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# The Khalifa Award Report

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## Bridging Boundaries

Khalifa International Award for Date Palm and Agricultural Innovation

Edited by
PROFESSOR DR ABDELOUAHHAB ZAID
DR SANDRA PIESIK

جائزة خليفة الدولية لنخيل التمر والابتكار الزراعي
KHALIFA INTERNATIONAL AWARD FOR DATE PALM AND AGRICULTURAL INNOVATION

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# Bridging boundaries: how can bio-regional collaboration convert the date palm industry into a successful model of the bio-circular economy?

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THE EMIRATES

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Celebrating the UN Decade on Ecosystem Restoration (2021- 2030)

**The Khalifa Award Report**
Bridging boundaries: how can bio-regional collaboration convert the date palm industry into a succesasful model of the bio-circular economy?

**Published by**
© Khalifa International Award for Date Palm and Agricultural Innovation, 2021

The idea of this book was devised by both Professor Dr Abdelouahhab Zaid, Secretary General of The Khalifa International Award for Date Palm & Agricultural Innovation and Dr Sandra Piesik, Director of 3 ideas B.V. Editing, design and publication was then commissioned by both co-editors.

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**Designed by**
Beautiful Minds Amsterdam,
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**Infographics by**
© Khalifa International Award for Date Palm and Agricultural Innovation, 2021 and 3 ideas B.V. Designed by Beautiful Minds

**Typeface Euro-Arabic by**
Beautiful Minds Amsterdam,
The Netherlands in cooperation with Khalifa International Award for Date Palm and Agricultural Innovation, Abu Dhabi, United Arab Emirates

**Project management**
The Khalifa International Award for Date Palm and Agricultural Innovation, Abu Dhabi, United Arab Emirates and 3 ideas B.V. in cooperation with Beautiful Minds, Amsterdam, The Netherlands



**Printed by**
United Printing and Publishing, United Arab Emirates

Made in United Arab Emirates

First printing, January 2021

NMC Printing Permit: MC-03-01-4739347
ISBN (Printed Book): 978-9948-25-831-5
ISBN (E-Book): 978-9948-25-836-0

For more information, please visit

www.bridgingboundaries.world

www.kiaai.ae

This book was printed on paper certified by the FSC®

With a special thanks to all who contributed to the production of The Khalifa Award Report.



We dedicate this report to the late Sheikh Zayed Bin Sultan Al Nahayan, “May God Bless His Soul”, founder of the United Arab Emirates (UAE), who dedicated his life to the protection of the environment and the well establishment of the UAE’s date palm sector.

The authors also dedicate this report to all who lost their lives during the COVID-19 pandemic, and for those working towards our #BuildBackBetter future.

## Editors

**Professor Dr Abdelouahhab Zaid**
Professor Abdelouahhab Zaid is an Agricultural Advisor to the United Arab Emirates Ministry of Presidential Affairs. He also serves as Secretary General of the Khalifa International Award for Date Palm and Agricultural Innovation, and is a Goodwill Ambassador to the UN Food and Agriculture Organization (FAO). Throughout a distinguished career devoted to crop science, horticulture and agronomy, he has held several high-level government, academic and institutional roles and participated in biotechnology development projects aimed at increasing plant production and employment in more than 20 countries.

Professor Zaid has been honoured with multiple awards, including a BR. Sen Award and Honorary Medal from FAO, and an Award of Excellence from the Arab Organization for Agriculture Development (AOAD).

**Dr Sandra Piesik**
Dr Piesik is an award-winning architect, author and researcher, specialising in the implementation of global sustainable legislation, nature-based solutions and traditional knowledge adaptation. She is the founder of 3 ideas B.V., an Amsterdam-based consultancy. Her diverse global engagements range from international lectures, judging of the competitions, nominator of awards, and evaluation of R&D projects for the European Union.

Dr Piesik is a stakeholder and network member of several United Nations organisations including UNFCCC: The Resilience Frontiers, the Nairobi Work Programme (NWP), the Paris Committee on Capacity Building (PCCB) and the Climate and Technology Centre & Network (CTCN). She was formerly the UNCCD Policy Support Consultant on Rural – Urban Dynamics and contributed to the UN-HABITAT *Urban-Rural Linkages: Guiding Principles and Framework for Action to Advance Integrated Territorial Development.* Her published work includes *Arish: Palm-Leaf Architecture* (Thames & Hudson, 2012), she is also the general editor of *HABITAT: Vernacular Architecture for a Changing Planet* (Thames & Hudson, Abrams Books, Flammarion, Editions Detail and Blume, 2017).

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**ABU DHABI, UAE GROUP OF CHILDREN VISITING SHEIKH ZAYED GRAND MOSQUE © SHUTTERSTOCK**

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# The Bio-Circular Economy is the roadmap to enhancing sustainability in the UAE

**The UAE has witnessed accelerated steps towards adopting the Bio-Circular Economy model, in order to achieve long-term sustainable growth, and which is in line with the global orientation to achieve the United Nations 2030 Sustainable Development Goals, human values and improve the quality of life. The UAE's vision and economical strategy is behind the interest in this transformation into a Bio-Circular economy, and specially UAE's vision 2021, Abu Dhabi's Economical vision 2030, UAE's Future Strategy, Abu Dhabi Environmental Vision 2030, and the UAE's Centennial 2071.**



# Preface

**HIS EXCELLENCY SHEIKH NAHAYAN MABARAK AL NAHAYAN**
Cabinet Member and Minister of Tolerance and Coexistence, Chairman of the Board of Trustees, Khalifa International Award for Date Palm and Agricultural Innovation

Thanks to His Highness Sheikh Khalifa Bin Zayed Al Nahyan, President of the United Arab Emirates, "May God Protect Him" for His Highness wise vision, and to His Highness Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi, Deputy Supreme Commander of the UAE Armed Forces, for his valuable directions, and to His Highness Sheikh Mansour Bin Zayed Al Nahyan, Deputy Prime Minister, Minister of Presidential Affairs, the sponsor of date palm cultivation, for his continuous support. The UAE is working on implementing the Bio-Circular, as part of its efforts to enhance the organizational sustainability across all sectors, and to establish the main principles of sustainable production and consumption in all society sectors. This is also because the application of the Bio-Circular economy system is one of the most important factors in achieving sustainability.

On the 6th of November, 2019, the UAE government announced the launch of the "360 Bio-Circular Economy Acceleration" initiative, in accordance with the strategic partnership that has been signed with the World Economic Forum for the Middle East and North Africa on the 6th of April, 2019, to harness the technological innovation and smart technologies potential to accelerate the Bio-Circular economy. This will make the UAE, the first country supporting this initiative globally, which reflects the country's position as a global center, an open laboratory for economic and technological innovations, and a pioneering model in sustainable development. The initiative also lies in line with the UAE's Centennial 2071.

Under this initiative, the UAE will plan moving towards a Bio-Circular economy, which will divert all efforts made to intensify the implementation of the standards of this economy, by launching various initiatives and projects covering all sectors, including the date palm cultivation and date production. Governmental, private sectors, and individuals will collaborate to implement the sustainability shift in production and consumption. Where this joint initiative reflects the strategic orientation towards introducing initiative which will help create the needed environment and sustainable infrastructure, which will support the growth of vital economic, social and environmental sectors, to serve the best to people.

The success of the UAE in linking its development plans with consideration to the environment, is a result of the wise decisions of our leaders, and their ongoing interest in promoting the process of development and prosperity while preserving the sustainability of our natural resources. This has contributed to achieving pioneering successes globally. By adopting the Bio-Circular economy, Khalifa International Award for Date Palm and Agricultural Innovation aims to implement the sustainability concept to existing and future projects in the date palm cultivation and date production fields, which will in return help to conserve resources and increase the reliance on clean energy, in addition to applying the sustainable development standards, which will reflect the government's interest in strengthening efforts to achieve global sustainability that will help preserve the planet and recourses for the future generations.

# 1 Introduction

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# 1.1 Editorial Statement

**PROFESSOR DR ABDELOUAHHAB ZAID**
Secretary General
Khalifa International Award for Date Palm and Agricultural Innovation

**DR SANDRA PIESIK**
Director
3 ideas B.V.

**The world has reached an inflexion point. A rapidly-increasing population, and an accompanying rise in demand for raw materials, has depleted the earth's natural resources to the point where we are consuming our environment at a rate that exceeds its ability to replenish itself. In other words, we are robbing future generations of their resources and their rights. Human activities and commercial practices have also greatly increased the threat of climate change, with negative effects already evident in various parts of the world.**

The global demand for resources is expected to double by 2030, which could see precious resources depleted, allowing carbon emissions to expand and biodiversity to decrease. Because of this, the topic of sustainability has reached worldwide importance, and the need for a bio-circular economy has emerged as one of the world's most critical themes.

## Building a bio-circular economy

Since the Industrial Revolution, the traditional (linear) economy – built around the 'manufacture, use and dispose' methodology – has prevailed. In sharp contrast, a bio-circular economy reduces waste, as part of a closed loop of operations that invests resources with high efficiency. The idea can be summarised simply: "everything that is extracted from nature returns to nature and to be recycled endlessly". Of course, this is not a new idea, and it goes beyond the recycling of resources to ensure that both production and consumption become sustainable.

There is another key issue to consider. Date palm cultivation (and date production in the world in general) has become a subject of concern because of its unique agricultural, economical and nutritional value. Global date production is estimated at eight million tonnes annually, with Arab countries responsible for more than 75 percent of this, distributed mostly to countries in Asia and North Africa, as well as Australia, the US, Namibia and South Africa. In fact, Arab-region countries continue to play a key role in terms of innovation and development of this sector, whether in terms of investing in modern date palm cultivation, manufacturing and marketing.

**The encouraging news is that date-producing countries are already taking accelerated steps towards adopting a bio-circular economy model, a system that aims to lower emissions by reducing the waste of large quantities of energy, and make the best use of natural resources.**

## Environmental impact of the date palm

But date palm cultivation, and the residue it creates (such as the accumulation of leaves, fronds and dead trunks), as well as date-processing residues produced from infected or distorted nuclei, places a great environmental burden on farms and date-processing factories. A recent study on date palm producing farms reports an annual average of 23 kilos of waste per tree. The environmental pollution from the impact of accumulated date palm residues has made it necessary to find alternatives, and to create projects to recycle this important waste, which is rich in fibre and sugar.

The encouraging news is that date-producing countries are already taking accelerated steps towards adopting a bio-circular economy model, a system that aims to lower emissions by reducing the waste of large quantities of energy, and make the best use of natural resources. By breaking the chains of the traditional linear economy, and its obsession with industrialisation and consumption, date-producing countries are seizing the opportunity to behave responsibly in the use and preservation of natural resources and energy in large quantities.

As this report demonstrates, the adoption of the bio-circular economy will constitute a quantum leap – and a necessary choice – which will contribute greatly to the reduction of global environmental damage and will have a positive impact on the economies of date-producing countries. In addition to introducing and securing new job opportunities, the bio-circular economy will bring innovation (through the invention of new technologies) and the use of artificial intelligence will create investment opportunities for the private sector that can expand the scope of application of new solutions. Thanks to its ability to influence consumers on one hand, and suppliers on the other, by adjusting supply chains to achieve a sustainable consumption equation.

## The aims and objectives of the Khalifa International Award

With the negative impact of the human activities combined with the damaging effect of the climate change on the oases' biodiversity and even its existence, Khalifa International Award for Date Palm and Agricultural Innovation (KIADPAI) and its Secretariat General have taken important global-level actions aimed at mitigating these devastating factors:

- Enhancing international cooperation among date palm-producing countries – for the sustainable development of the date palm sector.
- Working closely with both regional and international organisations to prepare and implement strategies and programmes to improve the resilience of oases to climate change.
- Developing 'good agricultural practices' and the capacities of date palm value chain stakeholders, with the objective of increasing date growers' income, preserving natural resources and protecting the fragile oases environment.
- Encouraging scientific research on the development of innovative agricultural practices, to ensure the sustainable development of the date palm industry, in harmony with its environment.

**On the publication of The Khalifa Award Report, we wish to highlight the invaluable efforts of His Excellency Sheikh Nahayan Mabarak Al Nahayan, Minister of Tolerance and Coexistence, Chairman of the Board of Trustees of the Khalifa International Award for Date Palm and Agricultural Innovation. His Excellency has spared no effort in providing the support and advice needed to achieve the wise vision of UAE's leadership – by developing the date palm sector regionally and strengthening the UAE's pioneering role in supporting and developing date palm cultivation and date production sectors internationally. These achievements have played a major role in enhancing food security and achieving sustainable development in the date palm cultivation sector.**

# 1.2 Statement from the Convention on Biological Diversity

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**HER EXCELLENCY ELIZABETH MARUMA MREMA**
Executive Secretary
Convention on
Biological Diversity

**Biodiversity makes production systems and livelihoods more resilient to shocks and stresses**

**— reduces its loss has long-term benefits for humans, ecosystems and animal health.**

نخلة



**Date palm ecosystems have been a rich source of nutrition, biodiversity and culture for millennia. These oasis agroecosystems comprise a rich genetic diversity of date palms, in addition to over a hundred species of plants, crops and other organisms. The genetic diversity of date palms has been key to their successful cultivation, as it has created locally-adapted varieties of date palms that are resistant to extreme heat, drought, salinity or floods.**

### Why is biodiversity important?

The conservation and sustainable use of genetic date palm diversity is critical to ensure date palm ecosystems are resilient to climate change. When sustainably managed, date palm ecosystems are also an important tool to reverse desertification in desert regions, as they provide habitat, shade and protection from wind and heat for other species. In fact, the biodiversity of all species in oasis agroecosystems must be conserved and sustainably used, as it underpins essential ecosystem services — such as pollination, pest control and nutrient cycling — critical for the productivity and sustainability of agriculture.

Biodiversity makes production systems and livelihoods more resilient to shocks and stresses — reducing its loss has long-term benefits for humans, ecosystems and animal health. It is a key resource in efforts to increase food production while limiting negative impacts on the environment. Preservation of the traditional knowledge of indigenous peoples and local communities associated with the management of date palm ecosystems is also crucial to ensure their long-term sustainability.

### The Khalifa Report: championing cultivation and collaboration

This report outlines key pathways by which date palm cultivation can contribute to ecosystem restoration, biodiversity conservation and climate change adaptation, while also providing food security and 'green' jobs. It also highlights the importance of regional collaboration within the date palm industry for achieving a sustainable agriculture and food systems transition, as outlined in the fifth edition of the *Global Biodiversity Outlook*, recently released by the Convention on Biological Diversity (CBD).

Date palm fruits, leaves and seeds have a multitude of different uses, including nutritional, medicinal, artisanal and cultural. Each species of date palm has unique properties and traits, each with varying growing seasons, which help to create a diversity of products that can be grown over an extended harvesting season. This report demonstrates how the genetic diversity of this fruit provides many opportunities for bio-circular economic diversification, which can help reduce food waste and support livelihoods.

The present COVID-19 crisis is a clarion call to fundamentally reorganise our relationship with nature. Around the world, new green initiatives are being spurred on in response to the pandemic. This timely report offers concrete solutions for the date palm industry of the Middle East and North Africa (MENA) region to answer this call and promote the sustainable management of date palm ecosystems.

I am pleased to welcome this report, which I am sure will become a key tool for CBD parties in the MENA region and beyond to implement the post-2020 global biodiversity framework.

واحة

**This report outlines key pathways by which date palm cultivation can contribute to ecosystem restoration, biodiversity conservation and climate change adaptation, while also providing food security and 'green' jobs.**

تمرة

# 1.3 Statement from the United Nations Convention to Combat Desertification

**HIS EXCELLENCY IBRAHIM THIAW**
Executive Secretary United Nations Convention to Combat Desertification

**The coronavirus pandemic is straining an already difficult macroeconomic environment and threatens to swallow hard-won development gains of the 2030 Agenda and Agenda 2063 – pulling millions of people back into extreme poverty, including in the drylands. In the UAE, the initiative to establish a thriving date palm industry in the Arabian Peninsula, North African countries and the Sahel region is both innovative and transformative, with the potential to improve the livelihoods of poor populations.**

### Merging science with principles

If land-use planning is effectively carried out so that unnecessary conversion of healthy land is avoided and degraded land is brought back into production, date palm farming can fuel sustainable development and growth in an ecologically-sound way. Rehabilitation miracles such as the SEKEM Initiative in Egypt and Elion in China prove that, regardless of their location, industries based on sound science and ecological principles will thrive, transform lives locally in a matter of decades, and bear multiple ecological benefits that serve local and distant communities when brought to scale.

The UAE initiative has at least three conditions that position it for success. First, date palms are native plants in large parts of these regions. Being adapted to the climate and soils and made resistant to local pest and disease attacks make their cultivation cheaper and easier to manage than that of exotic plants. Second, every part of the date palm, from the fruits and leaves to the trunks and seeds, have economic value. In a bio-circular economy, most of this value, which is currently disposed of as agricultural waste estimated at a staggering 10.3 million tonnes every year, can be turned into money. Third, the target area has the key resources needed to sustain and grow a thriving date palm industry. The land is vast, and 90 percent of the urban growth is expected to take place in these regions.

### Societal benefits

The farms will create new and sustainable jobs for a growing population that has skills to supply the industrial production. What is more, the approach builds in social safeguards, such that the local population becomes the industry's primary consumer market – one that grows and expands as household wealth increases.

Rehabilitation miracles in other dryland regions of the world show desert-friendly farms increase vegetation cover. This improves the quality of the air and health of the people. It also increases rainfall, making communities resilient to droughts. Biodiversity also thrives where ecological approaches are designed into the plantations. At the macro level, increased vegetation cover would enhance global efforts to sequester the carbon emissions in the atmosphere that are driving climate change.

Land degradation and climate change are the defining issue of our time and we are at a defining moment. We have a duty to move away from the 'business-as-usual' mindset and take active steps to align recovery with sustainable development, and economic value with social value. The United Nations Convention to Combat Desertification continues to play its part. Its objective is also to positively position a development-driven narrative and leverage the investments required to accelerate progress of the 2030 and 2063 Agendas, the Paris Agreement on Climate Change and achieve a land degraded-neutral world, in particular for women and young people.

### Conclusion

**The coronavirus pandemic has reminded us how land use change is a major pathway for infectious disease-causing viruses whose impact can been deep, swift, widespread and difficult to contain. Recovery initiatives built on sound science are vital and desirable ecological and economic contributions in our collective efforts to build new stronger, healthier and more productive communities that live in harmony with nature. Through initiatives like date palm farming, we can galvanise action and support for a new social contract for nature, conscious of our planet's current challenges.**

If land-use planning is effectively carried out so that unnecessary conversion of healthy land is avoided and degraded land is brought back into production, date palm farming can fuel sustainable development and growth in an ecologically-sound way.

The coronavirus pandemic has reminded us how land use change is a major pathway for infectious disease-causing viruses whose impact can been deep, swift, widespread and difficult to contain.

DRY CRACKED
GROUND
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**DR YOUSSEF NASSEF**
Director of the Adaptation Programme United Nations Framework Convention on Climate Change

**The international multilateral process to address climate change reached a milestone in 1994 when the United Nations Framework Convention on Climate Change (UNFCCC) entered into force. At that remarkable moment, the international community recognised the existence of the climate change problem, and agreed to work together to resolve it. The Convention put forward, explicitly and unambiguously, its ultimate objective: preventing dangerous human interference with the climate system.[1]**

واحة

### Shaping the climate change movement

In 1997, the Convention was complemented by the adoption of the Kyoto Protocol, which entered into force in 2005. The Protocol introduced quantified commitments for industrialised countries and economies in transition to limit and reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets.

And finally, six years ago in Paris, on 12 December 2015, the countries that are parties to the UNFCCC reached a landmark agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low-carbon and climate-resilient future – the Paris Agreement. The Agreement builds upon the experience accumulated with the implementation of the Convention and its Kyoto Protocol, and brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charted a new course in the global climate effort.

### The Paris Agreement in context

The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels, and pursuing efforts to limit the temperature increase even further to 1.5 degrees Celsius. Additionally, the Agreement aims to increase the ability of countries to deal with the impacts of climate change, and at making finance flows consistent with a low GHG emissions and climate-resilient pathway. To reach these ambitious goals, appropriate mobilisation and provision of financial resources, a new technology framework and enhanced capacity-building are put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives. The Agreement also provides for an enhanced transparency framework for both climate action and its related support.

The Paris Agreement requires all parties to put forward their best efforts through Nationally Determined Contributions (NDCs), and to strengthen these efforts in the years ahead.[2] In that regard, NDCs are at the heart of the Paris Agreement and represent a core element of its implementation. NDCs embody efforts by countries to reduce national emissions and adapt to the impacts of climate change, with the aim of achieving the objectives of such contributions. Each NDC is to reflect the country's actions on climate change, taking into account its domestic circumstances and capabilities.

**The Convention put forward, explicitly and unambiguously, its ultimate objective:**

**preventing dangerous human interference with the climate system.**

نخلة



# 1.4 Statement from the United Nations Framework Convention on Climate Change

### Building a brighter future

Together, the climate actions defined and implemented through NDCs will determine whether the world achieves the long-term goals of the Paris Agreement, including reaching global peaking of GHG emissions as soon as possible, and undertaking rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century.[3] It is understood and recognised that the peaking of emissions will take longer for developing country parties, and that emission reductions are undertaken on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty, which are critical development priorities for many developing countries.

In advancing ambition at national and regional level, it is important to build on regional synergy, as well as local knowledge, in managing natural resources such as date palms. This will serve as an important backdrop for countries of the region as they develop their climate change response. Circularity demands that transboundary work, especially as encapsulated in bioregional collaboration, be given priority as the region moves towards a sustainable future.

واحة

**In advancing ambition at national and regional level, it is important to build on regional synergy, as well as local knowledge, in managing natural resources such as date palms.**

تمرة

# 1.5 Statement from the United Arab Emirates Ministry of Climate Change and Environment

**HIS EXCELLENCY DR ABDULLAH BELHAIF AL NUAIMI**
Minister of Climate Change and Environment United Arab Emirates

**To build greater resilience in response to the COVID-19 pandemic, and other global social, environmental, and economic challenges, the world needs a robust, effective implementation of the circular economy model, in which products and materials are recovered, redesigned, and reused to reduce their environmental impact.**

The UAE's circular economy model is placing environmental sustainability at the heart of development.



In addition to significantly relieving the pressure on finite natural resources, a circular economy could generate $4.5 trillion in economic output by 2030. Other benefits include waste and pollution reduction, improving sector performance, and mitigating climate change.

### A dedicated programme of initiatives

The UAE is forging ahead in adopting the circular economy concept across all sectors. In 2018, the country joined the Platform for Accelerating the Circular Economy (PACE), a global public-private partnership scheme and project accelerator for the circular economy. In affiliation with PACE, and in collaboration with the World Economic Forum (WEF), the UAE launched the Scale360° initiative during the fourth annual meeting of the Global Future Councils in November 2019 in Dubai. Supporting the implementation of the United Nations Sustainable Development Goals (SDGs), the initiative mobilises action among innovators, governments, civil society, and private sector stakeholders to establish an ecosystem for circular Fourth Industrial Revolution technology innovation.

Furthermore, the UAE has teamed up with the Coalition of Innovation in Recycling Towards a Closed Loop Economy (CIRCLE) to test a closed-loop recycling model for plastic bottles and packaging. As part of the initiative, the Coalition has launched a pilot project in Abu Dhabi to assess the economic and environmental impact of applying circular economy principles to packaging materials, formulate recommendations that fast-track the adoption of sustainable solutions, and build an optimised waste management infrastructure. Aligned with the circular economy model, the implementation of waste-to-energy (WTE) solutions is an important part of the UAE's integrated waste management strategy that aims to turn waste from a burden to a valuable economic resource. At present, the country has several WTE facilities under construction that will contribute to achieving its target of diverting 75 percent of municipal solid waste away from landfills by 2021.

### The circular economy in action

In October 2020, the region's first refuse-derived fuel (RDF) plant, an AED132 million WTE facility, commenced operations in Umm Al Quwain. Emirates RDF will be able to convert over 1,000 tonnes of waste from Ajman and Umm Al Quwain per day into high-quality alternative fuel for factories. The plant will generate 300,000 tonnes of RDF annually. Another initiative in this space is the joint venture between the Ministry of Climate Change and Environment and the International Center for Agricultural Research in the Dry Areas that seeks to convert biowaste from date palms – palm fronds and dates that are unfit for consumption – into highly nutritious feed blocks for domestic animals. The exercise also helps farmers address the issue of farm waste that would have otherwise been burned, causing harmful emissions. As part of the collaboration, the partners issued a manual on producing animal feed blocks from biowaste.

### Conclusion

**The UAE recognises that 'business as usual' is no longer an option, given the colossal environmental challenges the world is facing. Its efforts to promote the circular economy, coupled with strong reliance on advanced science and modern technologies, have earned the UAE a solid reputation as a country that transforms challenges into opportunities. In line with this year's theme: 2020: Towards the next 50, the UAE is planning for the next five decades. Environmental sustainability has been at the heart of the country's development for the past five decades, and will remain so for the next 50 years.**

To build greater resilience in response to the COVID-19 pandemic, and other global social, environmental, and economic challenges, the world needs a robust, effective implementation of the circular economy model, in which products and materials are recovered, redesigned, and reused to reduce their environmental impact.

SAND DUNES AT
RUB AL KHALI
DESERT
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**HER EXCELLENCY MARIAM BINT MOHAMMED SAEED HAREB ALMHEIRI**
Minister
of State for
Food and Water
Security

# 1.6 Statement from the United Arab Emirates Ministry of State for Food and Water Security

**Food and water security are increasingly being prioritised on the political agendas in the Arab region, as well as globally. With climate change being a threat multiplier, scarce water resources and increased aquifer depletion, limited arable areas and accelerating salinisation of soils, high population growth rates and shifting diet preferences, and highly variable income levels between and within the Arab countries, deliberate action to ensure food and water security is paramount.**

**Achieving food and water security are key pillars of continued development, and can be achieved by leveraging advanced technologies as well as drawing on our past sustainable practices.**



Most Arab countries are net importers of food supplies. That situation will deteriorate further if decision-makers don't address the adverse challenges now, relying primarily on science, technology and innovation for a much-needed paradigm shift in local production, alongside a shift towards ecosystems restoration where needed, to ensure environmental stewardship towards precious resources – as well as returning to sustainable methods of production.

The UAE is striving to enhance sustainable, technology-enabled, domestic food supply across the value chain, spearheading regional efforts in the Arab world and showcasing what can be done with sound technological adaptations. Mindful of the energy-water-food nexus, we believe that an anchored sustainability viewpoint – one that encompasses economic viability, social inclusion and environmental sensitivity – based on enhanced agricultural water productivity rather than agricultural land productivity, offers the most viable solution, given how scarce and precious our water resources are. A resilient agriculture and food system necessitate higher effectiveness of natural resources' use, and thus phasing out water-intensive crops. The vision is to transition to Controlled Environment Agriculture (CEA) based products, coupled with alternative bio-based feedstocks and other food sources, including lab-originated products, thereby complementing classic components of local production.

## Actions to be taken

We need to facilitate the advances in biogenetic technology that will lead to the emergence of climate change resilient, extreme-heat resistant crops and livestock. Expanded use of, and improvement in, water-efficient irrigation methods, desalination technologies, controlled environment agriculture systems, and precision farming, will increase production yields while simultaneously optimising stewardship of critical resources.

Within the UAE, we are taking tremendous steps to adapt new technologies based on innovative concepts and advanced know-how, which are considered the basis for sustainable food security, including initiatives to promote locally-grown, technology-based foods. Hence the development and technology adoption for modern farming practices in the UAE, like CEA in its various forms, is central for the National Food Security Strategy and as part of the commitment to reducing the dependency on imported food, reducing exposure to market volatility by improving supply chain efficiency, while creating opportunities in a sector that is well-supported and growing rapidly.

**Summary**

**Beyond the essential technology component, seeking the restoration of ecosystems and agrobiodiversity would help complement such efforts. This would mean retreading the path of our ancestors, who understood the importance of diverse and balanced ecosystems. The responsible use of environmental resources would reduce water stress, conserve soil and enhance fertility, resort to safe pest control and disease management instead of the misuse and overuse of chemical fertilisers and pesticides, reducing the impact of agriculture on vulnerable environmental components such as native fauna and flora, and eventually contribute to safeguarding against the impacts of climate change – while ensuring food systems are more reliable and sustainable.**

**Achieving food and water security are key pillars of continued development, and can be achieved by leveraging advanced technologies as well as drawing on our past sustainable practices.**

# 1.7 Statement from the Committee on World Food Security

**DR THANAWAT TIENSIN**
Chairperson
Committee on World Food Security

**The Committee on World Food Security (CFS) has been working to address the global food security implications of the ongoing Coronavirus (COVID-19) pandemic and is contributing to the coordination of policy guidance to governments and others to address its various impacts on efforts to reach the relevant SDGs.**

The impacts of COVID-19 have been huge, affecting general society, economy, culture, ecology, politics, and others spheres of life. We clearly cannot exempt ourselves from discussing the implications and potential impacts of this pandemic on global food security and nutrition. The unfolding crisis that has unrolled rapidly and extensively around the world since late 2019 has affected food systems[4] and threatened people's access to food via multiple dynamics. We have witnessed major disruptions to food supply chains, with food workers unable to plant, harvest, transport and sell their produce in the wake of lockdowns triggered by the global health crisis, but also a major global economic slowdown. These crises have resulted in lower incomes and higher prices of some foods, putting food out of reach for many.

According to the World Health Organisation, the worst effects are yet to come, as most health analysts predict that this virus will continue to circulate for at least one or two more years.[5] The consequences for food security and nutrition are serious. Already, before the outbreak of the pandemic, according to the latest State of Food Security and Nutrition Report, some two billion people faced food insecurity at the moderate or severe level. Since 2014, these numbers have been climbing, rising by 60 million over five years.[6]

## The COVID-19 pandemic

Coronavirus is stalling efforts to achieve Sustainable Development Goal (SDG) 2. The complex dynamics triggered by the lockdowns intended to contain the disease are creating conditions for a major disruption to food systems, giving rise to a dramatic increase in hunger. The most recent estimates indicate that between 83 and 132 million additional people[7] including 38-80 million people in low-income countries that rely on food imports will experience food insecurity as a direct or indirect result of the pandemic. At least 25 countries, including Lebanon, South Sudan and Yemen, are at risk of significant food insecurity because of the secondary socio-economic impacts of the pandemic. In Latin America, the number of people requiring food assistance has almost tripled in 2020.[8] Food productivity could also be affected in the future, especially if the virus is not contained and the lockdowns continue. At the same time, malnutrition – including overweight and obesity – increases vulnerability to COVID-19.

In the past few months, we have learned more about the complex ways in which the pandemic has affected, and will affect, food security and nutrition, as well as its linkages with an increasing loss of natural habitats, the degradation of the environment and a decreasing of biodiversity. We need a more comprehensive analysis and in-depth review of the main trends affecting food systems that have resulted from COVID-19 as well as a deeper analysis of the pandemic's implications for the various dimensions of food security and sustainable development.

The current situation could represent an opportunity to highlight the importance of strengthening government management of food markets, protecting marginalised populations who have less power and resources to adapt to such an unpredictable crisis, and difficulty accessing nutritious foods already.

At this moment in time, we need the global community to monitor the food security situation closely, responding in necessary ways to avert the worst outcomes with respect to food security and nutrition, and carefully consider how to build more resilient food systems and ensure the right to food, in order to achieve SDG2. Never before has it been so important to focus our collective energy and efforts on promoting resilient, sustainable food systems.

In this regard, I commend the initiative of the General Secretariat of the Khalifa International Award for Date Palm and Agricultural Innovation in the United Arab Emirates, chaired by His Excellency Sheikh Nahayan Mabarak Al Nahayan, Minister of Tolerance and Coexistence, President of the Award's Board of Trustees, to issue a report on the potential of bio-circular economy, and the sustainable developmental character of the date palm industry as a solution to environmental issues, social well-being, economic and regional security challenges.

## Conclusion

**We need a prompt and resolute action by all responsible leaders – in governments, business, academia, civil society, and elsewhere – to do everything in their power to prevent this health crisis from becoming a food crisis. We saw such a scenario occur only a decade earlier, when a financial crisis morphed into a food crisis. We must prevent this from happening again, for the sake of our peoples and our planet. Sitting idly by is not an option.**

**The most recent estimates indicate that between 83 and 132 million additional people including 38-80 million people in low-income countries that rely on food imports will experience food insecurity as a direct or indirect result of the pandemic.**

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**ANTONIO LÓPEZ-ISTÚRIZ WHITE MEP**
President
EU-UAE Parliamentary Friendship Group

**The European Union (EU) has been discussing the circular economy for more than a decade. What seemed initially as a peculiar idea of the Internal Market Committee of the European Parliament soon became a mainstream topic, with ramifications on many other policies.**

Having sat in the Internal Market Committee for five years, and knowing the key players of the sectors involved in the circular economy, it does not come as a surprise that these issues are also tackled in the Foreign Affairs Committee. In fact, it is clear that collaboration with our southern neighbourhood should also be focused on key elements of the circular economy, such as sustainable development and climate change, as they are behind many of the most pressing challenges around the world.

### A North-South collaboration

Key to this is migration. The persistent South-to-North migration can largely be explained by regional conflicts along with other geo-political developments. However, climate change and desertification are also one of the main reasons why millions of migrants are forced each year to leave their homelands. The environmental (and consequently economic) resources available to them become too scarce which incentivises migration.

As President of the EU-UAE Parliamentary Friendship Group, I have witnessed first-hand all the efforts the UAE is doing to fight climate change. I salute the Khalifa International Award for Date Palm and Agriculture Innovation, a prize that encourages agricultural innovation and research in the specific field of date palm. A specific field, but common to a vast region from the Arabian Peninsula, from North African countries to the Sahel.

The cultivation of date palm is embedded in the cultures of these regions which provided a "lost" bio-regional cross-border collaboration that should now be restored for the benefit of the whole area; contributing to sustainable agriculture and, therefore, to the well-being of societies. This prize is not just a platform to recognize and reward those individuals and institutions around the world that have contributed significantly in this field. It is also an annual forum for exchange of knowledge and best practices, as well as a bridge for communication among all peoples.

### Collaborative efforts are key

The EU must play its role and be a key partner in such efforts that lead to bio-regional collaboration. All endeavours with the aim of enhancing regional stability and security are key for the region and for the European Union, since we share the political and economic objectives of our neighbours. Encouraging regional co-operation is a priority in the EU's policies. Regional co-operation is a catalyst for integration. The development of common goals on ecosystem restoration, food security and bio-waste have the potential to create a common market that can lead to common infrastructures and the establishment of free trade areas between neighbouring countries. Europe also recognises the importance of North-South collaboration, which is why we are partners for the Global Goals through concrete collaboration on sustainable development and climate change and in research and innovation.

**The EU must play its role and be a key partner in such efforts that lead to bio-regional collaboration. All endeavours with the aim of enhancing regional stability and security are key for the region and for the European Union, since we share the political and economic objectives of our neighbours.**



# 1.8 Statement from the EU-UAE Parliamentary Friendship Group

### Conclusion

**In summary, as the world's first donor in humanitarian aid, the EU can and should be more assertive in requiring that aid be focused in sustainable development and stabilisation of the region. Our success stories on circular economy, such as the EU Circular Economy Action Plan and the European Green Deal, provide a basis for 'Green Diplomacy' that can certainly contribute for a new North-South multilateralism based on the Paris Agreement. Making this happen would be for the benefit of all actors, and place us at the forefront of the future world economy.**

YOUNG FAMILY
WEARING A MASK
FOR PREVENT VIRUS
AT AIRPORT
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# Date Palm Oasis Ecosystem Services

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2

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واحة

# 2.1 The United Nations Decade on Ecosystem Restoration (2021–2030)

**DR MUSONDA MUMBA**
Chief, Terrestrial Ecosystems Unit Ecosystems Division,
UN Environment

**The year 2020 pretty much started with a bang, having been declared by world leaders and climate activists as the “Super Year for Nature”. Several conferences were planned to highlight the importance of the role played by nature or ecosystem-based solutions in offering the best way towards achieving human wellbeing, tackling climate change and protecting our living planet. As we now navigate a world where the COVID-19 pandemic has brought the planet to a standstill, it is more evidence of the inextricable links between our own existence and the natural world. Sadly, many studies have shown that the levels of degradation on the planet have resulted in detrimental effects on human wellbeing.**

The UN Decade on Ecosystem Restoration should provide an opportunity for many small-scale farmers in arid regions to have access to the relevant climate information for decision-making. It can also be a platform for various communities to share their lessons and experiences on climate-smart agriculture, sustainable land management and linking to resilient livelihoods within dryland areas of the world.



### A new decade of potential

Due to this awakening, world leaders came together on 1 March 2019 at the UN General Assembly and declared 2021–2030 to be the UN Decade on Ecosystem Restoration. The ambition was to align with the last decade of the Sustainable Development Goals (SDGs), with the objective of massively scaling-up the restoration of degraded or destroyed ecosystems. The Decade aims to use restoration to address issues related to the climate crisis, food and water security, biodiversity loss and others integral to the SDGs. Efforts during the decade will accelerate existing restoration goals, and will also support wider efforts at ecosystem restoration, across both terrestrial and marine biomes.

Perhaps the terrestrial ecosystems least spoken about are the drylands and desert landscapes that are equally central to restoration. Deserts in particular are the original primeval myths – featuring in stories of various cultures from Ancient Mesopotamia to the American Southwest. The ancient lands of Mesopotamia and the arid lands of parts of the Middle East are landscapes that have not only been food systems for millennia, but places where incredible biodiversity, ancient civilisations and innovations have thrived. This deep symbolism draws on an equally profound reality that even the driest landscapes of the planet are capable of spawning miraculous life.

### The importance of food security

As food systems, these dryland ecosystems have been sources of a particular fruit whose use and trade has gone beyond the area where its grown. With climate change threatening the very food systems that many dryland regions are dependent on, this UN Decade calls for sustainable innovation and inclusion within the circular economy. Studies have shown that locations where date palms grow will be affected by climate change as temperatures soar. Therefore, long-term management strategies to sustain the production of such economically important crops are crucial.

**Summary**

**The UN Decade on Ecosystem Restoration should provide an opportunity for many small-scale farmers in arid regions to have access to the relevant climate information for decision-making. It can also be a platform for various communities to share their lessons and experiences on climate-smart agriculture, sustainable land management and linking to resilient livelihoods within dryland areas of the world.**

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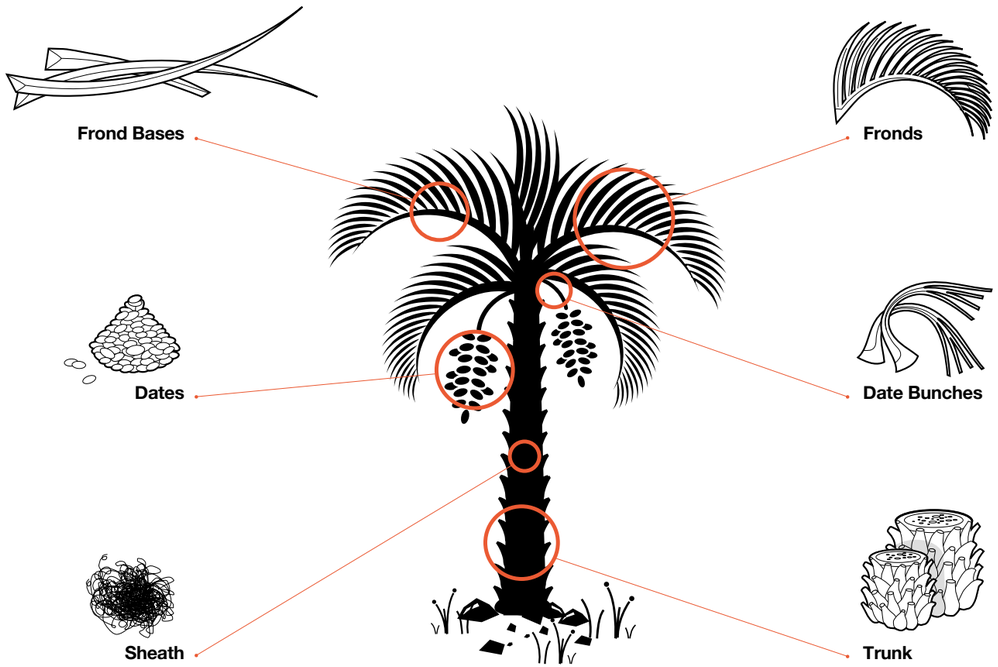


FIGURE 1: DATE PALM ANATOMY
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The date palm *(Phoenix dactylifera L.)* is one of the oldest cultivated crop plants in the world.

**Date production is achieving an increasing global level importance, as the sector makes a substantial contribution to enhancing food security, reducing unemployment and poverty, and strengthening income generation in rural areas.**

The world date production in 2018 was 8.5 million tonnes of which 1,561,827 tonnes are handled on the international market.

واحة نخلة



# 2.2 Date Palm in the World: A General Introduction

**PROFESSOR DR ABDELOUAHHAB ZAID**
Secretary General
Khalifa International Award for Date Palm and Agricultural Innovation

**The date palm *(Phoenix dactylifera L.)* is one of the oldest cultivated crop plants in the world. It is believed to have originated in the Near East Region, in Mesopotamia around 4000 BC. Its cultivation then spread to the Arabian Peninsula, other countries in the Near East and North Africa (NENA) and other parts of the World. Date palm is also cultivated in other areas outside the MENA region, such as the Southern African Subcontinent (South Africa, Namibia and Zimbabwe), North and South America (USA, Mexico, and Peru) and Asia (Pakistan, China, India,).**

Accurate and up-to-date statistics on the number of trees and their evolution in each country are difficult to obtain. However, available statistics put the total number of trees in the region at more than 150 million. While this figure does not reflect the current level of production, since a good number of trees are still young and unproductive, nonetheless it signals the expanded supply in dates to be expected in the near future.

Date production is achieving an increasing global level importance, as the sector makes a substantial contribution to enhancing food security, reducing unemployment and poverty, and strengthening income generation in rural areas. Dates are produced in 39 countries around the world but 90 percent of this production is concentrated in the MENA region, which represents around 87 percent of the total area planted with date palm.

### Global date cultivation

The date harvesting area at global level is about 1.1 million hectares, located mainly in the MENA region. There are more than 3,000 date varieties cultivated around the globe, but only a few of them are handled on the international market. This makes them intensively propagated by date producers. This has had a negative effect on date biodiversity in MENA date palm oases, since most of the new date plantations include a very limited number of date palms of high marketing value. Unfortunately, in traditional date palm groves, most planted date palm trees are of medium to low quality, therefore, their marketing value is low, and an important part of their production is lost.

## Main dates exporting countries

**Iran** 306,291 t
**Iraq** 265,352 t
**UAE** 200,887 t
**KSA** 161,966 t

واحة تمرة

In some traditional date-producing countries, waste reaches more than 40 percent of the total production. Date-harvested areas are increasing prevalent in many date-producing countries in the MENA region, resulting in an important increase in world date production, which reaches more than 8.5 million metric tonnes. This trend will certainly continue into the next decade, but unfortunately, post-harvest losses are also increasing, representing more than 40 percent of certain countries' production.

**Date quantities**

The quantities of dates handled on the international market has been steadily increasing during the last decade, and the average price varies between 0.9 and 1.7 US$/Kg. This price depends on the fruit variety, quality, standards and targeted market. The average price of dates on the international market in 2018 was 1.26 US$/kg. The dates prices in US$/kg per exporting country are represented in red; they show that the top date producers (Egypt) and top dates exporters in quantities (Iran, Iraq) are not getting the best income per unit.

**Conclusion**

**Therefore, it is crucial to develop regional strategies aiming at better organising the date palm sector in the world and enhancing the South-South and North-South collaborations, including the main date producing countries. The objective of such an organisation would be to:**

1. **Correct the anarchic extension of date plantation which is occurring in the region and re-orient it based on real market demand.**
2. **Avoid the overproduction of some varieties of dates (such as Mejhool) which may lead to an important drop in their market prices.**
3. **Analyse the market segmentation and produce dates based on targeted markets.**
4. **Agree on a zoning of date production based on the varietal mix in each sub region or country.**
5. **Exchange expertise and build capacity of concerned stakeholders across the world.**

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# 2.3 Regulating Services

## The 'Oasis Effect'

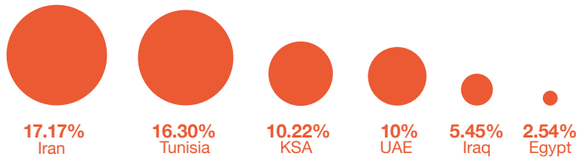
- Date palm cultivation would protect more delicate irrigated crops from winds, sandstorms and the scorching sun.
- The very high rate of transpiration from date leaves – together with its shading effects – results in significant cooling of the date grove environment and rising humidity.
- This "oasis effect" allows the production of heat-sensitive vegetables and fruit species during the hot season.
- The cooling effect of dates will become more important as global heating is felt more in the Sahel.

The date palm micro-environment results in two important effects for farmers:

1. Land is regenerated as date crop residues turn into organic manure
2. There is no need to move from one patch of degraded land to another to keep growing crops

The resulting ecological benefits – both in terms of land rehabilitation and improved land use systems – are substantial.[9]

**The value of dates marketing at global level in 2018 was about 1.97 Billion US$ represented by**




Iraq, the second date-exporting country in term of quantity represented only 5.45 percent and Egypt the leading date-producing country at global level represented 2.54 percent.

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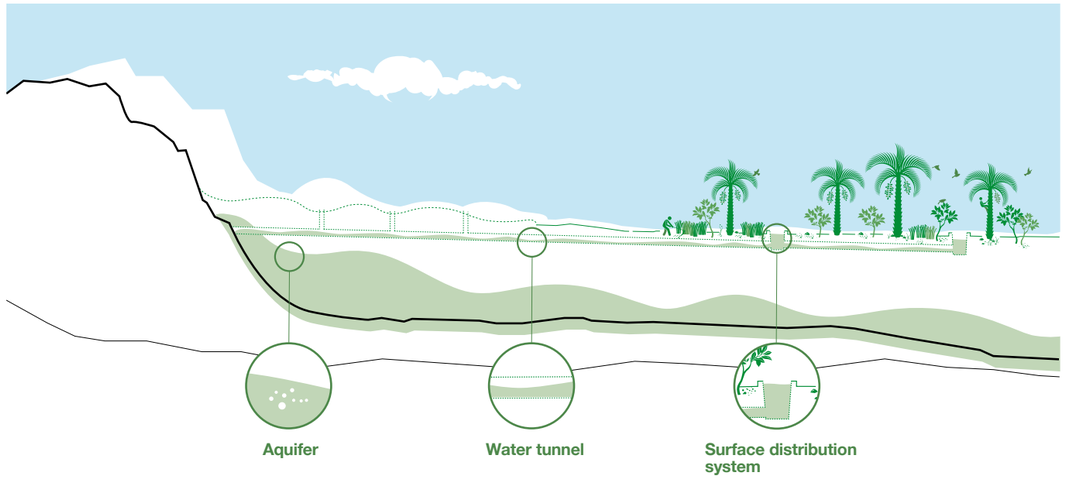


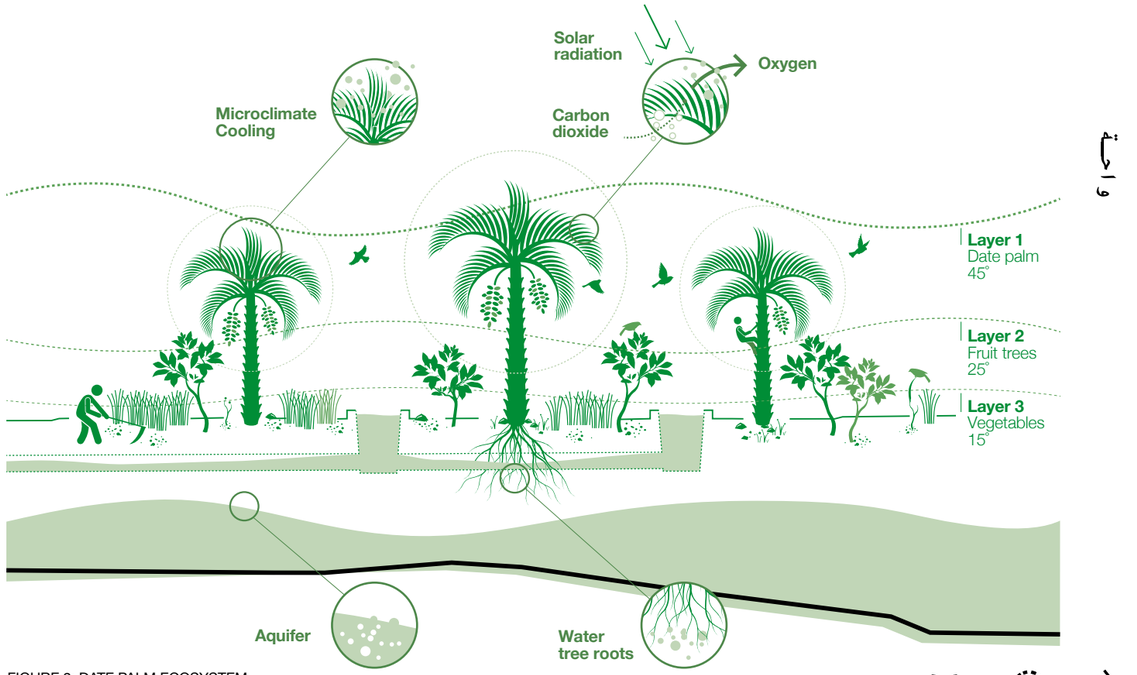


FIGURE 2: DATE PALM ECOSYSTEM
"THE OASIS EFFECT
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a)

# Ecosystems and the Biosphere

**DR HELAL HUMAID SAED AL KAABI**
Secretary General
Abu Dhabi Quality and Conformity Council

**The entire surface of the planet Earth is considered a series of linked ecosystems, often linked to a larger biome, or what is known as environmental habitats, which are generally areas organised according to the living types of animals and plants there, each of which possesses a set of life components and resilience in facing challenges of the biosphere to which they belong. Also highlighting that within each forest, oasis, or pond, there are various other ecosystems.**
**The oasis ecosystem is an integrated system, expressed by the geography rich in plants, animals, and other living creatures, along with the climate, regions and landscapes together form an ecosystem. Oasis ecosystems also consists of biotic and abiotic factors, where biotic factors include plants, animals, and other organisms, while rocks, temperature, and humidity are considered abiotic or non-living factors.**

The oasis ecosystems play an important role in the sustainability development equation, as it does not only represent environmental diversity, but also ancient oasis civilisation, and knowledge in line with the set standards of sustainability development. Oasis' are considered an exemplary area of coexistence and integration, where oasis civilisation worked over time to create an accurate and flexible production system to ensure its stability and continuity, while facing various internal or external dangers and obstacles that might represent a threat. The oasis ecosystem is an interconnected circle, where any change in one of its elements could affect others directly or indirectly. For example, a change in temperature in a place will determine the type of plants that will grow there, which will then affect the animals that feed on them, or consider them as a shelter, which could result in either its adaptation, migration, or death.

An ecosystem is not restricted to a specific area or size, where it could be a very large or very small area. Despite this, we believe that the oasis ecosystem has played a fundamental and effective role throughout history in combating desertification and drought.

### Sustainable Development Goal 15

The main aim of UN SDG 15 is to protect terrestrial ecosystems and manage oasis in sustainable practices, which plays a key role in combating desertification, land degradation, reversing the drought course, and stopping the loss of biodiversity. As healthy oasis ecosystems protect the planet and secure the living of people, the sustainability development goals seek to conserve and restore the use of oases terrestrial ecosystems, such as wet and dry lands and mountains. The goals also aim to prevent land degradation and the removal of oases which results in desertification, drought and climate change.

Therefore, urgent measures must be taken to limit the loss of oases' natural habitats and biodiversity as it is part of the common heritage of all humankind. Ensuring the conservation and restoration of terrestrial and inland freshwater ecosystems, especially forests, wetlands, mountains and dry lands, and their sustainable use, in accordance with the important obligations set in the international agreement.

### Summary

**Promoting the implementation of sustainable management in all types of oases, restoring degraded oases and achieving a significant increase in their number at the global level greatly helps in stabilising the living population and sustaining the oasis ecosystem as human beings are the head of the ecological pyramid. Therefore, fortifying oasis ecosystems plays an important role in combating desertification, restoring degraded lands and soils, including lands affected by desertification, drought and floods. It also preserves oasis ecosystems, including their biological diversity, to enhance their ability to provide benefits that are indispensable in combating desertification and drought to achieve sustainable development.**

**The entire surface of the planet Earth is considered a series of linked ecosystems, often linked to a larger biome, or what is known as environmental habitats, which are generally areas organised according to the living types of animals and plants there, each of which possesses a set of life components and resilience in facing challenges of the biosphere to which they belong.**

واحة نخلة تمرة

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b)

# Ecosystem-Based Adaptation

**DR AZAIEZ OULED BELGACEM**
Sustainable Rangeland Management Expert Food and Agriculture Organization of the United Nations
Riyadh, Saudi Arabia

**The oasis is a natural ‘green island’ ecosystem specific to desert environments. An oasis creates a favourable microclimate through a perfect symbiosis between humidity, heat and light, resulting in a biodiversity reservoir rich with flora and fauna. Beyond date production and many by-products, the palm tree is the foundation and the umbrella of the oasis ecosystem, which protects plants grown on the lower floors and acts as a stabiliser and crop regulator.**

### The importance of preserving oases

Given the diversity of services they provide to society, oasis ecosystems are multifunctional. Protecting them, and the benefits that they provide, is essential to the future of life on our planet and the wellbeing of humanity, particularly in those areas with a harsh desert environment. Those services, which are often called ecosystem services, include provisioning services such as availability of foods and water; regulating services such as climate change and natural hazards (such as sandstorms and dust mitigation); supporting services such as soil formation, nutrient cycling and water reserves in the dried grounds, and cultural services such as heritage, recreation and ecotourism.[10]

**The oasis is a natural ‘green island’ ecosystem specific to desert environments.**

An oasis creates a favourable microclimate through a perfect symbiosis between humidity, heat and light, resulting in a biodiversity reservoir rich with flora and fauna.

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These oasis ecosystems are among the most affected by climate change, which has resulted in reduced yields of agricultural production, poverty, and deterioration of natural resources. In Morocco, the area of palm groves has been significantly reduced in recent decades, due to the erratic drought phenomena, soil salinity, and the spread of the Bayoud fungal disease, resulting in the deterioration of the socioeconomic and environmental importance of the oasis system.[11]

Such degradation of ecosystems has tremendous consequences on the environment mainly through soil erosion, dilapidation of vegetation cover, carbon emissions, loss of biodiversity and changes to the water cycle. According to Ojima, et al.[12] and Sampson, et al. (1993), non-sustainable land use practices – such as inappropriate ploughing and mismanagement – are the root causes of the degradation of these ecosystems. Ouled Belgacem and Louhaichi[13] have demonstrated that global warming will contribute to the process of degradation because of mismanagement, and may have significant adverse impacts on flora and fauna under high $CO_2$ emissions scenarios. The ecosystem services of the oasis are in a state of degradation due to several factors. This requires us to look for new approaches to increase awareness by underlining the losses of oases over time, and also to determine the decision-makers and planners paying attention to the importance of the oasis attributes during design and development operations. [14]

### Adapting to climate change

Given the importance of the ecosystem services in combating the poverty of mainly rural communities in dry areas, the adaptation to climate change requires measures that conserve and restore biodiversity and reduce atmospheric greenhouse gases. Several approaches have been developed for climate change adaptation (Scarano, 2017). Ecosystem-based adaptation (EbA) to climate change is one of these approaches. It has been defined by the Convention on Biological Diversity (2009) as:

**“The use of biodiversity and ecosystem services, as part of an overall adaptation strategy, to help people to adapt to the adverse effects of climate change... it aims to maintain and increase the resilience and reduce the vulnerability of ecosystems and people in the face of adverse effects of climate change.”**

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This approach considers biodiversity and ecosystem services as the main component of any given policy mix designed to promote climate change adaptation.
EbA is mostly suggested for those developing countries that safeguard most of the planetary biodiversity and healthy ecosystems, as it aims to combine all the above-mentioned outcomes (alleviating poverty, restoring ecosystem biodiversity and services, and removing atmospheric greenhouse gases) by reducing vulnerability and building resilience to climate change. Within this approach, management and restoration of ecosystems is considered as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities.

According to the International Union for the Conservation of Nature (IUCN), EbA is a nature-based solution committed to achieve SDGs, reach global biodiversity targets and effectively address climate change. Such nature-based solutions should be treated as integral to adaptation strategies at global, national and local levels. This needs the development of an integrated policy that includes not only biodiversity ecosystem services, but also socioeconomic and development-related policies. The EbA approach is not simply an adaptation of ecosystems to climate change, but uses ecosystems for human adaptation to climate change.[15]

**Finding natural solutions**

Nature plays an essential role in climate change mitigation, through carbon sequestration and storage in natural ecosystems, and in adaptation, by maintaining the ecosystem functions essential to life and human survival.
In this context, it is worth considering how protected areas can be part of the solution, through the way their systems are planned and managed to maintain their ecosystem functions. The establishment and equitable governance of these protected areas – and ecological restoration by management agencies and rural communities – may reduce societal vulnerability to climate change resulting from the policies of income generation, poverty reduction and carbon mitigation.
As mentioned, oasis ecosystems offer lots of benefits for desert communities all over the planet and the maintenance of their life and wellbeing could be another reason for applying the EbA approach. In fact, given its ecological peculiarities, the oasis ecosystem can be considered as a perfect model of sustainable development, its economic function in favour of a society well-adapted to the desert context through the services and benefits provided by the oasis.

Finally, the ecosystem-based adaptation approach needs to be adopted and applied at a larger scale all over the world to repair degraded ecosystems. This will contribute not only to climate change mitigation by reducing emissions, but also to protect vulnerable communities from extreme weather, while simultaneously providing a variety of benefits so crucial for human wellbeing, such as clean water, food and income.

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C)

# Date Palm: Ecosystem Services and Climate Change Mitigation

**DR ZITOUNI OULD-DADA**
Deputy Director
Office of Climate Change, Biodiversity and Environment
Food and Agriculture Organization of the United Nations

The impacts of climate change are making water increasingly scarce, causing severe droughts, such as in the Near East and North Africa (NENA) region, and contributing to the outbreak and spread of pests and diseases. Agriculture is particularly vulnerable to the impacts of climate change, and we urgently need to build its adaptation and resilience to tackle hunger and malnutrition. While date palm distribution[16, 17] and productivity[18] are being affected by climate change, its greater ability to absorb carbon dioxide in comparison to other trees of similar size[19] makes it part of the solution – not only to adapt to a changing climate, but also to shape meaningful climate change mitigation strategies, particularly in areas where date palms are naturally grown.

**The value of the date palm within the oasis ecosystem**

Date palm is one of the few agricultural species that are closely connected with human life[20], it is often portrayed as one of the essential plant species in arid ecosystems. Not only does it pave the way for sustainable agricultural practices, but it also provides a wide range of ecosystem services from producing a fruit with unique nutritional value and biochemical characteristics, to climate regulation and other services such as those associated with its aesthetic, recreational, genetic and cultural values.[21,22]

Date palms create a microclimate for other plant species that is essential for the agro-ecological equilibriums in oasien ecosystems.[23] The root system and rhizosphere soil of date palms act as a reservoir for bacteria beneficial to plant growth[24] and was introduced as an ornamental tree to fight climate change.[25] Date palms can sequester carbon dioxide in arid lands, which makes it a good benchmark for

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afforestation and reforestation projects in areas where woody vegetation is scarce.[26] Date palm fronds[27] and seeds[28] can be part of the organic biomass used to produce biochar, a by-product derived from biomass pyrolysis that can be used as an organic amendment to soils, reducing the use of fertilisers, enhancing crop productivity, and sequestering carbon.[29] Research and technology could make biochar a reliable carbon sink[30], given its promising potential as a climate mitigation tool to reduce greenhouse gas emissions from agriculture while improving soil properties.[31]

What does the future look like for the date palm? These examples showcase some promising applications of date palm and its biomass in climate-smart agricultural practices for carbon sequestration, ecosystem services, and reducing the carbon footprint of agriculture.[32] Nonetheless, there is an urgent need to address the large number of anthropic and climate-driven threats facing date palms, including pests and diseases, such as Bayoud and the red palm weevil, as well as water shortage, urban expansion, soil erosion, and the prevalence of elite cultivars.[33]

While date palms have an important role to play in climate change mitigation, they should also be considered in national strategies for climate change adaptation and resilience, promoting nature-based solutions and tackling food insecurity. Long-term strategies for the sustainable production and management of date palms should consider investing in research and innovation, including strengthening the capacity of date palm farmers to innovate.

**Conclusion**

**Combining traditional knowledge with technological innovation and digital data will help date palm farmers understand and predict the potential change in distribution and abundance of date palms as a results of climate change impacts. The use of drones can also help track the potential spread of pests and diseases and help farmers and governments to put in place early warning systems and response strategies. Date Palms could be part of the solution to tackle the global climate crisis and help accelerate efforts towards ending hunger and malnutrition. This is particularly timely as we enter the UN's Decade of Action to deliver the Sustainable Development Goals by 2030.**

**While date palm distribution, and productivity are being affected by climate change, its greater ability to absorb carbon dioxide in comparison to other trees of similar size makes it part of the solution – not only to adapt to a changing climate, but also to shape meaningful climate change mitigation strategies, particularly in areas where date palms are naturally grown.**

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d)

# Biodiversity of the Date Palm Oasis

**DR MOHAMED BEN SALAH**
Head of the Research Programme
Arid Lands Institute

**An oasis refers to an area of isolated vegetation in a desert which occurs in the presence of source of a water close enough to the surface. Oasis ecosystems are widely present across Africa, Asia, America, Australia and southern Europe. Oasis can be classified by their topographic emplacement, as 'continental oasis' (including Saharan oasis located in the arid regions of Algeria, Tunisia, Saudi Arabia, UAE), 'mountain oasis' (Morocco, Mauritania, Mali, Niger, Pakistan) and 'coastal oases' near the sea coast (Oman, UAE, Iraq, Tunisia) (See Map on the next page). Oasis ecosystems are also viable through their various natural and biological components such as: climate, water, soil, vegetation, microorganisms and animals. New oases are mainly based on water supply, where the climatic conditions allow.**

While the date palm tree is the pillar of the oasis, it is very rich in terms of biological diversity. Numerous other species can grow, such as fruit trees and other crops (fodder crops, vegetables, condiments, cereals and ornamental species). An oasis is also an ecological niche of seeds, wide local vegetables and other plant cultivars. An oasis will also have a thriving wildlife ecosystem, as the home to rodents, small mammals, insects and reptiles, as well as sedentary and migratory birds. It is a refuge for large number of trans-Saharan and international migratory birds. Camel, sheep and goat are the major livestock in an oasis, which guarantees the supply of organic fertiliser.

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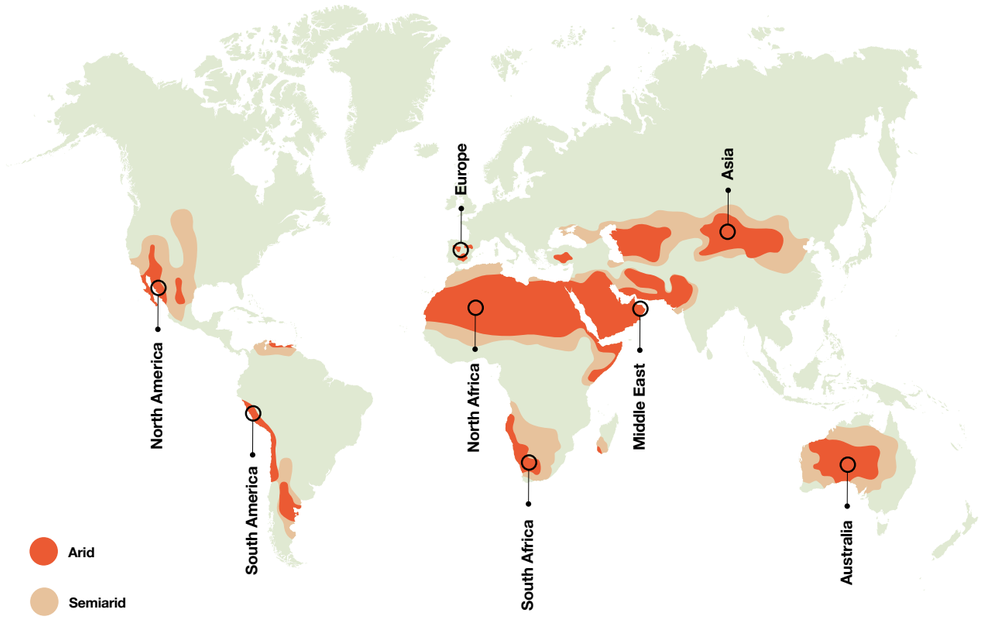


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FIGURE 3: OASIS ECOSYSTEMS
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**Continental Oasis**
Including Saharan oasis located in the arid regions of Algeria, Tunisia, Saudi Arabia, UAE

**Mountain Oasis**
Morocco, Mauritania, Mali, Niger, Pakistan and

**Coastal Oases**
Near the sea coast (Oman, UAE, Iraq, Tunisia)

### Traditional expertise is still highly important

The knowledge of the local population in an oasis is also of great interest to meet the varied needs and uses such as fresh consumption, preservation or processing into various products from dates, fruits and other species. They effectively help preserve the environment through the in-situ recycling and reuse of waste and by-products from agriculture and livestock activities. In addition to food security, biodiversity also has many environmental interests, as its genetic potential can result in resistance to diseases. Biodiversity has real impacts on the environment, and its preservation is a condition for better development of ecosystems.

Different international studies on date palm tree have revealed a rich biodiversity with more than 3,000 date palm cultivars in the world, including soft, semi-soft and dry dates. This important biodiversity and genetic potential is mainly concentrated in traditional oases. This is due to years of date palm propagation by seed; hence, the population of

**While the date palm tree is the pillar of the oasis, it is very rich in terms of biological diversity.**

**Flora**
Fruit trees, fodder crops, vegetables, condiments cereals and ornamental species.

**Fauna**
Rodents, small mammals, insects and reptiles, sedentary birds, migratory birds, camel, sheep and goat.

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males and females are as numerous in cultivated oasis. The harvesting period spread out on almost six months due to the presence of early, midseason and late ripening cultivars.

### Traditional sources of date palm production

The traditional regions of date palm production are focused in the MENA region, which features about 80 percent of date palm trees. There are also other regions are suitable to date palm cultivation, such as the Sahelo-Sudanian area, with big capacities and agro-ecological conditions favourable for the cultivation of date palm, in addition to some Sahelian and Austral-African countries, where date palm tree cultivation and knowledge of techniques are more extensive. In other continents, the date palm tree is an alternative crop, where development and efforts are in progress.

Oasis ecosystems is also considered as sensitive to not only climatic and environmental changes, but also to the local community, which has the knowledge of traditional agriculture practices. Some case studies show the rule of climate change on an oasis and pre-oasis ecosystems on migration named as climatic migration. The results also show the relationship between environmental problems and social balances that affects oasis ecosystems. In fact, oasis ecosystems are now facing multiple challenges, which includes the loss of biodiversity and especially local cultivars linked to local and traditional consumption patterns. Only 20-30 cultivars cover almost 80 percent of the genetic population and produce marketable dates.

### Seeking new markets for dates

The marketing of dates opens up new global markets capable of absorbing large quantities of dates, but the product itself remains limited. Countries seek to select marketable, soft or semi-soft cultivars that are easy to handle, such as Deglet Nour in Tunisia and Algeria, and Medjhool in Morocco, the US, Israel, and Jordan. Such strategies have led to the important reduction in the erosion of the date palm biodiversity. However, the US and European markets are demanding, and few countries have access which is now limited to semi-soft dates (such as Tunisia and Algeria for Deglet Nour dates and Namibia, Jordan and Israel for Medjhool dates), while some countries are exporting soft dates in small quantities such as Israel, Namibia, Jordan and UAE.

**Summary**

**Maintaining biodiversity is a mean to preserve not only oasis ecosystems, but also the sustainability of all the life components and the oasis population. The Results for Development Institute, national programmes and oasis non-governmental organisations (NGOs) in North Africa are all initiatives that help encourage and support the reintroduction of local cultivars and local seeds threatened with disappearance in ecosystems. Those initiatives are to be encouraged and supported. Other socio-economic actions in the oasis have to respect and preserve biodiversity.**

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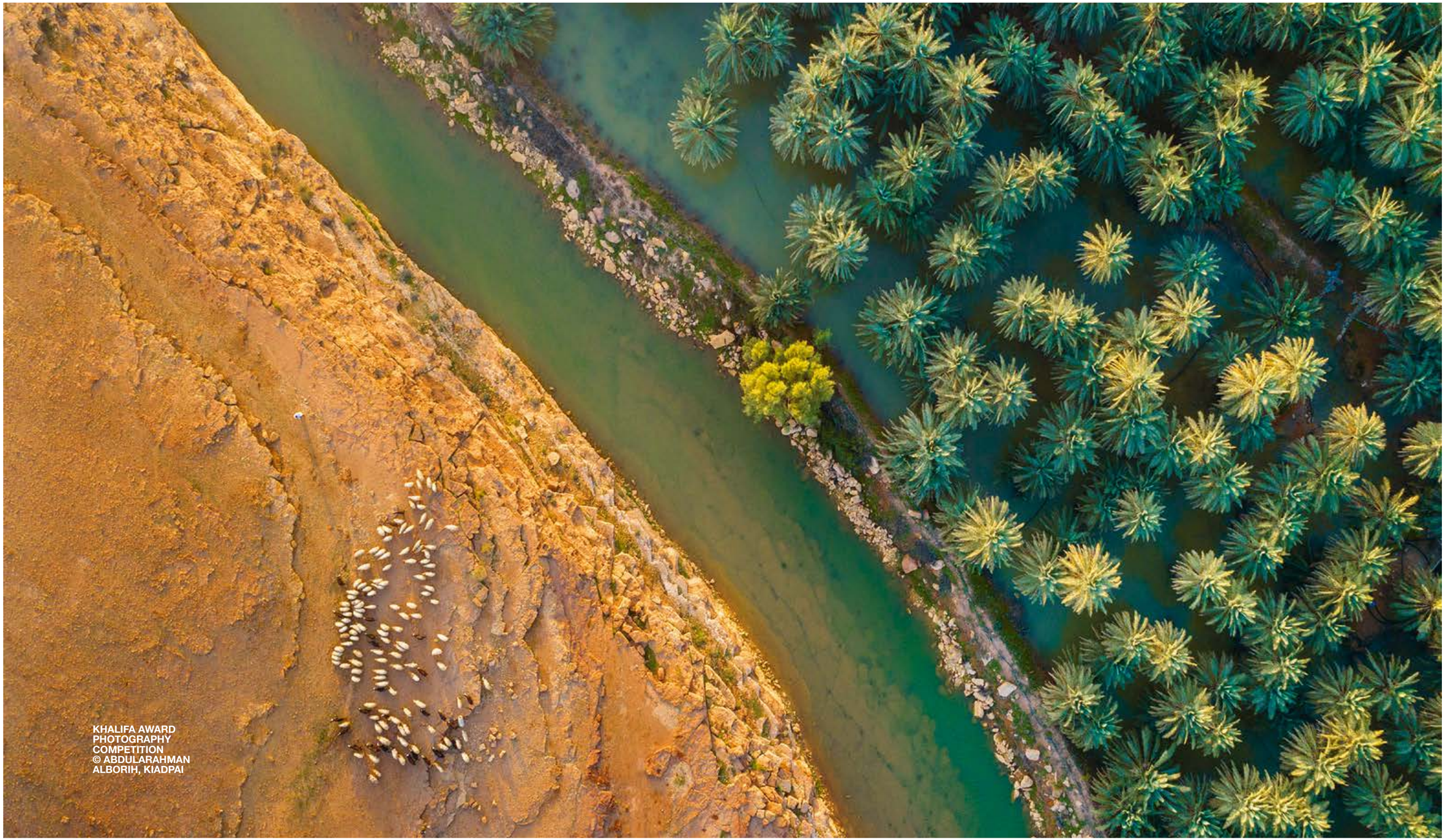

KHALIFA AWARD
PHOTOGRAPHY
COMPETITION
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ALBORIH, KIADPAI


FIGURE 4: MENA REGION
© DR MOHAMED BEN SALAH
HEAD OF THE RESEARCH
PROGRAMME ARID LANDS
INSTITUTE.

# 2.4 Provisioning Services

## a) Date Palm: Food System Value Chain Analysis

**DR ABDALLAH OIHABI**
Date Palm Value Chain Analysis and Good Agricultural Practices Expert

**The date palm value chain in most of the traditional date-producing countries is generally composed of five main functions:**

1. propagation
2. production (including harvesting)
3. post-harvest handling
4. marketing
5. consumption.

### Exponential growth within date production

Date production has increased rapidly during the last 50 years. According to FAOSTAT, in 1961, a total of 1.8 million tonnes of dates were produced globally.[34] By 2018, that number had increased to 8.5 million tonnes. This almost five-times increase in date production is attributed to the interest of governments, public and private sector in developing this high-value crop, rising demand for dates, adaptation to harsh environments and climate change, availability of modern technologies for utilising deep groundwater aquifers and to the improvement in water irrigation efficiency. Dates are the most important fruit crop in the MENA region – economically, socially, culturally and ecologically. They are the main source of income and employment and are among the main stable foods for local population in many countries in which they are cultivated, especially in the desert oases.

### Functions within the date palm value chain

The date palm value chain in most of the traditional date-producing countries is generally composed of five main functions: propagation; production (including harvesting); post-harvest handling; marketing and consumption. These phases are interrelated and, in certain cases like post-harvest handling and marketing, are overlapping. Other components to completing the value chain cycle include processing aimed at adding value to the dates of lower quality, and the waste recycling process. Unfortunately, as Figure 1 shows, these later phases are given less importance.

**Figure 1: Global key indicators of the date palm**

The date palm value chain in the MENA region represents the same main characteristics as represented in Figure 2. It includes the principal actors/stakeholders (farmers, collectors, intermediaries, conditioners, wholesalers, retailers and consumers) and supporting actors (input suppliers and supporting services). The relationships between the principal actors and the supporting services – as well as among the principal actors – are key factor for the efficient operation of the date palm value chain.





### Figure 2: Summary of the date value chain in the MENA region

Traditionally, the spread of date palm trees was propagated through offshoot plants produced by the mother palm. The use of offshoots guaranties the perfect duplication of the criteria of the selected date palm, mainly its fruit quality. However, this traditional method was unable to keep up with the market demand of date palms, primarily from commercial farms developed by most of the date-producing countries in the NENA region during the last two decades. Therefore, date palm multiplication has shifted from the traditional use of offshoots in favour of using date palm plantlets derived from tissue culture technology as the main propagation technique.

In spite of the significant efforts made by many date-producing countries to develop their date palm sector, limited progress was made to exploit the full potential of the

FIGURE 1: GLOBAL KEY INDICATORS OF THE DATE PALM

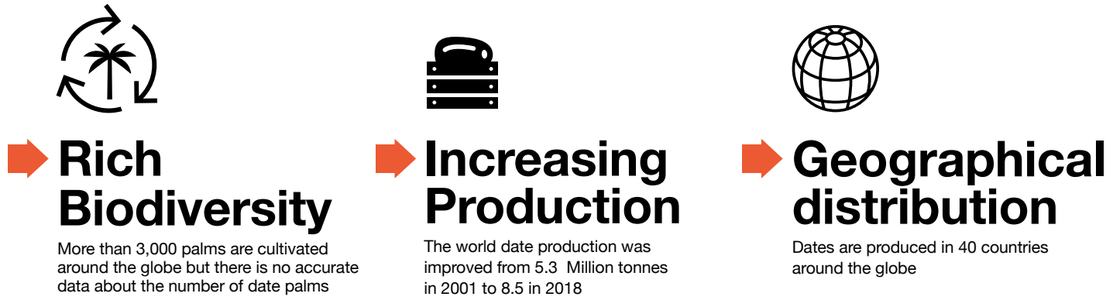


FIGURE 5: GLOBAL KEY INDICATORS OF DATE PALM
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sector due to multiple threats and challenges including:

- Predominance of traditional inherited agricultural techniques for the date production phase including irrigation, pollination, bunch management, harvesting as well as pests and diseases control and crop management.
- Lack of knowledge of **Good Agricultural Practices (GAP)** applied to date palm cultivation.
- **Harvesting** mainly done through archaic practices, which result in the depreciation of harvested dates
- Appropriate **post-harvest handlin**g is missing, such as field sorting, appropriate transportation means, adapted storage facilities and conditioning plants.
- **Marketin**g is the weakest link of the date value chain in most countries due to
    - o Local marketing goes through complicated channels controlled by intermediaries who are the main beneficiaries of local date trading while the date grower receives very low income.
    - o The absence of effective international marketing strategies aiming at identifying the market need in terms of quality standards and varieties. Therefore, only 16 percent of world date production is handled on the international market[35] and waste reaches 40 percent of the total production in some date-producing countries (AOAD report 2018).
- Absence in most of the date-producing countries in the MENA region of appropriate **organisation of the date palm sector** that allows an efficient coordination among the stakeholders.
- **Farmers' organisations** are lacking supervision and guidance on capacity building.
- **New commercial plantations** implemented within the extension of date palm areas in most date-producing countries in the MENA region are mainly focusing on few commercial date varieties. Therefore, the only source of biodiversity remains the small-scale farms of the traditional oases.
- **Several regional and international organisations** are involved in the development of the date palm sector in the MENA region. However, with no coordination among them, and in some cases with significant overlapping of their respective projects and programmes, the interventions have not achieved their targeted objectives and actions have failed to have the hoped-for impact. However, in the last decade, the Khalifa International Award for Date Palm and Agricultural Innovation (KIADPAI) has taken the lead in implementing practical development programmes in the region aiming at the sustainable development of the date palm sector in collaboration with other international organisations. KIADPIA focused its intervention on important segments of the date value chain – specifically post-harvest handling and marketing. In collaboration with the local, regional and international organisations, it has organised several date festivals and equipped local farmers with fully-equipped date conditioning units and cold storages.

### Conclusion

**The above-mentioned challenges, combined with the impact of climate change, constitute a serious threat to the perennity of the date palm sector in the MENA region. Small-scale farmers in traditional oases are already suffering from the combined effects of these factors, in addition to the negative impact of human activities. If no joint efforts are deployed to mitigate the effect of climate change and to develop strategies for the sustainable development of the date palm sector in the MENA region, the fragile ecosystem of the oases in this area will be destroyed, causing irreversible environmental and social adversities. Therefore, all stakeholders should coordinate their efforts, to ensure the sustainable development of this important sector.**

**The creation of an international alliance dealing with the date palm sector in the MENA region, including KIADPAI plus regional and international organisations, would be an excellent initiative to combine efforts to contribute to the sustainable development of the date palm sector.**

**If no joint efforts are deployed to mitigate the effect of climate change and to develop strategies for the sustainable development of the date palm sector in the MENA region,**

the fragile ecosystem of the oases in this area will be destroyed, causing irreversible environmental and social adversities.



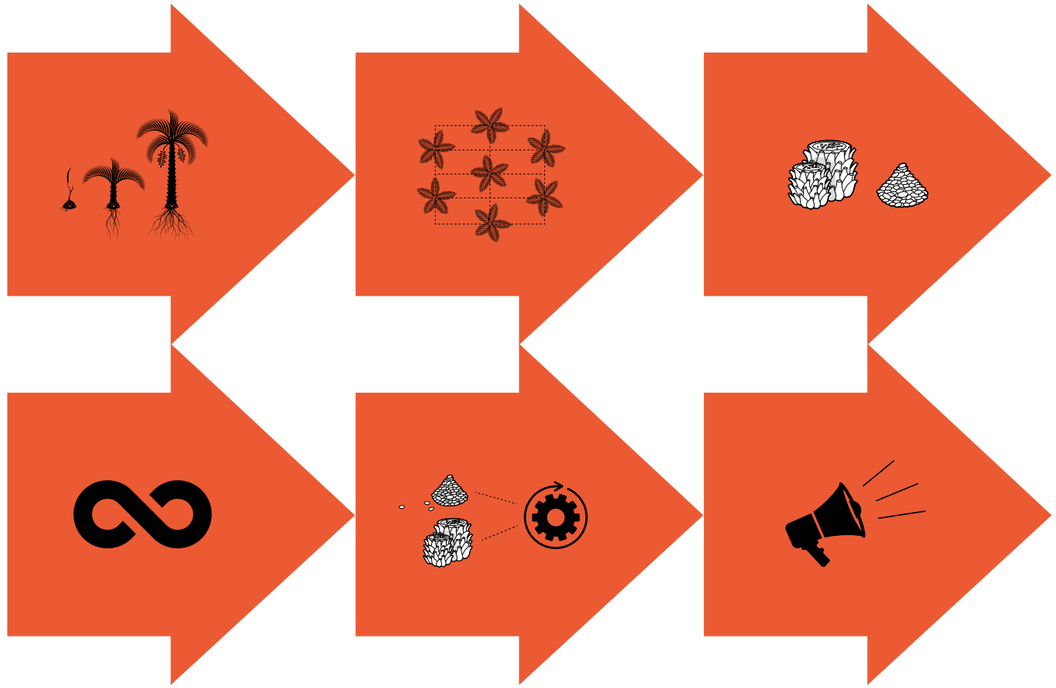


FIGURE 6: SUMMARY OF THE DATE VALLUE CHAIN IN THE MENA REGION
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**DR SALAH EDDINE ZAID**
Technical Director
Marrakech Date Palm Project

b)

# Propagation of Date Palm Tissue Culture

**Date palm forests and commercial plantations are critical habitats for biodiversity and are essential for the provision of a wide range of ecosystems. They provide a platform for living resources, playing an important role in mitigating desertification, land degradation, and erosion. As today's economies continue to shift, the integrated management of land, and the date palm sector and its propagation, provides an ecosystem approach that attains many positive global sustainable developments. There is increasing evidence the date palm industry – and natural orchards and their habitat biodiversity – can help to minimise the environmental impact and contribute to sustainable consumption, while sustaining production multifunctionality of ecosystem services.**

Date palm orchards and commercial plantations offer ample opportunity for optimising their composition and diversity. Therefore, the planting of mixed inter-row species should be given more consideration as it can provide a considerable range of ecosystem services. A multitude of cross-sectorial applications for a sustainable future are all available within current date palm natural forests, commercial plantation and protection of future lands.

## Date palm orchards

Date palm cultivation constitutes an important economical pillar of the agricultural sector in most of the MENA region. It represents a major source of income for a considerable number of growers and inhabitants. If choosing what to grow in a commercial, ecosystem platform, the date palm tree would be in an advantageous choice, as it has the ability to withstand adverse environmental changes such as drought, and extreme temperature fluctuations, as well as its use in prevention and control of desertification. While a major issue, the change of climate and the consequences and costs to the agriculture industry, date palm are a serious means to ecosystem degradation prevention.

## Propagation systems

The propagation of the date palm tree has been through three main techniques: 1) seed propagation; 2) offshoot transplanting; and 3) the tissue culture method. Seed propagation is the simplest approach. However, each genotype is unique, with half the seeds planted producing only males, which are commercially of limited value. Compared to established cloned trees, seed propagation leads to late maturing fruits that are also variable in quality. The production potential, overall quality, and harvest time are limitations opposed by commercial operations.

Offshoots propagation is a non-specialised method which is not commonly used. The separation and planting of offshoots typically occurs after four years from axillary bud. This timeframe discourages the use of offshoots when compared to tissue culture techniques. The use of offshoots for commercial propagation is impractical, since offshoots production is limited by a short vegetative phase, a restricted number of offshoots are hence produced per tree, low offshoots transferability and survival rates, and they have higher frequencies of the spreading of diseases and pests.

## Micropropagation: date palm in vitro tissue culture

Tissue culture is the aseptic culture of cells and various tissues grown in a controlled environment in *vitro* with chemical interaction. Plant propagation by tissue culture is beneficial since, once initiated, the culture can be indefinitely increased. The first true cultures were from cambial tissues of Salix caprea, Acer pseudoplantanus, and Robinia pseudoacacia, that were produced by Gautheret.

The advantages of using this system with date palms in mass propagation of selected cultivars may be accomplished while preserving the mother plant clone conformity of product (true-to-type/genetically identical). This approach may only be successful when effective means for establishment of aseptic cultures, multiplication of initiated cultures through the establishment of method 'organogenesis' and hardening of tissue culture-derived plants prior to their field planting are met. The organogenesis method is used most commonly for commercial production, because it has a higher survival rate when plantlets are transferred to fields.

## Organogenesis technique

The use of meristematic tissues allows for micropropagation while avoiding callus formation. Once initiation of the meristematic explant is accomplished, the four remaining steps are multiplication; elongation; rooting; and acclimatisation, whereby acclimation is only a period up to 22 weeks prior to point of sale.

## Date palm propagation

Various laboratories worldwide have attempted to propagate date palm through tissue culture techniques. Success was achieved by only a few international laboratories. This is due to the nature of the date palm, which is a woody species without cambium. Some of these laboratories were established within the last ten years, while others have been functioning for 15-20 years. There are currently more than 12 functional laboratories worldwide, in England, France, Israel, Morocco, UAE, Oman, Saudi Arabia and the USA. Most of these laboratories focused on the Medjhool date, and more recently the Barhee date.

Most laboratory facilities that practice date palm tissue culture have a low yield efficacy, and there is a lack of clear information on the date palm organogenesis technique.

However, it remains superior to the embryogenesis technique, as it avoids high somaclonal variation. The organogenesis method at its base form requires no improvements, yet certain cultivars of the same species during certain stages of in vitro production do benefit of differing media requirements, in a means to diminish stresses and facilitate proliferation.

## Conclusion

**Through tissue culture and all its advantages, the potential of meristematic tissue's totipotency ability is recognised as being a solution to future and current food security, and equally arable land preservation. It promotes ecosystem conservation and restoration by way of providing great amounts of high-quality plantlets, nutritious fruits (dates), and healthy plant-ecosystem establishment.**

**In the perceivable future, regions of the North Africa, Arabian Peninsula and Sahel characterised by definable favourable conditions are expected to harbour some of the largest developmental opportunities. The date palm industry is at its early stages as the apple and grape industries of 30 years ago. These combined aspects of proper climate and the date palm perspective along with a proven micropropagation method can together establish a bio-circular economy of which the preservation, restoration and sustainable development is a real possibility.**



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DATE PALM TISSUE OF MARRAKECH DATE PALM PROJECT © ZAFER MSHBB HASAN AL SHAHRY

# 2.5 Supporting services

## a) Sustainable Water Management in North African Oases

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**Oases are living examples of the sustainability of agricultural systems in locations where nature is aggressive for lack of water. Given the desert conditions and the lack of precipitation, irrigation is a necessity in oases and can combine different resources: surface water from wadis, flooding water, underground *khettaras,* or wells and boreholes. In the frame of the circular economy, other unconventional resources can be used, including through the desalination of seawater and the reclaimed use of wastewater, a still-neglected sector which can cause groundwater pollution problems.[36]**

**PROFESSOR AHMED BOUAZIZ**
Hassan II Agronomy and Veterinary Institute

In traditional oases systems, within a watershed, small hydraulic territories can be distinguished per types or resources or combination of resources.[37] Those resources are in general limited relative to the crop requirements, especially in those regions where rainfall is very low (60mm to 150mm in the case of Morocco) and integrated water and resources management is a necessity. In such conditions it is necessary to propose adapted institutions for the management of irrigations and drainage basins based on the outlines of networks of canals and hydraulic structures for sharing resources.[38] At this scale, the practices of irrigators can be observed at the village level of the irrigated perimeter, from defined spatial entities: cultivated fields, hydraulic blocks and well-defined perimeters, managed by institutions or organisations of irrigators, which quite often are based on principles of equity and equality, as defined by Ostrom.[39] These principles apply to the management of water as a collective public good. On the scale of large private date palm farms in Morocco and elsewhere, a different form of water management is required.

**The greatest threat is the depletion of water, as well as the drying out of traditional oases and permanent emigration, with a definitive loss of traditional know-how.**

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### Replenishing the date palm tree

Like any fruit tree, the date palm needs sufficient water of acceptable quality to reach its potential yield. In North Africa, over the last 50 years oases extensions or modern farms outside oases based on pumping have appeared on collective lands, especially in Tunisia, Algeria and Morocco. In Morocco, the town of Figuig has been built around an oasis of date palms. Water is obtained from rivers, dams and canals (Seguias), and combines with scarce and temporary surface sources linked to floods and underground water. The main irrigation technique is surface irrigation, but drip systems are also being introduced. A dam has been built at some distance from the village and the possibility of reusing treated wastewater after the implementation of wastewater treatment is being considered. In other regions of Morocco, the Agricultural Development Office in charge of irrigation and watershed management is collaborating with the Ministry of Interior and local-level farmers, in a system of collective stewardship called 'Jmaa'[40], which is dedicated to water resources management. In many regions of Morocco, surface water is combined with underground resources.

In recent years, the development of modern palm tree farms, and their intensive water consumption, has been a threat to the traditional oases and occupants of those territories. The challenge is to reduce water consumption to the strict minimum to ensure traditional oases can thrive, and that family farming can continue.

### Optimising the water supply

The water consumption of the date palm tree fluctuates throughout the year. In the oases area in southern Tunisia where dates are grown for export, water saving will mainly depend on water management.[41] Farmers facing scarce water or low selling prices may adopt extensive strategies, either by extending their plantations onto new land and drilling individual boreholes or by limiting their investment in their existing plantations. Saving water may then lead to lower total production at the scheme level and defaults in water payment, while the fixed costs of the collective hydraulic equipment remain the same. These observations show that water saving and water productivity have to be addressed together. By adopting a 'crop per drop' or 'cash per drop' perspective, the way water is processed into crop production and then into agricultural income becomes more central than the absolute volume of water consumed by a scheme or a farm. Such an approach requires a sound knowledge of the production functions that transform water into crop production and crop production into gross margins.

### Conclusion

**The Saharan oases have undergone particularly profound and destabilising changes during the second half of the 20th century and the beginning of the 21st, accompanied by social, economic, agricultural and environmental transformations, notably through competition for irrigation water and appropriation of pastoral lands for the modern cropping of the date palm. In addition to the classic tiered oases irrigated by gravity, there are new extensions or agricultural projects driven by state or local initiatives, with a shift to drip irrigation and large-scale pumping.**

**In a context where the most modern and traditional forms of agriculture are juxtaposed, it is relevant to think on the breaks and continuities between these two different forms of Saharan agriculture, where modernity becomes a threat to sustainable tradition. The greatest threat is the depletion of water, as well as the drying out of traditional oases and permanent emigration, with a definitive loss of traditional know-how. This dynamic also reveals very living oases, the sustainability of which undoubtedly depends on the coexistence of diversified initiatives, in particular in terms of innovative management of water, soils and territories.**

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FALAJ IRRIGATION CHANNEL IN DATE PALM PLANTATION IN OMAN'S WADI ABYAD © SHUTTERSTOCK

# 2.6 The Date Palm Global Economy

**PROFESSOR DR AMGAD EL-KADY**
Director
Food and Agro-Industries Technology Center

**In recent years, there has been a significant expansion in date palm cultivation and date production throughout the Arab world. The annual production of Arab countries represents about 6.5 million tonnes of various varieties of dates, representing 75 percent of the global dates production estimated at more than 8.6 million tonnes.**

## Date Palm waste

However, the percentage of dates lost during the farming process is estimated at about 10-15 percent, and dates excluded from the factory's sorting process represent about 15-20 percent, in addition to the low-quality varieties of dates that cannot be marketed and which are not desired by the consumer (of unknown seed varieties), and surplus dates.

The date palm is considered one of the tall trees with large vegetative parts, as it contains dense leaves with an average length of five metres, and each tree contains about 100 leaves, which makes it have a great ability to absorb carbon dioxide from the surrounding atmosphere, thus resisting global warming. The date palm tree absorbs about 200 kilograms of carbon dioxide annually, so it plays a major role in enhancing the environmental balance and reducing desertification, as it tolerates drought and water shortages, and plays an important role in protecting against dust storms and desertification.

Date palm waste is one of the most important agricultural waste products in the Arab region, estimated around 10.3 million tonnes annually. Therefore, to ensure that the date palm industry becomes a truly bio-circular economy, it is important to link scientific research with industry to reduce the number of dates that are wasted, and to ensure that date-producing countries take advantage of second-class dates in the production of new commodities.

## Date Palm waste utilisation

Second-class dates can be used in a variety of consumer products, such as chopped dates, date paste, date juice, date honey (Dibs), and is a valuable ingredient in the manufacture of pastry and baby foods and ketchup, making dried date sheets, dried date powder, liquid sugar, baker's yeast and alcohol. Date processing waste can also be used in the field of non-food projects and industrial fermentation, such as the manufacture of acetic acid, citric acid, acetone and animal fodder.

Date palm by-products are used in the compost industry, in growing environments in soilless farming systems, in improving the properties of degraded lands, in water purification and in animal feed manufacturing. In addition, date palm can be used to make wood, paper, fertilisers, cages, mats, and bricks. Palm trunks are also used in the manufacture of timber, doors, ceilings, garden benches, simple arches, partitions and physical supports. The fibre is used to make ropes, bath fibre, thermal insulation and evaporative cooling equipment, while palm leaf is used to make some furniture, boats, cages, organic fertilisers and compressed wood. Leaves are also used for roofing and awnings, making fences, making paper, and some chemical, while leaflets are used for handicrafts, fodder, furniture stuffing and organic fertilisers. Pollen is used for pollination but also in the food and pharmaceutical industries.

## Date Palm by-products

The by-products and remnants of the date palm are numerous, and they are associated with all parts of the palm, from the trunk to the fronds, the frond stalk, the wicker and the fruit bunches. The date palm pruning process also produces an enormous amount of leaves, which consist of leaflets, spines, base, and fibres. Annually, about 12 leaves are pruned from a single palm, with an average weight of 10kg for a 20-year-old palm. Also, during the thinning process (cutting the excess fruit bunch) after pollination with an average weight of 3.5kg per palm, and after harvesting dates, a quantity of dried fruit bunch with an average weight of 7kg per palm. Consequently, the general average for the products of pruning and loosening is about 17kg of dry by-products per palm per year. The chemical composition of these products varies from one class to another, and in general terms, the percentage of cellulose ranges between 30-48 percent, hemicellulose between 25-29 percent, and lignin between 20-25 percent.

## Summary

**It is strongly recommended to maximise the added value of date palm and dates, create job opportunities, provision of green jobs and generate new projects, which will have a direct return on the national economy and limit the import of similar goods from abroad, and achieve a high percentage of self-sufficiency in the food security, opening new global markets, and preserving the environment by using date and palm waste in the production of value-added products.**

**However, the industrial projects based on these wastes are hindered by some obstacles, including the difficulty and cost of collecting such wastes from farms and transporting them to project sites. It would be practical to provide to farmers the necessary guidance in the best way to deal with date palm by-products, how to collect palm waste at a specific point on the farm, and convert it into small chips using chipping machines, which can be mobile owned by small farmers' associations, and are leased to small farmers and encouraging investing in date palm waste recycling projects.**

**The annual production of Arab countries represents about 6.5 million tonnes of various varieties of dates, representing 75 percent of the global dates production estimated at more than 8.6 million tonnes.**

**Date Palm waste is one of the most important agricultural waste products in the Arab region, estimated around 10.3 million tonnes annually.**

واحة نخلة تمرة

2.7

# Horticultural Solutions to Food Security in Arid Regions

**DR ABDALLAH BEN ABDALLAH**
Senior Date Palm Expert

واحة

**The MENA region is today facing a turning point in its history. Concerned states are finding it increasingly difficult to provide for their populations' needs, as their agricultural sectors are crippled by severe inequalities and an increasingly arid climate. Each year, undernourishment intensifies, compelling Maghreb States to increase importations, thereby growing their debt as well as their vulnerability in the face of price volatility. Furthermore, climate change predictions announce severe natural resources and agricultural productivity degradation.**

The traditional oasis system, a fragile environment, relies heavily on the palm grove, its orchards and vegetable crops, which, with the aid of sustainable water resource management, can last for centuries. The predominant water shortage in the region, especially in oases, and the limited avenues for economically-augmenting water supply and the increasing degradation of water quality, limit the possibilities for horizontal expansion of date production and call for innovative systems for date vertical production.

It is within this alarming food security context that the imperative of working with other agricultural models is becoming clear. As the MENA region becomes increasingly waterless, oases stand out as resilient and sustainable agricultural systems, whose ability to adapt themselves perfectly to the region's specific current and future stresses could be a major asset for food security in coming years.

Traditional oases are meticulously organised across three levels. At the highest level is the date palm tree and, below, olive and fruit trees; at the bottom, depending on the season, vegetables, cereals and fodder for livestock. The traditional oases are cultivated by making the most of their microclimate. Results of some studies show that the traditional oasis has the lowest values of land surface temperature which generates a strong oasis cooling intensity (OCI) of -7.95 °C. This suggests that planting density is a determining factor of OCI rather than the size of vegetation cover.

**Summary**

**Despite the many challenges faced by the date palm industry, it remains the best option for sustainable development in the arid MENA region. The date palm industry has the ability to act as a solution to environmental issues, social wellbeing, economic and regional security challenges, through interlinkages between natural ecosystems restoration, an increase of biodiversity, food security, enhancement of rural-urban dynamics, with the unexplored potential of bio-circular economy and adaptation of traditional knowledge systems. The multitude of cross-sectorial applications and the similar regional geographical and climatic characteristics of the MENA region offer a unique opportunity for a transboundary collaboration through date palm cultivation and related industries.**

**Greenhouse gardening**

Alternatively, greenhouse gardening offers many benefits that go beyond conventional gardening and could be economically successful. However, greenhouse gardening requires significant investment at the outset, which is not easy for small farmers. Also, the greenhouse industry has to deal with some issues related to a poor design of a great number of greenhouses. One such problem is the inability of some greenhouses to deal with frost which, in the cold clear-sky days of winter, can destroy the whole work of a season. Another problem involves overheating during the hottest summer days.

If we need to improve the traditional oasis ecosystem by introducing a greenhouse element to grow food in an artificial environment with a help of technology, then polythene tunnels could be the solution. Also known as polytunnels, these protect crops from the effects of the weather, including wind, rain and extreme temperatures. They are large enough for people to work inside and can provide warmer conditions than if the crops were grown outside. Their use is also feasible for small dates growers.

**The MENA region is today facing a turning point in its history. Concerned states are finding it increasingly difficult to provide for their populations' needs, as their agricultural sectors are crippled by severe inequalities and an increasingly arid climate.**

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KHALIFA AWARD
PHOTOGRAPHY
COMPETITION
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2.8

# Major Challenges Facing the Date Palm Oasis Ecosystem

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**FLORENCE MARIE ROLLE**
FAO Representative to the Kingdom of Morocco

**In 2010, the Government of Morocco and professional organisations in the date palm sector signed a contract that provided for the rehabilitation and densification of 48,000 hectares of traditional date palm orchards – along with the creation of new date palm plantations on 17,000 hectares by 2020. The Moroccan date palm sector has consequently evolved to now include 48,000 hectares of traditional palm groves. These palm groves have kept their agroecosystem characteristics, as they are managed in a familial way, alongside newly-installed orchards that are farmed using modern techniques covering an area of approximately 10,000 hectares.**

In addition to this duality between these two types of oasis ecosystems, and the resulting consequences in terms of productivity and competitiveness, Moroccan oasis ecosystems are confronted with various issues such as degradation of natural resources, lack of appropriate knowledge and techniques, post-harvest losses and social hindrances. Depending on the type of date palm ecosystems, these issues might be different. However, there are several main issues faced by both traditional and modern oasis ecosystems.

### Water scarcity

Water availability is a key constraint of the development of the Moroccan date palm sector. Traditional oases, which have been irrigating using a customary system of sharing available water, are faced with recurrent droughts. As a result, farmers have sometimes been forced to resort to pumping, which accelerates the drying up of water tables and poses certain risks of drying out khettaras. With regards to modern palm ecosystems, irrigation is done by pumping from aquifers whose renewal is not certain, and the amount of water used could ultimately lead to loss of investments.

**Moroccan oasis ecosystems are confronted with various issues such as degradation of natural resources, lack of appropriate knowledge and techniques, post-harvest losses and social hindrances.**

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### Soil degradation

Another issue faced by oasis ecosystems is that of soil degradation. Indeed, already planted in poor soils in organic matter, date palm trees are suffering from further soil degradation through salinisation and silting. Salinisation occurs in both traditional and modern palm plantations, due to the use of poor-quality saline water for irrigation. Localised irrigation in modern orchards favours this phenomenon. Siltation mainly affects traditional palm groves.

### Biodiversity erosion

Biodiversity erosion is a less commonly known issue, and one which is due to monovarietal trend and the cultivation of new varieties promoted by seed companies. The same is true for local animal breeds known for their adaptation to hardship environments such as oases, and which are also generally in sharp decline. In the specific case of the date palm, biodiversity known through the exploitation of so-called 'khalts' ecotypes is also likely to decrease due to the expanding use of date varieties of higher commercial value. Modern orchards are generally planted with one to three date varieties, and the way they are designed does not allow any biodiversity, neither plant nor animal.

### Agricultural practices

In traditional oases, agricultural practices often remain very archaic, resulting in relatively low date production levels. With regards to modern orchards, the agricultural practices primarily focused on irrigation and inputs are largely based on international advice. This means there is a need for local research to irrigate and fertilise effectively and efficiently, as well as to address future pollination and harvest issues.

In addition, the lack of enough efficient genetic material for the rehabilitation and densification of traditional oasis – as well as for the planting of new modern orchards – has been a consistent issue. Despite combined efforts of state and private date palm multiplication laboratories, quantities of available tissue culture remains significantly below demand.

### Disease and infestation

Phytosanitary problems, especially the 'Bayoud' disease, is decimating traditional date palm trees and presents a great threat to new plantations made of very sensitive varieties. The red weevil, found in the north of Morocco, is another specific threat for Moroccan date palm trees.

### Cultivation and resource issues

As date palm farmers grow older, it becomes increasingly difficult for younger farmers to take over, not least because the work required (maintenance of orchards, pollination, harvesting, and post-harvest work) is not appreciated by young people. The problem of manpower and its qualification is beginning to arise acutely for both old and new orchards. The skill and tenacity of the older generation is being eroded and there is a clear lack of mechanisation. Harvest and post-harvest losses remain high, and storage and packaging capacities are insufficient.

Fire in traditional oasis is a significant threat. Due to lack of maintenance, large quantities of dry matter – that were used in cooking and construction before – are now left on-site. This increases the probability of fire outbreaks that are difficult to control due to the structure of the palm orchard and the lack of available water.

### Conclusion

**The 2010-2020 agricultural program has just ended and although it has induced a clear interest in date palm production, it has not been able to resolve these problems. The new agricultural strategy will certainly take them into consideration within the framework of its two fundamental axes: priority to the human element and sustainability of agricultural development.**

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# The Social Impact of Date Palm Cultivation in the Hashemite Kingdom of Jordan

**The date palm sector has contributed to reducing unemployment rates, providing about up to**

**8,000**

**job opportunities, with women making up one third of the workforce.**

**HIS EXCELLENCY MR MOHAMMED DAOUDIA**
Ministry of Agriculture
The Hashemite Kingdom of Jordan

"The date palm tree has been known in the Jordan Valley region for thousands of years. Today, investment in the date production sector has an overwhelmingly positive impact on local communities, due to the need for agricultural engineers, technicians, and skilled workers trained in agricultural and post-harvest operations. The date palm sector has contributed to reducing unemployment rates, providing about up to 8,000 job opportunities, with women making up one third of the workforce. In addition, many date palm farms and date packaging workshops in the Hashemite Kingdom of Jordan have gained certificates of good agricultural practices and international quality certificates, which is considered one of the main strengths of the date palm sector's development and sustainability."

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FIRE IN TRADITIONAL OASIS IS A SIGNIFICANT THREAT, DUE TO LACK OF MAINTENANCE, LARGE QUANTITIES OF DRY MATTER
© KIADPAI

**DR ISMAHANE ELOUAFI**
Director General
The International Center for Biosaline Agriculture

# 2.9 Sustainable Livelihoods, Food Security and Water Scarcity in Marginal Environments

**Development that meets the needs of the present generation, without compromising the ability of future generations to meet their needs, is the sustainable livelihood. It is easier to meet these needs without compromising the carbon footprints in non-stress environment than in the marginal environment where the opportunities are scarce. There is always a trade-off between sustainability and development as there are some 'limits to growth' or 'limits to development' in the fields of greenhouse gas emissions, deforestation, genetic manipulations, air and water pollution, land degradation, extraction of water, human poverty and levels of living. The MENA region is one of the most vulnerable regions, due to physical water scarcity and low soil fertility.**

**Development that meets the needs of the present generation, without compromising the ability of future generations to meet their needs, is the sustainable livelihood.**



**The date palm has played a fundamental role in the survival of indigenous people**

Not many plant species grow in harsh arid environments, but the date palm is native and traditionally cultivated in the world's arid regions, with its centre of origin in the Arabian Peninsula. Since ancient times, date palm has played a fundamental role in the survival and the livelihood of indigenous people. Date palm is the most adapted and oldest fruit tree species in the region, and the highly nutritious fruit is a vital component of people's food systems. It is rightly recognised as a symbol of prosperity in the Arab world, and deserves its status as the 'Tree of Life' due to its huge overall benefits to society.

The importance of palm trees in a marginal environment derives from production of renewable biological resources and converting these resources and waste into value-added products, such as food, feed, bioproducts, and bioenergy. Successful future development of a sustainable date palm sector mostly rests on (i) assessing and conserving the existing genetic resources, as well as local know-how, (ii) promoting the best management system practices according to on-site available inputs and the local product, (iii) enhance product quality and seeking better date palm varieties as well as others species to maintain or introduce to create a local label for better processing and national and international marketing.

Creating a sustainable programme of date palm farming Accordingly, defining a clear-cut agricultural pattern is very important, especially in areas that suffer from challenging natural factors and salinity of water and soil according to the available inputs for production or proposed solutions. The date palm-based farming pattern can be integrated with agriculture with a concept close to sustainable agriculture. But is more accurate and characterised by the production of foodstuffs and other high-quality products that prioritise resources and natural regulatory mechanisms to replace costly inputs that harm the environment (zero-agricultural-waste system) and ensure sustainable agriculture in the long term. Eco-agricultural practices consider all environmental management criteria for agriculture practices, such as saving water and its quality, reducing soil erosion and protecting it, and restoring what has been damaged by other agricultural practices, such as reforestation. Practical analysis of available resources and follow an appropriate system can achieve sustainable goals.

**Conclusion**

**In this way, the oases system can be strengthened and developed, where the intensive development leads to the ideal investment of the significant existing potentials, thus creating more job opportunities and supporting biodiversity and diversification through innovative and green activities, as well as business and tourism based on the unique natural attraction in this desert system.**

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# 2.10 Leadership and Ecosystem Investment Innovation

**The date palm is a blessed tree that has been cultivated by Arabs for generations. It is the best food-producing tree in arid regions. In addition, date palms provide protection from the sun, wind, sand encroachment, and preserve the ecological, economic and social balance of the Bedouin.**

### An agricultural renaissance

The date palm tree has a long history in the UAE. However, the UAE has made significant progress in date palm industry thanks to efforts of the builder of the UAE's agricultural renaissance, the late Sheikh Zayed bin Sultan Al Nahyan, who spared no effort in developing the agriculture sector in general. Since serving as the Ruler of Al Ain, Sheikh Zayed focused on developing irrigation systems, digging and maintaining Aflaj systems, to advance the agricultural sector, thus achieving prosperity in the UAE.

**SAEED AL BAHRI SALEM AL-AMERI**
Director General
Abu Dhabi Agri-culture And Food Safety

The UAE continues to 'go green', thanks to the attention paid by Sheikh Zayed's sons, particularly President His Highness Sheikh Khalifa Bin Zayed Al Nahyan, and His Highness Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi. As such, the Abu Dhabi Agriculture and Food Safety Authority (ADAFSA) was established to fulfil the leadership's aspirations in promoting sustainable agricultural development and advancing date palm industry.

### The role of the ADAFSA

Under the chairmanship of His Highness Sheikh Mansour bin Zayed Al Nahyan, the ADAFSA offers integrated services to advance the date palm industry and maximise its returns. Furthermore, it works on raising farmers awareness about the best practices for palm tree cultivation, post-harvest operations, and the best date varieties. It has also implemented the Integrated Date Palm Pest Management Programme in 24,000 farms in Abu Dhabi, comprising eight million trees. Using modern technology and innovations, ADAFSA conducts applied research programmes to discover proper scientific solutions to challenges facing date palm cultivation.

The UAE is ranked fourth among the top date-exporting countries in the world. It is a hub for the best laboratories producing palm tree offshoots using tissue culture technology, which helped increase palm trees to over 120 species. Now, the UAE is fulfilling needs of the regional and international markets of date palm offshoots. Established by the Abu Dhabi Government, the Al Foah Company plays a pivotal role in processing and marketing dates received from farmers, which enhances competitiveness of the Emirati dates globally.

Annual festivals celebrating the date palm are organised by the UAE, most notably the Liwa Date Festival in the Al Dhafra Region. Because of its heritage and economic importance, this festival creates a competitive environment to market Emirati date varieties. Consequently, the festival management has allocated prizes worth AED 8.2 million (US$ 2.2 million) for annual prize winners.

**Summary**

**The notable progress in date palm industry contributes to boosting the bio-circular economy by supporting farmers to convert by-products into value-added products, such as food, feed, bio-based products and bioenergy, as well as encouraging entrepreneurs to invest in this industry to ensure its sustainability. Now, thanks to the substantial development in the UAE's manufacturing sector, great opportunities are now available for advancing date palm industries, including producing syrup (dibs), vinegar, sugar, yeasts, coffee and feed.**

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**Eco-agricultural practices consider all environmental management criteria for agriculture practices, such as saving water and its quality, reducing soil erosion and protecting it, and restoring what has been damaged by other agricultural practices, such as reforestation.**

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# 3

# Date Palm Cultural Heritage and Urban Integration

واحة

**DR SANDRA PIESIK**
Director of
3 ideas B.V.

# 3.1 A Rural–Urban Dynamics Framework for Oasis Cities

**The subject of holistic approaches for rural and urban dynamics has been at the forefront of international dialogues for almost three decades. The COVID-19 pandemic has exposed unresolved pre-pandemic challenges involving the national food security of individual countries during national lockdowns, therefore the pursuit of a self-sustainable developmental model serves both planetary and human health. Date palm oasis cities offer a rare prototype of coexistence between a natural ecological oasis ecosystem and man-made urban ecosystems, often referred to as 'urban morphology'.**

**Globalisation, international trade and communication technologies and the fragmentation of approaches for rural–urban land use are introducing unprecedented levels of complexity, and making it harder to provide holistic solutions that can be easily understood at the global, regional, national and local authority level.**

Globalisation, international trade and communication technologies and the fragmentation of approaches for rural–urban land use are introducing unprecedented levels of complexity, and making it harder to provide holistic solutions that can be easily understood at the global, regional, national and local authority level. In order to identify the shared challenges faced by both rural and urban areas, and co-benefits that may arise from joint initiatives to address these challenges, the following framework introduces five capitals (Natural, Human, Social, Manufactured and Financial) to define 'Rural–Urban Dynamics Policy Recommendations for the UNCCD Global Land Outlook'.[42]

**Natural Capital** explores the existential co-dependency of rural areas for cities, emphasising population dependency on agriculture and food security. Opportunities for a greater rural–urban and oasis–city integration could be framed around existing frameworks, such as the United Nations Decade on Ecosystems Restoration, UNFCCC, FAO, and ICLEI regional programmes discussed in later chapters.
Consideration needs to be given to the use of land, as well as date palm oases as a carbon sink, especially in the context of cities, which are responsible for 70 percent of global GHG emissions.

**Human Capital** places people at the centre of sustainable development, and positions poverty alleviation, demographic shifts, globalisation, minority groups, equality and migration as shared challenges experienced by people in rural and urban areas. Opportunities could be sought in skills development, education, capacity building, and urbanisation itself, that in some places of the world is aiding poverty alleviation.

**Social Capital** addresses issues of governance and insufficient land regulations, with an attempt to identify the challenges created by constantly growing cities and rural areas. Recommendations for improvement of rural–urban linkages may touch upon: land tenure regulations; planning; the role of decentralisation; proposals for special economic zones in peri-urban areas as testing grounds; and schemes for incremental land supply.

**Manufactured Capital** explores pressures in the built environment sector deriving from a lack of affordable housing and informal settlements. Opportunities could be sought in improved connectivity, the role of intermediary towns, secondary roads, and information and communications technology (ICT) networks. However, one of the biggest chances for improvement in livelihoods and the provision of new jobs is in the sustainable management of natural resources and circular economy opportunities. 'Zero waste to landfill' strategies – for cities as well as rural areas – may prove fundamental for the emergence of a new green economy. Digitalisation for development and technology development and transfer are the cornerstones of contemporary industrialisation, and can aid regulatory processes for mapping expanding cities, as well as degraded land. Peri-urban areas in particular are the best places for the re-introduction of bio-circular economy models bringing oases and urban areas.

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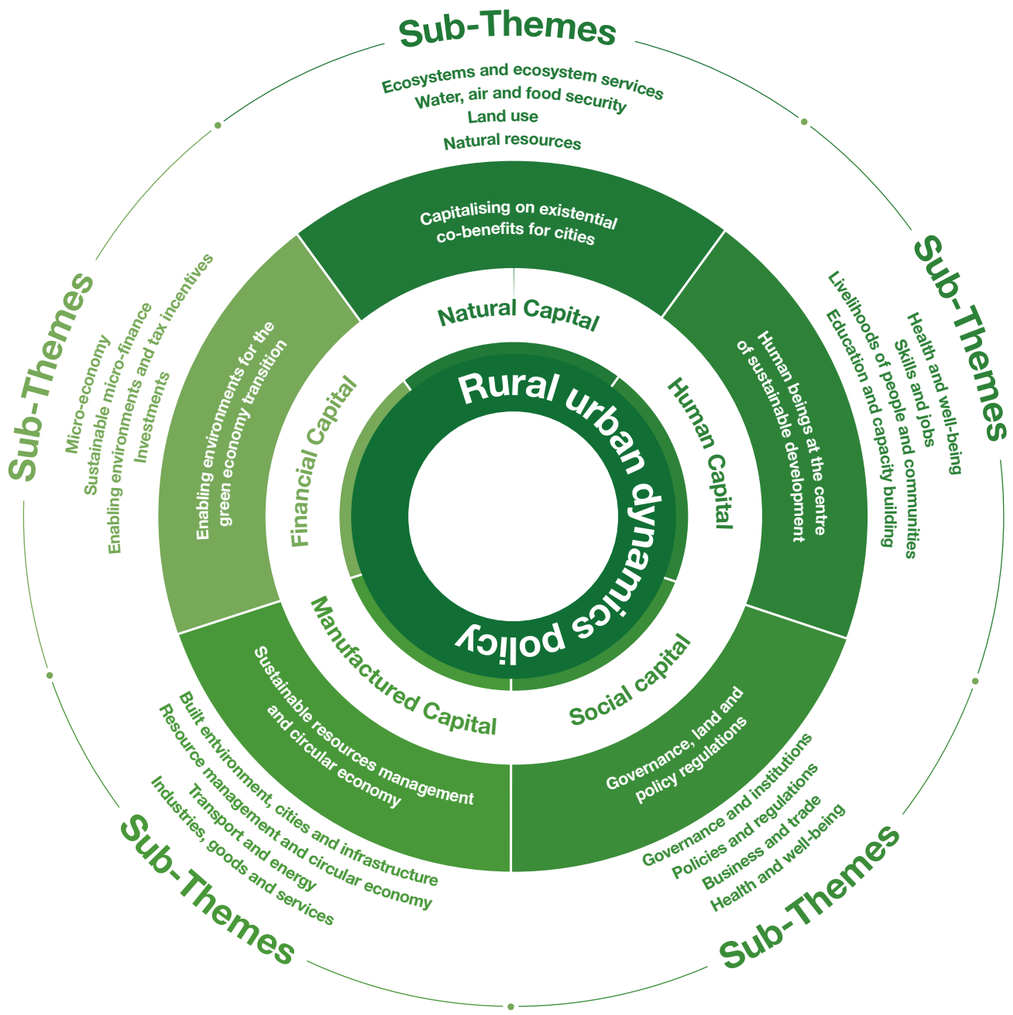


FIGURE 7: RURAL–URBAN DYNAMICS POLICY RECOMMENDATIONS FOR THE UNCCD GLOBAL LAND OUTLOOK
© 3 IDEAS B.V.



**Financial Capital** acknowledges that the implementation of greater urban and rural connectivity, and the re-introduction of a bio-circular economy model through regional collaboration, requires financial capital, investment, and multilateralism. There are a variety of climate finance solutions available and it is hoped that, together with the assistance of national governments and sustainable micro-finance, a transition to a more balanced rural–urban relationship can be achieved.[43]

Greater rural–urban integration in oasis ecosystems would enhance SDG implementation, in particular, SDG 11: "Make cities and human settlements inclusive, safe, resilient and sustainable" and the SDG 11.A target focused on:

**The support of positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.[44]**

Given that the adverse effects of climate change, desertification and drought are impacting both rural and urban habitats, there are clear socio, economic and environmental opportunities to be found in the transboundary management of natural resources through a bio-circular economy.

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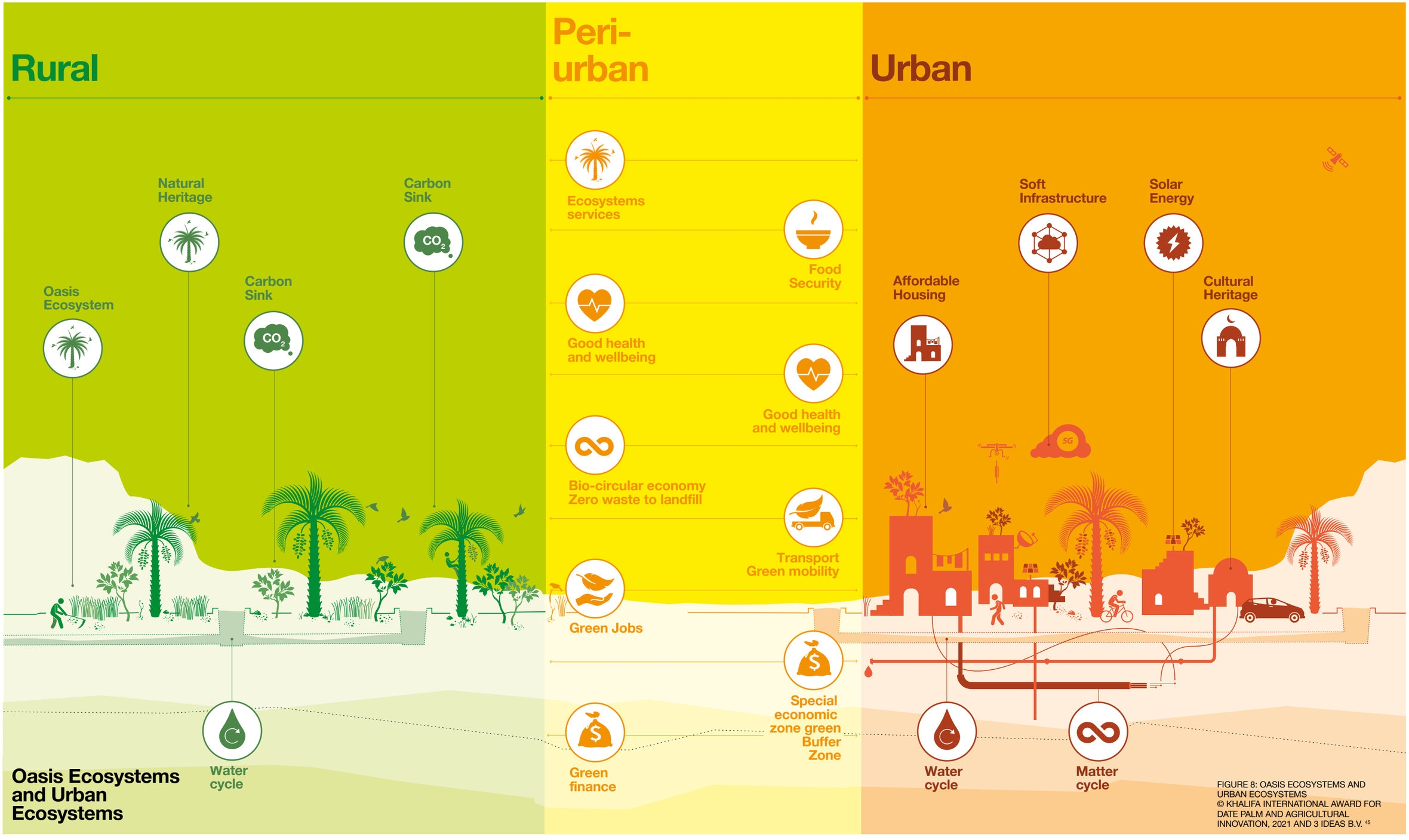


FIGURE 8: OASIS ECOSYSTEMS AND URBAN ECOSYSTEMS
© KHALIFA INTERNATIONAL AWARD FOR DATE PALM AND AGRICULTURAL INNOVATION, 2021 AND 3 IDEAS B.V. [45]

THE DOME OF THE LOUVRE
ABU DHABI
© SHUTTERSTOCK

# 3.2 The Governance of Cities in Desert Regions

**KOBIE BRAND, INGRID COETZEE AND DR ERNITA VAN WYK**
ICLEI – Local Governments for Sustainability: ICLEI Africa Secretariat and ICLEI Cities Biodiversity Centre

**Urbanisation is one of the world's megatrends. By 2018, 55 percent of the world's population was located in urban centres. This figure is expected to increase to 68 percent by 2050.[46] Moreover, almost 90 percent of the urban population growth is taking place in Africa and Asia.[47,48,49]**

Urbanisation is one of the world's megatrends. By 2018, 55 percent of the world's population was located in urban centres. This figure is expected to increase to 68 percent by 2050. Moreover, almost 90 percent of the urban population growth is taking place in Africa and Asia.



Urbanisation brings challenges as well as opportunities for innovation and therefore, questions around managing for sustainability, climate and disaster risk reduction and quality of life are central to the urbanisation debate. Urban societies have had to redefine their relationship with nature as they strive to balance the need for urban growth, development and vibrancy, with the protection and sustainable use of cities' nature-based life support systems.

Governance of urban biodiversity is an important issue. Conventional governance and planning approaches are not typically suited to African cities. This is because many fast-growing African cities outpace the rate of conventional planning, and because African cities are characterised by informal systems, for example through informal economies, informal decision-making in both civil society and government, and the informal use of space and utilities. Informal systems typically have emergent properties which cannot be planned for in conventional ways. With this in mind, experimental and co-production approaches to urban development and the mainstreaming of urban nature, are advocated.50

This contribution introduces ICLEI's work on urban nature, its assessment, governance and advocacy in Africa, and globally.

**Ecosystem services assessments and investment in urban nature**
Cities need to know what natural assets they have (e.g. forests, green open space, urban parks and corridors, rivers, wetlands and estuaries), where their ecosystems are located, and the value they offer in terms of ecosystem services.[51] City decision-makers need tools to help visualise ecosystems and the associated services (i.e. benefits to people), to compare, and to consider trade-offs among many ecological, social, and economic values. Only then can decision-makers incorporate the value of nature into real-world decision-making[52] and urban planning processes.[53]

An example of an ecosystem services assessment tool is the Thematic Atlas of Nature's Benefits to Dar es Salaam (a major city in Tanzania). This ecosystem assessment addresses seven themes, where each theme represents an urban issue such as heat, pollution or livelihoods, and uses spatial information about these themes, overlaying them with the spatial location of green open spaces, to identify where investment in green space is optimal (i.e. where green open space enhancement would achieve the best social outcomes). In this particular case, urban agriculture, even though also a production system, was considered a potential natural asset with associated ecosystem services – for example urban cooling – with local climate mitigating effects. Maps in these assessments can be used to create attractive visualisation to stimulate wider awareness of urban ecosystem services.

**Bioregional planning**
Local Biodiversity Strategy and Action Plans (LBSAPs) are instruments for sub-national governments to plan for the enhancement of local biodiversity and to mainstream urban nature into municipal development and spatial planning.

**UN Decade of Ecosystem Restoration**
The United Nations Decade of Ecosystem Restoration (DoER) aims to unite the world behind a common goal to prevent, halt and reverse the degradation of ecosystems worldwide. The seventh IPBES Global Assessment has recognised that one of the biggest drivers of biodiversity loss is land use change and degradation. With the rapid growth and development of urban areas, ecosystems are increasingly at threat. Ecosystem restoration aims to reverse degradation, which can improve the productivity and capacity of ecosystems to meet societal needs. The UN's DoER strategy will not set new targets for ecosystem restoration, but rather aims to contribute and accelerate the achievement of several other global agendas, such as the SDGs, through three main pathways: I) building a global movement; II) generating political support; and III) building technical support.

In April 2020, ICLEI's Cities Biodiversity Centre (CBC) coordinated efforts with ICLEI regional offices and took the opportunity to submit comments on the draft DoER strategy. Once the strategy is revised, the CBC plans to advocate for the integration and consideration of the DoER at the subnational and local government levels, through the three main pathways defined in the strategy. The CBC has extensive networks across global urban landscapes, and will leverage these to promote the DoER strategy. Urban areas are hubs of innovation where solutions can be generated to contribute towards restoring ecosystems and reconnecting communities with nature. The CBC will also seek to solicit political support for the DoER at the subnational and local level through the CitiesWithNature platform, and engaging political influencers who advocate for nature. Last, the CBC will look at ways to build technical understanding and support for the DoER strategy to ensure the strategy can be embedded in decision-making processes and planning.

**Local and subnational advocacy for nature**

The goal of ICLEI's advocacy for nature work is to ensure the voice of local and subnational governments is heard and reflected in the consultations, negotiations and outcomes of the Convention on Biological Diversity (CBD) and related processes. With the collaboration of its key partners, the ICLEI has developed a roadmap for local and subnational governments. The implementation of this roadmap is currently underway and has resulted in a series of advocacy interventions and events, regular monthly webinars and email updates.

**CitiesWithNature: a nature platform for cities**

CitiesWithNature is a global partnership initiative co-founded by ICLEI, IUCN and The Nature Conservancy. The initiative is growing and nurturing a community of practice comprising cities, regions, partner organisations, projects, practitioners, researchers, and urban communities to conserve, restore, and mainstream nature in and around urban areas. Co-shaped by a growing network of partners, including WWF, World Urban Parks, Cities4Forests, UNEP, and many others, the initiative provides a shared online platform for cities and regions to connect, learn, share, and inspire each other in pursuit of achieving global impact through collective local action for nature.

The platform is endorsed by the Secretariat of the Convention on Biological Diversity, as the space for cities and regions to share their ambitions, make their commitments, and monitor and report on their progress in demonstrating their contributions to achieving the global biodiversity agenda. Nature provides immense value and multiple benefits to urban communities, and CitiesWithNature provides the space to celebrate and showcase best practice from around the world. No action is too small.

**Conclusion**

**Now is the time for cities and regions to act with unprecedented ambition to secure our increasingly urban future. Our solutions lie in nature. CitiesWithNature aims to inspire a global movement of cities and regions who are committed to taking ambitious action in the UN DoER. The platform is ideally suited to combine and showcase all the tools mentioned here, and it also summarises each city's unique journey with nature.**





# 3.3 Small and intermediary towns planning in dry climate zones

**DR SHIPRA NARANG SURI**
Chief, Urban Practices Branch
UN-Habitat

**UN-Habitat's strategic planning interventions aim to promote ecological resilience as well as climate adaptation in a variety of contexts. Projects apply principles from the New Urban Agenda (NUA) to adopt and implement disaster risk reduction and management, mitigate vulnerabilities, and foster resilience, ultimately contributing to the achievement of the shared goals of Agenda 2030 for Sustainable Development, in particular SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action).**

This section shares some insights from a project in Saudi Arabia, where UN-Habitat's interventions effectively integrated the local climatic context. Key elements of this approach can be replicated in other small and intermediary towns in dry climate zones.

### The case of Al-Ahsa in Saudi Arabia

One of the key objectives of UN-Habitat's Future Saudi Cities Programme (2014-2020) was the protection of landscape integrated with natural ecosystems, biodiversity and human settlements in 17 cities across the Kingdom. This was especially important for cities like Al-Ahsa, Buraidah, and Madinah, where the programme proposed effective ways to relink natural elements to the city, and encouraged sustainable alternatives for protecting palm trees while supporting positive changes for land use, mobility, and local economy.

Al-Ahsa is one of the oldest settlements in the world, and home to the world's largest oasis, declared as a UNESCO World Heritage Site in 2018. The origin of the oasis traces back several millennia and owes its sustained vitality to fertile soil and copious groundwater in the region. Historically, Al-Ahsa has been the 'food bowl' of the region, producing dates, wheat, rice, and fruit. Several small villages sprouted within the oasis and four cities (Al Hofuf, Al Mubarraz, Al-Oyun, and Al-Oman) merged to form the Al-Ahsa municipality. The metropolitan population of Al-Ahsa is 1.2 million.

The Eastern region in Saudi Arabia is expecting a change in rainfall patterns and an increase in ambient temperatures, due to which the recharge time for the aquifer will increase. This will limit the regional agricultural potential as well as the development of open green spaces across the city. At the moment, the sparse green spaces configured in a discontinuous pattern neither contribute to protecting and replenishing water tables, nor mitigate the urban heat island effect.

UN-Habitat worked with the City of Al-Ahsa to develop a City Profile to diagnose the key challenges facing the city, and identify strategic actions to steer Al-Ahsa towards a sustainable future. These included, among others, the enhancement of regional linkages; encouraging compact growth patterns; restoring blue-green networks; and creating the right foundations to boost economic development.

### Strengthening regional linkages

Al-Ahsa is part of a larger system of cities in the Eastern region that is unique in terms of the balanced system of functional and economic relations with other significant urban centres performing complementary functions. To enhance regional linkages (urban-rural networks, connectivity, the network of cities), the strategy suggested the creation of a secondary town on the coast with strong linkages to Al-Ahsa, rather than development of a contiguous urban belt to the coast. Further, without well-defined nodes, main axes, and connections, the city feels divided by physical and cultural barriers. Large swathes of vacant land along wide roads appear discordant. The urban fabric can be reconfigured by concentrating development on vacant lands that run along the major roads and proposed transportation corridors. Therefore, the strategy recommended the establishment of a public transportation system to support the hierarchical structuring of the city's centres and spaces, and define a model that comprises well-defined nodes, corridors, and equitable distribution of amenities.

### Encouraging compact growth

Al-Ahsa is an L-shaped settlement with agricultural lands bordering the north, east and south. In an attempt to preserve the agricultural lands, the city has been pushing growth outwards rather than containing it, a pattern which is undesirable, inefficient and unsustainable in the long term, stretching infrastructure systems over long distances in order to serve a smaller population. The plan recommended a compact urban form that can accommodate a diverse mix of social classes and commercial uses to create a vibrant and thriving urban life. This can be achieved by densifying the city fabric, which will also reduce provision and maintenance costs for basic infrastructure and other services like public transport, positively impacting economic and environmental sustainability. Installing public transport could also help concentrate development along corridors that are accessible and strategically important to the city's hub.

### Restoring blue-green networks

The underground water table of Al-Ahsa has depleted to alarming levels, and the agricultural production from the region, which previously made a significant contribution to the region and economy, is now diminishing. Despite Al-Ahsa's pristine glory as the world's largest oasis, the city appears much like any other desert city and, in fact, has a lesser percentage of green space per capita when compared to other Saudi cities. The oasis is an integral part of the city's identity that should be made more visible by integration with the urban footprint, in the form of extended green spaces for the local community.

UN-Habitat recommended a growth strategy that does not infringe upon Al-Ahsa's unique agricultural lands, which will help nurture the oasis with its water channels, drains, and other related resources that contribute to its sensitive ecosystem. It also proposed creating open spaces to balance the density of the built form with the introduction of natural elements, landscaping, and other forms of outdoor social activities. This linked green network should be strategically interspersed with public spaces that are comfortable, accessible, inclusive and well-distributed across the city.

### Boosting local economic development

In line with the Saudi Vision 2030, economic development and diversification are crucial for strengthening the Kingdom's urban economy. From the analysis conducted in Al-Ahsa, Buraidah and Madinah, palm trees could provide a long-term source of competitiveness for these cities, spur innovative activities, diversify the local economy and support new pathways of growth, such as green tourism. As natural capital, palm trees may have a strong impact across different urban fields, like land use, mobility, and economic development. This requires a governance model able to involve public bodies, firms, research institutes, universities, and communities. At the same time, it also requires capable entrepreneurship to develop new ideas, linking knowledge and technologies with market growth potential.

### Summary

**As demonstrated by the example of Al-Ahsa, comprehensive and integrated planning strategies, drawing on an inclusive and evidence-based approach, are critical to ensure climate-tailored development of small and intermediary cities. With the harsh conditions experienced in dry climate zones, the plans must focus on creating liveable environments through efficient resource management, by adopting sustainable planning practices for urban and local economic development, often based on historic approaches. Moreover, a compact and well-connected built form that respects natural features – and strengthens the blue and green networks – must be an integral planning element in these cities.**

**Through its experience and expertise in integrated urban and territorial planning in different kinds of ecological contexts and climatic conditions, UN-Habitat is supporting a large number of cities and human settlements – such as Al-Ahsa – to build a sustainable and resilient future.**

The programme proposed effective ways to relink natural elements to the city, and encouraged sustainable alternatives for protecting palm trees while supporting positive changes for land use, mobility, and local economy.

As natural capital, palm trees may have a strong impact across different urban fields, like land use, mobility, and economic development. This requires a governance model able to involve public bodies, firms, research institutes, universities, and communities. At the same time, it also requires capable entrepreneurship to develop new ideas, linking knowledge and technologies with market growth potential.

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# 3.4 Date Palm Oases and Urbanisation: A Local Government Perspective

**MOHAMED ALI AL-MANSOORI**
General Manager
Al Dhafra Region Municipality

**With a total area of 35,250 square kilometres, Al Dhafra Region occupies 60 percent of the total area of the Emirates and falls between the Empty Quarter and the Arabian Gulf to the east of the capital. The region is rich in oil and gas reserves, is a representation of rural-urban livelihoods, and a worthy example of unique agricultural, industrial and modern social fabric. The date palm has a deep connection to the heritage and culture of the people of the Arabian Peninsula, in general, and the communities of Al Dhafra region, in particular. It was a society existence driver for a long time before the urbanisation of the cities and community gatherings in the region.**

The date palm has a deep connection to the heritage and culture of the people of the Arabian Peninsula, in general, and the communities of Al Dhafra region, in particular. It was a society existence driver for a long time before the urbanisation of the cities and community gatherings in the region.



Dhafra Region Municipality (DRM) plays a role in the development and growth of the seven cities and attached rural communities, in the aspects of infrastructure, city image, forests management, land escaping and community services.

DRM fosters the growth and maintenance of many forests spreading across the region. In total, 258,940 date palm trees have been planted among a wide range of native trees.[54] The number of palm trees in Al Dhafra cities is proportionally associated with the population of each city community. For example, 79,119 date palm trees are located in Bainouna Reserve, 71,621 in Madinat Zayed, 64,176 in Ghaythi, 42,880 in Liwa including Hamim forests, 1,000 in Sila, and 144 date palm trees have been planted in Delma Island.

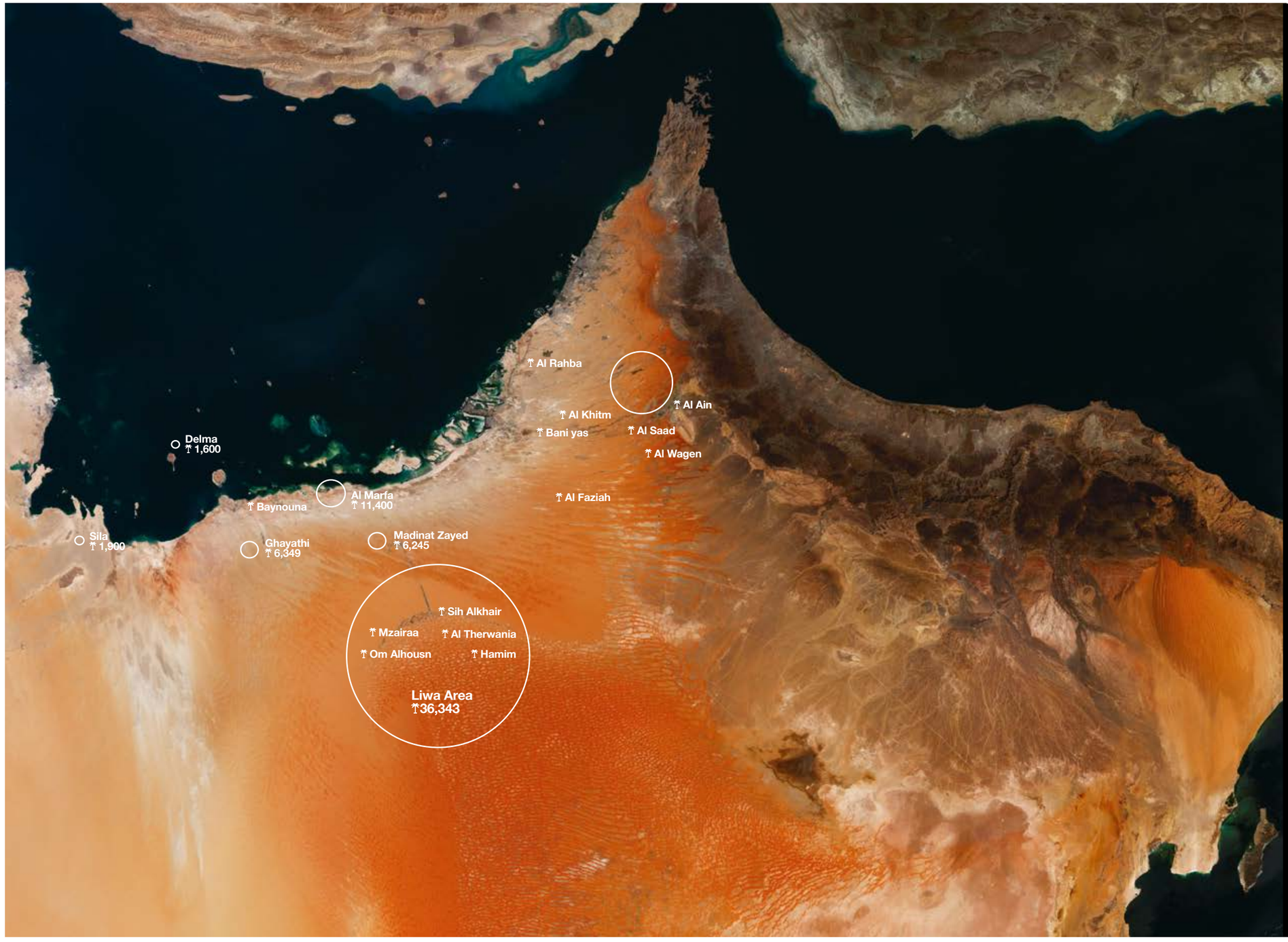
### Date production

It is important to draw attention to the fact that Al Dhafra areas are very old. Even their names were stemmed from the heritage of the country. They continue to be centres of human habitation and urbanisation. However, it is also important to recognise that there are several existing urbanised oases mostly in Liwa area, including Muzeraa, Khanour, Garmada, I'tab, Radoum, Jara, Jabana, Al Maria, Hameem, and Dhafeer. In these urban areas, DRM's parks divisions cultivate and care for 63,837 date palm trees. The majority are in Liwa areas, known as Mahader, with about 36,343 trees. The second largest group exist in Al Marfa, with about 11,400 trees, then in Ghayathi and Madinat Zayed with about 6,349 and 6,245, respectively. The rest are planted in Sila, about 1,900 and about 1,600 in Delma Island.[55] However, these numbers of date palm trees represent only those managed by DRM, which approximately counts to less than 21 percent of date palm trees in the region, based on estimated calculations, since date palm trees and other fruits planted area is about 1.03 million square metres.[56]

Date palm trees in Al Dhafra produced about 86,904 tons of dates in 2019, and production increases annually.[57] DRM utilises the annual production of dates both socially and environmentally, by distributing dates to citizens as well as to charities. It also makes use of low-quality dates for animal feeding, while the residues parts of date palm trees (fronds and bunches), residues, or non-edible fruits are recycled to use as organic fertiliser and to minimise water evaporation.

**Summary**

**Following the environment and sustainability achievements of the late Sheikh Zayed bin Sultan Al Nahyan, DRM does not spare any effort to improve, protect and develop date palms trees oases in the region (particularly the Liwa area), since oases are considered part of the authentic Emirati heritage, and the country as a whole. The emotional connection between the Emiratis and the date palm tree is such that the date palm tree is affectionally called 'Aunt', held in equally high esteem as a family member. As such, its place within the family must be preserved and cherished.**




**63,837**

**of Date Palm trees managed by DRM,UAE**

**which approximately counts to less than 21 percent of date palm trees in the region**

FIGURE 9: DATE PALMS MANAGED BY DRM
© MOHAMED ALI AL-MANSOORI
GENERAL MANAGER AL DHAFRA REGION MUNICIPALITY

# 3.5 Ecosystems cultural services

## a) Contemporary Adaptations of Date Palm Cultural Heritage: the Role of Creative Industries

**HABIBA AL MAR'ASHI**
Chairperson of Emirates Environmental Group

**With a history and culture dating back over 6,000 years, the ever-enduring date palm tree has become an inseparable part of the MENA region; convincing UNESCO to list it on its Intangible Cultural Heritage of Humanity, accrediting the date palm as a living pillar for the nations. For centuries, the date palm has served as source of nutrition, craftsmanship and folklore which, over millennia, formed unique traditions, cultural practices, customs and festivities. This acquired knowledge united and strengthened the connection between people from all across the Arab region, with date palm representing a symbolism of shared challenges faced in the desert environment. Today, the life skills acquired from the palm is in one form or another preserved, continued and added to, as technology allows one to expand its uses.**

Across the generations, various stakeholders have contributed to uphold the cultural heritage and traditions associated with the date palm. From farmers, craftsmen, weavers, storytellers, writers, and of course, the customers who bought the myriad of valuables derived from this tree. In the 21st century, the number of stakeholders has expanded to include entrepreneurs, nutritionists, scientists and environmentalists; who are continuously learning of new benefits that can be obtained from the date palm. These new findings cement and add to the existing social, economic, environmental benefits of the tree.

### Encouraging more people to embrace the palm date sector

The human skills factor is considered as an important element in preserving the date palm cultural heritage. The region faces the risk of youngsters preferring more white-collar vocations to traditional palm date cottage industries. Regional governments and authorities need to work on understanding and adopting global market trends and facilitate technology, product design for innovation, marketing and building value chain linkages. A regional platform should be created for product innovation, creative solutions between the farmers, stakeholders, designers, artisans, organisations, entrepreneurs, and the business community to remain connected to the latest innovations in the date palm industry, and encourage the use of modern technologies in all fields and explore new niche markets.

As the global demand for date palm fruit grows, countries of the region should focus on maximising value and minimising waste. The economy of a country will grow if its resources are used efficiently and sustainably. We have witnessed this in the expansion of the product range from the fruit and its derivatives to include all parts of the tree including to derive drinks, bars, biofuel, seed oil and furniture. Latest biotechnological advancements have found use for the fruit and its by-products to induce microbial growth for fermentation to be sold as bioactive compounds.

### Conclusion

**The continued traditions, such as breaking fast during Ramadan with dates, by planting date palm to increase urban green spaces and increase quality of the environment and health, all contribute to strengthening the deep bond between the people and the tree. Youths will be instilled with connections and memories that last a lifetime. The memories then can be harnessed that turn the tree to art by artists, to innovative products by entrepreneurs, to emotion by writers, to a visualisation by filmmakers, and other endless possibilities. The Latin name Phoenix is a fitting scientific name for a tree that starts from a simple sapling only to be reborn and reimagined as new aspects of life.**

The human skills factor is considered as an important element in preserving the date palm cultural heritage. The region faces the risk of youngsters preferring more white-collar vocations to traditional palm date cottage industries. Regional governments and authorities need to work on understanding and adopting global market trends and facilitate technology, product design for innovation, marketing and building value chain linkages.

KHALIFA AWARD PHOTOGRAPHY COMPETITION © MOUNA MOHAMMED MAHDI, KIADPAI

b)

# Date Palm Festivals and Local Community Engagement

**HIS EXCELLENCY GENERAL FARIS KHALAF AL MAZROUEI**
Chairman of the Cultural Programs and Heritage Festivals Committee – Abu Dhabi

As one of the world's largest producers of dates, with millions of trees, the UAE recognises the importance of preserving date-palm production systems and the rich traditions surrounding the fruit. Date palm production contributes immensely to economic revenue in the country through export, which supports the government's goal of utilising other available resources to diversify away from oil. The date palm's wide range of uses for nutrition and raw materials also makes it important for food security in the region. Additionally, being a labour-intensive industry, date palm production contributes to job creation and income generation for farmers.

To this end, we established the Liwa Date Festival in 2005, as a platform to raise awareness of the essential development of palm tree agriculture, to encourage local farmers to embrace modern agricultural techniques and eco-friendly practices, and to promote their date-palm products through auctions and competitions.

### Why festivals have tremendous value

Date palm festivals are crucial to the efforts of safeguarding the legacy of the palm tree and improving the livelihoods of farmers. Not only do such events bring attention to the heritage and cultural significance associated with the date palm, and renew interest in the fruit among locals and tourists, but they also promote the cultivation of the finest varieties of dates and give farmers a platform to share sustainable agricultural methods and exchange ideas and expertise.

For example, the Model Farm Award category at Liwa Date Festival encourages farmers to improve the quality of their produce, maintain excellent hygiene at the farm, and preserve the quality of the soil. Another competition, Al Rutab Beauty, invites farmers to participate with only half-ripe dates that are locally harvested in the same year. While 70 percent of the grading points are decided according to the quality of the dates, 30 percent are considered after inspecting the farm, which should meet the highest standards for the preservation of the palm tree and use of modern, water-saving irrigation methods.

### Conclusion

**We are extremely proud of what the Liwa Date Festival has accomplished over the last 16 years, during which it has grown from a small local competition to a large international celebration of heritage that attracts thousands of visitors from the Arab World and beyond. In this period, the number of participants has increased, new award categories have been added, and the quality of dates has improved, along with the efficiency and environmental friendliness of farms in the UAE. We will continue promoting and supporting the development of the date palm sector, so that succeeding generations may appreciate its importance and enjoy its numerous benefits.**

**Date palm festivals are crucial to the efforts of safeguarding the legacy of the palm tree and improving the livelihoods of farmers.**

We are extremely proud of what the Liwa Date Festival has accomplished over the last 16 years, during which it has grown from a small local competition to a large international celebration of heritage that attracts thousands of visitors from the Arab World and beyond.

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واحة تمرة

**HER EXCELLENCY DR MAITHA BINT SALEM AL SHAMSI**
Minister of State
The UAE Federal Government

C)

# Date palm and gender

**In the life of Emirati people, palm trees are considered an important economic revenue. Upon palm tree farms Emiratis have depended for living. They settled in those farms and built their houses in the shadows of those trees. The palms trees were the source of their food and trade.**

### Women's place in agricultural history

In the past, Emirati women worked mainly in agriculture. At that time, the palm tree was the most important economic source for the family. It is no exaggeration to say that any woman living in Al Ain Oasis or any other oasis in the Emirates, knew everything about palm trees. Whether the plant was still a seedling, a sapling or a fruitful palm, Emirati women would know what was needed to take care of the plant in order to preserve it and see it grow well. Upon the establishment of the UEA, and the development witnessed in the economic and social areas, women turned to other aspects of work, leaving jobs in the agricultural profession in a very limited scope.

As the College of Agriculture in the United Arab Emirates University developed specialisations in food and agriculture, UAE women found a renewed interest in the agricultural sector. His Highness the Late Sheikh Zayed Bin Sultan Al Nahyan and Her Highness Shikha Fatima Bint Mubarak, Mother of the Nation, encouraged female students to enrol in this college. They were also keen on finding them jobs in suitable positions after graduation. This was an incentive for the Emirati woman to take part in this sector even though this participation is not yet at a large scale.

### Providing necessary support to the date palm sector

In the framework of encouraging the participation of women in this sector, the authorities have given advisory support to agricultural operations in general, and to dates palm industries in particular. This has led to an increase in the number of women who work in this vital sector. The authorities have also shown interest in the latest technologies in the area of various plantations, methods of irrigation, plant pestilence, preservation of dates quality and the development of related industries.

Women's engagement in the agricultural sector depends on several factors, most important of which is the state's economic interest and its relationship with food security, in addition to setting plans to enable young people – especially women – to join the sector. Current indicators show that the agricultural sector is a promising one for the youth, and it provides big opportunities for women. But this requires women to upgrade their abilities and skills in this sector in order to cope with the scientific and technological advancement. Society, therefore, has to support and encourage women's efforts in this area.

### A collaborative effort

Several governmental organisations and societies encourage the engagement of women in traditional industries that are based on the palm tree. Examples of such industries are seen in the Sougha Project, organised by the Khalifa Fund, the Al Ghadeer Project in the Emirati Red Crescent and the Center for Traditional Industries organised by the General Women's Union, among others.

In this regard, I would like to mention the Emirati Planting initiative of Her Highness Shikha Fatima Bint Mubarak. This is a modern educational project supervised by the Ministry of Education, and is an unprecedented quality move for a sustainable, productive school environment that produces an intelligent upbringing. The project is an embodiment of the 2020 Year of Wellness and the modern concepts of the education of manners. The project serves to instil such concepts in students and encourage them to take interest in agriculture and learn more about it.

Upon the directives of Her Highness Shaikha Fatima, the Ministry of Education compiled information about the trees and plants that grow in the Emirati environment, especially the palm trees. This was included in the social study textbooks prescribed for classes from grades one to nine. The initiative, which adopts the motto of "The Emirati Planting is at the hand of the Mother of the Emirates" focuses on public schools which have ample space ready for use. The initiative rests on the concept of giving schools space enough to accommodate agrarian, marine and plantation projects that suit the Emirati environment.

Schoolgirls have turned their attention to environmental plants, especially the palm trees. A group of girls from Zayed University invented an intelligent method to pollinate palm trees by using drones powered by artificial intelligence. The project won the first prize in the International Student Conference on Environment and Sustainability for 2019.The conference was held at the University of Shanghai with the participation of about 400 teams.

### A more inclusive future

The spread of education and the development of agricultural technology will provide a wide opportunity for women to work in this sector. The availability of a Ministry for Entrepreneurship, in addition to a Ministry of Food Security and a Ministry of Environment, will open up a wide scope of opportunities to work in the agricultural sector. It is very important, therefore, for women to invest in this opportunity and participate effectively, especially in light of the current circumstances in which food security has become a priority. We need to re-enforce the potentials of this sector through research and development which is considered the first step in investment. We also need to set special programmes to encourage women to be creative and innovative, especially as the sciences of agriculture and food industries move ahead.

Women can take the initiative in the areas of research and innovation in the agricultural sector. This requires the encouragement of women to join the colleges and specialised programmes which enhance potential in the areas of science and advanced agricultural technology. The initiative would also enable women to develop technologies to improve the dates industry and make use of this resource, not only at the local level but also at regional and international levels.

**It is no exaggeration to say that any woman living in Al Ain Oasis or any other oasis in the Emirates, knew everything about palm trees. Whether the plant was still a seedling, a sapling or a fruitful palm, Emirati women would know what was needed to take care of the plant in order to preserve it and see it grow well.**

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# 3.6 Date Palm Ecosystems, Restoration and Climate Change: The Youth Perspective

**MOHAMED FOUAD BERGIGUI**
GEF Portfolio Support and Project Development Specialist Food and Agriculture Organization of the United Nations

**Deeply rooted in the cultures, traditions, and diets across the Sahel in the NENA region, the iconic value of date palms is increasingly stretching beyond nutrition and livelihoods to embrace its true potential as one of the promising value chains that can drive the transition towards a circular bioeconomy. By tapping into the unseized potential of date palms throughout the region, nations can accelerate the pace towards meeting their national and localised SDG targets by 2030, while also catalysing regional efforts to build back more resilient economies as we navigate the uncharted territories of the new normal post-COVID-19.**

### Moving beyond the iconic value of date palms

Traditionally used as a staple food, a source of shade, and a raw material shaped by skilled women and men to build and trade shelters, boats, ropes, and furniture, it comes with no surprise to see date palms mentioned in the Christian, Islamic and Jewish religions[58] and being cherished as a symbol of life. From an ecosystem perspective, besides their tolerance to salty soils and droughts, date palms trees play important roles such as reducing soil erosion, fighting desertification, filtering dust and pollutants, preserving biological diversity, enabling micro-climate temperatures[59], landscaping, and contributing to the diets of several frugivore species in novel ecosystems.[60]

Date palm is indeed a valuable natural asset to reverse land degradation and the loss of biodiversity, maintain the flows of critical ecosystem services, boost resilience, adapt to climate change, and strengthen livelihoods. While date palm distribution is being affected by climate change[61], there is a feedback loop where the date palm industry can also be part of the solution to the climate crisis.

### Seizing the promising potential of date palms, the youth perspective

Young people can play a leading role at the frontlines to seize the untapped potential of date palms, to unlock the power of breakthrough innovations, and reshape the future of the date palm industry. Research and development (R&D) investments are already yielding promising results, thus paving the way to reboot our linear economies while laying the foundations for circular bio-economies.

For instance, instead of using fossil fuels, or planting energy crops and grabbing land that could be used to grow plants for food and agriculture, naturally-available waste from date palms can be turned into biofuels and fertilisers using energy-efficient processes or even solar energy[62]. Similarly, biotechnology can drive the development of stress-resilient cultivars[63] by tapping into the gene pool to enhance production, improve quality, and adapt to climate change. To provide young people with the opportunity to make a difference, the FAO established a youth committee and is supporting other youth-focused initiatives, such as the junior farmer field and life schools[64], enabling thus a dynamic workforce and supporting international efforts and policies that promote youth employment and leadership, while delivering food security and environmental benefits.

The date palm industry offers a wide array of possibilities for young people to innovate and become the next generation of entrepreneurs at the frontiers of a decarbonised circular economy. Young entrepreneurs can play a key role to transform the potential of national bio-economies into green jobs and break the silos between venture capital and youth-led startups to shape innovation-driven ecosystems along the value chain. Drawing on the lessons learned from experiments along other agricultural value chains, blockchain-enabled platforms, for example, can disrupt the date palm supply chain by applying algorithms to match offer and demand while using valuable insights from behavioural sciences to predict consumption patterns. To build trust along the value chain, buyers can scan a QR code that tells the story of their dates by revealing the palm tree it came from, where it was packaged, how it was transported and the costs incurred at each milestone.

### The future of date palms, young people at the frontlines

As the innovation waves are building and breaking on the shores of our food systems, young people can play a leading role to disrupt business-as-usual and experiment with a blended mix of technologies – from robotics and artificial intelligence, to the internet of things, blockchain, and big data. For instance, FAO's hand-in-hand geospatial platform uses big data to inform decision-making and impact assessment.[65] But innovations in the fields of agriculture and food security are not just about technology, it goes beyond tech startups. As showcased in FAO's work to sow the seeds of transformation to achieve the SDGs[66], it also encompasses adopting novel approaches, such as to access markets and deliver extension services.

While the innovation winds are blowing towards a promising future, due consideration should also be given to the traditional knowledge enshrined in the region's globally important agricultural heritage systems and biosphere reserves. Young people can lead the way to innovate by using blended approaches where novel solutions are guided by ingenious farming practices and interdisciplinary approaches reported all across the region. From the UAE's Al Ain and Liwa historical date palm oases[67] to Morocco's oases in the Tafilalet valleys[68], the birthplace of the famous Mejhool dates. By investing in innovation, the youth can be part of the solution to trigger a paradigm change towards a more sustainable and resilient future, a one that is carbon-neutral, climate-smart, and food secure.

Young people can play a leading role at the frontlines to seize the untapped potential of date palms, to unlock the power of breakthrough innovations, and reshape the future of the date palm industry. Research and development (R&D) investments are already yielding promising results, thus paving the way to reboot our linear economies while laying the foundations for circular bio-economies.

Young people can lead the way to innovate by using blended approaches where novel solutions are guided by ingenious farming practices and interdisciplinary approaches reported all across the region.

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# 4 Bio-Circular Economic Potential

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DATE PALM WASTE
AL AIN OASIS
© DR SANDRA PIESIK

# 4.1 FAO and Sustainable Bio-economical Policy and Frameworks

**ANNE BOGDANSKI AND MARTA GOMEZ SAN JUAN**
Office of Climate Change, Biodiversity and Environment
Food and Agriculture Organization

**Our global food supply depends on complex value chains, sustained by large amounts of biological and fossil resources. Global resource use has tripled in the last 50 years. The current linear economic model highly depends on finite resources such as fossil fuels, and on a system that does not capture the maximum value from biological resources, such as date palm. While most of the current global food production and distribution is inherently unsustainable, the COVID-19 pandemic has shown that global industrialised food supply chains are fragile as well. Environmental, health and social risks, and hidden costs of current food systems, is a challenge that needs to be addressed at global, regional and national levels.**

### Towards a sustainable and circular bioeconomy

According to a 2019 study by the Food and Land Use Coalition, food systems generate 'hidden' un-accounted environmental, health and poverty costs estimated at almost $12 trillion a year, a number larger than the value of the system's world output measured at market prices.

Bioeconomy is understood as "the production, utilisation and conservation of biological resources, including related knowledge, science, technology and innovation, to provide information, products, processes and services across all economic sectors aiming towards a sustainable economy", a definition that was coined at the Global Bioeconomy Summit in 2018.

Bioeconomy, if done sustainably and in a circular manner, can comprehensively address interconnected societal challenges such as food security, human and ecosystem health, fossil-resource dependence, natural resource scarcity and climate change, while achieving sustainable economic development, and supporting the achievement of many SDGs.

### South-South and Triangular Cooperation

FAO has set out to support countries and regions in the development of sustainable and circular bioeconomy strategies and programmes.

In 2016, an FAO-led International Sustainable Bioeconomy Working Group (ISBWG) was established to support the exchange of knowledge about sustainable and circular bioeconomies between its members.

The ISBWG is a South-South and Triangular Cooperation (SSTC) platform as it provides knowledge and experience-sharing related to bioeconomy-relevant good practices, policies and monitoring, and evaluation frameworks. The group comprises a diverse pool of experts, including twenty member countries, as well as regional governing bodies and affiliated institutions, non-governmental organisations, private sector entities and research institutions.

The first milestone for the group was the design and agreement of the Aspirational Principles and Criteria for a Sustainable Bioeconomy in November 2016. ISBWG also contributes with various activities to improve coordination at international level, and the knowledge acquired by all ISBWG members on how to mainstream sustainability and circularity into the bioeconomy is used to inform several national and regional strategy and programme development processes. The mechanism adopted by the ISBWG is a good example of how to achieve SDG17, in particular target 17.9 on enhancing international support for implementing national plans, including through SSTC. These Principles and Criteria provide

Bioeconomy is understood as "the production, utilisation and conservation of biological resources, including related knowledge, science, technology and innovation, to provide information, products, processes and services across all economic sectors aiming towards a sustainable economy", a definition that was coined at the Global Bioeconomy Summit in 2018.

FAO has set out to support countries and regions in the development of sustainable and circular bioeconomy strategies and programmes.


FIGURE 10: EXAMPLES OF THE MULTIPLE USES OF DATE PALM WASTE PRODUCTS AT DIFFERENT STAGES OF THE VALUE CHAIN
© ANNE BOGDANSKI AND MARTA GOMEZ SAN JUAN OFFICE OF CLIMATE CHANGE, BIODIVERSITY AND ENVIRONMENT FOOD AND AGRICULTURE ORGANIZATION

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guidance on the common goals of a sustainable and circular bioeconomy that countries and regions can apply, and aim to set a common direction among global key players in the bioeconomy, including those in the date palm sector.

### Circular bioeconomy in the date palm sector

In 2018 there were 0.8 million hectares of date palm cultivated in the twelve main production countries of the MENA region.[69] This corresponds to 100 million trees, which means two-thirds of the world's plantations. This production generates around four million tonnes of in-farm waste per year, on top of the waste generated in industries at the processing stage (mainly date pits). Almost half of this waste comes from leaves, including midribs, rachis and leaflets. As shown in Figure 4, other waste includes stems, pits, seeds, coir, spathes, sheaths, petioles, fronds, trunks, offshoots and pruning biomass.[70]

Date palms have great potential for capturing carbon and cleaning the air. One tree can absorb 400 litres of $CO_2$ per day (or 0.79 kg $CO_2$ per palm per day), converting the gas into sugars and other important compounds.[71] This means that the 100 million trees in the MENA region have the capacity to absorb 28.7 megatons of $CO_2$ per year. This captured carbon by photosynthesis comes on top of the carbon captured by soil microorganisms, not readily quantified yet. Moreover, the captured carbon can be stored in products, if the biomass waste is used to produce a wide range of bioproducts.[72] As can be seen in Figure 4, the products can range from bioplastic packaging materials, to green chemicals, textiles, furniture or enzymes. Manufacturing bioproducts from date palm waste offers a unique opportunity to add higher value to the waste and to keep the captured carbon longer in the life cycle, slowing down the greenhouse gas (GHG) emissions rate.[73] Also, bioeconomy opportunities include alternative production pathways to current pollutant or unsustainable systems such as the production of alternative protein, fungi, on date palm waste that is also being looked at in the region.[74] The opportunities for the MENA region are significant: In the region, this biomass waste is currently either discarded or used to produce low-value products such as animal feed and home furniture.

**Summary**

**Designing out waste in the palm sector has the potential for adding significant value to date palm production. FAO guides countries and regions in the development of holistic sustainable and circular bioeconomy strategies and programmes, which correspond to the global call for a more sustainable development at national, regional and global level.**

Designing out waste in the palm sector has the potential for adding significant value to date palm production.

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DATE PALM TREE
TEXTURE
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# 4.2 Bio-economy and the Manufacturing Sector

**JOSSY THOMAS, TAREQ EMTAIRAH AND DR LUDOVIC LACROSSE**
United Nations Industrial Development Organization

The United Nations Industrial Development Organization (UNIDO), with its mandate of inclusive and sustainable industrial development, has been promoting principles of bioeconomy through its support to the agro-industrial sector of developing and least-developed countries including small island developing states over the years. Key to these efforts has been the promotion of circularity principles in the manufacturing industries.

The United Nations Industrial Development Organization (UNIDO), with its mandate of inclusive and sustainable industrial development, has been promoting principles of bioeconomy through its support to the agro-industrial sector of developing and least-developed countries including small island developing states over the years.



In 2016, the ISBWG developed its ten Aspirational Principles for Sustainable Bioeconomy, which address the following issues:

**1) Supporting food security and nutrition at all levels.**

**2) Conserving, protecting, and enhancing of natural resources.**

**3) Supporting competitive and inclusive economic growth.**

**4) Making communities healthier, more sustainable, and harnessing social and ecosystem resilience.**

**5) Relying on improved efficiency in the use of resources and biomass.**

**6) Applying responsible and effective governance mechanisms.**

**7) Implementing existing relevant knowledge and proven sound technologies and good practices and, where appropriate, promoting research and innovation.**

**8) Using and promoting sustainable trade and market practices.**

**9) Addressing societal needs and encouraging sustainable consumption.**

**10) Promoting cooperation, collaboration and sharing between interested and concerned stakeholders in all relevant domains and at all relevant levels.**

These ten principles are applicable to all bioeconomy sectors, including bioenergy, and are in line with the UN SDGs.

## Bioenergy and bioeconomy in developed and less-developed countries

There is still an enormous development potential for bioenergy and bioeconomy in developed countries (DCs) and less developed countries (LDCs). The economies of these mostly tropical countries are indeed still strongly based on agriculture and forestry. Food processing industries (rice mills, sugar mills, palm oil mills, etc.) generate large quantities of solid and liquid residues, which, if they cannot be used in other bioeconomic sectors, can be used as fuel. Forest and wood processing industries (sawmills, plywood/particle board factories) also generate significant amounts of solid residues, which can either be used as raw material in further downstream activities or as fuel in the manufacturing process.

Given the diversity of bioenergy projects demonstrated over the years by UNIDO and various other players, there is sufficient evidence that all SDGs can theoretically be covered by bioenergy projects.

**There is still an enormous development potential for bioenergy and bioeconomy in developed countries (DCs) and less developed countries (LDCs).**

## Bioenergy and SDGs

Bioenergy can help reduce poverty, as it offers small-scale farmers the potential to increase and diversify their crop production and generate additional revenues (SDG 1: No poverty). This means that small farming communities can have access to food, a better diet and improved health conditions, thus enjoy a better standard of living (SDG 1: No poverty, SDG 2: Zero hunger and SDG 3: Good health and wellbeing).

The use of biofuels such as bioethanol can reduce indoor air pollution (impacting on SDG 3: Good health and wellbeing) thanks to cleaner cooking. Vocational training and education in bioenergy (SDG 4: Quality education) raises the level of knowledge and understanding on these technologies and paves the way to new jobs, especially in the countryside (SDG 8: Decent work and economic growth). This includes women, who can improve their income and status (SDG 5: Gender equality).

Some bioenergy technologies, such as biomethanation, specifically address the treatment of wastewater and help reduce water pollution (SDG 6: Clean water and sanitation). All of them contribute to the access to affordable, reliable, sustainable, and modern energy across the globe (SDG 7: Affordable and clean energy). One of the objectives of bioenergy is to add value to biomass and allow the development of new activities and related jobs (SDG 8: Decent work and economic Growth) through the improvement of existing practices, the introduction of innovative technologies and the enhancement of the infrastructure along the whole value chain (SDG 9: Industry, innovation and infrastructure).

The development of bioenergy projects in rural areas, close to the biomass feedstock production, can contribute to the reduction of inequalities in less developed areas (SDG 10: reduced inequalities).

The management of organic waste via bioenergy conversion is key to making cities and communities more liveable and sustainable (SDG 11: Sustainable cities and communities). Production, promotion, and consumption of biofuels contributes to the improvement of the environment through the reduction of fossil fuel consumption, especially in the household energy and transport sector, and the reuse of waste material generated by bioeconomy activities (SDG 12: Responsible consumption and production). Within the bioeconomy, the development of bioenergy is one of the highest contributors to the mitigation of GHG emissions and carbon sequestration (SDG 13: Climate action).

Bioenergy conversion of waste that would otherwise be discharged into rivers, canals, and oceans can strongly contribute to the preservation of aquatic life (SDG 14: Life below water).

The sustainable management of biological resources – and the production and supply of biomass feedstock to bioenergy processes – can help prevent land degradation (SDG 12: Responsible consumption and production & SDG 15: Life on land). This also supports rural communities through the creation of more equitable and peaceful societies, which should generate more sustainable institutions (SDG 16: Peace, justice and strong institutions).

Many countries still face challenges in implementing bioenergy initiatives. These challenges may have already been solved elsewhere. The exchange of experience and the creation of global partnerships can help bioenergy keep growing steadily throughout the world (SDG 17: Partnerships for the goals).


## Key lessons

Proven and reliable technologies do exist from a small to large scale, and are thus able to provide solutions at household, community, and industrial levels. When it comes to the implementation of bioenergy projects, the type of technology should be carefully selected, so that it can convert the locally available resources and meet the local energy requirements. Therefore, the size of the equipment is a key parameter for a successful bioenergy project. It must be selected according to the feedstock availability and to the market for the final product (solid fuels, biogas, bioethanol, electricity, etc.) over the project lifetime. The technology has often strict requirements regarding the quality of the feedstock.

The management and organisation of the whole supply chain is key to the success of a bioenergy project. It goes from the production and collection of sufficient raw material, its purchase at a fair price and to its conversion into a final product that is attractive enough to be sold in a competitive market. This fair balance between the buying price of feedstock and the selling price of the end-product can have a significant impact on the economic, social, and environmental wellbeing of local populations.
Another key factor is the way plants are operated and maintained. When implementing a new plant in a DC or LDC, in-depth training of the operators must be organised to make sure it will be properly operated and maintained,

and that the equipment supplier will not have to be called every time there is a minor breakdown.

The transfer of a new technology to DCs and LDCs also means building capacity. It shall include other stakeholders such as farmers, biomass growers, policymakers, potential investors, and financiers. The involvement of research and development as well as academic institutions in technology transfer is essential for the absorption of the technology by the country. Capacity building should be combined with public awareness campaigns and, whenever possible, include workshops and site visits to existing reference projects which have been successfully operated for a few years.

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**Conclusions**

**Based on UNIDO's experience so far, bioenergy projects are in line with most of the SDGs, but this can only be achieved if the projects are professionally designed and operated.**
**The preparation phase of a bioenergy project is crucial for its smooth implementation, operation, and sustainability.**
**A preliminary study must include a thorough analysis of the sustainability of the whole value chain, from feedstock production to the demand of the final product (biomass fuel, biogas, bioethanol, heat, electricity, etc.). This analysis must encompass many key factors, such as the feedstock production and supply, the reliability and appropriateness of the bioenergy conversion technology, the economic viability and bankability of the project, the policy, legal and regulatory frameworks of the country or region of implementation, the awareness, familiarity of all stakeholders with this type of technology and equipment, the capacity and skills of the local operators and, ultimately, the environmental friendliness and sustainability of the project.**

FIGURE 11: BIO-CIRCULAR ECONOMY AND MANUFACTURING SECTOR
© KHALIFA INTERNATIONAL AWARD FOR DATE PALM AND AGRICULTURAL INNOVATION,
2021 AND 3 IDEAS B.V.

The transfer of a new technology to DCs and LDCs also means building capacity. It shall include other stakeholders such as farmers, biomass growers, policymakers, potential investors, and financiers. The involvement of research and development as well as academic institutions in technology transfer is essential for the absorption of the technology by the country.

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# Bio-Circular Economy and manufacturing sector


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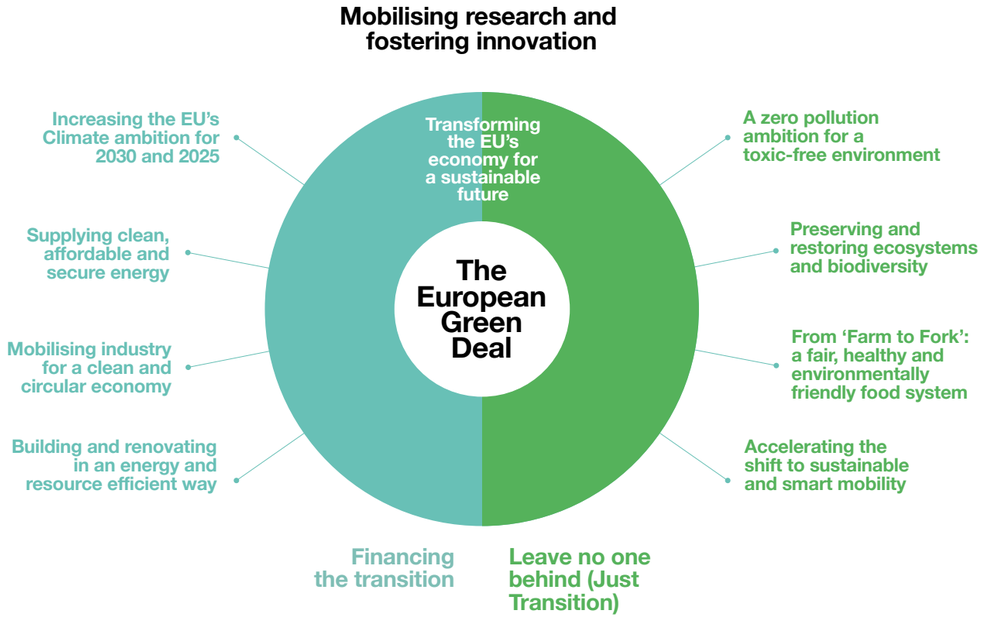
# 4.3 The European Perspective on the Bio-Circular Economy

**FREEK VAN EIJK**
Director
Holland Circular Hotspot

**We and our planet are facing some major challenges. Climate change, loss of biodiversity, the “plastic soup” littering oceans, and providing access to resources for our industries are just a few of them. Will it get better? The OECD Global Material Resources Outlook to 2060 projects a doubling of global primary materials use between today and 2060.[75] The Ellen MacArthur Foundation stated that in 2050 there might be more plastic in our oceans than fish.[76] Seawater rise will impact the deltas of the world (80 percent of global GDP takes place in deltas). One-third of the food we produce is wasted. To feed the world in 2050 we have to double food production.**

**A circular economy is often explained as a way to keep resources in circulation much longer. But it is not only about keeping materials in the loop. It also about renewable energy, preservation of biodiversity, social inclusiveness and new coalitions.**






COVID-19 has made the dependencies and interconnectedness of supply chains painfully clear. Today’s crisis is a ‘wakeup call’ for other risks just beyond the horizon that are climate and resource related. We are close to reaching irreversible tipping points and floods, droughts, forest fires, sea level rise and desertification are going to hit us hard – leading among other things to more migration and resource-related tension. Doing more of the same cannot be the answer.

**Go circular**

A transition to a circular economy makes more than makes sense in these circumstances. A circular economy is often explained as a way to keep resources in circulation much longer. But it is not only about keeping materials in the loop. It also about renewable energy, preservation of biodiversity, social inclusiveness and new coalitions. It is another way of designing, producing, consuming and dealing with waste. It is a system change and it is about both economy and sustainability.

The Netherlands is building a national and international circular economy programme that reaches across all sectors of society. Our government has pledged to become circular by 2050, including a 50 percent reduction of non-renewable raw materials by 2030. A seemingly unreachable target. It is inspirational and I believe we will get close to that target.

FIGURE 12: THE EUROPEAN GREEN DEAL
© FREEK VAN EIJK DIRECTOR HOLLAND CIRCULAR HOTSPOT

To overcome the challenges posed by climate change and environmental degradation, Europe is striving to be the first climate-neutral continent, where economic growth is decoupled from resource use and no person, and no place, is left behind. To do this, it will carry out a series of initiatives that will protect the environment and boost the green economy.

As a main building block of the European Union (EU) 'Green Deal', the European Commission has adopted a new Circular Economy Action Plan, which features a set of initiatives along the entire life cycle of products, targeting for example their design, promoting circular economy processes, fostering sustainable consumption, and aiming to ensure that the resources used are kept in the EU economy for as long as possible.[77] It introduces legislative and non-legislative measures targeting areas where action at the EU level brings real added value.

Adopting circular economy principles would bring considerable benefits to the EU, such as:

- The overall benefits amount to €1.8 trillion by 2030, double the benefits of the current development path.
- The average disposable income for EU households would increase by €3,000, or 11 percent higher than the business as usual development path.
- GDP would increase by as much as 11 percent in 2030 versus today, whereas the current development path shows 4 percent growth.
- Carbon dioxide emissions would be reduced by 48 percent in 2030, relative to today's levels or 83 percent by 2050.
- For primary materials from automotive and construction sectors, real estate land, synthetic fertilisers, pesticides, agricultural water, fuels, and non-renewable electricity, material consumption could go down 32 percent by 2030 and 53 percent by 2050, compared with today.

To make the transition to a complete circular economy, actions are required from all stakeholders and new cross-sectoral partnerships are inevitable:

- (Local) government should set the ambition (urgency), set boundary conditions and allow for experimentation.
- Knowledge institutes develop new insights, enable valorisation of their knowledge and create awareness.
- Local entrepreneurs show guts, take risks, accelerate and are the main actors of a scale-up.
- Involvement of inhabitants and the leaders (and consumers) of tomorrow is crucial.

### Lessons for other countries?

The Dutch do not pretend to have all the answers. However, our location in a delta forced us very early on to work together to keep our feet dry and to face environmental challenges. You could say that we learned the hard way, and that our lessons and failures might inspire others. The slogan of the Dutch is pioneering solutions to global challenges. Let me share some lessons.

### We are all connected and dependent

Changing today's linear system is a mighty challenge. In today's world, value-chains and resource flows are international. The environmental impact of products is not reflected in the price and there are disturbing market instruments that make a transition cumbersome (think of agricultural or fossil fuel subsidies). There are winners in the transition to a circular economy, but there are also losers. Linear companies can exercise power in the value chain to delay or even block a circular economy transition. First movers potentially have the biggest advantage. It takes courage to be a first mover because you will run into all kinds of barriers. It asks for both business and government leaders to think ahead about future markets and viable and liveable societies.

### Advice on stimulating circular innovation

It helps if (national and local) government sets an ambitious goal that fits with the local dynamics (energy neutral areas, zero emission inner city centres, circular or bio-based plastic valley, zero-waste factories). At the local level, it is important to give a platform to frontrunners that can inspire others. The local government can be the facilitator that bring actors together, for example in industrial areas where waste for one can be a resource to another. Give room for experimentation and create additional dynamics by letting start-ups temporarily use empty buildings. A bottom-up movement with a local hero can be very powerful. It is essential to include circular thinking in education: our children are the consumers and the leaders of tomorrow.

### Innovation is important but to be impactful we need to accelerate and scale up

Circular hotspots or hubs are organisations where the public sector and the private sector come together to 'fast-forward' the transition process to a circular economy. The main goals are to promote and share circular knowledge, business models opportunities, and bridge the gaps across the network so that information arrives to all. By sharing what is already being done, and what soon will become possible, circular hotspots create space and inspire motivation for new partnerships and cross-sectoral strategies to happen. By organising conferences, meetings, missions, and preparing publications of showcases and informative materials, circular hotspots can act as true catalysts for the local economy and boost sustainable development.

As a main building block of the European Union (EU) 'Green Deal', the European Commission has adopted a new Circular Economy Action Plan, which features a set of initiatives along the entire life cycle of products, targeting for example their design, promoting circular economy processes, fostering sustainable consumption, and aiming to ensure that the resources used are kept in the EU economy for as long as possible.

Changing today's linear system is a mighty challenge. In today's world, value-chains and resource flows are international. The environmental impact of products is not reflected in the price and there are disturbing market instruments that make a transition cumbersome (think of agricultural or fossil fuel subsidies).



**If you want to go fast, go alone;**

**if you want to go far, go together.**

(AFRICAN PROVERB)

# Bio-Circular Economy and Date Palm Industry

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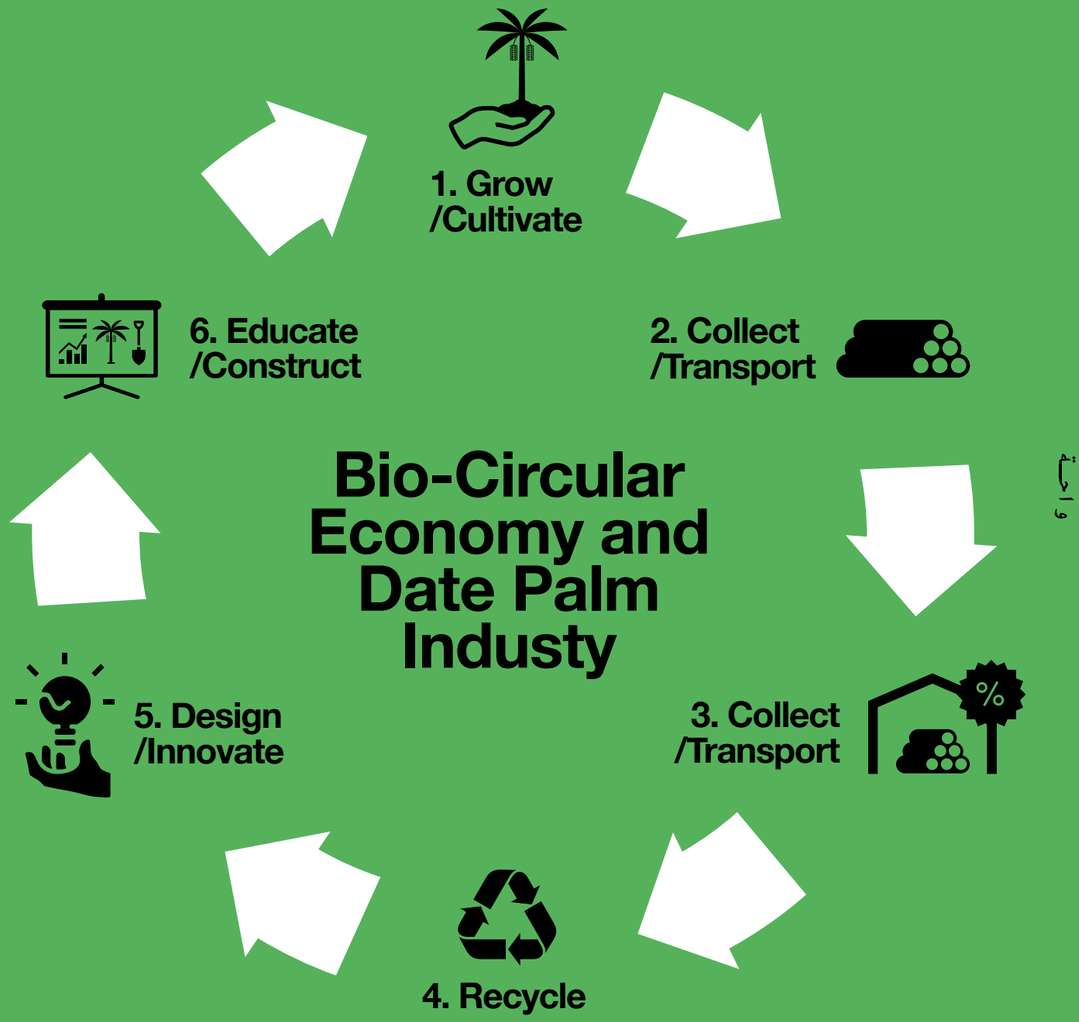


FIGURE 13: BIO-CIRCULAR ECONOMY AND DATE PALM INDUSTRY


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# 4.4 Future Applications of Plant Fibres: Nanomaterials and Composites

**PROFESSOR MIZI FAN**
Director of Research
Brunel University London

**Plant Fibre is an abundant resource: renewable, carbon negative and with many other merits. Plants through photosynthesis can produce 1.5x10$^{12}$ tonnes of natural celluloses annually.**

Plant fibre is an abundant resource: renewable, carbon negative and with many other merits. Plants through photosynthesis can produce 1.5x10$^{12}$ tonnes of natural celluloses annually.[78] The development and utilisation of plant fibre resources has mainly concentrated on 1) producing new energy and chemical products to replace traditional products such as oil, natural gas, coal and other chemicals, and 2) the full utilisation of plant fibres for new materials or products (e.g. woven lines, thread and hemp rope, paper or woven felts). Natural fibres can also be used to make other materials, such as hybrid composite materials. The low cost and effective strengths of plant fibres, in addition to environmentally friendly 'green' process and products, ensure their endless prospects.[79]

Natural fibres are substances composed of continuous or discontinuous filaments and can be classified into plant fibre, animal fibre and mineral fibre. Plant fibre can be extracted from the seeds, fruits, stems and leaves of plants, and is known as natural cellulosic fibre as the main chemical composition of plant fibre is cellulose.

### Uses of plant fibres

Plant fibre has been widely used in papermaking, textile, water treatment, and medical and construction products because of its wide range of resources, renewable and biodegradable characteristics. Various papers with



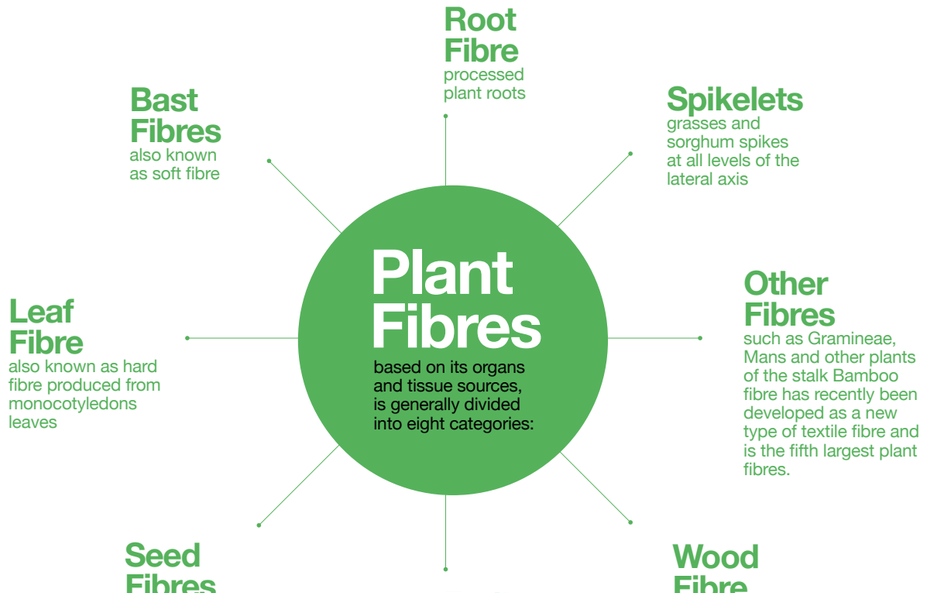


FIGURE 14: PLANT FIBRES
© PROFESSOR MIZI FAN DIRECTOR OF RESEARCH BRUNEL UNIVERSITY LONDON

different end uses could be produced through changing the combination of chemical and mechanical pulp fibres. In the **textile industry**, plant fibre such as viscose, Lyocell and others have been used for underwear, bedding, towels, bathrobes and bathroom supplies, non-woven fabrics, sanitary materials, daily decorations, and many other products.

In the **medical industry**, plant fibres have also been attempted to produce a variety of cellulose-based membranes through immersion precipitation phase transformation, melt extrusion, thermal induced phase separation and other methods, including cellulose microfiltration and ultrafiltration membranes, nanofiltration membrane and reverse osmosis membrane.

Because of its good biocompatibility, plant fibres are widely used in the preparation of various medical products, such as artificial skin, dialysis membrane, bioreactor and drug release systems, tissue engineering, construction of scaffold materials for cartilage repair, dental implants, artificial blood vessels, nerve surgical dressings, and dural repair substances. Plant fibre can also be

**Plant Fibre has been widely used in papermaking, textile, water treatment, and medical and construction products because of its wide range of resources, renewable and biodegradable characteristics.**

used as a template for the synthesis of antimicrobial materials, metal nanomaterials and surface-enhanced Raman spectroscopy for medical testing of special materials.

In the field of **construction**, plant fibre can be used to manufacture a variety of composite materials including fibreboard, particleboards, wood-plastic composites and many other laminate materials. Plant fibre composites have been widely used in furniture manufacturing, building decoration, automobile and motorcycle manufacturing and household appliances.
In recent years, many developments in plant fibre have taken place, especially in the nano, electronic and intelligent fields, such as nanomaterials, gel materials, optoelectronic materials and biomimetic intelligent materials.

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### Inherent nano and versatile structures of natural fibres

Plant fibres consist of a variety of cell morphology, pore structure and chemical compositions, and are a class of structured polymer-based natural composite materials, ranging from the centimetres of wood fibre, micron-grade wood cells to nanoscale microfibres and to the cellulose molecules.

### Plant fibre-based nanocelluloses

Nanocellulose from plant fibres can be prepared by physical methods, e.g. high-pressure homogenisation, mechanical grinding, ultrasonic and chemical methods, e.g. acid and alkali hydrolysis, and biological methods, (e.g. cellulase hydrolysis).[80] Nano-cellulose fibres have broad application prospects in a wide range of industrial sectors. The current research focus is on the development of cellulose nanostructure orientation design and construction theory, and methods to regulate the nanostructures of cellulose at the molecular level. This will achieve the design and trimming of cellulose nanostructures, and construct and assemble nanocellulose functional materials. In addition, the advance in technologies directs to more green and efficient approaches for the development of high value-added celluloses.

### Plant fibre-based aerogels

Cellulose aerogel is another new plant fibre development. Cellulose aerogel is a three-dimensional network structure constructed of cellulose or cellulose derivatives or with other polymers through cross-linking architectures. According to the type of crosslinking, gel size or gel medium, the cellulose gel can be divided into chemical gel or physical gel, microgel or nano-gel and hydrogel.

The construction of the cellulose gel can be achieved by covalent or noncovalent bonds (i.e. intermolecular interactions). The cellulose aerogel has the characteristics of biocompatible and biodegradable, and can be widely used in many applications, for example biomedical, filter, absorbent and highly insulated products.

### Cellulosic composites

Dissolving plant fibres with cellulose solvents (e.g. ionic liquids and N-methylmorpholine-N-oxide (NMMO) solutions) can lead to the development of a flexible transparent nanocellulose composite films. The incorporation of inorganic oxide (e.g. indium tin oxide) conductive materials with nanocellulose gives rise to flexible transparent conductive film as the base material for optoelectronic devices.

Some of the optoelectronic materials prepared with plant fibre celluloses have photoluminescence or fluorescence properties and can be used in organic light-emitting diodes, organic thin-film transistors, security and packaging. Some of these materials also have piezoelectric and ion transport effects for sensors, micro-electromechanical system, artificial muscle, microwave remote control drive. The films embedded with multi-walled carbon nanotubes can be used to prepare flexible lithium batteries, super capacitors and paper-based energy storage devices. Conductive cellulose films can also be used to produce the electrode material for flexible solar cells, flexible displays and other relevant applications.[81,82]

**Plant fibre composites have been widely used in furniture manufacturing, building decoration, automobile and motorcycle manufacturing and household appliances. In recent years, many developments in plant fibre have taken place, especially in the nano, electronic and intelligent fields, such as nanomaterials, gel materials, optoelectronic materials and biomimetic intelligent materials.**

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### Plant fibre composites

Fibre-reinforced plastic (FRP) materials consist of strong plant fibres and polymer matrix. Modern polymers were first developed in the 1930s, when oil became the main source of organic chemicals from which synthetic plastics, fibres, rubbers and adhesives were made. However, over the last two decades, advanced composite materials (e.g. natural fibre composites), have emerged as an attractive alternative material for many applications. Certain combinations of natural fibres and matrix could result in engineering materials that exhibit the strength of the fibres with great toughness, since the fibres inhibit crack propagation through the resin matrix.

### Conclusion

**Plant fibre is one of the most abundant resources in nature. It is non-toxic, biodegradable, biocompatible characteristics, unique natural structure of porous, flexible and high mechanical strength implicate its endless prospects. New solvents, advanced technologies and innovative ideas continue to evolve, and the applications of advanced plant fibre composites will become more widely dispersed, and its research more vigorously undertaken.**

واحة

**Plant fibre is one of the most abundant resources in nature. It is non-toxic, biodegradable, biocompatible characteristics, unique natural structure of porous, flexible and high mechanical strength implicate its endless prospects. New solvents, advanced technologies and innovative ideas continue to evolve, and the applications of advanced plant fibre composites will become more widely dispersed, and its research more vigorously undertaken.**

تمرة

DATE PALM WASTE
AL AIN OASIS
© KIADPAI

# 4.5 Challenges Faced in the Arab Region Date Palm Value Chain

**PROFESSOR DR IBRAHIM EL-DUKHERI**
Director General
The Arab Organization for Agricultural Development

The most important factor for smooth and efficient operation of the value chain is the relationship among actors and the governance of the value chain particularly the rules and regulations that govern the operation of the whole system and the relation among the actors and stakeholders in the value chain.

**In 2016, the cultivated area of the date palm in the Arab Region registered 1.014 million hectares, which was 75 percent of the global date area.[83]**

**In 2016, date production from the Arab region was 6.55 million tonnes, 77 percent of the world's total date production.[84]**

## A typical date palm value chain in the Arab region

Date palm value chains in the Arab region are generally composed of four main functions, namely production, post-harvest handling, marketing and consumption. The main stakeholders of the value chain are the inputs suppliers (seedlings, machinery and equipment, chemicals, packing materials, etc.); producers of dates; collectors who assemble the produce from production areas including agents who buy on behalf of wholesalers, exporters, processors or retailers; the commission brokers who buy on behalf of wholesalers and exporters or sell on behalf of farmers and other sellers.

The most important factor for smooth and efficient operation of the value chain is the relationship among these actors and the governance of the value chain particularly the rules and regulations (formal and informal) that govern the operation of the whole system and the relation among the actors/stakeholders in the value chain. The efficiency of each stage of the value chain greatly depends on the competitiveness of each stage and the easiness of entrance and exists of main actors from each stage.

## Challenges for the sustainable development of the date palm value chain

The sustainable development of the date value chain is influenced by a multitude of challenges and constraints. The most pertinent of those strategic drivers are summarised here:

1. **Low productivity –** resulting, in most countries, from institutional, financial and physical resources and environmental constraints, in addition to weak human resources and managerial capacities. Most countries are facing the problem of ageing trees, inferior quality varieties with low yields and the difficulty of replacing them due to insufficient planting materials (small supplies of offshoots and limited tissue culture palms). Furthermore, many farmers do not apply the necessary and optimum amount of inputs for production – either because of poor knowledge, high prices or lack of labour, pesticides, fertilisers, etc.
2. **Lack of industrialisation –** despite the rising costs of hired labour, and its scarcity in some occasions, the mechanisation of some farming operations – especially those related to date palm pollination, pruning and harvesting which proved successful in some Gulf Cooperation Council (GCC countries) are not widely adopted across the Arab region.
3. **Water scarcity –** the Arab region is the most water-scarce region in the world, and currently exploits over 74 percent of its renewable water resources. Rivers originating outside the region are acutely vulnerable and subject to the management of river flows upstream. The situation for underground water in the region is more alarming, especially for date farming which constitutes the basis of eco-systems in desert oases. The groundwater aquifers providing water for date palms are coming under increasing water stress and are in real danger of depletion.
4. **Shortage of qualified staff –** most countries face the problem of shortage of qualified and experienced staff in all aspects of date development including production, propagation, research, pest and disease control, processing, packaging, storing, marketing, and others.
5. **Date palm biodiversity losses** – caused by many direct factors comprising climate change, civil strives and wars, over exploitation of the vegetative cover, biotic agents, changing farming practices, socioeconomic change including increasing urbanisation and encroachment of residential areas into agricultural land.
6. **Pests and diseases –** Date palm pest and diseases are causing losses of about 28 percent of production. Pests and disease management strategies are based on intervention after occurrence of crop disorder. Date palm menaces are many, including Red Palm Weevil, Bayoud, Green Pit Scale, Dubas date bug, Boufaroua and black scorch.
7. **Inefficient post-harvest handling and high post-harvest losses –** due to limited storage facilities (particularly at the farmer level) and inadequate processing.
8. **Ineffective and disorderly marketing and production** – based not on demand and preferences of consumers, inadequate quality control and standards and limited export promotion mechanisms, declining local consumption, and mounting date surpluses.
9. **Difficulties faced by producers (particularly small farmers)** – including limited access to market, finance, extension services, weather information, risk management, social protection and weak bargaining position.
10. **Inadequate research and development –** including the lack of adoption of appropriate technologies.
11. **Lack of baseline information –** including the scarcity of accurate information on all aspects of date development.
12. **Absence or inadequate structures –** for design, implementation and monitoring of plans and programmes for date palm tree development.
13. **Lack of co-operation and co-ordination** among Arab countries in date development.

**A date palm tree can produce as much as 20kg of dry leaves annually.[85]**

**Every year as much as 3.2 million tonnes of dry date palm leaves are cultivated from 161 million date palm trees cultivated in the Arab region.[86]**

**The sustainable development of the date value chain is influenced by a multitude of challenges and constraints.**

# The MENA region produces 90 percent of the world’s dates

**DR RACHID SERRAJ**
Senior Officer
FAO Regional Office for
the Arab World

واحة

The MENA region produces 90 percent of the world’s dates. However, large quantities of dates are discarded by the processing industries leading to economic inefficiencies and environmental challenges. Post-harvest losses and waste in the date value chain are high, averaging 14 percent at production and more than 10 percent for processing, and up to 50 percent in some situations.

Applying the principles of bioeconomy and circular economy to the date palm value chain provides an opportunity to reduce losses while enhancing productivity, profitability and environmental sustainability. There is ample scope for the emergence of new bio-industries and bio-entrepreneurs in the date-growing countries towards efficient and effective date palm fruit waste management.

**Applying the principles of bioeconomy and circular economy to the date palm value chain provides an opportunity to reduce losses while enhancing productivity, profitability and environmental sustainability. There is ample scope for the emergence of new bio-industries and bio-entrepreneurs in the date-growing countries towards efficient and effective date palm fruit waste management.**

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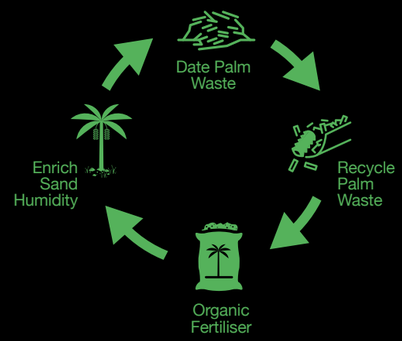
# Opportunities to Apply Bio-Waste Compounds from Date Palm

**DR BOUBAKER DHEHIBI**
Senior Agricultural Resources
Economist International Center
for Agricultural Research in
the Dry Areas

Quantity of
**Date Palm Waste**
per year

**Qatar**
**7,7**
tonnes

**UAE**
**121,9**
tonnes




Organic farming of date palm systems represents the optimum solution for sustainable date palm production through the use of organic fertiliser (compost). We conducted a feasibility study on how the waste agricultural residues available in palm groves could be recycled in the oasis farming system and capitalised as organic fertiliser:

- The estimation of the tonnage of date palm grove waste in the GCC countries varies between 7,734 tonnes in Qatar to 121,974 tonnes in the UAE.
- This can be used as organic fertiliser input in the date palm farming system, to enrich the sand with organic matter that helps in enhancing the sand humidity and water catchment in the root area.
- Collecting all vegetable matter (palm residues and other vegetables residues in the oasis orchards or groves) from the oasis environment and transforming it into compost will increase and improve fertility and productivity of the soil, improve the production of high-quality date palm, and decrease production costs.

**Organic farming of date palm systems represents the optimum solution for sustainable date palm production through the use of organic fertiliser (compost).**

تمرة

**FUAAD MANSOUR**
Date Palm
Waste Recycling
Consultant.

## Recyclable Elements of the Date Palm

### Waste
Recyclable plastics wood scrap and agricultural waste

### Making
Food, health, industrial and construction products

DatePalm Pallet

DatePalm Plastic Doors

DatePalm Partical Board

DatePalm MDF

DatePalm BBQ Charcoal

DatePalm Animal Feed

واحة

نخلة



# Date Palm Industrial Sector

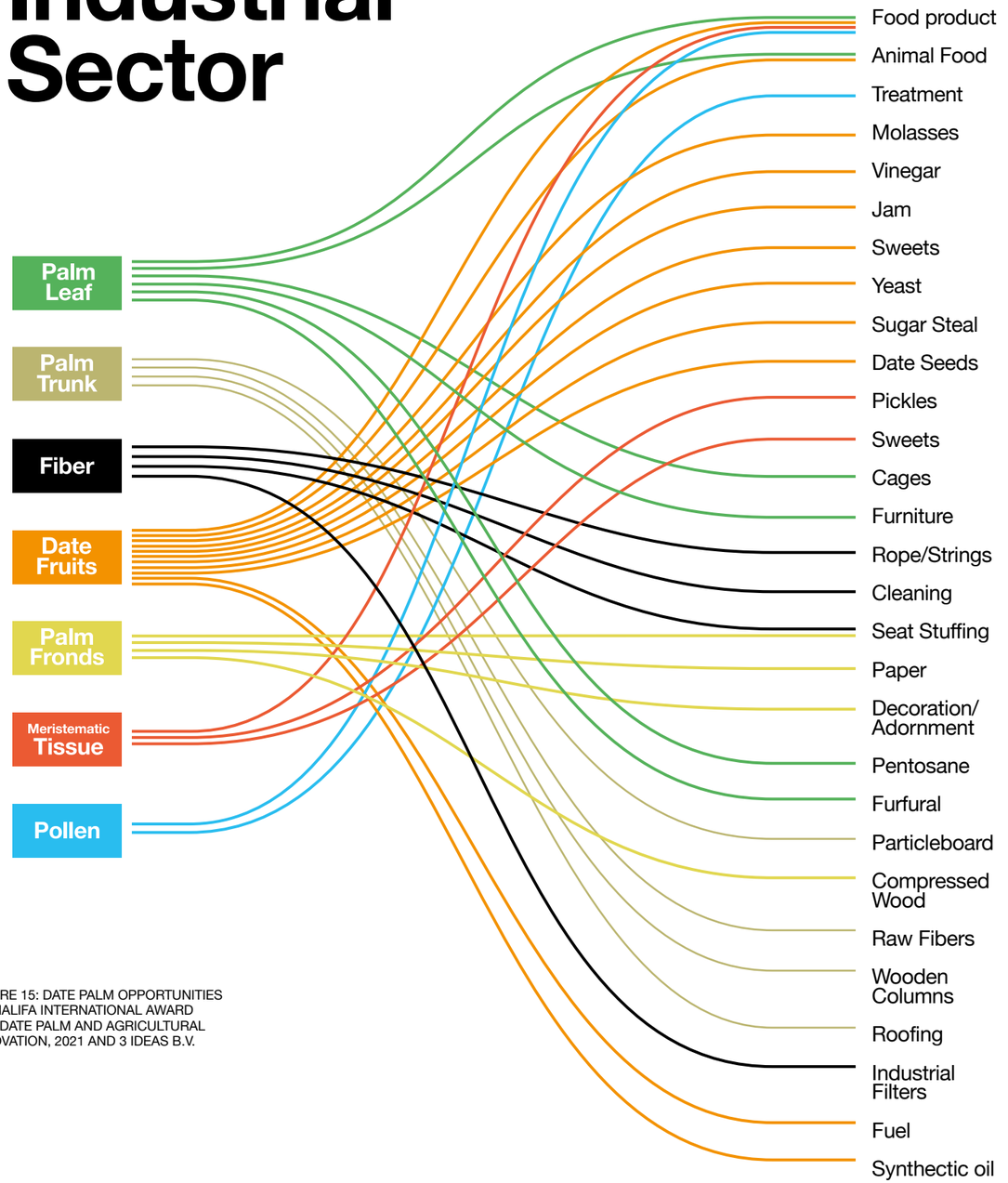
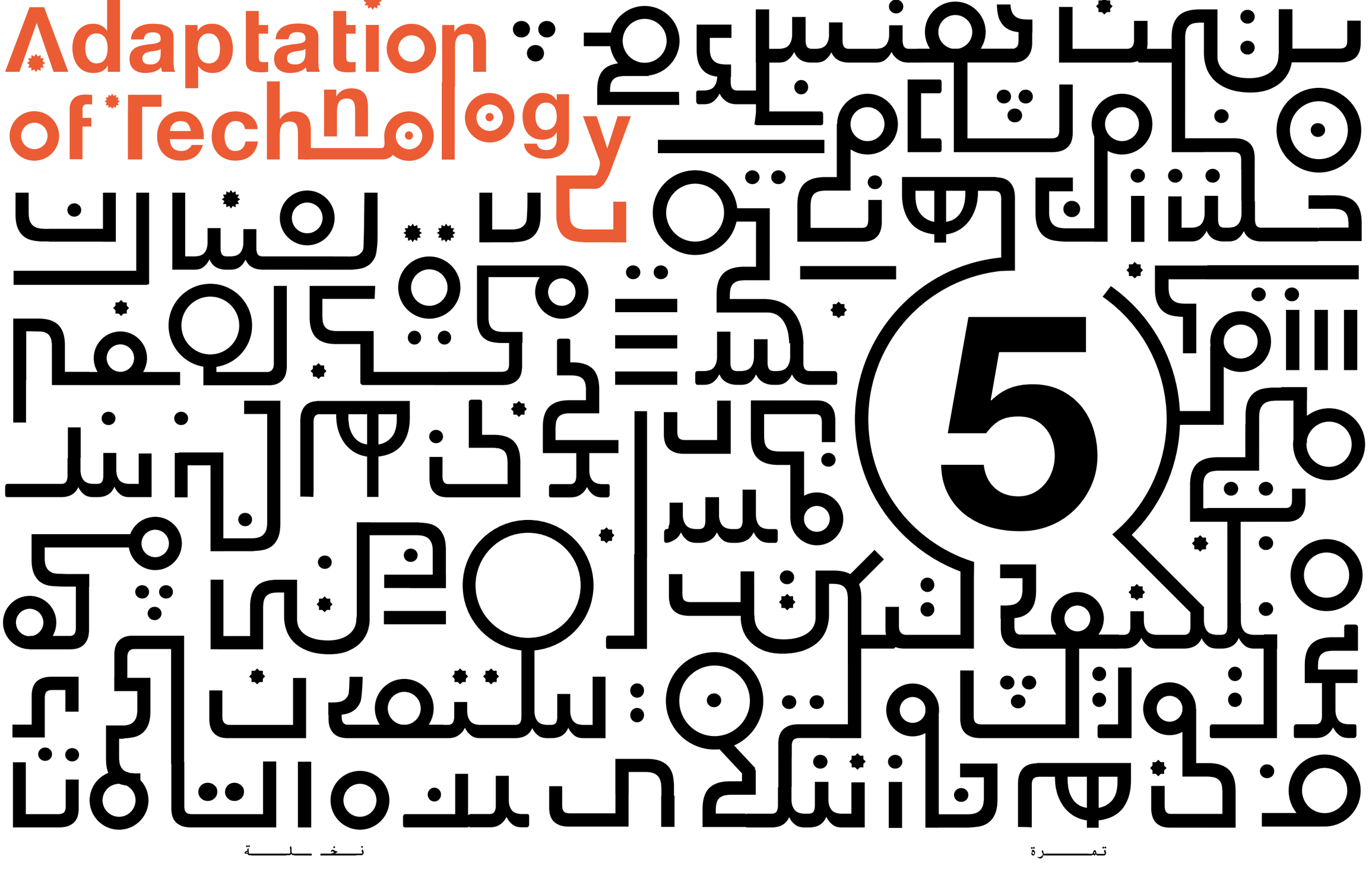



FIGURE 15: DATE PALM OPPORTUNITIES


واحة

تمرة

# Adaptation of Technology



# 5.1 Endogenous and Indigenous Technologies: Date Palm Technology Transfer and Skills

**DR SANDRA PIESIK**
Director
3 ideas B.V.

**The re-introduction of the bio-circular economy and new jobs creation in countries affected by desertification and land degradation is important because their adverse effects increase the national poverty rate.**



The Rio Declaration on Environment and Development of 1992 and subsequent climate change conventions addressed the importance of traditional knowledge systems:

**"Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development."**[87]

Today, indigenous people make up around five percent of the global population and occupy 80 percent of the world's remaining forests.[88] The significance of indigenous practices in the context of hot desert and semi-arid climate zones,[89] as well as date palm oasis ecosystems, cannot be underestimated. The adverse effects of climate change are becoming more apparent in desert regions, with a clear correlation between desertification, land degradation, food security, water scarcity, jobs, and national territorial security. Restoration of oasis ecosystems through adaptation of indigenous knowledge in the context of biodiversity, water management and the bio-circular economy, is essential for desert communities.

### Traditional methods for water management

Historically, endogenous technologies manifested themselves in various methods of water management in the

# Date Palm Technology Transfer

FIGURE 11: CONCEPTUAL FRAMEWORK OF A TECHNOLOGY TRANSFER IN THE HISTORICAL CONTEXT © PIESIK, S.

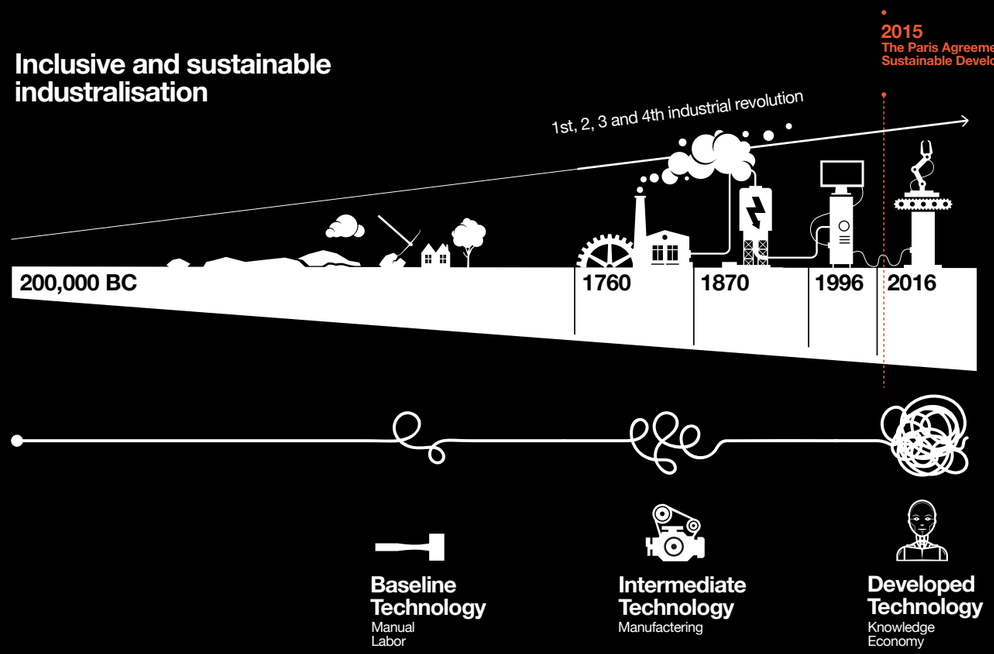



FIGURE 16: TECHNOLOGY TRANSFER © KHALIFA INTERNATIONAL AWARD FOR DATE PALM AND AGRICULTURAL INNOVATION, 2021 AND 3 IDEAS B.V.



oasis, from the falaj irrigation system to ground water well systems. Fundamental bioeconomy principles have been in practical use in the MENA region since 7000 BC.[90] This was demonstrated in the use of dry palm leaf fronds for the construction of cities, villages and individual houses. In 1950, Dubai had 4,000 date palm leaf houses accommodating 12,000 citizens. It is in the built environment and material culture, where endogenous technologies of date palm cultivation met with indigenous ingenuity of arts and crafts, as exemplified in various external facade ornamentation details, product designs of baskets and mats, often linked to tribal identity.

Social and religious customs were, and to some extent still are, interlinked in tribal societies, which today are pursuing forefront technologies in terms of lifestyles and consumer choices. Traditionally, technological 'know how' and crafts were passed on from one generation to another within a family unit or a tribe. An advancement of formal education led to a decline in these practices, including the evolution of technology and skills in response to contemporary social aspirations of women and a younger generation in the Arab world.

### The disadvantages of modernisation

The advent of modernisation also brought a decline in skills training that would sustain a supply value chain, and new skills and training are needed for the adaptation of traditional technologies and finding new economic use for bio-waste. The International Labour Organization (ILO) acknowledges that skills development programmes for enterprises and workers facilitate the transition to a green economy, though they are yet to be mainstreamed in policy discussions.[91]

The ILO also expects global employment growth services and waste management to create up to 45 million jobs in total.[92] There are opportunities in date palm waste value creation for less densely populated desert areas in small and medium-sized enterprises (SMEs), especially in communities, whose livelihoods depend on land, as well as women, who are traditionally linked to household activities. The re-introduction of the bio-circular economy and new jobs creation in countries affected by desertification and land degradation is important because their adverse effects increase the national poverty rate.

The big picture is that population pressure and climate change are already pushing people beyond their 'resilience thresholds', requiring new technologies and policies to help people adapt successfully.[93] The 'domino' effect of climate change and lack of jobs has security implications in the Sahel region in particular, driving rural-urban migration, which is often transformed into South–North migration.

**Summary**

**The existing Technology and Adaptation Mechanism within the UNFCCC process, the Paris Agreement as well as the Sustainable Development Goals, are important tools for technological solutions. The EU's 'Green Deal' diplomacy may also play a part in stimulating innovation, research and development. The scale of investment in these new technologies deriving from date palm production is such, that only through transboundary bio-regional collaboration will it be possible to re-introduce a new socio-environmental economic model.**

LIWA OASIS
© DR SANDRA
PIESIK

AL AIN OASIS
© DR SANDRA
PIESIK

# 5.2 Use of Emerging Technologies



a)

## Africapolis Geospatial Database on Cities and Urbanisation Dynamics in North Africa and the Sahel

**PHILIPP HEINRIGS**
Senior Economist,
Head of Unit
OECD Sahel and
West Africa Club
Secretariat

In many perceptions of Africa, the Sahara is seen as a natural division, an obstacle of aridity, separating the Mediterranean North Africa from the southern sub-Saharan Africa. And yet, since prehistoric times trans-Saharan routes connect the Sahel with the Mediterranean, the Nile and the middle East. Connecting the two shores of the Sahara (Sahel meaning shore in Arabic) required the development of stopover towns at the intersection of routes – oasis – and towns at the end of these routes that stand in as metaphorical ports. The development of this network of towns entailed heavy investments, attracting people from outside the Sahara-Sahel and creating close ties with the rest of the countries. Population settlement dynamics, urbanisation and socio-economic trajectories are intimately linked, particularly in highly-urbanised North Africa and fast-growing Sahelian countries.

**Africapolis provides several important insights about North Africa and the Sahel**

The Africapolis database explores, visualises and maps the development of urban agglomerations over the past 65 years in 50 African countries – providing unique insights in the drivers, dynamics and impacts of urbanisation dynamics in Africa. By employing a uniform definition of urban areas, the Africapolis database makes it possible to compare urbanisation across countries. It can be used to analyse urbanisation at the country level, but also provides insights about individual cities.

Of the 310 million inhabitants in the region, 60 percent (186 million) live in a city with more than 10,000 inhabitants. Yet, there are large differences in urbanisation across countries. The five North African countries have much higher urbanisation rates than the eight countries that make up most of the Sahel (Figure 12). The region contains both

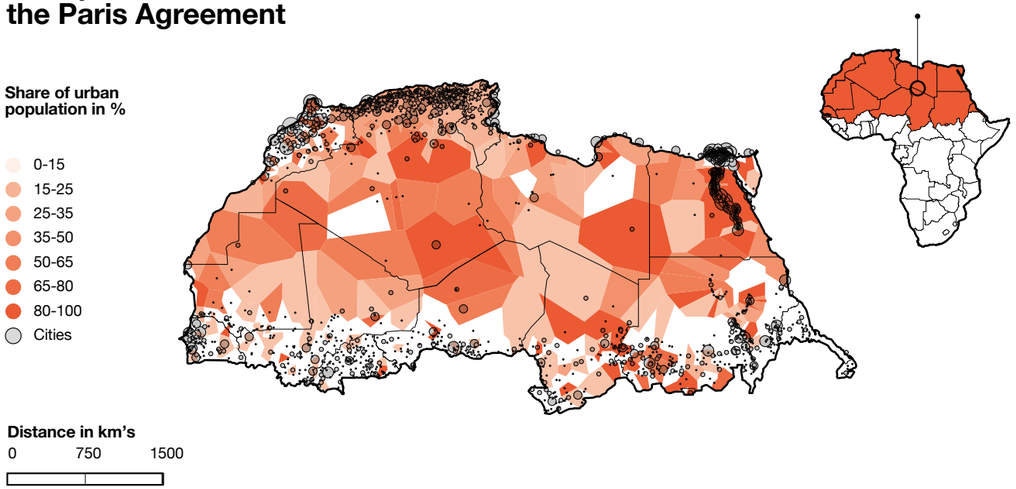
**The Africapolis database explores, visualises and maps the development of urban agglomerations over the past 65 years in 50 African countries – providing unique insights in the drivers, dynamics and impacts of urbanisation dynamics in Africa.**

Africa's most urbanised and Africa's least urbanised country. Egypt has the highest urbanisation rate with 93 percent of the population living in cities, while Niger is Africa's least urban country, with 17 percent of the population living in cities.

The Africapolis database allows to look beyond the country level at the 2,618 cities in North Africa and the Sahel. The region contains Cairo, Africa's largest city with more than 22 million inhabitants, and several other large urban agglomerations, such as Kharthoum (5.3 million), Casablanca (4.2 million) and Dakar (3.1 million). However, the prominence of the largest metropoles should not hide the importance of small and mid-sized urban agglomerations. More than 60 percent of the urban population lives in cities of less than one million inhabitants, and one-third of the urban population lives in cities with less than 100,000 inhabitants.

The fact that there are nearly as many inhabitants living in cities with fewer than 100,000 inhabitants as there are inhabitants in cities with more than one million inhabitants highlights the importance of investing in cities of all sizes. Countries that neglect smaller urban centres not only harm the local populations, they also waste the important potential for economic development that these cities offer, notably in connecting more rural environments to the larger urban network. Moreover, the importance of small and mid-sized cities shows the need to design urban policies that are targeted to the local context. Policies that are adequate for cities with several million people are not necessarily appropriate for smaller places.

FIGURE 17: SHARE OF URBAN POPULATION IN NORTH AFRICA AND THE SAHEL
© SOURCE: AFRICAPOLIS.ORG




**More than 60 percent of the urban population lives in cities of less than one million inhabitants, and one-third of the urban population lives in cities with less than 100,000 inhabitants.**

**Understanding urbanisation is crucial to developing urban policies that strengthen the economy of cities and make them more attractive places to live.**



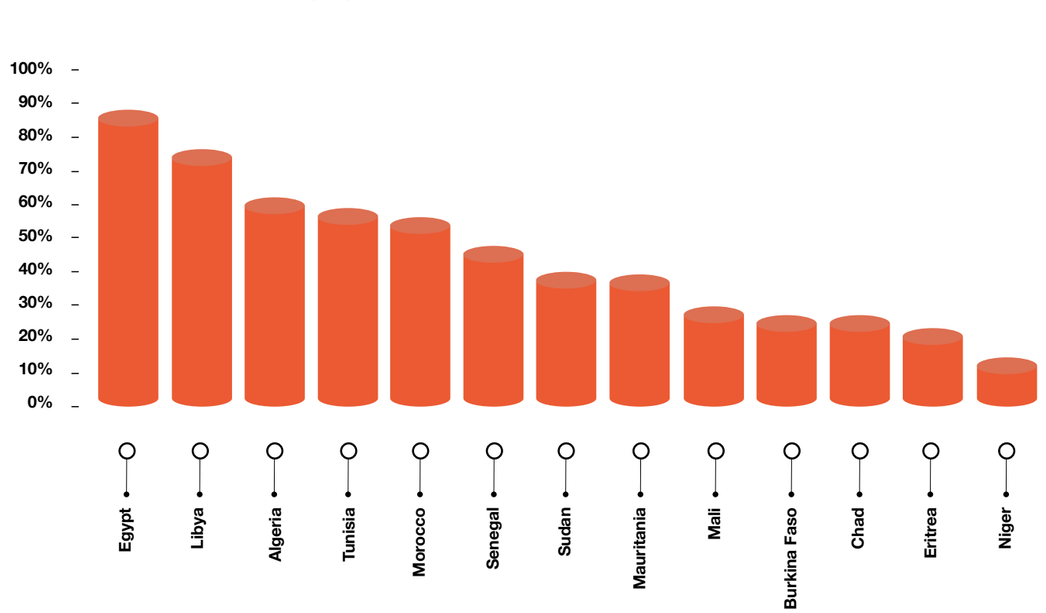
### Analysing urbanisation rates

Africapolis also makes it possible to analyse information related to the shape and location of cities. As Figure 13 demonstrates, many of the densely-populated areas in the Southern Sahel have a low urbanisation rate, whereas the sparsely populated areas to the North have much higher urbanisation rates. This counterintuitive pattern can be explained by the importance of agriculture for the spatial distribution of people. In the fertile regions of the Southern Sahel, a large share of the population lives from agriculture. The population in these areas is relatively evenly spread out across the fertile land. In contrast, the areas to the North are much less suitable for agriculture. Even though much fewer people live in these areas, they are more likely to live in one of the few cities, as their livelihoods do not depend on living close to cultivated land.

The pattern in Figure 13 can give clues about the future evolution of urban population levels. Cities that are located in light parts of the map are surrounded by proportionally large numbers of rural population. These cities are likely to grow quickly once the share of people employed in agriculture declines and people move to cities to find other livelihoods. Moreover, they are also likely to see the emergence of new cities in the future, as population increases and current villages become cities.

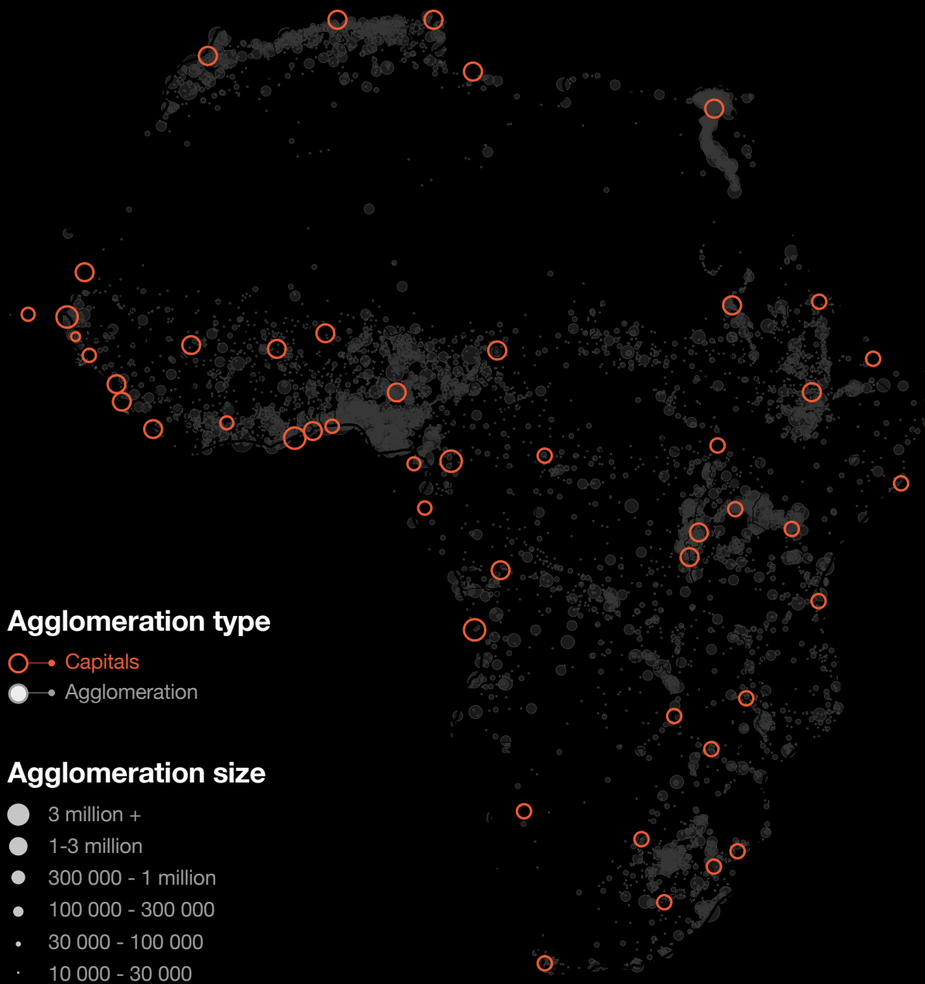
Understanding urbanisation is crucial to developing urban policies that strengthen the economy of cities and make them more attractive places to live. These examples show only a few of the analytical possibilities that the Africapolis database provides. Interested readers can use the interactive visualisation tool at Africapolis or download the data for further analysis.

FIGURE 18: AVERAGE URBANISATION RATES ACROSS NORTH AFRICA AND THE SAHEL
© SOURCE: AFRICAPOLIS.ORG



# Africapolis

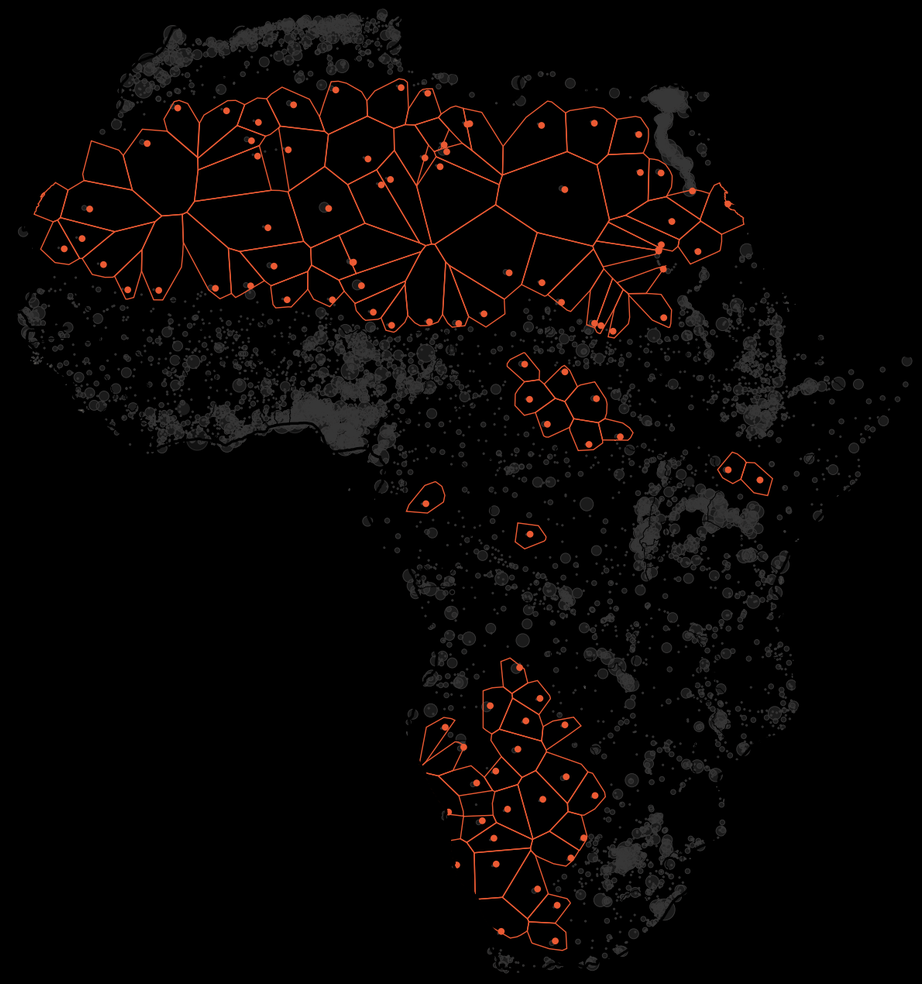
FIGURE 19: AFRICAPOLIS AGLOMERATION
© SOURCE: AFRICAPOLIS.ORG






# Least Connected Urban areas

FIGURE 20: AFRICAPOLIS LEAST CONNECTED URBAN AREAS
© SOURCE: AFRICAPOLIS.ORG



**DR BREMLEY W.B. LYNGDOH**
CEO
Worldview Impact Foundation

b)

# Accelerating Nature-Based Solutions using Blockchain for Sustainable Development

Land is the key for sustaining life and creating livelihoods for humans. The restoration of land is important for achieving the United Nations Sustainable Development Goals because plants grown in soil are the basis for food, they capture and store excess carbon produced by humans and also contribute to our supply of clean water. The global pandemic of COVID-19 has highlighted to many of us how far-removed we are from our food sources, with at least 75 percent of global supply chains having been disrupted. Land degradation in drylands, due to natural processes or induced by human activities, also known as desertification, is one of the biggest environmental challenges of our times, especially impacting people living in the Arabian Peninsula, North Africa, and the Sahel.

## A global commitment to reforestation

Worldview Impact Foundation and EcoFriend World are currently restoring cloud forest ecosystems in northeast India and mangrove forest ecosystems in southwest Myanmar, with a target of planting one billion trees by 2030. So far, five million trees have been planted in northeast India in partnership with Balipara Foundation, and ten million trees have been planted in southwest Myanmar in partnership with Worldview International Foundation, some using tree-planting AI-powered drones that can plant 100,000 trees per day. They are building a cross sector partnership between governments, NGOs and private sector investors to explore what it will take to plant one billion trees, and the role of nature-based solutions to certify the environmental outcomes.

The successful expansion of the two projects requires further financial incentives. To this end, they have been working with Earthbanc to design, develop, and implement a new ecosystem service assessment, and evaluation standard using blockchain Distributed Ledger Technology (DIT). This standard will ascertain the annual economic value of ecosystem services delivered by the forests that are restored, which has the potential to greatly increase the sustainability of the programme and incentivise reforestation and continuous forest stewardship. The cross-sector blockchain and climate change partnership will be addressing the challenges of total ecosystem collapse from serious land degradation that local indigenous communities living in northeast India and southwest Myanmar are facing before the DIT can be replicated in the Arabian Peninsula, North Africa, and the Sahel. These issues are important given that these vulnerable communities face food insecurity and lack sufficient resilience to climate change impacts.

## The cost of carbon-neutral programmes

Recently, a price tag of $300 billion was advocated by the UNCCD as a way to stabilise carbon emissions for 15-20 years, giving the world time to adopt critical carbon-neutral technologies. To put this into context, this is equal to the world's military budget spending every 60 days, used instead to save the majority of the world's critical ecosystems and food-producing lands. Explorations are also underway to enable refugee camps across Africa to offer work to refugees participating in large-scale ecosystems and land restoration, and supporting bioregional regeneration of agriculture and horticulture. The relationship between land restoration, climate change abatement, and human security are now increasingly recognised in the mainstream discussion around climate.

The mission of Earthbanc and its partners Worldview Impact Foundation and Ecofriend World, is to create land regeneration at scale by financing the planting of the equivalent of one trillion trees in order to stabilise our climate for generations to come. Earthbanc is uniquely positioned to be the world's first blockchain banking platform to measure and bank soil carbon, and to connect those working the land with fair compensation through data-powered carbon sequestration, measurement, and verification services. Imagine local farmers being able to 'bank' their carbon (stored in the soil and trees of their land) within a banking platform that financially rewards them for their land stewardship and restoration activities.

**Summary**

**The objective of existing blockchain partnerships is building collaboration for the design and development of a business model to enhance the rate, scale and economic viability of ecosystem restoration in affected areas in India, Myanmar, Kenya and the Sahel region adopting nature-based solutions, thereby improving and protecting the natural, human and social capital value of the target ecosystems. It is acknowledged that successful ecosystem restoration requires three things: 1) improved rate and efficiency of mapping, planting and monitoring using appropriate technology; 2) on the ground land management, administration, education, community engagement and monitoring by local partners; and 3) the development of an ecosystem service assessment and evaluation standard which supports an ecosystem service market place that incentivises long-term economic viability.**

**Future partnerships will need to ensure active participation and discussion with all concerned stakeholder on the process for measuring the economic benefit of the ecosystem services generated by ecosystems in the target communities in India, Myanmar, Kenya and the Sahel region.**

Land is the key for sustaining life and creating livelihoods for humans. The restoration of land is important for achieving the United Nations Sustainable Development Goals because plants grown in soil are the basis for food, they capture and store excess carbon produced by humans and also contribute to our supply of clean water.

The objective of existing blockchain partnerships is building collaboration for the design and development of a business model to enhance the rate, scale and economic viability of ecosystem restoration.

# Blockchain/Digitalisation
(Utopia)

**Date palm peer-to-peer**
Shared datepalm network

Commodity tokens

**Secure data**
Date palm bank

Verified Transactions

Stakeholders
Partnerships

**Industry Innovation**

**Solar Energy**

**Wind Energy**

**Transport Green mobility**

**Green roof**

**Internet Of Things**

**Blockchain stack**
Distributed Ledger technology

Data Base

Ledger

Currency Tokens

Nodes

**Secure Data**
5G Network

5G

**Data Stack**
Knowledge Sharing

5G

Engaged community for regional stability

**Collecting Data**
Production

Dates

Fronds

Frond Bases

Date Bunches

Sheath

Trunk

**Morphology statistics**

**Soil statistics**

**Growing statistics**

**Local community date palm farms**

**Habitat Protection Restauration**

FIGURE 21: BLOCKCHAIN/DIGITALISATION

c)

# Land Restoration and Carbon Capture through Remote Sensing

**BO SPROTTE KOFOD**
Advisor on Carbon Verification and Environmental Management
Earthbanc

**Remote sensing is the process of monitoring physical characteristics of an area by measuring its reflected and emitted radiation at a distance – typically from satellite, aircraft or even drones.**
**Recent advances in *hyperspectral* remote sensing have generated significant enhancements over conventional techniques. There is enough evidence demonstrating the potential of hyperspectral remote sensing in targeted assessment of crop characteristics such as measuring the following:**[94]

| | | |
|---|---|---|
| Biophysical and biochemical parameters | Measuring plant growth and increment of crop area | Evaluating crop requirements for fertiliser applications |
| Identification of crop species | Predicting yield | Detecting crop stress |
| Quantifying crop phenology | Determining crop water requirements | |

**Remote sensing is the process of monitoring physical characteristics of an area by measuring its reflected and emitted radiation at a distance – typically from satellite, aircraft or even drones.**





**“The largest impact is in the hands of the farmer”**
Current methods of physical verification of soil carbon are often cost prohibitive for small-scale landowners and for many sites, not easily accessible. The use of open access and commercial remote sensing data for carbon verification is a more cost-efficient and scalable solution. To serve the majority of land managers, we need to adopt radically scalable solutions. Figure 14 provides a comparison between unmanned aerial vehicles, manned aircraft and satellite for precision viticulture. It is clear from this figure that satellite is the most scalable technology, and therefore the most promising solution for supporting farmers in the developing world.

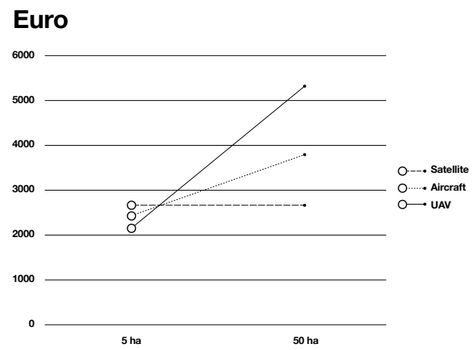



FIGURE 22: PLOT OF CATEGORY COSTS (EURO) FOR SATELLITE, AIRCRAFT AND UAV PLATFORM, CONSIDERING A 5-50 HA MAPPING AREA[95]

### Measuring carbon stock of standing forest

LIDAR (light detection and ranging) is the process of measuring distances by illuminating the target with laser light and measuring the reflection. The distance is calculated as the time it takes to hit an object and be reflected back to the laser. LIDAR measurements can be used for building models of physical objects or terrain.

The usage of airborne LIDAR and drone imagery has proven useful when estimating carbon stored in standing forest, and has enabled us to monitor and verify the carbon sequestration of both single standing trees and whole plantations. Providing data of such high accuracy means we can monitor the height of each single standing tree.

### Measuring carbon in soil

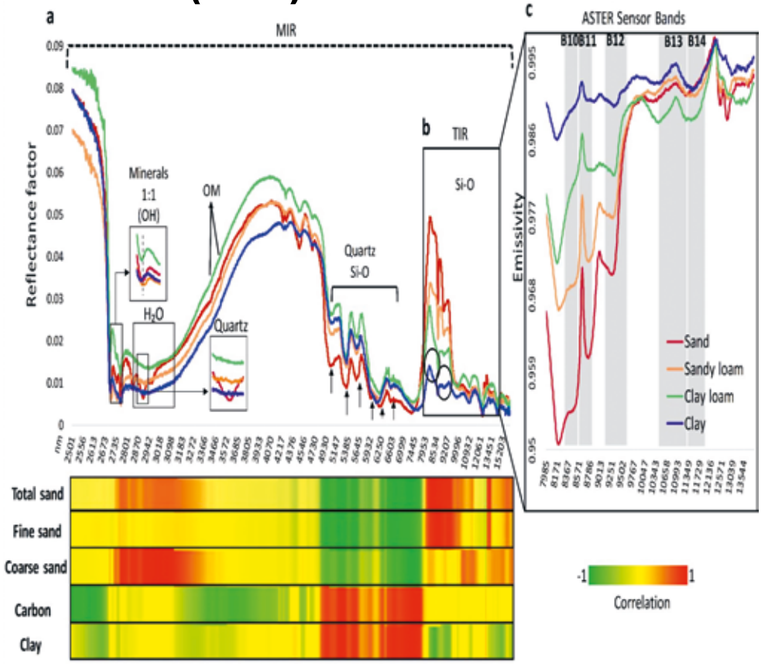
As recently reported, aerial spectroscopy using multispectral and/or hyperspectral sensors located on aircraft, unmanned aerial vehicles or satellite platforms can measure surface soil organic carbon.[96] Other uses of laboratory spectroscopy include the development of calibration models in larger contexts (i.e. aerial and satellite) reflectance measurements – something that will be key for the improvement of future verification methods.

Strict scanning protocols, appropriate spectral processing[97] and models that correspond with soil data obtained from the reference method is required for accurate prediction of soil organic carbon from the visible and near-infrared and mid-infrared spectra. Despite promising findings from Castaldi, et al.,[98] the estimation of soil organic carbon using current remote sensing techniques with aerial and satellite platforms is linked to problems of low accuracy and higher uncertainties. Identification using imaging spectroscopy needs refinement, with development of location-specific calibration and validation using ‘ground truthing’ – information directly observed at a physical location, allowing image data to be related to real features on the ground. Due to promising results of scaling the soil carbon credit market with satellite data, multiple initiatives are actively working on this approach.[99]

In terms of specific emissivity aspects, we can cite the work by Salazar, et al., which identified the spectral pattern of soils with different granulometry (sand and clay) and organic carbon content using laboratory and satellite sensors in the mid-infrared region, specifically in the thermal infrared range (ASTER, Landsat satellites).

**The usage of airborne LIDAR (light detection and ranging) and drone imagery has proven useful when estimating carbon stored in standing forests and has also enabled us to monitor and verify the carbon sequestration of both single standing trees and whole plantations.**

# Textural groups in the medium infrared as provided by salazar, et al. (2020)

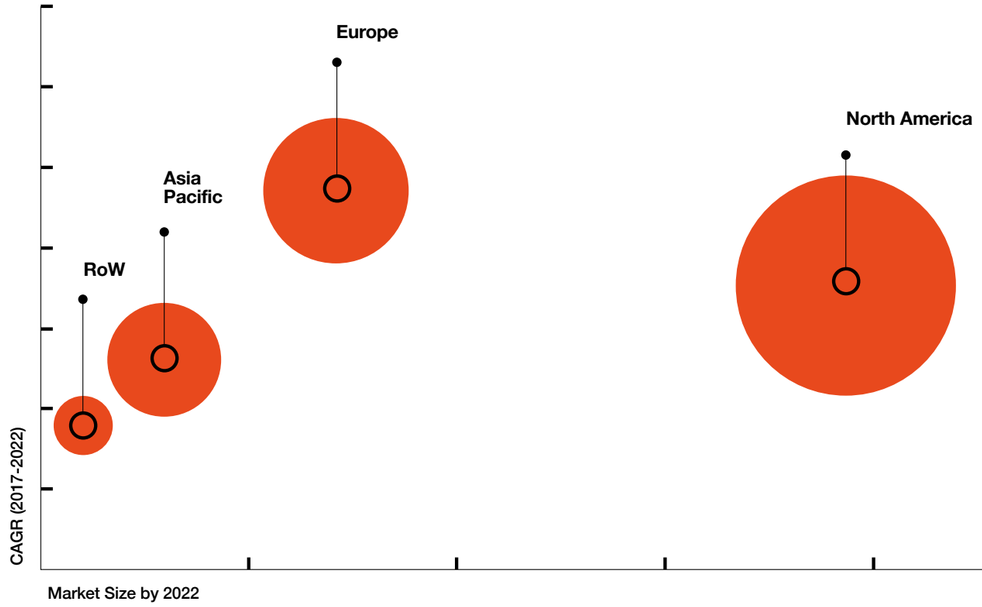



Models presented by Salazar, et al.,[100] showed good performance in the prediction of all attributes using the whole mid-infrared region. In the thermal infrared region, the models for total sand content and for fine and coarse fractions were good. The use of specific bands was useful in estimating some attributes in the mid-infrared and thermal infrared region, improving the predictive performance and validation of models. Therefore, the discrimination of soil attributes with satellite sensors can be improved with the identification of specific bands, as observed in the results with laboratory sensors.

FIGURE 23: TEXTURAL GROUPS IN THE MEDIUM INFRARED AS PROVIDED BY SALAZAR, ET AL. (2020)
© BO SPROTTE KOFOD ADVISOR ON CARBON VERIFICATION AND ENVIRONMENTAL MANAGEMENT EARTHBANC



# Remote Sensing Services Market, by Region, 2022 (USD Billion)




The monitoring of ecosystem services through remote sensing is a rapidly growing market. The market value of the environmental monitoring market is estimated to grow at a compound annual growth rate of 6.8 percent to reach $25.5 billion by 2024 from $18.4 billion in 2019.[101] The remote sensing services market was valued at $9.70 billion in 2016, and is projected to reach $21.62 billion by 2022.

FIGURE 24: REMOTE SENSING SERVICE MARKET POTENTIAL BY REGION ($ BILLION)[102]
© BO SPROTTE KOFOD ADVISOR ON CARBON VERIFICATION AND ENVIRONMENTAL MANAGEMENT EARTHBANC

The monitoring of ecosystem services through remote sensing is a rapidly growing market.

واحة نخلة تمرة

THE MIDDLE EAST AND AFRICA
© NASA

THE NILE DELTA AND THE SUEZ CANAL
© ESA (2017)

# Bio-Regional Collaboration

6

واحة

تمـــــرة

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# 6.1 National Adaptation Plans, Nationally Determined Contributions, and Transboundary Collaboration

**DR YOUSSEF NASSEF**
Director of the Adaptation Programme United Nations Framework Convention on Climate Change



**National Adaptation Plans: The regional context**

Building adaptive capacity and resilience in the face of climate change impacts has become an imperative pillar of climate change policy at the subnational, national, regional and international levels. In recent years, advances in climate observations – and in scaling up efforts to plan for and implement adaptation measures – has led to a recognition of the increasing relevance of transboundary cooperation in responding to the adverse effects of climate change.

Countries in the MENA region share similar geographic conditions and vulnerabilities, particularly those related to water scarcity, aridity and extreme heat. These pose implications on agriculture and food security, demographic trends, and on health. At the same time, different countries in the region possess a wealth of knowledge, traditional and contemporary, on how their societies have best adapted – and are continuing to adapt – to evolving climatic conditions. Existing regional institutions through which countries are already cooperating are a natural entry point for building synergy and collaboration on climate change adaptation.

Under the UNFCCC process, the formulation and implementation of National Adaptation Plans (NAPs) provide a consistent and comparable stepwise process for countries to approach adaptation planning. NAPs are a means to prioritise medium- and long-term adaptation actions for developing countries. A number of countries have already submitted NAPs, and many others are in the pipeline.

**Element A**

Element A of the NAP formulation process covers 'laying the groundwork and addressing gaps'. In this context, sharing datasets or, even better, establishing a common regional dataset on climate change impacts, vulnerability and adaptation, is the bedrock of effective transboundary collaboration in national adaptation planning. A solid compendium of accurate observational data, scenarios, projections and assessments, with inputs from throughout the region, would feed into subsequent steps of the planning process, and already invoke a collaborative platform for engaging regional experts.

**Element B**

Element B of the NAP formulation process entails 'preparatory elements', including those associated with analysis, assessment and review. Regional capacity-building to enhance joint expertise at the regional level in applying and advancing the relevant data, information and assessments, can advance with the help of regional institutions and also by way of existing UNFCCC bodies, like the Least Developed Countries (LDC) Expert Group, the Adaptation Committee, the Technology Executive Committee and the Paris Committee on Capacity-Building. Many of these entities conduct regional training sessions which can also be catalysed and tailored to identified regional needs.

Particularly relevant to this context is the Lima Adaptation Knowledge Initiative under the UNFCCC, which has conducted a process driven by a rigorous methodology to prioritise knowledge gaps for the GCC and the North Africa subregions. The methodology addresses the subregions as a whole, irrespective of political boundaries. The highest-

**Transboundary aspects of adaptation, especially in the MENA region, provide ample opportunities for enhancing the effectiveness of adaptation assessment, planning and implementation.**

**The NAP process is the optimal platform for optimising regional collaboration and synergy in our pursuit of attaining resilience in the face of climate change.**

priority gaps were found to relate to specific thematic areas where data was lacking, followed by areas where access to existing data needed support, followed by those where methods and tools were lacking. The UNFCCC's Regional Collaborating Center is currently supporting the UNFCCC Adaptation Division in collaborating with regional institutions to catalyse the filling of these gaps.

### Element C

Element C of the NAP formulation process covers implementation strategies. One of the questions posed under this part of the technical guidelines is: "How can the cross-sectoral and regional coordination of adaptation planning be promoted and enhanced?" Associated indicative activities include identifying and promoting "synergy in assessment, planning and implementation of adaptation at the regional level, as appropriate". Clearly, an important component of effective transboundary collaboration in the implementation of adaptation will be the adoption of a regional approach to the development of a region-wide NAP implementation strategy.

### Element D

Element D covers monitoring, review, iterative updates and outreach. There are significant opportunities for transboundary synergy in this step, including, for example, the harmonisation of time intervals for reviewing the NAP process across the region, and the establishment of common regional indicators for progress and effectiveness.

Finally, efforts at regional synergy need not be unidimensional in terms of their exclusive focus on climate change, but can also be activated in the context of other environmental and developmental priorities, especially in the implementation of multilateral environmental agreements.

Transboundary aspects of adaptation, especially in the MENA region, provide ample opportunities for enhancing the effectiveness of adaptation assessment, planning and implementation. The NAP process is the optimal platform for optimising regional collaboration and synergy in our pursuit of attaining resilience in the face of climate change.

### Nationally Determined Contributions

While NAPs prioritise concrete adaptation activities that a country plans to undertake, another instrument – Nationally Determined Contributions (NDCs) – encompass the overall and overarching national adaptation aspirations of a countries, as part of the countries pledged contribution to climate change ambition, and that is reviewed in a global collective context every five years by way of a global stocktake.

Many NDCs contain information on impacts and vulnerabilities, and communicate the intention by countries to develop national adaptation plans and strategies. Many adaptation components show that countries have, or are planning to, integrate climate change adaptation into overall development strategies across economic sectors. In accordance with the Paris Agreement, adaptation actions and/or economic diversification plans can also result in mitigation co-benefits which can be included in the NDCs.[103]

### NDC submissions

NDCs are submitted every five years to the UNFCCC Secretariat, with the current round of NDCs (new or updated) submitted by 2020. Once submitted, the NDCs are recorded in the NDC Registry which is publicly available and maintained by the UNFCCC Secretariat.[104] These 2020 submissions are a valuable, major opportunity to address the significant gap between the aggregate effect of Parties' mitigation efforts in terms of global annual emissions

Many NDCs contain information on impacts and vulnerabilities, and communicate the intention by countries to develop national adaptation plans and strategies.

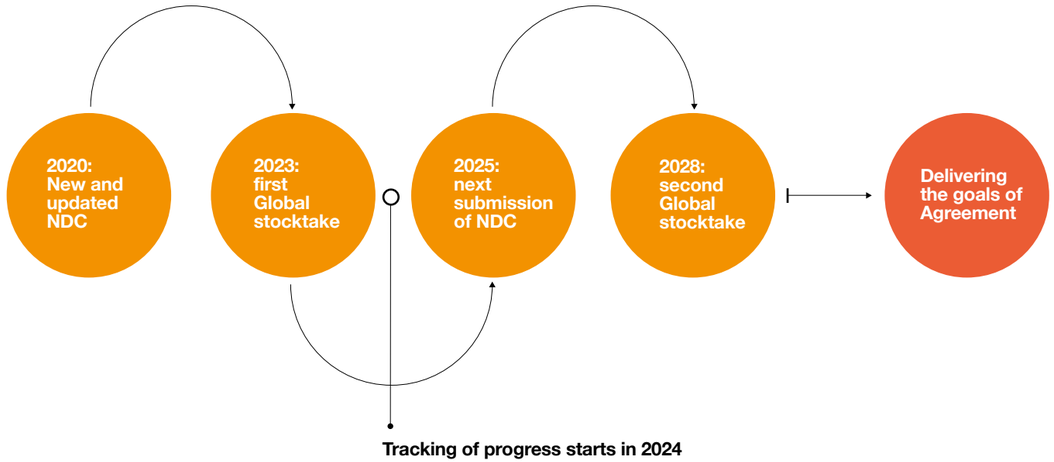


of GHGs by 2020 on the one hand, and the aggregate emission pathways consistent with the Paris Agreement's temperature goals on the other.[105]

Starting in 2023 and then every five years, governments will take stock of the implementation of the Paris Agreement to assess the collective progress towards achieving its purpose and long-term goals. The outcome of the global stocktake will inform the preparation of subsequent NDCs, in order to allow for increased ambition and climate action to achieve the purpose of the Paris Agreement and its long-term goals, see also the figure below.

More information about the international climate change process and the Paris Agreement is available on the UNFCCC website.

FIGURE 25: NATIONALLY DETERMINED CONTRIBUTIONS PROCESS UNDER THE PARIS AGREEMENT
© DR YOUSSEF NASSEF DIRECTOR OF THE ADAPTATION PROGRAMME UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE



# Bio-regional Transboundary Adaptation

**Climate Change**

Extreme Heat

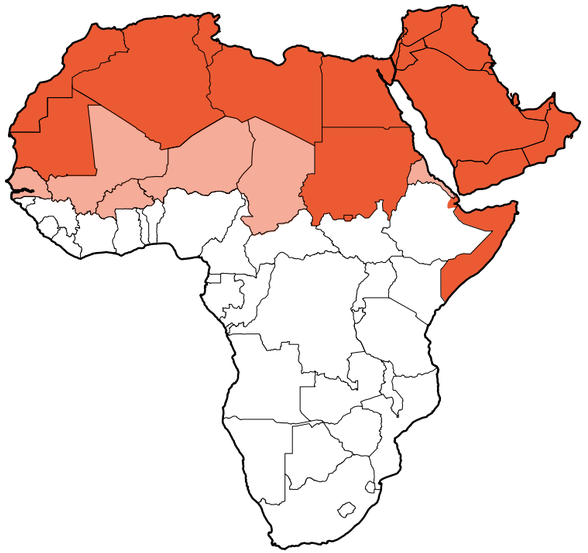
Water Scarcity

Aridity

**MENA Region**

Climate Change implications on agriculture food security demographic trends and health

**SAHEL Region**



**Synergy /Collaboration**

Knowledge /Wealth

Society /Adaptation

Existing Regional Institutions

**National Adaptation Plans**
Medium & Long Term Regional Actions





# NAPs National Adaptation Plans

Document

Process

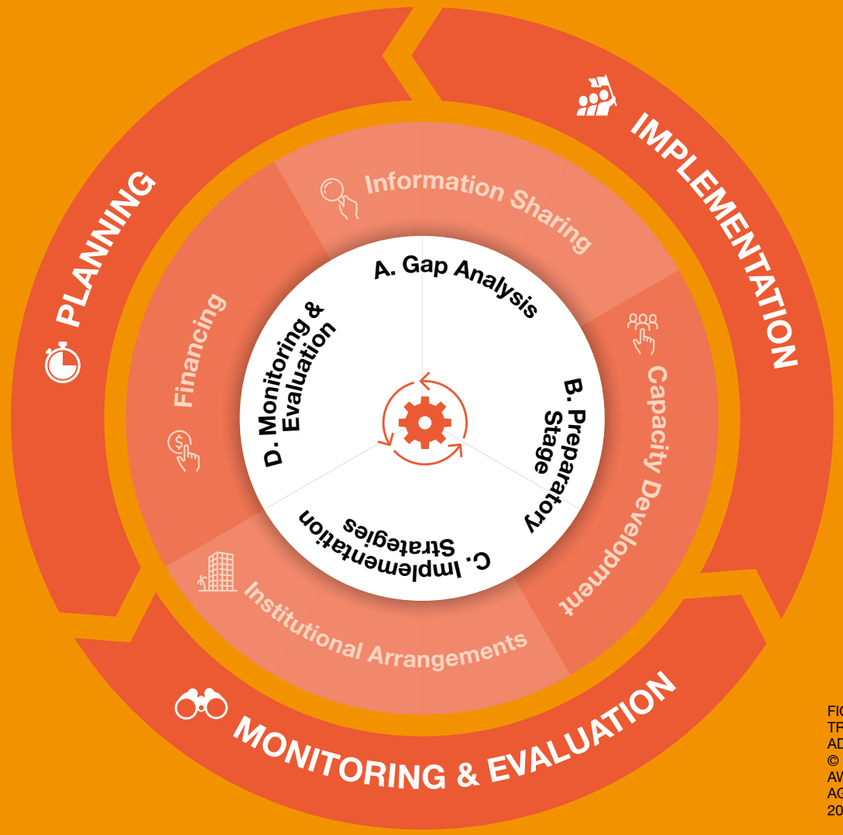



FIGURE 26: BIO-REGIONAL TRANSBOUNDARY ADAPTATION

# 6.2 Bio-Regional Collaboration in the Arab Countries

**PROFESSOR DR IBRAHIM EL-DUKHERI**
Director General
The Arab Organization for Agricultural Development

**Date palm is an important agricultural crop in the MENA region, and its economic, social and environmental roles are well perceived and well recognised. It is an important food and livelihood crop with a remarkable environmental dimension in terms of combating desertification and restoration of degraded environment. About 78 percent of the total world production, which amounts to 8.5 million tonnes, is produced in the Arab Region. In spite of this volume, tradition production dominates the region with smallholder producers comprising the majority of production systems.**

**Bio-regional collaboration looks into the regional efforts to promote the agenda of the agricultural sector at large, and date palm in particular, through the work of active partners individually as well as collectively.**

نخلة



### How does bio-regional collaboration work in practice?

Bio-regional collaboration looks into the regional efforts to promote the agenda of the agricultural sector at large, and date palm in particular, through the work of active partners individually as well as collectively. Different forms of partnerships exist among networks, councils and sub-regional organisations, as well as specialised institutions and civil society organisations. Together they form the basis for bio-regional collaboration, mainly for promoting the agricultural agenda and specifically the date palm sector. Such efforts cover pre-production arrangements, production, and post-harvest handling. Informed existing partnerships are either resource partnerships, technical, advocacy and other forms of support partnerships.

Formation of the International Date Network was a serious recognition of the need to come together to serve the agenda of the sector. The Khalifa International Award, ICARDA, ICBA, the International Date Palm Council, FAO and the Arab Organization for Agricultural Development (AOAD) have recently engaged in serious discussions to form an Alliance to support the agenda of the date palm sector in the Arab Region and beyond. The Alliance is yet to be operationalised, but the framework underpinning its formation is looking into a transformative agenda in the sector to result in real change along the value chain. The environmental dimension was well thought through and enshrined, and issues of date palm tolerance to atrocities, adaptability of the tree and its suitability to circular economy (at both input and output levels) constitute a cornerstone in defining the alternative course of actions required to speed up sector transformation.

### An important partnership

AOAD and the FAO have developed a joint framework for date palm transformation along the value chain through wide consultation with member countries, experts and relevant CBOs as well as specialised agencies. The framework is a comprehensive guideline for a core document to initiate and steer an innovation platform to contribute to fast-tracking transformation of the date industry in the Arab region.

Priority areas for proper regional collaboration after the joint framework include but not limited to: production and protection; post-harvest and processing technologies; and opportunities and socio-economic and commercialisation of the date palm. Clearly, commercialisation of the sector is currently underdeveloped. In essence, this includes improving marketing arrangements at all levels, which necessitates the proper development of grades and standards as well as all related pre-marketing activities. Proper governance along the value chain that results in pro-sector-development policies and regulations is of paramount importance, to ensure that the path of development remains on track once transformative measures have been triggered.

### Conclusion

**Multilateralism and regional collaboration are at the forefront of solutions to planetary and human health problems, as no country alone can address the magnitude of their impacts. Regional collaboration is critical to addressing the long-term global response to climate change, and for promoting economic growth, sustainable development, biodiversity restoration, sustainable food production and the supply chain. Bioregional collaboration in the date palm sector is needed to support research, development and innovation, and to meet transboundary environmental and pest and disease challenges. Bioregional collaboration can be achieved through building upon existing partnerships and frameworks of North-South collaboration and multi-stakeholder engagement by governments, civil societies, and other stakeholders.**

Bio-regional collaboration looks into the regional efforts to promote the agenda of the agricultural sector at large, and date palm in particular, through the work of active partners individually as well as collectively.

تمرة

KHALIFA AWARD
PHOTOGRAPHY
COMPETITION
© KAREM SAHIB
MHAISIN,
KIADPAI

6.3

# Recommendations for the Date Palm Industry

واحة

**PROFESSOR DR ABDELOUAHHAB ZAID**
Secretary General Khalifa International Award for Date Palm and Agricultural Innovation

**DR ABDALLAH OIHABI**
Date Palm Value Chain Analysis and Good Agricultural Practices Expert

**The previous chapters summarised the main challenges faced by the date palm sector in the MENA region. This chapter will focus on recommendations to propose strategic interventions to overcome the challenges and surmount the gaps faced by the date palm sector. This will lead to the development of a strategic programme for the sustainable development of the date palm value chain.**

These interventions should be organised around the main components of the date palm value chain such as:

- Building national and regional capacities of all primary stakeholders on good agricultural practices (GAP) applied to date palm cultivation, including:
  - Date palm tissue culture propagation, mainly mass production of certified vitro plants, to ensure their true-to-typeness and their satisfactory sanitary status.
  - Certified date palm nurseries to ensure the production of healthy and performing offshoots.
  - Date production technical practices – from planting to harvesting.
  - Post-harvest handling and packaging.
  - Integrated pest management (IPM) of the main date palm pests and diseases.
  - Innovative dates processing processes.
  - Waste management and re-use in agriculture.
- Developing programmes for the enhancement of date marketing;
- Enhancing regional and international collaboration and the exchange of expertise among the date-producing and processing countries.

Special attention should be given to the small-scale date growers in the traditional oasis, in order to contribute to:

- The preservation of existing date palm biodiversity.
- The rehabilitation of the oasis effect – through the restitution of three layers oasis (date palm, fruit trees, vegetables and herbaceous layer).
- Increasing oasis resilience to the effects of climate change through rehabilitation of its cultural, architectural and artistic roles.

International and regional organisations have separately provided tremendous assistance to the concerned countries in developing programmes and implementing technical cooperation projects dedicated to the development of the date palm sector. To make their interventions more efficient, it is highly recommended that a coordinating body or a structure is established, through the creation of an international consortium made of all regional and international organisations concerned by the sustainable development of the date palm sector and the oasis ecosystem in the MENA region.

A joint implementation of date development projects for the MENA region already formulated within the collaboration between AOAD and other international organisations including but not limited to FAO, ICARDA, and KIADPAI, may be an excellent achievement of such an entity.

**Building national and regional capacities of all primary stakeholders on good agricultural practices (GAP) applied to date palm cultivation.**

**It is highly recommended that a coordinating body or a structure is established, through the creation of an international consortium made of all regional and international organisations concerned by the sustainable development of the date palm sector and the oasis ecosystem in the MENA region.**

نخلة

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واحة

# Conclusions and Recommendations 7

واحة

نخلة

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# 7.1 General Conclusions and Recommendations

2020 marked the fifth anniversary of the UN SDGs, and the recommendations of this report are framed around 'the five Ps': people, planet, prosperity, peace, and partnerships shaping the 2030 Agenda for Sustainable Development.[106]

## People

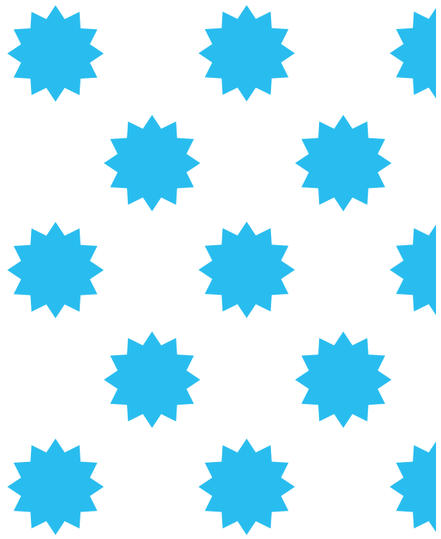
**"We are determined to end poverty and hunger, in all their forms and dimensions, and to ensure that all human beings can fulfil their potential in dignity and equality and in a healthy environment."[107]**

- Scale up the restoration of date palm ecosystems to alleviate poverty, to ensure food security and to see date palm as a holistic developmental solution.
- Place people at the centre of sustainable development, ensure development of new skills, education, and capacity building to meet social aspirations for all.
- Ensure authentic cultural continuity of indigenous communities in the changing world.

## Planet

**"We are determined to protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations."[108]**

- Implement transboundary adaptation programmes focused on date palm oasis restoration, to enhance its full environmental, economic, and social potentials.
- Re-introduce biodiversity to date palm oasis ecosystems, both in terms of date palm trees varieties as well as plants cultivated within the oasis.
- Create food security programmes that would offer a hybrid solution for food cultivation within the oasis ecosystems, as well as man-made environments.



**Scale up the restoration of date palm ecosystems to alleviate poverty, to ensure food security and to see date palm as a holistic developmental solution.**

**Implement transboundary adaptation programmes focused on date palm oasis restoration, to enhance its full environmental, economic, and social potentials.**

واحة نخلة



**PROFESSOR DR ABDELOUAHHAB ZAID**
Secretary General
Khalifa International Award for Date Palm and Agricultural Innovation

**DR SANDRA PIESIK**
Director
3 ideas B.V.

## Prosperity

**"We are determined to ensure that all human beings can enjoy prosperous and fulfilling lives and that economic, social, and technological progress occurs in harmony with nature."[109]**

- Re-introduce bio-circular economy models through North-South collaboration, research development and innovation.
- Focus on new jobs across all sectors with a diversity of skills from manual labour, intermediate technology to the Fourth Industrial Revolution.
- Ensure a financial mechanism for sustainable industrialisation, foster start-ups and SMEs, digitalisation, and ICT access for all, particularly for remote desert communities.

**Re-introduce bio-circular economy models through North-South collaboration, research development and innovation.**

## Peace

**"We are determined to foster peaceful, just and inclusive societies which are free from fear and violence. There can be no sustainable development without peace and no peace without sustainable development."[110]**

- Use climate action, the UNFCCC system, Agenda 2030, and other global frameworks to scale up oases' restoration, prevent degradation and foster sustainable urbanisation for regional security.
- Acknowledge the co-benefits of sustainable development for the reduction of South- North migration, invest and support all actions and efforts leading to the reduction of human displacement.
- Focus on oases and urban integration programmes, particularly in the Sahel region.

## Partnership

**"We are determined to mobilise the means required to implement this Agenda through a revitalised Global Partnership for Sustainable Development, based on a spirit of strengthened global solidarity, focused in particular on the needs of the poorest and most vulnerable and with the participation of all countries, all stakeholders and all people."[111]**

- Recognise the benefits of multilateralism and foster the implementation of the Paris Agreement, Agenda 2030, and global agreements.
- Enhance North-South, South-South and triangular regional and international cooperation.[112]
- Create an enabling environment for new policies at the regional, national and local government levels for the implementation of SDG 11.A to "Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning".[113]

**"The interlinkages and integrated nature of the Sustainable Development Goals are of crucial importance in ensuring that the purpose of the new Agenda is realized. If we realize our ambitions across the full extent of the Agenda, the lives of all will be profoundly improved and our world will be transformed for the better."[114]**

تمرة

# The Khalifa Award Report Recommendations


FIGURE 27: THE KHALIFA AWARD REPORT RECOMMENDATIONS


KHALIFA AWARD PHOTOGRAPHY COMPETITION © HUSSAIN BIN ABDELRAHMAN, KIADPAI

# 7.2 Editorial Conclusions

**PROFESSOR DR ABDELOUAHHAB ZAID**
Secretary General Khalifa International Award for Date Palm and Agricultural Innovation

**DR SANDRA PIESIK**
Director 3 ideas B.V

**This report was commissioned during the summer of 2020, at the end of the first wave of the COVID-19 pandemic. It was evident then, as it is now, that multilateralism and international collaboration are critical to successfully responding to the global pandemic. Whilst national and global reactions have been directed to immediate COVID-19 responses, the long-term transboundary risk of climate change remains a real threat to people across the world. Its adverse effects are acutely experienced in countries of the MENA region with hot desert climates, which calls for a regional scale up of adaptation programmes. The third component of the transboundary character of this report lies in technology development and transfer, through the upscaling of existing technologies, scaling up on bio-circular economy, and the introduction of new technologies, which no country can facilitate on its own in this interconnected world.**

**The co-benefits of regional collaboration are apparent, not only through cultural and political relationships, but in nature itself, with geographical characteristics and ecosystems fostering a model of collaboration based on resource availability and similar climate change threats.**



### Adapting to the 'new normal'

The COVID-19 pandemic has brought globalisation into question, despite its positive effects on the alleviation of poverty, and replaced it with a greater emphasis on regionalisation. The co-benefits of regional collaboration are apparent, not only through cultural and political relationships, but in nature itself, with geographical characteristics and ecosystems fostering a model of collaboration based on resource availability and similar climate change threats. The introduction of the term 'bio-regional' collaboration enabled us to focus on the environmental characteristics of date palm oasis ecosystems. These ecosystems have acted throughout the millennia as a catalyst for ancient trading routes and political exchanges, giving birth to cities and the development of ancient civilisations. We would like to build on this ancient heritage of collaboration, through nature and with nature, to respond to the immediate risks and shocks we are facing today, and to build resilience for the future.

### A note of gratitude to our fellow contributors

We are grateful to all who responded to our invitation to contribute to this report, and for sharing existing programmes, initiatives, opportunities and challenges. Recent months have shown us the value of human relationships and the value of nature which, in the words of Mr António Guterres, the UN Secretary General, continue to resonate today: "Nature is angry. And we fool ourselves if we think we can fool nature. Because nature always strikes back. And around the world, nature is striking back with fury."[115]

The UN Decade on Ecosystem Restoration (2021 – 2030)[116] offers a unique opportunity to restore global ecosystems and, in particular, desert ecosystems for planetary and human health. We are calling for the implementation of transboundary adaptation programmes in the MENA region, which can have a multiplicity of applications through date palm itself: from assessing common climate risks which could be mitigated through ecosystems restoration to carbon gas sinks; improved air quality and pollution control; biodiversity and food security; authentic cultural continuity; and greater rural and urban integration, whilst also meeting the aspirations of vulnerable communities, women and youth.

### Final thoughts

The bio-circular economic potential of the date palm industry remains unexplored. In some cases, it is a necessity that can save lives in oases prone to fire hazards caused by climate change, while at the same time, it can bring about new green jobs in the sustainable economy transition. The European circular economy transition can serve as a model for adaptation in the MENA region.

In this report, we also aimed to recognise the value of existing multilateral agreements, the Rio Conventions, the Paris Agreement, the Sustainable Development Goals, the European Green Deal and the many existing initiatives that we need to embrace to turn around the trajectory we are currently in, and to call for their implementation. Recommendations are given for holistic approaches fostering multidisciplinary collaboration and political goodwill, whilst embracing SDG 17.6 to "Enhance North-South, South-South and triangular regional and international cooperation on science, technology and innovation and enhance knowledge sharing (...)".[117]

We are all collectively aware that without greater collaboration we will be unable to address the global challenges we collectively face.[118] The 2021 UN Decade on Ecosystem Restoration and the great post-COVID-19 reset are calling for joint action, greater political and climate action ambition to deliver long term prosperity for all. We hope that this report lays the foundation to implement this equally ambitious goal.

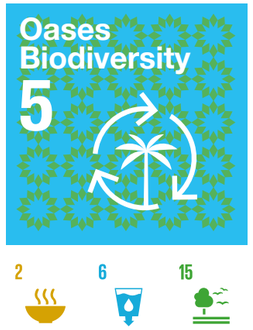
**The 2021 UN Decade on Ecosystem Restoration and the great post-COVID-19 reset are calling for joint action, greater political and climate action ambition to deliver long term prosperity for all.**

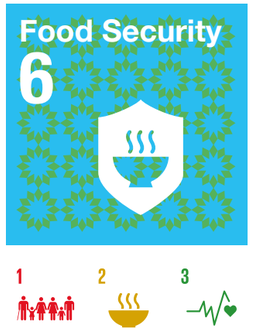
# The Khalifa Award Report Recommendations and Sustainable Development Goals

## People



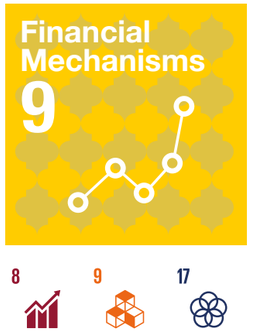

## Planet

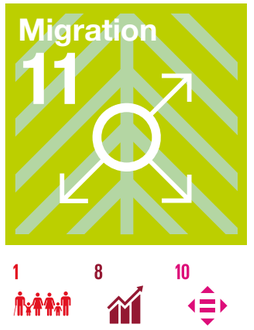




## Prosperity






## Peace



## Partnership




FIGURE 28: THE KHALIFA AWARD REPORT RECOMMENDATIONS AND SUSTAINABLE DEVELOPMENT GOALS


واحة نخلة

تمرة واحة

UAE, DATE PALM AGRICULTURE © KIADPAI

# 7.3 Acknowledgments

We dedicate this report to the late Sheikh Zayed Bin Sultan Al Nahayan, "May God Bless His Soul", Founder of the UAE, who dedicated his life to the protection of the environment and the well establishment of the UAE's Date Palm sector. The authors also dedicate this report to all who lost their lives during the COVID-19 pandemic, and for those working towards our #BuildBackBetter future.

The editors would like to thank all distinguished contributors for taking part in this report. In particular, His Excellency Sheikh Nahayan Mabarak Al Nahayan, Minister of Tolerance and Coexistence, Chairman of the Award's Board of Trustees.

The Khalifa Award staff who generously supported all efforts related to production of this report: Professor Dr Abdelouahhab Zaid, Dr Helal Humaid Saad Al Kaabi, Mr Tag El Sir Musa, Afra Al Kaabi, Ahed Karkouti, Sara Nasr, Esraa Shatnawi, Eng Emad Saad, Sameera Lakshan, Yasmeen Mohammed Al Yafei and Rona Burgos Inarsolin.

Thanks to all who contributed to its delivery: Ali Al Haj, Head of the European Union Section in Brussels, Mr David Cunliffe, Ms Nadine Van Dijk (FAO), Mr Bo Sprotte Kofod (Earthbanc), Ms Stephanie Loose (UN-HABITAT), Dr Abduallah Oihabi, Dr Meropi Paneli, Mr Sultan bin Khalfan Al Romithi, Ms. Barbara Sidoti (IOM), and Dr Youssef Nassef, Director of Adaptation at UNFCCC.

A special thanks go to the report's production and PR teams: Ms Majella Van Raalte, Mr Selmar de Jager, Mr Martijn Mulder (Beautiful Minds), copyeditor Kevin Dowling, Ms Leonne van de Ven, Ms Evi Coune and Paulien Kurris of Lewis Antwerp.

Last, but not least, we would like to thank our families and friends. Also, the indigenous peoples of the MENA region, who have been cultivating oases throughout generations. Although we represent different faiths and belief systems, we would also like to acknowledge all forms of spirituality that foster reverence for nature and each other, so we can share a more sustainable, resilient, and prosperous future.

تمـــــــرة

# Appendices and End Notes

8

# 8.1 Appendix 1: Date Palm and Sustainable Development Goals

**DR SANDRA PIESIK**
Director
3 ideas B.V.

**Sustainable Development Goals[119] and targets relevant for date palm cultivation communities, bioeconomy, and bio-regional collaboration.**





1 NO POVERTY

**Goal 1:**

## End poverty in all its forms everywhere

| Goals and Targets | Indicators |
|---|---|
| **1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day** | 1.1.1 Proportion of population below the international poverty line, by sex, age, employment status and geographical location (urban/rural) |
| 1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions | 1.2.2 Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions |
| **1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance** | 1.4.2 Proportion of total adult population with secure tenure rights to land, with legally recognized documentation and who perceive their rights to land as secure, by sex and by type of tenure |
| **1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters** | 1.5.3 Number of countries with national and local disaster risk reduction strategies |
| 1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions | 1.a.1 Proportion of resources allocated by the government directly to poverty reduction programmes<br>1.a.2 Proportion of total government spending on essential services (education, health and social protection) |
| 1.b Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions | 1.b.1 Proportion of government recurrent and capital spending to sectors that disproportionately benefit women, the poor and vulnerable groups |

2 ZERO HUNGER

Goal 2:

# End hunger, achieve food security and improved nutrition and promote sustainable agriculture

| Goals and Targets | Indicators |
|---|---|
| **2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round** | 2.1.1 Prevalence of undernourishment<br>2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES) |
| **2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment** | 2.3.2 Average income of small-scale food producers, by sex and indigenous status |
| **2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality** | 2.4.1 Proportion of agricultural area under productive and sustainable agriculture |
| 2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed | 2.5.1 Number of plant and animal genetic resources for food and agriculture secured in either medium or long-term conservation facilities |
| 2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries | 2.a.1 The agriculture orientation index for government expenditures |
| 2.b Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round | 2.b.2 Agricultural export subsidies |
| 2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility | 2.c.1 Indicator of food price anomalies |



3 GOOD HEALTH AND WELL-BEING

Goal 3:

# Ensure healthy lives and promote well-being for all at all ages

| Goals and Targets | Indicators |
|---|---|
| 3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination | |
| 3.b Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all | 3.b.1 Proportion of the population with access to affordable medicines and vaccines on a sustainable basis |
| **3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks** | **3.d.1 International Health Regulations (IHR) capacity and health emergency preparedness** |


Goal 4:

# Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

## Goals and Targets

4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship

4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations

**4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development**

## Indicators

4.4.1 Proportion of youth and adults with information and communications technology (ICT) skills, by type of skill

4.5.1 Parity indices (female/male, rural/urban, bottom/top wealth quintile and others such as disability status, indigenous peoples and conflict-affected, as data become available) for all education indicators on this list that can be disaggregated

**4.7.1 Extent to which (i) global citizenship education and (ii) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in: (a) national education policies, (b) curricula, (c) teacher education and (d) student assessment**




Goal 5:

# Achieve gender equality and empower all women and girls

## Goals and Targets

**5.1 End all forms of discrimination against all women and girls everywhere**

5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate

5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life

**5.a Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws**

5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women

## Indicators

**5.1.1 Whether or not legal frameworks are in place to promote, enforce and monitor equality and non discrimination on the basis of sex**

5.4.1 Proportion of time spent on unpaid domestic and care work, by sex, age and location

5.5.1 Proportion of seats held by women in national parliaments and local governments
5.5.2 Proportion of women in managerial positions

**5.a.1 (a) Proportion of total agricultural population with ownership or secure rights over agricultural land, by sex; and (b) share of women among owners or rights-bearers of agricultural land, by type of tenure**
**5.a.2 Proportion of countries where the legal framework (including customary law) guarantees women's equal rights to land ownership and/or control**

5.b.1 Proportion of individuals who own a mobile telephone, by sex

6 CLEAN WATER AND SANITATION

Goal 6:

# Ensure availability and sustainable management of water and sanitation for all

| Goals and Targets | Indicators |
|---|---|
| **6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all** | 6.1.1 Proportion of population using safely managed drinking water services |
| 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity | 6.4.1 Change in water-use efficiency over time<br>6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources |
| **6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate** | 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation |
| **6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes** | 6.6.1 Change in the extent of water-related ecosystems over time |



7 AFFORDABLE AND CLEAN ENERGY

Goal 7:

# Ensure access to affordable, reliable, sustainable and modern energy for all

| Goals and Targets | Indicators |
|---|---|
| **7.1 By 2030, ensure universal access to affordable, reliable and modern energy services** | 7.1.1 Proportion of population with access to electricity<br>7.1.2 Proportion of population with primary reliance on clean fuels and technology |
| 7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology | 7.a.1 International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems |
| **7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support** | **7.b.1 Investments in energy efficiency as a percentage of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services** |

8 DECENT WORK AND ECONOMIC GROWTH

Goal 8:

# Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

| Goals and Targets | Indicators |
|---|---|
| 8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors | 8.2.1 Annual growth rate of real GDP per employed person |
| **8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services** | 8.3.1 Proportion of informal employment in non agriculture employment, by sex |
| **8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead** | 8.4.1 Material footprint, material footprint per capita, and material footprint per GDP<br>8.4.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP |
| **8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training** | 8.6.1 Proportion of youth (aged 15-24 years) not in education, employment or training |
| 8.9 By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products | 8.9.1 Tourism direct GDP as a proportion of total GDP and in growth rate<br>8.9.2<br>Number of jobs in tourism industries as a proportion of total jobs and growth rate of jobs, by sex |



9 INDUSTRY, INNOVATION AND INFRASTRUCTUR

Goal 9:

# Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

| Goals and Targets | Indicators |
|---|---|
| **9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all** | **9.1.1 Proportion of the rural population who live within 2 km of an all-season road** |
| **9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries** | 9.2.1 Manufacturing value added as a proportion of GDP and per capita<br>9.2.2 Manufacturing employment as a proportion of total employment |
| 9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets | 9.3.1 Proportion of small-scale industries in total industry value added<br>9.3.2 Proportion of small-scale industries with a loan or line of credit |
| **9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending** | 9.5.2 Researchers (in full-time equivalent) per million inhabitants |
| 9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing | 9.a.1 Total official international support (official development assistance plus other official flows) to infrastructure |
| **9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020** | 9.c.1 Proportion of population covered by a mobile network, by technology |

10 REDUCED INEQUALITIES

Goal 10:

# Reduce inequality within and among countries

| Goals and Targets | Indicators |
|---|---|
| **10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status** | 10.2.1 Proportion of people living below 50 percent of median income, by age, sex and persons with disabilities |
| **10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality** | 10.4.1 Labour share of GDP, comprising wages and social protection transfers |
| **10.7 Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies** | 10.7.2 Number of countries that have implemented well-managed migration policies |
| 10.b Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programme | 10.b.1 Total resource flows for development, by recipient and donor countries and type of flow (e.g. official development assistance, foreign direct investment and other flows) |



11 SUSTAINABLE CITIES AND COMMUNITIES

Goal 11:

# Make cities and human settlements inclusive, safe, resilient and sustainable

| Goals and Targets | Indicators |
|---|---|
| 11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums | 11.1.1 Proportion of urban population living in slums, informal settlements or inadequate housing |
| **11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries** | 11.3.2 Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically |
| 11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage | 11.4.1 Total expenditure (public and private) per capita spent on the preservation, protection and conservation of all cultural and natural heritage, by type of heritage (cultural, natural, mixed and World Heritage Centre designation), level of government (national, regional and local/municipal), type of expenditure (operating expenditure/ investment) and type of private funding (donations in kind, private non-profit sector and sponsorship) |
| **11.a Support positive economic, social and environmental links between urban, per-urban and rural areas by strengthening national and regional development planning** | **11.a.1 Proportion of population living in cities that implement urban and regional development plans integrating population projections and resource needs, by size of city** |
| **11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels** | **11.b.1 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030a 11.b.2 Number of countries with national and local disaster risk reduction strategies** |
| 11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials | 11.c.1 Proportion of financial support to the least developed countries that is allocated to the construction and retrofitting of sustainable, resilient and resource-efficient buildings utilizing local materials |

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Goal 12:

# Ensure sustainable consumption and production patterns

| Goals and Targets | Indicators |
|---|---|
| **12.1 Implement the 10-year framework of programmes on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries** | 12.1.1 Number of countries with sustainable consumption and production (SCP) national action plans or SCP mainstreamed as a priority or a target into national policies |
| **12.2 By 2030, achieve the sustainable management and efficient use of natural resources** | 12.2.1 Material footprint, material footprint per capita, and material footprint per GDP |
| **12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse** | 12.5.1 National recycling rate, tons of material recycled |
| **12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature** | 12.8.1 Extent to which (i) global citizenship education and (ii) education for sustainable development (including climate change education) are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment |
| 12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production | 12.a.1 Amount of support to developing countries on research and development for sustainable consumption and production and environmentally sound technologies |



13 CLIMATE ACTION

Goal 13:

# Take urgent action to combat climate change and its impacts*

| Goals and Targets | Indicators |
|---|---|
| **13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries** | **13.1.3 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies** |
| **3.2 Integrate climate change measures into national policies, strategies and planning** | **13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/ strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)** |
| **13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities.* Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.** | **13.b.1 Number of least developed countries and small island developing States that are receiving specialized support, and amount of support, including finance, technology and capacity-building, for mechanisms for raising capacities for effective climate change-related planning and management, including focusing on women, youth and local and marginalized communities** |


Goal 15:

# Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

| Goals and Targets | Indicators |
|---|---|
| **15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements** | 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type |
| **15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world** | **15.3.1 Proportion of land that is degraded over total land area** |
| 15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species | 15.5.1 Red List Index |
| 15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts | 15.9.1 Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020 |
| 15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation | 15.b.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems |




Goal 16:

# Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

| Goals and Targets | Indicators |
|---|---|
| 16.6 Develop effective, accountable and transparent institutions at all levels | |
| **16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels** | |
| 16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance | |
| **16.b Promote and enforce non-discriminatory laws and policies for sustainable development** | **16.b.1 Proportion of population reporting having personally felt discriminated against or harassed in the previous 12 months on the basis of a ground of discrimination prohibited under international human rights law** |

17 PARTNERSHIP FOR THE GOAL

Goal 17:

# Strengthen the means of implementation and revitalize the global partnership for sustainable development

| Goals and Targets | Indicators |
|---|---|
| 17.3 Mobilize additional financial resources for developing countries from multiple sources | 17.3.1 Foreign direct investments (FDI), official development assistance and South-South Cooperation as a proportion of total domestic budget |
| **17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism** | **17.6.1 Number of science and/or technology cooperation agreements and programmes between countries, by type of cooperation**<br>**17.6.2 Fixed Internet broadband subscriptions per 100 inhabitants, by speed** |
| **17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed** | 17.7.1 Total amount of approved funding for developing countries to promote the development, transfer, dissemination and diffusion of environmentally sound technologies |
| 17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology | 17.8.1 Proportion of individuals using the Internet |
| Trade 17.10 Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda | |
| **17.13 Enhance global macroeconomic stability, including through policy coordination and policy coherence** | 17.13.1 Macroeconomic Dashboard |
| 17.14 Enhance policy coherence for sustainable development | 17.14.1 Number of countries with mechanisms in place to enhance policy coherence of sustainable development |
| 17.16 Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries, in particular developing countries | 17.16.1 Number of countries reporting progress in multi-stakeholder development effectiveness monitoring frameworks that support the achievement of the sustainable development goals |
| 17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts | |
| .19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries | |



# 8.2 Appendix 2: Date Palm World Statistics

**DR ABDALLAH OIHABI**
Date Palm Value Chain Analysis and Good Agricultural Practices Expert

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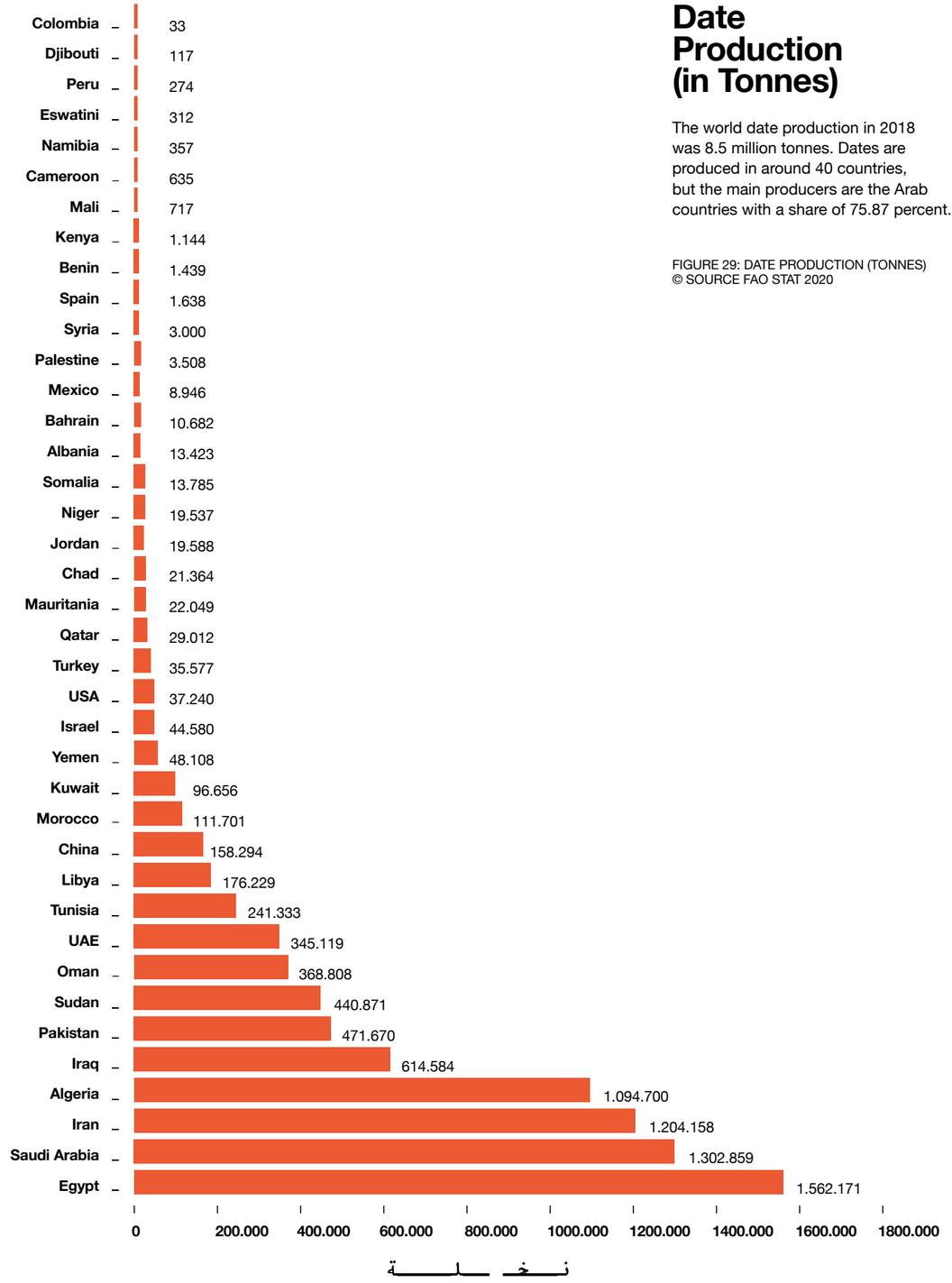
# Date Production (in Tonnes)

The world date production in 2018 was 8.5 million tonnes. Dates are produced in around 40 countries, but the main producers are the Arab countries with a share of 75.87 percent.

FIGURE 29: DATE PRODUCTION (TONNES)
© SOURCE FAO STAT 2020

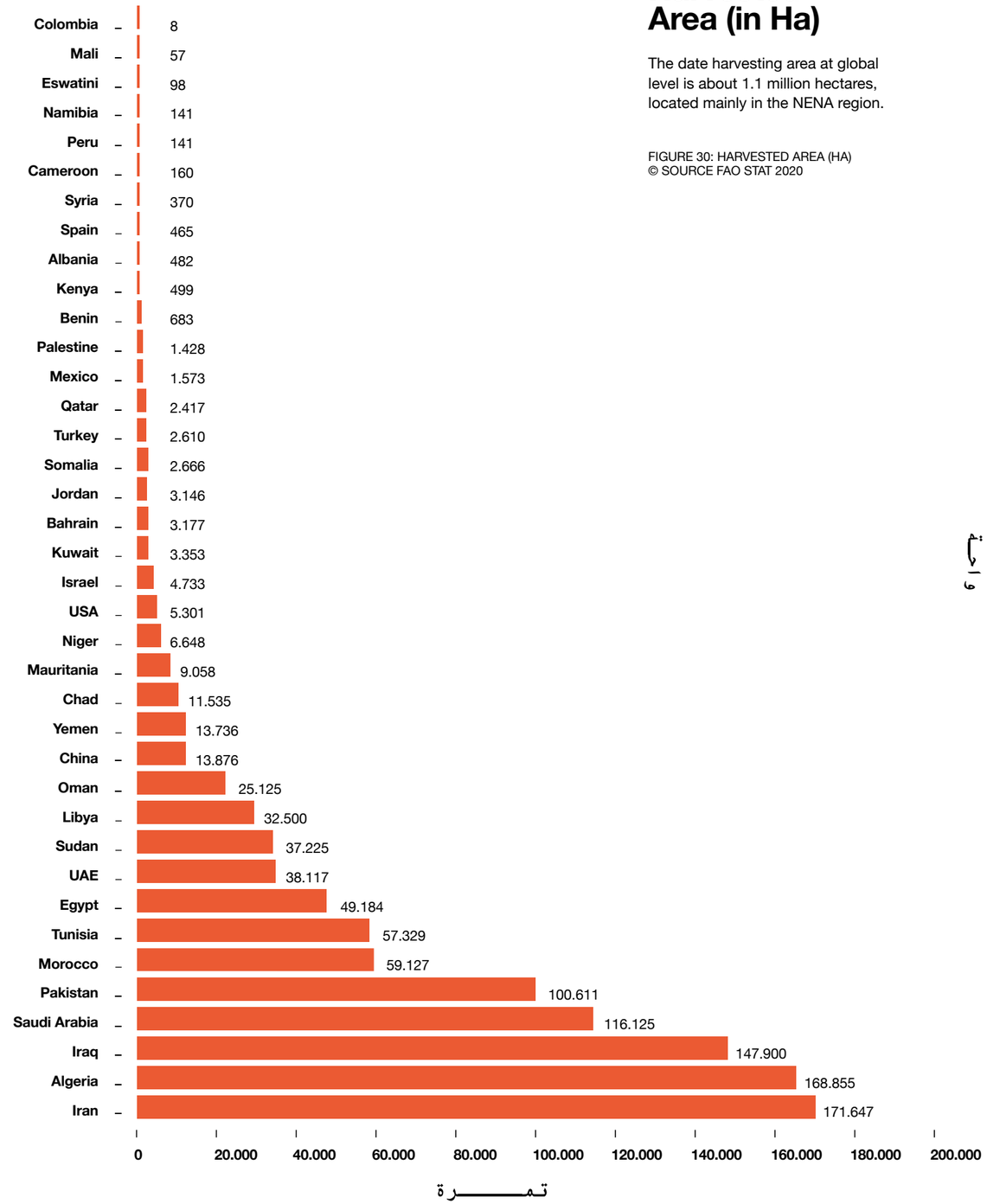





# Harvested Area (in Ha)

The date harvesting area at global level is about 1.1 million hectares, located mainly in the NENA region.

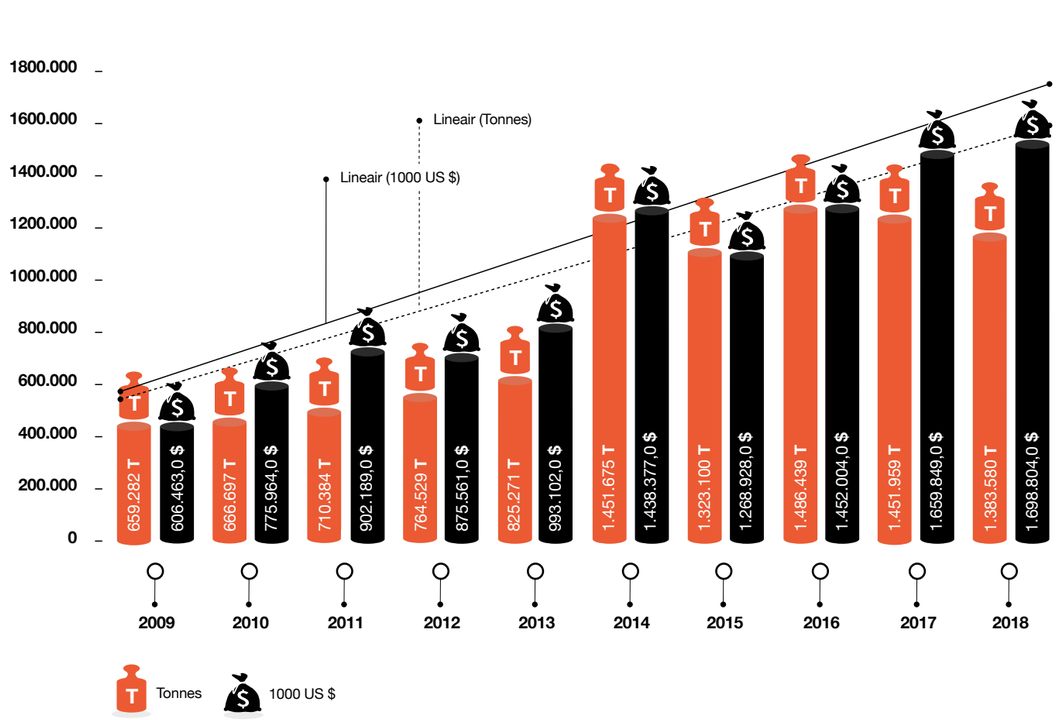
FIGURE 30: HARVESTED AREA (HA)
© SOURCE FAO STAT 2020



# Global date marketing

The quantities of dates handled on the international market has been steadily increasing during the last decade and the average price varies between 0.9 and 1.7 US$/Kg. this price depends on the fruit variety, quality, standards and the targeted market.

FIGURE 31: GLOBAL DATE MARKETING
© SOURCE FAO STAT 2020

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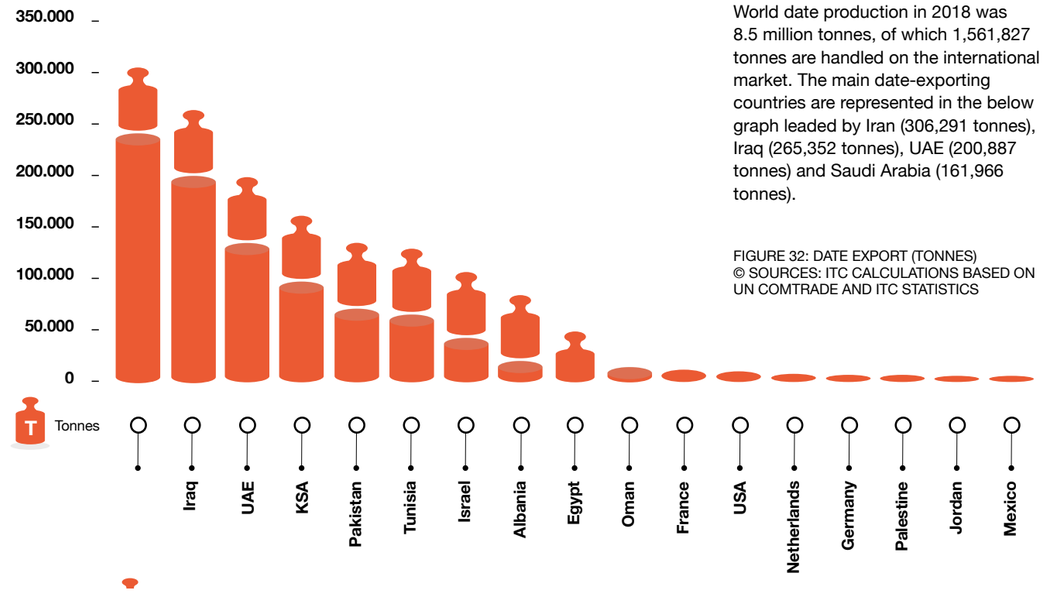
# Date export (in Tonnes)

World date production in 2018 was 8.5 million tonnes, of which 1,561,827 tonnes are handled on the international market. The main date-exporting countries are represented in the below graph leaded by Iran (306,291 tonnes), Iraq (265,352 tonnes), UAE (200,887 tonnes) and Saudi Arabia (161,966 tonnes).

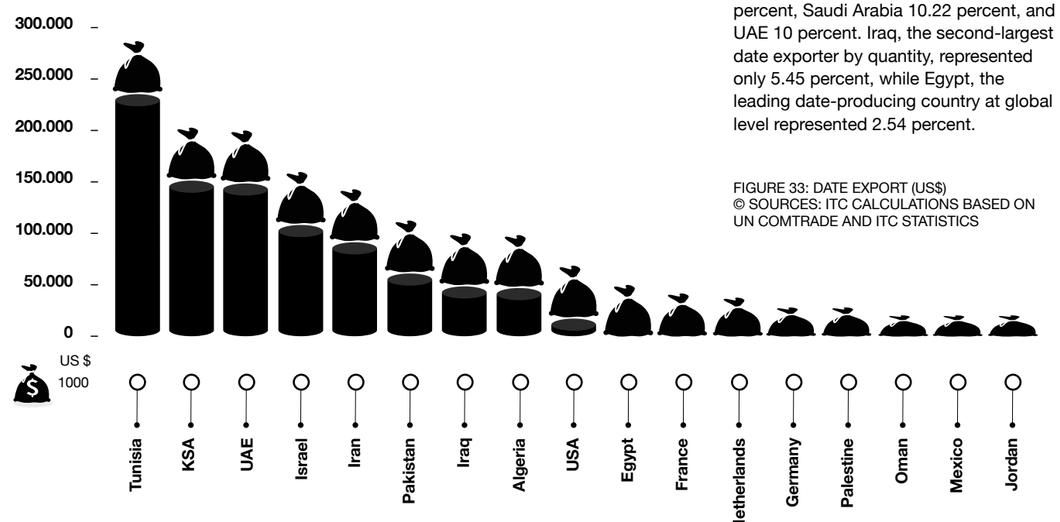
FIGURE 32: DATE EXPORT (TONNES)
© SOURCES: ITC CALCULATIONS BASED ON UN COMTRADE AND ITC STATISTICS




# Date export (USD)

The value of exported dates in 2018 was US$1.97 billion. Of this total, Iran represented 17.17 percent, Tunisia 16.30 percent, Saudi Arabia 10.22 percent, and UAE 10 percent. Iraq, the second-largest date exporter by quantity, represented only 5.45 percent, while Egypt, the leading date-producing country at global level represented 2.54 percent.

FIGURE 33: DATE EXPORT (US$)
© SOURCES: ITC CALCULATIONS BASED ON UN COMTRADE AND ITC STATISTICS

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# Date marketing: exporting countries

The average price of dates on the international market in 2018 was US$1.26/kg. The price of dates per exporting country are in red. Egypt as the largest date producer, and Iran and Iraq as the top date exporters, are not getting the best income per unit.

FIGURE 34: DATE MARKETING: EXPORTING COUNTRIES
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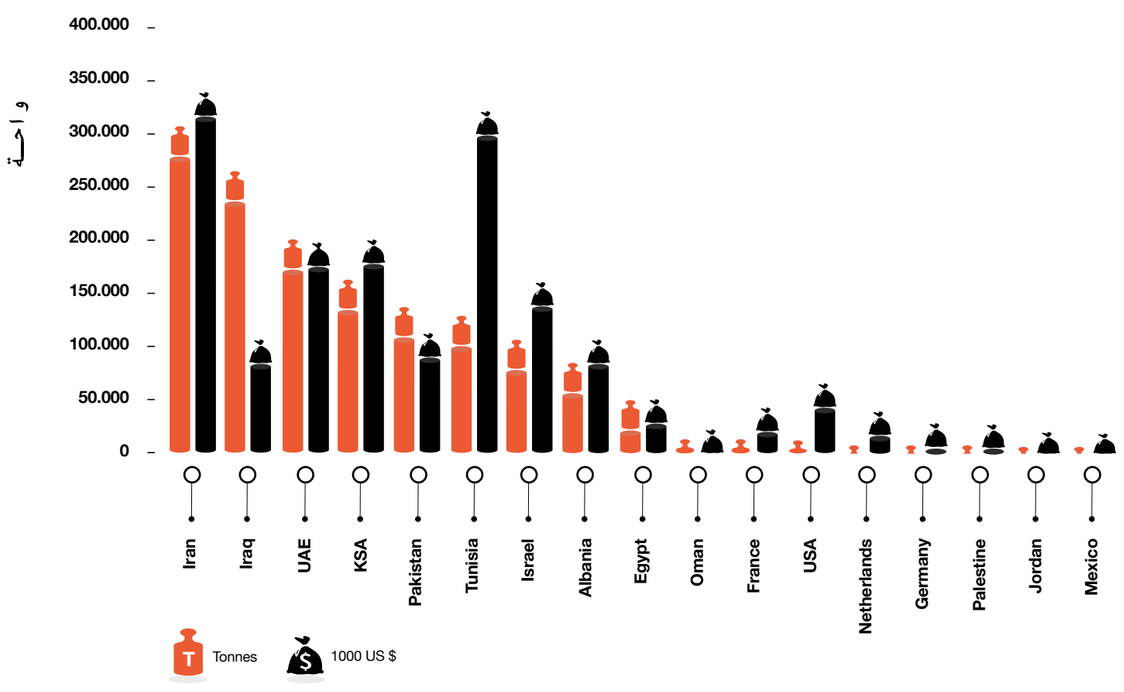


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# Date marketing: importing countries

The two main importer countries, India and UAE, represent 40 percent of the total quantity of dates handled at the international market, but in terms of value they represent 21 percent. The prices paid in US$/kg per importing country are shown in red.

FIGURE 35: DATE MARKETING: IMPORTING COUNTRIES
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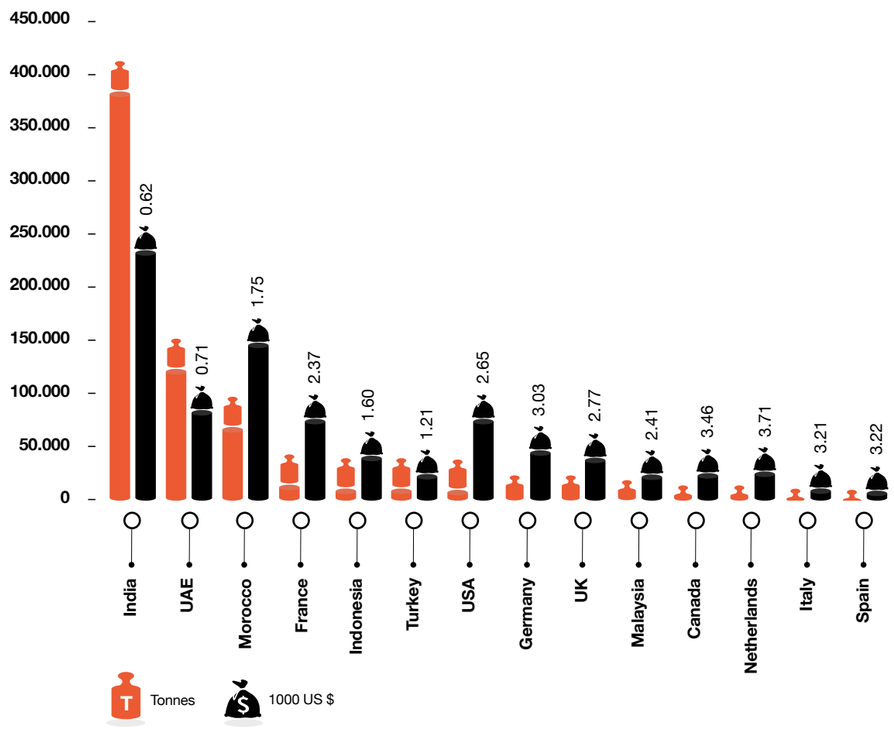


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# 8.3 Abbreviations

ACSAD - Arab Center for the Studies in Arid Zones and Dry Lands
AFESD - Arab Fund for Economic and Social Development
AOAD - Arab Organization for Agricultural Development
ASCOBANS - Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas
BRE - Building Research Establishment
CBD - Convention on Biological Diversity
CE - Circular Economy
CMS - Convention on the Conservation of Migratory Species of Wild Animals
COVID-19 – an infectious disease caused by a newly-discovered coronavirus
CTCN - Climate and Technology Centre & Network
CRRAO - Centre Régional de Recherches en Agriculture Oasienne (Regional Oasis Agriculture Research Center)
DPTCU - Date Palm Tissue Culture Unit
DIT - Distributed Ledger Technology
DNV-GL - Advisory Committee of the Det Norske Veritas
DRM - Al Dhafra Region Municipality
EAD - Environment Agency – Abu Dhabi
EbA - Ecosystem-based adaptation
EDIC - Emirates Defence Industries Company
EEG - Emirates Environmental Group
EFI - European Forest Institute
ERA - European Research Area
ESCWA - United Nations Economic and Social Commission for Western Asia
EU - European Union
FSCP - Future Saudi Cities Programme
GAP - Good Agricultural Practices
GBS - Global Bioeconomy Summit (held in 2018)
GCC - Cooperation Council for the Arab States of the Gulf (previously the Gulf Cooperation Council)
GDP - Gross domestic product
GEF - Global Environment Facility
GFFA - Global Forum for Food and Agriculture
GHG - Greenhouse gases
GIS - Geographical Information Systems
GISD - Global Investors for Sustainable Development
GIZ - Deutsche Gesellschaft für Internationale Zusammenarbeit
GPFLR - Global Partnership on Forest and Landscape Restoration
GRI - Global Reporting Initiative Stakeholder Council



FAITC - Food and Agro-Industries Technology Center
FAO - Food and Agriculture Organization of the United Nations
FAOSTAT - Food and Agriculture Organization Corporate Statistical Database
FRP - Fibre-reinforced plastic
IBD - Islamic Development Bank
ICARDA - International Center for Agriculture Research in the Dry Areas
ICLEI - Local Governments for Sustainability
IDEX - International Defence Exhibition
IFAD - International Fund for Agricultural Development
IFSA - IFSA Network (previously known as the International Finance Students Association)
IGO - Intergovernmental Organisation
ILM - Integrated Landscape Management
IUCN - International Union for Conservation of Nature
IUFRO - International Union of Forest Research Organizations
ISBWG - International Sustainable Bioeconomy Working Group
ISID - Inclusive and sustainable industrial development
IRA - Institute of Arid Areas
KIADPAI - Khalifa International Award for Date Palm and Agricultural Innovation
LDC - Least Developed Countries
MENA - Middle East and North Africa
NAP - National Adaptation Plans
NAVDEX - Naval Defence Exhibition
NCBI – National Center for Biotechnology Information
NDCs - Nationally Determined Contributions
NGO - Non-Governmental Organisation
NMMO - N-methylmorpholine-N-oxide solutions
NWP - Nairobi Work Programme
OECD - Organisation for Economic Co-operation and Development
OSS - Observatoire du Sahara et du Sahel (Sahara and Sahel Observatory)
PCCB - Paris Committee on Capacity Building
RALSP - Resilient Agricultural Livelihood Systems Program
R&D - Research and development
SDGs - Sustainable Development Goals
SIDS - Small Island Developing States
SSTC - South-South and Triangular Cooperation
UAE - United Arab Emirates
UAEU United Arab Emirates University
UNCCD - United Nations Convention to Combat Desertification
UNDP - United Nations Development Programme
UNEP - United Nations Environment Programme
UNESCO - United Nations Educational, Scientific and Cultural Organization
UNFCCC -United Nations Framework Convention on Climate Change
UNIFEM - United Nations Development Fund for Women
UNIDO - United Nations Industrial Development Organization
WGBC - World Green Building Council
WWF - World Wide Fund for Nature

# 8.4 List of Figures

# 8.5 List of Images

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# 8.7 Biographies

**Preface**

**His Excellency Sheikh Nahayan Mabarak Al Nahayan**
Cabinet Member and Minister of Tolerance and Coexistence
His Excellency Sheikh Nahayan Mabarak Al Nahayan occupies the position of Minister of Tolerance and Coexistence since October 2017.
His Excellency Sheikh Nahayan joined the Federal Government in 1990 and held a number of portfolios including Minister of Higher Education and Scientific Research, Minister of Education, and Minister of Culture and Knowledge Development.
His Excellency Sheikh Nahayan was also the Chancellor of United Arab Emirates University from 1983 to 2013; Chancellor of Higher Colleges of Technology from 1988 to 2013; and President of Zayed University from 1998 to 2013.
His Excellency is also the Chairman of the Board of Trustees of Khalifa International Award for Date Palm and Agricultural Innovation, since 2007.

**Statements**
*(In the order presented in the report)*

**Professor Dr Abdelouahhab Zaid**
Professor Zaid is Agricultural Advisor to the United Arab Emirates Ministry of Presidential Affairs. He also serves as Secretary General of the Khalifa International Award for Date Palm and Agricultural Innovation, and is a Goodwill Ambassador to the FAO. Throughout a distinguished career devoted to crop science, horticulture and agronomy, he has held several high-level government, academic and institutional roles and participated in biotechnology development projects aimed at increasing plant production and employment in more than 20 countries.

Professor Zaid has been honoured with multiple awards, including a BR. Sen Award and Honorary Medal from FAO, and an Award of Excellence from AOAD.

**Dr Sandra Piesik**
Dr Piesik is an award-winning architect, author and researcher, specialising in the implementation of global sustainable legislation, nature-based solutions and traditional knowledge adaptation. She is the founder of 3 ideas B.V., an Amsterdam-based consultancy. Her diverse global engagements range from international lectures, judging of the competitions, nominator of awards, and evaluation of R&D projects for the European Union.

Dr Piesik is a stakeholder and network member of several United Nations organisations including UNFCCC: The Resilience Frontiers, the Nairobi Work Programme (NWP), the Paris Committee on Capacity Building (PCCB) and the Climate and Technology Centre & Network (CTCN). She was formerly the UNCCD Policy Support Consultant on Rural – Urban Dynamics and contributed to the UN-HABITAT Urban-Rural Linkages: Guiding Principles and Framework for Action to Advance Integrated Territorial Development. Her published work includes Arish: Palm-Leaf Architecture (Thames & Hudson, 2012), she is also the general editor of HABITAT: Vernacular Architecture for a Changing Planet (Thames & Hudson, Abrams Books, Flammarion, Editions Detail and Blume, 2017).

**Her Excellency Elizabeth Maruma Mrema**
Her Excellency is the Executive Secretary of the Convention on Biological Diversity. Formerly Director of the Law Division, she has worked with the United Nations Environment Programme (UNE) for more than two decades. She has extensive experience in global environmental law and policymaking, implementation of environmental and sustainable development programmes, and a deep knowledge of multilateral processes.

Ms. Mrema holds a Master of Law Degree from Dalhousie University, Halifax, Canada, a Postgraduate Diploma in International Relations and Diplomacy from the Centre of Foreign Relations and Diplomacy in Dar-es-Salaam, Tanzania, and a Bachelor of Law Degree from the University of Dar-es-Salaam, Tanzania.

**His Excellency Ibrahim Thiaw**
Mr Thiaw was appointed Executive Secretary of the United Nations Convention to Combat Desertification in 2019. He brings to the position almost 40 years of experience in sustainable development, environmental governance and natural resource management. In 2018 he was Special Adviser to the Secretary-General for the Sahel and supported ongoing efforts to advance the recalibration of the United Nations Integrated Strategy for the Sahel and the development of the UN Support Plan for the Sahel. Prior to this he served as Assistant Secretary-General and Deputy Executive Director of the United Nations Environment Programme. Before joining the United Nations in 2007 he was the Regional Director for West Africa, and later Acting Director General, of the International Union for Conservation of Nature.

**Dr Youssef Nassef**
Dr Nassef launched the UN's work on adaptation to climate change and, as Director of the Framework Convention on Climate Change, he has led the UN's adaptation workstreams since their inception. He possesses over 30 years of experience in diplomacy and international environmental policy, and is a seconded diplomat from the Egyptian Foreign Service.

He regularly presents his insights on resilience and adaptation to climate change – focusing on developing countries – at international conferences, and recently created the Resilience Frontiers initiative which applies foresight for attaining post-2030 resilience. Dr Nassef holds a Doctoral Degree in International Technology Policy and Management and a Master's Degree in International Environmental Policy from the Fletcher School of Law and Diplomacy, as well as a Master's Degree in Middle East Studies and a Bachelor's Degree in Computer Science and Physics from the American University in Cairo.

**His Excellency Dr Abdullah Belhaif Al Nuaimi**
His Excellency Dr Al Nuaimi is Minister of Climate Change and Environment for the UAE. In this role, he leads the Ministry's mission of spearheading the drive to mitigate and adapt to the impact of climate change, and to protect the country's ecosystems through developing and implementing effective measures, policies, and initiatives. Previously, he served as Minister of Infrastructure Development, where he played a key role in developing the federal infrastructure. He was also Chairman of the Sheikh Zayed Housing Programme and Chairman of the Federal Transport Authority – Land & Maritime.

In addition to his ministerial responsibilities, His Excellency heads the UAE Council for Climate Change and Environment and the National Biosecurity Committee. He is also a board member of the International Fund for Houbara Conservation.

**Her Excellency Mariam bint Mohammed Saeed Hareb Al Mheiri**
Her Excellency was appointed Minister of State for Food and Water Security in July 2020, and is responsible for monitoring national food stocks, investing in food technology, and following up international relations in this area. Her Excellency also represents the UAE Federal Government in the FAO, as well as the International Center for Biosaline Agriculture. She is a member of the Board of Directors in the ADAFSA, and also a member of the Board of Trustees of KIADPAI, the Dubai Future Foundation and the World Economic Forum's Global Future Council on Food Systems Innovation.
Her Excellency received her Bachelor's and Master's Degrees in Mechanical Engineering from the Rheinisch-Westfälische Technische Hochschule (RWTH) in Aachen, Germany.

**Dr Thanawat Tiensin**
Dr Tiensin was elected Chairperson of the UN Committee on World Food Security in 2019. He is also the permanent Representative of Thailand to UN agencies in Rome. His other official responsibilities include Vice Chairperson of the 41st FAO Conference, Chairperson of the Asia Regional Group, Bureau member of the FAO Committee on Agriculture, Bureau member of the Commission on Genetic Resources for Food and Agriculture, Bureau member and Rapporteur of the Plenary Assembly of Global Soil Partnership Bureau member of the G77 & China. He has worked for international development programmes in various technical areas such as agriculture, livestock, food security and food safety, international trade, and capacity building of veterinary service-related issues. He also provides lectures for several international universities and institutions.
Dr Tiensin holds a PhD in Veterinary Epidemiology and Economics from Utrecht University, The Netherlands and a Doctorate of Veterinary Medicine from Kasetsart University, Thailand.

**Antonio López-Istúriz White MEP**
Mr López-Istúriz White is Secretary General of the European People's Party (EPP) and a Member of the European Parliament (MEP), representing Spain's People's Party. In addition, he serves as President of the European Union-United Arab Emirates Parliamentary Friendship Group. He is also Secretary Treasurer of the Wilfried Martens Centre for European Studies and the Secretary General of the Centrist Democrat International. He was elected MEP in 2004.

As an MEP, he is the Chairman of the Delegation for Relations with Israel. He sits on the Committee on Foreign Affairs and is a substitute on the Subcommittee on Security and Defence. He is also a board member of the ANAR Foundation that helps adolescents at risk and Aequitas Foundation, providing free legal advice for disadvantaged groups or those in need of better social protection.

**Remaining contributors**
*(In alphabetical order)*

**Dr Helal Humaid Saed Al Kaabi**
Dr Al Kaabi is the Secretary General of the Abu Dhabi Quality and Conformity Council. He holds a PhD in Plant Biotechnology, and a Bachelor's & Master's degree in Horticultural & Environmental Science. He has extensive knowledge and experience in date palm cultivation and plant tissue culture techniques, and has published several scientific articles in this field.

Dr Al Kaabi has held several leadership positions in various government entities including Executive Director of the Emirates Metrology Institute, Director of Parks & Recreational Facilities Division, Al Ain Municipality, and National Project Director of Date Palm Research & Development Program and Plant Tissue Culture Laboratory at UAE University. He is also currently the vice chairman of the Emirates International Accreditation Centre, and is a member of the Board of Trustees of KIADPAI, as well as serving as Head of KIADPAI's Administrative and Financial Committees.

**Habiba Al Mar'ashi**
Mrs Al Mar'ashi is the co-founder and Chairperson of the Emirates Environmental Group, which became the first environmental NGO to receive an ISO 14001 Certification. She established the Arabia CSR Network in 2004, as the MENA region's pioneering and only multi-stakeholder platform with local and multi-national entities. She also co-founded the Emirates Green Building Council in 2006 and serves as its Treasurer and Board Member.

Mrs Al Mar'ashi has been actively associated in leadership roles in global bodies such as UN Global Compact, UNEP, Global Reporting Initiative Stakeholder Council, World Green Building Council and is a member of the Advisory Committee of the Det Norske Veritas (DNV-GL) Certification Advisory Board for the Middle East. She is currently a Board Member of the Global Urban Development and Patronage Committee of myclimate and, most recently, has been selected as a member of the Global Investors for Sustainable Development Alliance.

**His Excellency General Faris Khalaf Al Mazrouei**
His Excellency General Al Mazrouei was appointed Chairman of the Cultural Programmes and Heritage Festivals Committee – Abu Dhabi in 2015. His Excellency's other duties include Chairman of the General Authority for the Security of Ports, Borders and Free Zones, Commander-in-Chief of Abu Dhabi Police, Chairman of the Higher Organising Committee of the International Defence Exhibition, and Chairman of the Naval Defence Exhibition.

His Excellency also holds the following board-level roles: Member of The Executive Council of Abu Dhabi, Chairman of NIMR Company for military vehicles, Vice Chairman of Emirates Defence Industries Company, Board Member of Abu Dhabi Ports, Board Member of the Environment Agency, Board Member of the Federal Transport Authority - Land & Maritime, and Board Member of the Federal Authority for Identity & Citizenship.

**Her Excellency Dr Maitha bint Salem Al Shamsi**
Her Excellency joined the UAE Federal Government as a Minister of State in 2008, and presided over The Marriage Fund until February 2016. Between 2013-

2014, Her Excellency was entrusted with the presidency of Zayed University, and previously held several administrative, academic and research roles at the United Arab Emirates University. Her Excellency is also a consultant to Her Highness Shaikha Fatima Bint Mubarak.

Her Excellency holds a PhD in Sociology and has authored several books, research articles and studies in areas such as demography, development and women and education. Her excellency has represented the UAE in several UN organisations including ESQUA, UNIFEM and UNESCO, and serves on numerous international, regional and local committees and universities.

**Saeed Al Bahri Salem Al-Ameri**
Mr Al-Ameri is the Director General of ADAFSA, responsible for agriculture, food safety, food security and biosecurity. His prime focus includes sustainable local production, strengthening research and development, promoting private investments in agriculture, reforming agricultural legislation and polices, and implementing the latest strategic guidelines in food security and food safety with updated intelligent control systems and digital transformation. Mr Al-Ameri has chaired and served on several councils and committees, including the Emirates Council for Food Security (ECSF), UAE Council for Climate Change and Environment, Abu Dhabi Energy Committee, Department of Energy, Advisory board of the Food & Agriculture College, United Arab Emirates University, Board of Trustees of SHK Khalifa International Award for Date Palm and Agricultural Innovations, and the Steering Committee of SHK Khalifa Bin Zayed Centre for Marine Research.

**Mohamed Ali Al-Mansoori**
Mr Al-Mansoori is General Manager of the Al Dhafra Region Municipality. He has held many leading positions throughout his career, with organisations including Abu Dhabi Petroleum Company, Abu Dhabi Health Services Company, and Abu Dhabi City Municipality. He attained a Bachelor's Degree in Business Administration from New York University, USA, and a post-graduate diploma in Human Resources Management and a Professional academic qualification as Chartered Human Resources Management Professional from Vancouver University, Canada. He also holds memberships in different entities as a board member, or as chairperson for the Tal Mirib 2020 International Festival Higher Committee.

**Dr Azaiez Ouled Belgacem**
Dr Belgacem is the Sustainable Rangeland Management Expert at FAO Riyadh, Saudi Arabia. His experience extends to more than 25 years in the field of arid and desert ecosystems in the MENA region. He is the former regional co-ordinator/ rangeland senior scientist for ICARDA's Arabian Peninsula Programme. Before that he was head of the rangeland programme and director of plant resources at The Arab Center for the Studies in Arid Zones and Dry Lands (ACSAD), Damascus, and head of the rangeland and mapping unit for the Institute of Arid Areas, Tunisia.

Dr Belgacem has participated in several research projects with German technical Cooperation (GIZ), European Union, IFAD, AFESD, ACSAD, FAO, OSS and GCC on natural resources management, biodiversity conservation, combating desertification and adaptation to climate change, rehabilitation and management of rangelands. He holds a PhD in Biological Sciences and MSc in Natural Resources Management.

**Dr Abdallah Ben Abdallah**
Dr Abdallah has worked as Chief Technical Advisor on several FAO projects including establishing International Date Palm Research Centres in Saudi Arabia, Namibia, Burkina Faso and Yemen. Other roles include FAO team leader for a date palm project in Eritrea, and as strategic consultant for the development of the date palm sector in Egypt.

Dr Abdallah holds a PhD from the Gembloux Agriculture University, Belgium, and secured the highest grand distinction for his "Research on new strategies of date palm multiplication (Phoenix dactyliferal)". He received the Khalifa International Award for Date Palm and Agriculture Innovation in 2018.

**Dr Mohamed Ben Salah**
Dr Mohamed Ben Salah is a Tunisian date palm specialist and leading researcher on date palm production, biodiversity and biotechnology. He heads the research programme on Oasis Production for the Arid Regions Institute (IRA), Tunisia. He holds a PhD in Plant Production Sciences, an MSc in Fruit Tree Production, MSc in Sustainable Development and BSc in Sociology of Development from the Faculty of Arts and Human Sciences.

Previously, Dr Salah was the regional date palm project coordinator for GCC countries of the Arabian Peninsula with the International Center for Agricultural Research in the Dry Areas (ICARDA). Before this, he served as the Director General of Regional Oasis Agriculture Research Center (CRRAO).
He is a consultant for many international agricultural organisations including IFAD, FAO, IDB, AOAD, GEF and SSO.

**Mohamed Fouad Bergigui**
Mr Bergigui is a project design and management specialist, with more than 12 years' experience as an environment and sustainable development practitioner in Africa and the MENA region. He is currently supporting the GEF portfolio at FAO as a Project Development Specialist. Previous roles include working with UNDP at the Istanbul regional hub, at the Morocco country office as a programme analyst in charge of biodiversity and natural resources management, and as a youth development specialist within the UNV Programme.

He holds an MBA from the Istanbul Şehir University, and a DVM Degree from the Agronomic and Veterinary Institute of Morocco. He also holds certificates on Multilateral Environmental Agreements from the University of Eastern Finland; on Climate Change Adaptation and Mitigation from SMHI (Sweden); on Sustainability from HOSEI University (Japan); and Nonviolent Conflict from the Fletcher School of Law and Diplomacy (US).

**Anne Bogdanski**
Ms Bogdanski is Natural Resources Officer at the Office of Climate, Biodiversity and Environment at the FAO in Rome, Italy. She coordinates the International Sustainable Bioeconomy Working Group, and the FAO "Towards Sustainable Bioeconomy Guidelines" project. This project guides and accompanies member countries in the development of sustainable and circular bioeconomy strategies and programmes. Anne's primary focus is the sustainable transformation of food systems, including through bio-innovations, and the role of the microbiome in agriculture, nutrition and health.

**Professor Ahmed Bouaziz**
Professor Bouaziz is a member of the department of Production, Protection and Crop Biotechnology at IAV Hassan II in Morocco. His courses focus on crop irrigation, crop water requirements, diagnosis of production systems, agro-climatic modelling and cropping systems management. He holds a PhD in Agronomy from Agro-ParisTech and graduated from IAV Hassan II with an Engineering degree. He is a regular contributor to the Ministry of Agriculture and collaborates with several American, French, English and Moroccan universities on subjects including irrigation management and adaptation to climate change, through research into new crop association systems (agroforestry) and water saving techniques for sustainable irrigation.

**Kobie Brand**
Ms Brand has more than 25 years of practical and managerial experience in Environmental Management and Urban Development. Her expertise ranges from biodiversity, climate change and coastal management to urban sustainability and planning. She is responsible for the strategic direction, growth, partnerships, programmes and scope of work for ICLEI in Africa. Ms Brand also leads ICLEI's biodiversity and nature-based solutions work globally in her capacity as Director of the Cities Biodiversity Center, embedded in ICLEI Africa.

**Ingrid Coetzee**
Ms Coetzee has more than 30 years' experience in sustainability and governance. She also serves as Technical Lead on ICLEI's Biodiversity Advocacy work. Ingrid's work focuses on mainstreaming nature and nature-based solutions into urban planning and decision-making in cities and city regions, thereby helping them become healthier, more resilient and more liveable places. Her expertise includes stakeholder engagement, facilitation, law reform, policy, and strategy development.

**His Excellency Mohammed Daoudia**
His Excellency Mr Mohammed Daoudia is the Minister of Agriculture for the Hashemite Kingdom of Jordan. His previous roles include Ambassadorships to Greece, the Republic of Cyprus, Morocco, Portugal, Monaco and Senegal. He also served as Minister of Political Development and Parliamentary Affairs (2003-2004), as Minister of Youth, and was a member of the 12th Jordanian Parliament from 1993-1997.

**Dr Boubaker Dhehibi**
Dr Dhehibi is an Agricultural Resources Economist in the International Center for Agricultural Research in the Dry Areas (ICARDA) and the Resilient Agricultural Livelihood Systems Program (RALSP). He is distinguished for his research and teaching on production economics, economics of climate change, economics of natural resources management, value chain analysis, economics of development, and competitiveness and productive analysis of the agricultural sector in the MENA region.

Throughout his career, Dr Dhehibi has supported research projects in over 22 countries in Africa, Europe, and Asia. Before joining ICARDA he worked as principal agricultural economist at the National Agricultural Research Institute of Tunisia. He holds a PhD in Economics from the University of Zaragoza, Spain, where he also obtained his Master's Degree.

**Freek van Eijk**
Mr van Eijk is CEO of Holland Circular Hotspot, a public-private initiative that wants to make the circular economy happen by sharing Dutch knowledge and innovation, and by connecting governments, knowledge institutions and businesses. He is also vice-chair of the Circular Biobased Delta, an alliance of Dutch provinces, businesses and knowledge centres pioneering a sustainable circular and biobased economy.

Mr van Eijk is one of the more senior Dutch experts in the fields of waste management and the circular economy. He currently also serves as Managing Director of Acceleratio, which empowers companies, cities, regions and governments to make the transition towards green growth. He holds an MSc. Eng. from the Delft University of Technology.

**Professor Dr Ibrahim El-Dukheri**
Professor El-Dukheri is the Director General of the Arab Organisation for Agricultural Development, which works to address major problems (such as water scarcity and salinity) facing the agricultural sectors of Arab countries. Previous roles include Federal Minister of Agriculture and Forestry, Director General of the Agricultural Research Corporation (ARC) and Minister of Agriculture and Forests, South Darfur, Sudan.

Professor El-Dukheri obtained his PhD in Agricultural Economics (system analysis; mathematical approach) from the Technical University of Munich in Germany, his M.Sc. in Agricultural Economics from Washington State University in the US, and his B.Sc. (Honours) in General Agriculture from the University of Khartoum in Sudan.

**Dr Amgad El-Kady**
Dr El-Kady is Director of the Food and Agro-Industries Technology Center (FAITC) and is also Head of the Technical Secretariat of the Supreme Council of Dates in Egypt. He is a founding member of the Arabic Union of Palm Dates Producers and Manufacturers and is an expert in the establishment of date palm factories and technical workshops in date palm processing.
Dr El Kady was the Technical Consultant for the FAO's Date Palm Value Chain Development Project. He is a member of the Organizing Committee of the Egyptian Palm Dates Festival and the Scientific Committee of the Sudanese and Jordan Palm Dates Festivals. He holds a PhD from the Faculty of Agriculture in Cairo University, Egypt.

**Dr Ismahane Elouafi**
Dr Elouafi is Chief Scientist (designate) at the UN's FAO, and is the first scientist to be appointed to this position. She is a strong advocate of diversifying into underutilised crops and rethinking food systems, and is a member of the boards of the International Food Policy Research Institute and the Centre for Agriculture and Bioscience International, as well as the Scientific Group for the 2021 UN Food Systems Summit and the CGIAR System Management Board.

Dr Elouafi is the recipient of several awards, including the National Reward Medal by His Majesty Mohamed VI, the King of Morocco, and the Excellence in Science Award from the Global Thinkers Forum. She holds a PhD in Genetics from the University of Cordoba, Spain.

**Tareq Emtairah**
Mr Emtairah is Director of the Department of Energy at UNIDO. His experience in developed and emerging economies spans more than two decades, with a progressive focus on sustainable industrial transformation, energy transition, policy advocacy, applied research and capacity development. Before joining UNIDO, he worked as a senior research fellow at the International Institute for Industrial Environmental Economics at Lund University, Sweden. Before that he served as the executive director of the Regional Center for Renewable Energy and Energy Efficiency, in Cairo, Egypt.

Mr Emtairah holds a PhD in Industrial Environmental Economics from Lund University; a Master's Degree in Environmental Management and Policy also from Lund University; a Diploma in Engineering (Materials Science) from the Tokyo Institute of Technology, Japan, and

a Bachelor's Degree in Engineering and Materials Science from the State University of New Jersey, US.

**Professor Mizi Fan**
Professor Fan is a Research Director, Founder and former Head of Department of Civil and Environmental Engineering at Brunel University London, UK. He is the Director of 'Grow2build' European Centre of Excellence and Director of Nanocellulose and Biocomposites Research Centre. Professor Fan was Principal Consultant at the Building Research Establishment in the UK.

Professor Fan is a Project coordinator and Technical Manager for 12 EU Framework/ Horizon projects; an assessor for ERA (European Research Area) and European R&D Framework programme FP6, FP7 and Horizon 2020; independent assessor of a number of governmental R&D programmes. He has authored or co-authored more than 320 technical papers and patents, eight textbooks on nanoparticles and natural fibre composites, and is an editor/editorial member of nine international journals on materials, construction and environment.

**Philipp Heinrigs**
Mr Heinrigs is Head of Unit at the OECD Sahel and West Africa Club Secretariat. He is leading the Secretariat's work on Cities and Territories and Food Systems, and his work focuses on regional dynamics and the integration of systemic approaches to policy formulation. Philipp completed his postgraduate studies in International Economic Policy Analyses at the Kiel Institute of World Economics, Germany, studied Economics at the School of Oriental and African Studies, University of London, UK.

**Marta Gomez San Juan**
Ms Gomez San Juan is an Agricultural and Biosystems Engineer in the Office of Climate, Biodiversity and Environment, at the FAO offices in Rome, Italy. She acts as strategic advisor to the FAO's "Towards Sustainable Bioeconomy Guidelines" project. Marta develops knowledge products, works with pilot countries, and supports the coordination of the International Sustainable Bioeconomy Working Group. Her focus is on the development of circular bioeconomy strategies, policies and practices, and the sustainable transformation of food systems.

**Bo Sprotte Kofod**
Mr Kofod is a Forest and Landscape Engineer specialising in nature and forestry management, biodiversity conservation and access of nature and forest. He is also the Danish President & Chair of IFSA, a non-profit NGO established in 62 countries, experienced in international collaboration and policymaking on forestry and nature management.

Mr Kofod has studied climate simulations to model policies for land usage, transportation and emerging technologies (such as Geographical Information Systems) to implement sustainable policies into natural resource management. He has worked on carbon sequestration and accumulation in mangrove forest, on remote sensing technology for monitoring and assessment of soil erosion and forest biometrics. He has worked with several UN international bodies and ministries of environmental protection and agriculture.

**Dr Ludovic Lacrosse**
Dr Lacrosse is an established international bioenergy expert and is currently the Executive Director of LL Green Energy based in Belgium. After seven years of research on biomass energy and the presentation of his PhD thesis on biomass gasification, he led the EU-funded Biomass Cogeneration Project in South-East Asia, aimed at transferring clean and efficient biomass cogeneration technologies from Europe to the ASEAN region. He has acted as team leader of multiple renewable energy projects (mainly biomass) in Asian and African countries, as part of the consulting team of Full Advantage, a Thai clean energy company.

**Dr Bremley Lyngdoh**
Dr Lyngdoh is a climate change and sustainable development professional with more than 25 years' experience of building strategic partnerships with governments, IGOs, NGOs and the private sector. He is also the founder and CEO of the Worldview Impact Foundation. Dr Lyngdoh's work involves developing producing ecologically sound and economically viable activities that contribute directly to reducing rural poverty, and generating productive sustainable livelihoods for vulnerable local communities.

Through his previous assignments working with the United Nations and the World Bank in Asia, Africa and Latin America, he has gained expertise in the effective monitoring and evaluation of field-based programmes. He developed climate change adaptation projects combining integrated agroforestry, regenerative farming, sustainable tourism, and renewable energy technologies. He established Spring Valley Farm in Shillong, Meghalaya, to honour his father and build upon his legacy by supporting organic farmers in northeast India.

**Eng Fuaad Mansur**
Eng Mansur is a Chemical Engineer with three patents in date palm and agricultural waste recycling. He has supervised several date palm and agricultural waste recycling projects in Iraq, Gabon, South Africa and UAE, and has worked as an expert with the Fraunhofer WKI Research Institute in Germany, the Polimex Forest Research Center in Poland, and also the United States Agency for International Development.

**Dr Musonda Mumba**
Dr Mumba heads the UN Environment Programme (UNEP) Terrestrial Ecosystems Team, and recently became Chair of the Global Partnership on Forest and Landscape Restoration (GPFLR). In her role, she provides strategic leadership on forests and climate change, integrated landscape management (ILM) approaches, policy support to governments globally, developing appropriate policy dialogue and strategic direction around terrestrial ecosystems. She will also be the UN Environment lead on Terrestrial Ecosystems for the United Nations Decade on Ecosystem Restoration (2021 – 2030), a UN General Assembly Resolution passed in March 2019.

Dr Mumba received her BSc. Ed Degree from the University of Zambia and her PhD in Wetland Conservation and Hydrology from University College London.

**Dr Abdallah Oihabi**
Dr Oihabi has 40 years of extensive expertise in crop production, protection, GAP and Value chain analysis and as a good agricultural practices expert, with a special focus on date palm cultivation. Dr Oihabi successfully managed the widest FAO cooperative programme in the MENA region, including several agricultural





development projects. He also implemented agricultural projects in Niger and Namibia. He is the co-founder and CEO of Agroprospective, an agriculture consulting company in Morocco. Previously he served as University Professor in Marrakech, where he supervised several international cooperation projects and PhDs.

**Dr Zitouni Ould-Dada**
Dr Ould-Dada is Deputy Director in the Office of Climate Change, Biodiversity and Environment at UN FAO. His 24 years of international work covers a wide range of areas including climate change; environmental policy; technology and innovation; energy security; SDNs; agriculture and food security; and radiation protection.

Previously, he was Head of the Technology Unit at UNEP for five years and worked for the British Government for 15 years, holding senior positions at the Department of Energy and Climate Change; Department for Environment, Food and Rural Affairs; Food Standards Agency; Environment Agency; and Ministry of Agriculture Fisheries and Food. He also worked for the French Government on international climate change during France's Presidency of the EU in 2008.

**Florence Marie Rolle**
Ms Rolle was appointed FAO Representative in Morocco in 2018. She joined FAO in 1998, as a consultant in the Office of the Assistant Director-General in the Department of Sustainable Development, then as a program officer in the Department of Technical Cooperation. In 2010, she became a Senior Officer at the Liaison Office for North America in Washington DC, USA before being appointed FAO Representative in Malawi in 2013. Ms Rolle possesses an extensive experience and a diversified expertise in managing large integrated development programmes in the area of food security and nutrition as well as sustainable rural development, and in leading transformational initiatives.

**Dr Rachid Serraj**
Dr Serraj is the Delivery Manager of the Regional Initiative on Small-Scale Family Farming at the NENA FAO regional office, and is Coordinator for the RNE's initiative on agrifood system innovation. He has more than 30 years' experience in technical expertise and management leadership in international agricultural development, agriculture and crop production systems research, and in particular dealing with the problems of adaptation to climate change, resilience of dryland farming systems, and resources interactions within farming systems. Dr Serraj served previously as director of diversification and sustainable intensification at ICARDA, senior project officer with the Science Council of the CGIAR; the leader of rice drought frontiers at IRRI, and as principal scientist at ICRISAT.

**Dr Shipra Narang Suri**
Dr Suri leads UN-Habitat's Urban Practices Branch, the hub for its normative work and the home of its portfolio of global programmes. She has extensive experience in advising national and local governments, as well as private sector organisations and networks, on issues of urban planning and management, good urban governance and indicators, liveability and sustainability of cities, urban safety, women and cities, as well as post-conflict/post-disaster recovery.

Dr Suri has worked with the United Nations, as well as international NGOs and private sector organisations, for over two decades, across Asia, Africa, South-Eastern Europe and the Middle East. She has a PhD in Post-War Recovery Studies from the University of York, UK.

**Jossy Thomas**
Mr Thomas is an Industrial Development Officer at the Energy Department of UNIDO. As a Sustainable Energy practitioner, he has more than 22 years of international technical cooperation experience with UN ESCAP and UNIDO in Asia and Africa. His current focus is on supporting developing and least-developed countries in fostering bioeconomy through bioenergy resources leading to resilience, self-reliance in energy and decarbonisation in households and transport sectors.
Jossy has a Bachelor's Degree in Mechanical Engineering from the National Institute of Technology, Bhopal, India, a Master's Degree in Energy Technology from the Asian Institute of Technology, Bangkok, and an MBA from the Open University, UK.

**Dr Ernita van Wyk**
For more than two decades, Dr van Wyk's career has spanned the design and implementation of research and operational work in the fields of invasive species, adaptive management, biodiversity mainstreaming and environmental stewardship. She has a particular interest in approaches and assessments that make strong arguments for incorporating nature and biodiversity into urban planning and governance in developing country contexts. Dr van Wyk holds a PhD in Environment and Development.

**Dr Salah Eddine Zaid**
Dr Salah Zaid is the Technical Director of the Marrakech Date Palm Project. As part of the enhancement of large-scale production chains, he is working on the automation in the fields of plant tissue culture. He has been recognised for a unique skill set in the field and in modern molecular techniques, developing resources for improvements in plant genetic structure quantification.

Dr Zaid received his PhD in Horticulture and Landscape Architecture from Colorado State University, and his Master's Degree in Molecular Training from the Department of Plant Genetics, Blumwald's Laboratory (salinity and drought tolerance), University of California, Davis. He has five years of experience in field-based plant establishment, ten years in genomic technologies and seven years teaching at Colorado State University.

# 8.8 End Notes


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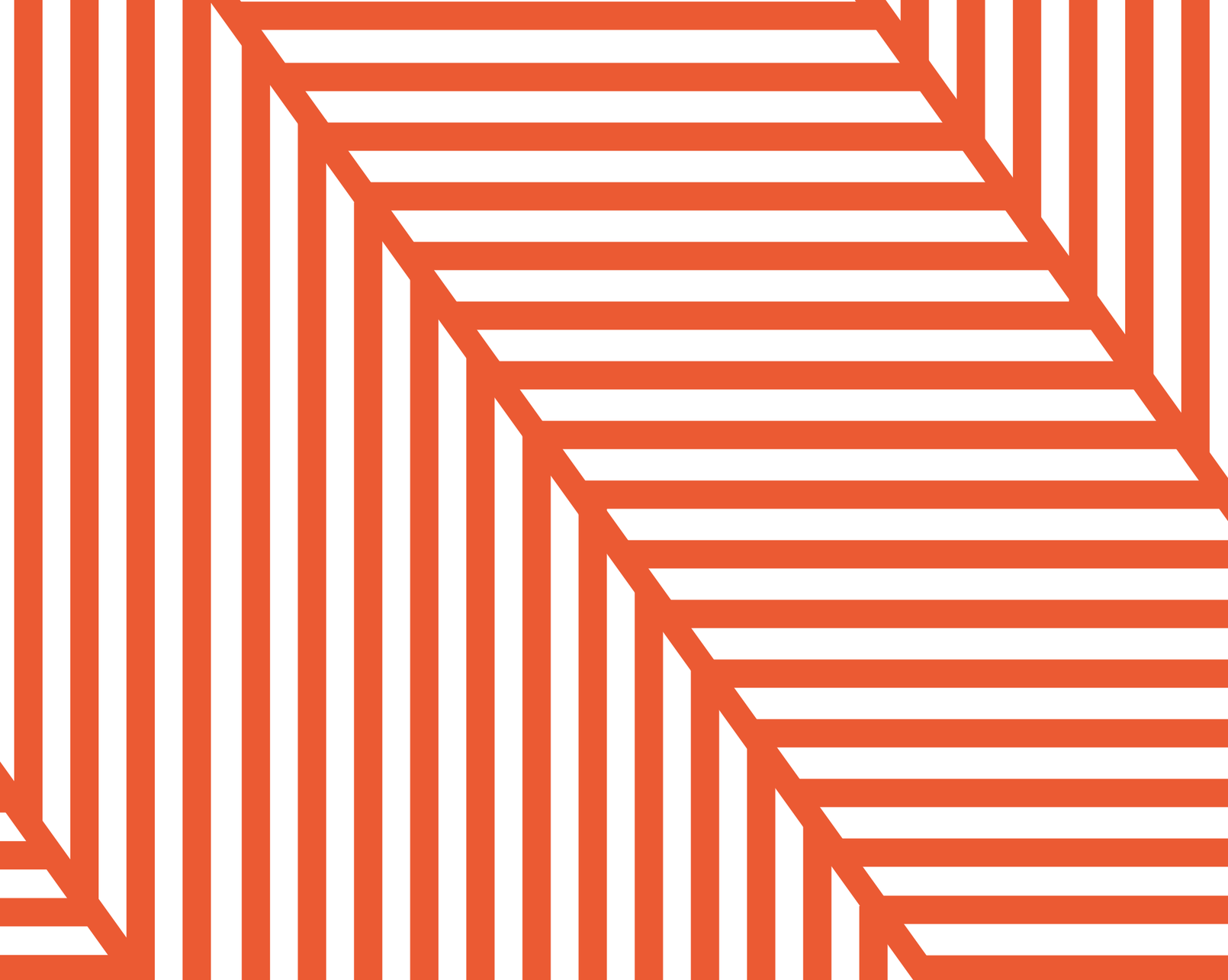

# The Khalifa Award Report

## Bridging boundaries: how can bio-regional collaboration convert the date palm industry into a successful model of the bio-circular economy?

This report is a call to action for governing bodies and industry leaders. It asks them to recognise the importance of date palm, particularly to the MENA region, and to use it as a springboard to create positive change across a multitude of sectors, for the benefits of people and the planet. Owing to the rising importance of date palm both globally and, more specifically in the MENA region, The Khalifa Award Report, inspired by 46 contributors across 21 countries, has been created with the following objectives framed around 'the five Ps': People, Planet, Prosperity, Peace, and Partnerships, which shape the United Nations' 2030 Agenda for Sustainable Development.

**People:** Scaling-up the restoration of date palm ecosystems to alleviate poverty, to ensure food security and to see date palm as a holistic developmental solution.
**Planet:** Implement transboundary adaptation programmes focused on date palm oasis restoration, to enhance its full environmental, economic, and social potential.
**Prosperity:** Focusing on new jobs across all sectors with a diversity of skills from manual labour, to intermediate technology to the Fourth Industrial Revolution. This will help ensure that all humans can enjoy prosperous and fulfilling lives, and that economic, social, and technological progress occurs in harmony with nature.
**Peace:** Using climate action, the UNFCCC system, Agenda 2030, and other global frameworks to scale-up the restoration of oases', preventing degradation and fostering sustainable urbanisation for regional security.
**Partnership:** Creating an enabling environment for new policies at the regional, national and local government levels for the implementation of SDG 17 on North-South, South-South, and triangular regional and international cooperation, as well as SDG 11.A to "Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning".

Edited by
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