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Beyond Basins The Political Delimitation Of Aquifers in Mexico¹

Mexico is the world's sixth largest extractor of groundwater,² which it uses to supply 39 percent of national needs except for hydroelectricity uses.³ Groundwater supplies 60.5 percent of the country's public water.⁴ In addition, it is important to point out that from 2005 to 2014, the volume of water licensed for self-supplied industrial use increased 57.9 percent.⁵ This is despite the fact that 146 groundwater protection orders are currently in effect covering almost 53 percent of national territory,⁶ effective entirely in 12 states and partially in 20 more.⁷ In addition, 105 of the 653 aquifers (16 percent) are recognized to be over-exploited.⁸

The lack of social awareness about the importance of groundwater is not pure happenstance; to a great extent, it is due to the naturalization of water's space through national management by basins, represented above all by surface bodies of waters, mainly rivers.⁹

This resource has been underestimated so much that some hydro-geologists, like UNAM Institute of Geography researcher Joel Carrillo, point out that Mexico's main authority in the matter, the National Water Commission (Conagua), forcibly defines aquifer boundaries according to the regionalization of basins in their administrative and institutional management of groundwater.¹⁰

Critical political geography is the framework for analyzing the supposedly natural delimitation of the space water occupies, whether a basin or an aquifer, as the ideological mechanism for naturalizing the social space; it is useful for hiding, justifying, and legitimizing the exercise of power and the accumulation of profits in capitalism.¹¹ Based on scientific evidence, then, we can confirm that institutions do have the political intention of making

the limits of basins and aquifers coincide, as well as of marginalizing hydro-geologists' positions and playing down the role of groundwater by managing basins.

The Debate on the Delimitation of Aquifers

In the 1960s, both academic and government studies about this water source considered that "water balance" was the ideal basis for defining the availability of water, given that this calculation is related to the ingress and egress of the water system. Aquifers were represented as a kind of pot with defined limits whose content was used up as water was extracted through wells and were filled when water was infiltrated. This vertical model of water movement underestimated the tri-dimensionality and definition of water flows.

Although the aim of national water management by basins is the comprehensive management of water resources, Perevochtchikova, Carrillo, and Godoy point out that in the Mexican case, water balance does not fulfill this objective, since it only takes into account three aspects: the calculations of river flows, the extraction of water from wells, and rainfall. Thus the water balance model does not include the natural physical characteristics of the territory, the environmental impacts derived from anthropogenic activity, or physical, biological, or chemical water processes.¹² That is, water balance is a reductionist vision of the complexity of hydro-geological phenomena.

In the second half of the last century, J. Tóth developed a methodology that included an inter-disciplinary analysis of the chemistry of water,¹³ kinds of soil, vegetation, and geological units. For Tóth, water is a dynamic system, a geological agent that changes over time, so much so that local and regional circulation is often unknown. In coun-

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tries like Japan, Canada, the United States, Australia, Holland, and Great Britain, scholars have used the theory of flow systems for water planning and government management in the short, medium, and long terms.

The Mexican government's official position has been that it is impossible to incorporate the flow system into comprehensive basin-based water management because it is "difficult" to apply it due to its implications in on-going conflicts. This seems to be a response to local interests, as though good and bad practices in comprehensive water management were not important even in the international debate. However, this becomes unavoidable when we are dealing with intensive water extraction.

The government position was clearly laid out in the presentation made by the engineer Rubén Chávez Guillén, the head of groundwater for the Conagua, at the first national Groundwater in Mexico colloquium held in November 2013 at the Mexican Water Technology Institute (IMTA) in Jiutepec, Morelos.¹⁴

At that colloquium, UNAM Geosciences Center researcher Marcos Adrián Ortega Guerrero, a groundwater specialist, asked Chávez Guillén why flow systems were not included among Conagua's challenges and why aquifer delimitations seem to correspond to eminently administrative interests. At the November 9 session, Chávez Guillén responded,

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[The circulation system] is implicitly being managed. . . . I would say that it's well within the scope of the academic projects that may have specific budgets to go a little beyond what's implied by the daily pressure of [resolving] certain problems related to water management that are important to us.

And about delimitation: this is a much debated issue. Actually, it's not that we're defending administration delimitation as "the good kind"; it's simply a delimitation forced on us by administrative, legal, and practical circumstances. On the one hand there are thousands and thousands of permits assigned, and handling all those units would be very complicated if we wanted to cover the entire aquifer.

Mr. Chávez Guillén has been in his post for more than 17 years. As manager, he has a clear idea of the differences between flow aquifers and aquifers that result from an administrative delimitation arising out of a practical decision, useful to institutions for issuing concessions, establishing protection orders, or resolving political tensions

due to concessions for groundwater being assigned to the states. In this regard, he continued,

Consider the case of Guanajuato or the Lerma River Basin: if we started from the head of the flow in the State of Mexico and follow it to its end in [Lake] Chapala, there would be problems with the State of Mexico, the Federal District, Querétaro, and Guanajuato regarding the most over-exploited aquifers, and we could practically be talking about a single aquifer because [all of them or sections of them] are connected in one way or another, perhaps through the mountainous massifs. If you want to manage a unit of that size putting [the issue] on the table to distribute the resources, the people from the State of Mexico, Guanajuato, and Querétaro will never be able to do it. So, you have to divide the problem up; that's where conventional delimitations come into play. . . . You use your judgment; [that is to say] we cut the aquifer into parts, with finite differences or elements, but each part is managed with its respective balance in a model taking into consideration the exchange of water toward adjacent areas, which is a macro-level problem.

Chávez Guillén's response is up front: the institutions use political-administrative guidelines; academics should take responsibility for scientific purposes. Elsewhere, the Conagua constantly states that the political division of basins and aquifers corresponds mainly to its knowledge of the natural logic of water and not political interests, given that it is precisely the recognition of these spaces as "natural" (both the aquifer and the basin) that legitimizes them as sustainable management units.

Researcher Marcos Adrián Ortega has stated that it falls to the institutions to deal with the vulnerability of groundwater because it is the institutions that do the assessments and it is "their studies" that are ideal for legislating about this natural resource.¹⁵ As decision-makers about groundwater, government institutions carry out

technical, legal, and economic studies, but the professional profile of those in charge is not precisely scientific, but rather that of technicians with political/management training.¹⁶

Now, as was argued in the justification of the regionalization of aquifers, this issue as explained by public officials seems rather colloquial. Nevertheless, when put at the center of the debate, as demanded by political geography, certain doubts and conflicts begin to arise. Among them are: Who is allowed to extract water based on water balance? Who is restricted from doing so? Who uses surface water and who uses groundwater? It then becomes clear that discretionary access to aquifers is far from being merely an inoperative matter in the paradigm of flow systems; and the current institutional design corresponds to neoliberal business interests, and not only local, but international interests, given that water is an input in all productive activities.

The following statement by the engineer from Conagua allows us to infer some of the answers to those questions, when he alludes to the challenge represented by water and energy as very ambitious:

Now that energy reform is fashionable, there's a very strong impetus that means a greater demand for water. . . . Today, there's a very ambitious program; the Ministry of Energy, the Federal Commission, *Petróleos Mexicanos* [Mexico's state oil company] are all part of this, and, regardless of the political aspects . . . the technical aspects have to be studied because it seems there's already a government decision to foster geothermal exploitation, in general for energy. [Shale gas] . . . is another [resource] that poses a new challenge. . . . There's a big polemic about the effects it might have. Some countries or sectors are against it because they think [it is] very dangerous and in some countries it's even banned, although in others it's moving ahead. There are a series of myths . . . but undoubtedly it has some risks, important risks: it requires

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Discretionary access to aquifers, further not only local but international business interests.

large amounts of fresh water . . . ; there is a certain amount of residual water; there's a risk of contaminating aquifers due to accidents; there's contamination of the air, contamination of the soil. There is, or there could be; it all depends on how it's handled or how the deposit is exploited.

In this statement, several power relations come into question. The first involves institutional transformations carried out through neoliberal structural reforms. Another reveals the power differences among the institutions responsible for water and for energy. While in other countries fracking to extract shale gas is banned, in Mexico, the process is accepted, and even if technicians may know that multiple dangers are involved, they simply obey government—read, presidential—decisions, which prevail over the interests of society. That is, a clear relationship exists between the official position on water management and the practice of fracking in Mexico.

It could be said that making groundwater politically invisible serves institutions for settling tensions about the intensive use of water to favor big capital investments. Given the possibility of conflicts over the use of surface water between towns and companies, the latter simply extract groundwater as they please. The same can be seen in the case of mining, a central activity for foreign investments under the aegis of the North American Free Trade Agreement (NAFTA), mainly from Canada.

Final Comments

The invisibility of the dynamics of water in capitalist production makes it possible to continually increase the extraction and hoarding of groundwater by certain national and international economically powerful groups.

The framework for water management by basins deliberately leaves reality out of the analysis, and, with that, the solution of current problems. The political geographic frame of reference is important for analyzing the use of power in this matter of underground sources be-

cause it also allows us to understand that the current design of institutional management is a source of conflicts rather than solutions. ■■■

Notes

- 1 The opinions expressed in this article are the responsibility of the author and do not necessarily reflect the official position of her organization.
- 2 Michael N. Fienen and Muhammad Arshad, "The International Scale of the Groundwater Issue," in Anthony J. Jakeman, Olivier Barreteau, Randall J. Hunt, Jean-Daniel Rinaudo, and Andrew Ross, eds., *Integrated Groundwater Management* (Switzerland: Springer, 2016), pp. 21-48.
- 3 Conagua, *Numeragua* (Mexico City: Semarnat, 2016).
- 4 Public water is that transported through potable water networks to domestic consumers as well as industries and services.
- 5 Conagua, *Estadísticas del agua en México* (Mexico City: Semarnat, 2015).
- 6 A protection order is an administrative instrument that establishes conditions or restrictions on exploitation or use of water within national boundaries in the public interest; it can also be used for issuing new licenses. There are three kinds of protected areas: places where extraction can no longer be increased without running the risk of devastating or depleting aquifers; where extraction is only permitted for domestic use; and where limited extraction is permitted for domestic, industrial, irrigation, or other uses. See Conagua, "Vedas, reservas y reglamentos de aguas nacionales superficiales," May 31, 2014, <https://www.gob.mx/conagua/documentos/vedas-reservas-y-reglamentos-de-aguas-nacionales-superficiales>, accessed January 31, 2018; and Conagua, *Vedas de agua subterránea en México* (Mexico City: Semarnat, 2010).
- 7 Conagua, *Vedas de agua subterránea*... op. cit.
- 8 Conagua, *Estadísticas del agua*... op. cit.
- 9 Mónica Olvera Molina, "El espacio hidropolítico: desnaturalización de la cuenca. El caso mexicano, 1930-2010," doctoral thesis, UNAM, Mexico City, 2018.
- 10 M. Perevochtchikova, J. J. Carrillo R., and A. E. Godoy A., "Gestión integral del agua en la Cuenca de México: ¿Coincide la cuenca superficial con la subterránea?" *Memorias del V Congreso Internacional y XI Nacional de Ciencias Ambientales* (Morelos: Universidad Autónoma del Estado de Morelos, 2006).
- 11 Mónica Olvera M., "Desnaturalizando la cuenca en México: notas sobre el espacio hidropolítico," *Agua y territorio* no. 7 (2016), pp. 11-21.
- 12 Perevochtchikova, Carrillo, and Godoy, op. cit.
- 13 J. Tóth, "Mapping and interpretation of field phenomena for groundwater reconnaissance in a prairie environment," *Hydrological Sciences Journal* vol. 11, no. 2 (1966), pp. 20-68.
- 14 José Joel Carrillo Rivera, "Por una gestión integral del agua subterránea (GIAS): una propuesta," paper presented at the "Agua subterránea en México" national colloquium, published in February 2014, https://agua.org.mx/wp-content/uploads/2014/04/ColoquioNacional_Agua_Subterranea_en_Mexico.pdf, accessed January 30, 2018.
- 15 G. M. Ortega, "Situación del agua subterránea en México: una experiencia científico-legislativa y sus implicaciones," *Punto de acuerdo* (2011), pp. 1-17, https://agua.org.mx/wp-content/uploads/2012/07/situacion_del_agua_subterranea_en_mexico-una_experiencia_cientifico-legislativa.pdf.
- 16 J. Arreguin, *Aportes a la historia de la geohidrología en México, 1890-1995* (Mexico City: CIESAS/Asociación Geohidrológica Mexicana, A.C., 1998).