



Food and Agriculture
Organization of the
United Nations

Report of the 2ND WASAG INTERNATIONAL FORUM

Making agriculture resilient to climate change: Water scarcity, an opportunity for action and collaboration

7-10 FEBRUARY 2023
PRAIA, CABO VERDE

With the technical
support of



A TRABALHAR PARA TODOS.



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Abbreviations

ANAS	Agência Nacional de Água e Saneamento (National Water and Sanitation Agency)
AUC	African Union Commission
AWM	agricultural water management
CFS	Committee on World Food Security
CIHEAM	Centre International de Hautes Études Agronomiques Méditerranéennes (International Center for Advanced Mediterranean Agronomic Studies)
CILSS	Comité Permanent Inter-États de Lutte contre la Sécheresse (Permanent Inter-State Committee for Drought Control)
CEBAS-CSIC	Centro de Edafología y Biología Aplicada del Segura-Centro Público de Investigación en las áreas de Ciencias Agrarias y Ciencia y Tecnología de los Alimentos (Segura Centre for Soil Science and Applied Biology – Spanish National Research Council)
COAG	Committee on Agriculture
COP	conference of the parties
CREA	Council for Agricultural Research and Economics
DWFI	Daugherty Water for Food Global Institute
FAO	Food and Agriculture Organization of the United Nations
GIZ	German Agency for International Cooperation
GSP	Global Soil Partnership
GWP	Global Water Partnership
ICARDA	International Center for Agricultural Research in the Dry Areas
ICBA	International Center for Biosaline Agriculture
ICID	International Commission on Irrigation
INIDA	Instituto Nacional de Investigação e Desenvolvimento Agrário (National Institute for Agricultural Research and Development)
INRAB	National Institute of Agricultural Research of Benin
INRGREF	National Research Institute for Rural Engineering, Water, and Forestry

INSAS	International Network of Salt-Affected Soils
INSS-CNRST	Institut des Sciences des Sociétés-Centre National de la Recherche Scientifique et Technologique (Institute of Society Sciences – National Centre for Scientific and Technological Research)
IOM	International Organization for Migration
IUNC	International Union for Conservation of Nature
IWRM	Integrated Water Resource Management
MENA	Middle East and North Africa
MIT	Massachusetts Institute of Technology
NDMC	National Drought Mitigation Center of the University of Nebraska
NGOs	non-governmental organizations
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SIWI	Stockholm International Water Institute
SLU	Swedish University of Agricultural Sciences
UM6P	Mohammed VI Polytechnic University
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
UNFSS	United Nations Food Systems Summit
UNU-CRIS	United Nations University Institute on Comparative Regional Integration Studies
UNW-DCP	UN-Water Decade Programme on Capacity Development
WaPOR	Water Productivity Open-access portal
WASAG	Global Framework on Water Scarcity in Agriculture
WfWP	Women for Water Partnership
WG	working group
WMO	World Meteorological Organization



Introduction

The **Global Framework on Water Scarcity in Agriculture (WASAG)** was launched during the UNFCCC’s COP22 in Marrakech Morocco in November 2016. WASAG has since steadily received recognition and mandate to support countries in finding solutions to cope with water scarcity in agriculture in the face of climate change. In April 2017, a meeting of partners agreed to establish the WASAG partnership to be hosted by FAO to advance the mandate of the Framework.

Emerging from its foundational years, **WASAG held its first International Forum** with the theme “*Leaving no one behind*”, from 19 to 22 March 2019 in Praia, Cabo Verde, where the partners – under the leadership of the six WASAG working groups – developed and adopted the Praia Commitments as a firm first step towards decisive actions.

With the contribution of its 70 partners, WASAG has since developed its strategy for 2021–2024. **WASAG is set to further play a greater role in developing collaborative actions as solutions to the increasing challenges posed by climate change and the resulting water scarcity, in order to make agriculture more resilient.**

The **second International WASAG Forum** which was again hosted by the Government of Cabo Verde, under the leadership of the Ministry of Agriculture and Environment (MAA), provided the setting for this step.

The objectives of the forum were:

- To mobilize political commitment to accelerate strategic actions, including policies and investments for addressing water scarcity in agriculture.
- To formulate messages that will raise the profile of water scarcity in agriculture in the climate change dialogues at the forthcoming at the UN Water Conference in March 2023 and UNFCCC COP 28 in November 2023.
- To discuss ways of making the partnership more effective and impactful for the implementation of the new WASAG Strategy 2021–2024 and involving all partners.
- To share relevant knowledge and information on key issues and to network and to foster collaboration among partners.
- To showcase the latest technologies, practices and products in agriculture (through the fair).

The forum aimed to promote and position agriculture at the core of climate change discussions in view of the forthcoming events and beyond:

- UN Water conference (New York, 22–24 March 2023) – Comprehensive mid-term review of the implementation of the Objectives of the International Decade for Action, 'Water for Sustainable Development', 2018–2028.
- UNFCCC COP 28 (United Arab Emirates, 6–17 November 2023) – Climate Change

The forum also aimed to define the actions and review the *modus operandi* of WASAG in order to accelerate the delivery of the Framework and its partnership on its mandate.

This summary report presents the course of the forum, as well as the themes and issues discussed and addressed during the various technical sessions and side events.

Outcomes of the forum: the Praia Call for Action

To collaboratively tackle water scarcity in agriculture, while emphasizing the continued relevance of the 17 commitments from the first WASAG International Forum of March 2019, [the Praia Call for Action](#) was endorsed during the closing ceremony of the 2nd WASAG International Forum. It consists of 17 actions that summarize the outcomes and key messages of the different technical sessions.



Day 1: 7 February 2023

OPENING CEREMONY

The forum opened with an artistic performance by Cabo Verdean duo “Mon na Roda”, followed by an introduction of the Master of Ceremony and WASAG team leader, Mr Ruhiza Jean Boroto.

During the opening remarks of the FAO Director-General, delivered by delegation by Mr Lifeng Li, Director of the Land and Water Division (NSL), Mr QU Dongyu congratulated and thanked the Government of Cabo Verde for their commitment to find solutions to water scarcity in agriculture by hosting for the International WASAG Forum for the second time. He informed the audience that water scarcity threatens food security and nutrition, with potential for other crises. It currently affects 2.3 billion people, and the agriculture sector, which is responsible for more than 70 percent of water withdrawals, is suffering the most from it. He suggested that solutions on various topics are developed, such as saline agriculture, droughts, water quality and migration, as well as adopt sustainable agricultural water use practices, innovative financing mechanisms and recognize the value of data, innovation

and technology. He further stated the importance of empowering farmers to manage water in a smart way. The specific case of Small Island Developing States, such as Cabo Verde, is also something to take in consideration in the development of solutions.

Mr QU Dongyu recognized the central role of water for achieving all Sustainable Development Goals and mentioned that FAO has put water onto the agendas of all governing bodies in the coming years. Indeed, water will be the theme of FAO Conference in July 2023 for the first time. He further highlighted the fact that WASAG is a core partnership in the FAO water journey. It is part of FAO commitment to promote and implement integrated water resources management to achieving Better Production, Better Nutrition, a Better Environment and a Better Life, leaving no one behind, as defined in FAO Strategic Framework.



Further high-level speakers' interventions on water scarcity and WASAG followed, highlighting the important role of water and agriculture, as well as the opportunity to find solutions in order to face climate change and overcome the water-related challenges we are facing. Dr. José Arlindo Barreto, rector of the University of Cabo Verde (*Universidade de Cabo Verde*) reminded the audience that water and agriculture are always at the centre of people's lives. His Excellency (H. E.) Gilberto Silva, the Minister of Agriculture and Environment of Cabo Verde, stated that water scarcity is not a problem of some countries, but a global one. Indeed, most natural disasters are related to water and have an impact on food security. The FAO Representative in Cabo Verde, Ms. Ana Touza, highlighted in her opening remarks that FAO shows through this Forum that solutions can be found in

collaborative ways. Long-term solutions are needed to achieve the four goals of the FAO Strategy: better production, better nutrition, a better environment and a better life, leaving no one behind. The Chair of WASAG, Mr. Felix Reinders, spoke on how WASAG has been committed to action in the water scarcity sector, despite the conditions, since its launch 7 years ago. Its footprint is global, and the progress made up to this second forum confirms the relevance and pertinence of WASAG. He stressed the main mission and vision of WASAG, which is to support measurable, significant and sustainable progress on improving and adapting agricultural conditions in times of water scarcity, and to world whose food systems are resilient to climate change. H. E. Ambassador Pio Wennubst, Permanent Representative of Switzerland to the United Nations' Organizations in Rome, reminded the audience that water scarcity is not a sectoral issue, but a systemic one. Since water is a public good, it is necessary to find common agreements on its use.

To conclude this opening session, the high-level speaker H. E. José Ulisses Correia e Silva, Prime Minister of the Government of Cabo Verde honoured us with his presence. He welcomed the participants in the audience and online, and expressed the pleasure it was for Cabo Verde to host the WASAG Forum for the second time. He mentioned the preoccupying

situation due to the consumption of water by agriculture, and the fact that 45 percent of global production will be at risk in 2050 due to water scarcity. But solutions involving technical and scientific knowledge for better water management do exist. WASAG can play a very relevant role in finding these solutions to share knowledge and technical tools to overcome challenges of water scarcity. To overcome and survive the triple global crises caused by climate change, the COVID-19 pandemic, and the war in Ukraine, resilience will be essential. He highlighted the importance to mitigate the impacts of water scarcity using natural resources to transform energy and drinking water and agriculture in order to adapt and transform. The critical factors to do so will be time, financing, and economy. Finally, he thanked FAO and Switzerland for its support and the organization of the Forum, which results will be valuable contributions to the UN 2023 Water Conference, co-hosted by the Governments of Tajikistan and the Netherlands in New York.



SPECIAL SESSION ON CABO VERDE

The second session of the day was dedicated to the state of water scarcity in Cabo Verde. It was chaired by Mr Miguel Ângelo Barreto da Moura, State Secretary for Agricultural Economy at the Ministry of Agriculture and Environment.

H. E. Gilberto Silva, Minister of Agriculture and Environment of Cabo Verde delivered a keynote speech, summarizing the impact of water scarcity in the country and the importance of water policy, as Cabo Verde is the only country of the Sahel region that does not have a stable source of water. It is fundamental to continue investing in infrastructure and equipment. The minister stated that it is also important to create conditions that facilitate agriculture, invest in accelerating desalination, introduce modern irrigation systems apply agroecological zoning and develop soil fertility.

The session then followed with a presentation on the agricultural sector in Cabo Verde by engineer Eneida Rodrigues, Director-General of the Directorate General for Agriculture, Forestry and Livestock (DGASP). She spoke about the importance of forestry in the fight against desertification, soil degradation, conservation of biodiversity, and meeting energy and forage needs. Ms Rodrigues also mentioned some initiatives ongoing to address the lack of water, such as the mobilization of the water resource through various sources – groundwater (galleries, wells, holes), surface runoff (dykes, dams, reservoirs), treated wastewater through a treatment station, desalination; the construction/rehabilitation of water storage and distribution infrastructure – reservoirs, supply and distribution networks, collection dykes; the reduction of production costs through renewable energies; the efficient use of water for irrigation and massification of micro-irrigation systems (drip irrigation); the introduction of incentive measures such as the drip irrigation subsidy program; and

the improved management and distribution of the water resource through an irrigation company. It is essential to continue focusing and putting efforts to increase water availability for agriculture through desalination, safe use of treated wastewater and mobilization of groundwater and surface water. Irrigation water management must also be a priority, promoting the efficient use of irrigation systems, better control in distribution, and the reduction of losses. Finally, technology and innovation through the introduction of more adapted species and varieties, modern production techniques such as hydroponics, youth integration to the agricultural sector, as well as promoting opportunities for farmers through incentives and financing, among other things, are also part of the answer to the transformation agriculture in Cabo Verde.

Several speakers from public institutions and the private sector took the floor, starting with Ms Nora Helena Ramos Silva, President of the National Institute for Agricultural Research and Development (*Instituto Nacional de Investigação e Desenvolvimento Agrário – INIDA*), who spoke about the role of agricultural research and its contribution to changing the profile of agriculture in Cabo Verde.

Ms Nora Silva gave a brief overview of agricultural research, emphasizing the importance of irrigated agriculture in the context of water scarcity, as a sector increasingly driven by productivity gains, particularly in the horticulture sub-sector. She highlighted out the intense applied research work in the areas of selecting varieties adapted to local agroclimatic conditions and adapting cultivation techniques, associated with drip irrigation, the introduction of new technologies such as greenhouse cultivation and hydroponics, which have contributed to increased productivity, diversification and staggered production.

Finally, she pointed to INIDA's main challenges as being the efficient use of water in irrigation and promoting the adoption of new production technologies and sustainable soil use systems which increase soil fertility and water retention, contributing to improve the resilience of agriculture in the face of water scarcity.

A presentation on the gains and sustainability of the water and sanitation sector by the president of the National Water and Sanitation Agency of Cabo Verde (*Agência Nacional de Água e Saneamento – ANAS*) Mr Cláudio Lopes dos Santos followed. Priority is given to the availability and access to basic services, namely quality and quantity water, meeting the needs of populations, economic activities, and agriculture in particular. He stated that the Government of Cabo Verde – being aware in the face of persistent and consecutive droughts – promotes investments in the mobilization of groundwater and in the multiplication of desalination units. The third speaker was Ms Ângela Moreno, president of *Águas de Rega*, a public irrigation water company whose mission is to address the challenges of water scarcity for irrigation and food production. Mr Damià Pujol then spoke about the private company *Águas de Ponta Preta* that provides basic services of water, energy and sanitation. He

presented examples of public-private partnerships in the water sector. The last speaker of the session was the civil engineer Nilton Duarte Santos from the public company of water and sanitation service provision *Águas de Santiago*. He gave an overview of the public water supply management in Cabo Verde, with six water service provider companies on eight islands.

TECHNICAL SESSION ON WATER AND NUTRITION


To start the technical session chaired by Mr Paulo Dias (FAO), Ms Jennie Baron from the Swedish University of Agricultural Sciences (SLU) introduced the working group on Water and nutrition, and stressed how cross-sectoral coordination is important to address multiple Sustainable Development Goals (SDGs). Indeed, multiple sectors need to be linked, like the inclusion of land and soil in water management practices. The UN 2023 Water Conference provides a good opportunity and important step to do it.

The session then continued with a case study on Santa Cruz and Santa Catarina wastewater treatment plants by Ms Maria Dos Anjos Lopez, who did an evaluation of the removal of pharmaceutical residues in wastewater. She raised the awareness on the importance of not only water quantity but water quality. She also highlighted the linkages between water and soil, and the fact that the high-risk of contamination induced by pharmaceutical residues impacts people's health.

The keynote speaker Mr Mure Agbonlahor, Senior Agricultural Production and Marketing Officer at the African Union Commission (AUC-DARBE) joined the session virtually and spoke about Food and Nutrition Commitments for Africa. He stated that about 65 percent of arable land is in Africa, that agriculture is the main stay of most economies in Africa-employment and that increased food productivity and access to broader markets have the potential to boost prosperity whilst supporting the growth of financial and social inclusion. He informed the audience that several commitments and declarations at the national and continental level have been made in the last decade to reposition African agriculture, including key features such as growth and increased production, food sovereignty and resilience, increased investments in support infrastructure, regional integration, public-private partnerships and scaling up of success stories in agricultural transformation. He gave some insights about food and nutrition security in the continent, like low productivity and an important food import bill, leading to an increase of hunger in Africa. To unleash the African food potential, Mr Agbonlahor spoke at the end of his intervention about the recently concluded Dakar2 Summit which emphasizes:



- The access to productive resources, such as land, water, fertilizers, agrochemicals and machineries.
- The access to local and non-local markets, widely connected agricultural value chains and market.
- The promotion of efficient and modern food production technologies that are market-based and private sector-led for long-term sustainability, to protect water and soil.
- The advocacy for policy and institutional reforms that are supportive to attract potential partnerships in agriculture, formalization of jobs and land ownership reform to make the sector more inclusive.



The session continued with an intervention by Armel Mensah, Senior Research Officer, National Institute of Agricultural Research of Benin (INRAB). He gave an overview of the situation in Benin regarding water and nutrition. He informed the audience about water quality and its importance for growing fresh food. What is often contaminated by micropathogens and pesticides residues. Furthermore, salinity is also a restraining factor for vegetable growing. He also mentioned that most farmers in Benin are smallholder farmers, for whom irrigation systems plays an important role for supporting a healthy nutrition as well as securing their livelihood.

The session ended with an interactive part with the participants, discussing what is needed to do better on SDG 2 and nutrition to achieve SDG 6, and what the WASAG network can contribute to through the Water and nutrition working group.

TECHNICAL SESSION ON SALINE AGRICULTURE

This technical session was moderated by Dionysia Angeliki Lyra, Halophyte Agronomist at the International Center for Biosaline Agriculture (ICBA). The session on Saline Agriculture started with a presentation by Mr Antonio Pedro Pina, hydrogeologist at ANAS on the salinization of soils and water of Santiago Island.

The president of the National Institute for Agricultural Research and Development (*Instituto Nacional de Investigação e Desenvolvimento Agrário*, INIDA), Ms Nora Silva, then spoke about the development of sustainable agricultural production systems in the face of climate change in Cabo Verde, focusing on community and resilient agriculture in areas with a propensity to salinity. She stated that the Ministry of Agriculture has an increased interest in trying to solve issues in order to provide means and solutions for populations for more productive agriculture. Resilience, research and capacity building need to be reinforced. Ms Silva also spoke about the sustainable agricultural production system in saline areas of Cabo Verde developed

as part of the south-south cooperation with Morocco. Indeed, the main objective of the system is to improve the sustainability and resilience in irrigated and rainfed drought-prone and saline areas of the country. It has three components related to capacity building and knowledge transfer: strengthening INIDA's capacities, reinforce the capacity of technicians and farmers, and knowledge transfer between INIDA staff and academics in Morocco.

The vice-president of the International Commission on Irrigation (ICID), Mr Marco Arcieri spoke about the trends and perspectives of irrigation management in saline agriculture. He informed the audience that water salinity is a major problem for agriculture, especially on Santiago Island, where the water source is of poor quality because it is too saline to be used. Mr Arcieri suggested there is no specific approach to be considered to counteract this problem, as there is no single methodology, especially in irrigated lands. Several aspects must be considered, and thus adopted in an integrated approach. He stated that desalination occurs naturally during the water cycle, but there are also other ways of desalinating water, such as distillation, reverse osmosis, and nanofiltration.

The session followed with a presentation by Ms Dionysia Angeliki Lyra from ICBA. She spoke about saline agriculture in hot desert regions and presented a roadmap for a sustainable and successful Farm-to-Fork approach. The crops used in saline agriculture are salt-tolerant crops – such as carrots, salad varieties, etc. – or halophyte crops in high saline areas. The agronomist explained that halophytes are crops that grow in highly saline environments. She gave the example of *Salicornia* that can grow in sea water, hot and desert areas. However, she emphasized the importance of the smooth implementation of a newly identified crop in local farming communities in order to avoid the various gaps in the value chain from their cultivation to adoption and consumption by local population. Many factors are to be considered to do so. The presentation concluded on determining that halophytes can play an important role in salt-affected areas. It would therefore be an interesting path to adopt a multidisciplinary approach for growing halophytic crops, developing a good cultivating and market proposition to guarantee the sustainable production of the special crop that has been identified. In addition to the important role that the food industry can play in halophytes innovative uses, Ms Lyra suggests creating community-based activities and a platform to raise public awareness about halophyte crops.

The last intervention of the session was by Ms Katarzyna (Kate) Negacz from the Vrije Universiteit Amsterdam who introduced the International Network of Salt-Affected Soils (INSAS). It is a technical Network of the Global Soil Partnership (GSP), hosted by the NSL Division of FAO, whose mission is to support and facilitate joint efforts towards the sustainable management of salt-affected soils for food security, agricultural sustainability and



climate change mitigation. Ms Negacz spoke about recent activities and impact of INSAS while inviting the audience to get involved in the four working groups of the network.

SIDE EVENT ON ACHIEVING SDG6 IN SMALL ISLAND DEVELOPING STATES (SIDS)

The first side event of the forum discussed water monitoring in Small Island Developing States (SIDS) and accelerating progress in SDG6 'Clean water and sanitation'. It was moderated by assistant FAO representative programme Katya Neves.

The first presentation by AQUASTAT coordinator Patricia Mejias Moreno, focused on the process and results global monitoring of SDG6.4 indicators, namely water-use efficiency and water-stress, in SIDS. Ms Moreno indicated that SIDS face a unique set of vulnerabilities, including challenges related to their limited water resources. Monitoring and accountability are essential elements to ensure the realization of a sustainable development of SIDS. She demonstrated that SDG6 target indicators are under-reported in SIDS, and that major knowledge gaps exist among countries to track the progress of the SDG. Therefore, providing support to build capacity for data collection and strong evidence-based decision-making should be a priority.

The senior water and climate specialist from the Global Water Partnership (GWP) Mr Valentin Aich spoke about Integrated Water Resource Management (IWRM) support programme to reach SDG6, target 6.5, which is to "to implement by 2030 integrated water resources management at all levels, including through transboundary cooperation as appropriate". IWRM is a process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment. There are four themes for IWRM which are enabling environment, institutions and participation, management instruments and financing, which all contribute to social equity, environmental sustainability and economic efficiency. Executive administrator and engineer Marize Gominho from ANAS then presented the priorities and challenges of SDG6 progress in Cabo Verde. She stated that the country has made notable advances in the field of water and sanitation in the last five years, reflecting the importance of mobilization and distribution of water for domestic consumption and the economy and ensuring the availability and sustainable management of safe drinking water and sanitation for all. The session followed with a presentation by coordinator of the planning and monitoring office of the National Institute of Statistics of Cabo Verde, Ms Nereida Moreira, who spoke about data collection and analysis for SDG6 monitoring in Cabo Verde.

The session concluded with a panel discussion with experts Mariet Verhoef-Cohen, president of Women for Water Partnership and WASAG Vice-Chair, Peter McCornick, executive director of the Daugherty Water for Food Global Institute at the University of Nebraska, and Robert Stefanski, chief of the Agricultural meteorology division in the Climate and Water Department at the World Meteorological Organization (WMO).

TECHNICAL SESSION ON WATER QUALITY

This session was moderated by AQUASTAT coordinator at FAO, Ms Patricia Mejias Moreno.

Mr José Saldanha Matos, President of Portuguese Water Partnership and professor at the Technical University in Lisbon, spoke about the use of wastewater in a water scarcity context. He stressed that Nature-Based solutions such as the use of wastewater can be used in these contexts, as they rely on natural elements. Wastewater is rich in nutrients and can help tackle not only water scarcity and reduce pressure on groundwater, but also help increase food production, economic growth, and contribute to fighting climate change.

He presented a first case study on the opportunities for water reuse for food production in arid climate conditions in the city of Moçâmedes, Angola, as well as a second case study on the rehabilitation of Ribeira de Vinha wastewater treatment plant in São Vicente, considering the safe reuse of treated wastewater for food production. He stated that the use of wastewater is a clear example of circular economy and climate change adaptation.

The session continued with two other interventions. The first one was on faecal sludge management, treatment and reuse in agriculture, where Vera Garcia presented a case study of Maputo and biosolids reuse potential in Cabo Verde.

The last intervention was on the Phos-Value Project: Sustainable nutrient recycle from wastewaters, an initiative promoted by UNDP Ocean Innovation Challenge and presented by Marize Gominho from ANAS.

TECHNICAL SESSION ON DROUGHT PREPAREDNESS

This afternoon session focused on the International Drought Resilience Alliance (IDRA). It aimed at discussing the way forward for IDRA by collecting input from various actors and countries at all levels. It also aims to facilitate experience-sharing at the global, regional,



and national levels, spanning sectors and scales with a focus on the appropriate policy, advocacy, financing, and implementation measures that are inclusive and sustainable. The session started with an opening speech by senior water advisor Ania Grobicki. Chief of Global Policy, Advocacy and Regional Coordination Miriam Medel then presented the United Nations Convention to Combat Desertification (UNCCD) that is becoming more and more relevant because it is the only multilateral agreement by 197 parties that aims to support countries to take care of the land and water resources. The main objective of the convention is to support everybody in their fight against desertification, learning how to be more resilient to face drought, which is – just like climate change and biodiversity loss – across borders and boundaries. The proposition from the alliance is to work on a proactive management of drought to get ahead and be better prepared to avoid unnecessary damages. The four pillars for drought resilience action are the following:

- i. building political momentum for the agenda;
- ii. common framework to accelerate action on drought resilience;
- iii. knowledge sharing;
- iv. innovative finance for drought resilience.

Ms Medel stated that because WASAG is an important and rich body of knowledge, it can support IDRA. The framework can provide lessons in agriculture to the rest of the economy.

The second part of the session took the form of an interactive dialogue, during which several United Nations entities – WMO, FAO, Global Water Partnership (GWP), National Drought Mitigation Center of the University of Nebraska (NDMC), and UNCCD – discussed the added value of a global approach to drought resilience and how we can enhance and ensure IDRA is fit for its purpose. Mr Daniel Tsegai from UNCCD stated that drought is not crisis, it is a risk. If it's a risk, then it needs a policy for risk reduction. A second panel presenting some country cases took place during the last part of the session, with cases from Italy, India, the Comoros and Cabo Verde.

SIDE EVENT ON PRESSURIZED IRRIGATION SYSTEMS

The last session of this first day addressed agricultural water management by presenting voluntary guidelines for design and management of pressurized irrigation systems prepared by the Italian Coordination Group. This group is constituted by seven Italian institutions that support WASAG. The project was born from an awareness that despite many publications on the topic, integrated methodological guidelines do not exist and yet can be relevant to guide and better orient the activities of technical governmental institutions.

The side event was moderated by senior land and water officer Maher Salman from FAO, who presented the objectives and expected outcomes of the event, and the importance of increasing water-use efficiency through an integrated technical and scientific approach. It is essential to develop and implement the appropriate irrigation management practices related to demand and supply management.

Subsequently, several institutions involved in the preparation of the guidelines intervened to discuss the main and important aspects to consider for design and management of pressurized irrigation systems. The first presentation by Mr Nicola Lamaddalena, Deputy-Director of the Mediterranean Agronomic Institute of Bari (*Centre International de Hautes Études Agronomiques Méditerranéennes*, CIHEAM) gave an overall view of the technical guidelines for design and management of pressurized irrigation distribution systems. These guidelines have been developed to provide a methodology for planning and designing investments in the irrigation field to increase the productivity of the water resource used for irrigation, especially in arid areas, not deteriorating already scarce water resources. They provide an integrated approach of the agronomic, economic, engineering and environmental aspects to consider when an irrigation system is implemented. The policy and bioeconomy researcher Filiberto Altobelli from the Council for Agricultural Research and Economics (CREA) presented the agronomic steps to be considered during the design phase of a pressurized irrigation system. He listed the important aspects to consider within the irrigation system design, such as the intervention area, the soil and climate conditions, the water source, availability and quality, and the crop water requirements. Mr Paolo Enrico Sertoli from the Italian Agency for Development Cooperation (*Agenzia Italiana per la Cooperazione allo Sviluppo*, AICS) gave some information on designing an on-farm irrigation network, starting from calculating irrigation parameters, performance indicators and distribution systems. The Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) also gave some inputs on the energy requirements of an irrigation system. Indeed, senior researcher Nicola Colonna stated that improving an irrigation system's efficiency can save both water and energy. He talked about the steps to be followed to save energy and money and how to properly set the size of an irrigation system. Research manager Raffaella Zucaro from CREA brought the audience's attention to the economics of irrigation: she spoke about the methodology for planning and managing pressurized irrigation systems to maximize farmer incomes and presented a cost-benefit analysis. Finally, Director-General of the Water Academy Alessandro Leto intervened on the governance-policy section of the guidelines, mentioning the importance of sustainable and responsible water management, beginning with the origin of water resources and their cautious use.

Pressurized irrigation systems, as opposed to surface irrigation systems, are more effective in applying irrigation water to crops but are highly demanding in energy and management. For this reason, when planning new investments, it is recommended to consider the bene-



fits of renewable energies as a complementary strategy to support policies of responsible sustainability and more careful use of financial resources. These systems represent a valuable tool to increase yield and improve water use efficiency: offering a coherent, resilient policy when dealing with the unpredictable level of precipitation and rise in temperatures, the two key climatic variables most influenced by the dynamics of climate change.

The session ended with a discussion with the participants, focusing on field insights on agricultural water management food and nutrition in a water scarcity context.

Before closing the session, Secretary of State of Cabo Verde Miguel Ângelo Da Moura gave his concluding remarks.





Day 2: 8 February 2023

FAO ON NOVEL APPROACHES

Director Lifeng Li presented FAO new water journey and shared some of the new initiatives of FAO. Water plays a fundamental role in supporting all life. Agriculture is one of the largest sectors of water users. It is also the sector that suffers from climate change. An additional 29 percent of fresh water should be needed considering climate change while another additional 20 percent of fresh water will be needed with the aim of sustainability. Thanks to the Rome Water Dialogue, FAO is ready to put water on its priority.

FAO Water Journey has developed the following Programmatic initiatives: soil-land water digital information system (SoLaWiSe); Addressing water scarcity for agriculture and environment (AWSAME); Data and WaPOR; irrigations needs and potential mapping; water quality and pollution; water and climate actions; national water dialogues and roadmaps; global dialogue on water tenure; integrated water resources managements (IWRM).

- Major global financial institutions stopped major investments in irrigation. Current rainfed agriculture will not be able to cope with the incoming climate change in the future. FAO will launch a global irrigation need and potential mapping.
- FAO's Action Plan on Climate Change will be centred around water. Water quality and pollution issues have to be addressed. The agricultural sector cannot produce safe food without addressing the water quality challenge.
- Among all 17 SDGs, none of them can be achieved without water. SDG6 can only be achieved together with all other SDGs. A crucial mechanism to achieve the SDGs is at the national level. Only one third of the Food System Pathways mentioned water as a driver for sustainable food systems. FAO will implement its new initiative of the National Water Roadmaps together with the countries, upon request.
- Water tenure is the key part of effective water governance. Use the water tenure to strengthen the water system in the future is important.

Through all these initiatives, IWRM initiatives can be reached at global, regional and national level.

Director Li announced that before the 2023 UN Water Conference at New York, FAO will organize a regional workshop on the National Water Roadmaps for the African countries. Hopefully, in New York we will hear from the countries about their National Water Roadmaps to achieve SDG6 and the 2030 Agenda.

FAO Land and Water staff shared their comments:

AQUASTAT coordinator Patricia Mejias Moreno stated that FAO has a lot of experience collecting data and information and disseminating information at a global level, including the following 3 major areas:

- Data collection through AQUASTAT.
- Developing methods and tools such as remote sensing data, like WaPOR for example, which provides information on near real data on water productivity.
- Providing support to countries, such as working with countries to raise awareness of how important it is to have gender-related data.

Ms Mejias Moreno also shared the idea of a collaboration with the government of Cabo Verde in the future.

The Land and Water Officer Eugene Rurangwa from the FAO Sub Regional Office for West Africa presented the perspective from the field. He confirmed that what farmers see in the field is also what FAO sees. He shared a project of one million cisterns to capture rain in the Sahel, aiming to support the use of rainwater for agriculture. The water that is collected through cisterns is crucial especially for pastoralists. The other source is groundwater, which is currently still not very well used in the Sahel region. FAO disseminates solutions for farmers on how to produce more with less water.

WASAG team leader and Senior officer from NSL Ruhiza Jean Boroto congratulated the partners of WASAG for their excellent work since the 1st WASAG Forum, including Farmers' guidelines developed by the working group on Saline agriculture, Guidelines of pressurized irrigation developed by the Italian chapter, WASAG Framework on Financing Mechanisms to be launched at the end of this session. Mr Boroto stressed that the AWSAMe Programme will be developed over the next 10 years. One component is drought resilient and nutritious crops. In order to have a greater impact, synergies need to be established.

The session continued with interventions by delegates from governments, UN agencies, research institutions and academia, Civil Society Organizations and NGOs who have been invited to share their comments.

Mr Abdoulaye Mohamadou from the *Comité Permanent Inter-États de Lutte contre la Sécheresse dans le Sahel* (CILSS) (Permanent Inter-State Committee for Drought Control in the Sahel) emphasized that water scarcity is the main challenge for countries of the Sahel region. The CILSS can play an important role with Cabo Verde and FAO in managing water use in the region. It is important to focus on capacity building to reinforce monitoring in the region's countries.

From the United Nations agencies side, Mr Robert Stefanski from the World Meteorological Organization stated that for the UN agencies, the main role is to reach out to the Members to make sure that they can provide better services. WMO is trying to develop regional hydrological centres. Collaboration is crucial and WMO will continue exploring how to foster collaboration with FAO on the water issue.

Ms Hind Aissaoui Bennani from the International Organization for Migration (IOM) mentioned that the organization is fostering collaboration in the field of human mobility in times of climate change. She highlighted that the WASAG forum provides an opportunity to discuss human mobility, in which water plays a crucial role. Her intervention was supported by other panelist including Ms Charity Osei-Amponsah from International Water Management Institute (IWMI) and Ms Nidhi Nagabhatla from United Nations University (UNU-CRIS) and Mr Lako Stephano (WASAG co-chair) also reiterated that water crises settings directly or indirectly impact people's decision to migrate or in other instances there is forced displacement. The complex nexus between water and migration is not just a problem to solved but a reality that needs to be managed in whole-of-government approach, which need to be adapted to sectorial and stakeholder's needs. In the agriculture sector for instance, farmers need to be considered as important private sector actor and employers of labor migrants. The session concluded by stating that solutions should not oppose the



human rights of labour migrants. The panelists in the session agreed that we need to see more coherence between different policies and strategies and between the different sectors to address water scarcity and all related issues linked to it.

Interventions from research institutions and academia, starting with Mr Peter McCornick from the Daugherty Water for Food Global Institute (DWFI) at the University of Nebraska who highlighted the necessity to integrate the issue of water into the decision-making process of farmers. Solutions need to be farmer centric, especially including youth and women and improving the situation of migration as well as the local economy. Rural communities are the stewards of the land and water resources. They need to get involved in the discussion about water resources management, all the way to the UN.

Mr Marco Arcieri from the International Commission on Irrigation and Drainage Drought Prediction in Italy (ICID) represented the professional organizations. He presented ICID as one of the founding institutions of WASAG and has a common path with the platform. The commission can guarantee its advocacy, with strong connections within the Ministries are important. According to the expert, one of the interesting aspects to focus on in the future of WASAG is irrigation scheduling. Mr Arcieri stressed that water loss should be considered as a priority aspect.

Finally, Ms Mariet Verhoef-Cohen from Women for Water Partnership (WfWP) represented the Civil Society Organizations and NGOs. Ms Verhoef-Cohen emphasized that women and small-holder farmers are the backbone of African agriculture, and they need to be heard. She stressed that there is a gap between policies and practices and between practicing and preaching. To achieve a change, it is important to involve women and youth in action and discussion, including designing, financing and decision-making. According to Ms Verhoef-Cohen, data need to be sector-aggregated and also based on citizen sciences, training for farmers is crucial. She finally stated that gender-balanced organizations, events and meetings is a good start.

In his concluding remarks, Mr Li raised that there is a huge gap if we look at the number of people that have a master's in agriculture and the number of young farmers that are needed in the agricultural sector. Transforming to more efficient, resilient and sustainable agrifood systems are needed. It is true that in FAO the focus is led on the management of water rather than the demand side. The supply side should be paid attention to as well. This is why FAO encourages countries to develop their country owned National Water Roadmaps.

The need for agriculture cannot compete with the need for drinking water. Social needs need to be satisfied first. Sustainable water allocation must happen from both national and policy settings level, but also on municipal level.



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The publication developed by the working group on Financing mechanisms “Unlocking finance for water and agriculture” was launched at the end of this session.

TECHNICAL SESSION ON WATER AND MIGRATION

Water scarcity is a significant driver of migration, especially in Africa, causing internal and cross-border movement, impacting societal, cultural, and economic landscapes. Migration negatively influences food security, particularly in cases of rampant rural-urban migration. Still, it can also offer opportunities for both migrants and host communities if policies and actions are directed to manage migration pathways. The Water and Migration Working Group aimed to position migration as beneficial for agricultural productivity through case studies in Africa, emphasizing positive aspects and proposing recommendations for managed migration in the wake of water and climate crises. The session experts reiterated that managed migration can create opportunities for host and sending communities, offering access to resources, technologies, and knowledge and facilitating rural transformations and cross-learning.

This session aimed to look at opportunities for migration and water scarcity to enhance agricultural productivity and identify practical solutions with the objective of building partnership and sharing knowledge. It was moderated by Ms Charity Osei-Amponsah, Regional Researcher from IWMI, West Africa Office, Ghana.

During this session, Mr Abdoulaye Mohamadou, Secrétaire Exécutif of CILSS shared the experiences on migration in CILSS countries in West Africa. He indicated that non environmental factors affect more than 90 percent of circular and long-term migration in sub-Saharan African countries. Then, capacity building, finance and technology transfer programs are key for local adaptation to climate stress and specifically water stress.

His presentation was followed by Mr Stephane Lako who presented posters of two case studies in Ghana and Cameroon focusing on in-migration as an opportunity for food and economic security. It was made clear that migration is a source of pressure on existing physical and financial resources, but also a driver of tangible and non-tangible resources, including knowledge, technology, labor which can be boosters of local development. Analyzing and engaging to migration management approaches could lead to new natural resource governance.

Ms Nidhi Nagabhatla, (UNU-CRIS) added her insights about policy gaps and need for strengthening institutional arrangements to address the water-migration nexus, more so in rural and agrarian settings. She also stressed on the importance of considering this growing phenomenon with climate pressures on water resources and water dependant habitats and activities.

Ms Hind Aissaoui Bennani (IOM) delivered the presentation *From the World Water Forum to COP28 – Key recommendations to the UN 2023 Water Conference*, highlighting that migration contributes to the resilience of the local communities. There are many different reasons that make people migrate to another region or country. These multiple factors need to be integrated into the discussion on issues of water and agriculture as well as climate and environment. The big majority of human mobility is internal. Cross-sectoral and integrated approaches are important. Smallholder farmers, transhumance, labour migration for agriculture should be focused. For the African region, agriculture is the backbone of the economy and the agricultural workers including migrants are a crucial part of agricultural activities. Associating labour rights in the agricultural sector are needed.

The Thematic talk “Collaboration on Water and Migration for comprehensive and tailored recommendations” involved Ms Sinafekesh Girma Wolde, Mr Paolo D'Odorico, and Ms Maria Cristina Rulli. The discussion showed that migration is also an interesting opportunity for the economy and investments. Specifically in East Africa three migration patterns can be observed: in migration, circular migration and long-term migration with environmental, economic, social and political drivers. These drivers are generally local, cross-border or inner-continental and need more insight to better understand them and change the situation to opportunities for populations involved in the migration dynamics.

The session concluded that the need for an enhanced understanding of the intricate relationship between water scarcity, climate change, and migration is crucial, and the merging impacts call for holistic solutions, integrating smart agriculture and sustainable water management practices and policies to inform the migration policies. Migration, driven by environmental pressures, presents challenges and opportunities for local development and resilience. Collaboration, knowledge sharing, and innovative approaches are pivotal in addressing the complexities of water stress-driven migration, advocating for transformative actions on a global scale. As a nexus between water and migration is complicated, such settings demand comprehensive strategies for a sustainable water-resilient future.

Ms Charity Osei-Amponsah in the closing remark stated that water scarcity and migration are real. Transformative solutions are needed. Water scarcity, climate change, agriculture and the vessels between these three things must be key in the global discourse.

TECHNICAL SESSION ON INCLUSIVE FARMER-LED WATER MANAGEMENT

Farmer-led agricultural water management, across the spectrum from improved small-scale rainfed to irrigation, could underpin millions of livelihoods, increase food and water security, enhance climate change resilience, and enhance rural economic development.



Farmers and entrepreneurs along the value chain can build resilience from suitable investments addressing growing weather-related water risks to food systems. The session was moderated by Mr Peter G. McCornick, from the Daugherty Water for Food Global Institute (DWFI) and included three presentations and a panel discussion.

Mr Amare Hailelassie from IWMI delivered the presentation on overview, progress and challenges in farmer-led irrigation at scale. This presentation takes stock of the latest advances in knowledge on the opportunities and bottlenecks in bringing water solutions to scale inclusively and sustainably from farm to watershed scale. It discusses the latest insights in using adaptive scaling approaches with the private sector and financing modalities to increase access to small scale irrigation technologies for farmers and provides a framework on how systemic changes can be triggered with private sector on ensuring sustainable water management at scale.

Ms Grace Mukarusagara from DWFI-Rwanda spoke about irrigation-as-a-service as a tool for supporting smallholder farmers. She presented findings from dozens of field interviews on how smallholder farmers access irrigation services even when they do not own the irrigation equipment. There are various business models providing irrigation services within informal markets in Rwanda, including farmer-to-farmer lending, entrepreneur-to-farmer rentals, and water tanker trucks. By increasing asset utilization rate, irrigation as a service business models leverage investments in equipment to increase irrigated area. To support scaling-up informal markets, she recommended that the Government of Rwanda considers encouraging farmers to lend their equipment and supporting irrigation-as-a-service entrepreneurs with startup grants.

Afterwards, Ms Mariet Verhoef-Cohen, the president of WfWP, presented five guidelines that have been formulated by the partnership to incorporate more women in decision-making processes in the water sector: capacity development, appropriate funding, ownership resources, sex-disaggregated data, accessible & affordable technology and tools. This can vary from analysing a situation, drafting a plan with clear targets, and a budget, seeking commitment from the top and involving managers, creating appropriate conditions for women to join and stay on board, to monitoring the developments based on a system with sex-disaggregated data. She informed the audience that the project *Women, Water, Leadership* has been educating, empowering and enabling 500 women farmers in Kenya to ensure their communities and families have access to clean water and learn how to produce sustainable nutritious food. The smallholder farmers now have the capacity, experience and education needed to manage water resources, produce sustainable food and gain careers in water-related professions. It means involving women farmers from the start, from the designing table to the decision-making, that guarantees the success.



During the panel discussion, Ms Jennie Barron, researcher from Swedish University of Agricultural Sciences (SLU), shared that labour should be investing to put farmer-led actions on the ground. Ms Natacha Akaliza and Ms Raissa Urujeni, from DWFI-Rwanda, also intervened, adding their perspective on Ms Mukarusagara's presentation. The session concluded with an interactive Q&A section, in which the panellists elaborated more on the use of data-base, remote sensing technologies and the role of women to support smallholder farmers.



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TECHNICAL SESSION ON DRYLAND AGRICULTURE

Dryland agriculture includes marginal rainfed production systems and rangelands. With a changing and variable climate, drylands need urgent and serious sustained attention.

To start the session, the moderator Mr Vinay Nangia, ICARDA invited the WASAG chair, Mr Felix Reinders, to deliver his opening remarks, highlighting the importance of dryland agriculture.

As the first presenter, Mr Nangia introduced Water for food, water for life: the drylands challenge. He stated that about 41 percent of the Earth's land area is classified as dryland. Agriculture is required to produce more food and welfare for rapidly increasing populations with less freshwater resources. Conventional responses to this situation focus on increasing yields, improving irrigation efficiency and managing demand. He argued that those strategies are not sufficient. A paradigm shift in how we manage water is needed going into the future. Climate-smart agricultural practices that require less water, can sustain climatic stresses, produce food with high nutritive value but require less water and energy to produce are the needs of the hour. He also presented ICARDA's success stories from MENA region and stated the following key messages:

- There is unequivocal evidence that there is no going back from some climate-induced changes in the system.
- The dry areas are naturally water scarce and there is a limit to which technologies and management options can overcome this.
- With a young aspirational population, advent of new materials and business models, significant ownership of smartphones and reduction in cost of IoT sensors, drones, remote sensing imageries etc., there is hope that digital technologies can bring transformative changes in the livelihoods and food security.

The session continued with a presentation by Mr Mitsuru Tsubo from Tottori University. He presented farmers' decision-making with an app for climate risk management in drylands.

Tottori University and agricultural research institutions in South Africa and Senegal have been collaborating on a project called “Development of Resilient E-farming for agroclimate risk management in African Multi-environments”. This project aims to develop a decision-making system driven by crop model simulation with seasonal forecasts. He also introduced the research activities of the project and discussed its way forward.

The next presenter Ms Susan Amrose, who is a research scientist from MIT talked about the feasibility of low-cost renewable powered integrated electro dialysis desalination and low energy drip irrigation systems. She brought 3 innovations to the audience’s attention to achieve low energy and low cost comparing with the existing technologies. This approach allows for lower cost solar-powered desalination without the need for batteries.

The session continued with the presentation delivered by Mr Ragab Ragab, the president of ICID, with the title of Accurate Estimation of crop water requirements using new technologies (COSMOS, Scintillometers, and Eddy Covariance). The cosmic-ray soil moisture observation system (COSMOS) for estimating the crop water requirement is a new approach. It is a step in the right direction as it provides continuous, integrated, area-based values of soil moisture and solves the problem of spatial variability often found in point measurements in relation to soil spatial heterogeneity.

Mr Marco Arcieri from ICID presented the project of accessing and estimating crop ET and Crop water requirements in Hydrographic District of Italy. In this project, FAO's CROPWAT program is used as one of the most reliable software for the assessment of ET and CWR.

Before closing the session, Mr Reinders thanked all the speakers for brilliant presentations which provided new innovations and technologies on dryland agriculture to the audiences.

TECHNICAL SESSION ON INNOVATION, TECHNOLOGY/DATA AND SCIENCE

Innovations include those in remote sensing of water use, field level spatial tools, and gathering accurate information on seeding rates, fertilizer application, crop yield and other relevant agronomic data. The adoption of innovations and technologies will improve on-farm agricultural water management, support decisions, and inform water and agricultural policies and investments.

The session was moderated by Mr Peter McCornick from DWFI. Mr Christopher Neale from DWFI delivered the first presentation on digital agriculture: the future of large-scale production systems. He introduced methodologies and approaches presently used by farmers, crop consultants, researchers, and industry providers to automate and increase the efficiency of agricultural crop production systems. These approaches include the use of high-resolution multispectral and thermal remote sensing from satellite and airborne systems to inform



irrigation scheduling and crop growth models. He also discussed the use of agricultural implement monitoring systems and how these technologies can be applied in different world agricultural regions and scales.

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The second presenter was Mr Andry Rajaoberison, from FAO investment centre. He spoke about using remote sensing for water management and showcased how WaPOR can be used for policymaking and water management in water scarce regions. He highlighted that WaPOR data provides an unprecedented opportunity to design well-informed water management policies and investments, as well as to monitor their results in real time.

The session continued with the presentation from Mr Julio C. Lima, from the *Instituto de Estudos da Macaronésia*, in Cascais, Portugal, and in Mindelo, Cabo Verde. He presented agri-integrated photovoltaics for reuse of water for irrigation. Photovoltaic (PV) electricity generation will play a crucial role in future sustainable energy systems. PV is conquering new application areas, such as building-integrated PV and agricultural-integrated PV (agri-PV). He introduced an agri-PV project in Cabo Verde to develop and applicate advanced water treatment technologies and solutions, which will target sustainable wastewater reuse in crops fertigation and production in Cabo Verde.

The session concluded with an active Q&A session, during which the speakers elaborated more on their perspectives on the use of innovation, technology and data to address water scarcity.

SPECIAL EVENT: DROUGHT RESILIENCE +10

A special event on drought resilience was organized as a preparatory meeting towards the High-level Meeting on National Drought Policy (HMNDP +10), that will take place in 2023, 10 years after the first HMNDP, coordinated by the Integrated Drought Management Programme (IDMP).

Ms Stefania Giusti from FAO moderated the event and invited Mr Miguel Ângelo Barreto da Moura, State Secretary for Agricultural Economy from the Ministry of Agriculture and Environment of Cabo Verde, to make the opening remarks. Mr da Moura highlighted the crucial of drought management and the action that Cabo Verde has been doing to deal with drought.

Mr Robert Stefanski from WMO introduced the background of Integrated Drought Management Programme and the National Drought Management Policies Initiative (NDMP) with UNW-DCP, FAO, UNCCD, & WMO. He showed the national framework of three pillars approach: Monitoring and early warning systems; Vulnerability and impact assessments; Drought preparedness, mitigation and response. The High-Level meeting on National

Drought Policies +10 aims to build drought resilience through knowledge, policy and practice. 8 work streams are proposed and were presented in the following parts of the session. Mr Stefanski also presented the first work stream on Drought Resilience and Global Mechanisms. He raised out 10 steps for drought policy and preparedness process.

He concluded his presentation by stating that sustaining collaborative networks across research, observations, services, and decision-making at different scales is still an ongoing challenge.

Ms Miriam Medel from UNCCD presented the second work stream on drought risk governance in the context of the UNCCD intergovernmental process. She informed the audience that UNCCD COP15 (Decision 23/COP.15) decided to establish an Intergovernmental Working Group (IWG) on drought during the triennium 2022–2024 and introduced the members, observers and tasks of the IWG.

Mr Mark Svoboda, who is the director of the NDMC, presented the third work stream on the role of drought impacts in drought risk management. Tracking drought impacts can help decision makers figure out where to focus efforts to reduce vulnerability to the next drought. Collection and monitoring, research, response & recovery, planning/policy are crucial. Using the past as a guide to the future should be considered. He raised some current and future drought management concerns, for example, given increased drought incidence and upward spiraling impacts, how can we convince policy makers that drought preparedness and the application of the principles of risk management are worthy of upfront investments, which worth the audience to think about.

Mr Maher Salman from FAO and Mr Daniel Tsegai from UNCCD jointly presented the fourth work stream on “from policy to action”. Mr Salman stated that countries take the centre stage from reactive to proactive drought management. He talked about four pathways to turn policy into action, including leading institutions with a clear mandate, coordinated governance framework, strengthened national capacities and inclusive participatory approaches. Mr Tsegai then introduced the UNCCD drought initiative and what is needed to turn policy into actions:

- The need to leverage drought as a “connector” among sectors, regions and organizations.
- The role of building capacity of individuals, institutions and organizations.
- The need to harness the benefits of modern technology (AI, Mobile and remote sensing) for drought resilience.
- The significant role of policy, financing & decision-making.



- The need to strengthen the links of droughts to human security.
- The need for strengthening institutional mechanisms and social values for collaboration on drought and related issues.

Ms Rachael McDonnell, co-leader of IWMI and IUCN, pre-recorded her presentation on the fifth work stream on bringing ecosystem into drought risk management. She introduced drought impacts on ecosystems and their services. She stated that ecosystems are not always brought into implementation of the 3 pillars: monitoring early warning systems; vulnerability and impact assessment; preparedness, mitigation and response. She also gave some examples to show how ecosystem service solutions are used in drought risk management.

The event continued by the pre-recorded presentation delivered by Ms Anna Smetanova from GWP on the sixth work stream on social inclusion, climate justice and drought. She introduced gender transformative approaches and social inclusion in integrated drought policies. She encouraged the audience to discuss the opportunity for effective, powerful and meaningful gender and social inclusion.

Mr Maher Salman delivered the presentation of the seventh work stream on drought finance. He introduced the topic in terms of delimitation of the concept, new taxonomy of instruments, critical role of private sector and the missing baseline of statistics.

Mr Valentin Aich from GWP presented the eighth work stream on public-private-civil society partnerships for integrated drought risk management. He provided the overview of Public-Private Civil Society Partnerships (PPCSP) and a variety of modalities for PPCSP. He showed some examples of PPCSP and brought out challenges of public sectors and private sectors.

The event had an active interaction between speakers and the audience during Q&A session, especially on flood and drought. Mr Stefanski thanked all the participants and concluded the event.

TECHNICAL SESSION ON SUSTAINABLE AGRICULTURAL WATER USE

Sustainable agricultural water management requires irrigation methods and strategies to minimize yield penalties while optimizing water, land and energy use efficiencies. Evidence suggests that we need a paradigm shift that provides an enabling, all-inclusive policy-making environment that cuts across sectors and systems.

The session was chaired by Ms Charity Osei-Amponsah. She invited the first speaker Mr Amare Hailelassie from IWMI to present Sustainable Irrigation Technologies: a Water-Energy-Food (WEF) nexus perspective towards achieving more crop per drop per joule per

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hectare. He highlighted the following key messages:

- The WEF nexus approach has potential to holistically appraise performance of irrigated agriculture.
- Drip irrigation was favored by WEF nexus approach, however adoption needs careful and informed consideration.
- Irrigation modernization to be complemented with sound basin-wide water management to realize WEF nexus benefits.
- There is a need to investigate the WEF nexus implications of other promising nexus-friendly sustainable agriculture interventions.

The session then continued with a presentation delivered by Mr Musandji Fuamba from Polytechnique Montréal. He talked about rainwater harvesting for sustainable agriculture in dry African regions. He stated that rainwater harvesting has positive side effects on water and soil conservation. Its use in African countries is still far below its potential. A specific goal on sustainable rainfall management for ecosystems and food production in Africa is needed to achieve the goals of eradicating hunger and poverty. Rainwater harvesting can enable long-term economic development.

Mr Christopher Neale from DWFI introduced water productivity: innovations on methods and applications. He described different methods of estimating water productivity, including the use of remote sensing data for spatial applications, giving examples showing the increase in water productivity of crops and livestock over the last 25 years in the Midwest United States and explored opportunities and challenges for determining water productivity and supporting viable water accounting in other regions.

The pre-recorded presentations that followed were delivered by Mr Jakob Seidler and Ms Hannah Mosleh, who are advisors from GIZ. They spoke about nexus in practice and integrated water, energy and food security solutions, which is based on the work they did in the Nexus Regional Dialogues Programme. They explained how we can institutionalize the WEF Nexus approach in regional governance structures and investment decisions and how we can upscale Nexus-based farming at the local level.

The last pre-recorded presenter, Ms Julienne Roux, talked about the perspectives from GWP on sustainable agriculture water management. She shared some GWP activities including supporting rainwater harvesting in Central America, mobilizing climate finance for integrated catchment management in Uganda, etc. She also introduced some interventions on nexus technical solutions and raised some challenges and lessons learned on applying Water-Energy-Food-Ecosystems nexus approach.



The participants were actively involved in the Q&A session. Ms Osei-Amponsah concluded that sustainable agriculture water management is crucial for enhancing agriculture productivity.

SIDE EVENT ON WATER PRODUCTIVITY, THE YIELD GAP, AND NUTRITION IN A CLIMATE CRISIS: FIELD INSIGHTS FROM BENIN, MOZAMBIQUE AND NIGER

This last side event that concluded the second day of the forum was moderated by Ms Jennie Baron from the SLU, and opened by Senior Agricultural Production and Marketing Officer Mure Agbonlahor from the African Union Commission.



Mr Paulo Dias from FAO delivered the presentation with the title of water productivity, the yield gap and nutrition in a climate crisis: Field insights, which is also the highlights from the FAO and IFAD “Nutrition-sensitive Agriculture Water Productivity Project (NsAWP)”. Paulo introduced the objective, pilot countries, project activities and training activities of the project. The project aims to improve diet quality and diversity, and livelihoods by strengthening the capacities of smallholder farmers to adopt sustainable water, soil and agronomic management practices that will contribute to increased yields, crop diversification, and quality of production. There are 6 countries (Jordan, Egypt, Niger, Benin, Rwanda and Mozambique) implementing the project with financial support from IFAD. The project activities include needs assessment, NsAWP training curriculum, and implement NsAWP through farmer field school (FFS) approach.

A number of speakers took part in a panel discussion. Arm el C. G. Mensah who is Senior Research Officer, National Institute of Agricultural Research of Benin (INRAB) shared his idea on how to better implement project at local level with farmers. Jennifer Riley-Chetwynd, who is the Co-director of One World One Water Center, introduced the interdisciplinary approach to interlinking water, nutrition, agriculture, etc. Mure Agbonlahor from African Union Commission also shared his perspective online. Paulo Dias, from FAO highlighted that data collection, collaboration and synergies, the efficiency management of resources are 3 key lessons learned to implement projects in the fields.

The session ended with an interactive Q&A session, focusing on field insights on agricultural water and nutrition management.



Day 3: 9 February 2023

SIDE EVENT ON OPERATIONALIZATION OF TRANSDISCIPLINARY PARTICIPATORY WEFE NEXUS APPROACHES FOR ACHIEVING WATER AND FOOD SECURITY

The last session of the forum covered the participatory Water-Energy-Food-Environment (WEFE) Nexus approaches for achieving water and food security. The side event's chair and research manager Raffaella Zucaro gave some opening remarks, informing the audience that WEFE Nexus approach applied to food and water systems can be a very useful way to promote recovery and resilience. It is characterized by interdisciplinary research, knowledge sharing and stakeholders' collaboration.

During this side event, global challenges has been discussed by international delegations with a comparative look at two diverse climatic and geographic settings of the USA and Italy, but that are facing the same climatic and social problems. First speaker Jennifer Riley-Chetwynd gave an overview of the Denver Botanic Gardens & One World One Water Center in Colorado, USA and some transferable lessons from small-scale urban agriculture in Colorado. It was followed by a presentation on tradeoffs, vulnerabilities, and inequities in the Food-Energy-Water Nexus by Mr Paolo D’Odorico from the Department of Environmental Science, Policy and Management of the University of Berkeley. The professor confirmed that water remains a major constraint on food and energy production, and that some of the possible ways forward are to reduce water consumption by changing diets and reduce waste, but also to expand irrigation to rainfed areas or finding new sources of water, through water treatment systems, for example. A case study from Italy on how to find balance between water saving, drought management and ecosystem services has been presented by Mr Francesco Cavazza from Canale Emiliano Romagnolo (CER). Ms Maria Cristina Rulli from Polytechnic University of Milan spoke about the water and food Nexus in the context of human health, discussing hotspots and unsustainable trajectories of land use. Land use change – due to agricultural expansion or intensification – in response to an increasing demand for food can increase the proximity between human and wild habitat. She stated that food and energy production have an impact on both environmental sustainability such as water consumption and human health. We therefore need to combine the food-energy-water nexus with the one health paradigm¹. Programme for Research and Innovation in the Mediterranean Area (PRIMA) Nexus-Nature-Ecosystem-Society-Solution (NESS) coordinator Mr Fernando Nardi from WARREDOC University for foreigners of Perugia made a presentation on how to consider the interconnection among WEF E from policy to technical point of view in order to mitigate the conflicts that often arise when different economic and social sectors want to access the same resource. He gave an overview of how to achieve water Nexus by engaging stakeholders and transferring transdisciplinary science-driven WEF E Nexus scenarios to co-demonstrate the Nexus-NESS solution in four Euro-Mediterranean Nexus Ecosystem labs. He informed the audience that Nexus-NESS services provide WEF E Nexus actionable information to help individuals and organizations make Nexus smart decisions. They also support the WEF E Nexus Community of Practice to further engage stakeholders to co-produce a Nexus-NESS service to co-validate WEF E Nexus strategies for fair access to resources in four Nexus Ecosystems Living Labs in Italy, Tunisia, Spain and Egypt. The side event concluded with a question and answers session with the audience.



¹ <https://www.who.int/news-room/questions-and-answers/item/one-health>

PARTNERS MEETING

A closed-door partners meeting took place on the third day of the forum, allowing the partners present to exchange and discuss a new WASAG business model.

DEBRIEFING OF THE FORUM AND CLOSING CEREMONY

The second WASAG Forum ended as it started with an artistic performance by an amazing music duo on piano and voice

This last session was chaired by WASAG leader, Mr Ruhiza Jean Boroto, who interacted with the audience, highlighting the fact that quite a lot of people traveled from afar to come to the forum. He then gave the floor to WASAG Chair, Mr Felix Reinders, who presented [the Praia Call for Action](#) hereunder before it was endorsed by the participants of the Forum.

Following the presentation, H. E. the Ambassador Pio Wennubst from Switzerland spoke about the strong uniting force that he wished for. The Ambassador suggested to expand WASAG's mandate to create a “safe space” to act in unified manner. It will also be an opportunity and space for other countries to tell their stories of success, of taking leadership.

The Deputy Director of FAO Ms Maria Helena Semedo – whose closing remarks were delivered by delegation by Ms Ana Touza – congratulated Cabo Verde, her home country, for successfully hosting the WASAG Forum for the second time and for demonstrating in practical way that solutions to water scarcity can be found innovatively and collaboratively. She took the opportunity to thank Switzerland for its financial and strategic support since WASAG's foundation, as well as the African Union Commission, ECOWAS, and CILSS, considering that Africa, and West Africa in particular, are affected by climate change. It has a big impact on food security, nutrition, biodiversity, peace and security. The Deputy Director also congratulated WASAG partners, friends and stakeholders, for the adoption of [the Praia Call for Action](#), which will now be the barometer of WASAG. She stated that the resilient food systems developed by Cabo Verde will serve as an example to inspire other countries to find similar solutions.

Recognition prizes were then offered to H.E. Ambassador Wennubst, to Mr Miguel Ângelo Da Moura, Secretary of State of Cabo Verde, to Mr Claudio Lopes Dos Santos, president of ANAS, to WASAG Chair Mr Felix Reinders and Ms Ana Touza.

The last speaker of the 2nd WASAG International Forum was H. E. Gilberto Silva, Minister of Agriculture and Environment of Cabo Verde, who delivered the closing remarks. First, he





thanked all participants and expressed his for the achievements of the forum. He affirmed that the event aligns with the idea and pertinence of making water scarcity an opportunity for agriculture and agrifood systems to become resilient and putting this issue at the top of the global political agenda. With regard to [the Praia Call for Action](#), the Minister wanted to reaffirm my strong commitment to continue to contribute actively to achieving all goals for which WASAG was created for. He stressed that it is urgent to face the phenomenon of water scarcity by positioning agriculture and global food security at the core of discussions. There is a necessity to apply the available technologies within the strategies to eliminate water scarcity, but also to understand the nexus between water, agriculture, food security and climate change.

In the name of the government of Cabo Verde, the Minister thanked the technical leaders of the working group in contributing and organizing this event. Lastly, He concluded by wishing the audience a good field visit and plantation of trees, with the strong conviction that the participants will come back to Cabo Verde for the next WASAG Forum to see how much their efforts have grown.

THE PRAIA CALL FOR ACTION

TO COLLABORATIVELY TACKLE WATER SCARCITY IN AGRICULTURE

Endorsed at the Second WASAG International Forum on Water Scarcity in Agriculture with the theme “Making agriculture resilient for climate change: Water scarcity, an opportunity for action and collaboration” (7–10 February 2023, Praia, Cabo Verde)

Preamble

Water scarcity remains one of the greatest challenges of the twenty-first century, especially for the agriculture sector. The Global Framework on Water Scarcity in Agriculture (WASAG) embodies the active commitment to deal with this challenge collaboratively as manifested in the adoption of the ‘Rome Statement on Water Scarcity in Agriculture’ on 20 April 2017 during its first meeting of partners.

The First WASAG International Forum – which took place in Praia, Cabo Verde, from 19 to 21 March 2019 with the theme of “Leaving no one behind” – adopted the Praia Commitments as a firm first step towards decisive actions.

Soon after, WASAG developed a strategy for 2021–2024 with the title “Turning Water Scarcity into opportunities for sustainable agriculture, food security and nutrition”. Its partners, driven by this objective, work together freely and innovatively to implement the

strategy, despite the COVID-19 pandemic. WASAG has held webinars and virtual workshops, resulting in several knowledge products as published on its website.

WASAG also continues steadily to receive recognition and the mandate to support countries in finding solutions to cope with climate change in agriculture in the face of climate change, as expressed during the meetings of the Committee of Agriculture (COAG) and the Committee on Food Security (CFS) of the Food and Agriculture Organization of the United Nations (FAO).

Consequently, while in the aftermath of COVID-19, the Prime Minister of Cabo Verde, H. E. Mr Ulisses Correia e Silva, together with the FAO Director-General, Mr QU Dongyu, invited the partners and stakeholders of WASAG to reconvene in Praia, Cabo Verde, from 7 to 10 February 2023 for the Second WASAG International Forum. The theme of the Second WASAG Forum is: "Making Agriculture more resilient for climate change: an opportunity for action and collaboration".



Recommendations

We, the participants of the Second WASAG International Forum, consisting of government and Intergovernmental Organizations, UN agencies, Academia and Research Institutions, Civil Society Organizations and Non-Governmental Organizations, Professional and Private Sector Organizations, consisting collectively of partners and stakeholders of WASAG.

Recognizing the confirmation of the continued and extraordinary commitment and leadership demonstrated by the Government of Cabo Verde at the highest level by hosting for two consecutive times the WASAG International Forum and by providing adequate resources for a successful forum.

Recognizing the resilience of the people of Cabo Verde to water scarcity in agriculture and the opportunity provided to experience uniquely in the field all the facets of water scarcity in agriculture and the efforts to find solutions in the country.

Appreciating the consistent supportive role that the Government of Cabo Verde, Switzerland and Italy provide to WASAG, both politically and otherwise.

Appreciating the continued mandate given to WASAG to support its Members in finding solutions to water scarcity.

Recalling the endorsement of WASAG by 83 Ministers of Agriculture during the 9th Berlin Agriculture Ministers' Global Forum for Food and Agriculture.

Acknowledging that water scarcity in agriculture will only get worse in the future.

Adopting the offer by the Government of Cabo Verde to make Praia the Capital city of WASAG.

Recommend that:

1. All Members Countries are invited to become partners of WASAG.
2. A Member Country is designated to Chair WASAG, starting with Cabo Verde.
3. FAO convenes, every two years in its headquarters in Rome, a Water Dialogue on WASAG with all the Member Countries, where WASAG will report on the progress made, receive an updated mandate and mobilize the required support.
4. The WASAG Forum is convened in Praia every other second year to provide space to partners and stakeholders for sharing solutions and progress towards tackling water scarcity in agriculture.

Call for Action

Emphasizing the continued relevance of the 17 commitments from the First WASAG International Forum of March 2019,

We, the participants of the Second WASAG International Forum, further call for the following actions:

1. Mobilizing greater political support, for an enabling environment to address the effects of water scarcity and climate change on global food and water security and positioning agriculture at the core of international climate change discussions.
2. Promoting national ownership and leadership of the Members to implement strategies to cope with water scarcity in agriculture, taking into account local perspectives.
3. Stepping up collaborative actions on water scarcity in agriculture among countries, accelerating strategic actions, including policies and investments and committing the required resources.
4. Adopting international and or cross sectoral collaboration and multidisciplinary approaches, adaptive governance, involving all concerned institutions – including those representing farmers and agriculture –, role-players, women and the youth in any action, including the design, decision-making and financing of projects as well as in capacity building on topics such as droughts, irrigation, saline agriculture, etc.
5. Using innovative financing mechanisms, including blended financing, to enhance inclusive technology access and incentivize farmers and private sector actors in accelerating sustainable water management practices at scale.



6. Developing the knowledge-base on viable and innovative business models promoting farmer-led irrigation, and effective ways to support entrepreneurs – especially youth and young entrepreneurs – in agricultural water management on farms and in the relevant value chains.
7. Sensitizing, sharing knowledge and support “proof of concept” projects, to couple agricultural water management (AWM) with food and nutrition and with water, sanitation and hygiene (WASH) development objectives to accelerate progress on SDG 6 ‘Clean water and sanitation’, SDG 2 ‘Zero hunger’, SDG 3 ‘Good health and wellbeing’, especially in off-grid rural and urban small and medium scale farming systems.
8. Promoting actions as a “community of practice of water and nutrition”, to elevate attention to water security and food and nutrition security, in global development policy and investments, including the follow-up of UN Water Conference 2023, UNFSS2021 and UN actions in adaption.
9. Including the safe reuse of wastewater and other non-conventional water resources in agriculture as one of the key components contributions to addressing water scarcity in agriculture and addressing water quality for the production of healthy and safe food and the conservation and protection of the environment.
10. Developing climate-sensitive and water-productive interventions for dryland agriculture, with special attention to the needs of women, youth and the elderly.
11. Tackling droughts urgently and proactively through early warning, assessing impacts and building resilience across social sectors and ecological systems.
12. Addressing the linkages between human mobility and water scarcity at local, national, regional and international levels in dedicated policies with whole-of government approaches, and facilitating the access to finance for the most vulnerable to water scarcity, including migrants and displaced persons.
13. Intensifying the monitoring of soil and water salinity in order to provide the best customized solutions for the soil and water management in salt-affected areas, selecting the proper salt-tolerant crops and suitable biosaline farming systems that can strengthen food and nutrition security for farmers affected by salinity.
14. Establishing capacity building programs, and particularly inclusive of women and youth, on farm and in the value chain, to strengthen the saline farming proposition in salt-affected areas.
15. Promoting and adopting farmer-led agricultural management as an important pathway to achieve inclusive, equitable and sustainable agriculture water management under climate change.
16. Applying digital agricultural water management and the early inclusion of users, including farmers, in the development of the tools as a condition for success.
17. Understanding the “water, energy, food and environment (WEFE) nexus” and the policy trade-offs needed for improved resource governance and management, and upscaling optimal utilization from these resources under increasing uncertainty.

Relevance of Praia Call for Action to each of WASAG's thematic areas

Refer to the full text of the Praia Call for Action for details on each action	Water and migration	Drought preparedness	Financing mechanisms	Water and nutrition	Sustainable agricultural water use	Saline agriculture	Inclusive farmer-led water management	Unconventional sources of water	Dryland agriculture	Innovation, technology, data and science	Capacity building, involving women and youth	Water, energy, food and environment (WEFE) nexus
1. Mobilizing greater political support, for an enabling environment to address the effects of water scarcity and climate change on global food and water security and positioning agriculture at the core of international climate change discussions.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. Promoting national ownership and leadership of the Members to implement strategies to cope with water scarcity in agriculture, taking into account local perspectives.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Stepping up collaborative actions on water scarcity in agriculture among countries, accelerating strategic actions, including policies and investments and committing the required resources.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. Adopting international and/or cross sectoral collaboration and multidisciplinary approaches, adaptive governance, involving all concerned institutions – including those representing farmers and agriculture – , role-players, women and the youth in any action, including the design, decision-making and financing of projects as well as in capacity building on topics such as droughts, irrigation, saline agriculture, etc.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5. Using innovative financing mechanisms, including blended financing, to enhance inclusive technology access and incentivize farmers and private sector actors in accelerating sustainable water management practices at scale.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6. Developing the knowledge-base on viable and innovative business models promoting farmer-led irrigation, and effective ways to support entrepreneurs – especially youth and young entrepreneurs – in agricultural water management on farms and in the relevant value chains.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7. Sensitizing, sharing knowledge and support “proof of concept” projects, to couple agricultural water management (AWM) with food and nutrition and with water, sanitation and hygiene (WASH) development objectives to accelerate progress on SDG 6 ‘Clean water and sanitation’, SDG 2 ‘Zero hunger’, SDG 3 ‘Good health and wellbeing’, especially in off-grid rural and urban small and medium scale farming systems.			✓	✓	✓		✓	✓		✓	✓	
8. Promoting actions as a “community of practice of water and nutrition”, to elevate attention to water security and food and nutrition security, in global development policy and investments, including the follow-up of UN Water Conference 2023, UNFSS2021 and UN actions in adaptation.			✓	✓						✓	✓	

Refer to the full text of the Praia Call for Action for details on each action	Water and migration	Drought preparedness	Financing mechanisms	Water and nutrition	Sustainable agricultural water use	Saline agriculture	Inclusive farmer-led water management	Unconventional sources of water	Dryland agriculture	Innovation, technology, data and science	Capacity building, involving women and youth	Water, energy, food and environment (WEFE) nexus
9. Including the safe reuse of wastewater and other non-conventional water resources in agriculture as one of the key components contributions to addressing water scarcity in agriculture and addressing water quality for the production of healthy and safe food and the conservation and protection of the environment.			✓		✓			✓		✓	✓	
10. Developing climate-sensitive and water-productive interventions for dryland agriculture, with special attention to the needs of women, youth and the elderly.	✓	✓	✓	✓	✓			✓	✓	✓	✓	
11. Tackling droughts urgently and proactively through early warning, assessing impacts and building resilience across social sectors and ecological systems.		✓	✓					✓	✓	✓	✓	
12. Addressing the linkages between human mobility and water scarcity at local, national, regional and international levels in dedicated policies with whole-of-government approaches and facilitating the access to finance for the most vulnerable to water scarcity, including migrants and displaced persons.	✓		✓							✓	✓	
13. Intensifying the monitoring of soil and water salinity in order to provide the best customized solutions for the soil and water management in salt-affected areas, selecting the proper salt-tolerant crops and suitable biosaline farming systems that can strengthen food and nutrition security for farmers affected by salinity.			✓		✓	✓				✓	✓	
14. Establishing capacity building programs, and particularly inclusive of women and youth, on farm and in the value chain, to strengthen the saline farming proposition in salt-affected areas.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15. Promoting and adopting farmer-led agricultural management as an important pathway to achieve inclusive, equitable and sustainable agriculture water management under climate change.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
16. Applying digital agricultural water management and the early inclusion of users, including farmers, in the development of the tools as a condition for success.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17. Understanding the “water, energy, food and environment (WEFE) nexus” and the policy trade-offs needed for improved resource governance and management, and upscaling optimal utilization from these resources under increasing uncertainty.			✓		✓	✓	✓			✓	✓	✓

After the closing ceremony, the participants took part in a tree planting ceremony on the campus of the university, before heading to visit the technical and agricultural fair in the presence of the Prime Minister of Cabo Verde.





Day 4: 10 February 2023

During the last day of the forum, the participants gathered at the venue for a field trip on Santiago Island.

Three sites were visited: one in Santa Cruz, and the other two in São Francisco.

The first site visited was a water agricultural project in Santa Cruz, demonstrating the efficient use of natural resources in Ribeira Dos Picos. The participants were accompanied by the *Agência Nacional de Água e Saneamento* (ANAS), the National Water and Sanitation Agency of Cabo Verde, who presented the irrigation projects they are conducting in the area. The sustainable irrigation techniques and technologies used have been developed in response to the lack of water resources and droughts. It has allowed farmers to respond to the needs of the island communities by growing fruits such as papayas and bananas.



The visit continued at the *Força de Vontade* project, which was an example of resilient agricultural practices to produce vegetables and fruits. The self-taught family of farmers uses about 46 cubic meters of water per day that they buy and transport by truck to their reservoir, watering the crops by a gravity fed irrigation system.

The field trip ended with the visit of *Afroponic PURAHVIDA* in São Francisco, an initiative by Helder Silva that started during the COVID-19 pandemic. It is an aeroponics farm that uses production towers to grow vegetables and legumes, flowers and aromatic herbs with minimum resources and energy, totalizing 21 days before harvesting.

The visit of these three sites highlighted the reality of water scarcity in agriculture in Cabo Verde and the coping resilient approaches developed by farmers.

POSTER EXHIBITION

The second WASAG Forum was an opportunity for professionals and stakeholders to present their work through a poster exhibition. More than 25 posters were displayed at the venue for the duration of the Forum, presenting various projects and research related to the topics addressed.

CONCLUSIONS

The second WASAG Forum brought high-level speakers from the Government of Cabo Verde and close to 300 participants who attended the forum physically, and around 1200 who attended virtually, representing approximately 80 countries. It was an excellent opportunity for networking, and a great success.

The participants adopted the Praia Call for Action, which declared Praia as the capital of WASAG and called all Member Countries to become partners of WASAG, under the leadership of Cabo Verde, as a start. WASAG Member countries will meet in Rome every second year for a Water Dialogue on WASAG, which will be the Assembly of WASAG. The international WASAG forum will take place every other second year to provide space to partners and stakeholders for sharing solutions and progress towards tackling water scarcity in agriculture.

The results of this second forum of WASAG constituted a great contribution to the UN 2023 Water Conference as well as to the regional workshop of the National Water Roadmaps in Zimbabwe that took place at the end of February.

While emphasizing the continued relevance of the 17 commitments from the first WASAG International Forum of March 2019, the Praia Call for Action will now be the blueprint for WASAG's work. It will help continue addressing and finding solutions to water scarcity, and achieving food security.

Annex 1: Initial summaries of the technical sessions prior to the event

Title of the session	Water and nutrition
Focus area	Coupling small medium farm production and water management in areas with water scarcity, with nutrition and WASH in development
Key words	Agricultural water management, food and nutrition security, family farm, sustainable intensification, climate adaptation
Sharing of knowledge to lever agricultural water management Session description (150 words)	<p>With more than 200 million more people facing acute food insecurity, mostly also facing water insecurity, there is a need for innovations in action. This session hosted by the WASAG Working Group on Water and Nutrition, seek to explore the coupling of agricultural water management with food and nutrition and Wash benefits for small-medium scale farming development. This entails both actions on the ground and the coordination and alignments of policy and investments in development.</p> <p>The session will provide an update in food and nutrition situation and recent policy action by the Africa Union and others and also share the key activities of the WASAG Working Group Water and Nutrition, shared for the UN Food System Summit 2021 and SIWI World Water Week 2022. A case study on the challenges of water quality will be presented from Cabo Verde.</p> <p>We will host a discussion with all session participants deliberating - <i>What do we need to do better on SDG 2 and nutrition to achieve SDG 6? What can WASAG network contribute?</i></p> <p>The discussions will feed into the plenary. The session will be closed by final reflections by FAO.</p>
Convening organization(s)	WASAG Working Group Water and Nutrition

<p>Programme schedule (90 minutes in total)</p>	<p>Session chair: Paulo Dias, FAO</p> <p>Session facilitator: Jennie Barron SLU/ WG Water and nutrition</p> <ul style="list-style-type: none"> • Welcome & who is in the room • Briefing: <i>The latest on food and nutrition commitments for Africa</i> (Mure Agbonlahor, Agricultural Production and Marketing, Africa Union Commission) • Briefing: <i>WASAG Working Group Water & Nutrition key messages and prospects</i> (Jennie Barron, SLU, WG co-lead) • Scientific contribution: <i>Evaluation of the removal of pharmaceutical residues in wastewater. Case study: Santa Cruz and Santa Catarina Wastewater Treatment Plants.</i> (Maria dos Anjos Lopes, Universidade de Cabo Verde) • What do we need to do better on SDG 2 and nutrition to achieve SDG 6? What can WASAG network contribute? <ul style="list-style-type: none"> – Discussion and feedbacks in groups – Discussion report back in plenary • Final perspectives (Lifeng Li, Director of Land and Water Division (NSL), FAO) • Closing
<p>Expected stakeholders (ex. Gender and Youth Balance, Regional representatives, etc.)</p>	<p>We strive to attract a diverse participation (age, gender, ethnicity) and representatives of different sectors (agriculture, water, nutrition and health, WASH). Among presenters, chair and facilitator, we have 40/60 gender balance.</p>
<p>Expected outcomes, impacts and follow-up linkages with events and initiatives after the Forum</p>	<p>Stakeholders commit to continue share and interact in the WG Water and nutrition under WASAG in coming year</p>

Media contact (name, organization, email, phone number)	<ol style="list-style-type: none"> 1. Mure Agbonlahor, African Union Commission (AUC), AgbonlahorU@africa-union.org, +226 74792723 2. Lifeng LI, FAO, Paulo Dias, FAO (paulo.dias@fao.org) 3. Jennie Barron, SLU/WG Water and Nutrition (jennie.barron@slu.se)
2 key messages for the Declaration	<p>Coupling agricultural water management (AWM) with food and nutrition with WASH development objectives, hold the potential to accelerate progress on SDG 2,3 and 6, especially in off-grid rural and urban small and medium scale farming systems.</p> <p>There are proof of concept that Coupling design and investments in AWM with WASH and food and nutrition objectives, are particularly benefitting women and youth with income, health and nutrition outcomes when using best practice in design of development action.</p>

Title of the session	Saline Agriculture
Focus area	Saline agriculture
Key words	Saline farming; salt-affected areas; salinization; soil and water management; salt-tolerant crops; halophytes; projects and initiatives on saline agriculture
Session description (150 words)	<p>The technical session brought together professionals and experts representing 14 organizations from Europe, Middle East, Far East and West-North Africa who showcased their work and research projects on saline agriculture. More than 120 participants attended the session both in-person and virtually which emphasized the importance of the topic and the major interest to find solutions to mitigate and adapt to salinity, considering the increasing soil and groundwater salinization challenges on global basis. This session was very much relevant to Cabo Verde (CV) context, since CV constitutes one of the Small Island Developing States (SIDS) that are severely affected by salinization due to prolonged droughts that affect the groundwater reservoir. With scarce rainfall, groundwater table drops, as it is pumped out for drinking water and to irrigate farmland, forcing seawater to flow further inland, further aggravating salinity issues. Many experts from water, soil and agriculture entities in CV and local farmers attended the session with high interest. They were very much keen on getting updated information on the soil and water management under saline conditions and suitable salt-tolerant crops to grow.</p>

Oral presentations submitted for the technical session, presented in hybrid mode

Moderator of the technical session: Dionysia-Angeliki Lyra, ICBA

Keynote Speaker: Bas Bruning, Salt Doctors, Netherlands. *Title of the presentation:* Saline Water and Food Systems and saline agriculture success stories. (This portion of the session was not presented)

Abstract: The Netherlands has a long history in managing water, given the fact that one third of its surface area is below sea level. Therefore, the threat of floating and seawater intrusion via seepage is constantly present. Throughout the years and decades, this has led to the accumulation of considerable knowledge, skills and tools to improve water management and deal with saline water and soils. Saline Water and Food systems, an initiative of the Netherlands Food Partnership, promotes adaptation to salinity. By bringing together Dutch companies with different fields of expertise, they try to address salinity problems all over the world. We will showcase a number of successful saline agriculture projects of various Dutch consortia, thereby showcasing what the partnership has to offer and provide an interesting 'portal' for those interested and those who seek solutions for their salinity problems.

Speaker 2: Nora Silva, President of INIDA, Cabo Verde. *Title of the presentation:* Sustainable agricultural production system in saline areas of Cabo Verde (SustainAg project).

Abstract: Cabo Verde is a country of ten islands located in the middle of the Atlantic Ocean. Due to its geographical location in the Sahel region, it is influenced by trade winds the climate is arid and semi-arid, with a long dry season (8–10 months between November and July) and a short, scarce and irregular hot and humid rainy season from August to September. The annual precipitation varies according to topography, not exceeding 300 mm in areas below 400 m and 700 mm in areas above 500 m (Monteiro et al., 2020). The arid climate of the country is posing numerous challenges such as prolonged droughts, scarcity of natural resources (water and agricultural land), high evaporation, intense over-exploitation of groundwater resources, saltwater intrusion, delicate balance with salt water in coastal areas, that have contributed to intensify soil salinization. In this context, the restoration of salt-affected lands into productive lands and protection of new areas from the spread of salinity is therefore of paramount importance. In Cabo Verde, the increasing area irrigated with poor quality water (brackish), associated with aridity and inadequate technical knowledge are the main

constraints of the agricultural production system, especially on the island of Santiago, resulting in low productivity and profitability. In high salinity areas where technical solutions to soil rehabilitation are expensive and time consuming and growth of normal field crops is restricted, biosaline agriculture can be an economical and effective approach to use unproductive lands. It can help improve the livelihoods of rural and pastoral communities in areas affected by salt and poor-quality irrigation water for growing different food and fodder crops. Therefore, under a cooperation agreement signed between INIDA and the OCP/ASARI-UM6P-MARROCOS Foundation, this pilot project emerged as a strategy to improve the agricultural production system on Santiago Island, which has the largest area in the country used for agriculture (52.5 percent). The project aims to improve the sustainability (economic, environmental and social) of the agricultural production system in irrigated and rainfed areas and saline areas in the municipalities of São Domingos and Santa Cruz on Santiago Island, developing a value chain of production of alternative crops adapted to salinity stress and drought conditions, such as quinoa and other crops. The major implementation approach of the project will be to build the capacity of INIDA staff and to pilot a sustainable agricultural production system in areas affected by soil salinity, involving farmers and farmer groups/cooperatives to develop and scale up the technology in other locations in the country.

Speaker 3: Antonio P. Pina, Water expert at ANAS / GJR, Cabo Verde.
Title of the presentation: Salinization of soils and water in Santiago Island, Cabo Verde.

Abstract: Salinization is a key process, which can lead to desertification. It is a growing rarity worldwide and affects millions of hectares of soil across Africa. Agriculture plays a major role in the origin of this phenomenon caused by the high consumption and chemical degradation of water, but it is simultaneously the economic sector that is facing the greatest impacts. Current climate change scenarios, which arise from rising temperatures and rising sea levels, can significantly increase the risk of salinization and result in the expansion of affected areas. Several factors can affect the poor cultivation or performance of a crop in a given field, including biotics and abiotics. With regard to biotics, we find in this group the diseases and pests that cause significant damage in a field where a given culture is implanted. In abiotic factors, we can find aspects

related to soil, climate, water quality, among others. With regard to soils, this is a major problem especially in countries with arid and semi-arid climates such as ours, needing, most of them, a correction due to their condition. It is generally linked to water, that is, the amount of water that is lost must be equal to that gained, balancing the amount of water in the soil. In the loss of water, several minerals accumulate in the acid form giving rise to acidic soils and in other cases to salts, giving rise to saline soils and in the combination of the two cases we can find the intermediate soils. Keywords: Coastal aquifers, contamination and salinization risks.

Speaker 4: Abdelaziz Hirich / Ayoub Elmouttaqi, Mohammed VI Polytechnic University (UM6P). *Title of the presentation:* Blue panic grass (*Panicum antidotale* Retz.), a potential salt tolerant fodder crop in desert environment: how do organic amendments and cutting time intervals affect the forage productivity and quality.

Abstract: Salinization becomes one of the major problems affecting agricultural activity in many regions of the world by reducing crop potential and yield. This situation is thus calling for urgent interventions such as the adoption of salt tolerant crops to fill the gap in food and feed availability. Blue panicgrass (*Panicum antidotale* Retz.) is one of the promising salt-tolerant crops that showed an excellent adaptation and performance in the south of Morocco. The reason why several research activities are being conducted to optimize its production and valorization including the present study which aimed to determine the optimal cutting time interval allowing high forage production and its responses to organic amendment and mineral fertilization under high salinity conditions in south of Morocco. The first experiment was conducted over one complete year covering summer and winter season testing the effect of five cutting time intervals (20, 40, 60, 80 and 100-days) on agromorphological traits, crop productivity, nutrient accumulation, and soil salt accumulation. The second experiment tested several organic and mineral amendments which consisted of farm-yard manure (30 t/ha), compost (5 t/ha), NPK fertilizer (100 Kg of N/ha) and their combinations (manure x NPK and compost x NPK) in four experimental platforms. The finding of the first study suggested that cutting blue panicgrass every 40 days maximized the annual fresh forage yield which reached 75 T/ha also revealing a significant effect of the season where productivity declined during the winter and increased during the summer. The nutrient parti-

tioning between shoots and roots especially K/Na ratio indicated the salt tolerance mechanism of blue panicgrass that rely mainly on sodium exclusion in the roots and compartmentalization in the leaves involving different K and Na transport channels. The second experiment revealed that blue panicum better performed at a low salinity level (3.8 dS/m), with a production of 60 t/ha/year, while no significant difference between amendments was recorded. While the application of organic amendment combined manure with NPK fertilizer has slightly improved biomass production by 71 percent under 6 dS/m compared to the control treatment. On the other hand, in highly saline conditions, the productivity of blue panicum was increased by 89 percent and 93 percent respectively for sheep manure and the combined manure with NPK fertilizer. Whereas the annual fresh biomass was up to 55.2 and 79.3 t/ha/year respectively under 8.7 and 12.4 dS/m. This study provides responses to both a technical question for farmers adopting this crop: at which time interval blue panicgrass should be harvested? and a scientific question: how blue panicgrass maintain a adequate high K⁺/Na⁺ ratio to cope with salinity stress? In the light of the results achieved, the adoption of good agronomic practices such as organic amendments could be a key element to improve the productivity of alternative forage crops and enhance fodder availability in dry and salt-affected lands.

Speaker 5: Marco Arcieri, Vice-President of ICID, Italy. *Title of the presentation:* Irrigation management in Saline Agriculture: trends and perspectives.

Abstract: By 2050, there will be almost 10 billion people living on our planet and 20 percent less arable land per person to grow enough food. And as population will grow by another 1.6 billion people over the next 20 years, food production will still need to double, but without further reduction of forests (greenhouse effect), avoiding environmental damages, reducing pollution due to fertilizers and pesticides and, most of all, without any upsurge in the use of good quality water (arctic ice melting). The key drivers to this irreversible drift are:

- increasing fresh water scarcity.
- growing trends of population and urbanization (with rapidly changing diets);
- rising water demand for industrial, energy and domestic sectors;

- climate change impacts on environment and agriculture.

As of today, the distribution of fresh water on our planet is only 2.5 percent of the global amount of the available resources; of these, more than two thirds (69 percent) are provided by snow glaciers and permanent snow cover; less than one third is represented by fresh ground water (30 percent), whilst only 0.3 percent is made up of fresh water lake and river flows. The remaining 0.7 percent is represented by soil moisture, ground ice and/or permafrost, and swamp waters. Especially water scarcity and uncertainties linked to climate change scenarios make it clear that we need to increase agricultural productivity by improving water use efficiency. But water demand often exceeds reliable and exploitable water resources; hence, we need to reach an appropriate balance between the limited supply and the increasing demand for water which, at the moment, is heavily unbalanced. That's exactly where innovative sources of irrigation start to fit in nowadays, changing the economics of global agriculture and allowing farmers to produce more per hectare of land and per cubic meter of water used. And this is why new, alternative forms of irrigation are becoming increasingly crucial to increase yields of crops and ensure agricultural food production. Which are the options available and what are the alternatives that could provide a sustainable solution to avoid water conflicts and to meet the increasingly water demand in agriculture? In the agricultural sector, the use of poor quality or non-conventional water resources as an additional source for irrigation is one of the exploitable solutions. Today, new advanced technologies are available thanks to results provided by research in recent years, and saline and brackish water can be effectively desalinated and used to produce food and fodder with a great reduction in the operating costs, compared to the past.

Speaker 6: Katarzyna Negacz, Vrije Universiteit, Institute for Environmental Studies, Netherlands. *Title of the presentation:* Introducing International Network of Salt-Affected Soils.

Abstract: The International Network of Salt-Affected Soils (INSAS), launched in 2019 during the International Center for Biosaline Agriculture (ICBA) first Global Forum on Innovations for Marginal Environments, is a Technical Network of the Global Soil Partnership (GSP) and follows its Rules of procedure. The Network aims to facilitate the sustainable and productive use of salt-affected soils for current and future generations. INSAS's mission is to support

and facilitate joint efforts towards the sustainable management of SAS for food security, agricultural sustainability and climate change mitigation. The network features four working groups focusing on soil assessment and monitoring, water management, sustainable management practices and salt-tolerant crops. During this presentation, we will briefly introduce the network, present its recent activities and impact. We will also show opportunities to get involved in the working groups.

Speaker 7: Henda Al-Mahmoudi, Plant Physiologist, ICBA, United Arab Emirates. *Title of the presentation: Importance of advanced technologies for the sustainability of agriculture in saline environment.*

Abstract: Youth unemployment, particularly among fresh graduates from higher education institutions, is one of the major problems in Tunisia. Helping youth and smallholder farmers by providing them technical know-how and other support to set up agribusiness startups will support creation of job opportunities. What is more, agriculture, which is the mainstay for rural communities in Tunisia, faces several challenges like climate change-induced recurrent droughts resulting in land degradation, water scarcity and shrinking crop yield, which ultimately leads to low income and food insecurity. Farming significantly impacts the food and feed security and livelihoods of people living in the country's rural areas. Therefore, with the right interventions, the agricultural sector and income can be improved. This can be achieved by developing the human and productive capacities in this vital sector and enhancing its contribution to the country's overall economic and social development. For this reason, we work with local partners to develop sustainable value chains for high-value crops such as quinoa and sorghum. These crops are climate-resilient and thrive in marginal environments -- areas of the world most vulnerable to climate change, water scarcity and salinity.

Speaker 8: Dionysia Angeliki Lyra, Halophyte Agronomist, ICBA, United Arab Emirates. *Title of the presentation: Saline Agriculture in hot desert regions: a roadmap for a sustainable Farm-to-Fork approach.*

Abstract: Due to prolonged droughts and rising heat, an increase in soil and water salinity is being observed in marginal areas, rendering agricultural lands unproductive. The situation gets aggravated in hot

	<p>and dry areas where freshwater resources are extremely limited and not replenished. Saline agriculture constitutes one of the farming solutions for marginal and salt-affected areas. In some cases, halophytic (salt-loving) crops need to be incorporated in such farming schemes. These halophytes have not been cultivated or consumed before by the local farming communities, creating multi-faceted gaps in the value chain from their cultivation and management to the produce reaching the market that obstructs their smooth implementation and satisfying adoption. Thus, targeted interventions should be deployed for ameliorating their cultivating and market proposition in order to guarantee their sustainable production. For such saline agriculture projects growing halophytic crops, it is important to consider embedding activities, targeting both the farming potential of these crops along with go-to-market activities component for full integration. Unfolding each part of the value chain and identifying the segments that need more R&D work to provide effective solutions in due time and ameliorate the status of the halophytic venture is vital. The current presentation is targeting to shed light on these aspects and propose a roadmap for a more successful and sustainable Farm-to-fork halophytic production.</p> <p>Q & A session and Closing Remarks</p>
<p>Convening organization(s)</p>	<p>International Center for Biosaline Agriculture (ICBA); Salt Doctors; Instituto Nacional De Investigaçao E Desenvolvimento Agrario (INIDA); Agência Nacional de Águas e Saneamento (ANAS); Mohammed VI Polytechnic University (UM6P); International Commission on Irrigation and Drainage (ICID); Institute for Environmental Studies, Vrije Universiteit; University of Sussex; Agricultural Research Organization - Volcani Institute; CEBAS-CSIC; Leiden University; Centre of Biotechnology of Borj Cedria; Arid Land Research Center, Tottori University; and Quercus CV.</p>
<p>Expected stakeholders (ex. Gender and Youth Balance, Regional representatives, etc.)</p>	<p>More than 1/3 of the contributors for oral and poster presentations were female; around 1/4 were young professionals; approximately 1/5 of the contributors were professionals and experts from Cabo Verde and more than 60 percent of the audience of the technical session were local stakeholders (researchers, extension officers, farmers).</p>

<p>Expected outcomes, impacts and follow-up linkages with events and initiatives after the Forum</p>	<p>The WASAG Working Group on Saline Agriculture is committed to provide up-to-date information to stakeholders relevant to agriculture on how mitigation and adaptation to salinity can be achieved in salt-affected areas. One of the main activities of the SA WG is to develop training materials related to this topic explained in simplified, laypeople, handy terms that allow farmers to follow and assist them to deal with salinity/sodicity effectively, while keeping the scientific essence to its core. The WG has already developed guidelines for farmers on the “<i>Soil and water management in salt-affected areas</i>” that will be officially published on WASAG’s website within the 1st semester of 2023 and, most probably, launched during the World Water Week late August in 2023. A second manual follows on the “<i>Saline agricultural production systems tailor-made for salinized rural areas</i>” targeted to be published on WASAG’s website by the end of 2023 and also to be presented at an international event. The SA WG aspires that the two manuals will serve as useful guides for the farmers living in salt-affected areas who are facing challenges with the rising salinity at their farmlands. The SA WG targets to attract funds to have the guidelines translated in other languages as well (i.e. Arabic, Hindi, Chinese, Spanish etc.) to achieve higher impact and outreach.</p>
<p>Contributors contact details (name, organization, email)w</p>	<ol style="list-style-type: none"> 1. Dionysia Angeliki Lyra, Halophyte Agronomist, ICBA, United Arab Emirates. <i>Email address:</i> d.lyra@biosaline.org.ae 2. Bas Bruning, Salt Doctors, Netherlands. <i>Email address:</i> bas@thesaltdoctors.com 3. Nora Silva, President of INIDA, Cabo Verde. <i>Email address:</i> Nora.Silva@inida.com.cv 4. Antonio P. Pina, Water expert at ANAS / GJR, Cabo Verde. <i>Email address:</i> Antonio.Pina@anas.gov.cv 5. Abdelaziz Hirich, African Sustainable Agriculture Research Institute (ASARI) & Mohammed VI Polytechnic University (UM6P). Laayoune, Morocco. <i>Email address:</i> abdelaziz.hirich@um6p.ma 6. Marco Arcieri, Vice-President of ICID, Italy. <i>Email address:</i> m.arcieri@icid.org 7. Katarzyna Negacz, Vrije Universiteit, Institute for Environmental Studies, Netherlands. <i>Email address:</i> k.e.negacz@vu.nl 8. Henda Al-Mahmoudi, Plant Physiologist, ICBA, United Arab Emirates. <i>Email address:</i> hmj@biosaline.org.ae

	<p>9. Tim Flowers, University of Sussex, Brighton, UK. <i>Email address:</i> t.j.flowers@sussex.ac.uk</p> <p>10. Alon Ben Gal, Senior Researcher, Agricultural Research Organization - Volcani Institute, Israel. <i>Email address:</i> bengal@volcani.agri.gov.il</p> <p>11. Francisco Pedrero Salcedo, Researcher, CEBAS-CSIC, Spain. <i>Email address:</i> fpedrero@cebas.csic.es</p> <p>12. José A. Hernández, Senior Researcher, CEBAS-CSIC, Spain. <i>Email address:</i> jahernan@cebas.csic.es</p> <p>13. Pim van Tongeren, Institute for Environmental Studies, Vrije Universiteit, Netherlands. <i>Email address:</i> p.van.tongeren@vu.nl</p> <p>14. Wen Wen, Ph.D. Candidate, CML, Leiden University, Netherlands. <i>Email address:</i> w.wen@cml.leidenuniv.nl</p> <p>15. Karim Ben Hamed, Professor, Centre of Biotechnology of Borj Cedria, Tunisia. <i>Email address:</i> karimbenhamed2016@gmail.com</p> <p>16. Kristina Toderich, Specially Appointed Professor, International Platform for Dryland Research and Education, Arid Land Research Center, Tottori University, Japan. <i>Email address:</i> ktoderich@yahoo.com</p> <p>17. Nemias Goncalves, Director of Quercus CV, Cabo Verde. <i>Email address:</i> moniznemias1983@gmail.com</p>
<p>3 key messages for the Declaration</p>	<ul style="list-style-type: none"> • Monitoring soil and water salinity has to be intensified in order to provide the best customized solutions for the soil and water management in salt-affected areas, selecting the proper salt-tolerant crops and suitable saline farming systems that can strengthen food and nutrition security for farmers struggling with salinity. • Multidisciplinary approaches are needed for a successful and sustainable saline farming adoption and implementation involving women and youth. • Capacity building programs are needed to be conducted to strengthen the saline farming proposition in salt-affected areas. Women and youth should be an indispensable component of such trainings on saline farming.

POSTER PRESENTATIONS SUBMITTED FOR THE TECHNICAL SESSION ON SALINE AGRICULTURE

1st Poster: **Tim Flowers**, Professor in Plant Physiology, University of Sussex, Brighton, UK.
Title of the presentation: eHALOPH a database of salt-tolerant plants.

Abstract: eHALOPH is a database of plants able to grow in salty environments. This list, based on an earlier publication by James Aronson called HALOPH' (Arizona Press, 1989), was constructed "for anyone growing or planning to grow halophytes" and included the traits plant type, life form, maximum salinity tolerated, photosynthetic pathway and economic uses. From 2005, the printed database was converted to a searchable database and made available as eHALOPH since 2010 (see Santos et al 2016 Plant Cell Physiol. 57(1): e10(1–10 for details of Version 3). Now, in Version 4, the original dataset has been supplemented with information on optimal salinity, antioxidants, secondary metabolites, compatible solutes and habitat, and if there have been publications on ecotypes, germination, ionomics, the presence or absence of salt glands, molecular data, microbial interactions and mycorrhizal status. Over the last five years the original data has been checked against information in the Web of Science and additional species added from other lists of halophytes. The database eHALOPH can be used in the analysis of traits associated with salt tolerance and for informing choice of species that might be used for saline agriculture, bioremediation or ecological restoration and rehabilitation of degraded wetlands or other areas.

2nd Poster: **Alon Ben Gal**, Senior Researcher, Agricultural Research Organization - Volcani Institute. *Title of the presentation:* ANSWER: An agronomic-economic decision-making app for crops irrigation with water as a function of salinity.

Abstract: Irrigated agriculture in particularly dry regions is challenged by the combination of water scarcity and high crop water demand. This challenge often leads to utilization of non-conventional, often low quality (high salinity) sources of water for irrigation. The need for leaching salts out of the rootzone mobilizes contaminants and pollutants, including but not exclusive to the salts themselves, to deep soils and groundwater. Typically, when there is no natural hydrological flow to the sea, such strategies are, in the long-term, non-sustainable. Desalination offers opportunity to minimize the leaching-contamination cycle, reduce water requirements and increase sustainability of irrigated arid-region agriculture. This comes at price due to facility and energy costs. Inland desalination of brackish water additionally has the challenge of brine disposal. I use the Israeli experience to demonstrate how large-scale desalination of sea water has reversed negative repercussions of dry region irrigated agriculture via both direct use and indirect use, utilizing recycled municipal wastewater, of desalinated water for irrigation. I demonstrate a decision support tool (ANSWERapp: <https://app.agri.gov.il/AnswerApp/>) that considers crop response to environmental conditions including water and salt balance calculations. Coupling prediction of crop response to irrigation amounts and salinity to farm and water

costs and benefits allows evaluation of the feasibility of desalination in irrigation schemes and indicates amounts of water required to minimize negative environmental effects and maximize profits.

3rd Poster: **Francisco Pedrero Salcedo**, Researcher, CEBAS-CSIC, Spain. *Title of the presentation:* Salt-tolerant crops as an integrated approach with intensive agriculture through nutrient and water recycling.

Abstract: Many halophytes are considered to be salt hyperaccumulators, adopting ion extrusion and inclusion mechanisms. Such plants, with high aboveground biomass, may play crucial roles in saline habitats, including soil desalination and phytoremediation of polluted soils and waters. In this study, four plots were dedicated to growing *Salicornia* species in saline and non-saline soil, and with saline and non-saline irrigation water. The highest production yield was recorded for the saline soil and saline water plot followed by the saline soil and non-saline water. These results proved that *Salicornia* is tolerant to salinity, which was also argued by the relative water content. The negative impact of salinity was on the polyphenol content in the plants, where polyphenols content decreased with the increase in salinity.

4th Poster: **José A. Hernández**, Senior Researcher, CEBAS-CSIC, Spain. *Title of the presentation:* Intercropping and crop rotation between tomato and halophytes: physiological and biochemical responses under saline conditions.

Abstract: In this two-phase experiment, we explored the feasibility of intercropping tomato (*Solanum lycopersicum* var. Sargento) with the halophyte *Arthrocaulon macrostachyum*, native of Southeast Spain, trying to mitigate the negative effects of saline soil while providing a value-added crop. Two consecutive greenhouse experiments, from March to July 2021 and from September 2021 to January 2022, were conducted in a saline soil. In the first season, three types of plots (halophyte and tomato in monocultures and mix cultivation) were arranged, whereas in the second season tomato was additionally cultivated where halophyte was previously grown (crop-rotation). Intercropping and crop-rotation affected the activity of antioxidant enzymes. This was reflected on an enhanced accumulation of reactive oxygen species, which may lead to the establishment of a moderate oxidative stress. In parallel, changes on chlorophyll fluorescence parameters were recorded. In this sense, non-photochemical quenching (NPQ) and electron transport rate (ETR) were higher in intercropping and crop-rotation than in monoculture. With respect to the halophyte, both leaves and roots showed higher Na and Cl than in monoculture, while in tomato the opposite occurred. Intercropping did not affect tomato production. However, crop-rotation significantly increased (up to 20 percent) both tomato number and weight. On the other hand, crop-rotation decreased Brix degrees and acidity for tomato in comparison to both tomato in monoculture and in intercropping.

5th Poster: Pim van Tongeren, Institute for Environmental Studies, Vrije Universiteit, Netherlands. *Title of the presentation:* Saline agriculture initiatives in Mediterranean and North Sea Region.

Abstract: Salinization is one of the main challenges of contemporary agriculture threatening food and water security. Climate change with more persistent droughts, floods and sea-level rise is expected to increase this challenge making it one of the most common land degradation processes. At the same time, an increasingly complex institutional landscape has emerged across multiple areas of global environmental governance related to salinization. This can be seen in a myriad of public, private, and hybrid international institutions coming together by creating transnational initiatives to address the issue of growing salinization through saline agriculture. Therefore, the aim of this poster is to characterize the status quo and development of a governance landscape of cooperative initiatives for saline agriculture in Mediterranean and North Sea regions. The results show a few overarching trends in the sample of 99 initiatives selected for the analysis. We suggest that initiatives can play an important role in the governance landscape of saline agriculture and can contribute to the upscaling of saline agriculture by advancing scientific research and participating in the policy debate.

6th Poster: Katarzyna Negacz, Vrije Universiteit, Institute for Environmental Studies, Netherlands. *Title of the presentation:* Saline agriculture initiatives addressing biodiversity conservation and sustainable use of saline ecosystems.

Abstract: Salinization is one of the main challenges of contemporary agriculture, which threatens crop yields along with biodiversity. Various public, private, and hybrid actors come together by creating initiatives to address the issue of growing salinization through saline agriculture. Yet, little research has been done on their performance. Therefore, the main aim of this study is to analyse to what extent saline agriculture initiatives contribute to biodiversity conservation and sustainable use of saline ecosystems. We design a framework to evaluate their performance and test it empirically on a dataset of 100 saline agriculture initiatives in Europe and North Africa collected via semi-automated content analysis. The preliminary results reveal that the governance landscape for saline agriculture is dominated by initiatives involving public actors conducting operational and on-the-ground activities. The initiatives focus on conventional agricultural biodiversity with some exploring halophytes, plants typical for salty environments. The activities of the initiatives address most often SDG2 “Zero hunger”, while SDG15 “Life on land” comes on the fifth place. We discuss these findings in relation to ongoing debates on challenges and solutions in the post-2020 Global Biodiversity Framework.

7th Poster: Wen Wen, Ph.D. Candidate, CML, Leiden University, Netherlands. *Title of the presentation:* Monitoring the combined effects of drought and salinity stress on crops using remote sensing.

Abstract: Global sustainable agricultural systems are under threat, due to increasing and co-occurring drought and salinity stresses. Combined effects of these stresses on agricultural crops have traditionally been evaluated in small-scale experimental studies. Consequently, large-scale studies need to be performed to increase our understanding and assessment of the combined impacts in agricultural practice in real-life scenarios. In this study, a novel monitoring approach for evaluating the joint impacts of drought and salinity on crop traits in real-life settings is proposed using Sentinel-2. Individual and combined effects of the stresses on the seasonal dynamics in crop traits were determined using both one-way and two-way ANOVAs. We found that crop responses to drought and salinity differ between growth stages. Compared to salinity, crop growth is most strongly affected by drought stress and is, in general, further exacerbated when co-occurring with salinity stress. Consequently, our study constitutes a way towards evaluating drought and salinity impacts in agriculture with the possibility of potential large-scale application for sustainable food security.

8th Poster: Karim Ben Hamed, Professor, Centre of Biotechnology of Borj Cedria, Tunisia.
Title of the presentation: HaloFarms: an active initiative to develop saline agriculture in the Mediterranean area.

Abstract: Recent research shows that saline agriculture is one of the most practical approaches to remediate salt affected soils. There is an increase in the number of cooperative initiatives focusing on saline agriculture in the Mediterranean. HaloFarms, a PRIMA project, is one of the active initiative, supported by the European PRIMA program. The main objective of this project is to develop new farming systems based on the cultivation of halophytes, for soil desalination. The preliminary results of the project showed that planting halophytes as intercropping or rotating crop plants with tomato play an important role for enhancing salt affected soil productivity. This mixing system adds economic value to tomato yield. Also, the optimized In vitro protocols for halophytes result in the rapid and successful production of many halophytes for use with commercial crops.

9th Poster: Kristina Toderich, Specially Appointed Professor, International Platform for Dryland Research and Education, Arid Land Research Center, Tottori University, Japan.
Title of the presentation: Circular Halophytic Mixed Farming (CHMF) to Improve productivity in salt-prone agroecosystems.

Abstract: The overall premise of this study is that halophytic plants (broadly defined to highly include salt-loving wild species and salt-tolerant crops) can be cultivated to maintain agricultural productivity with food and fodder production potential of saline lands. The technologies and business models for the sustainable saline agriculture on the marginal saline lands are developed based on the concept of *Circular Halophytes Mixed Farming (CHMF)*. CHMF focuses on the development and application of a soil-water-plant salinity dynamics model to the stimulation of the cultivation and management options over multiple growing seasons. The scheme is supposed to evaluate the potential for

halophytic plants to improve the long-term food security. A dynamic economic analysis of the scheme and its implications would become an important socio-economic factor and governmental policies in the regions where cultural, and political constraints are also discussed. Field demonstrations for the alternative land use options with CHMF concept is being performed in the Shortanbay, the lower stream of Amudarya River Basin. Since halophytes are the plants capable to live in saline environments, the natural/intentional existence of this plant species can reduce the salts present in the root zone. The plants are capable to cope with the problems of salinity in various ways; some of them avoid salinity by completing their growth cycle when salinity is low (rainy periods), some can resist against salinity, and a few are tolerative against salinity. The later species can accumulate salts in their cells and/or secrete the substances through their inherent organs/salt glands/trichomes and are thus useful for reversing salinization. The idea of CHMF implies that the intentional continuous cultivation and later recovery (and/or management) of the above ground plant tissues with high salinity could reverse the salinization levels and eventually reclaim the lands with minimum salinity towards a new/remediated agricultural use. The physiological/ecological information how halophytes adapt to the saline soils is also of great interest for breeding new cultivars which can tolerate higher levels of salinity. CCHF is expected to facilitate farms in the regions to replicate the practices which, in a long run. This also may yield increased supply of quality agricultural products for domestic market. A new strategy about scheduling irrigation and integrate surface/groundwater resources may be created based on the water and salt dynamics models. These approach and concept for the sustainable resource utilization are guided by the principle of efficiency: making an effective use of marginal land while the resources saved can be more profitably concentrated on the productive croplands.

10th Poster: **Nemias Goncalves**, Director of Quercus CV, Cabo Verde. *Title of the presentation:* Hidroquímica E Qualidade Da Água, Estudo De Variações Sazonais – O Caso Do Furo Fst – 924, Concelho De São Domingos.

Abstract: 'O Concelho de São Domingos situa-se na parte sudeste da ilha de Santiago, entre os paralelos 14° 57' e 15° 05' de latitude norte e 23° 26' e 23° 38' de longitude oeste de Greenwich. A maior problemática que tem assolado o concelho nos últimos anos tem sido a deficiente distribuição da água à população, que levou as autoridades municipais, nos anos 2014 e 2015, a explorarem o furo com a denominação oficial FST 924. Esse furo possui uma profundidade de 50 metros extraíndo água dos aluviões e basaltos, que atualmente é usada para consumo humano e rega. Foi feita uma monitorização semanal durante 3 meses para avaliar a qualidade da água para os dois fins (irrigação e consumo humano), desse ponto de amostragem. O presente trabalho apresenta o resultado desta monitorização e uma análise temporal, considerando os parâmetros definidores do comportamento hidroquímico e da qualidade ambiental. Os resultados obtidos evidenciam o carácter alcalino da água, com valores de pH entre 7.14 e 7.55 e alcalinidade que varia entre 339.5 e 457.5 mg/L CaCO₃. A condutividade elétrica oscila entre 1116 e 1660 mS/cm. De uma maneira geral as concentrações dos vários parâmetros são relativamente constantes ao longo do tempo. O

cloreto e o sódio constituem as exceções com alguma variação. O tratamento estatístico, nomeadamente através de classificação hierárquica e análise fatorial, põe em destaque as correlações entre os vários parâmetros, evidenciando vetores que explicam os processos controladores da qualidade da água, nomeadamente o efeito de salinização.

11th Poster: Dionysia – Angeliki Lyra, Halophyte Agronomist, ICBA, United Arab Emirates.

Title of the presentation: Nutritional benefits and potential healthy claims of *Salicornia bigelovii* fresh shoots and seeds grown in a hot and arid environment.

Abstract: The cultivation of freshwater-based crops is limited in salt-affected areas, however, halophytic crops could demonstrate great farming and food potential in these challenging spots with socioeconomic benefits for the local communities. In addition, halophytes consumption has been considerably increased in the past few years due to their unique organoleptic features and boosted nutritional profile. Studies comparing the nutritional value of a halophytic crop at different growth stages hardly exist. Knowledge on the detailed comparison of the nutrients load between halophytes and freshwater-based crops is also scarce. Our study tackles these points focusing on *Salicornia bigelovii*, the commercial species of *Salicornia* genus, exploring innovative food uses of the halophyte.

Title of the session	International Drought Resilience Alliance: The Way forward
Focus area	Drought preparedness
Key words	Drought, desertification, resilience
Session description (150 words)	<p>Drought is a threat to the survival of humanity. Drought puts livelihoods and ecosystems at risk. In extreme cases, droughts can trigger more famine, displacement, and conflict. Due to human activity and the links to land degradation and climate change, droughts are increasing in frequency up 29 percent since 2000, with 55 million people affected every year. By 2050, droughts may affect an estimated three in four of the world's population. Mortality related to droughts represents around 60 percent of the total deaths caused by extreme weather events, while droughts represent only 15 percent of natural disasters. In the period from 1998 to 2017, droughts have led to global economic losses of \$124 billion.</p> <p>Drought is a global and urgent issue. The recent droughts in Europe, being the worst in the last 500 years, and the voracious wildfires in Australia, Greece, Portugal, Spain or United States decimated nature reserves or left cities and rural communities in ruin. Droughts will hammer many countries simultaneously – on a regional level – and over several years. The Horn of Africa is in the grips of a sixth-year recurrent drought. By 2030, drought may displace 700 million people in Africa.</p> <p>Initiatives that started 10 years ago under the High-Level Meeting on National Drought Policy are commendable. More than 70 countries have set up national drought policies that clarify what actions need to be taken, and by whom. However, more needs to be done. As droughts are regional, not national, the work of the Intergovernmental Working Group on Drought set up by the United Nations earlier this year will agree on how to make this national process even more effective in all regions.</p>

	<p>The International Drought Resilience Alliance - Rationale</p> <p>At the UNFCCC COP27 in Sharm El Sheikh, the governments of Spain and Senegal led the launch of an International Drought Resilience Alliance (IDRA). The IDRA is a collaborative platform which aims to catalyse political momentum and action that supports countries, cities, and communities. It aims to go beyond disaster response to reduce country and community vulnerability to the impacts of drought by mainstreaming preparedness and adaptation measures. The Alliance will significantly contribute to the achievement of Sustainable Development Goals which call for multilateral action to address interconnected challenges.</p> <p>The IDRA seeks:</p> <ul style="list-style-type: none"> • To promote a paradigm shift in the way drought is managed – pivoting from a reactive and crisis-based approach towards a proactive and risk-based one. • To rally leaders to energize this work by promoting knowledge sharing and collaboration to reap maximum benefit from all work on drought resilience. • To drive the consolidation of regional actions and initiatives on innovation, technology and traditional knowledge transfer and resource mobilization by stimulating the full engagement of stakeholders, including the private sector. <p>More information about the International Drought Resilience Alliance, Leaders’ Declaration, and full list of supporting countries and organizations can be found in the following links: IDRA Alliance web.</p> <p>This interactive dialogue/round table aims at discussing the way forward for IDRA by collecting input from various actors and countries at all levels. It also aims to facilitate experience-sharing at the global, regional, and national levels, spanning sectors and scales with a focus on the appropriate policy, advocacy, financing, and implementation measures that are inclusive and sustainable.</p>
<p>Convening organization(s)</p>	<p>Organized by the Governments of Spain and Senegal with the support of UNCCD, WMO, FAO, GWP, IWMI and University of Nebraska</p>

<p>Programme schedule (90 minutes in total)</p>	<p>Opening speech: Ania Grobicki, Senior water advisor, FAO</p> <p>Keynote: Miriam Medel- The International Drought Resilience Alliance (IDRA)</p> <p>Panel 1: UN entities</p> <p>What is the added value of a global approach to drought resilience? Who should be the main players? How can we enhance ensure IDRA is fit for purpose? What are the missing elements? How can we fill the gap?</p> <p>Panellists:</p> <ul style="list-style-type: none"> • Robert Stefanski (WMO) • Stefania Giusti (FAO) • Valentin Aich (GWP) • Mark Svoboda (NDMC, University of Nebraska) • Daniel Tsegai (UNCCD) <p>Panel 2 (30 min): Country cases</p> <ul style="list-style-type: none"> • Marco Arcieri (ICID - International Commission on Irrigation and Drainage), Drought Prediction in Italy. • Amar Dhere, College of Home Science, SNDT Women’s University, India, Watershed Management for mitigation of droughts in India. • Mbae Mohamed, Head of head of agrometeorology department, Comoros, Agriculture in the face of drought. • Vera Garcia, Trend of precipitation values as an indicator of groundwater availability in Cabo Verde.
<p>Media contact (name, organization, email)</p>	<p>Daniel Tsegai, UNCCD, dtsegai@unccd.int</p>
<p>2 key messages for the Declaration</p>	<p>Tackling droughts urgently and proactively through early warning, assessing impacts and building resilience across social sectors and ecological systems.</p>

Title of the session	Water and Migration
Focus area	Water and migration
Key words	water, migration, youth, gender, economy, rural, urban
Session description (150 words)	<p>Local, regional and global migration has shaped the history of all civilizations. The migration patterns driven by several factors have led to crucial expected and unexpected societal, cultural, environmental and economic changes. Among all the drivers, <i>water scarcity</i> is one of the key causes of ‘internal and cross border migration’ in various geographies and socioeconomic landscapes, especially within Africa.</p> <p>The voluntary and forced movement of people brings changes in cultures, practices, technologies, societal organization and transformation, living environments and standards. These often negatively influence food security of the region, mostly in circumstances where rural-urban migration is rampant. While most studies examine these impacts from a viewpoint of pressures (negative impact of migration) on host countries/hosting sites, it is also important to examine how these migration trends are presenting opportunities both for migrants and host communities.</p> <p>In line with the second WASAG Forum theme, the Water and Migration Working Group, leads a technical session that looks at the global discourse on water scarcity-migration nexus, then presents learnings from 2 case studies in Africa to position migration as a positive phenomenon for enhancing agricultural productivity. The core part of the session will discuss and curate key recommendations for the upcoming UN World Water Forum and COP28.</p> <p>The perspective of the Working group for the technical session discussion centres on two main premises:</p> <ol style="list-style-type: none"> 1. Managed migration flows can create opportunities for host and sending communities, as well as the migrants, if opportunities are effectively utilized; 2. managed migration opportunities can facilitate better access to resources, technologies, knowledge, networks, revenue, rural transformations, and cross-learning.

Convening organization(s)	<p>Pr. Nidhi Nagabhatla, UNU-CRIS</p> <p>Dr. Charity Osei-Amponsah, International Water Management Institute (IWMI),</p> <p>Stephane Lako Mbouendeu, Water Youth Network</p> <p>Hind Aissoui Benani, UN International Organization for Migration</p>
Programme schedule (90 minutes in total)	<p>Moderator: Charity Osei-Amponsah, IWMI Ghana</p> <p>Opening: Charity Osei-Amponsah, IWMI-Ghana and Nidhi Nagabhatla (UNU-CRIS, Belgium)</p> <p>Presentation of the CILSS experience on migration in sahel: Mr M. Abdoulaye Mohamadou (CILSS, Senegal)</p> <p>Brief presentation of the WG poster on migration as an opportunity for food and economic security: M. Lako Stephane (Water youth network - WYN, Cameroon, online)</p> <p>Thematic talk: relationship between water resource availability, climate change, and environmental migration in East Africa:</p> <p>Ms. Sinafekesh Girma Wolde (Politecnico di Milano, Italy, online)</p> <p>Discussion on key recommendations for UN 2023 water conference led: Ms Hind Aissaoui Bennani (International Organization for Migration, IOM, Tunisia)</p> <p>Open discussion, Q&A</p> <p>Conclusions: Charity Osei-Amponsah (IWMI) + Nidhi Nagabhatla (UNU-CRIS)</p>

Summary of the session

Pr. Nidhi Nagabhatla, lecturer at UNU-CRIS, Belgium introduced the participants to the concept of migration and the links with water resources and water uses. She stressed on the importance of considering this growing phenomenon with climate pressures on water resources and water dependant habitats and activities.

Ms Charity Osei-Amponsah from IWM Ghana, setting the stage presented the “Water and Migration working group” of WASAG with an emphasis on the mission and objectives of the WG, presentation of members and the WG activities. The focus of this working group is on advocacy for political prioritization, cooperation on work programmes, sharing and dissemination of knowledge and experience, development of new or improved solutions, promotion of sustainable and integrated water resources management, capacity building of partners and countries and other stakeholders and contribution to consistent monitoring systems.

Speaker 1: Mr Abdoulaye Mohamadou, Secretaire Executive of CILSS shared the experiences on migration in CILSS countries in West Africa. He indicated that migration is an adaptation for climate security. Migration is linked to environmental and non-environmental factors. Second group affect more than 90 percent of circular and long-term migration in subsaharan african countries. Finally for any program capacity building, finance and technology are key for local adaptation to climate stress and specifically water stress environment. A project in 6 sahelian countries developed 15 technologies which seem to be suitable to answer the water crisis in rural areas.

Speaker 2: Mr Stephane Lako from Water Youth network presented a poster prepared by the working group on “water stress driven migration as an opportunity for food and economic security” outmigration as well as in migration represent both challenges and opportunities for migrants as well as host communities. The big difference lies in the balance of both, and the way migration is managed. Indeed, migration is a source of pressure on existing physical and financial resources but it is also a drivers of tangible and non-tangible

resources including knowledge, technology, labor which can be boosters of local development. Analyzing and engaging to migration management approaches could lead to new natural resource governance thinking, smart practices for efficient use of resources, knowledge transfer, new settlements, more income generation activities, harmonious social structures with benefit to all groups.

Speaker 3: Ms Hind Aissaoui Bennani (IOM) delivered the presentation *From the World Water Forum to COP28 – Key recommendations to the UN 2023 Water Conference*, highlighting that migration contributes to the resilience of the local communities. There are many different reasons that make people migrate to another region or country. These multiple factors need to be integrated into the discussion on issues of water and agriculture as well as climate and environment. The big majority of human mobility is internal. Cross-sectoral and integrated approaches are important. Smallholder farmers, transhumance, labor migration for agriculture should be focused. For the African region, agriculture is the backbone of the economy and the agricultural workers including migrants are a crucial part of agricultural activities. Associating labor rights in the agricultural sector are needed.

Speaker 4: Ms Sinafekesh Girma Wolde (Politecnico di Milano) introduced the link between environmental migration and climate change with a stress on the fact that women and girls are disproportionately affected by climate change and migration effects.

This situation is specifically true in Ethiopia where people in the same area can face both flood and drought sequentially, all leading to in-migration for subsistence. She identified 87 case studies documented which 32 were from sub-Saharan Africa. These focus on the magnitude of human displacement, direct, indirect, and underlying environmental drivers, timing, and geographic patterns.

These studies highlight three migration patterns: in migration, circular migration and long-term migration with environmental, economic, social and political drivers. As a result, it is very important to better study cross border and inner-continental migration to develop appropriate context specific solutions.

	<p>Later, the Thematic talk “Collaboration on Water and Migration for comprehensive and tailored recommendations” involved Ms Sinafekesh Girma Wolde, Mr Paolo D'Odorico, and Ms Maria Cristina Rulli. The discussion showed that migration is also an interesting opportunity for local and transboundary economy and investments.</p> <p>Ms Charity Osei-Amponsah, concluded that water scarcity and migration are real. Transformative solutions are needed. Water scarcity, climate change, agriculture and the vessels between these three things must be key in the global discourse</p>
Expected stake-holders (ex. Gender and Youth Balance, Regional representatives, etc.)	More than a third of the event presenters (panelists and speakers) will be female, two or more will be young professionals, and at least 1/3 will be from the region.
Expected outcomes, impacts and follow-up linkages with events and initiatives after the Forum	Stakeholders commit to support and promote positive water driven migration through adequate policy, programmes and advocacy at local, national, regional and global levels, with tangible target outcomes for the next forum.
Media contact (name, organization, email)	<ol style="list-style-type: none"> 1. Charity Osei-Amponsah, IWMI, c.osei-amponsah@cgiar.org 2. Nidhi Nagabhatla, UNU-CRIS, nnagabhatla@cris.unu.edu 3. Stephane Lako Mbouendeu, WYN lakostef@yahoo.com
3 key messages for the Declaration	<ol style="list-style-type: none"> 1. Policy dialogue, collaboration and partnership and integrated approaches are required at all levels to make human mobility and water scarcity solutions useful to migrants, host and departure communities with strong emphasis on gender, youth and vulnerable people. 2. Water stress driven migration should be well managed to create opportunities and develop shared benefit over governance, social structures, practices, economies, knowledge and spark innovative systems facilitating better access to resources, technology, knowledge, revenue and local economy, as well as cross-learning. 3. Water migration affected communities need support to adapt to context specific interventions that promote new natural resource governance thinking and efficient use of resources; knowledge transfer, new settlements, more income generating activities, and harmonious social structures that will benefit all social groups.

Session materials

Link to Ms sinafekesh presentation: https://drive.google.com/file/d/1e1-0G073azAGf9CCw7LtscOAJaG8rZze/view?usp=share_link

Link to poster presentation (video): https://drive.google.com/file/d/15up-OZfSJVFvK4d66R4doz6WeWHZoCWp/view?usp=share_link

Link to Poster on Water and Migration: https://docs.google.com/presentation/d/1Pj8eMdP_Pchrb_PrA4aI7-UCeoFJ8e_9/edit#slide=id.p1

Link to the presentation of Water and Migration working group: https://docs.google.com/presentation/d/1a1_P-S9p-G12ABk6w-Gib8zQMLKb6p5Og/edit#slide=id.g1dc2c4a7409_0_48

Title of the session	Inclusive Farmer-led Water Management for enhancing climate change resilience
Focus area	Farmer-led irrigation development, small-scale rainfed and irrigated agriculture
Key words	Farmer-led, irrigation, rainfed, resilience, climate change, women's involvement
Session description (150 words)	<p>Farmer-led agricultural water management, across the spectrum from improved small-scale rainfed to irrigation, could underpin millions of livelihoods, increase food and water security, enhance climate change resilience, and enhance rural economic development. Farmers and entrepreneurs along the value chain can build resilience from suitable investments addressing growing weather-related water risks to food systems.</p> <p>Where enabling conditions allow, including access to land and water resources, the relevant knowledge and skills, and viable business ecosystem, smallholder farmers in the Global South are expanding land under irrigation and other agricultural water management practices, taking advantage of cheaper and more accessible technologies, including solar-powered pumps for irrigation, and practices to manage water in the field enhancing soil moisture. However, the sustainable and inclusive scaling of improved agricultural water management has not kept pace with production and food security demands.</p> <p>Technology is not always affordable, accessible and appropriate, especially for women farmers, who are often not considered credit-worthy despite their high participation in agricultural production. Also, the present emphasis on farmers' access to credit as key to unleashing their investment in small-scale irrigation technologies overlooks the need for access to financing at other points along the scaling pathway. This session offers new insights into some of the outstanding challenges related to increasing farmers' access to irrigation technologies and knowledge of AWM approaches.</p>
Convening organization(s)	Daugherty Water for Food Global Institute (DWFI), Women for Water Partnership (WfWP), International Water Management Institute (IWMI), African Union Commission (AUC), Stockholm International Water Institute (SIWI)

**Programme
schedule (90
minutes in total)**

Moderator: Peter G. McCornick, DWF I

- Speaker 1: Amare Hailelassie. International Water Management Institute (IWMI). Overview, progress and challenges in farmer-led irrigation at scale.
- Speaker 2: Grace Mukarusagara, Natacha Akaliza and Raïssa Urujeni. Daugherty Water for Food Global Institute (DWF I) Rwanda team member. Irrigation-as-a-Service as a Tool for Supporting Smallholder Farmers
- Speaker 3: Mariet Verhoef-Cohen. Women for Water Partnership (WfWP). Case study from Kenya – and report: With Women Better Results in Water Management

Panel Discussion:

Panel: AUC, SIWI, SLU, IWMI, DWF I

Closing remarks

Speaker 1: Amare Hailelassie, IWMI. Overview, progress and challenges in farmer-led irrigation at scale. Farmer-led irrigation development and agricultural water management practices to sustain rainfed farming systems to enhance food security in a changing climate has been gaining attention by governments, private sector and development organizations. This presentation takes stock of the latest advances in knowledge on the opportunities and bottlenecks in bringing water solutions to scale inclusively and sustainably from farm to watershed scale. It discusses the latest insights in using adaptive scaling approaches with private sector and financing modalities to increase access to small scale irrigation technologies for farmers and provides a framework on how systemic changes can be triggered with private sector on ensuring sustainable water management at scale.

Speaker 2: Grace Mukarusagara, Natacha Akaliza and Raïssa Urujeni, DWFI. Irrigation-as-a-service as a tool for supporting smallholder farmers. Access to irrigation for smallholder farmers is critical to increase food security, income, and climate resilience in rural communities in Sub-Saharan Africa. This report presents findings from dozens of field interviews on how smallholder farmers access irrigation services even when they do not own the irrigation equipment. There are various business models providing irrigation services within informal markets in Rwanda, including farmer-to-farmer lending, entrepreneur-to-farmer rentals, and water tanker trucks. Loaning and renting pumps leverage investments in irrigation equipment to increase access to irrigation and irrigated area. For example, based on observed behavior, we estimate that lending and renting of small pumps has increased actual irrigated area between 8–45 percent in Bugesera district and 3–30 percent in Nyagatare district. To support scaling-up informal markets, we recommend that the Government of Rwanda considers encouraging farmers to lend their equipment and supporting irrigation-as-a-service entrepreneurs with startup grants.

Speaker 3: Mariet Verhoef-Cohen, WfWP. Women, water, leadership project. WfWP will present their five guidelines that have been formulated to incorporate more women in decision-making processes in the water sector: Capacity Development, Appropriate Funding, Ownership Resources, sex-disaggregated data, Accessible & Affordable Technology and Tools.

This can vary from analysing a situation, drafting a plan with clear targets, and a budget, seeking commitment from the top and involving managers, creating appropriate conditions for women to join and stay on board, to monitoring the developments based on a system with sex-disaggregated data. To keep abreast with the developments, develop a monitoring system which provides both quantitative data and qualitative data sex-disaggregated, analyse the data regularly to enable learning and to introduce necessary adaptations to plan and budget. Develop indicators to monitor changes in the performance of the organization which can be attributed to having more women on board. Currently this type of data is often lacking, for example gender responsive budgeting helps to gain more insights between inputs and results.

We will inform you on our project **Women, Water, Leadership**, educating, empowering and enabling 500 women farmers in Kenya to ensure their communities and families have access to clean water and learn how to produce sustainable nutritious food. The small holder farmers now have the capacity, experience and education needed to manage water resources, produce sustainable food and gain careers in water-related professions. Involving women farmers from the start, from the designing table to the decision-making guaranteed the success.

Panel 1: Mure Agbonlahor, African Union Commission (AUC)

The African Union acknowledges the rapid expansion of Irrigated area in the continent, in the last 2 decades, due to FLID initiative. It relates this as a positive development; an indication of the small holders' commitments to 1) take advantage of the huge opportunity presented by the agrifood markets and 2) take charge of their development agenda as it relates to increase income, food security and resilience livelihoods. This presents a huge opportunity for accelerating African agricultural transformation and the attainment of the AU development goals as enunciated in the Agenda 2063 – the Africa we want. The AU as a continental body of the 55 Member States (MS) advocates for policy, markets and institutional reforms and supports to encourage farmers' sustainable and equitable access to irrigation technologies, equipment and services in MS. The AU framework for Irrigation development (IDAWM) elaborates requisite policy and institutional considerations needed for the sustainable intensification of the FLID process. In the last 4years, AU have mobilized partners to provide 1) capacity building supports, through short/intensive field-level training of young professionals from MS ministries of Agriculture and irrigation supporting smallholders' irrigation projects and 2) support peer learning of best practices in small irrigation schemes design, operations and management and 3) support to regional economic communities (RECs) to develop AWM strategy. The AU continues to explore partnership opportunities to provide support to MS to sustainably scale FLID for African food systems development.

Expected outcomes, impacts and follow-up linkages with events and initiatives after the Forum	Stakeholders commit to form a relevant WASAG working group on farmer-led water management, with tangible target outcomes, event participation and initiatives for the next year.
Media contact (name, organization, email, phone number)	<ol style="list-style-type: none"> 1. Mure Agbonlahor, African Union Commission (AUC), AgbonlahorU@africa-union.org, +226 74792723 2. Mariet Verhoef-Cohen – WfWP – president@womenforwater.org, +31653753018 3. Peter G. McCornick, DWFI, PMcCornick@Nebraska.edu
2 key messages for the Declaration	<p>Farmer-led agriculture management has to be promoted and adopted as an important pathway to achieve inclusive, equitable and sustainable AWM under climate change.</p> <p>Blended financing mechanisms are strongly recommended to enhance inclusive technology access and incentivize farmers and private sector actors in accelerating sustainable water management practices at scale.</p> <p>Women have to be involved in any action/project including the design, decision-making and financing</p>

Title of the session	Dryland Agriculture
Focus area	Session will showcase state-of-the-art innovations in field of dryland agriculture water management that hold potential in making agriculture resilient to climatic variability and changes
Key words	Rainfed, irrigation, water productivity, evapotranspiration, WEF nexus
Session description (150 words)	<p>Dryland agriculture includes marginal rainfed production systems and rangelands. With a changing and variable climate, drylands need urgent and serious sustained attention. Approaches that can be implemented in drylands are, but not limited to, supplemental irrigation, rainwater harvesting, diversified (inter)cropping systems, maximizing economic water productivity, solar irrigation using desalinated water, agroforestry, and integrated crop-livestock-forage systems.</p> <p>The session will bring together examples of promising solutions in fields of accurate estimation of crop water requirements using</p>

	<p>modern techniques, the water-energy-food nexus, ultra-low energy drip irrigation, digital applications for informed decision-making, and those leading to improvements in physical and economic water productivity.</p>
<p>Convening organization(s) and contact information</p>	<p>International Center for Agricultural Research in the Dry Areas (ICARDA). Vinay Nangia. V.Nangia@cgiar.org, + 212 668853777</p>
<p>Programme schedule (90 minutes in total)</p>	<p>Moderator: Vinay Nangia, ICARDA</p> <p>Opening remarks: Felix Reinders</p> <p>Speaker 1: Vinay Nangia, ICARDA. Water for Food, Water for Life: The Drylands Challenge.</p> <p>Speaker 2: Ragab Ragab, ICID. Accurate Estimation of crop water requirements using new technologies (COSMOS, Scintillometers, and Eddy Covariance)</p> <p>Speaker 3: Marco Arcieri, ICID. Estimation of CWR using the the FAO CropWat approach: the case of Southern Italy Hydrographic District Authority</p> <p>Speaker 4: Thameur Chaibi, National Research Institute for Rural Engineering, Water, and Forestry (INRGREF). Technological solutions from the Water-Energy-Ecosystems nexus perspectives to improve the well-being of communities in African drylands</p> <p>Speaker 5: Susan Amrose, MIT. Feasibility of low-cost renewable-powered integrated electrodialysis desalination and low-energy drip irrigation systems designed for arid areas with brackish ground-water.</p> <p>Speaker 6: Mitsuru Tsubo, Tottori University. Farmers' decision-making with an app for climate risk management in drylands</p> <p>Speaker 7: Mohamed Ghrab, Institution of Agronomic Research and Higher Education - Olive Institute, Tunisia. Ways of improving water productivity of pistachio trees orchards in arid area</p> <p>Speaker 8: Karambiri Bienvenue L. Chantal N., Institut des Sciences des Sociétés (INSS/CNRST). Conséquences des inondations d'octobre et novembre 2022 dans la vallée du Sourou au Burkina Faso</p> <p>Closing remarks</p>

Speaker 1: Vinay Nangia, ICARDA. Water for food, water for life: The drylands challenge. Water scarcity is increasing, especially in dry environments with climate change and degradation of natural resources. About 41 percent of the Earth's land area is classified as dryland; wherein the farming system is characterized by low annual rainfall with much of it falling in the winter and spring. Agriculture is required to produce more food and welfare for rapidly increasing populations but with less freshwater resources. Conventional responses to this situation focus on increasing yields, improving irrigation efficiency and managing demand. Here, I argue that those strategies are either not working under current conditions or not anymore sufficient to cope with the daunting demand for more food in water scarce dryland regions. A paradigm shift in how we manage water is needed going into the future. The debate on how better to handle agricultural water allocation and use with increasing scarcity is being intensified over the last decade and is producing new transformative solutions. Climate-smart agricultural practices that require less water, can sustain climatic stresses, produce food with high nutritive value but require less water and energy to produce are the need of the hour. ICARDA success stories from CWANA region in these regards will be presented.

Speaker 2: Ragab Ragab, ICID. Accurate Estimation of crop water requirements using new technologies (COSMOS, Scintillometers, and Eddy Covariance). In order to accurately determine the irrigation water requirement, one should consider the actual crop demand expressed as actual evapotranspiration (ET). New technologies have recently emerged to measure the actual ET such as Eddy Covariance (EC) and Scintillometer.

The actual crop water requirement, based on the new technology, could save at least 50 percent of irrigation water estimated by the commonly used methods for potential evapotranspiration such as the Penman-Monteith equation. Another benefit is that these modern technologies for measuring the actual evapotranspiration do not need the crop coefficient K_c ; obtaining K_c is a major problem for many irrigation practitioners.

The Cosmic-ray Soil Moisture Observation System (COSMOS) for estimating the crop water requirement is a new approach. Soil moisture is a crucial parameter to determine the crop water requirement for irrigation. The soil moisture deficit (SMD) of the root zone is an indicator that can be used to determine the exact crop water require-

ment. COSMOS provides continuous, integrated, area-based values, with a measurement radius of up to 700 m, whilst being non-invasive.

The COSMOS technology is a step in the right direction as it provides continuous, integrated, area-based values of soil moisture and solves the problem of spatial variability often found in point measurements in relation to soil spatial heterogeneity. Cosmos has advantages as an integrated area-based, non-destructive and hazard-free method of measuring soil moisture and for determination of crop water requirements based on soil moisture deficit.

Speaker 3: Marco Arcieri, ICID. The Water Directive 2000/60/EC established a legislative framework for Community action, in order to guarantee the protection of surface and groundwater resources, to ensure a sustainable water use, mitigate the effects of floods and droughts, through the involvement of stakeholders and public opinion. To do so, EU Member States have been required to subdivide national territories into Hydrographic Districts, in order to carry out an efficient planning and programming of water resources. This planning process has been carried out in Southern Italy Hydrographic District with the elaboration of a specific "Water Management Plan", approved and recently updated in December 2021, as required by article 13, paragraph 7 of the Directive, and submitted for approval to EU. This planning document is an element of strict conditionality in the use of European Funds, providing a series of specific obligations for the financial approval of new irrigation investments. Thus, the proper assessment and estimation of crop ET and of relative water requirements constitute an ineludibly compulsory aspect for the sound management of water resources.

In this study, the analysis regarding the agricultural use of water resources has been focused on irrigated areas belonging to the Hydrographic District of Southern Italy. The information regarding extension and characterization of these areas has been possible by means of data made available by AGEA, Italian National Agency for Financial Support in Agriculture, which provided aero photogrammetric photos of agricultural areas of the Hydrographic District for year 2018. Data obtained after a thorough standardized process of photo interpretation made it possible to distinguish between areas characterized by collective irrigation (mainly served by Irrigation Service Providers) and areas with self-supplied irrigation (surface or ground water exploitation). The following step in the assess-

ment of ET and Crop Water Requirements has been to input these data inside FAO's CROPWAT program, characterized by a great ease of use and scientific robustness on the one hand and, on the other hand, its multiple applications and the capability of managing the huge amount of data required for such an assessment. Because of the vast use it has proved inside the scientific community, as well as the possibility of taking into account different pedo-climatic conditions practically worldwide, FAO's CROPWAT program is considered to be one of the most reliable software for the assessment of ET and CWR.

Results offer to analysis two different pictures. In regions of the Hydrographic District of Southern Italy where participatory irrigation management is prevailing (water delivered by Service Providers), agricultural activity globally seems to exert a lower pressure on the environment. The total amount of water needed in order to satisfy CWR inside these areas, as calculated by means of CROPWAT, is more than 900 million m³, with an average requirement of 3.856 m³ per hectare.

On the contrary, in areas where water is self-supplied by farmers, agricultural activity is larger, much more environmentally intense in some territories and with a global request for water of about 1,6 billion of m³, with an average CWR of 2.647 m³ per hectare.

Speaker 4: Thameur Chaibi, INRGREF. Africa is the driest of the world continents. Drylands, including arid, semi-arid and dry sub-humid areas account for 43 percent of land area and home to about 50 percent of population. Water-scarce regions in Africa have a great promise for renewable energy sources deployment like solar, wind, biomass, and geothermal energy. If properly managed, the use of renewable energy sources may present the opportunity to combine sustainable development with improved water availability and access in dryland regions. The tight interconnections between water, energy, and ecosystems (WEE) highlight the importance of understanding and recognizing the trade-offs associated with their planning and management. The recognition of the complex interlinkages between water, energy and ecosystems sectors creates incentives for new integrated implementing technological options for production of water and energy while minimizing negative impacts on the environment. This paper presents and discussed, from WEE nexus perspectives, a set of technological options to help policy makers and other stakeholders to identifying and implementing technology-based solutions that permits to improve the wellbeing of drylands

communities and the sustainability of ecosystems. On the basis of case studies from the drylands of the sub-Saharan and North Africa, technological options and challenges for achieving this objective are introduced, and the outcomes are more thoroughly assessed.

Speaker 5: Susan Amrose, MIT. This paper targets an innovation at the nexus of food, energy, and water: low-cost, renewable-powered integrated electro dialysis desalination with drip irrigation systems designed for arid areas with brackish groundwater. In the past six years, the MIT Global Engineering and Research (GEAR) Laboratory has created low-energy, high water recovery photo-voltaic (PV)-powered electro dialysis reversal (EDR) brackish water desalination systems, which are 1/4th the capital cost of existing PV-EDR technology; and ultra-low pressure, pressure-compensated drip emitters, which reduce pumping power in a drip irrigation (DI) system by 50 percent and can lower the capital cost of PV-powered DI by 40 percent. Integrating these two technologies provides a compelling value proposition for farmers in arid areas with brackish groundwater, with a predicted levelized water cost significantly lower than other commercially proven desalination-for-irrigation solutions. This paper will present preliminary estimates of feasibility of off-grid integrated EDR and DI systems in the Middle East and North Africa (MENA) region, using Jordan as a case study. A novel time-variant (TV) operational approach is presented for continuous PV-EDR wherein flow rate and EDR stack voltage are varied based on the available solar irradiance. This approach allows for lower cost solar-powered desalination without the need for batteries.

Speaker 6: Mitsuru Tsubo, Tottori University. African countries have been slow to digitalize farmers' decision-making, and one reason for this is the lack of research and development. Digitalization in farming can be achieved by compiling environmental and agronomic information, such as climate, soil, cultivars and fertilizers, and communicating the information via the Internet. Tottori University and agricultural research institutions in South Africa and Senegal have been collaborating on a project called "Development of Resilient E-farming for agroclimate risk management in African Multi-environments" funded by the Japan Science and Technology Agency. This project aims to develop a decision-making system driven by crop model simulation with seasonal forecasts. The system to be introduced for farmers works by using an app that connects cloud storage and on-premises computing environments. When a user of

the app inputs information such as location, crop type and target yield, the data are stored in the cloud, and then the model simulation is run with the data from the user on the premise. After computation, information on agronomic practices, such as appropriate planting time and fertilizer application rate for the target yield, is fed back to the user. In this presentation, we introduce the research activities of the project and discuss its way forward.

Speaker 7: Mohamed Ghrab, Institution of Agronomic Research and Higher Education - Olive Institute, Tunisia. Pistachio is a drought tolerant fruit tree widely cultivated in rain-fed areas. With increasing temperature and lack of precipitation induced by climate change, the performances of this nuts crop could be highly threatened. Field experiments were undertaken to improve the water productivity of pistachio trees orchards. It integrated genetic resources such as cultivar and rootstock, cultural practices and water supply strategy. Surveys concerned: i) different local and introduced cultivars grown under rainfed conditions; ii) scion-rootstock combinations of pistachio under contrasting watering regimes and iii) main local cultivar with different pruning and water supply alternatives. Flowering and fruiting of different cultivars, scion- rootstock combinations of pistachio was studied in relationship with water supply and warm conditions.

With important variation in winter chill accumulation and frequent exceptional warm winter, the flowering of the scion-rootstock combinations of pistachio was affected. However, the pistachio cultivars expressed different flowering and fruiting behavior to warm climate depending on their origin and rootstock. Local cultivar expressed better performances and water productivity under warm climate, while flower buds remained dormant for introduced one, which is related to their chill and heat needs. Vigorous rootstock induced high vegetative growth and more flower buds and increasing water productivity. Moreover, annual pruning strategy performed significant high yield with the same water supply. Consequently, cultivar, rootstock, pruning and water supply strategy seem to be potential ways of improving water productivity in warm and arid regions.

	<p>Speaker 8: Karambiri Bienvenue L. Chantal N., Institut des Sciences des Sociétés (INSS/CNRST).</p> <p>Les inondations sont des phénomènes climatiques extrêmes qui touchent le Burkina Faso depuis une certaine période. La zone nord-soudanienne du pays est affectée par ces phénomènes qui ont beaucoup de conséquences négatives. En octobre 2022, la vallée du Sourou a subi des inondations. Les eaux sont restées pendant plus d'un mois et demi dans la zone. Cette situation a engendré des dommages considérables pour les populations riveraines et surtout les agriculteurs. L'objectif de cette recherche est d'évaluer les conséquences des inondations de ces deux mois dans la vallée du Sourou. Pour atteindre cet objectif, une méthodologie basée sur une approche quantitative a été adoptée. Des images sentinelles de deux périodes ont été téléchargées. Le traitement des images a permis de spatialiser les événements. De plus, des données sur le nombre de personnes affectés et les quantités de superficie inondée ainsi que les pertes ont été collectées auprès des services compétents de la province du Sourou.</p> <p>Les résultats obtenus montrent que les eaux ont recouvert plus de 59460,29 ha dans les deux communes. Dans la zone aménagée de l'AMVS, 1264 ha ont été affectées et correspondent à 50,49 pour cent des superficies totales.</p>
<p>Expected stakeholders (ex. Gender and Youth Balance, Regional representatives, etc.)</p>	<p>A quarter of the event presenters will be female, and at least 1/2 will be from the region.</p>
<p>Expected outcomes, impacts and follow-up linkages with events and initiatives after the Forum</p>	<p>Stakeholders commit to form a relevant WASAG working group on dryland agriculture, with tangible target outcomes, event participation and initiatives for the next year.</p>
<p>Media contact (name, organization, email, phone number)</p>	<p>Vinay Nangia, International Center for Agricultural Research in the Dry Areas (ICARDA). V.Nangia@cgiar.org, +212 668853777.</p>

2 key messages for the Declaration	<p>Water is primary limiting factor of production in Drylands. We support sustainable use of water and land resources by integrated approach to managing resources that generate greater livelihoods with same or lesser amounts of water.</p> <p>Women and youth represent disenfranchised groups, facing high levels of unemployment, and we seek ways to make the dryland agricultural sector more attractive to women and young people using technology and the value chains of key commodities.</p>
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Title of the session	Innovation, Technology / Data and Science
Focus area	Innovation, technology, data and science
Key words	Smart water management; drone technologies; GIS & remote sensing
Session description (150 words)	The session will describe innovations in tools, methodologies and approaches to monitor and support the management of water and agriculture. Innovations include those in remote sensing of water use, field level spatial tools, and gathering accurate information on seeding rates, fertilizer application, crop yield and other relevant agronomic data. The session will also consider the integration, application and adoption of these innovations to improve on-farm agricultural water management, support decisions, and inform water and agricultural policies and investments.
Convening organization(s)	IWMI, DWFI, FAO
Programme schedule (90 minutes in total)	<p>Moderator: Peter McCornick DWFI</p> <ul style="list-style-type: none"> • Speaker 1: Christopher Neale, DWFI: Digital Agriculture: The Future of Large-Scale Production Systems? • Speaker 2: Andry Rajaoberison, FAO: Irrigating from Space: Using Remote Sensing for Water Management • Speaker 3: Julio C Lima, Instituto de Estudos da Macronésia, Cascais, Portugal, and Mindelo, Cabo Verde: Agri-Integrated Photovoltaics for Reuse of Water for Irrigation (Acronym: SOLAGUA) <p>Panel Discussion</p> <p>Closing remarks: Peter McCornick, DWFI</p>

**Programme
schedule (90
minutes in total)**

Speaker 1: Christopher Neale, DWFI: Digital Agriculture: The Future of Large-Scale Production Systems?

The presentation will describe methodologies and approaches presently used by farmers, crop consultants, researchers, and industry providers to automate and increase the efficiency of agricultural crop production systems. These approaches include the use of high-resolution multispectral and thermal remote sensing from satellite and airborne systems to inform irrigation scheduling and crop growth models. The use of agricultural implement monitoring systems to obtain spatial seeding rates, fertilizer application and crop yield will be discussed. In addition, examples of different in-field sensors, robotic systems, and related software will be given and how they are used to increase crop production efficiencies. The presentation will also discuss how these technologies can be applied in different world agricultural regions and scales.

Speaker 2: Andry Rajaoberison, FAO: Irrigating from Space: Using Remote Sensing for Water Management

Monitoring water consumption and productivity in agriculture is key for sustainable water management and allocation. In this context, FAO has developed WaPOR, a portal to monitor Water Productivity through Open access of remotely sensed derived data. The high spatial and temporal resolutions of WaPOR data allow to estimate several agrohydrological variables across nested scales, from field to scheme or watershed. Our paper showcases how WaPOR can be used for policymaking and water management in water scarce regions. As a case study, we track the performance of irrigation water management in the Bekaa Valley in Lebanon during three crop seasons. The resulting remote-sensing-based water productivity indicators are combined with crop budgets obtained from local experts. This ultimately allows to provide an economic valuation of irrigation water use at pixel scale and per crop season. From this example, the paper reflects on the potential and limitations of remote sensing data to inform policy and investment options, ranging from the control of irrigated area extent to the monitoring of irrigation best practices. The key takeaway is that WaPOR data provides an unprecedented opportunity to design well-informed water management policies and investments, as well as to monitor their results in real time. However, for that to happen, it needs to be paired with field data collection and institutional capacity which ensure that output data is accurate and hence that the policy conclusions can be trusted.

<p>Programme schedule (90 minutes in total)</p>	<p>Speaker 3: Julio C Lima, Instituto de Estudos da Macaronésia, Cascais, Portugal, and Mindelo, Cabo Verde: Agri-Integrated Photovoltaics for Reuse of Water for Irrigation (Acronym: SOLAGUA)</p> <p>Photovoltaic (PV) electricity generation will play a crucial role in future sustainable energy systems, as it satisfies the demand for carbon-neutral energy supply, thereby combating climate changes. In remote regions and islands, such as Cabo Verde, PV is an especially important energy source. With the continuous maturation and increase of power conversion efficiency (CE) of PV technologies, PV is conquering new application areas, such as building-integrated PV and agricultural-integrated PV (agri-PV). Agri-PV allows the dual use of land for electricity generation and simultaneous crops production under artificially reduced sunlight environment through semi-transparent solar modules applied in a roof-like structure covering the agricultural fields. The SOLAGUA project has two main objectives. The first one is to develop novel solar technology for agri-PV, based on the second generation thin-film solar cell technology that exhibits several significant advantages compared with mainstream silicon PV: higher cost-reduction potential, high-power CE potential. The second objective is to develop and apply advanced water treatment technologies, namely in the tailoring of adsorbents and catalysts to enhance the capabilities of current water treatment solutions. An integrated approach to the design of a tertiary treatment stage will target the sustainable wastewater reuse in crops fertigation and production in Cabo Verde.</p> <p>Panel Discussion</p> <p>Moderator: Christopher Neale, DWF I</p>
<p>Expected stakeholders (ex., Gender and Youth Balance, Regional representatives, etc.)</p>	<p>At least 25 percent of the event presenters (panelists and speakers) will be female, with at least who will be young professionals and at least 50 percent from the global South.</p>

<p>Expected outcomes, impacts and follow-up linkages with events and initiatives after the Forum</p>	<p>Discussion on how to use these technologies and approaches for the benefit of all farmers at different scales. Lead up to the Water for Food Global Conference in May 2023.</p>
<p>Media contact (name, organization, email, phone number)</p>	<p>Frances Hayes, Daugherty Water for Food Global Institute, fhayes@nebraska.edu, +14024175297</p>
<p>Two key messages for the Declaration</p>	<p>There are a number of important innovations in technology, data gathering and sciences to improve the management of agriculture, especially sustainable water management. Further investment in these areas is a priority, and in integrating the relevant information into decision-making at farm and higher scales.</p> <p>Each farm is unique, especially when contrasting the small-scale farms across Africa and Asia with large scale operations in the US mid-west and elsewhere. Successful application of digital agricultural water management requires that the approaches be developed with the context of the target user in mind, and including those users in the development of the tools early in the process.</p>

Title of the session	Sustainable agricultural water management
Focus area	Agricultural water management, irrigated and rainfed agriculture, water governance, water-smart management, water-energy-food nexus
Key words	Irrigation, rainfed, sustainable, water-smart
Session description (150 words)	Water management experts and policymakers have traditionally worked in silos, separate from the agriculture, energy and environment sectors. This fragmentation has led to resource inefficiencies and incoherence. With a projected increase in water and food demand, agri-food systems need to produce more food while using less water to meet rising food demand and maintain sustainable levels of water consumption. Achieving this will require balancing expansion in irrigated areas, mitigating energy demand, and environmental sustainability. Sustainable agricultural water management requires irrigation methods and strategies to minimize yield penalties while optimizing water, land and energy use efficiencies. Evidence suggests that we need a paradigm shift that provides an enabling, all-inclusive policy-making environment that cuts across sectors and systems. Using a water-energy-food-environment (WEFE) nexus approach, this session will share knowledge and experiences on how tradeoffs can be factored into improved and optimal decision-making for sustainable agricultural water management.
Convening organization(s)	International Water Management Institute (IWMI), University of KwaZulu-Natal, UNECE, IUCN, GIZ
Programme schedule (90 minutes in total)	<p>Moderator: Charity Osei-Amponsah</p> <p>Speaker 1: Amare Haileslassie. International Water Management Institute (IWMI): Sustainable agricultural water management: a WEF nexus perspective</p> <p>Speaker 2: Musandji Fuamba, Polytechnique Montréal. Rainwater Harvesting for Sustainable Agriculture for African Dry Regions</p> <p>Speaker 3: Christopher Neale, DWFI-UNL. Water Productivity: Innovations on Methods and Applications</p> <p>Speaker 4: Soumaya Zaddem, Africa Youth Advisory Board on Disaster Risk Reduction of the African Union: Assessment of Innovative Water Solutions as a Response to Water Scarcity in Africa</p> <p>Panel Discussion</p> <p>Panel: IUCN, GIZ, UKZN, IWMI, UM6P</p>

Closing remarks: Alok Sikka, IWMI

Speaker 1: UKZN/IWMI: Sustainable agricultural water management: a WEF nexus perspective.

Efficient water management is crucial for enhancing agricultural productivity and building climate resilience in Africa. Most farmers rely on rainfed agriculture, but farmers do observe the late onset of the rains and, as a result, shortened growing seasons, prolonged drought spells, and higher intensity rains that cause floods and soil erosion. Without adaptation measures, farmers will experience reduced quantity and quality of crop yields, crop damage and even loss of entire harvests. With a projected increase in water and food demand, agrifood systems need to produce more food while using less water and energy to meet rising food demand and maintain sustainable levels of water consumption. Achieving this will require balancing expansion in irrigated areas, mitigating energy demand, and environmental sustainability. Sustainable agricultural water management requires irrigation methods and strategies to minimize yield penalties while optimizing water, land and energy use efficiencies. This talk will assess, from a water-energy-food (WEF) nexus perspective, integrated water, energy and food policy development, trade-offs in expanding the area under irrigation and performance evaluation of agricultural water management interventions. Secondary to this, we assess the impact of adopting systematic approaches such as the WEF nexus on improving efficiency in irrigated agriculture through irrigation modernization.

Speaker 2: Musandji Fuamba, Polytechnique Montréal. Rainwater Harvesting for Sustainable Agriculture for African Dry Regions

Speaker 3: Christopher Neale, DWFI-UNL. Water Productivity: Innovations on Methods and Applications

Water footprint and water productivity have become common approaches for estimating and accounting for the multiple uses of water in the production of crops, livestock, and industrial products. Despite the multiple methodologies proposed in the literature, there is a need to establish and use methods that are widely accepted by the scientific and production community. This presentation will describe different methods of estimating water productivity, including the use of remote sensing data for spatial applications, giving examples showing the increase in water productivity of crops and livestock

over the last 25 years in the Midwest United States. The presentation will also explore opportunities and challenges for determining water productivity and supporting viable water accounting in other regions.

Speaker 4: Soumaya Zaddem, Africa Youth Advisory Board on Disaster Risk Reduction of the African Union: Assessment of Innovative Water Solutions as a Response to Water Scarcity in Africa

Today, 40 percent of the African population is living in cities, and that percentage is projected to grow to 50 percent by 2030. Besides the growing population, the groundwater over exploitation, water pollution risks in Agriculture and both observable and potential effects of climate change on water resources in Africa led to water scarcity as well as certain challenges like ensuring the basic water supply and sanitation, food security, and economic development. In order to feed the growing population and contribute to water quality and quantity in Africa there is a need for sustainable and innovative solutions. The three methods that have been proposed to address the issue of water scarcity in Africa are open access of remotely sensed derived data portal (WaPOR), designing and implementing an innovative agriculture system for producing food in urban areas (Vertical Farming) and implementing Integrated Water Resources Management (IWRM). Results showed vertical farming is the practice of growing crops on vertically inclined surfaces using less water and no soil. WAPOR uses remote sensing technologies to monitor and report on agricultural water productivity over Africa. IWRM, as the Global Water Partnership defined, promotes the coordinated development and management of water, land, and related resources to maximize the resultant economic and social welfare equitably without compromising the sustainability of vital ecosystems. This paper reviews the best practices of the three chosen methods to improve water quality and quantity in Africa. It's also a critical review of different resources that guides us to provide recommendations and lessons that can benefit young people to replicate them in Africa.

Panelist 1: IUCN

Panelist 2: GIZ

Panelist 4 (Prof Imane Adraoui, UIMP6): Harnessing Water Scarcity in Moroccan Oases: Key Water Challenges

<p>Expected stakeholders (ex., Gender and Youth Balance, Regional representatives, etc.)</p>	<p>At least one-third of the event presenters (panelists and speakers) will be female, with at least who will be young professionals and at least 50 percent from the global South.</p>
<p>Expected outcomes, impacts and follow-up linkages with events and initiatives after the Forum</p>	<p>The session will explore the transition from WEF E nexus theory to practice and how to inform decisions at the policy and practice level at multiple scales, from field to basin.</p>
<p>2 key messages for the Declaration</p>	<p>Sustainable agricultural water management is crucial for enhancing agricultural productivity and building climate resilience in Africa.</p> <p>Understanding WEF E nexus tradeoffs could improve and optimize decision-making to maximize food, water, environment and energy resources under increasing uncertainty.</p>

Annex 2: Detailed agenda

Time	Day 1 - Tuesday 7 February	Day 2 - Wednesday 8 February	Day 3 - Thursday 9 February	Day 4 - Friday 10 February
08:00-08:30	Registration & Welcome Coffee			Field Trip
08:30-09:00		8:30 – Debriefing of the day		1. "Afroponic PURAVIDA" Development – São Francisco, Santiago Island
09:00-10:30	Opening Ceremony	FAO on novel approaches	SIDE EVENT 5 Towards the operationalization of transdisciplinary participatory WEFEE Nexus approaches for achieving water and food security	2. "FORÇA DE VONTADE" development – São Francisco, Santiago Island
10:30-11:00	Photo Group and Press Conference	COFFEE – Poster Exhibition	COFFEE	3. Development "Water agricultural project, valuation and efficient use of natural resources in Ribeira Dos Picos, Municipality of Santa Cruz, Ilha De Santiago"
11:00-12:30	Special Session – CABO VERDE	Technical session 2.a Water and Migration	Technical session 2.b Inclusive Farmer-led Water Management	
			SIDE EVENT 3 Saline Agriculture (cancelled)	
12:30-13:30	LUNCH			
13:30-15:00	Technical session 1.a Water and Nutrition	Technical Session 2.c Dryland Agriculture	Technical Session 2.d Innovation and Technology/Data and Science	CLOSING CEREMONY
	Technical session 1.b Saline Agriculture		Special event on drought (13:30-17:00)	
	Technical session 1.c Water Quality	Technical Session 2.e Sustainable Agricultural Water Use		
15:00-15:30	COFFEE			COFFEE
15:30-17:00	Technical Session 1.d Drought Preparedness	SIDE EVENT 2 Guidelines on pressurized irrigation systems	SIDE EVENT 4 Water and Nutrition	Visit of the technological and agriculture fair
	Technical Session 1.e Drought Preparedness			
19:30		RECEPTION		

Annex 3: Photos of the forum

Photos from Day 1

Photos from Day 2

Photos from Day 3

Photos from the Field trip



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