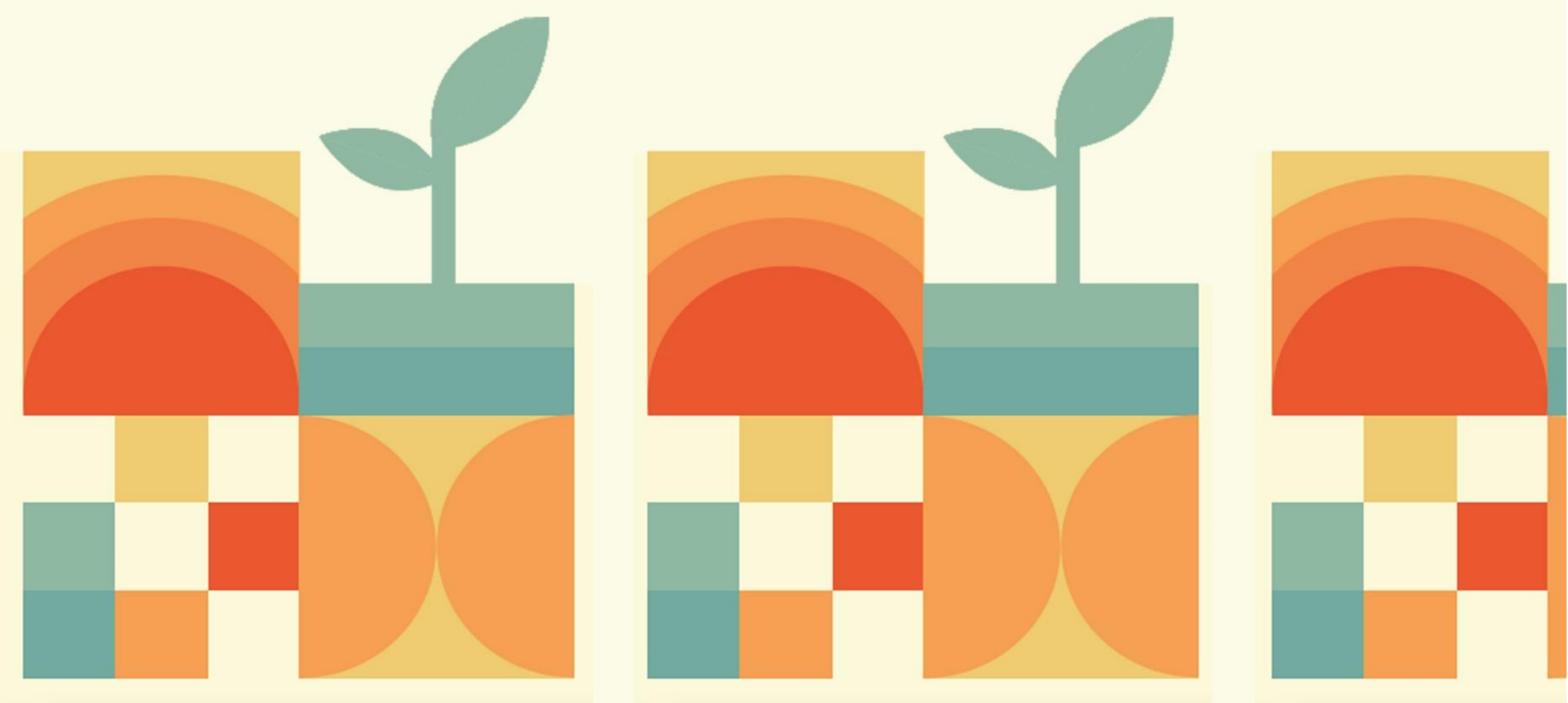
Food and Agriculture Organization of the United Nations

المركز الوطني لتنمية الغطاء النباتي ومكافحة التصحر
National Center for Vegetation Cover Development & Combating Desertification
المملكة العربية السعودية

وزارة البيئة والمياه والزراعة
Ministry of Environment Water & Agriculture

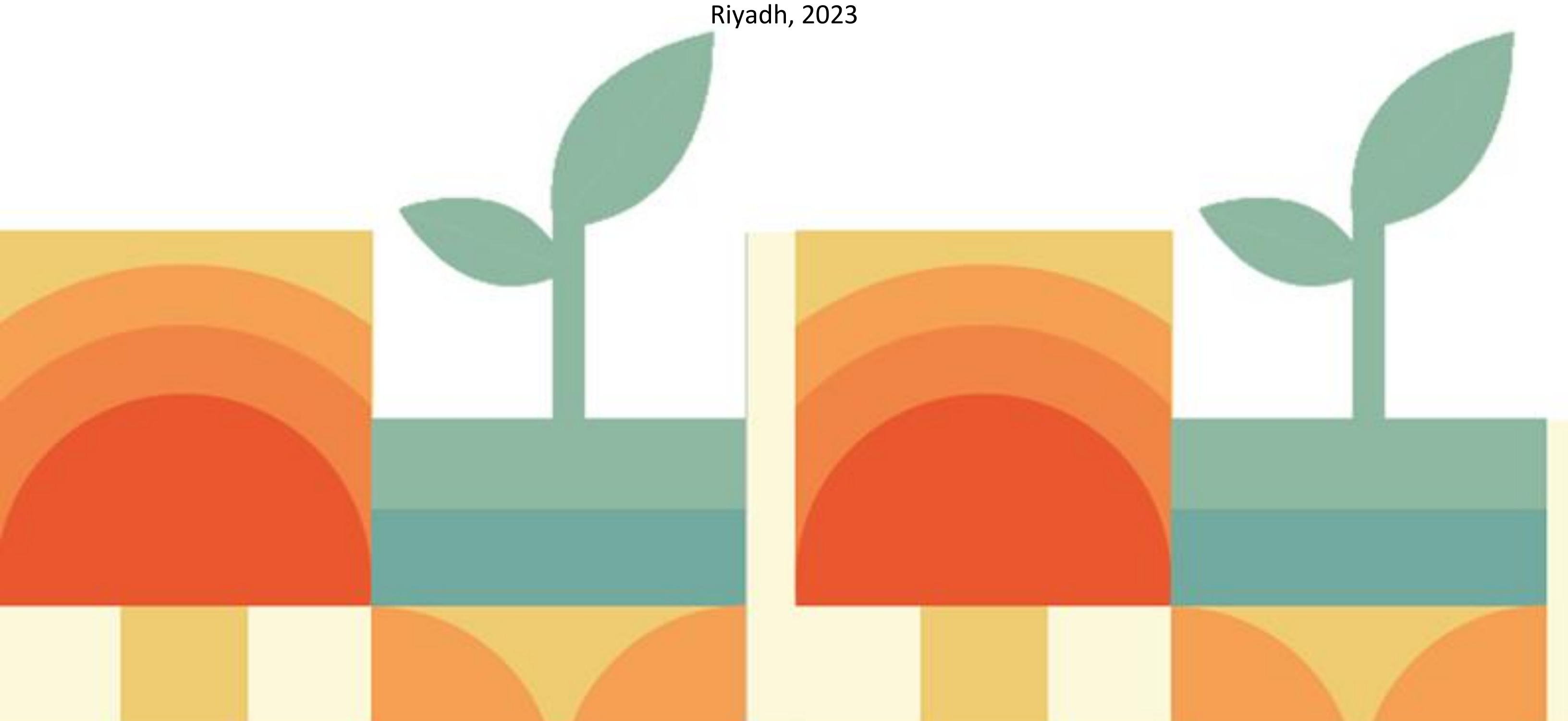
2022
Desertification and Drought Day
in Saudi Arabia



2022
Desertification and Drought Day in Saudi Arabia

Summary and Key messages
The National Center for Vegetation Cover Development and Combating Desertification (NCVCCD) in collaboration with the Food and Agriculture Organization (FAO) organized a special event on Thursday, 16 June 2022 at the Riyadh Fairmont Hotel, to observe the World Desertification and Drought Day. The event was hosted in a hybrid mode combining in-person and remote attendance and virtual participation

Food and Agriculture Organization of the United Nations
Riyadh, 2023



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Foreword

Desertification and drought are two of the most pressing environmental issues that we face today. Every year, on the 17th of June, we observe Desertification and Drought Day to raise awareness about the impact of these phenomena on our planet. This year, in 2022, the theme of the day is “Rising up from drought together.”

Desertification is the process by which fertile land becomes barren and unproductive due to various factors such as climate change, deforestation, overgrazing, and unsustainable agricultural practices. Drought, on the other hand, is a prolonged period of dry weather that results in water scarcity and crop failure, among other problems. Both desertification and drought have severe consequences for the environment, human health, and the economy.

The effects of desertification and drought are felt all over the world, but they are particularly devastating in more arid countries where water is naturally limited and severely competed for by different sectors. Further, due to the natural aridity, vegetation cover is sparse, soil moisture limited, and sand and dust storms and sand encroachment frequent. These countries are also the most vulnerable to the impacts of climate change, which exacerbates the problem of desertification and drought.

Through partnership and collaboration, we can effectively combating desertification and drought. Actions that we can take include development, promotion, and adopting of innovative sustainable land management technologies and practices; develop holistic policy for drought preparedness and mitigation including early warning systems; strengthening stakeholder engagement, awareness creation, and experience sharing; and building sustainable land management capacity at different levels including among local land users.

As we observe Desertification and Drought Day in 2022, let us remember that to effectively manage droughts and combat desertification, we need to learn from one another and rise from drought together. Acting today is a wise investment for a healthy and sustainable planet for current and future generations.

Ayman Omer
Programme Director, FAO Saudi Arabia

Acknowledgments

This *2022 Desertification and Drought Day in Saudi Arabia* publication was prepared by the Sustainable Rural Agricultural Development (SRAD) project- Natural Resources Management component in collaboration with the Outreach and Communication unit of the Food and Agriculture Organization of the United Nations (FAO), Saudi Arabia.

The publication was carried out under the direction of Njeru Jeremiah, Chief Technical Advisor, Natural Resources Management Component of the SRAD project with the overall coordination of Mona Dawalbait, Technical Advisor, Land Degradation and Desertification with support from Paolo Ceci, Natural Resources Social Economic Technical Advisor.

We would like to thank the following for their contributions and input:

First Session: Drought and desertification assessment, monitoring and scenario

- Jeremiah Njeru – CTA, FAO Sustainable Rural Agriculture Development (SRAD) Project
- Paolo Ceci – Technical Advisor, Social Economics SRADP
- Mona Dawelbait – Technical Advisor, Land Desertification Control SRADP
- Issa GARBA CILSS agro-pastoralist-LCD expert AGRHYMET/CCR-AOS, Regional Center in Niamey
- Lifeng Li - Director, FAO Land and Water Division (NSL)
- Maher SALMAN - Senior Land & Water Officer, NSL
- Gianluca Franceschini – Remote sensing Expert, NSL
- Matieu Henry – Technical Officer, NSL

Second Session: Innovative measures for drought management

- Fidaa Hadad - Forestry Officer (Drylands), FAO Forest Resilience Team
- Hugh W. Pritchard - Professor of Botany, Chinese Academy of Sciences, Kunming Institute of Botany
- Tiziana Ulian - Senior Research Leader, Royal Botanic Gardens, Kew, Ecosystem Stewardship Department
- Charlotte Seal - Research Leader Royal Botanic Gardens, Kew, Trait Diversity and Function Department
- Mohamed Albargawi Expert – Arab Center Organization for the Studies of Arid Zones and Drylands (ACSAD)

Third Session: The Role of Vegetation Cover in Reducing Desertification and Drought

- Abdullah Al-Buraiki - Director of the Department of Combating Desertification and Plant Diversity, NCVCCD
- Abdulaziz Al-Saeed - Professor of Rangeland, King Saud University and NCVC Board of Directors Member
- Kelly Helm Smith - Communications Coordinator and Assistant Director, US National Drought Mitigation Center
- Plato K. T. Yip - Vice Chairman, Elion International Investment Company Limited
- Jamaan Al-Qahtani - Executive Director Regional Center for Early- warning of Dust and Sand Storms

The opening remarks

Dr. Khaled Al-Abdulkader, CEO NCVCCD, and Dr. Ayman Omer, FAO Saudi Arabia's Programme Director

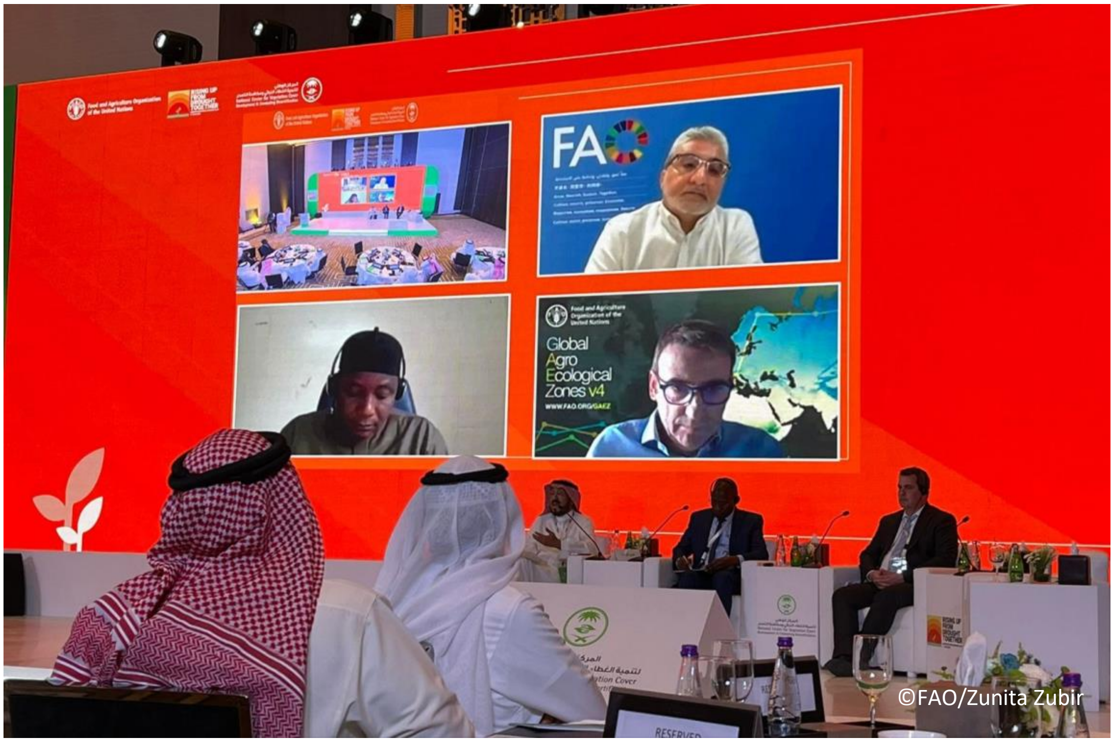
Opening the event, Dr. Khaled Al-Abdulkader, the CEO of the NCVCCD highlighted the great importance the Kingdom of Saudi Arabia places on securing its vital natural resources for the well-being of the citizen and sustainable development. Dr Khaled extended his thanks to FAO for its commitment to supporting the center to organize the event. He warmly welcomed the participants and invited them to enjoy rich speeches from invited speakers.

Ayman Omer, FAO Saudi Arabia's Programme Director, in opening remarks, applauded the Kingdom for denoting a high priority on conserving and protecting natural resources. He highlighted that drought affects all sectors with serious social, economic and environmental impacts, and emphasized the impact of drought on the agriculture sector, which absorbs 83% of the damage and loss caused by drought. In Arab countries where water scarcity is a major challenge, drought is the major threat to food security in about 25% of the countries, according to a recent FAO study. Ayman indicated that FAO is a founding partner in the UNCCD and has specialized programs which provide methods, tools, and capacities to help countries address drought and combat desertification. He closed his speech by emphasizing FAO continued commitment to support the Kingdom achieve its development goals.

First Session: Drought and desertification assessment, monitoring and scenario if timely action not taken

Pillar	Chairman	Title of the Presentation	Speakers
Drought and desertification assessment, monitoring and scenario if timely action not taken	Eng. Abdu Sharif	Drought assessment, monitoring, and management: general overview	Dr. Jeremiah Njeru – CTA - NRM Dr. Paolo Ceci – TA – NRSC Dr. Mona Dawelbait – TA - LDC NRM Component – SRAD - FAOSA jeremiah.njeru@fao.org mona.dawelbait@fao.org paolo.ceci@fao.org
		The state of drought risk in the Sahel, its future evolution and the CILSS regional monitoring and alert system	Dr. Issa GARBA CILSS agro-pastoralist-LCD expert AGRHYMET/CCR-AOS, Regional Center in Niamey issa.garba@cilss.int
		Framework of collaboration between FAO and UNCCD	Maher SALMAN - Senior Land & Water Officer Lifeng Li - Director lifeng.li@fao.org maher.salman@fao.org
		Contribution of FAO to Agro-Ecological Zoning	Gianluca Franceschini – Remote sensing Expert Matieu Henry – Technical Officer Land and Water Division (NSL) FAO-UN - Rome matieu.henry@fao.org gianluca.franceschini@fao.org

Table 1: Session on 'Drought event and desertification assessment, monitoring and scenario if timely action not taken'.



Abdu Sharif introduces the panel speakers during the opening session of 'Drought and desertification assessment, monitoring and scenario if timely action not taken'.

Drought assessment, monitoring, and management: general overview

Jeremiah Njeru, Paolo Ceci, Mona Dawelbait - FAO

1. Drought is a complex phenomenon that can be easily misunderstood. There is need for all stakeholders to have a common understanding on drought and how its impacts on different sectors.
2. Drought affects all sectors, and its impacts are far reaching. In many cases, the cost of drought is underestimated due to its secondary impacts.
3. To assess drought and its impacts, we need to have comprehensive field monitoring systems that do not only focus on precipitation but also soil moisture, surface and groundwater system, and vegetation cover. These bio-physical measurements need to be link to relevant local social and economic impacts.
4. Drought management is a continuous process involving many actors. Actions should allow engagement with all stakeholders including the most vulnerable that could be easily left out.

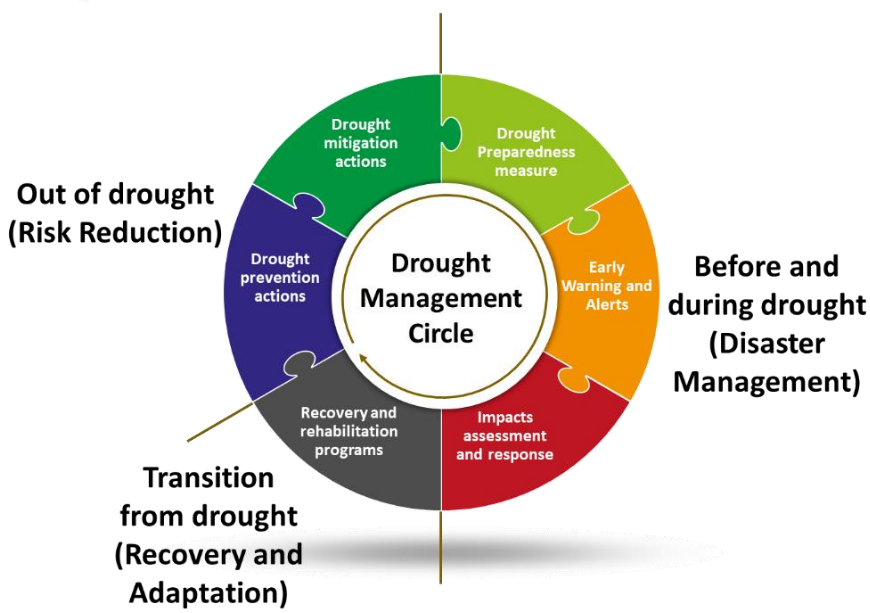


Figure 1: Drought Management Circle

5. Drought has a slow onset, and we can take advantage of this nature to better plan, prepare, and respond to drought.
6. Drought risk is a function of three factors – Drought hazard, Exposure to drought, and Vulnerability of the community, economy, or bio-physical system in question.
7. Vulnerability factors and processes (environmental, social, economic, power relation, etc.) are complex and dynamic, changing in space and time.
8. Different tools and framework for assessing vulnerability are available and it is important to combine various tools and frameworks to comprehensively address relevant vulnerability factors and processes.
9. We cannot control drought, but we can take a wide range of actions to minimize and reduce its impacts.
10. Drought risk management require a range of investments including: (a) Development of drought governance and policy; (b) Build drought management capacity; c) Create awareness and educate the community on drought management; (d) Strengthen partnership, coordination, and collaboration for better drought management.

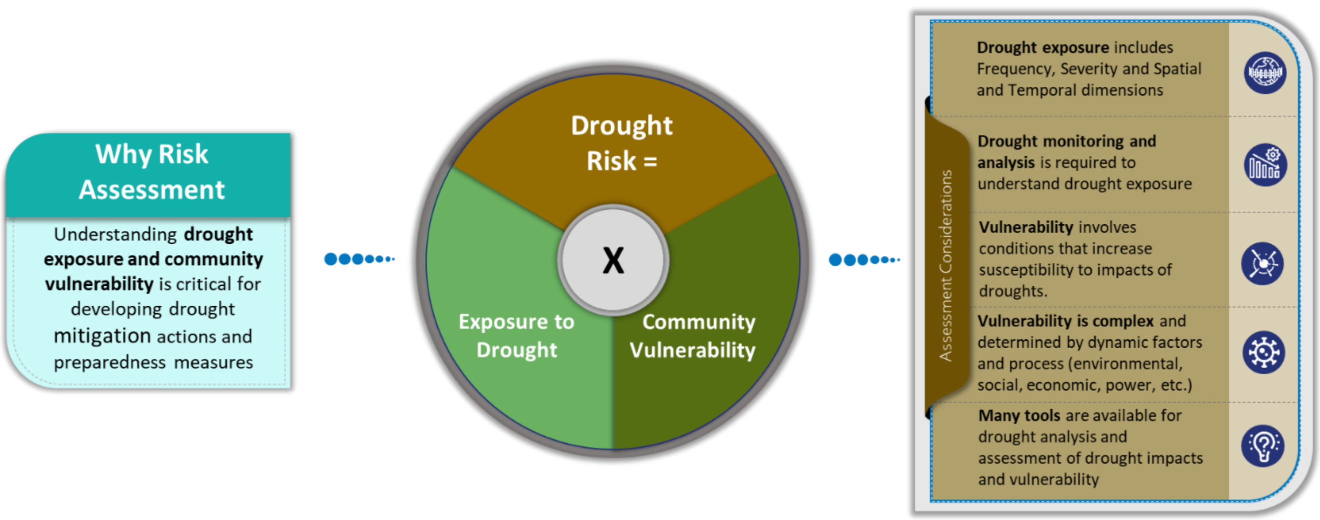


Figure 2: Drought assessment and risk

The state of drought risk in the Sahel, its future evolution and the CILSS regional monitoring and alert system: Experience of the CILSS

Issa GARBA - CILSS

1. The main risks of drought lie in the Sahel when it combines with desertification, especially in West Africa, the immediate risk of fire increases and when it interacts with climate change, human-caused threats (such as deforestation and forest fires) increase.
2. Committee for Drought Control in the Sahel “Comité de Lutte contre la Sécheresse au Sahel (CILSS)” (CILSS) aims to invest in food security and in the fight against the effects of drought and desertification, for a new ecologically balanced in the Sahel. It has success stories and best practices could be useful for hyper arid countries.
3. CILSS: Created in 1973 by 6 states after the severe droughts of the 1970s, it is composed of 13 member states: Benin, Burkina Faso, Cape Verde, Chad, Gambia, Guinea-Bissau, Guinea, Ivory Cost, Mali, Mauritania, Niger, Senegal and Togo.

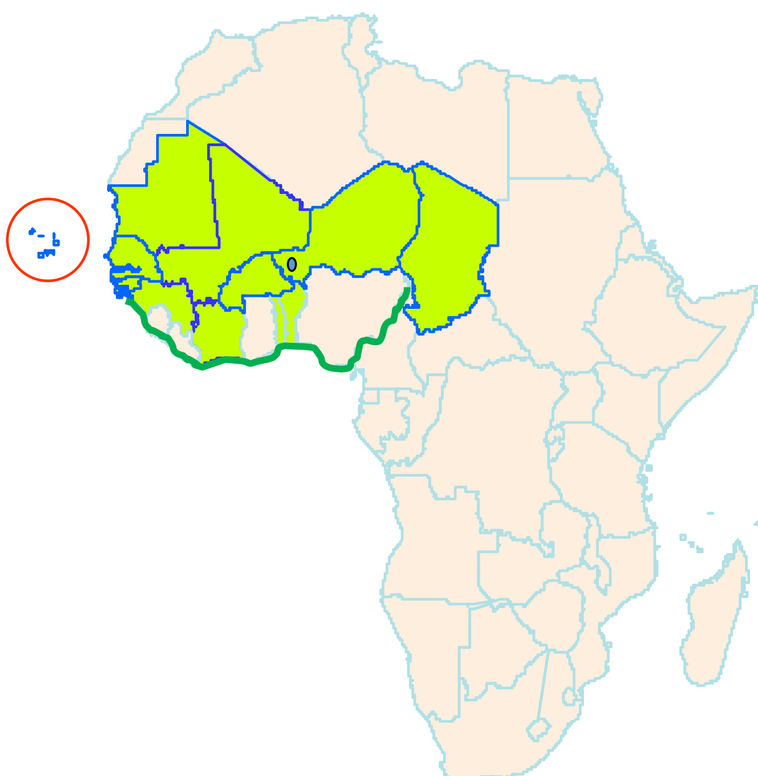


Figure 3: CILSS, map of six states after severe droughts in 1970s.

4. Agriculture, Hydrology, Meteorology (AGRHYMET) specialized institution of CILSS. It became the Regional Climate Centre (RCC) of ECOWAS in July 2020 based in Niamey, Niger. Ambition and Vision of the AGRHYMET are to ensure the best security against the vagaries of climate change for all the populations of CILSS and ECOWAS.

5. Under the context of climate change and a growing demand for water resources, aggravated by civil insecurity in the Sahel and West Africa, satellites and drone data are crucial for drought monitoring and early warning systems.
6. CILSS uses Earth Observation data for drought control to Seasonal forecast (climatic, agrometeorological and hydrologic) for the Soudano-Sahel zone (PRESASS) and the Golf of Guinea countries (PRESAGG), Monitoring of the agropastoral season and determination of the zones at risk of production deficit and Regional Pastoral Information Service (to inform and support the decision-making at pastoralists and agropastoralists levels to reduce risks)

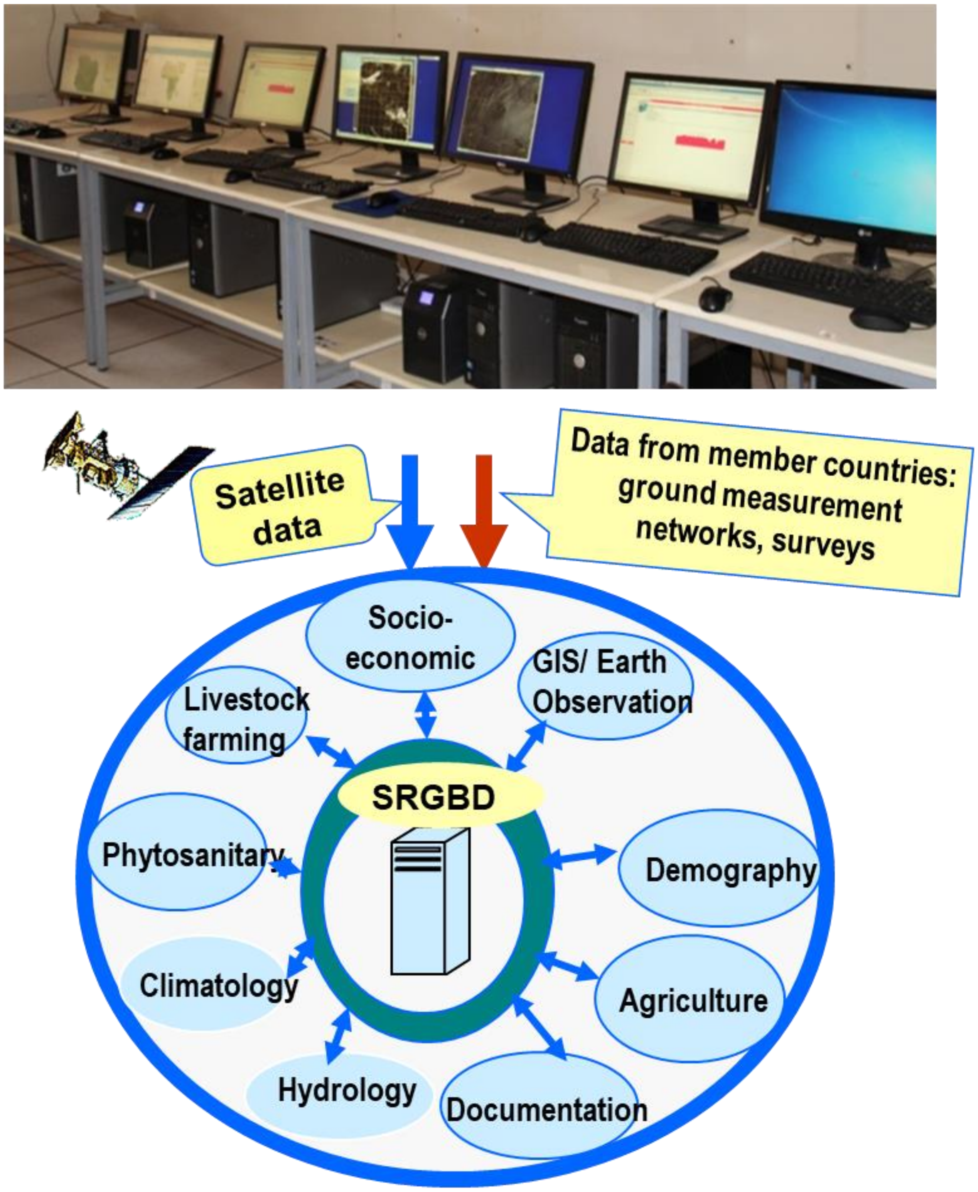


Figure 4: CILSS Earth Observation Data

Framework of collaboration between FAO and UNCCD

Maher SALMAN, Lifeng Li - FAO

1. The effects of drought accumulate slowly; the impacts are spread over a larger geographical area than from other natural hazards. Responding to drought once a crisis has begun is a reactive strategy that misses many opportunities to mitigate impacts and often comes at high cost; whereas proactive strategies that emphasize preparedness are cheaper and more effective.

2. Since millions of people who depend on agriculture for food production, marketing and consumption can be suddenly hit by natural disasters – like drought – causing migration to safer places, the governments and international organizations must collaborate to move from reactive to proactive management in drought emergencies. Proactive, and early interventions can be enabled, by raising awareness, building capacity and overcoming political inertia and it requires a concerted effort, from planning to day-to-day implementation. Supporting countries to shift to a proactive drought management approach is at the heart of FAO's Strategic Objective of increasing the resilience of livelihoods to threats and crises.
3. The Intergovernmental Working Group (IWG) on effective policy and implementation measures for addressing drought under the United Nations Convention to Combat Desertification (UNCCD) was established by decision 23/COP.14. FAO has been an active member of the IWG: member of task group on policy and governance and member of core group for synthesis report preparation.
4. Drought decisions at cop14: requested the Secretariat & the GM to continue with the Drought Initiative implementation - requested the GM to identify potential and innovative financing instruments - established an Intergovernmental Working Group (IWG) to review the existing policy, implementation, and institutional coordination frameworks, including partnerships, on drought preparedness and response and to consider options for appropriate policy, advocacy and implementation measures at all levels for addressing drought effectively under the Convention. The decisions at cop 14 also assigned the Science-Policy Interface (SPI) to provide science-based evidence on the assessment and monitoring of the resilience of vulnerable populations & ecosystems to drought.
5. FAO and UNCCD collaboration in the framework of GEF by developing a project with title: Enabling Activities for Implementing UNCCD COP Drought Decisions and objective: parties use the information derived from the UNCCD to complete and implement national drought plans according to the principles of Integrated Drought Management.

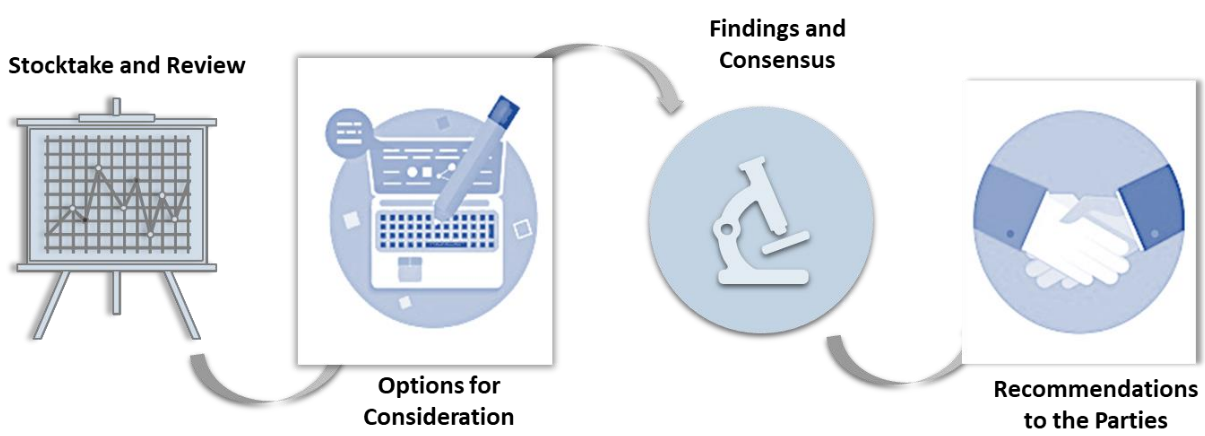


Figure 5: UNCCD COP Drought Decision

6. The overall goal of FAO actions on drought is to develop the capacity of drought-prone countries to increase societal resilience and enhance their drought responses and recovery capabilities to reduce the impacts of future drought events.
7. Integrated drought management is to protect both the people and the environment against the negative impacts of droughts, drought management practices and policies need to integrate three pillars: 1) early warning and prediction; 2) vulnerability and impact assessment; and 3) mitigation and response measures.
8. FAO Early Warning-Early Action (EWEA) system translates warnings into anticipatory actions to reduce the impact of specific disaster events. FAO EWEA System brings together existing monitoring mechanisms to harness information systems at global, regional and local levels to forecast potential disasters and safeguard critical agriculture and food security assets of the most vulnerable; targets a wide variety of risks in addition to droughts – e.g. floods, cyclones, harsh winters, conflicts, and animal/plant pests and diseases; and puts plans in place to ensure FAO acts when a warning is at hand.
9. FAO's Global Information and Early Warning System (GIEWS) and the Climate, Energy and Tenure Division developed a system for detecting agricultural areas with a high likelihood of water stress - drought at global, regional and country level. By monitoring vegetation indices across global crop areas during the growth season, Agriculture Stress Index System (ASIS) can detect "hotspots" around the globe where crops may be affected by drought.
10. FAO developed the Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists (SHARP) tool which address the need to better understand and incorporate the situations, concerns and interests of family farmers and pastoralists relating to climate resilience.
11. Resilience Index Measurement and Analysis (Rima) is one of FAO tools to assess drought vulnerability. RIMA is a quantitative approach that enables a rigorous analysis of how households cope with shocks and stressors. Comparisons can be made between different types of households (for example, male-headed versus female-headed or urban versus rural) in a given country or area.

Rural farmers took part in Self-evaluation and Holistic Assessment.

12. Resilience to drought in agricultural systems will be enhanced by diversifying livestock composition and movement and crop types, change crop sowing times, managing pasture and rangeland carrying capacities in line with fluctuations in the climate, increasing availability and access to water, and,

particularly in Africa, supporting an agricultural system that has space for smallholders and large-scale farms.

The contribution of FAO to agro-ecological zoning

Gianluca Franceschini, Matieu Henry - FAO

1. A land evaluation Framework for sustainable land management to assess agro-climatic indicators which is long-term averages (i.e. 30 years) of agronomic (e.g. Length of growing period, beginning crop season) and climatic (e.g. mositure and thermal regimes, extreme events) indicators. And climate change impacts on crops which is Changes in crop performances (potential yield and land suitability) is compared in historical and projected periods to understand impacts of a changing climate.
2. The AEZ information and tools is supporting the achievement of the paradigm shift of moving from responsive to proactive approach by: evaluation the overall future climatic conditions for agriculture; anticipating the impact of climate change on various crops and management options; providing options for sustainable crop diversification and crop shifts; assessing shifting on growing season and crop-specific sowing dates; and analyzing trends on suitable land and yield gaps.
3. The GAEZv4 platform is a web-application to display and access: (i) GIS data on land suitability, crop yields, water requirements, actual production and yield gaps. (ii) An Ecocrop database of thousands of plant physiology. (iii) An open source code for running national AEZ simulations (https://github.com/gicait/PyAEZ). (iv) Model documentation on the theory of AEZ. (v) Statistics on production, harvested area and yields at national and sub-national level. (vi) A growing community of practitioners.

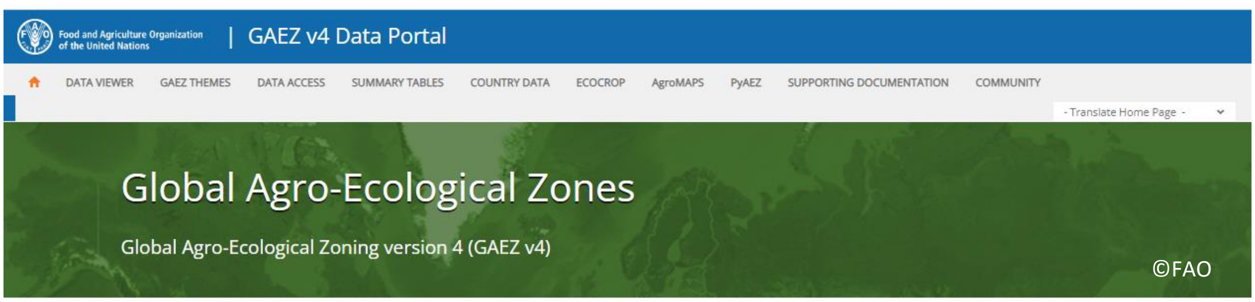


Figure 6: GAEZ v4 Data Portal

4. The main output of an AEZ assessment is the calculation of agro-climatic potential biomass and yield for a wide range of crops under various conditions. Procedures based on computation of daily crop water balances are based on the eco-physiological model developed by various FAO technical reports. Results include crop-specific maximum yields, yield reduction factors, yield impacts due to crop water deficits, estimated amounts of net irrigation requirements, land suitability, and the simulated optimum crop calendars.
5. The GAEZ v4 Data Portal provides access to the results of the crop evaluation module as aggregated tables, tabulated by administrative units. The results on crop suitability are calculated based on

Agro-climatic Yield Potential aggregated by Agro-Ecological Zone. Country profile for: Kingdom of Saudi Arabia: https://s3.eu-west-1.amazonaws.com/data.gaezdev.aws.fao.org/country_profiles/CountryProfile_KSA_20211209.pdf

BARLEY

In 2020, the harvested area for barley in Saudi Arabia was 2000 ha which was similar to that of 2019. (knoema, 2020). The total production of Barley in 2019 was 627,982 tons (FAOSTAT, 2019).

Table 2. Change in the extent of suitable areas and yield for Barley by Agro-Ecological Zone. Results are for base-line climate (1981-2010, source CRUTS32) and a climate scenario Ensemble (average of 5 climatic models) for RCP 2.6 and RCP 8.5 for the period 2040-2070 (2050s) without CO_2 fertilization and high input level for total cropland under irrigated conditions. Suitable area= VS+S+MS (VS- Very suitable, S- Suitable, Moderately Suitable). Yield = YVS+YS+YMS (YVS- Yield obtained from very suitable areas, YS- Yield obtained from suitable areas, YMS- Yield obtained from very suitable areas).

Agro-Ecological Zone	Suitable land (km^2)			% change in suitable land with historical		Yield (kg per ha)			% change in yield with historical	
	Hist.	RCP 2.6	RCP 8.5	RCP 2.6	RCP 8.5	Hist.	RCP 2.6	RCP 8.5	RCP 2.6	RCP 8.5
Land with ample irrigated soils	4,703	4,643	4,562	-1.3	-3.0	5,676	5,295	4,897	-6.7	-13.7
Desert/Arid climate	5,764	6,080	5,863	5.5	1.7	5,373	4,822	4,305	-10.3	-19.9
Total land	10,574	10,807	10,474	2.2	-1.0	5,507	5,022	4,561	-8.8	-17.2

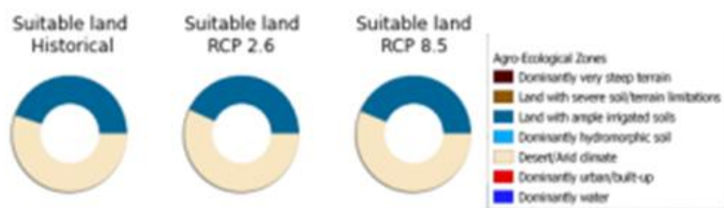


Figure 3. Suitable land for barley for the time periods 1981-2010 (left) and 2040-2070 for RCP 2.6 (center) and RCP 8.5 (right)

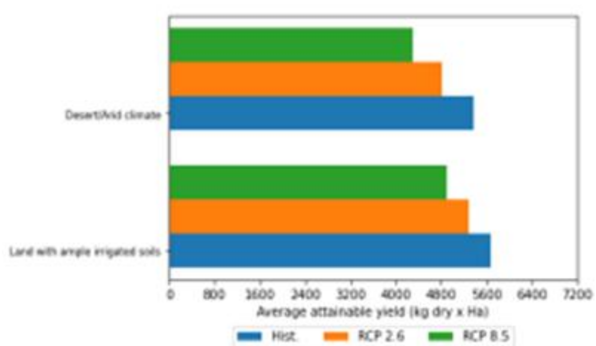


Figure 7: Assessment of land suitability for barley.

6. The way forward was based on three main pillars, a new global assessment is underway to leverage on: Partnership & Network, Data & Innovations and Knowledge transfer and applications.

Second Session: Innovative measures for drought management

Pillar	Chairman	Title of the Presentation	Speakers
Innovative measures for drought management	Prof. Mohamed Husain Almurshidi	Fostering communities' knowledge for better drought - forest management in dryland	Dr. Fidaa Hadad - Forestry Officer (Drylands) Forest Resilience Team Secretory of Committee on Forestry Working Group on Dryland forests and Agrosilvopastoral Systems – FAO- Rome fidaa.haddad@fao.org
		Environmental management and seed fitness	Prof. Hugh W. Pritchard, Professor of Botany, Chinese Academy of Sciences, Kunming Institute of Botany Dr. Tiziana Ulian, Senior Research Leader, Royal Botanic Gardens, Kew, Ecosystem Stewardship Department Dr. Charlotte Seal - Research Leader Royal Botanic Gardens, Kew, Trait Diversity and Function Department hwp@mail.kib.ac.cn t.ulian@kew.org c.seal@kew.org-
		Drought impacts and adaptation measures in arid and semi-arid regions.	Dr. Mohamed Albargawi Expert – ACSAD mbargaoui@ncvc.gov.sa

Table 2: Session on Innovative measure for drought management.

Fostering communities' knowledge for better drought - forest management in dryland

Fidaa Haddad - FAO

1. According to UNCCD, larger regions of the planet are becoming vulnerable to drought.

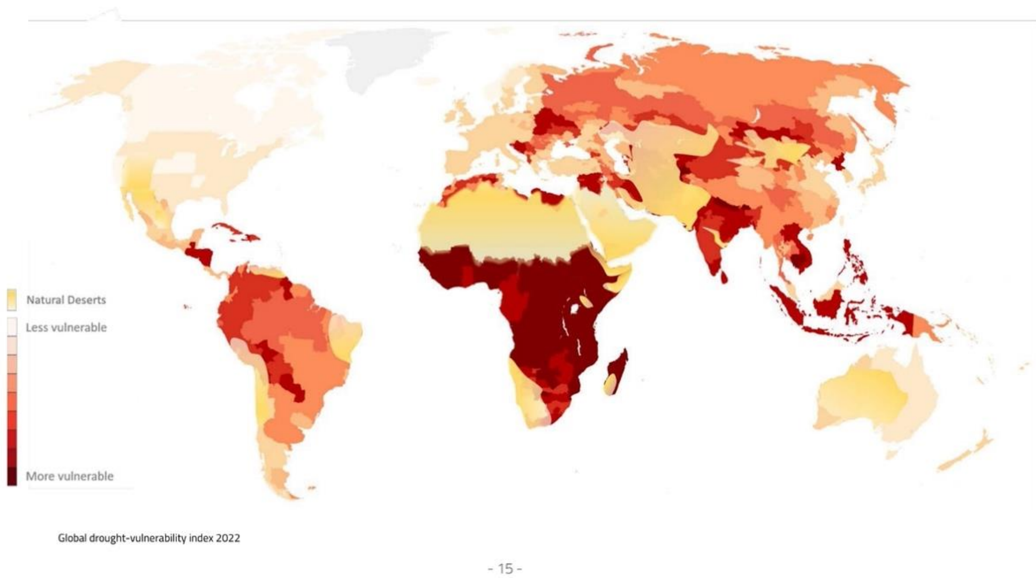


Figure 8: World map showed global drought-vulnerability index 2022. Source: UNCCD.

2. There are a number of interlinked ecological, economic and social drivers affecting dryland forests and agro-sylvo-pastoral systems. Among them climate change, loss of biodiversity, food insecurity, conflicts, crises, governance and land tenure issues as well as cooperation at the local level. agro-sylvo-pastoral systems have specific thresholds for buffering external trends, threats and shocks. Trespassing on such thresholds has a critical impact on ecological but also on social systems. Concrete action is needed to reverse the negative drivers.

3. An example comes from the Horn of Africa, where in March/May 2022 rainfall storage accounted for only 25-50% of the average. As a consequence, 20 million people in the region currently suffer from food insecurity. The extreme dryness is also turning the rangeland into very poor conditions, with widely spread pasture shortage.

4. “Think globally, act locally” is an imperative to avoid, reduce, and reverse further degradation, deforestation and desertification in drylands, through the sustainable management of production landscapes. This can be achieved via the establishment of innovation platforms for ecological sustainability, social fairness and economic growth. For instance, in the Tigray region of Ethiopia reviving the local knowledge on indigenous species improved the livelihoods of many. Enrichment of woodlands to trigger land restoration was undertaken on 1 600 ha via tree planting. Almost 300 households were endowed with trees, shrubs and grasses, more than 200 farmers were trained. Community ownership facilitated land management and rotational grazing over additional 600 ha of land.

5. Women have a great role to play as custodians of biological diversity, which is essential to combat desertification and drought. For instance, in Fiji more than 100,000 households were affected by drought 2018. FAO promoted the involvement of a women’s group to identify endangered native plants, trained them in nursery establishment and management and in plant propagation. As a result, 2 000 ha of communal lands were restored, 2 000 farmers had a better income and 240 were trained along with other 540 community members.
6. Institutionalizing farmer groups is a crucial approach. A case study from Bolivia can exemplify this. Half a million people may be affected by excess rainfall or drought in 109 municipalities. To tackle this potentially harmful situation 94 organizations were engaged, 28 producer groups were trained and 66 were supported across six departments in monitoring and better production. B transforming and marketing their products 32 organizations added value to their organic produces. As a result, the income of hundreds of thousands of small-holder producers raised by 500 to 1000 percent.
7. Drought is often at the basis of humanitarian and refugee crises. In Mongolia the risk was reduced by building landscape and livelihood resilience; in particular by Increasing the capacity and access to knowledge on sustainable forest and rangeland management for local herders. The capacity development package included rotational grazing, climate-resilient and locally-adapted plant species, wildlife management, water conservation and improved grazing practices including hay and fodder production. Additionally, risk funds and other financing mechanisms for pasture management were co-established by the local government and herder groups.
8. Other examples include increasing water productivity for nutrition-sensitive agriculture and improved food security in Jordan; and a cross-sectoral approach to sustainable forest and land management, which is able to enhance ecosystem resilience while enhancing livelihoods in the catchments of Save and Runde in Zimbabwe.
9. The image below shows the vulnerability of drylands to drought and conflicts.

Figure 9: Image of the vulnerability of drylands to drought and conflicts.

10. Conflict management itself can be the basis upon which resilience of livelihoods can be built through a cycle that goes from emergency response (short term) to processing and value addition of farm produces (mid-term) to enhancement of natural resources and promotion of climate-smart agriculture.

Environmental Management and Seed Fitness

Hugh W. Pritchard, Tiziana Ulian, Sami Albarih & Charlotte Seal

1. Probably the largest commitment to environmental management globally, for which seed fitness and seed quality are important, is the Bonn Challenge, started in 2011. The global effort is to bring 150 million hectares of deforested and degraded land including land subject to desertification into restoration by 2020 and 350 million hectares by 2030.
2. In Mexico the commitment is 8.47 million hectares with the main benefits identified as being for water quality and other environmental services. The main forest types identified are tropical and subtropical moist broadleaf forests and also coniferous forests. if we consider the best way to achieve this commitment is using wild harvested seed of native species, then at four kilograms of seed per hectare, it makes 1.4 million tons of seed, which is not sustainable.
3. What must happen is the sort of sustainable production and native seed agronomy demonstrated within the Great Green Wall, cross-border pilot project with Burkina Faso, Mali, and Niger, with the objective to fight against desert progress in the Sahel. This is the work of Tiziana Ulian with Paolo Ceci, with the objective of improving habitats, food security, livelihoods, and also contributing to climate change. The approach taken within the Great Green Wall was firstly to seek community advice that enabled the identification of 84 useful species, mostly woody but some also herbaceous. Seeds of those species have been harvested and banked ex situ for long-term conservation. And then through working with local communities and establishing village nurseries, 55 multi-purpose priority species, which generated income for the communities as well, has resulted in the production of more than one million seedlings. And those have been planted in 200 experimental plots covering an area of around 2000 hectares of degraded land. One of the main reasons for choosing native species for restoration projects is the likelihood that the species are resilient and general recommendations or golden rules for reforestation for example include advice on seeds and seedlings with appropriate levels of genetic diversity to match the local or projected climate.
4. Genetic diversity is just a surrogate for ecological diversity. It is not just the species selection that is important, but the seedlot selection. We need to better understand the functional traits of seedlots to help us define ecologically appropriate material for use in restoration. When we choose plant species for a particular environment, we can draw on the knowledge of a global spectrum of plant traits. For form and function, there are six traits and five of these are vegetative. Nitrogen content, leaf area, plant height, stem specific area, and leaf mass per area. There is only one trait that relates to the reproductive stage in the life cycle, and that is seed mass. But seed mass alone gives a rather restricted perspective on the importance of seed traits. Clearly seed mass, coat thickness, oil content, all relate to resource allocation. But the other attributes, from dispersal syndrome or dispersal distance, desiccation tolerance, longevity in the soil, response to light and smoke, and also germination performance in relation to temperature, water, or salt reflect different ecological functions and different physiological competencies. It is these competencies or traits for future environments that we need to pay greater attention to.

5. If we consider the probability of occurrence of the germination event over a range of temperatures, a changing climate means that some seeds will be unable to germinate in the future environment. That is why characterizing the germination niche for temperature, for drought stress and for salt stress is so important when choosing seedlots for use in restoration projects. To characterize the germination niche means that we have to manage the environment for germination. For temperature, light, water and salt stress.

6. One of the consequences of climate change will be an increase in global average temperature. Through our germination studies, we can ask the question, when will it become too warm for efficient seed germination? Data from 50 species of cacti suggest that about one quarter of the species will have difficulty in germinating in the future because the temperature will be above the optimum temperature for germination rate and that means there is a risk to regeneration naturally in the environment to about one quarter of the species in the future.

7. Another consequence of climate change as a result of heating will be the drying out of substrates. So, another question is, when is it too dry for efficient seed germination? A pairwise experiment in the Alps – calcareous versus siliceous grassland plants – showed that vegetative traits do not identify species' preference for soil type at altitude. Yet, the principal component analysis of the seed traits highlighted that seed germination under drought separates species' preference for alpine habitat.

8. A comparison between crop species and crop wild relatives – seedlots from Morocco and Algeria maintained at the Millennium Seed Bank – demonstrated that the wild harvested seeds can germinate under greater drought stress and that some crop seeds in production in a sense are relatively dysfunctional when it comes to germinating under drought conditions.

9. The majority of the excess energy accumulating the Earth system currently goes into the ocean and based on the state of the global climate 2021 report by the World Meteorological Organization, we can see that the average increase in sea level rise in millimeters for the decade 1993 to 2002 was about 2 millimeters per year. In the last decade from 2013 to 2022, it is 4.5 millimeters a year, so more than twice as fast. This means that an increasing number of species close to our coasts will be exposed to inundation with saltwater and that studying the physiological and environmental value of halophytes is very important.

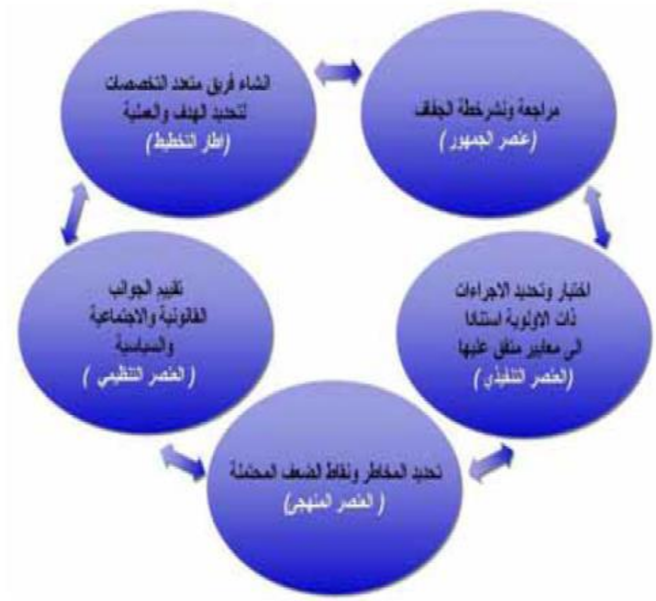
10. Halophytes are species that can survive and reproduce in environments rich in sodium chloride. They have various means by which they are able to adapt and cope with salt, perhaps through compartmentalization of the ions or indeed the synthesis of compatible solutes. Only 1% of the world's flora are able to cope with salt. The potential value of halophytes to the future of crop breeding could be very significant. Already 6% of the land surface is affected by salinity. That is 45 million hectares of agricultural land. There is both natural salinization as a result of very high drying of inland areas, but also secondary salinization, which is man-made through degradation as well. And there is also increasing risk of salt inundation through seawater flow. The economic cost of salinity to agriculture is huge, $27 billion per year. Halophytes can be the source of genes for the future development of cereals, for example, that are tolerant of saline lands.

11. To sum up, restoring landscapes to better manage the environment will require knowledge of seed functional traits. Restoration seed banks need to characterize seed quality in relation to both total germination (viability) and germination performance under stress (temperature, drought, salt). Restoration guidelines should shift the emphasis to "ecologically appropriate" from the undefined "genetically appropriate." Climate emergency, land degradation and the biodiversity crisis mean that there will be no future use of a majority of species if the world's native flora remain unbanked and available for use.

Effects of Drought and Adaptation Measures in Arid and Semi-Arid Regions

Mohamed Al-Barqawi - ACSAD

1. Arab region is witnessing climate change outlined in high temperatures, lack of rain, increased evaporation, frequent periods of drought and increased extreme weather (drought, flood). In addition, exposure to climate change requires determining effects, potential disasters and challenge risks.
2. Most area of Arab countries is covered by arid and semi-arid climate region, and it constitutes more than 80% out of Arab countries' area. About 67% of Arab land area receives less than 100 mm per year, and 18% of area receives more than 300 mm per year. There is spatial and temporal variation in precipitation within each country and between countries. Evaporation rate is more than 2,500 mm per year, and the limited surface water resources cause a decrease in groundwater recharge. Arab region is considered the most vulnerable to climate change.
3. Developing national and regional strategies in Arab region to combat drought and climate change, and developing implementation plans for adaptation are important measures, after making coordination and cooperation between Arab, regional and international countries and organizations. This must be followed by allocating more financial resources to face risks of severe droughts and climate change. Drought monitoring at local and regional levels and reporting drought cases are important measures that mainly help in drought management. This can be done through a platform designed and developed for this purpose. In addition, assessing risks and negative effects of drought and climate change is also conducted, while identifying drought-prone communities and regions is also one of the steps for drought management.
4. It is difficult to avoid droughts, but their effects can be mitigated. Perhaps the first step in preparing for drought is preparing future forecasts and Early Warning System (EWS). In addition, there are many measures that can be taken into account at the national and regional levels to adapt to, mitigate and limit negative effects of drought, including: (1) Getting ready, developing procedures and planning to meet challenges of severe and prolonged droughts, while adopting a proactive approach. (2) Implementing adaptation and mitigation measures, reuse of agricultural drainage water, water harvesting, appropriate agricultural practices, etc.
5. Five Components of Drought Measures: Planning framework, organizational framework, methodological framework, implementation framework, and human resources, as shown below.



Reviewing and publishing drought plan (The public element)	Forming multi-discipline team to determine objective and process (Planning Framework)
Selecting and determining priority procedures based on agreed on procedures (implementation Framework)	Assessing legal, social and political aspects (Organizational Framework)
Determining risks and potential weaknesses (Methodological Framework)	

Figure 10: Five Components of Drought Measures

6. Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR). In general, results of climate models indicated an expected rise in temperatures throughout Arab region. According to the medium stabilization scenario RCP 4.5, increased temperature is expected to reach 1.48 °C in mid-century, and within the range of 1.90 °C by the end of this century. In the worst-case scenario, temperature is expected to rise by 2.5 °C throughout mid-century, and 4 °C by the end of this century.

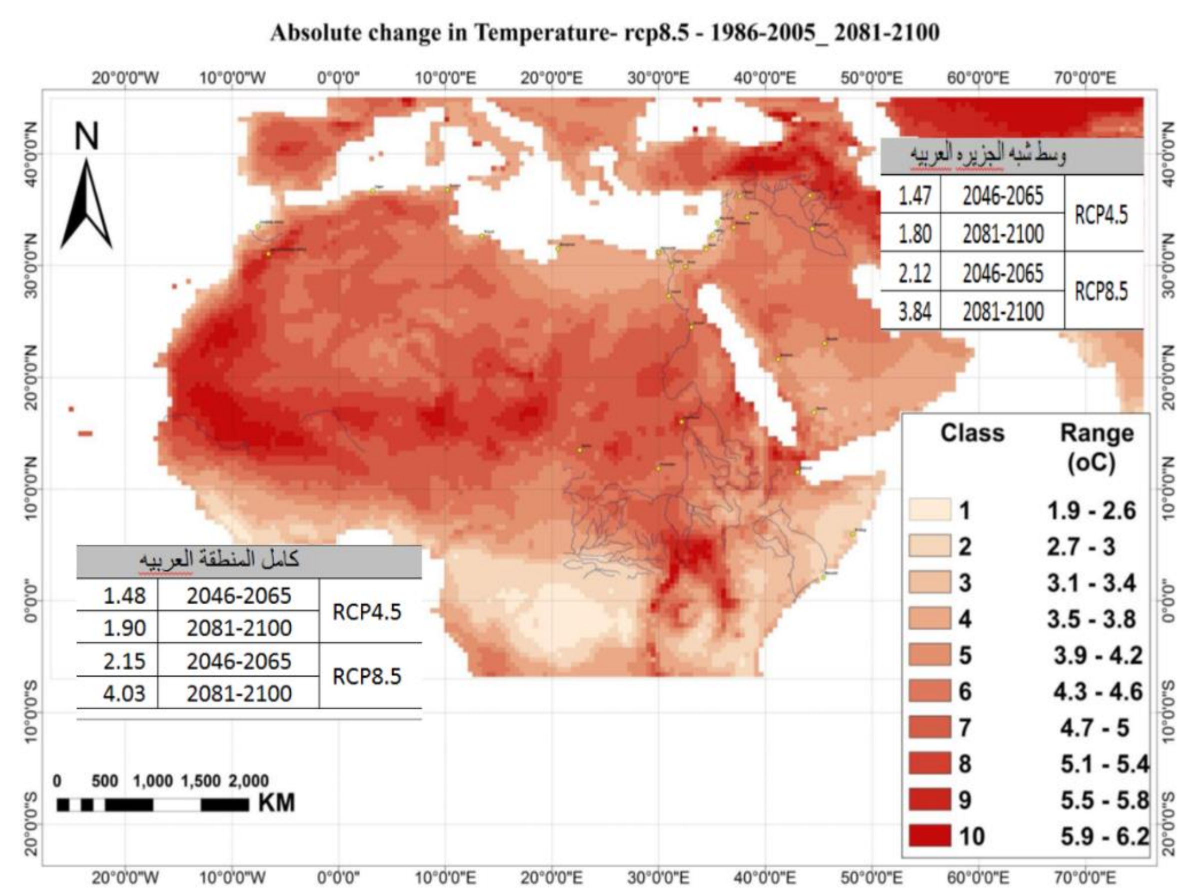


Figure 11: Absolute Change in temperature – rep8.5 – 1986-2005 and 2081-2100

7. The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) was established in 1968 in Damascus, Syrian Arab Republic. It is a specialized organization working within the framework of the League of Arab States (LAS) aiming at unifying national efforts to develop scientific agricultural researches in the arid and semi-arid areas and exchanging information and expertise in a way that ensures benefiting from scientific advancements and transferring, developing and localizing modern agricultural techniques in order to increase agricultural production in these areas. Some of ACSAD achievements in water harvesting – Integrated management of water resources – Development of vegetation cover and afforestation – Rehabilitation of degraded regions – Raising efficiency of water use in irrigation / Increasing irrigation efficiency – Using unconventional water / treated wastewater – Introducing a new variety of seeds that are tolerant to drought salinity and crop diseases related to climate change – Conservation agriculture to adapt to and mitigate risks and effects of drought on water and agriculture.

Third Session: The Role of Vegetation Cover in Reducing Desertification and Drought

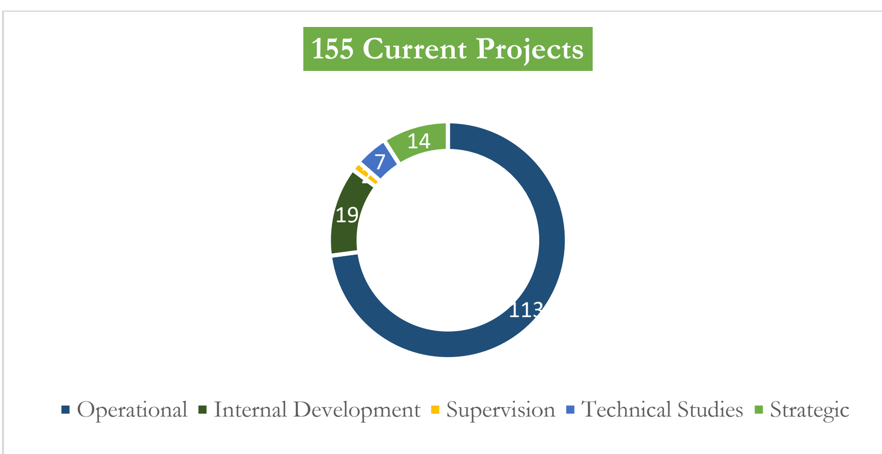
Pillar	The chairman	Title of the Presentation	Speakers
The Role of Vegetation Cover to Reduce Desertification and Drought	Dr. Sami Albarih	The role of the National Center for Vegetation Cover in Combating Desertification	Dr.. Abdullah Al-Buraiki Director of the Department of Combating Desertification and Plant Diversity NCVCCD asalburaiki@ncvc.gov.sa
		The role of vegetation in combating desertification	Prof. Abdulaziz Al-Saeed Professor of Rangeland at King Saud University and member of the Board of Directors of the Center NCVCCD assaeed@ksu.edu.sa
		Experience and approaches of the US National Drought Mitigation Center	Dr. Kelly Helm Smith Communications Coordinator and Assistant Director, US National Drought Mitigation Center ksmith2@unl.edu
		Role of Green Cover in Combating Desertification, Kubuqi Deser case	Speaker: Mr. Plato K. T. Yip, Vice Chairman, Elion International Investment Company Limited yipkwongto@elion.com.cn
		Regional Node of Sand & Dust Storm Warning, Advisory and Assessment System, for GCC countries	Eng. Jamaan Al-Qahtani Executive Director Regional Center for Early-warning of Dust and Sand Storms J.Alqahtan@ncm.gov.sa

Table 3: Session on 'The Role of Vegetation Cover to Reduce Desertification and Drought'

National Center for Vegetation Cover Development & Combating Desertification (NCVC) Role

Abdullah Al-Buraiki – NCVC

1. NCVC strategic objectives comprise three streams: (1) Habitat Conservation Stream that includes: Developing vegetation cover, increasing its area and conserving its diversity, monitoring desertification and applying procedures and treaties to reduce it, sustainable management of forests and reducing negative impacts of human activities and natural factors, sustainable management of pastures, organizing grazing, conserving plant diversity and rehabilitating degraded pasture lands, building knowledge base and setting incentives necessary for supporting researches, innovation and use of modern technologies in the fields of vegetation cover and combating desertification (2) Contribution to Economic Diversification Stream that includes: Enhancing partnerships with local communities and private sector to support vegetation cover development and related economic activities, sustainable management of national parks and preserving their natural components and developing their infrastructure (3) Stream of human and technical capacity building in the field of vegetation cover and combating desertification.
2. NCVC currently implements the initiative of developing capacity to prepare for drought and mitigating its severity by: Providing consulting services to follow up works of capacity development to prepare for drought and mitigating its severity, developing plan of national strategy for combating desertification, sand encroachment, dust storms and mitigating drought, assessing status of desertification and land degradation in the Kingdom of Saudi Arabia, determining a mechanism for combating desertification and reducing land degradation, conducting a comprehensive survey of the Kingdom of Saudi Arabia, determining sites that are threatened by sand encroachment and developing mechanisms and methods for combating sand encroachment, assessing the Kingdom's vulnerability to severe droughts, developing necessary measures and procedures to mitigate negative effects of drought, preparing an implementation plan for combating desertification, sand encroachment sand and dust storms, mitigating drought, considering and assessing invasive plants in the Kingdom of Saudi Arabia, and developing methods of combating and sustainable management of such plants.



73 Projects are subject to offering and awarding

Figure 12: NCVC projects.

3. As for afforestation programs, 64,481 hectares have been rehabilitated through 155 projects up to the end of Q1 of 2022. In addition, NCVC studied and identified 66 afforestation sites.
4. In the field of pasture management and forest protection, 8 different initiatives and programs have been implemented, which are: Initiative of implementing pasture strategy (17 projects), grazing regulation programs (8 projects), pasture protection and development projects (13 projects), and rehabilitation of salt marshes (Sabkhat al-Tarfiyah and Sabkhat Ghuwaymid), Wild Environment Treatment and Restoration Program, field surveys of vegetation cover, World Bank Studies Project (Cost of Pasture Degradation and Desertification), Saudi Plant Genome Project.
5. NCVC plays a major role in activating social participation through "Let's Make it Green" event 2021-2022, as 11 million trees were planted in 348 sites across the Kingdom's regions. The number of volunteers reached 67,579, and land area on which seeds were sown is 418.2 hectares, and the area of parks that have been cleaned is 425 hectares. Total number of seeds collected is 13 tons. NCVC also implemented, in the same stream, International Exhibition and Forum on Afforestation Technologies, which was under the auspices of His Royal Highness, Crown Prince, Mohammed bin Salman bin Abdulaziz, in May 2022.

22
Participating states and organizations

92
Speakers

90
Exhibitors

15
Thousand registered persons

117
Scientific papers

21
Dialogue sessions and workshops

Figure 13: Role of NCVC in activating social participation.

Prof. Dr. Abdulaziz bin Mohammad Al-Saeed

1. As for soil erosion in the Kingdom of Saudi Arabia, there is a scarcity of studies related to soil erosion by wind or water. A previous study can be taken into account. In addition, a contour map of soil erosion in the Kingdom has been redrawn. Moreover, there are no extensive studies on soil erosion by wind.

Table 8.10 Rainfall erosivity indices for selected stations

Station	*Yearly R*	*Monthly R (MJ mm ha^{-1} hr^{-1})*											
		Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Tabuk	160.1	3.2	7.0	11.5	18.5	–	–	–	–	–	3.0	21.0	95.9
Najran	569.9	6.0	13.9	75.9	238.2	11.5	–	52.9	21.8	32.4	130.6	13.7	–
Bishah 1	2647.1	270.9	229.2	471.3	659.2	367.5	6.5	65.1	132.5	0.5	46.1	132.0	206.5
Bishah 2	2187.4	0.8	9.2	125.5	1317.4	40.7	–	–	136.0	–	–	22.6	532.2
Buraydah	656.2	49.3	39.3	39.6	64.4	496.8	–	–	–	–	–	–	5.1
Riyadh	220.2	24.6	11.9	45.7	114.9	18.3	–	–	–	–	–	–	4.8
H.Sudair	396.1	34.7	12.1	92.5	25.7	72.4	–	134.4	–	–	27.2	86.6	30.5
Jiddah	1941.9	108.0	10.6	10.6	31.2	3.3	297.9	934.3	63.9	4.6	128.3	76.8	272.2
Malaki	4081.5	182.2	169.6	130.5	153.1	302.0	20.0	415.6	1186.9	392.1	603.1	331.9	195.6
Kwash	2384.1	65.1	56.0	114.9	40.6	267.5	235.6	190.4	470.5	561.6	250.5	36.8	94.7
Taif	1103.4	36.1	25.8	364.4	76.3	186.7	1202	–	28.8	35.6	165.0	20.4	44.3
Madinah	561.8	29.7	33.0	34.6	40.8	87.7	–	230.7	0.5	–	73.9	18.4	12.5

Source: Mohammad and Abo-Ghobar (1992).

Table 4: Rainfall erosivity indices for selected stations.

2. As for frequency of sand and dust storms in the Kingdom of Saudi Arabia, some scientific researches pointed out that there is an inverse relationship between frequency of storms and increased temperature, while there is no statistically significant relationship between frequency of storms and any of rain amount and wind speed throughout the period 1985-2014. In addition, other researches indicated that there is a positive relationship between rain amount and wind speed, and there is no relationship between frequency of storms and temperature throughout the period 2000-2016.

3. As for sand dune stabilization in the Kingdom of Saudi Arabia, several attempts have been made to use chemicals and non-living materials to stabilize sand dunes. In a study to evaluate behavior of cement-treated sand in Eastern Region, it was found that the angle of internal friction of cement-treated sand does not differ much from the angle of internal friction of untreated sand. In a review article on sand dune stabilization, it was noted that: Formation of three types of sand dunes by wind is affected by the percentage of vegetation cover, and that vegetation cover is the most attractive permanent solution and is achieved by planting protective belts that can withstand local environmental conditions.

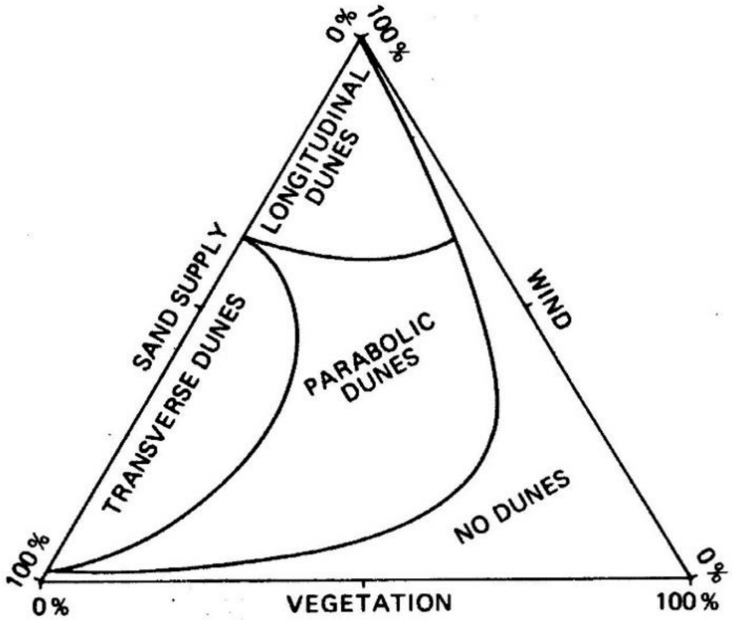


Figure 14: Relationship between frequency of storms between vegetation and wind speed.

4. As for improving soil properties and reducing its erosion, the effect of a number of environmental rehabilitation methods on improving soil properties in terms of erosion was tested, and they found that the use of shrub vegetation was the best way to reduce soil erosion. In New Mexico, grassy and shrubby vegetation was found to be able to trap wind-borne soil particles by 20% and 50% compared to bare ground, respectively. In another study on the effect of different plant species on runoff and soil loss, they found that both shrubs and grasses reduced soil runoff and loss.

5. There are other roles for vegetation in combating desertification, as facilitating (Facilitation) some plant species to other species helps in rapid spread of vegetation cover and increased diversity.

Plant species in KSA facilitate growing of other species helping in rapid spread of vegetation cover

US National Drought Mitigation Center

Kelly Helm Smith, USNDMC

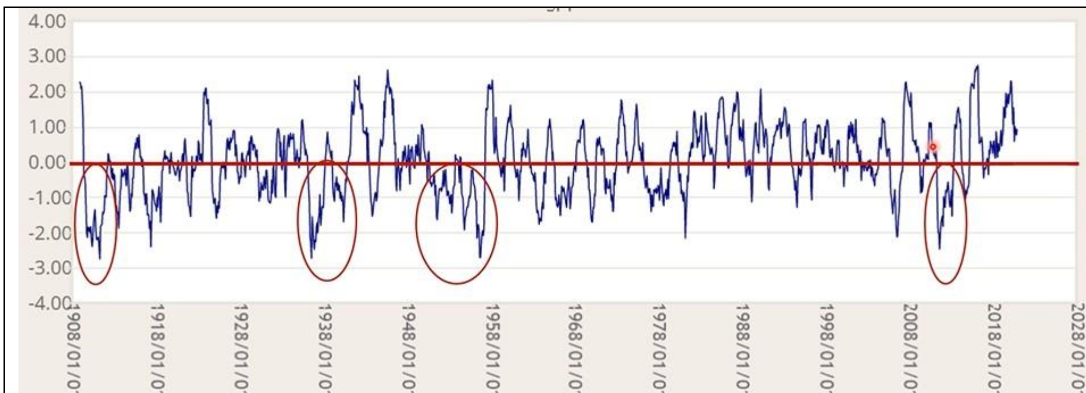
A. Introduction

The presentation by the USA National Drought Mitigation Center (NDMC) was made by Dr. Kelly Helm Smith (Assistant Director / Communication Coordinator) and focused on the experience of the NDM in drought management in the USA. NDMC is located within the University of Nebraska, Lincoln. The presentation was made through a recorded video that was played to the workshop, mostly based on the experience of the NDMC.

B. Key messages

The following key messages are summarized from the presentation:

1. Although we may not know exactly when drought will strike, we are sure it will, and we need to be ready for it. US NDMC helps US government, citizens, and organizations combat drought through drought risk management. The center help identify drought risk and actions to take to effectively address these risks.
2. Drought is a normal feature of every climate region on the planet, including very arid regions such as Saudi Arabia. It is important to differentiate between aridity (desert climate) and drought (water deficit compared to the normal. Droughts "water deficits" occur both in dry and wet climates.
3. One of the key challenges with drought is its slow onset. The slow nature allows drought to set in without being noticed and we can be in the middle of a drought without noticing it. A valuable contribution of drought experts is the skill to detect drought signal to be able to tell the onset of the drought.



Drought is a normal feature of every climate. Graph shows Standardized Precipitation Index (SPI) of a location in Oklahoma, USA, showing cycles of dry and wet years. Red circles marks drought years. One

Figure 15: Graph shows standardized precipitation index (SPI).

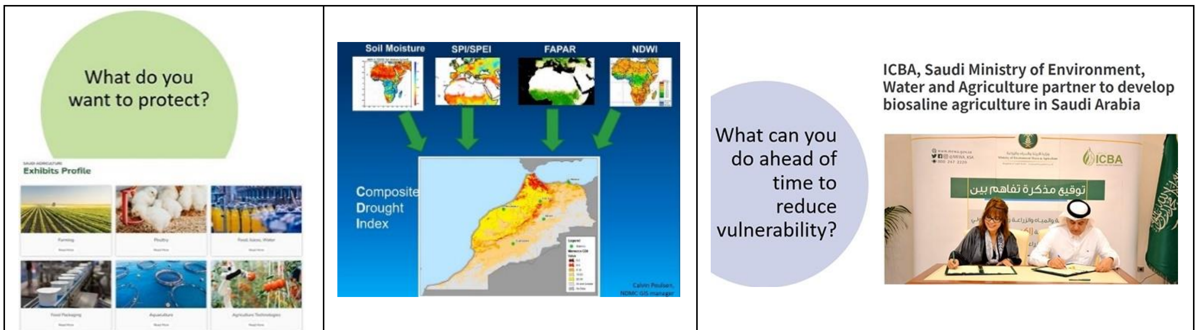
4. NDMC has developed, over the years, the US Drought Monitor which is a one-page map that focuses and unifies information and discussions about drought across the USA.
5. Drought information chain extends from data (field measurements); to Information (data analysis); to Knowledge (synthesis across sectors); to Policy (drought actions). Having data on the drought is

one thing, but knowing what to do is a different thing. To make effective use of drought information, we need a multi-disciplinary approach and multi-sectoral collaboration.

6. Drought planning involves three pillars: (i) Monitoring and early warning; (ii) Vulnerability and impact assessment; (iii) Mitigation and response. A successful drought policy bring these three pillars together.

7. NDMC follows a 10-step drought planning process shared between a drought task force; two committees (monitoring and impact assessment); and couple of working groups that take actions.

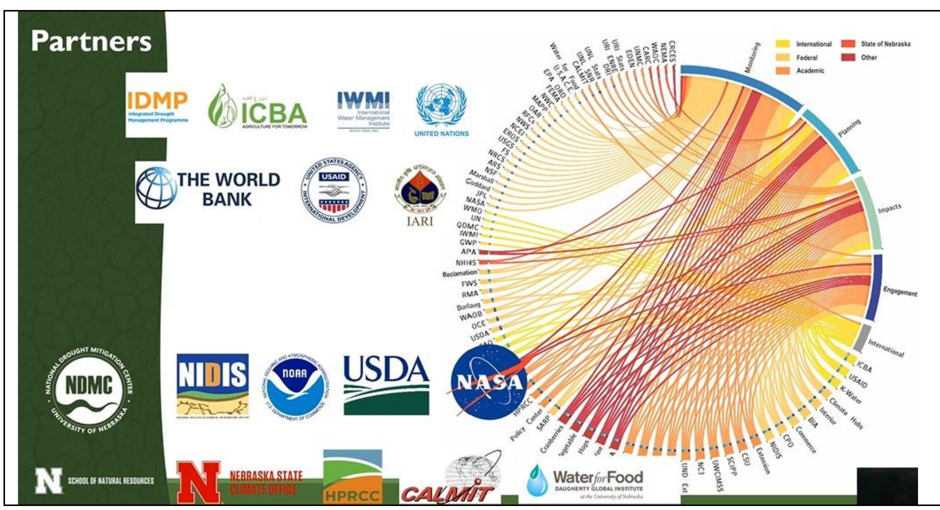
8. Drought planning needs to answer three questions: (i) What do we want to protect; (ii) How will we know we are in a drought; and (iii) What do we need to do – (a) Before the drought, (b) During the drought, and (c) Before the next drought. However, drought planning actions depend on the scale one is working with (Global, Regional, National, Local) and options and actions will be very different.



The presenter review of drought planning in Saudi Arabia reviews that there are many efforts and tools available to help answer the three drought planning questions.

Figure 16: Review of drought planning in Saudi Arabia.

9. It is important to observe that drought is about what is normal for a location and the system in place to make best use of available resources. It can be equated to the idea of living within one means and therefore drought management is also about resource budgeting. NDMC experience show that effective drought management require partnership and collaboration with many actors.



To deliver its mandates, the NDMC has an interdisciplinary team covering a wide range of disciplines – Meteorology, Climatology, Geography, GIS, Computing, etc. NDMC works with many partners organizations and institutions within and outside of USA.

Figure 17: NDMC interdisciplinary team and mandates.

C. Conclusions and remarks

NDMC provided a very good case study on drought management at a national level and drawing from many years of experience and strong collaboration with many partners. The three key drought planning questions, 10 drought planning steps, and range of drought management tools discussed are worth noting and further follow up.

Combating Desertification - The KUBUQI Model

Plato K. T. Yip, - Elion International Investment Company Limited

1. Introduction

- The presentation was delivered by Plato Yip and focused on the experiences of the Kubuqi International Desert Forum, mainly in developing, testing, and scaling up technologies for combating land desertification.
- China has made great strides in combating land desertification and these contributions have been recognized globally. The Kubuqi International Desert Forum has played an important role in this undertaking. Kubuqi International Desert Forum aims to strengthen cooperation on desertification control and prevention and push forward global environmental governance for the achievement of the UN 2030 Agenda for Sustainable Development, restoring the beauty of nature and improving the welfare for all.

2. Kubuqi Business areas

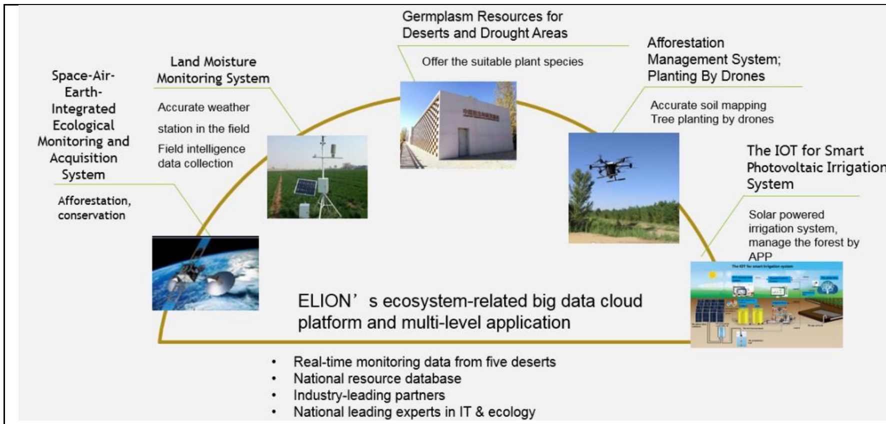
- Kubuqi Ecosystem Restoration model covers 4 business areas: (i) Soil and land restoration including restoration of deserts, salinized land, grasslands, and landfills; (ii) Water environment governance including water basin management, cleaning of water bodies, restoration and governance of lakes, and waste water management; (iii) Green landscaping including greening barren mountains, afforestation, national reserve forests, restoration of degraded forests, and reclamation of mines; (iv) Ecological parks including national parks, urban parks, Geoparks, mine parks, wetland parks, desert parks, and marine parks.

3. Innovative technologies for combating land desertification

- The presentation highlighted wide range of innovative technologies that have been developed, tested, and promoted to combat land desertification. The technology includes among others those for: (i) Large scale ecological environmental data collections; (ii) Germplasm resources management; (iii) Planting decision and success using big data, artificial intelligence, and robots; (iv) Soil biological conditioners; (v) Eco-agriculture including intelligent wedding and irrigation and fertilizer application, and digital animal husbandry systems; (vi) Block chain agro/livestock product source tracing; and (vii) Renewable solar power technology.

4. Selected examples of Kubuqi technologies

Figure 18: Example: Ecological Big Data Platform



Elion distributes 20 large-scale comprehensive data monitoring and collection equipment in five major deserts to monitor ecological environment data, which provides scientific decision-making basis for desert management and ecological restoration.

Figure 19: Example: Zhangjiakou Ecological Restoration Project for the 2022 Winter Olympics

In Chongli County, Zhangjiakou City, Hebei Province where most of the skiing events during the 2022 Winter Olympics will be held, ELION had planted over four million seedlings across an area of 2,076 hectares in less than six months since April 2014. With a survival rate of 96.90%, the planting sharply raises the forest coverage rate of the project area. In October 2015, ELION was granted the Prize for Outstanding Contribution to the Successful Bid of 2022 Winter Olympic Games.

5. Conclusion

- This presentation provided an interesting and different perspective on combating desertification – mainly providing a business-oriented perspective and giving the participants of the workshop an overview of the wide range of technologies and innovations that could be used effectively to support and enhance efforts made to combat land desertification.

Regional Node of Sand & Dust Storm Warning, Advisory and Assessment System, for GCC countries

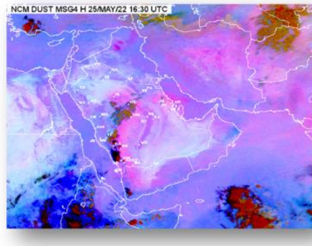
Jamaan Al-Qahtani - Regional Center for Early- warning of Dust and Sand Storms

1. In 2007 the 15th World Meteorological Congress endorsed the launch of Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) to improve capabilities for more reliable sand and dust storm forecasts. SDS-WAS aims to establish a coordinated global network of SDS research and forecasting centers to enhance operational SDS forecasts through technology transfer from research. Aligned with WMO SDS-WAS mission, Gulf Corporation Council (GCC) countries have taken the lead to establish a regional SDS-WAS node for GCC.
2. The framework of the Regional SDS-WAS Center/Node for GCC countries is as below:

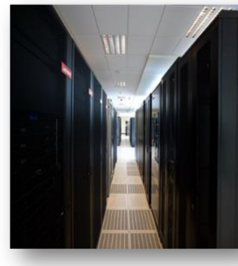
Figure 20: Framework of the Regional SDS-WAS Center/Node for GCC countries.

3. The SDS-WAS Center/Node for GCC countries, will have a leading role in regional level, providing services and linking institutions involved in SDS research, operations and delivery of services, will address the following objectives: share data and information, advance SDS-WAS products, enhance operational SDS-WAS forecasts, improve forecasting and observation technology, build capacity of relevant countries and pursue collaborations and partnerships.
4. The SDS-WAS Center/Node for GCC countries mission is to enhance the ability to deliver timely and quality sand and dust storm forecasts, observations, information and knowledge to users through an organized regional center and an international partnership of research and operational communities.
5. Example of existing capabilities as below:

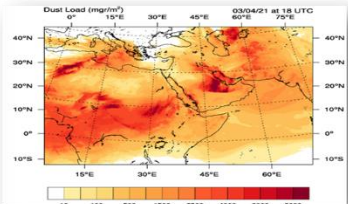
National Observing Network



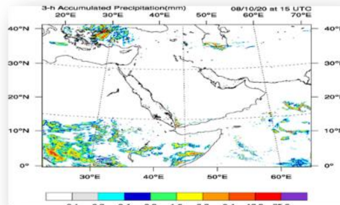
Satellite SDS Monitoring



High-performance computer with a capacity of 2.24



Dust forecast model gives a ten-day forecast with a spatial accuracy of up to 4.5 km



Weather model with a spatial accuracy of 4.8&1.6 km and a forecast range of up to 10 days

Figure 21: Existing capabilities of SDS-WAS Center/Node for GCC countries.

6. Regional SDS-WAS Center for GCC countries Responses are:

Early warning and monitoring

Building on up-to-date risk knowledge, monitoring and forecasting, ensuring that warnings are timely and targeted

Impact Mitigation

Preparedness reduces vulnerability, increases resilience and enables timely and effective response to SDS events

Cooperation and Coordination

SDS impacts are multi-faceted, cross-sectoral and often trans-national requiring cooperation and coordination between stakeholders

Source Mitigation

Land restoration, protect soil, and increase vegetation, can significantly reduce the extent and vulnerability of source areas, and reduce the intensity of SDS impacts

Table 5: Type of responses from regional SDS-WAS Center for GCC countries.

7. Mitigation of SDS hazards involves actions that address both source area mitigation—the on-site issues surrounding wind erosion and sand encroachment—and mitigation of hazards brought by atmospheric dust in suspension and on deposition

Strengthening MoEWA's Capacity to implement its Sustainable Rural Agricultural Development Programme
(UTF/SAU/051/SAU)
FAO Saudi Arabia Technical Cooperation Programme
Riyadh, Saudi Arabia

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Food and Agriculture Organization of the United Nations
Riyadh, Saudi Arabia