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INNOVAGRO

Innovations in agro-food sector

Transnational Networking Workshop

Final guidelines

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Transnational Networking Workshop publication

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Prof. Bartolomeo Dichio, Dr. Alba N. Mininni from - Department of European and Mediterranean Cultures: Architecture, Environment, Cultural Heritage (DiCEM) University of Basilicata, explain how an academic spin-off operates with high-skilled academic research and experimentation support, developed in the field of "Circular Economy".

Agreenment
towards a green society

Research areas of the Spin-Off are:

- Plant physiology in response to environmental *stimuli* (soil water content, irradiance, temperature, *VPD*….)
- Water and soil management of orchard and agro-ecosystems (leaf and plant WUE, crop coefficient, regulated deficit irrigation, schedule,)
- Nutrition and soil fertility remediation (plant's demand of nutrients, uptake and partitioning of minerals, fertilization, orchard-atmosphere CO_2 fluxes)
- Training systems and light interception (flowers and fruit quality, microenvironment)
- Design of actions for atmospheric CO_2 mitigation (CF)

Sustainable agricultural practices and strategies for adapting agriculture to climate change are necessary, considering that the UN predicts a global population of 9.8 billion by mid-century and food production in 2050 will have to be 70 percent higher than in 2005.
Climate-Smart Agriculture (sustainable), according to World Bank (2012) is needed because:

- increases yields (poverty reduction & food security),
- makes yields more resilient in the face of worsening weather conditions (adaptation), and
- transforms the farm into a solution to the climate change problem (mitigation).

About these themes some expertise comes out as the Implementation of a Water Management Adaptation Strategy for the farmers and the F.OR.s in view of climate change through:

1. **Application of GAPs** (Good Agricultural Practices) to increase orchard sustainability and reduce environmental impact.
2. **Scaling up at district level** (through the Projection of results from farm level) in order to evaluate the reduction of environmental impacts of the application of GAPs.
3. **Certify the water resource use at district level with European Water Stewardship (EWS)**

The project about promoting water efficiency and supporting the shift towards a climate resilient agriculture in Mediterranean countries - LIFE14 CCA/GR/000389 UNIBAS - Scientific Responsible Dr. Alba Mininni has selected as study area Metapontino Area – Agri Sub-Basin, involving **4455.4 ha** of crops in the sub basin level.

Good Agricultural Practices applied for each of the 10 pilot site has highlighted:

- No soil tillage
- Spontaneous cover crops
- Shredding of pruning residues
- Fertilizing based on soil analysis
- Application of organic material (compost)
- Winter and Summer pruning
- Irrigation schedule based on the daily water balance and soil moisture monitoring
- Application of post-harvest deficit irrigation

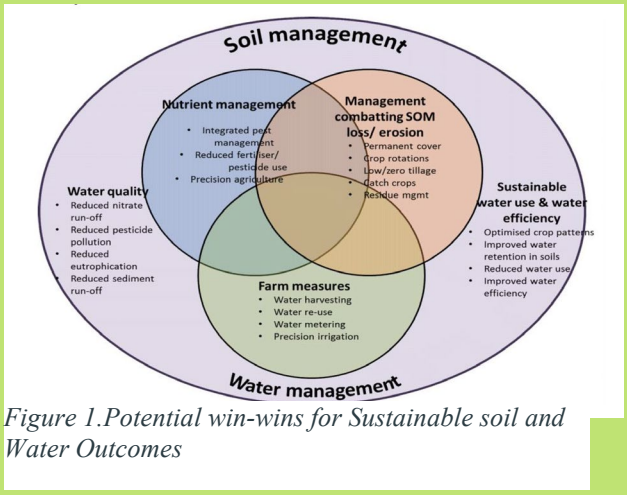


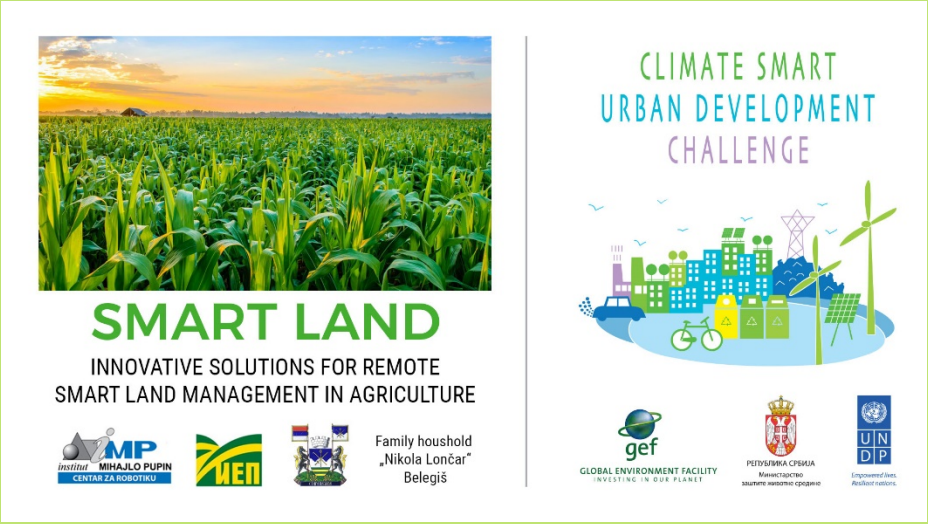
Figure 1.Potential win-wins for Sustainable soil and Water Outcomes

The environmental impact on the sub-basin scale applying sustainable management at sub-basin level, has shown that summer pruning applied 15 days before the traditional management allows a water saving of **$1*10^6$ m^3**!

Other experiences are related to European Innovation Partnership on water with the project WIRE (Water & Irrigated agriculture Resilient Europe) based on three priorities:

- Efficient water reuse in irrigation
- Energy saving in irrigation
- Integrated agricultural water management under drought

Vlado Kovacevic Ph.D., researcher at the Institute for agricultural economics Belgrade, Serbia explains how innovative remote operated smart land management in agriculture could have important ecological and economics impacts.



A problem to be solved....

- Serbia has ***extraordinary natural potential*** for various agricultural production.
- The agriculture in Serbia is dealt with ***1.3 million people*** or ***630,000*** **family households.**
- Despite this, the agricultural production is **low productive** and ***economically*** **unsustainable!!!**

Starting from an experimental pilot system, in Belegiš, in August 2018 the benefits achieved, using innovative remote-operated smart land management in agriculture are:

- Double yield of the household
- Better quality and uniformity of products
- Less labor effort (less time consumed)

Also, economic and ecological impacts are relevant:

ECONOMIC	ECOLOGICAL
Energy savings	Optimized use of natural resources
Less use of fertilizers and pesticides	Lower use of fertilizers and pesticides
Decreasing production risks	Elimination of use of fuels
Less work time	Reduction of emissions of polluting gasses

ROI for purchasing our innovative technology is

- **12 months** (applied to 10 hectares)
- **24 months** (applied to 7.5 hectares)
- **36 months** (applied to 3.5-5.0 hectares).

And we need….

- **Partner** for **FINANCING** and/or **MANUFACTURING** of a serial production of the Smart Land Management System (up to 500,000 $US)
- **Partner** for **SALES** in Serbia and region.

The **TARGET MARKET** in Serbia are **small** and **medium-sized** family households **(that is more than 90%)** so Serbia has a big market for this type of investment!

Irena Stokelj, from Municipality of Ajdovscina, Slovenia explains Innovations/Strategies in agriculture for the Upper Vipava Valley.
The Municipality of Ajdovscina (MA) has a direct vision to…..

- deploy the benefits of natural resources (climate, pedological characteristics, knowledge and tradition) in the Vipava Valley;
- strengthen/accelerate sustainable agriculture and livestock production, using advanced techniques compatible with environmental restraints and restrictions (Natura 2000);
- become a recognizable driving force for leading towards sustainable agriculture and food production consistent with Farm to fork strategy.

The role of MA is related to the importance and significance (economic, social and ecological) of the agriculture sector in the Vipava Valley, the Municipality of Ajdovscina, aware of its local authority position, contributes to sustainable agriculture and food production through implementation of politics and coordination of defined objectives and actions, in a form of cooperation and communication with identified relevant stakeholders, pursuing:

- **adaptation of agriculture to the climate change** (implementation of relevant strategies, multi-stakeholder partnerships to carry out strategic projects, e.g. construction of irrigation system in the Upper Vipava Valley, reducing/managing flood risk…) and **preservation/improvement of environment** (decision support system for irrigation, development of green wind breaks on the land affected by wind erosion, sustainable measures to combat harmful pests…);
- **enhancement of competitiveness** through promotion of diverse farm activities (introducing new exotic crops resistant to climate change, promoting the cultivation of indigenous crop, etc.) and to **increase/encourage local food**

consumption (raising consumer awareness about the importance and stimulate the development of short food supply chain).

The MA adopted **Climate change adoption Strategy for agriculture in the Municipality of Ajdovscina for the period 2018-2021**, based on project LIFE ViVaCCAdapt– LIFE15CCA/SI/000070. The document provides strategic action plan for implementation of various measures/actions focused on three priority action areas:

- first priority action list envisages necessary actions aimed at improving knowledge of **sustainable use of water**, and development of new eco-efficient or upgrading/modernising the existing water supply/consumption infrastructure;
- second priority action list encompasses measures relating to conservation and sustainable management of forest resources and livestock; **improved performance and competitiveness of agricultural holdings**, and **encouragement** of local agriculture product consumption, including **promotion of short food supply chain**;
- third priority action list sets out series of measurements aimed at **dissemination and improvement of organic agriculture** in the Vipava Valley.

A construction of an **irrigation system in the Upper Vipava Valley** – MA is carrying out a project in collaboration with the Ministry of Environment and spatial planning, the Ministry of Agriculture, forestry and food, and the Municipality of Vipava.
Actions to reduce/optimize water used for irrigation and damage impact of strong winds undertaken in a context of Project LIFE ViVaCCAdapt – LIFE15CCA/SI/000070 - http://www.life-vivaccadapt.si/en/ :

- Spon system (a decision support system for irrigation management) – estimates the reference irrigation dose volume of water and envisages the irrigation schedule. System processes various parameters received from measuring probes (temperature, moisture, soil type and type of crop) and weather parameters received from meteorological model ALADIN.
- Planting green windbreaks to prevent soil erosion caused by wind and reducing evapotranspiration.


During the GREVISLIN project implementation the development of **an IT-tool to optimize the use of PPPs** will be carried out, using the TRAPVIEW pest monitoring system by monitoring incidence/prevalence of certain harmful insects' parameters.

In 2015, MA implemented non-traditional crops project on permanent and nonpermanent test plantations to identify potential niche markets for local farmers, to find solutions to

climate changes and to promote healthy food products. In 2018, MA planted purple coneflower (Echinacea purpurea) and started the experimental production of a dietary supplement to inspire local smallholder farmers towards crop diversification. In 2019, MA undertook the project of reintroducing indigenous crop radicchio from Črniče in order to promote healthy food and to encourage cultivation of profitable vegetables by local farmers. **Community trademark „Vipavska dolina** "(the Vipava Valley), including uniformed packaging materials (of different dimensions), widespread visibility and quality recognition of locally produced fruit and vegetables. The start-up of **Brje Learning Centre** that enables local farmers various fruit manufactory/processing of various fruit produce (juice, marmalade, dried fruit). The centre carries out various training courses and workshops to disseminate (practical and theoretical) knowledge of agriculture to local farmers. The establishment and launch of a **website „Virtualna tržnica"**(Virtual Market) under the aegis of MA that enables marketing of agriculture crops and the promotion of short food supply chain. The portal facilitates coordination of demand and supply of local agriculture products between a consumer (addressing marketing demand via web portal) and local farmers. Following the acceptance of the offer, the system generates automatic message to selected supplier/farmer.

Prof. Vitale Nuzzo from - Department of European and Mediterranean Cultures: Architecture, Environment, Cultural Heritage (DiCEM) University of Basilicata; and Dr. Francesco Izzi, Dr. Maria Lanfredi from GeoSDI Laboratory National Council of Research (CNR), The Institute of Methodologies for Environmental Analysis (IMAA) CNR IMAA explain how drive winegrowers towards the adoption new sustainable viticulture practices by an interactive WEB-GIS platform.
In Basilicata Region there are four Appellation d'origine contrôlée (AOC) Denomination:

- Aglianico del Vulture
- Matera
- Val d'Agri
- Grottino di Roccanova

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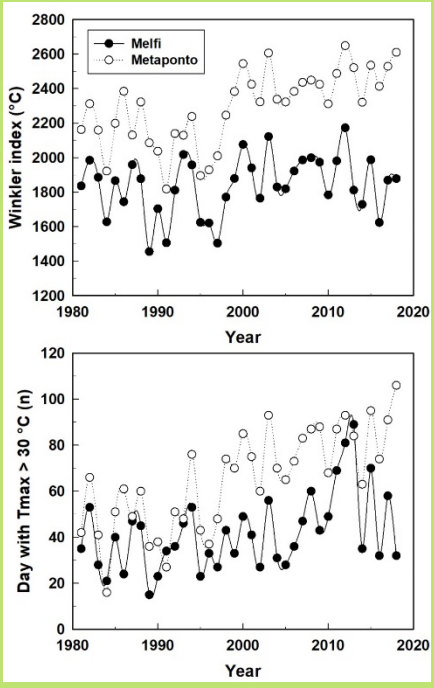
The viticulture is very spread in Basilicata Region and involves over 4000 ha of surfaces, considering the two provinces of Potenza and Matera.

Province	Surface (ha) (data from SIAN)
Potenza	2879
Matera	1140
TOTAL	4019

The varieties used by winegrowers are several, but for the province of Potenza there is a clear predominance of **Aglianico n.** variety with over 80% of cultivate surface.

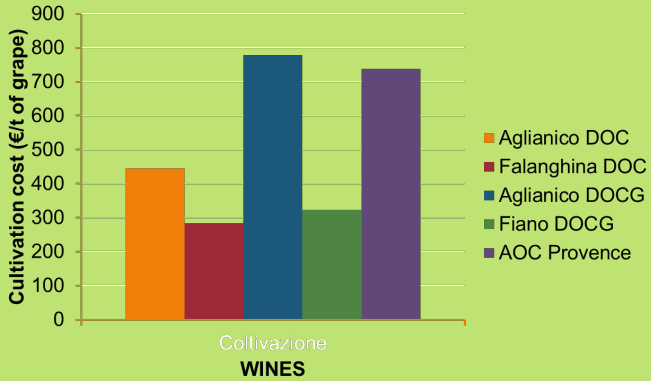
Main Varieties of Matera	Surface (%)
Aglianico n.	4.65
Cabernet Sauvignon n.	**11.53**
Chardonnay b.	3.07
Fiano b.	1.62
Greco bianco b.	8.87
Malvasie b.	3.60
Merlot n.	**11.74**
Montepulciano n.	3.53
Primitivo n.	**36.84**
Sangiovese n.	7.20
Syrah n.	3.00
Other	4.35

Main varieties of Potenza	Surface (%)
Aglianico n.	**84.71**
Greco bianco b.	1.06
Malvasie b.	1.90
Moscati b.	3.60
Sangiovese n.	1.53
Traminer r.	1.41
Other	5.79



Reasons for this, are searched for values under 2000 of Winkler Index and on average of 50 days in a year with a Tmax over 30 °C.

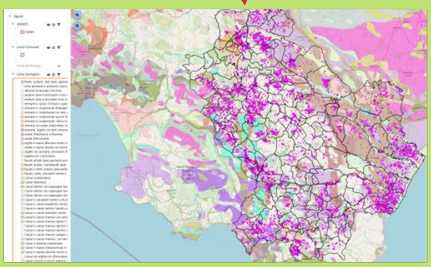
In addition to them, cultivation costs of Aglianico respect to other varieties (from Pomarici et al., 2005, Chambre du Commerce de France), are very competitive



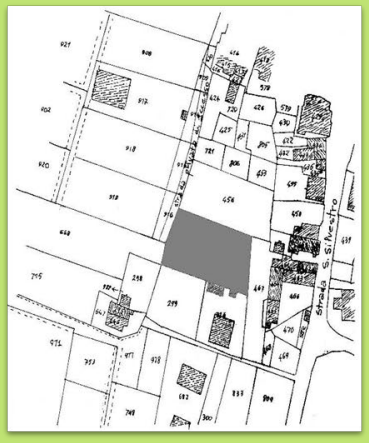
In summary, a web-gis could help winegrowers to manage many varieties, environments, cultural practices, information collecting all in a database, starting from the knowledge of lands by the digitalization of the vineyards.

Digitalization of the vineyards from

Technical Map of Basilicata Region



- **SIAN DATABASE**
- **Vineyard characteristics**: Variety; Age of the vine; Planting distances; Training system; Irrigation system; Soil physico-chemical



Real Estate Registry

Further implementations of the work are related to:

Meteorological data:
- Temperature;
- Air Humidity;
- Solar radiation;
- Wind velocity and direction;
- Rainfall;

Vineyard management:
- Soil and canopy;
- Nutrition;
- Pests and Diseases;
- Irrigation scheduling;

Vine growth and development:
- Satellite information;
- Simulation Models;
- Site specific data

Dr. Francesco Izzi, from GeoSDI Laboratory National Council of Research (CNR), The Institute of Methodologies for Environmental Analysis (IMAA) CNR IMAA explains a smart system for remote automation and management of irrigation; an integrated monitoring system, through the continuous measurement of the water content in the useful layer of occupied by the roots, optimizes irrigate interventions according to the real water requirement.

Methods of measurement of physical properties of the soil were used to estimate the water content of the soil, taking into account that there is a strong correlation between the water content and the constant dielectric of the soil.

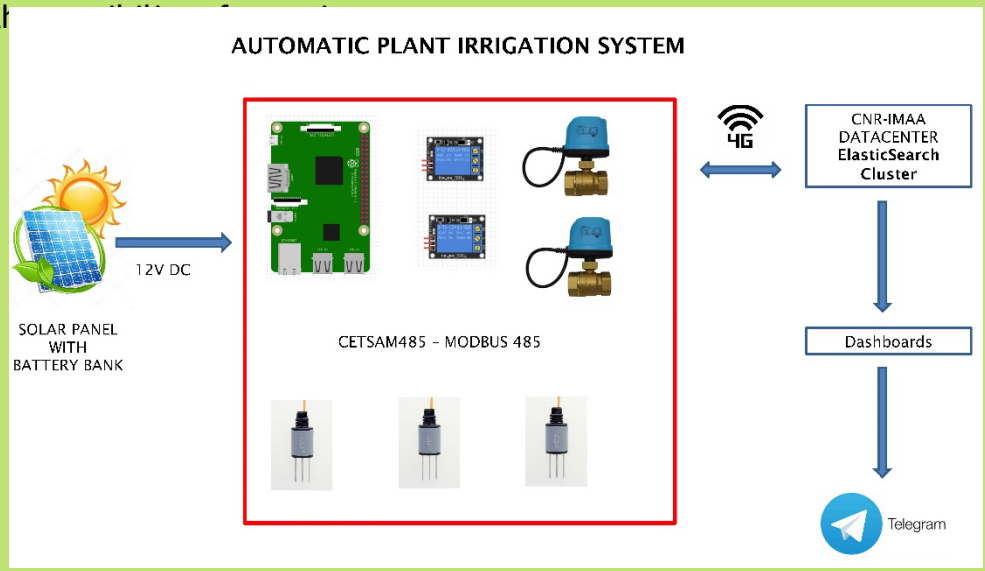
The sensor we have chosen is SAM485, a high-performance sensor whose operating principle is based on the measurement of complex high frequency impedance. an oscillator generates an electromagnetic signal that propagates through the guidelines of the sensor in the soil. the microprocessor present within the sensor itself, measures the complex soil impedance and therefore the real and imaginary components of the dielectric permittivity using the Maxwell equation.

Reliable volumetric moisture sensor for soil and artificial cultivation substrates. Main features:

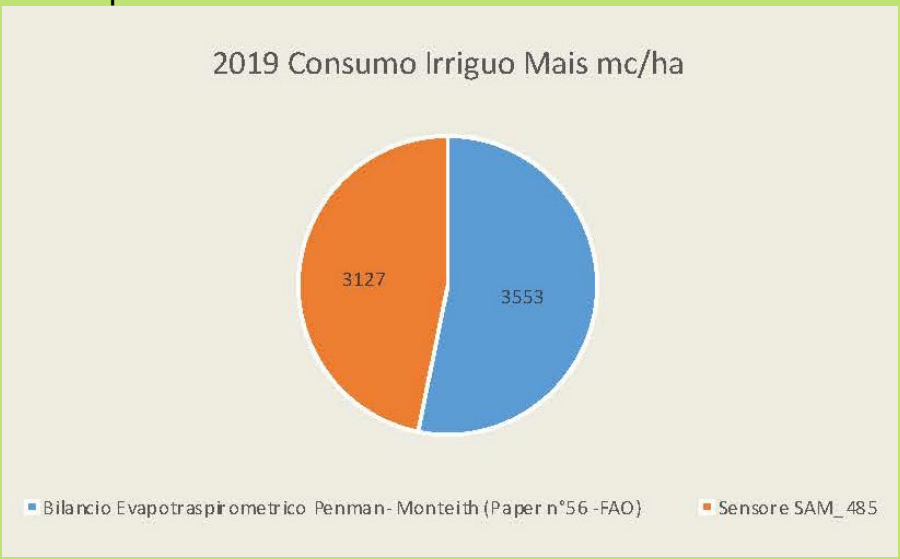
- Accuracy: 3%, 1% with specific soil calibration.
- Suitable for professional usage and for research.

• Measurement principle based on complex impedance measurement in high frequency.
• Measures also pore water EC and temperature of the device.
• Moisture measures are not influenced by EC of water. • Two communication possibilities: 2WI (2 wires only) o RS485+Power supply (4 wires).
• Compatible with MODBUS/RTU, WNode and ACX communication protocols over RS485 or 2WI. • Stainless steel replaceable electrodes

Automatic plant irrigation system continuously checks (every minute ... configurable) the VMC value (Volumetric Moisture Content), if the VMC value is below the preset threshold the system starts irrigation otherwise no. At each check we send the data to the CNR IMAA cloud by contacting a specific developed API and all data are stored on an elastic search cluster. We have implemented dashboards for real-time visualization of data and th



The experience in 2019 for a cornfield, using the SAM sensor has behaved a water saving between 20-30% compared to FAO Penman-Monteith method.



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