

# Selection of Cropland and Grassland Types and Management Systems for Further Consideration in Project MediNet





Deliverable D2/A2

Project MediNet

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# 1 Introduction and Methodology

This report is the second report of Project MediNet and is the deliverable of action A2 "Selection of Cropland and Grassland Types and Management Systems".

The main objective of this report is to provide guidance as to which cropland and grassland types and respective management practices should be the focus for further work of Project MediNet.

The main tool used for this is a questionnaire sent out to all Focal Points of Project MediNet, which were invited to send it to relevant stakeholders in their respective countries. With the questionnaire we aimed to:

- Identify which Cropland and Grassland types are relevant in each country
- Start characterising the main management practices that are relevant for each cropland and grassland management type
- Detect the main trends in crop relevance and changes in management which are currently occurring in Mediterranean Countries

The questionnaire was posted online on the 28<sup>th</sup> of March 2017 and was open for answers until the 27<sup>th</sup> of April 2017.

This analysis of the replies received thus allows the identification of the commonalities and the differences in crop type relevance and in management practices in each Mediterranean Country considered in Project MediNet (Figure 1).



Figure 1: Area of Intervention of Project MediNet

Section 2 provides an overview of the criteria that presided over the design of the questionnaire and describes the questionnaire itself. Section 3 presents the main results obtained and Section 4 presents the conclusions of the exercise and the final selection of the combinations of cropland and grassland types and management which Project MediNet will focus on in its future work.

**Errore. L'origine riferimento non è stata trovata.** shows the questionnaire as was posted online while the **Errore. L'origine riferimento non è stata trovata.** presents the list of all those which contributed to the results published in this report.

# 2 Questionnaire Design

The questionnaire was designed to confirm (or not) the relevance of a group of crop types in the Mediterranean Region and the associated management practices.

The crops and management types were previously identified by MediNet's Project Team, taking into consideration the crops already reported in the participating Mediterranean Countries (see report of Action A.1.) and the most common management practices and their variants practiced in the region which had a likely direct impact on greenhouse gas emissions.

Crop types and management types are further described in sections 2.1 and 2.2 below.

# 2.1 Cropland and Grassland Stratification

The following crop and grassland types were considered in the questionnaire. The questions included were:

- Is the crop relevant in your country?
- Is the crop gaining relevance in your country?

#### Table 1: Crop Types Included in the Questionnaire

UNFCCC Category	Category	Sub-Category
	Olive Trees	Extensive or traditional
		Intensive or super-intensive
		Wine grapes
	vineyarus	Table grapes
		Extensive or traditional
Cropland	Fruit Trees	Intensive or super-intensive
		Cereals
	Annual crops	Rice
		Horticulture: open field
		Horticulture: greenhouse
		Other
	Pastures	Natural pastures or natural grasslands
Grasslands		Seeded or improved pastures
	Shrublands	

## 2.2 Management Systems

## 2.2.1 Irrigation

Irrigation is a very important management practice in the Mediterranean, as it allows crops to grow when temperature and sunlight are optimal, but water scarcity would otherwise undermine plant growth and crop productivity.

MediNet selected this management practice for further analysis because it may increase plant productivity and the turnover of soil organic matter, and therefore is likely to influence the balance of emissions and removals in cropland and grassland.

The questions included were:

- Which types of irrigation practices are relevant in each crop?
- What types of irrigation practices are gaining relevance in each crop?

Main Management Type	Sub-Type	Includes
	Surface irrigation	Flood irrigation
		Furrow irrigation
	Precision irrigation	Drip irrigation
Irrigation		Micro-sprinklers irrigation
inguton	Sprinkler irrigation	Centre and liner pivots irrigation
		Travelling sprinklers irrigation
		Fixed sprinklers irrigation

#### 2.2.2 Tillage

Tillage is one of the most common practices in cropland and grassland management. It is usually practiced to prepare the soil for the seeding/planting of a new crop and/or to eliminate competition with other plants. In recent years, conventional tillage is being replaced by lower intensity tillage (reduced tillage or rotational tillage) and by management systems that eliminate tillage altogether.

MediNet selected this management practice for further analysis because conventional tillage exposes soils to wind and water erosion and because the aeration of soils quickly increases the soil respiration, i.e., soil emissions. On the other hand, reduced and no-tillage systems often lead to accumulations of soil organic matter, i.e., to carbon sequestration in the soils.

The questions included were:

- Which types of tillage practices are relevant in each crop?
- What types of tillage practices are gaining relevance in each crop?

Main Management Type	Sub-Type	Includes
	Intensive or conventional	Ploughing
	tillage	Disk harrowing
Tillago		Strip tillage
Thage	Conservation of reduced tillage	Mulch tillage
	Rotational tillage	
	No till	

## 2.2.3 Fertilization

Fertilization is one of the most common practices in cropland and grassland management. It is usually practiced to increase plant productivity and/or to compensate for lack of particular nutrients in the soil. However, typical mineral fertilization is challenged for its impacts on water and GHG emissions and is being replaced by practices that try to reduce overall amount of fertilization application, to change the type of fertilizer applied or to change the way the fertilizer is applied.

MediNet selected this management practice for further analysis because fertilization is responsible for direct  $N_2O$  emissions, but also because it influences plant productivity (including root biomass and crop residues) and soil microbial activity and, hence, influences Soil Organic Matter.

The questions included were:

- Which types of fertilization practices are relevant in each crop?
- What types of fertilization practices are gaining relevance in each crop?
- How are fertilizers applied to each crop?

Main Management Type	Sub-Type	Includes
	Minoral fortilization	Conventional fertilizer
		Slow release fertilizer
Fortilization	Organic fertilization	Manure
Fertilization		Compost
		Wastewater sludge
	No fertilization	

#### 2.2.4 Crop Residues Management

Crop harvesting and pruning usually results in the production of residues (straw, roots, and branches). Farmers deal with these residues in different ways, from burning them on the field, collecting them for other uses (e.g. animal feeding or animal beds, composting, bioenergy production) or incorporating them into the soil.

MediNet selected this management practice for further analysis because crop residues practices influence the input of organic matter to the soil and have, therefore, an impact on Soil Organic Matter.

The questions included were:

- Which types of cover residue practices are relevant in each crop?
- What types of cover crop residue practices are gaining relevance in each crop?

Main Management Type	Sub-Type	Includes	
	Field burning		
	Collected and transported to another location	Composting and organic fertilization	
Crop residues management		Energy production	
		Animal feeding	
		Animal bedding	
	Incorporated into the soil	Green fertilization	

#### 2.2.5 Cover Crop Management

Cover crops can be used to prevent soil erosion, promote soil fertility, increase water infiltration and retention or improve biodiversity.

MediNet selected this management practice for further analysis because cover crops influence the input of organic matter to the soil and have, therefore, an impact on Soil Organic Matter.

The questions included were:

- Which types of cover crop practices are relevant in each crop?
- What types of cover crop practices are gaining relevance in each crop?

Main Management Type	Sub-Type	Includes
	With permanent cover	Natural vegetation
Cover Cree Menagement		Seeded vegetation
Cover Crop Management		Mulch
	No permanent cover	

#### 2.2.6 Presence of Grazing

Direct grazing by animals is a common feature in Mediterranean landscapes. Alongside with the use of permanent (seeded or natural) pastures and grasslands, some crop systems are also used by animals for grazing, at least part of the year.

MediNet selected this management practice for further analysis because grazing provides an additional source of fertilization and input of organic matter to the soil and have, therefore, an impact on Soil Organic Matter.

The questions included were:

- Which types of grazing practices are relevant in each crop?
- What types of grazing practices are gaining relevance in each crop?

Main Management Type	Sub-Type	Includes
	Intensive grazing	All year round
	Intensive grazing	Part of the year
Presence of Grazing	Eutomaine evening	All year round
	Extensive grazing	Part of the year
	No grazing	

## 2.2.7 Presence of Landscape elements

Mediterranean landscapes often contain elements that may influence the amounts of Carbon present in agricultural landscapes. These may include the presence of isolated trees amongst the different crops, crops grown under low tree cover (agro-forestry), crops grown in fields with woody vegetation on its edges (sometimes serving as wind shields) or crops grown in fields where the margins are left with natural (non-woody) vegetation.

MediNet selected this management practice for further analysis because the presence of these elements increases the average biomass stocks of agricultural landscapes and they may constitute an additional source of Carbon sequestration or Carbon emissions.

The questions included were:

- Which types of special landscape elements are relevant in each crop?
- What types of landscape elements are gaining relevance in each crop?
- What types of landscape elements are losing relevance in each crop?

Main Management Type	Sub-Type	Includes
	Isolated trees amongst the crop	
	Crop grown in agro-forestry systems	
Presence of Landscape	Fields have woody vegetation or	n its edges
	Field margins are left uncultivated	
	Not applicable	

#### 2.2.8 Organic farming

Organic agriculture is a holistic production management system which promotes and enhances agroecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system. (FAO/WHO Codex Alimentarius Commission, 1999).

MediNet selected this management practice for further analysis because organic farming is likely to have an impact in Soil Organic Matter.

The questions included were:

• What is the relevance of organic farming in each crop?

Main Management Type	Sub-Type	Includes	
Organic Farming			

# 3 Main Results

## 3.1 Overview of questionnaire replies

The questionnaire was posted online on the 28<sup>th</sup> of March 2017 and was open for answers until the 27<sup>th</sup> of April 2017.

The number of replies varied per question, with 48 replies that included the entire questionnaire. The analysis below includes all available answers, i.e., includes also the incomplete questionnaires, which brings the total replies for the initial questions to 67.



The answers per country also varied considerably, with 23 complete questionnaires received from Portugal, 13 from Greece, 5 from Italy, 4 from Spain, 1 from Cyprus, France and Malta and no answers from Croatia and Slovenia.



The low level of participation by some countries may limit the validity of the results, as there may be different views about the same question within a particular country, which would not be captured by the low number of respondents.

However, we believe that it still provides valuable input to the project and allows the identification of the major management trends within each crop.

The individual results, per crop type, per question and per country are presented in the sections below.

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## 3.2 Olive trees

Extensive and traditional olive trees are considered important crops in all countries, with most replies considering it relevant because of both area and economic importance. Intensive olive trees are also considered relevant in all countries.



The answers on trends for traditional olive trees are less clear, but seem to suggest that this crop is relatively stable, while for intensive olive trees there is a trend in most countries for gaining relevance.



In traditional olive trees, irrigation is mostly identified as not relevant. The situation changes dramatically for intensive olive trees with most answers indicating that precision irrigation is practiced.



In terms of trend, the results suggest no changes or an increase in precision irrigation systems in both traditional olive trees and intensive olive trees.



Conventional tillage still largely dominates in traditional olive trees, while no-till and reduced tillages systems are also relevant in intensive olive trees.



However, no-till and reduced tillage systems seem to dominate the changes in tillage systems.



Results on fertilization in traditional systems are less clear and suggest that fertilization is not particularly relevant. Where it occurs, both mineral and organic fertilizers seem to be used. For intensive systems the dominante practice appear to be the conventional mineral fertilization.



In traditional systems there seems to be some increase in organic fertilization, while in intensive systems fertilization seems to be increasing with slow release fertilizers gaining ground over other forms.



Fertilizers are apllied less than once a year or annualy in extensive olive trees and mostly by fertigation in intensive systems.



Field burning and collection and transport of pruning residues seem to be the most relevant practices for extensive olives, followed by natural decay at soil surface and active incorporation into the soil. Regarding intensive olive trees there seems to be a predominance of collection and transport of pruning residues and incorporation into soil with tillage.



In both cases, there is no clear dynamics on management changes of crop residues, although some answers suggest an increase in soil incorporation and in collection and transport off-site.



Permanent coverage of soil with natural vegetation seems to dominate in both traditional and intensive systems. Tillage exposing soil during part of the year seems to be split between summer and winter, with some predominance of the former over the later. Seeded cover crops only have limited relevance in intensive systems.



The most dominant trend in both traditional and intensive systems seems to be an increase in permanent cover with natural vegetation.



Extensive grazing in at least part of the year seems to be a common practice in extensive systems and to be mostly absent in intensive olive trees.



There doesn't seem to be distinctive changes in grazing practices occurring.



Organic farming is considered relevant in traditional systems where it also seems to be gaining relevance, while in intensive systems it is less relevant.



Data on landscape elements was not particularly conclusive.



## 3.3 Vineyards

Vineyards are considered a relevant crop in all countries, with wine grapes being more relevant in area and economic relevance than table grapes.



Vineyards for wine production seem to be increasing in relevance in all countries, while the picture for table grapes is less clear, with some countries reporting an increase in relevance, while other countries report a decrease.



Irrigation of wine grapes is either not relevant or precision irrigation, while most of table grapes seem to be irrigated.



In both wine and table grapes increases in precision irrigation seem to be the main trend.





Conventional and reduced tillage seem to dominate in both types of vineyards and in all countries.

Increases in the use of reduced tillage and no-tillage are the main trends in tillage practices in vineyards.



Fertilization is a common practice in all types of vineyards and seems to be dominated by conventional fertilizers. With smaller expression, results suggest that organic fertilizers and slow release fertilizers are also used.



The changes in fertilization practices are also similar in both types of vineyards, and suggest an increase in the use of organic and slow release fertilizers.



There is no clear signal for how fertilizers are applied with fertigation and annual application seeming the most important forms.



In most countries crop residues seem to be mostly collected and transported off-site, but incorporation in the soil with tillage and field burning also seem to be relevant.



In terms of changes in crop residue practices, incorporation in the soil with tillage and collection and transport off-site seem to be the main trends.



There seems to be a slip between permanent coverage of soil with natural vegetation and exposure of soil in part of the year.



The results on trends in cover crops do not allow the identification of a clear trend.



Grazing doesn't seem to be relevant in any of the countries, being only mentioned in Portugal and Spain as extensive and only part of the year.



The grazing practices don't seem to be changing or show for an increase in no grazing.



Data on landscape elements was not particularly conclusive and suggests these are not particularly relevant in vineyards.





Organic farming is either already relevant or is gaining relevance in both types of vineyards.

## 3.4 Fruit trees

Both intensive and extensive fruit orchards seem to be relevant in all countries because of either the area occupied and/or its economic importance.



While traditional fruit orchards seem to be stable or losing relevance, intensive fruit trees seem to be increasing in relevance in all countries except Malta.



Precision irrigation clearly dominates the more intensive systems, while the situation in extensive systems is more diverse, with no irrigation or precision irrigation being the most referred systems, followed by the more traditional surface irrigation practices (mainly in Portugal and Greece).



The trends in irrigation are very similar in both extensive and intensive systems and suggest an increase in precision irrigation.



Tillage practices seem to be similar in all countries and in both extensive and intensive systems, with a predominance of conventional and reduced tillage. No till and rotational tillage seems to be also practiced, but results suggest that to a lower extent.



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Like with the other permanent crops, the main changes in tillage practices seem to be dominated by increases in the use of no till and reduced tillage.



Mineral fertilizers still dominate fertilization in fruit orchards, although with a lower predominance in extensive systems. Organic and slow release fertilizers also seem to be used. No fertilization is only mentioned in Portugal and, for extensive fruit trees, in France.



The changes in fertilization practices are also similar in both types of fruit orchards, and suggest no change or an increase in the use of organic and slow release fertilizers.



There is no clear signal for how fertilizers are applied with fertigation, split and annual application seeming the most important forms in intensive systems and annual application or less than that the most common practice in extensive systems.



Crop residues seem to be managed mostly by collection and transport off-site or through incorporation into the soil. Field burning appears to be mostly relevant in extensive systems.



Collection and transport off-site and incorporation into the soil also seem to be the most dominant trends in crop residue practices.



Permanent soil cover with natural vegetation seems to be the dominant practice, with soil exposure in part of the year also being mentioned as relevant.



There seems to be a trend towards increasing permanent coverage of soil, mostly by using natural vegetation.



Grazing in extensive systems is either not practiced or only extensive and during part of the year. As for intensive systems, grazing seems to be mostly absent.







Data on landscape elements suggests that these are not particularly relevant in fruit trees.



Organic farming in fruit trees seems to be more relevant in extensive than in intensive systems. In both cases organic farming seems to be increasing in relevance.



## 3.5 Annual crops

## 3.5.1 Cereals and Rice

Cereals are identified as a relevant crop in all countries, mostly because of the area and economic value of the crop. In the particular case of rice, the crop appears to be most relevant in Greece, Italy, Portugal and Spain, while Cyprus, France and Malta mentioned that the crop was not relevant in their context.



Except for France, cereals seem to be stable or loosing relevance in the region. In the case of rice, the crop seems to be mostly stable in the countries where it was identified as relevant.



Regarding cereals, irrigation practices seem to be split between not relevant and sprinkler systems, which is probably linked to winter and summer cereals. As expected for rice, surface irrigation is the dominant system.



For cereals, the use of sprinkler irrigation seems to be the most important trend in Greece and Portugal, while the other countries report mainly no changes in irrigation practices. Rice practices don't show any significant change.



Conventional tillage is dominant in all countries and both for cereals and rice. In the case of cereals, the use of reduced and rotational tillage is also mentioned by some countries.



In cereals, there seems to be a trend towards less intensive tillage systems, notably no tillage and reduced tillage. As for rice, tillage practices seem to be mostly stable.



The uses of conventional mineral fertilizers dominate both cereals and rice, but the use of organic fertilizers is also mentioned by some countries.



There seems to be a trend towards the use of different fertilizers in both cereals and rice, where slow release fertilizers and organic fertilizers seem to be gaining relevance.



Annual fertilization seems to be the dominant practice in both cereals and rice annual crops. Split fertilizations also appear as the second most common practice for most of the countries.



Incorporation of crop residues seems to be the most relevant practice in all countries, except in Greece where field burning is the most referred one. Grazing, field burning and natural decay are also referenced by about the same number of respondents as relevant.



Incorporation of crop residues into the soil or no changes in practices seems to be the most relevant trends.



Exposure of soil during part of the year (summer or winter) seems to be the most dominant practices in both cereals and rice.



Like with other crops, the increased use of permanent cover of soil seems to be the most important trend in cereals. As for rice, practices are reported mostly as not changing, with some references to increases of exposure of soil during part of the year in Greece and Portugal.



Extensive grazing during part of the year and no-grazing seem to be the most relevant practices in cereals, while grazing in rice is reported as being mostly not relevant.



Grazing practices seem to be stable in both cereals and rice.



Presence of isolated trees amongst the crop is the most reported element mentioned for cereals. Field hedges with either woody or natural vegetation are also mentioned. Agro-forestry systems combined with cereals are only reported as relevant by Portugal. In rice, these landscape elements are mostly reported as not applicable.



Organic farming is reported as being mostly not relevant, but there seems to be a trend towards some increase in relevance.



#### 3.5.2 Horticulture

Horticulture is considered relevant in all Mediterranean countries, regardless of being practiced in open fields or in greenhouses.





Horticulture, particularly in greenhouses is stable or gaining some importance in most countries.

Irrigation is widely practiced in this crop, with a mixture of mostly sprinkler and precision irrigation in open field horticulture and precision irrigation in greenhouse horticulture.



The presence of irrigation seems to be increasing with a clear trend towards precision irrigation.



Conventional tillage still dominates open field horticulture and in greenhouse horticulture reduced tillage also seems to have some relevance in Greece and Portugal.

Tillage Relevance Annual Crops: Horticulture Open F	Field	Annue	Tillage Relevance I Crops: Horticulture Gree	nhouse
	Conventional tillage No-tillago Rotational tillage Rotational tillage systems		· · · · · · · · · · · · · · · · · · ·	Conventional tillage     No tillago     Retational tillage     Rotational tillage system

Tillage practices seem to be relatively stable in both horticulture production systems, with some indications for a trend towards lower intensity tillage (reduced or rotational tillage).



In both horticulture systems, mineral fertilization is the most referred fertilization type, but organic and slow release fertilizers are also mentioned.



In terms of fertilization trends, there seems to be some shift towards slow release fertilizers and organic fertilizers in open field horticulture and to more mineral fertilizers (slow release included) in the case of greenhouse horticulture.



Fertigation and split application of fertilizers together with conventional fertilization practices seem to be common in horticulture.



Crop residues are mostly incorporated into the soil in open field horticulture and collected and transported in greenhouse horticulture.



The crop residue practices are either not changing or reinforcing the already most common practices (soil incorporation and collection and transport).



Cover crops don't seem to be particularly relevant in any of the horticulture systems and the soils are exposed at least part of the year.



The cover crop practices are either not changing or reinforcing the already most common practices (soil exposed part of the year).





Grazing is mostly absent from horticulture and there are no indications of changes in this situation.

As expected, landscape elements are not relevant in greenhouse horticulture. In open field horticulture, there are some references to landscape elements, with field margins being the most common one.



Organic farming is already relevant in most Mediterranean countries and seems to continue to gain relevance.



#### 3.5.3 Other

This group covers a relatively large group of crops (fundamentally all agriculture crops not mentioned before) and so, it is even harder to draw conclusions from the questionnaire. This diversity probably also explains the lower number of replies obtained for this category than for the previous ones. However, this group is identified as relevant by all Mediterranean countries, even if no particular trends can be identified.



Precision and sprinkler irrigation seem to be particularly relevant, except for Greece and Portugal which make references also to the surface irrigation. Some references suggest a trend towards an increase in precision and sprinkler irrigation, but this trend seems to be concentrated in Greece and Portugal.



Conventional tillage seems to be the most relevant practice, with some trend towards lower intensity tillage practices, mostly reduced tillage.



Fertilization with mineral fertilizers seems to be the most common practice, but also organic and slow release fertilizers are mentioned by some countries. Application of fertilizers seems to be also done mostly once or twice a year. There are no clear patterns of change in fertilization practices.



Crop residues seem to be mostly incorporated into the soils, with references to other practices in much smaller numbers. Incorporation into the soil seems to be also the most important trend in crop residue management.



In relation to the use cover crops, soil exposure during part of the year seems to be the most common practice, and there are no obvious changes in cover crop practices across the region.



Grazing is either not practiced or is practice in low intensity and only part of the year. There is no clear trend towards changes in grazing practices.



There are no obvious landscape elements in all countries in this group of crops. Organic farming is relevant and seems to be gaining relevance.



## 3.6 Grasslands

Natural pastures are identified as relevant by all Mediterranean countries, while improved or seeded grasslands seem to be relevant mostly to France, Greece, Italy and Portugal.



Natural grasslands seem to be mostly loosing relevance in all countries, except Greece and Portugal, which mention the opposite trend. With the exception of Portugal, seeded or improved grasslands seem to be losing relevance in the region.



Pastures are mostly not irrigated, except for improved pastures in Portugal, where sprinkler irrigation is mentioned as the most relevant practice.



Irrigation practices are mostly referred to as not changing, again with the exception of Portugal where an increase in sprinkler irrigation is mentioned, particularly in the case of improved pastures.



No-till seems to be the dominant practice in natural grasslands, while other forms of low intensity tillage are also mentioned for improved pastures, particularly in Portugal.



Tillage practices are considered mostly stable in both natural and improved pastures.



Natural pastures seem to be not actively fertilized, while improved pastures seem to be fertilized mostly with conventional fertilizers.



In terms of fertilization trends, no change to current practices or increases in no fertilization are the most referred options in both natural and improved pastures, except for Portugal which also mention an increase in the use of conventional or organic fertilizers.



Fertilizer application occurs less than once per year in natural pastures, while annual or occasional fertilization in improved pastures is also mentioned by Greece and Portugal.



As expected in both cases, the most common practice for crop residues is in-situ grazing, complemented with natural decay at soil surface.



#### There are no apparent changes in how crop residues are treated in both natural and seeded pastures.



As expected in both cases, there is permanent coverage of soil throughout the year, respectively by natural vegetation and seeded cover crop.



There are no obvious trends in changes of practices in cover crops in pastures.



As expected, grazing is identified as relevant in both cases, with a focus on extensive grazing in natural pastures and intensive grazing in improved pastures.



Grazing practices are mostly considered stable.



Isolated trees are the most referred landscape element in most countries, except for Portugal, where agro-forestry seems to dominate. Field margins left uncultivated and woody hedges appear to also have the same importance.



Organic farming in pastures doesn't seem to be particularly relevant yet, except for Greece, but seems to be gaining importance.



## 3.7 Shrublands

Shrublands are considered relevant in all countries mostly due to the area occupied. Shrublands are considered stable, except for Greece and Portugal, which also mention a gain in relevance and in the opposite direction for France.





As expected, irrigation is neither relevant nor gaining importance in shrublands.

Likewise, tillage is mostly not practiced in shrublands and there are no obvious changes in tillage practices.



#### Shrublands are mostly not actively fertilized, and fertilization practices don't seem to be changing.



Not being a real "crop", shrubland residues are left to decay on the soil surface or are directly grazed *in situ*.



As expected from the characteristics of shrublands, permanent coverage of soil is the most mentioned aspect and there is no clear trend in changing that status.



Extensive grazing in shrublands is mentioned in all countries except Malta, and there are no obvious trends in changes of grazing practices.



The presence of landscape elements is considered mostly not applicable with some references made to the presence of isolated trees and uncultivated margins. The presence of shrubs in agro-forestry systems is only mentioned in Portugal. Organic farming of shrublands is considered mostly not relevant.



# 4 Selection of Cropland and Grassland types for Further Consideration

The questionnaire confirmed the relevance of olive trees in both intensive and extensive systems. It also highlighted some significant management differences between the two management regimes (Table 2). Project MediNet will further consider this crop and its 2 variants.

Grantuna	Olive trees		
стор туре	extensive or traditional	intensive or super-intensive	
Relevance	<ul> <li>Crop considered relevant in all countries</li> <li>Crop stable</li> </ul>	<ul> <li>Crop considered relevant in all countries</li> <li>Crop stable or gaining relevance</li> </ul>	
Irrigation	Not irrigated	<ul> <li>Irrigated with precision systems</li> </ul>	
Tillage	<ul> <li>Conventional</li> <li>No-till</li> <li>Reduced till</li> </ul>	<ul><li>Conventional</li><li>No-till</li><li>Reduced till</li></ul>	
Fertilization	<ul> <li>Not fertilized</li> <li>Mineral fertilizer / applied 1 or 2 x per year</li> <li>Organic fertilizer / applied 1 or 2 x per year</li> </ul>	Mineral fertilization / fertigation	
Crop residues management	<ul> <li>Field burning</li> <li>Left to decay or incorporated in soil</li> <li>Collected and transported off-site</li> </ul>	<ul> <li>Left to decay or incorporated in soil</li> <li>Collected and transported off-site</li> </ul>	
Cover crop	<ul><li>Permanent cover with natural vegetation</li><li>Soil exposed part of the year</li></ul>	<ul><li>Permanent cover with natural vegetation</li><li>Soil exposed part of the year</li></ul>	
Grazing	<ul> <li>Extensive grazing part of the year</li> </ul>	• No grazing	
Landscape elements	Not applicable	Not applicable	
Organic farming	<ul><li>Not organic</li><li>Organic</li></ul>	<ul><li>Not organic</li><li>Organic</li></ul>	

Table 2: Main	Management	Practices i	n Olive Trees

The questionnaire confirmed the relevance of vineyards of both table and wine grapes. However, it showed that there are no marked differences in management between the two sub-types of vineyards considered (Table 3). Project MediNet will thus only further consider vineyards in aggregate.

Crophyse	Vineyards		
crop type	wine grapes	wine grapes	
Relevance	<ul> <li>Crop considered relevant in all countries</li> <li>Crop gaining relevance</li> </ul>	<ul> <li>Crop considered relevant in all countries</li> <li>Crop stable</li> </ul>	
Irrigation	<ul> <li>Not irrigated</li> <li>Irrigated with precision systems</li> </ul>	<ul> <li>Irrigated with precision systems</li> </ul>	
Tillage	Conventional     Reduced till	Conventional     Reduced till	
Fertilization	<ul> <li>Mineral fertilizer / applied 1 or 2 times per year</li> <li>Mineral fertilization / fertigation</li> <li>Organic fertilizer / applied 1 or 2 times per year</li> </ul>	<ul> <li>Mineral fertilizer / applied 1 or 2 times per year</li> <li>Mineral fertilization / fertigation</li> <li>Organic fertilizer / applied 1 or 2 times per year</li> </ul>	
Crop residues management	<ul> <li>Collected and transported off-site</li> <li>Field burning</li> <li>Left to decay or incorporated in soil</li> </ul>	<ul> <li>Collected and transported off-site</li> <li>Field burning</li> <li>Left to decay or incorporated in soil</li> </ul>	
Cover crop	<ul><li>Permanent cover with natural vegetation</li><li>Soil exposed part of the year</li></ul>	<ul><li>Permanent cover with natural vegetation</li><li>Soil exposed part of the year</li></ul>	
Grazing	No grazing	No grazing	
Landscape elements	Not applicable	Not applicable	

Table 3: Main Management Practices in Vineyards

Grantuna	Vineyards	
crop type	wine grapes	wine grapes
Organic farming	<ul><li>Not organic</li><li>Organic</li></ul>	<ul><li>Not organic</li><li>Organic</li></ul>

The questionnaire confirmed the relevance of both extensive and intensive systems. However, it showed that there are no marked differences in management between the two sub-types of fruit trees considered (Table 4). Project MediNet will further consider this crop but not its 2 variants.

Grantuna	Fruit Trees		
Crop type	extensive or traditional	intensive or super-intensive	
Relevance	<ul> <li>Crop considered relevant in all countries</li> <li>Crop stable or losing relevance</li> </ul>	<ul> <li>Crop considered relevant in all countries</li> <li>Crop stable or gaining relevance</li> </ul>	
Irrigation	<ul> <li>Not irrigated</li> <li>Irrigated with precision systems</li> </ul>	<ul> <li>Irrigated with precision systems</li> </ul>	
Tillage	Conventional     Reduced till	Conventional     Reduced till	
Fertilization	<ul> <li>Mineral fertilizer / applied 1 or 2 x per year or in split application</li> <li>Organic fertilizer / applied 1 or 2 x per year or in split application</li> <li>Not fertilized</li> </ul>	<ul> <li>Mineral fertilization / fertigation</li> <li>Mineral fertilizer / applied 1 or 2 x per year or in split application</li> <li>Organic fertilizer / applied 1 or 2 x per year or in split application</li> </ul>	
Crop residues management	<ul> <li>Collected and transported off-site</li> <li>Left to decay or incorporated in soil</li> <li>Field burning</li> </ul>	<ul> <li>Collected and transported off-site</li> <li>Left to decay or incorporated in soil</li> </ul>	
Cover crop	<ul><li>Permanent cover with natural vegetation</li><li>Soil exposed part of the year</li></ul>	<ul><li>Permanent cover with natural vegetation</li><li>Soil exposed part of the year</li></ul>	
Grazing	<ul><li>Extensive grazing part of the year</li><li>No grazing</li></ul>	• No grazing	
Landscape elements	Not applicable	Not applicable	
Organic farming	<ul><li>Not organic</li><li>Organic</li></ul>	Not organic	

#### Table 4: Main Management Practices in Fruit Trees

The questionnaire confirmed the relevance of both cereals and other annual crops, but showed that rice is not relevant in some countries (Cyprus, Malta and France). However, Project MediNet will further consider these 3 crops, as rice is relevant to all the larger countries in the region (Table 5).

Table 5. Main Management Practices in Cereais, Rice and Other Annual Crops			
Crop type	Cereals	Rice	Other Annual Crops
Relevance	<ul> <li>Crop considered relevant in all countries</li> <li>Crop stable or losing relevance</li> </ul>	<ul> <li>Not considered relevant in all countries</li> <li>Crop stable or losing relevance</li> </ul>	<ul> <li>Crop considered relevant in all countries</li> <li>Crop stable</li> </ul>
Irrigation	<ul> <li>Not irrigated</li> <li>Irrigated with sprinkler systems</li> </ul>	Surface irrigation	<ul> <li>Irrigated with sprinkler systems</li> <li>Irrigated with precision systems</li> </ul>
Tillage	Conventional     Reduced till	Conventional	Conventional     Reduced till
Fertilization	• Mineral fertilizer / applied 1 or 2 x per year or in split application	• Mineral fertilizer / applied 1 or 2 x per year or in split application	Mineral fertilizer / applied 1     or 2 x per year

Table 5: Main Management Practices in Cereals, Rice and Other Annual Crops

Crop type	Cereals	Rice	Other Annual Crops
	<ul> <li>Organic fertilizer / applied 1 or 2 x per year or in split application</li> </ul>		<ul> <li>Organic fertilizer / applied 1 or 2 x per year</li> </ul>
Crop residues management	<ul> <li>Left to decay or incorporated in soil</li> <li>Grazing</li> <li>Field burning</li> <li>Collected and transported off-site</li> </ul>	<ul> <li>Left to decay or incorporated in soil</li> <li>Field burning</li> </ul>	• Left to decay or incorporated in soil
Cover crop	<ul> <li>Soil exposed part of the year</li> </ul>	<ul> <li>Soil exposed part of the year</li> </ul>	<ul> <li>Soil exposed part of the year</li> </ul>
Grazing	<ul> <li>Extensive grazing part of the year</li> <li>No grazing</li> </ul>	• No grazing	<ul> <li>No grazing</li> <li>Extensive grazing part of the year</li> </ul>
Landscape elements	<ul><li> Isolated trees</li><li> Not applicable</li></ul>	Not applicable	Not applicable
Organic farming	<ul><li>Not organic</li><li>Organic</li></ul>	<ul><li>Not organic</li><li>Organic</li></ul>	<ul><li>Not organic</li><li>Organic</li></ul>

The questionnaire confirmed the relevance of horticulture in both open field and in greenhouses. However, it showed that there are no marked differences in management between the two sub-types of horticulture considered (Table 6). Project MediNet will thus only further consider horticulture in aggregate.

Croptupo	Hortic	ulture
стор туре	open field	greenhouses
Relevance	<ul> <li>Crop considered relevant in all countries</li> <li>Crop stable or gaining relevance</li> </ul>	Crop considered relevant in all countries     Crop stable or gaining relevance
Irrigation	<ul> <li>Irrigated with sprinkler systems</li> <li>Irrigated with precision systems</li> </ul>	<ul> <li>Irrigated with precision systems</li> </ul>
Tillage	Conventional     Reduced till	Conventional     Reduced till
Fertilization	<ul> <li>Mineral fertilizer / applied 1 or 2 x per year or in split application</li> <li>Mineral fertilization / fertigation</li> <li>Organic fertilizer / applied 1 or 2 x per year or in split application</li> <li>Slow release fertilizer / applied 1 or 2 x per year</li> </ul>	<ul> <li>Mineral fertilizer / applied 1 or 2 x per year or in split application</li> <li>Mineral fertilization / fertigation</li> <li>Organic fertilizer / applied 1 or 2 x per year or in split application</li> </ul>
Crop residues management	<ul> <li>Left to decay or incorporated in soil</li> <li>Collected and transported off-site</li> </ul>	<ul><li>Collected and transported off-site</li><li>Incorporated in soil</li></ul>
Cover crop	<ul> <li>Soil exposed part of the year</li> </ul>	<ul> <li>Soil exposed part of the year</li> </ul>
Grazing	<ul><li>Extensive grazing part of the year</li><li>No grazing</li></ul>	• No grazing
Landscape elements	Not applicable	Not applicable
Organic farming	<ul><li>Not organic</li><li>Organic</li></ul>	<ul><li>Not organic</li><li>Organic</li></ul>

The questionnaire confirmed the relevance of natural pastures or grasslands, but suggests that improved or seeded pastures are not relevant in some countries (Cyprus, Malta, and Spain). It also highlighted some significant management differences between the two management regimes (Table 7). Project MediNet will further consider these two pasture types.

Grantuna	Pastures or Grasslands		
стор туре	natural	seeded or improved	
Relevance	<ul> <li>Crop considered relevant in all countries</li> <li>Crop stable (references to gains or losses of relevance vary with country)</li> </ul>	<ul> <li>Not considered relevant in all countries</li> <li>Crop stable (references to gains or losses of relevance vary with country)</li> </ul>	
Irrigation	Not irrigated	<ul><li>Irrigated with sprinkler systems</li><li>Not irrigated</li></ul>	
Tillage	• No till	<ul> <li>No till</li> <li>Reduced till</li> <li>Conventional tillage</li> <li>Rotational tillage</li> </ul>	
Fertilization	<ul> <li>Not fertilized</li> <li>Mineral fertilizer / applied less than once per year</li> <li>Organic fertilizer / applied less than once per year</li> </ul>	<ul> <li>Mineral fertilizer / applied 1 or 2 x per year or less than once per year</li> <li>Organic fertilizer / applied 1 or 2 x per year or less than once per year</li> <li>Not fertilized</li> </ul>	
Crop residues management	<ul> <li>In situ grazing</li> <li>Left to decay or incorporated in soil</li> </ul>	<ul><li>In situ grazing</li><li>Left to decay or incorporated in soil</li></ul>	
Cover crop	<ul> <li>Permanent cover with natural vegetation</li> </ul>	<ul> <li>Permanent cover with seeded vegetation</li> </ul>	
Grazing	• Extensive grazing all year round	<ul> <li>Intensive grazing all year round or part of the year</li> <li>Extensive grazing all year round</li> </ul>	
Landscape elements	Isolated trees amongst the pasture	<ul><li>Isolated trees amongst the pasture</li><li>Field margins with wood/natural vegetation</li></ul>	
Organic farming	<ul><li>Not organic</li><li>Organic</li></ul>	<ul><li>Not organic</li><li>Organic</li></ul>	

#### **Table 7: Main Management Practices in Pastures or Grasslands**

The questionnaire confirmed the relevance of shrubland and that active management is mostly absent (Table 8). Project MediNet will further consider shrublands.

	Shrublands
Relevance	<ul> <li>Crop considered relevant in all countries</li> <li>Crop stable (references to gains or losses of relevance vary with country)</li> </ul>
Irrigation	Not irrigated
Tillage	• No till
Fertilization	Not fertilized
Crop residues management	<ul><li>In situ grazing</li><li>Left to decay</li></ul>
Cover crop	<ul> <li>Permanent cover with natural vegetation</li> </ul>
Grazing	<ul> <li>Extensive grazing all year round or part of the year</li> <li>No grazing</li> </ul>
Landscape elements	<ul> <li>Isolated trees amongst the shrubs</li> </ul>
Organic farming	• Not organic

**Table 8: Main Management Practices in Shrublands** 

Table 9 presents the summary of the crop types that will be further considered by Project MediNet.

UNFCCC Category	Category	Sub-Category	
	Olive Trees	Extensive or traditional	
	Olive frees	Intensive or super-intensive	
	Vineyards		
Cropland	Fruit Trees		
		Cereals	
	Annual crops	Rice	
		Other	
	Pastures	Natural pastures or natural grasslands	
Grasslands		Seeded or improved pastures	
	Shrublands		

Table 9: Crop Types for Further Consideration by Project MediNet