

2016

# *Medi***TERRA**

**ZERO WASTE IN THE MEDITERRANEAN**

Natural Resources, Food and Knowledge



Food and Agriculture  
Organization of the  
United Nations

**SciencesPo**  
LES PRESSES



**CIHEAM**  
International Centre for Advanced  
Mediterranean Agronomic Studies

# *Medi***TERRA**



ZERO WASTE IN THE MEDITERRANEAN  
Natural Resources, Food  
and Knowledge

16

INTERNATIONAL CENTRE FOR ADVANCED MEDITERRANEAN AGRONOMIC STUDIES  
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS  
PRESSES DE SCIENCES PO



**CIHEAM**

International Centre for Advanced  
Mediterranean Agronomic Studies

Created in 1962, the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM) is a Mediterranean organization which works for improving sustainable agriculture and fisheries, for ensuring food and nutrition security and for developing rural and coastal territories. The organization gathers thirteen Member States from both shores of the Mediterranean (Albania, Algeria, Egypt, France, Greece, Italy, Lebanon, Malta, Morocco, Portugal, Spain, Tunisia and Turkey) and works with several international and regional institutions.

CIHEAM is a space for intercultural dialogue, solidarity and sharing in which are discussed strategic development and cooperation issues in the Mediterranean. Research and dissemination of sustainable solutions for inclusive and responsible growth are the heart of its missions.

Its actions are the result of a "bottom-up" collaboration and are based on a holistic approach to development. With its Member States, its public and private partners, academic and research actors, CIHEAM strives to meet the four following challenges: combating all forms of waste; boosting sustainable agriculture and food; investing in new generations and fragile territories; preventing risks and managing tensions.

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# Food and Agriculture Organization of the United Nations

The Food and Agriculture Organization (FAO) is a specialized agency of the United Nations system with a mandate to raise levels of nutrition and standards of living for all people, to promote production, productivity and effective distribution of food and agricultural products, to ensure sustainable utilization and management of natural resources, and to contribute toward promoting world economy and eradicate poverty and hunger.

Within the framework of five Strategic Objectives, FAO works closely with Member Nations and a range of partners at national, regional and global levels to achieve these goals.

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# Table OF CONTENTS

<b>FOREWORD</b>	11
<i>José Graziano da Silva, FAO Director General</i> <i>Cosimo Lacirignola, CIHEAM Secretary General</i>	
<b>ACKNOWLEDGMENTS</b>	13
<b>INTRODUCTION</b>	15
<b>ABSTRACTS</b>	27
<b>1 NATURAL RESOURCES</b> in the Mediterranean	33
<b>&gt; CHAPTER 1</b> <b>Global perspective of natural resources</b> <i>Mathieu Brun, Pierre Blanc, Halka Otto</i>	35
<b>&gt; CHAPTER 2</b> <b>Management of living marine resources</b> <i>Anna Carlson, Francesc Maynou, Bernardo Basurco, Miguel Bernal</i>	49
<b>&gt; CHAPTER 3</b> <b>Management of water resources</b> <i>Andre Daccache, Maha Abdelhameed Elbana, Abdelouahid Fouial,</i> <i>Fawzi Karajeh, Roula Khadra, Nicola Lamaddalena, Ramy Saliba,</i> <i>Alessandra Scardigno, Pasquale Steduto, Mladen Todorovic</i>	69
<b>&gt; CHAPTER 4</b> <b>Sustainable development of land resources</b> <i>Pandi Zdruli, Feras Ziadat, Enrico Nerilli, Daniela D'Agostino,</i> <i>Fadila Lahmer, Sally Bunning</i>	91

- > CHAPTER 5**  
**Forests: facing the challenges of global change**  
*Inazio Martínez de Arano, Valentina Garavaglia, Christine Farcy* **113**
- > CHAPTER 6**  
**Plant and animal resources diversity**  
*Badi Besbes, Christini Fournaraki, Francesca Marina Tavolaro, Katerina Koutsovoulou, Grégoire Leroy, Irene Hoffmann* **135**
- > CHAPTER 7**  
**Energy and agri-food systems: production and consumption**  
*John Vourdoubas, Olivier Dubois* **155**
- > CHAPTER 8**  
**The 2030 Agenda for sustainable development in the Mediterranean**  
*Mélanie Requier-Desjardins, Dorian Kalamvrezos Navarro* **175**

## 2 FOOD LOSSES AND WASTE

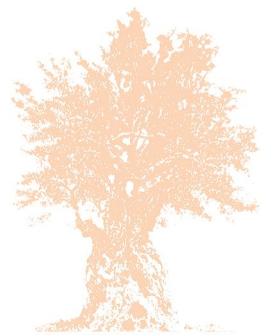
in the Mediterranean **191**

- > CHAPTER 9**  
**Food losses and waste: global overview from a Mediterranean perspective**  
*Roberto Capone, Anthony Bennett, Philipp Debs, Camelia Adriana Bucatariu, Hamid El Bilali, Jennifer Smolak, Warren T.K. Lee, Francesco Bottalico, Yvette Diei-Ouadi, Jogeir Toppe* **193**
- > CHAPTER 10**  
**The Mediterranean diet: a sustainable consumption pattern**  
*Fatima Hachem, Roberto Capone, Mary Yannakoulia, Sandro Dernini, Nahla Hwalla, Chariton Kalaitzidis* **243**
- > CHAPTER 11**  
**Innovative postharvest technologies for sustainable value chain**  
*Panagiotis Kalaitzis, Elena Craita Bitu, Martin Hilmi* **263**

<p><b>&gt; CHAPTER 12</b>  <b>Innovation for the reduction of food losses and waste</b>  <i>Biagio Di Terlizzi, Robert Van Otterdijk, Alberto Dragotta, Patrina Pink, Hamid El Bilali</i></p>	<b>281</b>
<p><b>&gt; CHAPTER 13</b>  <b>Consumer behaviour with respect to food losses and waste</b>  <i>Luis Miguel Albisu</i></p>	<b>303</b>
<p><b>3 KNOWLEDGE AND KNOWHOW</b>  <b>in the Mediterranean</b></p>	<b>319</b>
<p><b>&gt; CHAPTER 14</b>  <b>Waste of knowledge and human resources</b>  <i>Pascal Bergeret, Nora Ourabah Haddad, Rodrigo Castañeda Sepúlveda</i></p>	<b>321</b>
<p><b>&gt; CHAPTER 15</b>  <b>Saving traditional knowhow in agriculture</b>  <i>Pascal Bergeret, Juliette Prazak, Caterina Batello</i></p>	<b>337</b>
<p><b>&gt; CHAPTER 16</b>  <b>Family farming to bolster human knowhow and resources</b>  <i>Pascal Bergeret, Nora Ourabah Haddad, Sara Hassan, Francesco Maria Pierri</i></p>	<b>351</b>
<p><b>&gt; CHAPTER 17</b>  <b>Enhancing knowledge for food security</b>  <i>Biagio Di Terlizzi, Mohammed Bengoumi, Hamid El Bilali, Alberto Dragotta</i></p>	<b>363</b>
<p><b>BIOGRAPHIES</b></p>	<b>391</b>
<p><b>TABLE OF DOCUMENTS</b></p>	<b>407</b>

# FOREWORD

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The adoption of the 2030 Agenda marked the beginning of a new era with a strong commitment from the international community to promote a wide range of transformative and universal changes to achieve Sustainable Development, with local and regional specificities. The Sustainable Development Goals (SDGs) strive to provide inclusion and empowerment for all. The operationalization of this inclusive approach to growth and development relies on integrating the economic, social and environmental dimensions of development. Agriculture and food security play a key role in this regard. Indeed, they are at the heart of the 2030 Agenda.

The world, including the Mediterranean region, is faced with a number of challenges, such as inequalities, significant flows of distress migration and limited access to and poor management of natural resources, including water, land and biodiversity. Various forms of waste related to food, natural resources and knowledge are embedded in these challenges and pose significant obstacles for the achievement of sustainability.

In terms of food, the world produces enough today to feed the planet, but one third, representing 1.3 billion tons per year, is either wasted or lost in the supply chain, from initial agricultural production all the way to final household consumption.

Furthermore, continued increase in the use of natural resources such as water, land, forestry, biodiversity and fisheries, without paying sufficient attention to their depletion or environmental impacts, can lead to ecological crises and security threats. In the Mediterranean region, for example, wasting a precious resource like water may intensify such threats.

Additionally, the waste of human resources hampers development efforts. This happens, for example, in the form of unemployment, lack of access to education especially for girls, “brain drain” from developing countries, disappearance of local knowledge such as family farming practices and products, duplication of ideas without coordination and lack of synergies among relevant actors.



In this context, we are pleased to introduce the 2016 Edition of *Mediterra*, which addresses all of these waste challenges and presents innovative solutions while suggesting policy recommendations for the sustainable management of natural resources, food and knowledge in the Mediterranean.

For the first time ever, an Edition of *Mediterra* has been developed as a partnership between our two organizations: the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM) and the Food and Agriculture Organization of the United Nations (FAO). The two organizations share the same vision of a prosperous Mediterranean region.

CIHEAM and FAO have collaborated for more than 35 years through joint knowledge generation, brokering dialogues and developing cooperation projects to empower small-scale farmers and fisher folk and develop capacities of different actors. More recently, they felt the need to renew their strategic partnership in response to the 2014 Algiers recommendation, adopted on the occasion of the 10th CIHEAM ministerial meeting, during which the Ministers requested “that FAO and CIHEAM examine the idea of defining a common strategic cooperation agenda designed to support agricultural, food and sustainable rural development in the Mediterranean”.

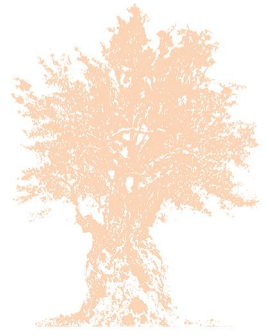
This 2016 Edition of *Mediterra* is an expression of the renewed strategic partnership between the two organizations. It represents an important step towards building consensus on innovations and inclusive policies needed to respond to the challenges faced by the Mediterranean region, particularly in terms of the triple wastes related to natural resources, food and knowledge. We believe that this new Edition of *Mediterra* contributes to fostering synergies in thematic areas of mutual interest. We hope that this joint piece of work will act as a catalyst for action towards achieving food security and sustainable development in the region, in collaboration with policymakers and all the other actors of the Euro-Mediterranean multilateral cooperation.

José Graziano da Silva  
FAO Director General

Cosimo Lacirignola  
CIHEAM Secretary General



## INTRODUCTION



Today as in the past, food security, and agricultural development as a whole, are major strategic issues for the planet. For public opinion, and those not closely involved in the sector, the food crisis of 2008 pointed to the key role played by food and agriculture in strategic global affairs. However, while such events can sometimes serve to raise the level of political and media awareness of agriculture, it should be remembered that food is an imperative everywhere and at all times. This is a story that is as old as humanity itself, and is not going to end any time soon. But a number of constraints are tightening their hold (shifts in demographics and food production, climate shocks), making this issue more of a structural challenge.

Against this background, the issue of agricultural losses and food waste has become a critical one. While there are various concerns about how the supply and demand of agricultural products will evolve in the years to come, the struggle to combat these losses and waste is proving to be one of the main pathways, both at local and global level, through which to tackle food insecurity. All countries face the same challenge – that of producing more with fewer resources and therefore having to husband these more effectively. The Mediterranean is no exception, not least because it remains prey to the dual problems of poor availability of land and water, forcing this already vulnerable region to be particularly careful of their management, so as not to increase future risks (see Chapter 1).

However, examining waste exclusively on the basis of production and poorly used resources runs the considerable risk of ignoring a deeply insidious and often neglected form of waste – that of human resources and knowledge related directly or indirectly to the agricultural and rural sector. The marginalization of some rural areas, which if addressed could make a significant contribution to local, national and regional development, and the unemployment that affects their communities, combined with the disappearance of knowledge and knowhow tested and accumulated over generations and lack of good governance – these are all resources that are being lost or at the very least, poorly used (see Chapter 14).

In its various dimensions (social and organizational, economic, technical and environmental), the question of waste should therefore be viewed from three separate, albeit complementary angles. Indeed, combining an analysis of natural resources,

production and knowledge makes it possible to position the scope more globally in a perspective of sustainable development, where human beings are placed at the centre of the debate. That is the goal of Edition 2016 of *Mediterra*, a report jointly published by CIHEAM and FAO, which explores the issue of wastage using this three-pronged approach. A number of technical, social and environmental innovations aimed at limiting and avoiding such wastage enrich the discussions presented in this report.

Innovative in both form and content, this study is an invitation to embark on a cross-cutting and inter-sectoral exploration of the Mediterranean region, which is emblematic of agricultural, food and environmental issues on a global scale. Taking such an approach would seem to be critical in order to reach an understanding of the many interactions that can be harnessed, in an effort to reduce volumes of losses and waste. The report also offers some responses and insights for the implementation of participatory, political recommendations, so that wastage can be transformed into opportunities, creating pathways for development in the region, at a time when it is crucial to define the Mediterranean's place in the Global Development Agenda up to 2030, to which both FAO and CIHEAM are firmly committed (see Chapter 8).

## Conserving natural resources

Food waste does not just mean losing a substance that is vital for humankind. It also means wasting precious natural resources (land, water, energy, forests, biodiversity) that are crucial to a sustainable food system. Unless a well functioning land base is maintained, with the water needed for agriculture, as well as forests to mitigate against climate change, inputs for and use made of sustainable energy in food production and transport, together with conservation of Mediterranean biodiversity, major determinants of food security will be disrupted. This land, this water, these forests, this pastureland and this biodiversity all serve as balancing factors for a humanity that is rooted in nature – one which does not need to be rendered sacred or dominated, but which must be handled carefully. Sound management of each of these resources is therefore both meaningful and decisive, and an integrated strategy to combat waste is essential, all the more given that scarcity and degradation are already making themselves felt.

Scarcity of natural resources is already causing tension and territorial instability in the Mediterranean region. Recent cases underscore the importance of this problem. It should be added that the region has gained notoriety as an example of conflicts over water. Leaving spectacular examples aside, the challenge of water is very real and its causes well known: poorly distributed between countries and territories, water is an increasingly coveted resource, especially in the light of population growth and the development of irresponsible tourism in some places, as well as climate change already under way in a region that is a hot spot of shifts in temperature and precipitation patterns. First and foremost, these tensions affect agriculture, for irrigation is often a major drain on this precious resource. However, resolving the water crisis in the Mediterranean will not be achieved by mobilizing increased volumes of this resource (see Chapter 3). After several decades of policy based on ensuring strong supply, which

saw a sharp increase in the number of dams and large water infrastructures built and areas of land irrigated, indicators for withdrawals show that the renewal threshold has been exceeded in many places. The exploitation index of renewable natural resources (ratio between the volumes withdrawn and renewable water available) offers a particularly interesting indication of the current strain on this resource. Many Mediterranean countries now have an exploitation index of more than 50% and, in these cases, the prospects for improving supply are reduced. The scope for increasing water resources therefore lies more in limiting wastage. In the agriculture sector, large volumes of irrigation water are lost due to lack of appropriate techniques or modern infrastructure. Some of the water lost trickles into aquifers and may be used at a later date, but a considerable share evaporates. Developing more efficient irrigation systems will therefore involve deploying hydraulic engineering in the region. But what use will this be without social planning for water use, in the form of water users' associations, in an effort to establish collective management of a resource that is often poorly managed and subject to conflict over its use? In a region that invented social planning for water use through the Code of Hammurabi more than 38 centuries ago, right up to the water tribunals set up in Andalusia under Muslim Spain this is nothing new. But the forms of organization need rethinking, involving all users, with producers – men and women – first in line.

In terms of scarcity, it is noteworthy that the total volume of water used on the planet each year to produce food that is subsequently lost or wasted (250 km<sup>3</sup>) is the equivalent of the annual flow of the River Volga (Russia), or three times the volume of Lake Geneva, between France and Switzerland. Naturally, this comparison should be treated with caution. With the problem of food insecurity largely overcome in terms of quantity, it is easy to lose sight of the fact that agricultural production can never be definitively guaranteed, especially when the issue of water is overlooked. It is worth bearing in mind that in order to obtain 1 kilogram of cereals, a staple food for human consumption, it takes 1,300 litres of water. In a Mediterranean region that has seen so many civilizations emerge, this wager on a new hydraulic revolution that can make the best of water resources without using any additional ones is by no means impossible. Indeed, there is clear evidence that the process has already begun. It would be a mistake to lose sight of the extraordinary resilience of Mediterranean societies and their time-honoured determination to innovate, despite the increasing constraints they face.

The problem of land is another issue that is frequently raised. The availability of hydroponic techniques is no reason to lose sight of the fact that land resources, like water, are crucial for agriculture. The situation is sufficiently worrying for the United Nations to have declared 2015 the International Year of Soils, following on from 2014, which was the International Year of Family Farming – an indication of the extent to which land constitutes a major pillar of the development of rural communities. Nearly 1.3 billion hectares of land, the equivalent of 28% of the world's entire agricultural surface area, is currently used to produce food that is subsequently lost or wasted. To this waste of land should be added the whittling away of arable land by advancing urbanization, which is taking place throughout the Mediterranean.

While the countries of the northern shores could in theory offer new opportunities for agriculture, albeit at the expense of areas that are often extremely important to ecosystems, that is far from the case in North Africa and the Middle East. This is the only region in the world without reserves of arable land. Due to the aridity of some Mediterranean countries, substantial expanses of soil are very skeletal, making it extremely difficult to practise agriculture, particularly in the south and east of the region. While in the north, arable land accounts for almost one-third of countries' surface area, in the rest of the region the figure is barely 10%, with large expanses of desert that can at best be used for the movement of livestock. To be sure, a policy of actively supplying water has succeeded in turning round this natural disaster, transforming desert lands into arable land, but this conquest of the desert has reached its limit. What is more, here, as elsewhere, cultivated soils have been affected by erosion and salinization, causing desertification. Linked to overgrazing and steep gradients, coupled with bursts of intense rainfall typical of Mediterranean climates, this phenomenon requires that soil be treated with greater care (see Chapter 4). Another less visible process than urban competition, but one that has equally grave consequences and must therefore be taken seriously, is the salinization of agricultural land due to poorly designed irrigation systems (inadequate drainage, evaporation of water reserves in hot climates and concentration of salts). This fragility of agricultural land, both in terms of arable surface area and its productive capacity, shows that the best path clearly lies in combating agricultural waste. What is the point of increasing the area of arable land if the food produced from it is to end up being lost at the end of the chain?

Forests face many of the same issues as those linked to land and water. Mediterranean forests are extraordinarily diverse (there are almost 300 species, of which some 200 are endemic), equipped with a resilience developed over a long period of time. In often drastic conditions, these forests have set in place adaptation mechanisms that have enabled them to survive in often difficult Mediterranean landscapes. Their responses to environmental stress are morphological (short leaves of persistent species, deep root systems, thick bark), phenological (early and rapid development of foliage) and physiological (tolerance of dehydration, early photosynthesis, maintaining capacity for photosynthesis after long periods of drought). Particularly resilient, Mediterranean forests have a multi-functional dimension, even though use is often only made of their productive function. And among the services provided by forests, one of particular importance is the prominent role that they play in protecting soils, water catchment areas, water quality and biodiversity, as well as promoting climate change mitigation by sequestering CO<sub>2</sub> and improving micro-climates. Yet despite all the major benefits they offer, forests are often subjected to all kinds of assault, starting with deforestation, especially due to urbanization and the development of agriculture and intensive timber trading. But it is fires that pose the greatest threat. It is hard not to equate this with waste, especially given that most fires are avoidable and that few have natural causes (such as lightning). Despite considerable efforts, the phenomenon appears to be spreading in the region, causing Mediterranean forests to become more fragile as a result, with 60 rare species at risk of extinction. Conserving forests and avoiding the waste of such a highly diversified resource is therefore an obligation (see Chapter 5).

The same is true of biodiversity on land and in the seas. Due to the variety of soils, landscapes and micro-climates found in different combinations, the Mediterranean has a remarkably rich range of diversity. The region hosts between 25,000 and 30,000 species of plants, of which more than half are endemic. Linked to the fact that vegetation established areas of resistance at the time of the ice age, this biodiversity of plants, but also animals, has been partly adapted by humans to fulfil their needs. As a result, the Mediterranean region has become a central point for disseminating living species throughout the world (breeds of goat and sheep and varieties of cereals, fruits and vegetables). Unfortunately, mainly man-made threats menace this biodiversity: the destruction of natural habitats, climate change, pollution and economic activities are all forms of waste brought about by human beings (see Chapter 6). Such biological diversity is also very marked in the Mediterranean Sea. Made up of maritime areas (Tyrrhenian, Aegean, Ionian, Adriatic) with particular biocoenoses, the Mediterranean hosts 7% of global marine species, including a number that are endemic. The wide range of life forms offers humans a diversified food source, which is now threatened by overfishing and pollution – both causes of waste at sea. While the concept of a blue economy based on a holistic and integrated vision of marine and coastal development is making headway, in the Mediterranean as elsewhere, there is a strong case for promoting operating practices for marine resources that are sustainable on three levels: ecologically, socially and economically. It is this approach that will assure the future of fisheries in the Mediterranean Sea, where the role of small communities of fishers is paramount (see Chapter 2).

Nor should energy waste be overlooked, given its critical contribution to agriculture. Foodstuffs produced and transported thousands of kilometres are never consumed, with a knock-on effect of substantial wasted energy. In addition, considerable greenhouse gas emissions are given off during the production and distribution of many foodstuffs. So just as there is a strong link between resource management and food, there can be no meaningful discussion on food unless the energy implications are taken into account. In a world whose limits are perceived in terms of resources, having once assumed that everything would last for a great deal longer, there is a more pressing need than ever to link these assets (energy and resources), in order to shape development policies that are sustainable. Against the backdrop of new climate initiatives that promote use of renewable energies, opportunities also exist for greater synergy between use of wind and solar energy in the food and agriculture sectors. In the Mediterranean, these developments herald promise for the future, so long as they are handled in an integrated fashion (specifically, through the water-land-energy nexus) and are implemented through inclusive, long-term policies (see Chapter 7).

Such discussions on wasted resources and the links between them are in keeping with the Sustainable Development Goals (SDG) that were drawn up in 2015, and which have confirmed and expanded on the development process launched in 2000 through the Millennium Development Goals (MDG). Some 17 objectives have now been established as part of this process to unify development programmes. The fight against resource waste goes straight to the heart of these objectives, often in a very direct manner. This is true of Goal 2 (zero hunger), Goal 6 (water), Goal 7 (energy),

Goal 14 (life below water) and Goal 15, which concerns the protection of ecosystems. But this struggle can also make an indirect contribution to achieving certain objectives, starting with the first of them, which aims to fight poverty. This brings us back to the initial observation on the need to place the human and social dimension at the centre of initiatives designed to make development more sustainable. Suffering, frustration and injustice are major factors in the evolution of socio-political dynamics. Reducing inequalities and pursuing inclusive policies are proving to be strategic approaches for checking the process of social decomposition that could affect some countries.

## Reducing food waste

According to FAO, about one-third of all food produced worldwide each year is lost or wasted. That represents a total of almost 1.3 billion tonnes. The wastage involves food destined for human consumption, which is lost at all stages of the food system. Such phases act in different ways and at varying levels, according to their place in the food supply chain and the geographical location, as well as the social and economic conditions that prevail. Developing countries are the worst affected by food losses as part of agricultural production (during harvest, transport and storage of foodstuffs produced), while higher income countries are mainly affected by food waste at retail and consumer level (in households and catering). Such polarization of the problem highlights the extent to which inequalities cause dysfunctions: on the one hand there is under-development, which hampers investment in infrastructure, and on the other, there is abundance (often unevenly distributed), which drives wastage.

Due to population growth and socio-economic changes, global food demand could rise by between 40 and 70% by 2050. In the light of this forecast, global agricultural production will need to increase by about 60%. That is a massive challenge, which will require a variety of solutions, both agronomic and technical, but also logistical, social, organizational and political. Within this range of responses, reducing food loss and waste is an approach that merits consideration, offering a real pathway for improving the efficiency and sustainability of agriculture and food production systems. It is a strategy that needs to be implemented on different territorial levels (see Chapter 9). Indeed, the problems vary widely, depending on the countries and supply chains involved. There will always be quantities of fruit and vegetables wasted during the transport phase, as these are fragile products. But it may be more difficult to accept that wheat, which is much easier to handle, should also be wasted. Or that, as happens far too often, part of harvests are lost due to lack of effective storage facilities and inadequate infrastructures in some countries.

A growing awareness is burgeoning and this must be spurred on. For example, in European societies, the fight against food waste has become an issue that has prompted strong public and citizens' protest in recent years. On all sides of the Mediterranean, there is a growing awareness that paying closer attention in this regard will not only result in personal savings, but will also make an indirect contribution to the state of the planet. Behaviour changes are emerging, especially in

times of economic recession, and as they become more widespread they can help to build greater food security (see Chapter 13). In this context, it is worth considering the potential contribution of the Mediterranean diet in the complex debate on the fight against food waste. If this is really to be considered a sustainable pattern of consumption in every sense of the word, it is clear that reducing agricultural and food losses will also have to involve this famous diet, which continues to be one of the living emblems shared by all Mediterranean societies (see Chapter 10).

Large-scale retail sector is also working to change its rules on unsold products and use-by dates for products on the shelves, making a much clearer distinction between expiry dates and best-before dates. This growing awareness on the part of consumers and agrifood chain operators is therefore a collective movement worth highlighting (see Chapter 11). In the rest of the Mediterranean region, there is less recognition of food waste than there is in the north, and to date it has barely been translated into a legal framework. However, certain sectors of society (schools and universities, environmental associations, businesses) are starting to catch on. The issue is now a strong factor in innovation policies rolled out both by private economic operators and national and international public institutions (see Chapter 12).

There can be no doubt that a drastic reduction in food waste, either post-harvest or during consumption, offers a more effective and sustainable lever for development of the planet. It also represents a critical opportunity for farmers. Post-harvest losses automatically translate into loss of income for them, since they have lower quantities available for sale. For a long time, this aspect was overlooked. It is to be welcomed that the issue has now been accorded a higher place on the international agenda and that strategies have been set up by a number of countries and regional and local authorities. The G20 ministerial meeting on agriculture, held in Istanbul on 8 May 2015, underscored the importance of the subject in its communiqué. The Turkish authorities naturally focused strongly on this issue, given their current efforts to reduce wastage of bread in the country, with highly encouraging early results. Other governments in the Mediterranean region have adopted policies seeking to reduce agricultural losses and food waste. FAO has made this a priority in its Strategic Framework, and has assigned it as one of its three regional priorities for countries of the Middle East and North Africa, along with support to small-scale and family agriculture and increasing resilience to crises. CIHEAM has also become more actively engaged on the issue, convinced of the need to combine strategies for combating wasted natural resources and agricultural output with steps to prevent loss of knowledge and knowhow.

## Feeding knowledge

The transfer of knowledge from one generation to the next, through good practices adapted to local conditions, is proving just as effective a strategy in the 21<sup>st</sup> century as it was in the past. But this transmission should not be exclusively vertical. It should be shared on the scale of landscapes, countries or even regions. In the Mediterranean, the challenges are such that there is a real need to promote good practices, exchange experiences and listen to how people use other techniques.



Knowhow is effective at the moment it is passed on to new generations, but it will become even more valuable if it is shared collectively and allowed to develop over time. The accumulation of top-down research that is never really shared, the duplication of ideas without any coordination and the lack of synergy between stakeholders – these are all facets of the same problem: wasted knowledge. Given the particular challenges posed by climate change, every solution counts and these can offer courses of action for farmers or fishers living on the other side of the Mediterranean, who observe the good practices of others and nearby innovations.

To feed the planet, it is important to nourish women and men with the ideas and knowledge that research can generate. But if these are to be used to the full, they must be integrated into training systems, which will need to become the receptacle through which knowledge is disseminated as it accumulates, without which it may well simply disappear. If there is to be sustainable food security in the world, it will be critical to combat this type of waste as well as the others! And when talking of new knowledge, let us not forget traditional knowhow, which deserves more attention, given its potential for offering solutions in some situations. This is especially true in the fight against climate change, as rural communities have long since learned how to deal with weather related events (see Chapter 15).

More broadly, local solutions need to be made more widely known, and modern communication technologies can help to catalyse this diffusion. That means nourishing knowledge through greater sharing of experiences, knowhow and ideas. A circular economy of knowledge represents a valuable tool to help combat difficulties, scarcities and threats. To put it another way, societies' primary source of resilience is often their knowledge, together with their ideas and experiences. Aside from combating wasted knowledge, there is a strong case for observing human action. People invent responses to problems that arise and in doing so accumulate knowledge, which settles over time and spreads to other areas. Women and men are protagonists of solutions that can overcome under-development. This positive vision of human activity on the state of the planet focuses firmly on people's ingenuity, which is capable of reversing trends, creating and finding local solutions and adapting them to respond to global challenges. Acknowledging this, the proposal can be organized around three pillars: economic, environmental and social approaches, supported by innovation, an important component of all three. In this sense, innovation means two things. First and foremost, the capacity of human beings to bring about change, advance scientific progress, nourish knowledge and make historic shifts, which can sometimes generate giant leaps for humanity. Implementation of the SDGs at local level must take into account the specific cultural, social, economic and geographical features of societies. Innovation for development is necessarily local and distinctive. There is no magic bullet solution. It is crucial to adapt to local realities if knowledge is going to be effectively aligned with practices, needs and the constraints of a situation for which an action needs to translate into a tangible result to improve people's lives (see Chapter 17). Each territory can therefore invent its own model (or models), at its own pace, with its own actors, difficulties and stories.

At a time when it is important to bear in mind the central role of human security in strategies for sustainable development, and therefore to play close attention to the coherence between the various social, economic and environmental pillars (which are catalysed by innovation and human ingenuity), it is critical to promote and support producers, in their diversity, taking account of their specific characteristics and their needs. In the Mediterranean, as elsewhere, it would be dangerous to build a future in which the human and social dimension of producers was diminished. There are a great many producers in this region. Their faces and territories are not necessarily well known and supported by public opinion and policies. But there will be no sustainable development of towns without development of rural areas, and there will be no dynamics in these outlying areas without producers becoming organized and unless there is participation by local communities.

No quantitative or qualitative improvement of agricultural output – crucial for all local development – can be lasting without the involvement of men and women farmers and their organizations. These are driving forces for proposals and vectors for change when it comes to helping to shape producers' activities in the best way possible. Despite their economic and social value and their right to participate in the decision-making process, farmers – especially men and women smallholder family ones – are too often excluded from local governance. While their presence is indispensable to the implementation of coherent development policies that are in line with local conditions, their voice is not sufficiently heard. This trend must be reversed if there is to be real progress on the path to sustainable, responsible and inclusive development (see Chapter 16).

Initiatives under way aimed at improving the organization and collective management of supply chains risk failing in their objectives if farmers are not sufficiently involved, as full partners, in the development of institutional frameworks, including legislation and the drawing up of regulations and agricultural policies. The agricultural cooperative movement shows the extent to which producers are capable of playing a leading role in the dynamics of governance, in this case at local level.

There is a similar pattern for the transfer of knowledge and knowhow. There continue to be insufficient exchanges between producers and the world of research, given the challenges of food insecurity, access to natural resources and conservation of biodiversity. It is an error not to draw more inspiration from the inventiveness shown by producers and for research institutes not to take adequate account of existing good practices. A farmer's land is an open-air laboratory. The solutions that he or she puts into practice are the fruit of careful analysis and seek to draw benefit from the constraints and opportunities offered. Transmitted locally, this skilful adaptability gives producers unrivalled expertise, to which researchers would do well to attribute greater value, and do more to disseminate further afield.

It is equally important to encourage producers to consider diversifying their activities and to offer them a central place in initiatives designed to make rural life more attractive. That would enable young people living in rural areas to make career plans there and feel that they have a place in society. It cannot be stressed enough that for today's young people, the rural exodus seems the only escape route possible. In

search of work, essential services and leisure activities, they move to the cities, while the world of agriculture grows progressively older. In the Maghreb, the average age of farmers is now more than 50, and fewer and fewer people are taking up the mantle. Public policies must overcome a double fissure between cities and rural areas. As well as an economic and social divide, there is also a generational one, which is becoming progressively wider. Taking account of the needs and aspirations of the new generation in these places will be achieved more than anything else by giving value to an agriculture sector that is in a state of flux – one that is increasingly rooted in the digital economy, but is able to absorb traditional knowledge, technical innovations and social development (including the feminization of agriculture), so as to take on a definitive role in the future.

It is clear that agriculture alone cannot supply all the needs of rural communities, who are often made vulnerable by poverty, unemployment or geographical isolation. But a public policy that integrates long-term agricultural development, mindful of the women and men who depend on it, can help to create a virtuous cycle in the Mediterranean region. Such considerations mainly concern agriculture. However, although their sphere of action may be different, the fisheries and forestry sectors are also threatened by the same dangers of scant social recognition and erosion of knowledge. Given their contribution, firstly to food security and secondly to climate change, this report would be wrong to ignore them.

All this points to a need to reposition issues linked to agricultural and rural development at the centre of the very wide and extremely complex topic of migration and human mobility in the Mediterranean region. Substantial numbers of people are currently on the move, against a backdrop of social and territorial distress. The management of humanitarian emergencies, where the issue of food is a central one, is an essential factor, which requires a simultaneous medium and long-term response. FAO and CIHEAM both regularly highlight the acute strategic importance of this challenge in the region and are working to develop concrete programmes that can help to advance inclusive development (both in social and spatial terms) in the Mediterranean.

## **Mediterra 2016: an invitation to overcome waste**

The subject of waste in its various dimensions (resources, loss of food and knowledge) is an important issue for the Mediterranean. In order to improve the food security of communities in this region, improved natural resource management, reduction of agricultural losses and the adaptation of knowledge to primary needs are all strategic levers for concrete and pragmatic action. It is for this reason that CIHEAM and FAO have decided to form a partnership to carry out a cross-cutting analysis of such forms of waste, with results of discussions presented in this edition 2016 of the *Mediterra* regional report. This three-dimensional vision of waste – whose strands are complementary and interwoven – and of innovations to combat it, are at the core of CIHEAM's Strategic Agenda 2025. This seeks to give priority to its mission of Mediterranean development in the years to come through a focus on

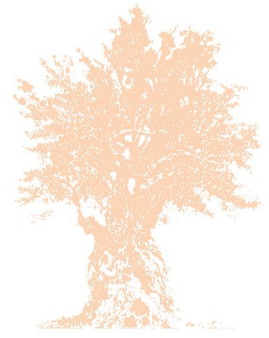
four pillars (combating waste, strengthening food and nutrition security, inclusive development and risk management/preventing tension). The same vision is central to FAO's Strategic Framework through a focus on five pillars (eradication of hunger, making agriculture, forests and fisheries more productive and sustainable, reducing rural poverty, setting in place more open and efficient food systems, increasing the resilience of livelihoods to threats and crises) and to one of the regional initiatives for North Africa and the Near East.

Readers will find the report structured around these three dimensions. The first part reviews each of the resources for which waste is a real issue and calls for an analysis in the particularly constrained circumstances of the Mediterranean. The second focuses on food losses and waste (both land and sea-based), exploring both the extent of the problem and a promising pathway for improving food security and, as a spin-off, resource management. The third part concentrates on the erosion of knowhow, due to poor knowledge dissemination, exploring the risk this poses of collapsing agricultural models and the rediscovery of new systems of knowledge and innovation.

While the report places the spotlight on this triple waste, it also looks carefully at the innovations and inclusive policies that are attempting to address the issue. Indeed, the study aims to shed light on these issues, in order to promote discussion and serve as a catalyst for action. We are firmly convinced of the need to pursue this path, working together with all actors in multilateral Euro-Mediterranean development, as well as with political decision-makers wanting to invest in the post-2015 development agenda. In this region, implementation of the agenda will rely to a large extent on agriculture, fisheries, forestry and food or, to put it another way – and at the deliberate risk of repetition – on human beings and social dynamics, above all else.

# ABSTRACTS

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## CHAPTER 1

Combined with the effects of climate change, urbanisation, economic, social and demographic transformations exert even greater pressure on the already threatened natural resources. At global level as well as in the Mediterranean, the management of water, land, forest and biodiversity is more than ever essential to meet the Sustainable Development Goals by 2030. This chapter addresses the state of natural resources at global level while stressing the necessity to struggle against waste and losses of natural resources but also the need for cooperation, social and organisational innovation at different levels.

## CHAPTER 2

Effective management that ensures the sustainable exploitation of living marine resources is crucial for the biological, environmental and socioeconomic vitality of Mediterranean fisheries. This chapter reviews the characteristics of the sector's management in the region and highlights challenges it faces, such as the reduction of discards and bycatch and the struggle against illegal, unreported and unregulated fishing. Current management efforts, such as the implementation of species prohibitions, gear selectivity measures, and fisheries restricted areas, are discussed, together with the legal framework and compliance mechanisms that support their application. Ongoing challenges and future action, both to better manage the resource and to improve sustainable livelihoods in the sector, are presented.

## CHAPTER 3

While Mediterranean agriculture suffers from water scarcity coupled with great yield and knowledge gaps with a permanent wastage of food and resources, future scenarios of water availability seem to validate the fact that multi-level action and measures are to be necessarily implemented to guarantee food security. In this perspective, this chapter addresses the key components of water resources management in order to contribute to a holistic understanding of the problems and the

corresponding adequate solutions. The latter are a combination of technological and managerial interactions within the water-food-energy nexus that may only be addressed correctly after the identification of the sectorial gaps. For this purpose, this chapter sums up problems and solutions in the form of water policy recommendations, an indispensable starting point to achieve sustainable food security.

## CHAPTER 4

This chapter analyses the status of land resources in the Mediterranean with a special focus on the Middle East and North Africa. The scarcity of natural endowments, limited options to increase cultivation and climate change threatening scenarios could increase the region's reliance on imported food. Consequently, sustainable land management becomes a strategic priority. The region must protect its limited productive lands and implement land use policies based on the biophysical potential, social and economic considerations and focused on the needs of farmers. In order to reverse the current land degradation trend and reduce the waste of arable land, a plan of actions and solutions should be provided to policy makers at different levels.

## CHAPTER 5

The human pressure exerted on Mediterranean forests for millennia has resulted in highly humanised ecosystems, which are considered as complex socio-ecological systems. The unsustainable use of forest resources has both led to land abandonment and overexploitation that, combined with climate and socio-economic changes, is creating conditions for an accelerated degradation of forest resources. In order to avoid the waste of forest resources and preserve their multifunctionality, innovative approaches to sustainable forest management are strongly required.

## CHAPTER 6

The Mediterranean area is a major centre for biodiversity that plays a key role in food security and nutrition and serves as a source of income and other services on which people depend for their livelihoods and welfare. This chapter provides an overview of the diversity of plant and animal resources in the Mediterranean region, including both wild and domestic species and focusing on crosscutting issues. Given the intensification of agriculture, tourism and demographic growth threatening these resources, as well as the challenges of increased food demand and climate change, this chapter highlights the importance and recalls the crucial need for a reasonable management of plant and animal resources and identifies possible solutions. The conventions and agreements on biodiversity signed by the majority of Mediterranean countries should be translated into national policies and strategic plans promoting the integration of agro-ecosystem approaches. The overview also reveals the need to better strengthen the institutional framework and capacities, particularly in the southern Mediterranean countries, and enhance the collaboration between existing organisations and programmes in the region.

## CHAPTER 7

Northern Mediterranean countries are usually more energy efficient than southern and eastern Mediterranean countries. This also applies to the use of renewable energy, where mature and cost-effective technologies exist. Combining energy efficiency with an increased use of renewable energy would reduce the dependency of agriculture on fossil fuel and thus contribute to the reduction of GHG emissions. However, this requires improvements in policy measures and institutional settings, and the use of a water-energy-food nexus approach. Currently, there is international support to promote both improved energy efficiency and increased use of renewable energy in the region. Such support should also be adequately provided for the agri-food sector.

## CHAPTER 8

While the 2030 Agenda is intended as a global framework, not much discussion has taken place yet to consider what the new Agenda could mean for a region such as the Mediterranean, given its unique features, particular challenges and fragmented political integration. Despite the progress made to achieve the MDGs in the region, several challenges remain to both ensure food security and reverse the degradation of natural resources. The waste of these resources is a serious constraint to sustainable rural and agricultural development while the loss of local knowledge associated to the environment is closely related to their depletion. This chapter outlines the main challenges faced by Mediterranean agriculture and natural resources in the framework of the 2030 Agenda towards the Millennium Development Goals (MDGs), highlighting critical improvements to be made and gaps to be filled with respect to the new Sustainable Development Goals (SDGs). It then specifically focuses on the main regional initiatives aimed at rural and agricultural sustainability, before an in-depth discussion on what it could mean and what it would take to implement the 2030 Agenda for Sustainable Development in the Mediterranean at regional, national and local levels.

## CHAPTER 9

Given the existing food security and increased resource scarcity challenges, the issue of food loss and waste (FLW) has become very important for the international agenda as it has far-reaching social, economic and environmental implications. FLW are of particular concern in the Mediterranean area. Their reduction is therefore widely acknowledged to contribute to abating interlinked sustainability challenges such as food insecurity, climate change and water shortage. This chapter focuses on the connections between FLW and sustainable development, food security and nutrition and sustainable food systems while highlighting their main economic and environmental implications. The list of the main drivers and causes and their extent along the food chain enable a comparative analysis of FLW of different agro-food product. The opportunities and challenges for FLW reduction and prevention are also addressed. This chapter also gives insights into the legal framework and the institutional environment for FLW reduction in the Mediterranean. Coordinated action and a systemic and holistic approach fostered by a comprehensive policy

addressing efficiently and effectively the FLW issue are necessary. Organisation and governance of the agro-food chain must also be improved. As such, the CIHEAM and the FAO have a crucial role to play in the harmonisation and coordination of regional initiatives.

## CHAPTER 10

The Mediterranean Diet is a dietary pattern and lifestyle that is characterised by its multiple nutritional benefits, as well as by its effects on the environment, society and economy. This pattern has been eroding steadily over the last few decades leading to an increasing waste of food, knowledge and natural resources. In order to promote the Mediterranean Diet as a sustainable food consumption pattern, it is essential to identify and quantify its constituents and promote policies that will integrate these characteristics in the lifestyles of modern societies.

## CHAPTER 11

In the Mediterranean region the food losses and waste are estimated to exceed USD 50 billion annually in terms of farm gate prices. These losses are often attributed to the lack of appropriate infrastructures throughout the food value chain; therefore there is a pressing need for establishing “green” food value chains to serve the specific goals of prevention, reduction and recapture centred on products, processes and systems. Within this context, critical issues in post-harvest management should be taken into consideration by implementing new technologies such as active and intelligent packaging, nanotechnologies, use of sensors, indicators and new ethylene removing approaches. Moreover, investment in research and development is a prerequisite for greening the food value chain in the Mediterranean while the major challenge is to attract funds for investments in green, innovative infrastructures in order to increase exports as well as food security. It is thus clear that policy-makers and policy-level decision makers must urgently consider these issues as they contribute to improved food security (and health and safety), the mitigation of climate change, increased employment opportunities and the struggle for gender equality.

## CHAPTER 12

The potential of innovation when addressing the challenges faced by the agri-food system is widely recognised today. This chapter aims to explore the contribution of innovation to FLW prevention and reduction that weaken the sustainability of food security and the agri-food system in the Mediterranean. After presenting innovation models and types (product, process, organisational, social, political, institutional), it then describes the existent strategies in food waste management hierarchies and pyramids and provides concrete examples of innovations that have been used in different countries and contexts for the prevention and/or the reduction of food waste along the food chain. Some initiatives and good practices for FLW recycling and re-use are also mentioned. Innovative practices should be mapped and disseminated to reach the concerned actors of the food chain and to develop an enabling political and institutional environment.



## CHAPTER 13

Food waste is directly related to consumer behaviour but it is also indirectly related to retailer behaviour. This chapter successively addresses the current trends in Mediterranean developing countries and those observed in developed ones. It also provides insights of some specific countries that are reviewing their national policies. This analysis reveals that food waste occurs with greater intensity in developed countries and developing countries should learn from past experiences of wealthy consumers. The economic crisis has resulted in a change in consumption habits and greater awareness on food waste. Food banks collecting important quantities of food, which are distributed to people in need, have strongly developed. Awareness-raising campaigns for short-term and long-term impact on consumer education seem to be the most effective tool to reduce food waste.

## CHAPTER 14

This chapter and the section that it introduces address a little tackled and yet very important subject: the waste of knowledge and human resources. It provides an overview of the establishment and evolution of agricultural knowledge in its various forms (technical knowledge, knowhow and associated lifestyles). It highlights both the factors that threaten knowledge and their rediscovery under the form of new systems of knowledge and innovation. The chapter concludes by providing a number of recommendations for inclusive policies aimed at the protection and the remobilisation of this knowledge.

## CHAPTER 15

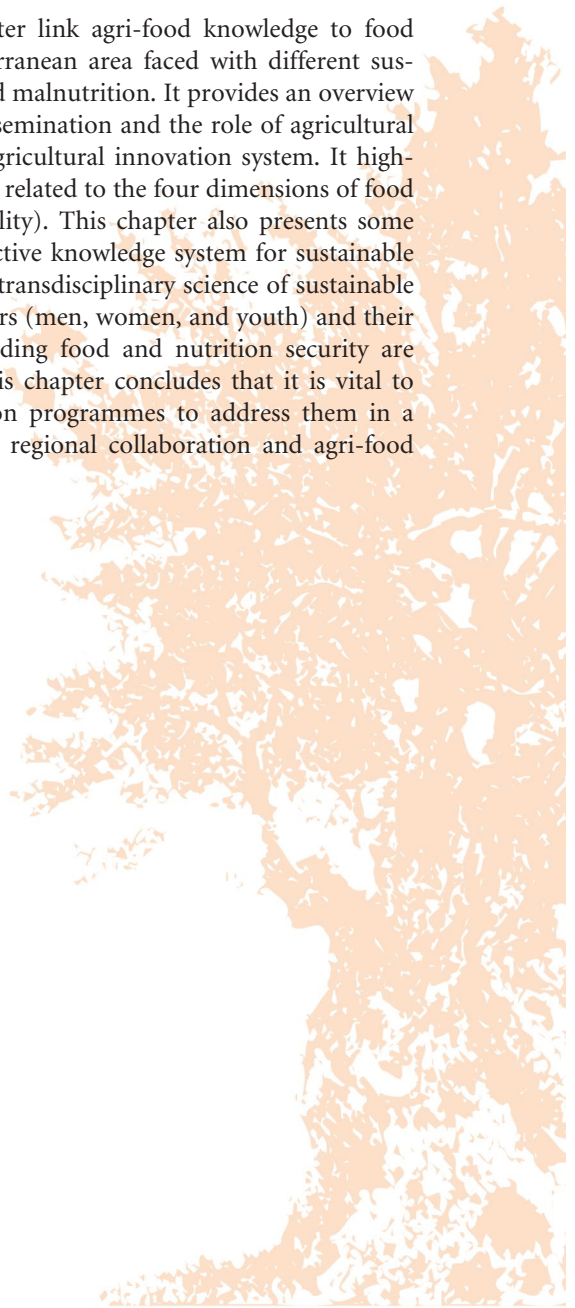
The concept of agricultural knowhow here refers to the knowledge accumulated over centuries and that has been slowly carved by exchanges, confrontations, trade and the mixing of cultures even at very local levels throughout the Mediterranean. Although the differences between the North and South of the basin are strongly marked, each locality has traditionally enjoyed a unique identity and a strong individuality in its history. Closely related to the loss of traditional knowhow, the weakening of these identities is shaping a new Mediterranean. A Mediterranean that is northern and southern, local and global, technical and traditional, a constant rebalancing region that is a both complex and unstable. A Mediterranean where it is becoming urgent to save knowhow in danger of being marginalised (and depleted) and align it with the scientific advances of the past decade, in order to address in an integrated way, the various current and foreseeable crises that threaten the fragile balance supporting life in this basin. This chapter argues for the emergence of new production systems, breaking with the current trend of resource degradation and marginalisation of large rural areas, in order to meet these challenges. Agro ecology is presented here as one possible way to collectively live through this course in the cultural, scientific and economic evolution of the Mediterranean.

## CHAPTER 16

This chapter addresses family agriculture and its assets to promote the development and the fight against all forms of waste starting with the waste of knowledge and human resources. It stresses the need to act in favour of this agriculture that is faced with several challenges. The well-known guidelines for such an action are recalled and new fields of intervention are identified in order to ensure that knowledge and innovation systems that are being implemented, or even the ongoing digital revolution in agriculture take account of family agriculture.

## CHAPTER 17

This chapter aims at exploring ways to better link agri-food knowledge to food security needs and challenges in the Mediterranean area faced with different sustainability issues including food insecurity and malnutrition. It provides an overview of agricultural knowledge generation and dissemination and the role of agricultural extension and advisory services within the agricultural innovation system. It highlights the main knowledge and research needs related to the four dimensions of food security (availability, access, utilisation, stability). This chapter also presents some options and strategies for developing an effective knowledge system for sustainable food security by stressing the need for a new transdisciplinary science of sustainable food systems and the involvement of producers (men, women, and youth) and their organisations. Many of the challenges regarding food and nutrition security are common to all Mediterranean countries. This chapter concludes that it is vital to set up a joint research agenda and education programmes to address them in a collaborative way and calls for strengthened regional collaboration and agri-food diplomacy.



# MediTERRA

## ZERO WASTE IN THE MEDITERRANEAN Natural Resources, Food and Knowledge

- Agriculture and food security are two major global challenges. Situated at the heart of the new Sustainable Development Goals (SDGs), they raise several strategic issues for countries and international cooperation. 'Produce more and better', such is the equation to help address the challenges related to population growth, changing consumption patterns and scarcity of natural and financial production resources. In this context, the reduction of agricultural losses and food waste has become a priority.
- The Mediterranean region is particularly concerned by these dynamics that affect human security, inclusive economic and social development and adaptation to climate change. The issue of waste has to be understood through the perspective of responsible management of natural resources, production and consumption of food but also the enhancement of knowledge and knowhow.
- *Mediterra 2016* offers an integrated, innovative and prospective approach on the issues of triple waste reduction (of natural resources, food and knowledge). This new edition features a collection of shared expertise and local experiences in the Mediterranean region. It provides the keys to reading and solutions for action targeting policy-makers, development operators, professionals and researchers.

This publication is codirected by the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM) and the Food and Agriculture Organization of the United Nations (FAO), two international organisations committed in the framework of a strategic partnership for sustainable development in the Mediterranean.



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ISBN 978-2-7246-1921-8



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