H2020-SC5-01-2017

MED-GOLD

Turning climate-related information into added value for traditional **MED**iterranean **G**rape, **OL**ive and **D**urum wheat food systems

Deliverable 6.3

Dissemination and Capacity Building Materials nº1

This project has received funding from the European Union's Horizon 2020 research and innovation programme under gran agreement No 776467.

DOCUMENT STATUS SHEET

Deliverable Title	**Dissemination and Capacity Building Materials nº1**	
Brief Description	Description and collection of the dissemination and capacity building materials created since the beginning of the project until M24 (November 2019)	
WP number		WP6
Lead Beneficiary	Barcelona Supercomputing Center Centro Nacional de Supercomputación	
Contributors	*Marta Terrado (BSC)*	
Creation Date	11/11/2019	
Version Number	1.0	
Version Date	11/11/2019	
Deliverable Due Date	30/11/2019	
Actual Delivery Date	29/11/2019	
Nature of the Deliverable	R	*R - Report* *P - Prototype* *D - Demonstrator* *O - Other*
Dissemination Level/ Audience	PU	*PU - Public* *PP - Restricted to other programme participants, including the Commission services* *RE - Restricted to a group specified by the consortium, including the Commission services* *CO - Confidential, only for members of the consortium, including the Commission services*

REVISION HISTORY LOG

Version	Date	Created / Modified by	Pages	Comments
1.0	11-11-2019	BSC	28	Initial Draft

All partners involved in the production/implementation of the deliverable should comment and report (if needed) in the above table. The above table should support the decisions made for the specific deliverable in order to include the agreement of all involved parties for the final version of the document.

Finally, after the peer review process, the deliverable should be modified accordingly to the comments and the reflections to the comments should be reported in the above table.

Disclaimer

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EXECUTIVE SUMMARY

Scientific results need effective dissemination to explain the wider societal relevance of science, build support for future research and innovation funding, ensure uptake of results within the scientific community, and open up potential business opportunities for novel products or services. However, to ensure results' uptake, building capacity within the user community is crucial, which helps to enhance their capabilities and skills and develop a dedicated understanding that can be useful for problem-solving. In turn, capacity building leads to a more efficient dissemination of actionable interdisciplinary knowledge to other users and user groups, for adaptation and planning in the context of climate change.

This deliverable presents a description of the dissemination and capacity building materials that have been developed within the framework of the MED-GOLD project. They are aimed to ensure uptake of climate services by agriculture, namely by user communities from grapes/wine, olives/olive oil and durum wheat/pasta sectors, but also by other sectors beyond those. This deliverable contains dissemination materials developed from the beginning of the project until month 24 (November 2019). Materials are addressed to different audiences (e.g. scientific peers, farmers, cooperatives, the business sector, public organizations, or policy makers), depending on the format the information is presented, the terminology used and the distribution channel.

Dissemination and capacity building materials included in this deliverable are scientific publications, project deliverables, poster and oral presentations in relevant events (excluding those with a communication purpose only), materials for training and workshops, info sheets on climate services for the different crops and food systems, and webinars. When possible, materials are collected and displayed in this deliverable. For materials not collected here, such as presentations or deliverables, the link to the original file is provided when publicly available. Materials such as newsletters, info sheets with information to join the MED-GOLD community, project news and press releases or interviews have not been included because they are considered communication materials.

Next steps in dissemination and capacity building will involve further development of the dissemination materials already mentioned (new info sheets and organization of webinars on additional topics, presentations at future relevant events, increase in the number of publications and deliverables, etc.) as well as the development of a policy brief addressed to the policy community.

With this deliverable, the project has contributed to the achievement of the following objectives (DOA, PartB Table1.1):

No.	Objective	Yes
1	To co-design, co-develop, test, and assess the added value of proof-of-concept climate services for olive, grape, and durum wheat	
2	To refine, validate, and upscale the three pilot services with the wider European and global user communities for olive, grape, and durum wheat	
3	To ensure replicability of MED-GOLD climate services in other crops/climates (e.g., coffee) and to establish links to policy making globally	
4	To implement a comprehensive communication and commercialization plan for MED-GOLD climate services to enhance market uptake	
5	To build better informed and connected end-user communities for the global olive oil, wine, and pasta food systems and related policy making	X

1. INTRODUCTION

1.1. PURPOSE

This deliverable describes and collects the dissemination and capacity building materials for climate services and agriculture that have been created since the beginning of the MED-GOLD project. These materials are necessary to increase the societal relevance of the project results and to ensure the uptake of the climate services developed within the project by the user communities from the grape/wine, olive/olive oil and durum wheat/pasta sectors but also by other crops and sectors beyond the ones initially targeted by the project (e.g. coffee crop, forestry sector, fisheries, etc.). All this aligns with the final aim, which is to increase the impact and innovation of the MED-GOLD project.

1.2. DEFINITIONS AND ACRONYMS

1.2.1. DEFINITIONS

Concepts and terms used in this document and needing a definition are included in the following table:

Table 1-1 Definitions

Concept / Term	Definition
Dissemination	Public disclosure of the results by any appropriate means (other than resulting from protecting or exploiting the results), including by scientific publications in any medium (EC Research & Innovation Participant Portal Glossary/Reference Terms).
Communication	Process strategically planned that starts at the outset of the project and continues throughout its entire lifetime, aimed at promoting both the project and its results to multitude of audiences, including the media and the public and possibly engaging in a two-way exchange (EC Research & Innovation Participant Portal Glossary/Reference Terms).
Capacity building	Process by which people, organizations and society systematically stimulate and develop their capability over time to achieve social and economic goals, including through improvement of knowledge, skills, systems and institutions (United Nations Office for Disaster Risk Reduction).

1.2.2. ACRONYMS

Acronyms used in this document and needing a definition are included in the following table:

Table 1-2 Acronyms

Acronym	Definition
An	Daily Net Photosynthesis
EN	English
ES	Spanish
Dr	Doctor
FR	French
GHG	Greenhouse gases
GR	Greek
ICT	Information and Communication Technology
IT	Italian
Prof	Professor
PT	Portuguese
RUE	Radiation Use Efficiency
SPEI	Standardized Precipitation Evapotranspiration Index
SPI	Standardized Precipitation Index

2. REFERENCES

2.1. REFERENCE DOCUMENTS

The following documents, although not part of this document, amplify or clarify its contents. Reference documents are those not applicable and referenced within this document. They are referenced in this document in the form [RD.x]:

Table 2-1 Reference documents

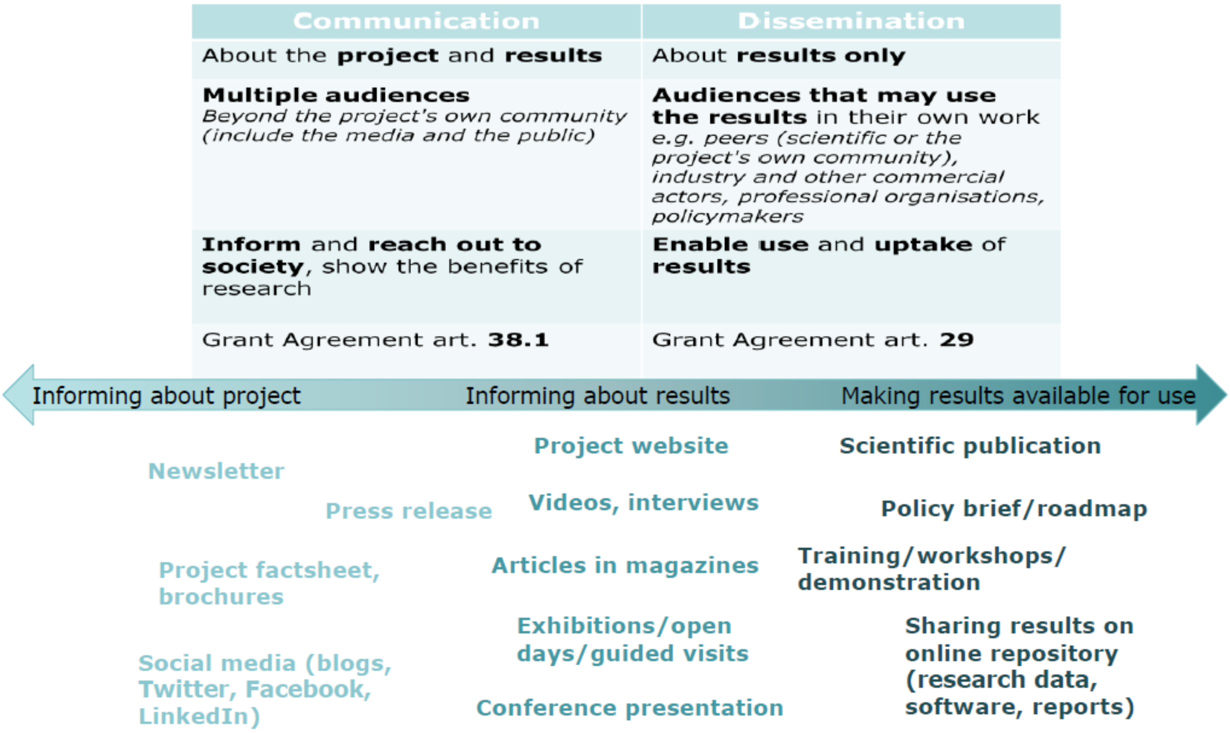
Ref.	Title	Code	Version	Date
[RD.1]	MED-GOLD Communication, Dissemination and Exploitation Management Plan	D7.1		2018
[RD.2]	Summary of dissemination and communication activities nº2	D6.22		2019
[RD.3]	Compilation of publications abstracts	D6.5		2019

3. DISSEMINATION AND CAPACITY BUILDING MATERIALS

Scientific results need effective dissemination that helps to explain the wider societal relevance of science, build support for future research and innovation funding, ensure uptake or results within the scientific community, and open up potential business opportunities for novel products or services[1]. Overall, it helps to increase the impact of research and innovation in many ways. Unlike communication, which is about the project and results, dissemination has the focus on the results only, bringing them to the attention of non-scientific audiences, peers (scientific or the project's own community), industry and other commercial players, professional organizations, or policy-makers.

Boundaries between dissemination and communication activities are sometimes blurry and can overlap (Figure 3-1). For instance, a journal article highlighting the project's achievements written for communication purposes could end up in the hands of potential stakeholders outside the project and trigger interest in using some of the results. In this case the initial communication tool has become a dissemination tool as well. This illustrates how certain tools and activities can oscillate between communication and dissemination, depending on the target group and content.

Figure 3-1 Communication and dissemination definition and activities (Kirsi Ala-Mutka, European Commission[2])



Dissemination encompasses different types of activities that can make use of various dissemination materials, including scientific publications, policy briefs, training materials, reports, presentations to conferences, articles, videos, etc. (Figure 3-1). Some dissemination materials can be used not only to disseminate the results of the project but also to build capacity, that is, to improve the knowledge and skills of the audience, enhancing their ability to evaluate and address crucial questions related to modes of implementation and even policy choices. Capacity building materials include training, workshop or demonstration materials or webinars, for instance.

Table 3-1 and the following sections present a compilation of the dissemination and capacity building materials that have been developed so far in the framework of the MED-GOLD project, describing the target audiences as well as the channels used to reach them.

[1] Scherer et al. (2018) Making the most of your H2020 project, The European IP Helpdesk, http://www.iprhelpdesk.eu/sites/default/files/2019-05/Brochure_Making_the_Most_of_Your_H2020_Project_web.pdf

[2] Kirsi Ala-Mutka (2017) Dissemination and exploitation in H2020, Presentation at the H2020 Coordinator's Day, European Commission, https://ec.europa.eu/research/participants/data/ref/h2020/other/events/2017-03-01/8_result-dissemination-exploitation.pdf

Table 3-1 Dissemination and capacity building materials developed in MED-GOLD

Materials	Channels	Target Audience	Language	Link
Scientific publications (peer and non-peer reviewed)	Project website Social media Project newsletter	Scientific	EN	
Project deliverables	Project website Project newsletter	Project's own community Scientific	EN	https://www.med-gold.eu/documents-deliverables/
Presentations in relevant events (including interactions with other initiatives)	Conferences, meetings	Scientific	EN, IT, PT	
Materials for training and workshops	Workshops Summer school	Scientific Farmers Industry and other commercial players Media	EN, IT, ES, PT	
Infosheets	Project website Social media Workshops Project newsletter	Farmers Industry and other commercial players Public organisations Policy-makers	EN, IT, ES, PT, GR, FR	https://www.med-gold.eu/documents-publications/
Webinars	Webinar platform Project website Social media Project newsletter	Scientific Farmers Industry and other commercial partners Public organisations Policy-makers Media	PT	https://www.med-gold.eu/webinars/
Policy brief	Project website	Policy-makers Commercial players (e.g. cooperatives, trade organizations)	EN	Ongoing

3.1. SCIENTIFIC PUBLICATIONS

Four peer-reviewed scientific publications have been published so far, while one other is currently under review (Table 3-2).

Table 3-2 Peer-reviewed scientific publications

Publications
Ponti, L., Gutierrez, A.P., Boggia, A., Neteler, M. (2018) Analysis of grape production in the face of climate change. *Climate* 6(2): 20, doi: 10.3390/cli6020020
Di Giuseppe, E., Pasqui, M., Magno, R., Quaresima, S. (2019) A Counting Process Approach for Trend Assessment of Drought Condition. *Hydrology* 6(4): 84, https://doi.org/10.3390/hydrology6040084
Giulioni, G., Di Giuseppe, E., Toscano, P., Miglietta, F., Pasqui, M. (2019) A Novel Computational Model of the Wheat Global Market with an Application to the 2010 Russian Federation Case. *Journal of Artificial Societies & Social Simulation* 22(3), http://jasss.soc.surrey.ac.uk/22/3/4/4.pdf
Solaraju-Murali, B., Caron, L.-P., González-Reviriego, N., and Doblas-Reyes, F.J. (2019) Multi-year prediction of European summer drought conditions for the agricultural sector. *Environmental Research Letters* (in press) https://doi.org/10.1088/1748-9326/ab5043
Rosati A., Wolz K.J., Murphy L., Ponti L., and Jose S. Modelling light below tree canopies overestimates An and RUE in understory crops by averaging light in space and time. *Agricultural and Forest Meteorology* (under review)

Ponti, L., Gutierrez, A.P., Boggia, A., Neteler, M. (2018) Analysis of grape production in the face of climate change. *Climate* 6(2): 20, doi: [10.3390/cli6020020](https://doi.org/10.3390/cli6020020)

Abstract: Grape, olive, and wheat are traditional Mediterranean Basin crops that have immense cultural, economic, and ecological importance, and are the basis for producing wine, olive oil, and pasta and bread products. Of fruit crops, grape has the largest area and the highest economic importance globally. These traditional Mediterranean crop systems and related food products have global relevance, and yet globally, all regions with Mediterranean climate are especially vulnerable to climate change that threatens this Mediterranean bio-cultural heritage. However, how to analyze the complex tripartite ecological, economic, and social effects of climate change on these systems has been vexing and largely unexplored. Here we review how a bioeconomic approach using physiologically-based demographic models in the context of geographic information systems may be an important step in examining the complexity of these factors on grape. We show that with relatively modest data and funding, regional bioeconomic analysis of grape production under present weather and climate change is possible, and that management-relevant complexity can be included in a mechanistic way.

Di Giuseppe, E., Pasqui, M., Magno, R., Quaresima, S. (2019) A Counting Process Approach for Trend Assessment of Drought Condition. *Hydrology* 6(4): 84, https://doi.org/10.3390/hydrology6040084

This paper is related to the evaluation of a new approach to identify drought risk trends at global scale for any specific threshold; in particular, the methodology was developed for tailoring climatic information for technical and non-technical end users in the decision making processes.

Abstract: This paper discusses some methodological aspects of the historical analysis of drought, particularly the trend assessment. The Standardized Evapotranspiration Index (SPEI) is widely used as a measure of drought condition. Since different SPEI thresholds allow classifying the risk into moderate, severe, and extreme, the drought occurrence becomes a counting process. In this framework, would a statistical trend test based on a Non-Homogeneous Poisson Process (NHPP) give a similar result of the nonparametric Mann–Kendall (M-K) test? In this paper, we demonstrate that the NHPP approach is able to characterize the information given by the classical M-K approach in term of drought risk classes. Furthermore, we show how it can be used to reinforce the framework of drought trend analysis in combination with a standard non-parametric approach. At a global scale, we find that: (1) areas under increasing risk of drought identified by the NHPP approach are considerably larger in comparison to those identified by M-K; and (2) the results of the two tests are different during crucial periods such as hydrological droughts in winter and spring.

Giulioni, G., Di Giuseppe, E., Toscano, P., Miglietta, F., Pasqui, M. (2019) A Novel Computational Model of the Wheat Global Market with an Application to the 2010 Russian Federation Case. *Journal of Artificial Societies & Social Simulation* 22(3), http://jasss.soc.surrey.ac.uk/22/3/4/4.pdf

This paper aims to contribute in enlightening the complex dynamics of wheat market and production at global scale; even if it is not directly related to the MED-GOLD activities, the wheat prices dynamic was identified as a key element in the decision making process by WP4 end users during workshops.

Abstract: In this paper, we build a computational model for the analysis of international wheat spot price formation, its dynamics and the dynamics of quantities traded internationally. The model has been calibrated using FAOSTAT data to evaluate its in-sample predictive power. The model is able to generate wheat prices in twelve international markets and traded wheat quantities in twenty-four world regions. The time span considered is from 1992 to 2013. In our study, particular attention was paid to the impact of the Russian Federation's 2010 grain export ban on wheat price and quantities traded internationally. Among other results, we found that the average weighted world wheat price in 2013 would have been 3.55% lower than the observed one if the Russian Federation had not imposed the export ban in 2010.

Solaraju-Murali, B., Caron, L.-P., González-Reviriego, N., and Doblas-Reyes, F.J. (2019) Multi-year prediction of European summer drought conditions for the agricultural sector. *Environmental Research Letters* (in press) https://doi.org/10.1088/1748-9326/ab5043

Abstract: Decadal climate prediction, where climate models are initialized with the contemporaneous state of the Earth system and run for a decade into the future, represents a new source of near-term climate information to better inform decisions and policies across key climate-sensitive sectors. This paper illustrates the potential usefulness of such predictions for building a climate service for agricultural needs. In particular, we assess the forecast quality of multi-model climate predictions in estimating two user-relevant drought indices, SPEI (Standardized Precipitation Evapotranspiration Index) and SPI (Standardized Precipitation Index), at multi-annual timescales during European summer. In addition, an assessment of the added value of near-term climate information with respect to standard uninitialized climate projections is presented. We obtain a high skill for predicting five-year average (forecast years 1-5) SPEI across Southern Europe, while for the same forecast period SPI exhibits high and significant skill over Scandinavia and its surrounding regions. The model initialization improves the forecast skill over Central Europe, the Balkan region and Southern Scandinavia. Most of the increased skill found with initialization seems to be due to the climate forecast systems ability to improve the

extended summer precipitation and potential evapotranspiration forecast, and as well as their ability to adequately represent the observed effects of these climate variables on the drought indices.

Rosati A., Wolz K.J., Murphy L., Ponti L., and Jose S. Modelling light below tree canopies overestimates An and RUE in understory crops by averaging light in space and time. *Agricultural and Forest Meteorology* (under review)

Abstract: By averaging in time and/or space, models predict less variable light patterns under tree canopies than in reality. We measured light every minute in 24 positions in a grid under different chestnut orchards, for several clear and overcast days. We also modelled this light with a purposely created 3D, spatially explicit, ray-tracing light interception model, where canopy porosity was calibrated to match measured daily light. Finally, we used both the measured and modeled light patterns transmitted under the tree canopies to estimate the daily net photosynthesis (An) and radiation use efficiency (RUE) of an understory wheat leaf. As expected, modeled light was more uniform than measured light, even at equal daily light. This resulted in large overestimation of daily An and RUE of the understory leaf. Averaging light in time increased the overestimations even further. A sensitivity analysis showed that this overestimation remained substantial over the range of realistic values for leaf photosynthetic parameters (i.e. Vc,max, Jmax, Rd) of the understory crop.

3.2. PROJECT DELIVERABLES

Dissemination of project results to the scientific community is done through project deliverables that are publicly available. However, although more limited, non-public deliverables also help disseminate the results of the project among the project's own community.

The list of public deliverables available on the project website is provided in Table 3-3.

Table 3-3 Public deliverables available online

Deliverable #	Title
D1.1	MED-GOLD Core Sectors Description and Analysis
D1.3	Report assessing the quality of European climate observations and their appropriateness for use in climate services for each sector
D1.5	Deployment of the MED-GOLD ICT platform
D1.6	Guidelines for appraising needs and critical decisions across the pilot services
D2.1	Report on the Knowledge capitalization of the olive oil sector
D4.1	Report on the identified specific needs and opportunities
D5.1	Report on the status of the MED-GOLD Community
D6.1	Climate Related Initiatives Interactions Report n.1
D6.7	Summary of Dissemination and Communication Activities n.1
D6.8	Launch of external website
D7.1	Communication, dissemination, and exploitation management plan
D7.2	Data management Plan

3.3. PRESENTATIONS IN RELEVANT EVENTS

Presentations to report project results in relevant events (in oral and poster format) are listed below. In the case of events with submitted abstracts, a compilation can be found in D6.22 [RD.3]. In the case of poster presentations, find the posters below, in Annex A.1.

Table 3-4 Presentations in relevant events

Nº	Presentation/ Event	Presentation type
1	**Mediterranean agro-climate projections and the case of olives in Andalucia: results from the MED-GOLD project**, European Meteorological Society (EMS) Annual Meeting, Copenhagen, Denmark, 9-13 September 2019	Oral
2	**Development of climate services from the user perspective: the MED-GOLD experience**, European Meteorological Society (EMS) Annual Meeting, Copenhagen, Denmark, 9-13 September 2019	Oral
3	**Multi-year prediction of European summer drought conditions for the agricultural sector**, International Meeting on Statistical Climatology (IMSC), Toulouse, France, 24-28 June 2019	Oral
4	**Agroforestry models overestimate photosynthesis of understory crops**, 16th AFTA (Association for Temperate Agroforestry) Biennial Conference, Oregon State University, Corvallis, Oregon, USA, 24-27 June 2019	Oral
5	**Climate change impacts in the Mediterranean food system: Results of the MED-GOLD project for the case of olive oils in Andalusia**, Adapt2clima Conference, Heraklion, Greece, 24-25 June 2019	Oral
6	***Il concetto di valore delle previsioni climatiche dalla prospettiva dell'utente: l'esperienza del progetto MED GOLD, Prima Conferenza Nazionale sulle Previsioni Meteorologiche e Climatiche*** (in Italian), Bologna, Italy, 17-18 June 2019	Oral
7	**Co-development of tailored climate services for adding value to olives, grapes and durum wheat production systems**, European Climate Change Adaptation (ECCA) conference, Lisbon, Portugal, 28-31 May 2019	Oral
8	**Unfolding the potential of climate services for climate change adaptation**, European Climate Change Adaptation (ECCA) conference, Lisbon, Portugal, 28-31 May 2019	Oral
9	**Climate services in the wine industry: promises from project MED-GOLD**, 8th Symposium of the Oenoviti International network, Athens, Greece, 13th-14 May 2019	Oral
10	**Turning climate-related information into added value for traditional MEDiterranean Grape, OLive and Durum wheat food systems: the MED-GOLD project**, General Assebly of the MEDSCOPE project, Milan, Italy, 15-17 May 2019	Oral
11	**Do agroforestry models overestimate photosynthesis and RUE of understory crops?** 4th World Congress on Agroforestry. Agroforestry: strengthening links between science, society and policy, Montpellier, France, May 2019	Oral
12	**Bioeconomic analogies as a unifying paradigm for modeling agricultural systems under global change in the context of geographic information systems**, European Geophysical Union (EGU) General Assembly 2019, Vienna, Austria, 7-12 April 2019	Oral
13	**Climate variability and predictions for agriculture,** Union for the Mediterranean workshop about climate change impact on agriculture, Barcelona, Spain, 9 April 2019	Oral
14	***Resiliência e adaptação: uso de informação histórica para prever a qualidade de uvas e vinhos numa determinada propriedade da região demarcada do Douro*** (in Portuguese), 11º Simpósio de vitivinicultura do Alentejo, May, Évora, Portugal, 2019	Oral
15	**The MEDGOLD project: advanced user-centric climate services for higher resilience and profitability in the grape and wine sectors**, 41st World Congress of Vine and Wine, Punta del Este, Uruguay, 19-23 November 2018	Oral
16	**Climate services for the Mediterranean food security**, 11th International Congress from the Spanish Association of Climatology (AEC), Cartagena, Spain, 17-19 October 2018	Oral
17	**Communicating, engaging and clustering: the MED-GOLD approach to provide climate services for Mediterranean grape, olive and durum wheat**, Climateurope Festival 2018, Belgrade, Serbia, 17-19 October 2018	Poster (Annex A.1)
18	**Evaluation of various bias correction methods for Mediterranean agro-climate projections: first results from the MED-GOLD project**, MEDCLIVAR 2018 - Bridging the Mediterranean climates, Belgrade, Serbia, 18-21 September 2018	Oral
19	**Assessing the added-value of near-term decadal climate information for decision making in the agricultural sector**, Second International Conference on Seasonal to Decadal Prediction, Boulder, USA, 17-21 September 2018	Oral
20	**Turning climate-related information into added value for traditional MEDiterranean Grape, OLive and Durum wheat food systems: the MED-GOLD project**, European Meteorological Society (EMS) Annual Meeting, Budapest, Hungary, 3-7 September 2018	Oral
21	**Voices from the field: climate prediction requirements in the agricultural sector from the MED-GOLD initiative**, European Meteorological Society (EMS) Annual Meeting, Budapest, Hungary, 3-7 September 2018	Oral
22	**Helping to ensure the future of the Mediterranean diet with climate services**, 7th Jornada Ambiental (Bodegas Torres), Barcelona, Spain, 30 May 2018	Poster (Annex A.1)
23	**Turning climate-related information into added value for traditional MEDiterranean Grape, OLive and Durum wheat food systems: the MED-GOLD project**, European Geophysical Union (EGU) General Assembly 2018, Vienna, Austria, 8-13 April 2018	Oral

3.4. MATERIALS FOR TRAINING AND WORKSHOPS

Dissemination materials, namely presentations, were used in the workshops organised to showcase the development of the MED-GOLD sectorial tools to MED-GOLD users and gather their feedback. This had he aim to ensure mutual understanding between project scientists and users. The workshops were hold at the facilities of the MED-GOLD partners representing each of the project crops/sectors (i.e. Sogrape Vinhos winery in Portugal, DCOOP central offices in Spain and the headquarters of the Barilla food company in Italy) during April-May 2019 (Figure 3-2).

Presentations were used to show workshop participants a proposal (beta version) of the new tools to support strategic decisions in each of the sectors and to ensure that the agro-climatic information included in the tools matched what users actually need. Aspects discussed during workshops included the preferred way in which users want to access information, and the way this information is visualized: preference to see maps/ graphs/ a short text description, display terciles/ percentiles, clearest colour scales providing a quicker interpretation, etc.

Presentations used during the sectorial workshops for the grape/wine and olive/olive oil sectors (the link for the durum wheat sector has not been made available yet):

- Proposed climate services for the grape/wine sector
- Preview of the climate service tool for the olive/olive oil sector
- Proposed climate service tool for the durum wheat/pasta sector

Figure 3-2 Sectorial workshops to gather users' feedback on the tools' development

3.5. INFOSHEETS

Three infosheets describing the climate services that MED-GOLD is developing for the three sectors of interest of the project (grape/wine, olive/olive oil and durum wheat/pasta) have been developed in close collaboration with the project stakeholders. Infosheets have originally been created and published in English on the website. The MED-GOLD translation team is currently working in the translation of the info sheets to Italian, Portuguese, Spanish, French and Greek with the objective to enhance user engagement. Infosheets have been made available through the project website and newsletter and have been distributed in the open stakeholder workshops organised as pre-events of the project annual meetings. Workshops entitled 'Adapting Mediterranean agriculture to climate change' were organised in Porto, Portugal, in 2018 and in Cagliari, Italy, in 2019.

An info sheet on climate services for coffee is currently under development.

See available infosheets in Annex A.2.

3.6. WEBINARS

A webinar on 'Climate services as drivers of value into the Mediterranean wine sector' was organised on January 8, 2019.

The webinar was run in Portuguese and therefore addressed to Portuguese speakers (note that since the MED-GOLD user for the grapes/wine sector is the Portuguese winery Sogrape Vinhos, an important part of the MED-GOLD community members with interest in this sector are Portuguese). The webinar was advertised through the project newsletter, which is sent to members of the MED-GOLD community that gave consent to receive this information. It was also advertised online on the project website and on social media. Fourty-four people registered for the webinar, from both the MED-GOLD community and external ones, although it was finally attended by 18 participants. To run the webinar, we used the Webex platform. Those questions that could not be answered during the webinar were posted on the project Forum (usable upon registration) to give participants the option to continue the discussion there. Webinar materials, including a summary of the webinar, the recording (Figure 3-3), and the speakers' presentations, were uploaded to the project website and are available at https://www.med-gold.eu/webinars/. A certificate of participation was issued to all the speakers.

During the webinar, different experts discussed how climate services can help the wine sector to cope with climate change and create opportunities. Antonio Graça, Director of Research and Development of Sogrape Vinhos and MED-GOLD partner, shared his insights on how climate services could add value to the wine business. Afterwards, a panel of experts composed by Dr Rita Cardoso (Instituto Dom Luiz, Lisbon) and Prof Dr João Santos (University of Trás-os-Montes and Alto Douro, Vila Real) fostered the discussion about the influence of Mediterranean climate on the wine sector. The webinar was moderated by another MED-GOLD partner, Marta Bruno Soares (University of Leeds).

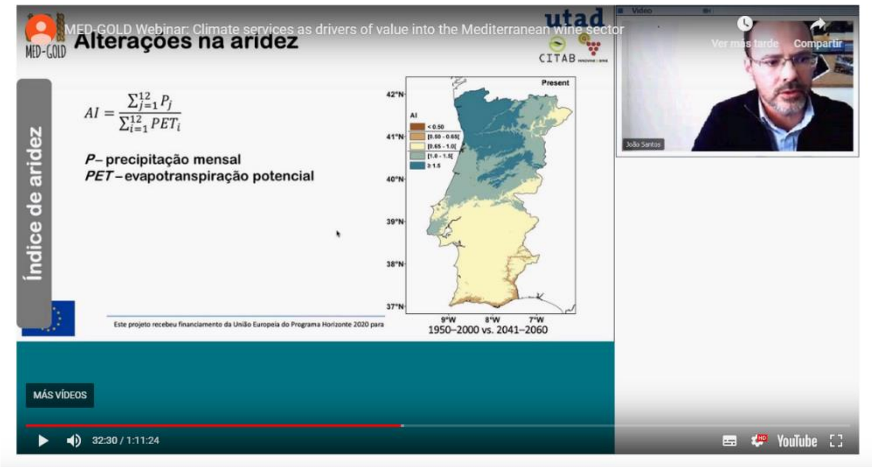
Presentations

Antonio Graça talked about 'The future of wine'. He described the notion of terroir in the wine business as a key issue and explained how its different aspects have evolved along history until nowadays. Using recent charts of the evolution of global temperature and correlated effects on grape quality, including the occurrence of recent extreme damaging events, he highlighted the confusion of grape growers, threatened by a quickly changing environment and overwhelmed by an exponentially growing amount of data, information and tools that make their activity hardly manageable. Antonio then, introduced the MED-GOLD project, explaining what is a climate service and what is the expected climate service output from the project as well as the added-value promise hold for the grape and wine sector.

Dr Rita Cardoso presented the lecture 'Climate Change in Portugal: high-resolution projections'. She explained what global and regional climate models are, detailing how they are assessed in terms of performance and how the consideration of both natural and anthropogenic forcings accurately describes the evolution of global climate in the last 100 years. She presented the results of her team's work published in 2018, detailing high-resolution comparisons between seasonal average temperature anomalies over Portugal from 1971-2000 with 2071-2100. Of particular interest were the projections regarding the number of heatwaves and their duration, bound to increase between the two periods and the predicted change in precipitation levels and yearly patterns.

The last speaker was Prof Dr João Santos, who presented 'Some studies on the influence of atmospheric conditions over the grapevine'. Drawing from data from the high-resolution (1 km) dataset created by his team for Portugal, he showed an analysis of the historical evolution of the aridity and thermicity indices for the period 1950-2000 compared to predictions for the period 2041-2060. He presented an analysis of bioclimatic indices (Huglin, dryness and hydrothermal) indicating strong impacts depending on grapevine varieties. Dr Santos showed a new way of calculating the thermal load as a function of the significant thermal thresholds for the grapevine (Growing Degree-Hours) and with much higher temporal resolution, allowing for greater detail in predictions and higher accuracy in matching varieties to sites. Applying this new index, he has grouped 44 grapevine varieties according to their thermal needs for ripening, supplying important information to assist decision-making when choosing varieties for plantation. He finalized his presentation by calling the attention to several potential measures for adaptation as a function of climate impact change and implementation time, giving as an example the mitigating effect the use of irrigation may have to counter climate-driven yield losses.

Figure 3-3 Webinar on Climate services as drivers of value into the Mediterranean wine sector



Questions & Answers

Presentations were followed by a round of questions and answers:

- Inês Campos asked about adaptation measures, namely the use of renewable energy in vineyards, citing the example of a French vineyard where solar panels are used to generate energy above the grapevines while providing shade and avoiding sunburn in heat intensive areas. Dr Santos was unaware of such a use for solar panels in vineyards but indicated that the use of trees inside the vineyard block can provide shade. He added that the use of solar energy is a positive factor as it does not produce GHG and therefore contributes to mitigate climate change, namely using that energy to power irrigation systems. He also noted that the main problem, however, is the scarcity of water, the costs of setting and operating irrigation systems and the danger of competition between agricultural and human use for the available water resources.
- André Galante asked if the increase in aridity could be compensated by cover crops in vineyards. Antonio Graça answered that it would provide a countering effect, but it would be negligible in the face of the magnitude of the change forecasted by the model presented by Dr Santos and indicated irrigation, good soil management, erosion control as complementary measures.

Discussion panel

The topic of discussion, for which participants were asked to give their opinions, was ‘How may climate services generate value for the grape and wine sector of the Mediterranean region’.

Antonio Graça focused the value of climate services by obtaining better timeliness in addressing mitigation measures and protection against extreme climate events. He added that value would also be added by higher geographical resolution, allowing for process managers to address the specific situation of their own properties. Dr Cardoso stressed as factors of value the quality of the forecasts and the conversion of deterministic forecasts into probabilistic forecasts. Dr Santos stressed the danger of extrapolating low-resolution predictions for local application, thus favouring the importance of having high-resolution products that allow for efficient and consequential decision making in terms of mitigation and adaptation.

3.7. POLICY BRIEF

A policy brief will be delivered at the end of the MED-GOLD project. With this finality, we have already started engaging with relevant stakeholders, recognising that a diverse policy community is relevant to the project, including European, national and local governments, sector bodies, regulatory and trade organisations, etc. We organize meetings with the aim to inform the policy community about the project and its results, stressing their relevance for the agriculture sector. At the same time, we aim to receive feedback about which are the policy needs regarding climate information and services.

For the strategy of engagement with the policy community, project results are presented through the distribution of the infosheets mentioned above and through a presentation prepared with this purpose.

4. CONCLUSION

Various dissemination and capacity building materials have been developed to date to help increase the impact of the MED-GOLD project among the sectors of interest (grape/wine, olive/olive oil, durum wheat/pasta) and beyond.

Materials developed during the first 24 months of the project include scientific publications, project deliverables, and presentations used at relevant events, which are mainly addressed to the scientific community. Other resources have also been developed, such as materials for training and workshops, info sheets or webinars, that are primarily directed to build capacity and that address a more diverse community, including farmers, agri-cooperatives, private businesses, and other stakeholders with an interest in the topics presented. Even though in this first period materials are more focused on the three crops of interest of the project, once the engagement and capacity building among these communities will be more advanced, additional materials will be developed to target stakeholders with interest in other crops (e.g. coffee) and, if possible, economic sectors (e.g. forestry). Other dissemination materials that will be developed at a later stage of the project include policy briefs, mainly targeting the policy community.

ANNEX A.

A.1. POSTER PRESENTATION

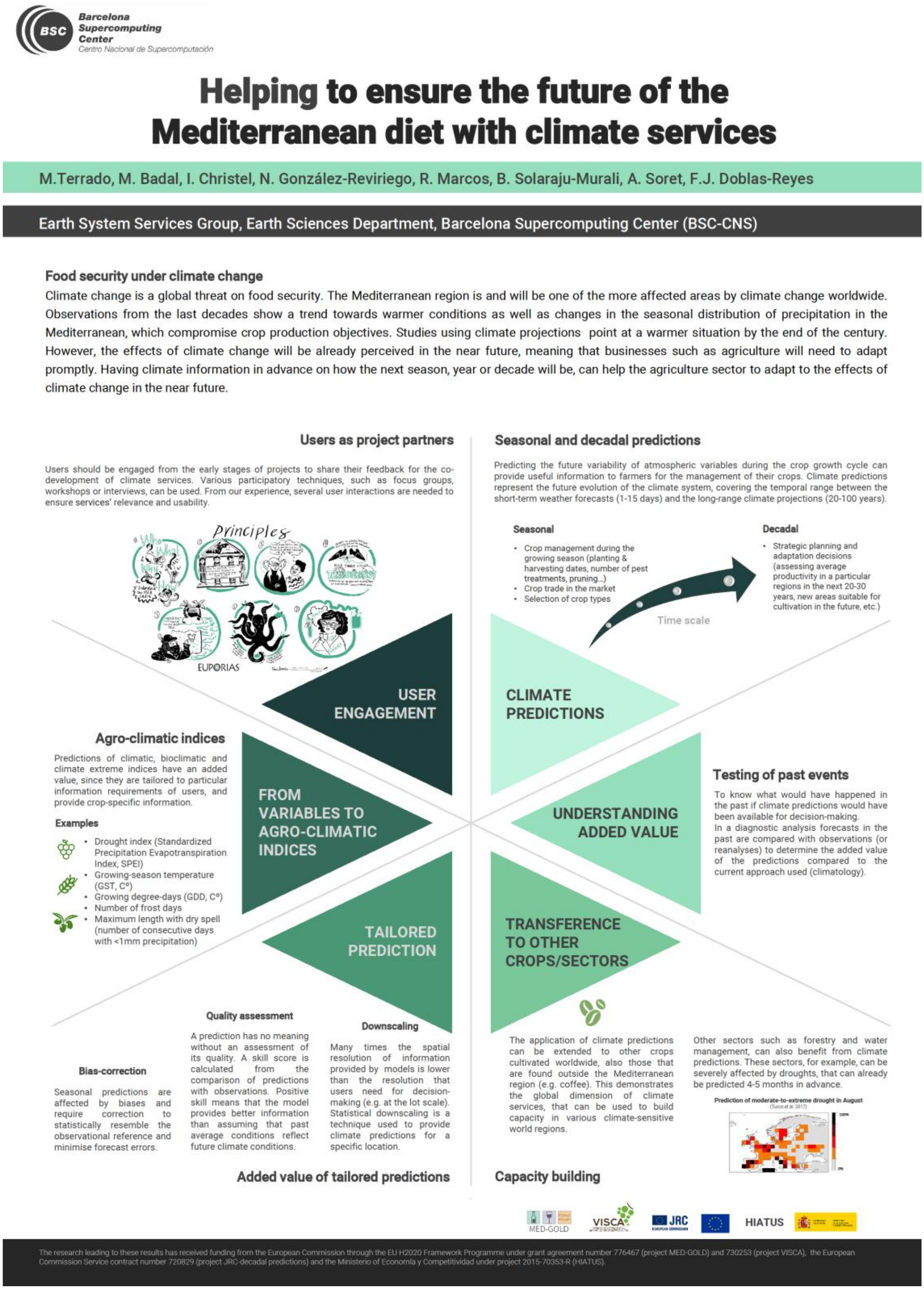


Figure 4-1 Poster 'Helping to ensure the future of the Mediterranean diet through climate services'

Figure 4-2 Poster 'Communicating, engaging and clustering'

A.2. INFOSHEETS

MED-GOLD

CLIMATE SERVICES FOR THE GRAPE AND WINE SECTOR

Grape and wine production is heavily affected by weather and climate, thereby is highly vulnerable to climate change. MED-GOLD will propose climate services deploying forecast information at the medium (next 6 months) and long-term (next 30 years). This information will be provided at higher spatial resolution than what is currently available. To provide the highest value for decision-making, the services will be co-developed with professional users from the sector.

Wine producers face diverse challenges affecting several decision processes in their business, such as strategical definitions, viticulture, oenological and stock management. Some examples are presented below to show how climate services - in this case, predictions of climate variables and bioclimatic indices - can improve decision-making and win over challenges posed by climate variability and climate change.

Time scale	Decision area	Challenge	MED-GOLD climate service	Benefits
Long-term (30 years)	Long-term strategy	• Purchase of new vineyards and/or selection of future new locations. • Choice of grape varieties, rootstocks and vineyard design. • Anticipation of needs to change wine style.	• Temperature • Precipitation • Growing season average temperature • Warm spell duration index • Growing degree days • Number of heat stress days • Spring total precipitation	• Indication of areas with suitable climate to meet production and quality goals for the next decades. • Matching adequate grape varieties and rootstocks to expected climate. • Identification of likely moment with adverse climate for current wine style.
Medium-term (6 months)	Viticulture management	• Better pruning and canopy management. • Improve planning of treatments and harvest setting with higher accuracy. • Better labour management, operational subcontracting and environmental protection.	• Temperature • Precipitation • Growing season average temperature • Warm spell duration index • Growing degree days • Number of heat stress days • Spring total precipitation	• Longer anticipation of best timing for vineyard operations. • Identification of time periods with high-demand for labour and inputs. • Schedule of best moments for treatments with higher temporal precision.
	Oenological management	• Better maturation control planning. • Improve harvest efficiency.		• Identification of likely moments for veraison and harvest. • Timely anticipation of adverse conditions.
	Stock management	• Improve supplier negotiation. • Better prices and supply chain. • Marketing and promotions.		• Anticipation of seasonal climate trends with adequate temporal and spatial resolution.

Figure 4-3 Infosheet 'Climate services for the grape and wine sector' (side 1)

Planning of plant protection treatments

Several diseases affecting grapevines are favoured by specific climatic conditions. These diseases may be of fungal origin, namely downy and powdery mildew, among others, and of bacterial origin or caused by pests, namely insects. Fungal diseases occur when the plant, being a carrier, is exposed to favourable climatic conditions such as high humidity and mild-warm temperatures, which associated to poor aeration promote their development. When emerging at critical phenological stages, these diseases damage grapes, ultimately reducing yields and resulting in a loss of wine quality.

Currently, SOGRAPE (MED-GOLD's champion user for the wine sector) uses 4 to 5-day lead-time forecasts to schedule their spraying while avoiding product loss from subsequent rainfall. This anticipation of vineyard protection planning results in important, sustainable benefits. Medium-term decisions are currently undertaken with reference to past average conditions, both intuitively and using 30-year climate data series available from the national weather service.

Advantages of having access to medium-term (seasonal) climate predictions:

1. **Efficient management of spraying against diseases**, supporting vineyard development or inducing grapevine's resistance against humidity-driven diseases (fungal) in more sensitive phenological states.
2. **Efficient stock management** to be prepared in advance to avoid higher prices and stock disruptions.
3. **Accurate setting of harvest dates**, which is influenced by adverse conditions, namely pests risk.

Glossary

Climate services: transformation of climate-related data and other information into customized products such as trends, economic analysis, advice on best practices, and any other climate-related service liable to benefit that may be of use for the society

Weather forecasts: probabilistic forecasts of climate variables for the next hours and days (up to two weeks)

Climate predictions: probabilistic forecasts of climate variables that extend further into the future than weather forecasts, from months and seasons up to decades

Seasonal predictions: climate predictions for the next season. These predictions can be provided for the next 6 months

Climate projections: probabilistic forecasts of climate variables that extend even further into the future than climate predictions, from decades up to centuries

Growing season average temperature (GST): average of daily average temperatures between April 1st and October 31st (Northern Hemisphere)

Growing degree days (GDD): sum of daily differences between daily temperature averages and 10ºC (vegetative growth minimum temperature) between April 1st and October 31st (Northern Hemisphere)

Spring total precipitation (SprR): total rainfall from April 21st to June 21st (Northern Hemisphere)

Number of heat stress days (SU35): annual count of days when daily maximum temperatures exceed 35ºC

Warm spell duration index (WSDI): annual count of days with at least 6 consecutive days when the daily maximum temperature exceeds its 90th percentile

About MED-GOLD

MED-GOLD, Turning climate-related information into added value for traditional **MED**iterranean **G**rape, **OL**ive and **D**urum wheat food systems, is a 4-year project contributing to make European agriculture and food systems more resilient, sustainable and efficient in the face of climate change by using climate services to minimize climate-driven risks/costs and seize opportunities for added value

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776467

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Figure 4-4 Infosheet 'Climate services for the grape and wine sector' (side 2)

CLIMATE SERVICES FOR THE OLIVE AND OLIVE OIL SECTOR

Olive and olive oil production is heavily affected by weather and climate, and is thereby highly vulnerable to climate change. MED-GOLD will use a range of tools to support decision-making in the olive and olive oil sector over a range of timescales, from months to decades. These tools will include climatic indices, numerical models, and agroecosystem analyses to turn climate and other data into customized products. This process of turning climate-related information into products with added value for decision-making is called climate service. Climate information underlying the services will be provided at higher spatial resolution and with less bias than currently available.

Olive and olive oil producers face a variety of climate-related challenges in the long, medium and short term that need to be tackled by climate-informed decision-making. Some of the main challenges are presented below, with an indication of how the related decisions can be optimized using appropriate climate services tools that support a long-term strategy as well as shorter-term agricultural and commercial management.

Time scale	Decision type	Challenges	MED-GOLD climate services tools	Benefits
Short-term (e.g., 30 days)	Agro-management	• Optimize pest treatments • Optimize irrigation planning	• Temperature • Precipitation • Numerical modelling of pests and evapotranspiration • Insolation	• Reduce pest damage while protecting the environment • Optimize the use of water resources
	Quality management	• Better estimate pest affectation and frost damages • Correct olive formation		• Optimize olive and olive oil quality
Mid-term (e.g., 6 months)	Agro-management	• Optimize fertilization planning • Optimize irrigation planning	• Temperature • Precipitation • Numerical modelling of productivity	• Sustainability • Optimization of the use of fertilizers
	Stock management	• Better estimation of olive production • Improve the selling process		• Improve stock and selling planning
Long-term (e.g., 10-20 years)	Long-term strategy	• Select production areas • Decide type of exploitation (traditional, intensive, etc.) • Select tree spacing, varieties, etc.	• Temperature and precipitation patterns • Bioclimatic indices (see glossary): - Mean summer max. temperature - Mean winter min. temperature - Num. of winter cold days - Num. of annual & spring heat days - Num. of summer heat days - Total annual, summer & winter precipitation - Num. of annual & winter dry days • Numerical modelling of pests and productivity	• Future productivity per geographical area • Regional recommendations for improved crop management strategy • Cost-benefit analysis per productivity area • Exploitation adaptation and investment evaluation

Figure 4-5 Infosheet 'Climate services for the olive and olive oil sector' (side 1)

Control of olive fruit fly *(Bactrocera oleae)*

Olive fruit fly is the major pest of commercial olives worldwide and its dynamics is strongly linked to both olive fruit development and the local climate, with mild temperatures and medium to high air humidity being especially favorable. In Andalusia (Spain), adult flies first emerge in spring and attack olives remaining on trees from the previous season, but damage typically starts in summer (usually in mid-July). When pits begin to harden, fly eggs are laid in olive fruits, and larvae that hatch from these eggs cause direct damage by feeding on olive fruit pulp. Larval feeding also causes indirect damage by both inducing fruit drop and allowing microorganisms to invade the fruit, which results in increased acidity and lowered quality and value of olive oil (losses can be up to 80%).

Currently, olive producers advised by DCOOP (MED-GOLD's champion user for the olive sector) use traps with sex-pheromones or diammonium phosphate food bait to monitor olive fruit fly. To control this pest, they apply phytosanitary treatments as well as other less common methods such as biological control.

Advantages of having access to mid-term (seasonal) climate predictions:

1. **Identification of regions at risk for olive fruit fly attack.**
2. **Improved control of olive fly pest** through anticipation of pest attacks and application of treatments during early stages of the fly lifecycle.
3. **Efficient management of phytosanitary treatments,** by applying them when more effective and by avoiding them when not needed, thus reducing environmental damage.

Glossary

Agroecosystem analysis: holistic approach required to analyze the complexity of agricultural systems that considers aspects from ecology, sociology, economics and politics (e.g. in the form of agro-technical inputs, invasive species, climate change…)

Climate pattern: a calculated value or profile used to describe the state and changes in the climate system

Climate projections: probabilistic estimates of climate variables that extend well into the future (long-term), from decades up to the end of the century

Climate services: transformation of climate-related data and other information into customized products such as trends, economic analysis, advice on best practices, and any other climate-related service liable to benefit that may be of use for the society

Mean summer maximum temperature: average daily maximum air temperature during summer

Mean winter minimum temperature: average daily minimum air temperature during winter

Numerical modelling: a computer model that is designed to simulate and reproduce the mechanisms of a particular system

Number of annual and spring heat days: count of days with maximum temperature above 28ºC per year and in spring

Number of annual dry days: count of days with precipitation below 2 mm per year

Number of winter cold days: count of days with minimum temperature below -7ºC in winter

Seasonal predictions: probabilistic forecasts of climate variables for the next season (up to 6 months)

Total annual, summer and winter precipitation: total amount of rainfall per year, in summer and in winter

Weather forecasts: probabilistic forecasts of climate variables for the next hours and days (up to two weeks)

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Figure 4-6 Infosheet 'Climate services for the olive and olive oil sector' (side 2)

MED-GOLD

CLIMATE SERVICES FOR THE DURUM WHEAT AND PASTA SECTOR

Durum wheat, and thus, pasta production is influenced by weather and climate conditions and is highly affected by climate extremes. Thereby, its vulnerability and exposure as well as the potential adaptation strategies under changing climate conditions must be assessed. MED-GOLD will use agro-climatic services deploying climate information at the medium (next 6-13 months) and long-term (2-30 years). To provide the highest value for decision-making, the services will be co-developed with professional users from the sector.

Durum wheat producers face diverse challenges affecting several decision processes in their business, such as agro-management and stock management and strategic decisions. Some examples are presented below to show how climate services - in this case, predictions of climate variables and bioclimatic indices - can support critical decisions along the durum wheat food chain and win over challenges posed by climate variability and climate change.

Time scale	Decision type	Challenges	MED-GOLD climate service	Benefits
Mid-term (e.g., 6-13 months)	Agro-management	• Better planning of soil tillage, fertilization, crop protection treatment and weed management • Improve choice of variety and density at sowing • Higher accuracy with sowing and harvest setting	• Wheat phenological development • Temperature • Precipitation • Hydrological balance • Heavy rain during winter • Useful rain for fertiliser activation • Frost risk index • Heat stress index	• Minimize exposure to weather extremes • Cost reduction through optimal fertilization and agro-management planning • Maximize crop yield and quality • Optimize use of fertilizers
	Stock management	• Better contracts and price • Better planning of supply chain		• Better planning of supply chain, contracts and prices
Long-term (e.g., up to 30 years)	Long-term strategy	• Selection of future new cultivation areas • Choice of new varieties, breeding and genetic improvement activities • Monitoring of new pests, pathogens, weeds • Anticipation of purchase needs	• Projected yield changes • Projected risk of climate extremes (i.e., heat stress, drought in critical phenological phases...) • Projected risk of quality and nutritional issues • Feasible adaptation strategies	• Indicate suitable cultivation areas • Better estimation of production for market and food security • Improve regional policy planning and development, national adaptation strategies and EU policies (e.g. CAP) • Match adequate varieties to expected climate • Prepare for crop protection and prevention of invasive species • Better use of investments (e.g., machinery, irrigation)

Figure 4-7 Infosheet 'Climate services for the durum wheat and pasta sector' (side 2)

Planning of fertilizers' application

Fertilizers are essential for the plant growth. The amount of nitrogen to be applied, the intervention timings and the form of nitrogen to be distributed are mainly influenced by the soil characteristics, the wheat variety and the climate in the cropping season (mainly temperature and precipitation, which drive the effect of fertilisers on the crop). Nitrogen can be distributed to crops in two forms: nitric nitrogen (NO_3^-), or ammoniacal nitrogen (NH_4^+). Nitric nitrogen can be readily used by plants and it does not bind to soil particles, so it is more prone to leaching. On the contrary, ammoniacal nitrogen needs to be transformed in nitric nitrogen by the action of bacteria in the soil in order to be used by the plants, and it can bound to soil and humus particles, so that it is less readily available to plants and it is not subject to leaching.

Currently, famers including those in the BARILLA (MED-GOLD champion user for the durum wheat sector) supply chain, do the first nitrogen application during tillering. This is particularly important for crops grown in poor soils, especially after periods of high rain and low temperatures (it should be limited in case of mild weather and low rains). The second application of nitrogen fertilisers takes place at the beginning of the stem elongation, making nitrogen available during the most demanding period for the crop and setting the base for the quality of the grains. The last application is done at booting, with effects on both potential production and grain quality in terms of proteins.

Advantages of having access to seasonal climate predictions:

1. **Improved choice of the type of nitrogen fertiliser** in order to optimise plant uptake and reduce losses (i.e. leaching)
2. **Better anticipation and planning of fertilizers' application** enhancing cost reduction
3. **Efficient stock management** accounting in advance for the fertilisers to be used

Glossary

Climate predictions: probabilistic forecasts of climate variables that extend further into the future than weather forecasts, from months and seasons up to decade

Climate projections: probabilistic forecasts of climate variables that extend even further into the future than climate predictions, from decades up to centuries

Climate services: transformation of climate-related data and other information into customized products such as trends, economic analysis, advice on best practices, and any other climate-related service liable to benefit that may be of use for the society

Frost risk index: number of days with minimum temperature below 2°C from wheat heading to end of flowering

Heat stress index: number of hot days with maximum daily temperature above 28 ºC between wheat heading to the end of grain filling period

Heavy rain during winter: number of days with cumulate rainfall above 40 mm

Hydrological balance: Standardized Evapotranspiration Index (SPEI) calculated for several time intervals linked to wheat phenology

Seasonal predictions: probabilistic forecasts of climate variables for the next season (up to 6 months)

Useful rain for fertilizer activation: number of days with rainfall above 10 mm during wheat tillering

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Figure 4-8 Infosheet 'Climate services for the durum wheat and pasta sector' (side 2)

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