

# NPP-SOL KICK-OFF

Cagliari – 6<sup>th</sup> to 8<sup>th</sup> November 2023

**NPP-SOL**   
Non-Point Pollution Solutions



## NPP-SOL project: an overview

Antonio Coppola

University of Basilicata & University of Cagliari



# NPP-SOL general objective

*2000/60/EC - Water Framework Directive*

*91/676/EEC - Nitrate Directive*

*128/2009/EC - Pesticide Directive*

*New Green Deal Strategy*

*Farm to Fork*

*Zero Pollution Action Plan*

To prevent diffuse pollution of water resources due to NPS agricultural pollutants under the Mediterranean soil and environmental conditions

Nitrate Vulnerable Zones (NVZ)

Limits to N application

Good Agricultural Practices (GAP)

# NVZ (Nitrates Vulnerable Zones)

Farmers are required to comply with specific limits of inorganic fertilizers and/or organic slurry application rates

(not more than 170 kg N/ha/yr)

**Not successful! Frequently N-NO<sub>3</sub> > 50 mg/l**

## Wetlands and coastal water bodies

**Eutrophication: Algal blooms and murky waters in many coastal wetlands**

(excess of Nitrogen and Phosphorus from cultivated fields)



# Reasons for the failure of the regulatory approach

1. Farmers may see mandatory rules as an obstacle to maintain and increase farm productivity and incomes;
2. Limiting manure applications would mean reducing the number of livestock units per hectare, which could have dramatic economic and social impacts on many areas based on livestock farming economy (e.g. Arborea Plain, Sardinia Region, Italy);
3. Under salinity conditions, limiting nutrient losses would conflict with the need of applying excess water to leach salts;
4. The Good Agricultural Practices, even when the farmer wants actually to apply them, are not site-specific and may produce very different – sometimes even worsening - results depending on the site-specific physical conditions (soil hydrological regime, climate, etc.).
5. Low-efficiency management of irrigation water and nutrients, so that even less than 170 kg N/ha may produce significant effects on the quality of the water bodies

# Project Solutions

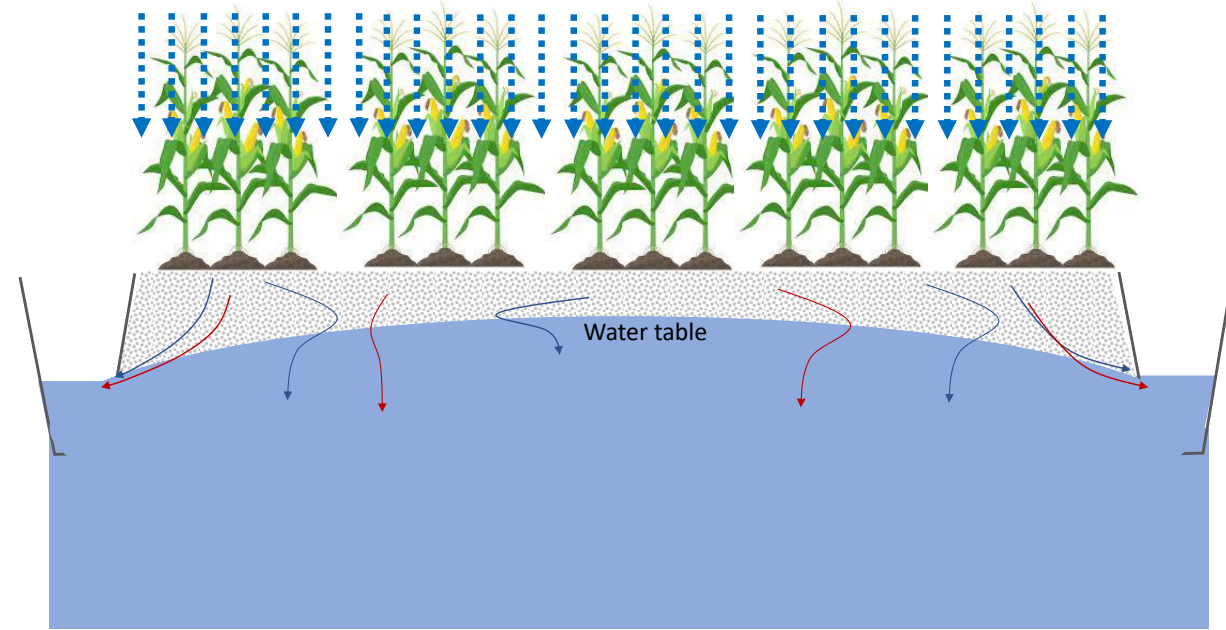
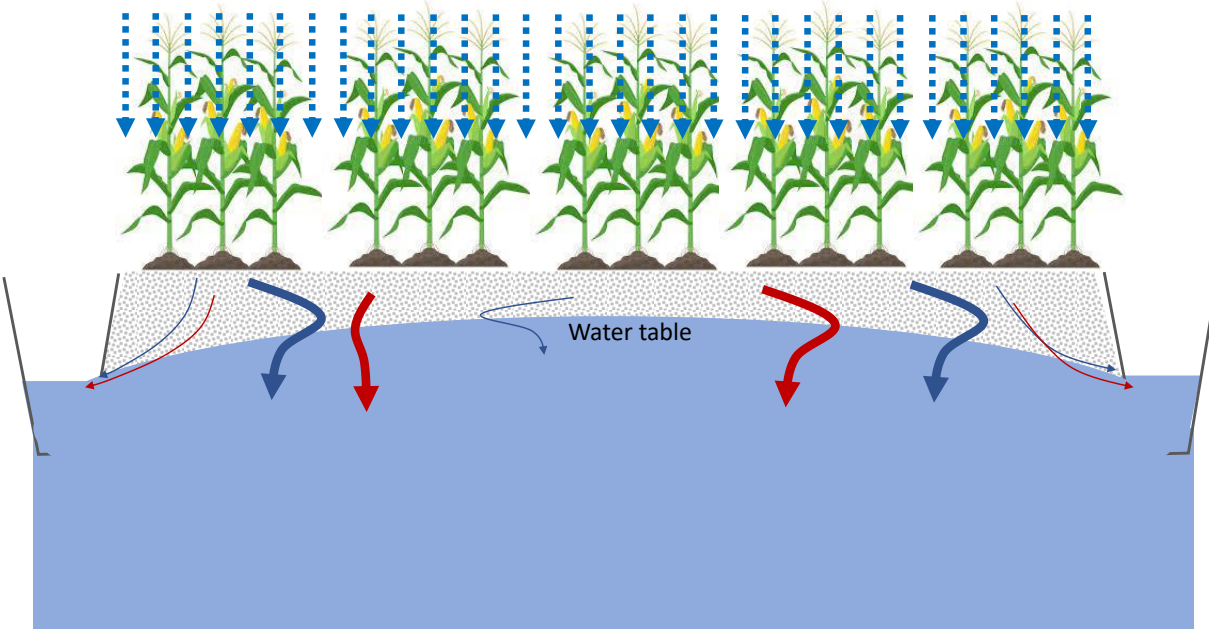
more site-specific, more oriented to support farmers rather than sanctioning and limiting their entrepreneurship)

## Preventing water bodies pollution by:

- ✓ Attenuating agrochemicals arrival to water bodies;
- ✓ Intercepting pollutants before they reach the groundwater and surface water bodies

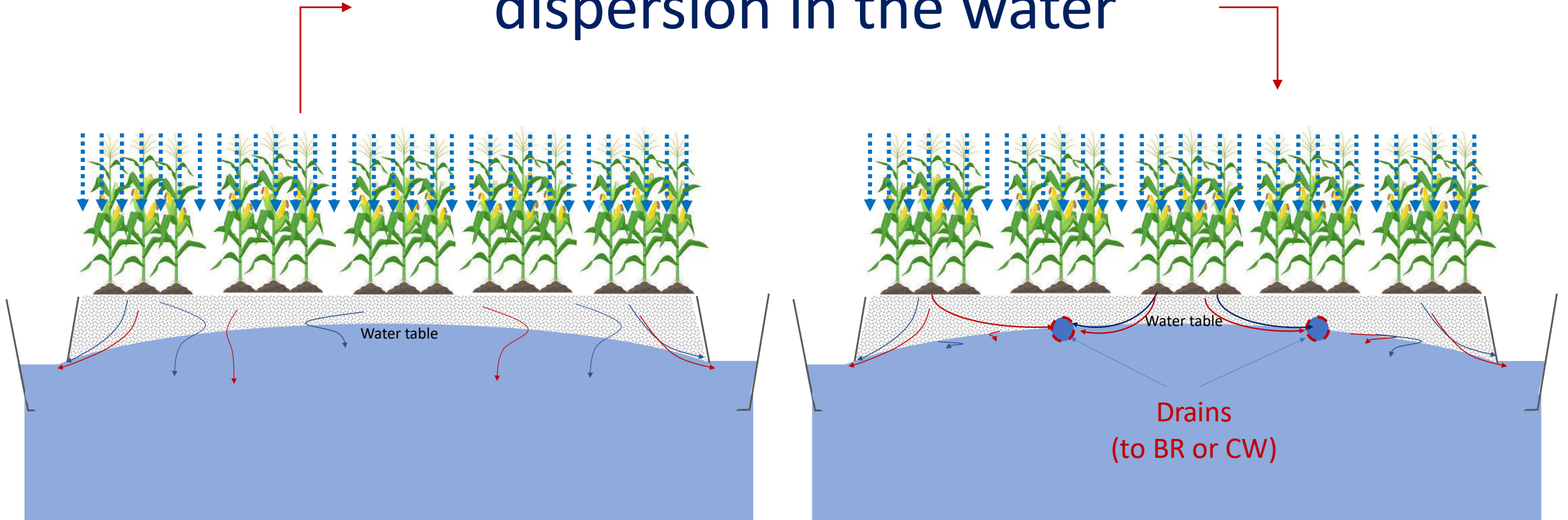
# Attenuating agrochemicals arrival to water bodies

## Improving water and nutrient management



# Intercepting deep percolation nutrient fluxes

## Diverting solute fluxes before dispersion in the water



# Attenuating agrochemicals arrival to water bodies

**Site-Specific Best Management Practices (SSBMP)** to improve soil, water and crop management and efficiently use irrigation water and nutrients under site-specific pedo-hydrological, agronomic, economic and climatic conditions

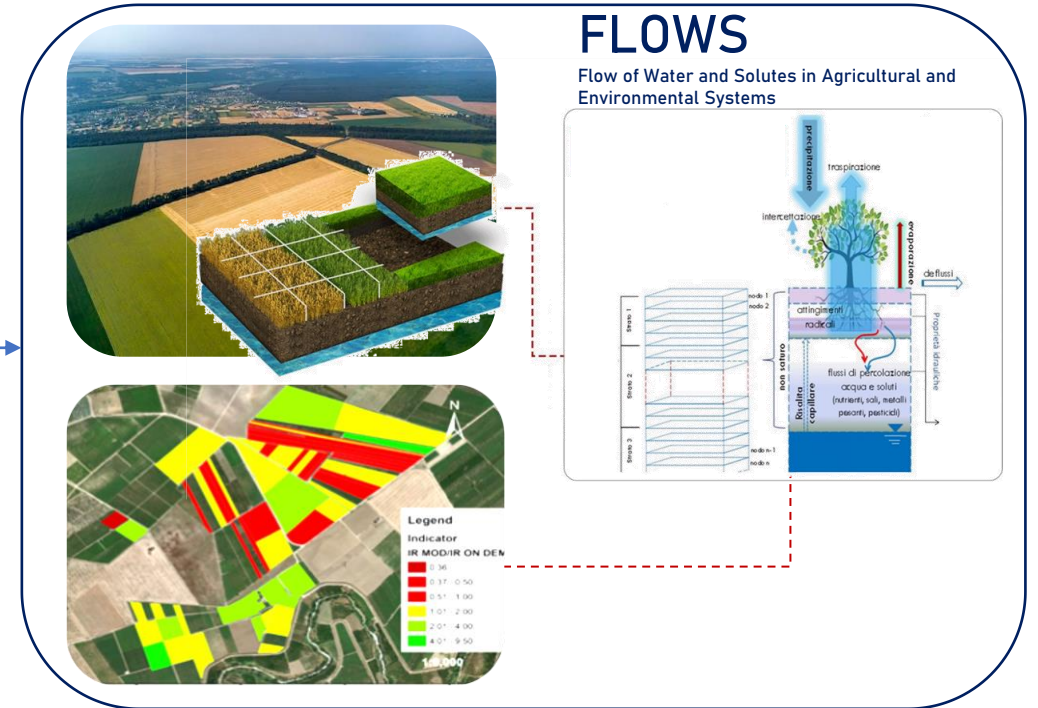


*Integrated Modelling Tools (MT)*

*Hydrological model*

*Bioeconomics model*

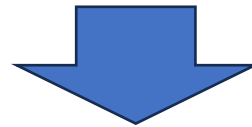
Anaerobic digester (*AD*)





# Intercepting pollutants before they reach the water bodies

**Nature based Pollution Preventing Technologies (PPTs):** in situ bioremediation and Nature-Based Technologies aiming to intercept and remove NPS pollutants before they reach the groundwater and surface water bodies



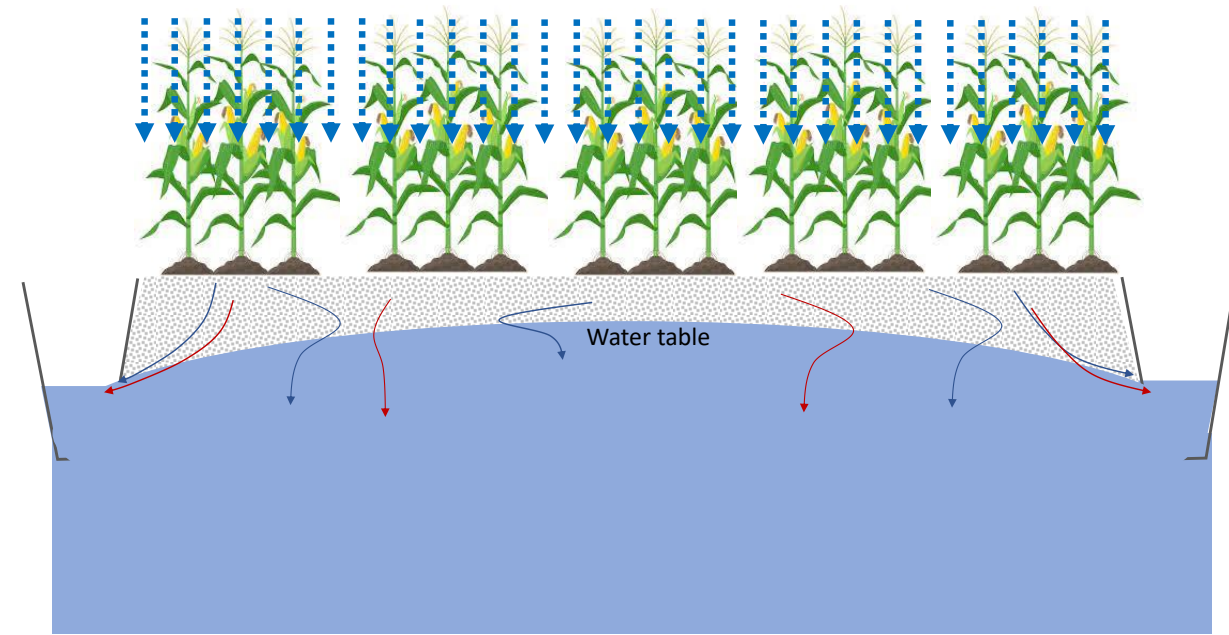
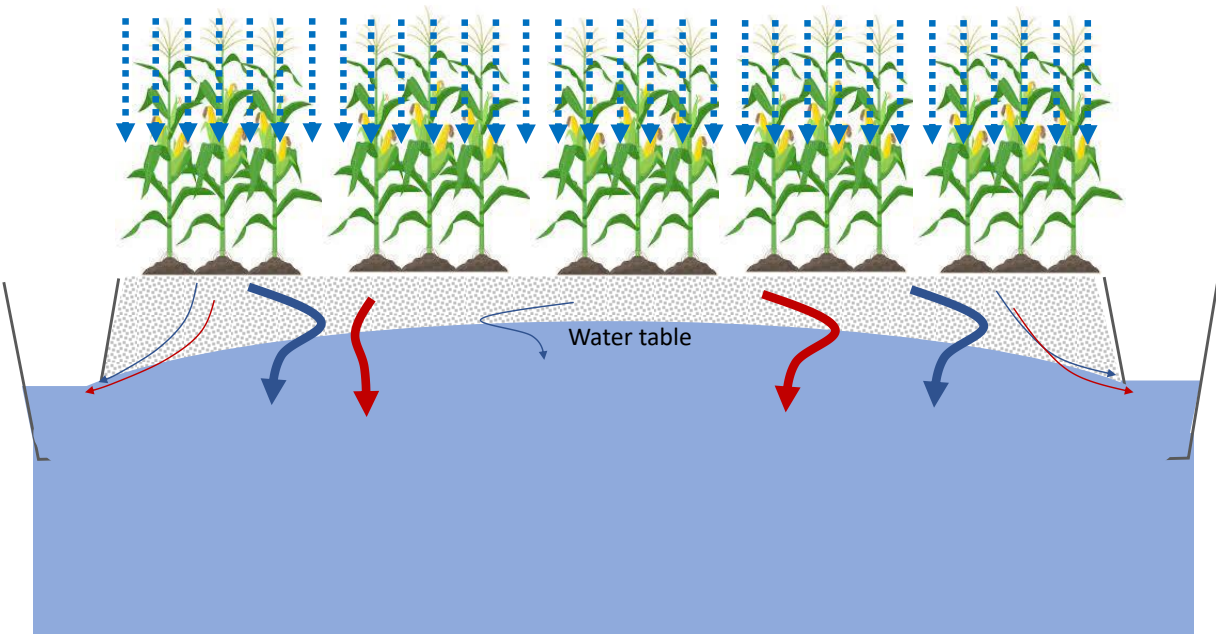
*Bioreactors (BR)*

*Constructed wetlands (CW)*

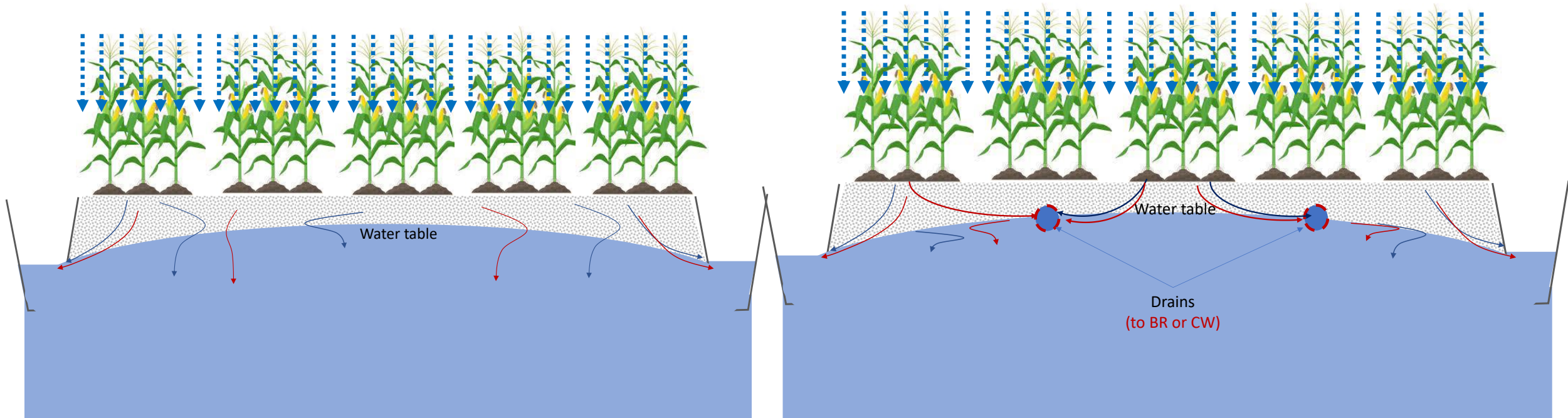
*Anaerobic Digesters (AD)*

# Attenuating agrochemicals arrival to water bodies

## SSBMP & AD

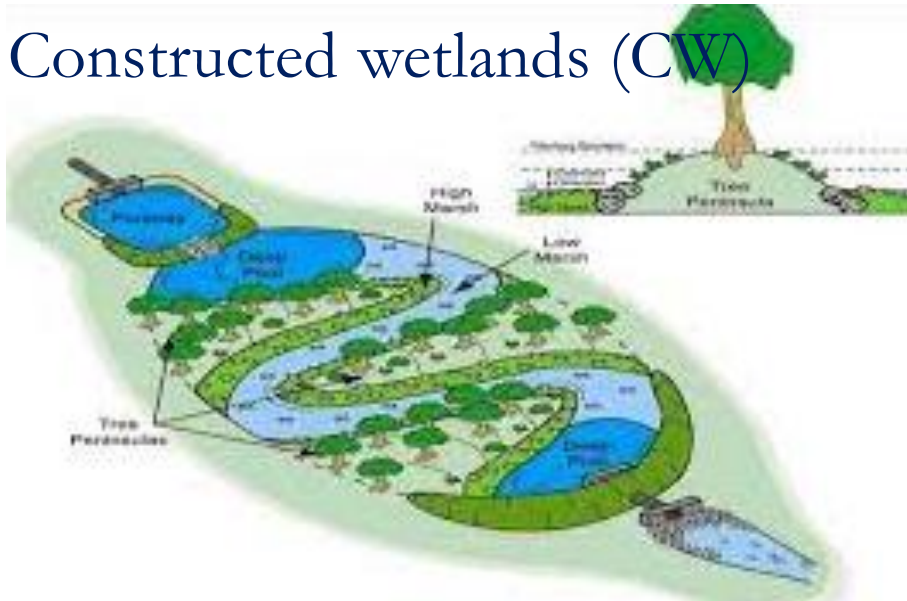


# Intercepting deep percolation nutrient fluxes

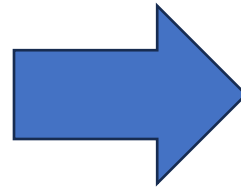


# Pollution preventing Technologies

Constructed wetlands (CW)

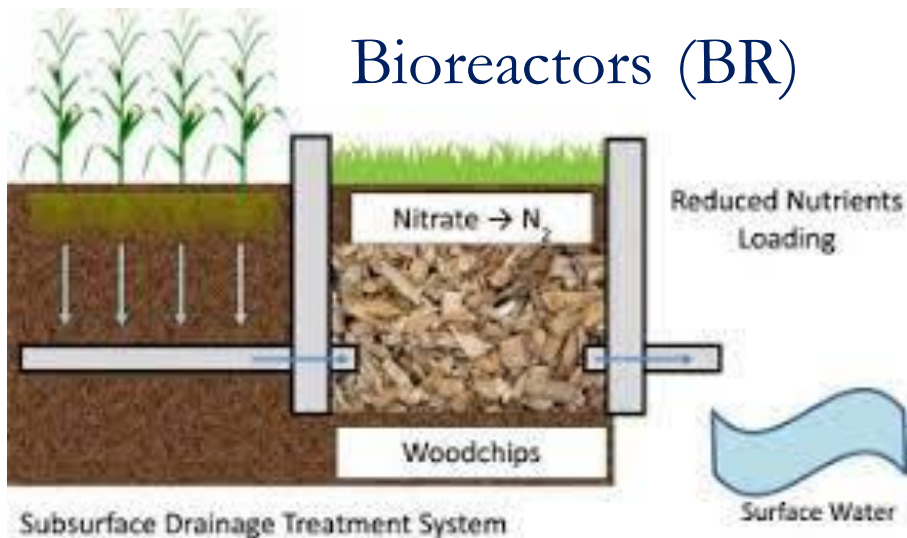


Scale  
 $10^2$  ha



Treatment of the drainage and overland water fluxes (after supplying the nutrients to soil)

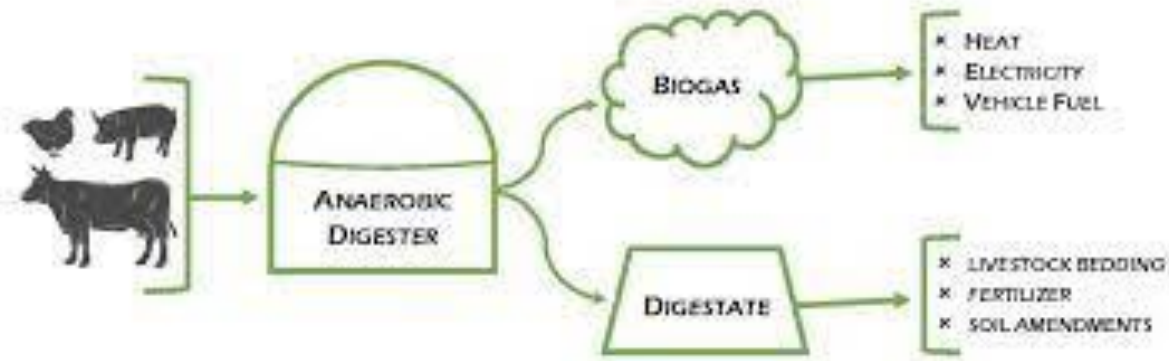
Bioreactors (BR)



Scale  
 $10^1$  ha

# Pollution preventing Technologies

## Anaerobic Digester (AD)



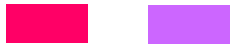
Treatment of the manure **before supplying it to soil**

# Study areas



**SPAIN**  
Lerma basin study area in the Arba River catchment

Irrigated agricultural land since the 2000s. A progressive increase in the use of fertilisers (NPK) lead to a three-fold increase of N input to the Arba river, recognized as affected by NO<sub>3</sub> pollution.



**ITALY**  
Arborea study area in Sardinia Region

Designated as NVZ IN 2006, a specific action programme for the reduction of NO<sub>3</sub> has been developed. Despite a significant reduction in nitrate concentrations during the first years of application, these concentrations are still high, above the threshold values established by national and European legislation.



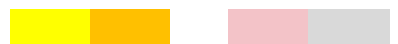
**MOROCCO**  
Mnasra Region in the Gharb irrigated study area in NE Morocco

The misuse of irrigation water and agrochemical inputs have brought to a widespread pollution of ground- and surface-water by NO<sub>3</sub> and salinity.

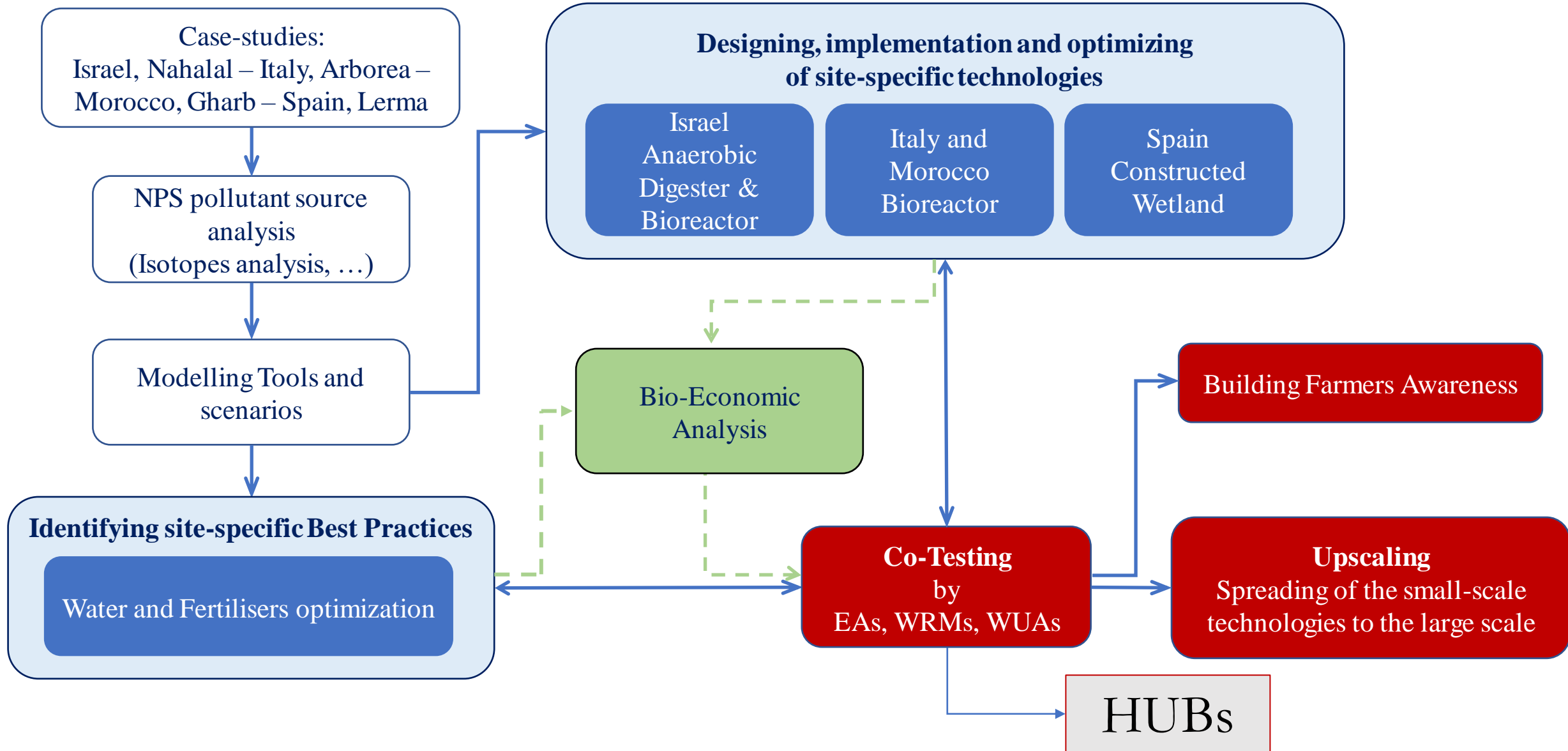


**ISRAEL**  
Nahalal Stream near Newe Ya'ar experimental farm

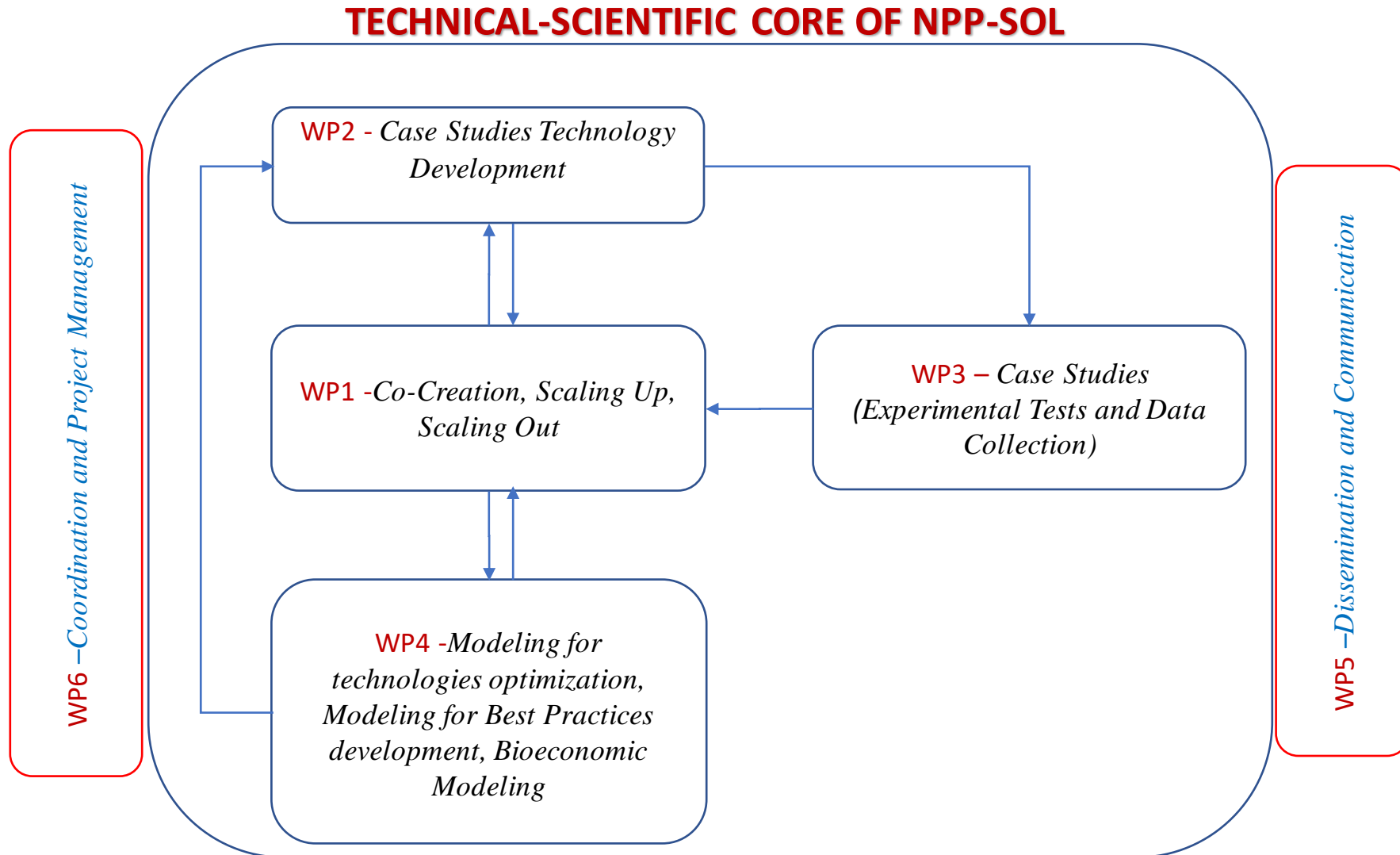
Agricultural practices in the area involve over fertilization and poor management of liquid effluents from CAFO. High NPS pollution sources threaten the sustainability of agriculture since it impacts on the quality of Nahalal River.



# FLOW of project ACTIVITIES



# Connections among WPs





# NPP-SOL partners



PI name	Organisation	Country
Antonio Coppola	University of Basilicata (UNIBAS)	Italy
Stefania Da Pelo	University of Cagliari (UNICA)	Italy
Alber Soler Gil	Universitat de Barcelona (UB)	Spain
Hatem Belhouchette	Mediterranean Agronomic Institute of Montpellier (CIHEAM-IAM)	France
Roy Posmanik	Agricultural Research Organization – Volcani Institute (ARO)	Israel
Roey Egozi	Ministry of Agriculture and Rural Development (MOAG)	Israel
Abdelmjid Zouahri	National Institute of Agricultural Research (INRA)	Morocco
Souad El Hajjaji	Mohammed V University of Rabat (UM5)	Morocco

# Second slide title

Contents here should be in this font, please.

# Second slide title

Contents here should be in this font, please.

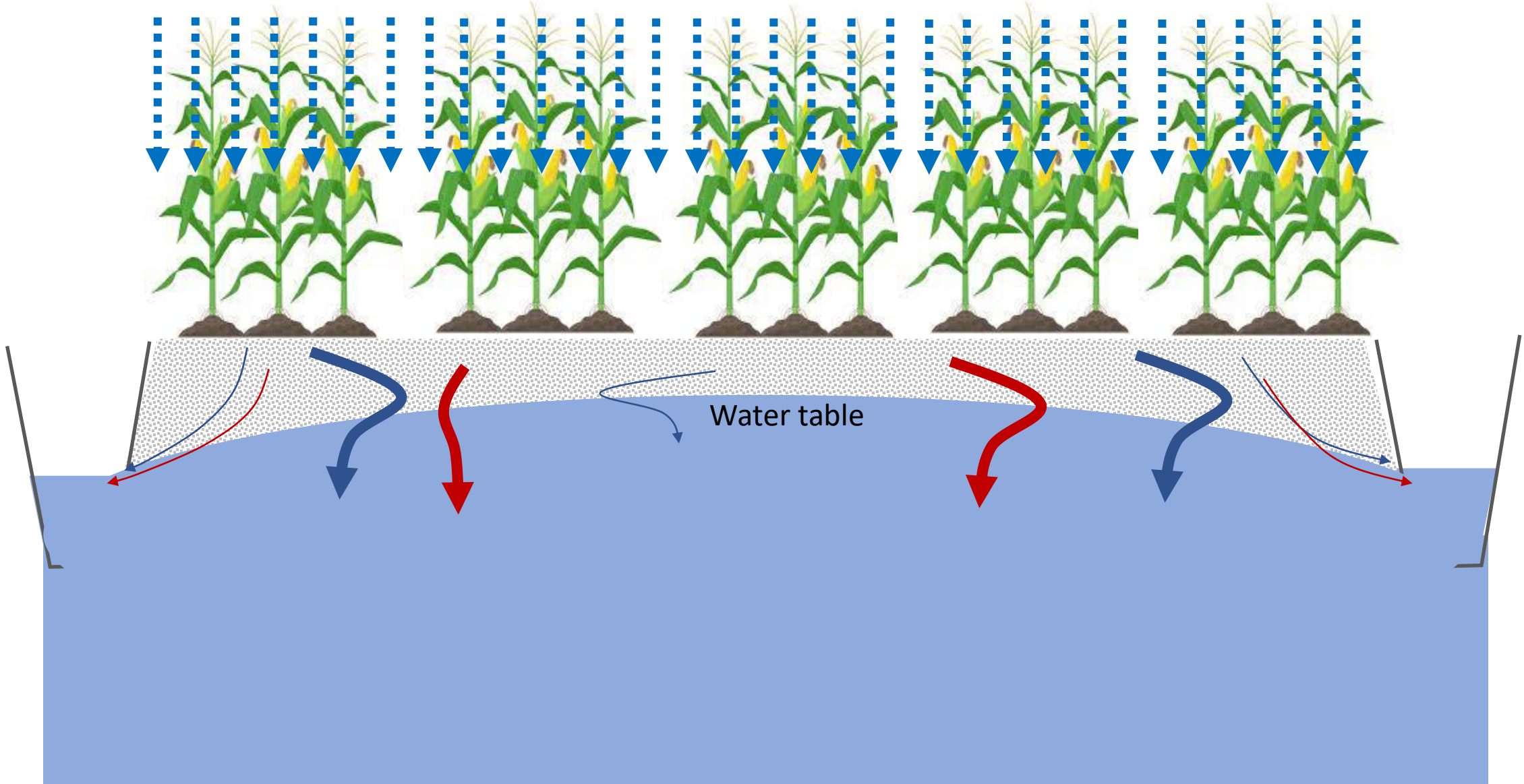
# Second slide title

Contents here should be in this font, please.

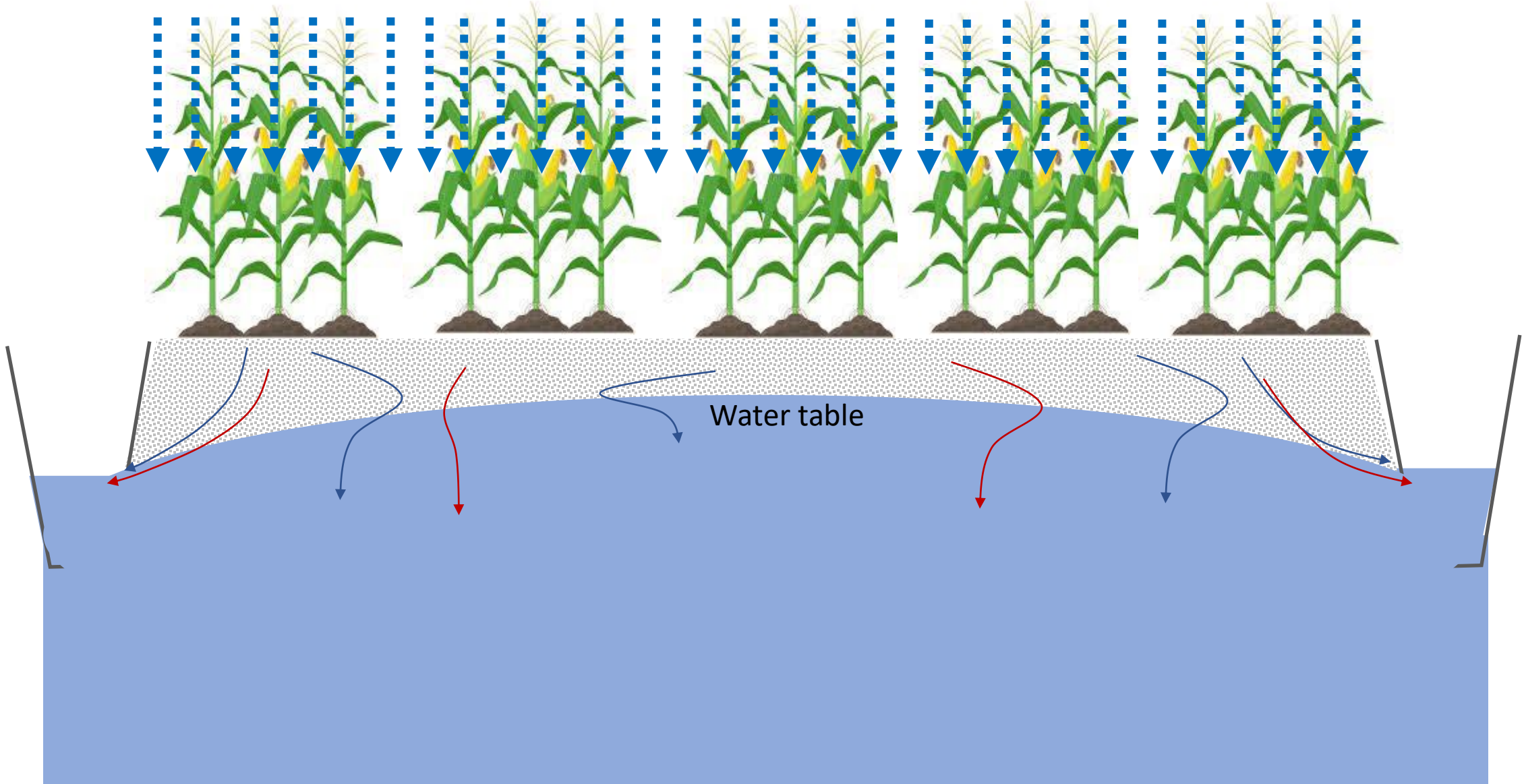
# Second slide title

Contents here should be in this font, please.

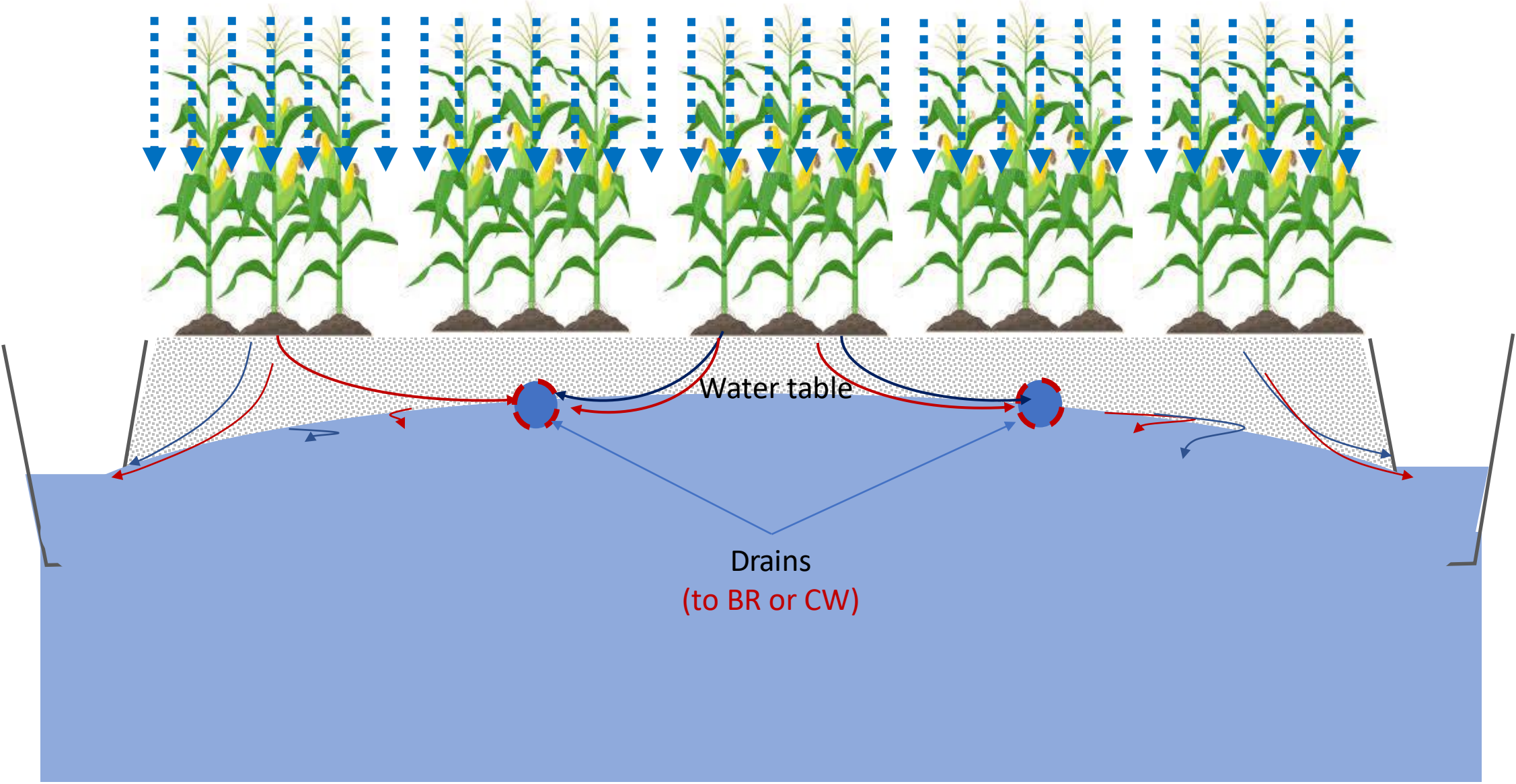
# Attenuating agrochemicals arrival to water bodies



# Attenuating agrochemicals arrival to water bodies



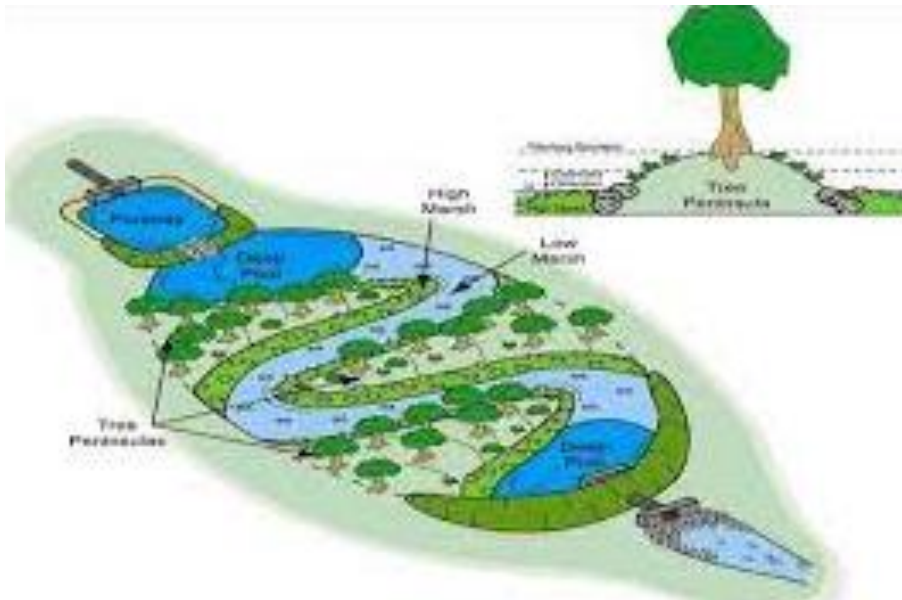
# Intercepting deep percolation nutrient fluxes



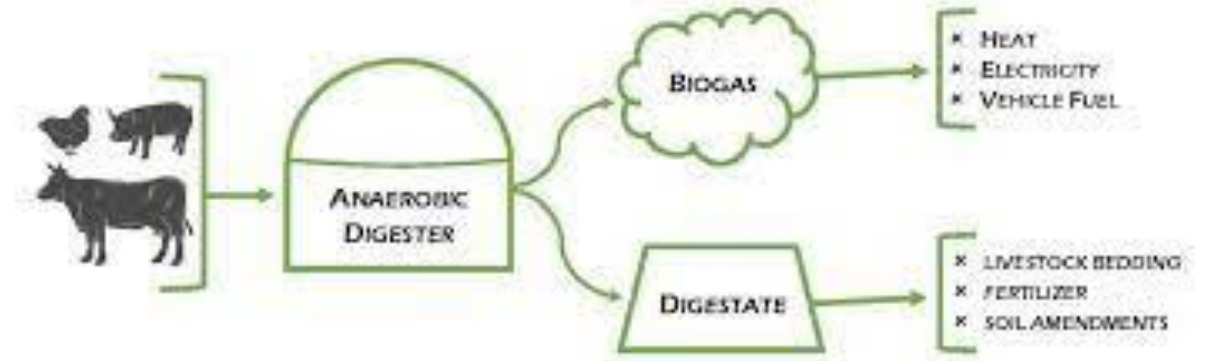


# Pollution preventing Technologies

## Constructed wetlands (CW)



## Anaerobic Digester (AD)



## Bioreactors (BR)

