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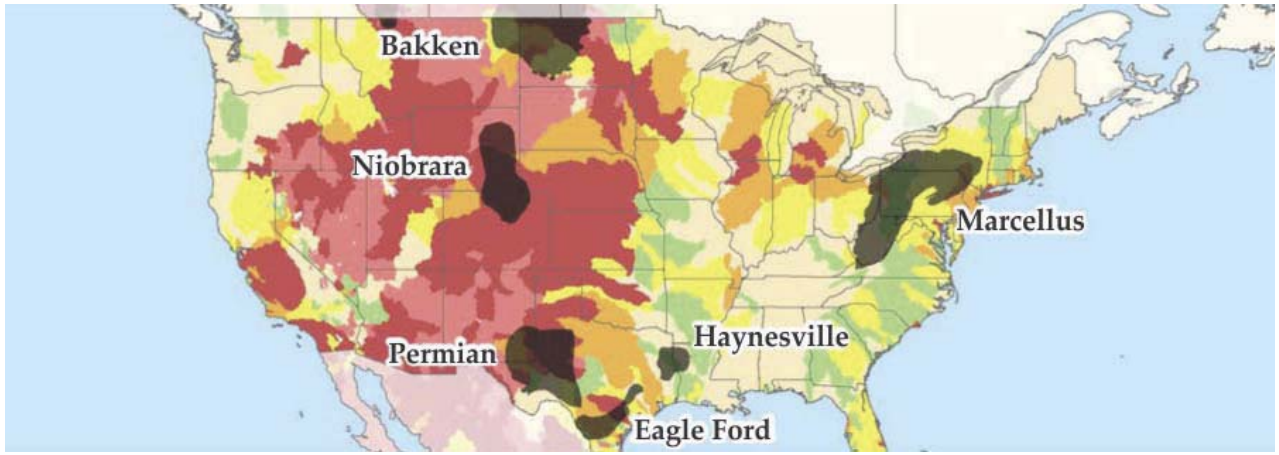
Fracking operations grow thirstier with time

From 2011 to 2016, the amount of water needed to extract a joule of energy more than doubled for some US shale formations.

Steven K. Blau

Even though the price of oil has been rising for the past couple of years, in the US it is still less than half of its maximum a decade ago. Some of the price relief is generally attributed to the production of oil and natural gas from fracking. In that process, water, sand, and chemicals injected into shale cause the porous material to fracture and provide pathways that enable fossil fuels to be extracted. (See the articles in *Physics Today* by Donald Turcotte, Eldridge Moores, and John Rundle, August 2014, page 34 and by Michael Marder, Tadeusz Patzek, and Scott Tinker, July 2016, page 46.)



Map of US water stress (red, more; green, less) and shale formations. Credit: A. J. Kondash, N. E. Lauer, and A. Vengosh

Fracking uses on the order of 10 000 cubic meters of water—a few Olympic-sized swimming pools—per well. Now a team of

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environmental scientists at Duke University, led by Avner Vengosh, has analyzed water use during the period 2011–16 at the six major US shale formations shown on the map. The researchers found that water injected per well—and the wastewater produced by fracking—increased across the board, sometimes dramatically. For example, water use in the Permian formation more than octupled during the study period. Moreover, as the map shows, many of the major shale regions are in portions of the US (marked in red or pink) where water is already a precious resource.

Much of the increase came about because the fracking wells grew in size and produced more energy. But water use per joule of energy extracted also increased, more than doubling for oil production at Eagle Ford and for both gas and oil production in the Permian region.

The Duke researchers project that water use in gas-producing shales may multiply 50-fold by the year 2030. Quantitative projections aside, they argue that the US experience of increasing water consumption for fracking may serve as guidance for other countries—notably China—that are embarking on fracking programs.

(A. J. Kondash, N. E. Lauer, A. Vengosh, *Sci. Adv.* 4, eaar5982, 2018.)

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