# PRIMA

## Joint Programme

# *Addendum*

Att.1

## INTRODUCTION

Taking into consideration Euro-Mediterranean RDI experience matured so far and simultaneously the fragmented funding landscape into small-scale projects or several co-fund actions under Horizon 2020, scientific, managerial and financial integration has become a necessary condition to obtain relevant innovative advancements in the crucial field of food production and water provision in the Area.

Challenges just mentioned need a wide, strongly structured and long –term committed partnership inspired by principles of co-ownership, mutual interest and shared benefits.

For this reason, I am very pleased to inform you that the support of Euro-Mediterranean Countries to the Consortium has considerably further grown after the submission of the Programme in 2014.

This is clearly demonstrated by financial commitment expressed in 2015 by Tunisia, and in 2016 by Cyprus, Egypt, Israel and Lebanon. This means additional long term cash contributions to be summed up to the commitment expressed on 22 December 2014.

Financial cash contributions, coming from 14 Countries, are now close to two hundreds and fifty million euros, with the significant participation of 5 non-EU States, out of which three are not associated to Horizon 2020. Furthermore, in-kind contributions are foreseen by the Participating States equalling at least their in-cash contributions. These in-kind contributions cannot be ex-ante quantified since they will highly depend on selected RDI projects but will be thoroughly reported ex-post.

Further countries have expressed strong interest and support to the PRIMA Initiative, participating regularly in PRIMA meetings. Furthermore, institutions of 5 countries who have not expressed yet their financial commitment to the PRIMA programme are willing to contribute to the definition of its Strategic Research and Innovation Agenda (SRIA) since they joined the application for a Coordinated Support Action entitled “4PRIMA”.

These signs all show a widespread attention and commitment to a stronger and integrated Euro-Mediterranean partnership in RDI.

Contributions announced so far are long-term national commitments (10 years) subject to the use of Article 185 of TFEU, which demonstrates that this instrument, compared to others, would allow the highest leverage effect on national public funds, and ensures the most stable commitments in the long-term.
Recent developments highlighted in this note and the contents of the attached Addendum make this belief even stronger.

The operational objectives of the Programme, defined in accordance also with the analysis of the previous Mediterranean and national RDI programmes and initiatives, has been structured around 3 pillars: 1) Sustainable management of water for arid and semi-arid areas; 2) Sustainable farming systems under Mediterranean environmental constraints; 3) Mediterranean food value chain for regional and local development. This structure in three pillars will also be the backbone of the upcoming Strategic Research and Innovation Agenda, but we would like to reiterate the willingness of the PRIMA

Consortium to take into consideration the priorities that the Commission will suggest, in particular with respect to the Work Programme 2018-2020 of Horizon 2020.

The definition and implementation of the Strategic Research and Innovation Agenda will promote the key principles of Open Innovation, Open Science and Openness to the World, highlighted by the European Commissioner for Research, Innovation and Science, M. Carlos Moedas. This commitment, dependent upon changes occurring in the ways science works, will allow widest possible dissemination of PRIMA results, thereby bringing greater concrete advantages to Euro-Mediterranean end-users, communities and enterprises, and fostering dialogue among different ministries (especially agriculture, environment, research, foreign affairs) from the largest possible number of Euro-Mediterranean countries.

PRIMA presents high potentialities in terms of Science diplomacy. Science diplomacy produces added value in promoting cooperation and conflict prevention, rebuilding trust and fostering shared understanding across countries. PRIMA Programme, as reported in the Addendum, aiming at tackling territorial imbalances, adaptation to climate change, water and food security through an integrated framework, could contribute to face migration issues.
International events occurred during 2015, such as the adoption of the 2030 Agenda for Sustainable Development and the related 17 Sustainable Development Goals by UN Countries and the Agreement achieved at the Paris Climate Conference (COP 21), confirmed the crucial role played by sustainability in the societal agenda for the future.

PRIMA topics and activities are perfectly in line both with this new international agenda and with the 10 priorities of Juncker's Commission – with a special focus on priorities 1, 3, 8 and 9. Furthermore, monitoring systems to assess the impacts of PRIMA projects will be based on the SDGs framework in the field of food security and water provision, taking into consideration general (e.g. poverty, health, land use, GHGs emissions) and sectorial issues (e.g. agriculture, water services), the biophysical limits of Mediterranean ecosystem and the water-food-energy nexus.

Since the date of the PRIMA Proposal submission, the importance of the PRIMA Programme has been reiterated by Ministers of Countries involved in the Initiative. In particular during the 2nd Dialogue 5+5 Ministerial Conference on Research, Innovation and Higher Education conveyed on 23-24 March 2015 in Madrid. In endorsing a work programme for 2015-2016 defining concrete steps to move forward cooperation, the Ministers of the ten governments involved (Algeria, France, Italy, Libya, Malta, Mauritania, Morocco, Portugal, Spain and Tunisia) expressed their full support to the PRIMA programme.

On 20 July 2015, Ministers of EU Member States confirmed their support to the PRIMA initiative during the Foreign Affairs Council, by inviting the Commission to a rapid adoption of a proposal for PRIMA under Art. 185 TFEU.

PRIMA is a scientific bridge across the Mediterranean sea. We hope to count on your support to reinforce the foundations of this bridge and make it as strong and as stable as possible in the long-term

Angelo Riccaboni
Chair of PRIMA Consortium

## 1. Information on the scale and scope of PRIMA's past activities and the relation to other initiatives

1.1 Detailed mapping on the past and ongoing activities in the Mediterranean Area in the fields expected to be covered by PRIMA. This mapping needs to include both EU-funded and Member States funded activities.

1 Mapping

1.2 Sufficient details on scope of the programme and the need to address the issues tackled by the programme at Mediterranean transnational level, development of Strategie Research and Innovation Agenda (SRIA), national integration and alignment

2 SRIA

1.3 Evidence why past and ongoing activities are not sufficient or have not led to successful results and established targets

3: Added Value

1.4 Identification of potential contribution coming from Cohesion Policy Funds related actions and to assess potential discontinuity and duplication issues in case PRIMA is adopted

1 Mapping

1.5 Indication of synergies and complementarities with ongoing initiatives (including non-EU funded initiatives).

3: Added Value

1.6 Justification why past and ongoing activities are not sufficient or have not reached PRIMA expectations.

3: Added Value

1.7 Clear prioritisation of targets, objectives and activities.

2 SRIA

## 2. EU added value and impacts

2.1 Detailed argumentation of the strengths and weaknesses of each major past and ongoing initiative, with an indication on how PRIMA would make the difference.

3: Added Value

2.2 Clear evidence of tangible, measurable and sustainable impact to be attained by PRIMA.

4 PRIMA impacts

5 Monitoring

2.3 In case the Art.185 option for PRIMA is adopted, which EU initiatives will be discontinued?

3: Added Value

## 3. Level of commitment of the Participating States to integration at scientific, management and financial level.

3.1 Information on the development of an SRIA, its definition, methodology and timeframe agreed among the Participating States in order to prepare the setting of detailed objectives, targets to be achieved, actions and impacts and its translation in (annual) Work Plans.

2 SRIA

3.2 Clarification of planned integration at national level, including beyond the researchers community, as well as integration towards countries/actors that are not part of the initiative.

Integration

3.3 Confirmation of the choice and legal form of a DIS and the planned legal provisions for the PRIMA governance (including relevant documents)

Confirmation of legal form DIS

3.4 Clarification of the planned implementation/integration modalities that would be applied (Central grant management, comprehensive use of Horizon2020 RfP and Model Grant Agreement (MGA) based on Horizon2020 MGA).

Clarification implementation

3.5 Confirmation of compliance with the Horizon 2020 Rules for Participation (e.g. evaluation of proposals, grant agreements, eligibility for participation and funding, funding rules, IPR) and clarification of any intended or desired derogations.

Clarification of compliance with the H2020 Rules

3.6 Additional information/confirmation on commitments by Participating States on cash and in-kind contributions and their intended use in relation to operational and administrative expenditure, annual attribution, matching with the Union contribution and leverage.

Financial Commitment

# Contents

# Chapter 1. Mapping

***Report on national, EU and international funded R&I programmes and activities with reference to PRIMA objectives***

# 1. National Programmes

## 1.1 National Programmes in Mediterranean Partner Countries

Based on a fast-track survey conducted in 2013 by **Med-Spring Project** (EU FP7 INCO-Net) on the national research programmes and involving 7 Mediterranean Partner Countries[1] (for a total of 13 programmes considered), an analysis was carried out in order to assess potential and themes for synergies in view of strengthening the present frame of Euro-Mediterranean cooperation and joint programming on research and innovation.

The survey has highlighted the following main features:

- National programmes might be divided into two groups: the ones having national connotation (but supporting also cooperation of national research teams with international partners) and the ones having a bilateral dimension mainly based on funding activities only with one specific country.

- As for the type of actions funded by the analysed national programmes, applied research is the most recurrent one, followed by capacity building, mobility, technological development, basic research.

- Within each MPC the programmes cover a large variety of topics. The topical area supported by most programmes is "**agriculture**", followed by "energy and energy technology", "environmental research", "social science and humanities" (Figure 1).

- The strategic orientations of the analysed programmes are quite similar among the countries concerned. The major objectives of the national programmes are: improving capacity of national research infrastructures, developing human resources, exchanging and importing knowledge, commercializing research results through different channels.

- The total financial efforts produced by all MPCs national programmes together is still limited to tackle important transnational challenges in agriculture, water and food. ***Synergies are to be sought with EU countries showing strategic programming in the same themes***.Support of MPC national programmes to projects varies from small project grants of **2000 Euro** (in Tunisia) to large project grants of **1.500.000 Euro** (Egypt) in different thematic areas. In box below some Countries' examples of project funding is given.

- In many cases there is a loss of time and resources caused by complex administrative procedures, and some inefficiencies are also due to the availability of funds which is subject to unforeseen changes not related to national research policy.
- The level of industry involvement is rather weak. The same holds true for involvement of other stakeholders and civil society.

[1] Algeria, Egypt, Jordan, Lebanon, Morocco, Palestine, Tunisia.

- The degree of opening for international participation varies a lot between the different programmes of the different countries. While four programs from Tunisia, Jordan and Palestine are reported not to be open for participation from "third countries", i.e. partners neither from the MPCs nor from the target countries, eight programmes show this possibility. In Egypt, all funding programmes foresee the involvement of foreign researchers if necessary. The foreign involvement should especially be used for consultancy purposes. In Algeria, programmes are based on international schemes, so international consortia are per se required for participation. In Lebanon different setups are used, and programs are open for participation of researcher from Europe, the US and Canada. The international component of the programs is in most cases aimed at exchanging experience between experts in the field of research, and to build up network to face the main societal challenges in the MPC.

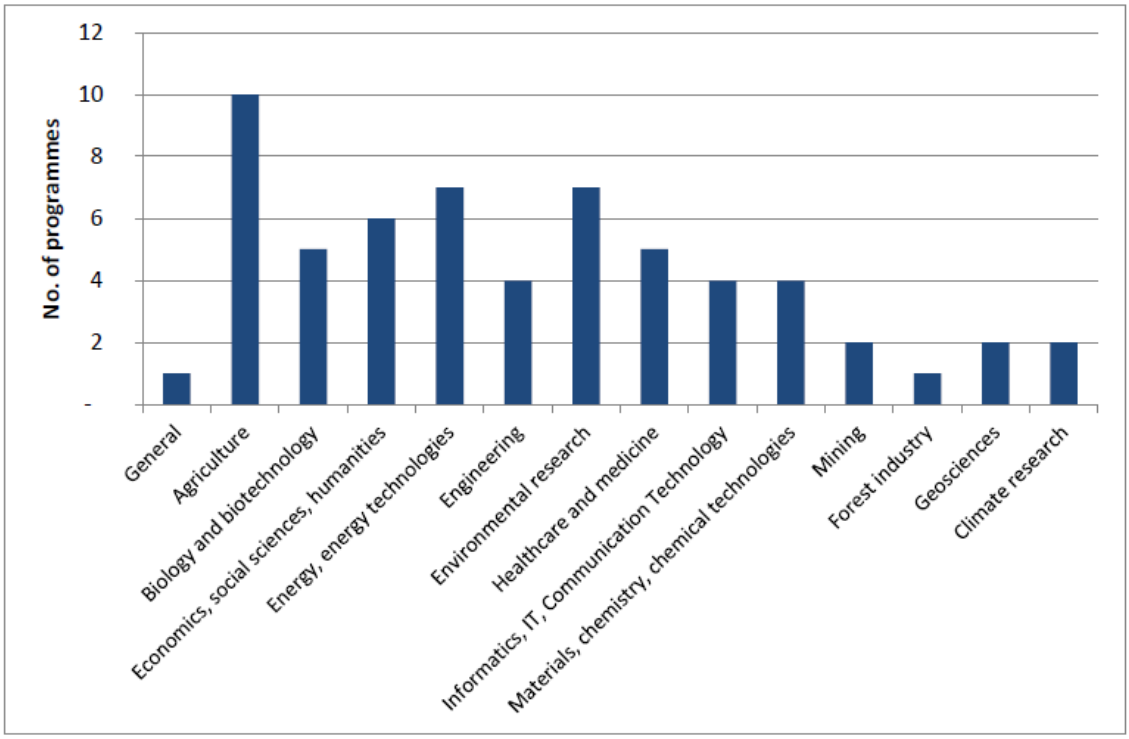


*Fig. 1 – Topics covered by MPCs national programmes*

Some good practices of national programming in MPCs are given in the box below:

**Some relevant funding examples from MPCs**

**Science and Technology Development Fund in Egypt**

The Egyptian Science and Technology Development Fund (STDF) constitutes an interesting example of how a MPC supported three ambitious programmes in the period 2011-2013 regarding: i) water desalination; ii) improvement of sustainable food production; iii) Renewable Energy Design, Fabrication and Verification - for a total of 3M Euros. These programmes funded applied research, capacity building and mobility projects aimed at achieving specific objectives related to the above mentioned topics. The projects funded achieved significant results, such as the novo sequencing of the Egyptian Buffalo Genome or the development of a prototype CSP (Concentrated Solar Power) system. The programmes were opened to the participation of international researchers and *STDF considers the further development and exchange of the results obtained with the international community an important opportunity for the programmes considered, which constitutes a base to build on for joint programming with other countries, both EU MS/AC and MPCs*

**CNRS-L Grant Research Programme (GRP) & PhD Scholarship Programme in Lebanon**

The National Council for Scientific Research - Lebanon (CNRS-L) established and launched the Grant Research Prorgamme (GRP) since 1962. It is designed to extend financial support to Lebanese researchers working in various academic institutions concerned with scientific research in Lebanon. With an annual budget of around 1.3 Million Euros, the Programme has funded a considerable number of research projects, having a strong impact with particular reference to the projects on Environment and Public Health. This programme is a good example of coherence with national priorities, as the call for proposals reflects the needs to face national challenges in Public Health, Social and Human Sciences, Environment, Food Security, Energy & National Resources Management.
In parallel, the CNRS-L through its Scholarship Programme, also supports Lebanese students who wish to pursue their doctoral studies. PhD scholarships are granted nationally (through 6 national agreements for co-funding PhD students within Lebanese Universities); or through co-direction with French Universities (4 Agreements with French universities/institutions co-funding PhD).

**National Research Strategy Morocco**

In the period 2016-2018 Morocco has foreseen the launch of calls targeted to specific sectors, particularly: cancer (with a budget of 2M Eur); agriculture (with a budget of 10M Eur); water (with a budget of 2M Euro).

**National Research Programme Tunisia**

The Tunisian National Research Programmeis a programme aimed at the valorization of research results in major societal challenges. In particular, in 2014, the programme used a budget of 4MEuros to support a total of 95 projects in the following themes: Agriculture and fisheries (26 **projects); Industry and Energy (19 projects); Health (14 projects);** Environment and Water **(12 projects); ICT (11 projects); Biotechnology (9 projects); Human and Social Sciences (1 project).**

Overall, there is a ***high potential for a stronger integration*** of national research programmes of the countries considered. In fact, we can conclude that there are "***potential benefits of a stronger cooperation through multilateral activities. A multilateral funding scheme could address some of the identified weaknesses of uni-or bilateral activities, e.g. fragmentation and the necessity to build up a critical mass of funding. Cross-border cooperation on commercialization using the different channels of technology transfer could be a driver for innovation activities. From the technical side, the survey shows that programme owners in the MPC follow similar approaches to***

***programme management. This indicates that good instruments for multilateral cooperation are in place. MPC programs target similar topics, showing potentials for further cooperation in the Mediterranean Region on common objectives***".

In addition , it is important to highlight that research and innovation in "**agriculture**" reveals to be the most important topic for all MPCs, therefore ***any future joint programming initiative on R&I, in order to be in line with national priorities, should address agriculture in all its dimensions.***

## 1.2 National Programmes in EU Member States

Based on a survey conducted in 2014 by ERANETMED project (final version to be published soon on www.eranetmed.eu) on the national R&I programming of eight EU member States[2],which considered 65 different programs, the analysis of potential for programme synergies and alignment among EU countries and with the MPCs has been also conducted. The following features should be underlined:

- All countries concerned have programs ranging from national (unilateral), to bilateral and multilateral (including opening for international cooperation). In almost all cases national programs are open to third country collaboration even if expenses for non-national researchers are not always eligible.
- As for the themes covered by the national programmes, they have a wide coverage and it is rare that a national programme is focused on a specific research area or theme like – for example - "only water" or "only food" or "only climate". These topics are generally linked to broader strategic intervention in agriculture, sustainable development, management of resources, environment. Globally speaking the funding for national calls for research proposals ranges from environment, climate agriculture and food to health, energy, sustainable development, biology, biotechnology, engineering, economics and social sciences, and other themes. (Table 2, Figures 2 and 3).
- The national programmes show slight differences in their main objectives. These differences are mainly linked to the internal process of granting projects, the type of eligible actions and – in particular – the financial size. Some countries, like France and Italy for example, support a wider range of actions, from basic research to innovation, flagship projects, actions dedicated to industry. While other countries having limited budget, tend to concentrate the financial support to basic research. In general, ***the opening to international cooperation is commonly seen in all countries as the main strategy to tackle societal challenges that needs transnational and regional approach, like for example climate, water, food.***.
- On the other hand, national programmes have some problems in common, like the need of higher link between research and innovation and low research competiveness compared with major countries outside Europe (i.e.: US, Canada, Japan) and the need to give more continuity to research in strategic topics. On the other side, some countries (i.e.: Cyprus, Malta, Greece) suffer of insufficient funding and lack of continuity in funds, brain drain, weak valorization of research results.
- There is no synchronisation of programmes in Europe. There are multi-annual programmes (example: Italy, Greece, Turkey), while there are yearly revised programmes (i.e.: Germany,

[2]Italy, Germany, France, Spain, Cyprus, Greece, Portugal, Malta

France), where each year the programme is financially and thematically reviewed. In some cases (i.e.: Italy, Greece) the national research programme is issued with one or two years delay in relation to the original plan, this situation creating important gaps and discontinuities in research projects funding.

- In general, the most important financial contribution for national R&D activities, is shown by Germany (**2.85% of GDP**), France (**2.23% of GDP**), Italy (**1.26% of GDP**), Spain (**1.24% of GDP**) and secondarily by the other countries (less than 1%).***It is worth noting that Germany public expenditure for transnational research is above the EU27 average***, amounting to 4% of total expenditure (for further information: http://ec.europa.eu/eurostat/web/science-technology-innovation). As mentioned above main national research programmes supporting project grants through national calls are multi-thematic, addressing a large spectrum of challenges. However main challenges addressed by national programmes(normally not earmarked)range from Agriculture (or Food Security & Demographic Change for some countries like France for example)to Environment, Geoscience, Life &Health Sciences, Sustainable Development, Biodiversities, Health, Energy, Resources. Specific topics(i.e. water or food). The latter fields could be integrated in above main themes and have no earmarked budget. As described here below, Turkey is quite unique in its strategic plan, following a bottom-up approach for supporting basic, applied and frontier research projects, while having an oriented approach in special actions (i.e.: innovation, acceleration of research).
- When looking at the financial efforts by the different national programmes, in spite of the fact that specific topics relevant to PRIMA are not always earmarked, ***it is possible to highlight the high potential for building an important critical mass by aggregating the different budget lines of national programmes*** addressing research projects in specific themes. In this regard, it is interesting to highlight the following elements for the main EU countries of PRIMA (please note that the budget lines considered below are exclusively related to the funding of call for proposal for research projects and do not consider funds for the whole research system maintenance (i.e. infrastructures, doctoral and post-doctoral activities etc.) :

    - **France**: The National Research Agency (ANR) involved as funding agency in PRIMA on behalf of France, provides continue support to research since its definitive establishment in 2007. From 2007 to 2013, funding was allocated through thematic calls. Since 2014, the research support has been relevant in different societal challenges almost equivalent to H2020 ones, with an executed budget in 2014 of 415 MEuro (marginal costs) for calls concerning the whole **main societal challenges** (generic call) of which 25 MEuro executed for food security and demographic change, and 29MEuro executed for management of resource efficiency and climate. The remaining budget is allocated to other challenges, like Health, ICT, All-knowledge challenges, Industrial renewal, Clean and Secure Energy, Freedom and Security in Europe, Innovative and inclusive societies,

Sustainable mobility and urban systems. Budget of comparable size was available in 2015 for call for proposals in main societal challenges as well as in 2016 to remark continuity of funding. The programme includes a relevant international component across all the above years. No earmarking is given for the above challenges.

- **Germany:300M Euro** for basic research and **200M Euro** for technology and innovation have been allocated in 2015 by the national research programme of the research ministry for calls for proposal. Challenges are not earmarked. The research annual national research plan addresses different challenges: climate change, sustainable development, resources (including water), biodiversity, marine and polar research, pollution of the oceans, social-ecological research.Worth of mention the flagship programme GlobE, **45MEuro** in five years, addressed to Africa on global food supply and agriculture.

- **Italy** : the new National Research Programme 2014-2020, foresees an annual The National Research Programme 2015-2020 under approval, foresees six key topics: - INTERNATIONALIZATION, aiming to coordinate and complement national European and international funds; - HUMAN CAPITAL. Focusing on people as research actors, fostering mobility, dynamism and generational change; - RESEARCH INFRASTRUCTURE.

  Evaluating and selectively support research infrastructure, pillar of international research, especially basic research; - PUBLIC-PRIVATE. Strengthening public-private partnership to foster applied research, innovation capacity and the link between research and societal challenges; - "MEZZOGIORNO" Incresing the potential of Southern Italy Regions, enhancing its specificities, avoiding waste and duplication; - EFFECTIVENESS AND EFFICIENCY OF PUBLIC SPENDING to strengthen monitoring and transparency of investments, simplify procedures, strengthening administrative management.
  Specific acitions will be realized within the twelve Smart Specialization Strategy Areas of interest defined: - Aerospace; - Agrifood; - Cultural Heritage; - Blue growth; - Green Chemistry; - Design, creativity and Made in Italy; - Energy; - Intelligent Factory; - Sustainable mobility; - Health; - Smart, Secure and Inclusive Communities; - Technologies for Life Environments

- **Spain:** in the period 2011-2015 Spain disposed of up to 539 MEuro to support projects related to national research programme challenge 1 (health, climate change and welfare) and challenge 2 (marine food security, agriculture, forestry, and research in inland waters). The other challenges namely -) Safe, efficient and clean energy, -) Sustainable, smart and integrated transport; -) Climate change and efficiency action in the use of resources and raw material; -) Social changes and innovations; -) Digital economy and society; -) Safety and protection are also

addressed in the national research programme to support research projects. In addition, during the period 2013-2015, there were provided 596 MEuro, in reimbursable grants, to promote national research, development and innovation. Spain is active ininternational cooperation through the participation in various ERANETS with the Mediterranean countries. Spain works also in cooperation with non-EU Mediterranean countries in the framework of themultilateral program Eureka, with a contribution of 27 M euro.

- **Portugal**: the research national programme covers the following main themes exact sciences, agriculture, natural sciences, health, engineering & technology, social sciences, humanities, with an executed budget in 2013 of **105M Euro.** The national programme gives continuity in 2014 and 2015 to research funding in the above challenges with comparable budgets. . About 30% of the programme budget (thus about **30M Euro**) supports Natural and Environmental Science, in which agriculture, water, climate themes are included but are not specifically earmarked.

- **Greece:** The National Smart Specialization Strategy (2014-2020) is focused on different challenges: Agrofood, Tourism-Culture, Materials and Life Sciences & Health/Medicine, ICT, Energy, Transport and Environment. The executed budget deriving from public funding of the Strategy programme is **50 MEuro** in 2015, **60 MEuro** in 2016 with progressive increase until 2020, with no earmarked themes.

- **Cyprus**: the national research funding for national research projects is in the order of an executed budget of **40-50MEuro**over two years(programme 2009-2010) of which about 50% is supported RPF (Research Programme Funding Agency) involved in PRIMA.Main thematic areas are health, sustainable development, economy, ICT, society, technology, with an average of about 300 projects and 100 support actions funded over two years. There is no earmarked theme.

- **Malta:**The annual budget for research project funding in Malta is rather limited and ranges in the order of **1.2-1.3MEuro**, addressing the following (not earmarked) main themes: environment (including water) and energy, ICT, value added manufacturing and services, health and biotechnology.

- **Turkey:** the national strategic research plan 2011-2016 is still ongoing and characterised by a pillar supporting a bottom-up approach to basic and applied research projects while another pillar has an oriented approach for supporting areas in which there is need to gain acceleration. The latter is oriented to defence, space, health, energy, water and food. The programme is open to international cooperation in the strategic areas above mentioned. However,

there are clear efforts to give priority to certain areas relevant to PRIMA, the strategic plan supporting Agriculture (94 MEuro) and Environment (17 MEuro) projects. Geoscience is the most supported theme (98 MEuro). Worth of mention that Turkeyhasalsoapproved in 2011 a National Water R&D and InnovationStrategy and a National Food R&D and InnovationStrategy in line with PRIMA thematicareas.

Above figures refer to funds related to or managed by funding agencies directly involved in the PRIMA initiatives.

***The above overview suggest that a relevant critical mass and programme alignment can be built on common challenges like environment / natural resources, food and agriculture, which are a common denominator attracting funds of different EU national programmes, as well as MPCs' research programmes***. However, as mentioned above, most national research programmes have a wide and large thematic focus, and important sub-themes like water and food are often "hidden" within these large themes.In some cases, "water" and "food" themes are earmarked ad-hoc programmes or sub-programmes, like for examplein France, Italy, Germany.Whenthese two topics do not fall under an ad-hoc earmarked programme,they are integrated in the different challenges or main themes.

Here follows a table outlining the occurrence titles and semantic of national programmes funding research projects in EU countries involved in PRIMA. Thus, the objective of the table is not to show the thematic coverage of the programmes but the different semantic used by different countries' programmes to indicate similar themes and priorities. It is then drawn the attention to the fact that countries coverage is more or less uniform but using different headings. For example, in the case of France, all titles listed in the table are encompassed by the titles marked in the France column.

| Programme main theme / challenge | France | Germany | Italy | Spain | Portugal | Greece | Cyprus | Malta | Occurrence |
|---|---|---|---|---|---|---|---|---|---|
| Health & well being | X | | X | X | X | X | X | X | 7 |
| Resources efficiency /efficient management of resources / sustainability of natural resources | X | X | X | | | | | | 3 |
| Energy / Clean and secure energy | X | | X | X | | X | | X | 5 |
| Industry / Industrial renewal | X | | | | | | | | 1 |
| Agriculture | X | | | X | X | X | | | 4 |
| Climate change | | X | | X | | | | | 2 |
| Biotechnology | | | | | | X | | X | 2 |
| Food / Food security and demographic changes / food & fisheries | X | | X | X | | X | | | 4 |
| Sustainable mobility & urban systems / transport | X | | X | X | | X | | | 4 |
| Digital economy & society | | | | X | | | | | 1 |
| ICT | X | | | | | X | X | X | 4 |
| Engineering & technology | | | | | X | | X | | 2 |
| Innovative & inclusive societies | X | | X | | | | | | 2 |
| Freedom & security in Europe / safety & protection | X | | | X | | | | | 2 |
| Sustainable development | | X | | | | | X | | 2 |
| Biodiversity | | X | | | | | | | 1 |
| Marine & polar research | | X | | | | | | | 1 |
| Oceans | | X | | | | | | | 1 |
| Social changes & innovations / Social sciences & humanities | | | | X | X | | X | | 3 |
| Social-ecological research | | X | | | | | | | 1 |
| Space | | | X | | | X | | | 2 |
| Economy | | | | | | | X | | 1 |
| Cultural heritage | | | X | | | X | | | 2 |
| Marine / maritime | | | | X | | | | | 1 |
| Exact sciences | | | | | X | | | | 1 |
| Material, nanotechnology, nanosciences / manufacturing | | | | | | | | X | 1 |
| Environment / Natural sciences | | | | | X | X | | X | 3 |

Table 1 – Occurrence of semantic and titles in national research programmes in main EU countries of PRIMA.

- For the majority of the countries considered, non EU Mediterranean countries are targeted by ad-hoc bilateral agreements and programmes. Bilateral programming is discussed in the next session.However, some international activities are also encompassedby the national programmes as mentioned above. Some interesting examples are given in the good practice box below.

- As for the type of actions which are funded by the national programs, regardless whether they include or not international cooperation or regardless the theme addressed, the most recurrent is *applied research* (as in the programmes of MPCs), followed by technology development, capacity building, mobility and basic research.

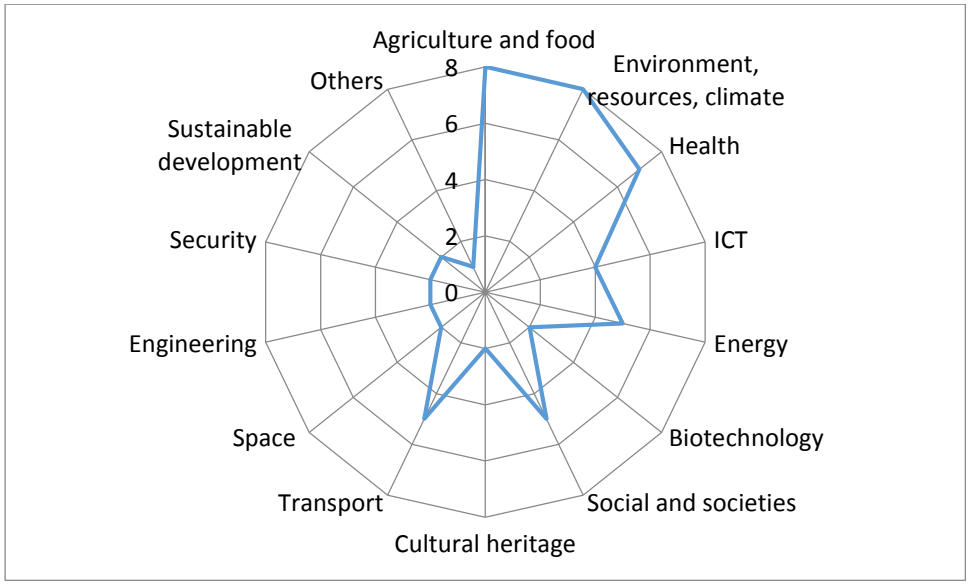


Figure 2 – Distribution by occurrence of aggregatedsemantic or titles in national programmes

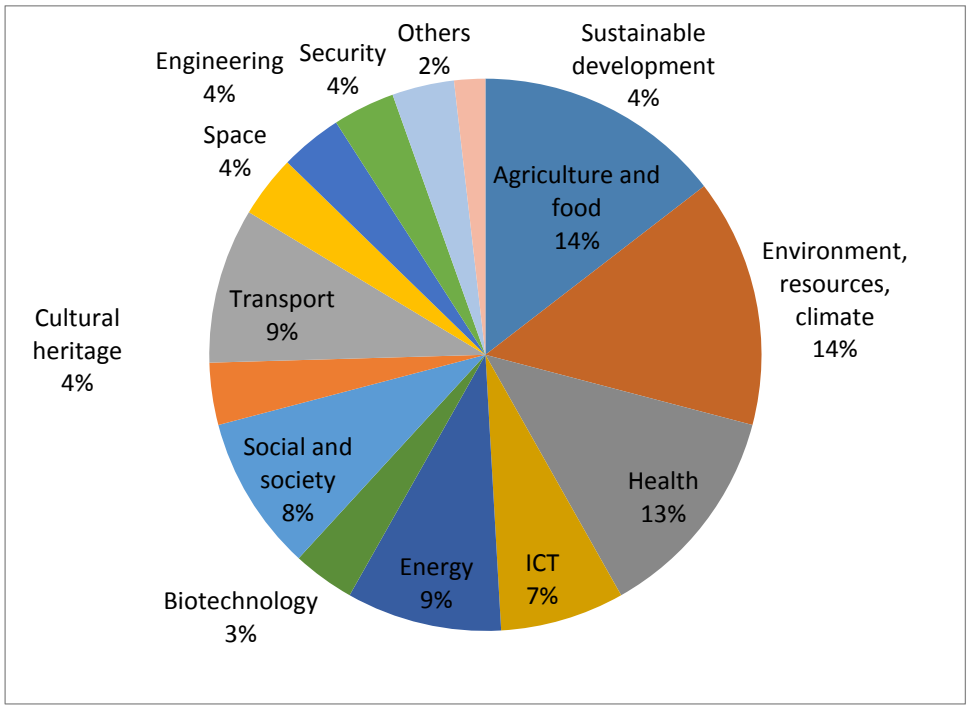


Figure 3 - Distribution by % of aggregated semantic or titles in national programmes of EU PRIMA members

**Good Practices**

**AllEnvi : Federating the French environmental research sector**

In a context of global change, increased awareness of the limited nature of the available resources, societies need to address environmental challenges on a global scale. To this aim, AllEnvi is federating and steering French environmental research. AllEnvi was established on the initiative of its twelve founding members, and is one of five French thematic research « Alliances ».**Allenvi pools the expertise of research organizations, universities and colleges in the field of environmental science, with a community of almost 20000 scientists**. . Allenvi works in four directions: Steering and planning research; Coordinating innovation and technology transfer and development ; Building networks of research infrastructures and Engaging with the European and international research area

**Italy National Strategy for Research and Innovation in Food, Agriculture and Forestry**

In April 2015 the Italian Ministry of Agriculture, Food and Forestry has approved a Strategy for the period 2014-2020 aimed at the identification of research and innovation projects carried out by the public or private sector related to the following macro-objectives: ***sustainable agricultural production, climate change, food chain, food quality & safety, sustainable use of resources for industrial purposes, development and re-organization of the knowledge system***. This Strategy has been drafted by the Ministry following an extensive consultation on research and innovation needs involving national and local institutions as well as enterprises and academia.

In conclusion, the data collected show that EU Member States have in place ***a good number of activities targeting themes of common interest ensuring possible programmes alignment in main challenges like environment, agriculture, natural scienceand that they are all aware of the potential benefits deriving from a stronger international collaboration*.** Topics such as agriculture/food, environment, energy, health are in most cases high positioned in the agenda of national programmes considered.

***A stronger integration and long-term collaboration among EU Member States would help facing the main threats and weaknesses of national programmes, and would in particular guarantee a more stable allocation of funds and larger regional impact*.** Any joint initiative to be undertaken in the future should also be able to foster innovation and facilitate the participation of the private sector.

## 1.2.2 Bilateral cooperation EU Member States – Mediterranean Partner Countries

In addition to international cooperation activities carried out within national research programmes (e.g. through targeted call openings), which have been considered in the previous paragraph, bilateral activities implemented in the frame of S&T agreements should also be taken into account

in order to have a clear view on the potential for long-term joint programming in the Mediterranean region. In fact, bilateral S&T agreements reflect the political willingness of countries engaged in carrying out join activities on given thematic areas. With reference to bilateral cooperation between single EU Member States and non-EU Mediterranean countries, as highlighted hereafter, ***agriculture, environment and health are targeted by several activities***, particularly – for some countries – agricultural water, food security, climate and marine environment. Bilateral cooperation activities are supported in most countries by S&T Bilateral Cooperation Agreements. In spite of the higher regional impact, only few multilateral agreements are in force between an EU country and MPCs (a good practice is provided in the box below).

Building on a study conducted by MedSpring in the early preparatory phase of PRIMA and presented at the Stakeholders meeting in Beirut in 2014, the major bilateral agreements between EU Member States and between a MS and a MPC of PRIMA can be synthesized in Table 2:

| **Research topic** *(colour intensity is proportional to the n. of agreements mentioning the topic)* | |
|---|---|
| Nanotechnology | 0-5 agreements |
| New Materials | |
| Aerospace | |
| Climate | |
| Civil Security | |
| Transports | |
| Marine science | 5-10 agreements |
| Social Science | |
| Food | |
| Biotechnology | |
| Energy | |
| Environment | |
| Natural resources | |
| ICT | |
| Agriculture | 10-25 agreements |
| Health | |

*Table 2: Most covered themes by bilateral S&T agreements in some countries (i.e.: France, Italy, Jordan, Lebanon, Spain, Germany, Morocco, Turkey)*

Table 2 shows that for themes of relevance for PRIMA (environment, water, agriculture) we can already appreciate an ***important number of cooperation actions, supported by up to 40lon-term S&T bilateral agreements involving France, Italy, Jordan, Lebanon, Spain, Germany, Morocco, Turkey***. France is the country showing a large number of bilateral agreements (more than 20 S&T agreements, Joint Lab, permanent networks) with almost all PRIMA MS/AC and MPCs, with the latters having agreements in different areas with emphasis on Health, Energy, Agriculture and Social Sciences. The number of bilateral agreements, although relevant in the whole picture, might not

completely contribute tackling the regional dimension of challenges in the Mediterranean, particularly when addressing themes like environment, water or food. A multilateral approach, through a long-term joint programming instrument, could be more effective (see also the good practice box below).***A broader multilateral initiative, up-scaling and building on the bilateral cooperation efforts could ensure a major impact in the region.***

A good example of implementation of the bilateral agreements is given through the support of specific programmes and projects. Here follow some examples of good practices, including bilateral and multilateral cooperation activities of EU Member States and MPCs.

## Good practices from bilateral to multilateral

**Germany cooperation with Mediterranean countries**

Germany has identified specific objectives for bilateral cooperation with MPCs, namely: i) strengthening bi-regional cooperation, ii) integrate international cooperation in education, iii) support the transformation in North Africa and the Middle East, iv) support measures regarding the development of innovation capacities in science and research, including vocational training. Germany has bilateral scientific cooperation with: Egypt, Morocco, Tunisia, Turkey, Israel, Jordan, Algeria, Palestine. Water, water technology, agricultural science, natural resources management, climate change are he major cooperation themes with Algeria, Palestine, Israel, Jordan. *Germany and Egypt have established, in 2008, the German Egyptian Research Fund (GERF) promoting joint research projects developing applied research, capacity building and technology development in areas of common interest including: food security, climate change, water, renewable energy*. The budget of the Fund amounts to 1M Euro per year on each side.

**Bilateral cooperation France-Morocco**

Morocco has an ongoing bilateral programme with France since 1981. This programme served as blueprint for other bilateral funding schemes, with target countries like Spain, Germany and Belgium in Europe as well with Tunisia and Egypt among the MPC. *Morocco reports higher visibility of researchers on international level and the positive effects of enlarged international networks on the research capability within the respective countries.*

Italian Strategy for Research Internationalization.

**In 2011 the Italian Government** has released a programmatic document on the Italian Strategy for Research Internationalization, outlining the main guidelines for international cooperation of Italy in R&I. This document is periodically updated in order to be in line with the National Programme for Research (PNR Italy). *According to the Strategy, which identifies research cooperation priorities for each geographic area, the following topics are of major interest for cooperation with all Mediterranean and Middle East countries: Agro-food and Health.*

**France ENVI-MED Regional Programme**

The ENVIMED regional programme is a French research cooperation initiative for countries in the Mediterranean.The programme aims to encourage discussions and initiate multilateral cooperation by supporting the mobility of researchers as part of joint research projects and seminars, workshops and regional scientific conferences. So far the Programme has launched four call for proposals. The last one – closed on 1st January 2016 – was encouraging applications related to the following themes: *climate change, aerosols in the Mediterranean, water resources, anthropic impacts, climate and geological hazards****, natural and anthropic risk.***

## Good practices from bilateral to multilateral

**CNRS-Lebanon & CNR-Italy: Agreement and Cooperative Programme**

The National Council for Scientific Research - Lebanon (CNRS-L) and the Council for National Research-Italy (CNR) have an ongoing Agreement and Cooperative Programme since 2011. The agreement aims at enhancing and strengthening cooperation, mobility and exchange of knowledge between Lebanese and Italian researchers. It relies on the principles of equality and mutual benefits between Lebanon and Italy, and seeks to promote cooperation and scientific research between qualified scientists in those research areas of most interest to both parties. Within the frame of the Cooperative Programme, joint calls for proposals are launched yearly, particularly in the fields of: Marine Sciences & Biodiversity, Management of Natural Resources, Renewable Energy, Food Security, Archeology, and Water. To date, there has been three successful calls for proposals, and a total of 12 Projects funded (4 completed and 8 ongoing).

**CEDRE:**

The CEDRE programme is a collaboration between the Lebanese government and the French government (with the National Council for Scientific Research- Lebanon acting as a focal point for Lebanon). Established in 1996, this programme aimed at enhancing Lebanese and French cooperation through scientific research, knowledge exchange, and academic exchange. The purpose was to establish and develop research and research instruments in Lebanon, and to facilitate the mobility of researchers between the two countries. Calls for proposals are launched on a yearly basis and are open for research projects encompassing relevant discipline, mainly social sciences, environment, health and medicine, and engineering. To date, there has been 16 calls for proposal (17$^{th}$ Call in Process). The CEDRE project has funded an average of 20 projects per year, including a partner from Lebanon, and a partner from France, each project being granted an average of 20,000 € (for a period of 2 years).

# 2. EU funded Programmes

## 2.1 ERANETs

Several ERANET and ERANET plus/COFUND projects under FP7 and H2020 are worth to be considered to have a comprehensive overview of the critical mass already built through joint activities in last five yearsin Europe and its neighbourhood, with a particular focus on the initiatives dealing with themes related to PRIMA and/or involving PRIMA partner countries.
12 initiatives have been considered to this purpose, which are briefly summarized in the following table:

| N. | Name | Status (ongoing/closed) | Countries | | | Themes | Budget committed | Projects funded |
|---|---|---|---|---|---|---|---|---|
| | | | EU | AC | MPC | | | |
| 1 | ARIMNET | Closed | 6 | 2 | 4 | Agricultural Research | 7 M Eur | 10 (78 eligible) |
| 2 | ARIMNET 2 | Ongoing | 9 | 2 | 4 | Agricultural research | 7 MEur (1st call) | 10 (146 eligible) |
| 3 | EUPHRESCO | Ongoing | 21 | 1 | 0 | Phytosanitary research | 8,9 M Eur | 47 |
| 4 | ICT-AGRI (1 & 2) | Ongoing | 15 | 2 | 0 | ICT for agriculture | -- | 24 |
| 5 | RURAGRI | Closed | 20 | 2 | 0 | Agricultural, rural development | 8,5 M Eur | 5 |
| 6 | ERACAPS | Closed | 17 | 1 | 0 | Plant science | 40 M Eur | 26 |
| 7 | C-IPM | Ongoing | 20 | 1 | 0 | Integrated Pest Management | 5,8 M Eur | 7 |
| 8 | ERANETMED | Ongoing | 10 (incl.1 int.og.) | 1 | 6 | Water, Energy (1st call) Water, Energy, Food (2nd call) | 12 M Eur (1st call) + 11 M Eur (2nd call) | 21 (190 eligible) |
| 9 | FACCE ERANET PLUS | Ongoing | 17 | 1 | 0 | Climate change adaptation | 18 M Eur | 11 (40 eligible) |
| 10 | FORESTERRA | Closed | 9 | 1 | 3 | Mediterranean forest ecosystem | 1,5 M Eur | -- |
| 11 | SUSFOOD | Closed | 18 | 1 | 0 | Sustainable food systems | 17 M Eur | 15 |
| 12 | ERA-ARD II | Closed | 14 | 1 | 0 | Agricultural Research | 3,9 M Eur | 11 |
| 13 | WATERWORKS 2014 | Ongoing | 12 | 3 | 0 | Water Management in extreme events | 9 M Eur + 5 M Eur EC top-up | Under evaluation |
| 14 | WATERWORKS 2015 | Ongoing | 23 | 2 | 2 | Sustainable water use in agriculture. | 18 M Eur + 7,9 M Eur EC top-up | Pre-announcement |

*Table 2 – ERANETs having potential synergies with PRIMA*

As shown in the table, ***an important common financial effort of more than 174MEuro has been possible, on a variable geometry, focusing relevant challenges of the Mediterranean region***.
Although the presence of EU countries is still prevalent, the participation of MPC in dedicated joint activities like dedicated **ERANET tools** (ERANETMED, ARIMNET, FORESTERRA), show an important participation of non-EU Mediterranean countries (Figure 4), demonstrating: -) the strong political willingness of EU and non-EU Mediterranean countries to engage together in joint activities, -) the rather important financial availability for funding the relevant challenges and the need of instruments beyond ERANET that could ensure more continuity and long-standing cooperation.

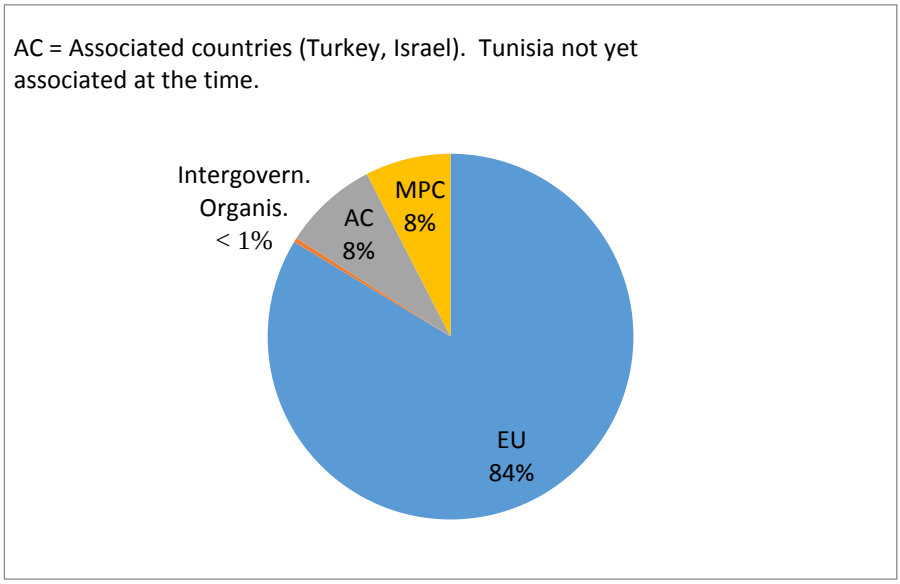

Table 4 – % distribution of participations of MS, AC and MPC in Joint Activities (Eranet, JPI)

As for the geographic coverage of participating countries, four ERANETs (three on-going) involve Mediterranean Partner Countries: ARIMNET (focused on Agricultural Research), ERANETMED (not thematic oriented but funding Water, Energy and their Nexus in the first call), FORESTERRA (focused on forest ecosystem) and WATERWORKS 2015.

All ERANETs considered have one or two Mediterranean Associated Countries (Israel, Turkey) participating. ***All the topics addressed by the above ERANETS are relevant to PRIMA and pave the way to more important long-term joint programming with strong engagement of Mediterranean partner countries***.

Another element worth mentioning is, where available, the impressive number of eligible proposals received in relation to the number of projects which have been retained for funding, with particular reference to the ERANETs dealing with Agriculture, Water & Energy, Climate Change. The case of ERANETMED and ARIMNet are particularly significant in this case. In ERANETMED, out of 190 eligible proposals submitted under the first call 58 had a high scientific impact and value (with a score starting from 3,8/5), but only 21 have been funded.It was the same in the ARIMNet-2011 and ARIMNet2-2015 calls with respectively 29 and 37 projects highly ranked and only 10 projects funded in each call.

***This implies that a joint programming action able to gather a higher critical mass in terms of funds would allow to award excellent research teams which could not be granted by existing ERANETs.*** As for the type of actions funded by these ERANETs considered, in the majority of cases, collaborative research was the action funded, plus some fellowships/scholarships.

Capacity buildingand innovation are not recurrent among the actions funded in the projects considered, therefore***a joint programming initiative addressing also capacity building and innovation driven projects would bring an added value to the current scenario of research cooperation in strategic topics for the Euro-Mediterranean region.***

An initiative like PRIMA could constitute the instrument to allow an enlargement and deepening of activities of the Mediterranean oriented ERANets (such as ERANETMED and ARIMNet) and ensure synergies with others. The latter, in fact, are complementary with some key priorities and macro-objectives of PRIMA (sustainable management of agricultural water systems, protection of food production).

**Good Practice**
**ARIMNET and ERANETMED**

With the participation of 4 (in ARIMNET) and 6 (in ERANETMED) Mediterranean Partner Countries, *these two projects are the only ongoing ERANETs having a highest "regional" focus in the Mediterranean area*. They are both excellent examples of synergies and political/financial commitment to ensure the creation of critical mass on R&I themes of critical importance for the Mediterranean (agriculture, food, water, energy). The success of ARIMNET and ERANETMED joint calls for proposals, in terms of high number of proposals submitted and impressive amount of funds requested, shows that *Euro-Mediterranean research actors and entities are fully capable to team-up and ready for a stronger international collaboration*. However, the impact of these ERANETs is rather limited considering the relatively low rate of projects retained for funding vs the proposals presented ( 13% for ARIMNet-2011, 7% for ARIMNet2-2015 and 11% for ERANETMED). This demonstrates that – beyond the strong engagement of EU and non-EU Mediterranean countries - there is also wide room for implementing a successful long-term joint programming regional activities on above topics. This will be the goal of PRIMA.

**Bridging gaps**
**ERANETMED and ARIMNET case**

The results of ERANETMED first joint call in terms of proposal retained for funding (21 projects) undoubtedly show the big success of such an initiative (being the first non-thematic ERANET addressed to the Mediterranean region) but, at the same time, prove the existence of a serious gap to be still filled. In fact, when looking at the considerable number of eligible proposals which obtained an high score for scientific excellence but could not be funded due to the lack of sufficient funds, it is rather evident that an ERANET project might not be enough to support R&I on key societal challenges in the Mediterranean. In particular, ERANETMED joint call had a budget of 12M Euros, but the total amount requested by scientifically excellent proposals (having a score comprised between 4 and 5 – 5 being the maximum) was more than 22M Euros. This resulted into the non-funding of 15 excellent projects in Water, Energy and their Nexus which would have had an important impact on research, development and innovation in the Mediterranean. Therefore, an initiative like PRIMA, which could count on a stronger critical mass in terms of financial commitments of participating countries, could contribute to the maximization of the potentials of research actors in the Mediterranean scenario.

The same reasoning applies for ARIMNET. The first joint call saw 78 eligible proposals involving 17 countries and 10 projects finally retained for funding. While for the second joint call 146 eligible pre-proposals were received involving 21 different countries and 10 projects were also selected for funding. These numbers show that Euro-Mediterranean research actors are increasingly ready and interested in applying for calls covering agricultural research related issues – but so far the critical mass built in terms of joint programming and joint funding is not enough to cope with such a huge request of funds by valuable trans-national research teams.

## 2.2 European Innovation Partnerships (EIPs)

Two EIPs are related to PRIMA thematic scope, namely EIP Agricultural Sustainability and Productivity and EIP on Water. The first one deals with the following topics of potential interest for PRIMA: agriculture, resource efficiency, food productivity, nutrition, food chain. The second includes water reuse and recycling, water and wastewater treatment, risk management. The above mentioned EIPs have good potential of synergizing with PRIMA since they involve different types of stakeholders and players, which could complement with the institutional/public profile of PRIMA partners. Furthermore, EIPs have a strong record of linking research and innovation and of creating a critical mass to pursue the objectives identified in a participatory manner**.** However, according to anevaluation carried out by external experts, EIPs have rather complex governance/management systems. Furthermore, EIPs have a soft legal structure which is not conducive to tangible and traceable commitment of the EU Member States involved. Last, EIPs have no openness to Southern Mediterranean Countries**.** ***To this regard, the implementation of joint activities under PRIMA could improve the prioritization of objectives, the management of coordinated initiatives and the commitment of participating countries.***

## 2.3 Joint Programming Initiatives (JPIs)

Four JPIs deal with topics of relevance for PRIMA, namely: FACCE (Food Security, Agriculture, Climate Change), HDHL (Healthy Diet), CLIMATE JPI (Climate), WATER (Water). These initiatives include in their consortia Israel and Turkey as Associated Countries. It is worth noting that recently JPI Water and JPI FACCE have launched a pre-announcement of a joint call within ERANET Co-fund Water Works 2015, including as funding countries two MPCs; namely Egypt and Tunisia.

According to a report of the High Level Group on Joint Programming, one of the main constraints of these initiatives is the lack of will at national level to re-orientate strategies and research programmes in line with the Strategic Research Agendas (SRAs) of JPIs.***The launch of an Article 185 initiative could pave the way for creating synergies with existing JPIs and ensure that the common identification of objectives and strategies is followed by a common course of action***.

**FOCUS: Mediterranean Partner Countries and JPIs**

In the frame of FP7 Inco-Net MedSpring project, an analysis has been carried out on the potential openness of existing JPIs to the participation of Mediterranean Partner Countries. Building on the results of this analysis, MedSpring has organized the *first meeting between JPIs and representatives of research/high education Ministries of seven MPCs (Morocco, Tunisia, Egypt, Algeria, Lebanon, Palestine, Jordan) held in Italy (CIHEAM Bari) in July 2014. In that occasion JPI coordinators and MPCs representatives have shown high interest in building synergies and opportunities for joint collaboration. The upcoming joint call of JPI Water and JPI FACCE including Tunisia and Egypt as funding countries demonstrates the interest of MPCs to participate in cofund actions on PRIMA related topics.*

## 2.4 ENPI-CBC-MED

In the period 2007-2014 the ENPI CBC Med (Cross-border cooperation programme between EU and non-EU Mediterranean countries of the EU Neighbourhood Policy) instrument has funded **95 projects** for a total budget of around **200M Euros**. Three calls for proposals have been launched in this period (two for standard projects and one for strategic projects). Although the programme does not fund research projects, it funds cooperation between EU and MPC in themes of relevance to PRIMA. Here follows a short overview on the number of project funded in the three calls:

| Call | No. of proposals | No. of projects funded | Total budget (M Eur) |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1st Standard Projects | 600 | 37 | 57.4 |
| 2nd Standard Projects | 1095 | 39 | 65 |
| Strategic Projects | 300 | 19 | 82 |
| Total | 1995 | 95 | 204.4 |

*Table3 – ENPI CBC MED projects (2007-2014)*

***Out of 95 projects funded, 11 are relevant to PRIMA thematic scope/objectives*** (7 in the first standard call, 3 in the second standard call, 1 in the strategic call). They deal with the following themes:

- Sustainable Water Use
- Adaptation to Climate Change in Irrigated Agriculture
- Nanotechnology for water treatment
- Valorization of wastewater
- Groundwater pollution
- Environmental sustainability of irrigated production
- Risk Analysis
- Pest Management Control

The majority of these projects has been closed in 2014 and 2015, therefore a joint programming action could ensure continuity to their results, with particular reference to PRIMA main themes. An evaluation report on the implementation of CBC Med Programme affirms that a significant number of projects approved faced strong delays in implementation – mainly due to administrative constraints - and that a fragmentation of efforts have also occurred.
On the other hand, an added value of these projects is the high diversification of actors involved, including also no profit organisations and private sector (SMEs, industry). ***The latters could be identifiedas actors for further synergies in research joint programming initiatives as they are involved in cooperation in the Euro-Mediterranean scenario.***

Looking at an analysis of the new work programme 2014-2020 of ENPI CBC Med, two overarching objectives are in line with PRIMA priorities:

- Overarching Objective no. 1: Promote Economic and Social Development (with particular reference to thematic objective no. 1 – Business and SMEs; no. 2 – Support to education, research, technological development and innovation
- Overarching Objective no. 2: Address Common Challenges in Environment (with particular reference to Water Priority)

The calls for the new work programme have not been published yet. ***Surely synergies should be sought in this phase for a coherent planning of the PRIMA activities.***

## 2.5 Structural Funds: LIFE + Programme and European Regional Development Fund

Concerning EU Structural Funds, a good potential for up-scaling activities carried out in recent years can be highlighted in Life + Programme and the European Regional Development Fund. Although these programme do not have a focus on research, they address relevant challenges like environment / climate, food and agriculture, resource efficiency through joint cooperation actions.

As for the first one, among the huge number of projects funded in the frame of LIFE + Programme, some Best Practices have been identified by LIFE Unit's External Assistance Team.
Under the Environment projects component of LIFE and LIFE+, some of the projects identified as Best Practices in 2014 (8 projects) and 2012 (4 projects) deal with issues of interest for PRIMA, namely: water & climate change, water & animal production, agriculture & climate change, water & animal production, sustainable use of pesticides.
It is worth noting that among the beneficiaries of such projects, the private sector as well as NGOs are well represented. They also include local authorities. None of these projects involves Mediterranean Partner Countries or Associated Countries from the Mediterranean region.

***However, the model of LIFE +, which is very inclusive and open to diversified range of actors can be considered as a best practice itself for the planning and implementation of long-term joint programming initiatives***. In addition, LIFE programmes have the intent to put in place with concrete actions EU Environment and Climate policies. This coherence is surely to be considered as a model, since PRIMA initiative will also be aligned with national policies and priorities.

As for the European Regional Development Fund, between 2007 and 2013 some interesting projects have been implemented involving PRIMA EU members States, particularly: Italy, Germany, France, Spain, Greece, Malta. A table of projects is given as example in Annexes. These projects, ***dealing mainly with RTD in Environment (including water) and Agriculture had a variable size, ranging from 600.000 Euro to 2.000.000 Euro***.

The projects achieved remarkable results such as: water management systems in drought risky areas; improving irrigation infrastructures; new methods of food testing and processing; new services to assess health and quality potential of vineyards.

***The examples given show that not only central administrations (i.e.: Ministries) have a stake in challenges addressed by PRIMA but also local administrations have strong interest and support transnational cooperation.***

***This is a positive factor to envisage potential for synergies between national and local priorities. Among local authorities of EU Member States (which are the main beneficiaries of EU structural funds) there are good premises for the creation of a critical mass on research, innovation and development in PRIMA thematic areas. The results of such efforts could be up-scaled at the national/international level and could pave the way for a stronger integration and cooperation including local entities of non-EU Mediterranean countries.***

## 3. International Programmes

In addition to initiatives funded in the frame of national, bi-lateral and EU programmes, it is worth considering potential synergies to be established between PRIMA initiative and projects funded by international donors targeting the Mediterranean region and addressing PRIMA thematic challenges.
***Intergovernmental organizations such as UN (particularly UNEP), FAO, CIHEAM have funded and implemented several projects and initiatives in the recent years.***
***Many of them are ongoing and have a limited duration (few years) and some of them are permanent like the research/cooperation capacity building programme of CIHEAM, whose results***

***and activities could be complemented with and by PRIMA initiative, in order to ensure a stronger impact at the regional level.***

An example of a successful multilateral initiative is given in the box below:

**Good Practice:**
UNEP Mediterranean Strategy for Sustainable Development (MSSD)
Adopted by the Contracting Parties of the Barcelona Convention in 2005, the MSSD results from a consultation process that mobilised most Mediterranean stakeholders including governments, the civil society through the participation of NGOs and key experts.The MSSD framework provides guidance for national decision makers to address sustainable development issues, implement international agreements and initiate partnerships. *It is also a benchmark against which the entire Mediterranean community can monitor and assess its contribution to a common vision of a sustainable Mediterranean*. The Strategy pursues four main directions:

- Contribute to economic development while building on Mediterranean assets
- Reduce social disparities and fulfill MDGs while strengthening diversity
- Ensure sustainable management of natural resources and change consumption and production patterns
- Improve governance at local, national, regional levels

*The MSSD identifies priority fields of action: water; energy; transport; tourism; agriculture; urban development, and; sea and coastal management*. For each of these, orientations and possible actions are proposed. In 2015, the Strategy was reviewed by the countries involved in the initiative, which agreed on a new text for the MSSD. This text will be validated by Barcelona Convention Conference of Parties in February 2016. *After endorsement of the new Strategy, expected in mid-February 2016, synergies and alignment with PRIMA should be sought since both initiatives have the ambition to face Mediterranean challenges of the future.*

# Chapter 2. SRIA

***Report on Scope of the Programme, Prioritisation and SRIA definition and SRIA definition methodology***

## Scope of the Programme, priorities and challenges to be addressed: definition of the three pillars of the initiative and their relationship with Euro-Mediterranean needs, current actions and future development

PRIMA focuses on the development of **smart** innovative solutions and the promotion of their adoption to improve the efficiency and sustainability of food production and water provision aiming at the development of inclusive and healthy Euro-Mediterranean societies.

Mediterranean countries share a number of characteristics related to geographical and physical features, climate, vulnerable ecosystems, presence of large arid and semi-arid zones and areas characterized by severe to moderate water scarcity. They have experienced long-lasting cultural, human and commercial relationships that created conditions of interdependence among all the countries of the Mediterranean region.

There is substantial evidence that this region, particularly its Southern rim, is undergoing important political and social changes linked to demographic trends, urbanization, food crises and natural resource degradation. The sustainable production and provision of an adequate quantity and quality of food and water in the Mediterranean Area are seriously threatened by the erosion of natural capital, human pressures, water scarcity and climate change. This results in foreseeable consequences on the socio-economic conditions, wellbeing and health of people living in the Area, the societal stability of the Region and the whole European Union.

In the Mediterranean area, like in other regions in the world, but with particular importance due to the natural and political context, the Water-Food-Energy nexus today requires crucial action to ensure economic and social development.

Water is by far the main strategic resource of the Mediterranean. The major problems of water resources management in the region arise from the pressure to meet the increasing food and water needs in areas characterized by fast-growing populations, water scarcity or limited water availability. In the near future, due to the expected effects of climate change, pressure on water resources will probably increase. This is already resulting in problems related to water scarcity as well as deteriorated water quality and the over-exploitation of natural resources. In addition to the environmental impacts, water pollution and, particularly, the constant increase in underground water salinization, are already limiting yield and damaging the mid-term soil potentials to sustain crop yields. In parallel, the chronic water scarcity is often resulting in a non-equitable access to water resources with negative effects on human health and conflicts at both the local and regional level and among the several water users (agriculture, urban areas, industry, tourism as well as ecosystem). On top of this, water scarcity in the Mediterranean basin might also result in trans-boundary conflicts, particularly when there can be harmful effects on the interests of downstream water users due to upstream activities such as excessive water use of pollution . As a consequence, ensuring **smart** sustainable water management is vital in the region. This is reflected in the recommendations of the Euro-Mediterranean water expert groups and inter-institutional dialogues (Barcelona 2012, CRIA 2012, MIRA 2009-2012, MedSpring/EMEG. 2013-2015) where the following water related problems were put forward for the Euro-Mediterranean research agenda:

- Mismanagement and poor governance.
- Un-equitable water allocation and un-sustainable water management.
- Lack of a holistic and integrated vision.
- Need to increase competitiveness of research in water quantity/quality management in agriculture, water use efficiency as well as management of non-conventional waters.

Food is a strategic priority for the prosperity and wellbeing of the Mediterranean region and Europe as well. The renewed position of food security at recent G8 and G20 Summits is an acknowledgment that more

sophisticated and long-term international cooperation is needed to meet the new challenge of food security. This is the reverse of a scenario that has prevailed in the last years of the 20th century, when food seemed relatively plentiful. It is certainly not a coincidence that the "Arab Spring" was initially triggered by riots for bread, a social symbol as well as a staple food.

Food security and food quality are serious emerging problems in the Mediterranean region, particularly in water scarcity areas, and innovative forms of sustainable agriculture and food processing/distribution are necessary to meet the challenge of food quality and security. Food in the Mediterranean is both a political and technical/research concern, being not only a question of national import dependency but also a problem of equal access to food. In the northern Mediterranean Countries, the local production contributes largely to supplies, whereas in the southern and eastern Mediterranean countries, with the exception of Turkey, supplies are provided to a very large extent through trade. This is no longer sustainable and even when adequate supplies of food are available, this does not necessarily guarantee that every individual has access to quality food. The development of a self-sustainable food production-transformation system is needed.

The above conditions must be seen as an opportunity and not only a constraint. It is urgent that Europe and Southern Mediterranean Countries pool together their resources of talent, knowledge and cultural heritage to develop "**smart**" arid / water scarcity areas, providing food job opportunities and competitiveness, for young entrepreneurs and women, while preserving ecosystems.

Specific concerns have been identified in recent Euro-Mediterranean expert groups and research policy dialogues (Expert group at Euro-Mediterranean Conference Barcelona, 2012; CRIA, 2012; MIRA, 2009-2011; Euro-Mediterranean Conferences of Ministers of Agriculture – CIHEAM, 2012, 2014; MedSpring / EMEG, 2013-2015, ARIMNet Stakeholders Conference, 2011 and ARIMNet2 Strategic Advisory Board2015):

- Unsustainable agriculture production, overspecialisation and intensification of agriculture production in a non-ecological way.
- Overexploitation of natural resources, natural plant cover, loss of soil fertility, soil erosion and salinization
- Limited use of local biodiversity, local breeds and mixed cropping systems.
- Poor nutritional value of food products and food diets.
- Decline in food culture and food sovereignty, calling for better reconciliation between modernity and tradition.
- Need to boost local food-chain and sustainable and competitive food production and transformation system.

In light of the findings above, the **overall aim** to be pursued by PRIMA is the following:

*To develop innovative solutions and promote their adoption for improving the efficiency and sustainability of food production and water provision, in order to support inclusive wellbeing and socio-economic development in the Mediterranean Area, within the framework of a reinforced Euro-Mediterranean co-operation*.

## Scope of the programme

To achieve such goal, the PRIMA Initiative will be underpinned by two 'drivers':

1. To advance existing knowledge and innovation for water management, food security, and food quality through long-term cooperation

2. To ensure the adoption of knowledge and unlock its innovation potential through end user-friendly and societally-affordable solutions

In order to achieve not only scientific but also socio-economic impacts, PRIMA intends to support the whole innovation chain to ensure that research results are translated into economic development.

Previous initiatives supporting scientific collaboration on themes relevant for PRIMA, such as the FP6 and FP7 programmes and ERA-Nets, more specifically, have led to three to four years of research projects dedicated to various but disparate topics through one-shot initiatives. **Discontinuous and short-term project time-lines didn't allow continuity of research activities in order to achieve tangible impact and enhance real innovation.**

Furthermore, several topics that are crucial for the Mediterranean require long-term research protocols, i.e. networks of observation of water dynamics to understand underground water trends, long-term cropping system trials to design low-input production systems, etc. They require continuous and stable research networks to be implemented, particularly because open field trials and pilot adoptions have to be conducted under natural conditions of an extremely variable nature.

Also, PRIMA is designed as an Open Innovation initiative. Key issues of open innovation management have been addressed in order to identify the correct research, development and implementation strategies among partners, along the entire value chain, from new science and technology to the definition of new markets and adoption scenarios. Community of users will also play a significant role into the co-development of solutions.

As regards to the thematic priorities, and in accordance with the analysis of the main national research programmes highlighting food and agriculture as well as water and environment as the most shared thematic challenges, the PRIMA consortium has identified eight operational objectives (identified in the document submitted in December 2014). They can be summarized along 3 main pillars (Figure 1):

1) Sustainable management of water for arid and semi-arid areas;
2) Sustainable farming systems under Mediterranean environmental constraints; and
3) Mediterranean food value chain for regional and local development.

All the 3 identified pillars are designed to ensure a long-term, economically sustainable, agro-food sector that safeguards natural resources.

This is in line with the recently-agreed Sustainable Development Goals (SDGs) and with the forthcoming European Sustainable Development Strategy (EU SDS). PRIMA activities will focus on SDG targets falling under goals:

- 2 - End hunger, achieve food security and improved nutrition, and promote sustainable agriculture,
- 4 - Ensure inclusive and equitable quality education and promote life-long learning opportunities,
- 6 - Ensure availability and sustainable management of water and sanitation for all,
- 9 - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation,
- 12 - Ensure sustainable consumption and production patterns,
- 13 - Take urgent action to combat climate change and its impacts and
- 15 - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Figure 1. – The 3 Pillars of PRIMA Program

Each pillar addresses the **major issues and gaps** identified by the PRIMA partners:

Table 1. – The 3 Pillars of PRIMA Program

| Sustainable management of water for arid and semi-arid Med areas | Sustainable farming systems under Med environmental constraints | Mediterranean food value chain for regional and local development |
|---|---|---|
| Inequitable water allocation and unsustainable water management | Overexploitation of natural resources and unsustainable ways of farming | Food and water losses and wastes |
| On-farm irrigation inefficiencies | Animal and plant diseases | Changes in food demand and their consequences on food supply chain, nutrition and health |
| Soil erosion and mismanagement of water cycle at the watershed level | Constrained environmental context | Business food systems unable to create employment and economic growth |

Activities that will be developed within the PRIMA initiative are strongly inter-dependent and will address the identified gaps by disentangling complementary aspects, thus ensuring that the three PRIMA thematic pillars will deliver a meaningful impact.

To achieve its ambitious overall aim, the PRIMA initiative identifies eight operational objectives, that are clustered within the three PRIMA Pillars on the basis of their pertinence and the respective extent.

Table 2. –PRIMA **Operational objectives and 3 Pillars**

| | PRIMA Operational objectives | Sustainable Smart management of water for arid and semi-arid Med areas | Sustainable Smart farming systems under Med environmental constraints | Mediterranean food value chain for regional and local development |
|---|---|---|---|---|
| **1** | **To develop smart and sustainable farming systems to maintain natural resources and to increase production efficiency** | ** | *** | |
| **2** | **To test and stimulate adoption of smart context-tailored water-saving solutions, in particular in agriculture** | *** | ** | * |
| **3** | **To innovate in the Mediterranean food products based on Mediterranean diet heritage and to enhance the links between nutrition and health** | * | ** | *** |
| **4** | **To find context-adapted solutions to increase food and water chain efficiency, and reduce losses and wastes** | ** | ** | *** |
| **5** | **To design and promote the adoption of novel smart approaches to reduce the impact of pests and pathogens in farming, including their consequences on human health** | | *** | ** |
| **6** | **To conceive and implement innovative, quality oriented models in agro-business as potential sources of new jobs and economic growth** | * | ** | *** |
| **7** | **To improve land and water sustainability in arid and semi-arid watersheds** | *** | ** | |
| **8** | **To elaborate and stimulate adoption of new policies and protocols for the governance of water management systems** | *** | ** | |

# Why addressing the PRIMA operational objectives is needed - issues tackled by the programme at Mediterranean transnational level

## Motivations for the development of an interconnected PRIMA Strategic Research and Innovation Agenda based on three pillars and associated transnational activities

The first PRIMA pillar addresses the following challenges and gaps:

- Inequitable water allocation and unsustainable water management
- On-farm irrigation inefficiencies
- Soil erosion and mismanagement of water cycle at the watershed level

Needs and expected actions are summarized in the following table:

Table 3. –PRIMA Pillar 1: objectives, needs and actions

| | PRIMA Operational objectives | Pillar 1 priority | Why it's strikingly needed | What PRIMA is going to address? | What kind of actions are expected by PRIMA to address these needs |
|---|---|---|---|---|---|
| 2 | **To test and stimulate adoption of context-tailored water-saving solutions in agriculture** | *** | • Cross-border cooperation is needed to encourage water use efficiency and treated wastewater use in agriculture | • Mitigating pressure on already scarce water resources and enhance sustainable water management | • Research projects<br>• Innovation projects<br>• Prototype development<br>• Network of infrastructure<br>• SME partnership<br>• Capacity building and training<br>• Dissemination and outreach |
| 7 | **To improve land and water sustainability in arid and semi-arid watersheds** | *** | The intensification of agriculture has led to a severe pressure on<br>• soil and water resources | • Mitigating soil loss and erosion by reducing pressure on groundwater and safeguarding biodiversity | • Research projects<br>• Innovation projects<br>• Prototype development<br>• Network of infrastructure<br>• Capacity building and training<br>• Dissemination and outreach |
| 8 | **To elaborate and stimulate adoption of new policies and protocols for the governance of water management systems** | *** | • Difficulties in overcoming some geo-political constraints in approaching water management at the basin/district level have been widely reported | • Improving adaptation to drought and climate change to mitigate their impact on water resources | • Research projects<br>• Network of infrastructure<br>• Capacity building and training<br>• Dissemination and outreach |

The second PRIMA pillar is mostly meant to address the following gaps:

- Overexploitation of natural resources and unsustainable ways of farming
- Animal and plant diseases
- Constrained environmental context

Needs and expected actions are summarized in the following table:

Table 4. –PRIMA Pillar 2: objectives, needs and actions

| | PRIMA Operational objectives | Pillar 2 priority | Why it's strikingly needed | What PRIMA is going to address? | What kind of actions are expected by PRIMA to address these needs |
|---|---|---|---|---|---|
| 1 | **To develop smart and sustainable farming systems to maintain natural resources and to increase production efficiency** | *** | The sensitivity of the ecosystems coupled with the heterogeneity of the farming structures need to develop approaches for the entirety of the Mediterranean area.<br><br>The richness of Mediterranean biodiversity is an asset that requires shared resources and objectives | • Improving crop and animal productivity, quality and management<br>• Increasing yield, quality and stability of farming systems<br>• Enhancing soil and water resources in Med farming systems<br>• Exploiting biodiversity and taking advantage of spontaneous and domesticated biological diversity in the Med agriculture/husbandry | • Research projects<br>• Innovation projects<br>• Network of infrastructure<br>• SME partnership<br>• Capacity building and training<br>• Dissemination and outreach |
| 5 | **To design and promote the adoption of novel approaches to reduce the impact of pests and pathogens in farming, including their consequences on human health** | *** | • Local food production and safety, as well as the economic development of rural areas, are deeply impacted by pests and pathogens | • Combating the drivers of pest and disease distribution<br>• Enhancing prevention, surveillance and control<br>• Posing the basis for better reactions to emerging outbreaks | • Research projects<br>• Network of infrastructure<br>• Capacity building and training<br>• Dissemination and outreach |

The third PRIMA pillar is mostly meant to address the following gaps:

- Food and water losses and wastes
- Changes in food demand and their consequences on food supply chain, nutrition and health
- Business food systems unable to create employment and economic growth

Needs and expected actions are summarized in the following table:

Table 4. –PRIMA Pillar 3: objectives, needs and actions

| | PRIMA Operational objectives | Pillar 3 priority | Why it's strikingly needed | What PRIMA is going to address? | What kind of actions are expected by PRIMA to address these needs |
|---|---|---|---|---|---|
| **3** | **To innovate in the Mediterranean food products based on Mediterranean diet heritage and to enhance the links between nutrition and health** | *** | In the Mediterranean area the prevalence of obesity and its associated metabolic diseases have increased<br><br>Sustainability and accessibility of Mediterranean diet requires crucial design based on low environmental impacts | • Improving food systems in order to ensure food security and healthy food production/consumption<br>• Improving dietary diversity and food quality in a sustainable way | • Research projects<br>• Innovation projects<br>• SME partnership<br>• Capacity building and training<br>• Dissemination and outreach |
| **4** | **To find context-adapted solutions to increase food and water chain efficiency, and reduce losses and wastes** | *** | There are many sources of waste or losses that are discarded or unable to be used along the food and water chain and there is a great opportunity and an urgent need for research to find solutions to reduce food and water losses | • Improving efficacy and efficiency of processing and storage to ensure food safety and security<br>• Reducing waste production and losses<br>• Enhancing food export by optimizing food logistics | • Research projects<br>• Innovation projects<br>• Prototype development<br>• Network of infrastructure<br>• SME partnership<br>• Capacity building and training<br>• Dissemination and outreach |
| **6** | **To conceive and implement innovative, quality oriented models in agro-business as potential sources of new jobs and economic growth** | *** | The last decades have witnessed a crisis of traditional agricultural paradigms, and now innovation of products and services offered by companies in the sector is required | • Increasing sustainability, competitiveness and market potential of the actors working across entire value chain<br>• Increasing the competitiveness of Mediterranean food production | • Research projects<br>• Innovation projects<br>• SME partnership<br>• Capacity building and training<br>• Dissemination and outreach |

## PRIMA prioritisation of targets, objectives and activities

As seen in Table 2, the PRIMA Initiative will develop three interconnected main pillars which are underpinned by specific operational objectives.

PRIMA will deliver a stepwise strategy in which objectives at higher priority within each pillar will be addressed first, in order to deepen existing knowledge gaps (e.g. existing knowledge gaps on groundwater processes, dynamics and yields) while delivering practical results for the major end users of the food and water systems in the Euro-Mediterranean area. Once the above-mentioned activities are launched, lower-priority initiatives will be embarked upon. In parallel, activities related to knowledge and technology transfer, outreach, and user and stakeholder engagement will be in place to broaden the scope of the PRIMA initiative.

## PRIMA Pillar 1: Sustainable management of water for arid and semi-arid Med areas - prioritisation of targets, objectives and activities

The Mediterranean is one of the regions in the world with the scarcest water. According to 'Plan Bleu', 180 million persons are considered as "water poor" since they rely on less than 1000 $m^3$/capita/year while the U.N. alert threshold is 1700 $m^3$/capita/year. Agriculture remains, by far, the largest water-consuming sector in the Mediterranean (70% of the total water consumed) but also the major source of income and employment for rural dwellers (AQUASTAT FAO 2015)[3]. Many countries in the Mediterranean are over-exploiting and intensively using their scarce water resources resulting in a fall in water table and river levels, and emptying of falls, reservoirs and wetlands. These countries are, therefore, headed towards a serious national water crisis. Libya, for example,ggg extracts 6 times more than its available renewable water resources largely as ground water. Egypt, Israel, Malta, Jordan and Syria extract more than their total renewable water resources, which raises serious environmental concerns and issues regarding water resources sustainability.

Water is crucial for Mediterranean agriculture as it ensures higher and stable productivity as well as production diversity; it has a major role in securing food production and reducing poverty in the Region. The demand for water is continuously increasing in response to population growth. The situation is aggravated by the increasing frequency of droughts, a consequence largely attributable to climate change. Therefore, the competition for water among different sectors of society (agriculture, urban and industry) will continue to grow, particularly during summer periods when supply is scarce and demand is high.

Finding solutions to cope with increasing water demand and decreasing water availability is an urgent and fundamental priority for the Mediterranean arid and semi-arid areas. In these areas, achieving sustainable management of water requires a better understanding and interventions related to biophysical processes as well as social and technical processes.

1. The first priority is a **better understanding of water resources availability**, especially for catchments and aquifers of medium or small size, which is the most common scenario. The ephemeral flow of rivers, the non-linear relationship between rainfall and runoff, the importance of extreme events, are major characteristics of surface water resources. This makes river-flow extremely variable in time and space, difficult to exploit in natural conditions, and often a threat for the riparian population. Quality issues (chemical and biological) are even more complex and less surveyed. Apart from a very small number of large rivers, aquifers are the most reliable source of water in the region, and are therefore essential for water supplying people and farming. However **contamination, seawater intrusion and over-exploitation of groundwater** are common problems in the Mediterranean. Understanding the complexity of the system under present and future climatic and socio-economic conditions is of crucial importance for ensuring the long-term availability of water resources and for avoiding irreversible damages on the environment and the agriculture systems depending on land and water.

2. Irrigated agriculture, which uses 70% of water resources, today provides more than 50% of the food produced in the Mediterranean basin, even though it only takes up 15% of the land devoted to agriculture. Despite the development of techniques, models and decision support systems to promote a more efficient use of irrigation water, their actual use and implementation by farmers is rather limited. The successful **adoption of new irrigation strategies and technologies** and **their**

[3] FAO 2015.AquaStat. http://www.fao.org/nr/water/aquastat/main/index.stm

**integration into farm management practices and the off-farm constraints,** require an additional effort in improving the exchange of information and dialogue between end-users, farmers, policy-makers and research teams, to facilitate the transfer of new knowledge and technologies and their practical implementation at field-level. Where irrigation modernization has already started through the replacement of surface irrigation with drip or trickle systems, new irrigation scheduling programmes to better match water application with real crop needs should be investigated and proposed. Regulated deficit irrigation strategies will have to be implemented in those countries where chronic paucity of summer rainfall allows supplemental water to act as a major controller of growth, yield and fruit quality. Conversely, in some countries of the North Mediterranean basin (namely part of Italy and France), now frequently experiencing temporary, yet still fairly occasional, summer drought, the major challenge is having physiological and/or agronomical decision-making tools to assess if the severity of water stress might justify supplemental watering. Presently, irrigation technical change in the Mediterranean has mostly taken place on large farms with the support of large-scale public subsidies. **Smallholders**, which represent hundreds of thousands of hectares of irrigated land, face considerable difficulties to access such subsidized programmes and to adopt standardized new technologies. However, some of have indeed adapted these new irrigation techniques to their own needs, involving local entrepreneurs and creating new jobs. This innovation process responds to small farmers' objectives mainly focused on labour and crop productivity rather than water-saving issues. Furthermore, these technical changes are often not sensitive to the related actual water footprint, and are sometimes based on new sources of water (open access groundwater or treated or non-treated waste water reuse) that could lead to serious environmental hazards (groundwater overexploitation, water pollution, health issues). From a users' perspective, the PRIMA approach should promote the acquisition of knowledge on the local experiences of Mediterranean countries, enhance this (informal) innovation process, and connect it to official national programmes dealing with water saving issues.

3. In arid and semi-arid areas, **soil, water and vegetation need to be viewed as a whole**. The way soil, plant cover and vegetation are managed is crucial in regulating water resources and this is currently not properly done. The mechanisms of soil erosion should be taken into consideration at different spatial and temporal scales. Soil microbiology and mineral nutrient cycles are also important issues. Degraded soils create a need for remediation solutions to be found. Integrated management of watershed systems in order to achieve higher sustainability should be implemented. Attention should be paid to designing innovative land use and crop management systems to optimize agricultural practices while protecting land and water systems in order to reduce soil degradation and salinization. Within this more holistic approach, studies on soil fertility could also be taken into account. A new approach addressing soil and underground water degradation accompanied by land and water monitoring mechanisms must be promoted. The factors impacting on soil and water quality must be reduced with a mix of policy measures and innovation actions in order to develop more sustainable land and water use. This might include designing land management practices to maximise on-site resources and determining how soil inherent properties and cropping practices affect the soil's ability to supply minerals and trace elements to plants.

4. **Sustainable, integrated water resources management** should ensure efficient multiple use in irrigation, drinking and industrial activities as well as the preservation of natural ecosystems through consideration of the quantity and quality of water needed for the functioning of aquatic ecosystem services. That requires efficient governance at different levels: watersheds, districts, national. PRIMA intends to improve water governance, taking into consideration both the socioeconomic context and meteo-climatic trends of the Mediterranean basin. Both are seen as important drivers of current and future water resources management. The development of innovative governance strategies, advanced planning methodologies, and monitoring tools are necessary that take into account the huge number of physical, technological and socio-economic variables in water management. This is required to address the ever-growing need for water and food. Drought analyses and water

accounting at regional scale should integrate the outputs of monitoring and forecasting systems at the Mediterranean level (downscaling global meteorological models and CC scenarios) in order to plan and manage water supply systems taking into consideration climatic and anthropogenic changes and the need to cope with water scarcity.

5. Use of **alternative water sources**, e.g. treated waste water or water from desalination, through efficient and competitive technologies (particularly in terms of energy content), is increasingly considered necessary to provide a complementary source of water in certain zones of the Mediterranean. Thus, integrating new resources (desalination and treated waste water) into water management systems should be studied and promoted taking into account the technical and environmental impact, economic efficiency, water governance rules and the local socio-economic context. PRIMA will address the problem of using non-conventional water resources through a holistic approach stimulating the joint collaboration between water treatment technology providers, water governing bodies, end-users and soil and water scientists. This will enable the consideration of water systems as part of a 'circular economy approach'.

**LESSON LEARNT**

**ENHANCING CROSS BORDER COOPERATION TO FIND SOLUTIONS RESPONDING TO MEDITERRANEAN WATER SCARCITY**

Effectively responding to water scarcity is among the key challenges that the Mediterranean region is facing in its quest for sustainable development. Demand for water is likely to continue increasing due to population growth as well as increased demand from in-stream users. If supply driven approaches have prevailed for decades in most of the region's countries, on-going water policy reforms are increasingly looking into a better integration of demand side management. In support to this challenge, the FP7-KBBE program funded the project SIRRIMED under the call KBBE-2009-1-2-03 - Irrigation water saving solutions for Mediterranean agriculture – SICA (Mediterranean Partner Countries).

SIRRIMED addressed the issues related to sustainable use of water in Mediterranean irrigated agricultural systems, with the overall aim of optimizing irrigation water use. The approach proposed in SIRRIMED for reaching this goal was based in an integrated water irrigation management where the improved water use efficiency was considered at farm, irrigation district and watershed scales. SIRRIMED developed new deficit irrigation strategies and protocols for the application of poor quality waters. The techniques were integrated with suitable husbandry irrigation practices. In conclusion of this projects, it was highlighted the fact that on-farm and off-farm aspects of agricultural water management have to be appraised together in an effort to link efficient farm irrigation technologies with specific watershed water governance models able to stimulate and facilitate the adoption of the on-farm technologies. In addition it was highlighted the need to conduct long term research in order to more quantitatively assess the final impact of the measures on the entire catchment balance. Under extremely variable weather conditions, as in the Mediterranean basin, up to 6 years demo studies are needed to demonstrate the usefulness of the available innovations.

On the other hand, considering a more environmental approach of the water challenges, the topic FP7 ENV.2009.1.1.5.2 - Climate induced changes in water resources in southern Europe and neighbouring countries as a threat to security, funded the WASSERMed project. The project analysed, in a multi-disciplinary way, ongoing and future climate induced changes in hydrological budgets and extremes in southern Europe, North Africa and the Middle East under the frame of threats to national and human security. As a result of the project execution, WASSERMed improved the understanding of the effects of climate change and the adoption of better policies. These policies should be of help to mitigate the potential threats to socioeconomic development and environmental sustainability in vulnerable areas around the Mediterranean. It was strongly highlighted the need to provide a better integration of the national policies with the local water governing systems. At a translational level, the need of cross-border cooperation and integration was identified in order to better adapt to the future scenarios of increased water scarcity.

Within PRIMA Pillar 1 "Sustainable management of water for arid and semi-arid Med areas", operational objectives are clearly prioritised and will feed into an associated plan of activities, that will be represented as part of the SRIA definition and establishment during the start-up phase of PRIMA:

Table 5. –PRIMA Pillar 1 themes

| Pillar 1<br>themes to be addressed | |
|---|---|
| **Understanding groundwater processes and link with surface water for catchment/basin balance** | The PRIMA DIS will ensure that a detailed prioritisation of the activities within each subtheme is defined and reflected in Annual Work Programmes.<br><br>Such prioritisation will be developed on the basis of the SRIA and of the specific input of the Member States and MPCs participating in the PRIMA Initiative. |
| **Technical and social aspects of water saving and water management in agriculture** | |
| **Technologies adapted to smallholders and to local conditions** | |
| **Soil, water and vegetation interactions** | |
| **Water systems governance** | |
| **Water reuse and water desalination for use in agriculture** | |

Activities within PRIMA Pillar 1 are meant to target these priorities and for a set of outcomes to be part of the exploitation potential of the PRIMA initiative. A prioritisation of the activities needed to achieve the expected impacts is provided hereunder.

The first type of activity foreseen for PRIMA Pillar 1 concerns networking (indicatively Year 1-2), which will be followed by Research and Innovation (R&I) activities and pilot studies (indicatively Y 2-10). In parallel to the activation of R&I activities, training and outreach activities (indicatively Y 2-10) )will be carried out and accompany the development of the R&I activities.

Table 6. –PRIMA Pillar 1 targets and activities

| PRIMA Operational objectives | Main target | Prioritisation of activities needed for PRIMA impact |
|---|---|---|
| 2 | • Novel plant varieties and technologies to increase productivity and water saving<br>• Innovative user-centered water saving processes and programs<br>• Awareness raising on water supply strategies and water treatment or reuse by farmers | • Research projects<br>• Innovation projects<br>• Network of infrastructure<br>• |
| 7 | • Novel approaches for the survey of water and soil resources<br>• Innovative strategies for soil management<br>• New technologies and approaches for management of water and natural resources | • Research projects<br>• Innovation projects<br>• Network of infrastructure<br>• Capacity building and training |
| 8 | • Novel tools/DSS for planning and adaptation to global changes<br>• New monitoring and forecasting water management systems<br>• New methods integrating desalination and wastewater treatment in water management<br>• Novel methods for water sanitation and quality protection for food production, agriculture and aquaculture | • Research projects<br>• Innovation projects |

## PRIMA Pillar 2: Sustainable farming systems under Med environmental constraints - prioritisation of targets, objectives and activities

Throughout past decades, Mediterranean ecosystems experienced the coexistence of abandoned areas or areas of agricultural decline together with areas of overexploitation of natural resources, erosion and pollution. This pillar aims to develop Mediterranean sustainable production systems in agriculture, aquaculture and fisheries, through a better management of natural resources and the adoption of solutions that can simultaneously increase ecosystem productivity and resilience.

The vulnerability of Mediterranean ecosystems has led to specific problems due to unsustainable farming, such as soil erosion and runoff, overexploitation of natural plant cover, loss of fertility of agricultural land, soil salinization and underground water contamination and pollution. Increase in food production is linked to the capacity of Mediterranean farming systems to better manage and valorise natural resources. Some of these aspects are mainly related to water management and will be covered in Pillar 1, however other issues should be addressed to improve farming systems in order to be more productive, resilient to climatic variability and extreme events, resistant to increasing pests and diseases, and able to cope with climate change. It is well-established that climate change will push the limits of climatic zones North and that solutions need to be found to adapt agricultural practices to increases in temperature, drought and extreme events. This is clearly a challenge that requires the pooling of resources, knowledge and capacities into common programmes.

1. In the whole Mediterranean area, vulnerability of the ecosystems and increasing climatic stresses, in particular climate variability, lead to the need to develop **production systems able to cope with climate risk and uncertainty**. Rusticity and flexibility of the different components and the whole are major factors of resilience of the systems and are required to improve their competitiveness and sustainability. Therefore, we need to improve simultaneously the productivity of agricultural systems and their sustainability and resilience. From this perspective, research is needed to i) better understand how plants adapt to environmental constraints and why certain Mediterranean crop varieties are tolerant to abiotic and biotic single or multiple stresses, such as aridity, high evaporative demand and multiple summer stresses, warm winters, salinity, etc.., with a primary focus on the genotype-environment interactions, ii) create new varieties of genotypes and cropping systems suited to Mediterranean conditions in a changing environmental context iii) develop ecophysiological and agronomical approaches of farming operations at plot, farm and landscape levels to optimize water and other inputs (fertilizers, pesticides) in rainfed and irrigated agriculture;
2. **Mediterranean biodiversity** is recognized as one of the richest in the world, however a very small part is valorised in agriculture; production systems are often overspecialised and do not take into account the diversity of breeds or varieties. The richness of Mediterranean biodiversity is an asset that can be used to restore or develop new varieties and hybrids, crops and breeds, but that requires the development of a long-term programme to share resources and objectives. Such programmes should enable the spontaneous and domesticated biological diversity in Mediterranean crops and livestock production systems to be taken advantage of. Species or farming practices that are currently used in the southern Mediterranean countries could be relevant for other locations, namely in the Northern shore, to adapt agriculture to the changing climatic conditions. Better integration of environmental natural regulation of biotic and abiotic stresses into farming systems, as promoted by the "agroecology" concept, could largely be developed in the Mediterranean but requires research and innovation to take into account specific Mediterranean ecosystem assets and vulnerabilities, and to develop solutions that are site-specific and could be adopted by different types of farmers;
3. The Mediterranean is a hotspot not just for biodiversity but also for the **emergence of animal and plant pests and diseases**. The fragile ecosystem, circulation and concentration of human and animal populations, and the effects of climate change are all factors that promote the persistence of diseases, the resurgence of epidemics and the emergence of new pathogens. Epidemics emerging in the Mediterranean Zone and moving North to Europe are a common problem that transcends national frontiers (Examples *Xylella fastidiosa*, *Bamisia Tabaci*, Brucellosis, Nile Valley Fever, etc.).

When a new disease breaks out, it is already generally too late to find solutions. Scientific knowledge has to be obtained in order to understand these phenomena and to develop preventive solutions as well as Integrated Pest Management solutions. The emergence of certain diseases also drives the need for a better understanding of the ecology of pathogens, the interactions between hosts andpathogens and the ways to prevent such interactions. Addressing these issues clearly requires work at the regional level, by promoting transnational research collaborations that can address the problem globally. Tackling these challenges also requires trans-disciplinary research actions, involving plant/animal health specialists (biology, entomology, plant pathology, and epidemiology), plant breeders, agronomists & zoo technicians, technologists (health product development and application, information scientists) and socio-economists (acceptability of systems, accompanying measures for innovation adoption). This issue has also strong interconnections with thequality and safety of food products in terms of human health. Collaboration with other disciplines working in food sciences and nutrition, is therefore needed. The surveillance of plant and animal diseases, as well as mitigation of their impact on food safety and/or human health, should involve different stakeholders including the human and animal health sectors, taking into account the ecology and environment within a One Health paradigm.

4. **Adoption of innovations** and achieving changes in farming practices in not only a question of finding technical solutions. It is also a question of social and economic conditions for realising investments, ability to get knowledge and experience, and learning and implementing new technologies co-developing solutions with the community of users. In several areas, public policies have a role to play, in providing economic incentives, information, training and advice. In agriculture, for instance, the AKIS concept (Agricultural Knowledge and Information Systems) that has been developed in the EU, helps to describe how the path from Research to Innovation is not a linear process. In the EU Member states, even if improvements are still needed (and are going on through programmes such as the EIPs) the experience of Extension Services, the involvement of farmers and end-users in the advisory systems have proven their efficiency. This is not the case in most of the southern and eastern Mediterranean Countries. Innovative farming systems and techniques should be adapted to the diversity of Mediterranean environmental constraints, available resources, cultural habits of growers and to the heterogeneity of farming structures. To reach this objective, the following should be developed: i) Multidisciplinary approaches, including biotechnology and social sciences for developing an integrated assessment and design of **smart** and sustainable agricultural systems and required public policies; ii) Tools (best practices, decision support system, models, discussion and co-development platforms etc.) that can assist farmers to improve their day-to-day or year-to-year decision-making management in a risky and uncertain environment, iii) Participatory approaches for integrating farmers' knowledge in the innovation process, iv) Territorial approaches that analyse the diversity and spatial organization of farming systems and their environmental and social conditions in the Mediterranean in order to be able to develop site-specific solutions needed by the heterogeneity prevailing within and between the Mediterranean countries.

LESSON LEARNT

Project title: PALM PROTECT - Strategies for the eradication and containment of the invasive pests Rhynchophorus ferrugineus Olivier and Paysandisia archon Burmeister
Funding Agency: EC FP7
Period: 2009-2013
Partners:
EU: Italy, France, Spain, Greece, Slovenia
Mediterranean Partner Countries: Israel, Egypt
Objectives of the action:
The PALM PROTECT consortium aims to develop reliable methods, for use by national plant protection organisations (NPPO), inspection services, growers and other end-users, for early detection, eradication, control and containment of the red palm weevil, Rhynchophorus ferrugineus and the moth Paysandisia archon. The methods will be developed for use at origin, point of entry, in transit and on-site to combat these invasive pests of palm trees. The methods will support stakeholders and end-users in the implementation of Council Directives 2000/29/EC, 2007/365/EC, 2008/776/EC, 2009/7/EC and 2010/467/EU.
Results and impacts:
Both these invasive pests are a major problem around the Mediterranean region and have been responsible for the loss of over 100 000 palm trees with estimated annual costs of several hundred million euros since their introduction into Europe.
Palm Protect developed detection techniques for use at trade points and open areas. Baited traps were found to be useful as a monitoring tool for R. ferrugineus, and the within the project the best trap (Picusan®) was selected as well as the optimal lure and trap distribution in both palm plantations and urban areas. A location aware system (CPLAS) and decision support was developed for use in urban and agricultural areas. A bio-economic model was used to estimate costs in three future spread scenarios in which improved detection and control methods were used. The overall outcome of the effect of improved detection and reduced management costs by implementing the technologies developed within Palm Protect, and assuming that the technologies operate as described in scenarios, a net saving of between € 50.4 million and € 31.6 million is predicted. A database of > 350 stakeholders was created from industry and end-users from European countries, Egypt and Israel, continuously updated about advances.
Link: http://cordis.europa.eu/project/rcn/101666
crops and varieties for the farming system

**LESSON LEARNT**

Mediterranean transnational research projects are required to address common issues : The case of Mediterranean Legumes/Pulses

Legumes are annual and multifunctional crops with extraordinary historical importance for the agriculture and the environment of the Mediterranean basin. They are protein- rich and integral part of the Mediterranean diet. Besides, they are used for animal feed and fodder. Grown in rotation with cereals, they improve significantly soil fertility and minimise the use of inorganic nitrogen fertilizers, contributing to a sustainable and environmentally friendly agriculture.

Despite the importance of legumes and the history of their recent breeding, the progress achieved in the Mediterranean region remains modest. In what can be considered as an EU-wide market failure, investment in advanced technologies for legumes lags behind that of other crops. However, a wide range of legumes is grown in Mediterranean countries, and this provides a potential to develop varieties adapted to different conditions and with increased yield and performance, by pooling Mediterranean resources and implementing transnational research projects to this aim. ARIMNet has supported two projects with this objective during the years 2012-2015 (REFORMA and Medileg). In these projects, a large number of researchers from Spain, Italy, France, Morocco, Algeria, Tunisia, Portugal and Egypt were involved. They produced strong results, by: i) identifying genotypes that are disease resistant and tolerant to drought and salinity and ii) proposing appropriate agronomic practices. In conclusion of their projects, they have highlight the fact that concurrently with pursuing breeding and marketing of improved and well-adapted varieties, it is essential to allocate more efforts to on-farm experimentation and knowledge transfer to farmers, with emphasis on the optimal management of legumes in different environments and farming systems. The 68th UN General Assembly declared 2016 the International Year of Pulses (IYP) (A/RES/68/231) recognizing the need to promote legumes for food and environmental concerns. Considering the prime importance of this objective for the Mediterranean region, PRIMA will permit to support research and innovation projects, in line with the first successful experience of Mediterranean transnational research projects.

Reference

http://www.fao.org/pulses-2016/about/en/ http://arimnet2.net/index.php/researchprojects
http://www.era-platform.eu/news/legume-society-conference-arimnet-projects-medileg-and-reforma-final-meetings-12-14-october-2016

Within PRIMA Pillar 2 “Sustainable farming systems under Med environmental constraints”, operational objectives are clearly priorities and will stem into an associated temporal plan of activities, herewith represented:

Table 7. –PRIMA Pillar 2 themes

| Pillar 2<br>themes to be addressed | |
|---|---|
| **Crop and cropping systems resistance to drought and climatic stresses** | The PRIMA DIS will ensure that a detailed prioritisation of the activities within each subtheme is defined and reflected in Annual Work Programmess.<br><br>Such prioritization will be developed on the basis of the SRIA and of the specific input of the Member States and MPCs participating to PRIMA Initiative. |
| **Optimizing pesticides and fertilizers use in rainfed and irrigated agriculture** | |
| **Use of local biodiversity in developing new crops and animal breeds** | |
| **Integration of natural regulation inside production systems , ecological intensification** | |
| **Integrated animal and plant pest and disease management** | |
| **Social aspects of adoption of innovation in farming systems** | |

Activities within PRIMA Pillar 2 are meant to target these priorities set of outcomes to be part of the exploitation potential of the PRIMA initiative. Associated, a prioritisation of the activities needed to achieve the expected impacts is summarised.
The first type of activity foreseen for PRIMA Pillar 2 concerns networking (indicatively Year 1-2), after that Research, Innovation activities and pilot studies are planned (indicatively Y 2-10). In parallel to the activation of R&I activities., training and outreach activities (indicatively Y 2-10) )will be carried out and accompany the development of the R&I activities.

Table 8. –PRIMA Pillar 2 targets and activities

| PRIMA Operational objectives | Main target | Prioritisation of activities needed for PRIMA impact |
|---|---|---|
| **1** | • Breeding and cropping systems suited to Mediterranean severe climatic conditions<br>• New farming systems adapted to Mediterranean environmental conditions<br>• Tools to assist farmers decision making and risk management | • Research projects<br>• Capacity building and training<br>• Innovation projects<br>• Dissemination and outreach |
| **5** | • Tools to control plant and animal pest and diseases in agriculture and aquaculture<br>Establishment of regulatory and surveillance networks and practices for the benefit of the Euro-Mediterranean area | • Research projects<br>• Capacity building and training<br>• Dissemination and outreach |

## PRIMA Pillar 3: Mediterranean food value chain for regional and local development - prioritisation of targets, objectives and activities

Food security of the Mediterranean area is not ensured. Increases in imports and trade balance deficits at the national level are connected with increase in poverty at individual level and social instability. This is particularly the case in rural arid and semi-arid areas, the latter being the most vulnerable regions, exposed to multiple challenges. Besides, changes in life-styles, scarce affordability of nutrient dense food products, urbanisation and development of food chains based on imported raw materials have led to a change in food diets, and a massive emergence of diet- and lifestyle-related chronic diseases. Moreover, poverty is often coupled to higher consumption of food products of lower quality, poor of essential nutrients and health promoting bioactive ingredients, thus worsening health of Mediterranean populations. Facing the urban demand, the traditional food sector has enormous difficulty in gaining access to commercial channels, and to compete in terms of business organisation, logistics and costs with the agro-industrial sector.
At the same time, the production and processing of food is still a key economic activity for Mediterranean Countries providing jobs and supporting local rural and urban economies. In the southern rim of Mediterranean, even if the rural population decreases in relative terms (compared to urban population) it increases in absolute terms. In fact, agriculture and food sectors are strategic in the whole Mediterranean area in terms of employment, livelihoods of rural population, opportunities for job creations and territorial development.

1. The North Africa/Middle East region is one of the worst off in terms of per capita food availability, a situation likely to worsen by 2030 due to growing demand for food. Imports can certainly compensate for a lack of production, but at the cost of high dependency on the international market, with all the concomitant risks that have been evidenced by the recent food crises. To ensure quantitative and qualitative regional food security, ambitious agricultural and food policies need to be designed. Technological innovation is a key issue in developing strategies that reduce the dependency from imports, by containing wastes while exploiting resources in a sustainable way. At the national level, the challenge is to reconcile increased production, environmental protection and regional development while involving rural stakeholders. Sustainability and quality standards must be defined throughout the sectors, with capacity building for stakeholders at all levels. Good functioning of food chains relies highly on physical infrastructure but also to a good management of the whole chain. These improvements need public investments and will help to appeal for private investments and arrival of foreign capital. Implementing new production systems, ensuring spatial organization of land-uses that could improve the resources management, developing environmental services produced by agriculture will also require specific public policy instruments.
2. Mediterranean food industries produce large quantities of products, often with unique qualities derived from Mediterranean natural advantages and local knowledge. They provide value-added to farmers, create rural employment and provide environmental services. However, most of these small companies operate in an informal setting, with lack of efficiency and with recurrent food safety problems. The **integration of small producers into formal supply channels** is one of the major challenges. In the Southern and Eastern Mediterranean, upstream suppliers are usually widely dispersed, creating logistical difficulties in gathering raw materials (with significant post-harvest losses) and assessing their quality. Suppliers of the downstream firms must meet rigorous standards of quality, traceability and product homogeneity and supply regularity. Improving supply chain management is needed to better link agricultural producers to urban markets and to reduce post-harvest losses. Post-harvest losses remain very high in many Mediterranean countries, representing up to 30-40% of the production in some of them and reducing them can contribute significantly to improve food security. Research is needed to find solutions all along the chain, from production to storage, transportation and commercialisation. A better control of the quality throughout the food chain is a condition for food safety. Actions should be implemented by a very close partnership with enterprises and address: hazards and risk assessment, improvements in food shelf life, storage and transportation conditions… Social organisation of the food chains, coordination among actors, norms

and standards and promotion of territorial products through geographical indications and designation of origin have also to be considered.

3. As a matter of fact, the need for companies to shift to more sustainable business models has widely emerged. Adoption of eco-innovation and **sustainable business models**, may then represent the chance for SMEs to increase their competitiveness and give their contribution to the struggle of sustainability issues. This is particularly relevant in the Mediterranean area, where Micro, Small and Medium Enterprises (MSMEs) constitute a significant economic and employment driver, representing ~70% of total workforce and 99% of overall enterprises in the Region (EMDC – Euro-Med Development Center for Micro, Small and Medium Enterprises, 2012). Furthermore, eco-innovation and promotion of local heritage by a better organization of local players (producers, industries, tourism actors), as well as the development of production chains that include food having a high added value can provide a solution to support the development of Mediterranean territories. Engaging with this actors is going to be a primary goal for the development of PRIMA's Open Innovation Strategy. Such approach needs to develop collaborations between the different disciplines, nutrition, food sciences, agronomy and social sciences, engagement of sources of innovation that can sparkle from a variety of sources (large companies, public research labs, universities, SMEs and community of users) in order to study the impact of diverse business models and management systems, their abilities to create employement and territorial development and to enhance the emergence of young entrepreuneurs in the agrifood sector.

4. The technological aspects of production and transformation are closely related to market and food chain organisation and to industrial strategies. In particular, it is necessary to develop **new processing technologies and valorisation of agricultural products** and by-products for better valorising the local typical products, to boost rural economy, and to create new jobs. The utilisation of the Mediterranean biodiversity, the traditional knowledge and culinary heritage could help to develop territories and regions as typical products can benefit from domestic and international market. A valorisation of the nutritional qualities of Mediterranean foods and the development of new Mediterranean Diet products based on functional foods are certainly an important issue to this respect. Besides nutritional quality, Mediterranean food new products could include many dimensions such as quality (availability of fortified plant varieties and products), potential health benefits, accessibility, convenience (easy to prepare). To meet the expectations of today's consumers it is necessary to retro-innovate by applying new technologies on traditional products. Improve the quality of traditional foods from intrinsic food properties, food production methodologies with a view to enrich nutritional characteristics and, possibly, improve the diet and transformation processes and at the same time preserving local resources, and important elements of the Mediterranean cultural inheritance.

5. While the traditional **Mediterranean diet** is considered particularly healthy, the Mediterranean is paradoxically one of the areas of the world where overweight and obesity are most prevalent—a clear sign of dietary shifts in progress: excess consumption of carbohydrates, sugars, saturated fat and salt, lower consumption of fruits, vegetables and fibers. The emergence of diet- and lifestyle-related chronic diseases (heart disease, cancer, chronic respiratory disease and diabetes) is massive in the southern and eastern Mediterranean. These diseases have become the leading cause of death both in the North and in the South. The complex relationship between diet and health in the Mediterranean context needs to be understood, as well as we must better understand taking heed of genetic, epigenetic and behavioural determinants of chronic disease. Furthermore, we must better understand eating habits, their heterogeneity and their determinants. PRIMA joint research programming will contribute significantly to the prevention of diet-related diseases by effectively integrating research in the food, nutritional, social and health sciences, while strengthening competitiveness of the Mediterranean food industry. Joint programming is already present in the EU Members and Associated States on healthy food (e.g. JPI HDHL, KIC), but it has to be expanded to

the whole Mediterranean basin, including the southern shore.

**LESSON LEARNT**

Involving the SMES in research-training-innovation systems: the case of Mediterranean dairy products
In a context of extreme pressure on southern Mediterranean countries food markets –direct consequence of the rapid population growth and recent changes in consumption patterns, the agri-food sector is emerging as a central element for the harmonious development of the euro-Mediterranean region. The dairy sector, mostly based on small and medium enterprises (SMES), is producing large varieties of products, often with unique qualities derived from Mediterranean culinary heritage and local knowledge. It contributes to improve the food nutritional balance, provides value-added to farmers and creates rural employment. However, most of the small companies operate in an informal setting, with lack of efficiency and with recurrent food safety problems.

The LACTIMED project has been supported by ENPI-CBC MED PROGRAMME from 2012 to 2015. This project brought together various private and public partners from six Mediterranean countries: EGYPT, LEBANON, GREECE, TUNISIA, ITALY, FRANCE, with the objective to foster the production and distribution of typical and innovative dairy products in the Mediterranean, by organising local value chains, supporting producers in their development projects and creating new markets for their products. Besides training actions and the establishment of marketing tools and guidelines, the project has produced very concrete results in terms of enterprises clustering and new entrepreneurs emergence. More than 100 SMEs producers have been involved in promotion and commercialisation actions, allowing them to promote and sell their dairy products. Eight pilot clusters have been developed around priorities such as quality, innovation, commercialisation and access to finance for SMEs. 38 entrepreneurs have been mentored on their projects development and the 10 most innovative ones benefited from a specific grant. Such experience shows the importance of creating networks of stakeholders bringing together private sector, public authorities, academic institutions and civil society, and provides a basis for further developments Http://www.lactimed.eu/en

**LESSON LEARNT**

Project title
Natural antioxidants of Olive Milling Wastewater (FAIR CT97-3039)
Funding Agency: European Union
Period: 1998-2006
Partners: Italy, France, Spain, Portugal, Turkey
Objectives of the action:
The objective was to improve the knowledge on the biological activities of antioxidant phenols obtained from olive oil processing wastewater, and to define procedures for their extraction and valorization as health food supplements and/or natural food antioxidant
Results and impacts:
As a result of the project a patent (PCT/02/02348) was obtained and registered. This patent was licensed to Tuyap, a Turkish company, which applied the new technology for extracting the bioactive components from olive oil wastewaters producing high quality extracts for the Middle East markets. The Turkish company paid a royalty to the whole project partnership. Over 100kEur of royalties deriving from the project has been generated.

Within PRIMA Pillar 3 “Mediterranean food value chain for regional and local development”, operational objectives are clearly priorities and will stem into an associated temporal plan of activities, herewith represented:

Table 9. –PRIMA Pillar 3 themes

| Pillar 3 themes to be addressed | |
|---|---|
| Orienting youths and industry towards sustainable competitive business models | The PRIMA DIS will ensure that a detailed prioritisation of the activities within each subtheme is defined and reflected in Annual Work Programmess.<br><br>Such prioritization will be developed on the basis of the SRIA and of the specific input of the Member States and MPCs participating to PRIMA Initiative. |
| Valorising food products from traditional Mediterranean diet | |
| Food safety in local food chains, health risk and hazards assessment | |
| Organisation and coordination in the food chains for improving efficiency and waste valorisation | |
| Integration of smallholders into formal supply chains | |
| Health effects of the dietary shifts and promoting healthy diet for the Med populations | |

Activities within PRIMA Pillar 3 are meant to target these priorities set of outcomes to be part of the exploitation potential of the PRIMA initiative. Associated, a prioritisation of the activities needed to achieve the expected impacts is summarised.

The first type of activity foreseen for PRIMA Pillar 3 concerns networking (indicatively Year 1-2), after that Research, Innovation activities and pilot studies are planned (indicatively Y 2-10). In parallel to the activation of R&I activities., training and outreach activities (indicatively Y 2-10) )will be carried out and accompany the development of the R&I activities.

Table 10. –PRIMA Pillar 3 targets and activities

| PRIMA Operational objectives | Main target | Prioritisation of activities needed for PRIMA impact |
|---|---|---|
| **3** | • New processes and technologies to increase nutritional quality of foods and better exploit raw materials<br>• Novel plant varieties<br>• Novel formulation methods and ingredients<br>• Innovative foods to enhance health and wellbeing<br>• Enhanced approaches to distribution, logistics, and policy support to sustainable local food production | • Research projects<br>• SME partnership<br>• Capacity building and training<br>• Innovation projects<br>• Dissemination and outreach |
| **4** | • Optimization of transportation and logistics in the food and water supply systems | • Research projects<br>• Capacity building and training<br>• Innovation projects |

| | | |
|---|---|---|
| | • Integration of all processes along the whole food chain to minimize waste and losses and recycling biomasses<br>• Development and optimization of novel preservation and processing technologies to reduce food waste<br>• Creation of new value chains from agriculture and aquaculture by-products and discard<br>• Energy recovery from waste in the landfill | • Dissemination and outreach |
| **6** | • Best practices in sustainable business model in the agrofood sector<br>• Support to SMEs business development and chain management<br>• Creation of new business and entrepreneurship opportunities from a sustainable and innovative use of local resources | • Research projects<br>• Capacity building and training<br>• SME partnership<br>• Dissemination and outreach |

Future PRIMA Initiative Workplan: how the SRIA will be developed, methodology and timeframe agreed among the Participating States

The SRIA will be established during the next 18 months, through the methodology that is described in details in the 4PRIMA proposal recently submitted to the H2020 topic SC5-12-2016. Briefly this includes: 1) A first priorization of the objectives to be pursued by the PRIMA Joint Programme, which describes 8 technical goals (**Smart** and sustainable farming; Water-saving solution; Nutrition/Mediterranean diet; Food and Water chain efficiency; Reduction of impact of pest and pathogens in farming; Innovative business models in agri-food industry; Land and water sustainability in arid and semi-arid watersheds; Policies and governance of water management systems), 2) Definition of the set of working documents that will be specifically designed as a tool for a CSA. the consultation will be developed, 3) Implementation of the results of the consultations of expert and stakeholders, the prioritization of need and gaps, setting the definitive contents of the SRIA, adjusting priorities (also by allocating them in urgent, medium and long term span) and considering which are the most suitable type of actions to be implemented in each items (projects, mobility) for the benefit of the broader Euro-Mediterranean research and innovation community.

Within the same 18 months' time frame of the 4PRIMA activities, PRIMA participants will also design a specific implementation plan for accomplishing the technical objectives defined. This is also described in details in the 4PRIMA proposal and will allow translating the research and innovation priorities for the short medium and long term as described in the PRIMA SRIA into common actions to be set up. The main goal is thus to facilitate and to speed up the start of PRIMA activities. This includes: 1) Promoting networking, coordination, alignment, collaboration and integration of national research programmes and activities; 2) launching joint Calls for Collaborative research; 3) launching calls for Innovation and demonstration projects; 4) bringing together research and enterprises to promote adoption of innovative solutions; and 5) fostering

capacity development for research and innovation in Mediterranean Partner Countries through promoting mobility, staff exchange grants, research training networks, mentoring and partnerships at individual or institutional or regional level  The PRIMA Programme will include the following activities:

Table 11. –PRIMA Projects

| **Collaborative Research Projects** | |
|---|---|
| **Innovation Projects** | |
| **Prototype development** | |
| **Network of infrastructure** | |
| **SME Partnership** | |
| **Capacity building and training** | |
| **Dissemination and outreach** | |
| **Tentative duration** | 24-48 months |
| **Indicative budget** | 3-8 M Eur |
| **Indicative number call launched per year** | 1-3 calls |
| **Eligibility criteria** | Minimum eligibility of projects: minimum 3 Partners from different countries, among which at least 1 MPC |
| **Participation of other countries (Y/N)** | Yes, according to rules defined by the DIS |
| **Participation of private entities, industries, SMEs (Y/N)** | Yes, based on rules of national research programmes regarding eligibility of actors from private sector |

# Chapter 3. Added Value

***PRIMA Initiative: added value, advancement on the current research & innovation scenario and future synergies and complementarities with ongoing initiatives***

## Introduction

The PRIMA Initiative will help to reduce the fragmentation of programming in the Euro-Mediterranean Area by strengthening coordination among national research programmes of European Member States, Associated Countries and Mediterranean Partner Countries.

It will set the basis for pooling fragmented human and financial resources in order to improve both the efficiency and the effectiveness of research efforts in the Euro-Mediterranean Area, thus contributing to the achievement of an effective (pan)-European Research Area.

The PRIMA Initiative is rooted on the results of a broad array of projects, such as Mediterranean-focused INCO-Net projects (MIRA, Med-Spring), ERANETs (ARIMNET, ERANET-MED), and BILAT projects as well as on other national/international initiatives dealing with food systems and water-related issues and mobility of researchers (e.g. Expo Milano 2015 "Feeding Knowledge" Programme).

PRIMA will stem from the understanding that only a comprehensive and integrated action will deliver a significant impact on the Euro-Mediterranean Research & Innovation domain. Complementarities with on-going and future EU and international actions in research and innovation with a focus on the Euro-Mediterranean will be of striking importance to maximise outreach and exploitation of the results of PRIMA.

## Critical evaluation of past and ongoing activities: advancement of PRIMA to achieve successful results and established targets - evaluation why past and ongoing activities are not sufficient or have not reached PRIMA expectations

In the current scenario of fragmented funding, a large number of proposals for activities, projects and initiatives to be developed in the field of food and water systems have been recorded. When focusing only on those ERANETs dealing with Agriculture, Water and Energy, and Climate Change, over 190 eligible proposals have been submitted in response to the ERANETMED call for proposals (CfP) and over 65 eligible proposals have been submitted across the two waves of ARIMNet. Despite this positive interest, the extent of funding has been very limited, especially when compared to the high expectations of the applicants. The number of funded projects is in the range of about 30. Moreover, a lack of massive, regular and structured involvement of industry, civil society and other relevant stakeholders has been registered.

This implies that a more coherent, and 'complexity-durable' joint programming action like the PRIMA Programme, which will be able to gather a higher critical mass in terms of funding, would enable adequate support for excellent research teams to embark on their work, avoiding the missed granting opportunities associated with the existing ERANETs. A longer-term and more-structured programme will therefore result in the achievement of significant impact in terms of scientific outputs, innovation potential and its return on the local territories addressed by these projects.

Furthermore, with respect to the programmes analysed below, the majority of funded activities involve collaborative research and some fellowships/scholarships. Capacity-building and innovation have featured less prominently, giving more weight to the need for a joint programming initiative that can address these two areas and would enhance the added-value of the current scenario of research cooperation in strategic topics for the Euro-Mediterranean region.

**An initiative like PRIMA could constitute the instrument that enables an enlargement and deepening of activities of the Mediterranean-oriented ERANets, the EC-funded JPIs, the KICs and the EIPs, and ensure synergies as well as a broadening of their scope and an enhancement of their results. In particular, it will support the role of scientific diplomacy in a region fraught with geo-political tensions.**

**The fundamental principle if to bring innovation into current research programmes developed in the Euro-Med area and foster innovative solutions for regional development.**

A summary of the most relevant ongoing EU and International initiatives is provided below. A critical evaluation shows **how the results of these initiatives, whilst being of immediate relevance, fails to deliver a paramount impact when the entire Euro-Mediterranean area is considered or in case of evaluating the food-water-energy nexus as a whole**.

<table>
<tr><th colspan="2">ERA-NET MED</th></tr>
<tr><td>Scope and Objective</td><td>Strengths</td></tr>
<tr><td rowspan="3">Following the Conference of Barcelona on 2012, the ERANETMED responds to the need to develop new ways of “sustainable” cooperation, in which both European and MPC partners will equally participate and benefit from the output and the opportunities created by the project. The ERANETMED will consider a broad area for research, addressing not only the most important societal challenges of the region but also actions to enhance innovation through applied research, capacity building, mobility and clustering.</td><td>In the framework of ERANETMED, the participation of 10 EU Countries, 1 AC and 6 MPC was foreseen. 21 projects have been funded for a total of about 23 m€.<br>In particular, collaborative research was the action funded, plus some fellowships/scholarships. Capacity building and innovation are not recurrent among the actions funded in thIs ERA-NET.</td></tr>
<tr><td>Weaknesses</td></tr>
<tr><td>Therefore, despite being this ERANET a good instrument of cooperation across the two shores of the Mediterranean, the limited funding and the lack of a broader scope, a larger and holistic coordination, a stronger stakeholder participation including industries and SMEs, did not allow the to full exploitation of its potential.</td></tr>
</table>

| ERA-NET ARIMNet (Agricultural Research In the Mediterranean Network) | |
|---|---|
| **Scope and Objective** | **Strengths** |
| ARIMNet aims at coordinating National Agricultural Research Programmes to strengthen the capacities of its members to address, in coordinated way, the major challenges that the Mediterranean agriculture. particularly those involving food security, natural resources management and mitigation of threats resulting from global change. | In the framework of ARIMNET, the participation of 9 EU Countries, 1 AC and 6 MPC was foresee end. 34 projects have been funded for a total of about 14 m€.<br>In particular, collaborative research was the action funded, plus some fellowships/scholarships. Capacity building and innovation are not recurrent among the actions funded in this ERA-NET. |
| | **Weaknesses** |
| | Therefore, despite this ERANET being a good instrument of cooperation across the two shores of the Mediterranean, the limited funding and the lack of a broader scope, a larger and holistic coordination, a stronger stakeholder participation including industries and SMEs, did not allow the full exploitation of its potential. |

| Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) | |
|---|---|
| **Scope and Objective** | **Strengths and weaknesses** |
| FACCE-JPI provides and steers research to support sustainable agricultural production and economic growth, to contribute to a European bio-based economy, while maintaining and restoring ecosystem services under current and future climate change. The 5 thematic areas of FACCE-JPI are: Sustainable food security under climate change; Environmentally sustainable growth and intensification of agricultural systems; Assessing and reducing trade-offs between food production, biodiversity and ecosystem services; Adaptation to climate change throughout the whole food chain; greenhouse gas mitigation | Alignment of national programmes is the core activity of FACCE-JPI.<br>The FACCE-JPI mission is to achieve, support and promote integration, alignment and joint implementation of national resources under a common SRA to address the diverse challenges in agriculture, food security and climate change.<br>By aligning national programming, FACCE-JPI seeks to progress faster towards solutions to solve societal challenges and to avoid duplication, to better cover research gaps, to create critical mass and European added value and to use limited resources more efficiently.<br>FACCE-JPI has developed a number of tools for alignment, in particular Knowledge Hub, Knowledge Network and the Thematic Annual Programming Network. Besides these FACCE-JPI tools, the ERA-NET Cofund instrument has been used. |
| | **Weaknesses** |

| | |
|---|---|
| | To date, FACCE-JPI, whilst being limited to the agricultural sector, has mobilised quite a significant critical mass of research groups with a significant investment, with ERA-NET in the range of 4 to 25 milion Euro. However, the nature of JPI itself is characterized by a rather not coherent participation of Member States (South European and Mediterranean Countries are often poorly represented in terms of dedicated budget) |

| Joint Programming Initiative "A Healthy Diet for a Healthy Life" (JPI HDHL) | |
|---|---|
| **Scope and Objective** | **Strengths and weaknesses** |
| JPI HDHL addresses the promotion of healthy lifestyles with better diets and increased physical activity. In particular it aims at developing solutions for the increasing demand for high quality foods for an ageing and growing world population whilst considering the increasing competition for resources such as land, water and crops for production of feed, food and raw materials used for fuels and industrial biotechnology.<br><br>JPI HDHL aims at providing coordination of research on the impact of diet and lifestyles on health, and to contribute significantly to the construction of a fully operational European Research Area on prevention of diet-related diseases and strengthening leadership and competitiveness on the research activities in this field. In particular, this is expected to be achieved through: 1) The coordination of the scope of research programmes across Europe and reducing duplication of efforts; 2) The support of cross-border collaboration and facilitation of data pooling and their collection in a uniform and standardised way | The JPI HDHL aims to provide a holistic approach to develop and implement a research agenda to understand the interplay of factors known to directly affect diet-related diseases, discover new relevant factors, mechanisms and strategies, as well as to contribute to the development of actions, policies, innovative products and diets, with the aim of drastically reducing the burden of diet-related diseases.<br>In the framework of this Joint Programming Initiative 25 Member States and Associated Countries are engaged. Jointly, the partners are looking forward to the challenges lying ahead and are confident that by working together, it will be possible to establish a fully operational European Research Area on the prevention of diet-related diseases to increase knowledge and deliver innovative and improved nutritional and health intervention strategies.<br>. |
| | **Weaknesses** |
| | till now, the three Joint Actions that have been launched first (DEDIPAC, ENPADASI and FOODBALL) as well as the ones launched during 2014-15 (NUTRICOG, MICROBIOMICS, FOOD PROCESSING) are still characterized by a fragmented participation of Member States (South European and Mediterranean Countries are very poorly represented), as well as limited budget has been foreseen. Furthermore, despite the high scientific and technical level of the partnership, the nature of public-public partnership and the poor involvement of SMEs and industries of the Food and services sectors failed to elicit a significant impact in term of innovation capacity and knowledge transfer |

| JPI "Water challenges for a changing world" (JPI WATER) | |
|---|---|
| **Scope and Objective** | **Strengths and weaknesses** |
| JPI WATER deals with research in the field of water and hydrological sciences. The availability of water in sufficient quantities and adequate quality is indeed a public issue of high priority and addresses a pan-European and global environmental challenge. | The Water JPI aims to make better use of public funds through research cooperation and RDI programming coordination than by working separately. The Joint Programming Initiative on water works to get participating countries to coordinate their individual water research agendas with a European-wide strategic research agenda on common research questions to be solved.<br>The Water JPI Implementation Plan stands in parallel to a number of Horizon 2020 work programmes, in particular that of Societal Challenge 5: Climate Action, Environment, Resource Efficiency and Raw materials.<br>The activities of the Water JPI are varied, and joint calls for collaborative research projects is just one of the many activities. This is coupled by activities aimed to interface with society, empowering RDI actors, improving the efficiency of RDI programmes, organize strategic knowledge exchange events, share good practice. |
| | **Weaknesses** |
| | Whereas Joint Calls are well developed and consolidated activities with overall budget also in the range of 15-20 m€, they are still characterized by a fragmented participation of Member States, with a number of countries that do not participate to all the calls and often dedicate also very limited budget (e.g., in the 2015 calls there was a huge difference between few countries funding in the range of 1-2 m€ and other countries investing less than 100 k€), thus leading not to have concrete opportunities of trans border cooperation |

<table>
<tr><th colspan="2">EIT Food4Future Knowledge Innovation Community (KIC FOOD)</th></tr>
<tr><th>Scope and Objective</th><th>Strengths and weaknesses</th></tr>
<tr><td rowspan="3">A KIC in this area will focus on the food supply chain. The objectives are to:<br>- Ensure a climate-resilient and sustainable global food system.<br>- Meet increasing food demand within the constraints of available land and declining fish stocks, protecting the natural environment and safeguarding human health</td><td>The European Institute of Innovation and Technology (EIT) aims to enhance Europe's ability to innovate, and to transform good ideas into new products or services. The EIT aims to achieve this by bringing together leading players from: 1) higher education; 2) research and; 3) business within Knowledge and Innovation Communities (KICs).<br><br>KICs carry out a whole range of activities, covering the entire innovation chain – including training and education programmes, reinforcing the journey from research to the market, innovation projects and business incubators. KICs should react in an effective and flexible way to new challenges and changing environments.<br><br>A KIC is a 7-15 years initial investment which enables it to maintain a long term focus on global challenges and to avoid short term political "hot" issues.<br><br>To have a real impact on innovation, KICs should include all parts of the chain: education, research and business development. KICs should involve all types of partners: SMEs & large companies, innovation infrastructure & venture capital providers, and entrepreneurs that can identify opportunities to develop economic activity. Such impact could be measured in new jobs, new companies, increased gross profits of the food sector in comparison with the rest of the world or increased consumer trust in products.<br>The nature of a KIC is quite diverse from any other Programme, being a Community and not a Public-Public or Public-Private Partnership. This Community deliver EIT's strategies but through instruments and agendas that are decided within the Community itself.<br><br>Therefore, an interaction between PRIMA Programme and the future KIC Food, that will be established in 2017, will be natural in order to mutually strengthen their respective impacts.</td></tr>
<tr><td>Weaknesses</td></tr>
<tr><td>n. a. yet</td></tr>
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| EIT Climate Knowledge Innovation Community (KIC Climate) | |
|---|---|
| **Scope and Objective** | **Strengths and weaknesses** |
| KIC Climate Specifically, the land and water theme address:<br>Extreme Events: how to adapt to rising sea levels and extreme climate events through advanced and innovative land and water engineering<br>Water security: creating water security for agriculture, industry and cities<br>- Ecosystem services: we help to develop innovative value chains and markets for ecosystem services | Differently from KIC FOOD, KIC CLIMATE has bene established in 2012. The driving principles behind EIT and the KICs has been summarized in the table above.<br>Climate-KIC is Europe's largest innovation partnership composed by industries and research institutes/universities that are working together to address the challenge of climate change.<br>All partners bring their industry experience to the community and are connected through a national or regional centre.<br>The main focus of KIC CLIMATE is not research, but innovation, with the goal of identifying, developing and linking market potential with business ideas and initiatives. The final output of the KIC is to create new products, services and jobs in Europe with global impact on climate change.<br>The second main area of interest of the KIC is the delivery of education and training programmes that instill climate change entrepreneurship into hundreds of students and leading professionals. |
| | **Weaknesses** |
| | Despite the huge budget of the KIC CLIMATE, probably due to the varied nature of the climate change challenge, the rationale has been so far to develop a plethora of small-to-medium scale projects and investing about half of the budget in education and entrepreneurship, without investing in large scale flagship research and innovation projects. |

## Synergies and complementarities of PRIMA with ongoing initiatives (including non-EU funded initiatives)

A summary of the most relevant **synergies and complementarities** foreseen within the PRIMA set of activities with ongoing EU and International initiatives is provided below.

| ERA-NET MED | |
|---|---|
| **Scope and Objective** | **Synergies and complementarities with PRIMA** |
| Following the Conference of Barcelona on 2012, the ERANETMED responds to the need to develop new ways of "sustainable" cooperation, in which both European and MPC partners will equally participate and benefit from the output and the opportunities created by the project. The ERANETMED will consider a broad area for research, addressing not only the most important societal challenges of the region but also actions to enhance innovation through applied research, capacity building, mobility and clustering. | The ERA-NET MED and ARIMNet Consortia, which are composed of a relevant number of partners of the PRIMA Programme will be pivotal in ensuring that awareness on the PRIMA themes and activities is raised within these Consortia and within the beneficiaries of the activities developed and funded by the ERA-NET and CSA, since they are composed of key stakeholders for the scope of the project.<br>However, and also facilitated by the mutual presence of many partners and Member States, ACs and MPCs, evaluations on how to best capitalize the more coordinated, long lasting, broad and impactful PRIMA Programme will be performed. This will ensure that the heritage from these ERA-NETs will not be lost, but at the same time will ensure to reach the maximum impact within an initiative of broader scope. |

| ERA-NET ARIMNet (Agricultural Research In the Mediterranean Network) | |
|---|---|
| **Scope and Objective** | **Synergies and complementarities with PRIMA** |
| ARIMNet aims at coordinating National Agricultural Research Programmes to strengthen the capacities of its members to address, in coordinated way, the major challenges that the Mediterranean agriculture. particularly those involving food security, natural resources management and mitigation of threats resulting from global change. | ERA-NET MED and ARIMNet Consortium, which are composed by a relevant number of Partners of the PRIMA Programme will be pivotal in ensuring that awareness on the PRIMA Themes and Activities will be raised within these Consortia and within the beneficiaries of the activities developed and funded by these ERA-NET and CSA, since they are composed by key stakeholders for the scope of the project.<br>However, and also facilitated by the mutual presence of many partners and Member States, ACs and MPCs, evaluations on how to best capitalize the more coordinated, long lasting, broad and impactful PRIMA Programme will be performed. This will ensure that the heritage from these ERA-NET will not be lost, but at the same time will ensure to reach the maximum impact within an initiative of broader scope. |

| Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) | |
|---|---|
| **Scope and Objective** | **Synergies and complementarities with PRIMA** |
| FACCE-JPI provides and steers research to support sustainable agricultural production and economic growth, to contribute to a European bio-based economy, while maintaining and restoring ecosystem services under current and future climate change. The 5 thematic areas of FACCE-JPI are: Sustainable food security under climate change; Environmentally sustainable growth and intensification of agricultural systems; Assessing and reducing trade-offs between food production, biodiversity and ecosystem services; Adaptation to climate change throughout the whole food chain; greenhouse gas mitigation | During their lifecycle, each JPI developed joint actions or knowledge hubs and mobilised a community of European researchers.<br>Addressing both the Governing bodies of the three JPIs and the beneficiaries of the ongoing joint actions or knowledge hubs will be a critical step in ensuring that awareness on the PRIMA Themes and Activities will be raised.<br>Furthermore, representatives of JPI FACCE will significantly contribute to the public discussion of PRIMA.<br>The Joint Programming Initiative "Agriculture, Food Security and Climate Change" (FACCE –<br>JPI) results from a long process encompassing earlier proposals initiated by INRA (FR) and<br>BBSRC (UK), and brings together 21 MS/AC, committed to addressing the challenge of providing sufficient high quality food through sustainable agriculture in the context of climate change.<br>Among them, there are not only the vast majority of EU countries, but also Mediterranean Countries like Turkey.<br>These activities of creation of synergies and complementarities will be also aimed at enlarging the number of Mediterranean Countries that might benefit from the participation of the JPI.<br>As indicated in the FACCE-JPI European and International Strategy, Member-countries suggest promoting greater coordination with selected European initiatives active in the FACCE-JPI remit and involving EU strategic partners. Moreover, it was suggested that, in a second phase, cooperation at joint research action level should have been considered with selected initiatives to support the implementation of FACCE's and these initiatives' strategic research priorities. These include the ERA-NET on Coordination Agricultural Research in the Mediterranean Area (ARIMNet2), IntensAfrica, a European initiative aimed at working with Africa on sustainable agricultural intensification, and PRIMA.<br>Therefore, in the long run, being the JPI FACCE a relevant initiative but well in line with Pillar II of the PRIMA Programme, evaluations on how to best capitalize from the differences between this JPI and the more coordinated, long lasting, broad and impactful PRIMA Programme will be performed. |

| Joint Programming Initiative “A Healthy Diet for a Healthy Life” (JPI HDHL) | |
|---|---|
| **Scope and Objective** | **Synergies and complementarities with PRIMA** |
| JPI HDHL addresses the promotion of healthy lifestyles with better diets and increased physical activity. In particular it aims at developing solutions for the increasing demand for high quality foods for an ageing and growing world population whilst considering the increasing competition for resources such as land, water and crops for production of feed, food and raw materials used for fuels and industrial biotechnology. | During their lifecycle, each JPI developed joint actions or knowledge hubs and mobilised a community of European researchers.<br>Addressing both the Governing bodies of the three JPIs and the beneficiaries of the ongoing joint actions or knowledge hubs will be a critical step in ensuring that awareness on the PRIMA Themes and Activities will be raised.<br>Furthermore, representatives of JPI HDHL will significantly contribute to the public discussion of PRIMA.<br>In the framework of this Joint Programming Initiative 25 Member States and Associated Countries are engaged. Among them, there are not only the vast majority of EU countries, but also Mediterranean Countries like Turkey and Israel<br>These activities of creation of synergies and complementarities will be also aimed at enlarging the number of Mediterranean Countries that might benefit from the participation of the JPI.<br>In the long run, being the JPI HDHL a relevant initiative but well in line with Pillar III of the PRIMA Programme, evaluations on how to best capitalize from the differences between this JPI and the more coordinated, long lasting, broad and impactful PRIMA Programme will be performed. |

| JPI “Water challenges for a changing world” (JPI WATER) | |
|---|---|
| **Scope and Objective** | **Synergies and complementarities with PRIMA** |

| | |
|---|---|
| JPI WATER deals with research in the field of water and hydrological sciences. The availability of water in sufficient quantities and adequate quality is indeed a public issue of high priority and addresses a pan-European and global environmental challenge. | During their lifecycle, each JPI developed joint actions or knowledge hubs and mobilised a community of European researchers.<br>Addressing both the Governing bodies of the three JPIs and the beneficiaries of the ongoing joint actions or knowledge hubs will be a critical step in ensuring that awareness on the PRIMA Themes and Activities will be raised.<br>Furthermore, representatives of JPI WATER will significantly contribute to the public discussion of PRIMA.<br>In the framework of this Joint Programming Initiative 20 Member States and Associated Countries are engaged, plus 4 Member states as observer. Among them, there are not only the vast majority of EU countries, but also Mediterranean Countries like Turkey and Israel<br>These activities of creation of synergies and complementarities will be also aimed at enlarging the number of Mediterranean Countries that might benefit from the participation of the JPI.<br>In the long run, being the JPI Water a relevant initiative but well in line with Pillar I of the PRIMA Programme, evaluations on how to best capitalize from the differences between this JPI and the more coordinated, long lasting, broad and impactful PRIMA Programme will be performed. Notably, JPI Water already foresees a Task Force on Alignment of Activities and therefore a synergistic approach should be facilitated. |

| EIT Food4Future Knowledge Innovation Community (KIC FOOD) | |
|---|---|
| **Scope and Objective** | **Synergies and complementarities with PRIMA** |
| A KIC in this area will focus on the food supply chain. The objectives are to:<br>- Ensure a climate-resilient and sustainable global food system.<br>- Meet increasing food demand within the constraints of available land and declining fish stocks, protecting the natural environment and safeguarding human health | The aim of a KIC will be to gather excellence in higher education, research and business to deliver jobs and growth opportunities. The KIC FOOD will be selected by the end of 2016, and will last at least seven years. PRIMA Programme will interact with representatives of the established KIC FOOD in order to cross-fertilise agendas and implementation plans. Representatives of the KIC FOOD will significantly contribute to the public discussion of PRIMA. Since the scope of the KIC is European, whilst its outreach and internationalization is expected, PRIMA may be a strong avenue to the Euro-Mediterranean Area in order to engage possible new members and mobilise local stakeholders in the KIC. Vice versa, instruments of the KIC might be of inspiration or might be co-developed, being the two initiatives not competitive in term of scope, vision, governance and funding, with particular emphasis on the training and business development/entrepreneurship support. |

| EIT Climate Knowledge Innovation Community (KIC Climate) | |
|---|---|
| **Scope and Objective** | **Synergies and complementarities with PRIMA** |
| KIC Climate Specifically, the land and water theme address:<br>Extreme Events: how to adapt to rising sea levels and extreme climate events through advanced and innovative land and water engineering<br>Water security: creating water security for agriculture, industry and cities<br>- Ecosystem services: we help to develop innovative value chains and markets for ecosystem services | The aim of a KIC will be to gather excellence in higher education, research and business to deliver jobs and growth opportunities. The KIC CLIMATE is its full spring, and has 6 Colocation across all Europe and 6 Regional Innovation Communities, two of them in the Southern Europe (Spain and Italy). PRIMA Programme will interact with representatives of the KIC CLIMATE in order to cross-fertilise agendas and implementation plans. Representatives of the KIC CLIMATE will significantly contribute to the public discussion of PRIMA. Since the scope of the KIC is European, whilst its outreach and internationalization is expected, PRIMA may be a strong avenue to the Euro-Mediterranean Area in order to engage possible new members and mobilise local stakeholders in the KIC, and leverage on what has been done so far by the KIC Regions. Vice versa, instruments of the KIC might be of inspiration or might be co-developed, being the two initiatives not competitive in term of scope, vision, governance and funding, with particular emphasis on the training and business development/entrepreneurship support. |

## EU initiatives that could be discontinued in the case the Art.185 option for PRIMA is adopted

A more coherent, and 'complexity-durable' joint programming action like the PRIMA Programme, which will be able to gather a higher critical mass in terms of funding, would enable adequate support for excellent research teams to embark on their work, avoiding the missed granting opportunities associated with the existing ERANETs. A longer-term and more-structured programme will therefore result in the achievement of significant impact in terms of scientific outputs, innovation potential and its return on the local territories addressed by these projects.

The PRIMA Partners, have already conducted a "first phase of analysis" focused on completed and ongoing national, bilateral and international initiatives, and this work has been fully presented in ANNEX I as well as in ANNEX III (in the section dealing with synergies and complementarities with other initiatives).

This analysis will be developed further in the coming months as part of the work of the 4PRIMA CSA, more specifically during the elaboration of the SRIA. The process will ensure that all the relevant stakeholder contributions and opinions are taken into account to provide the EU with a more comprehensive list of suggestions and recommendations on the issue.

At this stage, however, the PRIMA partners think it more appropriate to recommend an incentive for better alignment and coordination in the fields highlighted for synergies within Annexe I, rather than specify a list of initiatives to be deactivated.

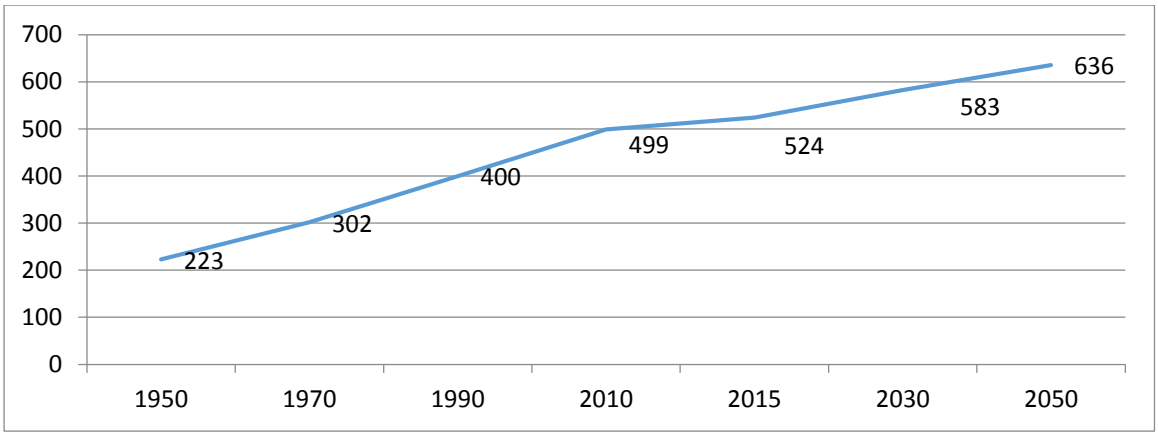
# 4 PRIMA Impacts

***Clear evidence of tangible, measurable and sustainable impact to be attained by PRIMA.***

## Socio-economic impacts

The world is facing a big challenge: how to feed a still-growing global population under uncertain and unpredictable conditions. According to the **United Nations forecast,** the current **world population** of 7.2 billion is projected to increase by 1 billion over the next 12 years and reach 9.6 billion by 2050. The Mediterranean population will reach more than 600 millions inhabitants in 2050.

**Table 1 -Mediterranean population estimated to 2050 (millions)**




*Source: Report on the Mediterranean Economies, ISSM-CNR, 2014*

**The overall objective of PRIMA Programme** is to contribute to a sustainable and inclusive growth in the framework of the Euro-Mediterranean Partnership. The specific objective is to intensify economic research and innovation on food system and water resources within a multidimensional and integrated approach. Water and food are two key and interrelated issues since in the Mediterranean region water accounts for 70% of total water use and in some Southern and Eastern Mediterranean countries (SEMCs) this already high share reach the 80%.

**Focused on the development of innovative solutions to improve the efficiency and sustainability of food production the Prima program can contribute to:**

- foster a new organization of the production chain aiming to redistribute the added value between producers and distributers;
- promote transnational cooperation in the agricultural sector;
- increase the competitiveness of agricultural production by supporting research and agronomic innovation;
- improve living conditions in rural areas through local governance and social inclusion;
- reduce internal and international migration.

The estimated results of PRIMA program will be:

- to enhance the capacities of Euro-Mediterranean networks of researchers committed to critical analyses and actions to support democratizing water-food governance;

- to encouraged institutional changes that would improve Water-Food Nexus governance;
- to support inclusive fora for learning about critical issues of water-food resources in local development processes.

Many **socio-*economic and political impacts are attended from the forthcoming projects in terms of:***

### Euro-Mediterranean Integration.

Agricultural development is at the core of Euro-Mediterranean integration and is going to influence socio-economic development, political equilibrium and migration flows between the two shores of the Mediterranean. The emergence of a new perspective in Euro-Mediterranean agricultural policy demands a stronger cooperation in some strategic issues: food quality standards, respect for environmental prescriptions, preservation of ecosystems and consumer protection. Cooperation in these sectors can upgrade the quality of agricultural production in SEMCs and increase the competitiveness of these countries in the international markets. **Prima Program could give a strong contribution to strengthening the partnership between Europe and the SEMCs and to promoting local development in rural areas. This Prima focus is also on providing solutions for citizens** - a prior concerns for ensuring food and water security in an ecologically sustainable way. **Prima program has the potential to guarantee long-term impact on human well-being, stable societies, job creation, good health and welfare in the Mediterranean area while addressing environmental pressures**. Such transformations in this region could naturally in turn lead to job creation, business opportunities and growth for the EU as a whole. Indeed, the EU absorbs 50% of agricultural and agro-food exports from SEMCs while in turn accounts for 38% of their agricultural and agro-food imports. There are obvious opportunities and complementary products for all Euro-Mediterranean countries.

### Job creation

Agriculture is a major source of jobs in many partner countries and the EU should continue to support sustainable and inclusive policies and investment in modernization of the sector, and diversification to other income creating activities in rural areas where necessary. The EU will support a resource-efficient economy by addressing environmental challenges such as degradation of and competition for natural resources. Analyzing the structure of employment in agriculture emerges a downing trend of the share of agriculture, forestry and fishing in total employment in all the Mediterranean countries but still remain a gap between the two shores of the Mediterranean basin. In the EU-28 this share passed from 6.3 % in 2004 to 4.4 % by 2014. The contribution of agriculture, forestry and fishing in SEMCs is generally much higher than in the EU-28. Some countries such as Lebanon (4.5%) and Israel (1.1%) show a contribution of the sector to the employment comparable to the EU. In the meantime, close to two fifths of the workforce in Morocco and more than a quarter of the workforce in Egypt are employed in agriculture, forestry and fishing, more than 10 % in Tunisia and Palestine and 8.8 % in Algeria. In SEMCs, the relative share of the rural population is lowering as a consequence of steadily urbanization, but rural areas are still very populate, particularly in some Middle Eastern countries like Egypt where the rural population is higher than the urban population

and agriculture is still a very important activity in terms of contribution to the national employment. **Prima program aiming to develop a smart and sustainable farming system could contribute to address the key societal challenges of contrasting unemployment and underunemployment in rural areas.**

### Support to small farmers

**The overall objective of Prima program is to create the overall conditions to a sustainable and inclusive growth in the framework of the Euro-Mediterranean Partnership. The specific objective is to intensify researches and direct engagement with stakeholders on the water-food nexus theme in Mediterranean countries.** The average size of farms in European countries is 16.1 hectares of utilized agricultural area in 2013, but this average doesn't show the remarkable differences between big farms, such as the ones specialized in the cultivation of wheat and small allotments reaching only a couple of hectares of land. Because of a limited agricultural area and fragmented land ownership the average farm size in the SEMCs is generally lower than in the European countries, ranging from 1.4 hectares per farm in Egypt, Palestine and Lebanon to 3.5 hectares in Jordan. Topographic and agro-climatologic conditions contribute to limit the dimension of farms with a utilized agricultural area not reaching 4% in Algeria, Egypt and Jordan. Nonetheless the limited availability of agricultural areas in most of SEMCs, the share of agricultural land in the last years was rising. **The Prima program will contribute to the inclusion of end-users supporting the farmers associations.**

### Migration

**The internal migration from rural to urban areas contribute to territorial imbalances and urbanization and increase the human pressure over natural resources in the coastal areas.** Lack of researches and investments in agriculture reduce the ability of many southern Mediterranean countries to adapt and contrast the climatic change. In the coming decades the deteriorating living condition in the rural areas exacerbated by climatic change will act as a powerful push factor for internal and international migration. **As the recent refugee crisis shows, addressing the root causes of irregular migration and forced displacement is central to the stabilization of the Mediterranean region (see infra).**

### Governance and awareness of local communities

The PRIMA program will increase the understanding of central and local institutions, the awareness of local communities and the engagement of farmers on the need to adopt a more sustainable production and consumption pattern in order to save water and increase food security. The main impact of the projects will be:

- increase the public awareness about the effect of climate change on agricultural production and the urgency to launch policies to face climate hazard and support the revenues of farmers by strengthening their resilience;
- support the capacity of European institutions to engage citizens as well as governments of the target countries in developing strategies and policy measures to enhance water and food security.

- create inclusive fora for learning about critical issues of water-food resources and local sustainable development.

The PRIMA program will elaborate and stimulate the adoption of new policies for a better governance of water, the progress of management systems and the achievement of water and food security.
The projects will strengthen the capacity building of Mediterranean countries in many different fields:

- giving support to the local, national and international institution to find solutions to increase food and water chain efficiency, reducing wastes and losses;
- involving the rural community in the discussion of the local development objectives;
- launching"awareness campaigns" involving the civil society;
- supporting a more inclusive participation in decision processes for farmers association, water technology companies, SMEs in the agro-food sector.

### Political stability.

In the future climatic change is going to play an important role in curtailing agricultural production determining sudden oscillations in the price of foodstuff. In an economic situation marked by increased social inequalities and growing unemployment, the food dependency increases the exposure of many Arab countries to the price oscillations in the international market. The pressure on domestic bread price can play a role in triggering social unrest. Arab spring cannot be considered a direct consequence of global food crisis occurred between 2008 and 2011 but initially riots for bread, became a symbol of the social discontent and the need of a regime change.
In SEMCs climatic change is acting as a threat multiplier because in a global world where countries tend to externalize their water and food demand by resorting to international markets, local hazards may generate a global impact by interacting with different economic, social and political drivers of instability. Increasing cooperation projects on research and innovation, can improve living condition all around Mediterranean countries with many impacts in terms of political stability, living conditions in the rural areas, job creation and reduction of migration flows. **Prima Program tries to approach security not in the conventional perspective based on risks, but in a human perspective. The attempt is to consider prosperity as strictly related to research and innovation, so the most important role of this program is to empower the role of the scientific community in contributing to economic, environmental and social development in the Mediterranean**. Water is a matter of conflict at different regional scale. A major efficiency in the management of scarce water resources in the Mediterranean countries will reduce the conflict between economic sectors - agriculture versus domestic and industrial use - and will contribute to reduce pollution and waste of natural resources. In SEMCs Prima program could also try to reduce the competition over water and land at the regional scale. In SEMCs, the need to meet the water and food requirements of fast-growing populations has increased competition within international river basins and led several countries to play a 'hydro-hegemonic' role at the expense of their co-riparian neighbors. An important hydro-conflict area is the Tigris and Euphrates basin, involving Turkey as upstream country and Syria and Iraq as downstream countries. In this basin, the geopolitical setting is going to be influenced by the

political instability affecting the Middle East. The traditional competition between the co-riparian countries is actually altered by the attempts of Islamic State to control the main dams on the two rivers. This concentration of the fight between Islamic State and the contrasting forces on the ground around the most important dams show the role of land and water in controlling the territory and the population of the area. Furthemore, also in the case of political turmoil in Siria the climatic hazards played a very important role as a "threaths multiplier". Before the Syrian uprising that began in 2011, the greater Fertile Crescent experienced the most severe drought in the instrumental record. For Syria, a country marked by poor governance and unsustainable agricultural and environmental policies, the drought had a catalytic effect, contributing to political unrest.

Millions of people across the Middle East and North Africa are facing drought, scarce drinking water supplies, and poor sanitation due to civil wars and conflict. Meanwhile, resource constraints and foreign military interventions risk more severe humanitarian disasters. Refugees of the civil wars in Syria and Yemen are struggling to secure clean water supplies. Two-thirds of Yemen's population – some 16 million people – is without clean drinking water and sanitation due to a simmering conflict between the government and rebels from northern provinces, while water supplies are dwindling at Syrian refugee camps in Lebanon and Jordan. **Prima program will contribute to analyses the hydro-politics in the Mediterranean region** since water and food security are strategic issues that will be affected and will affect the regional political equilibrium in a compelling and unpredictable way. **Water as a driver of conflict can be transformed in a driver of cooperation throughout the joint researches and technological transfers that Prima can enhance**.

In Mediterranean country food security is strongly interlinked with water availability and sustainable agriculture. The water–food nexus makes evident the importance of saving water and food, cultivating agricultural products with lower water requirements and adopting a more environmentally friendly vegetable-oriented diet. Production patterns need to be addressed properly in order to feed populations and reduce their exposure to price fluctuations on the global market. Due to the high percentage of population under or close to the poverty line and the high share of family expenditure devoted to food, the price of basic foodstuff can influence the political instability.

A shift in agricultural policy is essential to avoid social imbalances and political unrest. Furthermore, the search for food security strongly affects the regional geopolitical equilibrium. In the international river basins (Jordan, Tigris and Euphrates and Nile) the implementation of water projects aiming to increase irrigated land is mining natural resources and is contributing to deteriorate the political relations between co-riparian countries. In the last years the geopolitical competition over land and water resources increased as a consequence of the global food crisis. The export oriented agricultural model prevailing in many SEMCs reduced the self-sufficiency index for cereals, creating a strong food dependency.

Importing food - and, thus, virtual water - was a mean for water scarce economies to escape from their natural constraints. Furthermore, for many decades the low course of staple food in the international markets allowed water scarce economies not to question the water and agricultural policy. The global food crisis altered this equilibrium, making evident the dependency of virtual water importers from virtual water exporters and reversed a long trend of reliance on the world market for food security. This explains the upsurge of land deals. The countries involved in land

deals - mostly relying for their food requirements from the global markets – actually try to externalize their food demand buying land in foreign countries. The land deals represent a new form of geopolitical control over natural resources that increase regional competition, contribute to water and land depletion in the countries that host the land investments.

**Why this emphasis?**

Socio-economic issues directly affect (or are affected by) water food nexus in Mediterranean countries. Based on a previous extensive stakeholders' analysis (MedSpring), Prima program could address the following problems: 1) the evidence highlight a lack of adequate information on the impact of alternative policy options as a major constraint towards deepening the economic reforms for water and food in SEMCs. 2) such reforms continue to be externally designed without adequate economic analyses and hence lack of local ownership. 3) innovative indicators on food-water nexus should be developed, considering both national and local peculiarities in order to produce a useful and innovative body of knowledge and analyses, capable of helping political and economic decision makers in a geographic perspective. 4) the need to enhance research complementarities. Greater attention should be paid to technical options for improving efficiency and promoting food and water security, as well as to policy options which ensure cross-institutional collaboration. 5) the current economic-financial crisis and socio-political uprising in the Mediterranean Region need to encourage the creation of synergies based on common rules and objectives and the adoption of long-term strategies.

**SUCCESS STORIES**

**Project title**

**AquaStress - Mitigation of Water Stress through new Approaches to Integrating Management, Technical, Economic and Institutional Instruments**

**Partners**

**EU: Italy, United Kingdom, The Netherlands, Greece, Germany, France, Spain, Hungary, Portugal, Denmark, Belgium, Poland, Bulgaria, Cyprus,**

**Mediterranean Partner Countries: Tunisia, Morocco**

**Objectives of the action**

AquaStress attempts to develop stakeholder driven, European scale, comprehensive multisectoral, integrated (institutional, socio-economic, technical) approaches for the diagnosis and mitigation of water stress. AquaStress empowers actors at different levels of involvement, at different stages of the planning process, and working at different spatial scales, to mitigate water stress. AquaStress leads to prioritized actions that allow gradual improvement and flexibility to adapt to change in global systems, knowledge, technology and society.

AquaStress intends to deliver guidelines to implement integrated water stress mitigation options at local, regional and European scale. AquaStress delivers a "culture change" in approaches to water stress. It will achieve this through:

Major advances in the understanding, effectiveness and empowerment of stakeholder driven participatory decision making in water management at local and regional scales;

New insights into the pressures and drivers of water stress in different regions of the EU, and in the regional aggregation of stakeholder based decisions;

New assessments of diverse policies, institutions and cultural factors as causes and remedies to water stress, leading to new measures of the effectiveness and side effects of mitigation options;

New approaches to the integration of diverse multi-sectoral and multi-disciplinary expertise for participatory vulnerability assessment and adaptive planning;

The development of IT knowledge management tools to support this new management approach;

Identifying areas where new technologies would have the most impact in mitigating water stress;

A culture change in the European approach to water management, from centralist infrastructure dependency towards a distributed, bottom-up, adaptive integrated systems approach.

**Results and impacts**

**A major EU project, Aquastress, has completed an initiative to tackle water stress. Not just a matter of technological** developments, water shortage must be overcome using integrated water management strategies and sound decision making.

Relieving water stress © Thinkstock

Water supply is shrinking with ballooning population size, increase in consumption of water-thirsty production of meat and vegetables, demands from industry and potential effects of global warming. Efficient management of water supplies is therefore becoming increasingly important.

Under the Sixth Framework Program (FP6), Aquastress aimed to mitigate water stress problems using a combination of development of interdisciplinary tools and guidance documents. Deliverables would enable a range of stakeholders and actors at different levels of involvement to reduce water stress.

Aquastress partners come from both academic and industrial backgrounds with skills ranging from operational management to socioeconomic and environmental domains. A total of 35 partners from 17 countries made up the consortium.

The project adopted a case study approach that was stakeholder-driven. The order of operation was divided into three phases – characterization of reference sites and their water stress problems, identification of solutions, and finally testing of the different solutions according to stakeholder expectations.

Available on the project website at http://www.aquastress.net/index.php are the many deliverables produced by Aquastress during the project term. These include documents such as 'Guidance on water stress mitigation', a case study booklet and instruments for water saving in agriculture and industry together with related economics. Moreover, the Aquastress integrated solution support system helps interested parties to understand water stress from an integrated perspective and to find adaptable solutions to water stress. There is also a comprehensive list of factsheets.

The Aquastress website is in its entirety freely available to all and provides maximum dissemination of the many project publications. As such, the information is accessible by scientists, stakeholders and the general public to publicize solutions for this global concern.

**SUCCESS STORIES**

**WASSERMed - Water Availability and Security in Southern EuRope and the Mediterranean**

**Funding Agency EC Period: ( 2010-2013 )**

**Partners**

**EU: Italy, United Kingdom, Italy, Greece, Spain, Germany, France,**

**Mediterranean Partner Countries: Egypt, Tunisia, Jordan**

**Objectives of the action**

The WASSERMed project will analyse, in a multi-disciplinary way, ongoing and future climate induced changes in hydrological budgets and extremes in southern Europe, North Africa and the Middle East under the frame of threats to national and human security. A climatic and hydrological component directly addresses the reduction of uncertainty and quantification of risk. This component will provide an interface to other climatologic projects and models, producing climate change scenarios for the Mediterranean and Southern Europe, with special emphasis on precipitation. Five case studies will be considered: 1) Syros Island (Greece), 2) Sardinia Island (Italy), 3) Merguellil watershed (Tunisia), 4) Jordan river basin, and 5) the Nile River system (Egypt). The case studies are illustrative and represent situations which deserve special attention, due to their relevance to national and human security. Furthermore, impacts on key strategic sectors, such as agriculture and tourism, will be considered, as well as macroeconomic implications of water availability in terms of regional income, consumption, investment, trade flows, industrial structure and competitiveness. WASSERMed is an interdisciplinary project, which overall aims at all three targets of the call, through the integration of climate change scenarios, holistic water system modelling and interdisciplinary impact assessment, with three main contributions: a) Integration of climate change scenarios, holistic water system modelling. This provides results for reduction of uncertainties of climate change impacts on hydrology in the identified regions; b) Interdisciplinary approach, coupling macroeconomic implications and technical indicators. This provides a better assessment of climate effects to water resources, water uses and expected security risks; c) Proposal of specific adaptation measures for key sectors of the Mediterranean economy. This provides better basis for achieving water security

Results and impacts

The project objectives over the first reporting period are related to the establishment of an organisational structure for management, and to the identification, collection, building of data, tools and models. A detailed description of deliverables provided by each Workpackage is provided in the following.Among the various objectives achieved, the most relevant ones for the project as a whole are:

Establishment of a research cluster (CLICO), and continuous collaboration with other projects (in particular, CLIMB);

- Realisation of a series of five Case Study workshops, with involvement of local stakeholders;
- Dissemination activities at both the project and cluster level, including participation to several Science/Policy meetings.

WASSERMED was launched on January 1st 2010 and spans a 3 year-period. The project is disseminating its progress and findings through its web site (http://www.wassermed.eu), scientific publications, application-oriented material and policy briefs. Stakeholder involvement is fostered through dedicated workshops and targeted dissemination events.

During the first 18 months, the project has carried out most of the activities as planned in the Description of Work, with only minor deviations in a few cases (mostly due to delays in data collection). Two general assemblies and cluster meeting have taken place (in Cairo, January 2010, and Cagliari, February 2011). The series of five case study workshop has been completed in June 2011.

Potential impact:

WASSERMED forms part of a cluster of independent EU projects, together with CLIMB and CLICO, which also address environmental and social aspects of climate-induced changes as threats to security.

**Project title**

**SIRIUS - Sustainable Irrigation water management and River-basin governance: Implementing User-driven Services**

**Funding Agency EC** **Period: ( 2010-2013 )**

**Partners**

EU: Italy, United Kingdom, Greece, France, Spain, Romania, Portugal, Sweden, Malta, Cyprus,
Mediterranean Partner Countries: Egypt, Turkey
Other: Mexico, India, Brazil

**Objectives of the action**

SIRIUS addresses efficient water resource management in water-scarce environments. It focuses in particular on water for food production with the perspective of a sustainable agriculture in the context of integrated river-basin management, including drought management. It aims at developing innovative and new GMES service capacities for the user community of irrigation water management and sustainable food production, in accordance with the vision of bridging and integrating sustainable development and economic competitiveness.
SIRIUS merges two previously separate strands of activities, those under the umbrella of GMES, related to land products and services (which address water to some extent), and those conducted under FP5/6-Environment and national programs, related to EO-assisted user-driven products and services for the water and irrigation community. As such, it will draw on existing GMES Core Services as much as possible, by integrating these products into some of the required input for the new water management services. It also makes direct use of the EO-assisted systems and services developed in the FP6 project PLEIADeS and its precursor EU or national projects, like DEMETER, IRRIMED, ERMOT, MONIDRI, AGRASER, all addressing the irrigation water and food production sectors, some of which have resulted in sustainable system implementation since 2005.
SIRIUS addresses users (water managers and food producers) at scales ranging from farm, over irrigation scheme or aquifer, to river-basins. It will provide them with maps of irrigation water requirements, crop water consumption and a range of further products for sustainable irrigation water use and management under conditions of water scarcity and drought, integrated in leading-edge participatory spatial online Decision-support systems. The SIRIUS service concept considers the economic, environmental, technical, social, and political dimensions in an integrated way

**Results and impacts**

Earth observation aids water management
Researchers have developed satellite-assisted services to support adequate water resource management. These services are particularly useful in water-scarce regions where good management is essential for food production.

Earth observation aids water management © Thinkstock
In non-industrialized countries, a lack of water for farming can cause conflicts that destabilize entire regions, both economically and socially. Periodic droughts and floods, as well as growing populations, exacerbate the problem.
The EU-funded SIRIUS project drew on satellite imagery and other data and media to create tools that help communities manage water resources effectively. The tools include maps of irrigation water requirements and crop water consumption, as well as integrated river basin and drought management advice to facilitate sustainable agriculture.
All three SIRIUS services (drought, irrigation and farm management tools) are powered by an easy-to-use online system known as SPIDER. This platform encourages stakeholder participation, collaboration, and transparent governance due to its non-academic and non-technical interface.
The services have been piloted in water-scarce regions in Brazil, Egypt, India, Italy, Mexico, Romania, Spain and Turkey, during at least one growing season. In parallel, researchers assessed key aspects of sustainable water management within these regions.
Furthermore, SIRIUS developed a roadmap for ongoing implementation of the services in all of the pilot areas. Ultimately, these new tools will help reduce conflict caused by water shortages.

# Environmental Impacts

## Climate

According **to IPCC emissions scenarios**, high temperatures are projected to affect all aspects of hydrological cycle. The Euro-mediterranean Centre on Climatic Change (CMCC) forecast for the 2050 in the Mediterranean region an increase in the temperature around 2°C, a rainfall reduction between 5% and 10% and a major frequency and intensity of extreme wheater events.

**Table 2 - Ar5 IPCC scenarios for temperature variations on global scale to 2100**

| Scenario | Temperature rise compared to period 1986-2005 | Temperature rise compared to pre-industrial period |
|---|---|---|
| RCP2.6 | 0,3°C-1,7°C | 1°C-2,3°C |
| RCP4.5 | 1,1°C-2,6°C | 1,7°C-3,3°C |
| RCP6.0 | 1,4°C-3,1°C | 2°C-3,7°C |
| RCP8.5 | 2,6°C-4,8°C | 3,2°C-5,4°C |

Source: Elaboration on Ipcc data, 2013.

Climatic change and population growth are jointly stretching the **global water demand–supply gap** at an alarming rate. **Projections for 2025** show an increasing percentage of people with a very low availability of annual renewable water.

**Table 3 - Water supply**

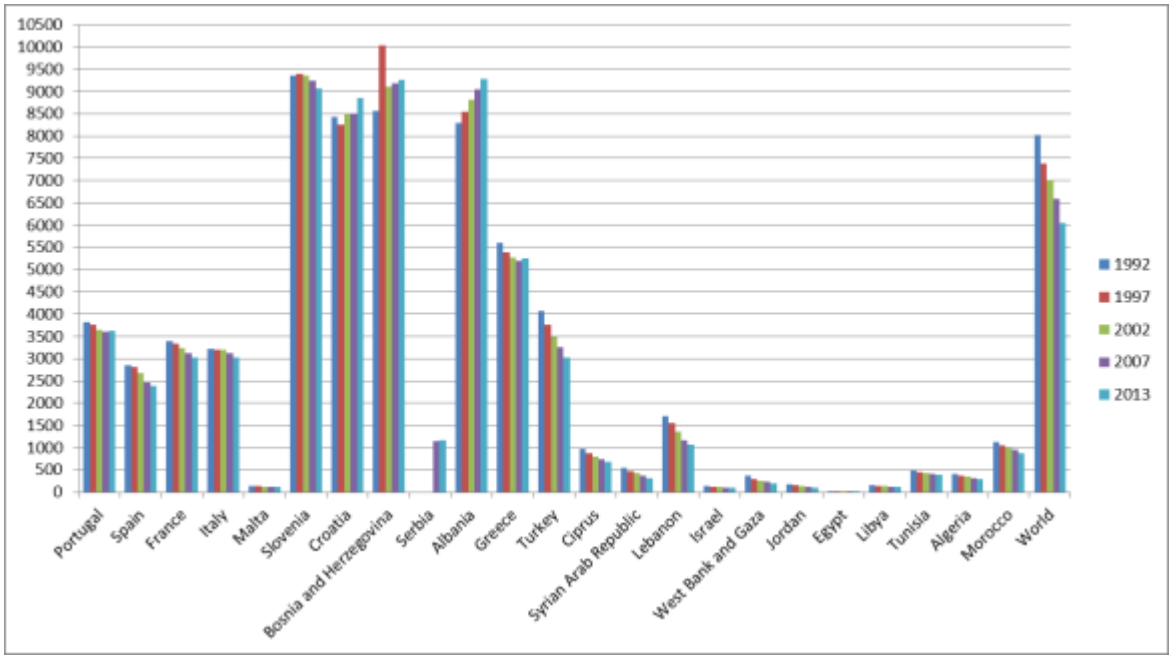
**Global Annual Renewable Water Supply Per Person in 1995 and Projections for 2025**

| Water Supply ($m^3$/person/year) | 1995 Population (millions) | 1995 Percent of Total | 2025 Population (millions) | 2025 Percent of Total |
|---|---|---|---|---|
| <500 | 1,077 | 19.0 | 1,783 | 24.5 |
| 500–1,000 | 587 | 10.4 | 624 | 8.6 |
| 1,000–1,700 | 669 | 11.8 | 1,077 | 14.8 |
| >1,700 | 3,091 | 54.6 | 3,494 | 48.0 |
| Unallocated | 241 | 4.2 | 296 | 4.0 |
| **Total** | 5,665 | 100 | 7,274 | 100 |

**Source:** WRI.

In the Mediterranean region, total renewable water resources per capita have steadily decreased in the last few decades and, according to a World Bank datasheet, in SEMCs only Turkey and Lebanon exceeded the threshold of 1,000 m3/inhabitant/year in 2013. C

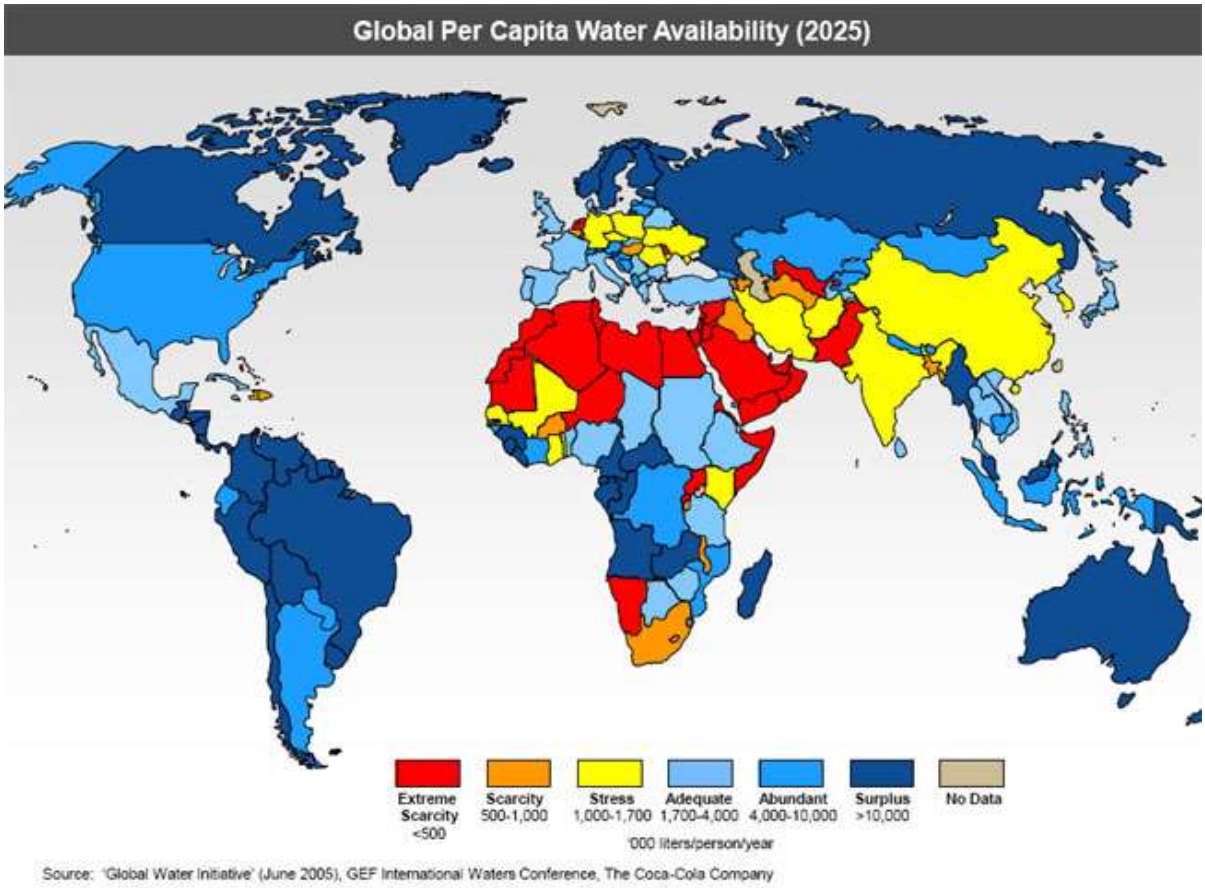
**Table 4 -Total renewable water resources per capita (cubic meter).**




Source: elaboration on World Bank data, 2015.

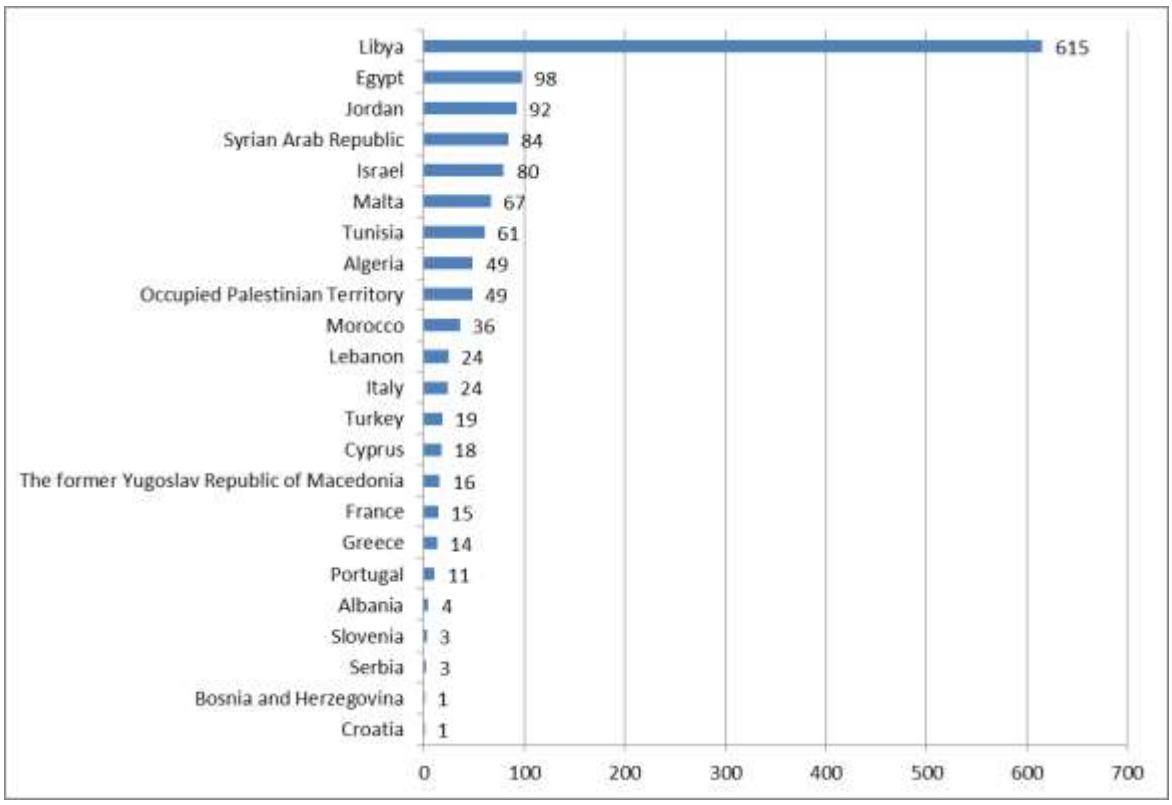
The global **per capita water availability scenario for 2025** shows a critical situation for SEMCs in Mediterranean area.

**Table 5 - Water availability**



Human pressure on water resources is measured by the Water Exploitation Index (WEI). In the Mediterranean region many SEMCs are reaching the alarming level of full exploitation of all renewable water resources.

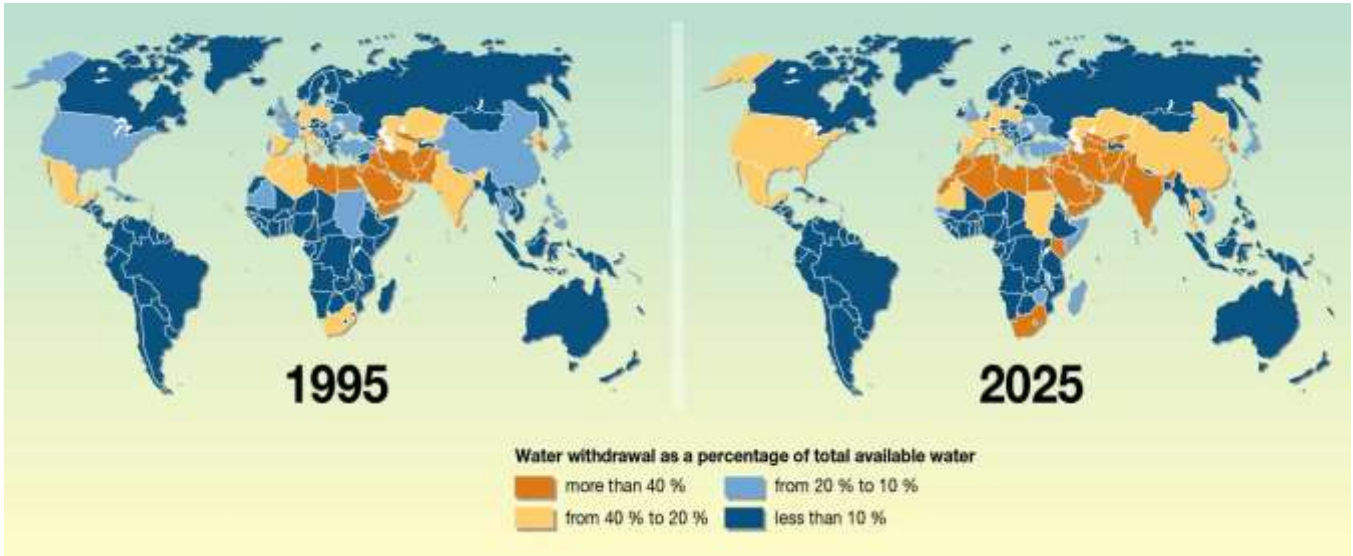
**Table 6 - Annual freshwater withdrawal as % of total actual renewable water resources**




Source: FAO. AQUASTAT database, 2015.

**Projections for 2025** forecasts a worsening in **freshwater stress** for Mediterranean countries and all over the world.

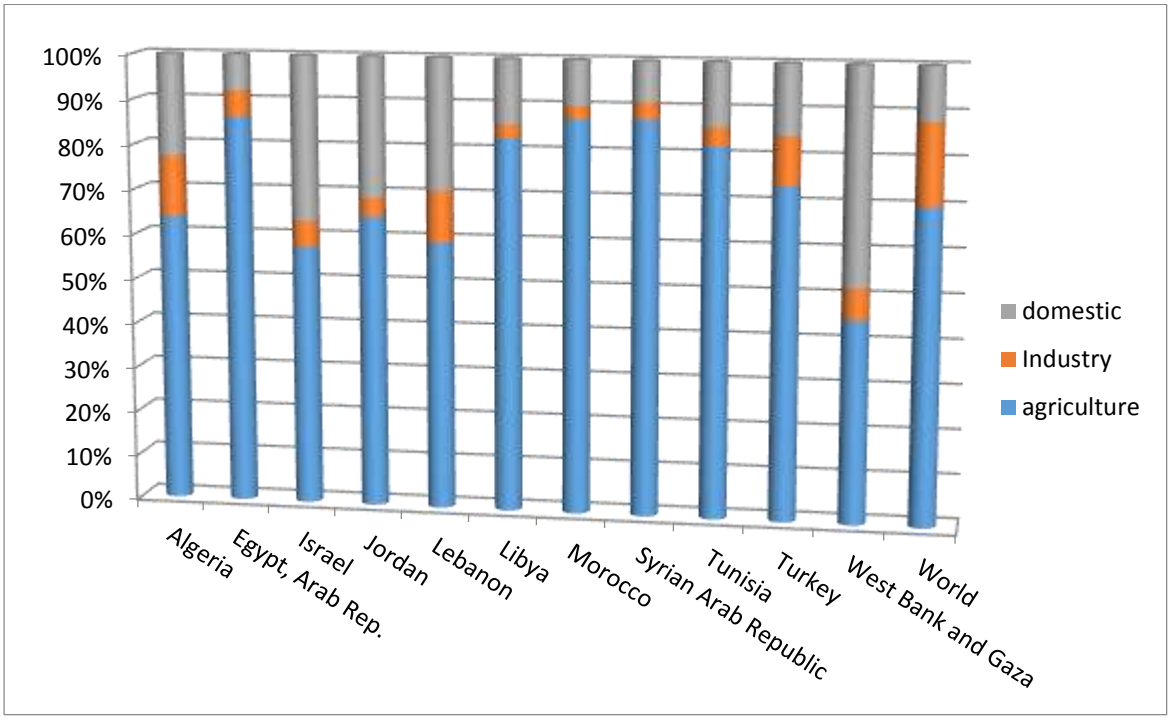
**Table 7 - Freshwater Stress (1995-2025)**




Source: Water Policy and Strategy of UNEP, 2015.

The water-food nexus explains the dominant role of agriculture in water allocation between different economic sectors. According to World Bank and FAO datasheets, agriculture is the largest user of water at the global level and it accounts for more than eighty per cent of total water use in many SEMCs, in comparison with a world average of seventy per cent. The highest percentages of agricultural water withdrawal are recorded for Syria (88 per cent), Morocco (87 per cent), Egypt (86 per cent) and Libya (83 per cent).

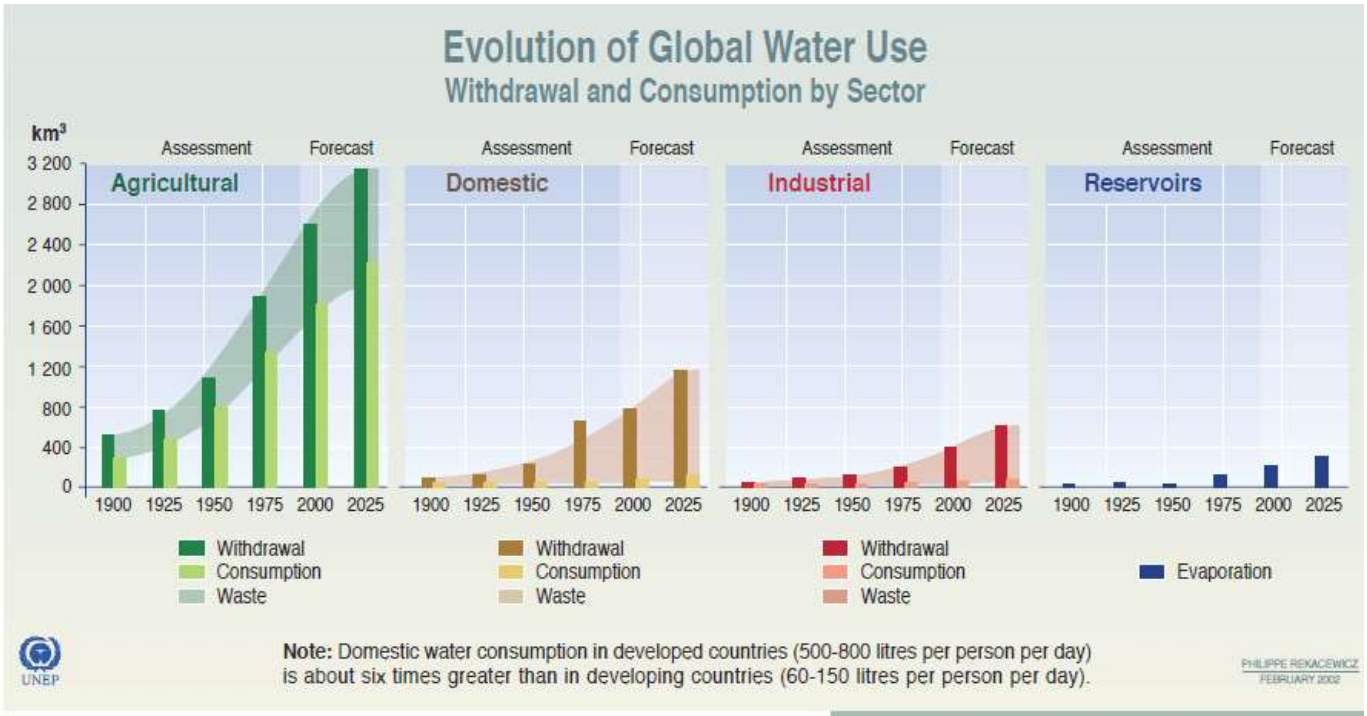
**Table 8 - Annual freshwater withdrawals, sectors % of total freshwater withdrawal**




Source: World Bank, 2014.

The evolution of global water use shows a major increase of withdrawal and consumption by agricultural sector in comparison with other sectors.

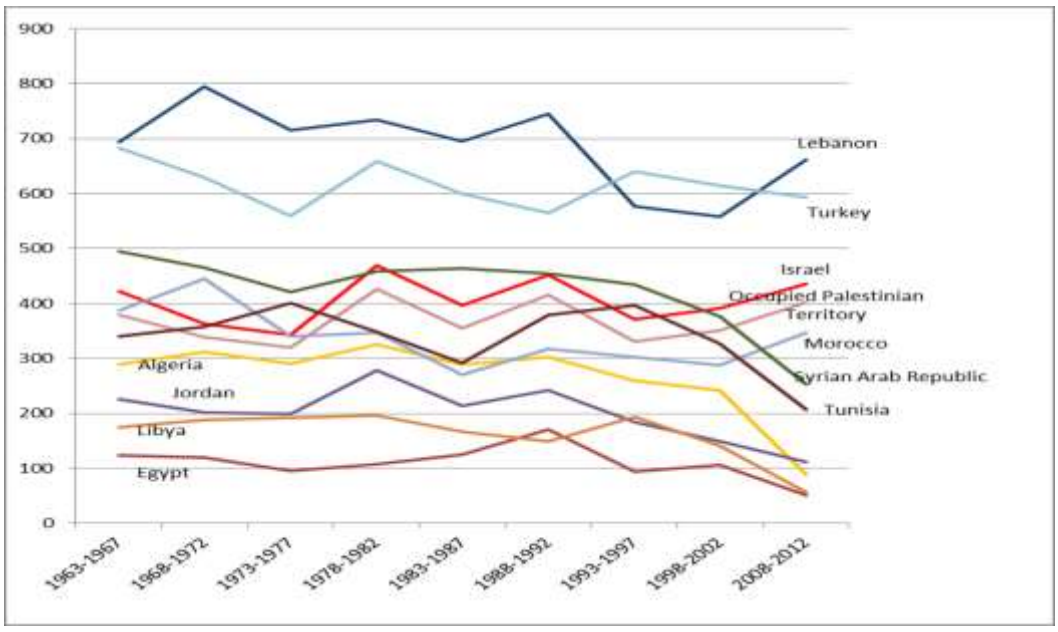
**Table 9 – Global Water use**




Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational,Scientific and Cultural Organisation (UNESCO, Paris), 1999.

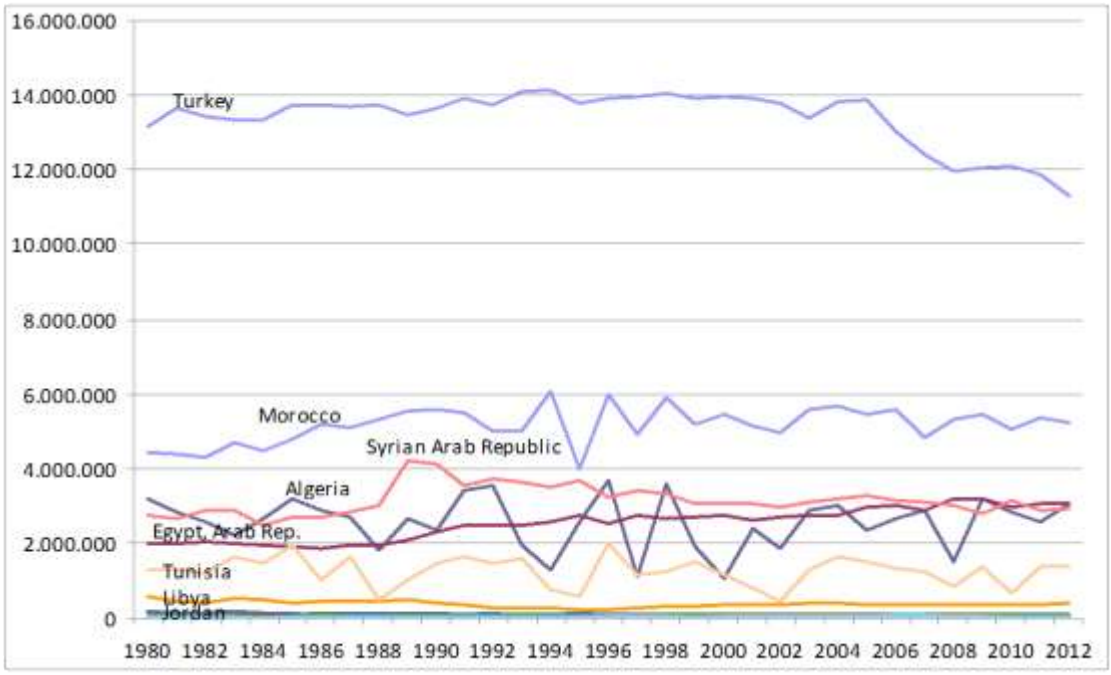
In Southern and Eastern Mediterranean Countries (SEMC's) climatic change significantly impacts agriculture, limiting crop productivity through increasing water demand and reducing water availability. National Rainfall Indices in SEMCs show a strong variability and a decreasing trend that affects most of those countries. Climatic change reduces rainfall and increases evapotranspiration, highlighting the water deficit of rain-fed crops. The oscillation of land dedicated to cereal cultivation between 1980 and 2012 shows the adverse influence of weather, with a surface reduction during drought periods, which had become more and more frequent by the end of the 1980s.

**Table 10 - National Rainfall Index (NRI) (mm/yr) 1963–2011.**



Source: data analysis – FAO 2013. AQUASTAT Database, Food and Agriculture Organization of the United Nations (FAO) and World Development Indicators 2014.

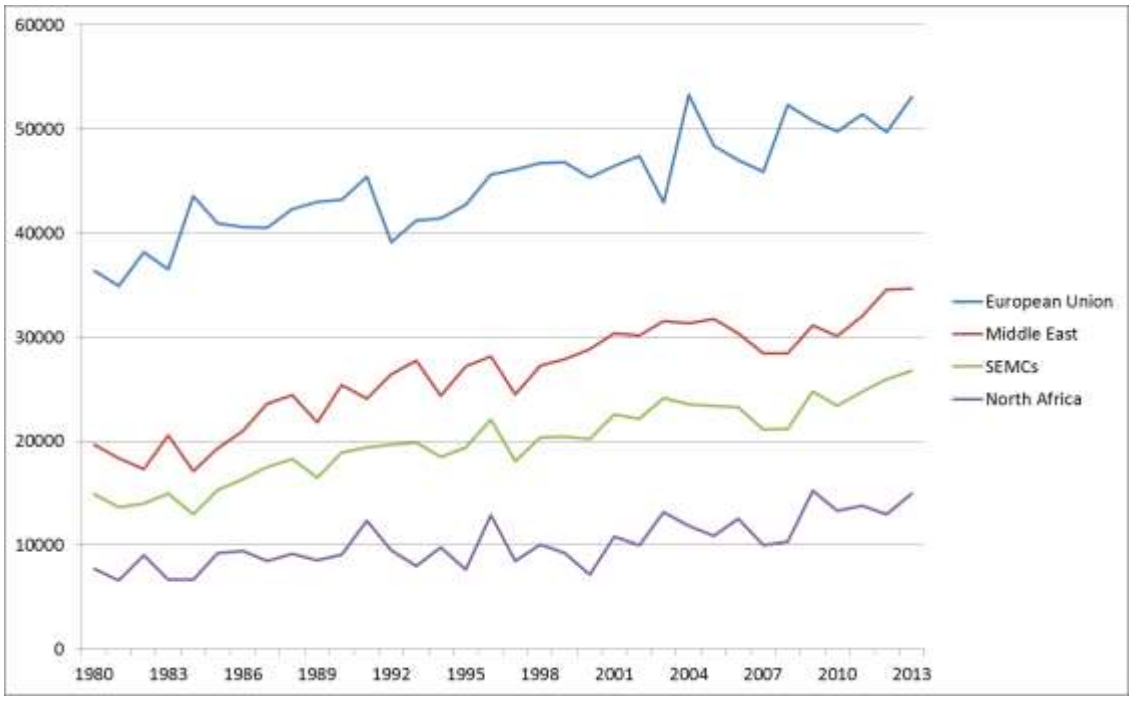
**Table 11 - Land under cereal production in some SEMCs 1980–2012 (hectares)**




Source: World Development Indicators, 2014.

Climatic change has a direct influence on cereal yields because the existing data show the dominance of green water – that is, water derived from rainfall – in cereal production. Actually there is a big cereal yeld gap between Southern and Eastern Mediterranean Countries (SEMC's) and European countries.

**Table 12 - -Cereals yield in SEMCs and European Union (Hg/Ha) 1980-2013.**

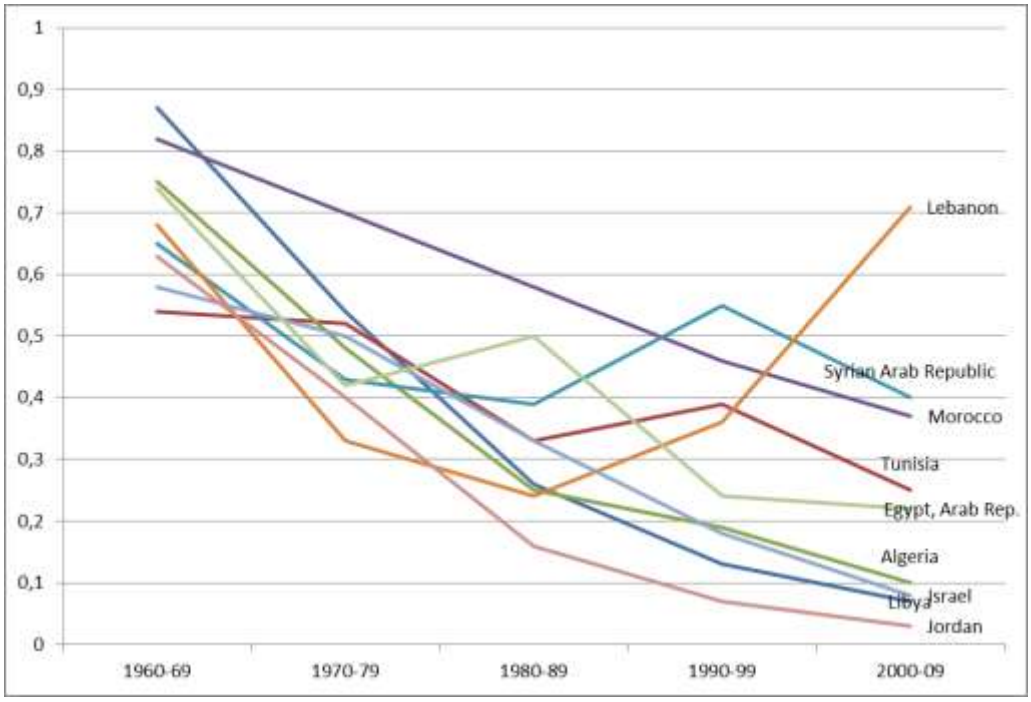


Source: Elaboration based on data from FAOSTAT Database, 2014.

**Bridging the yield gap in rainfed agriculture demands a strong investment in research and innovation because is urgent to increase the adaptation of rainfed crops to climatic uncertainty, to reintroduce cop varieties targeted to dry areas with high levels of resistance to insects and diseases and high tolerance to drought and salinity.** The transfer of European agronomic knowledge can play an important role in fostering dry agriculture. In all this aspect **PRIMA projects will develop a large range of research and activities aimed at achieving the sustainability and efficiency of agricultural production and a better management of water resources.**

The self-sufficiency index for cereals clearly shows the deterioration of the food situation in SEMCs. Those countries are the large net importers of cereals in the world it means they import around 56% of the cereals calories that they consume. The dependency on cereal imports to satisfy domestic demand measured by the ratios of imports to domestic consumption show a very high percentage for grains reaching 87% in Lebanon, 51% in Morocco, 51% in Syria, 68% in Tunisia.

**Table 13- Self-sufficiency index for cereals in SEMCs**




Source: Elaboration based on data from USDA–FAS.

The low self-sufficiency rate for cereals creates a strong vulnerability of SEMCs to food price fluctuation on the international markets. This vulnerability is also due to the high percentage of population under or close to the poverty line and to the share of family expenditure devoted to food (35.8% in Tunisia, 38.8% in Egypt, 43.9% in Algeria). According to the World Bank, a 30% increase in food prices in Egypt could determine a 12% increase in poverty.

Food security challenges between the two shores of the Mediterranean basin are different. In SEMCs investment in infrastructure and food systems are essential, since those countries often lack of basic infrastructure, above all storage systems to face sudden and unpredictable loss of

production of staple foods, while the high share of population under or close to the poverty line inhibit access to and affordability of food. Political risk and corruption frequently compound structural difficulties in these countries. European Mediterranean countries have a more diversified diet and a higher consumption of protein but they show also higher obesity levels. Moreover economic problems and unemployment have eroded affordability of food for lower income population.

A new index to measure the state of food global food security is the Global Food Security Index that considers the core issues of affordability, availability, and quality across a set of 109 countries. The index is a dynamic quantitative and qualitative benchmarking model, constructed from 28 unique indicators, that measures these drivers of food security across both developing and developed countries. The following data show a very low score for Algeria and Syria.

**Table 14 - Global Food Security Index in some SEMC 2012**

| | **Overall score** | Affordability | Availability | Quality and Safety | **GFS Rank** |
|---|---|---|---|---|---|
| France | **83,8** | 84,2 | 81,7 | 89 | **9** |
| Portugal | **80,5** | 79,7 | 78,0 | 89,6 | **16** |
| Spain | **78,9** | 82,1 | 73,4 | 86,0 | **16** |
| Israel | **78,9** | 81,8 | 74,0 | 85,4 | **19** |
| Italy | **77,0** | 82,8 | 69,6 | 82,9 | **22** |
| Turkey | **66,0** | 62,9 | 67,7 | 69,1 | **39** |
| Egypt | **61,8** | 55,6 | 67,9 | 60,9 | **47** |
| Serbia | **61,5** | 65,7 | 57,0 | 63,3 | **49** |
| Tunisia | **60,1** | 56,1 | 62,6 | 62,9 | **51** |
| Morocco | **53,9** | 49,6 | 57,9 | 53,9 | **62** |
| Algeria | **50,9** | 47,5 | 55,0 | 47,8 | **68** |
| Syria | **40,6** | 36,6 | 41,8 | 47,2 | **84** |

Source: The Global Food Security Index, The Economist Intelligence Unit, 2015

In Mediterranean countries the water food nexus is influenced by consumption patterns and food wastage. In the Mediterranean diet, the contribution of vegetable products to total dietary energy still prevails, but the consumption of meat and dairy products, which are highly relevant in terms of water consumption, is increasing. Of all food produced globally, about 30 to 50 percent is not eaten and the amount of food lost or wasted every year is equivalent to more than half of the world annual cereal crop (2.3 billion tons in 2009–2010). In the Near East region, along the whole production chain, 10 to 15 percent of non-perishables (e.g., grains—about 25 percent in the rice supply chain) and up to 60 percent of perishables, are lost (e.g., wheat total loss in Egypt, from harvesting until baking, accounts for 13 to 15 percent). For farmers and merchants, losses in grain and pulses range from 4 to 10 percent. Furthermore, post-cooking losses are also significant.

These factors call production and consumption models in SEMCs into question. Actually, it is fair to question the sustainability of their agricultural systems, since by mainly focusing on irrigated cultivation—fruit and vegetables—water consumption in the agricultural sector appear to be too

high in comparison with the scarce water resource endowment of these countries. More sustainable production and consumption patterns could reduce the strong pressure on water resources as well as the food dependency ratio.
PRIMA will therefore address these important issues with its set of actions, from research to innovation, from networking to capacity building and training.

**Project title**
**Impact of Climate Change on Agricultural Cropping Pattern in the MENA Region Egypt, Jordan, Yemen**

**Objectives of the action**
Global climate change may have dramatic impacts on agriculture and food security. This is especially so in the Middle East/North Africa (MENA) because of rainfall and groundwater scarcity. This project man aim was "Improving management is one of the most effective options in most agricultural systems, to increase water use efficiency" and it included number of reports that included the cropping patterns and examines the agricultural practices of the three MENA countries Egypt, Jordan, and Yemen, and looks closely at strategic crops and model input data in these nations.
These reports were result of a desk-review; its intention was to study the impact of various climate change scenarios on crop yield and water requirements for the selected crops in each country. The CROPWAT model developed by the Land and Water Development Division of the Food and Agriculture Organization FAO was used for this research as a decision-support system.

**Results and impacts**
In general, this study indicates that CROPWAT can be successfully used to assess potential impacts of climate change on cropping patterns. The model is user-friendly and simple. Agricultural cropping patterns should be enhanced to cope with anticipated climate change. Adoption of improved agricultural practices and technologies in general will be needed to cope with the constraints imposed by future climate change.
CROPWAT is a tool Model used to have pre prediction to the impact of climate change on the agriculture pattern in the future, so it's better to use real data for climate, soil and crop that measured for the three studies countries rather than using the available data in the FAO database in order to have model results that reflect the actual values of crop water requirement and yield reduction. The model activities in this research focus only on effects of climate change on crop water requirement. More constraints should be taken into consideration in future research including social, political, and economic aspects in optimizing the crop mix and water use.

## Water quality and resources

**Water scarcity is the most critical development problem in the Mediterranean area and the single most important factor in limiting agricultural growth**. Water availability in the region has been declining steadily since the late 1950s. Water resources in the Mediterranean region, according to Plan Bleu, are limited, fragile and unevenly distributed (UNEP/MAP/Plan Bleu, 2008). The most critical situation is recorded in the Near East and North Africa (MENA). Water demand has doubled during the second half of the twentieth century to reach 280 billion m3 per year for all riparian countries in 2005. Agriculture is the main water-consuming sector and accounts for 64 percent of total water demand: 45 percent in the North and 82 percent in South and East. According to the projections of the Blue Plan baseline scenario, water demand is increasingly met by an unsustainable water production (UNEP/MAP/Plan Bleu, 2008). Thus, improving the water demand management, water saving, rational water use and, in some cases, reuse of waste water even desalination projects to increase water availability especially for agriculture, is of paramount importance for sustainability in the Mediterranean area.
According to the Fourth IPCC report (IPCC, 2007), the Mediterranean is one of the major regions of the world where global warming will threaten environment and human activities (UNEP/MAP/Plan Bleu, 2008). Climate change is likely to affect agriculture and food security in the region primarily through changes in temperature, precipitation, extreme climatic events and sea level rise (Skuras and Psaltopoulos, 2012). Climate change may result in such adverse effects as further deterioration of water scarcity, land degradation, crop failures, loss of rangeland and other vegetation covers, livestock deaths, and fisheries production and quality decline. Desertification is also a major threat to productivity in the Southeastern Mediterranean countries. People in the dry areas mainly depend on agriculture and exploitation of natural resources for their livelihood and are hard hit by desertification. Of the 243 million hectares of agricultural land resources in the Mediterranean region, 63 percent are located on the southern shores but only 39 percent are deemed to be arable land. This area is decreasing under the pressure of urbanization and the rapid development of tourism, and soil quality is deteriorating due to the erosion from wind and rainfall and the intensive use of irrigation, in occasions with low quality water and the subsequent risks of salinization.

These pressures have encouraged more active consideration of alternative water sources as a strategic option to supplement water supplies and protect natural resources. Recognition of the potential role of water reuse in such a strategy is now well embedded within both European and national policy communities. Indeed, recent years has seen a sense of urgency in calls for water reuse to become more widespread. It is the top listed priority area in the recently published Strategic Implementation Plan of the European Innovation Partnership Water which drew attention to 'limited institutional capacity to formulate and institutionalize recycling and reuse measures, a lack of financial incentives for reuse schemes, and poor public perceptions towards water reuse.
Similarly, **maximisation of water reuse is a specific objective of the European Blueprint for Water (COM(2012) 673) with a proposal for development of a regulatory instrument on standards for**

**water re-use anticipated by 2015**. The published report on water reuse by the Water Supply and Sanitation Technology Platform notes that 'Although investors and water utilities are becoming increasingly enthusiastic about water reuse … the capability of Europe's water sector to deliver reuse projects is being compromised by a lack of suitable regulation, skills and public understanding'. This report also notes that 'with appropriate investment in people, knowledge, and technology, Europe could be a global leader in this rapidly developing market.' and highlights the 'huge eco-innovation potential in terms of technologies and services around water recycling in industry, agriculture and urban water systems'.

PRIMA will impact on the Euro-Mediterranean water quality and resources by devising a coordinated strategy that is currently needed in order to overcome the above mentioned challenges. In particular, by a successful adoption of the results of the PRIMA research and innovation activities, as well as capacity building and prototype development, of pivotal importance will be

- Demonstration of water treatment and desalinations technologies adapted to local context and their application validated for reuse purposes.
- Development of a Decision Support System (DSS) for water reuse, irrigation management and economical assessment.

In order to ensure the expected impacts the PRIMA activities will engage the full range of actors involved in the water management for safe food production (research, academia, extension, private sector, NGOs, producers, policy makers). Decision makers and other local actors involved in the water sector need to acquire specific capacities related to reuse practices. Capacity building activities within the funded project should include technical, organizational and raise awareness activities It is expected a broader understanding of technologies, but not only providing a technical solution, even more, promotion of policies and systems in water management is also taken into account in this proposal.

**Project title WATER DEMAND INTEGRATION -WADI**
**Funding Agency EC Period: 2006-2008**
**Partners**
**EU ITALY, SPAIN, Portugal, Malta,**
MPC Morocco, Tunisia, Egypt

**Objectives and results of the action**
1. to encourage the rational and sustainable use of freshwater resources within the Mediterranean coastal areas, experiencing freshwater scarcity, through participatory approaches;
2. to identify conflicts of use among stakeholders arising from improper management of water bodies and related constraints within selected study sites, across the Mediterranean coastal areas, which suffer from water scarcity and associated constraints;
3. to assess and estimate the impact/s of various water uses as well as nearby human activities on coastal water bodies, such as fluvial systems, estuaries, marshlands and lagoons;
4. to produce interdisciplinary scientific inputs for improved participatory water management strategies and related planning regimes for a rational use of water resources, taking into consideration economical, socio-cultural and environmental constraints at the local level, without losing sight of other broader scales (national, regional and international);
5. to develop and propose alternative management strategies and plans for the selected sites as well as general guidelines for appropriate and sustainable management of water resources in Mediterranean coastal areas;
6. to establish a network of scientists, authorities and local communities within the Mediterranean, to enhance local awareness on water quality, use and misuse.
ACTIONS
1. Key issues of water demand and sustainability of selected water bodies (study sites) were identified through meetings with different stakeholders. A conceptual framework was developed for the context of each case study;
2. Impacts were assessed, indicators of impacts were identified and their magnitude estimated according to prevailing conditions at each study site. Databases were built and results were integrated in G.I.S., providing suitable interfaces for management purposes. Models were developed to highlight trends of changes, and influential factors estimated;
3. Soft-system analysis was used to identify key issues and constraints for subsequent management of water resources. The results of the analyses conducted in the case studies have helped to develop alternative scenarios;
4. These alternative scenarios have been proposed to the stakeholders for the specific cases analysed, and in a wider context in the Mediterranean;
5. The follow up was made through international meetings held in different countries.

**RESULTS**
The project has contributed to enhance local competence for a sustainable use of water bodiesand to reduce existing and potential conflicts for water uses between different stakeholders, with special attention given to the weakest components of the community and to sustainability at the advantage of future generations.
Throughout the project comparisons of various case-studies over the Mediterranean coastal areas were conducted, at both northern and southern sides, in international co-operation and in collaboration with governmental and local stakeholders of different Mediterranean countries.
Data bases on a wide geographical scale (ideally the Mediterranean region, comparing data bases) and time scale (using time series) have been produced to enhance the power of the management plans and to assist stakeholders to apply for financial support at the national and international levels.
The project contributed to identify the various stakeholders in different case studies and their various forms of contribution to water management according to various physical, socio-economic and cultural backgrounds. This assisted in profiling different local communities and defining the roles of men and women at different areas and levels in water management and planning.
The specific role of women as end users of water was a main focus and special attention was paid to their involvement in the local dissemination of the project findings and results.
Dissemination material has been produced to convey messages easy to understand about the importance of water resource and its conservation through a correct use.

**Project title**
**DEMOWARE – INNOVATION DEMONSTRATION FOR A COMPETITIVE AND INNOVATIVE EUROPEAN WATER RE-USE SECTOR**

**Funding Agency EC Period: (2014-2016)**
**Partners Countries**
**EU: United Kingdom, Netherlands, Germany, France, Spain, Czech Republic, Belgium, Italy,**
**Other: Switzerland, Israel**

**Objectives of the action**
The ability of Europe's communities to respond to increasing water stress by taking advantage of water reuse opportunities is restricted by low public confidence in solutions, inconsistent approaches to evaluating costs and benefits of reuse schemes, and poor coordination of the professionals and organisations who design, implement and manage them. The DEMOWARE initiative will rectify these shortcomings by executing a highly collaborative programme of demonstration and exploitation, using nine existing and one greenfield site to stimulate innovation and improve cohesion within the evolving European water reuse sector. The project is guided by SME & industry priorities and has two central ambitions; to enhance the availability and reliability of innovative water reuse solutions, and to create a unified professional identity for the European Water Reuse sector. By deepening the evidence base around treatment processes and reuse scheme operation (WP1), process monitoring and performance control (WP2), and risk management and environmental benefit analysis (WP3) DEMOWARE will improve both operator and public confidence in reuse schemes. It will also advance the quality and usefulness of business models and pricing strategies (WP4) and generate culturally and regulatory regime specific guidance on appropriate governance and stakeholder collaboration processes (WP5). Project outcomes will guide the development of a live in-development water reuse scheme in the Vendée (WP6). Dissemination (WP7) and exploitation (WP8) activities, including the establishment of a European Water Reuse Association, ensure that DEMOWARE will shape market opportunities for European solution providers and provide an environment for the validation and benchmarking of technologies and tools. Ultimately the DEMOWARE outcomes will increase Europe's ability to profit from the resource security and economic benefits of water reuse schemes without compromising human health and environmental integrity.

**Results and impacts**
The activities delivered through the project will support equipment and scheme designers, planners and operational staff. The programme has two central ambitions:
(i) to enhance the availability and reliability of innovative water reuse solutions, and
(ii) to create a unified professional identity for the European Water Reuse sector.
DEMOWARE has been developed through close collaboration between SMEs (many of which are research active), major industrial players in the European reuse sector, and several of Europe's leading water reuse research institutions. It has also been informed by both European and national level studies as well as by consultation with major stakeholders such as the European Water Supply and Sanitation Technology Platform (WssTP) and water service & equipment providers who all urge greater coordination of efforts to overcome the barriers which constrain the emergence of a vibrant European water reuse sector.

**Project title**
**BLUEGREEN MED-CS - NETWORKING CIVIL SOCIETY IN THE MEDITERRANEAN REGION**
**Funding Agency** **Period: (2014-2017)**
Mediterranean Partner Countries: Algeria, Lebanon, Morocco and Tunisia.
Other: Albania

**Objectives of the action**
The project's overall goal is to strengthen existing - and promote new – cooperation and leveraging opportunities among Euro-Mediterranean civil society organisations (CSOs) dedicated to water and environment, thereby maximising their contribution to sustainable development in the region. In particular, the project aims to: Reinforce the participation and cooperation of southern CSOs in various areas, including wetlands protection and sustainable management, integrated water resources management, education for sustainable development and awareness, as well as marine litter, through an integrated and interactive capacity building programme that brings together technical and organisational expertise and tools and capitalises on existing practices and projects. Foster dialogue between civil society, public authorities and other relevant stakeholders by strengthening existing participation mechanisms, or promoting ones.
**Results and impacts**
The technical, organisational and institutional capacities of at least 120 Mediterranean environmental CSOs have been strengthened to provide goods and services to society more efficiently and sustainably. CSOs' capacity for designing, implementing, monitoring and evaluating high-potential, innovative projects have been reinforced. The target CSOs will actively participate in, and contribute to, national policy dialogues and regional processes on relevant environment and water issues.

**Project title**
**MEDITERRANEAN KNOWLEDGE PLATFORM ON WATER (Med Water Knowledge)**
**Funding Agency UfM project**
**Partners** EU: Spain Monaco
Mediterranean Partner Countries: Jordan • Lebanon • Morocco • Tunisia

**Objectives of the action**
This project aims to provide a common basis for the development of National Water Information Systems (NWIS) in four pilot countries from the Southern Mediterranean region. Furthermore, the project will deliver an assessment of water resources management and use (drafting of a White Paper) by collecting and exploiting data in the pilot countries and two additional European countries.
The project will define which data, information and expertise are needed to plan integrated water resources management (IWRM). It will also reinforce water regulation, ensuring data availability and ownership at local and national levels. The information provided by the project will allow for an evaluation of best practices, joint management of transboundary resources and follow-up on regional and sub-regional projects/policies in the Mediterranean region, on a voluntary basis.
**Results and impacts**
Implementation of an initial phase of National Water Information Systems (NWIS) in Morocco, Tunisia, Jordan and Lebanon, based on harmonised regional guidelines and international standards;Provision of training courses for the development and management of shared water information systems; Launching of a regional platform to exchange experiences and best practices on the process of developing national information systems and white papers on water; Preparation of automated data flows for international reporting agreed in the Mediterranean region.

**Project title**
**Monitoring and Evaluation of Water in North Africa (MEWINA)**
**Funding Agency Centre for Environment and Development for the Arab Region and Europe (CEDARE)**
**Period: (2011-2014)**
**Partners**
**Mediterranean Partner Countries: Egypt, Algeria, Libya, Mauritania, Morocco, Tunisia**

**Objectives of the action**
With a budget of about 1.9 million Euros, the project (2011-2014) is divided into 4 components including:
PHASE I: Assessment of existing M&E Systems
PHASE II: Standardizing and harmonizing National and N-AMCOW M&E systems and reporting
PHASE III: Preparing a North African M&E Action Plan and Program
PHASE IV: Project Management
The project is expected to establish national units for Water Monitoring & Evaluation within the main ministry in-charge of water at the national level in the 6 North African countries (Egypt, Algeria, Libya, Mauritania, Morocco, Tunisia) With North Africa being the first sub-region in Africa to start the M&E Water program under AMCOW, the expected harmonized Water M&E system at the North African sub-regional level, will eventually be replicated and implemented at the Pan-African level.

**Results and impacts**
Objectives and results of the action Implemented by CEDARE under the umbrella of the African Ministers' Council on Water (AMCOW), and funded by the African Water Facility (AWF), the Monitoring and Evaluation for Water in North Africa (MEWINA) Project is a pioneer project that embodied homogenous efforts among North African countries, in the area of Water Sector M&E, capacity building and more.
MEWINA main aim is to monitor and evaluate the MDGs concerning the water sectors especially the water supply and sanitation coverage. And to enhance the integrated water resources management through the development of water sector data and information management systems including indicators .
Three years of collaborative efforts between CEDARE, and the water ministries in Algeria, Egypt, Libya, Mauritania & Tunisia have resulted in launching five National Baseline State of the Water Reports (SOW) for the five countries, and a Regional North Africa State of the Water report for the first time in Africa.
A special session at the 3rd Arab Water Forum was dedicated to the launching of SOW reports on December 9th, 2014, in Cairo, Egypt. As the project's key output, the reports represent an all-new methodology setting the groundwork for a consistent M&E mechanism for the water sector.
They included about 170 indicators categorized under 15 groups of indicators; including Water & Availability, Water & Uses, Water & Land Use Changes, Water & Services, Water & Energy, Water & Quality, Water & Health, Water & Climate, Water & Population, Water & Socio-Economics, Water & Ecosystems, Water & Finance, Water & Governance, Water & Trade, and Water & International Relations.

Having reached that end, too many ultimate goals are still ahead.
Capacity building and vertical and horizontal expansion of the project's mandate is still promising in MEWINA Phase II, eventually targeting countries' improved efficiency, to assess and report on the State of the Water at the national and the transboundary basin levels periodically, and to be integrated at the regional and Pan-African levels.

## Biodiversity

The Mediterranean Basin Biodiversity Hotspot is the second largest hotspot in the world. The rich biodiversity of the Mediterranean terrestrial and marine flora and fauna, including many **endemic**

**species, is currently threatened by standardization of cultivation practices, monoculture, chemical contamination, overexploitation of natural resources, mechanization, and changes in lifestyles that are affecting traditional production systems across the Mediterranean area and have reduced the spectrum of the biodiversity, particularly relevant in preparing healthy and nutritious food recipes at the foundation of the Mediterranean diet heritage.**

Changes in the landscape and ecosystems have increased in recent decades, especially in the Mediterranean. The main pressure on these ecosystems and their biodiversity comes from tourism, urban development in coastal areas, overfishing, intensive farming and irrigation, and the abandonment of traditional agricultural practices (Numa and Troya, 2011).

Furthermore, indigenous knowledge on how to recognize, cultivate and use these local crops is also being lost at an unprecedented rate. The genetic diversity of food crops and animal breeds is diminishing rapidly. In fact, at the beginning of the twenty-first century it is estimated that only 10 percent of the variety of crops that have been cultivated in the past are still being farmed, many local varieties being replaced by a small number of improved non-native varieties (Millstone and Lang, 2008).

In Greece over 95% of traditional wheat varieties that were grown in farmers' fields by the middle of the twentieth century can no more be found and only a few of them are maintained in gene banks (IBPGR, 1981). In Spain, in the 1970´s, have been documented 350 local varieties of melons, today no more than 5% of them can still be found in the field. The first State of the World on Plant Genetic Resources for Food and Agriculture (PGRFA) (FAO 1998) shows that the picture is much the same throughout the world. The loss of agricultural biological diversity has drastically reduced the capability of present and future generations to face unpredictable environmental changes and human needs. The FAO report estimates that some 7 000 species have been used by mankind to satisfy human basic needs, while today no more than 30 cultivated species provide 90% of human caloric food supplied by plants (FAO 1998). Furthermore 12 alone provide more than 70% and a mere 4 species (potatoes, rice, maize and wheat) provide more than half.

The disappearance of ecological corridors and the homogenization of the natural mosaics are also threatening the survival and the reproduction of numerous wild species, many of direct economic importance (Zurayk, 2012). Environmental pressure is rising, particularly as a result of tourism, urban concentration in coastal areas, the development of intensive agriculture, the overexploitation of natural resources, overgrazing and the abandonment of traditional agricultural practices. Some effects of these pressures, such as changes in vegetation cover and habitat loss, can be estimated, but others are very difficult to quantify. About 18 percent of Mediterranean species are threatened with extinction, and it is estimated that only 5 percent of the original vegetation remains relatively intact in the Mediterranean region (FAO, 2013). The loss of agricultural diversity occurring around the Mediterranean area could threaten the food security and livelihood of populations living in the region.

Moreover, in spite of its wealth on Plant Genetic Resources for Food and Agriculture, Euro-Mediterranean agriculture is very much depending of plant genetic resources from abroad. Actually the Mediterranean countries, both North and South, depend on an estimated average of 70% on crops genetic resource coming from other regions of the world. Table 1 shows the estimated range

of dependency for each Mediterranean country from plant genetic resources from abroad (Flores Palacios 1998). It follows that international cooperation to ensure access to PGRFA from other countries is not a choice but a must for the region.

Access and International Cooperation in the Mediterranean region: The International Treaty on Plant Genetic Resources (ITPGRFA)4

Almost all Mediterranean countries have already ratified by their National Parlaments the ITPGRFA: Albania, Algeria, Cyprus, Croatia, Egypt, France, Greece, Italia, Lebanon, Libya, Morocco, Portugal, Spain, Syria, Tunisia and Turkey. Malta has already signed the Treaty but it has not yet ratified it. However much effort is still needed to fully implement its provisions.

The Treaty is not the only international agreement dealing with Genetic Resources for Food and Agriculture (GRFA), others such as the Convention on Biological Diversity (CBD) (CBD 2003)5,UPOV and TRIPS/WTO are also directly or indirectly related to access to GRFA and their related knowledge, technologies and information.

Food security is not simply a matter of delivering more calories to more people. Nutritional security, where dietary diversity plays an important role, is a vital component of food security. The Mediterranean Diet provides a good example which has been recognized by UNESCO as Immaterial Heritage of Mankind. It should be noted that most hungry people are living in rural areas. Solutions are needed to improve stability of production at local level, to provide increased options for small-scale farmers and rural communities and to improve quality as well as quantity of food available. To ensure that enough food is produced and is available for those who need it, public-sector research is needed in areas in which the private sector does not invest. In a number of Mediterranean countries many commercial crop varieties are not adapted to the needs of poorer farmers, who have limited or no access to irrigation, fertilizers and pesticides.

PRIMA will respond to the vision of the **EU Biodiversity Strategy, which aims to halt the loss of biodiversity and ecosystem services in the EU and help stop global biodiversity loss by 2020.** This reflects the commitments taken by the EU in 2010, within the international Convention on Biological Diversity, and will be scaled up at Euro-Mediterranean level, in order to achieve the unprecedented impact of mobilizing a critical mass of stakeholders for the establishment of a **new environmentally friendly, socially acceptable and ethically sound agricultural model .** Embedding a systematic and participatory process of cooperation between breeders and farmers will facilitate this valuable goal.

All the predicted scenarios of the Intergovernmental Panel on Climate Change (IPCC) (www.ipcc.ch) will have major consequences for the geographic distribution of crops and their genetic resources, including crop wild relatives. Some recent studies have used current and projected climate data to predict the impact of climate change on areas suitable for a number of staple and cash crops.

To cope with Climate Change, PRIMA will develop activities (mostly, but not limited to research) not only on diversity itself and development of varieties adapted to new conditions, but initiatives

[4] http://www.planttreaty.org
[5] http://www.biodiv.org/handbook/

started within the PRIMA Programme will also focus on how genetic resources can be used to broaden the genetic bases of our crops and to support mitigation strategies. This will ultimately lead to take advantage of all the more important and powerful technologies to increase the value and potential of PGRFA, especially for wild species, as potential donors of useful agricultural traits. Notably, emphasis needs to be put at local level, often on local and underutilized crops, to breeding and improve performance of a wide range of crops and varieties well adapted to local condition and needs, rather than just seeking uniform 'universal genotypes'. A systematic and participatory process of cooperation between breeders, farmers and consumers can achieve this.

Molecular genetics, genomics, proteomics, cryopreservation and ecogeographical remote-sensing techniques (using satellites and aircraft) have greatly expanded the technological bases for the location, conservation, management and use of genetic resources. This includes, for example, techniques for estimating the spatial and temporal distribution of genetic diversity, relationships between and within populations (http://www.fao.org/biotech/C13doc.htm), gaining insights into crop domestication and evolution (Lenstra et al. 2005; Diamond. 2002), monitoring gene flows between domesticated and wild populations (Moraesa 2007) and increasing the efficiency and effectiveness of gene bank operations (e.g. deciding what material to include within a collection, identifying duplicates, increasing the efficiency of regeneration and establishing core collections (de Vicente 2004; Tivang et al. 1994). To ensure complementarity and synergy in the implementation of existing legal instruments related to Plant Genetic Resources in the agricultural (ITPGR), environmental (CBD) and trade (WTO/TRIPs), possibly through the development of Mediterranean sui generis provisions in line with the requirements of these three international agreements (see Box below).

**Table 15: Estimated range of plant genetic resources dependency (%) for each Mediterranean country**

| Mediterranean Countries | Minimum (%) | Maximum (%) |
|---|---|---|
| **Albania** | 92.07 | 99.32 |
| **Algeria** | 73.84 | 80.48 |
| **Cyprus** | 78.93 | 90.19 |
| **Croacia** | 87.02 | 98.99 |
| **Egypt** | 90.80 | 98.70 |
| **France** | 75.55 | 90.67 |
| **Greece** | 54.24 | 68.94 |
| **Israel** | 27.89 | 42.33 |
| **Italy** | 70.82 | 81.21 |
| **Lebanon** | 33.85 | 58.57 |
| **Libya** | 67.21 | 81.24 |
| **Malta** | 84.35 | 98.15 |
| **Montenegro** | No data available | No data available |

| | | |
|---|---|---|
| **Morroco** | 58.13 | 75.11 |
| **Palestina** | No data available | No data available |
| **Portugal** | 78.86 | 90.88 |
| **Slovenia** | 89.99 | 98.81 |
| **Spain** | 71.41 | 84.84 |
| **Syria** | 14.17 | 23.47 |
| **Tunisia** | 68.90 | 83.04 |
| **Turkey** | 32.21 | 43.16 |
| **AVERAGE** | 65.70 | 78.32 |

Based on ( ftp://ftp.fao.org/docrep/fao/meeting/015/j0747e.pdf ).

The table shows the mean of countries' degree of dependency on crop genetic resources which have their primary centre of diversity elsewhere. The indicator used is the food energy supply in the national diet provided by individual crops. On the basis of the primary area of diversity of each crop, it has been calculated the estimated dependency that has maximum and minimum indices, showing there is a high rate of dependency by practically all cases.

### Waste production

Food waste is a very complex social, economic and environmental problem which, over the last decade, reached disquieting proportion and is having a dramatic influence at global level. In an historical era in which food security is widely acknowledged as a crucial need for feeding the nine billions of people expected to inhabit the planet by 2050, it is imperative for the sustainability of our society and economy to reduce the quantity of food that is either lost or wasted. Also the Euro-Mediterranean area is subjected to this global tendency. In particular, it is necessary to enable Europe with an array of opportunities to: i) invert the increasing tendency in food waste generation: food waste was 90 million tons in Europe in 2010, and expected to be 126 million tons in 2020 without action (*EU Preparatory study on food waste in EU 27, BIO IS, October 2010*); ii) develop the basic principles of a circular economy, which relies more on reuse and high-quality recycling of goods and less on primary raw materials (*Towards a circular economy: A zero waste programme for Europe, COM(2014) 398*); iii) increment the use of food waste by new valorisation routes in order to avoid incineration or landfill *(Directive 2008/98/EC)*.

In this challenging scenario, the main objective of the ENABLE project is to provide European Community with a structured system approach for the reduction and utilization of food and packaging waste including set of knowledge, tools, instruments, demonstrators and procedures to better understand the reasons of food waste generation at different levels and of developing the required actions to optimize the performances of the whole food chain, intended as that complex interplay whose dynamics span from primary production to consumers and final users.

The ambitious PRIMA SRIA depicted an integrated strategy which, taking advantage from the generation of the highest level of innovation for the benefit of all the relevant stakeholders of the food chain, will ensure food waste generation at all relevant stages of the food system are tackled. The projects that will be developed in the framework of PRIMA will generate innovative solutions, strategies, ideas, market–oriented approaches that will have a concrete and sustained low-to-mid term impact for policy- and decision-makers, the EU food and drink and chemical industry, and the consumers.

PRIMA impact will be achieved via four main innovation domains: 1) practical, easy-to-market and consumer-driven technological innovation; 2) advanced scientific and technical innovation, which will be either easily adoptable and transferable to technological outputs by the industry or already developed in house by a joint effort of research performers and industrial partners; 3) social innovation, thus valorizing the outstanding potential of the civil society in the unprecedented consumer-based challenge to the key barriers and opportunities to the achievement of a near-to-zero-waste society; 4) food chain innovation, thus responding to the need of "fostering a transition towards more sustainable food systems" (FoodDrinkEurope Competitiveness Report 2014) by increasing efficiency and decreasing waste generation along the whole food supply chain, from production to consumption.

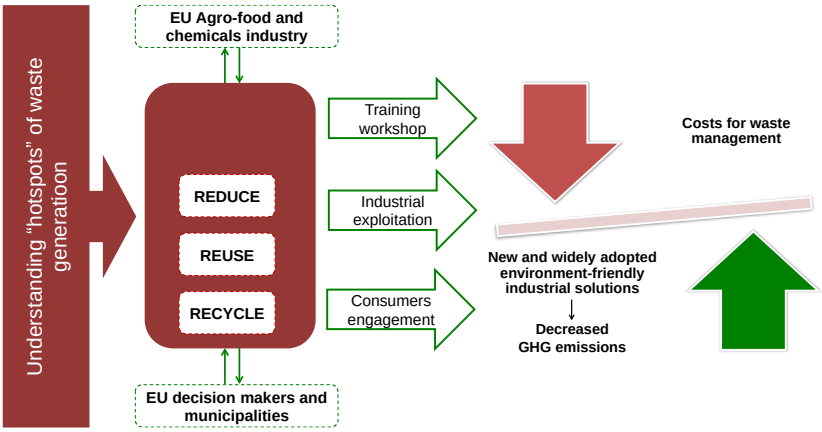
In providing these strategic and valuable impacts, PRIMA will primarily accomplish the complex EU scenario depicted by: Waste Framework Directive (2008/98/EC), Landfill Directive (Directive 99/31/EC), Communication on bio-waste management (SEC(2010) 577), Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP, COM(2008) 397 final) Action Plan, Thematic Strategy on the prevention and recycling of waste (SEC(2005) 1681, SEC(2005) 1682), the Green Paper on the management of Biowaste (SEC(2008) 2936), Council Directive on waste (75/442/EEC), Council Regulation on the supervision and control of shipments of waste (259/93/EC), Commission Decision establishing a list of wastes (2000/532/EC), Regulation on health rules concerning animal by-products not intended for human consumption (1774/2002/EC), Council Directive on nutrition labelling for foodstuffs (90/496/EEC), Council Directive on food additives other than colours and sweeteners (95/2/EC).

**Achieving the European policy target of reducing food waste by 50% by 2030, including at the consumer level**

Developing breakthrough innovations easily adoptable by the food and drink industries is mandatory to make them protagonist and pioneers in the adoption of technical, technological, managerial and behavioural solutions to reduce waste generation, improve waste exploitation and optimize waste management, along the food chain. Enabling the EU decision- and policy-makers with an array of recommendations and guidelines resulting from a thorough discussion and a mutual understanding at edge between consumer and business behaviours, PRIMA will be the first-of-a-kind integrated effort that will act as a Euro-Mediterranean catalyst in speeding up a process in which the industrial innovation framework influencing food waste generation will be moved by the choice of consumers of promoting a zero waste society. This will result into the request of a bottom-up consumer- and environment-friendly EU legislative supporting and facilitating the spreading of the proposed anti-waste measures into the most diverse (geographically and socio-economically) real life conditions.

**Reduction in waste management costs, and in environmental impacts, including emission of greenhouse gases.**

Food waste has many negative economic and environmental impacts, reducing the wellbeing of the different actors along the food value chains and representing unnecessary GHG emissions and wasted water and land. The production of greenhouse gases contributes adversely to climate change. Globally, the amount of food loss waste in 2009 was responsible for roughly 3,300–5,600 million metric tons of GHG emissions, 173 billion cubic meters/y of water consumption; 198 million hectares/y of cropland used to grow this wasted food; 28 million tons/y of fertilizer are used to grow this wasted food (WRI 2013).




PRIMA will produce a direct environmental impact that will ultimately generate an economic level (both at industry level, by decreasing waste management costs, and at societal level by decreasing the waste impact and GHG emissions)

**Decrease of waste management costs**

Providing measures to prevent waste generation during the relevant industrial stages (handling, storage, logistics, processing, distribution), PRIMA will guarantee less food waste is generated and therefore ensuring that an highest percentage of edible foods will be delivered in a form the consumer is willing to buy

Providing technical, technological and behavioural solutions aimed at reducing, reusing and recycling food waste along the food chain, PRIMA will ensure a significant decrease in the amount of unavoidable waste that is expected to be disposed in landfill, with an abatement of the associated disposal costs.

Providing innovative technologies for reusing food waste or recovering high value molecules from waste, PRIMA will ensure an economical valuation of an array of waste and by-products that have been currently accounted as economical losses.

Reduction of the environmental impact and emission of GHG. When considering the entire lifecycle of a food product, the economic/environmental impacts increase from production along the supply chain. The household stage has the greatest impact in this respect, with 45% of estimated GHG emissions linked to food waste; the processing sector accounts for around 35% of annual emissions (Preparatory study on food waste across EU 27, BIO IS, 2010). Therefore, the further along the supply chain a product is wasted, the higher is its cost. As a consequence, the reduction on food waste generated the projects developed within PRIMA will have a positive impact at each phase of the supply chain, but mainly at household level. At industrial level, the decrement of GHG emission will also be a significant outcome in the industry-targeted reuse and recycle activities. As an example, considering a possible stream of production of a bio-based molecule for food packaging application (e.g., bio-succinic acid produced after fermentation of food waste), it will allow a

decrease in GHG emissions of 94% with respect to the conventional petrochemical succinic acid (from data disclosed by Myriant Corporation). Valorising waste and byproducts within the PRIMA framework will also allow to accomplish another striking need for the modern society, the decrement of petrol dependence, which is acknowledged as a milestone due to the expected depletion of traditional energy resources by the Green Paper on Energy Efficiency (COM(2005)265). Indeed, switching from a carbon and petrol bases society to a renewable energy based one is a major feature contributing to a greener society demand. PRIMA will contribute to the decrement of the cost of biomass-based feedstocks, which generally are 60% more cost effective than petrol-based feedstocks, thus ensuring the consolidation and the expansion their market potential.

**Increase in the competitiveness of the European food and drink industry through new value chains based on waste and byproducts of the agri-food sector**

PRIMA will directly impact on the competitiveness of the European food and drink, and also packaging, industry, through creating new knowledge, on which better competitive edge can be built, and provision of this knowledge to SMEs, improving cost effectiveness and efficiency of using resources, generating new and maintaining existing jobs, creating and protecting IPR, improving energy efficiency. Turnover, profit and market share will be improved. In particular, food and drink industry will benefit from competitiveness improvement coming from different factors: 1) reduction of waste generation and resources spending; 2) availability of reused and recycled raw materials, through a better exploitation of food products and bio-based molecules produced, 3) a general reduction of costs for raw materials; 4) implementation of novel processes to recover the materials and energy contained within currently wastage food and packaging, 5) overall resource utilisation within the whole food and waste management chain, 6) new products with enhanced properties.
Ultimately, these features boosting the EU industrial competitiveness will not only result into an increased market shared, a more robust positioning in the global market, augmented revenues but will have the potential for empowering EU with an enhanced employment rate by the creation of new green jobs in existing industries, as well as fit-for-purpose creation of SMEs in the area of building new value chains from Food Grade Biowaste materials.

**TURNING BIOWASTE INTO SUSTAINABLE PRODUCTS: DEVELOPMENT OF APPROPRIATE CONVERSION TECHNOLOGIES APPLICABLE IN DEVELOPING COUNTRIES**
**BIOWASTE4SP –**

**Funding Agency EC Period:**
**Partners** EU: Italy Denmark) (Sweden)

**Mediterranean Partner Countries: Egypt, Morocco, Turkey**
**Other: (Malaysia) (Ghana) (South Africa) (Kenya)**

**Objectives of the action**
Developing and checking feasibility-sustainability of systems-processes to convert agricultural and industrial waste of some African countries - i.e. Egypt, Morocco, Kenya, Ghana, South Africa - into biofuels (bioethanol and biogas), biomaterials (fertilizers and feed) and other value-added products (e.g. lactic acid). Specifically, the project has explored sustainable biotechnological processes (through culture of microorganisms) for converting biodegradable fractions of identified African and Mediterranean agricultural and industrial waste. 4) Outputs
Catalogue that provides systematic information on various typical biowaste and bio-residues found in large quantities in the partner countries. There are a total of 49 biomass samples that have been studied and are included in the catalogue.
Guidelines that provide critical recommendations to the stakeholders in participating countries interested in investing along the value-added waste value chain. The project has defined procedures to assess the level of sustainability of the different biowaste uses and selection of the best alternatives for the use of biowaste from a sustainability viewpoint
Results and impacts

The Biowaste4SP, a project between European and African partners and Malaysia, has provided the basis for knowledge exchange between Europe and Africa in terms of how biowaste can be converted into sustainable useful products by developing appropriate conversion technologies applicable in developing countries. In this sense the possibility of building small scale plants (especially for biogas) is able to create diffused job opportunities and access to energy, mitigating the problem of cooking and heating in rural areas.
The main impacts on environment are the substitution of fossil energy with renewable ones and that he production of biogas, its captation and use produces heat and/or electricity and reduces GHGs emissions. A correct manure management can be a key factor to reach the goal of reducing GHGs for example the reduction for Morocco could be by around 18%). The production of value added materials can give further economic advantage to this production system.
How PRIMA could improve
The PRIMA programme can contribute to further develop the ideas carried out by the BIOWASTE4SP project, implementing practically the solutions envisioned in the project.

## Efficient use of resources

In order to increase agriculture productivity and food production the easy approach followed since the 1980's was mainly to improve irrigation developments based on augmenting water supplies via the construction of new storage facilities, but these activities have slowed down substantially. This signalled a paradigm shift, away from supply to demand management where improving the resource use efficiency is nowadays the main focus.

PRIMA activities on agriculture water management will impact on water use efficiency (WUE). This should be achieved through a holistic approach considering on and off farm aspects affecting WUE. In order to quantify the potential impact of PRIMA activities on the efficient use of resource several technological solutions are considered.

Implementing **precision irrigation** scheduling procedures combining crop evapotranspiration models and plant and soil water status information. Based on previous scientific trials,[6][7] it is expected that WUE can be increased by 15% without detrimental effects on yield. This is mainly because irrigation regime will be adjusted to the actual whole farm water needs and the frequency of irrigation will be guided by the soil water status information. This will allow minimizing water lost through deep percolation.

Implementing **regulated deficit irrigation** protocols where deficit irrigation is only applied in periods of time where crops have low sensitivity to water stress. WUE can be increased up to 40% in woody perennial crops such olive and grapevines, 20-30% in stone fruit trees and around 15% in citrus trees[8]. In herbaceous crops, the increased in WUE by using deficit irrigation will be of only 10-15% because there are few options for reducing water application without impacting on yield. However, in order to obtain the expected impacts, it will be crucial to jointly consider the off-farm aspects affecting water use efficiency. This includes hydraulic and water engineering constraints due to the use of collective network and the implementation of water governance models and pricing schemes able to stimulate the adoption of the practice and the implementation of the on-farm watering decision in the watershed water governance and accounting systems. PRIMA will consider on and off farm aspects of the resource use efficiency because it will favour the participation of all relevant stakeholders involved in the entire WUE chain. This will guarantee that the expected impacts to be achieved according to the scientific literature available will be translated in on-the ground verifiable solutions to be up taken by the end-users.

On the other hand, under the PRIMA umbrella, it will be possible to conduct long-term and integrated research programs. This will allow establishing north-south cooperative breeding and clonal selection trials able to identify drought and salinity tolerant cultivars and rootstocks.

This should guarantee a long-term and sustained impact on WUE because the PRIMA more basic research activities should identify genotypes with higher intrinsic plant WUE after having identified the stomatal controlling mechanisms able to improve leaf WUE. The potential of this approach will be guaranteed also considering the possibility of testing the material in long-term trials under different environmental conditions within the both shores of the Mediterranean Sea allowing for a better exploitation of field results.

[6] Bonet et al. 2010. Soil capacitance sensors and dendrometers. Useful tools for irrigation scheduling of orchards. *Spa J Agr Res* 2:S52-S65.

[7] Jones, H.G., 2004. Irrigation scheduling: advantages and pitfalls of plant-based methods. *J. Exp. Bot. 55*, 2427-2436.

[8] Fereres, E., Soriano, M.A., 2007. Deficit irrigation for reducing agricultural water use. *J Exp Bot* 58, 147-159.

The integration of water aspects with agriculture knowledge will also allow designing new field practices able to improve WUE in both, rain-fed and irrigated systems. The possibility of testing new canopy management and orchard designs for woody crops and new sowing dates better adapted to the temperature regimes, should result in WUE gain up to 20%.

A better water management and more precise irrigation scheduling will also result in higher nutrient use efficiency and lower risk of nutrient leaching to the environment reducing then underground water contamination mainly due to nitrates. This is particularly important since many Mediterranean regions are already included within the European list of nitrates vulnerable zones

**Sustainable use of irrigation water in the Mediterranean Region–. SIRRIMED**
**Funding Agency EC Period:**
**Partners**
**EU: Italy, Spain, England, France, Netherlands, Greece,**
Mediterranean Partner Countries: Egypt, Morocco, Lebanon

**Objectives of the action**
Objective 1. Improvement of water productivity through sustainable irrigation practices and management (farm and irrigation scheme scales). Testing, adapting, evaluating and proposing novel/alternative irrigation practices and management tools for improving water use and irrigation efficiencies
Objective 2. Assessment of the impact of irrigated agriculture on the regional water resources (watershed scale). By quantifying the magnitude and direction of change of key components of the watershed hydrological cycle in response to irrigation activities it is possible to clearly identify the major drivers that determine the available water resources and how they are altered by irrigation activities.
Objective 3. Towards a new concept of water governance. The focus on institutional issues has major implications for irrigation. Water governance is developed and managed differently in every country. Levels of governance and authority vary; responsibilities and mandates are somewhat confused, particularly between management of the resource and provision of services, and between the roles of the public and private sectors.

**Results and impacts**
The field trials executed at farm level provided new scientific baselines for precision irrigation and water-deficit control, as well as practical recommendations on the most suitable irrigation-scheduling strategy and monitoring technique / indicators to improve irrigation-water productivity for different crops (lemon, mandarin, and olive, peach, potatoes, tomatoes, vines and wheat) under different climatic Mediterranean conditions. The results emerging from these studies allowed quantifying the potential of sustainable irrigation water savings at farm level. New longer-term trials are now needed in order to ensure the sustainability of the identified practices particularly considering the risk of soil salinization their continuous use might imply.
In what concerns improving regional planning of water resources and environmental impacts of irrigation activities and their interactions with surface water and groundwater bodies, a Watershed information system was developed to provide synthetic and quantitative outputs of the different components of the catchment hydrologic balance and to diagnose the likely impact of irrigation water use on the quantity and quality of water resources downstream of the irrigation schemes. It was identified the need to carry out a cross-border watershed information system particularly for those countries sharing water resources or where the effect of the upstream practices will have consequences downstream.

## Sustainable consumption and food production

The human populations face today a global food security challenge. Feeding 9 billion people, who are soon expected to inhabit the planet, will result into an increase of food demand by 50% in 2030 and 80 to 100% in 2050. Climate change, water deficiency and environment decline (either at land and seas/oceans level) are also related to food insecurity. The Euro-Mediterranean area is not only aware, but also to some extent involved in this unprecedented trend. Therefore, responding to an increase of food demand is not only a matter of increase of productivity in the food industry, but also making the food system more sustainable by taking concrete actions to avoid that one third of

edible food is loss or wasted worldwide. This would result in a greener and more eco-efficient food system, with a reduced footprint and an overall greater benefit for our society. Tackling food insecurity goes in parallel with an evolution of the Euro-Mediterranean food and drink market, which is challenged by an increasing lack of consumer trust in the food industry and by a more marked attention to the theme of food safety. Authenticity, transparency, quality, safety and sustainability of foods are increasing concerns for the Euro-Mediterranean consumers.

Notably, the food and drink industry is the largest manufacturing sector in terms of turnover (€1,017 billion), value added and employment (4.25 million people) with 287,000 companies, mostly SMEs (99%) that constitute 49% of the turnover and 63% of the employment. Food and drinks make 14.9 % the turnover in the EU manufacturing industry, and machinery and equipment make the 8.5 %. Within the machinery and equipment sector, the subsector of industrial processing machinery for food, beverage and tobacco processing counts with 9,800 enterprises in the EU with a turnover of 19,300 EUR million, 6,600 EUR million value added and 130,000 persons employed (Food Drink EU Data & Trends 2014).
However, despite its huge economical relevance, to date the innovation potential of the food sector has been always depicted as medium-to-limited. Also the significant amount of European, national and international funding dedicated to research in the food sector didn't provide significant results. This is mainly due to inefficient knowledge transfer to industry (which, in the food and drink sector, is dominated by SMEs) and to difficulties in convincing EFSA of the validity of the health claim dossiers on which the positive effects of health-promoting foods, considered not as pure compounds but as an integral part of a food contributing to the overall diet, are based.
Although SMEs are aware of the importance of innovation for growth and diversification, they have limited organisation and resource capacities (especially in the current economic climate), and lack the necessary managerial competencies, experience and strategic vision to take part in such opportunities on their own. Conscious of that and the importance of innovation for their competitiveness, PRIMA will devise specific actions to encourage SMEs participation in its activities and will address outreach and technology transfer initiatives aimed at ensuring SMEs in the food sector (across the whole food chain), as well as food machinery and equipment sectors will profit the most from the PRIMA Programme results.
Furthermore, the innovative food production, transformation and processing required in order to boost the sector potential needs the adoption of new emerging technologies that needs an improvement of the professional skills of the existing workforce as well as to create new high qualified jobs as food technology operators, which is expected to attract the talent of the local human capital.

If successfully implemented, PRIMA Programme will have positive impact for the food chain, consumers, and society.
For industry, the most tangible impact will be a considerable increase in the success rate of new products introduced on the market, a better valorisation of resources, and increased revenues from sales of new products. Better interaction with consumers will allow managing the development of new and reformulated products in such a way that potential failures are recognized before market

introduction, resulting in a considerable reduction of wasted increasingly valuable resources such as food, water and energy. This will increase the competitiveness of the Euro-Mediterranean food sector compared to other actors in the global food market. This effect is expected for various types of actors in the food chain, both large and small. For many SMEs in the food sector, getting access to pre-competitive insight into consumer trends will give them a boost in their market insights. And while continuous interaction with consumers will be limited to core markets, the general increase in the level of both substantial insight into consumer trends and in tools enabling better consumer understanding will also facilitate access to new markets.

For industry, another impact will be a better alignment of business activities with societal goals and their own Corporate Social Responsibility policies. Many actors in the food chain already explicitly endorse aims of healthier food and more sustainable food production. However, business activities do no always mirror this, because launching healthy and sustainable new products with commercial success turns out to be difficult. Better interaction with consumers will reduce this risk and facilitate the successful launch of products that are aligned with societal goals.

Better interaction with consumers will also facilitate decision-making in the public sector. A better alignment of food chain activities with societal goals is useful for evaluating regulatory activities and provides a platform for industry-based voluntary agreements. Just as engaging consumers will increase the effectiveness of innovation in the food chain; it can likewise contribute to tailoring the allocation of public research funds to consumer needs.

For consumers, the empowerment resulting from more transparency and insight and having a more active role in food production will result in more trust in the food chain and less concern about specific issues related to food production. The better alignment of the supply of food products with their needs and demands will increase consumer satisfaction and, ultimately, well-being.

For society, the major outcome is an acceleration of healthy and sustainable food choices. At the same time, the better alignment of consumer needs and wants and food supply will decrease food waste.

**Food Authenticity**

PRIMA will answer to the need to address the quality and safety issues urgently as the food industry needs to regain consumer trust and meet the demand of a growing world population calling for an easy and secure access to foods with substantiated health promoting properties that have been sustainably sourced and produced.

In particular, the provision of safe and authentic Euro-Mediterranean food produced to defined quality standards is a key expectation of consumers as well as a key selling point for the European agrifood economy. However, despite the significant scientific and technological advancements in food science, many outbreaks and frauds are frequently reported. At the same time, ongoing and expected changes occurring in the food system (participative and solidarity economy, food banks and food donations, informal economy, urban livestock and farming) and in consumer eating habits (barter local food trade, street food, ready-to-eat foods) require a greater emphasis on addressing the global food safety concerns and counteract the increase of the risk for contaminations and accumulation of contaminants along the food chain.

PRIMA Programme will impact on the Euro-Mediterranean food sector by extensively tackling the food authenticity gap in the sector. This will be ensured by developing tools, methods, technologies, approaches and strategies to detect fraud, to verify the quality of foods and to improve (in term of performance, time and cost of analysis) the current procedures included in the regulatory standards and normative. Developing newly conceived integrated approaches embedding Key Enabling Technologies, ICT and classical food technologies, PRIMA activities will enable to re-design the entire food chain from food production to consumption and food preparation, with a significant benefit in relation to food traceability along the entire production-to-consumption chain and food safety.
The ultimate goal of PRIMA in relation to this issue will be to improve the protection of consumer and provide the market with a lower vulnerability to fraud and illegal events.

The European Parliament released its draft report regarding food fraud in October 2013, calling for increased enforcement and oversight regarding fraud prevention through the food supply chain. For this reason, the PRIMA Programme will deliver a significant impact by arming the Euro-Mediterranean food industry, professionals and quality control laboratories with the framework research, innovation, capacity building, training and networking/outreach conditions required to win the food authenticity challenge.

**Food Production**

In order to accomplish its ambitious goal, PRIMA Programme will pose a specific attention to the themes of processing technologies and food preservation for a better quality of food and drink products. This will be achieved, among other, through the development of innovative and/or mild processing technologies to substitute of those commonly used in the European food production framework (especially in the SME context) and which will be characterized by lower environmental impact, will prevent undesirable reduction of nutrient and bioactive compounds and will ensure the maintenance of of the core sensorial properties. Similarly, the role of food packaging is of particular importance, since it will guarantee sustainable consumption and production patterns by enabling a more efficient use or resources, ultimately helping to concomitantly ensure food safety within a global effort for counteracting increased food insecurity. The contribution of logistics is also pivotal. Identifying sustainable infrastructures and optimizing food distribution are not just sectorial needs but societal imperatives, in order to decrease emissions along the entire food chain. Besides, the use of innovative wireless technologies can help in valorising local productions and supporting a trusted relationship between producers and consumers.

PRIMA Programme will impact on the innovation capacity of the Euro-Mediterranean food system also by leveraging on regionality and local production specificities. This means that PRIMA will pose specific attention to actions and framework conditions (both at business, regulatory, educational and socio-economic level) for strengthening the diverse set of local Euro-Mediterranean food markets and developing a food system where production and consumption are balanced between local, regional and global levels. In order to achieve this impact, business and innovation strategies to redesign specific productivity systems at local level, scaling down the food production with a 'fork to farm' approach, and ultimately reducing the environmental impact of food production and helping to preserve the local biodiversity, will be devised.

**Food and Health**

Europe, and the Euro-Mediterranean area, are facing an unprecedented societal shift, with an increase in the prevalence of unhealthy lifestyle and habits that is resulting in a rise of overweight, obesity and unhealthy conditions to impaired access to healthy foods. According to WHO, in 2025 more than 50% of the population will be overweight or obese in 15 out of the 28 EU countries. At the same time, the EU population is aging, with more than 30% of population that is expected to be 65+ by 2025. This great socio-demographic challenge currently faced by the EU represents not only a serious threat for international public health if not properly managed, but also an untapped opportunity from an economic point of view for the innovative targeted products and food/service industries.

Taste is still the major driver of the food purchase and consumption habits together with low price and quality ratio, while the change in lifestyle is a matter of fact, with a wider variety of food products, increasing amount of food eaten out of home, new consumption occasions (street food, brunches, happy hours or slow food, among others) and specificity of life stage (from school to workplace, from nursing home to retirement house). Furthermore, consumers are devoting an increasing attention to local food production, as well as to local or cultural food models (e.g. Mediterranean diet, kosher, halal, vegans or vegetarians, among others).

In this context, the JPI Healthy Diet for Healthy Life (HDHL), the major joint programming initiative across the border of food and health, encompasses in its vision that "*in 2030 all Europeans will have the motivation, ability and opportunity to consume a healthy diet and adopt healthy lifestyle, and the incidence of DRD will have decreased significantly*." Therefore, understanding the needs of this evolving scenario, PRIMA Programme will achieve a meaningful impact by delivering effective strategies to make the healthy choices the easiest choices.

Moreover, PRIMA strategic approach will respond to the critical need of overcoming the imperfection and inefficacy of existing prevention programmes, especially in poorest countries or in countries undergoing an emergency crisis, as reported by WHO.

The challenges to ensure safety, quality, sustainability and health-promotion in modern food chains are to identify new opportunities that may arise when new breeds, sustainable agricultural practices together with new production processes, new food formulations, personalized food strategies, as well as distribution systems – also those leveraging on regionality - are introduced to meet changing and continuously evolving consumer needs and demands.

PRIMA Programme will take advantage of the scientific and technological advancement and will impact on the Euro-Mediterranean society (and beyond) by developing a set of coordinated actions, spanning from research to innovation, from SME partnership to networking and training/capacity

building, to deliver novel, effective and personalized food strategies and addressing specific nutritional needs of the population and the need of making the healthy option.

PRIMA Programme can leverage on the exceptional heritage that is represented by the overall diversity and wide choice of safe and high quality Euro-Mediterranean food and drink products that are available to consumers today and which are exported and renowned worldwide.

As main impact, PRIMA will achieve a better quality of the European diet in general and will contribute to tackling obesity and diet-related non-communicable diseases. Innovation in food production and consumption will not be seen and addressed in isolation, but rather they will form part of a comprehensive, holistic and long-term policy agenda, including consumer education, dietary recommendations, product information and the promotion of active and healthy lifestyles.

It is noteworthy to underline how food and nutritional education for the general population is lacking in most educational programs worldwide, and this is having a growing impact on the dissemination of unhealthy behaviours leading to increasing public health concerns. PRIMA Programme will arm future generations with the basic skills they need to lead happier, healthier and more productive lives. Altogether, this will lead to the development of a set of innovation actions aimed at delivering new products, services and strategies that can be translated into new business opportunities.

**MEDITERRANEAN RESCP POST RIO+20 Supporting the adoption of Sustainable Consumption and Production (SCP) and Resource Efficiency (RE) models in the Mediterranean Region**

Funding Agency UfM Period: (2009-2013)

Partners Egypt ; Jordan; Montenegro; Morocco; Tunisia; Turkey

Objectives and results of the action

In a two-pronged approach the project aims to: Provide access to financing for companies adopting Sustainable Consumption and Production (SCP) / Resource Efficiency (RE) models in Egypt, Jordan, Morocco, and Tunisia. Stimulate the development of green industries and entrepreneurship in the Western Balkans and Turkey through the implementation of technical assistance and pilot projects.

In Egypt, Jordan, Morocco and Tunisia: Market assessment of resource efficiency opportunities. Policy dialogue activities, training and capacity building seminars to raise awareness on SCP and RE opportunities. Design and implementation of new financial instruments for companies adopting SCP/RE models as well as technical assistance packages to support these instruments.

In Turkey, Albania, Bosnia & Herzegovina and Montenegro: Implementation of demonstration projects for companies investing in cleaner & more resource efficient (water, energy, raw materials and waste minimization) manufacturing based on the MEDTEST methodology.

Provision of training and advisory services to green entrepreneurs. Provision of capacity building programmes on SCP/RE to civil society organisations, business and consumer associations, universities, etc. Provision of information on lessons learnt, best practices and strategies for replication, as well as on ways to ensure long-term sustainability of SCP/ RE demo initiatives

RESULTS: Increased number of industries and stakeholders applying SCP/RE principles in their activities; At least 30 demo projects successfully implemented and 100 new local initiatives identified as business opportunities; At least 10 new green businesses created and in operation by the end of the project; access to financing granted to the best 4 new green businesses; and grassroots innovations joint ventures established. A web-based regional platform established and linked with other regional and international initiatives to provide integrated information to stakeholders

**Sustainable agri-food systems and rural development in the Mediterranean Partner Countries Sustainmed**
**Funding Agency FP7 EC Period:**

Partners has brought together during three years recognised researchers working in six research institutions of four Southern EU Member countries (France, Greece, Spain, Italy) , one partner from Turkey originally four partners from Mediterranean Partner countries Tunis, Egypt, and Syria, the latter having dropped out because of political events in that country. In addition, two teams from Northern EU countries have been mobilized because of their specific and well recognized competencies on value chain analysis (Kent Business School) and sustainable agriculture and forestry (PTT Finland).
Objectives and results of the action
he overall objective of the SUSTAINMED project has been to examine and assess the impacts of EU and national agricultural, rural, environmental and trade policies in the Southern and Eastern Mediterranean region, namely in so-called Mediterranean Partner Countries (MPCs) as well as in Turkey. The impacts to be analysed were very diverse, including socio-economic structural changes, employment and migrations trends, income distribution and poverty alleviation, resource management, trade liberalisation, as well as commercial relations with major trading partners (in particular the EU) and competitiveness in international markets. The rationale for such a wide research agenda was the realization that trade liberalization alone, which has been the linchpin of Euro-Mediterranean cooperation for decades, will not be sufficient to promote sustainable development in the Mediterranean region
Results and Impacts
The potential impact of this SUSTAINMED project could be very significant, not so much because of the originality of the scientific insights gained but because of the topicality, relevance, and urgency of the policy lessons learnt. Admittedly, many of these lessons had been formulated before in one form or another. But it is their robustness which is striking. The main merit of our project may be the contribution to this robustness of the conclusions. In summary, rural poverty remains a major problem which can and must be tackled more effectively through a re-examination of the intellectual foundations of past policies; sustainability issues are serious, worrisome for the long term and not adequately addressed by existing public policies so far, because the social and environmental dimensions are not given sufficient attention; trade liberalization alone will not be sufficient to promote sustainable development in Southern and Eastern Mediterranean countries and the European Neighbourhood policy must give much more attention to the core issues of long term rural development than it has done so far.

## Land use and soil quality

**Status of Mediterranean soil resources**

Soil is the earth's fragile skin that anchors all life on Earth. Consisting of countless species that create a dynamic and complex ecosystem, it represents one of the most precious resources to humans. Soil degradation is the decline in soil quality caused by its improper use for agricultural, pastoral, industrial or urban purposes. Half of the topsoil on the planet has been lost in the last 150 years. Soil degradation is considered a serious global environmental problem which can be exacerbated by the impact of climate change. Soil degradation involves physical loss and the reduction in quality of topsoil associated with nutrient decline and contamination. In physical loss, the two main soil degradation processes are soil erosion by water or wind. In the second category are chemical, physical, and biological degradation. The chemical degradation mainly consists of soil pollution and acidification and its consequences as mobilization of harmful elements/compounds, salinization and/or sodification, unfavourable changes in the nutrient regime, and decrease of natural buffering capacity. Physical deterioration comprises surface sealing or crusting of top soil, soil compaction,

structure destruction, and extreme moisture regime. Biological deterioration includes imbalance of biological activities via loss of soil organic matter and biodiversity. Biodiversity and organic matter can decline due to erosion or pollution, leading to a reduction in soil functions such as control of water and gas flows. Reduced above-ground plant diversity as a result of tillage, overgrazing, pollutants, and pesticides decreases the microbial diversity in the soil ecosystem and disturbs its normal functioning.

The degree of soil degradation depends on soil's susceptibility to degradative processes, land use, the duration of degradative land use. The processes of soil degradation have major implications on:

a) global carbon cycle, mainly due to the decrease in soil organic matter and the release of CO2 to the atmosphere;

b) reduction in soil buffering capacity that is the capacity of soil to adsorb contaminants;

c) water and air quality;

d) biodiversity;

e) food production, food and feed safety;

f) Human health (Soil Science Institute of Athens-National Agricultural Research Foundation, 2010).

Nevertheless, soil is still considered the “Cinderella” among the natural resources that are indispensable to life and long-term sustainable development, not receiving the same importance given to water, coastlines and forests. Its ecological and productive values are not sufficiently recognized and thus, improving information on this subject is critical.

Along with water, coastlines and biodiversity, soils constitute one of the Mediterranean region's "critical" natural resources. Their enhancement and the care given to their conservation management have been a big contributor to the spread of successive civilisations. By contrast, their degradation, particularly through excessive erosion or salinisation, has in the past been a cause of sustained decline. Still today degradation in its various forms constitutes a significant threat to the future of the Mediterranean Basin (Plan Bleu, 2003).

The soils of the Mediterranean region are the product of interactions that have taken place between the natural processes of pedogenesis and the activities of human societies that have occurred over the millennia in this region. Anthropic activities have sometimes been beneficial, such as the conversion of slopes into terraces, but often they have led to various degrees of land degradation (e.g. the loss of organic matter, loss of soil structure, water and wind erosion, pollution) which have ended in the worst cases with the near-disappearance of the soil's upper strata and consequent desertification. Several types of soil degradation, such as erosion, are as old as the region itself, but actually new threats have appeared which are closely linked to socio-economic development and change in lifestyle, i.e. increase of urban population, economic growth, and farming intensification in marginal lands, all factors which lead to the over-exploitation of natural resources and urban and industrial waste pollution. Because soil degradation affects its capacity to fulfil its ecological functions and the socio-economic uses that depend on it, soil conservation in the Mediterranean region is a political and social challenge.

**Land degradation in the Mediterranean countries**

The degradation of soil resources is a major threat in the Mediterranean region due to climate conditions and global warming, topography, soil characteristics, changes in land-use, overgrazing and inappropriate cultivation practices, and dumping of hazardous wastes.
In the Southern-Eastern Mediterranean countries, salinization, water and wind erosion, loss of vegetation cover, soil physical degradation reduce the soil's capacity to provide ecosystem services and food security. These processes are exacerbated by the expansion of agriculture into marginal lands. The extend of degradation is greatest in: Tunisia (49%) and Jordan (41%), and Syria (35%) (Tab. 1).

**Tab. 16 - Land degradation extent distribution for SEMs**

| Country | Total Area (000 km$^2$) | None (%) | Light (%) | Moderate (%) | Severe (%) | Very Severe (%) | Total Area degraded (%) | Wighted index |
|---|---|---|---|---|---|---|---|---|
| Algeria | 2,319 | 89 | 0.51 | 1.56 | 7.26 | 1.60 | 10.93 | 3.18 |
| Egypt | 998 | 96 | 0.68 | 0.37 | 1.17 | 1.34 | 3.56 | 1.03 |
| Jordan | 90 | 59 | 0.001 | 22.65 | 4.88 | 13.18 | 40.72 | 11.27 |
| Lebanon | 10 | 94 | 1.72 | 0.14 | 4.52 | 0 | 6.38 | 1.56 |
| Libya | 1,618 | 85 | 0.13 | 0.47 | 10.43 | 3.98 | 15.01 | 4.83 |
| Morocco | 407 | 87 | 0.74 | 7.48 | 2.81 | 1.77 | 12.80 | 3.12 |
| Israel | 21 | 99 | 0.90 | 0.48 | 0 | 0 | 1.38 | 0.19 |
| Syria | 187 | 65 | 0.13 | 9.41 | 12.20 | 12.89 | 34.63 | 10.71 |
| Tunisia | 154 | 51 | 0 | 0 | 49.28 | 0 | 49.28 | 14.78 |
| Turkey | 781 | 63 | 0 | 0.03 | 21.64 | 14.88 | 36.55 | 12.45 |

Source: GLASOD

Many reports on the global state of soil degradation in the Mediterranean European countries describe a situation less alarming compared with that of the Southern-Eastern shore. However, the extent of soil degradation in Europe appears to be underestimated, because soil degradation on the territory has many facets, not all considered in previous estimates. The processes of human-induced soil degradation started in many parts of the region in ancient times. And even though soil changes can occur naturally, threat from a wide range of anthropogenic pressures are increasing, actually constituting the main reason for soil degradation in many parts of Europe. Particularly, land degradation within the southern European Mediterranean is partially due to dramatic land use changes that occurred during the second half of the last century as well as due to climate linked to human influence and its possible adverse influence on the environment (Hill 2003). They are mainly the Mediterranean islands which have been recognized as "hot spots" for various forms of soil degradation. For example, the main factors of soil degradation in the Mediterranean island of Sardinia (Vacca et al, 2009) are essentially human related to soil degradation processes which consist mainly in accelerated erosion, loss of prime farmland, compaction, salinisation, contamination, decrease of organic matter content, and adverse alteration of biological processes. These issues inhibit soil's key role as the basis for provision of food, feed, fibre and energy as well as for ecosystem services and mitigation of climate change (Tab.2).

**Tab. 17 - Land degradation extent distribution for European Mediterranean Countries**

| Country | Total Area (000 km$^2$) | None (%) | Light (%) | Moderate (%) | Severe (%) | Very Severe (%) | Total Area degraded (%) | Wighted index |
|---|---|---|---|---|---|---|---|---|
| Albania | 29 | 36 | 0 | 2.15 | 2.52 | 59.37 | 64.04 | 24.93 |
| Bosnia-Herzegovina | 51 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| Croazia | 57 | 30 | 0 | 0 | 34.14 | 35.69 | 69.83 | 24.52 |
| Cyprus | 9 | 83 | 0 | 0 | 16.92 | 0 | 16.92 | 5.08 |
| France | 547 | 86 | 3.79 | 8.28 | 1.83 | 0 | 13.90 | 2.58 |
| Greece | 132 | 70 | 0 | 15.18 | 14.76 | 0.52 | 30.46 | 7.67 |
| Italy | 303 | 77 | 0 | 14.94 | 8.03 | 0.09 | 23.06 | 5.43 |
| Macedonia | 25 | 47 | 0 | 4.20 | 15.37 | 33.06 | 52.63 | 18.68 |
| Malta | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| Slovenia | 20 | 39 | 0 | 3.72 | 10.25 | 47.09 | 61.06 | 22.66 |
| Spain | 510 | 78 | 1.59 | 11.04 | 7.99 | 1.19 | 21.81 | 5.24 |

Source: GLASOD

## General threats to soils in the Mediterranean region

*Wind and water erosion*

Wind and water erosion are determined by a complex interaction of factors closely related to the resilience of land resources, land use and management, and socio-economic conditions. Water erosion mainly affects those areas which have sloping lands and where rainfed agriculture is practiced. It results in the removal of fertile soils and in the reduction of irrigation efficiency and storage capacity (Fao, *Status of the World's Soil Resources Report 2015)*.

According to Fao and the GLASOD survey, the total area affected by water erosion in the MENA is of about 41 million ha, but the extent varies significantly by country (Tab. 3)

**Tab. 18 - Land degradation caused by water erosion in the Mediterranean Mena countries (1000 ha)**

| Country | Area |
|---|---|
| Algeria | 3,900 |
| Egypt | - |
| Libya | 1,300 |
| Morocco | 3,600 |
| Tunisia | 3,800 |
| Jordan | 330 |
| Lebanon | 65 |
| Palestine | - |
| Syria | 1,200 |

Source: Fao, *Status of the World's Soil resources 2015.*

Since more than half of the total area in the region receives annual rainfall of less than 150 mm, large areas are without plant cover, or the cover is sparse and fragmented. This situation is aggravated by land-use pressure, both from human and animals. The resulting wind erosion is the most common environmental problem in the region and accounts for approximately 60% (135 million ha) of soil degradation in many SEMCs (tab. 4).

**Tab. 19 - Land degradation caused by wind erosion in the Mediterranean Mena countries (1000 ha)**

| Country | Area |
|---|---|
| Algeria | 12,000 |
| Egypt | 1,400 |
| Libya | 24,000 |
| Morocco | 600 |
| Tunisia | 4,000 |
| Jordan | 3,000 |
| Lebanon | - |
| Palestine | - |
| Syria | 3,000 |

Source: Fao, *Status of the World's Soil resources 2015.*

In the Southern-Eastern shore, wind erosion which affects land quality by removing the fertile top soils, is primarily linked to overgrazing and cultivation of marginal land in arid and desert regions (Fao cit., 2015). In Morocco, erosion causes soil loss between 12 tons ha/year as a result of several factors such as, increased population pressure; deforestation; removal of natural vegetation from sloping lands; cultivation of vulnerable soils in arid and desert region; unappropriated land management. Furthermore, water erosion accelerated by anthropic factors is the main cause of soil degradation and deterioration of water resources. Soil erosion in Morocco affects up to 40% of its territory with the total annual soil loss evaluated at 100 million tons. In Algeria the Sirocco, a dust-blowing wind, causes significant wind erosion. A recent study (Houyou et al., 2014) showed that 20 million ha of steppe land faced a high risk of wind erosion due to low rainfall and poorly rooted vegetation on sandy soils. This area is further threatened by recent adopted government policies which aims to increase extensive rainfed cereal cropping. In Tunisia, soil loss due to water erosion has been estimated to be equivalent to 23,000 ha/year, while in Syria, it has been estimated to range from 10 to 60 kg/ha under forest, from 2000 to 2,5000 kg/ha under burned forest and from 960 to 3,280 kg/ha under agricultural lands. In Jordan, water and wind erosion are both cause of soil deterioration as well as in Palestine where farmers' willingness to adopt conservation measures is influenced by many factors, including knowledge and risk perception, land tenure, and the type of landscape. While previous studies estimated the risk of water erosion in Lebanon to be 50-70 tons ha/year, actually it has increased to 150 tons ha/year because of cultivation of fragile soils, overgrazing, deforestation and overexploitation of woodland resources, uncontrolled use of fire, unsustainable agricultural practices, inefficient water use and irrigation methods, and chaotic urban sprawl into fertile and forests (Fao cit., 2015). In Turkey, where 80 % of soils are located on slopes steeper, the area affected by moderate, severe and very severe erosion is 61.3 million ha, or 78.7 % of the total area of the country; wind erosion affects about 500 thousand ha (Senol and Bayramin, 2013).

Soil erosion in Europe is mainly due to water (about 92 % of the total affected area) and less to wind that mostly affects the marginal drylands of the European Mediterranean countries. The major causes for water erosion are intense rainfall (particularly pronounced in clay soils after long droughts), topography, low soil organic matter content, percentage and type of vegetation cover

and land marginalization or abandonment. The combination of these major drivers is mainly found in the Mediterranean zone where several areas have a high risk of erosion due the increase in frequency and extent of forest fires and to unsustainable cultivation practices (SoCo Project Team report, 2009). Almost 50–70 % of agricultural land in the European Mediterranean countries is at moderate to high risk of erosion. Moreover, in parts of the Mediterranean region, erosion has reached a stage of irreversibility and in some cases erosion has ceased because there is no more soil left (Montanarella, 2005). A recent report (Jones et al., 2011) estimated that already in the 1990s 105 million ha, or 16 percent of Europe's total land area were affected by water erosion, and that 42 million ha were affected by wind erosion.

*Soil organic carbon change*

Soil organic matter (SOM) is affected mostly by climate, soil parent material, texture, hydrology (drainage), topography, land use (tillage) and land cover and/or vegetation (grasslands, forests, agricultural crops) (Smith et al., 2005; Hanegraaf 2009). The prevailing arid and semi-arid conditions combined with high temperatures result in very low contents of SOC in most of the Mediterranean area. The decline of SOM is accelerated by changes in land use, intensification of agricultural practices at the expense of the naturally forested areas (Davidson and Janssens, 2006). In Europe, most soils are out of equilibrium as regards soil organic matter content. Particularly, land use and climate change have resulted in soil organic carbon loss at a rate equivalent to 10 % of the total fossil fuel emissions for Europe as a whole. Jones et al. (2005) calculated that about 0.6% of soil carbon in European terrestrial ecosystems is lost annually. In addition approximately 45% of soils in Europe have a low or very low SOM (0-2% organic carbon) and 45% have a medium SOM (2-6% organic carbon). In the Mediterranean region the loss of organic matter during last decades is estimated at around 50% of the original content. Nearly 75% of the total area in Southern Europe has a low (3.4%) or very low (1.7%) soil organic matter content (Montanarella 2005). Soils with less than 1.7% organic matter to be in pre-desertification stage. Decline of soil organic carbon content threatens the diversity of organisms in soils and limits the soil's ability to provide nutrients to crops leading to lower yields and less nutritious food. Furthermore, loss of soil organic matter reduces soil's water infiltration capacity increasing run-off and erosion. In particular, in arid and semi-arid areas loss of SOM is closely linked to the process of soil erosion. Erosion reduces the organic matter content by washing away fertile topsoil which may lead to desertification under arid and semi-arid conditions.

*Soil contamination*

Soil contamination from diffuse and localized sources can result in the damage of several soil functions and the contamination of surface water and groundwater. The soil functions most affected by contamination are its buffering, filtering and transforming capacities. Diffuse soil contamination is in general associated with atmospheric deposition, certain agricultural practices and inadequate waste and wastewater recycling and treatment. Pollutants can be washed by rainfall both into the soil and from soil into surface and groundwaters Currently, the most important soil contamination problems are atmospheric deposition of acidifying and eutrophying compounds or potentially harmful chemicals, deposition of contaminants from flowing water or eroded soil itself,

and the direct application of substances such as pesticides, sewage sludge, fertilizers and manure which may contain heavy metals (Soil Science Institute of Athens-National Agricultural Research Foundation, 2010). Due to more than 200 years of industrialization, soil contamination is a widespread problem in Europe. The most frequent contaminants are heavy metals and mineral oil. The number of sites where potentially polluting activities have taken place now stands at approximately three million. Acidification in the European Mediterranean countries' soils, although not frequent, is caused by land use through the removal of base cations from the soil by harvesting, careless use of nitrogen fertilizers and soil drainage. Major effect of acidification is the mobilization of aluminum from clay minerals which the soil might have accumulated. Heavy metal input in agriculture may be caused by human activities, such as fertilisation and amendment practices used to increase the level of soil productivity. Heavy metals together with excessive nitrogen inputs are regarded as the main sources of contamination in agricultural soils. Metals like Hg, Cd, As, Pb can contaminate the soil gradually and damage soil and ecosystem functioning. These contaminating elements will become part of the nutrient cycling resulting in biodiversity decline, water pollution and consequently a potential danger for human health. The main soil functions that degraded due to extensive use of pesticides are the food web support, the retention and transformation of toxicants and nutrients, soil resilience, and the ability of soil to protect surface and groundwater (Ibid.).

Soil contamination in the Mena region is most prevalent in countries with high population growth, high oil production and heavy mining. The overuse of chemical fertilizers and the residues of applied pesticides are also sources of pollution of soils and water resources. In Egypt the construction of the Aswan High Dam reduced soil fertility as the result of sediment load reduction, forcing farmers to rely heavily on inorganic fertilizers which led to high levels of nitrogen and phosphorous in run-off and drainage water, causing an off-site impact on water quality (Fao cit., 2015).

Acidification is not commonly a problem in the region and is restricted to coastal areas with relatively high rainfall that tends to leach bases from the soil. The excessive use of nitrogenous fertilizers, in particular the use of acidifying fertilizers has in some cases caused reduction in ph.

*Salinization and sodification*

Salinisation is the accumulation of water-soluble salts (include sodium, potassium, magnesium and calcium, chloride, sulphate, carbonate and bicarbonate) on or near the surface of the soil, whereas sodification concerns an increased content of exchangeable sodium (Na+ ) resulting in completely unproductive soils. The main natural factors influencing soil salinity are climate, the salt contents of the parent material and groundwater, land cover and topography. Secondary salinisation is caused by human activities, such as land use, farming systems, groundwater exploitation, industrial activities, the use of salt-rich irrigation water and/or insufficient drainage and evaporation of saline groundwater, (European Commission, 2000). The salt accumulation in a certain area depends by water balance, particularly by the ratio of evapotranspiration to drainage. In arid and semi-arid areas water scarcity and poor irrigation practices are closely linked to salinization. Salinization has a direct negative effect on soil biology and crop productivity. It increases the dispersion and destruction of the soil structure and causes the formation of crust on the soil surface. High levels of salinity in soils provoke the withering of plants and increases the impermeability of soil layers,

eliminating the possibility to use the land for cultivation. Excess sodium results in the destruction of the soil structure that due to a lack of oxygen, cannot sustain either plant growth or animal life (Soil Science Institute of Athens-National Agricultural Research Foundation, 2010).

In Europe, salinization is generally the result of the accumulation of salts from irrigation water and fertilizers. Improper irrigation methods, the use of low quality water with salt concentrations and the use of highly mineralized irrigation water lead to rapid accumulation of soluble salts in soil profiles. This form of salinization affects approximately 3.8 million ha mainly in the European Mediterranean countries where the 25 % of irrigated cropland is affected by moderate to high salinisation and is a major cause of desertification. Geographically this threat is localized in the drier parts of countries such as Spain, Italy, Albania, and Greece. In Spain 3 % of the 3.5 million ha of irrigated land is severely affected, reducing markedly its agricultural potential, while another 15 percent is at serious risk. Soil salinization is more frequent in arid and semiarid regions like Southeast Spain (Hernández Bastida, Vela de Oro and Ortiz Silla, 2004). In these areas, demand for water for agriculture and increasing frequency of drought events have led farmers to irrigate with poor quality water which has caused processes of soil degradation and salinization, limiting crop growth and impairing productive capacity (Pérez-Sirvent et al., 2003; Acosta et al., 2011).

Several studies revealed that 11.2% of the Mena region's soils are affected by various levels of soil salinization. These soils are mainly concentrated in irrigated farming systems in the arid and semi-arid zones. In many countries where irrigation mainly depends on groundwater, excessive irrigation has caused the formation of a shallow water table leading to increased salinization and degradation of the soil resource base. Salt-affected soils vary in extent by country. In Algeria 10-15% of soil is salinized while about 50% of the reclaimed lands in the Euphrates plain in Syria and Iraq and 93% of the cultivated land in Egypt are seriously affected by salinization and waterlogging. Salinity in the region has negatively affected cropping systems and in many cases has significantly reduced crop yields. Soil salinity in the Jifara plan in Libya has caused wheat yields to decrease from 5 tons/ha in the 1980s to just 0.5 tons/ha, while yield reduction due salinization and/or waterlogging amounts to 25% in Egypt and has led to a complete loss of productivity and abandoned agricultural lands in several areas. The major areas with salt-affected soils in Turkey are: Konya-Eregli, the Aksaray and Malya plains of Central Anatolia, and the alluvial plains of lower Seyhan, Igdır, Menemen, Bafra, Söke, Acıpayam and Salihli. The distribution of the salt-affected arable lands is: 60 % slightly saline, 19.6 % saline, 0.4 % alkali and 8 % saline-alkali. Although sodium salts are the main components of the salt-affected soils, there are also magnesium soils in Denizli-Acıpayam, potassium-nitrate-alkali soils in Nigde- Bor, Kayseri, and gypsiferous soils in Central Anatolia (Fao cit. 2015).

Although there are several local and national studies on soil deterioration forms in the Mediterranean countries, a systematic and standardized approach is lacking. Results on the extent and intensity of soil deterioration processes still refer to the GLASOD study carried out in the late 1980s. What emerges is that ecosystem service quality and capacity is reduced by degradation induced by salinity, water and wind erosion, contamination and poor management that leads to a loss of soil organic matter. Water erosion is predominant in those parts of the Mediterranean region characterized by sloping lands and by gently sloping areas where rainfed agriculture is practiced. Wind erosion is also an important factor that causes topsoil removal. Degradation due to salinity

and sodicity varies geographically with climate, agricultural activities, irrigation methods and land management policies and is mainly restricted to irrigation farming systems. The main factors causing soil salinity are linked to natural features, seawater intrusion and irrigation from groundwater with high salt content. Degradation due to contamination mainly affects countries with high rate of growth population, high level of oil production or heavy mining, and in irrigated farming systems with overuse of chemicals.

Even though the degradation of soil is considered one of the main threat to agricultural production in the region, data analysis on the correlation between land degradation, agricultural yields, and food security are scarce at the regional and national levels. However recent studies (2000-2010) show that land losses due to degradation are very high mostly in the Mena Region. In several countries, the reduction in soil productivity was estimated to be in the range of 30-35% of the potential productivity. This increases the dependence of the Southern-Eastern Mediterranean countries to food imports making them extremely vulnerable to the instability of international markets for agricultural commodities. The deterioration of the food self-sufficiency levels threaten food security especially of the most poor populations.

Soil deterioration affects food security also through the phenomenon of hidden hunger. In addition to inadequate calorie intake, micronutrient deficiencies are an important cause of morbidity and mortality. Lack of micronutrients in soils affects plants' nutritional values triggering the hidden hunger syndrome. More than two billion people worldwide suffer from hidden hunger linked to a slightly varied diet and nutrient deficient food. In North Africa the percentage of children suffering from anemia and iodine deficiencies exceed 45%. The inadequate intake of vitamins and minerals significantly affect people and society in terms of health costs, loss of human capital and the reduction of economic productivity. Yet, soils contamination represents a serious threat to food safety.

Since soil degradation affects human nutrition and health through its adverse impact on quantity and quality of food production, sustainable management of land resources is a major challenge in the Mediterranean countries, binding to objectives 1, 3 and 7 of PRIMA Programme.

**Project MEDINA – Marine Ecosystem Dynamics and Indicators for North Africa – EU FP7 Project Contract 282977**
**Funding Agency FP7 EC Period:**
**EUParticipants IT, ES, EU, CH, UK; FR;**
**MPCs Participants: Morocco, Egypt Algeria**

**Objectives**
The main aims of MEDINA were: 1) enhancing the capacities of Algeria, Egypt, Libya, Morocco and Tunisia, Libya to monitor and assess their Mediterranean marine coastal ecosystems; 2) contributing to populate the GEOSS (Global Earth Observation System of Systems) Common Infrastructure (GCI) in terms of assessment tools and results.
Outputs
MEDINA produced: 1) methodologies for mapping in a cost-effective, by combining field data, remotely sensed Earth Observation, namely satellite data, and simulation models a set of indicators of the environmental status of coastal marine ecosystems: these indicators will have to be monitored in the framework of the implementation of the UNEP MAP Ecosystem Approach by Contracting Parties of the Barcelona Convention ; 2) a portal for visualizing the above maps (www.medinageoportal.eu) free of charge; 3) Modelling tools for assessing the impact of human activities, including agriculture and aquaculture, on the status of coastal marine ecosystems.

**Impacts**
-Increased awareness in North African monitoring agencies of the potential use of. Earth Observation and modelling, for monitoring and assessment of the EcAp indicators of environmental status, as a result of Capacity Building activities (10 workshops, 7 in North Africa).
-A cost-effective methodology of site selection for the development of sustainable marine aquaculture in the region: the methodology was tested at Bejaia (Algeria) and in Lake Burullus (Egypt)

**How PRIMA could improve**
PRIMA could contribute to further develop tools for the responsible and sustainable development of marine and land based aquaculture in the region. All countries, except for Libya, have plans for developing aquaculture activities: tools for appropriate site selection and management of aquaculture areas, as required by the Ecosystem Approach to Aquaculture endorsed by FAO, are nevertheless lacking or not suitable for application in data poor areas, such as the North African coastal marine ecosystems and coastal lakes.
Proper site selection and management ensure, on the one hand, the profitability of these activities and, on the other, are of paramount important for the biosecurity of aquaculture products and the minimization of the environmental impact of aquaculture.
PRIMA could also contribute to implement innovative integrated food production systems, which are suitable for arid regions, such as aquaponics. To this regard, model and tools originally developed in MEDINA for marine and brackish water aquaculture could be adapted to assess the environmental impact of recirculation systems

## Climate change, water conflicts and Migration issues

One of the key societal challenges of the Euro-Mediterranean region is climate change. It is now increasingly recognized that environmental degradation and climate change are major drivers in both forced and voluntary migration, and that this trend is set to continue and increase in scale in the next decades to come. It is expected that climate change will significantly affect migration flows from the Southern to the Northern shore of the Mediterranean in three distinct ways. First, the effects of warming and drying in some regions will reduce agricultural potential and undermine "ecosystem services" such as water availability and fertile soils. Second, the increase in extreme weather events, in particular, heavy precipitation and drought, will affect ever more people and generate mass displacement. Finally, sea-level rise will permanently destroy extensive and highly productive low-lying coastal areas that are home to millions of people who will have to relocate permanently.

The environmental refugees phenomenon is relatively recent and it is not easy to investigate. A quantification of environmental refugees is difficult, since the environment plays a decisive role in feeding migration flows only when catastrophic events occur. The multi-causal nature of migration represents a challenge in identifying environmental factors as the primary driver of migration. Normally, environmental issues (scarcity of land and water, soil degradation, desertification) represent an aggravating factor in a broader context of economic, political and social imbalances. Poverty is the decisive variable in feeding migration flows and it is often the cause and effect of environmental problems. The main reports on climate change, identified in the Mediterranean one of the most exposed and vulnerable areas to the impact of global warming. If the concentration of carbon dioxide and other greenhouse gases were to grow at the current rate, by the end of the century, the average temperature in the Mediterranean could rise by at least six degrees, with a reduction in rainfall between 10-20 percent . The expected impacts could be:

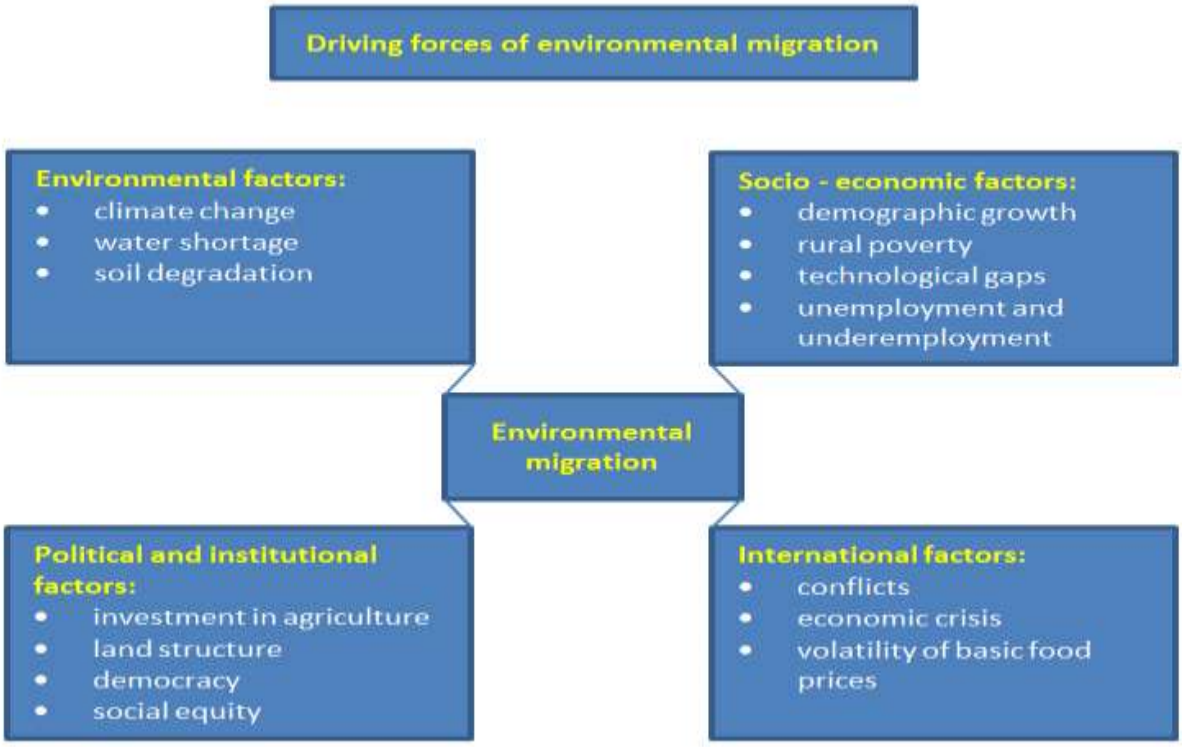
- a rise in the sea level resulting in loss of coastal and farmland areas (Nile Delta, Alexandria; Istanbul);
- a reduction in water availability determined by the drop in rainfall and increased water demand by the agricultural sector;
- more frequent extreme weather events, resulting in aggravation of hydrogeological phenomena; (landslides and floods) in the Northern shore and droughts in the Southern shore of the basin;
- a loss of biodiversity due to the marine and terrestrial ecosystem changes.

**Table 20 Potential impact of the raising sea level on the population and territory in the Middle East and North Africa and globally**

| Area | Rising sea level | Population affected | | Total area submerged | | Urban area submerged | | Agricultural area submerged | |
|---|---|---|---|---|---|---|---|---|---|
| | meters | Millions | % | $km^2$ | % | $km^2$ | % | $km^2$ | % |
| Middle East and North Africa | 1 | 8,3 | 3,2 | 24.654 | 0,3 | 3.679 | 1,9 | 4.086 | 1,2 |
| | 2 | 10,9 | 4,2 | 33.864 | 0,3 | 5.037 | 2,7 | 6.031 | 1,7 |
| | 3 | 13,7 | 5,3 | 43.727 | 0,4 | 6.529 | 3,4 | 8.007 | 2,3 |
| | 4 | 16,5 | 6,3 | 53.615 | 0,5 | 7.951 | 4,2 | 9.819 | 2,8 |
| | 5 | 19,4 | 7,5 | 63.120 | 0,6 | 9.384 | 4,9 | 11.451 | 3,2 |
| World | 1 | 56,3 | 1,3 | 194.309 | 0,3 | 14.646 | 1,0 | 70.671 | 0,4 |
| | 2 | 89,6 | 2,0 | 305.036 | 0,5 | 23.497 | 1,6 | 124.247 | 0,7 |
| | 3 | 133,0 | 3,0 | 449.428 | 0,7 | 35.794 | 2,5 | 196.834 | 1,1 |
| | 4 | 183,5 | 4,2 | 608.239 | 1,0 | 50.742 | 3,5 | 285.172 | 1,6 |
| | 5 | 245,9 | 5,6 | 768.804 | 1,2 | 67.140 | 4,7 | 377.930 | 2,1 |

Sorce: elaboration on data Earth Policy Institute, 2011.

At the intersection of three continents, the Mediterranean region, is the crossing point of the migratory flows coming from different areas. There are no currently official data on migration flows caused by environmental factors, but in the future the rapid climate change and its effects on the natural resources endowments, could act as a powerful driving force of migrations.




There is a link between social exclusion and spatial marginalization. People without power (economic, cultural and social) are forced to seek livelihoods in the most ecologically vulnerable areas. Human pressure on resources, triggering soil degradation processes and the depletion of

natural resources alters over time the carrying capacity of the land and affects the basis of the survival of populations living in marginalized areas, fueling internal and international migration flows. In particular, North Africa could became a transit area from sub-Saharan Africa towards European Mediterranean countries and Northern Europe. The environmental induced migration has, therefore, important geopolitical implications, since it is associated with the control of migratory movements and the effects on the countries of departure and destination of the flows.

**PRIMA Program, paying more attention on territorial imbalances, adaptation to climate change, water and food security, could contribute to tackle the root of the problem contrasting the massive scale of Europe's migrant crisis. Discussions of migration triggered by environmental changes, usually see migration as the result of a failure to adapt to the environment, rather than as a possible way of enhancing adaptation to climate change. In this regard, Prima's goals such as, the development of smart and sustainable farming systems to maintain natural resources and increase production efficiency (objective 1); the adoption of water-saving solutions (objective 2); the valorization of the Mediterranean diet as a tool to enhance a healthy and environmental-friendly diet (objective 3); the identification of context-adapted solutions to increase food and water chain efficiency and reduce losses and wastes (objective 4); the adoption of novel approaches to reduce the impact of pests and pathogens in farming systems (objective 5); improve sustainability of land and water use in arid and semi-arid areas (objective 7); and the adoption of new models for the governance of water management systems (objective 8), could all be considered strategies able to increase adaptation capacity to climate change and, consequently, avoid environmental induced migration. Moreover, by sustaining its broader societal and economic impact, also through instruments like SME partnership, training, networking and outreach, the mobilisaiton of the larger communities in both shores of the**

**Project title**
**CLICO - Climate Change, Hydro-conflicts and Human Security**
**Funding Agency EC Period: (2010-2012)**
**Partners Countries**
**EU: Spain (Coo), UK, Germany, Cyprus, Belgium**
**Other: Norway, Israel, Egypt, Switzerland, Palestine, Ethiopia**
**Objectives of the action**
Media headlines are dominated by the prospect of regional water wars. Clearly, climate change poses several threats to human security; in particular, hydro-climatic hazards such as droughts and floods have a considerable capacity to exacerbate social tensions, intra- and inter-state conflict. Still, cooperation often trumps conflict. There are surprisingly few peer-reviewed studies rigorously addressing links between climate change, hydrological systems, conflict and security. CLICO will fill this gap in knowledge over the social dimensions of climate change, by looking whether hydro-climatic hazards intensify social tensions and conflicts in the Mediterranean, Middle East and Sahel, or if they provide a catalyst for cooperation and peace. It will examine why some countries and communities are more vulnerable to droughts, floods and related conflict, and what types of policies and institutions are necessary to ensure adaptation, security and peace in the face of global and regional hydro-climatic change. The project will mobilize 13 research teams from Europe, North Africa, Sahel and the Middle East and will bring together for the first time some of the world's leading researchers in water resource, vulnerability, and peace and security studies. Ten cases of hydro-conflicts will be studied ranging from Niger, Sudan, the Jordan and Nile basins to Cyprus, Italy and the Sinai desert. A large dataset – the first of its kind – of hydro-conflicts in the Mediterranean, Middle East and Sahel will be regressed against climatic, hydrological and socio-economic variables. Policies and institutions at the national, international and transboundary levels will be investigated and their ability to face climate change and ensure human security will be assessed. Project results will be synthesised in a report that will identify potential security hotspots in the region and provide fresh policy ideas for promoting peace and security under changing hydro-climatic conditions
**Results and impacts**
Project partners examined 11 case studies and collated the first dataset of its kind on water-based conflicts, which was compared against climatic, hydrological and socioeconomic variables. Results showed that adaptation plays a key role in whether climate change is likely to undermine human security. Although state-led adaptation was important for providing security, there can be negative consequences if policies do not reflect the needs of affected people and are not properly implemented. Adaptation can either strengthen or widen inequalities between different social groups, depending upon power relations, governance and institutional structures, and existing marginalisation of certain sections of society. Consortium members identified stronger links between political, economic and social factors and water-related conflicts than between climate-related variables and water conflicts. However, these relationships could change in the future and, at present, methods for addressing future environmental, climatic, socioeconomic and political uncertainties need improving. Furthermore, policies explicitly aimed at reducing conflicts are lacking. CLICO made a number of recommendations to policymakers that included increasing knowledge, strengthening accountability and institutions, better policy implementation, and improving communication and cooperation between actors. In addition, climate change adaptation and risk reduction should be mainstreamed, social security systems and civil protection strengthened, and early warning systems used to highlight systemic issues. Project results can be used to identify potential hotspots in the Mediterranean, Middle East and Sahel and to provide fresh policy ideas for promoting peace and security in the face of a changing climate and dwindling water resources.

Over the last few years a growing interest in the likely impact of climate change on migration raised. Estimates highlight that around 25 million to one billion people could move from their country because of climate change, in the next 40 years (Jacobson, 1988; Myers, 1997, 2002; Stern et al., 2006). However there is no large agreement, on this figure, among experts. On the contrary many authors say that parts of the earth are becoming less habitable due to factors such as climate change, deterioration of agricultural lands, desertification, and water pollution.
As stated by Susan Martin[9] climate change affects people movements by (i) intensifying natural disasters, (ii) increasing warming and drought that affects agricultural production and access to clean water, (iii) rising sea levels and making costals areas uninhabitable and (iv) rising competition on natural resources causing conflicts and in turns displacements.

So migration and environment is certainly a relationship that generates attention from International Organizations, Academia and policy makers.

Nevertheless, there are not scientific evidences of dependence of migrations on environmental factors as main causes. This is confirmed by the contribution of Hugo[10] which argues that "Population mobility is probably best viewed as being arranged along a continuum ranging from totally voluntary migration to totally forced migration, where reality is somewhere in between".

As confirmed by the large and exhaustive literature review proposed by the report "Migration, Environment and Climate Change: assessing the evidence" the lack of data on environmental-migration nexus is one of the relevant challenges to be faced. Moreover the nexus between climate change, environmental degradation and migration in contemporary society has not been explored empirically in a way that generates conclusive results[11].

After an initial comprehensive analysis of this topic through thories, classifications and conceptualization of environmental migrants, a further line of research might be proposed in this field. What is not yet explored is how different factors related to the country of origin (political instability and conflict, lack of economic opportunities, and lack of access to resources), the country of destination (availability of employment and demand for workers, political stability) and interveining factors (ease of transportation, family or social networks, government immigration or emigration policies, economic ties or social and cultural exchanges) interact with each other to understand migration behaviour and infer if and how environment affects people decision to migrate, in respect of other socio-economic factors. A multidisciplinary approach is intended to be the right method for this topic.

Confirms on this side come from the contribution of the Russel King and Aija Lulle[12] prepared for the European Commission on research and migration. They approach to the problem by analysing EU policies and flows, integration and immigration and development nexus and conclude with the challenging question "does the development which is potentially actioned by migration lead to more, or to less, migration?"
Studies on this field do not clarify the magnitude of the development-migration nexus.

[9] Susan Martin, *Migration, Environment and Climate Change: assessing the evidence*, International Organization for Migration, 2009
[10] Hugo, G., *Environmental concerns and international migration, International Migration Review*, 30(1): 105–131, 1996.
[11] Black, R. et al., *Demographics and climate change: future trends and their policy implications for migration*. Report prepared for the Department for International Development (DFID) by the Development Research Centre on Migration, Globalisation and Poverty, University of Sussex, 2008.
[12] King and Lulle, *Research on migration: facing realities and maximising opportunities. A policy review.* European Commission, 2016

Amongst the UN Millennium Development Goals (MDGs), to be achieved by 2015, there was no mention of the potential of migration to address several of the goals, such as poverty reduction, improved education and health and gender equality. Whereas the 2030 Agenda for Sustainable Development adopted by the UN Sustainable Development Summit on 25 September 2015, partly rectify the situation by including migration in one of the 17 Sustainable Development Goals (SDGs), namely SDG10 on reducing inequality within and between countries. PRIMA would contribute to SDGs, especially numbers 6, 2 and 9, as well as goals 10 and 17 when it comes to strengthen multi-stakeholder partnerships and to foster international cooperation in research and innovation. Likely also PRIMA's impacts on migration could contribute to SDG10 reduce the transaction costs of migrant remittances and eliminate remittance corridors among Mediterranean Countries.

Due to the lack of evidences and strong dependence of migration flows from development in general and environment in particular, a large part of literature analyse the problem also through the lens of other variables strictly linked with the environment as food security, water scarcity, conflicts, institutions and quality of democracy.

Starting in the 1990s, political scientists have devoted growing attention to the complex linkages between environmental change and violent conflict. The scientific discussion over this controversial topic is extensive and it is influenced by a variety of approaches from both social and natural sciences. After the end of the Cold War security studies widened their scope to environmental issues (Barnett, 2001, 2003; Dalby, 2002; Buzan & Hansen, 2009). Unlike traditional military threats, "environmental threats tend to be diffuse, indirect and international, originating both inside and outside the state", and they are usually embedded in long-term processes (Deudney, 1999). Since Homer-Dixon introduced the argument that environmental scarcities lead to resource capture or ecological marginalization (Homer-Dixon, 1991, 1994), IR scholars have increasingly explored the multi-dimensional relationship between natural resources and conflict, developing intense debates around the role of crucial commodities in contexts of organized violence.

The question of whether environmental changes – such as increasing temperatures, water depletion, rising sea levels, desertification and deforestation – affect the risk of violent conflicts has been traditionally framed according to two opposite perspectives: a "Neo-Malthusian" model and a "Cornucopian" response (Gleditsch, 2003). The resource-pessimistic Neo-Malthusian view claims that decreasing supplies of key resources induces the onset of armed conflict. Conversely, the resource-optimistic Cornucopian approach argues that market, technological innovation and multilateral institutions are viable solutions to cope with short-term shortages and disruptions. According to Gleditsch, these conceptions are ideal-types defining the boundaries of the debate about environmental security. While the former stresses the potential for conflict, the latter points out the adaptive capacity of human societies. Both perspectives offer a wide array of explanatory models and causal mechanisms.

Homer-Dixon's articles paved the way to the Neo-Malthusian approach to environmental conflicts. He claimed that resource scarcities – be they demand induced, supply induced or structural – shape two patterns of interaction. When resource depletion and population growth cause unequal resource access, powerful elites "capture" resources by shifting the distribution in their favour. Instead, unequal resource access combined with population growth cause resource degradation and depletion, spurring migration and contributing to economic hardship (Homer-Dixon, 1994). Clearly, demographic pressure is a crucial link in the two causal chains.

Although the relationship between environmental degradation and conflict is not as linear as envisioned in the neo-Malthusian formulation, the worsening of environmental conditions undoubtedly harms the livelihood and well-being of individuals. Environmental security is then included in a broader (or maximalist) view of human security, which assumes that the safety of the individual is the key to global security (Hampson, 2008). According to Alkire, "the objective of human security is to safeguard the vital core of all human lives from critical pervasive threats, in a way that is consistent with long-term human fulfillment" (2003). The United Nations Development Programme (UNDP) introduced the concept with the publication of the 1994 Human Development Report. The Report acknowledges environmental security ("protecting people from the short- and long-term ravages of nature, man-made threats in nature, and deterioration of the natural environment") as one of the seven defining areas of human security. Along with this, food security ("ensuring that all people at all times have both physical and economic access to basic food") is also comprised as a critical dimension (UNDP, 1994).

These two areas (environmental and food security) are inextricably linked since ecological damage may affect the agro-food supply chain and consequently trigger economic shocks, particularly in countries where development is at early stage and agriculture is the largest sector of economic activity. To a certain extent the stable availability of and access to food is dependent on safe water, adequate sanitation and proper hygiene education – a key interrelated public health issue that is generally referred to as WASH in international development and humanitarian interventions. Therefore, water-stressed countries are more vulnerable to chronic or transitory food insecurity. Such a circumstance suggests that water and food security should be seen together in their interplay with climate change on one side, and political stability on the other side. For instance, Barnett and Adger (2007) put forward that climate driven outcomes - be they long term and chronic (such as declining productivity of agricultural land) or episodic (such as floods and droughts) - "may undermine human security by reducing access to, and the quality of, natural resources that are important to sustain livelihoods". In this regard, the impacts on livelihoods will be more pronounced "in sectors of the population with high resource-dependency, and in more environmentally and socially marginalized areas".

Academic research on climate-induced deterioration in water and food security and their interactions with political conflict eventually looks at the adaptive capacity of the targeted countries. The lower the institutional, economic, and technological capabilities to cope with external and internal threats, the higher the exposure to instability and the likelihood of violence.

Since "the link between environmentally induced migration and conflict remains speculative" (Bernauer et al. 2012a) and this is mainly due to the lack of long-term data on the linkages between environmental degradation and migration flows on one side and the effect of environmentally induced migration on the other side (Laczko & Aghazarm, 2009; Bilsborrow & Henry, 2012), the implementation of further research is needed. PRIMA builds on this direction one of its research lines taking advantages from the active interaction between EU member states and several countries affected by migration flows in the Mediterranean area. Dealing with countries interested both from incoming and outgoing flows would be an asset in order to conduct research activities and to measure relative impacts. Moreover, the multidisciplinary approach ranging from the social sciences, to the life sciences seems to be the methodology largely recognised to cope with a similar topic.

## Fundamental rights: Gender equality, equality treatment and opportunities, non–discrimination, and rights of persons with disabilities

Promoting a culture of acceptance and inclusion of any form of diversity is a milestone of the **European Union**, supported by the "European Convention on Human Rights" (including Protocol 12) and the European Union's Gender Equality Directives, Racial Equality Directive and Employment Equality Directive" and shall be endorsed by the PRIMA initiative and systematically/practically carried out during its implementation. Further documents issued by the European Commission have dealt with issues of gender equality and among others: Report on Progress on Equality between Women and Men – The gender balance in business leadership (2010), She Figures – Gender in research and innovation (from 2003 to 2015), the Gender equality strategy mid-term review 2010-2015 (2013), Gendered Innovations – How gender analysis contributes to research (2013), and also A Women's Charter - Declaration by the European Commission on the occasion of the 2010 International Women's Day Strengthened Commitment to Equality between Women and Men (2010).

**T**he EU objectives on gender equality are to ensure equal opportunities and equal treatment for men and women and to tackle any form of discrimination on the grounds of gender. Within the PRIMA Initiative, participants will act according to the European policy of equal opportunities to ensure gender equality.

In addition, PRIMA looks at fulfilling these same principles in carrying out the programme as set by the European Charter for Researchers, which among its Principles and Requirements specifies the terms of the relationship between researchers and employers or funders, expected to be conducive to successful performance at all stages of the process of knowledge and technological development.

**On gender equality as a field of investigation in today's research**

Looking at these documents we see how we are rather far from achieving gender equality in research. This is overall regrettable for society/the humanity not to say overall for women, being these in any culture and at any stage of their career, since they feel that they cannot give their contribution and be fully valorised. However, this is also regrettable for any minority, including ethnical ones, or for all individuals that feel to be emarginated in consideration of any form of disability. Specifically on figures showing the extent of gender inequality, these documents above show how women are still under-represented in both the public and private research sectors: for instance, only one third of European researchers are women, and this proportion falls to less than one fifth in the business sector. In the higher education sector, where initially women graduates outnumber their male colleagues, women represent only ten per cent of the rectors of universities. Furthermore, we still have an unbalanced representation of women and men in decision making bodies with on average only one woman for every two men on scientific and management boards across the EU.

**As a result of the figures described above, in today's research** there has been close attention to issues of gender equality/inequality in most recent years, these including gender typing or

occupational segregation, which stands for women holding certain occupations and at lower status or paid less than men for doing a same type of job. However, nowadays much of this attention is both on women in the overall workforce – who are however under-represented in certain job types or professions, in boards, or also in certain scientific disciplines – and also on the extent of this under-representation in leadership roles in the majority of sectors and organisations. Thus, the investigation of what lies behind this level of under-representation has received substantial consideration, primarily in relation to the identification of specific barriers, these being culture or society, sector, organisation, or also individual-driven. For this reason, it is also growing the amount of research and it is on rise the body of literature which investigates the barriers that women encounter in any culture and at different stages of their career or life. For instance, forms of under-representation of women in the higher education sector should not be surprising at all and this in light of the dominant organisational culture, which is still depicted as 'man-centred' (David and Woodward, 1998), the 'men's room' (Oakley, 2000) and also as 'one of the last bastions against the recognition of women's worth' (Stanley, 1997).

**With particular attention to research conduct for the purposes of PRIMA**, gender equality should be regarded as a key issue since the concept is tied up with further concepts that highlight the importance of fairness, equal opportunities and representativeness in relation to all genders and this to be applied to the workplace as well as to all spheres of public life. Any forms of gender equality, therefore, should be embedded in overarching principles, and as a result these principles should further inform any policy aiming at the promotion of gender balance in research, in decision-making bodies and also in analysis of any R&I content.

In light of the overview of the documents above, it is acknowledged -- in the European Union's Gender Equality Directives among the main sources -- that backing gender equality means to promote fairness, to enhance any form of creativity, to highlight the competitive advantages arising from mixed teams, and also to look at effects on research output that can derive from all this. In addition, again in relation to the EU policies, gender equality and balanced groups both in research and in public life can back and improve research and innovation; this calls for raising awareness among the public that dealing with gender equality is not just about promoting women's rights or having blind quotas to have women represented in public bodies. This is more about sharing the awareness that having balanced teams with women – or however teams that are representative of those from any gender or from under-represented group – involved in any aspect of public life can contribute to a steady and fair development of any country and stick any culture, including those of countries from the Mediterranean region.

It is therefore key to embed issues relating to diversity and gender in all these aspects of public life, these going from raising women's awareness to social inclusion of women in all aspects of public life; and also from having women involved in decision-making processes to engage women as policy-makers. In doing so, it is key to involve stakeholders, policy makers, and all those sensitive to address these issues.

**More specifically in relation to PRIMA and its plan of actions**, the principles set by the European Commission in the documents above should be coupled with further documents, which more specifically look at the situation in place in the Mediterranean areas in this project. This is the case with the OECD report gender Equality in Public Life which specifically refers to cultural features in Arabic countries and draws its set of recommendations for having gender balanced and aware policies covering all aspects of public life.

This is just what **the OECD report on Gender Equality in Public Life** aims to do: among objectives from the report we read the call for empowering women to be effective policy makers and for introducing inclusive approaches to policy making and to public service delivery, including monitoring of these processes. The final Recommendations issued by the Council on Gender Equality in Public Life back actions to promote: mainstream gender in the design, development, and then in the implementation and evaluation of relevant public policies; accountability in relation to these policies; achieve a balanced representativeness in decision-making bodies and in all spheres of public life; and lastly fairness of treatment in public employment.

**In light of the recommendations above**, diversity in the MED region stands not just for raising the awareness but also for introducing a fair level of sensitivity and then for becoming sympathetic with any form of diversity that may be encountered in today's life. Looking at the recommendations above in depth, we see the added value arising from the first recommended action -- backing the design, development and evaluation of these fair and diversity-sensitive policies – in the form of the combination of different perspectives on common issues brought in from diversity, and how this can enrich social and public life; and also how forms of diversity, which include all the cultural dimensions grouped within PRIMA, should be, firstly, exploited and, then, valorised. Nowadays it is, however, acknowledged that diversity can be regarded as a strength as much as that diversity supports excellence13,14 (Gratton et al., 2007). It is therefore more important than in past years to valorise differences both in research and in everyday-life; and then to create value through cultural, diversity and gender awareness. This aim may be achieved within the PRIMA Initiative.

However, in relation to issues and actions of gender equality, equality treatment and opportunities, non–discrimination, and rights of persons with disabilities, **PRIMA aims to steadily work for the promotion of a fair level of**:

- Awareness of any form of diversity and gender equality since these can enrich and enhance effectiveness and productivity
- Inclusion, being this social or group-related, in relation to all forms of diversity made in the previous point
- Sensitivity for environmental issues
- Valorisation of the repository of knowledge in the fields of the PRIMA project

[13] EC (2013), Gender Equality Policies in Public Research, Based on a survey among Members of the Helsinki Group on Gender in Research and Innovation.

[14] LERU (2012), Women, Research and Universities: Excellence without Gender Bias [League of European Research Universities].

- Sharing of this body of knowledge, once combined with gender, diversity and with environmental sensitivity as further but complementary assets.

**While, in light of the actions mentioned above, PRIMA aims to implement the following actions of**:

- Overall, fulfillment of all the principles set by the European policies, including the European Charter for Researchers, on gender equality, inclusion and gender balance in relation to countries of the MED area and all countries partnering in PRIMA; this may also include indirect benefits for all neighbouring countries
- More specifically, PRIMA will work for the:
- Empowerment of women and minorities, including persons with disabilities who should be valorised and given the opportunity to contribute in society
- Inclusion of the above mentioned groups in any policy making processes
- Shadowing opportunities in policy and in practice, so to give people the chance to understand where their expertise could be more or further valorised
- Further research on any culture-specific area of the PRIMA, wince these areas are rather specific and cannot be fully valorised prior to any further contextualisation
- Development of training opportunities that are tailor-made and responsive to needs from women and minorities from the Med region
- Valorisation of expertise that enhance procedures of job recruitment based on this valorisation of one’s expertise.

# Chapter 5. Monitoring

***Monitoring System for the PRIMA Initiative***

The initiative *Partnership for Research and Innovation in the Mediterranean Area* (PRIMA) aims to establish a long-term structured partnership in research and innovation in the Mediterranean area. The goal of the initiative is to develop innovative solutions and promote their adoption for improving the efficiency and sustainability of **food production** and **water provision**[15].

According the most relevant criticalities, PRIMA initiative will address 8 *operational objectives* (see ANNEX 4):

1. To develop smart and sustainable farming systems, to maintain natural resources and to increase production efficiency.
2. To test and stimulate adoption of context-tailored water-saving solutions, in particular in agriculture.
3. To innovate in the Mediterranean food products based on Mediterranean diet heritage and to enhance the links between nutrition and health.
4. To find context-adapted solutions to increase food and water chain efficiency, and reduce losses and wastes.
5. To design and promote the adoption of novel approaches to reduce the impact of pests and pathogens in farming.
6. To conceive and implement innovative, quality oriented models in agro-business as potential sources of new jobs and economic growth.
7. To improve land and water sustainability in arid and semi-arid watersheds.
8. To elaborate and stimulate adoption of new policies and protocols for the governance of water management systems.

The research and innovation activities that will be implemented in the context of PRIMA initiative have to attained clear evidence of tangible, measurable and sustainable **impact**. This is a crucial aspect that requires feasible tools for the monitoring process.

The framework of Sustainable Development Goals (SDGs) launched by the United Nation Sustainable Development Solution Network (UN-SDSN)[16] includes two specific goals, among the 17 SDGs, dedicated to **food security** (# 2 *End hunger, achieve food security and improved nutrition and promote sustainable agriculture*) and **sustainable management of water** (# 6 *Ensure availability and sustainable management of water and sanitation for all*). For each of them there are several indicators that can be used to monitor the magnitude of the effects produced by projects under the PRIMA initiative.

Furthermore there are many other issues related to food production systems and water resources that are linked to other SDGs (i.e. *cross-cutting issues*). This means that, while improving the efficiency and sustainability of **food production** and **water provision,** the PRIMA initiative will also generate a positive domino effect according to which the involved countries will also progress in SDGs as:

- No poverty (SDG 1)
- Good health and well-being (SDG 3)
- Affordable and green energy (SDG 7)

[15] PRIMA, Joint Programme. Partnership for Research and Innovation in the Mediterranean Area. An integrated programme on food systems and water resources for the development of inclusive, sustainable and healty Euro-mediterranean societies (http://www.unisi.it/programma-prima).

[16] SDSN, Indicators and a Monitoring Framework for the Sustainable Development Goals – Launching a Data Revolution, May 15, 2015 (http://unsdsn.org/resources/publications/indicators/).

- Decent work and economic growth (SDG 8)
- Reduce inequalities (SDG 10)
- Sustainable communities (SDG 11)
- Sustainable consumption and production (SDG 12)
- Climate action (SDG 13)
- Sustainable management of oceans and coastal areas (SDG 14)
- Sustainable land use, forest and other terrestrial ecosystems (SDG 15)

## Selection of indicators

The selection process of feasible indicators for the monitoring systems was carried out on the basis of specific criteria to be satisfied:

- Cover most of SDGs: starting from the two SDGs about *food security* and *water provision* (the specific topics of PRIMA initiative), an improvement of the selected indicators should be able to positively influence the achievement of as many goals as possible.
- Consider biophysical limits: it is fundamental to have indicators that give information about the biophysical limits of the system, from both resource consumption and environmental loading point of view.
- Consider the nexus: food, water, and energy have a strong relationship with each other and play a crucial role in the achievement of SDGs; the use of indicators that can highlight the linkages among all three is needed.
- Consider both national and sectoral systems: some indicators have to monitor national systems (e.g. poverty, health, land use, GHGs emissions), while others shall monitor sectoral systems (e.g. agriculture, water services).
- Be limited in number: the indicators should be limited in number in order to have an effective tool that can easily support the monitoring process of projects under the PRIMA initiative.
- Data availability should be guaranteed frequently enough to be meaningful in the PRIMA time horizon.

Below a short-list of the provisionally selected indicators (with their units) for PRIMA monitoring is reported:

1. Multidimensional Poverty Index
2. Population overweight (%)
3. Land Use (%)
4. GHG emissions (total and AFOLU – t $CO_{2e}$)
5. Cereal Yield (kg/ha)
6. Agriculture Value Added (US$/worker)
7. Fertilizers consumption (kg/$ha_{arable\ land}$)
8. Crop water productivity (kg/$m^3$)
9. Proportion of total water used (%)
10. Population using safely managed water services (rural, %)
11. Population using safely managed sanitation services (rural, %)
12. Amount of agricultural residues used for energy purpose (t)

All the listed indicators are reported in Table 1, with the aim to show which goals are affected by the improvement generated by the PRIMA initiative.

Table 1. Table representing which goals (in rows) can be positively influenced by an improvement of the PRIMA indicators (in columns).

| SDGs \ INDICATORS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. No poverty | ■ | | | | | ■ | | | ■ | | | |
| 2. Food security and sustainable agriculture | | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | | | |
| 3. Good health and well-being | ■ | ■ | | ■ | | ■ | | | ■ | ■ | ■ | ■ |
| 6. Clean water and sanitation | | | | | | | | ■ | ■ | ■ | ■ | ■ |
| 7. Affordable and green energy | | | ■ | | | | | | | | | ■ |
| 8. Decent work and economic growth | ■ | | | | | ■ | | | | | | |
| 10. Reduce inequalities | ■ | | | | | ■ | | | | ■ | ■ | ■ |
| 11. Sustainable communities | ■ | ■ | ■ | | ■ | ■ | | ■ | ■ | ■ | ■ | ■ |
| 12. Sustainable consumption and production | | ■ | ■ | | ■ | ■ | | ■ | ■ | | | |
| 13. Climate action | | ■ | ■ | | | | ■ | | | | | |
| 14. Sustainable management of oceans | | ■ | | | | | ■ | | | | | |
| 15. Sustainable land use, forests, etc. | | ■ | ■ | | ■ | | | ■ | | | | |

## PRIMA Indicators

1. Multidimensional Poverty Index

Among the US SDSN goals, "End poverty in all its forms everywhere" is here represented by the Multidimensional Poverty Index (MPI). This is an international poverty measure developed by the Oxford Poverty and Human Development Initiative (OPHI) for the United Nations Development Programme. The index reflects the multiple deprivations that a poor person faces with respect to education, health and living standards.

According to Alkire and Foster (2011), the MPI is an index of acute multidimensional poverty. It assesses the nature and intensity of poverty at the individual level, creating a vivid picture of people living in poverty within and across countries. The MPI has three dimensions: health, education, and living standards. These are measured using 10 indicators. It consists in the first international measure of its kind and it offers an essential complement to income poverty because it measures deprivations directly.

The MPI can be used as an analytical tool to identify multidimensionally poor people, show aspects in which they are deprived and help to reveal the interconnections among deprivations. It can also identify the poorest among the poor, reveal poverty patterns within countries by province or social group, and track changes over time. This can enable policy makers to target resources and design policies more effectively.

Source: The MPI indices for the Mediterranean countries are based on the works of Alkire *et al*. (2014) and Alkire and Robles (2015).[17]

[17] Alkire, S., Apablaza, M., and Jung, E. (2014). 'Multidimensional poverty measurement for EUSILC countries.' OPHI Research in Progress 36b.
Alkire, S. and Robles, G. (2015). "Multidimensional Poverty Index 2015: Brief Methodological Note and Results." Oxford Poverty and Human Development Initiative, University of Oxford, *Briefing 36*.

2. Population overweight (%)

This indicator was selected in order to investigate the nutrition aspects in Mediterranean countries. In fact, according to the MDG Report (2015)[18], they all have reached values that are lower than 5% for what concerns the share of population undernourished.

The percentage of population overweight is estimated according to the data related to the Body Mass Index (BMI), that is an index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in meters ($kg/m^2$). The population with a BMI value equal or higher then 25 is classified as overweight[19]. The increasing prevalence of overweight and obesity is associated with many diet-related chronic diseases including diabetes mellitus, cardiovascular disease, stroke, hypertension and certain cancers.

*Source*: World Health Organization (WHO), Global Database on Body Mass Index (http://apps.who.int/bmi/index.jsp)

3. Land Use (%)

An indicator describing the land use was identified in order to keep track the change of land area referred in particular to agriculture and forest in time. The extension of the different types of land area is expressed as percentage of the total land area. The **Agricultural land** includes the land area that is arable, under permanent crops, and under permanent pastures[20]:

- Arable land includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded.
- Land under permanent crops is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber. This category includes land under flowering shrubs, fruit trees, nut trees, and vines, but excludes land under trees grown for wood or timber.
- Permanent pasture is land used for five or more years for forage, including natural and cultivated crops.

The **Forest area** is the land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens.

It is important to follow the variation in time of these portions of total land use to monitor possible conflicts between urban, forest and agricultural land due, for example, to population increase and/or other pressure factors.

*Source*: Worldbank database (http://data.worldbank.org/indicator/AG.LND.AGRI.ZS)

4. GHG emissions (total and AFOLU – t $CO_{2e}$)

[18] UN, Millennium Development Goals Report, New York, 2015 (http://unstats.un.org/unsd/mdg/Resources/Static/Products/Progress2015/English2015.pdf)
[19] WHO, Obesity: preventing and managing the global epidemic, Geneva, 2000 (http://apps.who.int/bmi/index.jsp?introPage=intro_5.html)
[20] WB, Worldbank database(http://data.worldbank.org/indicator/AG.LND.AGRI.ZS)

This indicator is aimed at defining the total net greenhouse gas (GHG) emissions, expressed in tons of $CO_2$ equivalent ($tCO_{2e}$), in the Agriculture, Forest and other Land Use (AFOLU) sector[21], according to the Intergovernmental Panel on Climate Change (IPCC) 2006 guidelines (with updates to the 2013 ones) for the national GHG inventory[22].

Investigating the GHG emissions of the AFOLU sector allows monitoring the emissions related to the several land types and to the land use change as well. Livestock is an increasingly important factor for GHGs increase. By means of this indicator and the previous one about land use it is possible to evaluate the behavior of Mediterranean countries with respect to a critical issue such as the climate change.

*Source*: UNFCCC database (http://unfccc.int/ghg_data/ghg_data_unfccc/items/4146.php)

5. Cereal Yield (kg/ha)

This indicator was selected in order to evaluate countries on one of the main sectoral aspects about agriculture: efficiency in producing cereals. It is worth to note that this indicator has to be coupled with indicators 8 and 9 on water efficiency and availability, indicator 7 on fertilizer efficiency and should be combined with one about the integrity of soil to better analyze the performance of systems under study. In fact an improvement of the agriculture yield is desired, unless the soil is stressed with an excessive uptake of nutrients, or too much water is used compromising its availability for other purposes.

The indicator cereal yield, expressed as kilograms per hectare of harvested land, includes wheat, rice, maize, barley, oats, rye, millet, sorghum, buckwheat, and mixed grains. Production data on cereals relate to crops harvested for dry grain only[23].

*Source*: Worldbank database (http://data.worldbank.org/indicator/AG.YLD.CREL.KG)

6. Agriculture Value Added (US$/worker)

This indicator is aimed at measuring the agricultural productivity in money terms. Value added in agriculture measures the difference between output of the agricultural sector (International Standard Industrial Classification - ISIC divisions 1-5[24]) and the value of intermediate inputs. Agriculture comprises value added from forestry, hunting, and fishing as well as cultivation of crops and livestock production[25]. Data are in constant 2005 U.S. dollars.

*Source*: Worldbank database, (http://data.worldbank.org/indicator/EA.PRD.AGRI.KD)

7. Fertilizers consumption ($kg/ha_{arable\ land}$)

This indicator, together with *cereal yield* and *agriculture value added*, provides a focus on the agriculture sector. With regard to fertilizers, it would be meaningful to monitor also the total load discharged into the Mediterranean Sea. This approach allows including the evaluation of biophysical limits in the monitoring system.

*Fertilizer consumption* is expressed as kilogram of fertilizer per hectare of arable land and measures the quantity of plant nutrients used per unit of arable land[26]. Fertilizer products include nitrogenous, potash, and phosphate fertilizers (including ground rock phosphate). Arable land includes land defined by the

[21] SDSN, Indicators and a Monitoring Framework for the Sustainable Development Goals – Launching a Data Revolution, May 15, 2015 (http://unsdsn.org/resources/publications/indicators/).
[22] Eggleston HS, Buendia L, Miwa K, Ngara T, and Tanabe K (eds.), IPCC guidelines for national greenhouse gas inventory, 2006.
[23] WB, Worldbank database (http://data.worldbank.org/indicator/AG.YLD.CREL.KG)
[24] UNSTAT, International Standard Industrial Classification of All Economic Activities, Rev.3 (http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=2)
[25] WB, Worldbank database (http://data.worldbank.org/indicator/EA.PRD.AGRI.KD)
[26] WB, Worldbank database (http://data.worldbank.org/indicator/AG.CON.FERT.ZS)

FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded.

*Source*: Worldbank database, (http://data.worldbank.org/indicator/AG.CON.FERT.ZS)

8. Crop water productivity (kg/$m^3$)

This indicator is directly related to freshwater use for irrigation. Under the System of Environmental-Economic Accounting (SEEA) water productivity is defined as the value added of agriculture divided by water use by agriculture[27].

For this indicator data are needed in order to monitor countries in time. Currently, the available data refer to 2007 and were included in the baseline with all the other indicators.

The role of this indicator is pivotal since it represents the nexus between two fundamental sectors such as agro-food and water.

*Source*: Sander JZ, Benchmarking water productivity in agriculture and the scope for improvement - remote sensing modelling from field to global scale, 2010.

9. Proportion of total water used (%)

This MDG indicator is crucial for the monitor system of PRIMA initiative, because it investigates the biophysical limits of the systems. It measures water stress and is defined as the total volume of groundwater and surface water abstracted (withdrawn) from their sources for human use (e.g. in sectors such as agriculture, industry, or urban), expressed as a percentage of the total annual renewable water resources. This indicator shows whether a country abstracts more than its sustainable supply of freshwater resources. It can be used to track progress in the sustainable, integrated, and transparent management of water resources[28].

*Source*: UNSTAT, MDG (http://unstats.un.org/UNSD/MDG/Data.aspx)

10. Population using safely managed water services (rural, %)

This indicator measures the percentage of the rural population using safely managed drinking water services, as defined by the WHO/UNICEF Joint Monitoring Programme[29].

A basic drinking water source is a source or delivery point that by nature of its construction or through active intervention is protected from outside contamination with fecal matter. Basic drinking water sources can include: piped drinking water supply on premises; public taps/stand posts; tube well/borehole; protected dug well; protected spring; rainwater; and bottled water (when another basic source is used for hand washing, cooking, or other basic personal hygiene purposes)[30].

*Source*: UNSTAT, MDG (http://unstats.un.org/UNSD/MDG/Data.aspx)

11. Population using safely managed sanitation services (rural, %)

[27] UNSTAT, System of Environmental-Economic Accounting (SEEA) (http://unstats.un.org/unsd/envaccounting/seea.asp)
[28] SDSN, Indicators and a Monitoring Framework for the Sustainable Development Goals – Launching a Data Revolution, May 15, 2015 (http://unsdsn.org/resources/publications/indicators/).
[29] WHO/UNICEF Joint Monitoring Programme (http://www.wssinfo.org)
[30] SDSN, Indicators and a Monitoring Framework for the Sustainable Development Goals – Launching a Data Revolution, May 15, 2015 (http://unsdsn.org/resources/publications/indicators/).

The indicator measures the percentage of the population in rural areas using safely managed sanitation services, as defined by the WHO/UNICEF Joint Monitoring Programme[11].

Safely managed sanitation services are those that effectively separate excreta from human contact, and ensure that excreta do not re-enter the immediate environment. This means that household excreta are contained, extracted, and transported to designated disposal or treatment site, or, as locally appropriate, are safely re-used at the household or community level.

Access to adequate excreta disposal facilities is fundamental to decrease the fecal risk and the frequency of associated diseases. The use of basic sanitation facilities reduces diarrhea-related morbidity in young children and also helps accelerate economic and social development in countries where poor sanitation is a major cause for missed work and school days because of illness.

This indicator and the previous one, investigate countries behavior at a sectoral level (i.e. water services).

*Source*: UNSTAT, MDG (http://unstats.un.org/UNSD/MDG/Data.aspx)

12. Amount of agricultural residues used for energy purpose (t)

This indicator is aimed at identifying and quantifying the agricultural and food industry waste as well as fractions of municipal and animal solid waste that are available and can be converted, by means of biotechnological processes, into food, feed, value-added products for nutraceuticals and healthcare, biogas and organic based fertilizer.

It is worth to note that this indicator is fundamental for the nexus food-energy and it is especially relevant for the development of the south-shore countries.

*Source*: data are needed.

Further aspects that could deserve an indicator:

Biodiversity of Food

Soil Integrity or soil degradation

Pesticides and Herbicides use

## Baseline

According to the data collected for each indicator, a baseline has been developed including the last update data. The aim was to have a reference set of values to rely on for the future monitoring of countries. The indicators *land use* and *GHG emissions (total and AFOLU)* are represented separately by means of pie charts and histograms, respectively. As example, the baseline of three countries is reported (i.e. Italy, Jordan and Morocco).

Table 2. Baseline of PRIMA Indicators.

| | Multidimensional Poverty Index (MPI) | Population overweight, % | Cereal Yield, kg/ha | Agriculture value added per worker, 2005US$ | Fertilizer use, kg/ha | Crop water productivity, kg/m$^3$ | Proportion of total water use, % | Safe water service (rural), % | Safe sanitation service (rural) % |
|---|---|---|---|---|---|---|---|---|---|
| Albania | 0,005 | 52,7 | 4606 | 3614 | 87,5 | 1,09 | 4,3 | 95 | 90 |
| Algeria | n.a. | 59,1 | 1814 | 4470 | 15,3 | 0,72 | 48,9 | 82 | 82 |
| Bosnia and Herzegovina | 0,002 | 51,8 | 4027 | n.a. | 91,4 | 1,04 | 0,9 | 100 | 92 |
| Croatia | n.a. | 58,8 | 5451 | 24913 | 234,9 | 0,98 | 0,6 | 100 | 96 |
| Cyprus | 0,108 | 60,3 | 1710 | 13906 | 199,8 | n.a | 17,6 | 100 | 100 |
| Egypt, Arab Rep. | 0,014 | 62,0 | 7253 | 2562 | 636,4 | 1,22 | 97,8 | 99 | 93 |
| France | 0,084 | 60,7 | 7074 | 84574 | 140,6 | 1,42 | 14,8 | 100 | 99 |
| Greece | 0,121 | 60,5 | 4481 | 18602 | 157,4 | 1,05 | 13,8 | 100 | 98 |
| Israel | n.a. | 63,5 | 3797 | n.a. | 268,7 | 1,01 | 79,7 | 100 | 100 |
| Italy | 0,096 | 58,8 | 5229 | 52519 | 129,0 | 1,21 | 23,6 | 100 | 100 |
| Lebanon | n.a. | 68,7 | 3382 | 48067 | 456,5 | 0,62 | 24,3 | 99 | 81 |
| Libya | 0,006 | 68,7 | 833 | n.a. | 4,3 | 0,74 | 615,4 | 68 | 96 |
| Malta | 0,089 | 64,0 | 5151 | n.a. | 397,1 | n.a. | 67,3 | 100 | 100 |
| Montenegro | 0,001 | 55,8 | 2844 | 6939 | 324,7 | 1,06 | n.a. | 99 | 92 |
| Morocco | 0,067 | 56,5 | 1828 | 4600 | 52,4 | 0,82 | 35,7 | 65 | 66 |
| Palestine | 0,006 | n.a. | 1583 | 2278 | n.a. | n.a. | 48,7 | 82 | 90 |
| Slovenia | 0,054 | 60,6 | 4610 | 166068 | 267,4 | n.a. | 3,0 | 99 | 99 |
| Spain | 0,100 | 60,9 | 4081 | 41740 | 139,2 | 0,91 | 28,6 | 100 | 100 |
| Syrian Arab Republic | 0,016 | 58,5 | 1576 | n.a. | 21,3 | 0,67 | 84,2 | 87 | 95 |
| Tunisia | 0,004 | 62,9 | 1691 | 4524 | 41,1 | 0,95 | 69,7 | 93 | 80 |
| Turkey | n.a. | 66,3 | 3249 | 6855 | 113,5 | 0,64 | 18,9 | 100 | 86 |
| *Portugal* | 0,166 | 55,6 | 4183 | 9659 | 150,3 | 1,07 | 10,9 | 100 | 100 |
| *Jordan* | 0,006 | 65,9 | 1678 | 4848 | 681,9 | 0,51 | 92,4 | 92 | 99 |
| *Macedonia, FYR* | 0,002 | 55,2 | 3381 | 11460 | 69,2 | 0,94 | 16,1 | n.a | n.a. |

Land use

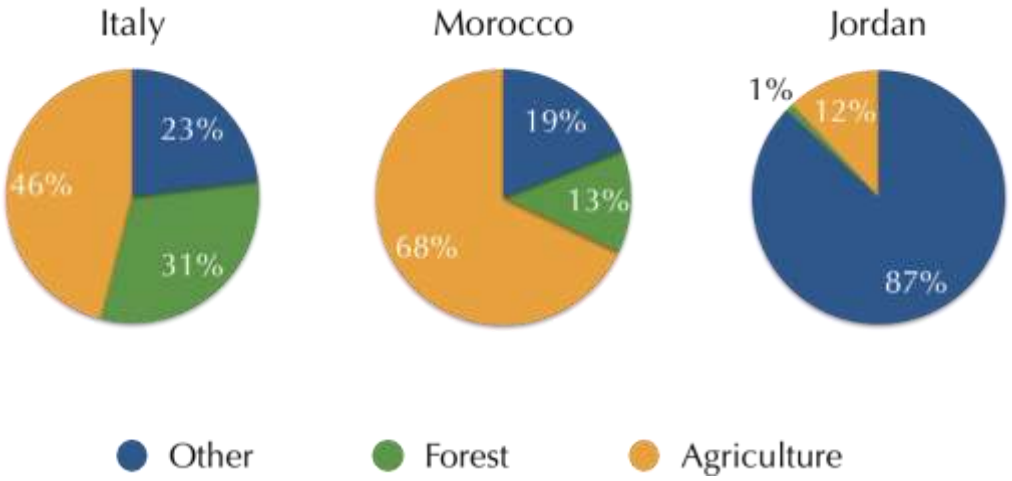



Figure 1. Baseline for the indicator *land use* (Italy, Morocco and Jordan are reported as example).

GHG emissions (total and AFOLU – t $CO_{2e}$)

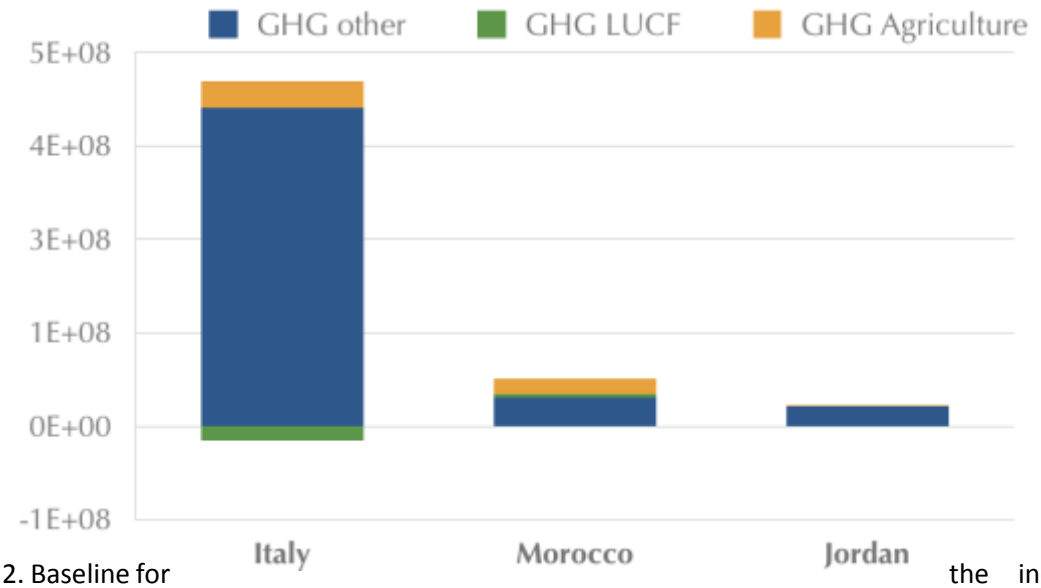



Figure 2. Baseline for the indicator *GHG emissions* (Italy, Morocco and Jordan are reported as example).

**PRIMA operative objectives and the selected indicators**

Below a diagram representing the eight operative objectives identified in the context of PRIMA initiative and the chosen indicators: each indicator is coupled with the objective most influenced.

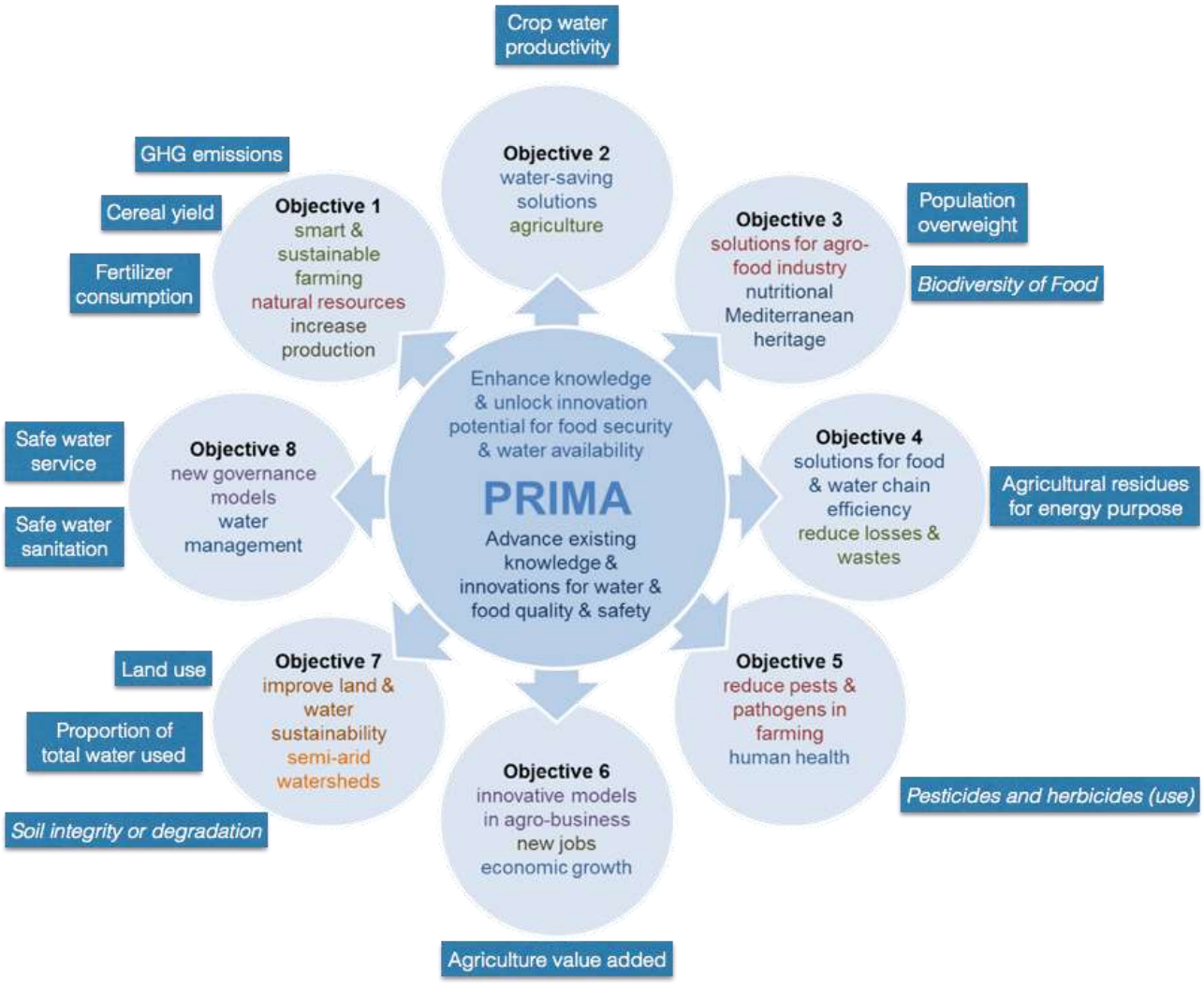



Figure 3. The relationship between the selected indicators and the PRIMA operative objectives.

**Synthetic representation**

The monitoring system is meant to track the behavior of each system in time rather than the comparison among systems and establishment of rankings. A useful representation of the results (and of the evolution in time) is the *radar diagram* (or "amoeba") reported below for the case of Italy, highlighting 8 of the selected indicators.

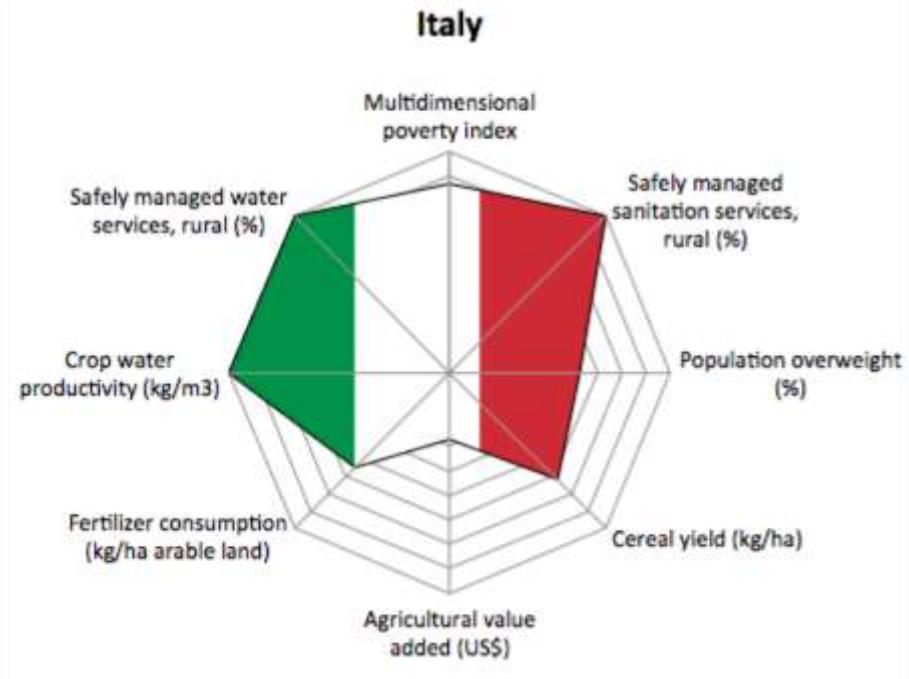



Figure 4. Radar diagram of Italy.

For part of these indicators it may be possible to have also a detailed spatial representation, mapping areas where, for example, water shortage is particularly relevant.

## Conclusions

The monitoring system developed for the PRIMA initiative consists of a dozen of indicators. It is a flexible set that can be integrated with other indicators depending on the necessity to make it able to investigate other aspects that are considered relevant. Currently, for all the indicators, with the exception of one, a reliable baseline has been developed.

Among the possible indicators to be integrated in the present monitoring tool, it is worth to mention an indicator of land degradation or soil erosion that should be combined with the one on *cereal yield* in order to focus on the durability of present conditions.

Moreover, a relevant aspect to be stressed is the fact that the developed monitoring systems, with its indicators, should be used to monitor countries' development in time (or particular subnational systems). This is because it is fundamental that each Mediterranean country and, consequently, the Mediterranean area as a whole will improve and give their contribution to achieving the Sustainable Development Goals.

# 6. Partners Integration

**Level of commitment of the Participating States to integration at scientific, management and financial level.**

## Integration towards countries/actors that are not part of the initiative: other countries and other Ministeries

PRIMA initiative has been conceived and will be implemented under a participatory and open approach, based on the awareness that the involvement of non-research actors and the promotion of citizen-research-policy dialogue is crucial for the success of an ambitious multilateral programme.

Several PRIMA Participating States have clearly supported the participation of non research actors in previous and ongoing joint programming initiatives (e.g. ERANETMED, where the proposals addressing cross-cutting issues like gender, governance were given a highest score for impact) and are willing to do so in the upcoming joint calls.

Therefore PRIMA support for R&I activities will be very attentive to ensure a strong impact on the civil society and vulnerable communities, whose well being is posed at risk by the overexploitation or misuse of resourced like water and food. Furthermore, during its implementation PRIMA will keep a high degree of openness towards the inclusion of actors of non Participating States in the implementation of joint activities as well as the inclusion of the authorities of other States willing to contribute to PRIMA challenges such as Turkey. Romania, Germany, Slovenia, Algeria.

## Confirmation of the Choice on the legal framework

As a preamble to the discussion on legal aspects, PRIMA Participating States wish to point out the special character of the PRIMA Programme as a long-term institutionalised science diplomacy initiative under art.185 TFEU. In the proposal submitted in December 2014, PRIMA Participating States already highlighted that the Programme is based on the principles of co-ownership, mutual interest and shared benefits with the same rights and obligations for all members of the consortium. In order to guarantee the respect of such principles, in particular co-ownership and same rights and obligations in the governance and implementation of PRIMA, a certain degree of compromise is required as to the definition of the governance of the Programme, in particular the choiceof the DIS. In particular, strong differences between EU and Non EU Participating States with reference to the management of RDI funds and projects had to be reconcilied.
Therefore, as stated in PRIMA Programme Proposal (p. 80), the PRIMA Participating States have debated various possibilities for the establishment of the Dedicated Implementation Structure (DIS). Fully aware of the fact that other existing initiatives under art.185 TFEU have created ad hoc non-profit associations according to different national laws, they have duly taken into consideration such a possibility. Nonetheless, they have decided for a different route. This is due specifically to political and legal constraints existing in Non-EU Participating States, not able to devolve national contributions to a foreign private law entity. In order to overcome said constraints the choice was made to look at existing inter-governmental organizations capable of hosting PRIMA DIS. In particular, the Secretariat of the Union for the Mediterranean (UfM Secretariat), an international organization promoting regional cooperation and integration between both rims of the Mediterranean, has been considered as the most suitable choice for it. Indeed, both its geographical and thematic scope are fully compatible with the scope of the PRIMA programme : all PRIMA Participating States are members of the UfM Secretariat, and the UfM Secretariat aims at promoting cooperation and dialogue in the Euro-Mediterranean area, among other in the fields of research, water and

environment.. Moreover the UfM functioning includes the same methodology and principles of PRIMA, notably co-ownership (co-decision and co-financing of projects between countries from the North and the South of the Mediterranean).
The UfM Secretariat has expressed its strong interest and availability to host the PRIMA DIS in two different Senior Officials Meetings (SOM) where all UfM Member States are represented (Naples, 28th October 2014 and Brussels, 16th February 2016). In fact, during the last SOM, representatives of the 43 UfM Member States have confirm their choice to encourage the UfM Secretariat to work with PRIMA Participating States in order to define modalities and legal framework for the establishment of PRIMA DIS hosted by the UfM Secretariat.
Questions were addressed to the PRIMA Consortium as to the suitability of UfM Secretariat as hosting institution for the DIS, specifically concerning the legal status of UfM as an international organization. As to these questions we would like to point out that the Union for the Mediterranean was created by means of an intergovernmental agreement dated July 13, 2008, in a Declaration adopted by its members during the Paris Summit for the Mediterranean (see Annex ---). Following such a Declaration, a Final Statement of Foreign Affairs Ministerial (Marseille, 4 November 2008), the Euro-Mediterranean Foreign Affairs Ministers agreed that "The statute of the Secretariat will be adopted by Senior Officials (on the basis of a proposal to be prepared by a drafting group of experts to be established for this purpose) before the end of February 2009, taking into account the legal system of the country in which the Secretariat will be established." (see Annex ---) The Statutes of the Secretariat were drawn up and adopted by the Senior Officials of the UfM Member States on 3rd March 2010 (see Annex ---). It has to be noted that the establishment of an international organization does not require necessarily a treaty but an international act having the legal binding force of a treaty, at it is clearly demonstrated by the definition adopted by the International Law Commission (ILC) according to which an international organization is "an organization established by a treaty or other instrument governed by international law and possessing its own international legal personality….".
It is worth noting that international law recognizes the existence of so call "agreements in simplified form", meaning international agreements which have been signed by governmental representatives without been followed by ratification process, to which States recognize binding force. Such binding force is implied also looking at the approach followed by member states to the organization of the Secretariat and the Headquarters agreement adopted with Spain (see Annex--). With this regard, article 1 of the referred agreement states that "Spain recognizes the full legal capacity of the Secretariat of the Union for the Mediterranean to contract, purchase or transfer movable and immovable property, to receive and disburse public and private funds, and to institute legal proceedings and/or to do whatever is necessary to fulfil its functions and objectives".
PRIMA Participating States consider UfM as an international organization, the same holds true for the General Assembly of the United Nations, to which UfM has been granted Observer status on December 2015 (see Annex --).
We would also like to point out that the UfM Secretariat maintains transparent procedures and correct circulation of information concerning all activities carried out. Thus, financial control and audit mechanisms are ensured in full compliance with the principles of good financial management and in accordance with internationally recognized standards as per its Statutes.
In addition, the UfM Secretariat follows the rules and procedures laid down in the Financial Regulation applicable to the general budget of the European Union and the ENPI Regulation in accordance with section VIII.1 of its Statutes. Thereofre the UfM Secretariat receives EU funds to cover operational costs.
Article 5 of the Headquarters' Agreement foresees the waiver of immunity (i.e. Operating Grants signed with the EC; inter alia Grant Agreement number ENI 2015/359-702 or ENI 2014 /342-550).
*Legal form of DIS*: PRIMA DIS will be an autonomous entity hosted under the legal framework of the UfM Secretariat. In this respect, the DIS shall not affect UfM Secretariat set up and existing activities.
In order to guarantee the autonomous character of PRIMA DIS, which is a crucial element for all art.185 initiatives the decision making process, rules of procedure, voting rules, and other aspects of governance as well as signing of contracts, management of funds, bank accounts, book keeping, recruitment of personnel, etc. will be defined by PRIMA Participating States. In particular the General Assembly of PRIMA Participating States will enjoy supreme decision making.

As at today there still on-going discussions between UfM Secretariat and PRIMA Participating States as to how to regulate in detail the relationship between the Secretariat and PRIMA DIS.
Presently two options are being discussed and need further exploring and clarification.
In the first option PRIMA DIS will be an independent Unit within the existing structure of UfM Secretariat. UfM Secretariat will be the legal representative of PRIMA DIS. PRIMA Participating States and UFM will enter into a new international agreement which will make express reference to PRIMA Governance and to the complete independence of the Unit from UfM Secretariat daily management. The same agreement will make reference to the Rules of Procedure of the DIS. PRIMA DIS personnel will be recruited following its own procedure. The same objective independence could also be obtained by PRIMA DIS being established by an act of UfM Secretariat and PRIMA Participating States creating an independent sub entity of the UFM Secretariat which will solely manage PRIMA Programme. The establishment of such an independent sub delegated entity will possibly need a new Protocol to be added to the existing Headquarters agreement between UfM and Spain, which will confer legal personality to the DIS.
In the second option PRIMA DIS will be an independent legal entity which will be hosted in the premises of UfM Secretariat and will enjoy a special cooperation agreement with the Secretariat.
The choice of the most suitable option will be taken in the next PRIMA Participating States General Assembly which will took place at the beginning of April 2016. Meanwhile consultations with UfM Secretariat are continuously taking place. Although we have taken good note that no-one can prejudge the results of the Impact Assessment, guidance and advice from the European Commission regarding the implications of the two options, in particular as far as its delegation agreement for the management of EU funds is concerned, would be most appreciated.
In both the above mentioned options PRIMA participating States are discussing the structure of PRIMA Governance with a clear aim at guaranteeing the full independence of the DIS from UfM Secretariat as far as the decision making of PRIMA Programme and its management its management are concerned.
In the discussed preliminary scheme PRIMA Governance is as follows:

a) PRIMA General Assembly: The General Assembly shall be the decision-making body of the PRIMA Joint Programme. All Participating Member States, equal ownership between EU, Associated Countries to Horizon 2020 and Non EU Countries. It vote on the basis of one country one vote rule UfM Secretariat and EC will have the status of Observer. The General Assembly will take decisions, among others, in particular on:

1) Policy and budget
2) Adoption of annual work plan and budget
3) Election of Chair, Co- Chair and Board
4) Monitoring of the implementation of the Programme
5) Approval of objectives and strategy;

b) PRIMA Chair and Co-Chair (EU and Non EU Participating states): acting as legal representatives of the DIS.

c) PRIMA Executive Board: appointed by the General Assembly, is formed by a selected number of Participating States and the Chair and Co-Chair, takes decision in all question related to the administration of the Programme, in particular, among others, those referring to:

1) the drafting of the budget each year
2) all contracting of the Programme;
3) the annual scientific work plan upon advice from the Scientific Advisory Board
4) preparation and launching of the Programme calls;
5) development and updating of the Programme;
6) prepare and decide on funding conditions for the execution of the Programme including the criteria for the selection of evaluators.

By common agreement between the PRIMA DIS General Assembly and the UfMS, a representative of the PRIMA Executive Board could participate in the meetings of the UfMS internal bodies and a representative of the UfMS could participate in the meetings of the PRIMA Executive Board, both in their capacity of observers.

d) PRIMA Scientific Advisory Board: composed of experts in the scientific fields of the PRIMA programme, coming both from the public and the private sector and covering the whole chain from exploratory research to end-users, will give strategic advice in matters of the PRIMA Programme and will be consulted about the decision making process for the implementation of the Programme It will provide recommendations for priorities and topics to be addressed in the calls for proposals and other actions of the PRIMA annual work plans.

e) PRIMA Secretariat will be the Operational Management Unit as PRIMA DIS shall be responsible for the central management of the PRIMA Joint Programme. The staff will be hired according to the national law applicable for DIS. Staff will be recruited according to principles of transparency and expertise. Participating States can second personnel to PRIMA Secretariat as means of in kind contribution to the Programme.

## Clarification of implementation modalities

The PRIMA Executive Board through PRIMA Secretariat shall manage the Union's financial contribution to the Programme and shall be responsible for preparing and implementing the annual work plans, the organization of calls for proposals, the handling of proposal evaluation and ranking of the projects, monitoring of the implementation of the PRIMA, and any other activities resulting from the annual work plans. The Executive Board, through the Secretariat shall be responsible for grant management including signature of grant agreements, the receipt, allocation and monitoring of the use of the Union's financial contribution and payments to participants in the selected projects. The Programme will thus have central and integrated management as to calls, evaluations, eligibility of costs criteria. Comprehensive use of H2020 Rules for participation is foreseen. National contributions allocated to each research project will be directly paid by the competent national bodies. This choice has been made in order to accommodate in particular the requests of Non EU Participating States not able to have national funds crossing borders and being managed by foreign legal entities.

## Confirmation of compliance with H2020 Rules of Participation and Derogation

The Participating Member States confirm that the management of the Programme will be in line with the objectives and research and innovation priorities of Horizon 2020 and with the general principles and conditions laid down in H2020 Rules of Participation. Model Grant Agreements based on H2020 MGA will be used within PRIMA Programme.

Participation to the Programme and its governance is open to all EU Members, Associated countries to Horizon 2020 and Mediterranean Partner Countries who have expressed long-term indicative financial commitments to the PRIMA Programme. After the PRIMA decision is adopted the participation of new member States will be agreed upon by PRIMA General Assembly on a case by case basis (qualified majority vote).

Participation to the calls for proposals of research teams is open to any eligible legal entity. However, in order to avoid the well-know phenomenon of "free riders" which could dissuade countries to fulfill their financial commitments, it is proposed to make one sole derogation to H2020 Rules of Participation by reserving the EU contribution to the co-funding of entities affiliated in PRIMA Participating States. This could also contribute to reduce the oversubscription which is already being observed in the two ongoing cofund actions related to PRIMA (ARIM-Net and ERA-Net MED).

To sum up, PRIMA governance will be reserved to members of the PRIMA consortium while PRIMA projects will be open to all entities affiliated in other countries provided that they bring their own funding.

In case some researchers in a highly-ranked project cannot be funded by their State of affiliation, PRIMA Participating States will set aside part of the EU contribution as a reserve fund as described at pages 88 and 89 of the Proposal. The use of this “reserve fund” cannot exceed 20% of a given national contribution.

# 7. Financial Commitment

**Additional info/confirmation of cash/in-kind from Participating Countries**

# Additional info/confirmation of cash/in-kind from Participating Countries

Since the submission of PRIMA Proposal, PRIMA Consortium has received five new Commitment Letters by Egypt, Tunisia, Cyprus, Israel and Lebanon (see Annexes). Confirmation of the Letters of commitment have been received from Greece (see Annex). PRIMA Participating States have also received expressions of interest by other States such as Germany, Slovenia, Turkey. Germany and Turkey are in fact participating as partners to PRIMA CSA. For instance, a positive signal towards the "science diplomacy" characteristic of PRIMA" is to be found in the fact that Greece and Turkey accepted to be work packages co-leaders in the PRIMA CSA.

Further enlargement of the PRIMA Consortium is a continuous process, and PRIMA Participating States hope to receive further confirmation of commitments from further countries before the PRIMA decision is adopted. Nonetheless PRIMA Participating States would appreciate for the EC to include in its proposal of the Basic Act some degree of flexibility in order to maintain the possibility to increase EU contribution should national contributions to PRIMA Programme increase after the Basic Act is adopted.
Moreover, PRIMA Participating States will contribute in-kind to the realization of the Programme. In particular in-kind contributions will cover part of administrative costs through the secondment of national personnel to the DIS.

In-kind contribution will also cover operational costs in the various research projects which will receive funds through PRIMA Programme calls, with reference by way of example to the salaries of the researchers involved, the use of scientific equipment and infrastructures. It is not possible to quantify ex-ante the amount of such in-kind contributions. However, they will be regularly reported ex-post by each Participating State.

As of today, the budget allocation of the PRIMA programme is foreseen to be balanced between the three pillars of the programme, but PRIMA Participating States would be open to make adjustments in a partnership approach with the European Commission, following its definition of the 2018-2020 priorities for Horizon 2020.