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TENSION BETWEEN AGRICULTURAL GROWTH AND SUSTAINABILITY THE EL BAJÍO CASE, MEXICO

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The production model that was promoted internationally in the wake of the Second World War led to some notable gains in terms of economic growth and sharp rises in productivity in a wide range of economic sectors. At the same time, however, it brought consequences to the detriment of natural resources that were intensively exploited, especially underground water.

In Mexico's case, the modernisation of agriculture can be divided into two stages. The first, or “inward”, stage took the form of an extraordinary increase in the production of feed-grains, sorghum in particular, for the nation's pork and poultry industries. The second, or “outward”, phase -- from 1982 to the present -- has been typified by the rapid growth of export crops, mainly of vegetables (see Marañón and Wester, 2000; Marañón 2004, and 2002a).

The aim of this analysis, which is based on Mexico's El Bajío region, is to present the process that led, in the second half of the 20th century to the deterioration of aquifers as a result of the rapid expansion of commercial and export-led farming.

El Bajío is an extensive valley about three hours' drive from Mexico City. It includes a large slice of the state of Guanajuato and neighbouring areas of the states of Michoacán and Querétaro, with altitudes that range from 1,600 to 2,000 metres above sea level. The region has more than 400,000 hectares of high-quality irrigated land that produces grains for human and animal consumption, vegetables and fruit. Agro-industry is diversified, ranging from the production of wheat and maize flour, processed animal feed and dairy products to poultry and pork. El Bajío is also the nation's leading producer of canned and frozen fruit and vegetables, including asparagus, broccoli, cauliflower, baby corn, carrots, Brussels sprouts, yellow squash, mangetout peas and strawberries, among others. The region accounts for 90 percent of Mexico's exports of frozen produce, and is also the leading exporter of garlic and fresh green asparagus in the summer (Bivings and Runsten, 1992; Echanove, 1998; Marañón, 2002a).

*“Inward” modernisation*¹. Between 1960 and 1982, El Bajío's agrarian structure was radically changed in favour of commercial production. The importance of such traditional crops as wheat, maize and beans was sharply reduced in favour of sorghum, the raw

¹ This analysis is based on Marañón-Pimentel Boris y Philippus Wester “Institutional response to groundwater management in the Lerma-Chapala basin, Mexico”, IWMI, Latinamerican Series, No. 17, Mexico, 2000.

material of processed animal feed (Gómez Cruz and Perales, 1981), and alfalfa. The area sown to sorghum rose dramatically, from 1,278 hectares of irrigated land between 1960 and 1964 to 150,681 hectares in the 1980-83 period, with a corresponding decrease in the area sown to maize. The huge increase reflected the growing demand for sorghum as animal feed, its resistance to drought, and the ease with which harvesting could be mechanised -- many farmers found that wheat harvesters they had bought in the 1950s could be readily adapted for the new crop (Roberts, 1995). The increase in sorghum production was closely linked to that of the poultry industry: the number of chickens raised in Mexico rose from 77 million a year in 1960 to 240 million in 1977. By the mid-1970s, the poultry industry was consuming 70 percent of all forage grains, of which sorghum accounted for 60-80 percent. Given the strength of the demand, sorghum production increased rapidly in Guanajuato, especially after Anderson Clayton in 1975 and Purina in 1977 set up major mills in El Bajío. (Young, 1987). Another crop that expanded rapidly during this period was alfalfa, linked to the dairy industry. Because of its nature as a perennial, alfalfa has to be irrigated more than 10 times a year, mainly from underground sources since surface water is only available for irrigation during five or six months of the year.

This change in crop patterns, based on a paradigm that implied the intensive use of natural resources, was the consequence of a decision by the nation's political elite, from the 1940s on, to promote commercial agriculture that would fulfil the functions assigned to it at a national level (by ensuring food supplies, providing employment and generating earnings in foreign exchange). As a result, policies on the use of water in agriculture favoured commercial agriculture, a tendency that led to the emergence of a dual system in the countryside with major differences between the two in provision of resources for production, income levels and productivity (Wionczek, 1982; Hewitt, 1978).

“Inward” modernization in El Bajío implied a change in favour of commercial crops in a region that historically had been known as the “Mexican grain belt”, a centre for the production of grains for human consumption. However, as sorghum took over from maize and production of alfalfa increased, the region took on the role of a supplier of meat and dairy products to Mexico's urban centres. The change brought prosperity to certain segments of the farming community but at the cost of a decline in the level of subterranean water supplies because of the intensification of agriculture and the drilling of wells as irrigation was introduced to what had been rain-fed land. Perales (1986:53) maintains that the spectacular increase in sorghum production was achieved by the switch from maize, an increase in yields, and the introduction of irrigation to previously fallow land; the use of subterranean water supplies is estimated to have expanded the agricultural frontier of central Guanajuato by 28,300 hectares.

The *second, or “outward-orientated” stage* of El Bajío's agricultural development, from 1982 to the present, has also had a marked impact on the aquifers. This phase of modernisation is part of the emergence of non-traditional farm exports (including fresh and processed fruit and vegetables), which in turn are a fundamental component of the global system of fruit and vegetable production.

El Bajío's incorporation into the global trade in fruit and vegetables was strengthened by a change in the nation's economic direction at the end of 1982, when a programme of structural adjustment and stabilisation was introduced in the quest for economic growth based on the world market and Mexico's comparative advantages. The trend was further reinforced in the 1990s when the North American Free Trade Agreement (NAFTA) with the United States and Canada consolidated a price structure that favoured export crops at the expense of those for domestic consumption. The new development strategy encouraged exports. Sharp reductions in the subsidies for credit, inputs and energy for the production of traditional crops combined with the lowering of trade barriers to effect a major change in the profitability of agriculture that favoured export products (Calva, 1996). In El Bajío, the new economic scenario led to growth in the area assigned to the production and exports of (frozen) fruit and vegetables, irrigated for the most part from underground sources, from 10,000 to 50,000 hectares between 1980 and 1998. During the same period, exports of produce -- principally broccoli, cauliflower, garlic and asparagus -- rose from \$10 million to \$170 million, according to the Commission for the Promotion of Foreign Trade (COFOCE). Currently, El Bajío is Mexico's main centre for the production of canned and frozen fruit and vegetables. See Marañón (2002a, 2002b y 2004), Marañón and Cebada (1998), and Echanove (1998) for a more detailed account of the development of export-led agriculture in El Bajío.

The frozen broccoli business is controlled by a small group of Mexican and foreign companies that have promoted major technological changes (the introduction of greenhouses; significant mechanisation of fieldwork, though not of preparation and selection in the fields and packing stations; integrated pest control; and the use of hybrid seed, herbicides and high-tech irrigation). The big companies have also moved to ensure supplies of the vegetables by the use of production contracts -- awarded mainly to medium-sized and large farmers -- that allow them to control crop management. The production and export of broccoli make intensive use of labour both in the fields and in the freezing plants. Even so, the region's agricultural markets describe themselves as "unstructured" since most of the jobs that are generated are low-paid and temporary, nor are there any trade unions to moderate between workers and bosses. The division of labour by gender is very marked in the freezing plants, where most of the workers are women, especially in the selection and preparation of the vegetables. However, employers are having to hire increasing numbers of men for these tasks because women are being lured away by better-paid jobs in a growing number of "maquiladora" industrial assembly plants in the region. This tendency appears to show that women are used for trimming the vegetables, not just because of their supposedly natural aptitude for such delicate tasks, but because there has been a relative abundance of them on the jobs market. The growth in the cultivation of fruit and vegetables continued on the basis of "green revolution" technology, with intensive use of natural resources, underground water among them, to the detriment of their capacity for renewal.

The technology, transferred by the international companies, is slanted towards large-scale producers and is unsuitable for an agrarian structure in which small-scale production predominates. Small farmers also face major barriers to making the switch -- high financial and transaction costs, and lack of entrepreneurial capacity among them. In the

absence of almost any support from the State, they are all but ruled out from becoming a key factor in non-traditional agro-exporting. Instead, the role of small farmers is to provide labour, land for sale, rent or -- exceptionally -- production contracts, all of which favour economies of scale. Politically, the dice are weighted against the small farmers: on one hand, major companies, on the other, producers of little significance. As a result, the risks and benefits of agro-exporting are far from evenly shared out, while the state does nothing to try to give the small farmers more bargaining muscle (Marañón 2004 y 2002a, 20002b).

The combined effect of these two stages of modernization has resulted in a sustained increase in the area under irrigation between 1960 and the present, mainly through a growth in the use of underground water and a significant change in the crop pattern. At the beginning of the 1960s, maize and wheat were the principal crops, followed by beans and alfalfa. Now, the relative importance of basic grains for human consumption has been sharply reduced, while the area sown to sorghum, alfalfa, fruit and vegetables has swiftly increased (See table).

On the issue of irrigation from underground sources, the 1966 Inventory of Surface and Underground Usages compiled by the Ministry for Hydraulic Resources (SRH 1966) showed that the 73,400 hectares watered from underground sources constituted 31.6 percent of the total area of irrigation. However, by the end of the 1990s, the figures had grown to 250,000 hectares and 60 percent respectively. That makes clear that aquifers were the basis of the growth in irrigation in Guanajuato by means of a sharp increase in the drilling of wells: the number drilled rose from 4,800 to 15,700 during the period under study while the area irrigated by surface water hardly grew at all (See table).

Table. Evolution of area irrigated and number of wells in Guanajuato
(areas in thousands of hectares)

	1966 ¹	1999 ²
Total irrigated area	232.5	416.7
Using surface water	159.1	166.7
Using underground water	73.4	250.0
Percentage of total using wells	31.6	60.0
Number of agricultural wells (thousands)	4.8	15.7

Source: Marañón and Wester (2000)

¹Ministry of Agriculture and Hydraulic Resources (SRH, 1966)

²Information on the area under irrigation was made available by the Ministry for Hydraulic Resources (SDAyR). The number of agricultural wells has been obtained from internal statistics made available by the Federal Electricity Commission (CFE), in Guanajuato.

These estimates reveal a trend: the area irrigated by aquifers grew by leaps and bounds in the second half of the 20th century in response to the needs of the two stages of agro-industrial modernisation. However, although irrigation uses 84 percent of all Guanajuato's underground water (CEAG, 1999), the importance of urban and industrial

use should not be underestimated. The intensive industrialisation and urbanisation of Guanajuato is having a marked impact on the levels of the underground deposits of specific aquifers, mainly in El Bajío.

In conclusion, we can say that efforts to contain the excessive exploitation of aquifers have not met their objectives. Attempts at regulation, mainly by means of bans, have been contradictory as well as being subordinated to the needs of agricultural growth in the “inward” stage of development. Policies aimed at promoting participation have met strict barriers in the limited way in which users are invited to take part, while those who are invited issue opinions that have nothing to do with the problems of underground water in their locality. Final decisions are always taken by the central institution charged with the management and planning of water in Mexico.

At the same time, it has to be pointed out that the attempts to promote participation have been undertaken during a political transition that De Grammont (2001) has described as being from corporative authoritarianism to democracy, a stage during which a client relationship has persisted in political relations between the state and farmers. This has made things difficult. There is resistance to the delegation of functions and related financial resources on the part of some segments of the federal government; at the same time, there is a marked tendency among those directly involved -- particularly the members of ejidos (the collective units of land ownership that emerged from the Mexican Revolution at the beginning of the last century) – to maintain a political relationship based on the delegation of consensus and social representation to popular leaders, known as *caudillos*, and to *caciques*, the regional political strongmen who are large landowners.

Sustainable management of the aquifers requires the establishment of a genuinely participative scheme for the regulation of water use. However, first it has to be understood that underground water is not an infinite resource, and that economic mechanisms must be established for its assignation. Moreover, those mechanisms have to take account not only of existing social inequality but also of the problems of profitability that are attributable to the reduction in trade barriers and NAFTA (Marañón y Fritscher, 2004).

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