the number of termite barriers. The wooden pole bases must be treated, and if possible disconnected from the ground using a metal connector.
- Walls can integrate a termite barrier, i.e. a protruding element that termites cannot climb.
- A peripheral slab around the building also reduces the risk of a direct soil-to-straw invasion.



TREATMENT OPTIONS

Smoking

Thatched roofs are traditionally treated by smoking. Straw coated with soot is more resistant to moisture on the one hand, and discourages termites on the other. Ideally, smoking should be done several times a week, using dry wood that does not spark while burning. Wood species used include *Kasaana* (clears evil), *Musizi*, *Endagi*, *Muzanganda* (to connect with the spirits), *Mwule* and *Muwafa*. In any case, *eucalyptus* and *Twalabafo* are totally prohibited.

Regular indoor fires also help to dry the straw from the inside by sending hot air through the thick thatch layer. To avoid fire hazards. To avoid the risk of fire, it is obvious that the layer of lemon grass on the ground and the mats covering it must be moved when the fire is lit. On the other hand, no fire should be lit during a storm or on a windy day.

Ashes & salt

Traditionally, a mixture of ashes and salt was applied around the buildings by the Kago (a person with a key religious role on each site).

Chemicals

Various chemical treatments similar to wood treatments are commercially available to treat contemporary thatched roofs against the risk of mould. They are sprayed on the dry straw. These treatments are to be avoided, as they can penetrate the straw and end up in the building, where they could be breathed or even ingested if infested water drops drip on food. They also present a risk of contamination of the surrounding gardens when they are washed away by the rains and spread around the buildings. We therefore advise against the use of these commercial products for health reasons.



Rings protected by a layer of suit at Wamala tombs.

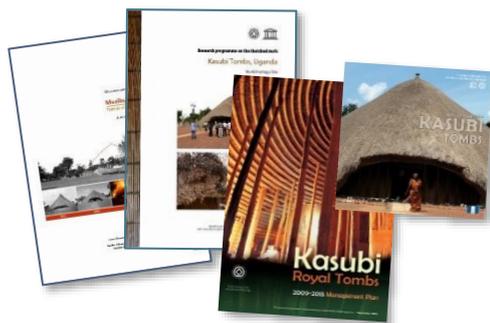


Fire place within Wamala tombs.



Fire place at Naggalabi-Buddo coronation site (Photos Nelson Adebo Abiti, Uganda Museum)

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ENGLISH-GANDA GLOSSARY

<i>Luganda</i>		<i>English</i>
Olusenk --- Essubi		Fresh spear grass --- Dry spear grass
Enjole		Spear grass bundle
Olumuli/Emuli		Reed/Reeds latin: <i>Pennisetum purpureum</i> (also known as elephant grass or Uganda grass)
Ekizizi/Ebizizi --- Olubanyi		Ring/Rings --- Ceiling
Nkata - Katumyo - Bugwe		Names of the 3 upper rings
Amavuvuume		Palm frond sticks used to wrap the rings but also manufacture the small upper rings that cannot be made of reeds
Enjulu		Water grass used to wrap the rings
Obuso		Elephant palm tree leaf used to wrap the small upper rings

Luganda

English

Kigoogwa



Industrial sisal rope

Bugogwa
Mugwa



Sisal
Hand-braided sisal rope

Enga



Strips of swamp reed

Ebinsambwe
(Ekinsambwe)



Tree bark
(Ekinsambwe)

Musambya



Small sections of the Musambya
tree

Sserugatikka



Central pole

Lubugo



Bark Cloth

Ekyoto



Fire place

AUTHORS

Coordination

This guide was written and designed in December 2019 by Sebastien Moriset, Architect, CRAterre

Contributions

CRAFTSPEOPLE | On one hand, the main contributors are the craftspeople themselves, who openly shared their knowledge with us over the years:

- Christopher Kawoya, *Wabulakayole* (Senior thatcher) of the Buganda Kingdom;
- Fabius Barungi, Mark Galiwango, Lawrence Kakooza, Brian Kalema, Zakayo Kalule, Emma Kasule, Steven Lumbuye, Steven Lumbuye Junior, Abdul-Rahman Musisi, Joseph Mwanje, Eddie Ndawula, Simon Ssekayita, Ronald Ssekibule, Joel Ssenkaali, Simeo Ssentamu, Joseph Ssentongo, Mourice Ssewanyana, ganda thatchers.

RESEARCHERS | On the other hand, the production of this guide would simply not have been possible without the scientific works of the following researchers, who had the patience to provide us with countless data:

- Jonathan Nsubuga, Architect, Kampala, supervisor of the Muzibu-Azaala-Mpanga reconstruction project;
- Dr. Ephraim R. Kamuhangire, former Commissioner, Museums and Monuments, Ministry of Tourism, Wildlife and Antiquities, Uganda;
- Kazuhiki Nitto, Conservation Architect and Professor at the University of Tsukuba;
- Junichi Hasegawa, Architect specialised in Disaster mitigation;
- Shigeru Sugawawa, Architect, Department of architecture at the Kogakuin University.

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- Brian Kalema, who acted as an ambassador for the thatchers during the writing of the manual and meticulously answered all our questions;
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- Daniel Kaweesi, Programme officer at the Uganda National Commission to UNESCO.

Photos & drawings

Unless otherwise stated, all photos and drawings are by Sebastien Moriset. Other photos are by David Gandrau, Jun'ichi Hasegawa, Remigious Kigongo, Kazuhiko Nitto, Brian Kalema and Nelson Adebo Abiti.

Dedication



We dedicate this guide to the exceptional Ganda craftspeople who have always endeavoured to share their passion and who gave us great lessons of humility. A big thank goes to Christopher Kawoya, *Wabulakayole* (Senior thatcher of the Kingdom) who never stopped fighting to defend and transmit his knowledge. Despite his great age, he keeps working at the Kasubi Tombs World Heritage Site.



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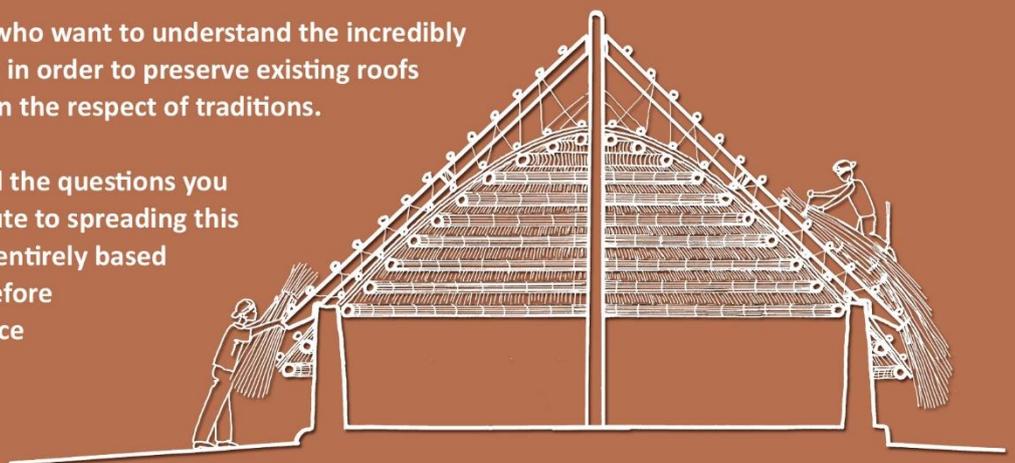


An introduction to the smart Ganda thatching technique

This guide, made possible thanks to the financial support of the Japanese government, is the result of 20 years of exchange and mutual learning between ganda craftsmen who keep their thatching technique alive and many Ugandan and foreign researchers who have shown interest in their art of building once the Kasubi Tombs were inscribed on the UNESCO World Heritage List. The content of this illustrated guide is based on the writings of these researchers and has been enriched with new information obtained through interviews conducted in 2019 at Kasubi with craftspeople.

This guide aims to help all those who want to understand the incredibly smart Ganda thatching technique in order to preserve existing roofs but also start building new ones in the respect of traditions.

We hope this book will answer all the questions you may have and that it will contribute to spreading this construction technique, which is entirely based on vegetable materials, and therefore represents a technical tour de force and a beautiful way of showing respect for the environment.



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Uganda National Commission for UNESCO



United Nations Educational, Scientific and Cultural Organization



From the People of Japan



United Nations Educational, Scientific and Cultural Organization



World Heritage Convention