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Waste water reuse in France - Social perception of an unfamiliar practice

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Authors

Patrice Garin, INRAE UMR G-Eau, Montpellier University, Montpellier, France

Marielle Montginoul, INRAE UMR G-Eau, Montpellier University, Montpellier, France

Benjamin Noury, INRAE UMR G-Eau, Montpellier University, Montpellier, France and SCP IMSIC, Aix en Provence, France

Abstract

This article presents the results of a local survey conducted in a French wine-growing region where the public authorities were considering irrigating fields and green spaces with treated wastewater. 845 potential consumers were interviewed face-to-face close to their purchasing place. The majority were in favour of such a project and willing to use recreation areas and purchase local farm products irrigated with treated wastewater. However, we demonstrated the paucity of lay knowledge about treated wastewater. Simple information flyers have a significant effect on attitudes and intended behaviours. Nevertheless 20% of informed respondents said they would no longer buy such irrigated products. Given the lack of confidence in the public authorities' guarantee of food quality, they will be unlikely to change their minds. These unacceptable results to farmers may interest public authorities promoting these projects, still rare in France, in response to the increase in droughts.

Graphical abstract



Keywords

Consumer attitude; wastewater reuse; social representation; French local survey; information effect; intended behaviour

Highlights

- WWR an unfamiliar practice in France with no anchored social representation
- Information influences attitudes towards WWR of undecided people
- Attitudes and intended behaviours driven by disgust, environmental sensitivity, risk perception, and type of use
- Working women more reluctant than men to WWR; farmers rejecting WWR
- By communicating, farmers strengthen the social acceptability of their project but with a loss of customers

Introduction

Every second year, half the French departments set up restrictions on use due to water scarcity (Benoit et al. 2017). Irrigation is then limited or even prohibited for weeks. Waste Water Reuse (WWR) is thus be seen as an interesting solution in these territories, especially as it may be considered as participating in the circular economy and contributing to a so-called virtuous circle (Maurer 2018). However, only 0.2% of treated urban wastewater effluents are reused annually in France. This figure is lower than the European average (2.4%), and a long way from the practices of Italy and Spain, which reuse between 8 and 12% of their treated effluents (Aquarec 2006).

This situation can be explained firstly by the very restrictive regulatory framework. In France, thanks to the 1992 French Water Law, treated wastewater can be utilized but only to irrigate lands, "provided that its characteristics and manner of use are compatible with the requirements for the protection of public health and the environment" (decree of June 3, 1994). And the Order of June 25, 1994 defines four classes of water quality from A to D. Each class is associated with constraints of use, distance and terrain to be respected according to the crop, the area to be irrigated, and strict technical regulations for sprinkling irrigation – the dominant practice in France¹. CEREMA identified only 63 schemes in operation in 2017 in France, including 35 for agricultural purposes, concerning much less than 1‰ of the 1.5 million hectares irrigated annually in the country. Most projects, less than 100 ha, were initiated before the 2000s in rare areas of a real acute lack of water (i.e. islands, coastal zones, etc.), to satisfy some agricultural uses close to wastewater treatment plants.

But this poor practice of WWR is also due to the French situation, where water has not been scarce (thanks also to other solutions to fight against water scarcity, like dams, canals, etc.). This second key reason (both reasons underlined by Lazarova & Brissaud (2007) and Cerceau (2015)) may explain the gradual change that appeared after 2000, with 40% of the new projects considered as addressing quantitative or qualitative water issues at the catchment level. There is now an annual growth rate of 7% in the number of projects (Franck-Néel 2020). WWR is emerging in public and/or national French debates as a way to cope with repeated droughts, especially to supply water to territories not yet covered by irrigation networks, and thus to crops previously not irrigated (wine, lavender, olive trees). For instance, the "Assises de l'eau", a national forum organized by the National Water Committee proposed in their conclusions (16 July 2020) to triple the WWR projects' numbers.

¹ See the following link for an in-depth presentation of the regulation: https://www.arpe-arb.org/files/20171130_2017Rutiliserleseauxtraites.pdf. A survey done by the public institution CEREMA (Centre for studies and expertise on risks, the environment, mobility and development) reports that the main treatment is "activated sludge" which accounts for 73% of WWR cases (against 44% of all waste water treatment plants in France), ahead of ponds 23% (against 28%), and membrane processes 3% (against 0.3%) (Franck-Néel 2020).

In this context, French Water Agencies are increasing pilot experiments, to explore the potentialities of this “new” method of satisfying increasing water needs. The French research and development project ‘SOPOLO’ (‘WWR a possible local solution?’) takes up part of these, looking to estimate wastewater demand, especially for irrigation purpose, in a Mediterranean fine wine-growing territory, “Pic Saint Loup”, located in the South of France (Figure 1). This vineyard is not irrigated yet. There is no WWR project for agriculture nearby. However, after several severe droughts during the last decade, more and more farmers are complaining about lack of water for irrigation. Recycling water from several sewage treatment plants is one of the options for the local public authority (‘Communauté de Communes du Grand Pic Saint Loup’ - CCGPSL), which is a partner in our research activity.

As irrigation can be viewed, from the point of view of economics, as an intermediate resource desired not in itself but for growing products later sold in the market, it seems important to assess the level of acceptance by customers of agricultural products (i.e. households). The aim of this paper is to present the attitudes of consumers, buying their fruit, vegetables and wines in this area, toward a WWR project and their intended behaviour concerning local irrigated foods and recreational areas. These elements will give indicators of the risk of consumers turning away from local production, which would jeopardize the viability of the WWR project.

In the first part, we provide a brief overview of the state of the art of WWR's social acceptability issues; we then present the research method before discussing the main results.

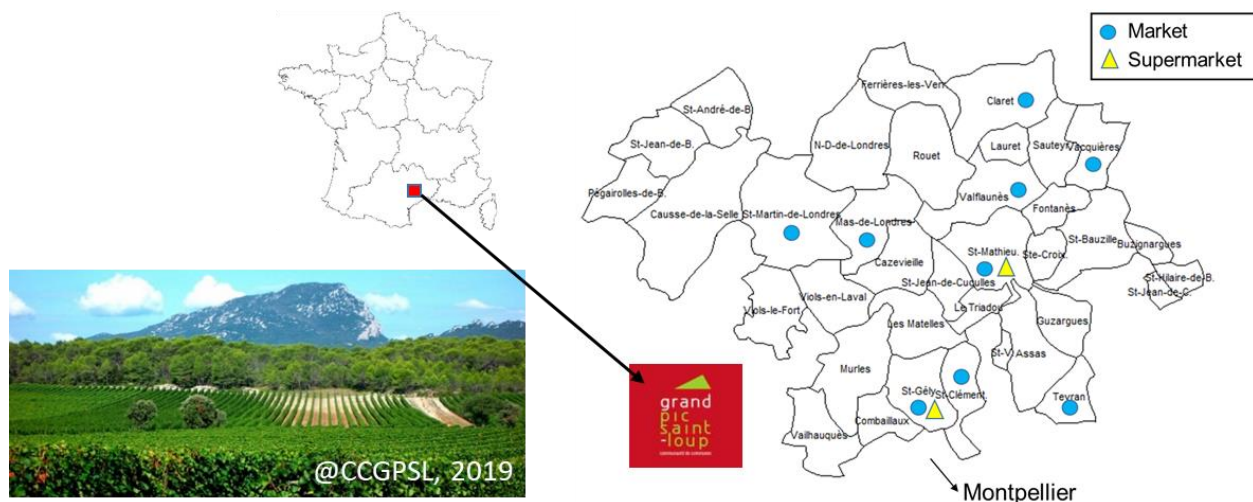


Figure 1. Pic Saint Loup Territory and location of the survey's sites.

State of the art of WWR social acceptability

“Social acceptability” is an “embarrassing” notion (Barbier & Nadaï 2015), but it was soon acknowledged as being a key element in the development of WWR in the same way as technical issues are (Baumann & Kasperson 1974). During the last forty years, there has been a lot of research investigating factors associated with public acceptance of recycled water in many countries (Fielding et al. 2018), but not in France. In addition, in this country, Berry et al. (2016) revealed difficulties related to the rise of controversies concerning all major infrastructure projects (in their case study on WWR, the interviewees refer in particular to the highly controversial project of a new airport ‘Notre Dame des Landes’). Water is not exempt from these controversies, whether for the justification of irrigation, the quality of drinking water (Hervé-Bazin 2014), or the public interest in new dams for irrigation (Sibertin-Blanc 2019). France has been marked by health scandals affecting food: mad cow disease, children's milk contaminated with salmonella, avian influenza, swine fever, meat and cheese

affected by *Escherichia coli*. Consumer associations regularly denounce the high levels of pesticide residues on fruit and vegetables, and question the government about emerging pollutants. This context creates a climate of mistrust in food chains that use industrial processes. Our hypothesis is that the treatment of wastewater for agriculture could be seen by consumers as one of these complex industrial processes, susceptible to malfunctions in the elimination of bacteriological, viral or chemical elements. However, WWR has so far received very little media attention in France: the media analysis conducted by Noury et al. (2019) for the period 2000-2017 for fifty national, regional and specialized press titles revealed that few press articles (156) mentioned WWR, with only 30% focusing on it. Most of these, published after 2010, mentioned WWR as a way to deal with repeated droughts without the need for new dams, a particularly sensitive subject, and one in conformity with the political trends of circular economy.

The main French reference to public views of water issues is the annual national barometer of opinions from a representative sample of 2,508 people, about water and wastewater services. In the questionnaire with over than one hundred questions, there are only three concerning people's acceptance of using recycled water and one on their knowledge of the water cycle (Centre d'Information sur l'Eau & TNS Sofres 2018). However, this national barometer reports general public opinions on the principle of recycling water, measuring "the extent to which a person believes that supporting the recycled water scheme will deliver positive outcomes" (Nancarrow et al. 2008); this is not an opinion on the desirability of a WWR project close to their homes. Nancarrow et al. (2008) had already documented a difference between supporting the concept of recycling water, because this attitude is in line with the values people stand for, and accepting personal contact or ingestion of food irrigated with such water, because this involves other intimate factors. More precisely, we wanted the answers to five questions, based on literature reviews (Dolnicar et al. 2010, Etale et al. 2020, Fielding et al. 2018), and the French national survey (Centre d'Information sur l'Eau & TNS Sofres 2018):

- What were the main components of the social representation of WWR in this area, if any?
- Were the inhabitants of this area in favour of irrigating agricultural or recreational areas with recycled water?
- Did their opinions vary depending on the agricultural products or recreational spaces considered?
- Did their opinions change if they were provided with basic information on the principles of water treatment and control?
- Was there consistency between their judgment on the appropriateness of a WWR project and their envisaged purchasing of agricultural products and use of recreational areas irrigated with recycled water?

The French national survey indicated that 52% of the population believed that wastewater was already directly used for drinking water, even though this is strictly forbidden by regulation, and so no treated wastewater is directly used for this purpose. This observation, combined with only the very few number of French WWR projects (no one near to Pic Saint Loup Region), and the low media visibility, led us to assume that the local population, too, had very little knowledge of the subject, and that it was an unfamiliar practice. According to social representation theory (Rateau et al. 2011), in this context of unfamiliarity, opinions and beliefs were probably not yet imbedded in knowledge collectively produced by a social group (i.e. a social representation). Identifying the "central core" of cognitive elements constituting the social representation of wastewater treatment, if any, was therefore of fundamental importance. The central core, anchored in people's minds is particularly difficult to change (Vergès 1992), even with an information campaign. On the contrary, the other

(‘peripheral’) elements of a social representation can be changed by ordinary exchanges through social networks and by the media. These elements are also sensitive to ‘information and awareness-raising’ (Noury et al. 2019). We intended to test whether positive information on WWR increases the acceptance rate for people who do not yet have deep-rooted beliefs about this topic (Noury et al. 2019).

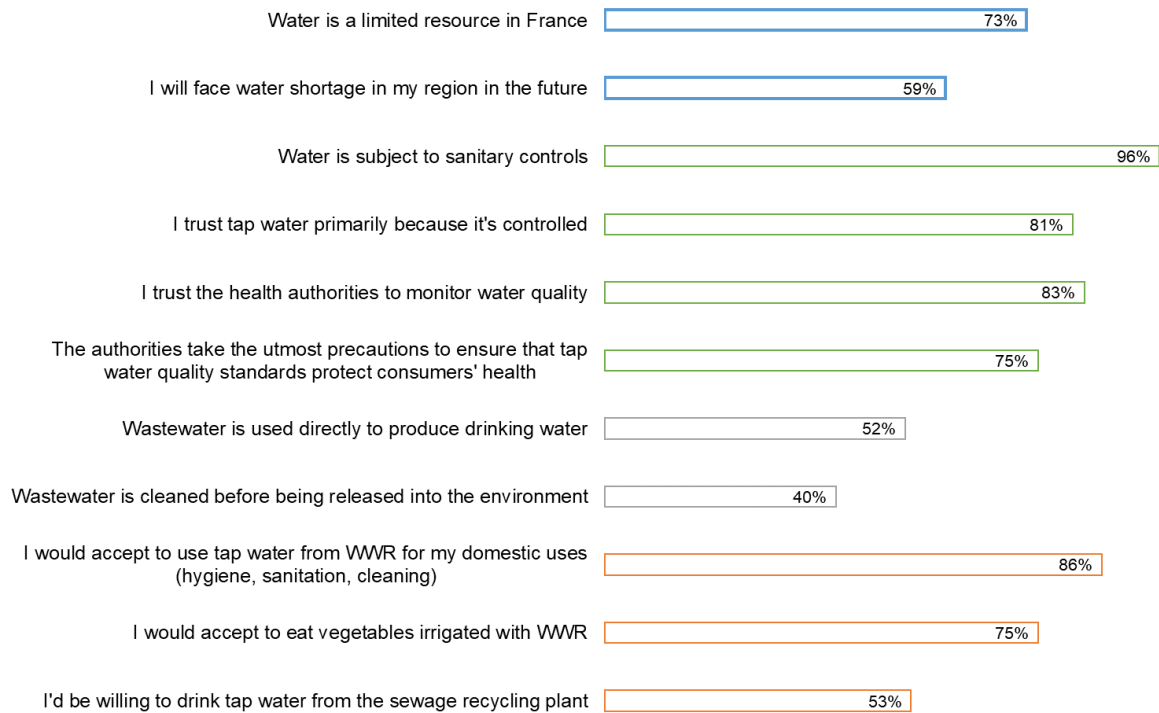


Figure 2. Key assertions in relation to WWR given by people interviewed in the 2018 French national barometer (Centre d'Information sur l'Eau & TNS Sofres 2018)

At the national level (2018 survey) (Figure 2), 73% of the population considered water as a “limited” resource, and 59% feared water shortages in the future; 83% trusted health authorities to control water quality; 86% would accept using tap water from recycled wastewater for their domestic purposes (hygiene, sanitation, cleaning, etc.), and 75% would be willing to consume vegetables irrigated with treated wastewater. This proportion seems to be increasing slowly in France: in 2013, there were 32% who expressed their opposition to the idea of eating fruits and vegetables watered with treated wastewater (Ben Maïd et al. 2014), without mention of their motivations. We had no reason to assume that the consumers in the Pic Saint Loup region had a different attitude towards WWR in general. However, we wanted to know if they would have the same judgment if a project were set up in their neighbourhood, bringing them into contact with products irrigated with reclaimed water. We aimed to go a step further in the evaluation of the acceptance rate, by determining the purchasing intended behaviour: would they agree to maintain their purchasing habits for local products (wine, fruits and vegetables, cheese) or utilize recreation areas if they knew they had been irrigated with reclaimed water (all economic aspects neutral, such as prices, ...)? In this research project, we did not have the means to make a taste test with a large panel of consumers. We assumed that stated purchasing intentions would provide a fair approximation of actual behaviour.

For this purpose, we used the theoretical framework proposed by the psychologist Ajzen (1991), who distinguished attitudes, the intended behaviour, and the actual behaviour. This framework has already been successfully used by Nancarrow et al. (2008) who established a structural equation model to predict communities' behavioural decisions in relation to the recycling of wastewater for uses involving close personal contact. This framework helped us to select a limited (but observed as relevant in Nancarrow *et al.* study) number of factors influencing attitudes, and expected behaviours to test their relevance to our case study and assess their sensitivity to an information action:

- *Disgust*. The extent to which a person experiences the “yuck” factor at fruit and vegetables irrigated with treated wastewater;
- *Perceived sanitary risk*. The sanitary quality of food products is controversial in France, where there have been high-profile health scandals. Moreover media alert concerning emerging pollutants in water (drug residues, pesticides, plastics, endocrine disruptors...) may be considered by consumers as another source of sanitary risky for WWR.
- *Declared sensitivity to environmental issues*, as part of a perceived social pressure, widely relayed by the media (promotion of recycling, sobriety, local sourcing).
- *Trust*. In France, there is both goodwill towards local agriculture, which supplies local markets, and a strong mistrust of intensive agriculture, which is widely reported in the media. Similarly, there is great confidence in the quality of domestic water but mistrust of private water companies (Hervé-Bazin 2014) and the majority of the population believes that water quality in the environment is poor and deteriorating². Therefore, we want to measure consumer confidence in the ability of farmers and professionals of the water sector in the Pic Saint Loup area to control the WWR's health risks.
- *Confidence in technology*. We want to test whether general confidence in progress could influence attitudes towards WWR that is very scantily practised in France.
- *Information habits*. This factor has been added with regard to the study of Nancarrow et al. (2008) following the works of Dolnicar et al. (2010) who found a statistical positive change in the acceptance of recycled and desalinated water when respondents are regular newspaper readers. We thus aim to test whether information habits impact French attitudes to WWR.

Methods

We conducted a survey in spring 2018 involving 845 consumers, carried out in 10 localities belonging to the CCGPSL (Figure 1), near the main markets and supermarkets of the area, before or after they had bought their foodstuffs. Most of them (84%) were inhabitants of the “Communauté de communes”, and 7% were living nearby. Interviews were carried out face-to-face in the street with the help of Master students from Montpellier University, wearing “Grand Pic Saint Loup community flags” to inspire confidence. All these people were questioned. When people came together, they were either interviewed independently (using two separate interviewers), or only one person was asked to respond. The refusal rates were very low (less than 10%). The sample did not include persons under the age of 15, as children are not responsible for household fruit and vegetable purchases. Apart from this bias, we afterwards checked that the sociodemographic characteristics of our sample of local inhabitants were close to that of the overall population (around 21.000 inhabitants in the area – see Supplementary Material for more details of this survey).

The questionnaire, which was designed for completion within ten minutes, comprised only closed questions, and was the same regardless of the level of information previously provided. First of all,

² For instance 75% of French people believes in 2018 that “the authorities take the utmost precautions to ensure that tap water quality standards protect consumers' health”. 85% of French people are confident of tap water quality and drink it, at least occasionally, while 75% consider that the water in the river and aquifers is polluted (Centre d'Information sur l'Eau & TNS Sofres 2018) (see Figure 2).

consumers were asked to give the 3 words they spontaneously associate with the expression “treated wastewater” and to rank them in order of importance, following the associative method (Rateau et al. 2011) to qualify the social representations of this resource, if any³. When people were unable to think spontaneously of 3-word associations, we did not insist. The rate of people who did not comply with this simple instruction is an indicator of the lack of social mobilization on the subject. A few people asked what treated wastewater was. After giving the word association instructions, we simply told them that it is water from sewage treatment plants.

The questionnaire continued in four different ways:

- A first sample with “no information” (N=204) simply went on with the questionnaire.
- For the "neutral information" group (N=310), people received a flyer on which were the characteristics of a WWR project, its objectives, who is involved and for which tasks. There was a very recognizable picture of the Pic Saint Loup at the top of the flyer to associate the project with the site. The rest of the text was not illustrated. The sentences did not include any value judgment (see the supplementary materials). A student read the main points of the flyer to make sure they were understood. Then the questionnaire went on.
- For the "persuasive information" group (N=176), the protocol was the same, but the flyer was organized as an advertising medium, highlighting the benefits of WWR through key words on a circle to emphasize the message of recycling.
- Finally, for the "commitment" group (N = 155), students presented to respondents the Pic Saint Loup's map asking the following question: "are you in favour of short circuits for food products? If yes, put a green sticker on your district of residence, otherwise a red one". This type of commitment to a cause was meant to put the respondent in a benign disposition with regard to new information in agreement with the cause to which he had just committed himself (Bernard & Joule 2004). The students then presented the flyer of the persuasive communication on WWR. Then the questionnaire went on.

The questionnaire then focused on consumers' acceptance of nine uses in the village they were living in. We insisted on this point to make sure that they felt directly concerned by the project: three "recreational" uses (golf, roundabout and green spaces) and six "agricultural" uses (shared gardens, market gardening, orchards, olive trees, vine and meadows for livestock). The uses were chosen among the options studied by the local public water authority, and to reflect the range of proximity of skin or mouth contact with the wastewater. We used a four-item system rated on a Likert scale, from strongly agree to strongly disagree, with no 'neutral' response to force an agreed or disagreed position, but with an option of “I don't know” for people who had no opinion.

Intended behaviour (purchasing, public garden visits) was assessed through one question per item (wine, fruit and vegetables, goat cheese, parks). Four answers were possible yes / no / maybe / I don't know (five for wine and cheese with "not usually buying"). Individuals were invited to rank their environmental sensitivity on a three-item level Likert scale (with the option to say “don't know”). They were then asked to agree / disagree / partially agree or give no opinion on four aspects (on disgust, on health risks, trust in water actors, trust in technology). They were asked about their media information habits⁴. The questionnaire ended with socio-demographic data.

³ Etale et al. (2020) asked the same type of question « recycled water » and « desalinated water ». Then they classified the words or expressions into 18 categories, which were tried in our case to follow (adding some categories due to the fact the question was not exactly the same), and we used it especially in our factorial analysis.

⁴ This question was further interpreted in four categories on the following basis:

Results and Discussion

R1. There is no social representation of “treated wastewater”.

The 3-words associations with the expression “treated wastewater” and their rank clearly indicated that citizens did not yet have social representation on it⁵:

- The vocabulary associated with “treated wastewater” was poor: the rareness indices (words cited only once by one person) and diversity indices (number of different responses) were 0.14 and 0.22 respectively before lemmatization⁶. For comparison, a similar study conducted on the word “water” obtained indices of 0.3 and 0.46 (Montginoul & Vestier 2018). Among the sample, 6% were unable to give a single word, 25% could give only one, 47% only two. These figures show that treated wastewater hadn’t been much discussed among the population, which is at the origin of social representation (Rateau et al. 2011). This weakness of local knowledge and beliefs on this topic may be explained by the low media coverage of this subject in France.
- “Treated wastewater” was strongly associated with “wastewater treatment plant” (Table 1), indicating that citizens related this type of water to its producing entity. This sole strong association with any other, even in the first peripheral perimeter (lower rank but highly cited), indicates interviewers had difficulty in suggesting links. They were able to give only a neutral association, close to a synonym. We can however observe that 9% of the words (and then 21% of respondents) related “treated wastewater” to WWR, which seems high given the WWR French context.

-
- Well informed: at least 2 media read/listened daily
 - Informed: at least 1 media read/listened daily
 - Mildly informed: at least 2 media read/listened one or twice a week
 - Poorly or not informed: the other answers
 - No reply: when no answer to any media sources

⁵ We followed the hierarchical evocation method proposed by Vergès (1992) who differentiates four areas based on two criteria (the level of interest, and the frequency of occurrence): the “core” composed of consensual and fundamental elements characterized by coherence and stability, which are thus resistant to change), the “contrasting elements” (proposed by few people but with a high rank), and peripheral elements with more personal components (see Table 1 and Montginoul & Vestier (2018) for more details).

⁶ Lemmatization consists of grouping similar expressions. For example, we have grouped the terms “connection”, “pipeline”, “water tower” and “pipe” under the same term “network”, in the second step of the analysis, to build Table 1.

		Level of interest	
		High (rank<2)	Low (rank ≥ 2)
Frequency of occurrence	High (≥ 10%)	The “core”: Wastewater treatment plant (16%)	The “first perimeter”: None
	Low (<10%)	The “contrasting elements”: <i>Recycling (9%), environment (7%), treated wastewater (6%), sanitation (4%), pollution (4%), dirt (3%), clean (3%), water (3%), water saving (3%), positive opinion (2%), process (2%), cost (2%), potable (2%), septic tank (1%)</i>	The “second perimeter”: Toilet (2%), disgust (1%), network (1%), organic pollutant (1%), chemical process (1%), waste (1%), etc.

Table 1. Structural analysis of 3-words/expressions associated with ‘treated wastewater’ (green+italic/black/red+bold for expressions positively/neutral/negatively connoted) (expressed words – no reply excluded) (N= 845)

R2. Citizens see WWR as an opportunity.

Contrasting elements (low frequency but high rank in Table 1) highlight different and less common ways of thinking. They refer here mainly to people who saw treated wastewater as an opportunity (recycling, water saving, etc.). There are very few elements negatively connoted (i.e. disgust, pollutions, dirt, cost...) appearing mainly in the “second peripheral perimeter” (low frequency and low rank), that is for only a few respondents and at a low rank.

R3. Citizens are well intentioned toward WWR, and even more so as the usage is far distant.

The survey questioned the attitude of citizens towards nine uses: three "recreational" uses (golf, roundabout and green spaces) and six "agricultural" uses (shared gardens, market gardening, orchards, olive trees, wine and meadows for livestock) (Figure 3).

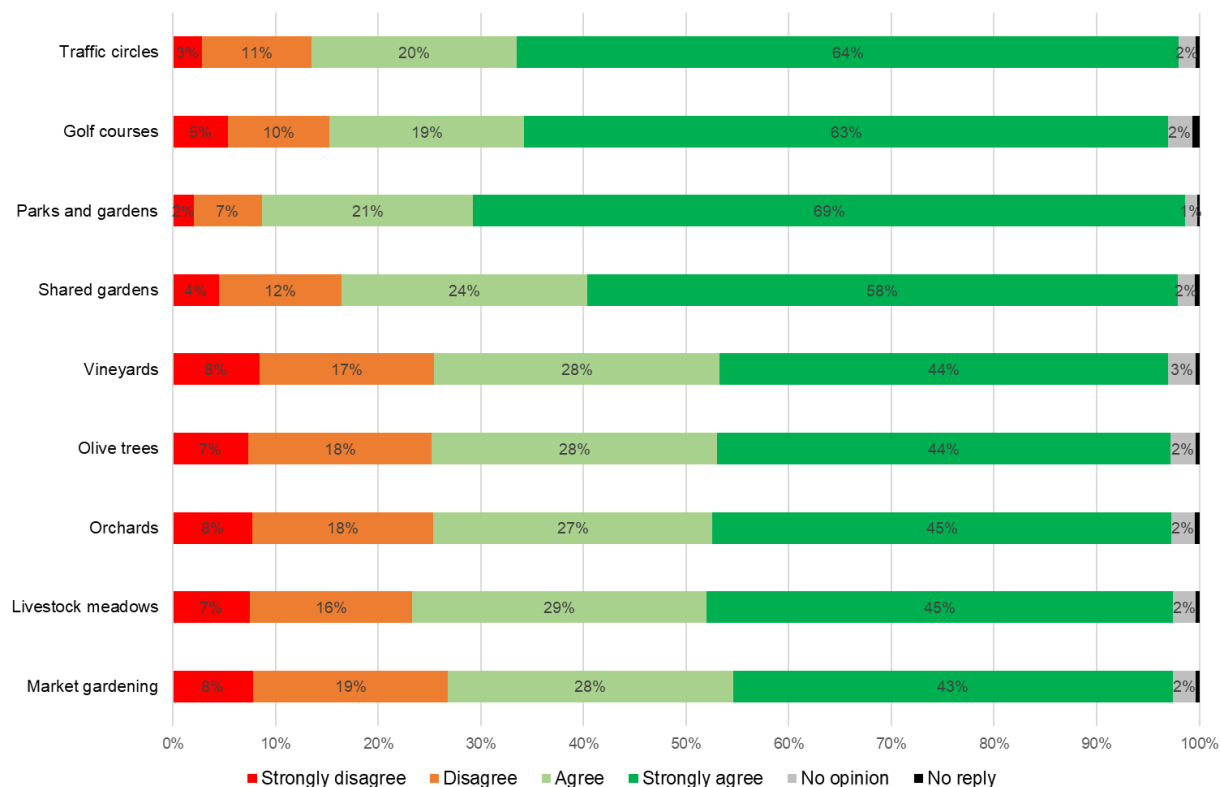


Figure 3. Attitudes towards different irrigation uses of treated wastewater.

These results support the patterns identified in the literature (Smith et al. 2018) on the relationship between attitude and uses: respondents were less likely to use treated wastewater for market gardening (70%) than for watering green spaces (90%). This distinction is also confirmed when consumer behavioural intentions were questioned: 83% would continue to frequent green spaces irrigated with treated wastewater while only 69% would continue to buy from grocers who sell fruits and vegetables irrigated with treated wastewater.

This corroborates the annual French national water survey in which a very large majority of individuals (75% in 2018) were ready to eat fruit and vegetable irrigated with WWR (Centre d'Information sur l'Eau & TNS Sofres 2018).

A statistical analysis was conducted to identify the sociotechnical variables that could be correlated with these attitudes, among those cited as relevant by various works in other countries (Fielding et al. 2018, Nancarrow et al. 2008, Smith et al. 2018). Table 2 presents results for the irrigation of the three typical uses for which behavioural intentions have been questioned during our survey.

	Parks and gardens	Wine	Market gardening
Disgust	- (0.000)	- (0.000)	- (0.000)
Environmental sensitivity	+ (0.000)	+ (0.001)	+ (0.000)
Risk perception	- (0.003)	- (0.000)	- (0.000)
Information	(0.811)	+ (0.007)	+ (0.001)
Trust in technologies	+ (0.021)	(0.106)	(0.142)
Gender	(0.744)	(0.383)	Women - (0.019)
Age	(0.409)	(0.259)	(0.092)
Information habits	(0.557)	(0.418)	(0.438)

Table 2. Chi-Square Test of Independence (p-value<5% in bold to highlight dependencies) between respondents' characteristics and their intention to consume products from WWR (*in case of dependence, the positive or negative link is specified*)

Disgust, environmental sensitivity and risk perception influenced attitudes for all three uses. These results are in line with the synthesis of Fielding et al. (2018) in several dozen studies on the most discriminating factors of attitudes for non-potable uses. In this literature review, disgust, and the perception of health risks were cited as the main factors explaining unfavourable attitudes, while the claim of environmental sensitivity characterized favourable opinions. In our study, people who said they were disgusted with the thought of eating a vegetable irrigated with treated wastewater were unfavourable to all WWR projects; those believing there was no risk in using treated wastewater to irrigate vineyards were more favourable than others to all the WWR projects. The more environmentally sensitive the respondents, the more they were in favour of reusing wastewater to irrigate parks and gardens.

In our survey, confidence in technology also acted on WWR attitudes, but the probability of independence is less significant between these two variables. A gender-related effect is also observed but only for market gardening, for which men were more favourable to WWR than women were. In the synthesis of Fielding et al. (2018), the other variables (age, gender, confidence in technology) had varying effects across studies. When they have a significant effect, it is the same as the one observed in our study.

R4. Citizens trust neutral information more than positive information.

Information seemed to influence attitudes (Table 3), but not uniformly: it varied according to the type of use and the type of communication.

		No information N = 204	Neutral N = 310	Persuasive N = 176	Commitment N = 155
Recreational uses (p. value 0.001)	Strongly disagree	2%	3%	3%	5%
	Disagree	11%	7%	6%	13%
	Agree	21%	16%	27%	19%
	Strongly agree	64%	72%	62%	61%
	<i>No opinion</i>	1%	2%	2%	1%
Agricultural uses (p. value 0.001)	Strongly disagree	8%	8%	4%	8%
	Disagree	22%	12%	17%	18%
	Agree	28%	23%	32%	29%
	Strongly agree	37%	55%	44%	44%
	<i>No opinion</i>	3%	2%	3%	2%
Disgust (p. value 0.02)	Yes	16%	14%	14%	14%
	Mitigate	19%	13%	7%	15%
	No	63%	70%	80%	65%
	<i>No opinion</i>	2%	3%	0%	6%
Sanitary risks (p. value 0.23)	Yes	25%	27%	32%	26%
	Mitigate	26%	18%	18%	19%
	No	41%	47%	43%	41%
	<i>No opinion</i>	7%	7%	7%	15%

Table 3. Attitude, disgust at, and perception of remaining risks of WWR, according to the type of information provided to the interviewees

Information described as neutral significantly strengthened the favourable attitudes for all uses. This result is in line with Fielding et al. (2018) who wrote in their synthesis, “providing factual information about recycled water increases knowledge about, and acceptance of, recycled water”. This impact may be explained by the mention of the health authority's controls exclusively on this communication medium. In the national survey, 83% of the population trusted the authority to control water quality. The so-called persuasive information changed the opinion of the very opposed participants, but only as far as agricultural uses were concerned. This brochure explicitly mentioned agriculture in its slogan "WWR - a resource for our agriculture", and as a local solution to food insecurity. Finally, in the commitment scheme, participants gave their opinion on local food systems, as a preparatory act, before being subjected to persuasive information. The results do not validate the scientific hypotheses (Bernard & Joule 2004) assuming that the effects of the information could be reinforced by an act of commitment. There was even a slight decrease in positive opinions compared to the control group ('no information'). The relevance of the preparatory act must be questioned.

Information seemed to have some influence on the people who answered “mitigate” when we asked them if they were disgusted by the idea of eating a fruit or vegetable irrigated with treated wastewater. With information (whatever its nature), the rate of these hesitating persons decreased significantly ($p < 0.02$). We can assume that many among them were completely unaware of the process of recycling water. The flyer was sufficient to convince them that the treatment had “purified” the water. However, when a person claimed to be disgusted, he or she was in the realm of emotion, not reasoning, and information did not matter. These findings are in agreement with the work of Rozin et al. (2015) who studied the disgust at drinking treated wastewater.

Information had less of a reassuring effect on the perception of risk. When people first read the flyers, the rate of persons hesitant about their perception of sanitary risk decreased but not significantly. If information seemed to reassure some of the undecided, others feared contagion or did not express an opinion. We assume that the multiplication of recent health and food scandals (mad cow disease, meat and milk quality, pesticides residues in food, etc.) aroused a great deal of suspicion of the reassuring information provided by public bodies.

The remaining sanitary risk perception was significantly and positively correlated with i) disgust at the thought of eating food irrigated with treated wastewater, and ii) the lack of trust in water actors (at the 0.001% threshold). Disgust and risk perception seemed independent of environmental sensitivity, and of general confidence in technology.

Media consumption habits (radio, TV, web, newspapers), too, seemed to influence the effect of information among those who had received useful information through the media; their number increased the probability of responding "strongly agree" rather than "agree" (at the 1% threshold) by 25 percentage points. This supports an Australian study (Dolnicar et al. 2010) on WWR, which pointed out that the cause of heterogeneity in information responses was rather the experience of information processing than of socio-demographic data.

R5. A strong cohesion between attitudes and behavioural projections, but some apparent contradictions.

The study also found a significant correspondence between attitudes and behavioural intentions (p-value= 0.000). People in favour of WWR would not change purchasing habits if they learned that vineyards are irrigated with treated wastewater. A reassuring effect of the information was also noted. Consumers were less hesitant when they had information, but it did not greatly change unfavourable opinions.

Attitudes	No information (N = 191)				Information (N= 556)			
	No purchase	Don't know	Purchase	Total	No purchase	Don't know	Purchase	Total
Highly unfavorable	6,8%	0,5%	0,5%	7,9%	7,0%	0,5%	0,7%	8,2%
Rather unfavorable	12,6%	2,6%	8,4%	23,6%	8,1%	1,8%	4,6%	14,4%
Rather favorable	3,7%	2,1%	23,0%	28,8%	3,5%	1,1%	23,5%	28,0%
Highly favorable	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%

Table 4. Effect of information on attitudes and purchasing intentions for irrigated wine with treated wastewater (sample without people declaring they never buy wine)

The results presented in Table 4 for wine purchases were similar for vegetables or cheeses from breeding that uses fodder watered with wastewater (cf. the graphical abstract). Without information, 22% to 30% of consumers would switch shops if they knew that the shop buys its products from a farmer who irrigates with treated wastewater. With information, this rate was around 20%.

Again, disgust and the perception of persisting sanitary risk played a major role in the intention of purchasing food (p-value 0.01). Two thirds of those who would change shops (for vegetables, goat cheese, wine) said they were disgusted by the idea of eating such fruit and vegetables; two thirds also thought there was a health risk with WWR. As our flyers had an effect only on those who were most ignorant of WWR and hesitant about expressing disgust and about risks, purchase intentions changed little with the information, in the case of this profile of consumers mainly.

Table 4 also reveals complex judgments. 5.8% of the uninformed and 4.6% of the informed were from favour to very much in favour of water recycling for irrigating food products, as citizens, but not as consumers. Conversely, 8.9% of uninformed and 5.3% of informed persons opposed to it as citizens, would tolerate it as consumers. In addition, depending on the products, the motivation of between 20 and 25% of those who would change shops was unknown, since they said they were not disgusted, and that they did not perceive risk of contagion. The very limited questionnaire did not allow for a more in-depth analysis of their motivations.

The cohesion between attitudes in favour of WWR for public parks was less consistent with the envisaged frequenting of them if they were irrigated with reclaimed water (see supplementary material). Information did not significantly influence this level of inconsistency. A majority of those in favour of this use of WWR would use the parks if the project were carried out, but the actions of a larger part of the population would not be consistent with their opinions. Among those who would no longer use the parks, three quarters of the people were in favour of this use. Conversely, three quarters of the few initial opponents would eventually continue to frequent these places. Feelings of disgust and health risks could not explain these contradictions between attitudes and intended behaviours.

These apparent inconsistencies confirm the need to go beyond the stated intentions of action by interviewees, the level at which most of the work cited in the literature stops (e.g. Nancarrow et al. 2008). Between stated intention and actual action there are often great differences, as has been demonstrated regarding other pro-environmental behaviours (de Leeuw et al. 2015). It will be necessary to go as far as the observation of actual actions, i.e. here the actual decision to eat or buy food in a taste test for example.

Using a factorial analysis (of the 802 respondents who replied to all questions participating in the factorial analysis), we have thus clearly distinguished two opposing sub-populations: half of the total respondents (54%) were in favour to very much in favour of the development of WWR, for all uses. They would not change their consumption habits (more than 80% of them), they were not disgusted (95%), they did not perceive any health risks (67%), they were rather more confident of technological progress (62%), and sensitive to environmental issues (96%). This group is composed of people who had previously received information on WWR (81%), and for 41% of them a neutral kind.

On the other hand, a group representing 17% of the population is made up of people opposed to WWR (both in opinion and intention). Including 22 (out of 23) of the farmers who replied to all questions; this group comprises a majority of retired people (53%), especially more than 75 years old (24%). It includes the more heterogeneous population (cf. the hierarchical clustering - more details in supplementary materials), but is highly characterized by persons who have difficulties in associating words to "treated wastewater" (60% did not give three words, 20% of them did not come up with any word).

The last group comprises 28% of the population (37% belongs to the "no information" group, of which only 31% was given "neutral" information); they were resistant to WWR, preferring to stop consuming products that result from the WWR (for more than 50% of them). This group comprised "mitigated" people (on disgust, health risks, technology, and confidence in decision-makers), and a significant proportion of them (12%) declared themselves not very sensitive to the environment, but were concerned about health problems (the word "contamination" was cited by 28%). This includes a majority of women (62%), people between 30 and 44 years of age (28%), working people (61%), and those less open to the media (27%). The great majority of them (80%) had a considerable idea of "treated wastewater" (only 2% did not have anything to say).

R6. A change in purchasing habits with a great economic impact on local producers.

The threat of a 20% (26% when no information) drop in potential local buyers would not be acceptable in an agricultural and wine-growing area such as Pic Saint Loup. We did a reconstitution of this work, at the invitation of a mayor. The few winegrowers present confirmed that selling to local customers was essential to the profitability of their business. They stated that they could not accept a 20% reduction in their clientele.

The reduction of current discharges from treatment plants was of interest to drinking water managers (i.e. reducing the risks of aquifer pollution in this karstic area). But the result of this study reinforced other weaknesses in the cost recovery and economic profitability of the WWR project pointed out by other studies conducted in the 'SOPOLO' project. This explains why the Pic Saint Loup community of communes decided not to carry out the project in the near future.

The next research actions on this topic will include i) a wider range of factors explaining attitudes towards WWR, ii) an extension of the sample to people with a sound knowledge of wastewater treatment (professionals and students), iii) an extension of the study of behaviours with tasting tests of products resulting from irrigation with treated wastewater, and iv) feedback on the behaviour of consumers of agricultural production from some projects currently implemented in France.

Conclusions

WWR projects in France are still rare, and are only rarely the subject of social acceptability studies. In our survey, disgust and the perception of persisting sanitary risks clearly explained the reluctance of 5% to 30% of our sample of consumers. We found three groups of consumers: the promoters of WWR (50%) significantly more sensitive to the environment, and more confident in the technology and in water managers; the opponents (20%) fearing sanitary risks; and the reluctants partly reassured by prompt information on this little known subject. WWR project leaders will see this as encouragement to launch intensive targeted information campaigns. But the reluctant group, significantly less open to the media and made suspicious by health scandals, will be difficult to convince. This study needs to be deepened, including taste tests, as some inconsistencies between attitudes, food buying intentions, disgust, and perceived risks have emerged among a significant minority.

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References

- Ajzen, I. (1991) The theory of planned behavior. *Organizational Behavior and Human Decision Processes* **50**(2), 179-211.
- Aquarec (2006) Integrated Concepts for Reuse of Upgraded Wastewater, Report on Integrated Water Reuse Concepts. 184 p.
- Barbier, R. & Nadai, A. (2015) Acceptabilité sociale : partager l'embarras (*Social Acceptability: Sharing the Embarrassment*). *VertigO - la revue électronique en sciences de l'environnement [En ligne]* **153**.
- Baumann, D.D. & Kasperson, R.E. (1974) Public acceptance of renovated waste water: Myth and reality. *Water Resources Research* **10**(4), 667-674.

- Ben Maïd, A., Devaux, J. & Thao Khamsing, W. (2014) Ressources en eau : perception et consommation des Français (*Water resources: French perception and consumption*). Commissariat général au développement durable, Paris, 82 p.
- Benoit, G., Berlizot, T., Bortolotti, S., Brugière, Y., Domallain, D., Jourdier, G., Madignier, M.-L., Mailleau, C., Piaton, H., Pinçonnet, D., Renoult, R. & Rocq, S. (2017) Eau, agriculture, et changement climatique : Statu quo ou anticipation ? Ministère de l'agriculture et de l'alimentation and CGAAER, 66 p.
- Bernard, F. & Joule, R.V. (2004) Lien, sens et action : vers une communication engageante (*Relationship, meaning and action: towards communication with commitment*). *Communication et organisation* **24**.
- Berry, P., Strosser, P. & Berge, M. (2016) Investigating the public acceptance of wastewater reuse at the Vendée greenfield demonstration site. ACTeon, 47 p.
- Centre d'Information sur l'Eau & TNS Sofres (2018) Baromètre C.I.EAU / TNS SOFRES - 22ème édition : "Les Français et l'eau", enquête nationale 2018 (*Barometer C.I.EAU / TNS SOFRES - 22nd edition: "The French and water", national survey 2018*). p.
- Cerceau, J. (2015) NOW MMA Livrable 4.2 - Acceptabilité sociale des projets de réutilisation des eaux usées (*NOW MMA Deliverable 4.2 - Social Acceptability of Wastewater Reuse Projects*). ARMINES/Ecole des Mines d'Alès, 40 p.
- de Leeuw, A., Valois, P., Ajzen, I. & Schmidt, P. (2015) Using the theory of planned behavior to identify key beliefs underlying pro-environmental behavior in high-school students: Implications for educational interventions. *Journal of Environmental Psychology* **42**, 128-138.
- Dolnicar, S., Hurlimann, A. & Nghiem, L.D. (2010) The effect of information on public acceptance – The case of water from alternative sources. *Journal of Environmental Management* **91**(6), 1288-1293.
- Etale, A., Fielding, K., Schäfer, A.I. & Siegrist, M. (2020) Recycled and desalinated water: Consumers' associations, and the influence of affect and disgust on willingness to use. *Journal of Environmental Management* **261**, 110217.
- Fielding, K.S., Dolnicar, S. & Schultz, T. (2018) Public acceptance of recycled water. *International Journal of Water Resources Development*, 1-36.
- Franck-Néel, C. (2020) Réutilisation des Eaux Usées Traitées. Le panorama français (*Reuse of Treated Wastewater. The French panorama*). Cerema, 23 p.
- Hervé-Bazin, C. (2014) Boire en eaux troubles (*Drinking in turbid waters*). *Communication et organisation* **45**, 127-138.
- Lazarova, V. & Brissaud, F. (2007) Intérêt, bénéfices et contraintes de la réutilisation des eaux usées en France (*Interest, benefits and constraints of wastewater reuse in France*). *Revue de l'Eau, l'Industrie et les Nuisances* **299**, 43-53.
- Maurer, H. (2018) L'économie circulaire dans le petit cycle de l'eau : la réutilisation des eaux usées traitées (*Circular economy in the small water cycle: reuse of treated wastewater*). Institut National de l'Economie Circulaire, 16 p.
- Montginoul, M. & Vestier, A. (2018) Smart metering: A water-saving solution? Consider communication strategies and user perceptions first. Evidence from a French case study. *Environmental Modelling & Software* **104**, 188-198.
- Nancarrow, B.E., Leviston, Z., Po, M., Porter, N.B. & Tucker, D. (2008) What drives communities' decisions and behaviours in the reuse of wastewater. *Water Science & Technology* **57**(4), 485-491.
- Noury, B., Pascual Espuny, C. & Ferrand, N. (2019) How can participation and communication support decisions towards wastewater reuse projects? A methodological proposal. Conference on Communication and Environment (COCE) (ed), p. 14, University of British Columbia, Vancouver, Canada.
- Rateau, P., Moliner, P., Guimelli, C. & Abric, J.C. (2011) Social representation theory. *Handbook of theories of social psychology* **2**, 477-497.
- Rozin, P., Haddad, B., Nemeroff, C. & Slovic, P. (2015) Psychological aspects of the rejection of recycled water: Contamination, purification and disgust. *Judgment and Decision Making* **10**(1), 50-63.

- Sibertin-Blanc, C. (2019) Formal Analysis of the Conflictive Play of Actors Regarding the Building of a Dam. In: *Law, Public Policies and Complex Systems: Networks in Action*. Boulet, R., Lajaunie, C. and Mazzega, P. (eds), pp. 177-202, Springer International Publishing, Cham.
- Smith, H.M., Brouwer, S., Jeffrey, P. & Frijns, J. (2018) Public responses to water reuse – Understanding the evidence. *Journal of Environmental Management* **207**, 43-50.
- Vergès, P. (1992) L'évocation de l'argent : une méthode pour la définition du noyau central d'une représentation. *Bulletin de Psychologie* **45**, 203-209.

Supplementary materials

The questionnaire

Names of interviewers: 1

2

Interview No.: Location:

Irrigation with Treated Wastewater (TWW)

Hello, we are working for the Community of Communes of the Pic Saint Loup (*show letter*) to study the possibilities of developing irrigation with treated wastewater on the territory. We are students in the 1st year of the 'Master EAU' at the University of Montpellier. Thank you for giving us a few minutes to answer this questionnaire.

Gender: M / F

District of living:

1. If you are told "Treated Waste Water" (TWW), **what are the 3 words that come to mind?**

Words			
-------	--	--	--

Rank them from most important (1) to least important (3)

Words' rank			
-------------	--	--	--

If the question is "what is treated wastewater": simply say that it is wastewater that is treated in treatment plants.

2. In your opinion, what type of water is used to irrigate in the districts' community? (*show them, tick if yes*)

- River water
 Borehole water
 Regional hydraulic networks (BRL)
 Lake
 Treated wastewater
 Drinking water
 Don't know

Depending on the protocol, inform / engage or not on REUSE at that time

3. **If information:** Would you say this information was for you:

- indispensable
 useful
 not very useful
 useless
 no opinion

4. Here is a list of places or crops that can be watered. Tell me if you are in favour or against, with mixed or no opinion, for gardeners or **farmers from your district** to use TWW to water them (*tick and show the list for the person to read it with you*).

	Very favourable	Rather yes	Rather no	Very opposed	No opinion/don't know
Public parks and gardens					
Golf					
Shared gardens					
Traffic circles					
Market gardening					
Orchards (apricot, peach, apple)					
Olive trees					
Meadows for farm animals					
Wine					

5. **If you learned that a public space was irrigated with TWW, would you visit it less often?**

- Yes
 No change
 Maybe

6. **If you find out that your fruit and vegetable seller is sourcing fruit irrigated with TWW, without changing their prices, will you continue to go there?**

- Yes, no change
 There are some products I won't buy anymore
 I'll go elsewhere

(which:)

7. If you learned that one of the wines from the Pic Saint Loup area that you like is irrigated with TWW, would you continue to buy it?

- Yes No Don't know No wine consumer

8. If you learned that a cheese you like is produced in a farm where the meadows are irrigated with TWW, would you continue to buy it?

- Yes No Don't know No cheese consumer

9. On a scale from 1 to 4, how would you rate your environmental sensitivity to the environment?

- 1 (Insensitive) 2 (Not very sensitive) 3 (Sensitive) 4 (Very sensitive) Don't know

10. Give your opinion on each of the following statements:	Yes	No	Mixed	Don't know
Technology will always help to find solutions to meet our water needs.				
People who decide to irrigate with TWW are as sensitive as I am to health issues.				
The idea of eating a fruit or vegetable that has been irrigated with TWW disgusts me.				
I think there is no risk in using treated wastewater for irrigation (Caution, tick Yes if no perceived risk, as this indicates agreement with this 'negative' sentence.)				

11. Can you tell us what your sources of information are? (by showing them the list and checking with them)

	Daily	1 to several times a week	1 to 2 times a month	Never or very rarely
Newspaper or paper magazine				
TV News				
Web information				
Radio				

12. Do you read the Journal intercommunal "Grand Pic Saint Loup"? regularly rarely
 never

13. Do you consult the website of the districts' community <https://www.cc-grandpicsaintloup.fr/> :
 rarely never regularly

14. What is your year of birth?

15. What is your status?

- Retired Student Active Stay-at-home parent Not working (unemployed, other)

16. What is or has been your occupation?

- Farmer Artisan Shopkeeper or business owner Executive or senior intellectual profession
 Intermediate profession (e.g. nurse, teacher, category B official, etc.) Employee Worker
 None

Information materials presented and/or given to respondents

Persuasive information (positive flyer)



Neutral information (neutral flyer)



L'utilisation des eaux usées traitées est autorisée en France pour l'irrigation depuis 2010.

Comment est utilisée l'eau usée traitée ?

Arrosage des espaces publics, des jardins, des terrains de golfs...
Irrigation des champs (pommes de terre de Noirmoutier)

Comment l'eau usée est traitée ?

L'eau subit une filtration et une désinfection pour enlever les contaminants et les micro-organismes.

Quels sont les enjeux ?

Economie d'eau
Région aride (canal BRL)
Réutilisation des nutriments présents dans l'eau

Quelle est la qualité requise ?

après traitement, l'eau doit avoir une qualité proche de ce qui est requis pour l'eau de baignade.

Où utilise-t-on de l'eau usée traitée ?

Floride
Berlin
Espagne
Noirmoutier

Tunisie
Israël
Golfs (Grande Motte)

Existe-t-il des contrôles ?

Des contrôles de la qualité sont effectués par l'Agence Régionale de Santé et la Direction Régionale de l'Environnement de l'Aménagement et du Logement.

Commitment

Protocol for the Commitment Act:

- 1) When presenting the Pic Saint Loup districts' community map, ask the question "Are you in favour of short circuits for food products?"
 - 2) If yes, put a green sticker on the map, otherwise put a red sticker on the same map.
- Then the interviewer quickly present the positive communication flyer.

Descriptive statistics

The SoPoLo project interviewed 845 people. This database will be used to study the attitudes and arguments of this sample towards products from agriculture irrigated with treated wastewater. All the people were interviewed in the Grand Pic Saint Loup community of communes.

The descriptive statistics are presented here by comparing them with the statistical data available from the national statistical institute (INSEE). INSEE delivers precise data every seven years, which explains our choice: to compare our results from the survey made in 2018 to the statistics available for the year 2014.

The sample of the population is evenly distributed with 51% of women interviewed and 48% of men (for people for which we have the information see Table 5), which is roughly the same as we find in the total population belonging to the studied area (Table 6).

Age groups	Woman	Man	Uninformed	Total
15 to 29 years old	26	47		73
30 to 44 years old	88	79		167
45 to 59 years old	142	83	1	226
60 to 74 years old	130	149	5	284
75 years old and over	46	43		89
Uninformed	5	1		6
Total	437	402	6	845

Table 5. Distribution of respondents by gender and age.

Age groups	Man		Woman	
	2014	2018	2014	2018
0 to 14 years old	19%	0%	17%	0%
15 to 29 years old	16%	12%	14%	6%
30 to 44 years old	18%	20%	18%	20%
45 to 59 years old	22%	21%	23%	33%
60 to 74 years old	18%	37%	18%	30%
75 years old and over	6%	11%	9%	11%
Total (answered)	48%	49%	52%	48%

Table 6. Distribution of respondents by gender and age in the 2018 survey and for the general population (INSEE 2014).

Age groups	Man		Woman	
	2014	2018	2014	2018
0 to 14 years old				
15 to 29 years old	20%	12%	18%	6%
30 to 44 years old	22%	20%	22%	20%
45 to 59 years old	28%	21%	28%	33%
60 to 74 years old	22%	37%	21%	30%
75 years old and over	8%	11%	10%	11%
Total (answered)	48%	49%	52%	48%

Table 7. Distribution of respondents by gender and age in the 2018 survey and for the general population (INSEE 2014) by trying to focus only to adults' population

People aged between 60 and 74 are the most represented in the sample with 34%. The 45-59-year-old people follow with 27% of respondents. Then the 30 to 44-year-olds with 20%. For the 15 to 29-year-olds, their presence is lower in the sample. The remaining 9% are those aged 75 or over. Finally, 2% of respondents did not indicate their age. When we compare the population sample (845) to the total population of 38,260 people aged 15 or over (INSEE, 2014), we can see that our sample is underrepresented for the 15 to 29-year-olds and over-represented for the 60 to 74-year-olds (Table 7). Note that the comparison is somewhat biased, since the first class of the INSEE includes minors.

Overall, the distribution of men and women in each age group is fairly equitable. It should be noted that for the 45-59 age groups, women are slightly more represented.

Still by comparing the sample surveyed and the INSEE population (Table 8), we can see an over-representation of farmers (3% for the sample; 1% for the population), a slight over-representation of craftsmen, shopkeepers or business managers. However, manual workers and those with no socio-professional category are underrepresented in the sample. Managers or senior intellectual professions, intermediate professions and employees are evenly distributed within the sample.

Socio-professional category	Population (INSEE 2014)	Survey (2018)
Farmer	1%	3%
Artisan, shopkeeper or business owner	7%	13%
Worker	9%	2%
Employee	18%	20%
Intermediate profession	23%	28%
Executive or senior intellectual profession	21%	24%
None	21%	6%
No answer	0	3%

Table 8. Distribution of respondents by socio-professional categories in the 2018 survey and for the general population (INSEE 2014)

In terms of working status, half of respondents' work, and 39% are retired (Table 9).

	Working status
Active	51%
Student	4%
House wife or father	2%
Retired	39%
No professional activity	4%
No information	0%

Table 9. Distribution of respondents by working status in the 2018 survey.

Finally, we aimed to verify the absence of an age effect in the sample surveyed regarding the distribution between the different types of information provided. As we can see in Table 10, the distribution of the age groups according to the type of information received is globally balanced, except for an over-representation of 45 to 59-year-olds in positive and neutral information.

Age groups	No information		Neutral info		Positive info		Commitment		Total
15 to 29 years old	23	11%	29	9%	14	8%	13	9%	79
30 to 44 years old	39	19%	59	19%	33	19%	36	24%	167
45 to 59 years old	44	22%	90	29%	58	33%	33	22%	225
60 to 74 years old	76	37%	99	32%	52	30%	52	35%	279
75 years old and over	18	9%	26	8%	15	9%	13	9%	72
Uninformed	4	2%	7	2%	4	2%	2	1%	17

Table 10. Distribution of respondents by socio-professional categories in the 2018 survey and for the general population (INSEE 2014).

Table 11 details the structural analysis for the whole population (845 respondents), taking into account the three words (the word "non réponse" has been indicated for each of the words requested and for which no reply has been received).

Structural analysis	Lemmatized words	Frequency	Relative frequency	Rank
Contrasting elements	recyclage	175	9%	1,71
	environnement	124	7%	1,90
	Echo-à-EUT	121	6%	1,90
	réseau-assainissement	77	4%	1,64
	pollution	77	4%	1,78
	eau-sale	55	3%	1,78
	eau-propre	53	3%	1,75
	eau	50	3%	1,58
	économie-eau	48	3%	1,94
	avis-positif	46	2%	1,80
	procédé	41	2%	1,83
	prix	39	2%	1,92
	potable	36	2%	1,97
	fosse-septique	24	1%	1,83
	gestionnaire	17	1%	1,88
	crainte	15	1%	1,73
	gaspillage	13	1%	1,62
	domestique	13	1%	1,69
	jardin	13	1%	1,85
	santé	13	1%	1,85
	qualité	12	1%	1,67
	boire	12	1%	1,75
	respect-environnement	12	1%	1,83
	dépollution	11	1%	1,45
	pure	11	1%	1,91
	hygiène	9	0%	1,89
	fécal	8	0%	1,63
innovation	6	0%	1,67	
développement-durable	5	0%	1,60	
norme	3	0%	2,00	

	nettoyer	5	0%	1,80
	anti-bactérien	4	0%	1,00
	sanitaire	4	0%	1,75
	anti-pollution	3	0%	1,33
	avenir	3	0%	1,33
	collectivité	3	0%	1,33
	laver-linge	3	0%	1,67
	masse-eau souterraine	3	0%	1,67
	développement	2	0%	1,50
	non-pollution	2	0%	1,50
	normalité	2	0%	1,50
	confiance	1	0%	1,00
	invisible	1	0%	1,00
	ménage	1	0%	1,00
	non-calcaire	1	0%	1,00
	non-usée	1	0%	1,00
	pas-de-perte	1	0%	1,00
Core area	step	307	16%	1,47
Second periphery	wc	29	2%	2,03
	dégout	27	1%	2,04
	réseau	25	1%	2,20
	polluant-organique	24	1%	2,25
	procédé chimique	23	1%	2,30
	polluant-chimique	22	1%	2,00
	déchet	20	1%	2,35
	masse-eau surface	19	1%	2,11
	agriculture	17	1%	2,18
	irrigation	15	1%	2,27
	chlore	10	1%	2,00
	se-laver	10	1%	2,00
	procédé naturel	10	1%	2,20
	usage	9	0%	2,00
	stockage	9	0%	2,11
	rejet	8	0%	2,00
	non-potable	8	0%	2,13
	procédé physique	8	0%	2,38
	pénurie	7	0%	2,29
	boue	6	0%	2,33
	consommation	6	0%	2,33
	risque-sanitaire	6	0%	2,33
	cuisine	6	0%	2,50
	avis-négatif	5	0%	2,00
	produit	5	0%	2,00
	ressource	5	0%	2,20
	contrôle	4	0%	2,00

distribution	4	0%	2,50
compétence	2	0%	2,00
information	2	0%	2,00
mal-traitée	2	0%	2,00
source	2	0%	2,00
adaptation	2	0%	2,50
nombreuse	2	0%	2,50
nuisance	2	0%	2,50
responsabilité	2	0%	2,50
pluvial	2	0%	3,00
prélèvement	2	0%	3,00
step-saturée	2	0%	3,00
besoin	1	0%	2,00
circulation	1	0%	2,00
collectif	1	0%	2,00
écoulement	1	0%	2,00
esthétique	1	0%	2,00
goût	1	0%	2,00
neuf	1	0%	2,00
pas-de-fosse-septique	1	0%	2,00
propriété	1	0%	2,00
rejet-eau-vaisselle	1	0%	2,00
toilette-sèche	1	0%	2,00
borne-incendie	1	0%	3,00
compteur-externe-gelé	1	0%	3,00
couleur	1	0%	3,00
élevage	1	0%	3,00
engagement	1	0%	3,00
Espagne	1	0%	3,00
inodore	1	0%	3,00
manque-infos	1	0%	3,00
mer	1	0%	3,00
station-service	1	0%	3,00
utopie	1	0%	3,00
volume	1	0%	3,00

Table 11. Structural analysis of 3-words/expressions associated with 'treated wastewater'

	Number of occurrence	Relative frequency		Rank
		All	Without any answer or "other words"	
01_Cleanliness	71	2,8%	3,8%	1,77
02_Disgust	71	2,8%	3,8%	2,10
03_Contamination	195	7,7%	10,5%	1,90
04_Organoleptics & riparian nuisances	34	1,3%	1,8%	2,00
05_Environment	141	5,6%	7,6%	1,88
06_Cost	39	1,5%	2,1%	1,92
07_Minerals	0		0,0%	
08_Uses	107	4,2%	5,7%	2,06
09_Bottled water	0		0,0%	
10_SavingWater	49	1,9%	2,6%	1,92
11_SimplyWater	50	2,0%	2,7%	1,58
12_TreatmentProcess & infrastructure	546	21,5%	29,3%	1,67
12ter_Treatment management	21	0,8%	1,1%	1,81
13_Reuse	186	7,3%	10,0%	1,74
14_PositiveAttributes	70	2,8%	3,8%	1,81
15_SourceOfTheWater	28	1,1%	1,5%	2,14
16_Apprehension	16	0,6%	0,9%	1,81
17_Potability	48	1,9%	2,6%	1,92
18_HeathSafety	48	1,9%	2,6%	1,69
19_XX_Scarcity	7	0,3%	0,4%	2,29
19_XX_TreatedWastewaterReference	121	4,8%	6,5%	1,90
19_XX_UnfavorableOpinion	21	0,8%	1,1%	1,90
Out of previous categories	9	0,4%		2,33
No answer	657	25,9%		2,52

2535

Table 12. Categorization of the 2535 words/expressions associated with 'treated wastewater' following Etale et al. (2020)'s classification.

	Strongly disagree	Disagree	Agree	Strongly agree	No opinion	No reply
Roundabouts	3%	11%	20%	64%	2%	0%
Golf courses	5%	10%	19%	63%	2%	1%
Parks and gardens	2%	7%	21%	69%	1%	0%
Shared gardens	4%	12%	24%	58%	2%	0%
Vineyards	8%	17%	28%	44%	3%	0%
Olive trees	7%	18%	28%	44%	2%	0%
Orchards	8%	18%	27%	45%	2%	0%
Livestock meadows	7%	16%	29%	45%	2%	0%
Market gardening	8%	19%	28%	43%	2%	0%

Table 13. Attitudes towards different irrigation uses of treated wastewater

Public parks and gardens		Fruits and vegetables			Wine	Cheese
No change	697	No change	573	No change	558	583
Yes	94	Stop buying	194	Stop buying	163	176
Maybe	50	Stop buying some products	63	Don't know	43	53
				No consumer	78	29
No reply	4	No reply	15	No reply	3	4

Table 14. Intentions to use or buy (questions 5 to 8).

Attitudes	No information (N = 203)				Information (N= 637)			
	Stop attending the square	Continue attending the square	May be continuing	Total	Stop attending the square	Continue attending the square	May be continuing	Total
Highly unfavorable	0%	1%	0%	2%	1%	0%	0%	2%
Rather unfavorable	1%	5%	1%	8%	2%	3%	2%	6%
Rather favorable	1%	19%	1%	22%	3%	16%	2%	20%
Highly favorable	9%	56%	2%	67%	5%	64%	2%	70%
Don't know	0%	0%	0%	1%	0%	1%	0%	1%
Total	13%	82%	5%	100%	11%	83%	6%	100%

Table 15. Effect of information on attitudes and intention of attending public square irrigated with recycled water.

Insensitive	10
Not very sensitive	49
Sensitive	401
Very sensitive	369
Don't know	9
No reply	17

Table 16. 'On a scale from 1 to 4, how would you rate your environmental sensitivity to the environment?' (question 9).

	Technology will help	Trust in people who decide	Disgust	No risk perception
Yes	444	464	121	369
No	147	95	587	233
Mixed	224	152	115	171
Don't know	26	127	16	66
No reply	4	7	6	6

Table 17. Give your opinion on each of the following statements (question 10).

	Daily	1 to several times a week	1 to 2 times a month	Never or very rarely	No reply
Newspaper or paper magazine	211	250	115	226	43
TV News	462	186	47	119	31
Web information	418	162	58	181	26
Radio	286	133	35	140	251

Table 18. Sources of information (question 11).

	Categorization	Number of respondents
Well informed	At least 2 media read/listened daily	437
Informed	At least 1 media read/listened daily	295
Mildly informed	At least 2 media read/listened one or twice a week	65
Poorly or no informed	The other answers	39
No reply	When no answer to any media sources	9

Table 19. Level of information of respondents (question 11 interpreted)

	Regularly	Rarely	Never	No reply
Reading the intercommunal journal	478	164	192	11
Consulting the districts' community website	56	160	600	29

Table 20. Information level on districts' community events (questions 12 and 13).

Factorial analysis

Variables included in the Multiple Correspondence Analysis:

- Active.

 - Binary variable: having previously informed on WWR or not before the survey.
 - Gender.
 - Age category.
 - Socio-professional category
 - Media information level
 - Q9. Environmental sensitivity
 - Q10. Technology trust.
 - Q10. Decision makers' trust.
 - Q10. Disgust.
 - Q10. Risk.
 - Q1. Representation of "treated wastewater": no (when no answer), poor (when only one word or words directly linked to the expression), rich (other cases).
 - Q2. Binary variable: wrong reply ("river", "drinking water", "WWR") or correct (other cases/combinations).

 - Illustrative. Q2 (details), Q4, Q6, Q7, Q8, Q15, words categorized with the Etale and al. classification.
-

Hierarchical Clustering

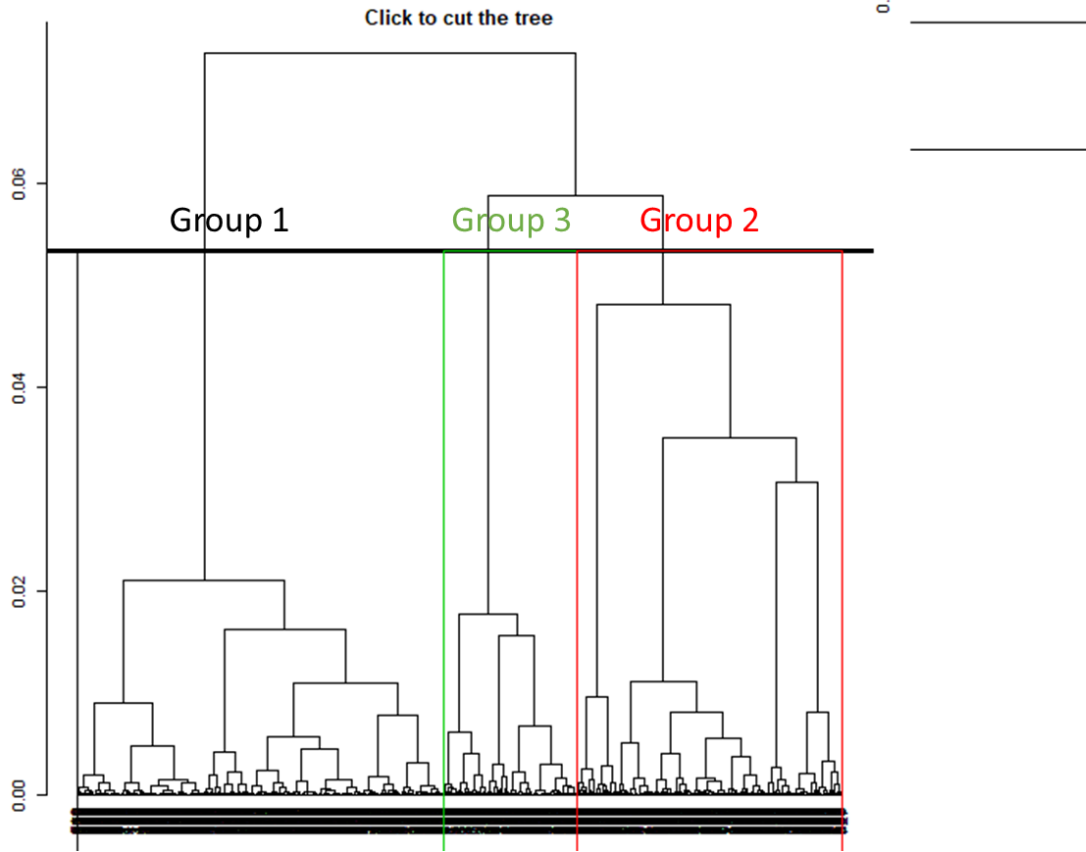


Figure 4. Hierarchical clustering

Class 1: 437 (54%)													
Previously informed		Opinions			Intentions			Socio-demographic variables			Words		
Informed	81%	Disgust	no	95%	Fruits & vegetables	yes	87%	Media awareness	Well informed	59%	Water saving	yes	9%
Information (neutral)	41%	Perceived risk	no	67%	Wine	yes	83%		Mildly informed	-5%	Contamination	no	84%
		Decision-makers' trust	yes	76%		No wine consumer	-7%	60-74 years old	yes	39%	Environment	yes	18%
		Technology's trust	yes	62%	Cheese	yes	87%	> 75 years old	yes	-8%	Positive attributes	yes	9%
								Non-working	yes	-2,50%	Source of water	no	98%
		Environmental sensitivity	yes	96%	Wineyards' irrigation	Highly favorable	61%	Executive or intellectual profession	yes	30%	"Water"	no	96%
		Irrigation through boreholes	no	75%	Market gardening irrigation	Highly favorable	61%	district of Teyran	yes	5%			
					Meadows' irrigation	Highly favorable	62%	district of Cazevieille	yes	-0,20%			
Class 3: 226 (28%)													
Previously informed		Opinions			Intentions			Socio-demographic variables			Words		
no informed	37%	Disgust	mitigé	49%	Fruits & vegetables	Go somewhere else	35%	Media awareness	No or poorly info	12%	Contamination	yes	28%
Information (neutral)	-31%	Perceived risk	mitigé	73%		Go somewhere else for some products	15%		Mildly informed	15%	Water saving	no	98%
		Decision-makers' trust	mitigé	55%		Don't know	3%		Well informed	-39%	Source of water	yes	6%
		Technology's trust	mitigé	43%	Wine	no	30%				No word (first one)	yes	-2%
						Don't know	9%	30-44 years old	yes	28%			
		Environmental sensitivity	no	12%	Cheese	no	35%	60-74 years old	yes	-25%	Rich representation	yes	80%
						Don't know	12%	Working	yes	61%			
					Wineyards' irrigation	Rather no	25%	Woman	yes	62%			
						Don't know	6%	Employee	yes	26%			
						Highly opposed	12%	Farmer	yes	0%			
					Market gardening irrigation	Rather no	30%						
						Don't know	5%						
					Meadows' irrigation	Don't know	5%						
						Rather no	21%						
						Highly opposed	11%						
						Rather yes	34%						
Class 2: 139 (17%)													
Previously informed		Opinions			Intentions			Socio-demographic variables			Words		
No specificity		Disgust	yes	53%	Fruits & vegetables	no	55%	Farmer	yes	16%(96%)	No word (first one)	yes	20%
		Perceived risk	yes	71%	Wine	no	45%	Employee	yes	-14%	No 3 words	yes	60%
		Decision-makers' trust	no	43%	Cheese	no	47%	Executive or intellectual profession	yes	-17%	Environment	no	94%
		Technology's trust	no	32%							"Water"	yes	7%
					Wineyards' irrigation	Highly opposed	23%	> 75 years old	yes	24%	Positive attributes	no	97%
		Environmental sensitivity	no	17%		Rather no	29%	30-44 years old	yes	-6%	Reuse	no	86%
		Collective irrigation network	no	70%	Market gardening irrigation	Highly opposed	23%				Treatment process and infrastructure	no	60%
					Meadows' irrigation	Highly opposed	20%	Retired	yes	53%	Water saving	yes	-0%
						Rather no	33%	Student	yes	0%			
								Media awareness	Mildly informed	-1%			

Figure 5. Details for the three classes (when the percentage is indicated in negative, it means that the value is statistically lower than in the total population, and conversely).