AGROSTRAT PROJECT - LIFE11 ENV/GR/000951

Central Management & Monitoring System

# User Guide

CENTRAL MANAGEMENT & MONITORING SYSTEM

# User Guide

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# Introduction

The "Central Management & Monitoring System" (CMMT) is a tool designed and developed in the framework of the Agrostrat project (LIFE11 ENV/GR/000951) aiming to enhance local authorities, stakeholders or other interested parties to screen Pistachia vera L. cultivated areas, identify potential risky conditions and proceed to detailed and continuous monitoring of these areas.

The CMMT web application combines the usability of Microsoft .NET framework with the stability and flexibility of Javascript and Google Maps API. It features a rich web-interface, and through the Bootstrap framework provides integration from phones to tablets to desktop platforms. Most components of the CMMT system are considered closed source; however, the web application itself can be used or downloaded freely from the website of the Agrostrat project.

This document, the CMMT User Guide, describes how to use the system from a user's viewpoint.

# Basics

This guide is intended for users of the CMMT system. We describe how to use the web-based interface of the web application.

## What is the CMMT?

In short, the CMMT web application is an online tool, integrating a Geographic Information System (GIS), which can be accessed through a web browser. Aimed at individual or corporate users, agricultural cooperatives, public entities or local authorities, the CMMT has all the basic features for the effective management and monitoring of Pistachia vera L. cultivated areas, such as:

- Management of cultivated areas (fields); basic Create/Read/Update/Delete (CRUD) operations on chemical analysis data for soil, irrigation water, compost and other organic additives (measurements)
- Evaluation of the quality of soil, irrigation water, composts or organic wastes of cultivated areas measurements
- Fertilization consultancy and advisory based on chemical analysis data
- Temporal monitoring of cultivated areas; monitoring and assessment of principal soil indicators through intelligible charts
- Statistical analysis of cultivated areas on a spatial scale; map visualization of cultivated areas status

Next to these basic features, the CMMT also offers advanced collaboration features. Individual users such as farmers are capable of requesting certain directives and guidelines about their cultivated areas by sending over the respective chemical analyses, through the "Cultivation Management Software" (CMS). Thus, the CMMT is able to collect data and provide feedback and updated information regarding guidelines that farmers have to take in account for sustainable cultivation of pistachio trees.

The web application is a very easy to use and freely available platform, either directly through the already existing CMMT web application of the Agrostrat project, upon contacting with Agrostrat for login account, or by installing the system (Web Deploy) to your own server. Specific information for above actions is provided further below.

## CMMT requirements

In order to use the CMMT, you only need any modern browser that supports HTML5. For installing the CMMT web application in your server (Web deploy) you need the following:

- Windows Server operating systems: 2008, 2008 R2, 2012, 2012 R2 (x86/x64)
- IIS 8
- .NET 4.5
- SQLEXPRESS (2008 or above)

## Logging in

To login to the CMMT, point the browser to the URL supplied by your local CMMT system administrator. By default, this URL will look like:

http://LOCAL_DOMAIN_NAME/Account/Login

For the existing Agrostrat project's CMMT, the URL is:

http://cmmt.agrostrat.gr/Account/Login

The CMMT login screen will appear when the connection succeeded, as shown in Figure 1. The login credentials can be obtained by your local CMMT system administrator. These by default consist of:

- A username
- A password

As a security measure, all characters will be displayed as dots, when the password is entered. Click "Log in" to log in to the CMMT system.

**Note**

The CMMT web application is available in Greek and English. The preferred language can be set and changed anytime from the language button on the "Main menu". Please refer to section "Changing the language" for more information.

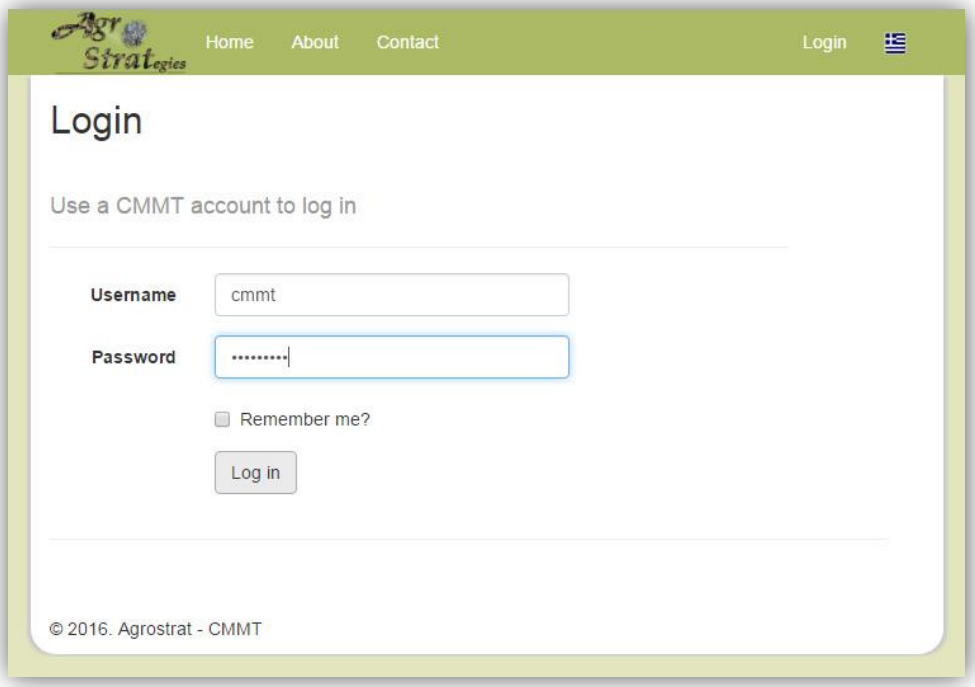



Figure 1. The CMMT login screen

## CMMT overview

The CMMT web application supports in a comprehensible way all features described in the beginning of the section. All features use the same interface style and elements, so a user can quickly find his or her way around in each of them. Each feature will be covered in this manual in its own section.

To begin with, the CMMT user, after logging in, will be presented with the main (home) page, as illustrated in Figure 2. The CMMT main page can be divided into three main areas:

- **Main screen (1)**: Depending on the action selected in the respective menus, the main content of the corresponding page is shown. For example, when the "Notifications" link has been selected, the notifications viewing area will be shown; when the fields "Monitoring" link has been selected, the respective view area of field measurement data temporal monitoring will be shown, etc.
- **Main menu (2)**: The "Main menu" contains links to all basic functions of the CMMT application; "Home" link, redirects the user to the main page where main actions, measurement "management", "monitoring" and "analysis" are possible. The "About" and "Contact" links provides information about the Agrostrat project and the CMMT system. The "Notifications" link provides information of incoming measurement data from the CMS. The "Manage" link has a drop-down option▼, which allows quick access to "Shortcut menu" items.
- **Shortcut menu (3)**: As its name implies, the "Shortcut menu" contains shortcuts to the various management features of the CMMT; "Users" or "Account" management, depending on the role of the logged in user; "Measurements" and "Notifications" management. For the convenience of the

user, shortcuts to "Field monitoring" and "Measurement Analysis" main features are available as well. The "Manage" shortcut menu also shows the username of the currently logged in user.

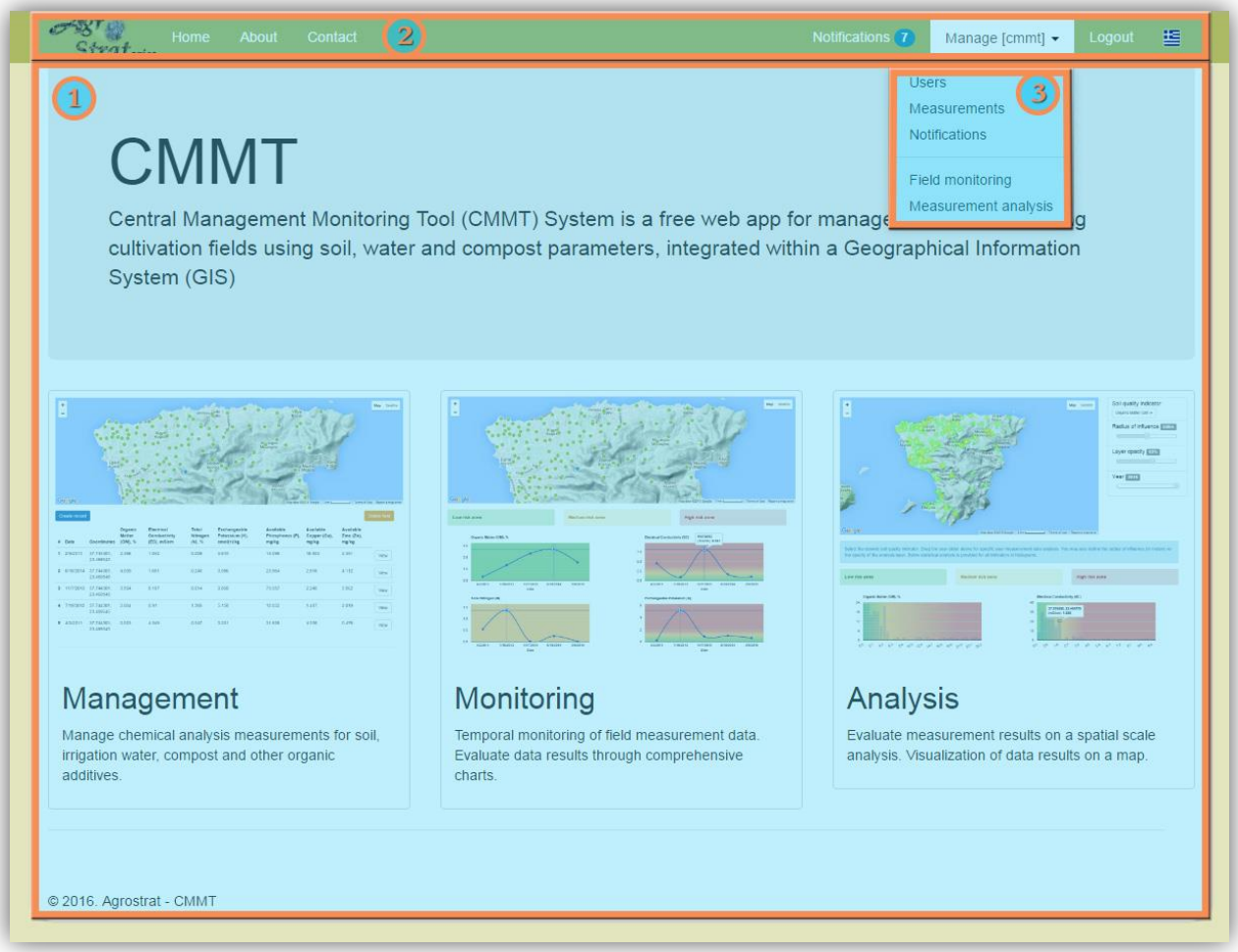
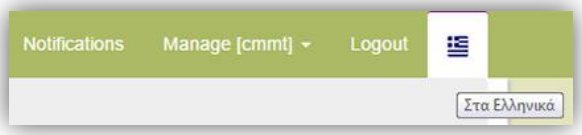


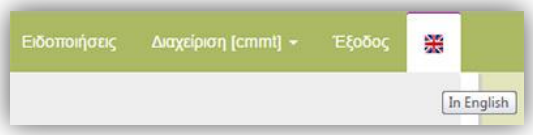

Figure 2. The main areas of CMMT

In the next sections, we will illustrate all main features of the CMMT system.

## Changing the language

The CMMT is available in Greek and English language. You may change the language anytime, by selecting the corresponding "flag" button from the "Main menu" **(2)**, as illustrated in the figures below.



## Logging out

Logging out from the CMMT system can be done by selecting on the "Logout" link in the top right corner of the "Main menu" **(2)**.

# Users/Account management

One of the important features of CMMT is the ability to control how and what users can access. CMMT allows you to setup three different kinds of users or user "Roles":

- **Administrator**: CMMT administrators are able to have the overall supervision of the system, such as CRUD operations on users or data records (cultivated areas, corresponding chemical analyses etc.) as well as make system configuration changes.
- **Editor**: CMMT editors are able to make CRUD operations on data records but not on CMMT users.
- **User**: CMMT users are able only to view data records.

All main CMMT features (data Management, Monitoring and Analysis) are available for all types (roles) of users.

## Users/Account management overview

By selecting "Users" or "Account" from the "Manage" shortcut menu **(1)**, the respective CMMT user is displayed with the account(s) management screen, as illustrated in Figure 3.

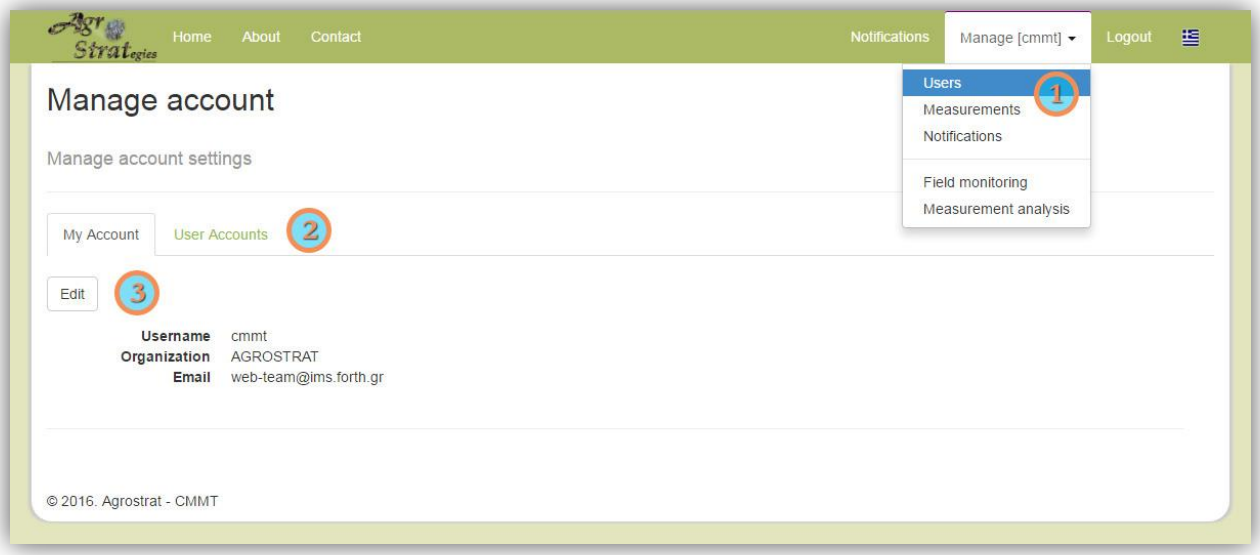



Figure 3. Users/Account management main screen

In the example of Figure 3, logged in user "cmmt" has an administrator role. Users are able to view "My account" tab **(2),** independently of role assigned. Users can modify/update their credentials (username, organization, email, and password) by clicking on the "Edit" button **(3)**.

**Note**

"User Accounts" tab is available for administrators only **(2)**, Figure 3.

## Administrator actions

Since several CMMT (server) systems can be installed (and, thus, available for the CMS data upload feature), administrators need to choose which one of these settings has to be applied (name, country, GIS-LIS service, etc.), by selecting the corresponding "CMMT" server from the dropdown list available in the administrator's settings **(3)**.

**Note**

If installing a CMMT web application to your own server (Web deploy), you need to contact with Agrostrat project (Section "Providing feedback about CMMT"), in order for the CMMT to be available in the administrator's and the CMS settings.

Administrator users are capable of CRUD operations on CMMT users, as illustrated in Figure 4 below.

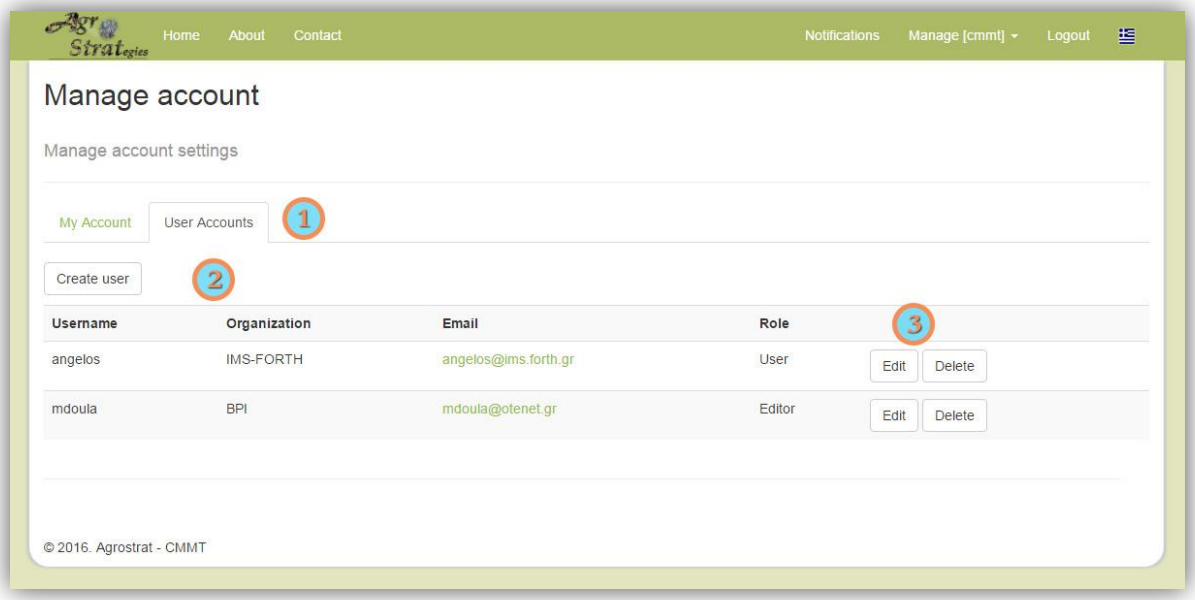



Figure 4. CRUD operations on CMMT users

An administrator can view all available CMMT users by selecting the "User Accounts" tab **(1)**. Administrators are able to create **(2)**, edit or delete **(3)** CMMT users. On user creation or editing actions, an administrator can also select a specific coverage area for the user, by using the rectangle on the map, as illustrated in Figure 5 below.

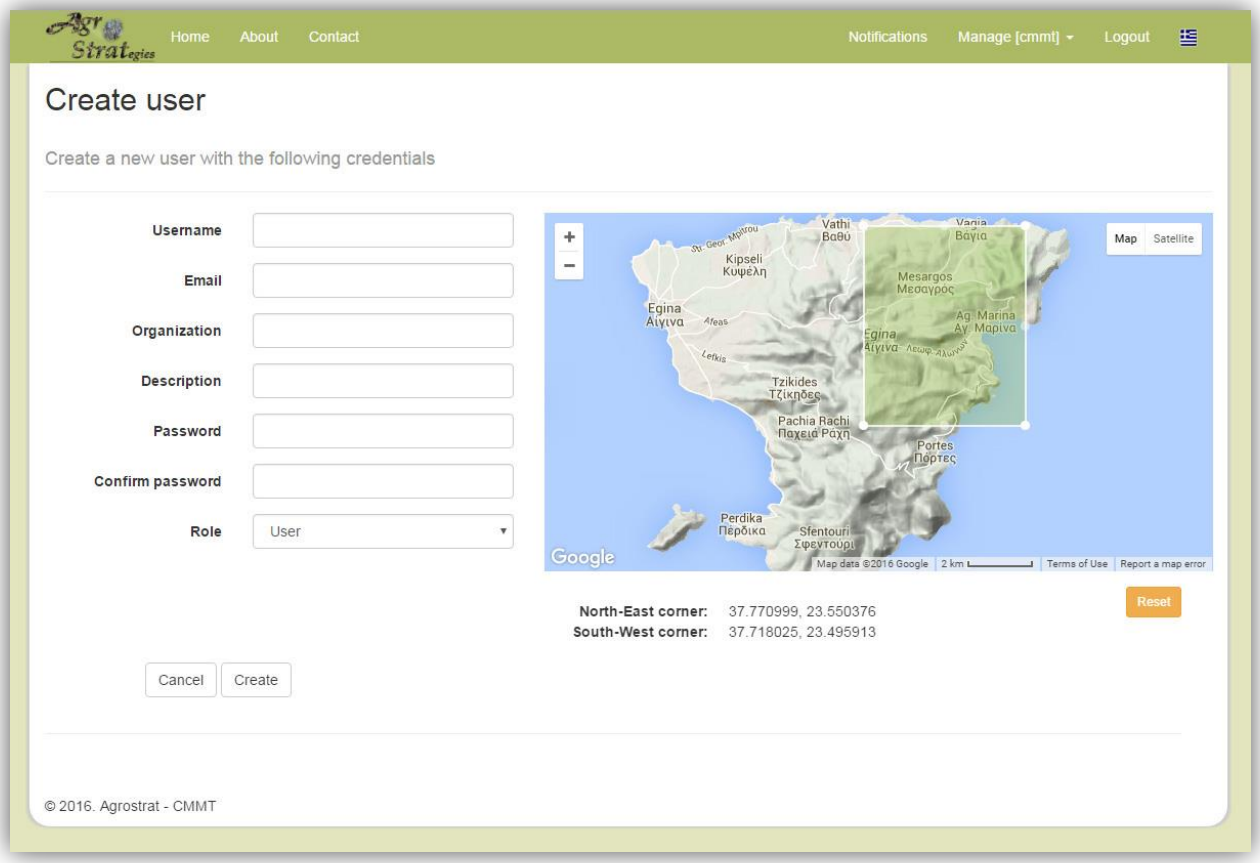



Figure 5. Selecting a specific coverage area for a user

# Notifications

The CMMT system and the CMS developed in the framework of the Agrostrat project, use a "client-server model" architecture, where software (client) users can communicate with the system (server). In such a way, individual users, such as farmers or landowners, can upload their fields and corresponding measurement data to the CMMT system through the CMS and request directives and guidelines about their cultivated fields. Whenever a cultivated field (with its corresponding measurement data), along with the individual user's information and request, is sent to the CMMT system, a "notification" is created.

Importantly, a notification includes field information with its corresponding data measurement(s) and it is visible only to specific CMMT users, depending on their specified coverage area (bounds), as illustrated in

Figure 5. When new (unread) notifications are available, their number is indicated accordingly in the "Main menu", as illustrated on the right.

## Notifications overview

"Notifications" page is accessed either from the "Main menu" or from the "Shortcut menu", by selecting the corresponding link (Figure 2). Notifications main screen is illustrated in Figure 6 below.

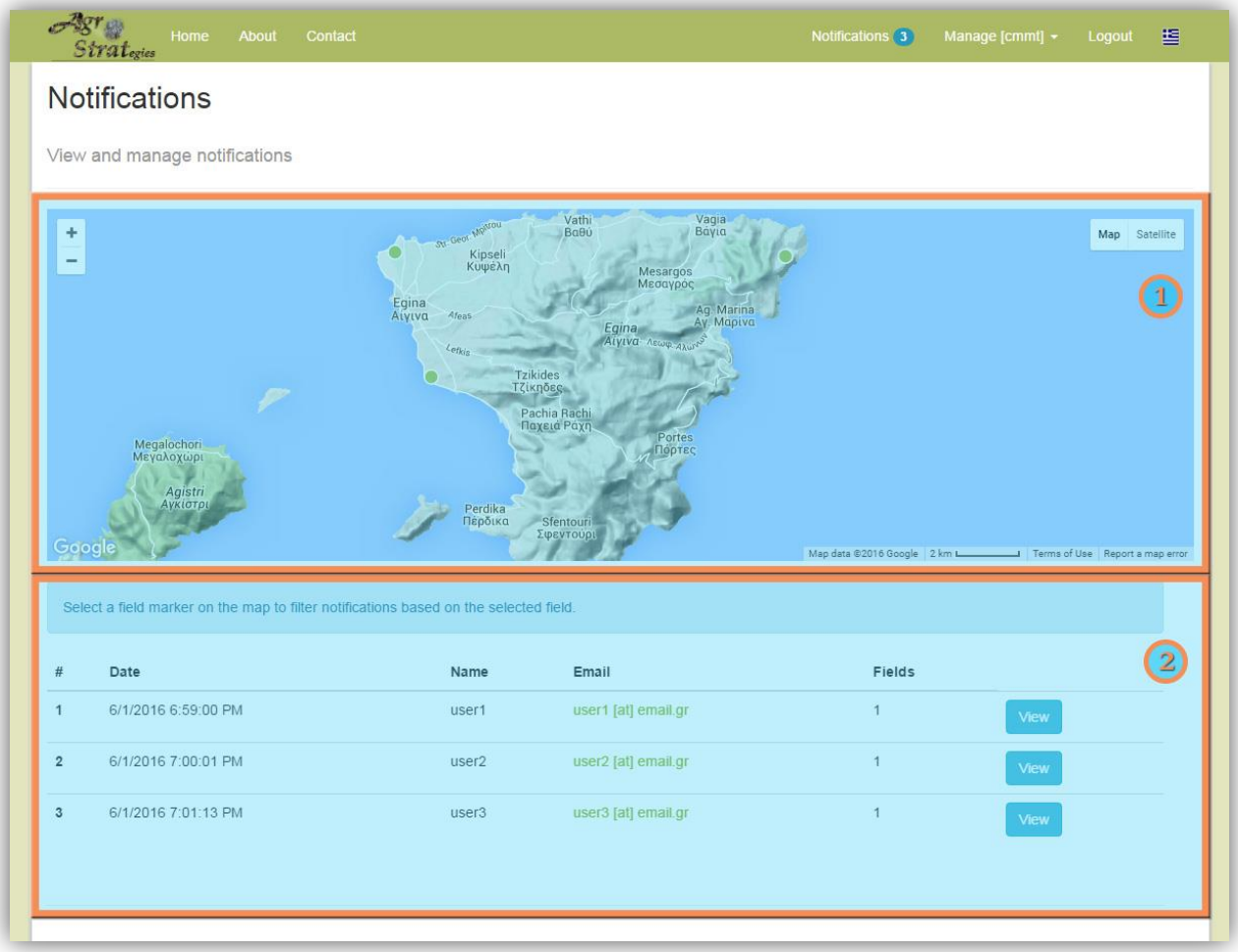



Figure 6. Notifications main screen

There are two main areas: the map **(1)**, where field locations can be identified as (green) markers, and the notifications list **(2)**, where incoming notifications are briefly noted. Notifications can be filtered by field, by selecting the corresponding field marker on the map. Notification data page can be accessed by clicking on the "View" button. When CMMT users click on an email link **(2)**, their default e-mail application will launch and a blank e-mail addressed to the specified email account will open up, in order to respond, if necessary.

**Note**

If a notification is already viewed (read) by a CMMT user then View turns into View

If a response to a notification is also sent (by email), then View turns into View ✉ (notification status need to be set as "Replied", see the following section)

## Notification data

When a CMMT user clicks on the "View" button of a specific notification in the list (Figure 6), the corresponding notification's data main screen is displayed, as illustrated in Figure7 below.

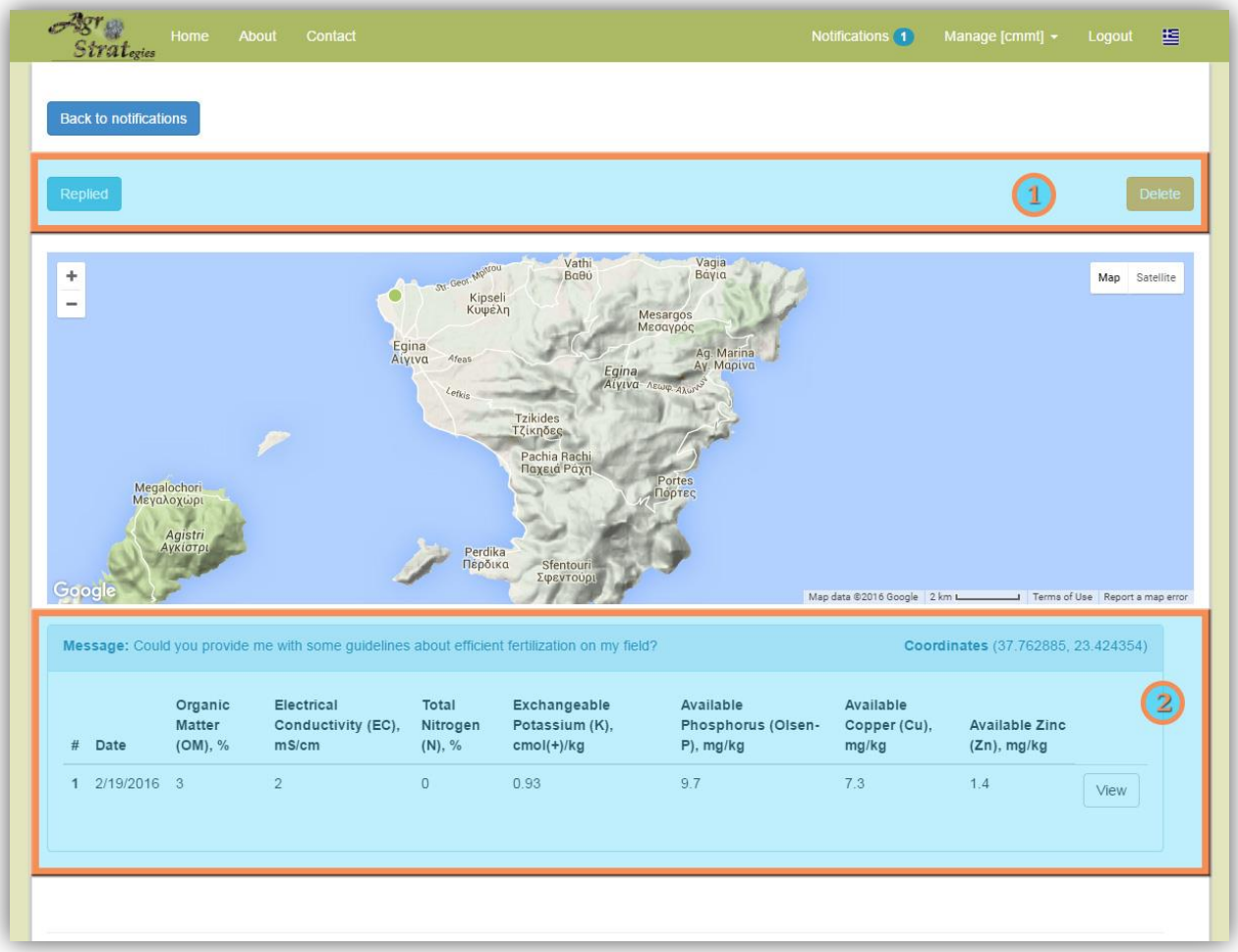



Figure 7. Notification data main screen

There are two main areas in this screen: the area on top of the screen **(1)**, where the CMMT user can change the status of the corresponding notification as "Replied" (or not), or even to "Delete" it, by clicking on the corresponding button, and secondly, the notifications daat area **(2)**. The status of the notification need to be changed only if the user has sent a response (by email) to the corresponding notification's email account

**Note**

While a user may delete a notification, it can be still visible to other CMMT users (if they have not deleted it as well). Only CMMT users with "Administrator" role can permanently delete a notification from the system.

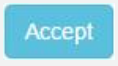
In the notifications data area **(2)**, relevant information about notification's message (if any provided), field coordinates and area (as a tooltip on the field marker on the map), and corresponding measurements' date and major soil indicator values, are displayed as a list. A notification's measurement (data) page can be accessed by clicking on the "View" button for a specific field measurement on the list.

## Notification measurements

When a CMMT user clicks on the "View" button of a specific notification's measurement in the list (Figure 7), the corresponding measurement data main screen is displayed, as illustrated in Figure 8.

There are three main areas. The first one is the area on the top of the screen **(1).** Here the user can "accept", that is, to save the respective notification's measurement to the system, by clicking on the corresponding button on the left. The user may also view the suggested by the system "Evaluation" or "Advisory" for the respective chemical analysis data, by clicking on the corresponding buttons on the right. For detail information about the two last actions, see the corresponding sections described further on.

**Note**

If a notification's measurement is saved to the system then 

turns into


Also in the notification's measurements list **(2)** (Figure 7)

turns into

for the corresponding measurement.

In the second area **(2)**, the notification's measurement data, such as cultivation type and measurement date are displayed. Moreover, the different data entry's subject categories are displayed as tabs, such as field information, soil, water and organic material measurement data. By selecting one of these tabs, the corresponding information is displayed in area **(3)**. By default, the "Field information" tab is selected in area **(2)**, while the corresponding information such as field coordinates and area is displayed in area **(3)**. For the particular subject category (tab), the estimated land area of the field is shown with green color on a map (considering that the area is a circle with field coordinates as a center).

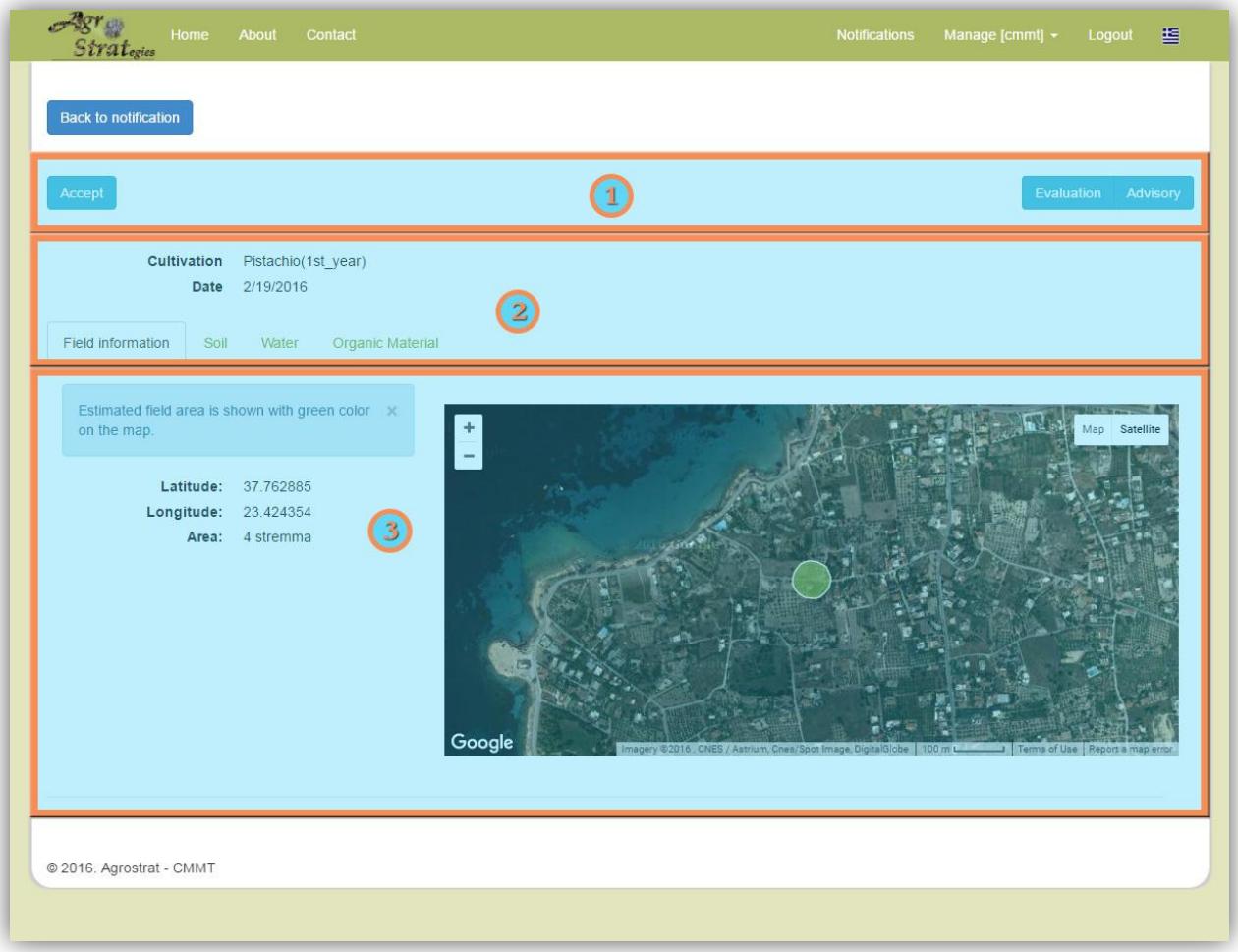



Figure 8. Notification's measurement data main screen

# Data management

Fields and their corresponding measurements management, is one the main features of the CMMT system. Basic CRUD operations on chemical analyses data and cultivated fields allow CMMT users to manage efficiently system's data records in a friendly and easy-to-use web-GIS interface. Moreover, evaluation of the quality of soil, irrigation water, composts or organic wastes of specific cultivated areas, as well as fertilization consultancy and advisory based on specific chemical analysis data, allows system users to detailed monitoring of these areas and identification of potential risky conditions.

## Data management overview

CMMT data management page is accessed either from the "Manage" shortcut menu by selecting the "Measurements" link, or by the CMMT home page by selecting the "Management" link on the "Main screen" (Figure 2). Data management main screen is illustrated in Figure 9 below.

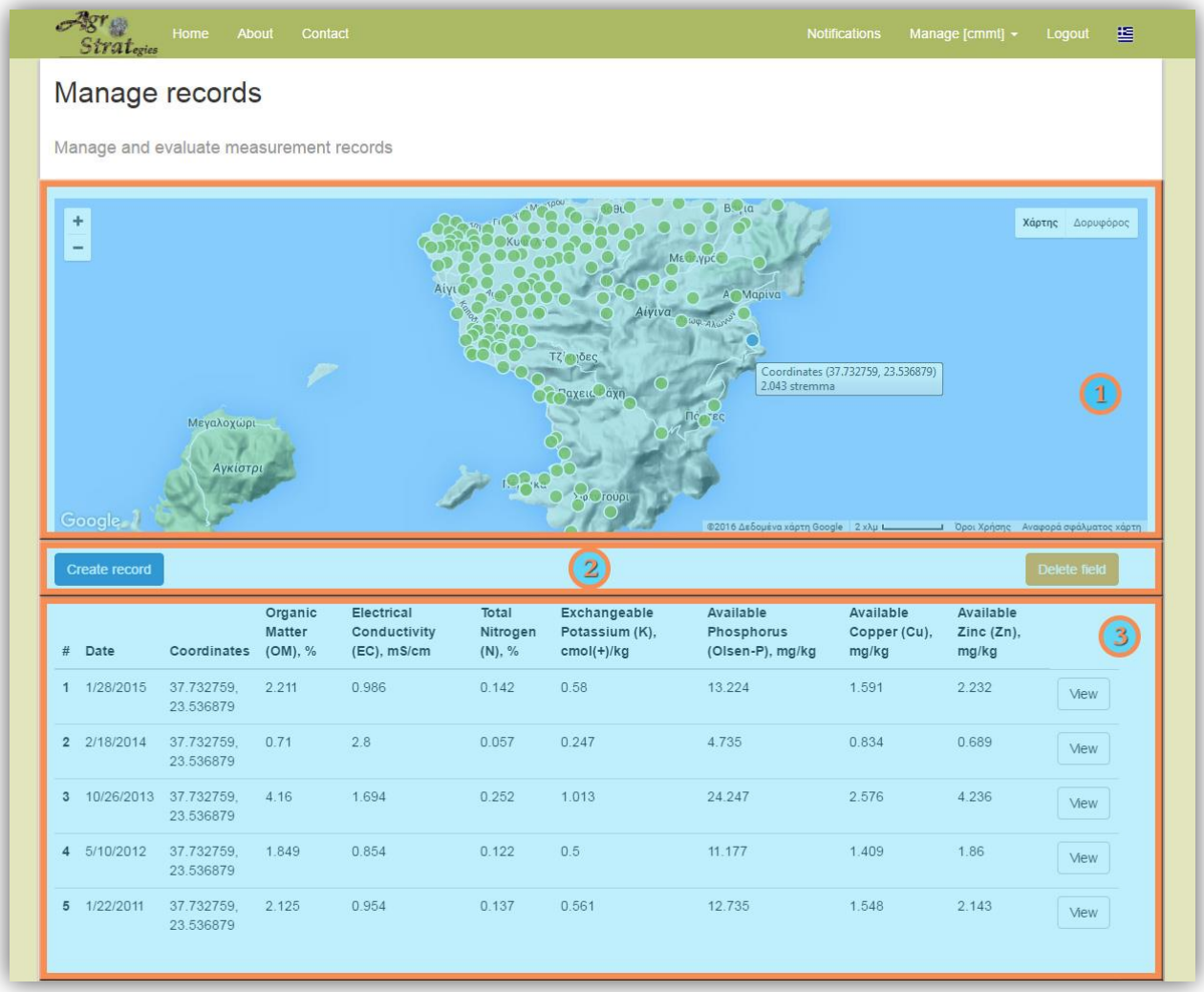



Figure 9. Data management main screen

Again, there are three main areas here: the first one is the map area on the top of the screen **(1).** Here all existing fields in the CMMT database are displayed as (green) markers on a map. In the second area **(2),** the respective CMMT user is provided with certain actions. The user can create a new field or measurement (or both), by clicking on the "Create record" button on the left, or delete the selected field on the map (blue marker), by clicking on the corresponding "Delete field" button on the right.

**Note**

Data management page's actions area **(2)** is not available for simple CMMT users ("User" role).

The third area is the measurements list **(3)**, where existing measurements are briefly noted. Measurements are sorted by date (ascending), by default. Moreover, measurements can be filtered by field, by selecting the

corresponding field marker on the map, as illustrated in Figure 9. Finally, measurement data page can be accessed by clicking on the "View" button of the respective measurement in the list **(3)**.

## Create measurement

When a CMMT user clicks on the "Create record" button on the CMMT data management main screen (Figure 9), the "Create measurement" main screen is displayed, as illustrated in Figure10 below.

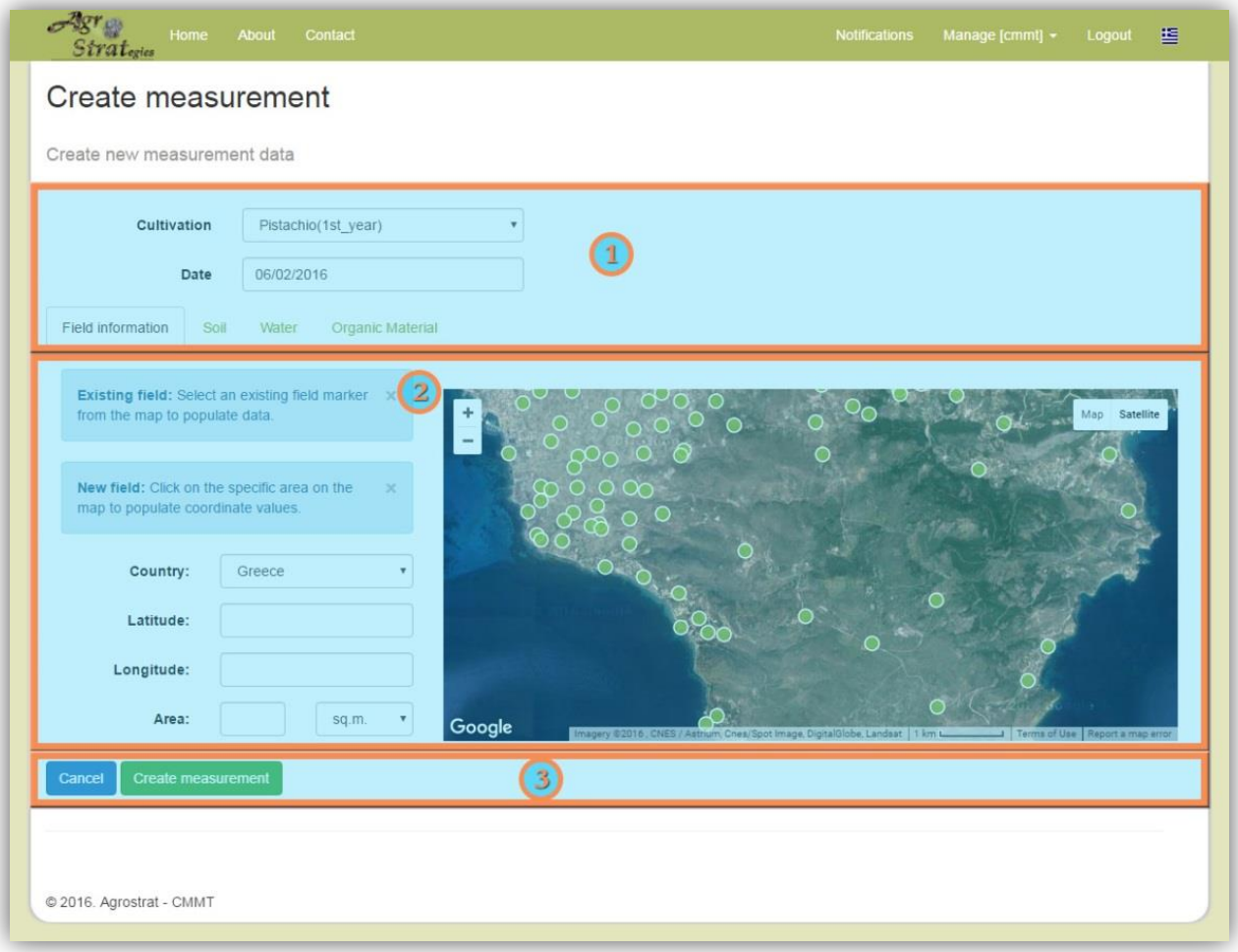



Figure 10. Create measurement data main screen

The main screen is divided in three main areas: the first one is the area on the top of the screen **(1)**. In this area, general measurement data need to be filled in; measurement cultivation type and date. Moreover, different measurement's subject categories are displayed as tabs, such as field information, soil, water and organic material data. By selecting one of these tabs, the corresponding input data fields need to be populated are displayed in the main area **(2)**. By default, the "Field information" tab is selected.

In the third area **(3)**, the user can post the inserted measurement data to the system, by clicking on the corresponding "Create measurement" button, or "Cancel" the measurement creation process and be redirected to the data management main screen (Figure 9).

## Add cultivated area information

The CCMT user needs to select the "Field information" tab, if not already selected (bottom of area **(1)** of Figure 10). Respective field information need to be inserted by the user is:

- the country the field is located
- specific field coordinates (i.e., latitude and longitude in WGS84)
- the actual cultivated area (provided in several units, square meter, hectare, or stremma)

If the user does not know the exact field coordinates, a map is available on the right of the main area **(2)** (Figure 10) in order to assist the user locating the area and automatically populate corresponding coordinate fields by clicking on the specific area on the map. If the field already exists in the system, the user needs only to locate and select the corresponding field marker on the map.

## Add soil, water and organic material data

The CCMT user needs to select the corresponding tab for "Soil", "Water" or "Organic material" data input (bottom of area **(1)** of Figure 10). Corresponding data input fields for each measurement subject category are provided in several unit formats for the convenience of the user, depending on the chemical analyses parameters unit format available. There are more than a hundred input parameters provided for the user to populate, depending on the chemical analyses parameters available.

**Note**

For the "Soil" (tab) data input, in case no soil chemical analysis is available for a specific field location, CMMT system can populate soil parameter values automatically from the GIS-LIS (Agrostrat project, Action A3), if these are available for the corresponding field location. This is possible by clicking on the corresponding button on the top of the main area **(2)**,


By clicking the corresponding "Create measurement" button, the user can post the inserted measurement data to the system. If valid measurement data are posted , a success message will be displayed, or an explanatory error message otherwise.

## View/edit measurement

The CMMT user can view measurement data page by clicking on the "View" button of the respective measurement on measurements list area (3) of the data management page (Figure 9).

Measurement data main screen is illustrated in Figure 11 below. Same as before, the different measurement's subjects are displayed as tabs, such as field information, soil, water and organic material data. By selecting one of these tabs, the corresponding information available is displayed.

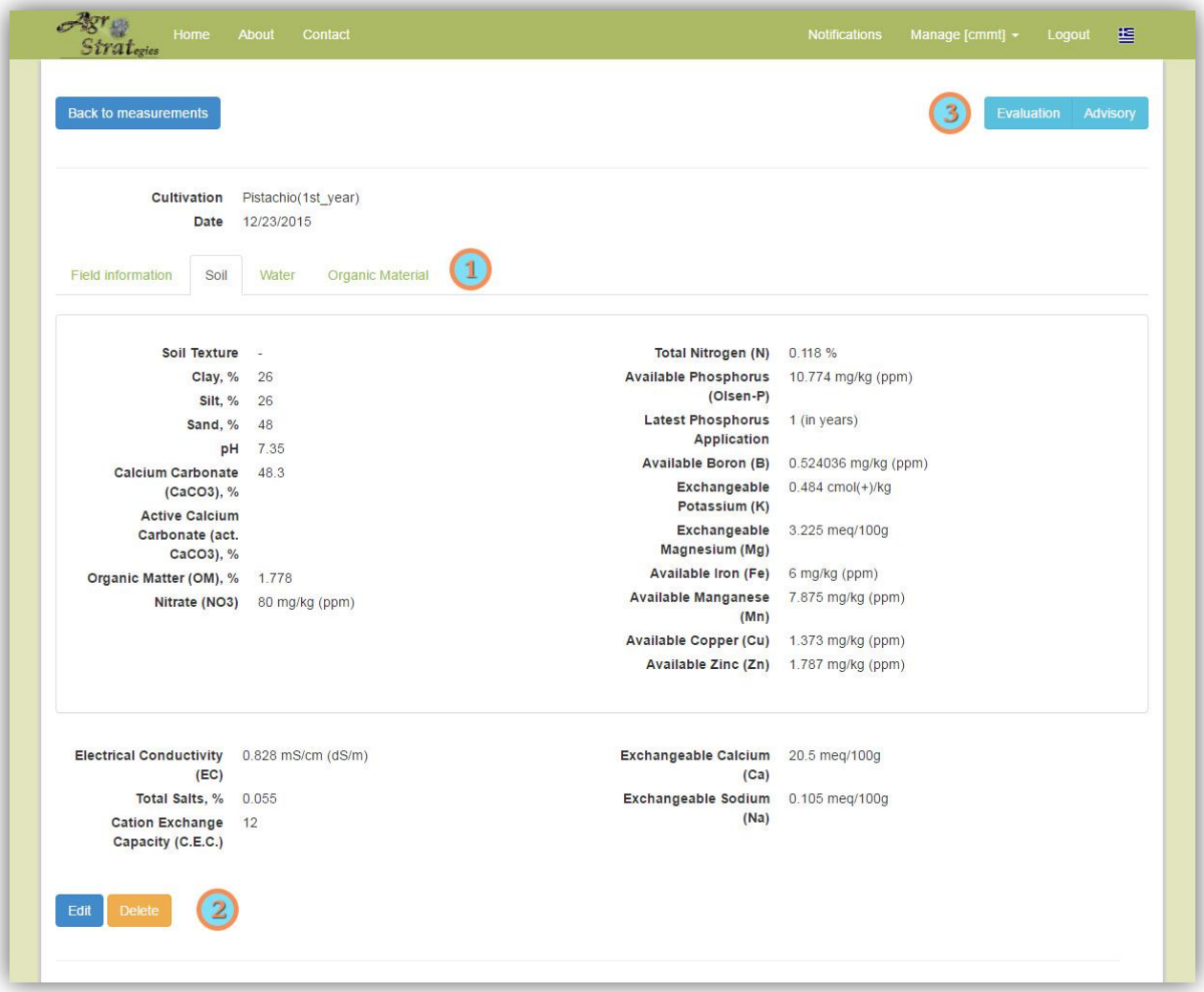



Figure 11. Measurement data main screen

As you may have already noticed, the measurement data main screen is similar to the one of the Notification's measurement data main screen (Figure 8). However, edit and delete actions are now available **(2)**, since the respective measurement now exists in the system's database.

**Note**

"Edit" and "Delete" actions **(2)** are not available for simple CMMT users ("User" role).

## Evaluation

From the measurement data main screen (Figure 11) the CMMT user can view the suggested by the system "Evaluation" for the respective chemical analysis data, by clicking on the corresponding button **(3)**. The corresponding "Evaluation" page is illustrated in Figure 12 below.

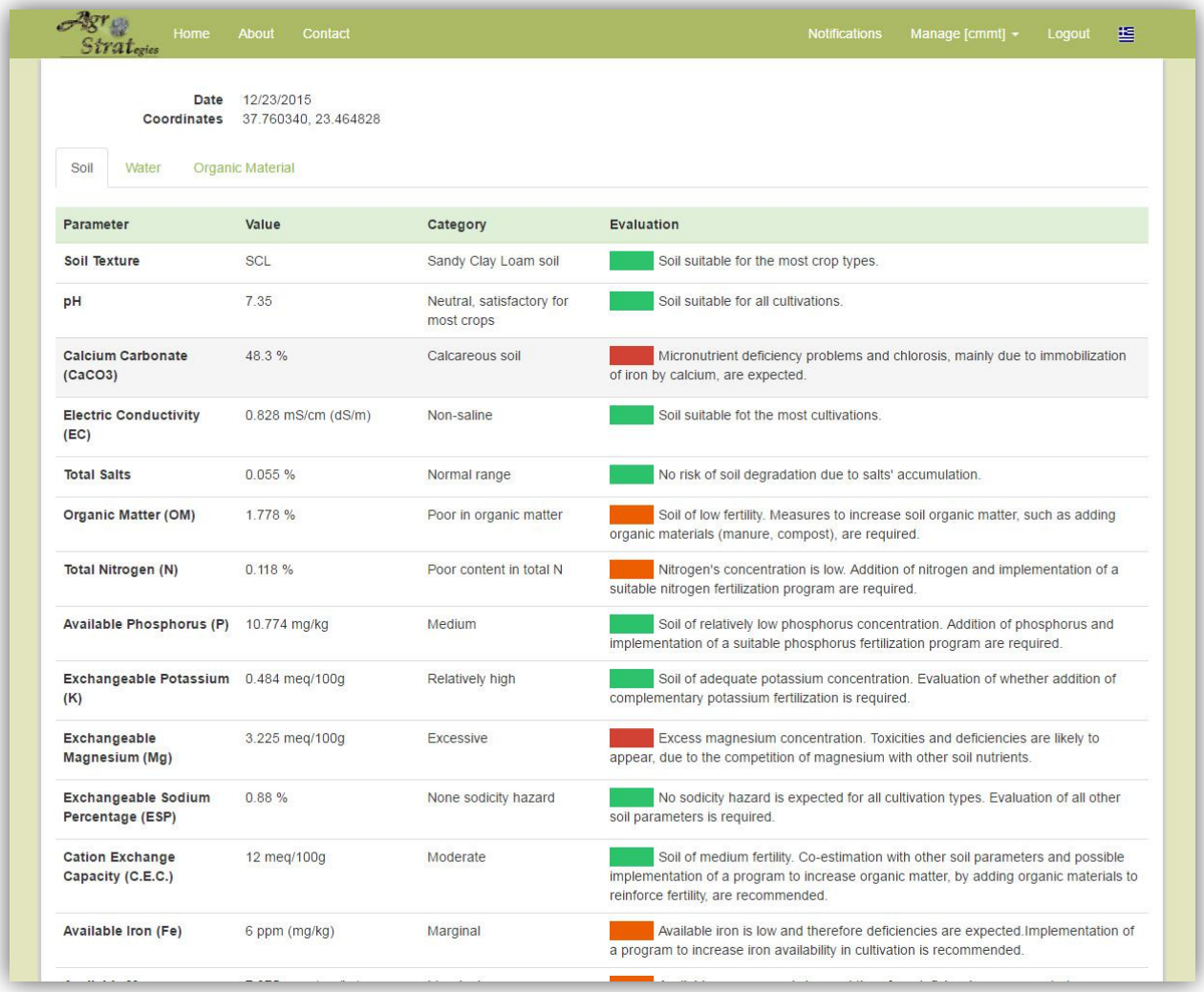



Figure 12. Measurement evaluation main screen

The system provides evaluation for each one of the chemical parameters available in the respective measurement. For each parameter, its value, suggested category and evaluation is provided considering a detailed evaluation of the quality of soil, water and organic materials. European legislative restrictions for wastes or organic materials landspreading are taken into account for the evaluation of composts and wastes properties. Furthermore, for the convenience of the user, the evaluation is accompanied with its corresponding color as illustrated in Figure 12 (i.e., green – low risk, orange –medium risk and red – high risk).

## Advisory

The CMMT user may also view the suggested by the system "Advisory" for the respective measurement data, by clicking on the corresponding button **(3)** from the measurement data main screen (Figure 11). The corresponding "Advisory" page is illustrated in Figure 13 below.

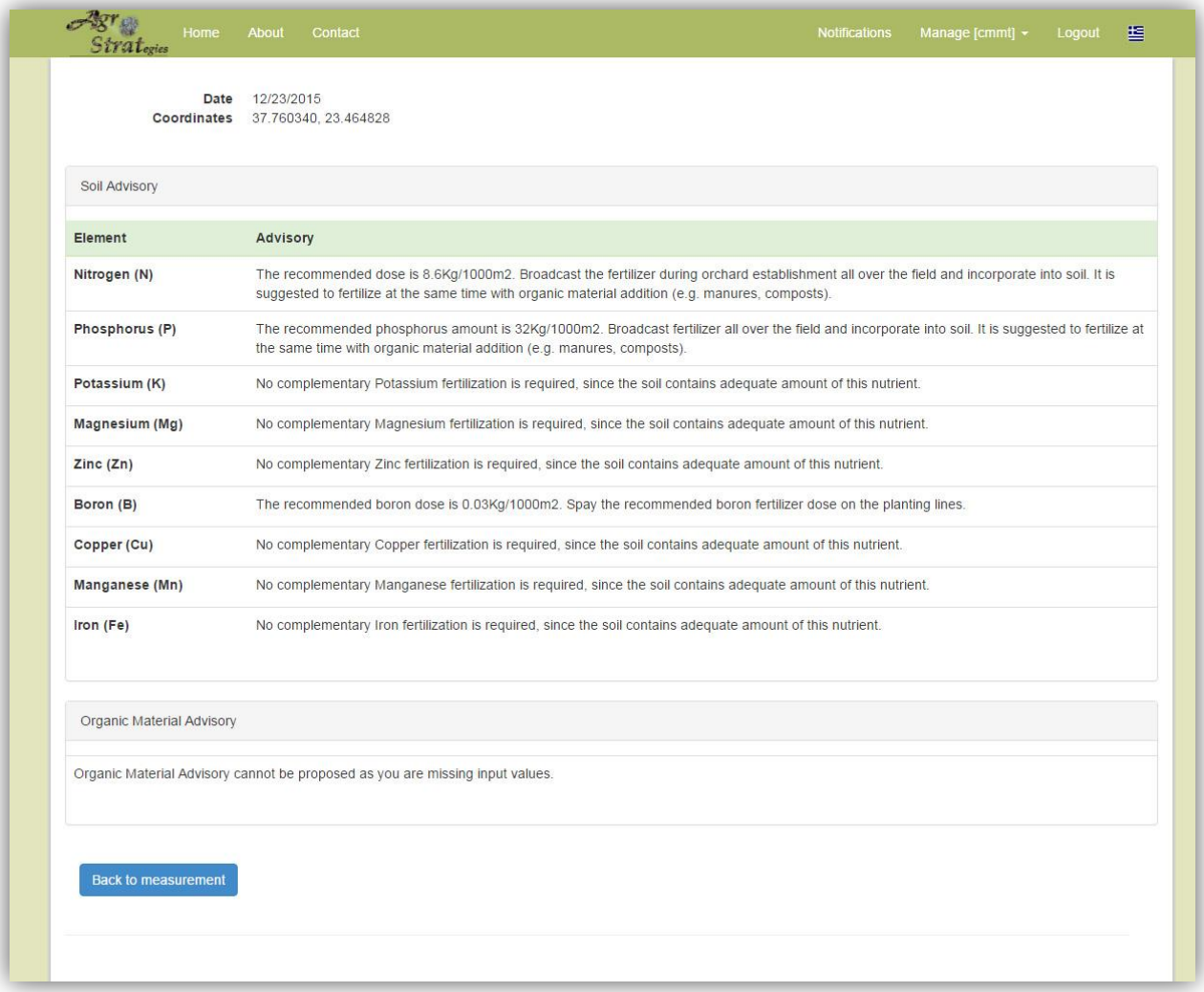



Figure 13. Measurement advisory main screen

For the example depicted in Figure 13, only soil chemical analysis results were inserted, thus, the CMMT user may receive only fertilization consultancy with respect to soil (soil advisory). If chemical analysis data results for irrigation water and other organic material were available, the system automatically evaluates the safety level of composts/organic amendments considering legislative restrictions, and if the respective materials can be used on soil then a detailed scenario is provided to the user.

# Data monitoring

Fields and their corresponding measurements temporal monitoring, is another main feature of the CMMT system. The user is capable of monitoring a specific cultivated area by assessing the corresponding field state, based on the fluctuation of the several principal soil indicators through time. CMMT provides also the user with intelligible charts for the respective task.

## Data monitoring overview

Field monitoring page is accessed either from the "Manage" shortcut menu by selecting the "Field Monitoring" link, or by the CMMT home page by selecting the "Monitoring" link on the "Main screen" (Figure 2). Field temporal monitoring main screen is illustrated in Figure 14 below.

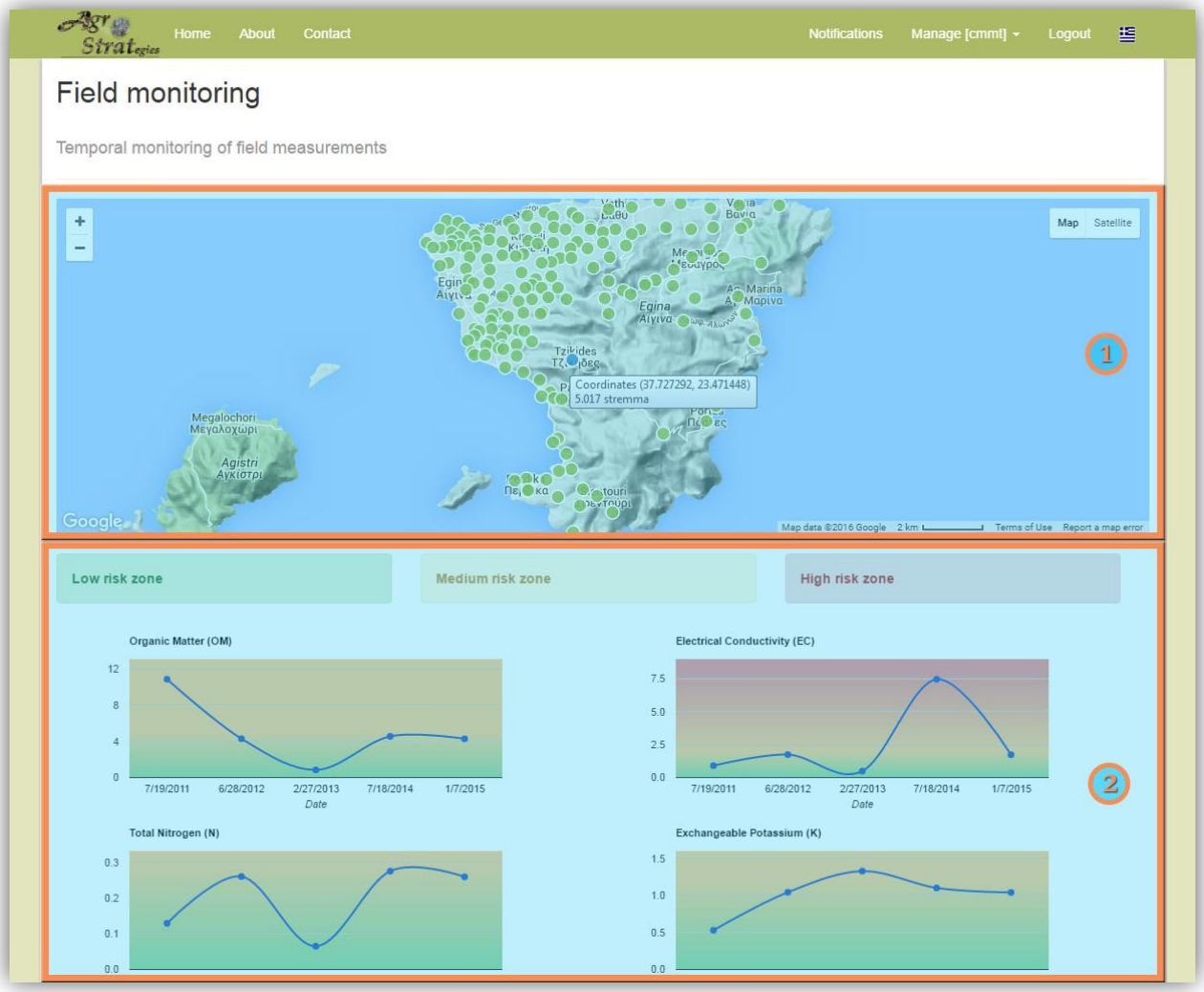



Figure 14. Field Monitoring main screen

There are two main areas in this page: the map area on top of the screen **(1)**, where the respective CMMT user can select a specific cultivated field from all available to the specific user bounds (Figure 5), by clicking on the corresponding (green) field marker on the map. Corresponding information for the several main soil indicators risk assessment is displayed in the main area **(2)**. These main chemical parameters are: Organic Matter (OM), Electrical Conductivity (EC), Total Nitrogen (N), Exchangeable Potassium (K), Available Phosphorus (Olsen-P), Available Copper (Cu), Available Zinc (Zn).

For the convenience of the user, in the main area **(2),** interactive charts are available for all the above soil indicators for the selected cultivated field, depicting corresponding values through time. For the effective risk assessment, the system provides the user for each soil indicator chart a dynamic visualization with appropriate color mapping, considering three main risk zones (i.e. low, medium and high).

## Charts

For each of the available soil indicators of a specific cultivated field, the system provides the user with an interactive chart. Corresponding measurement values are visualized as points according to measurement date. Considering three main risk zones, low (green), medium (orange) and high (red), an appropriate gradient colored background, dynamically created with respect to measurement values, is embedded for assisting the user on the quick and easy temporal monitoring and evaluation of the respective soil parameter.

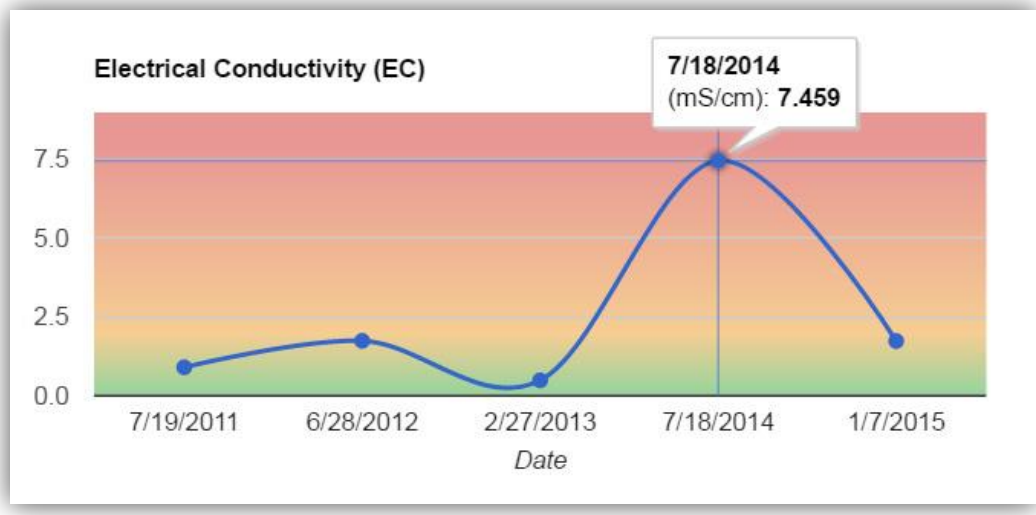



Figure 15. Temporal monitoring of EC soil indicator for a specific field

In Figure 15 above, the electrical conductivity (EC) parameter for a specific field is demonstrated as an example. Five measurement values are available (for different measurement dates), where only one of them being on the high-risk zone. The exact measurement date and value is indicated when the user clicks (or hovers) on a specific point in the respective chart.

# Data analysis

Probably the most important feature of the CMMT system is the (temporal) measurement data analysis on a regional spatial scale. The user is capable of monitoring cultivated areas on a regional scale, by assessing fields' status (within his coverage area) based on the influence of the specified principal soil indicators through time and space. Statistical data analysis is also provided through intelligible histograms.

## Data analysis overview

Measurement data analysis page is accessed either from the "Manage" shortcut menu by selecting the "Measurement analysis" link, or by the CMMT home page by selecting the "Analysis" link on the "Main screen" (Figure 2). Fields measurement data analysis main screen is illustrated in Figure 16 below.

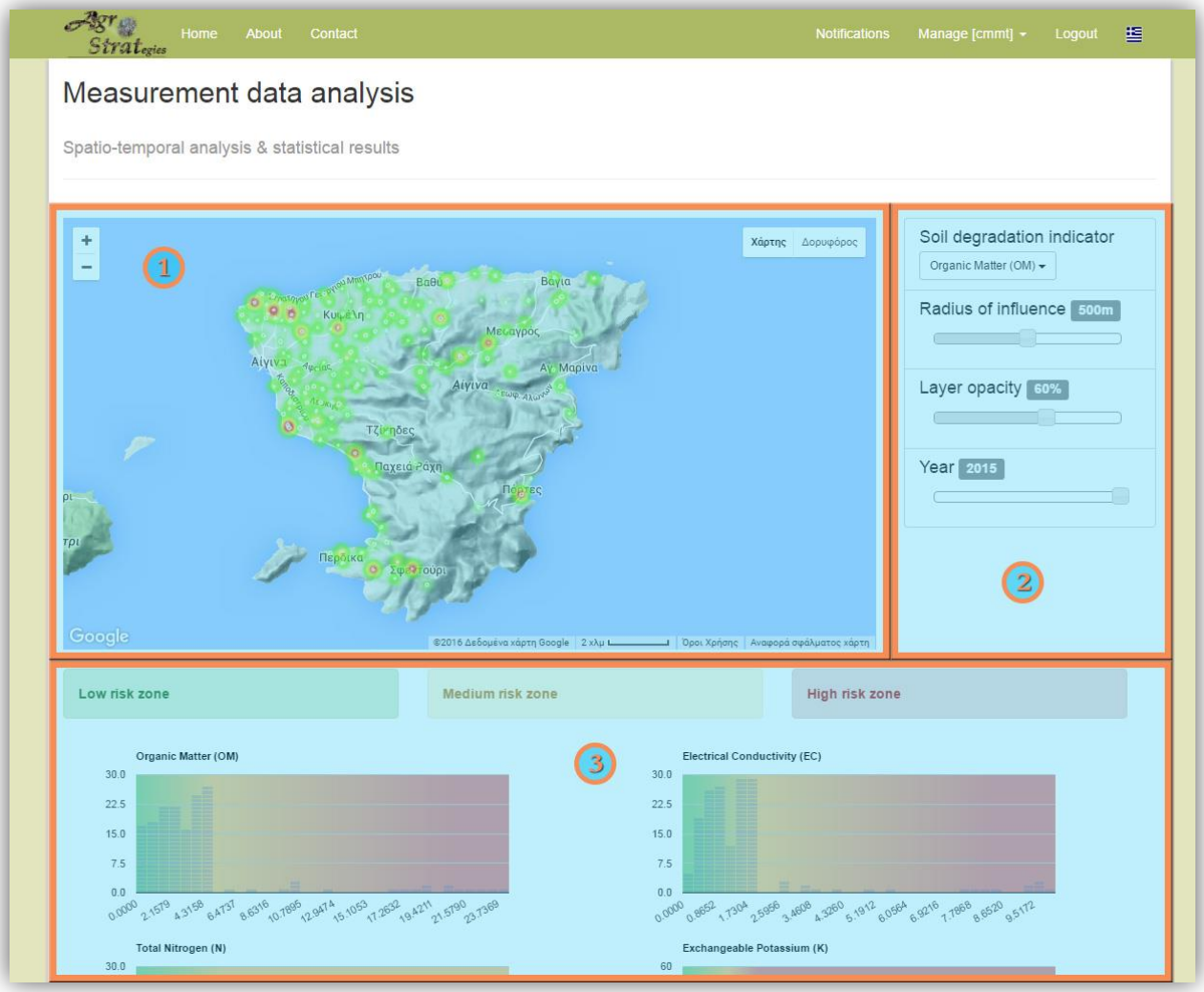



Figure 16. Field measurement data analysis main screen

There are three main areas in this page: the map area on top-left of the screen **(1)**, where the respective map can visualize the data analysis results as a "heat map". A heat map (or heatmap) constitutes the graphical representation of the measurement data where the individual measurement values of the corresponding field areas are represented as colors (i.e. green as low risk values, orange as medium risk values and red as high risk values). The dynamically generated heatmap is based on several user defined parameters available at the parameters area **(2)**. These parameters are:

- **Soil degradation indicator**: the user can select one of the main chemical parameters: Organic Matter (OM), Electrical Conductivity (EC), Total Nitrogen (N), Exchangeable Potassium (K), Available Phosphorus (Olsen-P), Available Copper (Cu), Available Zinc (Zn) as well as an "Overall" one, where the total cultivated area risk assessment is provided on average percentage (%)
- **Radius of influence**: intuitively represents the distance that any field measurement value influences nearby areas. This distance ranges between 0 to 1000 meters
- **Layer opacity**: the opacity of the heatmap layer in percentage (%)
- **Year**: the specified year for the spatial analysis process to take place

For the convenience of the user, in the main area **(3),** interactive histograms are available for all major soil indicators for the user's coverage area (bounds). Histograms are consisted of rectangles representing cultivated fields, while the vertical axis is proportional to the frequency of these fields for the corresponding interval range value in the horizontal axis.

## Histograms

The system provides the user with an interactive histogram, that is, a graphical representation of the frequency distribution of available field measurement values. A histogram for a specific soil indicator, the entire range of measurement values is divided into a series of intervals, and the number of field measurement values that fall into each interval is counted.

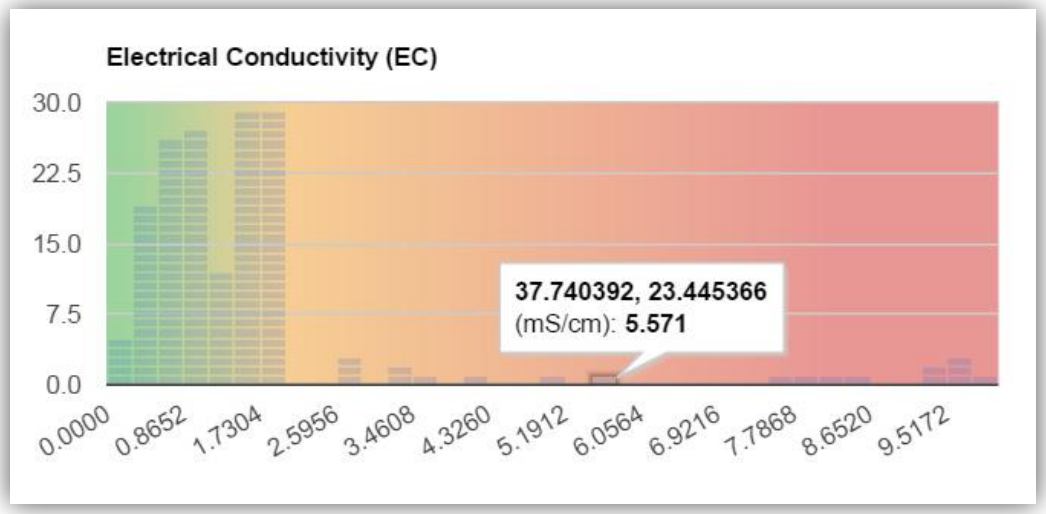



Figure 17. Histogram of measurement data for EC soil indicator in year 2015

In Figure 17 above, the electrical conductivity (EC) soil degradation indicator is selected as an example for the regional analysis process. Similarly, three main risk zones are considered with respect to values of field measurement data: low (green), medium (orange) and high (red) risk zones are presented as a gradient colored background that is dynamically embedded within the histogram, for assisting the user on the quick and easy evaluation of cultivated areas on a regional scale.

The user is able to discover, and view, the underlying frequency distribution of the available set of field measurement data for several data value intervals. The exact field coordinates and corresponding measurement value is indicated when the user clicks (or hovers) on a specific rectangle in the respective histogram.

# Providing feedback about CMMT

For any support inquiries or feedback, you may contact the development team at info [at] agrostrat.gr using "SUPPORT" as subject title.