



National Research Council-Pisa

The biggest research area in Italy



Institutes:

1. Biofisica
2. Biologia e Biotecnologia Agraria
3. Chimica dei composti organo-metallici
4. Fisiologia clinica
5. Geoscienze e georisorse
6. Informatica e Telematica
7. Istituto Nazionale Ottica
8. Linguistica Computazionale
9. Neuroscienze
10. Processi Chimico-Fisici
11. Scienza e Tecnologia dell'Informazione
12. Ricerca sugli Ecosistemi Terrestri
13. Tecnologie Biomediche

Staff: about 2000 employees

IRET: Research Institute on Terrestrial Ecosystems

It is a very young institute, it was born in September 2018 by the joint of ISE (Institute of Ecosystem Study) with IBAF (Institute of Agro-Environmental and Forest Biology).

Six sections in ITALY

- | | |
|---|---|
|  Porano |  Montelibretti |
|  Pisa |  Napoli |
|  Firenze |  Sassari |



- ecophysiology
- soil ecosystem
- urban ecosystems
- biodiversity and nature conservation
- environmental pollution
- agroforestry
- scientific dissemination

IRET Mission

To study the structure, functioning and productivity of terrestrial ecosystems and biotic and abiotic components with their interactions also in relation to global changes and anthropic pressure.

Research group: A women Team



Grazia Masciandaro
Team leader



Cristina Macchi



Serena Doni



Eleonora Peruzzi

Supported by:

2 Technicians (men support)

the financier



**Fernando
Di Giovanni**



**Manuele
Scatena**



**Alessandra
Bartolini**

Main research topics

✓ Bioremediation and recycling of dredged sediments

- 2018 -2021 European project SUBSED LIFE17 ENV/IT/000347 "Sustainable substrates for agriculture from dredged remediated marine sediments: from ports to pots"
- 2018-2021 European project AGRISED LIFE17 ENV/IT/000269 "Use of dredged sediments for creating innovative growing media and technosols for plant nursery and soil rehabilitation"
- 2017-2019 National project financed by Fondazione Cassa di Risparmio Pistoia e Pescia "Posidonia oceanica e sedimenti per la produzione di substrati per la vivaistica"
- 2015-2018 European project HORTISED LIFE13 ENV/IT/113 "Demonstration of the suitability of dredged remediated sediments for safe and sustainable horticulture production"
- 2014-2016 European project CLEANSED: LIFE12 ENV/IT/000652 "Innovative integrated methodology for the use of decontaminated river sediments in plant nursing and road building"
- 2009-2012 European project AGRIPORT ECO/08/239065/SI2.532262 "Agricultural Reuse of Polluted Dredged Sediments"

Main research topics

✓ Soil quality and functionality and ecological techniques to recover stressed soil

▪ 2020-2023 “Research Leaders 2025 fellowship. GrassGen: genetic fingerprinting of Irish grassland soils”

▪ 2018-2022 European project ZEOWINE LIFE17 ENV/IT/427 “ZEOLite and WINERY waste as innovative product for wine production”

▪ 2016-2019 National project financed by Società Chimica Larderello S.p.A. «Fitotrattamento di suoli contaminati da Hg nell’area CANOVA»

▪ 2015-2018 European project ERASMUS+ 2015-1-ES01-KA203-016214 “Land degradation and rehabilitation in Mediterranean Environments”

▪ 2013-2015 European project BIOREM LIFE11 ENV/IT/000113 “Innovative System for the Biochemical Restoration and Monitoring of Degraded Soils”

▪ 2006-2012 National project financed by San Giuliano Terme Municipality “Ecological approach to remediate polluted soil located in Madonna dell’Acqua (San Giuliano Terme municipality) through natural technologies”

▪ 2005-2008 European project ALMOND PRO-SOIL LIFE05/ENV “Soil protection in Mediterranean areas through cultivation of new varieties of almond tree”

Main research topics

- ✓ Valorization of organic residue (organic fraction of waste residues, olive residues, biological sewage sludges) through biological techniques
- 2018-2022 European project ZEOWINE LIFE17 ENV/IT/427 “ZEOLite and WINERY waste as innovative product for wine production”
- 2004-2012 National project financed by Acque S.p.A. (Pisa) “Phytomineralization of sewage sludge”
- 2000-2002 National project financed by San Giuliano Terme Municipality “Valorization of olive residues through vermicomposting process (*Eisenia foetida*)”

✓ Bioremediation and recycling of dredged sediments



- 2018 -2021 European project SUBSED LIFE17 ENV/IT/000347 "Sustainable substrates for agriculture from dredged remediated marine sediments: from ports to pots"



- 2018-2021 European project AGRISED LIFE17 ENV/IT/000269, "Use of dredged sediments for creating innovative growing media and technosols for plant nursery and soil rehabilitation"

✓ Valorization of organic residue (winery waste) through biological techniques and its application for soil quality improvement



- 2018-2022 European project ZEOWINE LIFE17 ENV/IT/427 "ZEOLite and WINERY waste as innovative product for wine production"

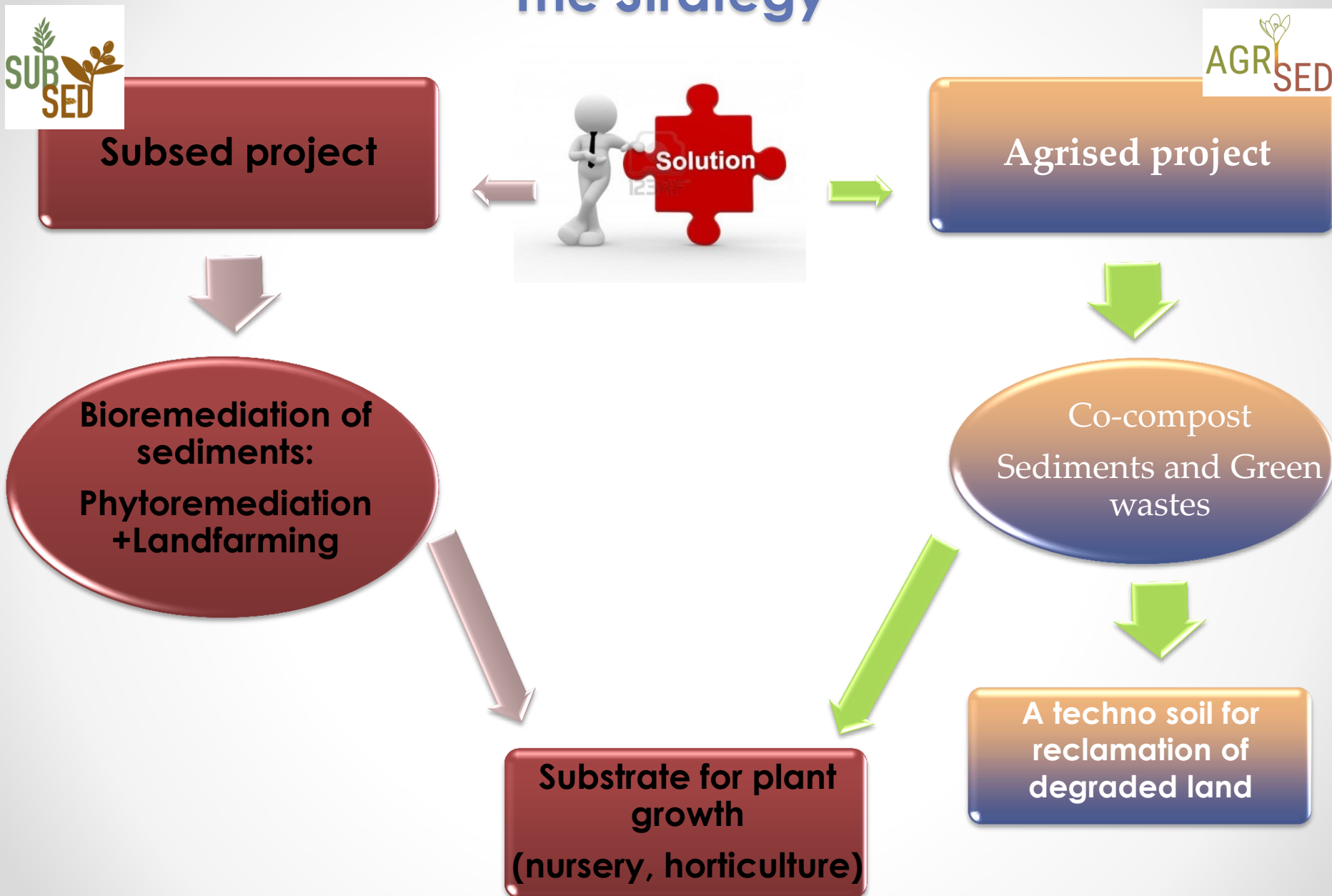
The Problems



- Every year in Europe 100-200 million m³ of polluted sediments are dredged and need to be disposed of in specific and expensive ways.



The Strategy



Sustainable substrates for agriculture from dredged remediated marine sediments: from ports to pots

LIFE SUBSED LIFE17 ENV/IT/000347

October 2018-September 2021

Objective: To convert dredged sediments into a commercial substrate to replace the peat currently in use. To demonstrate the performance of the new substrate compared to nursery production with conventional substrates (peat and coconut fiber)

Remediated Sediment for the production of:

- fruit trees (olive and citrus)
- cultivation of ornamental plants (protea, calla, laurel)
- cultivation of food plants (basil, blueberry, wild strawberry and citrus).

Expected results:

- Commercial quality of non-food species;
- Chemical (contaminants), biochemical, sensory and morphological characteristics of edible parts;
- Definition of protocols for using the new substrate

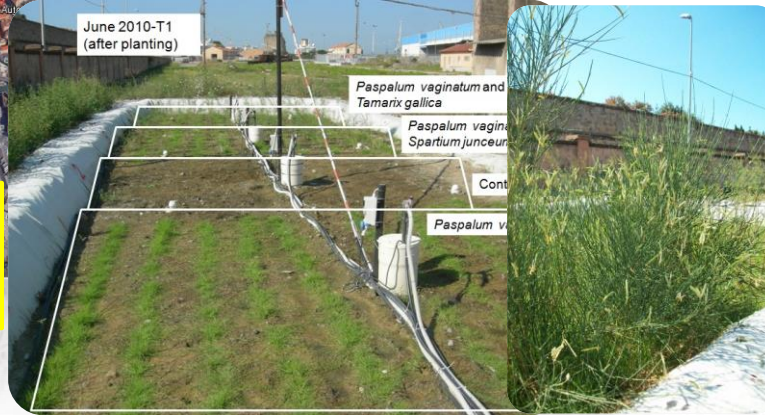




Phytoremediation process (three years)

- Decrease of heavy metals (20%) and total petroleum hydrocarbons (50-60%)
- Improvement of chemical-nutritional properties (nutrient balance)
- Stimulation of the biological parameters contributing to create a functional "soil ecosystem"

The basin with
phytoremediated
sediments in Leghorn's port



Paspalum vaginatum, Tamarix Gallica Spartium Junceum

Landfarming (three months)



- Homogenization of the substrate
- Increasing of biological activities
- Further reduction of organic contaminants (15%)

Physical and chemical characteristics are comparable with those of an agronomic substrate according to the Italian legislation cultivation substrates (D.lgs 75/2010)



Parameter	Sediments at the end of landfarming in the Subsed Project	D. lgs. 75/2010
Bulk density (g/cm ³)	1,19 ±0,05	<0,95
pH	7,4±0,2	4,5-8,5
Electrical conductivity (dS/m)	0,13 ±0,01	<1
TOC %	1,38 ±0,08	>4
TN %	0,11±0,01	<2,5
P ₂ O ₅ %	0,17 ±0,01	<1,5
Cd (mg/kg)	< LOD	1,5
Cu (mg/kg)	48,6 ±1,7	230
Hg (mg/kg)	0,070 ±0,001	1,5
Ni(mg/kg)	37,7 ±0,7	100
Pb(mg/kg)	37,2 ±6,4	100
Zn (mg/kg)	145 ±4	500



In order to reach the C concentration and bulk density required by Italian regulation, the mixing of sediments with a source of organic matter rich in Carbon, such as peat, is suggested

We are waiting for the authorization for using remediated sediments for plant production

●....However in the previous European project Hortised

Demonstration of the suitability of dredged remediated sediments for safe and sustainable horticulture production LIFE HORTISED LIFE14 ENV/IT/000113 LIFE

October 2015-March 2018

Objective: the HORTISED project aimed at demonstrating the suitability of dredged remediated sediments as an alternative for the preparation of growing media in horticulture (pomegranate and strawberry) in Italy and Spain.



Substrates

TS100 = 100% remediated sediments

TS50 = 50% peat+ 50% remediated sediments

TS0 = 100% peat

Results

-Similar yield, numbers of fruit, and fruit weight average of pomegranate and strawberry fruits in TS50 and TS0, while worst production in TS100

-Instead, quality and composition of fruits in TS50 and TS100 media was comparable or even higher than that observed in control fruits TS0.

Use of dredged sediments for creating innovative growing media and technosols for plant nursery and rehabilitation LIFE AGRISED LIFE17 ENV/IT/269

October 2018-September 2021



Objective: To recover dredged sediments through a co-composting process with green waste to produce an innovative techno-soil for the recovery of degraded land and for the cultivation of ornamental plants in Italy and the Czech Republic

Expected results:

- Definition of composting protocols for the preparation of growth substrates based on sediments;
- Cultivation of ornamental plants (*Viburnum tinus* and *Photinia x fraserii*) on innovative substrates;
- Recovery of degraded soils through the application of techno-soil;
- Safety for humans and the environment.



Dredged sediments

Sediments
+
Green waste



Composting process



Techno-soil



Growing substrate peat-free

Sediment characteristics suitable for composting

- Low salinity
- Sand texture
- No high level of organic contaminants
- Very low content in heavy metals



Navicelli Canal (Length: 17 km, Width: 30 m, Depth: 3 m) a navigable canal that connects Pisa to Livorno (Italy) and flows into the sea



In Italy we are waiting for the final authorization in order to start with the composting process...it is arriving

Smaller regulated stream located in the agricultural area Kunice, Czech Republic



Just started, few days



CO-Composting
Sediments and Green wastes (obtained by maintenance of public and private green areas) mixed in three ratios (w:w): 1:1; 3:1; 1:3

6-8 months for full maturation and stabilization of the composted materials in compliance with Italian or Czech Republic regulation for agronomic substrate



A techno soil for reclamation of degraded land and brownfields

Growing substrate for plant nursery



Viburnum tinus



Photinia x fraseri

ZEOLite and WINery waste as innovative product for wine production LIFE ZEOWINE: LIFE17 ENV/IT/000427

July 2018-August 2022



UNIVERSITÀ
DEGLI STUDI
FIRENZE
DAGRI
DIPARTIMENTO DI SCIENZE
TECNOLOGICHE, AMBIENTALI E FORESTALI



dn360



Progettazione Ricerca Management
per la Formazione

Objective: LIFE ZEOWINE project (LIFE17 ENV/IT/000427) will demonstrate the improvement of soil protection and sustainability, grape quality, and yield stability through the development and application of an innovative by-product derived from the composting of winery wastes and natural zeolite.



Vine pruning

Grape pomace

Expected Results

- Improvement of agronomic and biological fertility of the vineyard soils
- Improvement of the characteristics of the grapes and the wine
- Reduction in the use of fertilizer
- Improvement of the sustainability and competitiveness of the wine supply chain
- Closure of the the production cycle of waste material

Layout of composting process



Organic wastes
from viticulture
activities
Circular Economy



Features of zeolite HIGH:
-cation exchange capacity,
-water holding capacity,
- surface area.

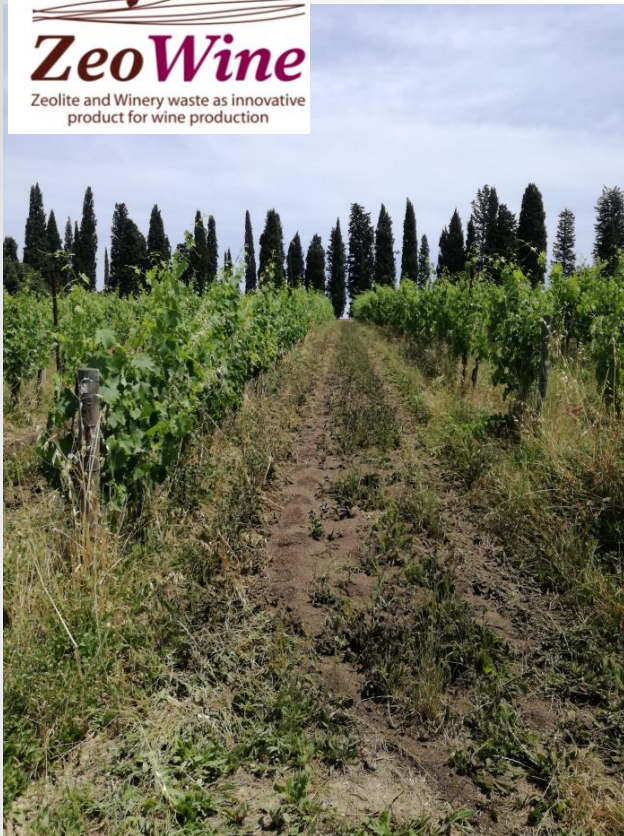


Three Piles of 9 tons
2.5 wastes : 1 zeolite w : w
Periodical turning and
irrigation for **five months**

RESULTS of the obtained compost

- The increase in cation exchange capacity improved the ability of compost to retain nutrients (higher TK and lower available K) - fertilizer nutritional value optimization
- Physical-chemical properties of compost within the threshold values proposed by Italian legislation (DL 75/2010 and subsequent amendments) for a green wastes compost.

Treatments



COMPOST
20 t ha⁻¹



ZEOWINE
30 t ha⁻¹



ZEOLITE
10 t ha⁻¹

Samples under analyses

**Thanks for your
attention**