DEPARTMENT OF THE COMMISSIONER GENERAL FOR SUSTAINABLE DEVELOPMENT

n°52 EV
English version
September 2011
SUSTAINABLE DEVELOPMENT

Études & documents

Studies and documents

Assessing water pollution costs of farming in France

ECONOMICS AND ASSESSMENT

Resources, land, habitats and housing
Energy and climate
Sustainable development
Risk prevention
Infrastructure, transport and the sea

Present for the future

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

Ministère de l'Écologie, du Développement durable, des Transports et du Logement

Department for the Economics, Assessment and Integration of Sustainable Development

www.developpement-durable.gouv.fr

Collection « Études et documents » of the Department for the Economics, Assessment and Integration of Sustainable Development
(Service de l'Économie, de l'Évaluation et de l'Intégration du Développement Durable, SEEIDD)
in the Department of the Commissioner-General for Sustainable Development
(Commissariat Général au Développement Durable, CGDD)

Title: « Assessing water pollution costs of farming in France »

Director of publication: Françoise Maurel

Authors: Olivier BOMMELAER, Jérémy DEVAUX

Date of publication: September 2011

TABLE OF CONTENT

SYNTHESIS

This study provides a first partial assessment of the direct costs of quality degradation of water resources and aquatic environments caused by excess nitrogen fertilizer and pesticides from agriculture, i.e. the quantities of agricultural inputs that are not used by plant and soil and concentrated in surface and ground water[1]. The results illustrate the benefits of an action to limit water contamination by residues of fertilizers and pesticides. However, they are not alone a cost-benefit analysis of such a policy. The benefits in some market sectors (tourism, shellfish farming, fishing, spas, etc.) could not be taken into account. Conversely, the costs for agriculture and for other market sectors (low turnover of producers of bottled water for instance) have not been studied. This work could still be used as part of a cost-benefit analysis. It is intended to fit into a series of studies, some of which are on-going for the recovery of environmental externalities of agricultural ecosystems, both positive (biodiversity, landscape amenities, etc.) and negative (pollution, odour nuisances, etc.).

The approach taken is to analyze, in terms of households only, the difference between the current situation (called reference) and the situation that would occur if there was no pollution by excess nitrogen from agricultural fertilizers and pesticides. This means identifying:

1. *Additional costs incurred by households due to agricultural pollution by nitrogen and pesticides in the water intakes of the public water supply and sanitation utility. This assessment is the subject of Part 2 of this report and only concerns 1.2% of the average annual water flows in continental France[2] and about 0.3% of the stored water resources. The paper proposes an assessment of two types of expenditures: those that are independent of the tap water bill, excluding households' health expenditures, and those that affect this bill because of the clean-up costs related to agricultural activities. Both types of expenditures are cumulated without the risk of double counting. The assessment mainly uses national averages but proposes a review of the magnitude of the additional expenditures for households in communities most affected by this pollution.*
2. *Other market impacts of this pollution; Part 3 is limited to an inventory without any assessment.*
3. *The costs of cleaning-up water resources and aquatic environments of the agricultural pesticides and nitrates transferred and accumulated in these environments. They are based on unit costs of the existing water purification ("potabilization") processes. The purpose of Part 4 of this paper is to summarily quantify these costs to identify the magnitude of a possible full cleaning-up of the resource. It is independent of other assessed items.*

The main results are as follows (see summary figure on page 5):

1. *The estimated additional expenses of households, generated by this pollution linked to excess nitrogen and pesticides from agriculture would fall at least in a range between 1,005 and 1,525 million euros[3], of which 640 to 1,140 million euros are passed on to the water bill, accounting for between 7 and 12% of the national average bill.*
2. *For households located in the most polluted communities, these additional expenses could reach 494 euros per household or 215 euros per person, i.e. an additional cost of almost 140% of the average water bill in 2006.*
3. *The costs of water purification due to conventional agriculture in plots located in the catchment areas of drinking water intakes are within a range of 800 to 2,400 euros per hectare of conventional agriculture per year.*
4. *The expenditures of coastal communities due to eutrophication are provisionally estimated at 100 to 150 million euros.*
5. *Based on the treatment costs of nitrates and pesticides in drinking water purification plants[4], the costs for eliminating nitrates and pesticides in aquatic environments are respectively above 70 euros per kg for nitrates and 60,000 euros per kg for pesticides.*
6. *The full cost of the annual treatment of this surplus from agriculture and animal husbandry dissolved in water would exceed 54 billion euros per year.*
7. *The full cost of cleaning up groundwater would exceed 522 billion euros.*

---

[1] These surpluses are the subject of regular MAAPRAT reports quantifying them: see page 8 of this document.

[2] Corresponding at about 3% of the rainfall that do not evaporate.

[3] Excluding the costs for EU Community litigation.

[4] The old values of these parametric costs were updated and consolidated in 2011 thanks to the ASTEE's commission on drinking water and the study of the Ile-de-France Region and INAPG. They are respectively from 0.40 to 0.61 euro per m^3 for treating nitrates and from 0.06 to 0.20 euro per m^3 for treating pesticides in drinking water production.

These results seem consistent in magnitude[5] with the recent update of the Master Plan for Water Development and Management (SDAGE) of the Seine-Normandy basin, whose 2010 paper on cost recovery estimated at 1,100 million euros per year the environmental costs generated by agriculture in the basin, agriculture only contributing for 86 million euros per year for the water services it uses.

Despite these additional expenses for water treatment, in 2008, more than 8% of French people were fed at least once with water contaminated by pesticides at levels above the drinking water standards[6].The annual public report of the Court of Auditors of 11 February 2010 (chapter on financing instruments for sustainable water management) denounces the shortcomings and lack of sustainability of this French model of curative financing that could lead to costs higher than those of models that focus on prevention, while neglecting the environmental and health consequences of a degraded resource.

The very high costs, which the study highlights for the post treatment of aquatic environments, show the interest of previous action to reduce spreading at its origin. The spectacular successes recorded in agricultural spreading of phosphorus, whose surpluses were divided by 3 in a few years, or those that the Bavarians and Danes[7] recorded on nitrogen and pesticides, demonstrate that good practices can be established efficiently. This study confirms the vital importance of implementing all the commitments of the "Grenelle" impacting aquatic resource quality, including commitments on organic farming, protection of the catchment areas of drinking water intakes, grass strips and the withdrawal of pesticides. It is not a new assessment of the impacts of these commitments, or a cost-benefit analysis of each of these commitments. However, using the results of this assessment provides a cost/benefit ratio greater than 1.5 for commitment 101 on the protection of the catchment areas of 500 priority intakes. Applied at the local level, the costing elements developed hereafter will establish the charge transfers associated with current excess inputs, land application of manure and pesticide use, to clarify local issues at stake with changes in agricultural practices to be fostered.

[5] They were used in a 2010 report of OECD on the financing of water management in France (see Studies and Documents N°33 of the CGDD http://www.developpement-durable.gouv.fr/IMG/pdf/ED33-eng.pdf) and they are also consistent with those of other OECD countries mentioned in the joint work of the agriculture and environment programmes.

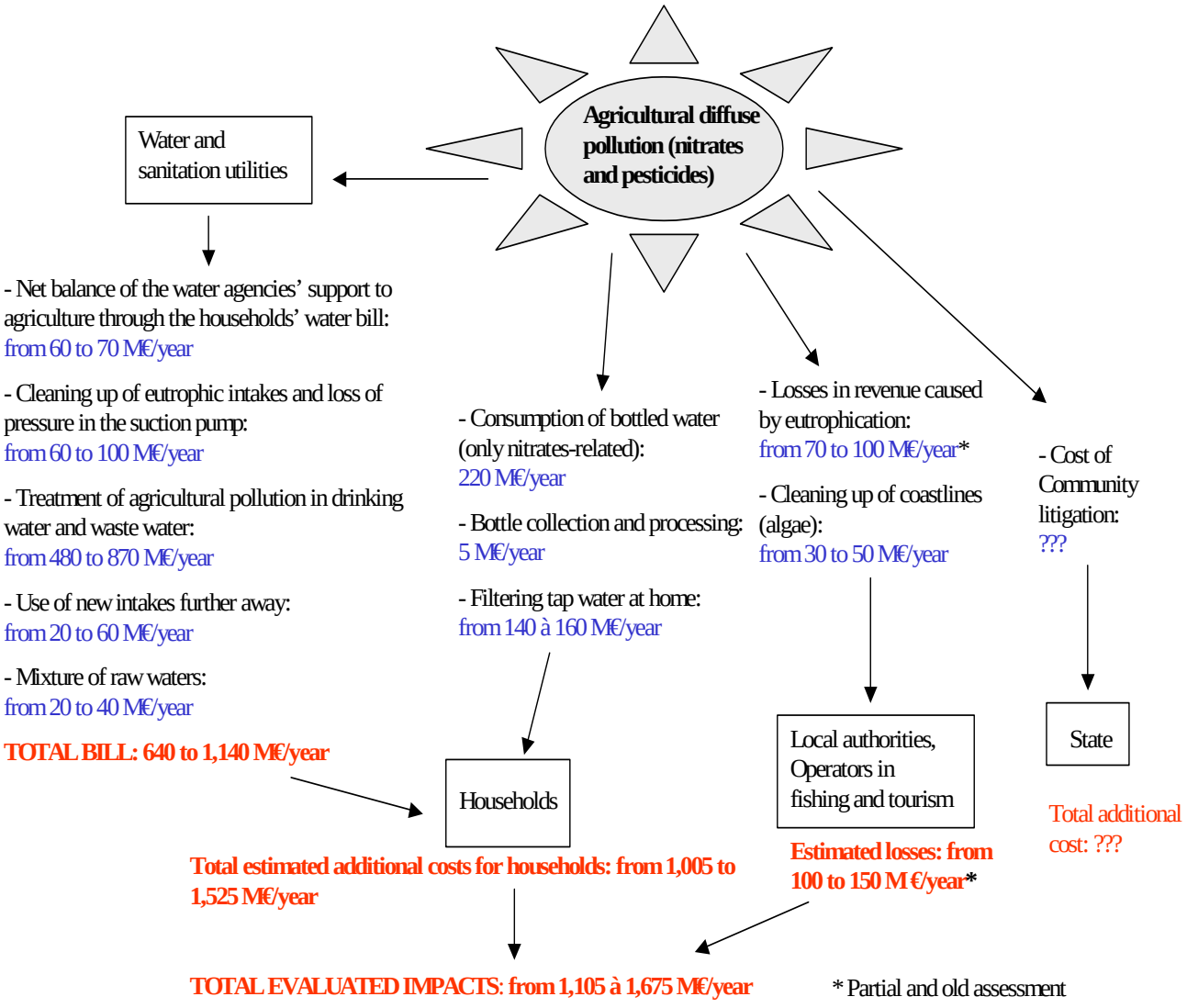
[6] Report of the Ministry for Health/DGS 2009.

[7] Examples given by the Court of Auditors and summarized on pages 8 and 9 of this paper.

Estimated additional costs and financial losses caused by agricultural diffuse pollution
(excluding impacts on tourism and health)

Annual budgets in millions of euros

Estimated additional costs and financial losses caused by agricultural diffuse pollution - Annual budgets



OPENING REMARKS

The work presented here is the result of a patient data collection from various partners, either Water Agencies, the Ministry of Agriculture, or members of the Drinking Water Commission of the Scientific and Technical Association for Water and the Environment (ASTEE). The estimated ranges have a variable accuracy depending on the areas studied. Some estimates are still to be completed for a quite comprehensive costing. Indeed, when the assumptions we had to do seemed to be insufficiently substantiated, we preferred not to advertise a costing, and carry out additional studies later to clarify it. This applies to the costs of substituting tap water by bottled water, for which we only selected the costing related to the impact of nitrates on the feeding of children under 2 years old. Other data may also be refined over time. The cost for Community (EU) litigation also remains to be estimated.

Moreover, it is comforting to note that the treatment cost per kilogram of excess nitrogen thus obtained is entirely consistent with the figures from a recent study of the Belgian Flanders Region (section 4.1).

Thus, this work should be deepened in the next months and years.

Finally, it is of course a contribution, both on the method and on the results, which can be used in the evaluation of public policies. Of course, such assessments to be complete will use other data in other fields, especially when it concerns a cost-benefit analysis.

1. BACKGROUND[8] AND DATA

Water volumes involved in the water cycle:

The total annual volume of renewable water is about 200 billion m³ (billion cubic meters) in continental France (see Annex 2). It corresponds to the rainfall input (503 billion cubic meters) plus any inflow from neighbouring countries (11 billion m³) and less actual evapotranspiration (314 billion cubic meters): about 60% of rain water goes back into the atmosphere as water vapour.

Out of the 200 billion m³ available, 120 billion seep into the ground and recharge groundwater, the stock of which is estimated at 2,000 billion m³, while 80 billion run off into rivers and stagnant water, whose volume is estimated at 108 billion m³.

France recorded an output of 18 billion m³ to its neighbours (mainly Rhone, Rhine and Meuse), leaving a theoretical resource of 182 billion m³, 176 billion m³ of which flow into the sea and 6 billion m³ evaporate.

Uses usually identified: abstractions and consumption of the key sectors of the economy and society.

Globally, the water uses are distributed as follows, in decreasing order: agriculture (70%), industry (20%) and households (10%). The weight of agriculture is actually higher: if it uses 70% of the abstractions, it consumes 90% of the water resource[9].

In France, the corresponding figures are as follows:

- Abstractions: 57% for energy, 18% for domestic use, 15% for agriculture and 10% for industry;
- Consumption in ordinary times: 48% for irrigated agriculture, 24% for domestic use, 22% for energy, 6% for industry;
- Summer consumption (summer peak): 79% for irrigated agriculture, 10% for domestic use, 9% for energy, 2% for industry.

Water abstractions and consumption are to be compared to the above-mentioned figures that characterize the water cycle in continental France.

The abstractions were estimated by the French Institute For ENvironment (IFEN)[10] at 34 billion m³ in 2001, including 28 in surface water and 6 in groundwater.

The abstracted water is back into the flow totalling 28 billion m³ and final consumption stands at 6 billion m³. Annex 3 outlines the flow volume.

All these data, frequently mentioned, are of limited reliability because some water uses are not well known and understood: for example, the abstractions for waterways transport are badly estimated and abstractions for agriculture are probably underestimated.

EU water policy is almost as old and elaborated as the Common Agricultural Policy (CAP). It is now based on about twenty European directives. The oldest ones have given obligations to achieve results regarding health: limit values and concentration standards defining the quality of water intended for human consumption, for groundwater, shellfish and bathing water, etc. The second generation has given obligations of means to protect water resources and aquatic environments: urban and industrial wastewater treatment (Urban Wastewater Treatment Directive, 1991), nitrates (1991). The third generation, which dates from this millennium, concerns the recovery of the ecological status of water and marine environments: Water (WFD, 2000) and Marine Strategy (MSFD, 2008) Framework Directives. Much more complex and ambitious, these Directives allow each Member State (MS) defining, in a participatory manner, its initial status and future good status with a common timetable. Derogations and delays to achieve this good status must be reported and justified by socio-economic analyses (disproportionate costs), and programmes of measures, to pass from initial to good status, must be published and financed within the timetable given by these directives.

France is in litigation for non-compliance with some directives of the first generation and for delay in the implementation of the Urban Wastewater Treatment Directive (UWWD). MS defined their ecological water status in 2004 and had until the end of 2009 to communicate their WFD programmes of measures. They have until July 2010 to designate the

[8] This section on the water cycle resumes work of the public report 2010 of the State Council on "Water and its right".

[9] Distinguishing abstractions from consumption is important as some abstractions result in almost immediate discharge on site, the abstracted water not being treated or polluted (cooling of thermal or nuclear power plants or agriculture are the main activities concerned). Only a fraction of the abstractions is consumed, i.e. used in a place far from the abstraction site and, on this occasion far from treatment and pollution.

[10] Currently the Department of Statistics and Observation (SOeS).

competent authorities on the MSFD implementation, until mid 2012 to define the ecological status of their marine environments and 2014 to communicate their programmes of measure for MSFD.

Water quality in France has shown a marked overall decrease in industrial, domestic and urban pollution since the creation of water agencies 40 years ago, but an increase in agricultural and animal husbandry pollution, primarily nitrates and pesticides, except in some areas. In 2007, this finding has motivated a number of commitments of the "Grenelle" on Agriculture (pesticide restrictions, increase of the UAA in organic farming, grass strips, maintenance of plant cover), biodiversity (wetlands, green and blue fields) and water (protection of catchment areas of water intakes). The Agricultural Modernization Law (AML) which was submitted to Parliament in May 2010 and the CAP reform in 2013 are an opportunity to implement agricultural policies having an impact on the quality of inland and marine waters.

There is a lack of general studies to assess the impact of such measures on the competitiveness of French agriculture; it should be incidentally remembered that 70% of its trade is made with EU countries and has to comply with the same environmental requirements. However, it was demonstrated in extensively studied river basins that the improvement of treatment and fertilization practices led to a significant improvement in water quality without negative impact on yields.

1.1 The Court of Auditors' remarks on water quality in 2010

The words of the Court of Auditors (Cour des comptes) are given in italics.

From a qualitative viewpoint, human activity, industry and agriculture are the source of pollution mainly organic, chemical (fertilizers, pesticides, metals, etc.) and biological (bacteria, viruses, etc.) that ultimately reach aquatic environments. This pollution can be point (domestic or industrial discharges, livestock manure, etc..) or non-point -diffuse (land application of pesticides and fertilizers). If the first is beginning to be properly treated, it is not the case of the second. River basin characterizations have been made in late 2004 by the water agencies to implement the Water Framework Directive. For rivers, these reviews suggest that pollution from organic matter and phosphorus, coming from urban and industrial discharges, significantly decreased over the past ten years, thanks to investments made by local authorities and companies but it has now reached a plateau. Pollution caused by nitrates from agricultural origin and mainly dependent on climatic conditions remains however high on the average. Decreases in the most affected basins are offset by increases elsewhere, contributing to the 'green tide' phenomena in some coastal areas. 65% of surface water bodies and 61% of groundwater bodies present a (real or potential) risk of not achieving good status in 2015 and pesticides were found in two thirds of the groundwater bodies.

This situation led the court to *"question the ability of France to reach in 2015 the quality objectives it has given itself, except if improvements are made soon. In any event, the financial stakes are very high since the meeting of this deadline will have a cost that has been estimated at 24.7 billion euros for the actions identified in the programmes of measures for 2010-2015."*

The Court also noted that countries like Denmark and Bavaria have succeeded in making their farmers responsible for their preventive actions to reduce by 30% their consumption of nitrogen and pesticides in favour of their water quality, while France has generalized the practice of treating these pollutants at the entrance of drinking water supply systems. According to the court, these treatments are 2.5 times more expensive per treated cubic meter than the prevention[11] made in Bavaria, and they do not improve the quality of the resource. The court attributed the disappointing results to:

- "The poor will of the State to challenge the agricultural practices heavily marked by fostering productivism and choosing intensive agriculture";
- The few policy instruments and tax levers used, "for lack of charges/taxes on nitrogen pollution and charges on "animal husbandry" and "diffuse pollution", are not real deterrent." The agencies are indeed financing actions on drinking water, which are often curative, with amounts 1.8 times higher than what they spend on preventive action[12] by changing agricultural practices and the protection of the resource. Just over half of the assistance planned for controlling agricultural diffuse pollution in the agencies' ninth action plan has been used to date: 90 million euros have not been paid over the period 2007-2008 for lack of projects.";
- The inadequacy of the measures taken and of the controls of their implementation;
- The low efficiency of incentives for reasoned agriculture and animal husbandry: agri-environmental measures, plans to control pollution of agricultural origin (PMPOA) plant and environmental plan.

[11] The Court of auditors compares the financing by the Bavarian water board of the preventive management of agricultural lands, at a cost of 0.087 euro per m^3, to the French cost (reference D4E 2005) of water purification regarding nitrates alone of 0.23 euro per m^3.

[12] In the 9th programmes, 1.29 billion euros against 712 million euros.

In total, the State has failed, before the "Grenelle for the Environment", to foster the "transformation movement" which, according to the "Grenelle I Law" "is needed for agriculture".

1.2 Origins of nitrogen and pesticide inputs to water resources

Nitrogen

- Discharges of domestic and industrial wastewater before treatment annually amount to about (CGDD estimate)[13] : .....360,000 tons
- The land application of mineral fertilizers is approximately: .....2,370,000 tons[14]
- The land application of manure and livestock wastes amounts to approximately: .....1,410,000 tons[15]

The total gross annual nitrogen inputs to soils and aquatic environments are about 4,068,000 tons. Agriculture and plant cover export about 3,064,000 tons[16]. The wastewater treatment processes treat about 270,000 tons[17]. Excess nitrogen discharged into aquatic environments is respectively:

- Discharge of domestic and industrial wastewater after treatment: .....90,000 tons
- Excess from mineral origin from agricultural fertilization: .....416,000 tons
- Excess from animal origin from land application of manure: .....300,000 tons

The total residual nitrogen contamination of water resources and marine environments is thus estimated at 806,000 tons, about 715,000 tons of which come from agriculture and animal husbandry, i.e. 88.7%.

Pesticides

With more than 76,000 tons of active substances from nearly 500 families of fungicides, weed killers, insecticides, nematocides and other pesticides, France is the largest user in Europe. Although the tonnage sold decreases, the effectiveness of new molecules continues to grow and substances that act at very low doses are replacing heavier substances whose effects are better known (sulphur and copper products).

It is estimated that agriculture uses 95% of the pesticides sold in France. Unlike nitrogen, we do not know the balance between the quantity used in the crop and soil from the surpluses that go back into aquatic environments.

1.3 Surface water quality (sources: SOeS, 2009 & 2010)

In 2006, pesticides were detected and quantified at least once at 90% of the 1,097 interpretable points of the general knowledge and plant health information networks. The measured contents are sometimes very low and in these cases have little impact on water quality. However, this reflects a significant dispersion of pesticides and their ubiquitous presence in aquatic environments.

The analysis outcomes are used to define, for each measurement point, a quality class. If contamination levels are variable, they are nevertheless often significant. Thus, 37% of the points in the knowledge network have a fair to poor quality. This rate rises to 48% at the points of the plant health information networks. 10% of the points of the knowledge network and 15% of the points of the plant health information networks have poor quality, which can significantly affect the ecological balance. The corresponding rivers are unfit for drinking water supply according to the regulations. The observed contamination levels are logically higher in plant health information networks which monitor the rivers in areas where pesticides are heavily used. For 2008, the latest Department of Statistics and Observation (SOeS)[18] report on Water Status states that ***7% of surface water stations exceeded the limit value that requires purification and 1% exceeded the concentration limit that excludes any possibility of treatment.***

[13] Taking 12 grams per day of total nitrogen per pop. equivalent.

[14] Source AGRESTE 04/2003 Ministry of Agriculture.

[15] Source AGRESTE 04/2003 Ministry of Agriculture.

[16] Source AGRESTE 04/2003 Ministry of Agriculture.

[17] After complying with the UWWD standards in sensitive areas.

[18] http://www.developpement-durable.gouv.fr/L-environnement-en-France-Edition.html

Regarding nitrates, the SOeS report states that in 2008 the surface water situation remained stable, with 13 of the 1,628 sampling points (0.8%) exceeding the drinking water standards of 50 mg per litre, ***more than 11.8% of the WFD-characterized river basins having more than 30 mg per litre and less than 40% of these areas falling below the good quality limit of 10 mg per litre.***

1.4 Groundwater quality (sources: SOeS, 2009)

The measurement network of the water quality monitoring system (SEQ water) of the water agencies and DIREN shows that, in 2006[19], pesticides were detected and quantified at least once at 53% of the 1,507 interpretable points of the knowledge networks. The measured contents are sometimes very low and in these cases have little impact on water quality. However, this reflects a significant dispersion of pesticides and a significant presence in groundwater. The analysis results are used to define, for each point, a quality class. If contamination levels are variable, they are nevertheless often significant. Thus, 24% of the points of the general knowledge network, i.e. 376 stations out of 1,507, and 27% points of the plant health information networks had poor to bad quality. However, less than 1% of the points of the knowledge network, and none of the points of the plant health information networks had poor quality: only 10 stations had pesticide contents above the standard of 2µg per litre of the Groundwater Directive.

A Directorate General for Health (DGS) survey of September 2005[20] revealed that 20.6% of the drinking water intakes producing 46.7% of the raw water abstracted in 2002 were water of poor or bad quality with respect to pesticides requiring treatment or water purification measures. Regarding peaks of pesticide concentration, this poor or bad quality concerned 65.3% of the controlled surface water flows and 23% of groundwater flows. With regard to average concentrations, only 0.5% of the controlled flow rates of the two water classes were of poor to bad quality. With respect to the new WFD standards, the latest SOeS report underlined that ***groundwater contamination with pesticides was confirmed in 2008, 4% of water points exceeding the limit value that requires water purification, and 0.2% were above the limit at which treatment is no longer possible.***

Regarding nitrates, the report also noted *a slow but continuous degradation of groundwater with respect to nitrates: the slow degradation of groundwater by nitrates appears to be have been continuing at the national level since the sixties … In general, over the past ten years, we noted less and less significant percentages of water points with contents below 10 mg per litre (decreasing from 56 to 48%) and* **an increase of about 50% of those whose nitrate concentration exceeded 50 mg per litre (increasing from 4 to 6%).**

2. MONETARY IMPACTS OF AGRICULTURAL NITRATES AND PESTICIDES ON THE WATER DRINKER

2.1 Additional costs of water supply and sanitation services related to agricultural diffuse pollution and affecting the water bill of domestic consumers

2.1.1 Expenses for agricultural pollution control financed by the water agencies

In 2007 and 2008, the water agencies paid 144 million euros for agricultural pollution control while they only levied about 11 million euros of pollution charges from the farmers: the analysis of the water agencies' budget thus shows **a net annual profit/loss result of 60 to 70 million euros in expenses due to agricultural pollution and mainly financed by domestic charges**, i.e. by the drinking water bill of domestic consumers (see PLF, 2010).

2.1.2 Costs generated by the eutrophication of water intakes

A study carried out in 2005 by the Loire-Brittany Water Agency estimated at 39.3 million euros (in euros of 2003) the cost of mechanical cleaning up of eutrophicated water intakes in the basin, these costs included cleaning up the suction strainers and the additional energy expenditure generated by the pressure drop caused by eutrophic waters *(additional*

[19] SOeS data 2008.

[20] http://www.sante.gouv.fr/IMG/pdf/dossier_presse-3.pdf

cost of pumping energy caused by algae and plants clogging the water pump extracting eutrophic raw water). 24% of the annual abstractions of drinking water in the basin were concerned. On this basis, we can roughly estimate that, at national level, **the annual expenditure caused by the eutrophication of raw water is between 60 and 100 million euros.**

2.1.3 Costs of moving the water intakes used

To avoid investing in expensive treatments of diffuse pollution mainly from agriculture, the drinking water supply utilities had to give up many contaminated intakes and relocate the corresponding pumps, resulting in investment costs and permanent additional operating costs, the new catchments being systematically further away from urban areas than the old ones (higher costs for abstraction and transport of raw water to the treatment plants and supply facilities). As a first approximation, we can estimate that this permanent additional cost is in the range of 0.04 to 0.10 euro per m^3, and refers to no less than 10% of the abstracted drinking water. Based on the figure of 6 billion m^3 of annual abstractions for drinking water (2005), **this annual additional cost is estimated at between 20 and 60 million uros, without taking into account the health externalities of this practice.**

2.1.4 Costs of mixing raw waters by the drinking water producers (interconnections)

In order to continue using the old contaminated water intakes without investing in additional treatments, when the costs of moving the production facility would have proved prohibitive, the producers of drinking water in urban areas with multiple water resources from different geographical origins have embarked on mixing contaminated water with 'clean' water through interconnections between drinking water production networks. This practice, which caused some bewilderment for the local authorities concerned, raised real ethical questions[21] and tended to spread in recent years. We estimate at this stage that it affects about 15% of drinking water and generates a permanent operating cost between 0.02 and 0.04 euro per m^3. **The corresponding annual cost would amount to between 20 and 40 million euros**.

2.1.5 Additional costs caused by complementary treatments

- ***Additional costs due to drinking water treatment with respect to nitrates***

In order to supply drinking water from raw water, while meeting quality standards on the concentration of nitrates, the community bears various costs: it can carry out a number of tasks (dropping intakes, or dilutions or palliative work for poor quality, etc.) or develop complementary treatments.

According to a report of the Directorate General for Health of September 2005[22], nitrate content levels above 50 mg per litre indicate a much degraded status of the resource and the need to take action. According to representatives of private operators, members of the Drinking Water Commission of the Scientific and Technical Association for Water and the Environment (ASTEE), nitrate reduction is always carried out for a maximum concentration of 25mg per litre in treated drinking water. Also, according to members of the Commission, the water volume annually treated against nitrates would be around 5% of the abstracted volumes (i.e. 300 million m^3). Based on studies of the Ile-de-France (RIF) in 2010 and of the Loire-Brittany Water Agency in 2007, the SEEIDD considered it to be closer to 10% (600 million m^3).

The additional curative cost for nitrates is included, according to Drinking water commission of ASTEE, in the range of 0.4 and 0.6 euro per m^3. This range is also validated by a study of the Seine-Normandy Water Agency[23].

Considering that the only measure taken is the introduction of additional water treatment, we give a SEEIDD cost estimate for the community to supply drinking water meeting the standards for nitrate concentration. **The expenses borne by the local authorities for water purification from pollution by nitrates would thus be between 120 and 360 million euros**.

---

[21] Populations and districts usually and "naturally" supplied with water of very good quality are now, without any notice or public debate, supplied with water deliberately loaded to the limit of drinking water standards in force.

[22] *http://www.sante.gouv.fr/IMG/pdf/dossier_presse-3.pdf*

[23] Seine-Normandy Water Agency - Marine Drouet study performed on 28 plants (September 2008) - *Water purification plants in Seine-Upstream: technical and financial balance*.

➢ *Additional costs caused by complementary water purification from pesticides*

In order to supply drinking water from raw water, meeting quality standards on the concentration of pesticides, the community must develop complementary treatments.

According to the Drinking Water Commission of ASTEE, 45% of the water volume annually abstracted for drinking water undergoes treatment against pesticides (i.e. 2.7 billion m^3). By amortizing the investment over a period of 15 years and adding operating costs, the value of the additional costs of treatment due to pesticides for private operators is between 0.06 and 0.11 euro per m^3 (these values apply both to groundwater and surface water). For what is beyond the scope of private operators (State-owned organization), the value of the additional costs of treatment due to pesticides is 0.2 euro per m^3 (Drouet 2008 value made in 28 plants in the upstream Seine River basin). Knowing that private operators manage 75% of the utilities, we can estimate the costs borne by the community to supply drinking water meeting the standards on the concentration of pesticides. **The costs borne by local authorities for water purification generated by pesticides found in water resources can thus be estimated in a range between 260 and 360 million euros.**

➢ *Expenditure for water purification per hectare of conventional agriculture located in catchment areas of drinking water intakes*

The annual average infiltration for groundwater recharge is in France between 180 and 300 mm, i.e. 1,800 to 3,000 m^3 per hectare of catchment area. As discussed above, reduced to gross cubic metre, the cumulative cost of water purification with respect to nitrates and pesticides is in a range between 0.46 euro per m^3 (0.4 per nitrates + 0.06 per pesticides) and 0.81 euro per m^3 (0.61 per nitrates and 0.20 per pesticides). Under these conditions, we can estimate that **the annual cost of water purification caused by conventional agriculture in plots located in the catchment areas of water intakes are in the range of 828 to 2,430 euros per ha thus cultivated. This estimate can justify in some cases the benefits to the community of the public water and sanitation utility (SPEA) purchasing some plots that can be planted with grass or leguminous vegetables.**

➢ *Additional cost for wastewater treatment related to agricultural nitrates*

The European Directive 91/271 on Urban Wastewater Treatment (UWWD) requires the tertiary treatment of discharges into sensitive areas of cities over 15,000 pop-equivalents (pe). This treatment concerns the discharges of several major cities, Paris included, including total nitrogen and phosphorus. We have no data on the corresponding costs for phosphorus. We will therefore limit ourselves to a first approximation of the agricultural part of the nitrogen treatment required by UWWD in metropolitan wastewater discharges. Indeed, on-going huge investments made in Paris are an eloquent showcase[24].

UWWD sets at 10 mg per litre the concentration limit of total nitrogen in treated discharges in sensitive areas, which is more constraining than the EU standard for drinking water with respect to nitrates[25]. In practice, Greater Paris has reduced by more than 91% the daily input of 121.2 tons of nitrogen in its wastewater treatment plants[26], of which we can estimate that at least 12 tons come from agricultural nitrates in the supplied drinking water and about 10 tons from collected rainwater[27]. This suggests that at least 10% of the costs for tertiary treatment of nitrogen are generated by agriculture. At the national level, the urban wastewater discharges to be treated are estimated at about 2.5 billion m^3 (including stormwater discharges arriving at the wastewater treatment plants). The corresponding expenditure of local authorities due to the tertiary treatment of agricultural nitrogen can then be estimated, based on the range of ASTEE treatment costs per cubic metre (0.40 to 0.60 euro per m^3), at 250 million m^3 per year

The annual expenditure of public sanitation utilities for wastewater treatment due to excess nitrates from agriculture can thus be estimated in the range of 100 to 150 million euros.

---

[24] For its wastewater treatment plant of Achères alone, which discharges into the Seine the wastewater of more than 6 million pop-equivalents, the SIAAP started in 2007 a first denitrification step at a cost of 320 million euros and is at mid-term of an additional investment of 1,125 million euros, including the denitrification step in particular.

[25] The limit value of 50 mg per litre of nitrates (NO3) in drinking water corresponds to 11.4 mg per litre of total nitrogen.

[26] Activity report for year 2007 of Union Interdepartmental Sanitation of Greater Paris (SIAAP).

[27] Partly impacted by agriculture.

2.1.6 Total of additional costs of water supply and sanitation services related to agricultural diffuse pollution and affecting the water bill of domestic consumers

Although we have not been able to assess all the impacts, including the treatment of phosphorus[28], we can however estimate that agricultural pollution generates on water bills annual additional costs amounting to at least 640 to 1,140 million euros, i.e. from 6.6% to 11.8% of the water bill of French households (about 9.7 billion euros).

2.2 Additional expenses of households due to agricultural diffuse pollution that have no impact on the drinking water bill

2.2.1 Cost of replacing tap water by bottled water

2.2.1.1 First approach: Overall estimate of expenses linked to the replacement by bottled water

INSEE data on annual consumption show that consumption of mineral and spring waters increased from 79 to 161 litres per person per year in France between 1987 and 2007, and that soft drinks weighed more heavily on the households' budget in 2008 (1.1%) than the invoice of the public water supply and sanitation utility (0.8%). If the TNS SOFRES 2009/CI WATER survey on "The French and water"[29] shows that the number of drinkers of bottled water has decreased since 2006 (only 33% of respondents, corresponding to 20.5 million people, declared drinking bottled water several times a day), 17% of respondents said that they did not trust the quality of tap water, which is more than 10.5 million consumers fearing pollution of tap water.

However, the detailed data we have are older: according to an IFEN / CREDOC survey[30] (see Annex 7), 33.7 million people were drinking bottled water in 2000, including 22.6% for health reasons, for fear of pollution. These water drinkers motivated by tap water pollution only represented 7.6 million consumers. This part of bottled water consumption is replacing the consumption of tap water considered as unsafe, and the corresponding cost can be considered as substitution expenses due to the poor quality of drinking water supplied to the tap.

According to the IFEN / CREDOC survey, the national average value for bottled water consumption is 258 litre per year per person who drinks it. As for the price of a litre of bottled water, it is approached here with an amount of 0.538 euro per litre[31].

Thus it is possible to estimate at about 1,100 million euros per year the purchase of bottled water motivated by pollution in general (national population basis in 2000, see Annex 7). This means estimating the share of the expenses that can be attributed to the fear of tap water contamination by agricultural pollution. We will not estimate here the costs of transporting bottled water from selling points to homes, or the related emissions of greenhouse gases. The SEEIDD made a first global estimate and a second estimate trying to distinguish the expenses related to nitrates from those linked to plant health products.

In order not to attribute to agricultural pollution alone the entire consumption of bottled water to households who buy for fear of pollution, we will assume here that the share of this bottled water consumption specifically related to agricultural pollution is between 65% and 95%. Under this assumption, the additional cost for households related to the replacement of tap water by bottled water due to agricultural pollution would be between 688 and 1,005 million euros.

Indeed, the main -if not the only- pollution parameters for which tap water in France still regularly exceeds the drinking water standards are nitrates and pesticides from agricultural origin, which are also the only pollution mentioned by the producers of natural mineral water to explain regional differences in their sales in France: "*the French people are indeed more used to drinking natural mineral water in agricultural regions like Picardy, Nord-Pas-de-Calais or Brittany, where tap water suffers from the current development of groundwater and surface water pollution caused by pesticides and nitrates*[32]*". Moreover, according to a 2008 survey commissioned by Ifop and MDRGF, public opinion is "very sensitive*" to the pesticide risk since 95% of the respondents consider that it is very important (75%) or important (20%) that the farmers decrease by half the frequency of their treatment within 10 years (SOeS source). The 5.1 million people supplied

[28] In which the agricultural surpluses were reduced by a factor 3 in 10 years.

[29] *http://www.fp2e.org/fic_bdd/actu_actualite_fr_fichier/12393702292_CIEAU24pagesDEFbd.pdf*

[30] Research Center for the Study and Observation of Living Conditions.

[31] In 2004, the industry of natural mineral waters generated a turnover of 3.5 billion euros for 6.5 billion litres produced, i.e. a price of 0.538 euro per litre. *http://www.eaumineralenaturelle.fr/economie/production-eau.html*

[32] *http://www.eaumineralenaturelle.fr/*

in 2008 with water that at least temporarily exceeded the pesticide standard alone accounted for 67.1% of bottled water drinkers motivated by water pollution in 2000. And, if the total population supplied with water exceeding the nitrate standard is unknown by the authors of this paper, it is likely of the same order of magnitude and should, in part, be added to the populations affected by pesticide pollution, especially in areas of intensive animal husbandry.

Please note however that these figures:

– Only correspond respectively to 5.83% and 8.51% of the households' expenses for soft drinks in 2008 (INSEE data: 11.8 billion euros)[33]

– Are based on an average annual consumption, by people fearing agricultural contamination, of 258 litres per year, or 0.7 litres per day, i.e. half of the water volume normally drunk in France, estimated at 500 litres per person per year, and just over a third of the WHO recommendations (2 litres per day)

– Do not include the water volumes consumed outside home, which are usually much more expensive: cafeterias, restaurants, cafés, hotels, beverage dispensers in public places and enterprises.

Therefore, we believe that the substitution cost actually generated is probably higher than this initial estimate.

2.2.1.2 Second approach: Estimate that distinguishes expenses caused by nitrates from those due to plant health products (pesticides, fungicides, biocides, etc.)

- Costs of replacing tap water by bottled water due to nitrates

The small children are a class of population at-risk from nitrates; these can cause methemoglobinemia (or "blue baby" disease). The medical contra-indication of tap water is routine in France for bottle-fed babies. Expenses related to consumption of bottled water replacing the consumption of tap water thus appear as an additional expenditure for households because of nitrates. Thus, considering children under 2 years old and excluding breast-fed babies (25% of the total number of children for the first 4 months), nearly 1.5 million children would be concerned. With an average consumption of 0.75 litres of bottled water per day (i.e. 274 litres per year), we obtain a total purchase of 410 million litres of bottled water per year at an average price of 0.538 euros per litre. Household spending induced by nitrates rises to 220 million euros a year. It does not account for the expenditure of households without small children not drinking anymore tap water for fear of nitrates.

- Costs of replacing tap water by bottled water due to plant health products

According to a report of the Directorate General for Health in 2008, 5.1 million people were supplied with drinking water exceeding at least once a year pesticide standards. Based on an average consumption of 258 litres per person per year (survey made by IFEN-CREDOC in 2000) and an average purchase cost of 0.538 euros per litre, the bottled water expenses motivated by plant pollution are estimated at about 710 million euros a year.

Total expenditures for bottled water caused by agricultural pollution would thus be estimated at 920 million euros a year.

2.2.1.3 Costing retained by this study

The importance of the amounts estimated by each of these two approaches and the lack of recent robust study to clearly identify the share of purchases of bottled water motivated by agricultural pollution encouraged SEEIDD to plan the studies required for this clarification.

At this stage, we only retain the quantification of expenses directly related to nitrates and only concerning households with small children, i.e. 220 million euros per year.

2.2.2 Costs of collecting and processing the packaging of bottled water

Based on an average weight of 30 grams of packaging (plastic bottle) per litre of bottled water, and a cost for collection and processing (including recycling) of about 250 euros per ton, this average cost does not account for the costs of transportation of rural households wastes from their homes to the recycling centres.

[33] The mentioned surveys appear to have excluded a priori a substitution of soft drinks distinct from natural mineral and spring water, which implicitly means that nobody ever drinks soda water, flavoured water or fruit juice for fear of tap water, and leads to exclude from the estimate the households' expenses for soft drinks.

Under these conditions, on the basis of 410 million litres of water consumed by infants for fear of pollution by nitrates, the packaging wastes represent more than 12,000 tons per year generating **an expenditure of about 5 million euros**. This expense is passed on to the household budgets through the tax for collection of household refuse (TEOM) or the domestic refuse removal charge (REOM).

2.2.3 Costs of domestic filtering of tap water due to agricultural pollution

If some consumers buy bottled water, others are purchasing systems for filtering tap water. The C.I.EAU / TNS SOFRES 2009 Barometer "The French and water" estimated at 23% the number of French people using water treatment appliances, i.e. water softeners (scale removers), and known pollutant filtering devices (water filter jugs and activated carbon purification systems). If 13% of the respondents said that they are already equipped with filter jugs, the survey does not provide a number of fixed filtration systems.

- The filter jugs are sold from 30 to 60 euros each[34]. We believe their life span to be about four years. They operate with cartridges to be replaced every month, with an average unit cost of 5 euros (or 60 euros per year) per household, for about 3.4 million households. We estimate that 70% of the households, who use filter jugs, do so for fear of agricultural pollution and that they actually replace their cartridges only 8 times a year (instead of 12 times). This corresponds to 2.38 million households, and leads to a national annual expenditure for domestic jug filtration related to agricultural pollution between 113 and 131 million euros.
- Regarding domestic fixed filtration systems, we estimate, until we have a more robust value, that at least 2% of households are equipped for fear of agricultural pollution, i.e. 520,000 households. We take an average purchase price of 40 to 120 euros per fixed system, amortized over about 8 years, whose cartridges must be replaced twice a year at a unit cost of 24 euros each. We believe that these households will properly replace their filters for a total annual expenditure of about 58 euros per household. This leads to an annual value of about 30 million euros.

Based on the above, the expenses of households for filtering tap water caused by diffuse pollution from agriculture are estimated to be in a range between 140 and 160 million euros.

2.2.4 Total of additional expenses of households due to agricultural diffuse pollution that have no impact on the drinking water bill

In total, we can thus estimate that agricultural pollution generates between 365 and 385 million euros as additional annual expenditure for households, regardless of the tap water bill.

2.3 Estimated total direct impacts on household budgets

By adding the additional expenses of households regardless of their tap water bills (domestic filtration, bottled water and related domestic waste) and the additional costs on the drinking water bill caused by that pollution, we conclude that **its direct financial impact on annual expenditures of households is at least in the range of 1,010-1,530 million euros**. The additional expenditure for enterprises and local authorities caused by agricultural diffuse pollution for water and wastewater treatment has not been estimated.

2.4 Impacts on the populations located in the most polluted communities

Although the local impacts of agricultural pollution on the resource require an assessment on a case-by-case basis that has not been made, we can draw, from the previous approach, including from the ranges of treatment costs of the Antéa study and SOeS and SEQ water monitoring data on water quality, the following analysis:

[34] Brita and Terraillon are the main suppliers. In 2009, the Terraillon CEO believed that the French market for filter jugs was "booming" and estimated it at 90 million euros.

1. This pollution is frequently concentrated on the same communities and families whose intakes are simultaneously affected by nitrates and pesticides *(8 to 12% of households?)*
2. For these households, the additional costs *(average cost basis and 2.3 persons per household)* can be both:
    a. The additional costs of collective treatment of tap water, or 0.81 euro per m³ [35] corresponding to an additional cost of 97 euros per year for an average bill of 120 m³.
    b. The purchase of bottled water, linked to mistrust of tap water quality[36], i.e. an average of 600 litres per household at 0.54 euro corresponding to an additional expenditure of 320 euros per year.
    c. Additional household waste, equivalent to about 5 euros per year.
    d. The additional costs for tertiary treatment of wastewater passed on to the drinking water bill corresponding to the agricultural or livestock inputs in nitrates, i.e. about 72 euros per year.
    e. In total, these **additional annual expenses** for access to drinking water meeting the drinking water standards in force would thus reach **494 euros per household or + 215 euros per person.**
3. In 2006, these households would have paid a **"total bill"[37] of 854** euros to cover their basic drinking water needs instead of the average bill of 360 euros in 2006 for households with access to resources of "fair quality" less polluted by agricultural surpluses.
4. These expenses transferred from agriculture to households are proportional to the number of family members, at approximately 215 euros per person per year: **for a family of five, the annual additional expense caused by such pollution would be of the order of 1,074 euros.**

[35] Seine-Normandy Water Agency - Marine Drouet study performed on 28 plants (September 2008) - *Water purification plants in Seine-Upstream: technical and financial balance*: cost for pesticide treatment of 0.20 euro per m³ added to the cost for nitrate treatment of 0.61 euro per m³.

[36] Despite the purification treatment, this mistrust was justified by water exceeding pesticide standards in force at least once a year for more than 8% of the households reported in the DDAS analyses/DGS surveys.

[37] Including purchase of substitution bottled water.

3. OTHER IMPACTS

3.1 Estimated annual market loss due to eutrophication

Eutrophication is associated with nutrient excess (phosphorus and nitrogen), solar radiation and temperature. If eutrophication of inland waters is mainly due to phosphorus, marine eutrophication depends, in turn, essentially on the discharged nitrogen amounts. An inter-agency study carried out in 1991[38] estimated losses due to eutrophication in the following way:

- Estimates of losses for tourism on water bodies: 60 to 140 million francs in 1988 (i.e. 14 to 32 million euros 2009).
- Estimates of losses for tourism due to decrease in the practice of fishing: 16 to 21 million francs in 1988 (i.e. 4 to 5 million euros 2009).
- Estimates of losses due to marine eutrophication: 240 to 310 million francs in 1988 (i.e. 54 to 70 million euros 2009).

Or a grand total of between 316 and 471 million francs in 1988, representing, after processing by the francs-euros conversion tables provided by INSEE, a total of **between 70 and 100 million euros 2009.**

However, this figure will have to be updated on the basis of more recent data.

3.2 Costs of cleaning green algae along the coast

On February 3, 2010, the Minister of Agriculture Bruno Le Maire and the Secretary of State for Ecology Chantal Jouanno jointly presented a project to fight against the spread of algae on the coast of Brittany. This control plan is scheduled for a period of five years, ranging from 2010 to 2014. It will fund the collection of algae, storage, processing and research for better understanding of the phenomenon. Each year, **between 30 and 50 million euros** are allocated to finance the collection and composting of algae.

3.3 Costs of Community litigation

These are the parts due to agriculture for non-compliance with the old Directives on nitrates, drinking water, groundwater and UWWD. Other Directives may also be involved: bathing and shellfish farming waters, the Water Framework Directive. Agriculture is clearly the largest source of pressure on the good ecological status of inland and marine waters. The cost of litigation generated by non-compliance or delay in implementation of these directives has not been estimated.

Adopted in July 2008, the Marine Strategy Framework Directive (MSFD) extends the objective of good ecological status of marine environments to the 200-mile zone. Many studies have clearly established the extent of the food chain disruption in marine environments caused by eutrophication. Maintaining current agricultural pressures would seriously compromise achieving the goals adopted by the whole community policy and generate litigation.

3.4 Other market impacts

This agricultural pollution is now the main pressure on the quality of water resources and aquatic environments. It directly impacts fishing and aquaculture, fish and shellfish farming, whose activities are totally dependent on the good quality of aquatic environments and represent a turnover of about 1.9 billion euros. The almost total disappearance of several species, including anchovies and eels, and decommissioning of 37% of shellfish farming areas of Brittany between 2000 and 2010, are to be put against the degradation of coastal water quality. It is the same for the economic activities of mineral water (3.5 billion euros of turnover) and thermal (more than 1 billion euros with the associated activities).

[38] Inter-agency study conducted in 1991 by Christophe Yann Laurans Bouni - *Determining the nation for cost and damages of any kind caused by eutrophication.*

4. COST FOR REMOVING POLLUTION IN WATER RESOURCES AND AQUATIC ENVIRONMENTS

This section seeks to estimate the cost for pollution removal or "depollution" in water resources and aquatic environments with respect to agricultural nitrates and pesticides. There is currently no method of pollution removal on the scale of the water body, the pollution removal costs are estimated by assuming that the water purification technologies could be used for removal on a large scale. This is obviously an academic assumption, mainly used for estimating the orders of magnitude. Therefore the results of this estimate are presented independently of the previous estimates.

4.1 Treatment cost of excess nitrates and pesticides discharged into the natural environment

4.1.1 Treatment cost per kilogram of excess nitrogen

Regarding nitrates, as water purification treatments aim to lower on the average the initial concentration by 25 mg per litre (e.g. to reduce from 65 to 40 mg per litre) the treatment of a ton of nitrates dissolved in the resource corresponds to the processing of 40,000 m^3 of raw water. However, one ton of nitrogen corresponds to 4.4 tons of nitrates. It is therefore necessary to treat 176,000 m^3 of raw water to remove one ton of nitrogen from water resources and aquatic environments. Under these conditions, the costs of denitrification of the water purification plants correspond to a processing cost per ton of nitrogen between 70,400 and 105,600 euros (excluding pumping costs). **The treatment cost of a kilogram of excess nitrogen (nitrogen unit)[39] found in the aquatic resources is thus between 70 and 106 euros, which is a range consistent with the cost of 74 euros per unit of nitrogen published by the Flemish region in 2011.**

4.1.2 Treatment cost per kilogram of excess pesticides

The assumption retained for pesticides is that the water purification treatments aim to lower on the average the concentration by 1 µg per litre. This means having to treat 1 million m^3 of contaminated water to remove 1 kg of pesticides. We can then deduce from the preceding unit costs (ASTEE and Drouet) **the cost range for the removal of one kilogram of pesticides, between 60,000 and 200,000 euros.**

4.2 Annual cost for pollution removal from surface and coastal waters

The "stock" of surface waters is roughly estimated at 10 billion m^3 in lakes and reservoirs and 110 billion m^3 in rivers. Most of this stock is quickly running to the sea. It is thus more a flow, which is renewed continuously, than a real stock. We will retain, on the one hand, an annual river flow of 80 billion m^3, and, on the other, an annual groundwater flow to the sea of 100 billion m^3. Thus, it is more appropriate to estimate the cost of processing annual nitrogen and pesticide surpluses to aquatic environments than the cost of restoration of a pseudo stock.

4.2.1 Cost for removing nitrogen surpluses from agriculture and animal husbandry

The 715,000 tons of annual nitrogen surpluses brought annually to the natural environments thus represent the mass of pollution transferred from agriculture and animal husbandry to water resources and aquatic and marine environments. Based on the previous unit costs of treatment, complete removal of this nitrogen pollution in these areas to maintain their current status would represent an **annual treatment cost between 50 and 76 billion euros.**

4.2.2 Cost for removing of pesticide surpluses

Based on the average concentrations of the System of Quality Assessment for surface water, we can estimate the quantities of pesticides diluted in annual runoff flows into rivers or groundwater discharged into the sea, i.e. about 74 tons per year: about 48 tons transferred from rivers and 26 tons from groundwater to the sea, respectively.

[39] Whose purchase price is between 0.5 and 1 euro per unit for mineral nitrogen.

The cost of treating these annual inputs of pesticides to surface and coastal waters would be in the range of 4.4 to 14.8 billion euros.

In total, the annual cost of treating these annual flows of nitrogen and pesticides would be between 54 and 91 billion euros.

4.3. Cost for removing pollution from groundwater (stock depollution)

The groundwater stock is roughly estimated at 2,000 billion m^3 in continental France. According to the preceding bases, its restoration to drinking water standards would imply to treat 14% for denitrification and 24.7% for reducing the pesticide content. This roughly corresponds to the removal of 7 million tons of nitrates and 526 tons of pesticides. Regarding pesticides, the removal of these 19 tons would be sufficient to meet the concentration limit of 2 µg per litre of pesticides given in the Groundwater Directive in the 0.7% of the most polluted waters, whose average concentration would only fall from 3.35 µg per litre[40] to 2µg per litre, i.e. a reduction of 1.35 µg per litre. This is not in any case a true restoration of the initial status, or achieving the quality level which requires pesticide concentrations below 0.1 µg per litre for all groundwater.

Using again the previous externalities, the cost for nitrate removal would be between 490 and 742 billion euros, and the removal cost for pesticides between 32 and 105 billion euros (7 billion of which just for complying with the Groundwater Directive). **In total, the cost for pollution removal from groundwater would be between 522 and 847 billion euros (excluding energy costs for pumping before treatment).**

NB: by reducing the pesticide target to compliance with the limit value of the Groundwater Directive, the cost of removing 19 tons of pesticides allowing compliance would be between 1.14 and 3.8 billion euros.

[40] SEQ Water data for 2006.

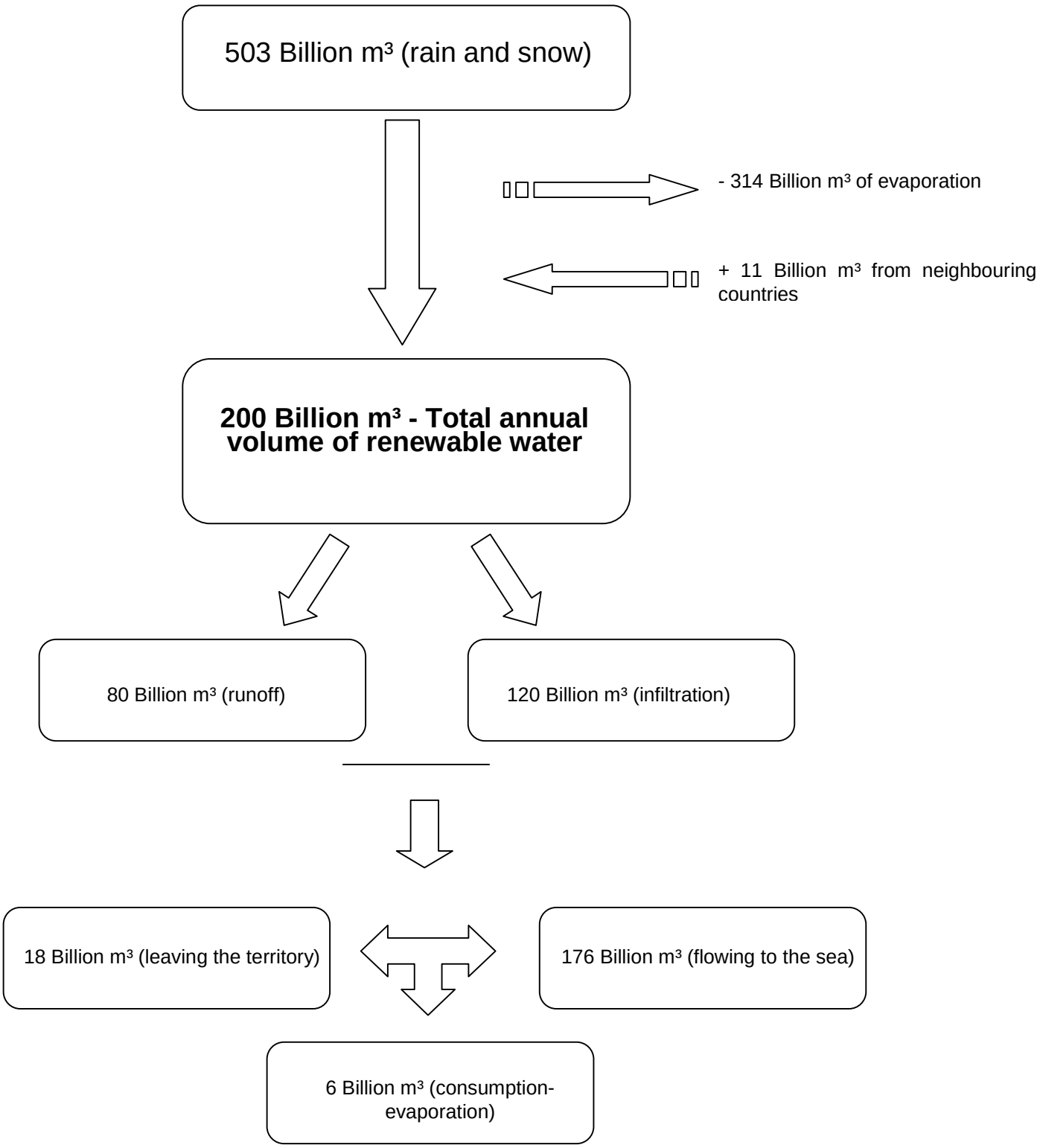
5 ANNEXES

Annex 1: Draft summary of costing agricultural diffuse pollution in aquatic environments (in millions euros)

	Low value	High value
I) ANNUAL EXPENDITURE CAUSED BY AGRICULTURAL DIFFUSE POLLUTION: 1 + 2 + 3	**1,105**	**1,675**
1) Additional costs of water supply and sanitation services affecting the water bill	**640**	**1,140**
• Assistance to farmers through the agency's charge on the water bill	60	70
• Cleaning up of eutrophicated water intakes and strainers	60	100
• Costs of using new far away water intakes	20	60
• Costs of mixing raw waters by the drinking water producers	20	40
• Additional costs of complementary treatments due to agricultural diffuse pollution:		
➢ Additional costs due to water purification with respect to nitrates	120	360
➢ Additional costs due to water purification with respect to pesticides	260	360
➢ Additional costs for wastewater tertiary treatment related to agricultural nitrates	100	150
2) Additional expenses of households located in communities affected by this pollution	**365**	**385**
• Replacement of tap water by bottled water due to nitrates	220	220
• Collection and processing of the corresponding households' bottles (households waste)	5	5
• Domestic filtering of tap water due to agricultural pollution	140	160
Total additional expenditure of households: 1 + 2	**1,005**	**1,525**
3) Impacts due to eutrophication (Partial and old estimates on tourism and fishing)	**100**	**150**
• Estimated annual market loss due to eutrophication	70	100
• Costs of cleaning green algae along the coast	30	50
4) Costs of Community litigation	**?**	**?**
II) ESTIMATED ANNUAL COST FOR THE NECESSARY TREATMENT OF SURFACE AND COASTAL WATERS	**54,000**	**91,000**
III) ESTIMATED COST FOR GROUNDWATER RECOVERY	**522,000**	**847,000**
IV) ESTIMATED COST FOR COMPLIANCE WITH THE GROUNDWATER DIRECTIVE	**1,100**	**3,800**

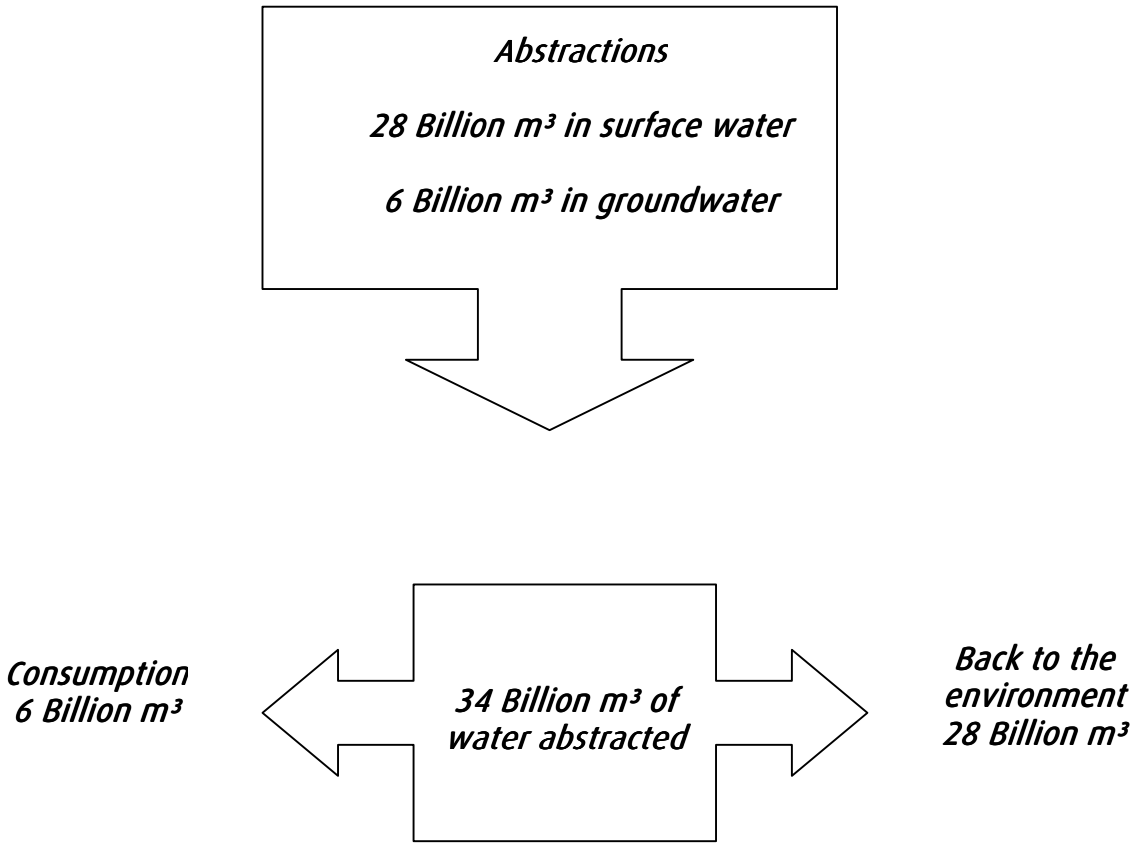
Source: CGDD/SEEIDD/ERNR2 – September 2011

Annex 2: Annual flows of the water cycle in continental France (billions of m³) in 2001



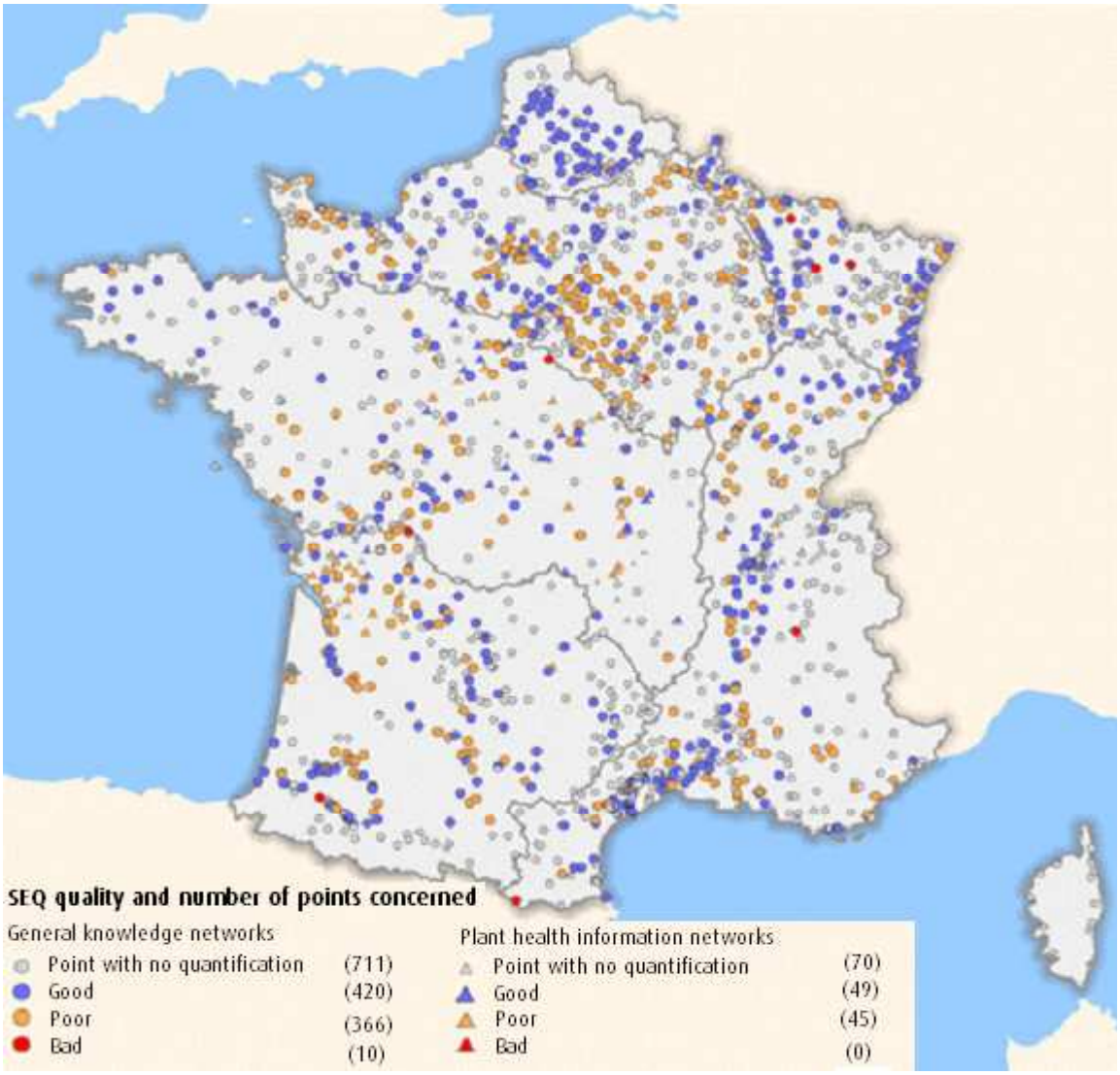
Source: Public report 2010 of the State Council on "Water and its right".

Annex 3: Water volumes abstracted in continental France in 2001



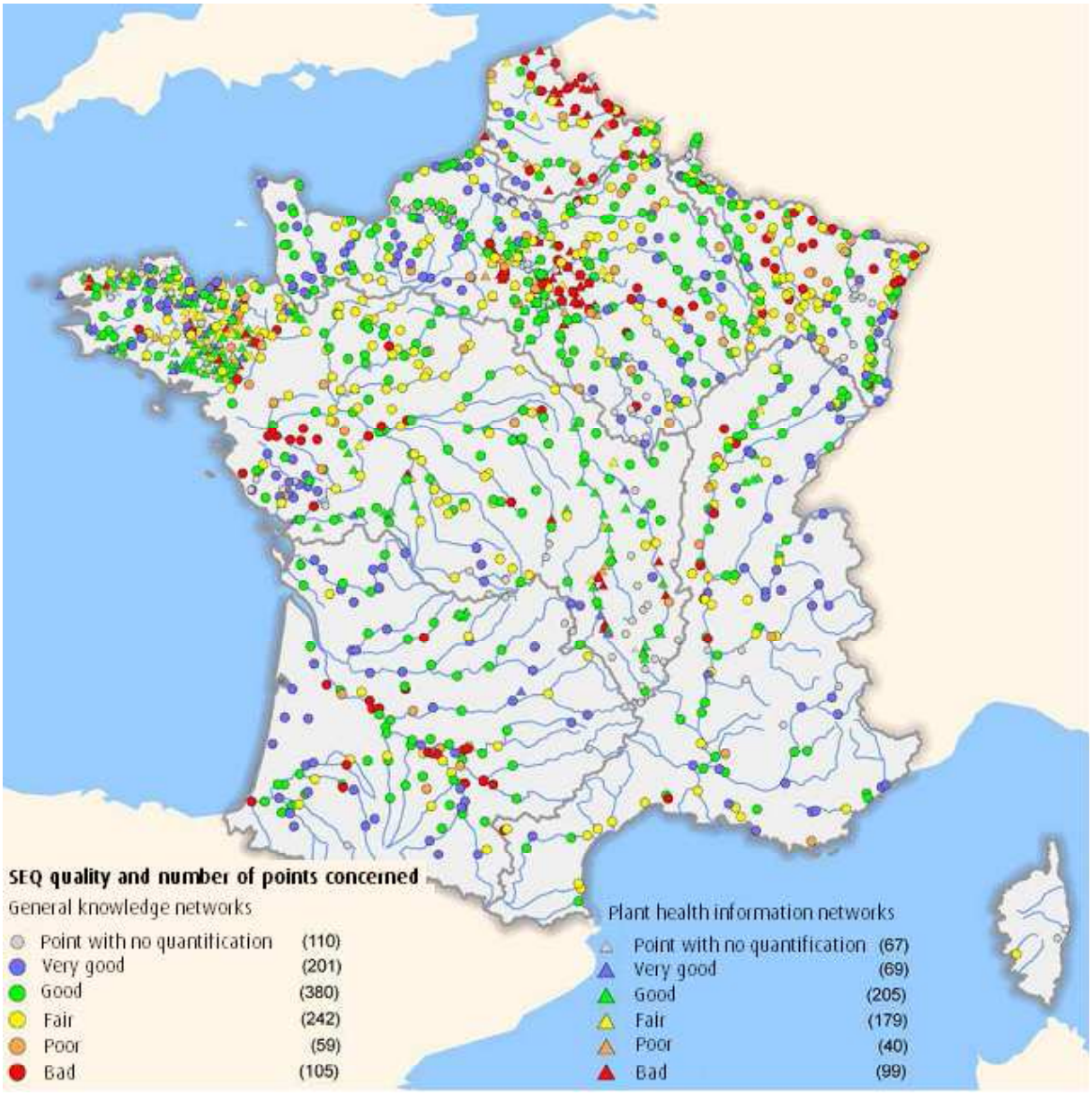
Source: Water, IFEN's syntheses, publication 2006.

Annex 4: Groundwater quality with respect to pesticides in general knowledge and plant health information networks in 2006



Source: Water Agencies – General Councils – DIREN - DRAF-SRPV - SOeS Treatments (SEQ-water drinking water use)

Annex 5: River quality with respect to pesticides in general knowledge and plant health information networks in 2006



Source: Water Agencies – General Councils – DIREN - DRAF-SRPV - SOeS Treatment (SEQ-water overall surface water quality)

Annex 6: Grid for interpreting water quality

Water quality with respect to pesticides is assessed according to three grids depending on whether it concerns surface water or groundwater and assessing the overall quality or the ability of producing drinking water. The table below shows the correspondences between the different grids.

Limits and meaning of SEQ-water quality classes for pesticide balance

		0,01 µg/l	0,05 µg/l	0,1 µg/l	0,7 µg/l	1,4 µg/l	2 µg/l
Surface water	Overall quality	Except for 39 substances that have a lower limit, the limit of the blue-green class is 0.1 µg/l (0.5 µg/l for the sum of substances) Allows for the life of aquatic organisms and drinking water production without specific treatment for pesticides		Except for 33 substances that have a lower limit, the limit is 0.7 µg/l (2 µg/l for the sum of substances)	Except for 33 substances that have a lower limit, the limit is 1.4 µg/l (3.5 µg/l for the sum of substances)	Except for 6 substances that have a lower limit, the limit is 2 µg/l (5 µg/l for the sum of substances)	Can no more meet the ecological balance or drinking water production unless derogation
	Drinking water use	Except for 4 substances that have a lower limit, the limit is 0.1 µg/l (0.5 µg/l for the sum of substances) Allows drinking water production without specific treatment for pesticides		2 µg/l (5 µg/l for the sum of substances)Allows drinking water production but requires a specific treatment for removing pesticides			Does not allow drinking water production unless derogation
Groundwater	Drinking water use	Except for 4 substances that have a lower limit, the limit is 0.1 µg/l (0.5 µg/l for the sum of substances) Allows drinking water production without specific treatment for pesticides		2 µg/l (5 µg/l for the sum of substances)Allows drinking water production but requires a specific treatment for removing pesticides			Does not allow drinking water production unless derogation

Colour coding of SEQ-water quality classes

Overall quality	Very good	Quality for drinking water use	Good
	Good		Poor
	Fair		Bad
	Poor		
	Bad		

Annex 7: Outcomes of the IFEN / CREDOC 2000 study

Substitution expenses

	Total population of the basin	Percentage of people drinking bottled water	Percentage of people drinking bottled water due to pollution	Population consuming bottled water for fear of pollution	Bottled water quantities purchased for fear of pollution	Expenditure for bottled water consumption for fear of pollution
Units	*Million of inhabitants*	*Percentage*	*Percentage*	*Million of inhabitants*	*Million of litres*	*Million of euros*
Seine-Normandy	17.25	63.0	21.3	2.3	597.2	321
Rhone-Mediterranean	13.89	41.5	25.6	1.5	380.7	205
Rhine-Meuse	4.17	63.6	16.7	0.4	114.3	61
Artois-Picardy	4.68	83.9	17.9	0.7	181.3	98
Adour-Garonne	6.67	50.3	20.3	0.7	175.7	95
Loire-Brittany	11.85	60.4	27.9	2.0	515.2	277
TOTAL	**58.51**	**57.6**	**22.6**	**7.6**	**1,965.1**	**1,058**

Sources: IFEN / CREDOC 2000 study + SEEIDD calculations based on the distribution keys provided by the SOeS

NB: The survey IFEN / CREDOC 2000 gave percentages by region. Using allocation keys of SOeS for population by basin, the SEEIDD recalculated the rate of consumption of bottled water by watershed.

Department of the Commissioner-General for Sustainable Development
(Commissariat général au développement durable)
Department for the Economics, Assessment and Integration of Sustainable Development
(Service de l'économie, de l'évaluation et de l'intégration du développement durable)
Tour Voltaire
92055 La Défense cedex
phone number : 00 (33) 1.40.81.21.22

You may connect to the following web site to view this publication :
http://www.developpement-durable.gouv.fr/developpement-durable/, heading « Publications »

Abstract

This report considers some household expenses caused by diffuse farming pollution due to overspreading of nitrogen and pesticides. It identifies:

1. *households spending generated by the pollution of water supply intakes, which represents a tiny part of polluted water resources. This evaluation mainly deals with the average national case but also attempts to give a rough assessment of the financial impacts upon populations of the most polluted areas*

2. *a first survey of other commercial impacts of this pollution*

3. *an appraisal of complete clearing of aquatic bodies and resource from nitrates and pesticides, based upon the known costs of existing drinking water purification plants.*

The main results are:

- *concerned additional households spending are estimated between 1,005 and 1,525 million euros, among which from 640 to 1,140 million euros are charged through the water bills, representing 7 to 12% of average water & wastewater bills*

- *populations living in the most polluted areas could face additional costs reaching some 494 euros per household representing an extra cost of 140% of the standard yearly water bill (2006)*

- *eutrophication costs or tourism losses for coastal municipalities are estimated between 100 and 150 million euros a year*

- *the costs of total cleaning of those pollutants would be above 70 euros per kilogram of nitrogen treated and over 60,000 euros per kilogram of pesticides*

- *In the catchment areas of drinking water supplies, conventional farming practices generate yearly treatment costs estimated between 800 and 2,400 euros per cultivated hectare.*

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

Ministère de l'Écologie, du Développement durable, des Transports et du Logement

Legal Deposit: September 2011
ISSN: 2102 - 4723

Department for the economics, assessment and integration of sustainable development

www.developpement-durable.gouv.fr