AgroStrat

Sustainable Strategies for the improvement of seriously degraded agricultural areas: The example of *Pistachia vera* L.

LIFE11 ENV/GR/951

Layman's Report

Department of Soil Science of Athens-Hellenic Agricultural Organization DEMETER

Institute for Mediterranean Studies - Foundation for Research and Technology

Technical University of Crete

With the support of the Region of Attiki-Regional Union of Islands
the Agricultural Association of Aegina,
the Agricultural Cooperative of Aegina's Pistachio Producers

Objective and Innovations

The Main Objective

Development of sustainable cultivation practices at Mediterranean areas under desertification risk, which include sustainable management of soil, water and nutrients, valorization of agricultural waste streams and reduction of cultivations' environmental footprint.

AgroStrat Innovations

- An Integrated Management Scenario for intensively cultivated areas to address specific issues (e.g. waste management at field, soil erosion) or as holistic approach to support regional plans.
- A set of soil indicators suitable for pistachio cultivation practices and wastes disposal for the determination of soil quality, degradation and desertification risk.
- A composting methodology for pistachio waste with very high electrical conductivity with the addition of natural zeolite as additive to the feedstock.
- A unique system for land evaluation for waste landspreading, which considers soil physical and chemical properties, geological and hydrological characteristics.
- A Cultivation Management Software (CMS) that provides consultancy to farmers for soil and water quality, fertilization according to soil properties and crop needs, evaluation of the soil suitability for waste/organic materials landspreading or use for fertilization.
- A Central Management and Monitoring Tool (CMMT) that allows network development between farmers and local authorities and establishment of a center of monitoring/management cultivated areas.
- Construction of a practical, easy to use, field equipment for rapid measurement of soil pH, moisture and electrical conductivity which could be used by individual farmers.
- Analysis of pistachio production sustainability considering the three pillars of sustainability (environmental, economic and social)-Life Cycle Analysis of pistachio production

A project co-funded by the European Commission and implemented in Greece

Total Budget	1,026,509 €
EC contribution	509,504 €
Beneficiaries contribution	517,005 €
Pilot areas	Aegina Island, Attica and Kilkis, Macedonia
Duration	1/10/2012-30/9/2017

The Integrated Management Scenario

The Integrated Management Scenario (IMaS) is the overall deliverable of LIFE AgroStrat project, which includes all project achievements and integrates them into a strategy for cultivation under desertification risk, soil management, waste exploitation and reuse, waste management and treatment.

The project, through its actions, demonstrated how local/regional communities (farmers and authorities) can cooperate between each other and with scientists to develop and promote sustainable integrated management of resources and wastes; continuously monitor effectiveness of their actions while at the same time, ensure and advance environment protection and increase productivity.

The scenario is a document of seven chapters, accompanied by

- An Implementation Guide,
- A techno-economic analysis, and
- A supporting guide manual for developing soil monitoring plans

The Seven Chapters of IMaS

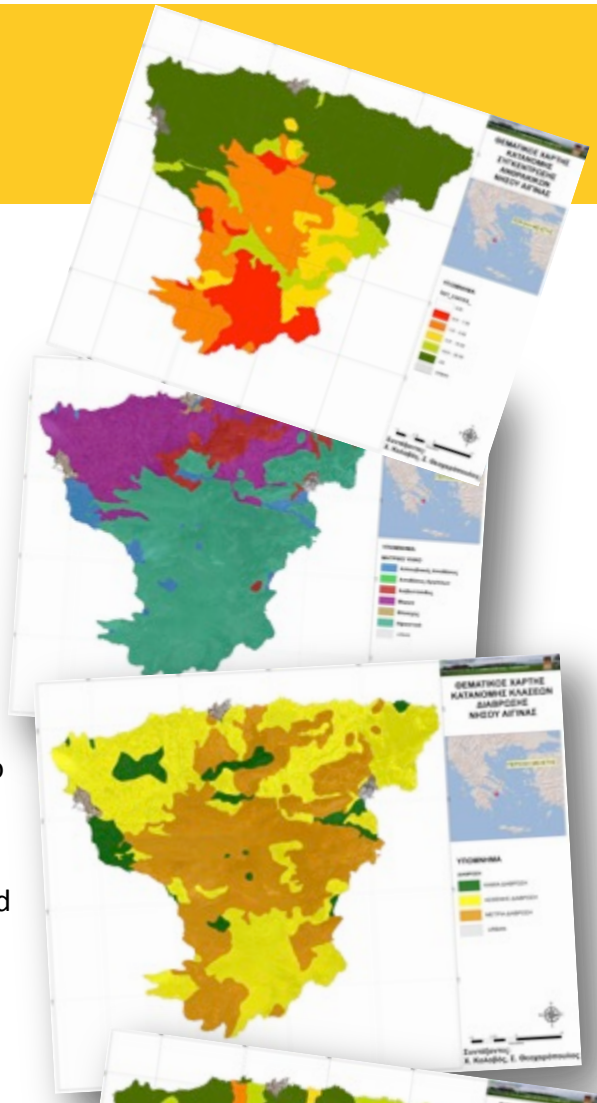
Chapter 1: Integrated fertilization practices for pistachio trees
Chapter 2: Environmental footprint of pistachio cultivation
Chapter 3: Addressing soil threats
Chapter 4: Development of sol thematic maps-Definition of soil indicators
Chapter 5: Pistachio wastes management
Chapter 6: The decision-making tools of AgroStrat
Chapter 7: The IMaS in eight steps

Not only for pistachio trees cultivation

The IMaS although it was developed using the example of pistachio trees cultivation, it was developed in a such a way that can be also implemented for other cultivation types and at other Med countries.
This is because the scenario proposes sustainable cultivation practices for Mediterranean areas under degradation/desertification risk, for sustainable soil and water monitoring and management, nutrients use, proper management of agricultural wastes (recycling, disposal, composting and use in agricultural sector, potential use of wastewater for irrigation, production of biochar) as well as, practices for minimizing soil salinization risk and erosion while promoting soil protection.

IMPORTANT INFORMATION: Farmers were informed that before any action or waste application on soil, the authorized competent authority must be informed and provide the appropriate permission.

Soil Thematic Maps
Land Suitability Maps



AgroStrat as part of the IMaS, developed a system for assessing soil quality as regard physical and chemical properties and an evaluation system for land suitability for waste distribution or reuse for nutrients valorization.

After a two years soil characterization, sampling and analyzing campaign, and by using Aegina island as pilot area, a series of GIS soil thematic maps were developed (e.g. soil depth, texture, nutrients content, erosion risk).

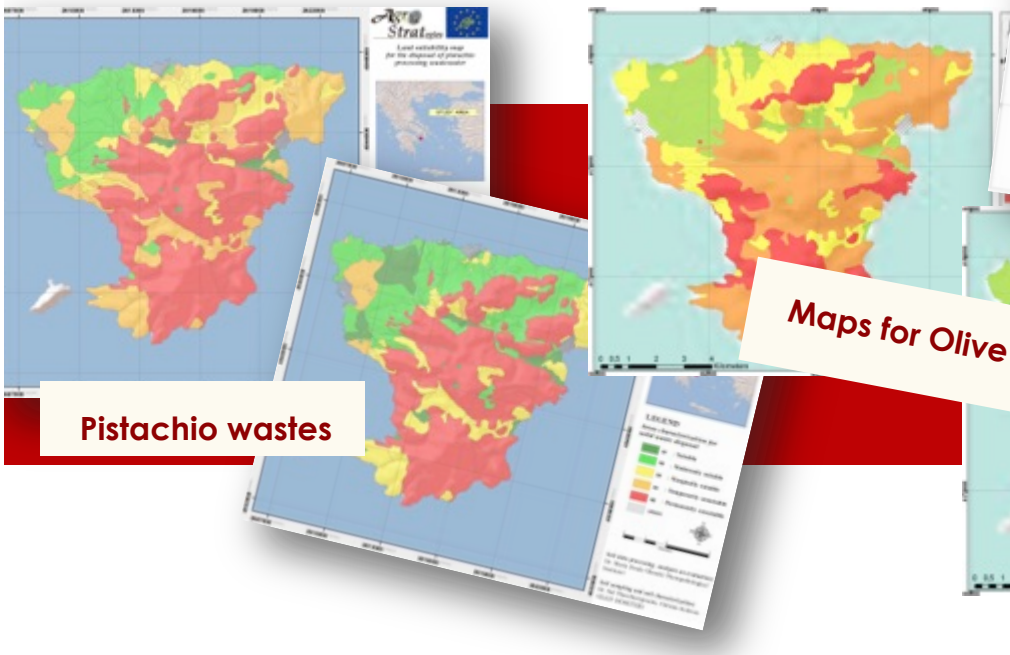
Thereafter, soil properties and areas characteristics were evaluated according to FAO land evaluation system. The GIS soil thematic maps were also exploited in order to develop Land Suitability Maps for agricultural waste distribution on soil.

Four such maps were developed, i.e. for distribution of solid pistachio waste; wastewater from pistachios processing; solid olive mill waste and olive mill wastewater.

The Maps were included in the Cultivation Management Software and into the Central Management & Monitoring Tool to provide consultancy to the authorities on fertilization and waste reuse on soils.

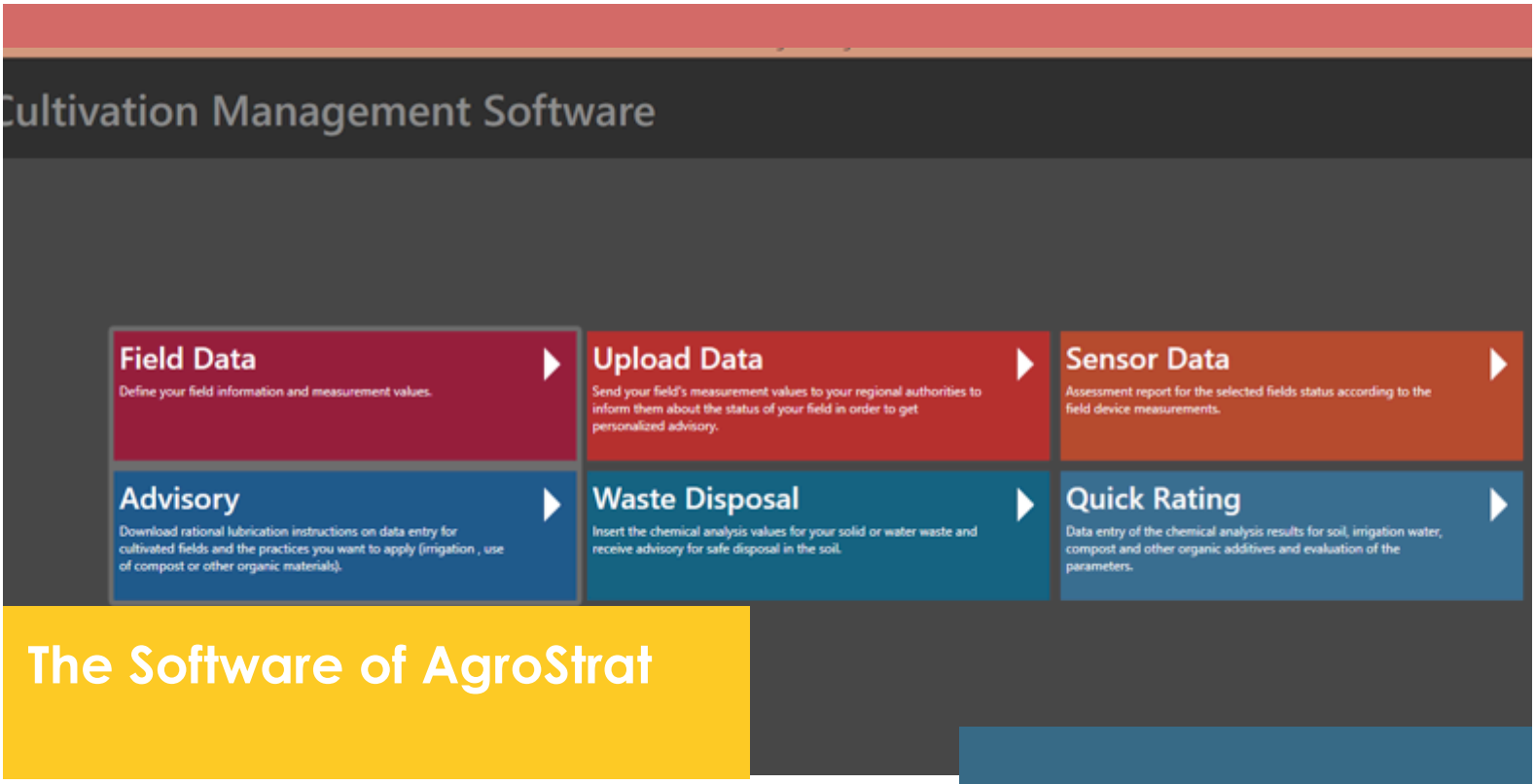
By using the methodology of AgroStrat, it is possible to develop respective maps for other waste type, as for example for olive mill waste.

Land Suitability Maps



Pistachio wastes

Maps for Olive Mills Waste



The Software of AgroStrat

The project developed a software that can be used in the entire Mediterranean region and promotes sustainable agricultural practices for *Pistachia vera* L. cultivation but also to other cultivations.
The software provides consultancy on:

- Quality of soil, irrigation water, composts and waste
- Mineral fertilization in combination with organic materials
- Use of composts and wastes for fertilization
- Use of composts for soil improvement

Evaluation

By inserting results of the chemical analysis, the software provides a fast evaluation of the quality of soil, irrigation water, composts or organic wastes.

Consultancy

The end-user indicates the exact position of the cultivated field of interest by inserting field coordinates or by finding the field on Google Earth. In case of Aegina island, the software considers the results of the chemical analysis of soil, water and composts provided by the user and in case of missing soil properties, data from the thematic maps are automatically inserted. Fertilization consultancy and sustainable use of composts and organic waste are provided. For other areas, the software considers the results of the chemical analysis.

Connection with the Regional Authority

This unique software feature connects farmers with the Regional Authority via Internet. The farmers may receive additional consultancy by the scientists of the Authority. It also supports networking between farmers, authorities and citizens

A Dynamic Decision-Making Tool for the entire Mediterranean region

Because…

- after slight modifications, the software can provide consultancy for other cultivation types, in addition to pistachio trees
- the software allows the incorporation of soil thematic maps of other areas in Greece and in other countries, providing therefore the potential to be fully exploited for farmers consultancy throughout the Mediterranean region and Europe.
- not only agricultural waste, but many different waste types can be considered for landspreading evaluation, taking into account national and European legislative frameworks.

The Cultivation Management Software aims to provide consultancy and by no mean to substitute authorized competent authorities. Therefore, farmers and individuals are informed by specific note on the AgroStrat page and also on the different software page to consult national competent authorities in case of waste disposal on soil.

Central Management & Monitoring Tool-CMMT

Field monitoring, measurement, spatial analysis and visualization

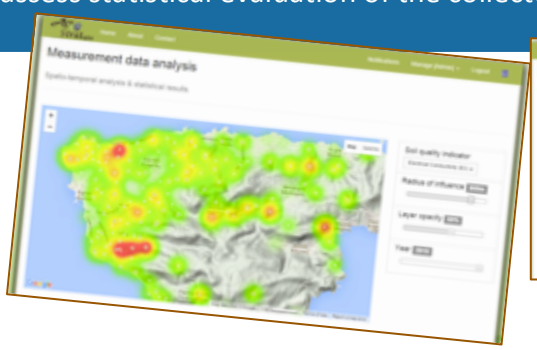
CMMT system is a web app for the management and monitoring of cultivation fields using soil, water and organic waste parameters, integrated within a Geographical Information System (GIS).

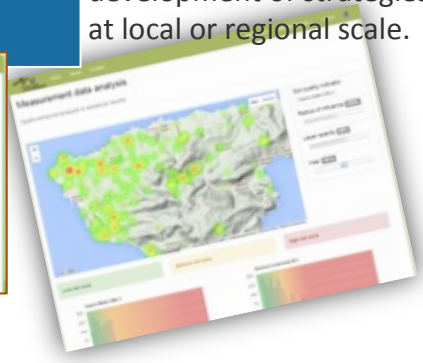
The Central Management & Monitoring Tool supports the establishment of a Monitoring Centre, which could be located, for instance, at the premises of a Regional Service/Agency, farmers' association or of a Municipality, and enhances the continuous monitoring of cultivated areas or areas where wastes are disposed.

Connection with the Monitoring Authority

This unique web application provides the option for the farmers to inform the Monitoring Authority for their field and cultivation status by uploading soil, water and wastes analysis on CMMT Server and may receive additional consultancy afterwards by the scientists of the Authority

The cultivated fields or the waste disposal areas are presented on maps. The user may select which soil property wishes to monitor and for which period. The results are presented on the maps, while special features provide the authorities with the potential to screen all data sent by the farmers as well as to assess statistical evaluation of the collected data at regional scale.

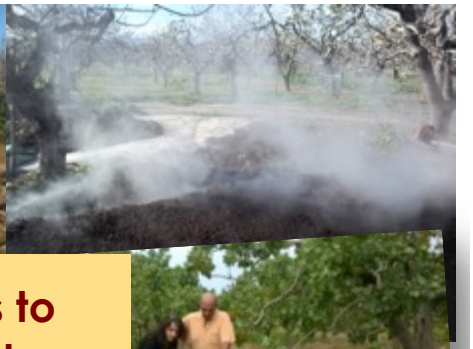




The Central Management Monitoring Tool (CMMT) of AgroStrat is a unique web GIS-based application that will assist Local and Regional Authorities to monitor soil quality and agricultural practices at local and regional scale

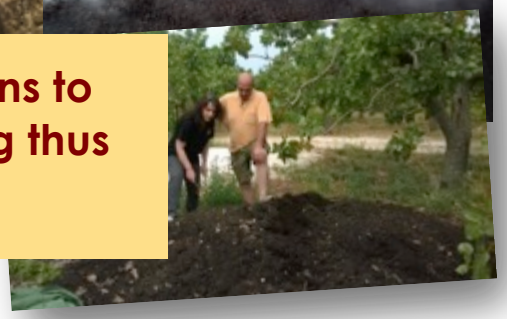
The CMMT enhances authorities to screen cultivated areas rapidly, identify potential risky conditions and proceed to detailed monitoring, if necessary. The tool strongly promotes the implementation of resources monitoring at field, municipal or regional scale

Data can be uploaded by local farmers through the Cultivation Management Software or by the Authorities through the CMMT. Therefore, the CMMT can collect, store and process soil and cultivation data allowing short and long term evaluation of the agricultural environment as well as, the development of strategies and plans at local or regional scale.



Waste Management at field

Reducing waste amounts by simple constructions to manage wastewater and solids at field, reducing thus the need for discharge in the environment



Simple waste management systems were developed and implemented at two pilot fields in Aegina island. The first one by constructing three shallow evaporation ponds and the second one by building four sequential wastewater collection reservoirs.

The systems aim to assist separation of pistachio waste into solid waste and wastewater at field.

Shallow evaporation ponds

Wastes are separated into solid and wastewater immediately after their production by using a simple separation equipment. The solid part is composted while wastewater is collected into three shallow ponds and left to evaporate. The ponds can be permanent or temporary. Protective media (geotextiles) must be used to prevent infiltration of wastewater into soil.

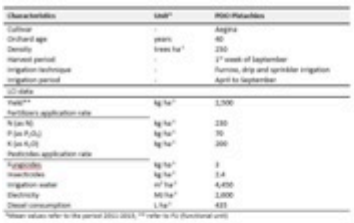
Sequential Collection Reservoirs

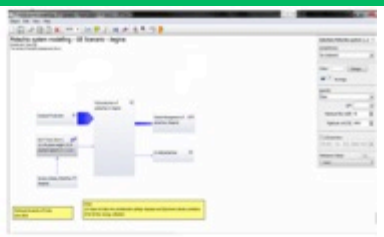
The system was constructed by exploiting a former, almost destroyed, pig breeding area.

In the case of the sequential system, wastes are not separated after production. Instead, they are collected into the five reservoirs. The solid part is left to precipitate and then used for composting. Wastewater is left to evaporate.

The five stall places were reconstructed to form a sequential system of five reservoirs for waste collection.

Life Cycle Analysis (LCA) – Environmental Risk Assessment





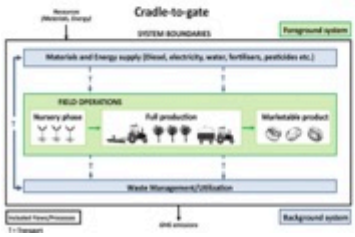
Emissions to air, water and soil

Inventory

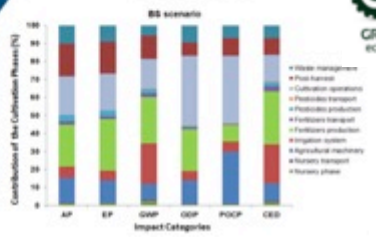
GaBi modelling

It is the first time that a research study is focused on analyzing the life cycle of pistachio production worldwide.

Boundaries



Results



LCA was carried out to determine the consumption of raw materials i.e. fertilizers, pesticides, irrigation and processing water, energy and agricultural waste, as well as to calculate emissions of pollutants (CO_2, CH_4, VOCs, NOx, SO_2 etc.) to air, water and soil in relation to pistachio production.

RESULTS

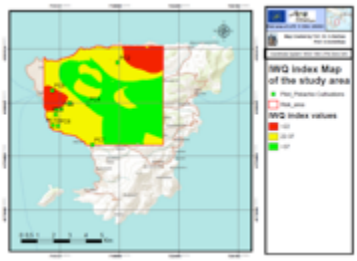
LCA identified that fertilizers production, irrigation system and cultivation operations were the most impactful phases. Impacts of critical importance were also ascribed to waste management, mainly attributed to the uncontrolled disposal of the pistachio waste and the unavoidable surface runoffs to ground- and/or surface water.

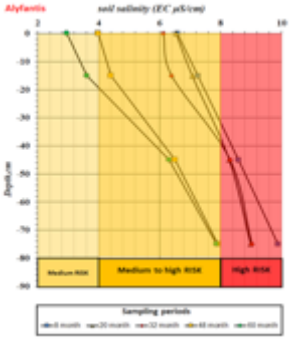
BENEFITS

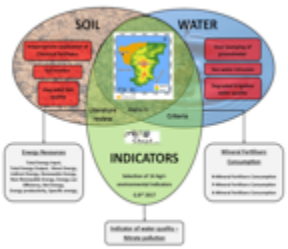
- Application of LCA to evaluate the environmental impacts caused by pistachio cultivation can be extended to other tree cultivations in similar arid and semi-arid environments, in the Mediterranean region and elsewhere.
- The LCA results can be also used by several end-users (i.e. farmers, agronomists), policy makers and other stakeholders for developing eco-friendlier and goal-oriented sustainable strategies for similar tree cultivation systems.

AN INTEGRATED ENVIRONMENTAL RISK ASSESSMENT was carried out to:

- assess the improvement of environmental quality of the pilot area due to the developed and applied strategies (IMaS) during the project.
- assess the risk for water bodies due to agricultural waste disposal and agricultural practices, and
- evaluate the environmental impact of pistachio production in the Mediterranean countries using suitable environmental indicators.







Five years close to farmers and policy makers

PUBLICATIONS and more…

AgroStrat published six scientific papers in peer reviewed international journals, two book chapters and participated in international and national conferences with 35 announcements and posters.

AgroStrat is continuing…

Interreg
EUROPEAN UNION
Balkan-Mediterranean
BalkanRoad

An INTERREG BalkanMed project, with the title "*Towards farms with zero carbon, waste- and water-footprint. Roadmap for sustainable management strategies for Balkan agricultural sector-BalkanROAD*" started its activities on 8 September 2017. The project foresees, among others, the development of fertilization consultancy for grapes, vegetables and apples based on the already developed software of AgroStrat and also the development of a software that will record and estimate the environmental footprint of the marketable agricultural products, considering all production steps (from field to the market). The estimated footprint can be then indicated on products' label increasing their value compared to other similar products found in the market.

BalkanROAD and ClimaMED will boost and communicate Agrostrat results in the Balkan Peninsula and in the Mediterranean Region

A new LIFE project under the title "*Innovative technologies for climate change mitigation by Mediterranean agricultural sector- ClimaMED*" (LIFE17 CCM/GR/87) will start on 1st July 2018. One of the main objectives of the ClimaMED project is the establishment of an Operational Central, similar to the CMMT of AgroStrat, for recording and monitoring Greenhouse Gases emissions and Changes in Soil Organic Carbon in the Mediterranean agricultural sector.

Life

LIFE AgroStrat

AgroStrategies

We remain on the Web!

Visit us at:

http://www.agrostrat.gr

Contact us

Dr. M. K. Doula (project coordinator): mdoula@otenet.gr
Dr. A. Sarris: asaris@ret.forthnet.gr
Prof. K. Komnitsas: kkomnitsas@isc.tuc.gr
Dr. S. Theocharopoulos: sid_theo@otenet.gr

Life