



PRIN
2022
PNRR

VerticHalPonics

Titolo progetto (P202277Y78):

Vertical haloponics: exploiting brackish water resources for sustainable, resilient and high valuable aquaponics productions

Acronimo:

VerticHalPonics



Kick off meeting – 9 gennaio 2024

Vertical halponics: exploiting brackish water resources for sustainable, resilient and high valuable aquaponics productions

Partner di progetto:



**Università degli Studi di Padova
(Coordinamento)**



Università di Pisa



CNR



Università di Perugia



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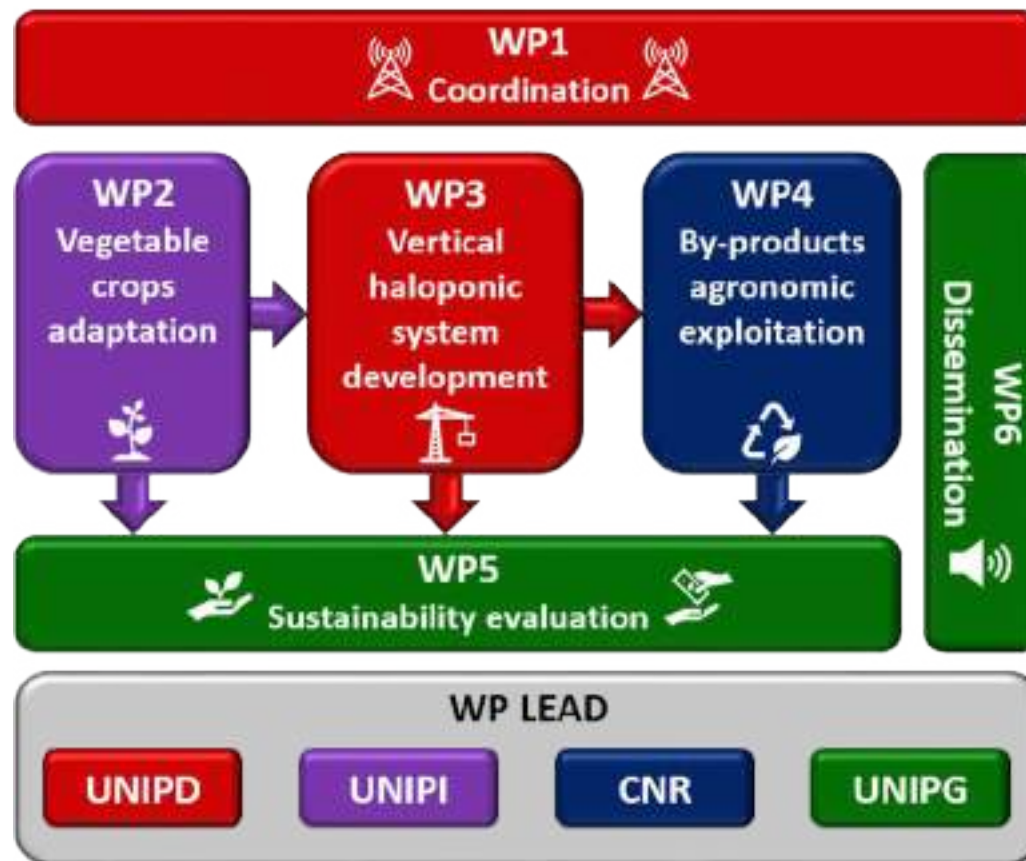
Vertical halponics: exploiting brackish water resources for sustainable, resilient and high valuable aquaponics productions

RU	Staff involved	Gender	SSD	Academic position	H-index (Scopus)	Expertise	Role
UNIPD	Nicoletto C.	Male	AGR/04	Associate professor	18	Hydroponics Aquaponics Food quality	Principal Investigator Responsible of coordination activities – WP1
	Birolo M.	Male	AGR/20	RTD-B	12	Aquaponics Aquaculture	Responsible of vertical halponic system development, test and optimisation – WP3
	Locatelli S.	Female	AGR/04	PhD student	n.a.	Hydroponics Food quality	Assistance to <i>in vivo</i> recordings, lab and data analysis – WP3
	Maretto L.	Female	AGR/13	PhD student	2	Plants stresses Microbiology	Assistance to <i>in vivo</i> recordings, lab and data analysis – WP3
UNIFI	Pardossi A.	Male	AGR/04	Full professor	35	Hydroponics Aquaponics Soilless systems	Coordinator of UNIFI RU – WP2 & WP4 Responsible of studies on vegetables crops adaptation to water salinity changes
CNR	Macci C.	Female	--	Researcher	24	Organic matrices valorisation	Responsible of studies on vermiconposting
UNIPG	Rocchi L.	Female	AGR/01	Associate professor	12	LCA & LCC Multi-criteria Analysis	Coordinator of UNIPG RU – WP5 & WP6 Responsible of LCA and LCC analysis Responsible of dissemination activities



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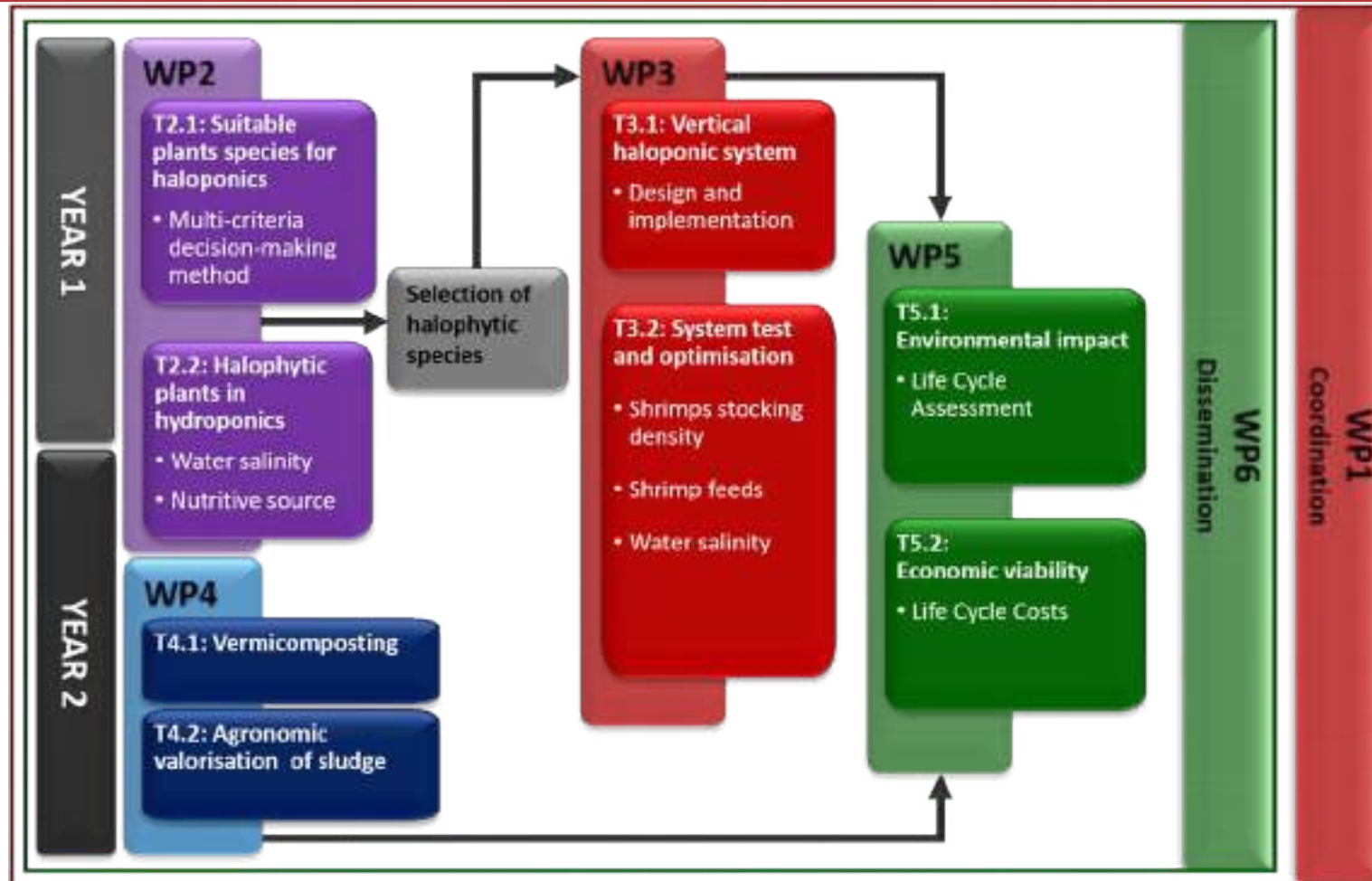


WP list

- 1. Project management (UNIPD)**
 - T1.1: Technical coordination
 - T1.2: Legal and contractual management
 - T1.3: Financial and administrative management
 - T1.4: Evaluation and quality assurance cycle
- 2. Vegetable crops adaptation (UNIPi)**
 - T2.1: Selection of most suitable plant species for halponics
 - T2.2: Salt response of selected plant species grown in hydroponics and halponics
- 3. System development (UNIPD)**
 - T3.1: System design and implementation
 - T3.2: System test and optimisation
- 4. By-products agronomic exploitation (CNR)**
 - T4.1: Vermicompost
 - T4.2: Agronomic valorisation of sludge
- 5. Sustainability (UNIPG)**
 - T5.1: Environmental impact
 - T5.2: Economic Viability
- 6. Dissemination (UNIPG)**
 - T6.1: Dissemination plan
 - T6.2: Technological knowledge transfer
 - T6.3: Public communication
 - T6.4: Scientific communication
 - T6.5: Education



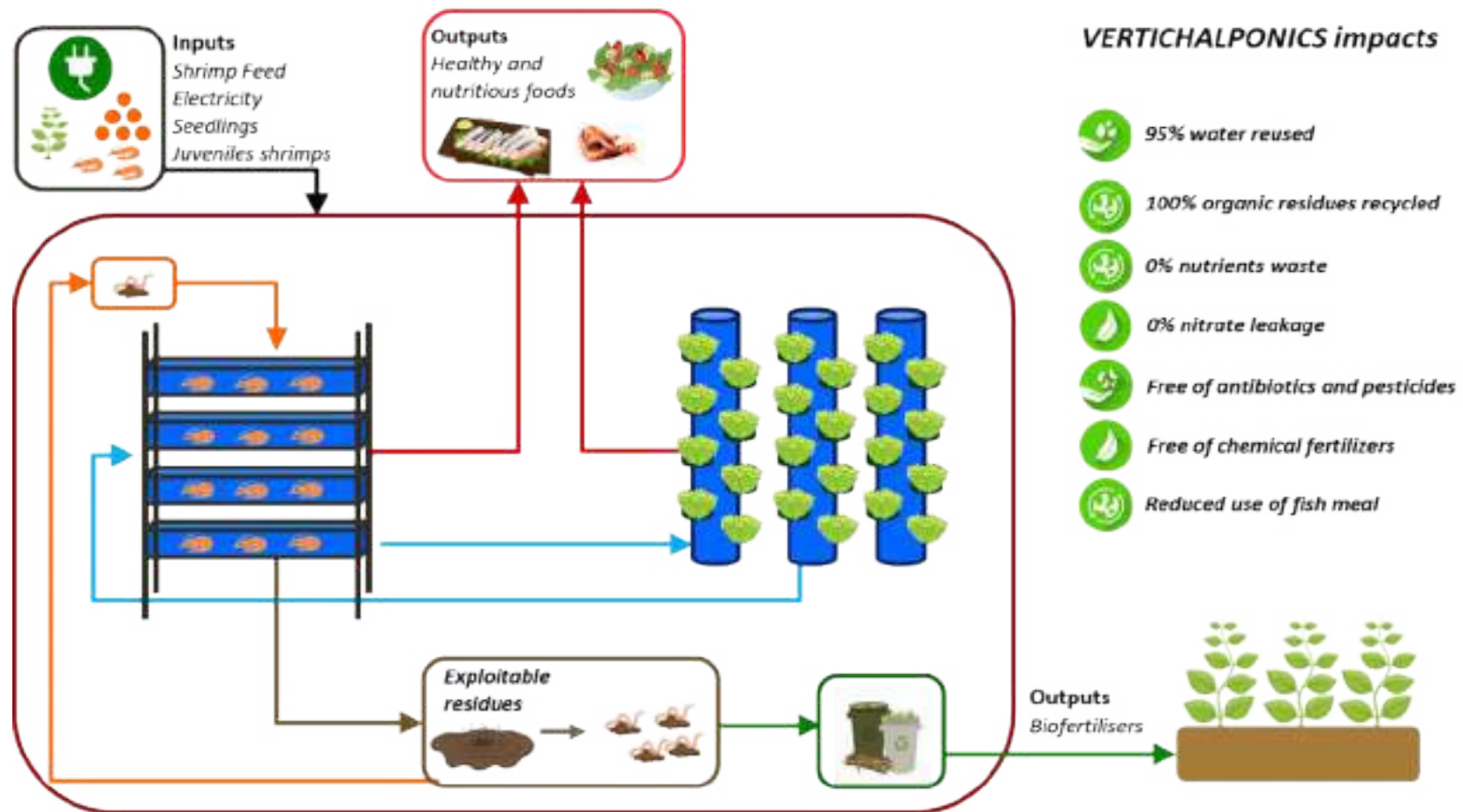
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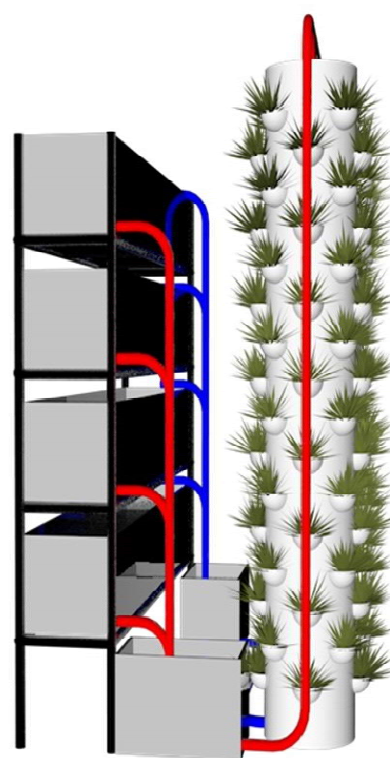
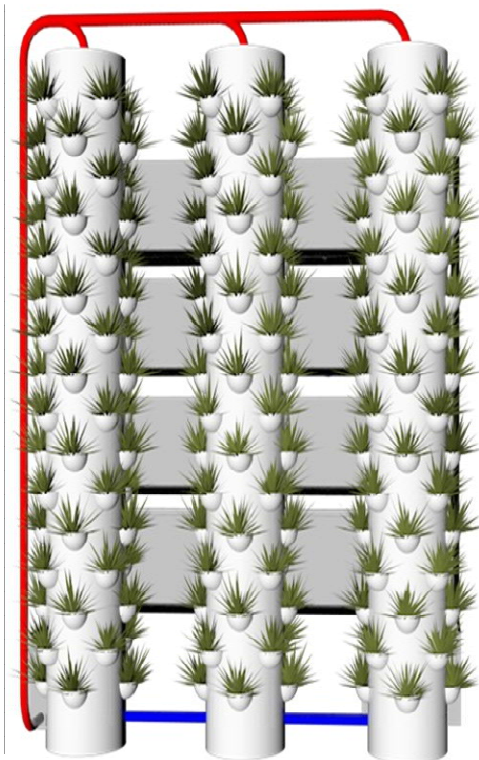
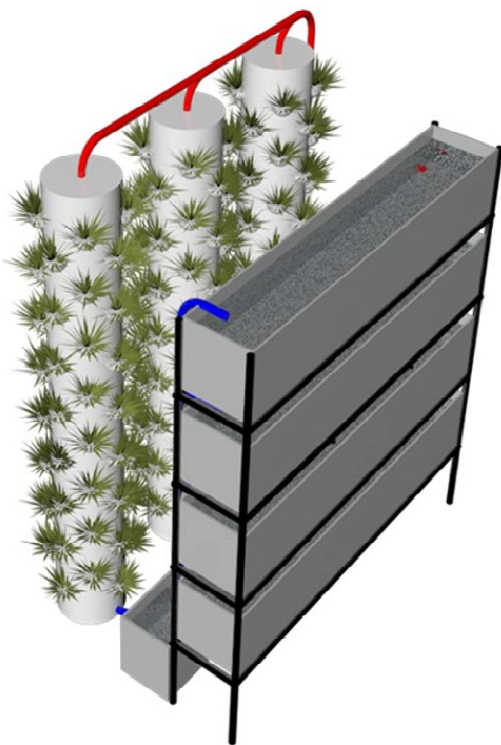


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Vertical halaponics – UNIPD (WP3)



- **Vertical halaponic system implementation**
- **Shrimps stocking density**
- **Shrimps feed**
- **Water salinity**



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VerticHalPonics - UNIPi

UNIPi – (University of Pisa, Department of Agriculture, Food and Environment, Laboratory of Vegetable and Ornamental Crops)

Team leader: Alberto Pardossi (Full Professor, PhD)

Team:

- Dr. Giulia Carmassi (Research Assistant, PhD)
- Prof. Tiziana Lombardi (Associate Professor, PhD)
- Dr. Martina Puccinelli (Postdoc, PhD)
- Dr. Irene Ventura (PhD student, MSc)

WP2 Vegetable crops adaptation (UNIPi)

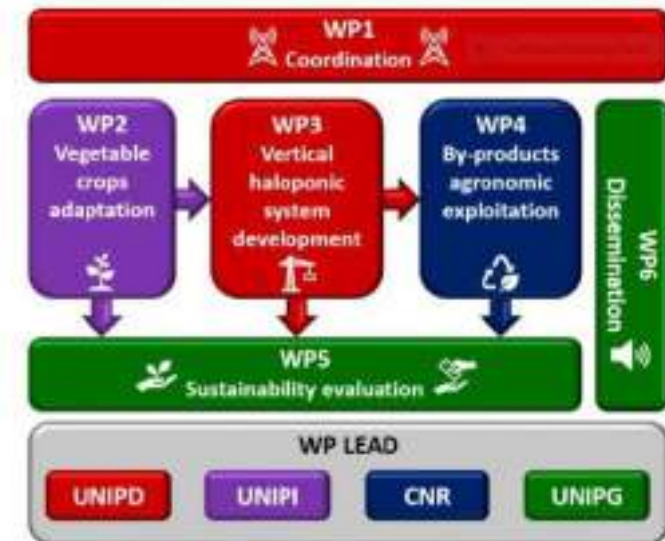
T2.1: Production, nutrient uptake and quality of glycophytic plants cultivated at different water salinity levels

T2.2: Production, nutrient uptake and quality of halophytic plants cultivated at different water salinity levels

WP4 By-products exploitation (CNR)

T4.1: Vermicomposting (CNR)

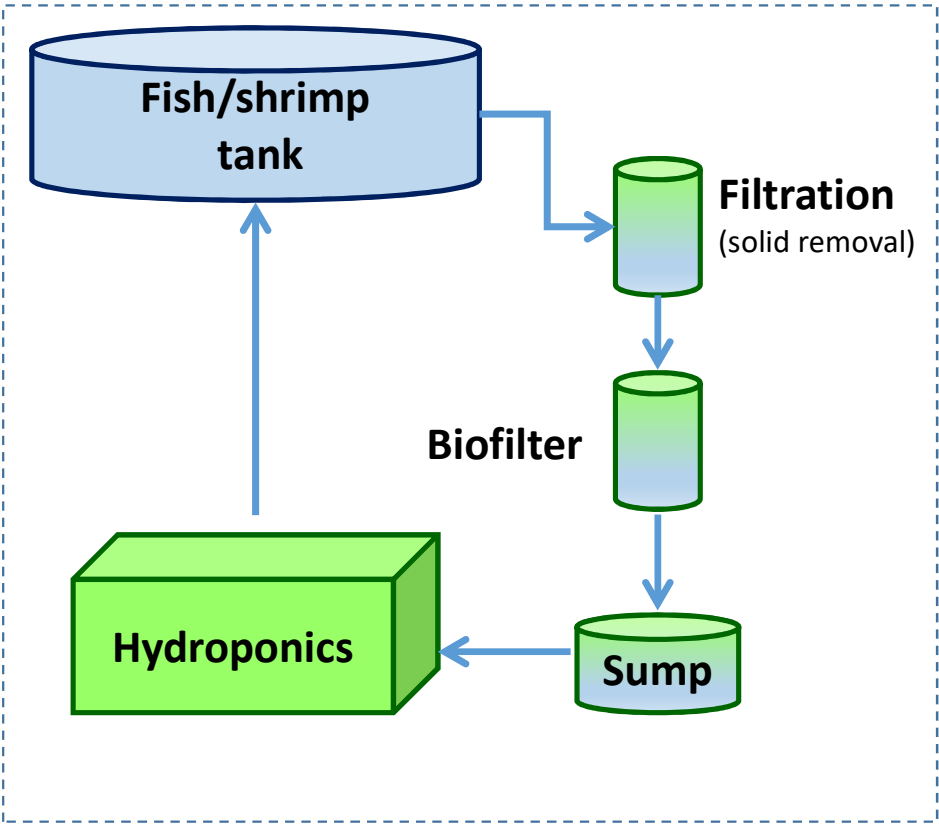
T4.2: Agronomic valorisation of sludge



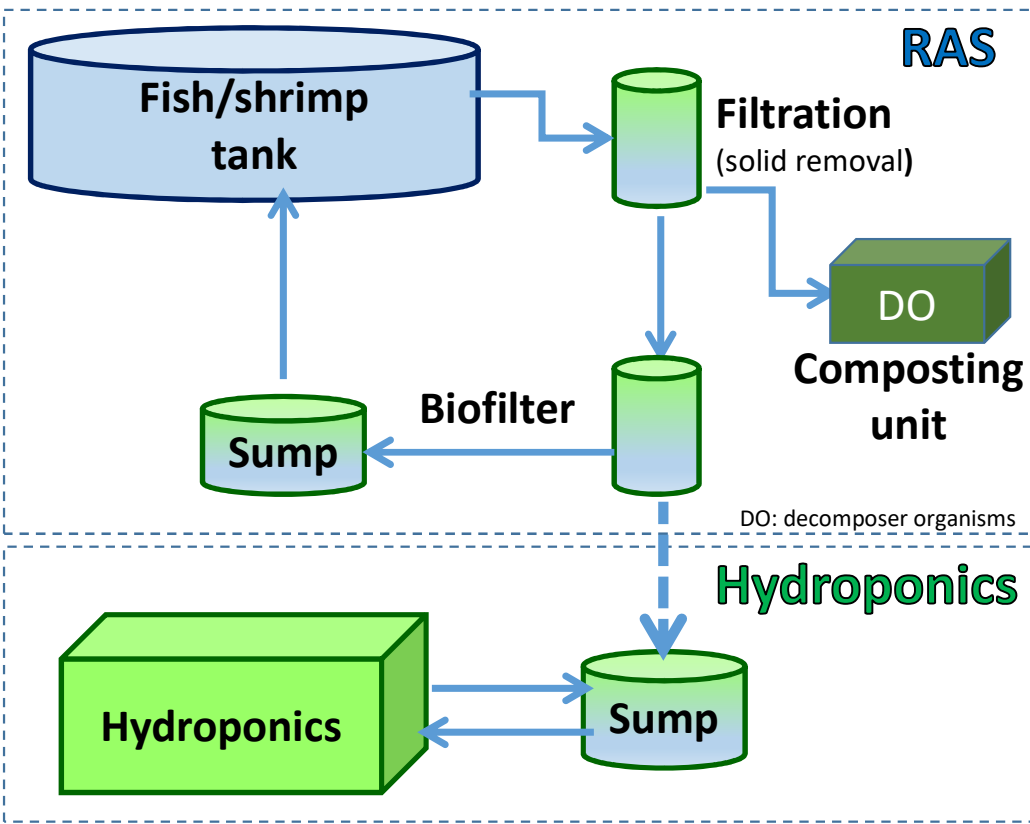
- 1. *Beta vulgaris* L. subsp. *maritima* (L.) Arcang. (sea beet)
- 2. *Cakile maritima* Scop. subsp. *Maritima* (sea rocket)
- 3. *Crithmum maritimum* L. (sea fennel)
- 4. *Halimione portulacoides* L. (sea purslane)
- 5. *Plantago coronopus* L. (buck's-horn plantain)
- 6. *Portulaca oleracea* L. subsp. *oleracea* (purslane)
- 7. *Salsola soda* L. (Monk's beard)
- 8. *Suaeda maritima* L. Dumort (Sea-blite).
- 9. *Ocimum basilicum* L (sweet basil)

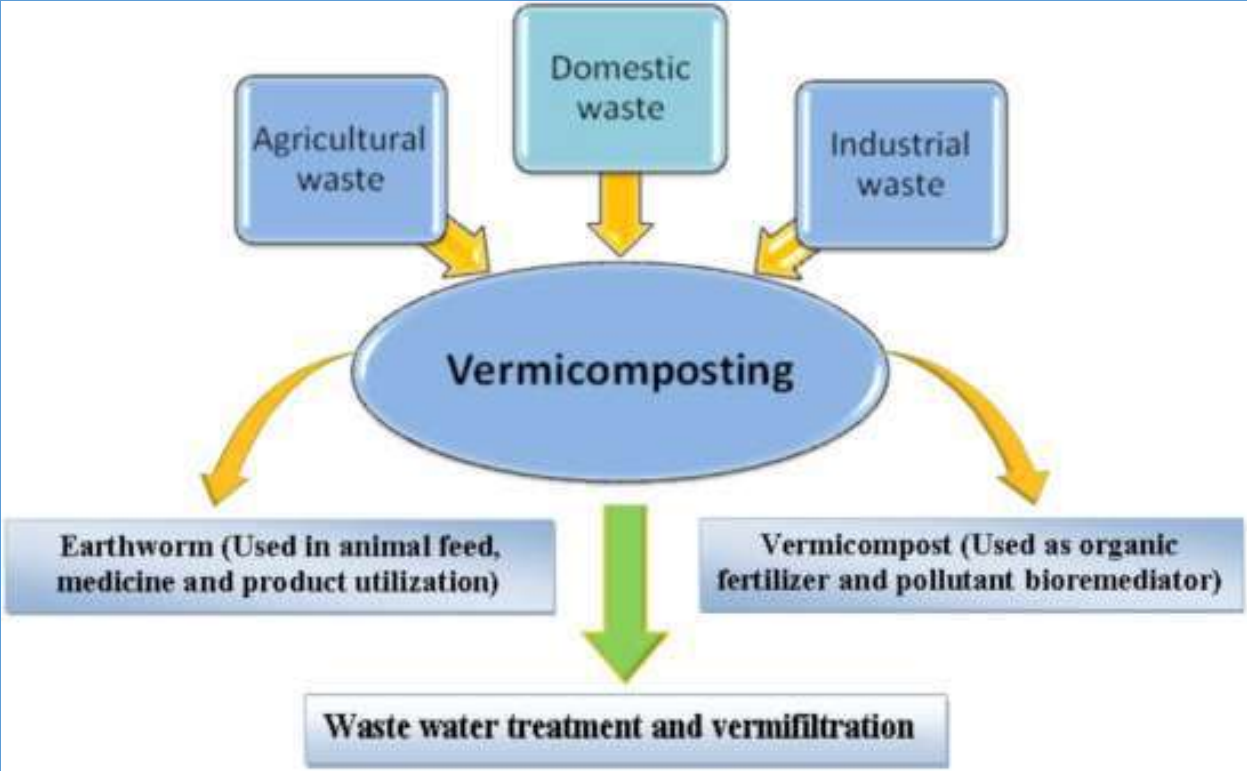


Coupled aquaponics

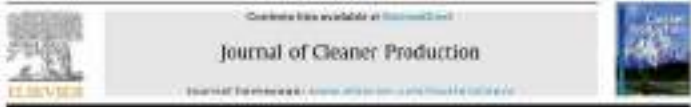


Decoupled aquaponics





<https://www.sciencedirect.com/science/article/abs/pii/B9780444642004000104>



Vermicomposting of sludge from recirculating aquaculture system using *Eisenia andrei*: Technological feasibility and quality assessment of end-products

Antonín Kouba, Roman Lunda, David Hlaváč, Irena Šulcova, Jitka Hamáčková, Tomáš Karelík, Pavel Kozák, Anna Koubková, Miroslav Hájek

Faculty of Food Science, University of South Bohemia, Faculty of Science and Technology of South Bohemian University of Applied Sciences, Faculty of Agriculture and Food Science of South Bohemian University of Applied Sciences, Faculty of Science and Technology of South Bohemian University of Applied Sciences



CNR (IRET): Italian National Research Council - Institute for Ecosystem Study (Pisa)

Lead of WP4 - By-products exploitation

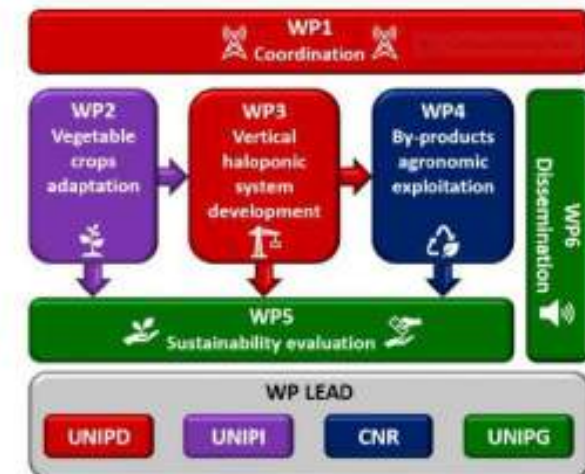
Team leader: Cristina Macci (Senior Researcher)

Collaboration: Francesca Vannucchi (Researcher); Centro di Lombricoltura

- 20-years' experience in **valorization of several organic wastes** (dredging sediments, green wastes, agri-food wastes, urban organic wastes) using **different biological technologies** (phytoremediation, composting/vermicompost, and anaerobic digestion) for **reusing them in the environmental and agricultural fields**, respecting the principles of the circular economy.
- In the last 3 years, activity focused on **vermicompost process** for valorization of different organic wastes, in particular green waste from horticultural sector



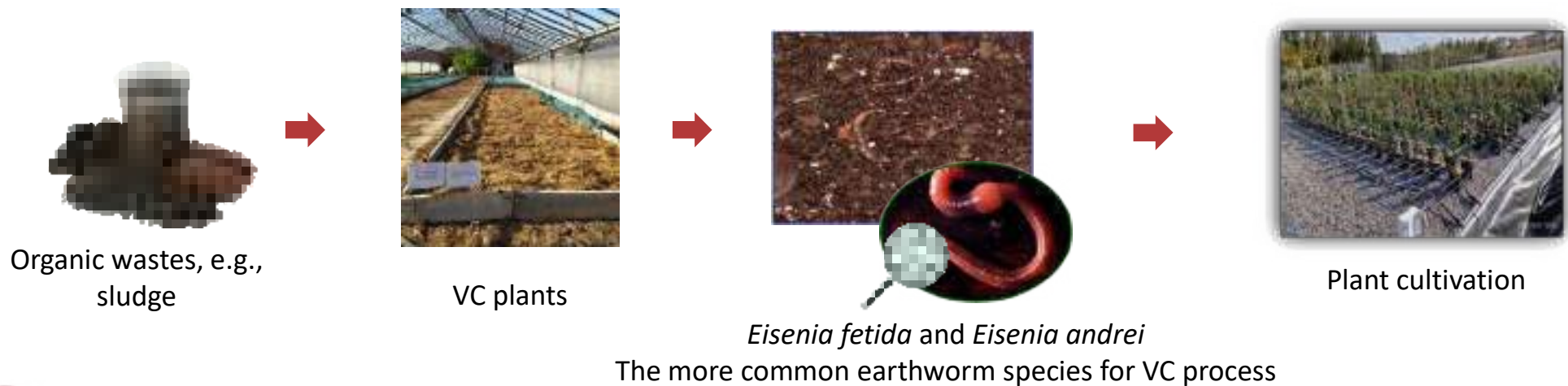
CNR-Research area of Pisa



Vermicomposting (VC)

A simple, rapid, energy-saving, and economically sustainable strategy to convert organic waste into potential plant nutrient enriched resource.

VC is an aerobic process that involves the interaction of earthworms and microorganisms. This process leads to the bio-oxidation and stabilisation of the organic material (e.g., humus-like matter)



Project activity

The VC process will be carried out on HAL solid waste (sludge) with two different level of salinity:

- ✓ **high salinity**
- ✓ **low salinity**

Earthworms are quite sensitive to salinity; in case of high mortality of earthworms in the raw sludges a pretreatment such as a **washing or mixing with low salinity materials** will be taken into consideration.

The VC process will be carried out both on dewatered sludge (DS) and sludge (S) as such

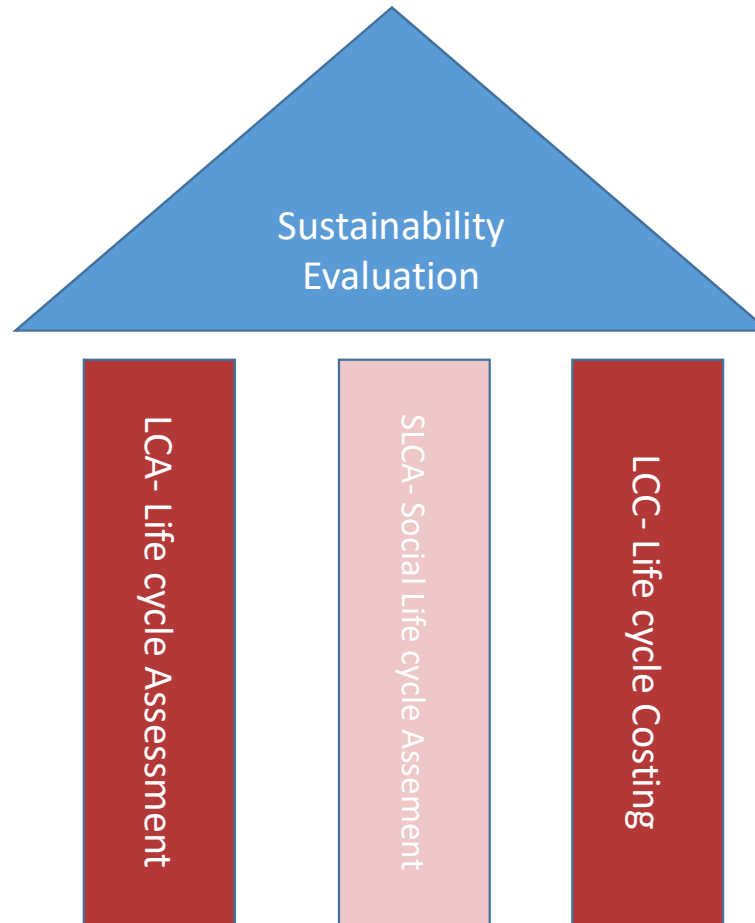
Monitoring activity:

- *chemical characterization*: pH, electrical conductivity values, total and available nutrients, cation exchange capacity;
- *biological characterization*: hydrolytic enzyme activities, respiration rate
- *toxicological characterization*: phytotest, heavy metals, salmonella and *E. coli*





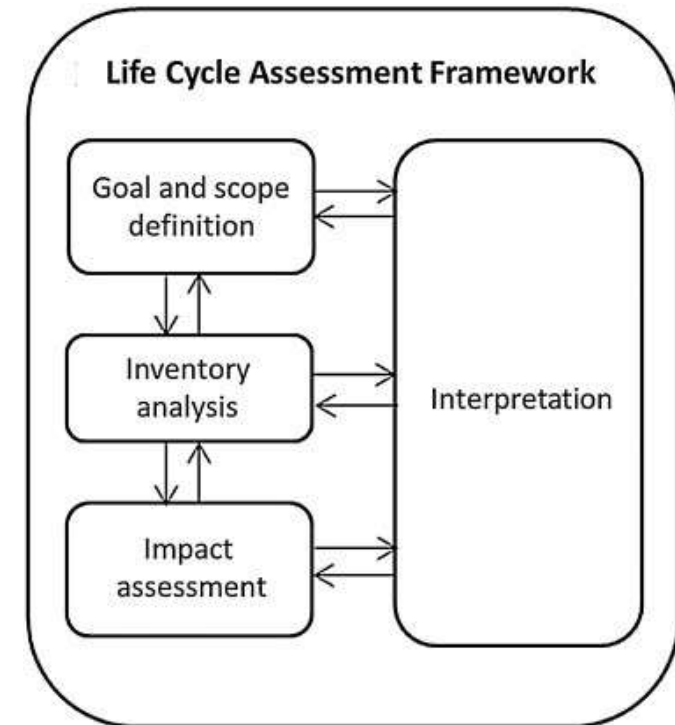
WP 5 Sustainability evaluation





LCA Life cycle assessment

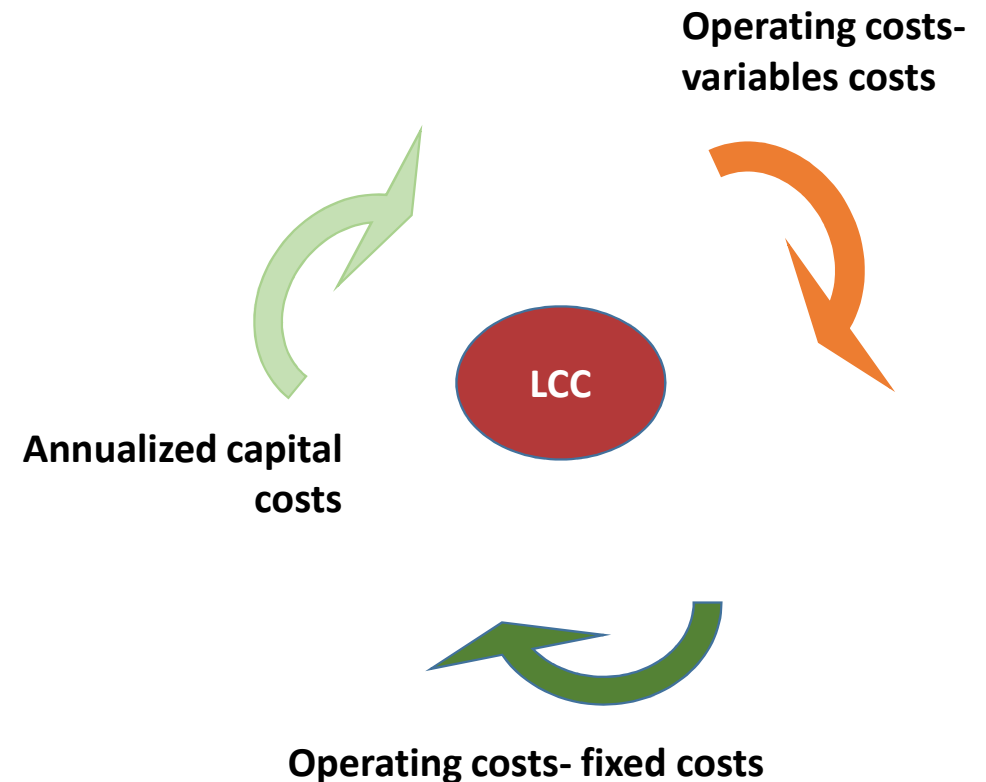
- The LCA will be performed using the data coming from the experimental WP, applying an attributional LCA type.
- Systems expansion will be used to evaluate the beneficial effect of reducing global environmental burdens from the recovery of by-products and the use of side-stream wastes → sludge valorization.
- LCA will be performed considering also a hypothetical scaled-up system





- LCC will assess the hypothetical investment over its life cycle, considering the scale-up perspective, allowing a financial analysis.
- Two main parameters assessed: the Net Present Value (NPV) and the Internal Rate of Return (IRR), including capital and operating costs.
- The system boundaries will be set according to the LCA ones.
- LCC will be performed considering also a hypothetical scaled-up system

LCC- Life cycle Costing



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GRAZIE PER L'ATTENZIONE!



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