

➤ Water reuse irrigation for vineyard in Occitanie region, France

Innovation Pathway 2022-Lisboa
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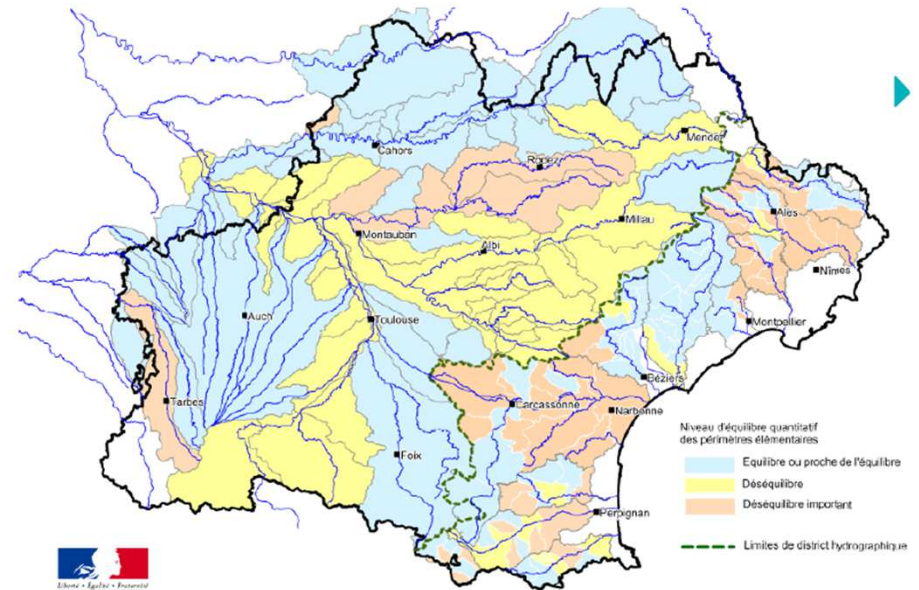
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➤ Occitanie regional contexte

- Agriculture 1st economic sector
- The world's leading wine region and also second ranking in French farming region.
- Today, in Languedoc-Roussillon 23,000 hectares of vines are irrigated, 10% of the region's vineyards
- The region is rich in natural water resources (lagoons, wetlands, basin heads ...)
- An important heritage of channels for the raw water transfer.
- **However some areas are already subject to significant inequalities between the available resources and the uses.**



Equilibrium map of water resources and uses



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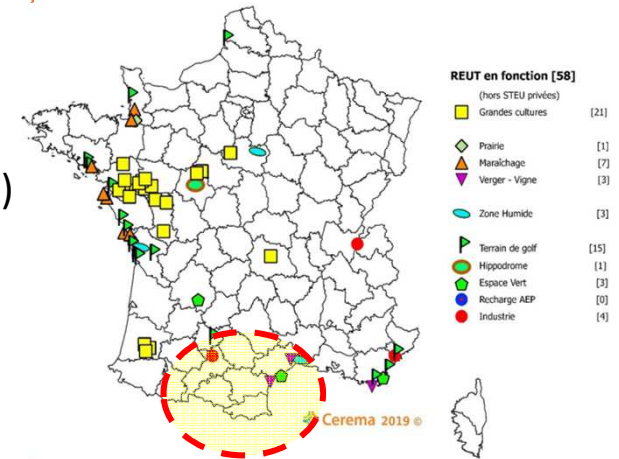
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DREAL Occitanie

➤ Potential of agriculture water Reuse

- Save the conventional waters for sensitive uses.
- Reduce the impact on the aquatic environments (wetlands, rivers...).
- Fertigation potentials (Nitrogen and phosphorus nutrient crop needs) depending on the treatment process.
- Water availability in the touristic areas during the summer periods.
- Long experiences of water reuse projects in the world....



Although over 3 000 treatment plants , only few water reuse projects throughout the region, most of them are demonstrator or research purposes.

Examples of projects supported by French Water Agency RMC:

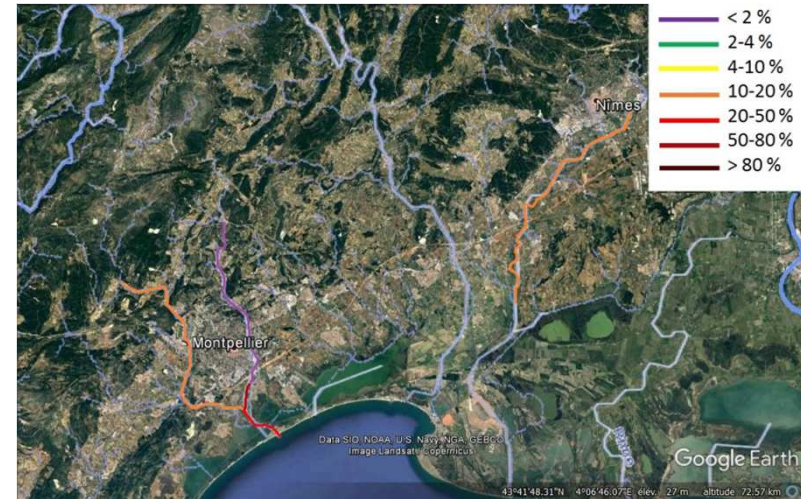
- From 2018, 15 hectares of vines in Roquefort-des-Corbières (Aude)
- After more than 7 years of project construction, Cap d'Agde international golf course (18 holes)



Illustration 5 : Site de REUT Roquefort-des-Corbières (source: dis-leur)

➤ Occitanie region water reuse

Why with many incitation and record droughts every year
As other regions in France, the water reuse is not developed in Occitanie ?



Estimates of wastewater impact in the **Le Vistre, La Mosson, and Le Lez** river basins with indicated dilution ratios in 2017 (Drewes et al 2017 report)

Some hypothesis:

- Competition with other more accessible resources such as the raw water networks (BRL, CACG) ,
- Reclaimed wastewater is already part of the surface waters (competition with eco-flow in the rivers),
- Water reuse option seem too restrictive to be implemented (i.e. administration constraints, specific irrigation requirements for sprinklers) and to manage collectively (i.e. water quality monitoring),
- Difficulty to enlarge to the rural areas : Cost and Water quantity (**Very few hectares can be really irrigated**).

➤ Improve the knowledge using Murviel Lès Montpellier Reuse platform from 2017



Agricultural field:
vines, trees, alfalfa



In greenhouses soil tanks:
unregulated water qualities

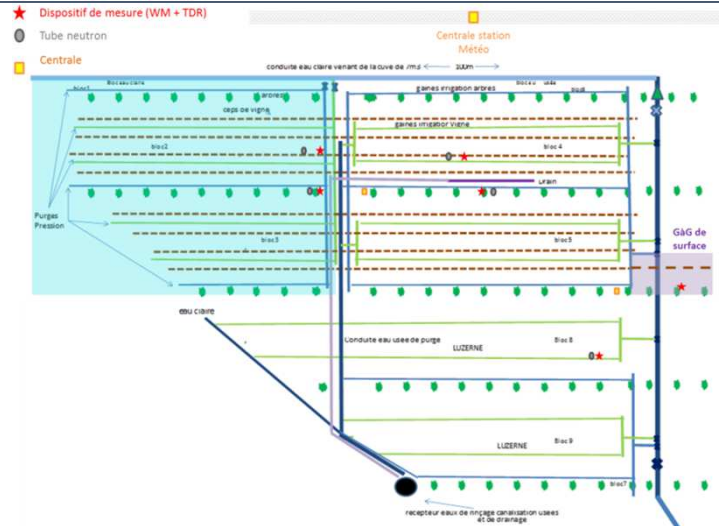


- According to national regulation
- 0.5 ha field surface
- Agroforestry: vines - olive trees and alfalfa
- Irrigation by a 1.5 l/h drip system.

- With different wastewater qualities: untreated wastewater, innovative treatments, etc.)
- Crops: Vegetables
- Irrigation system: Drip irrigation

Vineyard irrigation in Murviel Lès Montpellier Reuse platform

Nutrient inputs

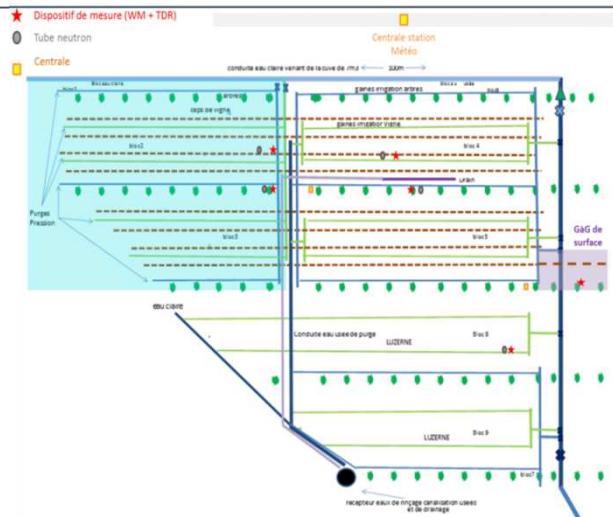


Quality	Nitrate	Phosphate	COD	Conductivity
	mg/l	mg/l	mg/l	μS/cm
Treated wastewater	24.3 ± 4,9	0.6 ± 0,9	31.6 ± 26,4	1386 ± 190,3
Clear water	1.9 ± 0,04	0	0	791.7 ± 6,6

Quality	Irrigated water		Nitrate	Ammonium	Phosphate
	m3/hectare	l/vine	kg/hectare	kg/hectare	kg/hectare
Treated wastewater	831.9	208.0	20.2	6.5	0.5
Clear water	832.7	208.2	1.6	0.0	0.0

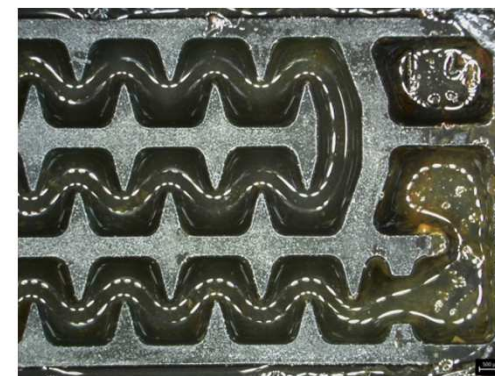
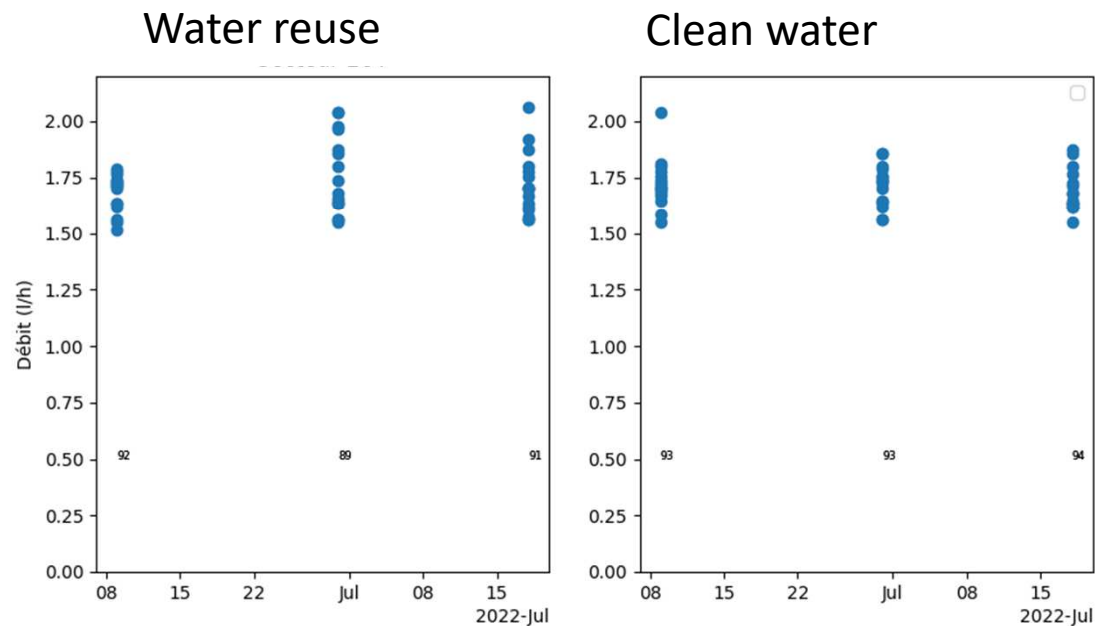
Vineyard irrigation in Murviel Lès Montpellier Reuse platform

Drip irrigation efficiencies



Dripper observations
(after 2 years)

Dripper flowrates (after 2 years)



Vineyard irrigation in Murviel Lès Montpellier Reuse platform

Pathogen indicators



NIVEAUX DE QUALITÉ SANITAIRES DES EAUX USÉES TRAITÉES

Quatre niveaux de qualité sanitaire des eaux usées traitées (A, B, C et D) sont définis comme suit :

PARAMÈTRES	NIVEAU DE QUALITÉ SANITAIRE DES EAUX USÉES TRAITÉES			
	A	B	C	D
Matières en suspension (mg/L)	< 15	Conforme à la réglementation des rejets d'eaux usées traitées pour l'exutoire de la station hors période d'irrigation		
Demande chimique en oxygène (mg/L)	< 60			
<i>Escherichia coli</i> (UFC/100mL)	≤ 250	≤ 10 000	≤ 100 000	-
Entérocoques fécaux (abattement en log)	≥ 4	≥ 3	≥ 2	≥ 2
Phages ARN F-spécifiques (abattement en log)	≥ 4	≥ 3	≥ 2	≥ 2
Spores de bactéries anaérobies sulfito-réductrices (abattement en log)	≥ 4	≥ 3	≥ 2	≥ 2

French water reuse Minimum quality

	External analysis (Eurofins hydrology)			
	Spores of sulfate-reducing bacteria	<i>Escherichia coli</i>	Bactériophages ARN-F	Enterococci
	log(CFU/ml)	log(CFU/100ml)	log(UFP/100ml)	log(CFU/100ml)
Treated wastewater	3,0 ± 1,1	3,6 ± 1,0	1,5 ± 1,0	2,8 ± 1,3

No detections in grapes of various pathogen indicators (preliminary results, year 2022):
Escherichia coli, Anaerobic sulfate-reductive bacteria, *Bacillus*, *Listeria*
monocytogenes, *Salmonella*, Spores of sulfate-reducing bacteria, *Staphylococci*,
Streptococci.

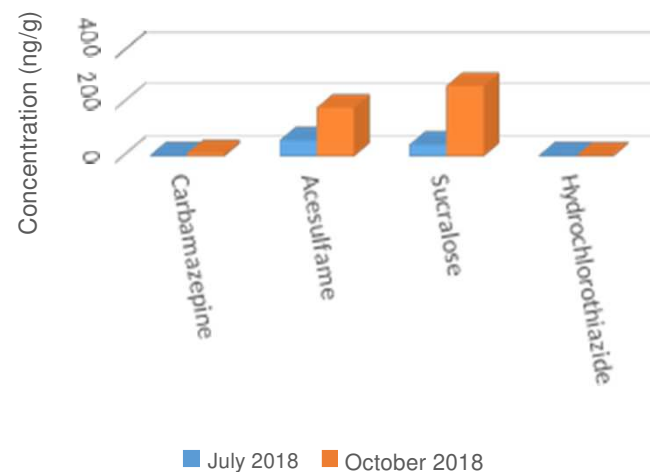
➤ Uptake and translocation of pharmaceuticals contaminants

In sol and plants



- Organic contaminants (OC) accumulate in the soil over time
- Lettuce is able to absorb OCs under field conditions.
- **The presence of OCs in lettuce leaves need to be considered also in the grapes?**

Treated wastewater



Spiked wastewater



■ July 2018 ■ October 2018



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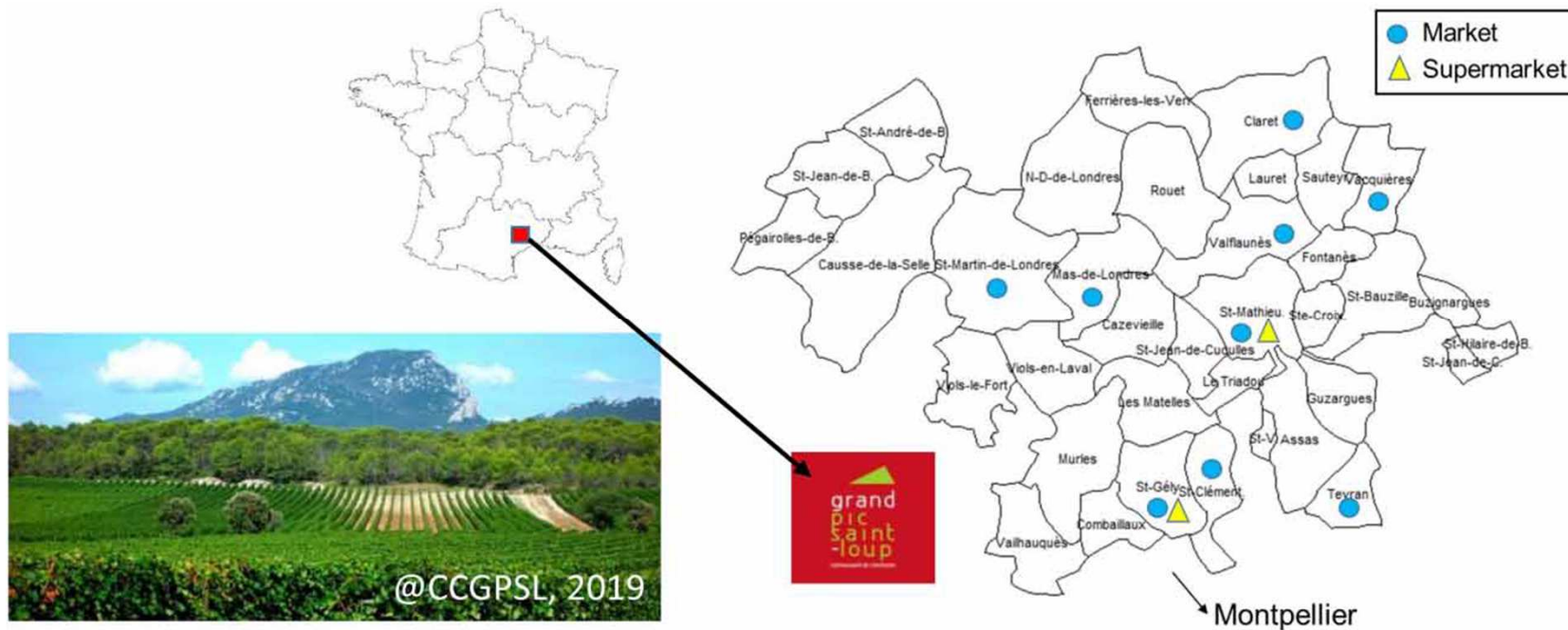
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Organic contaminants concentrations across successive crop cycles in lettuce leaves samples irrigated with treated wastewater (TWW) (Manaf et al . 2020)

➤ SOCIAL PERCEPTION OF WATER REUSE

Consumer surveys



➤ SOCIAL PERCEPTION OF WATER REUSE

Behavioral intentions (case of wine)

Attitudes	No information (N = 191)				Information (N = 556)			
	No purchase	Don't know	Purchase	Total	No purchase	Don't know	Purchase	Total
Highly unfavourable	6.8%	0.5%	0.5%	7.9%	7.0%	0.5%	0.7%	8.2%
Rather unfavourable	12.6%	2.6%	8.4%	23.6%	8.1%	1.8%	4.6%	14.4%
Rather favourable	3.7%	2.1%	23.0%	28.8%	3.5%	1.1%	23.5%	28.0%
Highly favourable	2.1%	0.5%	33.5%	36.1%	1.1%	0.9%	45.4%	47.3%
Don't know	0.5%	2.6%	0.5%	3.7%	–	0.5%	1.2%	2.1%
Total	25.7%	8.4%	66.0%	100.0%	20.0%	4.7%	75.3%	100.0%

- A significant unfavorable attitudes on local customers.
- Consumers less uncertain with more information about water reuse
- What is the economic effect on wine producers if there is 20% loss of sales?

➤ Perspectives for water reuse in Occitanie region

Requefort Les corbiere
Reuse irrigation



Murviel Reuse platform



- **Related to the climate change, in Occitanie region** , a real dynamic and several initiatives about the vineyard irrigation.
- Our first results do not demonstrate **any significant change in the grape crops** except related to the water supply (in comparison with rainfed conditions)



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➤ Perspectives for water reuse in Occitanie region

Requefort Les corbiere
Reuse irrigation



Murviel Reuse platform



In perspectives :

- Research work in progress on 15 h of vineyard in Roquefort-des-Corbières (Aude) in association with 8 wine producers (preliminary results in progress)
- **How the new EU water reuse regulation will impact the Water Reuse?**
- **Is it economically sustainable? Who pays for the addition investment and higher cost of water?**
- **Within a territory, how to manage the equity of water reuse distribution (which can be restricted)?**

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➤ Thank you

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