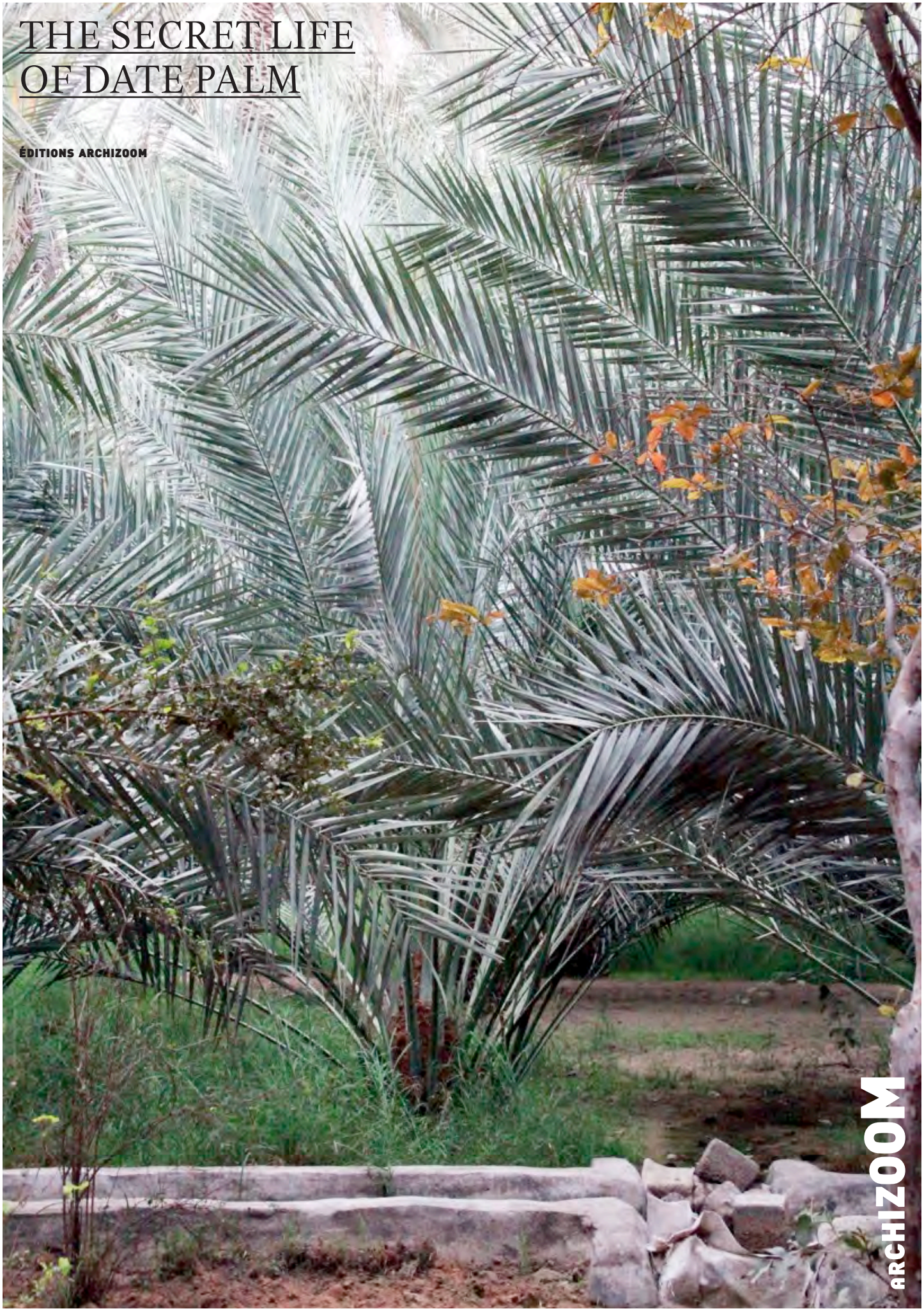
THE SECRET LIFE OF DATE PALM

ÉDITIONS ARCHIZOOM



ARCHIZOOM

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Six date palm characteristics provide the structure of this book: Form, Fruit, Hydration, Metamorphosis, Shade and Shadow, and Gender. Each investigation draws on Emirati traditions and tacit knowledge to share a narrative that is infused with sensitivity, genuine curiosity and human inventiveness.

This is the story of a species that continues to provide great value to the Middle East. It is our hope that the spirit of engagement and ingenuity employed throughout history inspires others to find value in their own regional resources, climates and cultures. We invite you to join us in exploring the date palm as a provider and sustainer of life.

This publication follows an exhibition initially envisioned by Cultural Engineering, Dubai, produced by Case Design, Mumbai, in collaboration with Ellen E. Donnelly, for the UAE pavilion of the World Expo Milan in 2015.

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PREAMBLE

Cyril Veillon / director of Archizoom

In our standardised world, dictated by the global economy and by industrialisation, can genuine local tradition ever inform architectural debate?

At Archizoom, a centre within the EPFL dedicated to the built environment, I value open questions on how to build differently. I am therefore especially interested in the work of Cultural Engineering, a Dubai practice that works on renovation, urbanism, publishing and education across the Arabian Gulf. They focus on vernacular intelligence and empirical knowledge as means of strengthening our contemporary identity.

“The Secret Life of the Date Palm” is based on research conducted by Cultural Engineering for the 2015 Milan Universal Exhibition’s UAE pavilion. They journeyed through the centuries-old love story between date palm trees and its multiple uses in food, design, construction, landscape and infrastructure. They also looked at the historical meaning and symbolic dimension that the palm tree has for inhabitants of the Middle East.

This integrated approach invites various practitioners to the debate. The know-how of a carpenter meets that of a date palm expert, a scientist and an historian. The architect uses folk knowledge in contemporary architecture and explores typologies and building techniques, whilst making rigorous use of common sense. On a macro scale, the research looks at the date palm’s impact on the urban setting, such as the irrigation systems designed for plantation that end up serving as high-quality public spaces in the desert.

With this book, we wish to support broad-minded thinking and to commend smart urban intervention that is rooted in curiosity, pragmatism and inclusiveness.

THE SECRET LIFE OF DATE PALMS

The date palm [Phoenix Dactylifera]: the tree of life, of abundance and riches. For at least 7000 years, this species has sustained and fostered life in the Middle East. As a food source, it is highly nutritious, easily preserved and travels well, making it ideal fare for the Bedouin people as they traversed the desert landscape, and for sailors as they crossed the open seas. Equally important, it provided shelter from the sun and wind, building materials for housing and raw materials for tools and utilitarian objects.

Today, the date palm continues to play a critical role in the region as population growth and resource shortages create greater value for renewable resources. The Secret Life of Date Palms is a collection of scientific, empirical and anecdotal research compiled from design workshops, experiments, tests, samples, site visits and countless conversations with scientists, farmers, students, researchers and makers.

Form

Almost unrecognisable in its natural state, the surface and proportion of the date palm has been shaped by man for thousands of years. In its uncultivated form, it is a multi-stemmed plant, not the tall, branchless tree commonly recognised throughout the world. It reaches its full diameter in the first few years, meaning farmers are able to systematically cut the lower branches of the tree to encourage vertical growth, thereby helping to prevent insect and animal infestations, and creating a shaded microclimate conducive to cultivating other crops below. The surface and texture of the trunk is created by the skillful hand of the farmer as he removes each successive frond. Calibrated through generations of accumulated knowledge, the farmer's tools deftly slice through the unwanted branch, leaving behind a distinct series of ridges. Using this stepped surface and the help of a rope saddle made from the fibres of the tree, farmers can literally walk to the top of the trunk to pollinate, harvest and care for this precious resource.

Fruit

Like the date palm itself, the date fruit is harvested and processed in countless ways, making it a versatile and essential part of traditional Arabian life. Nutrient-filled, easily preserved and long-lasting, dates, in conjunction with camel milk, sustained the Bedouins for thousands of years. It is said that the Prophet Muhammad once proclaimed, "A house with a date palm will never go hungry."

There are approximately 37 varieties of dates currently cultivated in the UAE. Scores of products made from date fruit include date spreads, pastes (agwa), syrup, sugar, sap, juice (nabidh), vinegar and perfume. Historically, fermented dates were used as a substitute for yeast in leavening bread; and male flowers have been used to make a scent called Tara water. The terminal bud, the heart of palm, often is eaten as a salad when the tree is cut down.

Hydration

It is said that the date palm is happiest when its "feet are in water and its head is in heaven's fire," making the Arabian desert oasis an optimal home. Often fed by underground irrigation systems or a natural ground-water source, its root system is comprised of a thick bunch of radiating rootlets, containing a large number of air passages. The roots, defined in four zones by their growing depth include the respiratory zone, the nutritional zone, the absorbing zone and an unnamed zone, depend on the ground-water supply.

Few roots accumulate near the surface, enabling other plant life, including wheat, alfalfa and vegetables to flourish in the shade provided by the fronds above.

The vascular circulatory system of the date palm contributes to its strength, flexibility and significant absorptive qualities. In its monocot trunk, the vascular bundles are scattered throughout the stem tissue and the plant has no clearly defined pith. The bundles, which appear as thick fibres, carry sap from the root system upwards to the midribs and leaves.

Metamorphosis

In an ancient Persian hymn, recounted by the Greek geographer Strabo (64 BC–25 AD), there are said to be 360 uses of the date palm tree, corresponding to the 360 days in the Old Persian calendar. While the hymn itself did not actually name each of these uses, the use-per-day allusion confirms the plant's esteem in ancient cultures. Limited resources, combined with human inventiveness, transformed the date palm into food and shelter for humans, animals and other plants.

Through history, the date palm served the Middle East as a primary source of building materials. Trunks were used as columns and beams while the mid-ribs were utilised to weave the walls of traditional houses (arish) and construct fishing boats (shasha). In addition, mid-ribs and fronds were transformed into fencing, roofing material, window screens, mats for sitting, fish traps, chicken coops, carrying sacks, baskets, food mats and covers, ropes, and brooms and brushes. Unused materials were either burned for fuel or further transformed: date stones were soaked and ground to become animal feed, dates were made into medicine and ash was used to create a simple form of plaster. Today, this holistic appreciation of the date palm has waned as primary attention is focused on the production of fruit.

Shade and Shadow

One of the most important and most abstract by-products of date palm cultivation is the shade it produces. The plants provide protection from the harsh desert sun and winds to humans, animals and crops by creating a temperate microclimate more suitable for sustaining life, while also reducing the damage caused by sandstorms and wind erosion.

Under the canopy of the date palm oases, often fed by an underground water source (falaj), other crops such as citrus trees, alfalfa, watermelon, sweet potatoes and beans, cotton, wheat, barley and millet can flourish and animals, such as cattle, sheep and goats, can graze. Planted adjacent to houses, the palms provided shade for human and animal settlement and air filtration in a dusty, desert landscape.

In addition to the shade produced by the date palms, buildings constructed from date palm materials provide ventilation, and can reduce the interior temperature by 30 degrees. Woven window coverings made from palm leaves reduce solar penetration and filter dust and dirt out of the air. Small fibres protruding from the surface of each frond are able to trap the unwanted particles more efficiently than modern synthetic materials.

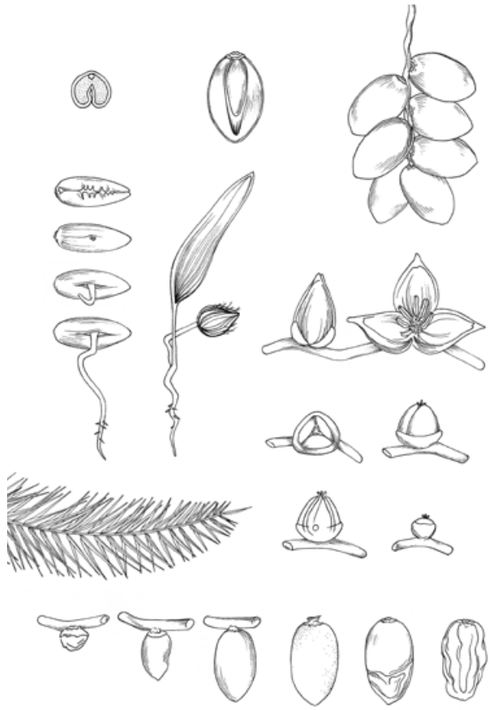
Gender

In ancient myths and fables, date palms are personified and often assume male or female gender roles. These stories portray the trees as a social, sentient beings, affected by environmental factors in the same ways as their human counterparts. Because the date palm is dioecious (it is either male or female), its reproductive process is a carefully choreographed event: the male date palm matures first, and has flowers that produce pollen, while female date palms have flowers that bear fruit if pollinated. The flower clusters (inflorescence) of each are housed in soft, long green shields called spathes which turn tough and fibrous at the end of the reproduction cycle, causing them to split open to expose the flowers within.

The tree has been genetically engineered for several thousand years. While wind pollination is possible, since at least the second millenium BC date palm reproduction has been aided by human intervention to increase the quality and quantity of fruit production, as flowers on female trees must receive pollen within two days of blooming. Traditionally, farmers climb trees and sprinkle the pollen on the female flowers, or tie a flowering male branch inside the blooming female cluster.

While manual or natural pollination produces dates, actual reproduction through seeds is extremely rare and typically undesirable for agriculture. Both in ancient times and today, the most common form of reproduction is the separation and use of offshoots of "known producers". This method creates identical clones of a female plant ensuring female offspring with the same favourable traits.

In 1993, the Date Palm Tissue Culture Laboratory was established in the Date Palm Development Research Unit Department, at the UAE University, Al Ain. This laboratory, which houses a gene bank of over 100 date palm varieties, is responsible for introducing date palm reproduction through tissue culture, the most common method of propagation today. In this form of reproduction, small amounts of tissue from the heart of palm are grown in a sterile growth medium. Each culture produces its own root, stem and leaf system and is transplanted into boxes and grown in greenhouses. These plants are guaranteed to be pest free and mature more quickly, producing fruit sooner than other methods of propagation.



GLOSSARY

AGWA
A date paste, often used as a natural form of sugar and nutrition. Agwa is made by soaking date fruits for over an hour, before blending them together to form a smooth and consistent paste.

ALFALFA
A flowering plant and crop with small purple flowers, typically found in warm climates. Alfalfa flourishes among the roots and under the shade of the fronds of the date palm tree.

AL MASJID
Otherwise known as the Prophet's Mosque, Al Masjid is located in the city of Medina, Saudi Arabia. The mosque was originally built by Prophet Mohammed in 622 AD and is regarded as the second holiest mosque in the world. A variety of elements from the date palm tree were used to form its walls, roof and floor coverings.

ARISH
The arish is a specific type of traditional palm leaf architectural building found in the Arabian Peninsula. Used as a form of shelter throughout the Arabian desert for centuries, the vernacular technology managed to significantly reduce the temperature of its interior and protect its inhabitants from the heat and winds of the desert climate.

BARASTI
Sometimes confused with arish, the barasti is a broader term for the traditional palm leaf architecture used throughout the Arabian Peninsula in which the thatched leaves of palm fronds are bound together to create shelter, walls and other constructions.

BEDOUIN
Taken from the Arabic term "bedu" and used to refer to a nomadic people, the Bedouin of the United Arab Emirates are known for their proud and resourceful nature and hold a significant and symbolic history in Emirati culture.

FALAJ
Known collectively as "aflaj", the falaj is an ancient irrigation system. Well-regarded for its sophisticated natural technology, falaj techniques are still employed today. Also known as qanat in the wider region.

FROND
The large leaf of the palm tree or fern. The frond has a distinctive design, with two row of finer leaves lined up along a central stem. Date palm tree fronds are often used for thatching and weaving, due to their malleable and durable nature.

HAJJAR MOUNTAINS
Stretching from Oman to the eastern territories of the UAE, the Hajjar Mountains separate the coastline from the desert plains. The mountain range is also a vital source of water, used to irrigate the oases of the date palm tree.

ISAMU KENMOCHI
A pioneering Japanese designer, widely known for his mid-century furniture designs such as the bamboo basket chair. He is also credited as one of the main protagonists who helped to revitalise the use of bamboo in contemporary Japanese design.

MIDRIB
The midrib is the central vein of the leaf or frond. The midribs of the date palm tree are quite fibrous in nature and retain a great deal of moisture.

MONOCOT
An abbreviation of monocotyledon, which refers to a plant with seeds contained in one "cotyledon" or embryonic leaf. Roughly 25% of plant life is defined as monocotyledon.

NABIDH
A type of date juice. Made from dates and water, nabidh has been traditionally used as a tonic to relieve digestion problems and other ailments and is said to have been drunk by Prophet Mohammed.

PHOENIX DACTYLIFERA
The Latin name for the date palm tree, "dactylifera" loosely translates to "date-bearing", from the Ancient Greek "dáktulos" meaning date or finger. The Phoenix Dactylifera is part of the Arecacae palm family, a group of roughly 2600 species that prosper in tropical or subtropical climates.

SHASHA
A traditional fishing boat used in the waters of the UAE and Oman. The boat is made from wood and discarded palm fronds, which are soaked in water before use.
The craft is still in use today however it is threatened by more modern boatmaking technology.

SHELTER

In the early years of the Arabian Peninsula, neither human life nor palm trees could survive without the other – the palm tree relied on human care to keep it alive, to attend to its branches and to provide it with irrigation systems to feed it. And likewise, the human population relied on the palm tree for basic survival – for food, as well as for shelter.

The relationship between the date palm tree and its people is therefore an intimate one. It's a bond that shares a common ancestry of survival, one that has weathered the harsh desert climate and continued to grow and prosper for millennia. From nutrition to construction, the date palm is not only a "tree of life" but a pillar of Arabian society.

The indigenous material, therefore, has a deep biological and cultural power, as well as a symbolic and religious presence.

In 622 AD, the Prophet Muhammad settled in Medina after the Hirjah, his journey from Mecca, and began to build a place of worship. On a 30 by 35 square metre plot of land, the Prophet's Mosque – the first mosque in history – was humble in its form. It relied on the trunks of the date palm tree, as well as mud, to build its walls. The leaves of the date palm were also used, for the mosque's thatched roof, floor covering and prayer mats – a form that would provide a template for mosque architecture for years to come. While Al Masjid, "the Prophet's Mosque", has dramatically increased in size and scale over the years (from Umayyad mosaics to King Fahd bin Abdul Aziz Al Saud's extra prayer halls and air-conditioning) the role of the date palm is still a natural component of the region's historical, indigenous and vernacular architecture.

The Prophet's Mosque, however, is not the earliest use of the date palm in the architecture of the Arabian Peninsula. Rudimentary structures made from the date palm are estimated to date back 7,000 years.

From this primary function, the use of the date palm as a form of shelter has developed to meet human needs. It is an essential material of indigenous architecture, particularly in the UAE and Saudi Arabia. The arish, also known as a "barasti", is a traditional form of housing that relies on date palm leaves for its walls, roof thatching as well as room dividers. Most innovatively, a four-sided window, shaped almost like a chimney, is placed through the roof of the house to allow cool breezes to flow through the home, in a cooling mechanism that is now admired as one of the first forms of "air conditioning".

Later, in 13th century Mali, the date palm found its way into the construction of the Great Mosque of Djenné. Still one of the largest and most impressive examples of mud brick architecture in the world today, the date palm branches were used in bundles for the mosque's walls, to prevent them from cracking during Mali's dramatic changes of temperature. Ladders made from date palm materials provided a simple form of scaffolding to allow for future repairs to the building, too. As well as the cooling windtowers of the arish, the date palm can also be used as a natural source of insulation to retain the warm desert heat after the sun has set.

The date palm was a valuable construction material and form of shelter in the Emirates until the mid-20th century. With the advent of technology however, it has been replaced by glass, steel and concrete. Yet the material still offers valuable lessons in sustainability, human intervention and maintaining a connection to both craft and land.

Meeting Ghafoor Ahmad
Carpenter / Noor Ahmad Manzoor Marine Equipment Repairing L.L.

What did you use the material from the date palm tree to make?

We basically made "slices" of the outer-side of a date palm trunk. It was not so much artisan-like, really, we just squared-off the main trunk of the tree and kept the surface, the bark, to be laid on the floor, texture side up, for the exhibition "The Secret Life of the Date Palm" in Milan.

How did you make it?

The outer side of the date palm tree was cut and squared-off using a lathe – it's a common procedure to cut wooden trunks into sections this way. Four people stand on one side of the lathe, and four people stand at the other in order to operate it. So, from one date palm tree, we collected four or five long pieces of wood. We didn't throw away the centre, though, we saved that.

What tools or treatments were involved?

We used a bandsaw, or lathe, which most other carpentry workshops in the UAE don't have a license to use. But since our workshop is in Al Jaddaf – a ship repairing yard – it's easier to obtain a license to use these types of machines here. We were only cutting the outer part of the trunk for the wood, so we didn't use any treatments. The lathe is very powerful, though, and you can get injured using it. It has such a strong rebound that it takes eight people to operate it.

What are the challenges of working with the palm material itself?

Well, we didn't do anything special. The wood came and we just cut it, but that's not an easy job. In comparison to other types of wood, the date palm tree takes a lot of time to work on. Dry wood is easier to cut, but the date palm tree is what we call "wet" wood. We're used to it, though – we never face any difficulties.

How long have you been working with date palms?

You ask how long, but we've been doing this forever. We've worked with the date palm tree since our childhood – we are all used to it. We're all from Pakistan, where we use the date palm tree just like we do here. The UAE is especially known for its date palm trees.

When not working with date palm, what does your company usually produce?

We do all sorts of woodwork, and usually make wooden boards for flooring and furniture. A cupboard does not make itself. That's what's in our trade license – wooden cupboards, window frames, furniture and other wooden things. Nothing but wood.

What do you enjoy most about your job?

I've worked here for seven years. It's a very nice job – I like the people, and I especially like working outside and with things from nature.

FRUITATION

The epic poem of Gilgamesh, the most famous poem of Ancient Mesopotamia, speaks nobly of the date palm and its fruit: "And did you not love Ishullanu, the gardener of your father's palm grove? He brought you baskets filled with dates without end; every day he loaded your table."

Written in the 3rd millennium BC and often regarded as the first piece of literature, Gilgamesh is a poem of richly precise images and its overflowing baskets of sweet date fruits, delivered by the gardener Ishullanu day after day, is not only an image of luxury but one of security.

The date has provided vital nourishment to the human species for thousands of years. For many of our Bedouin ancestors, the date meant survival. The original "superfood" of Arabian and North African civilisation, its use for nourishment reaches back further than Gilgamesh's epic. So far, in fact, that it is difficult to trace. Archaeologists have discovered the "remains of dates" from the late Stone Age, but its exact origins are unknown.

In the Quran, Mary is instructed by Allah to eat a date after giving birth, and it is still advised for a newborn baby to suck on the fruit for a vitamin boost. Rich in dietary fibre, the date can lessen the risk of diabetes and reduce cholesterol. The fruit also has a high concentration of antioxidants and essential minerals such as potassium and magnesium.

The religious and spiritual value of the date is ever-present: the fruit is mentioned throughout the Quran as well as more than 50 times in the Bible. A hand-coloured copperplate engraving of the date palm, "phoenix dactylifera 73", from 1811 clearly emphasizes the majestic importance of the fruit to the tree. Originally appearing in G. T. Wilhelm's Encyclopedia of Natural History ("Unterhaltungen aus der Naturgeschichte"), the proportions are bold, with an almost golden pair of dates suspended next to the spindly trunk of the tree, eclipsing it in size completely.

While the date palm tree may have lost much of its primary function as a construction material and form of shelter, the date fruit is still big business and the palm continues to be cultivated for its fruit, with an immense cultural and capital value.

While the Bedouin relied on the fruit as a pure source of survival – its high nutritional value and long expiry date making it ideal for the desert environment – the date continues to be an essential element of the modern Arabian kitchen today. They can be pitted, stuffed, pasted or pressed into sweet syrup. In keeping with the date palm's transformative personality, after eating the fruit the leftover stones can be used as animal feed.

Meeting Dr Hasan Shabana
"Dr Date" / Date palm expert

Dr Hasan Shabana has dedicated much of his life's research to the date. The former Director General of the Date Palm Research Institute in Baghdad, his well-known expertise has lent him the moniker of "Dr Date" in the UAE.

Your study of the date palm started a number of years ago. How did your research begin?

After I finished my PhD in Belgrade, I came back to Iraq, my home country, and worked in an institute of scientific research of the date palm for about 20 years. After that, organisations from the Gulf began recruiting scientists in the date palm field, and I was one of the researchers brought over. I came to the UAE about 15 years ago. In addition to all the research we completed, I also transferred

new technology to the UAE for the propagation of the date palm. We took plants from other countries and brought them here because the best, or the tastiest, date palms here couldn't produce the offshoot, which propagates the palm tree.

How does the UAE date palm differ from those in other Gulf countries?

In the UAE, there are some good breeds, like the lulu, but there is not that much variety. Saudi Arabia has a lot of variety, for example, as well as Iraq, which has nearly 20 million date palm varieties. But there is a deficiency of water for irrigation in the Emirates. The date palm needs about 50 cubic metres of water every year. And because there is less water, the country lacks the variety that other countries in the Gulf naturally produce.

What has been the biggest discovery of your career so far?

We've focused a lot on pollination. This was previously a big problem because the date palm needs to be pollinated by man. There are male and female date palms – so, we would take the pollen from the male tree and, by ourselves, put it in the flower of the female palm tree.

It's dangerous to climb up to the top of a palm tree however, so we created a machine that would do it for us. So now we use mechanical pollination and we were the first to make this machine. We also worked a lot on irrigation and studied how the date palm receives water at different periods of growth. Now, we are able to calculate exactly when to feed the tree water and how much to use, so that we don't lose any.

The UAE produces roughly 6% of the world's dates. How vital is date production to the country's economy?

This is a very important question. The date palm, just looking at the production of it, is largely environmental for the UAE. The date palm is resistant and suitable for the conditions of the land. It succeeds in sandy soil and a hot climate – it can grow even in 50 degrees centigrade.

Could the date palm business be improved in any way?

Yes. It will be improved because the people of the UAE like their history with the date palm, as it's original to the region. So they will always promote its production.

What do you personally find so fascinating about the date palm?

The processing of the date palm is interesting. There are also so many things you can get from dates. They're very healthy. The fruit has so many things that are good for human beings – especially, for example, the sugar of the date palm, which is monosaccharide, meaning it's glucose and fructose. It doesn't have sucrose, which is a bad sugar that other fruit have. It also has so many minerals, like vitamin A and potassium.

Do you have a favorite variety?

My favorite variety is "khalas", and also we have "khadrawi" from Iraq, which is very sweet... and very tasty.

FURNITURE

"Dating back thousands of years, the date palm has multiple layers as both a seemingly endless resource and a mirror to our own needs as a civilization. While the date palm has traditionally been used as an indigenous architectural material, it also has a footing in our instinctive desire for product design. We eat, we shelter and we make." Samuel Barclay / Case Design

What can we continue to make from our ancient knowledge of the date palm and how can we refresh its value as a natural material in a contemporary context? It's easy to find examples of the date palm's versatility as a material. It's evident in the long, century-spanning list of objects that have been made from it: baskets, bowls, fishing nets, rope, crates, floor mats and screens. Even hats.

However, this particular use and understanding of the material is fading fast from contemporary Arabian society, just as the culture of craft is disappearing across the globe, and perhaps requires a rethink to ensure its status in the modern design world.

The material's sharp, smooth and angular leaves can still be used and woven effectively as a low-cost form of storage. But what about sustainable furniture?

"It does have strength, it does have flexibility. And it does have fibres that are lined in a particular way, so I do think there is potential there," says Samuel Barclay of Case Design in Mumbai, who studied the material closely, and very "naively", in preparation for the exhibition "The Secret Life of the Date Palm" for the UAE Pavilion at Expo Milano 2015.

"The Secret Life of the Date Palm" experimented with date palm trunks to create stools and other display items for the exhibition. Samuel Barclay admits, however, the wood is in desperate need for a chemical treatment and new technologies to be able to produce commercial furniture designs. Perhaps the date palm requires a similar intervention as other natural materials, such as cork, or bamboo.

In 1950, Japanese designer Isamu Kenmochi introduced bamboo, a material associated with traditional basket weaving, into furniture design, along with fellow designer and sculptor Isamu Noguchi. The pair's famed rounded, rattan chairs and other designs brought Japanese furniture design into the mid-century moment, and also repurposed a material from heavy, traditional crafts into light, contemporary design.

Bamboo's natural form makes it an easy fit for furniture design, however. Long, hollow and lightweight, even an unsophisticated craftsman is able to work with bamboo, which only needs to be left to dry, in the sun or on the ground, to prepare it for use.

In comparison, the date palm's trunks and midribs are far more complex. Yet, with patience, there is potential.

"The wood has its own rules, and those rules can tell you what you can use and what you can't use. Whatever you make in 2015 is going to be contemporary. That's my personal view of it. It's a matter of understanding the advantages and disadvantages of the wood," says Jaykishan Mistry, who worked with the material closely during the research and production stages of "The Secret Life of the Date Palm".

He shares an example of the date palm's use as a roofing material in Al Ain, where the lumber is kept thick and its fronds intact, to ensure the palm's vital outer ring doesn't disintegrate. "As long as you know and understand the wood, there are many ways it can be used – there is a Japanese system of 'flaming' the wood, for example," Jaykishan explains. "One of the things I tried was to take a blowtorch and burn the wood three or four times. Then I brush off the ash, so the outer layer becomes hard. And that's what the wood basically needs – particularly the younger wood. The date palm is incredibly soft. It's just fibres compacted together, and what's holding the fibres together is literally just the humidity inside."

The date palm is a renewable resource – the seeds of the date palm can be replanted to produce an exact copy of the original. Still farmed for date production, the leftover elements of the date palm tree – its trunks, leaves and midribs – are all too often discarded. Furniture production, despite its challenges, could see a new life for the date palm in contemporary culture, and a continuation of its place in the Emirati home.

"There's an abundance of Date Palm trees, from India to across Africa and California. Now it's up to us to take it back up as a resource and to turn it into a relevant contemporary model."
Samuel Barclay / Case Design

Meeting Samuel Barclay
Architect / Case Design

Samuel Barclay is an architect based in Mumbai, former associate at Studio Mumbai. Currently co-founder and principal of Case Design, a collaborative design practice and studio with a focus on furniture, architecture and built design, Samuel was a key collaborator and leading curator of "The Secret Life of Date Palms" exhibition at the Milan Expo 2015.

You worked closely with the date palm in preparation for the exhibition "The Secret Life of Date Palms". What did you enjoy about working with the material?

I've lived in Mumbai for the past eleven years and I grew up in a cold climate. So the date palm isn't something I've come into intimate contact with before. What I liked about it – and what we tried to do with the workshop and exhibition – was to convey the idea that this is a very important regional resource. In the way that the bison are in North America, and whales are in Japan and Korea. They are valued locally.

The date palm has a great cultural value too.

Yes. The role that the date fruit plays in Ramadan, the parts of the tree that can be used as medicine, the way it's used for shade – not just "that's nice, now you can get some shade in the desert" but the fact that you can grow crops, vegetables, wheat and grain underneath it. The climate that it produces, not just for people to be comfortable but to enable people to grow their own food is extremely valuable. To understand all of these things was eye-opening.

It must have been exciting to work with a material with that kind of naivety?

I teach product design and materials in Mumbai, and for a lot of the students in the class it's the first time they're encountering materials and tools. For me, there's so much to be gained and learnt by simply taking a piece of material and cutting it with a saw. Or taking a piece of sandpaper and trying to sand it. By sanding it, you'll understand its weight, its density, how much water it absorbs – all of these different qualities. I feel this approach has a deep value, to really understand how something grows, the way it looks in the landscape... And I use the word material not only in the sense of a building material, but as a material in the sense that it has physical characteristics.

Do you see any potential for the material in furniture design?

The midribs of the tree need a fair amount of work in order to be useful. An industrial process needs to be looked at for anything beyond the traditional weaving techniques. In some ways, it requires the same level of investigation as George Washington Carver on peanut research. He was a scientist who tried to figure out different uses for the abundance of peanuts in the southern United States. For example, if you use it for crop rotation, then the species actually replenishes the nutrients in the soil. He created peanut butter and all these other things – some of them good, some of them not. So I think the date palm would require that level of investment, in a more scientific way. There's definitely potential. There's an abundance of this species, from India to across Africa and California. But it would require that engagement.

Date palm has been used as a construction material for millennia, however it has fallen out of fashion over the last century. Do you feel this is permanent?

I think, as a species, we consider comfort more today. I'm not saying that 150 years ago or 500 years ago we weren't concerned with comfort. Different cultures have different demands. Based on geography, environment, history and culture and so on. But there's a shift that's happened in the last 100 years for sure. If you look at aerial photos of Dubai in the 1950s and 1960s, all of the city, or 98% of the city, existed in these date palm structures. One shift in our mechanized controlled environment has made a lot of old technologies obsolete, and that's the invention of air conditioning. Traditional structures were replaced by these modernist, super concrete, climate-controlled buildings with escalators, elevators, etc, so there's this huge shift. Our unfamiliarity with the date palm material and the resource as a species comes from that "break". Now it's up to us to take it back up as a resource and to turn it into a relevant contemporary model.

Can you see any avenues for further research on the date palm as a follow-up to "The Secret Life of Date Palms"?

I think an interesting next step or follow up to the exhibition would be to look at the midribs of the species. To try to find, whether it's through art practices or something else, a practical use for it that could reach a broader audience. In a way that a material like cork is harvested – it's not destructive, it doesn't kill the tree, you just take off the outer layer and the tree regrows it. Effectively the midribs of the date palm operate in the same way – as the leaves grow from the top, the leaves at the bottom are cut off, both for the health of the tree and for the safety of the people who are occupying the space below. As far as I understand, this extra material is just composted. An interesting next step would be to find another way to use the leaves or the midribs, outside of the breadth of what we're exploring now.

PAPER

From the paper mills of Samarkand to the libraries of Baghdad and Alexandria, palm leaf paper was once the hallmark of academia and religious study.

Used for manuscripts, the palm leaf paper is one of the earliest forms of paper, other than the widely used papyrus of the papyrus plant (*cyperus papyrus*), and was equally revered in Asiatic cultures. Religious scripts, early alphabets and age-old myths have all been recorded on palm leaf paper.

While the Palmyra palm tree of Indonesia and Cambodia lends itself well to paper-making – it's leaves are dried and smoked to form a stiff parchment – the leaves of the date palm tree are traditionally more demanding.

It's a tricky process, and largely why date palm paper has not found itself among the heritage industries of the UAE. However, with the arrival of modern science and paper techniques, there are many academics within the Gulf who are now devoted to developing new techniques for the production of date palm paper.

These experts, such as the Juma Al Majid Center for Culture & Heritage in Dubai, use the ancient Chinese methods of papermaking, developed during the Han Dynasty. The leaf is pounded by mortar and pestle (or blended, for a faster process), to be laid on the screen of a wooden deckle to dry. A lengthy technique, it was eventually replaced by the more industrial pulp mills of the 8th century, which quickly spread from Baghdad, Damascus, Cairo and Muslim Spain to the rest of Europe.

The Juma Al Majid Center uses branches that have naturally fallen from the date palm tree. Cellulose fibre – the secret to paper production – is then extracted from these fallen leaves. The final paper is used by the centre for restoration projects, to repair and to preserve manuscripts, such as Arabic and Islamic texts from its 300,000-strong collection.

To use date palm paper as an everyday A4 paper, however, is more challenging, not only because of its delicate procedure. The paper is known to disintegrate altogether after 50 years, perhaps due to the watery make-up of the date palm fibres. There are a few tricks, though: the fibres of the trunk are generally the toughest, and easiest to use for paper. The fibres of the tree's midrib are 20-30 percent less effective, while the leaves are the most troublesome. Regardless of the demands of their texture, it is more often than not the leaves of the tree that are used for making palm paper.

A professor at the American University of Dubai, Luis Castaneda, has experimented with date palm paper on a more aesthetic, and perhaps more immediate, level. Different surface areas and textures of the date palm are used to create prints, using ink and palm paper. Castaneda's inks are also taken from the plant, at least partially, such as a mixture of "Japanese sumi ink, water-based palm ink, oil based palm ink, ash and soot" used to create a print from the date palm's trunk.

Meeting Mohammed Nidal Kawaf
Head of Leaf Casting System Restoration / Juma Al Majid Center for Culture & Heritage

At the Juma Al Majid Center for Culture & Heritage – a library of culture and heritage buried in Dubai's old town – Mohammed Nidal Kawaf sources and develops raw materials into paper, used to restore and repair the centre's centuries-old collection of rare manuscripts.

Is making paper from palm trees part of the UAE's heritage?

Honestly, there's no special history. Palm trees were usually used to make other things – carpets, baskets and bowls. It's not a tradition or a heritage industry. Now, however, there are more people researching a good, simple way to extract cellulose fibre from the palm tree. I've given a few workshops in Dubai to show people the correct way to do it.

Which parts of a palm tree are used in the papermaking process?

Palm trees have a high quantity of cellulose fibre. Not inside its leaves, but inside its branches and the trunk itself. But the value of palm trees is high so we use fallen branches, leaving the tree as it is.

How is the cellulose fibre extracted?

It's more difficult to extract cellulose fibre from palm trees because plant cells also contain lignin and chlorophyll. Extracting pure cellulose and separating it from any lignin requires a special technique – a chemical treatment with alkaline materials, under certain pressures, temperatures and circumstances.

Such as?

In this case, we take fallen branches and remove any leaves. We put them in water to make them easier to cut into smaller pieces, and we start extracting cellulose fibre by adding calcium hydroxide or sodium hydroxide.

What are the steps to actually make a sheet of paper?

The old-fashioned way, the Chinese way. We use a blender to make the cellulose fibre smooth, like syrup or juice, and mix it with water. Then we dip a deckle into it, remove it and let all the excess water filter out. The cellulose fibre spreads over the surface of the deckle and, slowly slowly, a sheet of paper forms.

How do the properties of palm tree paper compare to, say, everyday printer paper?

It's like hemp paper. If you check the textile of it under a microscope, you'll see that the cellulose fibre molecules from a palm tree are "short". When they're short, that means its physical properties are low – it's very soft, and very flexible. It's not a strong paper.

So how useful could it be?

I make pure, 100 percent palm tree paper that's good for the restoration work we do here. If you wanted to use it in commercial manufacturing, though, it wouldn't really be very successful. It needs to be mixed with another cellulose fibre to give it more physical properties, and more strength, shape and the capability to survive for a long time.

What other types of raw materials are you experimenting with?

We can extract cellulose fibre from all kinds of plants. Trees. Cotton. Whatever. The most useful is cotton – its flower consists of around 95 percent fibre cellulose. Bamboo, too. It's wonderful, but nobody knows about it. It's our secret.

WHICH CAME FIRST? THE FALAJ OR THE OASIS?

Dr Walid Yasin Al Tikriti asks, contemplating the ancient irrigation systems that zigzag through the many date palm copses of Al Ain, the UAE's fourth largest city. "It's like the chicken and the egg," he decides.

Dating back thousands of years, the falaj systems (known collectively as aflaj) that continue to bring water to Al Ain's date palm groves were built "out of a necessity to survive", according to Al Tikriti, Head of the Archaeology Section in the Historic Environment Department at the Abu Dhabi Authority for Culture & Heritage.

Conceived during the Iron Age, falaj are manmade channels that carry water from its source (either above or below ground) to nearby farms and communities. "They were mainly used for date palm trees," explains historian Dr Hassan Al Naboodah. "The techniques were very advanced and took many potential problems into account," he adds, explaining how falaj were usually built in zigzags, not straight lines, to ensure that water would never stop flowing.

Prior to the introduction of aflaj, the ancient tribes of Al Ain bore for water using vertical wells. The tribes, however, later began to harness the water flowing from the foothills of the Hajjar Mountains and channel it into both farmlands and existing oases.

"It's not certain why the system changed during the Iron Age – around 1000 BC – but we think perhaps it was due to a change in climate," Al Tikriti says. "Date stones have been found at several Bronze Age sites, so there's archaeological evidence of the date palm's existence in the area before the aflaj were built. But date palm cultivation became much, much wider thanks to them."

Water from the aflaj was, as Al Naboodah explains, first and foremost distributed to date palm plantations. "In the oasis, people agreed on how the water was distributed between them. It depended on two things – the type and the size of the farm. It would first go to those growing palm trees," he adds. "People from Abu Dhabi, Liwa or other emirates, used to import their food – especially dates – from Al Ain."

Currently, there are several aflaj systems in Al Ain that have been restored or are else in the process of restoration. "With regards to history, it's important," says Al Tikriti. "Without falaj, of course, we wouldn't have this number of date palms and this amount of oases. The falaj system is a really important part of our cultural heritage – UNESCO has put it on its list of World Heritage Sites."

Thanks to its aflaj systems, Al Ain has earned the nickname of "the garden city" – the sum of an etymological equation of Al Ain meaning "the spring", and "falaj" meaning distribution. "The falaj are very important for growing date palms," says Al Naboodah. "In fact, they are still used in exactly the same way – to grow date palms. If you go to Al Ain oasis today, it's exactly the same as it once was – extremely beautiful."

The topic of water is a global discussion in a world challenged by increasingly scarce resources. In particular, when looking at the topic of water systems, and the arrangement and planning of water sources, it shows to become problematic in the years to come. Although the deserts of the Gulf are associated with limited water sources, there are aquifers and oases that have acted as depositories deep underground over the past centuries. These water sources are channeled within the Hajjar Mountains, which then seep into the limestone deep underground. They act as small arteries, which then go into aquifers or oases, which then act as water banks.

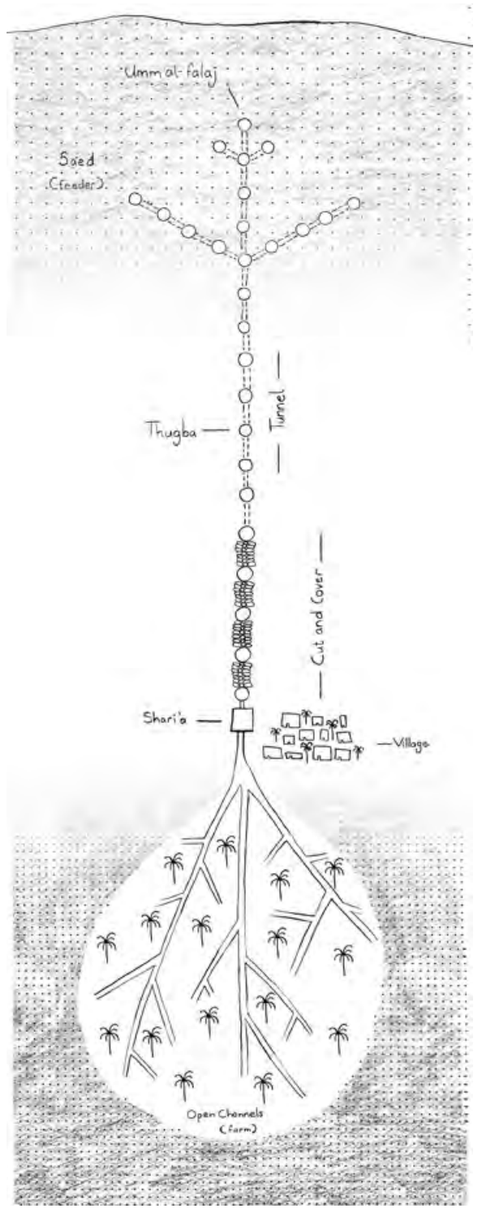
The first question is where does the water come from? Although rain is known to be scarce in the region, these water banks are constantly replenished by the rainy season over the years. They are either stored in cavities within the mountain, or seep into the desert, which then slowly trickle down until water reaches rock formations deep under the desert. The rock formations below have small veins, which then grow into bigger ones finally reaching a larger hole, "The Oases". There are hundreds of such oases scattered across the desert and rain constantly replenishes these sources. The quality of water varies, but these water sources are located almost everywhere.

Gulf natives invent systems to tap into these water sources and channel them through their villages in an innovative system called falaj. By studying the intricate web of channels, it is clear how they mobilize water for miles from aquifers to civic spaces, houses, mosques, plantations, animal farms, local bathes and back into different aquifers. Since water is known to be a scarce resource, there are dedicated houses that manage the distribution of water; it is channelled evenly throughout the city to nourish crops, act as ablution spaces, and get stored into households for bathing, washing.

These systems are still used today in modern settlements in evolving towns throughout the Gulf. A time based sharing system is regulated by wali, the town mayor, who fairly distributes the water ration to every household and plantation. The water is first channelled for miles into a large house to checks the water's quality and flow. The water then moves through the city into visible water channels, which become narrower as they move from public into private spaces. In the case of plantations, daily irrigation is unnecessary for local plants (i.e the date palm); therefore plantations are flooded once every three weeks. This flooding process might sound wasteful at first, but becomes an efficient way of nourishing the palm trees and growing crops in its shade.

Modern settlements such as Falaj–Daris in Oman continue to make the falaj system relevant; water channels flow through the city into modern houses, government offices, palm plantations and even three storey buildings. A large town with hundreds of settlers living side by side with an ancient water system proves that the falaj continues to be a sustainable water system.

The Gulf continues to grow and use solutions such as desalination plants for water resources. Complex machines require high energy to turn seawater into viable water sources. This creates new forms of complex problems. The process increases the salt table in the sea affecting marine life and requires complex pumps to feed water into cities. The solution for the Gulf's water cycle might be the falaj, which needs to, and could be adapted to fit into the modern context of today.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