



DESERT

Low cost water desalination and sensor technology compact module



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Water JPI

WaterWorks2015 Cofunded Call

8 May 2018, Larnaca

Summary

- 1. Scientific and technological progress**
- 2. Collaboration, coordination and mobility**
- 3. Stakeholder/industry engagement**
- 4. Dissemination of the results**
- 5. Identified problems or specific risks**

Summary

- 1. Scientific and technological progress**
2. Collaboration, coordination and mobility
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5. Identified problems or specific risks

I. Scientific and technological progress

WPI: Integration of two water compact modules: both solar powered modules HidroNIC-Desal and HidroNIC-Fert

ROLDAN (SPAIN)



**CONTAINERS WITH
PHOTOVOLTAIC PANELS**

BARI (ITALY)



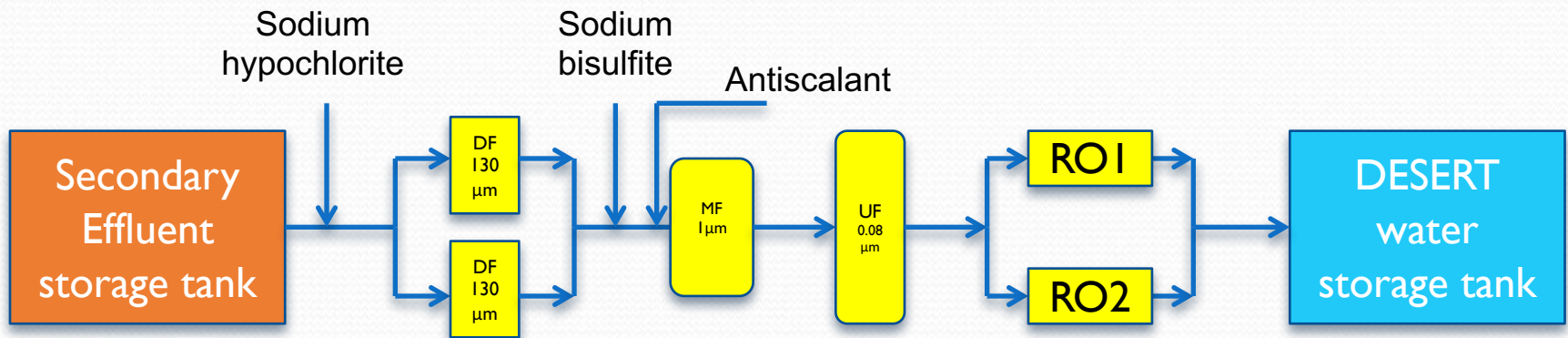
**Two
experimental
platforms**





WASTEWATER TREATMENT

HIDRONIC DESAL



Category	Parameter	Unit	Average Concentrations		Removal Efficiency
			SW	DW	
Physicochemical	EC	dS/m	1.6	0.8	53.5%
	SAR	meq/L	5.7	4.3	23.9%
	Turbidity	NTU	1.0	0.4	60.0%
	TSS	mg/L	4.6	1.8	61.6%
Macronutrients	NO ₃ ⁻	mg/L	9.2	3.5	61.7%
	PO ₄ ³⁻	mg/L	1.0	1.0	-140.9%
	K	mg/L	12.8	12.8	57.5%
	Ca	mg/L	21.9	21.9	61.2%
	Mg	mg/L	8.1	8.1	64.3%
	SO ₄ ²⁻	mg/L	31.6	31.6	75.0%
Micronutrients / phytotoxic	Fe	mg/L	0.07	0.05	29.8%
	Mn	mg/L	0.20	0.08	60.3%
	B	mg/L	0.71	0.56	20.7%
	Cl ⁻	mg/L	251.7	106.1	57.8%
	Na	mg/L	194.6	92.0	52.7%
Microbiological	E. coli	cfu/100 mL	163.8	<-	99.4%



I. Scientific and technological progress

- **HidroNic Fert. Xilema.** Automatic fertilizer supply equipment through electrovalves and venturis. Distribution of fertilizers.



- **Output mesh filter.** Mixing and filtering different fertilizers.
- **Blower pump** to carry out the aeration process, in the mixture of the fertilizer tanks.
- **Fertilizer tanks.** 4 fertilizer tanks and 1 acid tank.



I. Scientific and technological progress

The integrated water treatment system + Fertirrigation will work autonomously, that is, we will produce the energy that we will consume whenever we have sun.

The solar energy system consists of:

- **Solar panels.** 6-10 solar panels, composed of 72 polycrystalline cells, 327 W and 6.46 A. = 3270 W peak and 64.6 A.



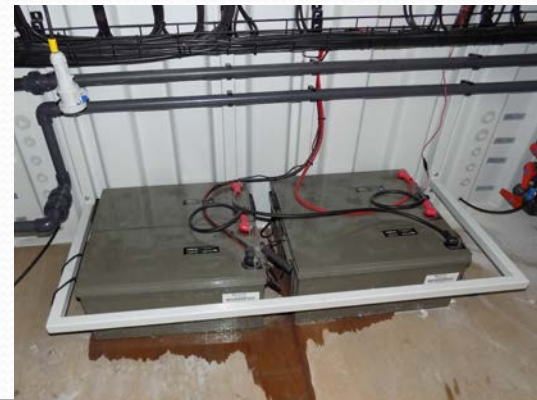
6 Panels
Bari



10 Panels
Roldan



- **Inverter.** Solar charge controllers, solar energy inverters and electronic regulators.



- **Batteries.** The energy produced are stored in 4 batteries of 12 vdc and 220 A / h. = 48 Vdc and 220 A / h.

I. Scientific and technological progress

- WP2: Development of on-line intelligent fertigation equipment

QUANTUM

- Hardware:

PLC

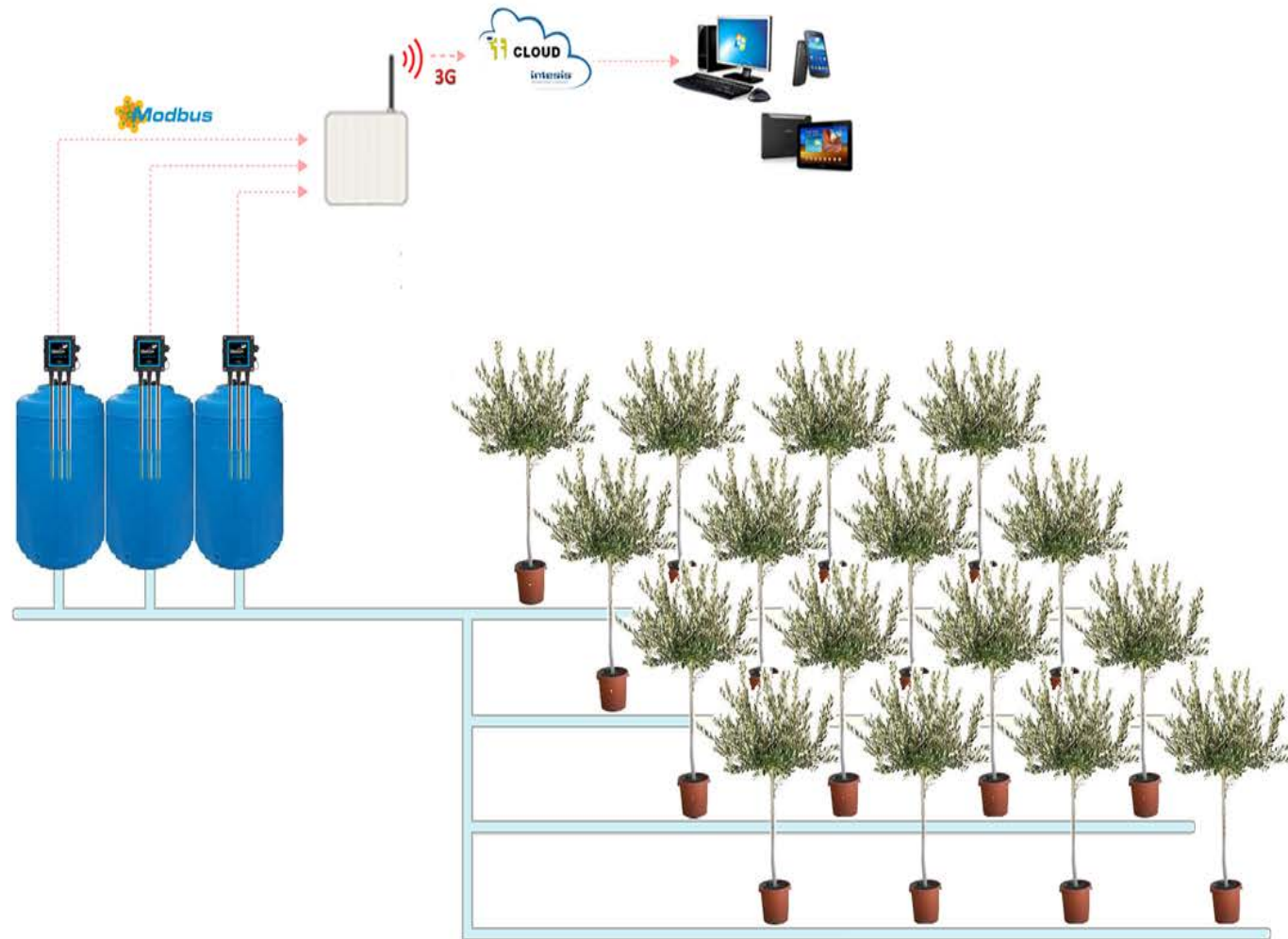
Control units

Router

Sensors....

- Software:

DSS



HARDWARE components



Sensors

Parameters

- Ca
- Cl
- Cu
- Br
- F
- NH_4^+
- Mg
- NO_3^-
- NO_2^-
- K
- Na
- TSS
- Ec
- pH



```

pt1000Class tempSensor;

// INIZIO DEFINIZIONE DEI PARAMETRI DI CALIBRAZIONE
// =====
// Calibration concentrations solutions used in the process
// =====
#define point1 10.0
#define point2 100.0
#define point3 1000.0
// =====
// Calibration voltage values for Calcium sensor
// =====
#define point1_volt_Ca 2.144
#define point2_volt_Ca 2.268
#define point3_volt_Ca 2.366
// =====
// Calibration voltage values for NO3 sensor
// =====
#define point1_volt_NO3 3.080
#define point2_volt_NO3 2.900
#define point3_volt_NO3 2.671
// =====
// Calibration voltage values for Fluor sensor
// =====
#define point1_volt_F 2.847
#define point2_volt_F 1.574
#define point3_volt_F 1.380
// =====
// Calibration values for chloride sensor
// =====
#define point1_volt_Cl 2.852
#define point2_volt_Cl 2.588
#define point3_volt_Cl 2.330
// =====
// Define the number of calibration points
// =====
#define NUM_POINTS 3
    
```

```

// =====
// Read the chloride sensor
// =====
float chlorideVolts = chlorideSensor
float chlorideValue = chlorideSensor
// delay(500);

USB.print(F(" Chloride: "));
USB.print(chlorideVolts);
USB.print(F(" ppm/mg*L-1 | "));

USB.print(F("\n"));
// SWIonsBoard.Vf();
    
```



```

// Read and store the values in the Modbus registers
regs[MB_0] = (int) flourideValue;
regs[MB_1] = (int) calciumValue;
regs[MB_2] = (int) NO3Value;
regs[MB_3] = (int) chlorideValue;
regs[MB_4] = (int) (tempValue*10);
regs[MB_5] = PWR.getBatteryLevel();
regs[MB_10] = (int) (FlourVolts*1000);
regs[MB_11] = (int) (CaVolts*1000);
regs[MB_12] = (int) (NO3Volts*1000);
regs[MB_13] = (int) (chlorideVolts*1000);

counter = 0;
}
counter = counter +1;
    
```

```

delay(10)
}

Calcium: 1.1391316917 Volts Calcium: 0.0000000081 ppm/mg*L-1 NO3: 2.2676517963 Volts NO3: 182874.7890625000 ppm/mg*L-1 Fluoride: 3.2256258381 Volts Fluoride: 1.73236322
Calcium: 1.12193813885 Volts Calcium: 0.0000000056 ppm/mg*L-1 NO3: 2.5307188834 Volts NO3: 5320.8108664462 ppm/mg*L-1 Fluoride: 3.2318941219 Volts Fluoride: 1.7828751573
Calcium: 1.11780467936 Volts Calcium: 0.0000000051 ppm/mg*L-1 NO3: 2.5435318946 Volts NO3: 4695.2949218750 ppm/mg*L-1 Fluoride: 3.257194423 Volts Fluoride: 1.6783286094
Calcium: 1.1166875362 Volts Calcium: 0.0000000051 ppm/mg*L-1 NO3: 2.5488024814 Volts NO3: 4379.2119140625 ppm/mg*L-1 Fluoride: 3.239375144 Volts Fluoride: 1.6919784954
Calcium: 1.12893138084 Volts Calcium: 0.0000000043 ppm/mg*L-1 NO3: 2.5449317620 Volts NO3: 4532.5941210937 ppm/mg*L-1 Fluoride: 3.2427190582 Volts Fluoride: 1.6438497562
Calcium: 1.18959661000 Volts Calcium: 0.0000000044 ppm/mg*L-1 NO3: 2.5439064582 Volts NO3: 4585.9135742187 ppm/mg*L-1 Fluoride: 3.2451875209 Volts Fluoride: 1.6291792392
Calcium: 1.1182538956 Volts Calcium: 0.0000000044 ppm/mg*L-1 NO3: 2.5484999256 Volts NO3: 4765.227590625 ppm/mg*L-1 Fluoride: 3.2476572998 Volts Fluoride: 1.6165970882
Calcium: 1.1238062341 Volts Calcium: 0.0000000047 ppm/mg*L-1 NO3: 2.5558000667 Volts NO3: 4047.4182128906 ppm/mg*L-1 Fluoride: 3.2491153239 Volts Fluoride: 1.688228077
Calcium: 1.1146343946 Volts Calcium: 0.0000000049 ppm/mg*L-1 NO3: 2.5556566715 Volts NO3: 4017.6830273437 ppm/mg*L-1 Fluoride: 3.2584447170 Volts Fluoride: 1.6085823956
Calcium: 1.1167777770 Volts Calcium: 0.0000000051 ppm/mg*L-1 NO3: 2.5579373836 Volts NO3: 3915.744628962 ppm/mg*L-1 Fluoride: 3.2525312000 Volts Fluoride: 1.5795880847
Calcium: 1.1184999942 Volts Calcium: 0.0000000053 ppm/mg*L-1 NO3: 2.5625123294 Volts NO3: 3730.8883789062 ppm/mg*L-1 Fluoride: 3.2558878117 Volts Fluoride: 1.5826155884
Calcium: 1.1196847417 Volts Calcium: 0.0000000053 ppm/mg*L-1 NO3: 2.5678626163 Volts NO3: 3533.3938664462 ppm/mg*L-1 Fluoride: 3.2574374675 Volts Fluoride: 1.5677189626
Calcium: 1.1196847417 Volts Calcium: 0.0000000067 ppm/mg*L-1 NO3: 2.5727822780 Volts NO3: 3313.4013628906 ppm/mg*L-1 Fluoride: 3.2581258667 Volts Fluoride: 1.5643387794
Calcium: 1.1111249792 Volts Calcium: 0.0000000069 ppm/mg*L-1 NO3: 2.5795888236 Volts NO3: 3862.4421386718 ppm/mg*L-1 Fluoride: 3.2587499618 Volts Fluoride: 1.5612709799
Calcium: 1.1136916990 Volts Calcium: 0.0000000072 ppm/mg*L-1 NO3: 2.5795319995 Volts NO3: 3212.49139168156 ppm/mg*L-1 Fluoride: 3.2594086927 Volts Fluoride: 1.5576812134
Calcium: 1.1136465785 Volts Calcium: 0.0000000076 ppm/mg*L-1 NO3: 2.5817818641 Volts NO3: 2993.7463378906 ppm/mg*L-1 Fluoride: 3.2600811825 Volts Fluoride: 1.5551526544
Calcium: 1.1180238432 Volts Calcium: 0.0000000079 ppm/mg*L-1 NO3: 2.5871878252 Volts NO3: 2880.1662979556 ppm/mg*L-1 Fluoride: 3.2603174993 Volts Fluoride: 1.5536275863
Calcium: 1.1482589743 Volts Calcium: 0.0000000083 ppm/mg*L-1 NO3: 2.5816562175 Volts NO3: 2997.9863281520 ppm/mg*L-1 Fluoride: 3.2607183456 Volts Fluoride: 1.5516556739
Calcium: 1.1441442573 Volts Calcium: 0.0000000085 ppm/mg*L-1 NO3: 2.58763882076 Volts NO3: 2801.1291589306 ppm/mg*L-1 Fluoride: 3.2610945701 Volts Fluoride: 1.5488241424
Calcium: 1.14350814738 Volts Calcium: 0.0000000089 ppm/mg*L-1 NO3: 2.5849129847 Volts NO3: 2888.245117187 ppm/mg*L-1 Fluoride: 3.2614399124 Volts Fluoride: 1.5481476793
Calcium: 1.1464865927 Volts Calcium: 0.0000000093 ppm/mg*L-1 NO3: 2.5852131313 Volts NO3: 2879.4815326718 ppm/mg*L-1 Fluoride: 3.2614684194 Volts Fluoride: 1.5480862961
Calcium: 1.1487221217 Volts Calcium: 0.0000000099 ppm/mg*L-1 NO3: 2.5816249847 Volts NO3: 2999.8485273437 ppm/mg*L-1 Fluoride: 3.2617189848 Volts Fluoride: 1.5467891693
Calcium: 1.148943643 Volts Calcium: 0.0000000099 ppm/mg*L-1 NO3: 2.5856566429 Volts NO3: 2865.9418945312 ppm/mg*L-1 Fluoride: 3.2617158889 Volts Fluoride: 1.5468093327
Calcium: 1.1516618481 Volts Calcium: 0.0000000105 ppm/mg*L-1 NO3: 2.5876616847 Volts NO3: 2885.1165971187 ppm/mg*L-1 Fluoride: 3.2618117564 Volts Fluoride: 1.5463411880
Calcium: 1.1527243852 Volts Calcium: 0.0000000107 ppm/mg*L-1 NO3: 2.5844731994 Volts NO3: 2891.3350933993 ppm/mg*L-1 Fluoride: 3.2620008839 Volts Fluoride: 1.5454249388
Calcium: 1.1553781852 Volts Calcium: 0.0000000113 ppm/mg*L-1 NO3: 2.5924696932 Volts NO3: 2654.311851562 ppm/mg*L-1 Fluoride: 3.2618124485 Volts Fluoride: 1.5463515157
Calcium: 1.1596647128 Volts Calcium: 0.0000000117 ppm/mg*L-1 NO3: 2.5977616541 Volts NO3: 2580.2094270562 ppm/mg*L-1 Fluoride: 3.2617821093 Volts Fluoride: 1.5464432464
Calcium: 1.1599371789 Volts Calcium: 0.0000000123 ppm/mg*L-1 NO3: 2.5939888715 Volts NO3: 2611.6678687500 ppm/mg*L-1 Fluoride: 3.2619068985 Volts Fluoride: 1.5455252372
Calcium: 1.1486258162 Volts Calcium: 0.0000000099 ppm/mg*L-1 NO3: 2.5815558880 Volts NO3: 2786.4287189375 ppm/mg*L-1 Fluoride: 3.2619066238 Volts Fluoride: 1.5458784183
    
```

Serial monitor



Sensors calibration

QUANTUM

Integration with HidroNic Desal and HidroNic Fert




I. Scientific and technological progress



I. Scientific and technological progress

Decision support system



Desert|

.....

Inserire le credenziali per effettuare il login

Accedi

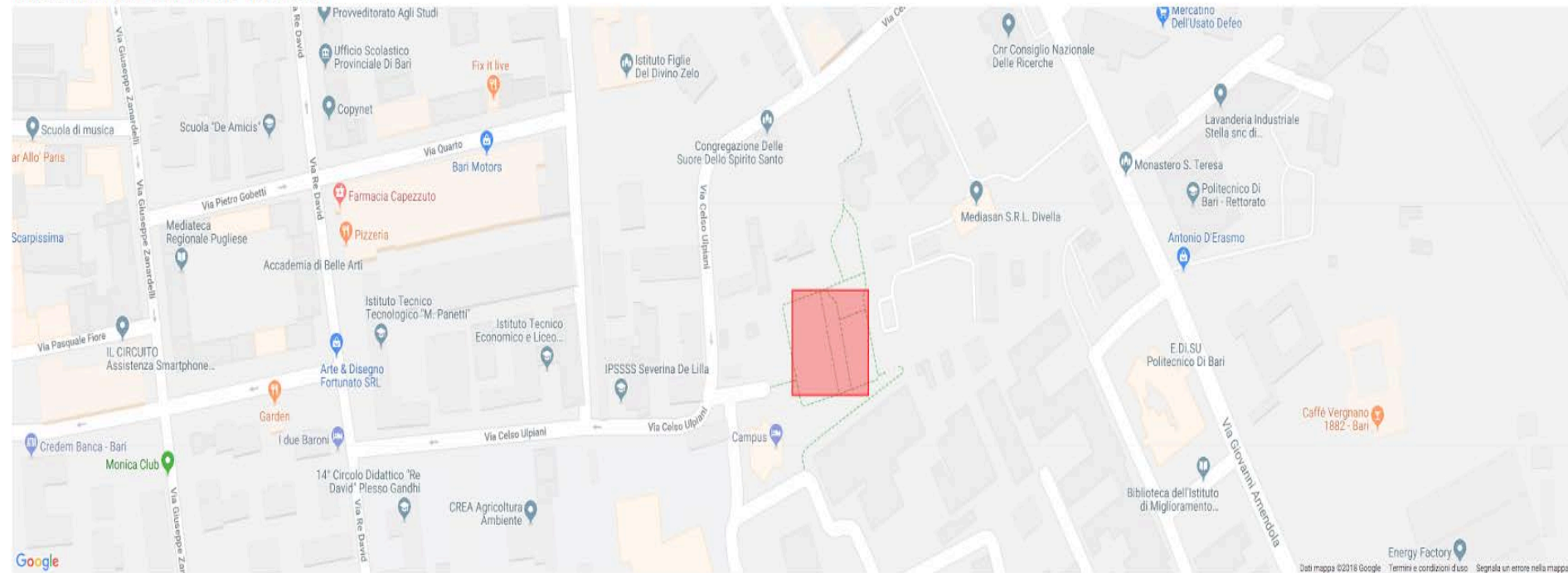
I. Scientific and technological progress



Azienda Aree Omogenee Dispositivi Allarmi Grafici

Benvenuto! Disconnettiti

Università degli Studi di Bari "Aldo Moro"



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[Vai alla lista degli appezzamenti](#)

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Farm data

Azienda	Nome	Superficie (ha)
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Università degli Studi di Bari "Aldc

Olivo

10

Crop characteristics

Gruppo	Specie	Fase Ciclo	Produzione Attesa (t/ha)
--------	--------	------------	--------------------------

Arboree

Olivo olive, legno e foglie

Piena Produzione

10

Soil characteristics

Fosforo (ppm)	Sabbia (%)	Calcare Totale(%)	Azoto Totale (g/kg)
---------------	------------	-------------------	---------------------

30

40

21

1,1

Potassio (ppm)	Argilla (%)	Classe Tessitura	Sostanza Organica (%)
----------------	-------------	------------------	-----------------------

300

40

TendenzialmenteArgilloso

2

Profondità (cm)	Limo (%)	Ubicazione	Drenaggio	C/N
-----------------	----------	------------	-----------	-----

50

20

Pianura Limitrofa a Zone Urbanizz

Normale

10,5636361346757

Climatic parameters

Precipitazioni in mm dal 1/10 al 31/01	Apporto Ammendanti	N Anno Precedente (kg/ha)	Frequenza
--	--------------------	---------------------------	-----------

170

Ammendante

30

Ogni 3 anni




[Ritorna indietro](#)

I. Scientific and technological progress

Azienda	Aree Omogenea	Fase/Ciclo	Superficie (ha)	Produzione Attesa (t/ha)
Università degli Studi di Bari "Aldo Moro"	Olivio	Piena Produzione	10	10

+ NECESSITA'		N (kg/ha)	P205 (kg/ha)	K20 (kg/ha)
A)	Fabbisogno della Coltura	248	48	200
C)	Perdite per Lisciviazione	6	0	10
D)	Immobilizzazioni e dispersioni	6	/	/
B1)	Arricchimenti	0	0	0
A2)	Anticipazioni anni futuri	0	0	0
Totale Necessità		260	50	212

- DISPONIBILITA'		N (kg/ha)	P205 (kg/ha)	K20 (kg/ha)
B)	Fertilità del Suolo	24	0	508
E)	Precessione	0	/	/
F)	Fertilità Organica Residua	6	/	/
G)	Apporti Naturali	20	/	/
Totale Disponibilità		50	0	508

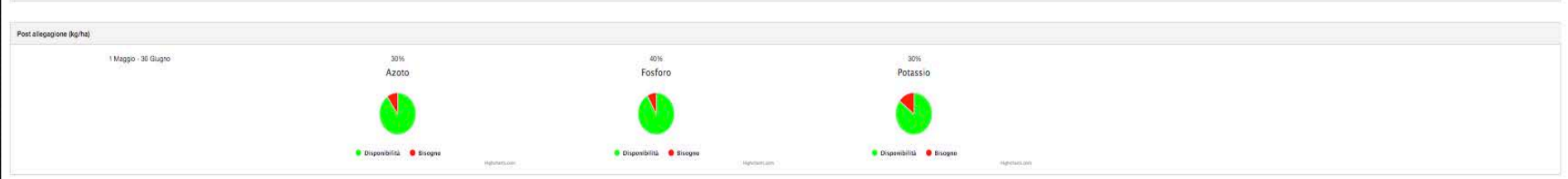
= BISOGNO CALCOLATO		N (kg/ha)	P205 (kg/ha)	K20 (kg/ha)
Totale		210	50	-296
		 <p>● Disponibilità Suolo ● Bisogno</p>	 <p>● Disponibilità Suolo ● Bisogno</p>	 <p>● Disponibilità Suolo ● Bisogno</p>

I. Scientific and technological progress

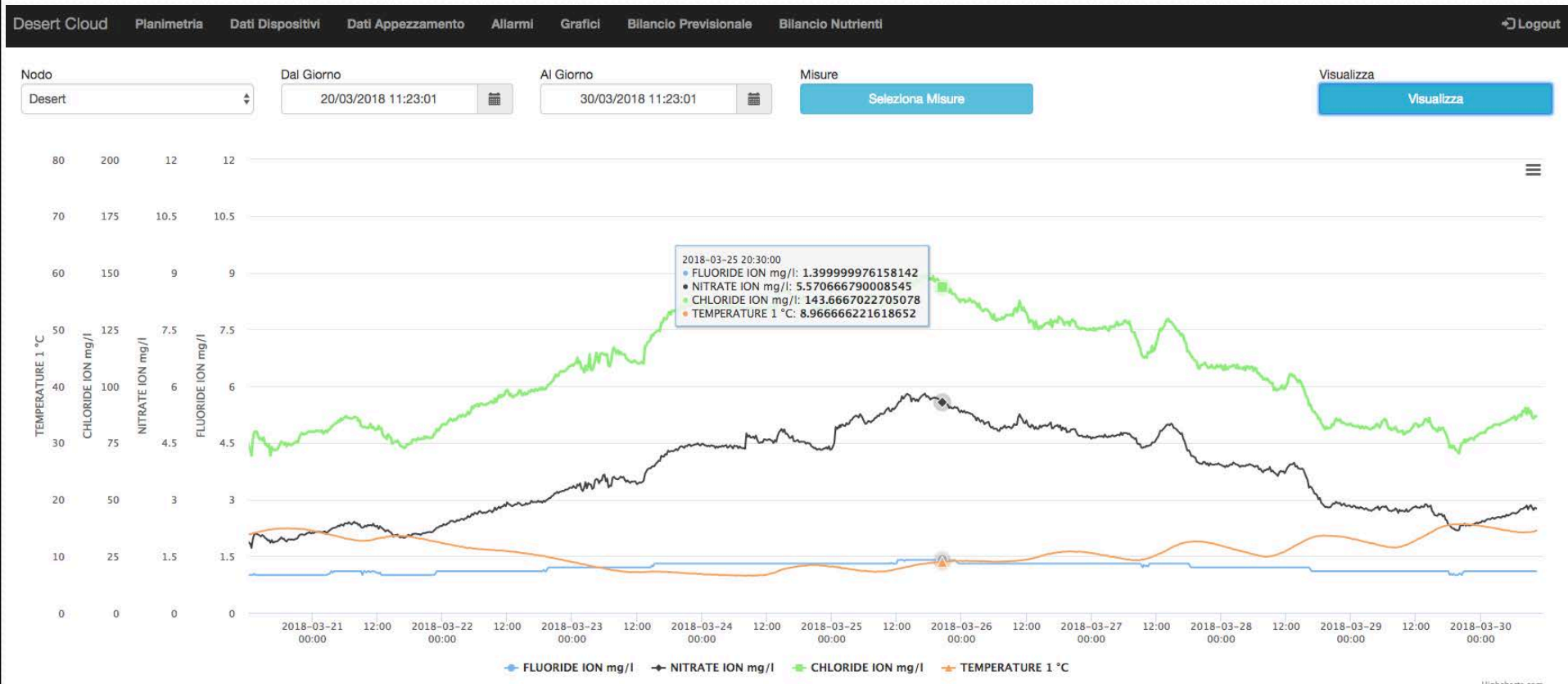
Dati Azienda

Azienda: Università degli Studi di Bari Aldo Moro - Agraria | Appezamento: Appezamento olive | Specie: Olive | Fase Ciclo: Produttore Alleva | Data: 05/04/2018

Visualizza



I. Scientific and technological progress



I. Scientific and technological progress

Lista delle concimazioni effettuate:

Data / Ora	Concime	Modalità Somministrazione	Titoli (kg/q)			kg/ha	Efficienza (%)			Somministrati			Operazioni
			N	P2O5	K2O		N	P2O5	K2O	N	P2O5	K2O	
04/05/2018	Fertil MBS 9/14/13 +2+16+7,6	Granulare - Tre Somministrazioni	9	14	13	10	90	100	100	0,81	1,4	1,3	Elimina
07/09/2018	AZO TOP 18,5/0/0	Granulare - Unica Somministrazione	18,5	0	0	10	60	100	100	1,11	0	0	Elimina
01/03/2018	BELFRUTTO MB 5/10/15 +5+16	Per via Fogliare	5	10	15	10	100	100	100	0,5	1	1,5	Elimina
05/05/2018	Acido fosforico 85%	Fertirrigazione	0	61	0	10	100	100	100	0	6,1	0	Elimina

Aggiungi Modalità Somministrazione e Concime

Giorno	Concime	Modalità Somministrazione	Quantità	
05/05/2018	✓ Acido fosforico 85%	zione	10	Aggiungi

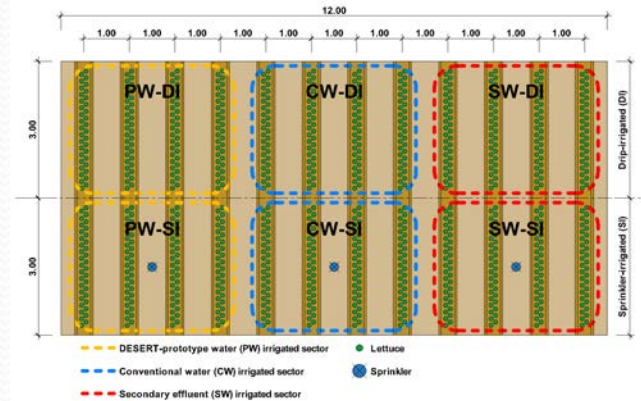
[Ritorna indietro](#)

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- ✓ Acido fosforico 85%
- AGRESTE ORG.MIN. 7,5/12/21
- AGROFERT MB ORG.MIN. 10/5/15 +2+16
- AGROFERT MBS O MIN. 9,5/5/14,5 +2+24
- AZO TOP 18,5/0/0
- AZO TOP 18,5/0/0 +32
- Azogold 40 N + 12 SO3
- Azoplus 35 N + 22 SO3
- BELFRUTTO MB 5/10/15 +5+16
- BELFRUTTO MBS KG 25 ORG.MIN. 6/10/15
- Calciocianamide oleata
- Calciocianamide granulare
- Calciocianamide in polvere
- Cloruro di potassio
- Ferroumato
- Fertil agreste start kg 50 10/12/7
- Fertil MBS 9/14/13 +2+16+7,6
- Fosfato biammonico 18-46
- Fosfato biammonico 21-52
- Fosfato monoammonico 12-61
- Fosfato monopotassico 0-52-34
- Fosfato naturale tenero 0-27-0
- Fosfato monoamm multi map
- Fosfato monopot multi mcp
- Geomag mcr 0,2+5+0,5+0,5
- Humofos 3/15/0 +16+8

I. Scientific and technological progress

- **WP3:** DESERT irrigation water validation and agronomic assessment for fruit tree crops and soil quality monitoring



Physiological parameters	SPRINKLER IRRIGATION (SI)			DRIP IRRIGATION (DI)		
	Secondary RW (SW)	Irrigators Community	DESERT	Secondary RW (SW)	Irrigators Community	DESERT
A ($\mu\text{mol m}^{-2} \text{s}^{-1}$)	19,94	17,58	16,65	20,64	21,67	20,94
g_s ($\text{mmol m}^{-2} \text{s}^{-1}$)	385,1	267,0	171,9	397,0	327,3	276,3
WUE intrinsec (A/ g_s)	51,8	65,8	96,9	52,0	66,2	75,8

LETTUCE (var. Romana)

TOMATO

Yield and fruit quality



DESERT water reached the highest WP values with 17,4 Kg/m³.



BROCCOLI

Yield



Water productivity and yield

WATER QUALITY SOURCE	PLANT WEIGHT (g)	Yield (Kg/ha)	Water applied (m ³ / ha)	Water productivity (kg /m ³)
Brine + Secondary RW	438,1 ± 71,1 a	21905 ± 3555	1254	17,5
DESERT	393,9 ± 63,6 a	19695 ± 3180	1254	15,7 (-10%)

ORANGE ORCHARD

Yield

Water productivity and yield



WATER QUALITY SOURCE	Yield (Kg / tree)	Yield (Kg/ha)	Water applied (m³/ ha)	Water productivity (kg /m³)
Irrigators Community water	59,4	24750	4987,4	5,0
DESERT water	61,8	25750	4987,4	5,2 (+4%)

ORANGE ORCHARD

Fruit Quality

WATER QUALITY SOURCE	FRUIT WEIGHT (g)	FRUIT DIAMETER (mm)	PEEL THICKNESS (mm)	JUICE (mL)	SSC (°BRIX)
CONTROL	235,9 ± 7,4 a	76,9 ± 0,8 a	4,25 ± 0,09 a	126,9 ± 4,1 a	14,6 ± 0,19 a
DESERT	264,5 ± 9,8 b	79,4 ± 0,9 b	4,44 ± 0,10 a	141,9 ± 5,15 b	12,9 ± 0,39 b
% increase by DESERT	12,1	3,2	4,6	11,9	-11,4

Colour index: HUE and L slightly higher (1,9 and 0,9%) and less Chroma (-0.8%).

Olive trees - Oil quality

WATER QUALITY SOURCE	Fenols	Acidity	Peroxide	Chl
DW-FI	391 c	0.23 ab	7.80 b	0.17 b
DW-RDI	441 b	0.20 b	7.64 a	0.18 b
RW-FI	406 c	0.23 ab	8.52 c	0.18 b
RW-RDI	459 a	0.25 a	8.81 d	0.09 a

DW Desert Water
RW Not treated water

DW
Ecw= 1.5 dS/m
RW
Ecw= 3.0 dS/m



Almond trees – leaves

WATER QUALITY SOURCE	Na	K	NTot
Ecw 1.5 DW-FI	0.06 b	1.69 ab	2.03 a
Ecw 1.5 DW-RDI	0.05 b	1.71 b	2.10 ab
Ecw 3.0 RW-FI	0.14 a	1.54 ab	2.34 bc
Ecw 3.0 RW-RDI	0.19 a	1.49 a	2.41 c

Ecw=1.5 dS/m



DW Desert Water
RW Not treated water

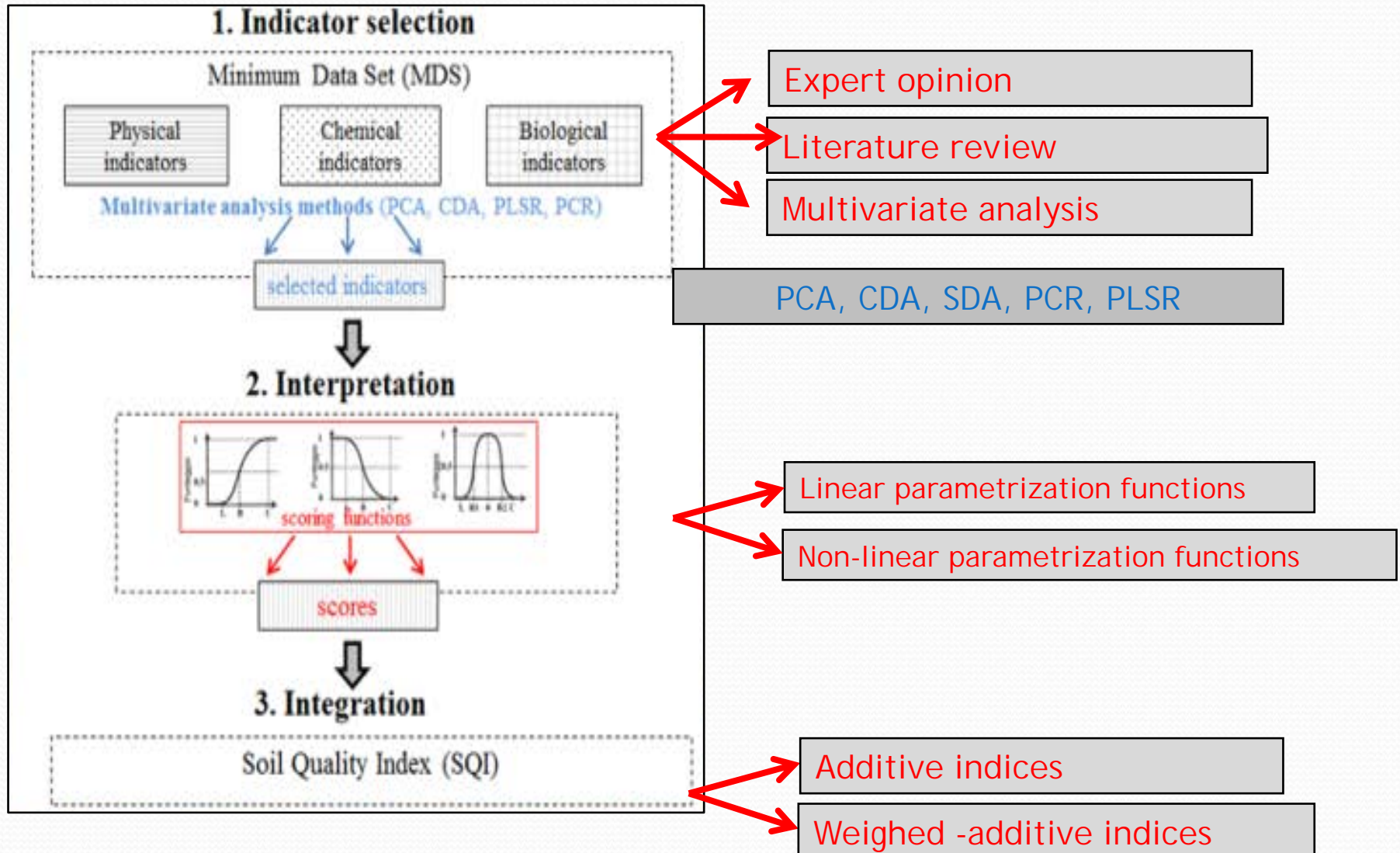
Ecw= 3.0 dS/m



Task 2.1: Comparison of different methodological approaches to compute soil quality indices (SQIs)

SQIs allow to synthesize in a standardized value information brought by numerous soil indicators

A critical aspect is the choice of representative indicators for building the Minimum Data Set (MDS)



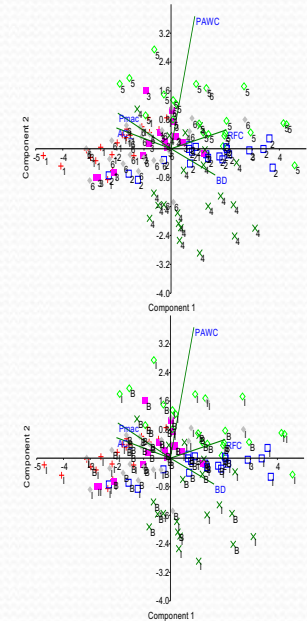
Task 2.1: Comparison of different methodological approaches to compute soil quality indices - Results



1 Article

2 Application of multivariate analysis techniques for
3 selecting soil physical quality indicators: a case study
4 in long-term field experiments in Apulia (southern
5 Italy)

6 Mirko Castellini ^{1,*}, Massimo Iovino ² and Anna Maria Stellacci ³



AIMS:

-Investigating soil variables selection with the use of different statistical approaches: **correlation analysis, PCA and SDA**, using datasets deriving from **long-term field experiments**.

RESULTS:

Results highlighted the **complementary and supplementary role of the three data analyses procedures applied (corr, PCA, SDA)** and the **importance to use simultaneously different approaches to have a complete understanding of the processes investigated**.

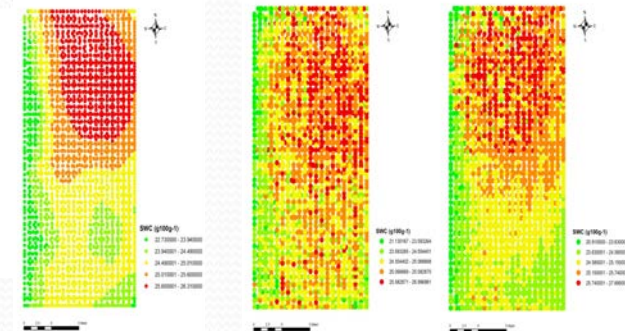
RFC showed to have a crucial role among soil physical quality (SPQ) indicators, being **able to synthesize part of the information given by AC and PMAC**.

Task 2.2: Characterization of the soil spatial variability of the experimental site - Results

Submitted to GEODERMA

Contribution of EMI and GPR proximal sensing data in soil water content assessment by using linear mixed effects models and geostatistical approaches

Emanuele Barca¹, Daniela De Benedetto^{2*}, Anna Maria Stellacci^{2,3}



AIMS

- investigating the single or combined contribution of EMI and GPR sensor data in soil water content (SWC) assessment;
- comparing linear mixed effects models (LMM) and geostatistical approaches to estimate SWC.

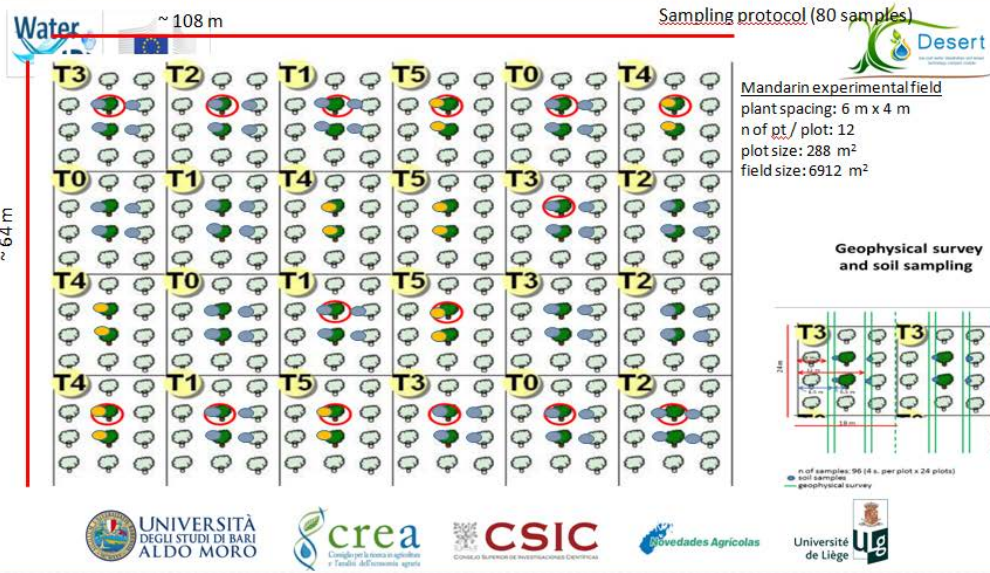
MAIN FINDINGS

GPR was more effective than EMI in estimating soil water content (SWC).

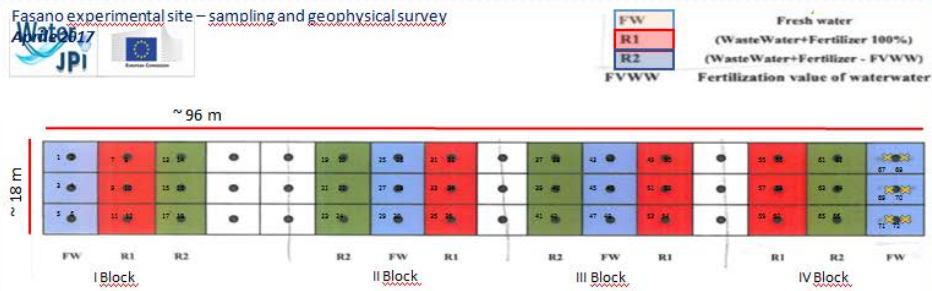
The combined use of both data sources showed an even larger explaining capability with more accurate predictions of SWC.

LMM and geostatistical approaches proved to behave very similarly.

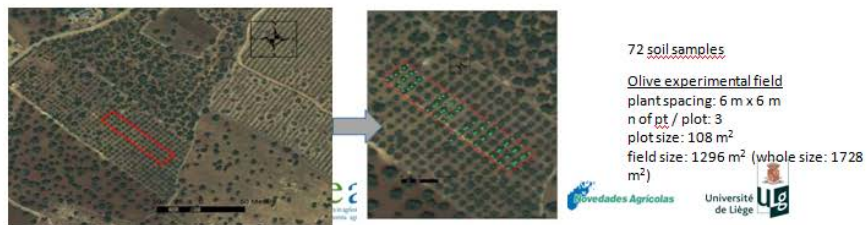
Characterization of the soil spatial variability of the experimental site – ongoing activities



80 sampled locations



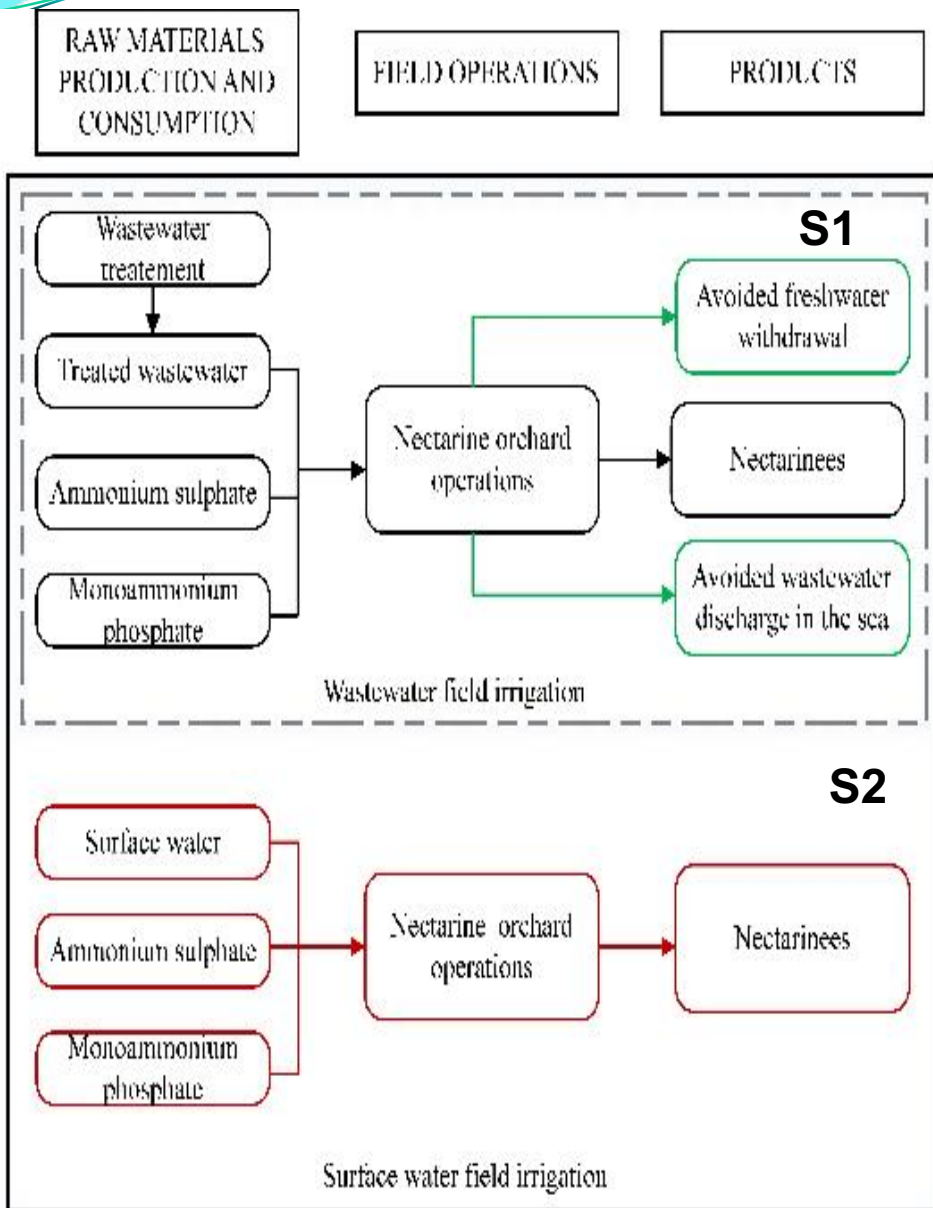
72 sampled locations



- Two experimental sites:
- Long-term (8 years): Campotejar (Murcia, Spain)
 - Short-medium term (3 years): Fasano (Puglia, Italy)

I. Scientific and technological progress

- **WP4:** Sustainability assessment, energy and cost efficiency of the DESERT system



The environmental impact assessment model is based on the Environmental Life cycle analysis framework

- Three-year study (2012–2014)
- *Prunus persica L. Batsch*
- Drip irrigation with SW and TMW

Functional unit:

1 kg of Nectarines

Scenario 1 → Treated municipal wastewater

Scenario 2 → Conventional water

VALUATION OF TREATED URBAN WASTE-WATER FOR IRRIGATION:

a cross-country study

Scope

1

- *Farmers' willingness to use treated urban wastewater for irrigation to complement conventional water resources*

2

- *Use value of treated urban wastewater used for irrigation in agriculture in water-scarce regions*

3

- *Farmers' response to future credible policies options*

Summary

1. Scientific and technological progress
- 2. Collaboration, coordination and mobility**
3. Stakeholder/industry engagement
4. Dissemination of the results
5. Identified problems or specific risks

2. Collaboration, coordination and mobility

Collaboration

Collaboration:

- Deep collaboration among partners

New projects

H2020 - A digital platform for w**A**Ter quaLity AwareNess, Technologies and Solutions
Acronym: ATLANTIS

PRIMA call - Efficient production and sustainable management of REclaimed wasteWATER and desalinated seawater in the MEDiterranean area
Acronym: REWATMED

Erasmus Plus – NUCIF

Knowledge hub Agroalimentare y Agroindustria (water reuse in agriculture)
With different Universities of South America



Cofinanciado por el
programa Erasmus+
de la Unión Europea



Collaboration

During the Mid Term Meeting of DESERT we invited the project coordinator of **IRIDA** project



IWA Conference in California Poster With **MEPROWARE**
Alfieri Pollice Project Coordinator

NOVEL METHODOLOGY FOR THE PROMOTION OF TREATED WASTEWATER REUSE FOR MEDITERRANEAN CROPS IMPROVEMENT (MEPROWARE)

A.G. Vivas*, S. Campese†, F. Pedraza-Solís†, M. Murillo†, P. Latorre†, T. Dugali†, L. Galera Galera†, A. Vázquez, A. De La Hoz†, C. Rodríguez, A. Pollice†

ABSTRACT: A large percentage of the world population still live in areas with water scarcity and poor water quality due to climate change and increasing population. In these "hotspots", agriculture will face the challenge of supplying the increasing demand for food resulting from the increasing population growth while, at the same time, maintaining or increasing productivity under reduced security in the greater use of marginal quality lands and water. The two projects DESERT and MEPROWARE, funded under the EU Water-CHES2 call (Water4Agri2014) tackle different aspects of this issue, addressing wastewater treatment technologies and related security in a framework with research, operational and strategic objectives.

DESERT: DESERT project is to create an innovation ecosystem in a smart sector (water) combining technology on water treatment and water quality control. In the long duration, DESERT project addresses the water reuse of agricultural crops. One of the main objectives is to improve the productivity of the crops through the use of treated wastewater. The project will focus on the development of new technologies in terms of conventional water treatment, irrigation and reduction of crop water consumption.

MEPROWARE: MEPROWARE aims at promoting a novel water resource management concept based on the idea of allowing the reuse of treated wastewater to irrigate, through irrigation, with conventional water resources in the agricultural sector. The main objective is to improve the knowledge of wastewater treatment and related security in a framework with research, operational and strategic objectives.

Methodology: MEPROWARE will be implemented in a Mediterranean area. A monitoring system will be developed and implemented in a Mediterranean area. A monitoring system will be developed and implemented in a Mediterranean area. A monitoring system will be developed and implemented in a Mediterranean area.

Results: MEPROWARE project will be implemented in a Mediterranean area. A monitoring system will be developed and implemented in a Mediterranean area. A monitoring system will be developed and implemented in a Mediterranean area.

Conclusions: MEPROWARE project will be implemented in a Mediterranean area. A monitoring system will be developed and implemented in a Mediterranean area. A monitoring system will be developed and implemented in a Mediterranean area.

Collaboration with Dipartimento di Scienze Biomediche e Oncologia Umana (DIMO)
Food Science, Clinical Chemistry, Epidemiology for microbiological analysis



2. Collaboration, coordination and mobility

Coordination

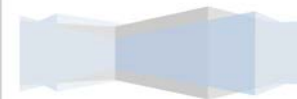
Kick off meeting DESERT project
21st September 2016 - Bari - Italy



MID Term Meeting
April 2018 – Murcia - Spain



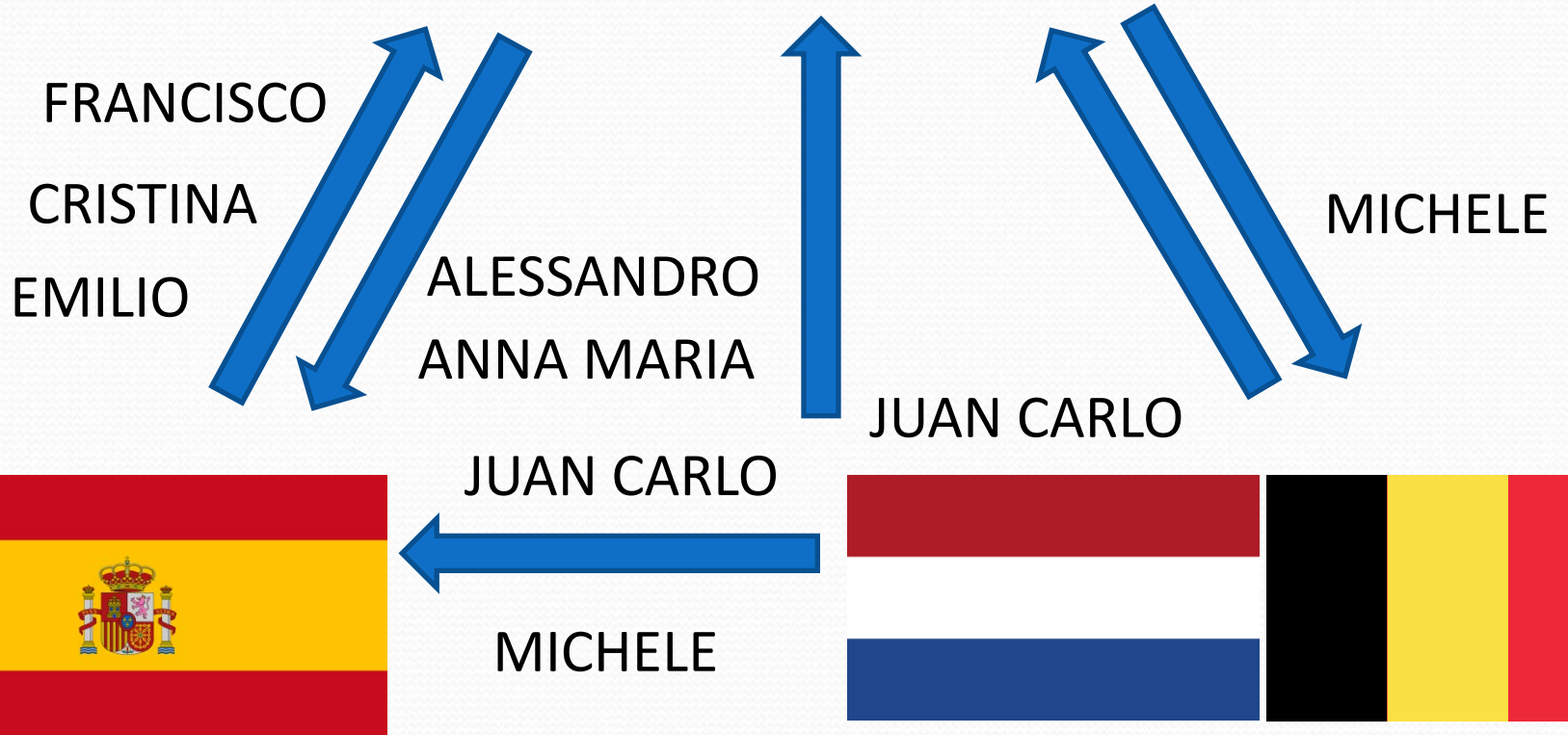
MID TERM REPORT



Mobility



2 post-doc
1 Internship
1 Visiting researcher



Summary

1. Scientific and technological progress
2. Collaboration, coordination and mobility
- 3. Stakeholder/industry engagement**
4. Dissemination of the results
5. Identified problems or specific risks

3. Stakeholder/industry engagement

DESERT technologies



To test the plant performance under different salt and nutrients loads



AGROMILLORA

Tertiary wastewater treatment plant of Bisceglie municipality interested on QUANTUM system




Summary

1. Scientific and technological progress
2. Collaboration, coordination and mobility
3. Stakeholder/industry engagement
- 4. Dissemination of the results**
5. Identified problems or specific risks


4. Dissemination of the results

- **WP5:** Dissemination on strategy and exploitation plan for transfer of knowledge and market uptake



Federazione Regionale degli Ordini dei Dottori Agronomi e dei Dottori Forestali della Puglia

ASSOCIAZIONE REGIONALE PUGLIESE DEI TECNICI e RICERCATORI IN AGRICOLTURA
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ACCADEMIA DEI GEORGOFILI SEZIONE SUD-EST UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO CONSIGLIO PER LA RICERCA IN AGRICOLTURA E L'ANALISI DELL'ECONOMIA AGRARIA

IL RIUSO DELLE ACQUE REFLUE URBANE IN AGRICOLTURA
Il progetto europeo DESERT

Merccoledì 10 Maggio 2017, ore 17:00 - Auditorium di Villa La Rocca, via C. Ulpiani, 27 - BARI

Apri i lavori: Prof. Vittorio Marzi, Presidente della Sezione Sud-Est dell'Accademia dei Georgofili
Introduce: Prof. Pietro Rubino, già Ordinario di Agronomia generale all'Università di Bari

RELAZIONI

- ✓ **Overview del Progetto DESERT**
Salvatore Compagno, Università di Bari - Coordinatore del Progetto
- ✓ **Controllo del monitoraggio qualitativo delle acque reflue urbane affluite per il riuso in agricoltura**
G. Alessandrini, Università di Bari - Coordinatore esecutivo del Progetto
- ✓ **Approcci metodologici innovativi per la valutazione della qualità del suolo irrigato con acque non convenzionali**
Anna Maria Santucci, Università di Bari - Responsabile scientifico dell'Unit del CSIA
- ✓ **Water-to-desert e Water-to-Zero: sistemi integrati a basso impatto ambientale per il trattamento delle acque reflue in la fertirrigazione**
Francesco Pedrero Salcedo - CSIC Murcia e UNISA

Desert
Segreteria organizzativa: www.desertproject.eu



UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO ACCADEMIA DEI GEORGOFILI SEZIONE SUD-EST

GIOVEDÌ 15 FEBBRAIO ALLE ORE 15:30
AULA MAGNA DELLA EX FACOLTÀ DI AGRARIA
CAMPUS UNIVERSITARIO - "E. CANGIARELLO" - VIA ORABONA 4 - BARI
INCONTRO DI STUDIO
APERTURA DEI LAVORI
PROF. VITTORIO MARZI - PRESIDENTE DELL'ACCADEMIA DEI GEORGOFILI SEZIONE SUD-EST

P. RUBINO, S. CAMPOSEO, A.M. STELLACCI, G.A. VIVALDI, A. IONIGRO
«ATTIVITÀ DI RICERCA CONDOTTA DAI DIPARTIMENTI DI S.A.A.T. E DI S.S.P.A. DELL'UNIVERSITÀ DI BARI NELL'AMBITO DEL RIUTILIZZO IN AGRICOLTURA DI REFLUI MUNICIPALIS SOTTOPOSTI A TRATTAMENTO.»

ANTONIO LOPEZ
"ECONOMIA CIRCOLARE E ACQUE REFLUE: RIUSO IN AGRICOLTURA E NON SOLO"
SEGUIRANNO INTERVENTI E DIBATTITO

AGLI STUDENTI CHE PARTECIPERANNO AL SEMINARIO E CHE REGISTRERANNO LA PROPRIA PRESENZA SUI MODULI APPUNTOMENTE PREPARIATI, POTRANNO ESSERE ATTRIBUITI 4 S.CREDITI FORMATIVI, NELL'AMBITO DI QUELLO PREVISTO PER LA "ATTIVITÀ INTEGRATIVA" O "ALTRE ATTIVITÀ PER L'INSEGNAMENTO NEL MONDO DEL LAVORO" (SECONDO LE MODALITÀ RIPORTATE NEI RELATIVI REGOLAMENTOI)




UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO Dipartimento di Scienze Agro-Ambientali e Territoriali




Seminar
Sustainable reuse of treated municipal wastewater for tree crops irrigation
DESERT project

Tuesday 5th December 2017 15:00-18:00
Aula Magna di Agraria - Via Amendola 165/A - Bari, Italy



www.desertproject.eu

*Saranno rilasciati i crediti formativi



Il Fatto Quotidiano 10 August 2017

National new paper



SEZIONI **Il Fatto Quotidiano**

annuncio chiuso da Google

Int. visual. ann. Perché questo annuncio? ▸

← **Siccità, per combatterla un'idea made in Italy. Ecco Desert: "Riuso dell'acqua reflua grazie ai depuratori per evitare lo spreco"**



TGR 3 – Regional TV news report



Students: \approx 150

Seminar: Irrigation Water Management on Semi-Arid Climates: Strategies and Reuse" 22th September 2016 - Bari - Italy



CEBAS-CSIC, received the visit from staff of the
Agriculture Department, State Govt. of Himachal
Pradesh (India)

19th October 2016 - Murcia - Spain



Students of University of Wageningen
visited experimental platform of CEBAS
-CSIC

22nd October 2016 - Murcia - Spain



Workshop "Youth Innovating with Wastewater" Workshop of the European Group of LIFE
for a Sustainable Mediterranean" ReQpro project
21st-22nd March 2017 - Marseille - France 27th and 28th October 2016 - Murcia - Spain



DESERT

Low-cost water desalination and sensor technology compact module



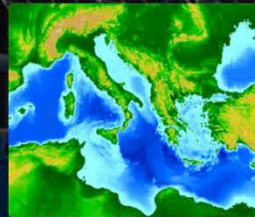
DESERT

[Home](#) [Project](#) [Partners](#) [Events](#) [Press review](#) [Multimedia](#) [Contacts](#)

The DESERT technology can contribute to mitigate the negative effects of intensive surface and groundwater abstraction, improving water quality and increasing farmers' income through saving costs of energy and reducing the water and fertilizers needs



Water scarcity



Mediterranean



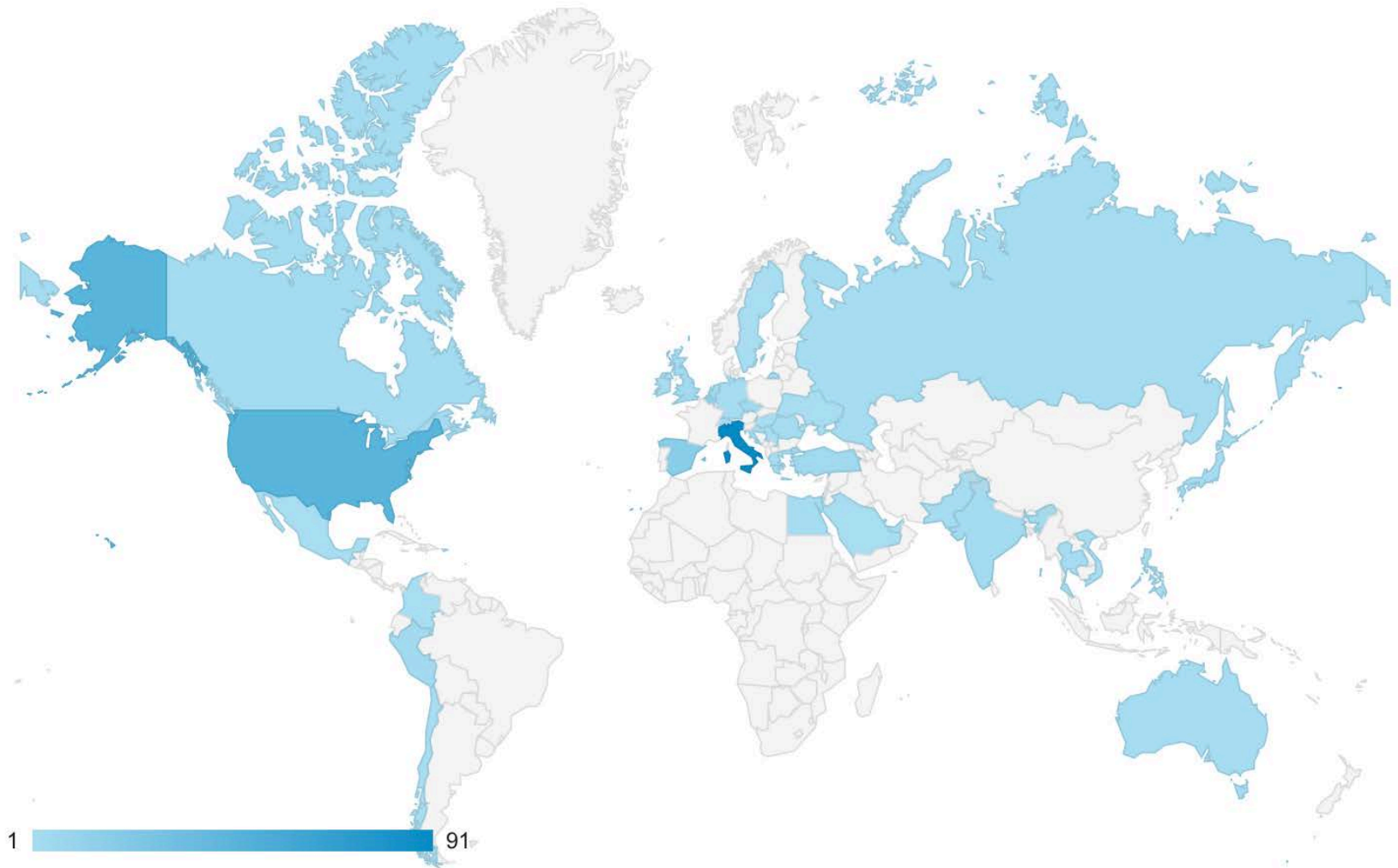
Desert outline




















The main aim of DESERT project is to create



www.desertproject.eu

www.desertproject.eu



1.	 Italy	90 (39,82%)	81 (37,85%)	184 (55,59%)	42,39%
2.	 United States	44 (19,47%)	44 (20,56%)	48 (14,50%)	93,75%
3.	 Spain	18 (7,96%)	17 (7,94%)	23 (6,95%)	26,09%
4.	 Belgium	11 (4,87%)	11 (5,14%)	11 (3,32%)	72,73%
5.	 Czechia	5 (2,21%)	5 (2,34%)	5 (1,51%)	100,00%
6.	 Turkey	5 (2,21%)	5 (2,34%)	5 (1,51%)	60,00%
7.	 United Kingdom	4 (1,77%)	3 (1,40%)	5 (1,51%)	40,00%
8.	 Netherlands	4 (1,77%)	4 (1,87%)	5 (1,51%)	0,00%
9.	 Peru	4 (1,77%)	4 (1,87%)	4 (1,21%)	100,00%
10.	 Canada	3 (1,33%)	3 (1,40%)	3 (0,91%)	100,00%
11.	 United Arab Emirates	2 (0,88%)	1 (0,47%)	2 (0,60%)	100,00%
12.	 Australia	2 (0,88%)	2 (0,93%)	2 (0,60%)	50,00%
13.	 Germany	2 (0,88%)	2 (0,93%)	2 (0,60%)	100,00%
14.	 Egypt	2 (0,88%)	2 (0,93%)	2 (0,60%)	0,00%
15.	 India	2 (0,88%)	2 (0,93%)	2 (0,60%)	50,00%
16.	 Japan	2 (0,88%)	2 (0,93%)	2 (0,60%)	100,00%
17.	 Pakistan	2 (0,88%)	2 (0,93%)	2 (0,60%)	0,00%
18.	 Romania	2 (0,88%)	2 (0,93%)	2 (0,60%)	100,00%
19.	 Russia	2 (0,88%)	2 (0,93%)	2 (0,60%)	0,00%

Source: google analytic



MGW.
TARE
NET
CU.CAP.

30.480 KGS
67.200 LBS
2.000 KGS
4.410 LBS
28.480 KGS
62.790 LBS
33.2 CU.M.
1.172 CU.F.T.

Desert
The best water. Maximum yield.
Water technology. Complete service.

Novedades
Agrícolas

Prof. Steve Robert Grattan – UC California



**Prof. Ing. LUIS ALBERTO LIMA MORRA
MINISTRO PRESIDENTE DEL CONSEJO NACIONAL DE CIENCIA
Y TECNOLOGÍA (CONACYT) Paraguay**



4. Dissemination of the results

Conference

IWA Regional Conference on Water Reuse and Salinity Management

11-15 June 2018. Murcia- Spain



ResearchGate

Project

LOW-COST WATER DESALINATION AND SENSOR TECHNOLOGY COMPACT MODULE - DESERT

Francisco pedrero salcedo · E. Nicolás · Gaetano Alessar · [Show all 6 collaborators](#)

Goal: The next decades a large percentage of the world population will live in areas with water scarcity and poor water quality due to climate change and increasing population pressure, thus agriculture will face the challenge of supplying the increasing demand for food resultin...

[Show details](#)

Updates 5 0 new

Recommendations 3 0 new

Followers 16 0 new

Reads ⓘ 122 4 new

Project log

References (39)

Questions

Add research

Add update



Twitter



Tweet 6 Following 23 Follower 9 Mi piace 1

Segui

Desert Project

@DesertProject

The aim of DESERT project is to create an innovative concept as a smart system combining sustainable technology on water treatment and water quality sensor

Italy

desertproject.eu

Iscritto a novembre 2017

Invia Tweet

Conosci 3 follower

Tweet Tweet e risposte Contenuti

Desert Project @DesertProject · 28 apr
CEBAS - CSIC Centro de Edafología y Biología Aplicada del Segura hosted, last 26th April #Murcia, #desertproject meeting. Promotion of networking activities among projects funded by the #WaterWorks2014 #EraNet the project coordinator of #Iridaproject has been invited. #Uniba

Traduci il Tweet



Tendenze per te · Modifica

#CagliariRoma
@OfficialSRoma sta twittando su questo argomento

#BarcaReal
5.662 Tweet

#chetempocheafa
3.822 Tweet

#NoneiArena
3.197 Tweet

#SonoInnocente
1.350 Tweet

#Gentiloni
@RaNews sta twittando su questo argomento

Bocelli

#Emiliano

#LaDS



Facebook

Facebook group page for Desert Project. The page features the group logo, a cover photo, and navigation options. The main content area shows a post from Alessandro Vivaldi dated 12 April 2017, titled "Presentation of Desert Project to the World Bank delegation in visit in #Bari #uniba #CasaUniba #francofera #Desert". The post includes a link to the project website and a photo of the presentation. The right sidebar displays group statistics (203 members), suggested members, and a description of the project: "Irrigated agriculture is the primary user of wat... Altro... TIPO DI GRUPPO I progetti diventano realtà".

Published

1. Pedrero F et al., 2018. Use of reclaimed wastewater on fruit quality of nectarine in Southern Italy. **Agriculture water management**
2. **Pedrero et al., 2017.** Nutrient uptake and fruit quality in a nectarine orchard irrigated with treated municipal wastewaters.. **Desalination and water treatment**
3. Intriago et al., 2018. Agricultural Reuse of Municipal Wastewater through an Integral Water Reclamation Management. **Journal of Environmental Management**
4. Castellini M., Di Prima S., Iovino M., 2018. An assessment of the BEST procedure to estimate the soil water retention curve: A comparison with the evaporation method. **Geoderma**, 320, 82–94.
5. Vivaldi et al., 2017. Progetto DESERT, irrigazione sostenibile da fonti alternative. **Fruit journal**
6. Pedrero et al., 2017. Multidisciplinary approach on reclaimed water use projects in agriculture. **Web**

Submitted

1. Barca E., De Benedetto D., Stellacci A.M., 2018. Contribution of EMI and GPR proximal sensing data in soil water content assessment by using linear mixed effects models and geostatistical approaches. Submitted to **Geoderma**
2. Castellini M., Stellacci A.M., Iovino M., 2018. Application of multivariate analysis techniques for selecting soil physical quality indicators: a case study in long-term field experiments in Apulia (southern Italy). Submitted to **Water**.

Preparing

1. Moretti et al., 2018. Modelling environmental impacts of treated municipal wastewater reuse for tree crops irrigation in the mediterranean coast. **The International Journal of Life Cycle Assessment**
2. Pedrero et al., 2018. Opportunities for expanding the use of waste waters for irrigation of olives. *Irrigation Science*.
3. Intrigliolo et al., 2018. Effects of full and deficit irrigation on yield and grape composition of cv. Bobal grapevines in semi-arid terroirs of eastern Spain. *Agricultural water management*.

Conference

1. Nicolás E. Usos del agua depurada en Agricultura. **III Jornadas Campesinas**. Bullas (Murcia). June 2016.
2. Nicolás E. Respuesta de cultivos leñosos al riego con agua depurada. **Training courses** about “Especialización en Riego Deficitario. Implementación de una gestión eficiente del riego para una agricultura sostenible”. Centro Integrado de Formación y Experiencias Agrarias (CIFEA). Molina de Segura (December 2016), Torre Pacheco (February 2017) and Jumilla (March 2017).
3. Nicolás E. Caracterización físico-química y microbiológica de las aguas regeneradas de la EDAR de Jumilla. Aspectos generales y recomendaciones de uso. **Irrigators Community of Miraflores** in Jumilla (Murcia) (CIFEA). March 2017.
4. Nicolás E. Sensores, robótica y big data en la gestión del fertirriego. **Jornadas FAME-INNOWA**. Foro de conocimiento e innovación agrícola. IFEPA. Torre Pacheco (Murcia). March 2017.
5. Nicolás E. Reutilización en el ámbito agrícola, experiencia CR Miraflores. **Jornadas LIFE SIAMEC**. Murcia. June 2017.
6. Nicolás E. Caracterización físico-química y microbiológica de las aguas regeneradas de la EDAR de Jumilla. Aspectos generales y recomendaciones de uso. **Jornadas LIFE IRRIMAN**. Jumilla (Murcia). December 2017.
7. Nicolás E. Procesos y consideraciones para la reutilización de aguas regeneradas en riego agrícola. Caso práctico. **Jornada «La regeneración de agua para riego en Andalucía: Una alternativa sostenible»**. FERAGUA. Sevilla. March 2018.

National Congress

1. Lorente B., Zugasti I., Luna A., Ortuño MF., Sánchez-Blanco MJ., Nicolás E, Nortes P., Alarcón JJ. Efecto del medio de cultivo en el comportamiento hídrico, nutricional y productivo de plantas de tomate regadas con aguas regeneradas con altos niveles de salinidad. XXXVI Congreso Nacional de Riegos (Valladolid). June 2018.
2. G.A. Vivaldi, F.P. Salcedo, M.A. Mastro, S. Camposeo Vivaldi. Innovativo sistema di supporto alle decisioni per il riuso sostenibile di acque reflue urbane in olivicoltura. IV Convegno Nazionale dell’Olivo e dell’Olio. 18 Ottobre 2017

Summary

1. Scientific and technological progress
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- 5. Identified problems or specific risks**

5. Identified problems or specific risks

In the desalination part, the process of setting up the prototype of Roldan and its first phase of experimentation, has given us as results, **rapid fouling of the ultrafiltration membrane** due to the high rate in incoming water of:

- Dissolved solid
- Organic componets

This in a very short time, has resulted in an excessive clogging of the ultrafiltrate membrane, causing its saturation, and a great loss of pressure, which has required several chemical cleaning processes.

To solve these problems the following actions have been taken:

1. Installation of a 1 micron microfiltration cartridge, as a measure of retention before microfiltration, to retain particles or biofilms of organic origin.



2. Modify the flow that is drained in the filtration process to twice the expected, passing to 250 l / h of cross-flow, thus achieving a considerable **increase in the time between chemical cleanings**, not having to be done before 40 hours of operation, giving us in our test a frequency of 1 cleaning per month.

3. To be able to carry out the chemical cleaning of the ultrafiltration membrane in situ. Design and installation of a new chemical cleaning system, consisting of a tank for the chemical preparation of the cleaning solution, hydraulic lines and a pumping system, as well as an additional programming in the control automation to carry out the process.



1st Problem



Different sizes
Did not fit with probe holders

2nd Problem

Malfunctioning of 8 probes holders



Thank you for your attention

