

LIFE17/ ENV/IT/000347

## Sustainable substrates for agriculture from dredged remediated marine sediments: from ports to pots: «LIFE SUBSED»

PROJECT LOCATION: Pescaia, Pistoia – Italy  
San Javier, Alicante, - Spain

### BUDGET INFO:

Total amount: 1,745,524 Euro  
EU Co-funding: 59.97%

DURATION: Start: 01/10/2018 - End:30/09/2021

### PROJECT'S IMPLEMENTORS:

Coordinating Beneficiary: Flora Toscana

Associated Beneficiaries:

Viveros Caliplant

Miguel Hernández University of Elche

CREA Research Centre for Vegetable and Ornamental Crops

Carbon Sink Group s.r.l.

Institute of Ecosystem Study of the National Research Council



# OBJECTIVES & SCOPE

The main aim of the project is to demonstrate that is possible **convert a waste** (the dredged marine sediment) **into a supply** (a commercial substrate)

Sediment-based substrates will be applied to:

- Nursery production: Cherry Laurel, Olive Tree and Citrus
- Ornamental and Flower production: Cherry Laurel, Protea, Calla Lily
- Food crops: Blueberry, Strawberry, Citrus and Basil

The performance of the new substrate will be demonstrated by comparison with the typical production cultivated on a peat or cocopeat-based commercial substrates

# OBJECTIVES & SCOPE

## LIFE SUBSED Key words

1. MARKET
2. POLICY LINK
3. REPLICABILITY
4. ENVIRONMENT



Treated sediments  
(Port of Leghorn-IT)



Physical and chemical analysis of substrates  
Monitoring rooting and vegetative growth of plants  
Monitoring flowering and fruiting  
Morphological and chemical characterisation of plants and fruit  
Sensorial evaluation of foods  
Life Cycle Analysis



Comparative evaluation of vegetative and productive parameters



Legal issues on sediments re-use  
Commercial issues for marketing  
Treated sediment preparation and packaging



Pre-commercial trials



Dissemination - Nurseries and Fruitgrowers

# EXPECTED RESULTS

The main result of the LIFE SUBSED project is the set up of a protocol to optimize an 'environmental friendly' commercial substrate obtained with remediated marine sediment for replacing the current peat-based substrates.

The specific technical results will be:

- the 100% evaluation of the suitability of the sediments for the nursery production of food/non food species (laurel, olive and citrus);
  - the 100% evaluation of growth and commercial quality of non food crops (calla lily, protea and laurel)
    - the 100% characterisation from the morphological, biochemical and sensorial point of view of 1 basil, 2 blueberry and 1 woodland strawberry cultivars grown in container on treated sediment-based substrates;
  - the 100% evaluation of the suitability of food crops in relation to heavy metals and other pollutants also of organic origin;
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## EXPECTED RESULTS

- the 100% improvement of the knowledge on the treated sediments and their influence on plant growth and fruit quality;
- the 100% evaluation of the suitability of treated sediments to be converted into a marketable product and also face the normative and legal issues related to the use of dredged remediated sediment as substrate in agriculture;
- waste management: amount (%) of reduction of the use of peat and its substitution with treated sediments (10-20% of substitution are expected). We have considered the dredged sediment as a waste, although this specific type of waste was not listed in the Life Project Specific Indicators Excel document.
- reduction of CO<sub>2</sub> emission (kg) due to the substitution of peat by treated sediments (expected to be about 80-90% less)
- a marketable product

# EXPECTED RESULTS

- Technical Guideline
- 2 Technical training courses
- 4 project workshops
- Dissemination results (detailed in the specific presentation)

## EXPECTED IMPACTS, at 3 years replication scale

Indicator		Estimated Impact	
		absolute value	%
Reduction of greenhouse gas emission (GHG)	CO <sub>2</sub>	0,0120 tons/year	21
Reduction of dangerous substances	Zn	1685 kg/ year	30
Waste Management	Waste Reduction	1780 tons/ year	100
Reduced resource consumption	peat and coir based substrates	700 tons/ year	100
Sustainable land use and agriculture	Soil Surface improved	56 ha	100
Improved Nature, Species and Biodiversity	Habitat (peat)	0,147ha	100
Market uptake	Jobs created (direct/indirect)	150	8
	N. of replication/transfer	13	
	Expected revenues	€ 128,850	15
Communication	Number of individuals reached	250,000	100
Awar ness activities	Technical informative course	12	100
	Workshop	12	100
	Manual	3	100



## POLICY IMPLICATIONS

- EU legislation is still unclear on the possibilities of dredged sediments as by-products recyclable in agriculture (Oslo 1972, London Protocol 96, Paris 1974, OSPAR 1992 and Barcelona 1995 Conventions , EU waste and water directives (1999/31/CE, 2000/60/CE) and EU Parliament Decisions 2000/532/CE, 2001/118/CE, 2001/119/CE, 2001/573/CE (European Waste Inventory).
- European Countries has only individual national legislations
- LIFE SUBSED may lead to a single European legislation in order to allow the EU-wide use of transformed sediments in horticulture for cultivation of vegetable and fruit plants, after proper testing of human and environmental safety.

# CONTINUATION (REPLICATION, TRANSFER, MARKET UPTAKE)

Application of LIFE SUBSED both in Italy and Spain will confirm that this model will be transferable and replicable

Planned Activities:

- 1) to keep on monitoring media with dredged sediments in nursery and crop production
- 2) to implement SUBSED in other European sites
- 3) to organize training courses and workshops
- 4) to update SUBSED website
- 5) to distribute SUBSED manual, leaflets, brochure and video
- 6) to disseminate by specialized press and scientific papers
- 7) to network with H2020 and LIFE projects related to sediments
- 8) to search funds for further implementation

# TIMETABLE

Action		2018				2019				2020				2021				
Action number	Name of the action	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
<b>A. Preparatory actions (if needed)</b>																		
A.1	Review of the EU and national regulations on the use of sediments for plant nursery and of the analytical protocols				■													■
<b>B. Implementation actions (obligatory)</b>																		
B.1	Phytoremediated Sediment treated via landfarming process				■	■												
B.2	Demonstration of the use of remediated sediments as a substrate for nursery production						■	■	■	■	■	■	■					
B.3	Demonstration of the use of remediated sediments as substrate for non food crops cultivation (from plantlets to final production: flowers/ornamental)						■	■	■	■	■	■	■					
B.4	Demonstration of the use of remediated sediments as a substrate for food crops production						■	■	■	■	■	■	■					
B.5	Training courses, workshops and guidelines for project replicability and transferability													■	■	■	■	
B.6	SUBSED Business Plan															■	■	■
<b>C. Monitoring of the impact of the project actions (obligatory)</b>																		
C.1	Monitoring and validation of treated sediments					■	■											
C.2	Monitoring and validation of the use of remediated sediments as a substrate for plant nursing and cultivation: non food crops production							■	■	■	■	■	■	■	■	■	■	
C.3	Monitoring and validation of the use of remediated sediments as a substrate for nursing and cultivation: food crops production							■	■	■	■	■	■	■	■	■	■	
C.4	Monitoring of socio-economic impact of the project and LCA													■	■	■	■	
C.5	Performance indicators monitoring				■					■					■		■	

# ACTIONS

## ACTION A.1

Review of the EU and national regulations on the use of sediments for plant nursery and of the analytical protocols FLORA, CREA and UMH

- A1.1 Preconditioning process for increasing the organic carbon and decreasing the bulk density in order to reach the limit required (expected Bulk density 0.9-0.95, TOC 4-6%) and to produce the clear confirmation that the sediments can be used in agriculture as agronomic substrate.
- A1.2 - A review of the EU and Italian and Spanish regulations/laws regarding the transport and use of dredged sediment based substrates for plant nursery being in force at the date of the project beginning;
- A1.3 - An update (if advisable, and in relation to the findings of the previous task) of the list of the analysis to be performed on substrates and products (plants and fruits).

# ACTIONS

## ACTION A.1

Review of the EU and national regulations on the use of sediments for plant nursery and of the analytical protocols  
FLORA TOSCANA, CREA and UMH

A1.4 - Defining a common protocol for the analysis (sampling, extraction, quali-quantification, etc.).

A1.5 - On the basis of the final project results the beneficiaries FLORA TOSCANA, CREA and UMH will study and define the final national and EU legislation overview with recommendations for future EU legislation of dredged materials

The A.1 Expected results are:

- starting LIFE SUBSED project based on the existing regulations and with the operational and useful toolkits for all partners,
- towards the end of the project, the project will update this legislative overview with recommendations for future EU legislation of dredged materials based on its final results

# ACTIONS

## ACTION A.1

Review of the EU and national regulations on the use of sediments for plant nursery and of the analytical protocols FLORA TOSCANA, CREA and UMH

### DELIVERABLE PRODUCTS OF THE PROJECT

Name of the Deliverable	Number of the associated action	Deadline
Authorization of the sediments use in agriculture as agronomic substrate	A 1	31/12/2018
Overview of national and EU legislation	A 1	31/12/2018
Final national and EU legislation overview with recommendations for future EU legislation of dredged materials	A 1	30/09/2021

# ACTIONS

## ACTION B.1

Phytoremediated Sediment treated via landfarming process  
ISECNR

The sediment samplings (at the start and every month during landfarming process) will be characterized and analysed by ISECNR from the physical, chemical and eco-toxicological points of view.

Expected results:

- decontamination of 29 (80) m<sup>3</sup> of dredged marine sediments;
- pollutant load reduced by about 20% of the phytotreated material

### Deliverable

Report on the sediment treatment	B 1	31/03/2019
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# ACTIONS

## ACTION C.1

Monitoring and validation of treated sediments  
ISECNR

The sediment samplings will be characterized and analysed by CNR-ISE from the physical, chemical, biochemical and toxicological points of view.

Expected results

- chemical, physical, biological characterization of river sediments
- nano- and micro-analyses
- General recommendations for the use of the treated sediments in plant nursing

### Deliverable

Report on the characterization of treated sediments	C 1	30/06/2019
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*Maria, Castellani, Coordinator*





# ACTIONS

## ACTION C.5

Performance indicators monitoring  
FLORA TOSCANA and all the partners

This monitoring activities consists of measuring the efficiency of the performance indicators defined in the attached LIFE SUBSED project specific indicators excel document, in order to fulfil the environmental and social viability of the LIFE SUBSED process.

The group of indicators will be revised in each of the projects coordination meetings in order to check any irregularities.

### Subaction C.5.1 KPI Webtool

All partners will monitor and measure during all the project duration the LIFE SUBSED performance indicators in order to support the coordinating beneficiary FLORA TOSCANA in updating and reporting the KPI Webtool upon throughout the project implementation.

# ACTIONS

## ACTION B.2

Demonstration of the use of remediated sediments as a substrate for nursery production  
FLORA TOSCANA and all the partners

Expected results:

- 1260 laurel rooted cuttings growing and developing saplings
- 200 olive plantlets growing and developing
- 700 citrus saplings growing and developing

# ACTIONS

## ACTION B.3

Demonstration of the use of remediated sediments as substrate for non food crops cultivation (from plantlets to final production: flowers/ornamental)  
FLORA TOSCANA and all the partners

Expected results:

- 270 calla lily plants developing and flowering
- 525 protea plants growing and developing
- 525 cherry laurel saplings growing and developing
- marketable products (flowers or whole plants)

# ACTIONS

## ACTION B.4

Demonstration of the use of remediated sediments as a substrate for food crops production  
FLORA TOSCANA and all the partners

Expected results:

- 14.400 basil seeds sowed
- 120 blueberry saplings of two different cv developing and fruiting
- 120 plants of a woodland strawberry cultivar developing and fruiting
- 90 Citrus plants developing and fruiting

# ACTIONS

## ACTION B.5

Training courses, workshops and guidelines for project replicability and transferability  
FLORA TOSCANA and all the partners

Expected results:

- 2 Technical training courses
- 4 project workshops
- Technical Guidelines

## ACTION B.6

SUBSED Business Plan  
FLORA and all the partners

Expected results:

- SUBSED Business Plan

# ACTIONS

## ACTION C.2

Monitoring and validation of the use of remediated sediments as a substrate for plant nursing and cultivation: non food crops production  
CREA

Expected results:

- Typization of the dose-effect relationship, aimed at assessing the range of sediment % which can be added to a growing substrates in horticultural nursing.
- Validation of the use of remediated sediments for horticultural nursing
- waste management: amount (%) of reduction of the use of peat and its substitution with treated sediments (10-20 % of substitution are expected).
- reduction of CO2 emission (kg) due to the substitution of peat by treated sediments (expected to be of about 80-90% less)

# ACTIONS

## ACTION C.3

Monitoring and validation of the use of remediated sediments as a substrate for nursing and cultivation: food crops production  
CarbonSink

Expected results:

Validation of the use of remediated sediments in horticulture, both as main components of growing media for fruit production and horticultural nursing, according to current standards of the sector.

Every demonstration item will be monitored through periodic analysis of the physical and chemical properties of the substrate-based growing media, in order to evaluate their suitability and occurrence of modifications induced in the sediment-based substrates over time.

# ACTIONS

## ACTION C.4

Monitoring of socio-economic impact of the project and LCA  
FLORA TOSCANA and all the partners

Expected results:

- socio-economic impact of the project
- LCA document with the elaboration and analysis of project data in terms of technical and environmental impact of the project process