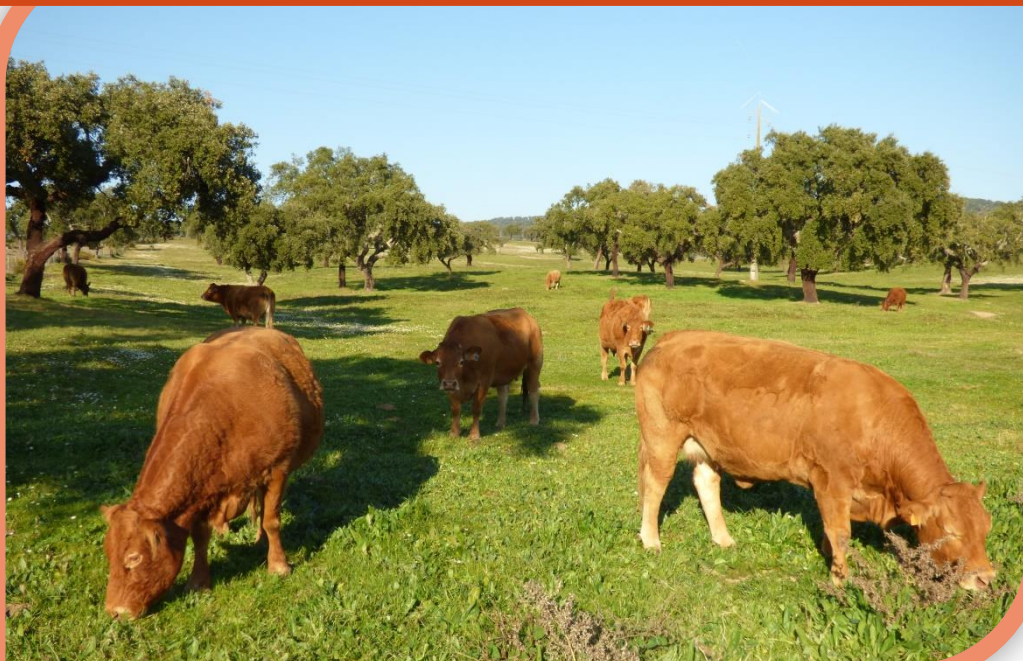# State of the Art in Reporting of Emissions and Removals in Cropland and Grassland in Mediterranean Countries

MediNet

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1   Introduction and Methodology

This report is the first report of Project MediNet and is the deliverable of action A1 "Characterisation and comparison of institutional arrangements for cropland and grazing land management reporting".

It's main purpose is to characterize the current status of reporting of cropland and grassland under the United Nations Framework Convention on Climate Change (UNFCCC), which will inform the further work within Project MediNet.

This report allows the identification of commonalities and differences in reporting strategies in each Mediterranean Country. It also allows the identification of common gaps in information used.

Figure 1: Area of Intervention of Project MediNet

The methodology for this report consisted in a detailed desk analysis of the latest National Inventory Reports submitted by countries (see Annex I: Overview of Activities, Pools and Gases Reported), complemented with comments and/or interviews with inventory compilers for the reporting of cropland and grasslands emissions and removals in each of the countries involved in Project MediNet.

For each country we characterised reporting of cropland and grassland under the UNFCCC, focusing on the following characteristics and questions:

- Stratification used
    - Is cropland and grassland further stratified into different sub-categories?
    - Are any special management practices within each cropland or grassland category considered?
- Activity data
    - How is the area of each cropland and grassland type reported?
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    - Where does the information come from? Who provides the data?
- Living biomass data
    - How is this pool considered?
    - Which data is being used to derive emission factors?
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- Deadwood and litter data
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- Organic soil data
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    - Which data is being used to derive emission factors?
    - Who provides the data being used?

A draft version of this report was sent to all MediNet focal points on the 27th of March 2017 for comments and suggestions.

Section 2 presents the main results for this exercise per country. Additionally a summary table for each country of which categories / pools are reported / included elsewhere / not occurring / not estimated is provided in the Annex I: Overview of Activities, Pools and Gases Reported.

Section 3 presents the main the main results and conclusions of this analysis.

2   Individual Country Reports

2.1   Croatia

2.1.1   Stratification of Cropland and Grassland Reporting

Croplands definition changed after 2000. Until the year 2000 cropland included arable land, gardens, nurseries, osier willows, orchards, olive groves and vineyards. After 2000 the nomenclature was adjusted to rainfed arable land, permanently irrigated arable land, vineyards, fruit trees and berry plantations, olive groves and annual crops associated with permanent crops.

The grassland are defined as pastures, land principally occupied by agriculture, with significant areas of natural vegetation, natural grasslands, moors and heathland and sclerophyllous vegetation.

There is no reference to unmanaged grasslands.

Except for irrigated/rainfed arable land, there are no references to other management practices in both cropland and grasslands.

2.1.2   Activity Data

Geographic information was used to determine areas of grassland, wetlands and settlements. Cropland data was based on statistic information. Forest areas were based on forest management information.

CORINE Land Use Change maps, data from the project "Improving Croatian reporting in Land use, Land use change and Forestry sector in the First commitment period of the Kyoto Protocol" (LULUCF 1)[1], expert judgment and IPCC 2006 Guidance book was used to determine land use change categories.

CORINE Land Cover Maps are available for the years 1980, 1990, 2000, 2006 and 2012. This allowed the estimation of land cover changes: CLC change for each pair of subsequent maps, i.e. 1980-1990, 1990-2000, 1990-2000, 2000-2006 and 2006-2012.

Some land-use changes were considered by expert-judgement to not occur: conversions from wetlands to cropland and grassland; conversions from settlements or other land; conversions from grasslands to wetlands; and conversions from wetlands to settlements.

Statistic Yearbooks for cropland and for the years 1990-2011 were extracted from Croatia Bureau of Statistics (CBS).

The same information sources were used throughout the time series, although data from CBS needed corrections and gap filling, which was done by linear interpolation of the CBS data for the period 1991-1998. CBS data following the year 2000 was also corrected using the CLC database and maps.

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[1] project based on survey data initiated by the Ministry of Environmental and Nature Protection (MENP) with cooperation with other relevant institutions

2.1.3   Reporting on Living Biomass

For forest biomass, yields from LULUCF 1 project and IPCC default values were applied combined with expert judgement, except for maquis and shrub, for which the default IPCC value was used).

The approach is different for annual and perennial crops: for perennial crops the default IPCC values were used; for annual crops biomass the mean annual yield of individual crops from CBS statistical yearbook (from 2000 to 2010) was used.

For annual crops only the following additional data and methods were used:

- Weighted mean value of the total biomass per ha, calculated for each year in period 2000-2010 on the basis of crop yields,
- Dry weight factors as contained in the NIR 2012 reports of Austria, Bulgaria and Luxembourg,
- Biomass expansion factors from the Austrian Expert Panel for Soil Fertility, which include biomass of straw, leaves or other aboveground plants parts
- Root to shoot ratios of the United States Department of Agriculture.

Grassland aboveground biomass was approximated by comparison with hay yields from the CBS statistical yearbook and IPCC 2006. Default IPCC parameters were used to estimate carbon content in biomass and root to shoot ratio.

2.1.4   Reporting on Dead wood and Litter

No data is provided for both dead wood and litter.

Dead wood is reported as not occurring (NO). Litter, is considered to be included elsewhere (IE), in this case in the organic soil carbon pool, but only where land use changes are reported.

Dead wood and litter pools were considered as not occurring in other cropland and grassland categories.

2.1.5   Reporting on Mineral Soils

Reporting on mineral soils uses tier 1 IPCC methodology and factors.

Soil classification derives from the "Geological Maps of Croatia" (performed in the period from 1997 to 2003). According to expert judgment there was no change in the relative stock change factors (tillage, land use and input factors). Carbon soil from cropland converted to forest land was classified as not occur (NO) when it should be not estimated (NE).

2.1.6   Reporting on Organic Soils

Reporting on organic soils uses tier 1 IPCC methodology and factors.

Organic soils distribution was determined on the basis of current Basic Soil Map of the Republic of Croatia (scale 1:50,000) and available data and information obtained from the Land Parcel Identification System (LPIS).

2.2 Cyprus

2.2.1 Stratification of Cropland and Grassland Reporting

The cropland/grassland subcategories considered are those of the CORINE Land Cover Categories. For cropland non-irrigates arable land, permanently irrigated land, vineyards, fruit trees and berry plantation, olive groves, pasture, annual crops associated with permanent crops, complex cultivation, land principally occupied by agriculture, with significant areas of natural vegetation were considered. For grassland natural grassland, sclerophyllous vegetation and transitional woodland/shrub were considered.

There is no reference to unmanaged grasslands or to special management practices.

2.2.2 Activity Data

Activity data is based on geographic information, provided by Corine land Cover, available for the years 2000, 2006, 2012.

2.2.3 Reporting on Living Biomass

Emissions and removals from living biomass are Not Estimated.

2.2.4 Reporting on Dead wood and Litter

Emissions and removals from dead wood and litter are Not Estimated.

2.2.5 Reporting on Mineral Soils

Emissions and removals from mineral soils are Not Estimated.

2.2.6 Reporting on Organic Soils

Organic soils are reported as Not occurring.

2.3 France

2.3.1 Stratification of Cropland and Grassland Reporting

Cropland is defined as cultivated land that is not forest. It is divided in:

- Annual crops (cereals, roots and tubers, industrial crops, pulses, fresh vegetables, flowers);
- Permanent crops, that remain in place for more than one crop year (fruit trees, berries, vines, olive trees, nurseries, etc.);
- Temporary pastures (up to a maximum of 6 annual harvests)

Grasslands are defined as areas of natural or planted grass cover (for period of more than 5 years). Grasslands include also planted trees or surfaces covered with shrubs that do not meet the thresholds of the forest definition and are not croplands or artificial areas (like most hedges and thickets).

There is no reference to unmanaged grasslands or to special management practices.

2.3.2   Activity Data

The activity data are provided by the statistical service of the Ministry of Agriculture (Series TERUTI 1982-1989; Series TERUTI 1992-2004 and Series TERUTI-LUCAS from 2005 onwards). Despite the fact that the information source is consistent over time, some inconsistence in the data is acknowledged, which is attributed to: changes in classification of categories through time; inconsistency in the classification of the same land use from year to year; or difficulty in categorizing some classes.

2.3.3   Reporting on Living Biomass

Carbon stock values per hectare of forest living biomass are used only in the calculation of land clearing emissions. In metropolitan France, these stocks are estimated on the basis of NFI data.

Only woody biomass from permanent crops is considered. In cropland remaining cropland living biomass is assumed to be in balance, i.e. gains equal losses. Losses are calculated from the consumption of pruning wood (from vineyards, olive and fruit trees), which is estimated based in statistics of consumption of wood for energy. Removals from the establishment of new areas with permanent crops are not estimated. Default tier 1 IPCC stocks of biomass are considered in cropland.

Only woody biomass from woody grasslands (i.e. shrublands) is considered. In grassland remaining grassland living biomass is assumed to be in balance, i.e. gains equal losses. Losses are calculated from the consumption of wood, which is estimated based in statistics of consumption of wood for energy. Removals from the establishment of new areas with shrublands are not estimated. Default tier 1 IPCC stocks of biomass are considered in shrublands.

2.3.4   Reporting on Dead Wood and Litter

Both dead wood and litter was considered a not occurring pool in cropland and grassland, except in the cases of deforestation to cropland or grassland, where the loss of dead wood and litter from the previous land-use (forest) was considered.

2.3.5   Reporting on Mineral Soils

Data for carbon stocks in cropland and grassland uses information from the Network of Measurement of Soil Quality (RMQS) which is based on the follow-up of 2200 sites distributed uniformly on the French territory, according to a square grid of 16 x16 km. Soil carbon is assumed to be in balance (i.e. no emissions or removals) in cropland remaining cropland and grassland remaining grassland.

2.3.6   Reporting on Organic Soils

Organic soils are considered to be not representative in France and the corresponding emissions and removals were not estimated.

2.4   Greece

2.4.1   Stratification of Cropland and Grassland Reporting

Cropland category includes all annual and perennial crops as well as temporary fallow land.

Grassland includes rangeland and pasture with vegetation that falls below the forest threshold.

There is no reference to unmanaged grasslands or to special management practices.

2.4.2   Activity Data

Activity data is obtained combining statistical from different sources:

- 1st National Forest Inventory (1st NFI) prepared by the General Secretariat of Forests and

Natural Environment (GSFNE, 1992, 1994);

- Afforestation registry and statistics of the Ministry of Environment and Energy;
- "Agricultural Statistics of Greece" of the Hellenic Statistical Authority (EL.STAT., annual census);
- "Distribution of the Country's Area by Basic Categories of Land Use" of the Hellenic Statistical Authority (EL.STAT., decennial survey);
- "Land Use Change Database" of the Ministry of Environment and Energy, which comprises annual acts of land use change since 1990;
- "Forest Management Plans Database", of the Ministry of Environment and Energy.

2.4.3   Reporting on Living Biomass

Cropland remaining cropland used country specific value carbon accumulation and loss rates. Only perennial cropland is considered and estimates are only provided when new plantations are established or eradicated. Average biomass stocks per tree crop type (15 fruit tree types + vineyards + olive trees) are provided by the Ministry of Agriculture and expert judgement.

The IPCC tier 1 default of no net-change in biomass stocks was used to estimate carbon in grassland remaining grassland. Except when vegetation clearing took place and woody vegetation was substituted by annual vegetation. In this case areas of intervention have been provided by the local Forest Service, disaggregated by vegetation type.

For cropland (majority abandoned annual cropland) converted to grassland default values were used.

For forest land converted to grassland country specific data provided by local Forest Service was used. Biomass expansion factors were taken from the Forest Inventory of Catalonia and default values from IPCC.

2.4.4 Reporting on Dead wood and Litter

The dead wood and litter pools were only reported in conversions from forest land to cropland and grassland. For the estimation of litter stocks prior to conversion, the data collected within the European project BioSoil was used. For dead wood Carbon stocks data obtained by Italy was applied, and more specifically dead wood coefficients estimated on the basis of data collected in the framework of the Italian forest inventory per Italian region and per inventory typology. A selection of coefficients was carried out, in order to detect only those that are more suitable to Greek climatic conditions and vegetation types.

2.4.5 Reporting on Mineral Soils

Mineral soils were reported using the IPCC tier 1 default methodology and data. Country specific soil carbon reference stock levels were used (Land Taxonomy Project). For cropland remaining cropland because there weren't different set of data of the relative stock change factors (FLU, FMG, FI) demonstrating subsequent changes in management for the inventory period 1990-2014, carbon stock changes in mineral soils have been reported to be equal to zero. For grassland remaining grassland it was assumed that annual change in carbon stocks in mineral soils was zero.

2.4.6 Reporting on Organic Soils

It was used a tier 1 methodology. Area of cultivated organic soils was obtained from a study of the Soil Science Institute of Athens (only covering cropland remaining cropland), which was combined with the IPCC default emission factors.

2.5 Italy

2.5.1 Stratification of Cropland and Grassland Reporting

Cropland includes all annual and perennial crops.

Grassland includes all grazing land and other woodland that do not fulfil the forest definition (e.g. shrublands).

There is no reference to unmanaged grasslands or to special management practices.

For Grazing Land management Italy reports only organic grazing land with the plan to include also other grazed land in the next future. This subdivision is not reflected in the Grassland category under the UNFCCC.

2.5.2 Activity Data

Cropland and Grassland areas are evaluated on the basis of IUTI assessment (i.e. classification of orthophotomaps for 1990, 2000, 2008 and 2012). It is technically impossible to have a clear distinction among some subcategories in cropland and grassland categories (i.e. annual pastures

versus grazing land). Therefore cropland and grassland categories are aggregated, as detected by IUTI, and then disaggregated into the different subcategories, using as proxies the national statistics (ISTAT) related to annual crops and perennial woody crops. The IUTI (i.e. classification of orthophotomaps) assessment for 1990, 2000 and 2008) is provided by the Ministry of Environment, while the 2012 assessment of land use and land use changes has been carried out in the framework of the III NFI, on an IUTI's sub-grid (i.e. 301.300 points, covering the entire country) by the National Forest Service (Ministry of Agricultural, Food and Forestry Policies (MIPAAF))

Shrublands areas are derived from national forest inventories (CRA-MPF, several years) (NFI1985, NFI2005 and the ongoing NFI2015), through linear interpolations for the periods 1985-2005, 2005-2012 and linear extrapolation for 2012-2014.

National statistics on cropland areas are used to derive the land in conversion from cropland to grassland, by the way of LUC matrix, following the assumption that transition into cropland category occurs only from grassland category.

2.5.3   Reporting on Living Biomass

Change in living biomass in cropland have been estimated only for perennial crops, since for annual crops the increase in biomass stocks in a single year is assumed equal to biomass losses from harvest and mortality in that same year.

Concerning woody crops, estimates of carbon stocks changes are applied to aboveground biomass only, according to the 2006 IPCC Guidelines (IPCC, 2006). The carbon stock change in living biomass has been estimated on the basis of carbon gains and losses, computed applying a value of biomass C stock at maturity. In the absence of country specific values, and following the suggestion of Joint Research Centre (JRC) experts, in the framework of European Union QA/QC checks of the Member States' inventories for the preparation of EU greenhouse gas inventory, an average value of 10 tC/ha (carbon stock at maturity), deduced from the values adopted in Spain, has been chosen (JRC, 2013).

For Grasslands, the changes in biomass were estimated only for subcategory "other wooded land", since for grazing land the increase in biomass stocks in a single year is assumed equal to biomass losses from harvest and mortality in that same year.

Regarding shrublands, growing stock and the related carbon are assessed by the Forest model, estimating the evolution in time of the different pools and applied at regional scale (NUTS2). Belowground biomass was estimated applying a Root/Shoot ratio to the aboveground biomass.

2.5.4   Reporting on Dead wood and Litter

Reporting on dead wood and litter is reported only for other wooded lands (Shrubland) and considered as "not occurring" for croplands and grazing lands. Dead wood mass has been estimated using coefficients calculated from outcomes of a survey conducted by the Italian national forest

inventory (Di Cosmo et al., 2013)[2]. Carbon amount contained in Litter pool has been estimated using the values of litter carbon content assessed by the Italian national forest inventory.

2.5.5   Reporting on Mineral Soils

For cropland remaining cropland and grassland remaining grassland, the IPCC tier 1 assumption of no net-changed was adopted, i.e. no emissions or removals are reported.

For conversions to cropland/grassland the tier 1 IPCC methodology was used. Changes in management practices have not been considered.

2.5.6   Reporting on Organic Soils

CO_2 emissions from cultivated organic soils (CRPA, 1997) in cropland remaining cropland and grassland remaining grassland have been estimated, using default emission factor for warm temperate, reported in Table 5.6 of 2006 IPCC Guidelines (vol.4, chapter 5);

2.6   Malta

2.6.1   Stratification of Cropland and Grassland Reporting

Cropland is defined as arable and tillage land, and agro-forestry systems where vegetation falls below the thresholds used for forestry land categories. Cropland includes all annual and perennial crops as well as temporary fallow land.

Annual crops may include cereals, oils seeds, vegetables, root crops and forages.

Perennial crops can include trees and shrubs, in combination with herbaceous crops (e.g. agroforestry) or as orchards, vineyards and plantations such as cocoa, coffee, tea, oil palm, coconut, rubber trees, and bananas, except where these lands meet the criteria for categorization as forest land.

Grassland is defined as areas with highly biodiverse grassland, defined at habitat directives (92/43/EEC, Directive 92/43/EEC, 2009/147/EC and 92/43/EEC).

Some unmanaged grasslands are reported. No special management practices are considered.

2.6.2   Activity Data

Areas of Forest Land, Grassland, Wetland and Settlement are derived from Corine Land Cover maps (1990, 2000, 2006, 2012) provided by Malta Environment and Planning Authority. Areas related to Cropland were provided by the National Statistics Office and Agriculture Census.

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[2] The values used, aggregated at regional level, may be found on the NFI website: http://www.sian.it/inventarioforestale/jsp/dati_carquant_tab.jsp

Annual values for areas in transition from one type of land use to another have been derived by a hierarchy of basic assumptions with expert judgement of land-use changes in Malta. Land-use change matrices for each year of the period 1990-2013 have been assembled based on time series of national land use statistics for Forest lands, Croplands, Grasslands, Wetland and Settlement areas.

National Statistics was provided annually by National Statistics Office (NSO) from 1999 onwards.

There are two information sets being used to derive activity data on perennial crops. For the years 1990 to 1998 the 1991 Agriculture Census was used, whereas for the years 1999 onwards activity data on perennial crops published by the National Statistics Office has been used.

2.6.3   Reporting on Living Biomass

Biomass from annual cropland was reported as "Not Occurring". As for permanent crop only vineyards (the main permanent crop of Malta) was considered. Dry matter data was provided by the Joint Research Centre (JRC).

Grassland biomass was also reported as "Not Occurring".

2.6.4   Reporting on Dead wood and Litter

Reported as "Not Occurring".

2.6.5   Reporting on Mineral Soils

Reported as "Not Occurring".

2.6.6   Reporting on Organic Soils

Reported as "Not Occurring".

2.7   Portugal

2.7.1   Stratification of Cropland and Grassland Reporting

The cropland are divided in rain-fed annual crops, irrigated annual crops, rice paddies, vineyards, olive groves and other permanent crops. No-tillage is reported as a special management practice under annual crops.

Grassland includes all grassland this is all lands covered in permanent herbaceous cover. Biodiverse Pastures is reported as a special management practice under grasslands.

Shrubland area was categorized in "other land" and includes all lands covered in woody vegetation that do not meet the forest definition or permanent crop definitions.

2.7.2   Activity Data

The activity data was based on country Land-Use Cartography (COS), available for the 1995, 2007 and 2010, complemented with statistical data from National Forest Inventory and General Census of Agriculture. A conversion is made between the 270 categories in COS to the 19 categories used for the purposes of UNFCCC reporting.

Land-use maps are provided by the General Directorate of Spatial Planning, the National Forest Inventory (1974, 1985 and 1995) is provided by the Institute for Nature Conservation and Forestry and the General Census of Agriculture (1979, 1989 and 1999) is provided by the National Statistical Institute.

Additionally, data for the period 1970 – 1995 is based on National Forest Inventory (forest areas) and General Census of Agriculture (cropland and grassland areas). For other land-uses the same area as reported in the 1995 COS was used.

2.7.3   Reporting on Living Biomass

Living biomass data for cropland and grassland, a series of biomass values (and root-to-shoot values) from literature and/or from similar countries was used: Spanish NIR (submission 2012), for permanent crops; Emission Inventory Guidebook of EMEP/EEA (2009), for grasslands; a country specific factor based on Olson model adjusted for Portugal, for shrublands.

The default carbon fraction from IPCC 2006 was used.

2.7.4   Reporting on Dead wood and Litter

Dead wood in cropland and grassland is reported as Not Occurring. Litter values are derived from EMEP/EEA emission inventory guidebook 2009, Chapter 11b Forest fires. For shrublands a value from a national study was used.

2.7.5   Reporting on Mineral Soils

Soil emission factors are derived from three data sets: Measurements made over the ICP forest grid[3] extended to plots with agriculture and grassland Project Biosoil (1999); LUCAS soil assessment (2009). This data was used only to characterize the average carbon stock in each land-use. Only stock-changes in conversions were used. Land-remaining-land was assumed to be in equilibrium (i.e. no emissions or removals).

Data for specific management practices (no-till in annual crops and biodiverse pastures in grasslands) are derived from national studies.

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[3] International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests

2.7.6   Reporting on Organic Soils

Reported as "Not Occurring".

2.8   Slovenia

2.8.1   Stratification of Cropland and Grassland Reporting

Cropland is divided into two subcategories: annual and perennial (woody). The categories included in cropland are: arable land, hop fields, greenhouses, other permanent crops and lands, vineyards, nursery, intensive orchards, extensive orchards, olive groves, other permanent crops and forest plantation.

Grassland is divided into two subcategories: herbaceous and perennial (woody). Grassland is defined as agricultural areas with grass and other herbaceous plants that are regularly cut or grazed. These areas are not tilled or under fallow land. Included are areas covered with some of forest trees (less than 50 trees / ha) and alpine pastures. The categories associated to this class are: meadows and pastures, swampy meadows and pastures, alpine meadows, uncultivated agriculture land, overgrown areas, mixed land use (small areas of arable land and forest); forest trees on agricultural land.

Unmanaged grasslands are reported as Included Elsewhere. No special management practices are considered.

2.8.2   Activity Data

Information sources differ in 2 periods: 1986-2001 and 2002-2014. Statistical Yearbook of the Statistical Office RS (SORS) was used to present cropland area in the period 1986-2001; for the period 2002-2014 Cropland and Grassland areas are provided by:

- Digital orthophotomaps (2002, 2006 and 2012) from Surveying and Mapping Authority RS,
- Land-use database (until 2002) of the Statistical Yearbook of the Statistical Office RS,
- Agricultural Land Use Map and LPIS database of the Ministry of Agriculture, Forestry and Food,
- Land cover map of Slovenia from Landsat satellite imagery (images for the period 1984-2014 collected by ZRC SAZU).

Data on organic soils is provided by Agricultural Institute of Slovenia complemented with expert judgment.

2.8.3   Reporting on Living Biomass

For annual cropland and grassland changes in carbon stocks in living biomass was assumed to be at equilibrium (i.e. no emissions and no removals) and for perennial crops the default values from IPCC 2006 were used.

For annual and permanent crops the default IPCC values of C Stocks at maturity were used. Conversions to and from perennial crops are estimated based on a 30 year conversion period. Conversions top grasslands assume the default IPCC accumulation rate and the loss of the carbon

from the previous land-use. Annual crops remaining annual crops and perennial crops remaining perennial crops are reported as having no net-changes in C stocks.

2.8.4   Reporting on Dead wood and Litter

The dead wood and litter C stock in cropland and grasslands was assumed as zero or at equilibrium. Only losses from conversions from forest land to cropland or grassland are considered.

2.8.5   Reporting on Mineral Soils

Average C Stocks in Soils are based on soil samplings conducted in 2012 to estimate the average carbon stock on 40 cm depth in mineral soils, for different land uses. Only gains/losses from conversions from forest land to cropland or grassland are considered.

2.8.6   Reporting on Organic Soils

Organic soils are reported using the IPCC 2006 default emission factor.

2.9   Spain

2.9.1   Stratification of Cropland and Grassland Reporting

Cropland is divided in arable crops and wood crops. These can include arable land, including rice or agro-forestry systems where the structure of the vegetation is below the thresholds used to define forest. Permanent crops have been grouped in olive groves, vineyards and other permanent crops. Herbaceous crops have been divided in crops and fallow land.

Grassland includes grazing lands and rangelands dominated by herbaceous or shrub vegetation, as well as woody vegetation that is not considered cropland and that do not reach the lower threshold values used to define forest. This category is divided in grassland and shrublands/arboreal vegetation.

In cropland areas the following management practices were considered:

- Traditional tillage
- Minimum tillage
- Spontaneous vegetation cover
- Seeded vegetation cover
- Inert cover
- No intervention
- No till

Unmanaged grasslands are reported as Included elsewhere. No special management practices in grasslands are considered.

2.9.2   Activity Data

The geographic information was based on: CORINE Land Cover, Forest, Crops and statistical information.

- CORINE Land cover maps (1990, 2000 and 2006) were provided by National Geographic Institute
- Crops and harvest maps (for the period 1980-1990 and 2000-2010) were provided by General Directorate of Agricultural Production and Markets
- Forest map (from 1996 to 2007) was provided by the General Directorate of Rural Development and Forest Policy

Information about changes to and from permanent crops are derived from two different sources: Annual statistics from MAGRAMA for the period 1990-2003; Survey of Crops Surfaces and Yields of Spain (ESYRCE) provided by the Sub-Directorate General of Statistics of MAGRAMA (2004-2014)

2.9.3   Reporting on Living Biomass

Country specific carbon stocks are provided by the Focal Point of the Secretary General of Fruits and Vegetables, Olive Oil and Vitiviniculture of MAGRAMA. Emission Factors were estimated based on C Stocks and transition periods for each permanent crop type.

Only changes to and from each of the permanent crops were considered.

2.9.4   Reporting on Dead wood and Litter

Dead wood was reported using tier 1 methodology for forest land converted to/from cropland or grassland. It was calculated based on data from the forest inventory, equations from national studies, and default factors from IPCC 2006.

Litter was calculated the same way as dead wood. The conversions from cropland to grassland, wetland and settlements as well as from grassland to cropland, wetland and settlements were reported as tier 1. Grassland to forest or other uses were reported as tier 2 using average forest carbon stock from the Portuguese NIR (2013).

2.9.5   Reporting on Mineral Soils

Country specific Soil Reference Carbon Stocks were derived from ~2000 soil profiles and are available per main land use (forest, cropland, grassland, and wetland) and province.

Default IPCC 2006 factors were used to describe the impact of the following management practices:

- Traditional tillage
- Minimum tillage
- Spontaneous vegetation cover
- Seeded vegetation cover
- Inert cover
- No intervention
- No till

2.9.6   Reporting on Organic Soils

Reported as "Not Occurring".

3   Main Results and Conclusions

3.1   Stratification

The definitions of both cropland and grassland are very similar in all countries; however stratification (understood as the actual level of detail by which data is provided) within each category differs considerably.

In cropland, most countries distinguish between annual and perennial crops, but further detail is only provided in Greece, Portugal and Spain. Grasslands are usually not further sub-divided except for a sub-division into woody and non-woody grasslands in Italy, Portugal and Spain.

Country	Sub-categories of Cropland	Sub-categories of Grassland
Croatia	• Annual Crops • Perennial Crops	• Grassland
Cyprus	• Cropland	• Grassland
France	• Annual Crops • Perennial Crops • Temporary Pastures	• Grassland

Greece	• Annual Crops
	• Perennial Crops
	  ○ Fruit trees [15 individual types]
	  ○ Vineyards
	  ○ Olive trees
		• Grassland

Italy	• Annual Crops • Perennial Crops	• Grazing Land • Shrubland
Malta	• Annual crops • Vineyards	• Grassland
Portugal	• Rain-fed annual crops • Irrigated annual crops • Rice paddies • Vineyards • Olive groves • Other permanent crops	• Grazing Land • [Shrubland] [reported as Other Land]
Slovenia	• Annual Crops • Perennial Crops	• Grassland • Woody Grasslands

Spain	• Annual Crops
	• Perennial Crops
	  ○ Vineyards
	  ○ Olive trees
	  ○ Other permanent crops
		• Grazing Land
		• Shrubland

The consideration of particular management practices in both cropland and grassland is very incipient in all countries analysed. Spain is the country where more practices are reported, but uses tier 1 default values to characterise them. Portugal reports 2 practices (1 in cropland and 1 in grassland), both characterised by country specific values.

3.2   Activity Data

Most of MediNet countries are already using geographic information maps to build annual land use change matrices, but still face problems associated with the following issues:

- Map production timing – maps are not produced annually, and annual data needs to be interpolated/extrapolated;
- Minimum mapping unit – Most of the countries are using CORINE Land Cover Maps that have a minimum maps unit of 25 ha for the land use maps and 5 ha for the land use change maps. This means that land use changes smaller than 5 ha are not detected on these maps;
- Map legend – some of the categories provided by the maps available are incomplete or different from the ones needed for reporting;
- Mapping management – maps identify land use / land cover, but don't allow the monitoring of special management practices.

These problems are usually overcome by referring to statistical information and/or expert opinions to complete information on the categories that are necessary for the emission reports, which are provided by different sources. Some countries are using only statistical information to build land use and land use change matrix.

3.3   Living Biomass

In all cases of a land-use remaining in the same land-use category for more than the transition period are considered in equilibrium, and, hence, only land use conversions are reported.

For perennial crops only Greece and Spain use country specific data; Portugal and Italy use the country specific values from Spain; Croatia and Slovenia use default IPCC values; France reports only losses from wood pruning; Malta uses values provided by the JRC; and Cyprus does not estimate living biomass.

For annual crops Croatia uses the yields to derive biomass data. Portugal reports gains and losses in land-use conversions based average C Stocks from EMEP/EEA emission inventory guidebook 2009[4]. All other countries report living biomass in cropland as "Not Occurring".

For perennial grasslands / shrublands Greece, Italy, Portugal use country specific values; France uses default IPCC values; and Cyprus, Malta, Slovenia and Spain do not estimate living biomass.

3.4   Dead Wood and Litter

Dead Wood is reported as "Not Occurring" in cropland and grassland by all countries.

Litter is also considered as "Not Occurring", except for Portugal and Spain which use default values provided by EMEP/EEA emission inventory guidebook 2009.

As litter and dead wood C Stocks are usually known for forests, the emissions resulting from conversions from forest land to cropland or grassland are usually reported. Portugal and Spain report

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[4] Default values used for category 11B Fire Emissions

emissions from conversions of shrubland to cropland and Portugal reports also conversions of shrubland to grassland.

3.5 Mineral Soils

Mineral Soils are reported by most countries. National data on average C Stocks is available in France, Portugal, Slovenia and Spain. Default IPCC C Stocks are used in Croatia, Greece and Italy. Cyprus and Malta do not report Mineral Soils.

In all cases of a land-use remaining in the same land-use category for more than the transition period are considered in equilibrium, and, hence, only land use conversions are reported.

3.6 Organic Soils

Italy reports some organic soils in cropland remaining cropland and grassland remaining grassland. France reports only conversions of wetlands to cropland or grassland. In both Italy and France the area of reported cropland and grassland areas under organic soils is smaller than 0.5% of the respective area. The remaining Mediterranean countries report Organic Soils as "Not Occurring".

This suggests this pool is not particularly relevant in the Mediterranean Region.

Annex I: Overview of Activities, Pools and Gases Reported

Croatia

Croatia			CO_2 living biomass	CO_2 dead biomass	CO_2 mineral soil	CO_2 organic soil	CH_4	N_2O
4A Forest Land	4A2 Lands converted to Forest Land	4A2a Cropland converted to FL	NO (1990 – 2002) R (2003 - 2014)	NO (1990 – 2002); NO (dead organic wood; IE/NO (litter) 2003 NO (dead organic wood); IE (litter) 2004-2014	NO (1990-2002) R (2003-2014)	NO		
		4A2b Grasslands converted to FL	R	NO (dead organic wood); IE (litter)	R	NO		
4B Cropland	4B1 Cropland remaining Cropland		R	NO	R	R		
	4B2 Lands converted to Cropland	4B2a Forest converted to CL	NO (1990 – 2003) R (2004 - 2014)	NO	NO (1990 – 2003) R (2004 - 2014)	NO		
		4B2b Grassland converted to CL	R	NO	R	NO		
		4B2c Wetlands converted to Cropland	NO	NO	NO	NO		
		4B2d Settlements converted to CL	NO	NO	NO	NO		
		4B2e Other Uses converted to CL	NO	NO	NO	NO		
4C Grassland	4C1 Grassland remaining Grassland		NO	NO	NO	R		
	4C2 Lands converted to Grassland	4C2a Forest converted to GL	NO	NO	NO	NO		
		4C2b Cropland converted to GL	R	NO	R	NO		
		4C2c Wetlands converted to GL	NO	NO	NO	NO		
		4C2d Settlements converted to Grassland	NO	NO	NO	NO		
		4C2e Other Uses converted to GL	NO	NO	NO	NO		
4D Wetlands	4 D22 Land converted to flooded land	4D222 Cropland converted to flooded land	R	NO	R	NO		

Croatia			CO_2 living biomass	CO_2 dead biomass	CO_2 mineral soil	CO_2 organic soil	CH_4	N_2O
		4D223 Grassland converted to flooded land	NO	NO	NO	NO		
4E Settlements	4E2 Lands converted to Settlements	4E2b Cropland converted to ST	R	IE	R	NO		
		4E2c Grassland converted to ST	R	IE	R	NO		
4F Other Uses	4F2 Lands converted to Other Uses	4F2b Cropland converted to OU	NO	NO	NO	NO		
		4F2c Grassland converted to OU	NO	NO	NO	NO		
4(II) Drainage and rewetting of Soils	4(II)B Cropland	4(II)B1 Organic Soils				NA	NA	
		4(II)B2 Mineral Soils			NA, NO		NA, NO	NO
	4(II)C Grassland	4(II)C1 Organic Soils				NO	NO	
		4(II)C2 Mineral Soils			NO		NO	NO
4(III) N2O Emissions from SOM mineralization	4(III)B Cropland	4(III)B1 CL remaining CL						NE
		4(III)B2 Lands converted to CL						R
	4(III)C Grassland	4(III)C1 GL remaining GL						NO
		4(III)C2 Lands converted to GL						NO
4(IV) Indirect N2O Emissions	4(IV)1 Atmospheric Deposition							IE
	4(IV)2 Drainage and Leaching							IE
4(V) Biomass Burning Emissions	4(V)B Cropland	4(III)B1 CL remaining CL	NO	NO			NO	NO
		4(III)B2 Lands converted to CL	NO	NO			NO	NO
	4(V)C Grassland	4(III)C1 GL remaining GL	NO	NO			R	R
		4(III)C2 Lands converted to GL	NO	NO			NO	NO

Cyprus

Cyprus			CO_2 living biomass	CO_2 dead biomass	CO_2 mineral soil	CO_2 organic soil	CH_4	N_2O
4A Forest Land	4A2 Lands converted to Forest Land	4A2a Cropland converted to FL	NE	NE	NE	NE		
		4A2b Grasslands converted to FL	NE	NE	NE	NE		
4B Cropland	4B1 Cropland remaining Cropland		NE	NE	NE	NO		
	4B2 Lands	4B2a Forest	NE	NE	NE	NO		

Cyprus			CO_2 living biomass	CO_2 dead biomass	CO_2 mineral soil	CO_2 organic soil	CH_4	N_2O
	converted to Cropland	converted to CL						
		4B2b Grassland converted to CL	NE	NE	NE	NO		
		4B2c Wetlands converted to Cropland	NE	NE	NE	NO		
		4B2d Settlements converted to CL	NE	NE	NE	NO		
		4B2e Other Uses converted to CL	NE	NE	NE	NO		
4C Grassland	4C1 Grassland remaining Grassland		NE	NE	NE	NO		
	4C2 Lands converted to Grassland	4C2a Forest converted to GL	NE	NE	NE	NO		
		4C2b Cropland converted to GL	NE	NE	NE	NO		
		4C2c Wetlands converted to GL	NE	NE	NE	NO		
		4C2d Settlements converted to Grassland	NE	NE	NE	NO		
		4C2e Other Uses converted to GL	NE	NE	NE	NO		
4D Wetlands	4 D22 Land converted to flooded land	4D222 Cropland converted to flooded land	NE	NE	NE	NE		
		4D223 Grassland converted to flooded land	NE	NE	NE	NE		
4E Settlements	4E2 Lands converted to Settlements	4E2b Cropland converted to ST	NE	NE	NE	NE		
		4E2c Grassland converted to ST	NE	NE	NE	NE		
4F Other Uses	4F2 Lands converted to Other Uses	4F2b Cropland converted to OU	NE	NE	NE	NO		
		4F2c Grassland converted to OU	NE	NE	NE	NO		
4(II) Drainage and rewetting of Soils	4(II)B Cropland	4(II)B1 Organic Soils				NO	NO	
		4(II)B2 Mineral Soils			NE		NE	NE
	4(II)C Grassland	4(II)C1 Organic Soils				NO	NO	
		4(II)C2 Mineral Soils			NE		NE	NE
4(III) N2O Emissions from SOM mineralization	4(III)B Cropland	4(III)B1 CL remaining CL						NE
		4(III)B2 Lands converted to CL						NE
	4(III)C Grassland	4(III)C1 GL remaining GL						NE

Cyprus			CO₂ living biomass	CO₂ dead biomass	CO₂ mineral soil	CO₂ organic soil	CH₄	N₂O
		4(III)C2 Lands converted to GL						NE
4(IV) Indirect N2O Emissions	4(IV)1 Atmospheric Deposition							NE
	4(IV)2 Drainage and Leaching							NE
4(V) Biomass Burning Emissions	4(V)B Cropland	4(III)B1 CL remaining CL	NE	NE			NE	NE
		4(III)B2 Lands converted to CL	NE	NE			NE	NE
	4(V)C Grassland	4(III)C1 GL remaining GL	NE	NE			NE	NE
		4(III)C2 Lands converted to GL	NE	NE			NE	NE

France

France			CO₂ living biomass	CO₂ dead biomass	CO₂ mineral soil	CO₂ organic soil	CH₄	N₂O
4A Forest Land	4A2 Lands converted to Forest Land	4A2a Cropland converted to FL	R	R	R	NO		
		4A2b Grasslands converted to FL	R	R	R	NO		
4B Cropland	4B1 Cropland remaining Cropland		R	NO	NO	NO		
	4B2 Lands converted to Cropland	4B2a Forest converted to CL	R	R	R	NO		
		4B2b Grassland converted to CL	NO	NO	R	NO		
		4B2c Wetlands converted to Cropland	NO	NO	NO	R		
		4B2d Settlements converted to CL	NO	NO	R	NO		
		4B2e Other Uses converted to CL	NO	NO	NO	NO		
4C Grassland	4C1 Grassland remaining Grassland		R	NO	NO	NO		
	4C2 Lands converted to Grassland	4C2a Forest converted to GL	R	R	R	NO		
		4C2b Cropland converted to GL	NO	NO	R	NO		
		4C2c Wetlands converted to GL	NO	NO	NO	R		
		4C2d Settlements converted to Grassland	NO	NO	R	NO		
		4C2e Other Uses converted to GL	NO	NO	NO	NO		
4D Wetlands	4 D22 Land converted to flooded land	4D222 Cropland converted to flooded land	NE	NE	NE	NE		

France			CO₂ living biomass	CO₂ dead biomass	CO₂ mineral soil	CO₂ organic soil	CH₄	N₂O
		4D223 Grassland converted to flooded land	NE	NE	NE	NE		
4E Settlements	4E2 Lands converted to Settlements	4E2b Cropland converted to ST	NO	NO	R	NO		
		4E2c Grassland converted to ST	NO	NO	R	NO		
4F Other Uses	4F2 Lands converted to Other Uses	4F2b Cropland converted to OU	NO	NO	NO	NO		
		4F2c Grassland converted to OU	NO	NO	NO	NO		
4(II) Drainage and rewetting of Soils	4(II)B Cropland	4(II)B1 Organic Soils				NO	NO	
		4(II)B2 Mineral Soils			NO		NO	NO
	4(II)C Grassland	4(II)C1 Organic Soils				NO	NO	
		4(II)C2 Mineral Soils			NO		NO	NO
4(III) N2O Emissions from SOM mineralization	4(III)B Cropland	4(III)B1 CL remaining CL						NE
		4(III)B2 Lands converted to CL						R
	4(III)C Grassland	4(III)C1 GL remaining GL						NO
		4(III)C2 Lands converted to GL						NO
4(IV) Indirect N2O Emissions	4(IV)1 Atmospheric Deposition							NO
	4(IV)2 Drainage and Leaching							NO
4(V) Biomass Burning Emissions	4(V)B Cropland	4(III)B1 CL remaining CL	NO	NO			R	R
		4(III)B2 Lands converted to CL	NO	NO			R	R
	4(V)C Grassland	4(III)C1 GL remaining GL	NO	NO			R	R
		4(III)C2 Lands converted to GL	NO	NO			R	R

Greece

Greece			CO₂ living biomass	CO₂ dead biomass	CO₂ mineral soil	CO₂ organic soil	CH₄	N₂O
4A Forest Land	4A2 Lands converted to Forest Land	4A2a Cropland converted to FL	NO (1990 – 1993) R (1994 - 2014)	NO	NE	NO		
		4A2b Grasslands converted to FL	NE	NE	NE	NO		

Greece			CO$_2$ living biomass	CO$_2$ dead biomass	CO$_2$ mineral soil	CO$_2$ organic soil	CH$_4$	N$_2$O
4B Cropland	4B1 Cropland remaining Cropland		R	NO	NO	R		
	4B2 Lands converted to Cropland	4B2a Forest converted to CL	NO (1990) R	NO (1990) R	NO (1990) R	NO		
		4B2b Grassland converted to CL	R	NO	R	NO		
		4B2c Wetlands converted to Cropland	NO	NO	NO	NO		
		4B2d Settlements converted to CL	NO	NO	NO	NO		
		4B2e Other Uses converted to CL	NO	NO	NO	NO		
4C Grassland	4C1 Grassland remaining Grassland		R	NO	NO	NO		
	4C2 Lands converted to Grassland	4C2a Forest converted to GL	R	R	R	NO		
		4C2b Cropland converted to GL	R	NO	R	NO		
		4C2c Wetlands converted to GL	NO	NO	NO	NO		
		4C2d Settlements converted to Grassland	NO	NO	NO	NO		
		4C2e Other Uses converted to GL	NO	NO	NO	NO		
4D Wetlands	4 D22 Land converted to flooded land	4D222 Cropland converted to flooded land	NO	NO	NO	NO		
		4D223 Grassland converted to flooded land	NO (1990-1992) R (1993-2014)	NO (1990-1992) IE (1993-2014)	NO (1990 – 1992) R (1993-2014)	NO		
4E Settlements	4E2 Lands converted to Settlements	4E2b Cropland converted to ST	NE	NE	NE	NO		
		4E2c Grassland converted to ST	R	NO	R	NO		
4F Other Uses	4F2 Lands converted to Other Uses	4F2b Cropland converted to OU	NO	NO	NO	NO		
		4F2c Grassland converted to OU	R	NO	R	NO		
4(II) Drainage and rewetting of Soils	4(II)B Cropland	4(II)B1 Organic Soils				NO	NO	
		4(II)B2 Mineral Soils			NO		NO	NO
	4(II)C Grassland	4(II)C1 Organic Soils				NO	NO	
		4(II)C2 Mineral Soils			NO		NO	NO
4(III) N2O	4(III)B	4(III)B1 CL						NE

Greece			CO$_2$ living biomass	CO$_2$ dead biomass	CO$_2$ mineral soil	CO$_2$ organic soil	CH$_4$	N$_2$O
Emissions from SOM mineralization	Cropland	remaining CL						
		4(III)B2 Lands converted to CL						R
	4(III)C Grassland	4(III)C1 GL remaining GL						NO
		4(III)C2 Lands converted to GL						NO
4(IV) Indirect N2O Emissions	4(IV)1 Atmospheric Deposition							NO
	4(IV)2 Drainage and Leaching							NE
4(V) Biomass Burning Emissions	4(V)B Cropland	4(III)B1 CL remaining CL	NO	NO			NO	NO
		4(III)B2 Lands converted to CL	NO	NO			NO	NO
	4(V)C Grassland	4(III)C1 GL remaining GL	NO	NO			R	R
		4(III)C2 Lands converted to GL	NO	NO			NO	NO

Italy

Italy			CO$_2$ living biomass	CO$_2$ dead biomass	CO$_2$ mineral soil	CO$_2$ organic soil	CH$_4$	N$_2$O
4A Forest Land	4A2 Lands converted to Forest Land	4A2a Cropland converted to FL	NO	NO	NO	NO		
		4A2b Grasslands converted to FL	R	R	R	NO		
4B Cropland	4B1 Cropland remaining Cropland		R	NO	NO	R		
	4B2 Lands converted to Cropland	4B2a Forest converted to CL	NO	NO	NO	NO		
		4B2b Grassland converted to CL	R	NO	R	NO		
		4B2c Wetlands converted to Cropland	NO	NO	NO	NO		
		4B2d Settlements converted to CL	NO	NO	NO	NO		
		4B2e Other Uses converted to CL	NO	NO	NO	NO		
4C Grassland	4C1 Grassland remaining Grassland		R	R	NA, NO	R		
	4C2 Lands converted to Grassland	4C2a Forest converted to GL	NO	NO	NO	NO		
		4C2b Cropland converted to GL	R	NO	R	NO		
		4C2c Wetlands converted to GL	NO	NO	NO	NO		
		4C2d Settlements converted to	NO	NO	NO	NO		

Italy			CO₂ living biomass	CO₂ dead biomass	CO₂ mineral soil	CO₂ organic soil	CH₄	N₂O
		Grassland						
		4C2e Other Uses converted to GL	NO	NO	NO	NO		
4D Wetlands	4 D22 Land converted to flooded land	4D222 Cropland converted to flooded land	R	NO	NO	NO		
		4D223 Grassland converted to flooded land	R	NO	NO	NO		
4E Settlements	4E2 Lands converted to Settlements	4E2b Cropland converted to ST	R	NE	R	NO		
		4E2c Grassland converted to ST	R	NE	R	NO		
4F Other Uses	4F2 Lands converted to Other Uses	4F2b Cropland converted to OU	NO	NO	NO	NO		
		4F2c Grassland converted to OU	NO	NO	NO	NO		
4(II) Drainage and rewetting of Soils	4(II)B Cropland	4(II)B1 Organic Soils				NO	NO	
		4(II)B2 Mineral Soils			NO		NO	NO
	4(II)C Grassland	4(II)C1 Organic Soils				NO	NO	
		4(II)C2 Mineral Soils			NO		NO	NO
4(III) N2O Emissions from SOM mineralization	4(III)B Cropland	4(III)B1 CL remaining CL						NO
		4(III)B2 Lands converted to CL						R
	4(III)C Grassland	4(III)C1 GL remaining GL						NO
		4(III)C2 Lands converted to GL						NO
4(IV) Indirect N2O Emissions	4(IV)1 Atmospheric Deposition							
	4(IV)2 Drainage and Leaching							
4(V) Biomass Burning Emissions	4(V)B Cropland	4(III)B1 CL remaining CL	R	NO			R	R
		4(III)B2 Lands converted to CL	NO	NO			NO	NO
	4(V)C Grassland	4(III)C1 GL remaining GL	R	NE			R	R
		4(III)C2 Lands converted to GL	NO	NE			NO	NO

Malta

Malta			CO$_2$ living biomass	CO$_2$ dead biomass	CO$_2$ mineral soil	CO$_2$ organic soil	CH$_4$	N$_2$O
4A Forest Land	4A2 Lands converted to Forest Land	4A2a Cropland converted to FL	NO	NO	NO	NO		
		4A2b Grasslands converted to FL	NO	NO	NO	NO		
4B Cropland	4B1 Cropland remaining Cropland		R	R	R	NO		
	4B2 Lands converted to Cropland	4B2a Forest converted to CL	NO	NO	NO	NO		
		4B2b Grassland converted to CL	IE	IE	IE	NO		
		4B2c Wetlands converted to Cropland	NO	NO	NO	NO		
		4B2d Settlements converted to CL	NO	NO	NO	NO		
		4B2e Other Uses converted to CL	NO	NO	NO	NO		
4C Grassland	4C1 Grassland remaining Grassland		NO	NO	NO	NO		
	4C2 Lands converted to Grassland	4C2a Forest converted to GL	NO	NO	NO	NO		
		4C2b Cropland converted to GL	NO	NO	NO	NO		
		4C2c Wetlands converted to GL	NO	NO	NO	NO		
		4C2d Settlements converted to Grassland	NO	NO	NO	NO		
		4C2e Other Uses converted to GL	NO	NO	NO	NO		
4D Wetlands	4 D22 Land converted to flooded land	4D222 Cropland converted to flooded land	NO	NO	NO	NO		
		4D223 Grassland converted to flooded land	NO	NO	NO	NO		
4E Settlements	4E2 Lands converted to Settlements	4E2b Cropland converted to ST	NO	NO	NO	NO		
		4E2c Grassland converted to ST	NO	NO	NO	NO		
4F Other Uses	4F2 Lands converted to Other Uses	4F2b Cropland converted to OU	NO	NO	NO	NO		
		4F2c Grassland converted to OU	NO	NO	NO	NO		
4(II) Drainage and rewetting of Soils	4(II)B Cropland	4(II)B1 Organic Soils			NO	NO	NO	
		4(II)B2 Mineral Soils			NO	NO	NO	NO
	4(II)C Grassland	4(II)C1 Organic Soils				NO	NO	
		4(II)C2 Mineral			NE, NO		NE,	NE

Malta			CO_2 living biomass	CO_2 dead biomass	CO_2 mineral soil	CO_2 organic soil	CH_4	N_2O
		Soils					NO	
4(III) N2O Emissions from SOM mineralization	4(III)B Cropland	4(III)B1 CL remaining CL						-
		4(III)B2 Lands converted to CL						NO
	4(III)C Grassland	4(III)C1 GL remaining GL						NO
		4(III)C2 Lands converted to GL						NO
4(IV) Indirect N2O Emissions	4(IV)1 Atmospheric Deposition							IE
	4(IV)2 Drainage and Leaching							IE
4(V) Biomass Burning Emissions	4(V)B Cropland	4(III)B1 CL remaining CL	NE	NE			NE	NE
		4(III)B2 Lands converted to CL	NO	NO			NO	NO
	4(V)C Grassland	4(III)C1 GL remaining GL	NO	NO			NO	NO
		4(III)C2 Lands converted to GL	NO	NO			NO	NO

Portugal

Portugal			CO_2 living biomass	CO_2 dead biomass	CO_2 mineral soil	CO_2 organic soil	CH_4	N_2O
4A Forest Land	4A2 Lands converted to Forest Land	4A2a Cropland converted to FL	R	IE (dead wood) R (litter)	R	NO		
		4A2b Grasslands converted to FL	NO R (- 2014)	IE (dead wood) NO (litter) (1990 - 1994); R (litter) –(1995 – 2014)	NO (1990 – 1994) R (1995 - 2014)	NO		
		4A2e Other land converted to forest land	R	IE (dead wood) R (litter)	R	NO		
4B Cropland	4B1 Cropland remaining Cropland		R	NO	NO (1990 - 1995) R (2014)	NO		
	4B2 Lands converted to Cropland	4B2a Forest converted to CL	R	R	R	NO		
		4B2b Grassland converted to CL	NO (1990 – 1994) R (1995 - 2014)	NO (1990 – 1994) R (1995 - 2014)	NO	NO		

Portugal			CO_2 living biomass	CO_2 dead biomass	CO_2 mineral soil	CO_2 organic soil	CH_4	N_2O
		4B2c Wetlands converted to Cropland	NO (1990 - 1994) R (1995 - 2014)	NO (1990 - 1994) R (1995 - 2014)	NO	NO		
		4B2d Settlements converted to CL	NO (1990-1994) R (1995 - 2014)	NO (1990 – 1994) R (1995 - 2014)	NO	NO		
		4B2e Other Uses converted to CL	R	R	R	NO		
4C Grassland	4C1 Grassland remaining Grassland		NO	NO	NO	NO		
	4C2 Lands converted to Grassland	4C2a Forest converted to GL	R	R	R	NO		
		4C2b Cropland converted to GL	R	R	NO	NO		
		4C2c Wetlands converted to GL	NO	NO	NO	NO		
		4C2d Settlements converted to Grassland	NO	NO	NO	NO		
		4C2e Other Uses converted to GL	NO	R	R	NO		
4D Wetlands	4 D22 Land converted to flooded land	4D222 Cropland converted to flooded land	NO (1990 - 1994) R (1995 - 2014)	NO (1990 - 1994) R (1995 - 2014)	NO (1990 - 1994) R (1995 - 2014)	NO		
		4D223 Grassland converted to flooded land	NO (1990 - 1994) R (1995 - 2014)	NO (1990 - 1994) R (1995 - 2014)	NO (1990 - 1994) R (1995 - 2014)	NO		
4E Settlements	4E2 Lands converted to Settlements	4E2b Cropland converted to ST	NO R (1991 - 2014)	NO R (1991- 2014)	NO R (1991 - 2014)	NO		
		4E2c Grassland converted to ST	NO R (1991 - 2014)	NO R (1991- 2014)	NO R (1991 - 2014)	NO		
4F Other Uses	4F1 Other Uses remaining Other Uses							
	4F2 Lands converted to Other Uses	4F2b Cropland converted to OU	NO R (1991 - 2014)	NO R (1991 - 2014)	NO R (1991 - 2014)	NO		
		4F2c Grassland converted to OU	NO R (1991 - 2014)	NO R (1991 - 2014)	NO R (1991 - 2014)	NO		
4(II) Drainage	4(II)B	4(II)B1 Organic				NO	NO	

Portugal			CO_2 living biomass	CO_2 dead biomass	CO_2 mineral soil	CO_2 organic soil	CH_4	N_2O
and rewetting of Soils	Cropland	Soils						
		4(II)B2 Mineral Soils			NO		NO	NO
	4(II)C Grassland	4(II)C1 Organic Soils				NO	NO	
		4(II)C2 Mineral Soils			NO		NO	NO
4(III) N2O Emissions from SOM mineralization	4(III)B Cropland	4(III)B1 CL remaining CL						NE
		4(III)B2 Lands converted to CL						R
	4(III)C Grassland	4(III)C1 GL remaining GL						NO
		4(III)C2 Lands converted to GL						R
4(IV) Indirect N2O Emissions	4(IV)1 Atmospheric Deposition							IE
	4(IV)2 Drainage and Leaching							IE
4(V) Biomass Burning Emissions	4(V)B Cropland	4(III)B1 CL remaining CL	NO	NO			R	R
		4(III)B2 Lands converted to CL	NO	NO			R	R
	4(V)C Grassland	4(III)C1 GL remaining GL	NO	NO			R	R
		4(III)C2 Lands converted to GL	NO	NO			R	R

Slovenia

Slovenia			CO_2 living biomass	CO_2 dead biomass	CO_2 mineral soil	CO_2 organic soil	CH_4	N_2O
4A Forest Land	4A2 Lands converted to Forest Land	4A2a Cropland converted to FL	NO	NO	NO	NO		
		4A2b Grasslands converted to FL	R	NA NO	R	NA NO		
4B Cropland	4B1 Cropland remaining Cropland		R	NA NO	R	R		
	4B2 Lands converted to Cropland	4B2a Forest converted to CL	R	R	R	NO		
		4B2b Grassland converted to CL	R	NO	R	NO		
		4B2c Wetlands converted to Cropland	NO	NO	NO	NO		
		4B2d Settlements converted to CL	R	NO	R	NO		
		4B2e Other Uses converted to CL	NO	NO	NO	NO		

Slovenia			CO_2 living biomass	CO_2 dead biomass	CO_2 mineral soil	CO_2 organic soil	CH_4	N_2O
4C Grassland	4C1 Grassland remaining Grassland		NA	NA	NA	NA		
	4C2 Lands converted to Grassland	4C2a Forest converted to GL	R	R	R	NA NO		
		4C2b Cropland converted to GL	R	NO	R	NO		
		4C2c Wetlands converted to GL	R	NO	R	NO		
		4C2d Settlements converted to Grassland	R	NO	R	NO		
		4C2e Other Uses converted to GL	R	NO	R	NO		
4D Wetlands	4 D23 Land converted to wetland	4D232 Cropland converted to flooded land	NO	NO	NO	NO		
		4D233 Grassland converted to wetland land	R	NO	R	NO		
4E Settlements	4E2 Lands converted to Settlements	4E2b Cropland converted to ST	R	NO	R	NO		
		4E2c Grassland converted to ST	R	NO	R	NO		
4F Other Uses	4F2 Lands converted to Other Uses	4F2b Cropland converted to OU	NO	NO	NO	NO		
		4F2c Grassland converted to OU	NO	NO	NO	NO		
4(II) Drainage and rewetting of Soils	4(II)B Cropland	4(II)B1 Organic Soils			NO	NO	NO	
		4(II)B2 Mineral Soils			NE	NE	NE	NE
	4(II)C Grassland	4(II)C1 Organic Soils			NO	NO	NO	
		4(II)C2 Mineral Soils			NO	NO	NO	NO
4(III) N2O Emissions from SOM mineralization	4(III)B Cropland	4(III)B1 CL remaining CL						NE
		4(III)B2 Lands converted to CL						R
	4(III)C Grassland	4(III)C1 GL remaining GL						NO
		4(III)C2 Lands converted to GL						R
4(IV) Indirect N2O Emissions	4(IV)1 Atmospheric Deposition							R
	4(IV)2 Drainage and Leaching							R
4(V) Biomass Burning Emissions	4(V)B Cropland	4(III)B1 CL remaining CL	NO	NO			NO	NO
		4(III)B2 Lands converted to CL	NO	NO			NO	NO

Slovenia			CO_2 living biomass	CO_2 dead biomass	CO_2 mineral soil	CO_2 organic soil	CH_4	N_2O
	4(V)C Grassland	4(III)C1 GL remaining GL	NO	NO			NO	NO
		4(III)C2 Lands converted to GL	NO	NO			NO	NO

Spain

Spain			CO_2 living biomass	CO_2 dead biomass	CO_2 mineral soil	CO_2 organic soil	CH_4	N_2O
4A Forest Land	4A2 Lands converted to Forest Land	4A2a Cropland converted to FL	R	R	R	NO		
		4A2b Grasslands converted to FL	R	R	R	NO		
4B Cropland	4B1 Cropland remaining Cropland		R	NE	R	NO		
	4B2 Lands converted to Cropland	4B2a Forest converted to CL	R	R	R	NO		
		4B2b Grassland converted to CL	R	R	R	NO		
		4B2c Wetlands converted to Cropland	NO	NO	NO	NO		
		4B2d Settlements converted to CL	NO	NO	NO	NO		
		4B2e Other Uses converted to CL	R	R	R	NO		
4C Grassland	4C1 Grassland remaining Grassland		NE	NE	NE	NO		
	4C2 Lands converted to Grassland	4C2a Forest converted to GL	R	R	R	NO		
		4C2b Cropland converted to GL	R	R	R	NO		
		4C2c Wetlands converted to GL	NO	NO	NO	NO		
		4C2d Settlements converted to Grassland	NO	NO	NO	NO		
		4C2e Other Uses converted to GL	NO	NO	NO	NO		
4D Wetlands	4 D22 Land converted to flooded land	4D222 Cropland converted to flooded land	R (1990-2000) NO (2001-2014)	R	R	NO		
		4D223	R (1990-	R	R	NO		

Spain			CO$_2$ living biomass	CO$_2$ dead biomass	CO$_2$ mineral soil	CO$_2$ organic soil	CH$_4$	N$_2$O
		Grassland converted to flooded land	2000) NO (2001-2014)					
	4 D23 Land converted to other wetland	4D232 Cropland converted to other wetland	IE (1990-2000) NO (2001-2014)	IE	IE	NO		
		4D233 Grassland converted to other wetland	IE (1990-2000) NO (2001-2014)	IE	IE	NO		
4E Settlements	4E2 Lands converted to Settlements	4E2b Cropland converted to ST	R	R	R	NO		
		4E2c Grassland converted to ST	R	R	R	NO		
4F Other Uses	4F2 Lands converted to Other Uses	4F2b Cropland converted to OU	NO	NO	NO	NO		
		4F2c Grassland converted to OU	R (1990-2000) NO (2001-2014)	R	R	NO		
4(II) Drainage and rewetting of Soils	4(II)B Cropland	4(II)B1 Organic Soils			NO	NO	NO	
		4(II)B2 Mineral Soils			NO	NO	NO	NO
	4(II)C Grassland	4(II)C1 Organic Soils			NO	NO	NO	
		4(II)C2 Mineral Soils			NO	NO	NO	NO
4(III) N2O Emissions from SOM mineralization	4(III)B Cropland	4(III)B1 CL remaining CL						NE
		4(III)B2 Lands converted to CL						R
	4(III)C Grassland	4(III)C1 GL remaining GL						NE
		4(III)C2 Lands converted to GL						R
4(IV) Indirect N2O Emissions	4(IV)1 Atmospheric Deposition							NO
	4(IV)2 Drainage and Leaching							R
4(V) Biomass Burning Emissions	4(V)B Cropland	4(III)B1 CL remaining CL	NE (1990) NE, IE (1991-2014)	NE (1990) NE, IE (1991-2014)			NE (1990) NE, IE (1991-2014)	NE (1990) NE,IE (1991-2014)
		4(III)B2 Lands converted to CL	NE NE, IE (1991-	NE NE, IE (1991-			NE NE, IE (1991-	NE NE, IE (1991-

Spain			CO$_2$ living biomass	CO$_2$ dead biomass	CO$_2$ mineral soil	CO$_2$ organic soil	CH$_4$	N$_2$O
			2014)	2014)			2014)	2014)
	4(V)C Grassland	4(III)C1 GL remaining GL	NE	NE			R	R
		4(III)C2 Lands converted to GL	R	R			R	R

Annex II: List of Official Country Submissions Used in this Report

Country	Years	Document / Submission Date
Croatia	1990-2014	NIR, 15th June 2016 CRF, 15th June 2016
Cyprus	1990-2014	NIR, 31th October 2016 CRF, 3rd November 2016
France	1990-2014	NIR, 15th June 2016 CRF (KP), 7th November 2016
Greece	1990-2014	NIR, 31sh May 2016 CRF, 14th October 2016
Italy	1990-2014	NIR, 15th April 2016 CRF, 15th April 2016
Malta	1990-2014	NIR, 12th October 2016 CRF, 3rd December 2016
Portugal	1990-2014	NIR, 27th May 2016 CRF, 22nd December 2016
Slovenia	1986-2014	NIR, 14th April 2017 CRF, 12th April 2016
Spain	1990 - 2014	NIR, 13th June 2016 CRF, 26th November 2016

All documents were retrieved from the UNFCCC official website at

http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/9492.php

Annex III: Project MediNet

Project focus

Improve the transparency, consistency, comparability, completeness and accuracy of cropland and grassland reporting of emissions and removals in Mediterranean Countries

Project objectives:

1. Compilation and systematization of existing knowledge and data with relevance for reporting croplands and grasslands emissions in Mediterranean conditions, in particular for mineral soil and aboveground biomass of perennial crops
2. Sharing experiences and approaches in reporting croplands and grasslands emissions in Mediterranean conditions
3. Exploring the possible use of common methods and/or reference data and/or data sets for reporting purposes
4. Identifying information and research gaps
5. Enhance the participation and involvement of agriculture stakeholders in climate change mitigation and adaptation

Actions and means involved

To accomplish its objectives, MediNet will involve public Institutions and Universities from different countries in the Mediterranean basin working specifically on themes related to Agriculture and emissions and removals reporting. For this purpose, different Actions of the project will involve both the Institutions with the official responsibilities of reporting on Cropland and Grassland emissions and removals at National level, and the Institutions/Universities working in specific themes related to Grassland and Cropland management.

The establishment of the MediNet network, involving Italy and Portugal as beneficiaries of the project, and Spain, Greece, France, Malta, Cyprus, Croatia, Slovenia as stakeholders, will allow identifying, sharing and maximising the potential of existing knowledge that can be used for reporting purposes. The identification of gaps in data at National level and the adoption of solution to fill these gaps coming from the experience gained by other Mediterranean counties is an aim of the MediNet project. The main objective of the MediNet network is to increase the knowledge on the effect that different management activities applied to Croplands (e.g. conventional agriculture, biological, reduced tillage, other) and Grasslands (e.g. grazed, mowed, sown, other) have on the soil organic carbon (SOC) and biomass C stocks.

This represents a crucial and necessary point, needed to allow for an identification of new and more specific factors to be related to different management activities for Cropland and Grassland management in the Mediterranean area. As a result, more accurate, complete and consistent estimates of C gain and losses due to emission and removal from Cropland and Grassland will be provided at National level. The sharing of reporting experiences and of specific solutions for reporting (i.e., methodologies, activity data and emission factors) will also allow for increased comparability across Mediterranean Countries.

A preliminary action characterizes the Institutional arrangements (Institution and data provision) for each country involved in MediNet (Actions A.1). Subsequently, the preliminary Action A.2 will select the types of Management Systems for Cropland and Grassland to be used in subsequent Actions. The core of MediNet will be expressed through Actions A.3, A.4 and A.5, that will specifically identify the

type of data and methodologies present in the different Institutions/Universities necessary to report emissions and covering three main topic areas:

- Activity data for Cropland and Grassland under different management types and the area that is annually subject to a land use/management change: methodologies and data sharing;
- Assessment of the contribution of the above and below ground biomass of perennial crops to annual Carbon gains and losses: data available and gaps.
- Soil organic carbon stock and variations in mineral soils under different management options for Cropland and Grassland: data available and gaps;

To accomplish the purposes of MediNet, specific workshops will be held during the course of the project involving both the Institutions doing the emission & removal estimations and the Institutions/Universities working on Cropland and Grassland related themes. People from other LIFE and non-LIFE projects will be also invited so to possibly increase the exchange of data and of experiences. Specifically, the workshops will follow the specific themes treated in Actions A.3, A.4 and A.5, and will be focused on: a) Cropland and Grassland areas that are subject to a change in management; b) SOC data for the different types of management used in Cropland and Grassland; c) contribution of above ground biomass and deadwood from perennial crops. The workshops are included in the implementation Actions rather then in the communication Actions since they aim specifically at allowing for a wider exchange of data, rather than on communicating project results.

An important part of the project is devoted to increase project visibility and in sharing of information among partners and stakeholders. A project website (Action B1) will be created soon after the beginning of the project to specifically widespread information useful for stakeholders (e.g. Institutions) and the general public. To allow information to be spread widely a Facebook page with the LIFE logo will be also created allowing for a wider visibility of the proposed Actions and of the project results (Action B1). Twice per year, the status of the progress made on the different themes treated by the project will be published on the webpage.

Brochures reporting the results/decisions of the specific workshops will be made available soon after their conclusion on the project website. Networking with other projects will also represent an important part of the project (Action B2) allowing collecting information useful for the project.

A Farmer's day (Action B3 and B4) will be organized in each of the two countries (Italy and Portugal) to involve farmers and provide capacity building on agriculture and climate change, the opportunities for improved climate management practices in each of the Rural Development Programmes and share information on specific themes such has the effectiveness of the application of good managements practices (e.g. reduce tillage; organic fertilizers) aimed at soil conservation and to increase soil fertility. Questionnaires will be spread among farmers so to evaluate the uptake and quality of implementation of these practices. The involvement of stakeholders in those workshops, particularly farmers and/or their representative organisations, represents a crucial and fundamental part of the project. All the outputs of the farmer's day will be available on the website of the project (Action B1). A Layman's report (Action B5) and Board Notices (Action B6) will be also performed so to allow for a wider visibility of the project structure and its results, particularly among the general public.

Expected results

The main results expected at the end of the project are the following:

1. Increased knowledge on the soil organic carbon data for at least the top 30 cm (if possible 50 or 100 cm depth) of mineral soil for different crops/grassland management types from each Mediterranean country involved in MediNet. A database will be created to collect all the information correlating the average SOC content and stock to the different management activities applied for Cropland and Grassland.

2. Improved default emission factors in SOC as a result of land management change in Cropland and Grassland for use in Mediterranean conditions, to replace the IPCC tier 1 default factors and to increase the number of management practices that are currently used for reporting purposes at National level.

3. Increased knowledge on the contribution from the above ground biomass of perennial crops and from deadwood to annual emissions and removals. A database will be created to collect all the information and to relate the carbon in the aboveground biomass of perennial crops to the different management activities applied for Cropland and Grassland.

4. Creation of a network of stakeholders to be used for monitoring the agriculture contribution to climate change in the Mediterranean area.