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Management of drinking water catchment areas in cooperation with agriculture and the specific role of organic farming. Experiences from Germany and France

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ABSTRACT

Many problems with nitrate and pesticide contamination from agriculture exist in European drinking water catchments, and quite different management options are presently searched for. Among them, organic farming is considered as an important option to conciliate agricultural activities and water preservation. Based on different type of interviews, literature and documentation analysis, and participation in a steering committee, we compare the construction of agreements between city water utilities and farmers for the preservation of drinking water quality in three drinking water catchment areas (Munich and Augsburg in Germany, Lons-le-Saunier in France). The main differences found are the delimitation of the city's field of action, compensation payments for farmers for certain practices, involvement of the city council in the acquisition of land, and importance granted to organic farming. Successful city-farmer coordination is based on the presence of a facilitator as an intermediary, technical support, dialogue, contracts that span sufficiently long periods, and participation of farmers in elaboration of contracts. In this frame, organic farming did not appear as the major solution and was not systematically developed.

Introduction

The development of intensive agriculture in Europe over the past few decades has resulted in the deterioration of quality of groundwater resources, to the extent that some authors even talk of a real "nitrate bomb" (Lerner and Harris, 2009). In some regions the nitrate concentrations of surface and underground water are very high,[1] despite the European Nitrate Directive of 1991 specifically targeted at nitrate control (Directive 91/676/EEC). Although a stabilization of nitrate levels in rivers has been found in France, in many cases the degradation of groundwater is still worsening. This has prompted the member states of the EU to introduce action programmes that aimed at reducing pollution from agriculture. In a complex game of mutual influence (Brun, 2003) the EU and national environmental policy-makers in many countries have been seeking to make the regulatory framework more stringent. The European Water Framework Directive (WFD, Directive 2000/60/EEC) innovated by imposing an obligation for states to produce results, i.e. to achieve "good quality surface and underground water" by 2015.[2] This directive has profoundly altered water management at national levels in so far as it has subjected the states to an authority responsible for measuring the performance and coherence of this management (Bouleau and Richard, 2009). This obligation on results weighing on member states is new, and is forcing them to seek effective solutions also to preserve quality of domestic drinking water supply. In France for example, a law on water and aquatic environments was concretized only in 2006 to implement the WFD's obligation to produce results (LEMA no 2006–1772 of 30/12/2010). In contrast, in Germany implementation of the WFD has been started much earlier with the Federal Water Act (WHG), originally dating from 1957, recently renewed in 2009 and 2012. The Federal Water Act and other ordinances

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[1] "High concentrations are recorded in the groundwater of Estonia, in the south-east of The Netherlands, in Belgium (Flanders), in the UK (England), in several regions of France, in northern Italy, in the north-east of Spain, in the south-east of Slovakia, in southern Romania, in Malta and in Cyprus. Concentrations are particularly high in the surface water of Malta, the UK (England), Belgium (Flanders) and in France (Brittany)" (European Commission, 2010).

[2] For certain countries, the timeline was pushed back to 2027.

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such as the Ordinance on Fertilization (1996, 2006) and Ordinance on Drinking Water (2001, 2006) transpose the European WFD into national law (Umweltbundesamt, 2010).

In the last decade, different initiatives by either national, regional or local authorities in many countries in the world have been started to improve water quality in catchments for drinking water. The proposed solutions applied for catchments where agricultural land use is dominating are (i) to limit pesticides and nutrients inputs from agricultural practices, (ii) to purchase agricultural land by the institution managing the catchment and to lend it to farmers with fixed rules for agricultural practices, (iii) to conduct reforestation, (iv) to exclude agriculture, or (v) to convert partially or completely to organic agriculture. The latter option is favoured in some catchments as generally organic farming practices results in a significant decrease of contamination by synthetic pesticides, which are forbidden in organic agriculture (examples provided in Wilbois et al., 2007; Haas, 2010). The decrease in nitrate leaching is more controversial as some crop sequences in organic farming may create an occasional nitrate flush (Stopes et al., 2002). Nevertheless, scientific conclusions are generally in favour of organic farming for water catchment protection, including for nitrate leaching (Stopes et al., 2002; Drinkwater et al., 1998; Honisch et al., 2002; Halberg et al., 1995; Haas et al., 2002; Küstermann et al., 2010).

The different measures to protect water resources originate not only from the strategic orientations of the states, but also from the actions of local actors, which one has to know in order to understand how these measures can be effectively implemented. As in many EU member countries the pollution of groundwater, rivers and lakes has not been reduced significantly although the arsenal of different environmental regulations has grown (Heinz, 2008), the role of local institutional actors such as municipalities, water managers, and water utilities is fundamental if these actions are to succeed (Barraqué, 1995; De Loë et al., 2002). According to Heinz (2008) co-operative agreements between water utilities, farmers, and authorities can be efficient to reduce water pollution.

But these cooperative arrangements involve formulating technical agricultural solutions that are effective on the scale of catchment areas s and acceptable to stakeholders. In this article, we focus more specifically on the place of organic farming in these cooperative arrangements between farmers and urban water services and their modality for implementation.

To contribute answering these questions, we analyze three case studies, two in Germany – the cities of Munich and Augsburg – and one in France – the town of Lons-le-Saunier. We carry out a comparative analysis of the ways in which, in Germany and France, strategies to preserve drinking water resources have been or are being developed. Each of three the cities has set up, or is currently setting up, coordination with farmers to promote new practices which are beneficial to the local water resources quality. Among the proposed practices is also organic farming, which receives a particular focus in the present paper. Munich and Lons-le-Saunier are cases frequently cited as examples of preservation of water quality thanks to the development of organic agriculture but the way contracts with farmers were established was not sufficiently studied in scientific literature so far. And Augsburg was not studied whereas this case is representative for many other cases in Bavaria, southern Germany.

Materials and methods

Context

In the three study cases the drinking water catchment areas are more or less of the same size but the number of inhabitants concerned differs considerably, as do the physical environment, the types of farming, and trends in nitrate and/or pesticide pollution (Table 1).

The Munich water catchment area is the largest of the three and serves the biggest population. It consists of three catchments but our study focuses only on the most important catchment, the Mangfall Valley catchment with 6800 ha, which provides 80% of the city's water needs. In the case of Augsburg the catchment is very close to the city and covers an area of 5000 ha. Finally, Lons-le-Saunier is the smallest town and its 5400 ha catchment is situated at the neighbouring municipality of Villevieux. The types of farming in each area differ. Half of the Mangfall Valley is under forests; the rest is characterized by traditional extensive mixed farming with cattle (mostly dairy but sometimes also beef), strongly based on grass, but also with crops being used as fodder. The Augsburg area is characterized by mixed crop-livestock farming systems. Whereas previously the herds were mainly dairy cows, they are now essentially fattening cattle, along with pigs and poultry. Agriculture in the Lons-le-Saunier area consists of dairy farming and cereal crops, mainly wheat and maize.

In the 1980s diffuse water pollution linked to agricultural activities was revealed in all three cases. In Munich, analyses[3] showed a weak but regular increase in the level of nitrates (Schuchardt, 2010), whereas the water utility, the Stadtwerke München (SWM), had an ambitious target of less than 10 mg l^{-1} nitrates without treatment (drinkability compatible with the required threshold for an infant), which was far below European norms of 50 mg l^{-1} (and 0.1 μg l^{-1} for pesticides); Barraqué (1995) underlines that most German water utilities have such ambitious goals. From 1991 the SWM introduced measures targeting agriculture.

In Augsburg the first problems identified were bacterial but with the intensification of agriculture nitrate pollution also appeared occasionally (Otilinger, 1998; Otilinger et al., 2010; Weidel, 2005; Zipfer, 2012). It has to be mentioned that the Augsburg catchment area has predominating alluvial and shallow gravelly soils, the latter highly permeable (Table 1). This makes the groundwater particularly vulnerable to pollution. From 1986, based on the European definition of thresholds and recommendations, the local water utility, the Stadtwerke Augsburg (SWA), launched a strategy of protection and anticipation aimed, as in Munich, at ensuring a domestic water supply without treatment. It also proposed agricultural measures, although these took longer to be implemented. At Lons-le-Saunier the water wells built in 1961 gradually dried out the Villevieux marshy area, allowing the intensification of agricultural practices since the mid-1970s in this area. In 1985 the water utility, the Service Technique des Eaux de Lons (STE) found nitrate pollution in the groundwater. It consequently set up a protective area around the wells and started to buy up the surrounding land. In 1989 a new municipal councillor decided to introduce monthly water analyses of pesticides. These analyses revealed chronic pollution by triazines (an herbicide) and a constant increase in nitrate levels (Martin, 2010; Zipfer, 2012). He therefore decided to launch a concerted policy to restore the quality of the town's water (Hellec et al., 2013).

The zoning of the catchment area into management zones (Fig. 1 and Table 2) also differs in the three cases: in Munich and Augsburg, in compliance with federal law, it was divided into three zones (Fig. 1a and b) based on the time of raindrop, its infiltration and transport to the water well: (i) a water wells zone (core management zone with transfer time less than ten days) where access was restricted to the employees of the water utility and farming was banned (zone I); (ii) a proximity management area (zone II) where water needs 50 days or less to reach the wells; these are zones

[3] http://www.swm.de/dms/swm/dokumente/m-wasser/trinkwasser-analysewerte.pdf.