# Closing the loops on nutrient losses – Bonus Return

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HELSINKI, 1.OCT.2019

# BONUS

Turning waste into circular solutions for the Baltic Sea



# SOURCES OF NUTRIENTS IN RIVERINE LOADS TO BALTIC SEA

## Riverine load in 2014 to BALTIC SEA



Spatial segregation of livestock-intensive and crop-intensive areas has led to creation of nutrient hot spots



**HELCOM PLC-6, 2018** 



# OUR GOALS

REDUCE KNOWLEDGE GAPS THROUGH SYSTEMATIC REVIEWS & EVIDENCE MAPPING

2. ASSESS SOCIAL, ECONOMICAL, HEALTH, ENVIRONMENTAL AND TECHNICAL EFFECTIVENESS OF ECOTECHNOLOGIES

**3.** SUPPORT INNOVATION, COMMERCIALIZATION AND UPTAKE OF NEW ECOTECHNOLOGIES 4 IDENTIFY GAPS AND OPPORTUNITIES TO CONNECT POLICY WITH INNOVATION AND MARKETS

5. MAP EFFECTS OF ECOTECHNOLOGIES IN REDUCING EUTROPHICATION IN THE BALTIC SEA

6. REGIONAL COLLABORATION THROUGH STAKEHOLDER ENGAGEMENT.



# NUTRIENT MANAGEMENT AND THE CIRCULAR ECONOMY



# recovery

- cities



#### WITOLD WITKIEWICZ, COMMONS

#### ANTTI FAVEN, VIEW OF HELSINKI

# INNOVATIVE MANAGEMENT PRACTICES AND CIRCULAR ECONOMY



WHAT ARE **ECOTECHNOLOGIES?** 

"Ecotechnologies are human interventions in socio-ecological systems in the form of practices and/or biological, physical, and chemical processes designed to minimize harm to the environment and provide services of value to society"

HADDAWAY N, MCCONVILLE J., & PINIEWSKI M. "HOW IS THE TERM 'ECOTECHNOLOGY' USED IN THE RESEARCH LITERATURE? A

SYSTEMATIC REVIEW

WITH THEMATIC SYNTHESIS" ECOHYDROL AND HYDROBIOL. 2018;18:247 –61.



# ECOTECHNOLOGIES IN BONUS RETURN







HADDAWAY N., JOHANNESDOTTIR S., PINIEWSKI M., AND MACURA, B. (2019) WHAT EVIDENCE EXISTS RELATING TO EFFECTIVENESS FROM DOMESTIC WASTEWATER? A SYSTEMATIC MAP PROTOCOL. ENVIRONMENTAL EVIDENCE, 8(1)

# GROUPS OF AGRICULTURAL ECOTECHNOLOGIES

 Fertilisation / amending soils with reused products
 Anaerobic digestion

(Vermi)composting

Combinations

Struvite precipitation

Crop management

Pyrolysis

Cover crops

HADDAWAY, N. R., PINIEWSKI, M. AND MACURA, B. (2019) WHAT EVIDENCE EXISTS RELATING TO EFFECTIVENESS OF ECOTECHNOLOGIES IN AGRICULTURE FOR THE RECOVERY AND REUSE OF CARBON AND NUTRIENTS IN THE BALTIC AND BOREO- TEMPERATE REGIONS? A SYSTEMATIC MAP PROTOCOL. ENVIRONMENTAL EVIDENCE, 8(5)

	Microalgae cu 2%
Aqua	aponics 3%
Manure tre	eatment / manag 3%
Industry	/ systems
	Membrane filtra 4%





## WINNERS OF BONUS RETURN INNOVATION COMPETITION.

Multi-Criteria Assessments of system alternatives accounting for: health and hygiene, environmental impacts, cost-benefit, socio-cultural dimensions, and technical efficiency



Aquacare's BiOPhree® technology enables the minimization or elimination of micro bio growth to avoid biofilm. The technology can recover phosphorous and convert it to a concentrated liquid with the ability to be re-used as a fertilizer for agriculture. **BiOPhree material is** simple to engineer and after regeneration, it is reusable.



#### TerraNova Energy GmbH' Ultra

turns sewage sludge into climate friendly coal for energy production and clean Phosphorous fertilizer. The final product is sterilized with low water content and can be used as CO2neutral fuel for energy production or for agricultural application. rits.

#### RAVITA

provides an innovative process for nutrient recovery directly from the wastewater stream. Phosphorus is post- precipitated at the very end of the water stream, and the chemical sludge formed precedes the main part of the RAVITA process. The end- product is phosphoric acid, which has high value both in fertilizer and other industries.



#### BONUS RETURN CASE STUDIES – CARBON RECOVERY AND REUSE?

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#### **FYRISAN RIVER**

The Fyrisån river is located in the Swedish province of Uppland. It is a tributary of Lake Mälaren, which has its outlet through Stockholm into the Baltic Sea. The basin covers a diverse set of landscapes including actively managed forests and agricultural lands in Sweden's fourth largest city, Uppsala.

PHOTO: KARIN JONSSON/FLICKR

#### VANTAANJOKI RIVER BASIN

The Vantaanjoki river basin in Finland flows through the Helsinki metropolitan area, where there are about one million inhabitants, before discharging into the Baltic Sea.

PHOTO: TIMO NEWTON-SYMS/WIKIMEDIA

#### **SŁUPIA RIVER BASIN**

The Słupia river basin is one of the largest catchments on the Polish coast that includes a large city (Słupsk), thus offering a unique opportunity to study both the pressure from rural and urban areas on water quality.

PHOTO: MACIEJ PRZEMYK/WIKIMEDIA



## **CONCEPTUAL DIAGRAM OF A , CIRCULAR' SCENARIO**



**Baltic Sea** 

,Adding' recovery and reuse to the system directly affects:

-Import of fertilizers

- -Types and amounts of applied fertilizers
- -Soil properties (e.g. SOC, conductivity) Indirectly affects:

-Crop yield

-N, P, OC emissions from point sources and agriculture

#### Most of these aspects can be modelled with SWAT

# **REUSE OF RECOVERED**







# BENEFITS



# SOCIO-ECONOMIC BENEFITS

SOCIAL

- Jobs in new industries
- **Development of new** agriculture
- Health issues

## ECONOMIC

- **Development of new technologies**
- Room for the start-ups
- High quality agricultural products
- Reducing costs for waste management

### ADDRESSING KEY ECOLOGICAL ISSUES:

- **Biodiversity loses**
- Soil fertility loses
- Eutrophication









# SYNERGIES



## BARRIERS (-) AND OPPORTUNITIES (+) FOR A CIRCULAR ECONOMY OF P



derived products

#### Directionality

 Lock-in effects from existing and emerging technologies + EU's Circular Economy Action Plan

provides a common goal + P is listed as a critical resource for

#### Interactions

- Uneven playing field between conventional and reuse-based fertilizers

#### Capabilities

 Lack of knowledge on the performance of technologies for capturing and reusing P + Some technologies have already progressed to commercial implementation

BARQUET K., JÄRNBERG L., ROSMARIN A., MACURA B. (UNDER REVIEW IN WATER RESEARCH). IDENTIFYING BARRIERS AND OPPORTUNITIES FOR A CIRCULAR PHOSPHORUS ECONOMY IN THE BALTIC SEA REGION.



## HOW CAN WE STRENGTHEN SYNERGIES BETWEEN NUTRIENT MANAGEMENT AND A BROADER CIRCULAR ECONOMY TRANSITION?

- 1. We should streamline the research outputs towards technology development,
- 2. Avoid a new system "lock-in" and diversify the options for circulating nutrients,
- Change farm structures for better balance between manure surplus in one area and fertilizer demand in another area,
   Helping innovators in surviving the so-called "valley of death"
- Helping innovators in surviving the so-called "v between innovation and market adoption,
- 5. We should suport public procurement for fostering sustainable innovation,
- Without legislation making recovery and reuse a
  requirement, market development will remain limited.





# BONUS RETURN

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