Food and Agriculture Organization of the United Nations

BUILDING FORWARD BETTER

INITIATIVE

Strengthening natural resources management capacities to revitalize agriculture in fragile contexts

E-LEARNING NUGGET BRIEFS

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ABOUT THE INITIATIVE

Conflict and fragility are at the core of some of the biggest challenges today – they are able to hinder development progress and also to reverse any development gains. Environmental factors are rarely, if ever, the sole cause of conflicts. However, the exploitation of natural resources and related environmental stresses can be implicated in all phases of the conflict cycle from contributing to the outbreak and perpetuation of violence to undermining prospects for peace.

Countries can experience vulnerable conditions at different level of intensity and under different dimensions: from socio-economic, to environmental to human health. Crises generated by global pandemics, such as COVID 19, can have further negative effects on fragile contexts.

Natural resources management, in particular land and water resources, also becomes a most critical challenges under such dire situations. Against a backdrop of lost human capital and declined institutional capacity in fragile contexts and in the aftermath of a conflict, sound natural resources management to boost food production, create new job opportunities, mitigate the risk of conflict, and foster post-crisis reconstruction process is important.

A fundamental problem in fragile contexts is the loss of human capital. Without the contribution of knowledgeable professionals, the re-building process becomes even more complicated. The local capacities should be at the base of any re-building planning and investments – they provide access to local knowledge and information and can guarantee the sustainability of the program in the long-term. Indeed, effective institutions are central to address both the “capacity deficit” and “legitimacy deficit” faced in fragile contexts.

Re-building depends on national policy choices as much as on international support. The role of the international community, that is essential to timely provide humanitarian aid to affected populations, must not be limited to infrastructure and largely extend to invesment in human capital to achieve a long-lasting impact.

A comprehensive and well-coordinated capacity-building project is thus instrumental to tackle such challenges and to address the knowledge gaps in natural resources management while aiming at rebuilding the human capital at different levels – individual and institutional.

The "Strengthening natural resources management capacities to revitalise agriculture in fragile contexts" project stems from the recognition of the importance of investing in human capital in fragile contexts. The project aims at addressing the loss of human capacity provoked by fragility in Libya, Niger and Mali, three countries equally confronted with the need to improve natural resources management, strengthen national institutions and boost human capital to enhance agricultural productivity, improve food security and progress towards the SDGs. In the specific, the project will result in:

- Critical capacities in the field of natural resources management for sustainable agriculture identified;
- Skills in natural resources management upgraded through dedicated training in key thematic areas; and
- A network of experts and technicians set-up and equipped as appropriate with necessary technologies for assessments, planning and piloting of natural resources management investments and development projects.

TARGET AUDIENCE

National professionals in the relevant domains, and technicians from relevant ministries, research institutes and national institutions.

TRAINING PARTNERS

Key knowledge and training partners with long-standing capacity-building experience in relevant domains, including national, regional and international research institutes, academic centers and universities.

METHODOLOGY

In order to reach the widest and most diverse set of audiences, and to adopt tailor-made and effective training and capacity building methods, the project foresees a combination of the following training methods:

- **Executive education** – intensive training over 1 or 2 weeks in a single location (FAO Headquarters, regional office, partner's Headquarters, etc.) involving external trainers and multiple topics clustered around sub-topics.
- **E-learning course-administrated (webinar)** – An administered training limited to one topic/one day exploring more specific facets of the topic.
- **E-learning course-self-administered** – A self-administered training limited to one topic that explores one or more specific facets of the topic.
- **E-learning nugget** – A 30-60 minutes online course that can be used to refresh knowledge on specific topics or provide examples and best practices in a continued manner.

THEMATIC AREAS

The training program focuses on 13 thematic areas related to natural resources management.

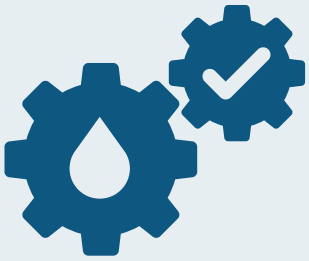
1. WATER PRODUCTIVITY

An overview of Crop Water Productivity approach currently employed to address food security and to evaluate the effects of the environment and of different management practices on crop production. Moreover, the module will present the evolution of the standard approach and will introduce the most recent tools developed through on-field applications, which will lead to the formulation of model improvements.

2. LAND RESOURCES PLANNING

An approach for achieving sustainable and efficient resource use, taking into account biophysical and socio-economic dimensions. It allows a systematic assessment of land potential and land-use alternatives for achieving optimal land uses and improved socio-economic conditions through a participatory multisectoral, multi-stakeholder and scale-dependent process. The module will focus on several topics, including Sustainable Land Management (SLM), Land Degradation Neutrality, land assessment and impacts, digital soil mapping, and remote sensing for land use planning.

3. WATER USE EFFICIENCY AND PERFORMANCE ASSESSMENT



A focus on the main elements of water use efficiency and illustration of related strategies to increase water performance for the improvement of water and food security and moving towards the achievement of SDG6. The module presents FAO MApping System and Services for PRESSsurized irrigation (MASSPRESS) as a step-wise approach for the mapping of the behavior of pressurized irrigation systems and the assessment of their hydraulic performance. Discharge measurement techniques and flexible water resource allocation will also be presented.

4. HYDRO-ECONOMIC MODELLING FOR RIVER BASIN MANAGEMENT

An effective tool employed for various water resources management, the module will present hydro-economic modelling that, on one side, integrates spatially-distributed water resources, economic values, infrastructure, and management policies and, on the other, optimizes water allocation between different uses across time and space, taking into account various physical, economic, environmental and institutional constraints. Moreover, the module will introduce the potential of hydro-economic modelling to serve as a useful tool to guide the policy making process based on a clear understanding of trade-offs arising from conflicting stakeholders' objectives.

5. INTEGRATED DROUGHT MANAGEMENT

Among the most far-reaching natural disasters, FAO is strongly committed to fighting drought and is advocating for a proactive, coordinated and holistic drought risk management based on three key pillars: (i) Early warning and monitoring systems; (ii) Vulnerability and impact assessment; and (iii) Drought risk mitigation measures. The module will discuss main concepts related to drought and will present international frameworks and initiatives as well strategies to move away from a reactive towards a proactive approach in drought management.

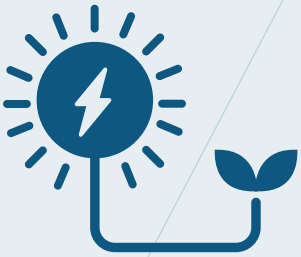
6. WATER HARVESTING AND AGROFORESTRY

Taking into account the vast range of water harvesting and agroforestry practices for agriculture and transforming landscapes, applicable under various geographical conditions, practices will be presented, also in association with agronomic and soil water conservation techniques such as managing soil fertility and enhancing soil water infiltration and retention capacity. Case studies will also be presented at local level and from different geographical areas. Finally, the module will enhance knowledge and raise awareness on the need for the management of water harvesting and for increased coordination of interventions for rainfed agriculture at different levels.

7. INVESTMENT IN AGRICULTURAL WATER AND ENERGY

A clear and comprehensive understanding is needed on the uses of water resources at country level, on the legal, policy and institutional frameworks governing these sectors and on the existing public and private investments for the development and management of water. Decision making processes should build on a thorough quantitative and qualitative knowledge of these sectors to support elaboration of investment strategies according to defined priorities. The module will discuss effective investment strategies and prioritization of water/energy projects through the provision of a set of tools developed by FAO. It will present FAO-developed Diagnostic Tool for Investment and its three main clusters: Context, Institutional and Policy, and Financial. This knowledge is then translated into the definition of investment needs and priorities, in order to formulate a National Investment Framework for the sector.

8. RENEWABLE ENERGY USE FOR IRRIGATION



Modernizing food and agriculture systems by increasing the use of fossil fuels as was done in the past may no longer be an affordable option. The role of energy must be reconsidered, and new energy options must be adopted for improving food systems. Renewable energies, such as solar and wind, can be used in agri-food systems and can be a sustainable alternative to fossil fuels to generate power needed. The module will provide knowledge on the water-food-energy nexus and the key concepts related to energy-smart agriculture. It will present technological aspects of solar irrigation and introduce examples of successful applications of its use in agriculture.

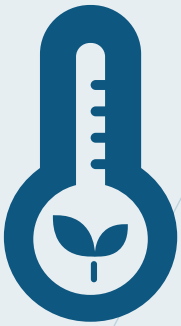
9. IRRIGATION ASSET MANAGEMENT

In spite of the generally recognized importance of the maintenance component during the definition of project infrastructure, investments usually focus on modernizing existing systems rather than addressing proper installation, operation and monitoring activities. The training will provide a comprehensive presentation of currently available asset management systems (within and related to the irrigation sector) and will address the main challenges to maintain diverse irrigation infrastructure. The module will introduce the characteristics of modern asset management approaches and will illustrate, also through the presentation of field case studies, the application of effective systems for increased performance of water delivery services and reduced maintenance and operational costs.

10. EARLY WARNING SYSTEMS

The availability and access to reliable and timely information and comprehensive datasets regarding food production, food prices, and hunger levels not only help responding to periods of food crisis but are critical to allow policymakers to identify challenges, take action and anticipate food security crises in order to mitigate the severity of their effects. The module will present main concepts related to early warning and its application and will introduce the FAO Global Information and Early Warning System on Food and Agriculture (GIEWS), a system that regularly monitors food supply and demand and other key indicators for assessing the overall food security situation in all countries of the world. Part of the module will be dedicated to the role of early warning in disaster management as a major element of disaster risk reduction and it will introduce the FAO Early Warning Early Action System (EWEA), a tool used to translate warnings into anticipatory actions to reduce the impact of specific disaster events.

11. CLIMATE CHANGE AND AGRICULTURE: MITIGATION AND ADAPTATION STRATEGIES



The module focuses on mitigation and adaptation strategies in the agricultural sector. Great efforts are made to mitigate the effects of climate change and find solutions to make agriculture more sustainable. At the same time, it is becoming harder to ignore that climate change is already upon us. For this reason, effort is needed to adapt to increased temperatures, longer droughts, unpredictable rainfalls and more intense floods. The module presents and discusses strategies to accelerate adaptation in key systems (natural environment, water

and food production), and highlights benefits and financial options to invest in adaptation and main challenges. A number of specifically-designed tools (i.e. FAO MOSAICC) and best practices and approaches (i.e. climate-smart agriculture) to be adopted in the target countries will also be presented and discussed.

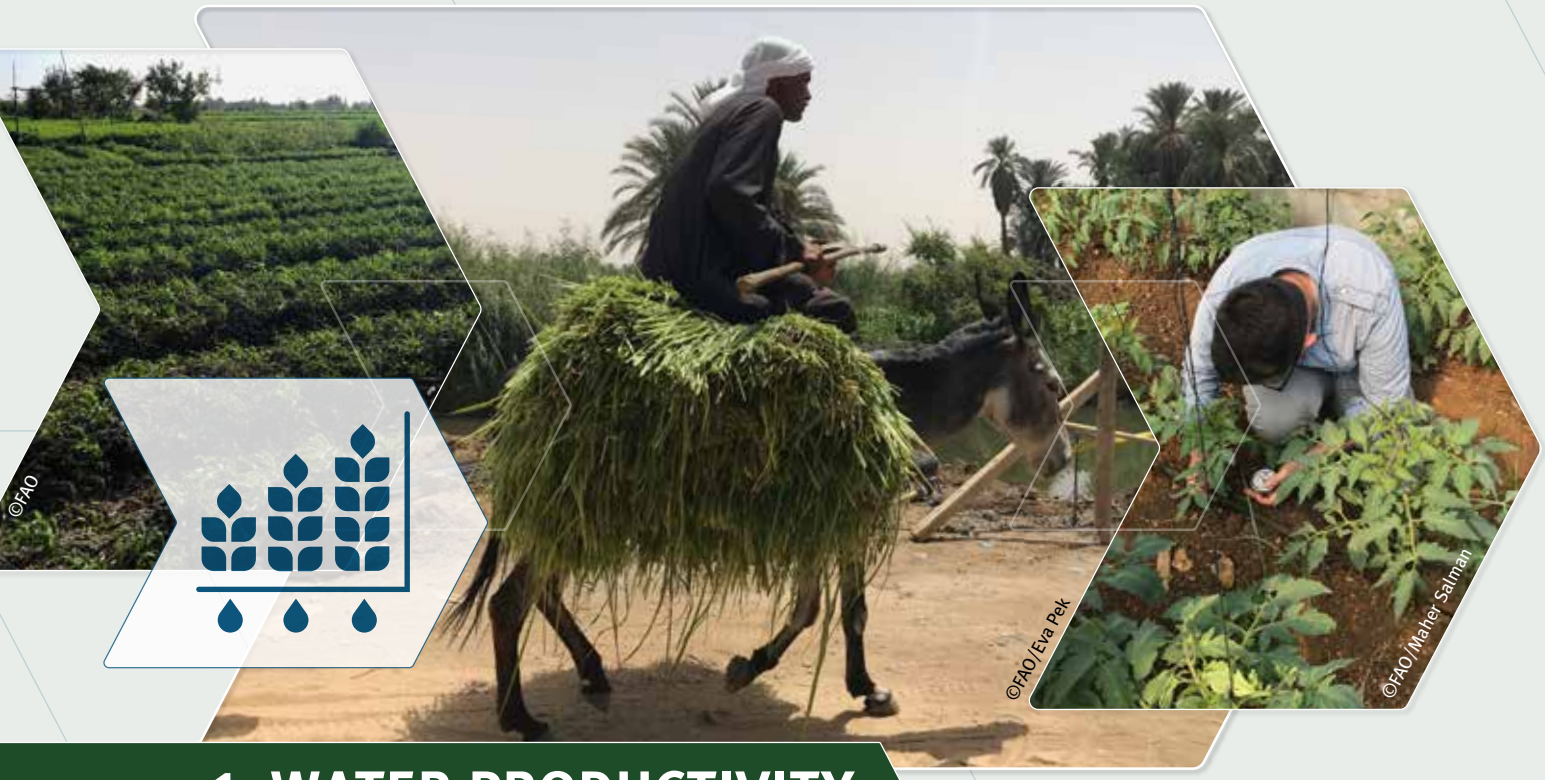
12. AGRICULTURAL INDEXES FOR PERFORMANCE ASSESSMENT

Indexes are employed in the agricultural sector to examine area, yield, production, productivity, prices and other relevant trends over time and elaborate a comparative view of the sector performance according to multiple indicators. Indexes in agriculture respond to different needs and can be employed for a number of purposes, such as: (a) plans for crop insurance; (b) elaboration of national policies; (c) evaluation of production gaps and needs; (d) identification of problem and solutions for price stability; and (e) promotion of positive management changes. The module will present and discuss both FAO and global agricultural indexes and how to best employ them to inform policy processes and programming in the agricultural sector.

13. MONITORING AND EVALUATION

Complex and interlinked trends, including global population growth and climate change, are increasing pressure over the world's natural resources. The need for regular and accurate monitoring of these resources has increased in parallel with rising global awareness and acknowledgement of the urgent need for innovative, measurable pathways to ensure sustainable management and development. Monitoring and Evaluation (M&E) is a continuous management function to assess if progress is made in achieving expected results, to spot bottlenecks in implementation and to highlight whether there are any unintended effects (positive or negative) from an investment plan, program or project and its activities. The module will present the elements of a M&E system and discuss how the processes of planning and M&E make up the Result-Based Management (RBM) approach, which is intended to aid decision-making towards explicit goals.

NUGGET BRIEFS



1. WATER PRODUCTIVITY

1. Description of the module

The module will initially provide an overview of Crop Water Productivity approach currently employed to address food security and to evaluate the effects of the environment and of different management practices on crop production. The module will present practical case studies and will guide participants through the four steps of its approach to provide insights and present a standard methodology, to be later tailored to different contexts, for assessing and improving Crop Water Productivity. Moreover, the module will present the evolution of the standard approach and will introduce the most recent tools developed through field applications.

The tool

The AquaCrop crop growth model (http://www.fao.org/aquacrop/) is internationally recognized as one of the most suitable crop models for simulating crop yield response to water, particularly under conditions in which water is a key limiting factor in crop production. Developed and launched in 2009 by the Land and Water Division of FAO to support the enhancement of agricultural production by assessing the yields of major herbaceous crops as a function of water supply, the tool is applied under different farming conditions to:

1. Evaluate attainable yields under local conditions;
2. Compare potential yield to actual production in order to diagnose yield gaps of selected crops.

2. Module structure

1. Evolution of the Crop Water Productivity approach • Sustainable Agricultural Water Management and Enhanced Crop Water Productivity • Crop Water Productivity: A new methodological approach & tools tailored to local conditions
2. On-farm irrigation and drainage systems
3. Crop – environment interaction
4. Crop management
5. Soil and water conservation practices
6. Economic and environmental dimensions of Agricultural Water Management

3. Learning objectives

Trainees become familiar and consolidate their knowledge of Crop Water Productivity concept, also through the evaluation of field applications, in order to:

- Optimize the use of water for increased crop production;
- Maximize the performance and sustainability of irrigation schemes;
- Design new irrigation schemes according to sustainable criteria;
- Apply farming practices to enhance CWP at any irrigation condition.

The step-by-step presentation of the AquaCrop tool, moreover, will allow participants to thoroughly apprehend how to tailor this approach to local contexts to boost crop production through the implementation of enhanced and integrated farming management practices.

2. LAND RESOURCES PLANNING

1. Description of the module

1. Land resource planning for sustainable land management

Land resource planning is an approach for achieving sustainable and efficient resource use, taking into account biophysical and socio-economic dimensions. It allows a systematic assessment of land potential and land-use alternatives for achieving optimal land uses and improved socio-economic conditions through a participatory multisectoral, multi-stakeholder and scale-dependent process. The purpose of land resource planning is to support decision-makers and land users in selecting and putting into practice land uses that best meet the needs of people while safeguarding natural resources and ecosystem services for current and future generations.

2. Sustainable Land Management (SLM)

Sustainable Land Management (SLM) comprises measures and practices adapted to biophysical and socio-economic conditions aimed at the protection, conservation and sustainable use of resources (soil, water and biodiversity) and the restoration of degraded natural resources and their ecosystem functions. The selection of appropriate SLM practices and approaches is an important step in ensuring the effectiveness of land management and restoration.

3. Land Degradation Neutrality (LDN) - Restoring degraded lands

Identifying the impacts of land degradation on provisioning ecosystem services (i.e. productive, regulating/supporting and socio-cultural services) is a crucial aspect of a strategic approach to food security. FAO's contribution to land degradation neutrality (LDN) is based on its expertise in policy development on SLM and addressing land degradation, including governance and land rights, and on its role as the foremost global custodian of agricultural information for the Organization's country members.

4. Land assessment and impacts

FAO assists member countries in assessing the physical, socio-economic, institutional and legal potential and constraints on land use, with the aim of achieving the optimal and sustainable use of land resources and empowering people to make informed decisions on the allocation of those resources.

5. FAO Digital soil mapping (DSM)

DSM refers to techniques of soil mapping mostly through digital techniques, incorporating field and traditional legacy soil information. DSM makes use of pedometrics, which refers to the application of numerical techniques to describe and map soils. The scope is to make soil survey, classification, and land evaluation as objective as possible.

6. Remote sensing for land use planning

Remote sensing covers all techniques related to the analysis and use of data from environmental and earth resources satellites and from aerial photographs. Land cover maps constitute necessary tools for the planning and management of the territory and satellite remote sensing provides a cost-effective and accurate tool for their updating.

2. Module structure

1. Land resource planning for sustainable land management: current and emerging needs
2. Sustainable Land Management (SLM): practices and tools
3. Land Degradation Neutrality (LDN) - Restoring degraded lands
4. Land assessment and impacts
5. Digital soil mapping: tools and real cases applications
6. Remote sensing for land use planning: production of land maps and presentation of case studies

3. Learning objectives

Trainees acquire knowledge and skills in developing and updating land use policies and strategies in their respective countries. They also learn on different tools available and how to make use of soil data to produce soil digital maps.

3. WATER USE EFFICIENCY AND PERFORMANCE ASSESSMENT

1. Description of the module

1. Irrigation water performance: Methodologies and approaches

This part of the module presents the main elements of water use efficiency (starting from its definition and objectives) and discusses strategies to increase water performance for the improvement of water and food security and moving towards the achievement of SDG6. Starting from the principles of performance assessment of pressurized irrigation systems, the module narrows down to illustrate objectives and domains of the Rapid Appraisal Procedure (RAP) and its components. A part of the module is dedicated to the presentation of on-field applications and lessons learned through direct implementation of the approach.

2. Mapping System and Services for Pressurized irrigation systems (MASSPRESS)

The MASSPRESS model is presented together with application cases. MASSPRESS is a step-wise approach for the mapping of the behavior of pressurized irrigation systems and the assessment of their hydraulic performance at network and hydrant level. MASSPRESS application will be further illustrated though the presentation of COPAM, a computer tool for the diagnosis of performance of pressurized irrigation systems through the integration of relevant indicators.

3. Discharge Measurement Techniques

The module presents traditional and non-traditional discharge measurement, a multi-objective activity that considers the relation between water supply and demand and monitors optimal water allocation to enhance water use efficiency.

4. Flexible water resource allocation

In order to achieve the enhancement of production while reducing the water consumed, sufficient knowledge of irrigation schemes' discharge data is required together with a clear understanding of the potentiality to increase efficiency of those schemes and access to mechanisms to do so. Accessible databases on historical water use, thus, represent useful decision-support tools that can facilitate the elaboration of tailored flow models for optimal water service. Resource allocation at scheme level should thus promote flexible water services according to the most efficient and sustainable standards in terms of: (1) Adequate water rates; (2) Frequency; (3) Duration; and (4) Control.

2. Module structure

1. Agricultural water performance: methodologies, approaches and tools
   - Principles of performance assessment of pressurized irrigation systems (MASSPRESS)
   - Rapid Appraisal Procedure (RAP) and related domains
   - Mapping of the behavior of pressurized irrigation systems through performance indicators
   - Modelling of hydraulic performance (COPAM)
2. Discharge Measurement Techniques and technologies to improve water-use efficiency
3. Flexible water resource allocation

3. Learning objectives

Participants will acquire knowledge on the approaches to assess the performance of irrigation systems and increase water use efficiency at system and farm levels. They will apprehend how to apply and use MASSPRESS and become familiar with the related tool, COPAM, for the diagnosis and the design of pressurized irrigation networks.

4. HYDRO-ECONOMY MODELLING FOR RIVER BASIN MANAGEMENT

1. Description of the module

Hydro-economic modelling combines economic management concepts with an engineering level of understanding of a hydrologic system. Hydro-economic models have emerged as an effective tool for studying various water resources management problems around the globe: inter-sectoral water allocation, climate change adaptation, reservoir operation, transboundary water management, conjunctive management, water-food-energy nexus, investment planning, and others. The module will illustrate hydro-economic models that, on one side, integrate spatially distributed water resources, economic values, infrastructure, and management policies and, on the other, optimize water allocation between different uses across time and space, taking into account various physical, economical, environmental and institutional constraints. Moreover, the module will introduce the potential of hydro-economic modelling to serve as useful tools to guide the policy making process based on a clear understanding of trade-offs arising from conflicting stakeholders' objectives.

Methods and Tools

Hydro-economic modelling employs two main categories: optimization- and simulation-based models. Simulation models answer to specific "what if" scenarios, whereby allocation policies are externally imputed. Optimization models, on the other side, help identifying the most appropriate management decisions based on the maximization/minimization of a stated mathematical objective function subject to physical, institutional and/or economical constraints. The Water Evaluation and Planning system (WEAP) is a water-planning tool that operates on the principle of water balance accounting, and represents different interconnected catchments, demand nodes, infrastructure, water flows and water transmission links to calculate the components of the hydrological cycle by simulating rainfall-runoff processes at the catchment level.

2. Module structure

1. Introduction to hydro-economic modelling
   - Schematization of the water resources system
   - Performance indicators
   - Data pre-processing

2. Tools for cross-country and river basin water management
   - Optimization method
   - Simulation method

3. Scenario analysis
   - Baseline assessment
   - Inter-sectoral allocation policies
   - Evaluation of development and management scenarios

4. The Water Evaluation and Planning tool (WEAP)
   - Introduction to the model
   - Potential application to the case scenario
   - Employment of the tool for policy making and planning

3. Learning objectives

Taking into account national-, catchment- and basin-level scenarios, the module aims at increasing planning and management capacities to maximize the economic benefits of water resources allocation through sectors, according to the most relevant and updated hydro-economic principles. Through the presentation of simulation and optimization methods and the introduction of relevant tools, the training supports the assessment of the economic, hydrologic and institutional impacts and, accordingly, the formulation of efficient resource allocation policies.

5. INTEGRATED DROUGHT MANAGEMENT

1. Description of the module

Drought is among the most far-reaching natural disasters and have affected more people worldwide in the last 40 years than any other natural hazard. It is a complex phenomenon with varying levels of intensity, duration, spatial extent and impacts. In Africa, the Sahel region is particularly exposed to climatic shocks and recurrent drought events have already been recognized among the key drivers of growing humanitarian needs.

FAO is strongly committed to fighting drought and, together with other international partners, is advocating for a proactive, coordinated and holistic drought risk management based on three key pillars:

1. Early warning and monitoring systems;
2. Vulnerability and impact assessment;
3. Drought risk mitigation measures.

The module will discuss the main concepts related to drought and will present international frameworks and initiatives as well strategies to move away from a reactive approach towards a proactive approach in drought management.

2. Module structure

Drought: Conceptual definitions and types

The international framework: The role of UNCCD and the UN Convention to Combat Desertification
Regional past trends and future projections
Integrated Drought Management Programme (IMDP)

The UNCCD three pillars: Definition and key concepts
Pillar 1. Early warning and monitoring systems
- Drought monitoring and forecasting
- Drought indices and indicators: how to use them and interpret results
- Monitoring drought with remote sensing data

Pillar 2. Vulnerability and impact assessment
- Drought Risk Assessment in the agricultural sector
- Assessing impacts in the social, environmental, and economic spheres

Pillar 3. Drought risk mitigation measures
- Risk management through adaptation and mitigation
- Risk strategies: risk assessment, mapping and reduction

Hands-on training: exercises on scenarios from the region
National drought policies: key elements and examples from the region
Raising public awareness: presentation of case studies
UNCCD-led Drought Toolbox
FAO Drought Portal

3. Learning objectives

The participants will familiarize with the main concepts related to drought and the international agenda. They will acquire skills in integrated drought management and knowledge of the options available to decrease and manage drought risks. They will develop a comprehensive understanding of the different fields involved in drought management through both theoretical bases and real cases and scenarios.

6. WATER HARVESTING AND AGROFORESTRY

1. Description of the module

The module will introduce a vast range of water harvesting and agroforestry practices for agriculture and transforming landscapes, applicable under various geographical conditions. Practices will be presented also in association with agronomic and soil water conservation techniques such as managing soil fertility and enhancing soil water infiltration and retention capacity, according to existing case studies, at local level and from different geographical areas. Finally, the module will enhance knowledge and raise awareness on the need for the management of water harvesting and for increased coordination of interventions for rainfed agriculture at different levels.

2. Module structure

1. Introduction to in-situ water harvesting and surface storage techniques
2. Planning and management of landscapes for agricultural production
3. Water recharge and retention systems for agriculture
4. Soil water retention techniques
5. Composting techniques
6. Assisted Natural Regeneration (ANR)

3. Learning objectives

Participants will become familiar and consolidate their knowledge on Water Harvesting and Agroforestry practices, also through the evaluation of field applications, in order to:

- Present a number of existing Water Harvesting and Agroforestry practices, to illustrate their main features, benefits and limitations;
- Evaluate their performance with respect to several biophysical, technical, and socioeconomic criteria;
- Guide decisions on the choice of a single or a combination of several Water Harvesting and Agroforestry techniques that show positive impacts on the environment, socio-economic development, and agricultural productivity and profitability.

7. INVESTMENT IN AGRICULTURAL WATER AND ENERGY

1. Description of the module

Water and energy are key production factors for agriculture and the possibility of harnessing their potential would markedly contribute to achieving food and energy security goals. A clear and comprehensive understanding, however, is needed on the uses of water resources at country level, on the legal, policy and institutional frameworks governing these sectors and on the existing public and private investments for the development and management of water. Decision making processes should build on a thorough quantitative and qualitative knowledge of these sectors to support elaboration of investment strategies according to defined priorities.

The Tool – Diagnostic Tool for Investment (DTI)

The FAO-developed Diagnostic Tool for Investment is a comprehensive toolbox that provides a clear representation of all the dimensions relevant to the use and management of water resources for agriculture and hydropower generation, through three components:

1. The Context tool;
2. The Institutional and Policy tool;
3. The Financial tool.

The application of the Diagnostic Toolbox for Investment in Agricultural Water Management can lead to the formulation of a National Investment Framework, which clearly prioritizes investment needs over time and across sectoral typologies, and translates into specific policy and legislative measures for programmes, projects and budgets considering the institutional, regulatory and legal as well as infrastructural measures.

2. Module structure

1. Effective investment strategies and prioritization of water/energy projects
2. The FAO-developed Diagnostic Tool for Investment (DTI) • Glossary of terms • Advantages of a comprehensive Toolbox
3. The Context tool • Indicators of investment • Potential for investment
4. The Institutional and Policy tool • Relevant policies • Indicators of institutions
5. The Financial tool • Investment envelope • Internal Rate of Return • Financing sources • Cost distribution • Developed areas • Types of investments
6. Application of the DTI – Presentation of country cases

3. Learning objectives

The participants will learn about effective investment strategies and prioritization of water/energy projects through the provision of a set of tools developed by FAO. They will familiarize with FAO-developed Diagnostic Tool for Investment and its three main clusters: Context, Institutional and Policy, and Financial. This knowledge is then translated into the definition of investment needs and priorities, in order to formulate a National Investment Framework for the sector.

8. RENEWABLE ENERGY USE FOR IRRIGATION

1. Description of the module

As the global population continues to increase, food production will have to grow to meet the increase in demand. Agriculture is both impacted by climate change and a source of GHG emissions and can contribute to fight climate change by being a source of renewable energy and by using less fossil fuels throughout the agri-food chain. The identification, planning and implementation of appropriate energy, water, food security and climate-smart strategies can stimulate agricultural growth and rural development without increasing energy production. The module will introduce the concept of water, energy and food security nexus, and will discuss technical options (and their operation) of the use of renewable energy sources for irrigation.

Energy-smart agriculture

Modernizing food and agriculture systems by increasing the use of fossil fuels as was done in the past may no longer be an affordable option. The role of energy must be reconsidered, and new energy options must be adopted for improving food systems. Renewable energies, such as solar and wind, can be used in agri-food systems and can be a sustainable alternative to fossil fuels to generate power needed.

Solar irrigation

Irrigation is among the measures implemented to increase yields and thus reducing dependence on more and more unpredictable rainfalls. Nevertheless, any increase in irrigated areas comes at the price of increases in the energy consumptions. Using solar energy for irrigation is a viable alternative to conventional electricity and diesel-based pumping systems. This session will present technological aspects of solar irrigation and introduce examples of successful applications of its use.

2. Module structure

1. The Water-Energy nexus
2. Essentials of solar pumping for agriculture
3. The application of solar energy for irrigation – Aspects of operation and maintenance
4. Hands on training: case studies

3. Learning objectives

The participants will acquire knowledge on the water-food-energy nexus and familiarize with the key concepts related to energy-smart agriculture. They will improve their knowledge in the field of solar irrigation by being presented with both theoretical bases and real cases to its application in agriculture.

9. IRRIGATION ASSET MANAGEMENT

1. Description of the module

Proper irrigation asset management is a critical element of ensuring the sustainability and efficiency of agricultural projects. In spite of the generally recognized importance of the maintenance component during the definition of project infrastructure, however, investment usually focus on modernizing existing systems rather than addressing proper installation, operation and monitoring activities.

The training will provide a comprehensive presentation of currently available asset management systems (within and related to the irrigation sector) and will address the main challenges to maintain diverse irrigation infrastructure. The module will introduce the characteristics of modern asset management approaches and will illustrate, also through the presentation of field case studies, the application of effective systems for increased performance of water delivery services and reduced maintenance and operational costs.

Highlights from the module

- Challenges of asset management in irrigation schemes: Social, financial, engineering, institutional;
- Participatory Irrigation Management and farmers' participation;
- Financial sustainability and the water-energy nexus;
- Protection of hydraulic infrastructure in multiple service systems.

2. Module structure

1. Introduction to Irrigation Asset Management for sustainable water, food security
2. Irrigation rehabilitation and planned asset management
3. Characteristics, challenges and opportunities in asset-poor irrigation schemes
4. Characteristics, challenges and opportunities in irrigation pumping systems
5. Characteristics, challenges and opportunities in peri-urban irrigation schemes
6. Asset management and Water Operator Partnerships (WOPs)
7. Integration of asset management in new projects

3. Learning objectives

Participants will become familiar and consolidate their knowledge on Irrigation Asset Management characteristics and processes, also through the evaluation of field applications, in order to:

- Enhance the performance and reliability of irrigation systems;
- Improve equity and efficiency of water delivery services;
- Reduce O&M costs of irrigation infrastructure;
- Strengthen sustainability of financial investments in agriculture.

They will gain awareness on the importance to incorporate asset-related considerations into projects, to extend infrastructure lifespan and reduce costs in the long-term. Participants will also increase capacities in irrigation O&M activities through the introduction to related governance and institutional mechanisms.

10. EARLY WARNING SYSTEMS

1. Description of the module

The module focuses on early warning systems applied to two different domains: food security and disaster management.

Early warning systems and food security

The availability and access to reliable and timely information and comprehensive datasets regarding food production, food prices, and hunger levels not only help responding to periods of food crisis but are critical to allow policymakers to identify challenges, take action and anticipate food security crises in order to mitigate the severity of their effects. For this purpose, FAO has developed the Global Information and Early Warning System on Food and Agriculture (GIEWS), a system that continuously monitors food supply and demand and other key indicators for assessing the overall food security situation in all countries of the world. As a result of its activities, regular analytical and objective reports are released highlighting prevailing conditions and providing early warnings of impending food crises at country or regional level.

Early warning systems and disaster management

A paradigm shift has recently taken place in disaster management, replacing traditional reactive response – act after an emergency occurs – with a proactive approach – act early before an emergency occurs – to mitigate its impact. With the frequency and intensity of climate-driven natural disasters and conflicts increasing, great efforts are made in this direction to create new tools able to attenuate the impact of disasters before they occur. Early warning is a major element of disaster risk reduction, as it can help preventing loss of life and reduce the economic and material impacts of hazardous events, including disasters. Access to reliable and coherent datasets is key for planning and organizing effective responses to hazardous event. FAO has developed the Early Warning Early Action System (EWEA) to translate warnings into anticipatory actions to reduce the impact of specific disaster events. It focuses on consolidating available forecasting information and putting plans in place to make sure action is taken when a warning is at hand.

2. Module structure

1. Module introduction: Early warning in support of decision making

2. The role of the international community: the Sendai Framework and its guiding principles

3. Who does what: roles and responsibilities of international, regional, country and local actors?

4. The Global Information and Early Warning System on Food and Agriculture (GIEWS)
   - Overview: Information networks, information analysis, products and services
   - Datasets and country information
   - Hands-on training: Cases from the targeted countries

5. The Early Warning Early Action System (EWEA):
   - About EWEA: Establishment, goals and categories of hazardous events
   - Global EWEA: Analysis and reports
   - Country EWEA: Classification of countries, country reports
   - Early actions and early responses
   - Funding mechanisms
   - Hands-on training: Cases from the targeted countries

3. Learning objectives

Trainees become familiar with the concept of early warning and its application in the fields of food security and disaster management, they learn on the international framework and guiding principles, they acquire skills in the use of FAO GIEWS and EWEA systems with reference to application to their respective countries.

11. CLIMATE CHANGE AND AGRICULTURE: MITIGATION AND ADAPTATION STRATEGIES

1. Description of the module

The module focuses on mitigation and adaptation strategies in the agricultural sector. Great efforts are made to mitigate the effects of climate change and find solutions to make agriculture more sustainable. At the same time, it is becoming harder to ignore that climate change is already upon us. For this reason, effort is needed to adapt to increased temperatures, longer droughts, unpredictable rainfalls and more intense floods. The module presents and discusses strategies to accelerate adaptation in key systems (natural environment, water and food production), and highlights benefits and financial options to invest in adaptation and main challenges. The module also presents a number of concrete tools and best practices to be applied in the target countries.

Modelling System for Agricultural Impacts of Climate Change (MOSAICC)

FAO, in partnership with European research institutes, has developed MOSAICC, an integrated package of models to assess the impact of climate change on agriculture. MOSAICC is a modelling system which allows users from various disciplines, including climatology, agronomy, hydrology, forestry and economics, to assess the impacts of climate change. It integrates a powerful data management system which allows users to upload data, as well as a flexible and configurable system to run multiple models.

Climate-smart agriculture

Climate-smart agriculture (CSA) is an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate. CSA aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible.

Dryland farming

Doubling food production by 2030 will not come from putting more fertile land into production but mainly from sustainably intensifying production – that is increasing the productivity of agricultural lands already in use and from using marginal lands, such as drylands. For this reason, increased attention is paid to innovations in agriculture and practices for restoring degraded lands and growing food in the desert.

2. Module structure

1. Climate change science: Global warming, GH gases, consequences and scenarios
   - Impacts on water resources and agricultural systems
   - International agreements, conventions and green financing mechanisms
2. Modelling System for Agricultural Impacts of Climate Change (MOSAICC)
3. Climate-Smart Agriculture
4. Towards low-carbon agriculture: Strategies and examples from the region
5. Dryland farming
6. Climate change adaptation
   - Benefits of investing in climate change adaption and investment options
   - Adaptation strategies in key systems (natural environment, water and food production)
   - Supporting and spreading innovation: best adaptation practices and tools from the region

3. Learning objectives

Trainees become familiar with climate change concepts and apprehend how to use specific tools to enhance climate change mitigation. They learn about the urgency to invest in adaptation and on the possibility to apply best practices in their respective countries.

12. AGRICULTURAL INDEXES FOR PERFORMANCE ASSESSMENT

1. Description of the module

Indexes are employed in the agricultural sector to examine area, yield, production, productivity, prices and other relevant trends over time and elaborate a comparative view of the sector performance according to multiple indicators.

Indexes in agriculture respond to different needs and can be employed for a number of purposes, such as: (a) plans for crop insurance; (b) elaboration of national policies; (c) evaluation of production gaps and needs; (d) identification of problem and solutions for price stability; and (e) promotion of positive management changes.

FAO agricultural indexes

Availability of high-quality and timely national data is key in the agricultural sector to inform decision-making and shape accurate and effective policy and programmatic decisions, particularly in low- and middle-income economies. Developing countries strive to build comprehensive data systems, vital to agricultural and food security areas in order to monitor progresses and achieve the Sustainable Development Goals. The module will illustrate the latest and mostly employed approaches developed by FAO to address the need for reliable data on natural resources and generate the knowledge on the key data required for a thorough understanding of the agricultural sector.

Global agricultural indexes

Worldwide application of agricultural indexes proved to be a significant development tool to promote resilience of developing economies, also thanks to their indirect effect in attracting international investment aids. Bypassing the high costs of evaluating individual losses of farmers

and rural livelihoods, agricultural indexes represent effective development tools given their capacity to predict crops, livestock and relevant natural resources yearly trends. The module will present the most reliable and valuable indexes used worldwide to support countries in conceiving resilience-building programs and attracting financial investments in the agricultural sector.

2. Module structure

1. Introduction to agricultural indexes
   - Purpose and scope of application
   - Tools and approaches for development of indexes

2. FAO-developed agricultural indexes
   - Natural resources indexes
   - Biodiversity indexes
   - Food security indexes

3. Global agricultural indexes
   - Market indexes
   - Commodity indexes
   - Risk management indexes

3. Learning objectives

Participants will increase their knowledge on the use and development of agriculture-related indexes, built from indicators on the performance of relevant natural resources and trends in the food security domain. They, in particular, will familiarize with these tools and learn how to best employ them to inform policy processes and programming in the agricultural sector.

13. MONITORING AND EVALUATION

1. Description of the module

Complex and interlinked trends, including global population growth and climate change, are increasing pressure over the world's natural resources. The need for regular and accurate monitoring of these resources has increased in parallel with rising global awareness and acknowledgement of the urgent need for innovative, measurable pathways to ensure sustainable management and development.

Monitoring and evaluation of natural resources management projects

Monitoring and Evaluation (M&E) is a continuous management function to assess if progress is made in achieving expected results, to spot bottlenecks in implementation and to highlight whether there are any unintended effects (positive or negative) from an investment plan, program or project and its activities. The session will present the elements of an M&E system and discuss how the processes of planning and M&E make up the Result-Based Management (RBM) approach, which is intended to aid decision-making towards explicit goals.

Strengthening M&E for decision making and planning in the agriculture sector

The importance of monitoring and evaluation (M&E) of climate change adaptation has been highlighted at global level, including under the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement. Simultaneously, adaptation M&E systems are beginning to emerge at the national level in the context of national planning and budgeting processes. This session will focus on how to develop M&E systems for adaptation planning in agriculture sectors.

Monitoring and reporting the SDGs indicators and the role of Big Data

The availability of high-quality, timely and reliable data to produce the relevant SDG indicators and other statistics is key for the achievement of the SDGs. The results of Statistical Capacity Assessment for the FAO- SDG indicators conducted in 2019 provide insights about member countries' national statistical systems with regards to their capacity to monitor and report the 21 SDG indicators under FAO custodianship. From the results of the survey in the project target countries, it emerged the need to strengthen institutional coordination on data reporting and to develop new surveys/data sources. This session will focus on the methodology, compilation and interpretation of indicators. Benefitting from the international momentum around the use of Big data in the development sector, the session will present the main concept related to Big Data, its use in the development sector and contribution to the achievement of SDGs and will discuss strategies to introduce Big Data into the production and dissemination of official statistics in target countries. E-learning course is already available on SDG indicators.

2. Module structure

1. Monitoring and evaluation of natural resources management projects
   - Principles of Results-Based Management
   - Definition, key principles and concepts of M&E
   - Project analysis (situation analysis, needs assessment, strategy analysis)
   - Design of Results in Monitoring and Evaluation
   - Logical Framework approach and theory of change
   - M&E data management, use and dissemination

2. Strengthening M&E for adaptation planning in the agriculture sector

3. Monitoring and reporting the SDGs indicators and the role of Big Data
   - Overview of SDGs and Global Indicator Framework
   - How SDG M&E processes can support national progress on sustainable development
   - Strategies to integrate SDG M&E into national M&E systems
   - Big data contexts and concepts: the foundations of the Big Data for the development

3. Learning objectives

Participants will familiarize with the principles of M&E for Natural Resources Management projects and the main concepts related to goals and targets of the 2030 Agenda for Sustainable Development. They will learn about the methodology to compile and interpret SDG indicators and will acquire skills on the integration of Big Data in the national statistical systems and how to use Big Data for development purposes.

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