

Variability of Oil and Gas Well Productivities for Continuous (Unconventional) Petroleum Accumulations

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Sheet 2 of 3

Comparing Clouds

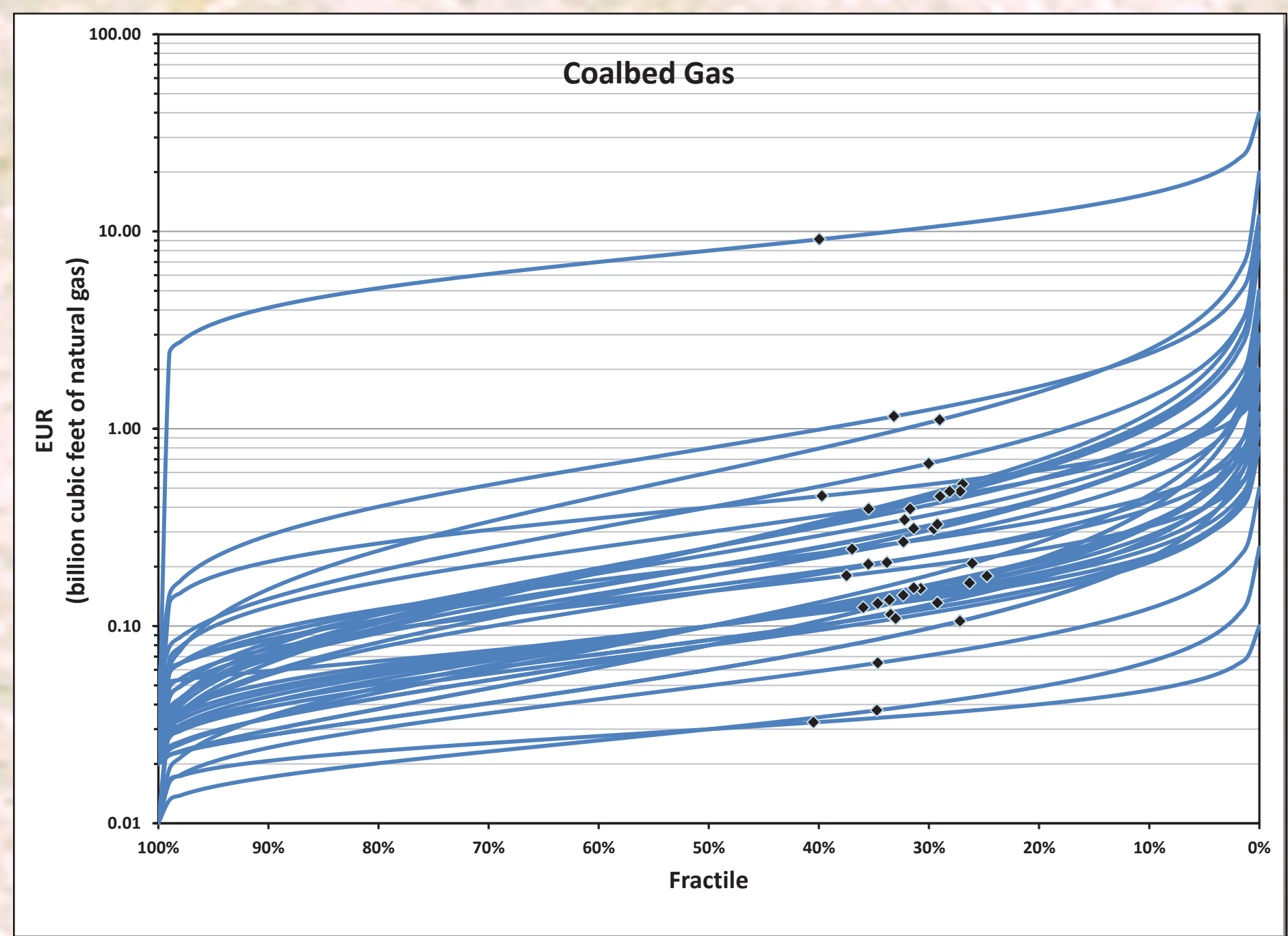


Figure 8.

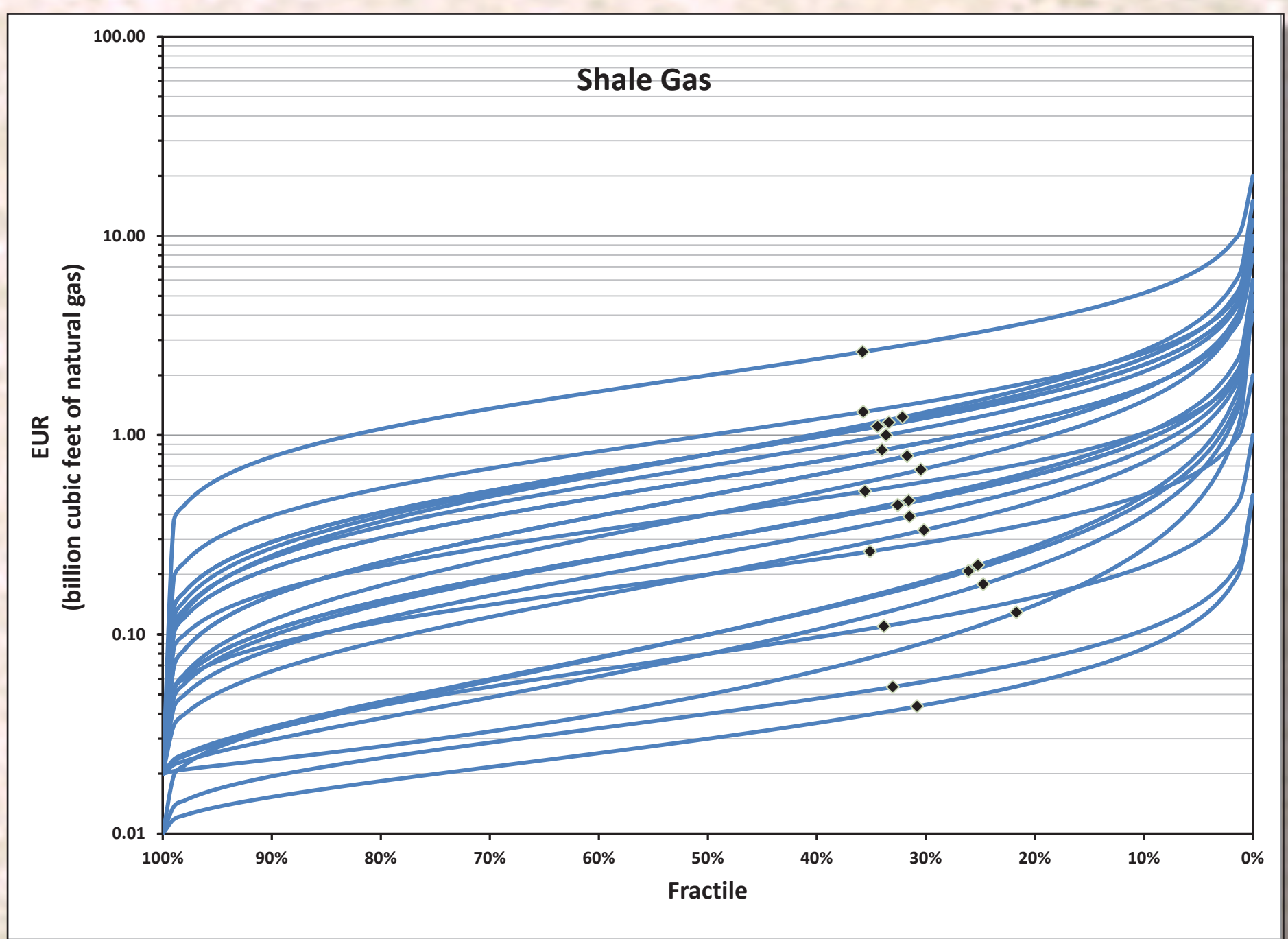


Figure 9.

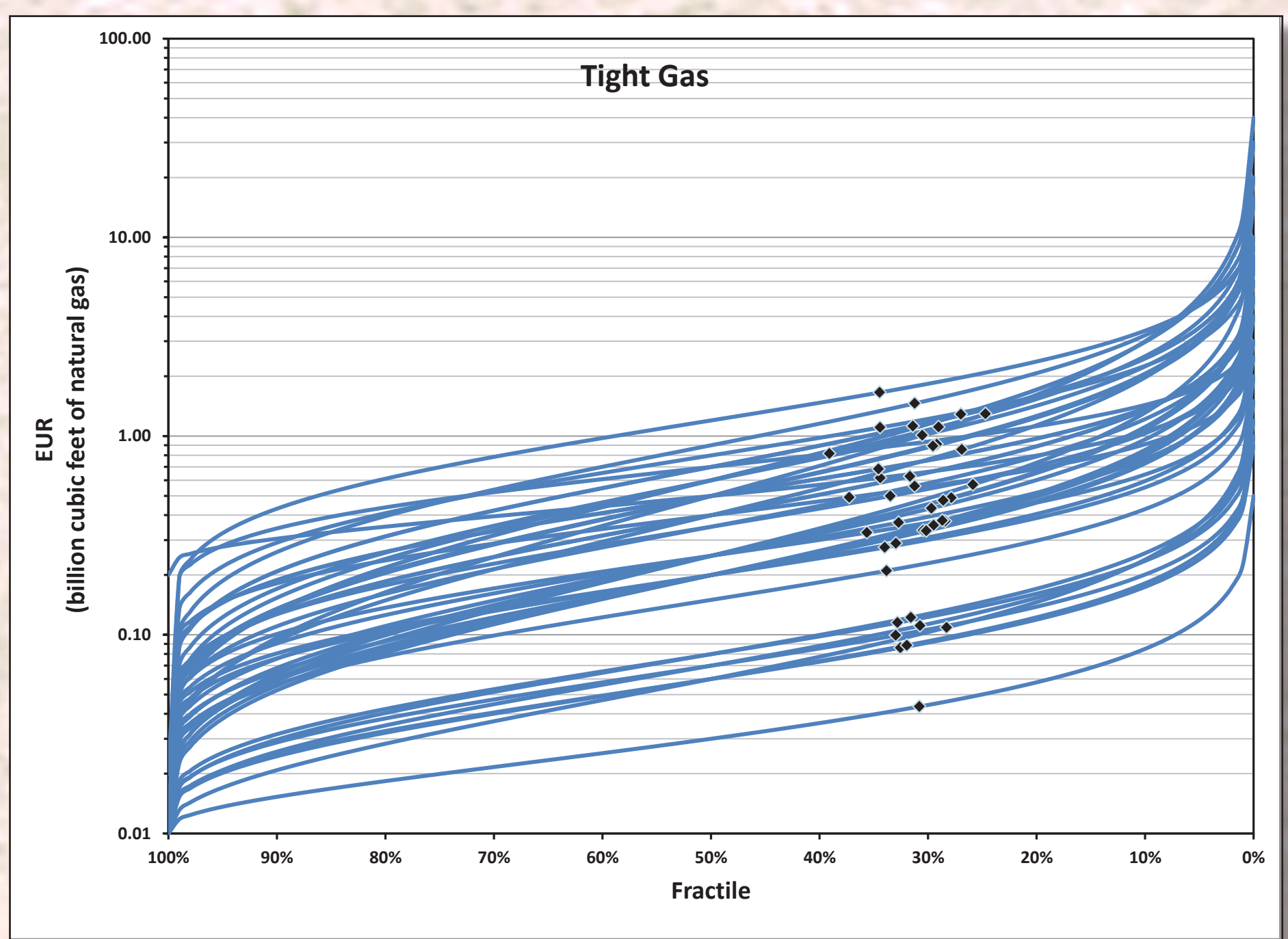


Figure 10.

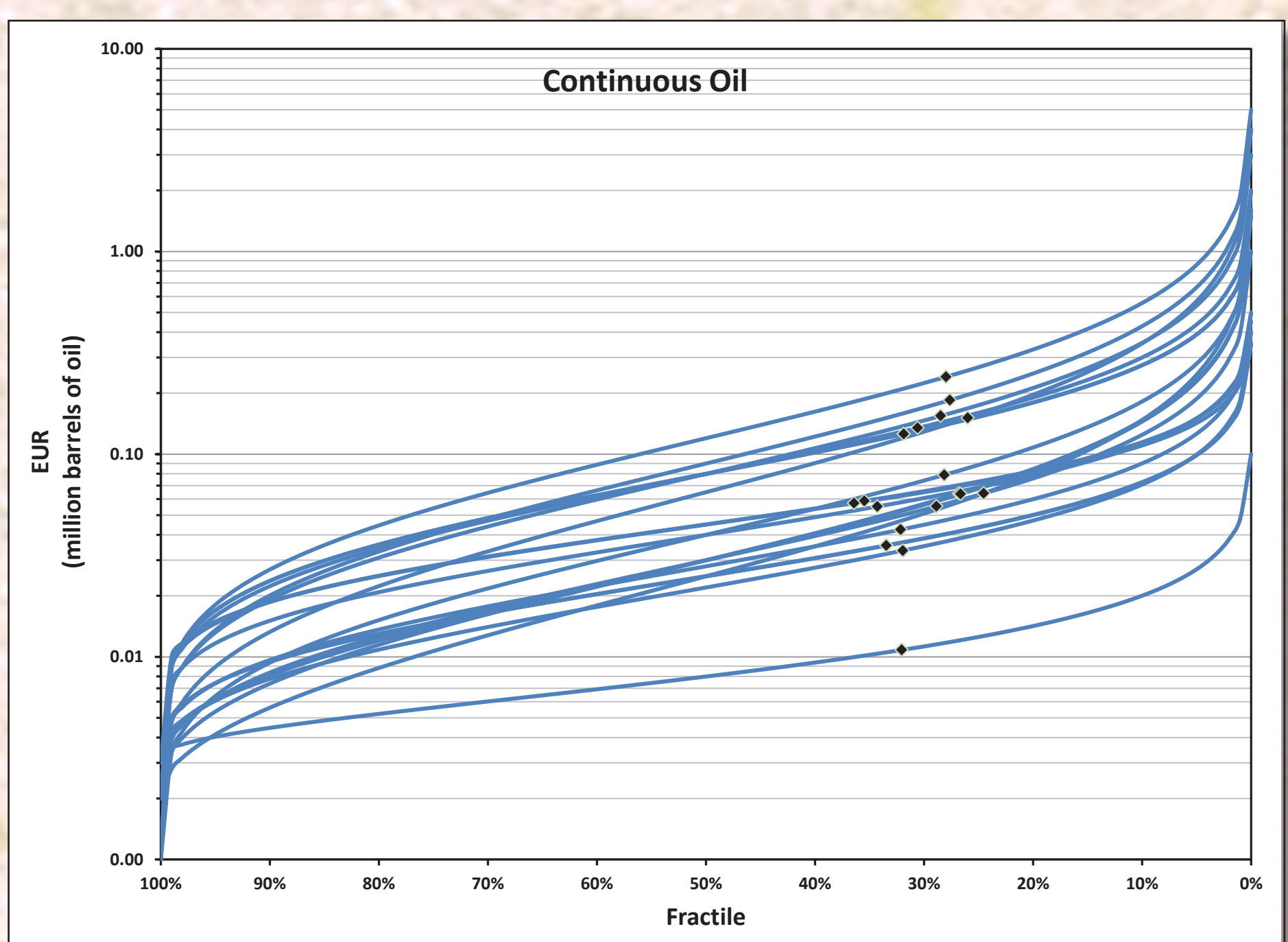


Figure 11.

Figures 9–11. The USGS AUs were divided into four categories based on reservoir type and major commodity (oil or gas): coalbed gas, shale gas, other low-permeability gas AUs (referred to as tight gas), and continuous oil AUs. These graphs show the variation among the four groups. Note the large variations between the highest EUR distributions and the lowest, and between the highest means and the lowest. Note also the considerable overlap among the clouds. Especially note the very high outlier distribution for coalbed gas (the Fruitland Fairway Coalbed Gas AU in the San Juan Basin). The black diamonds are the means for each distribution. Data for these graphs are given in U.S. Geological Survey Oil and Gas Assessment Team (2012).

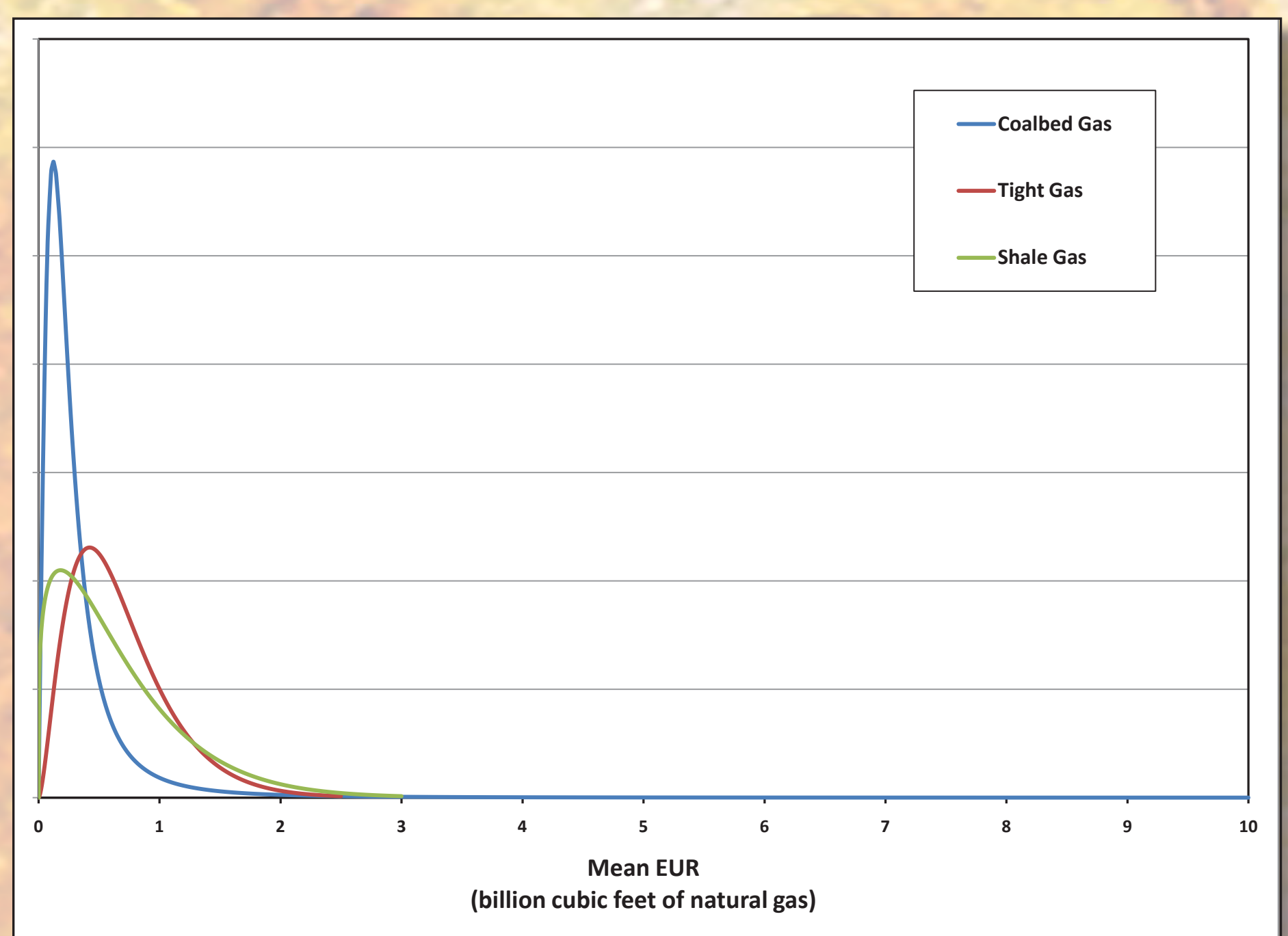


Figure 12.

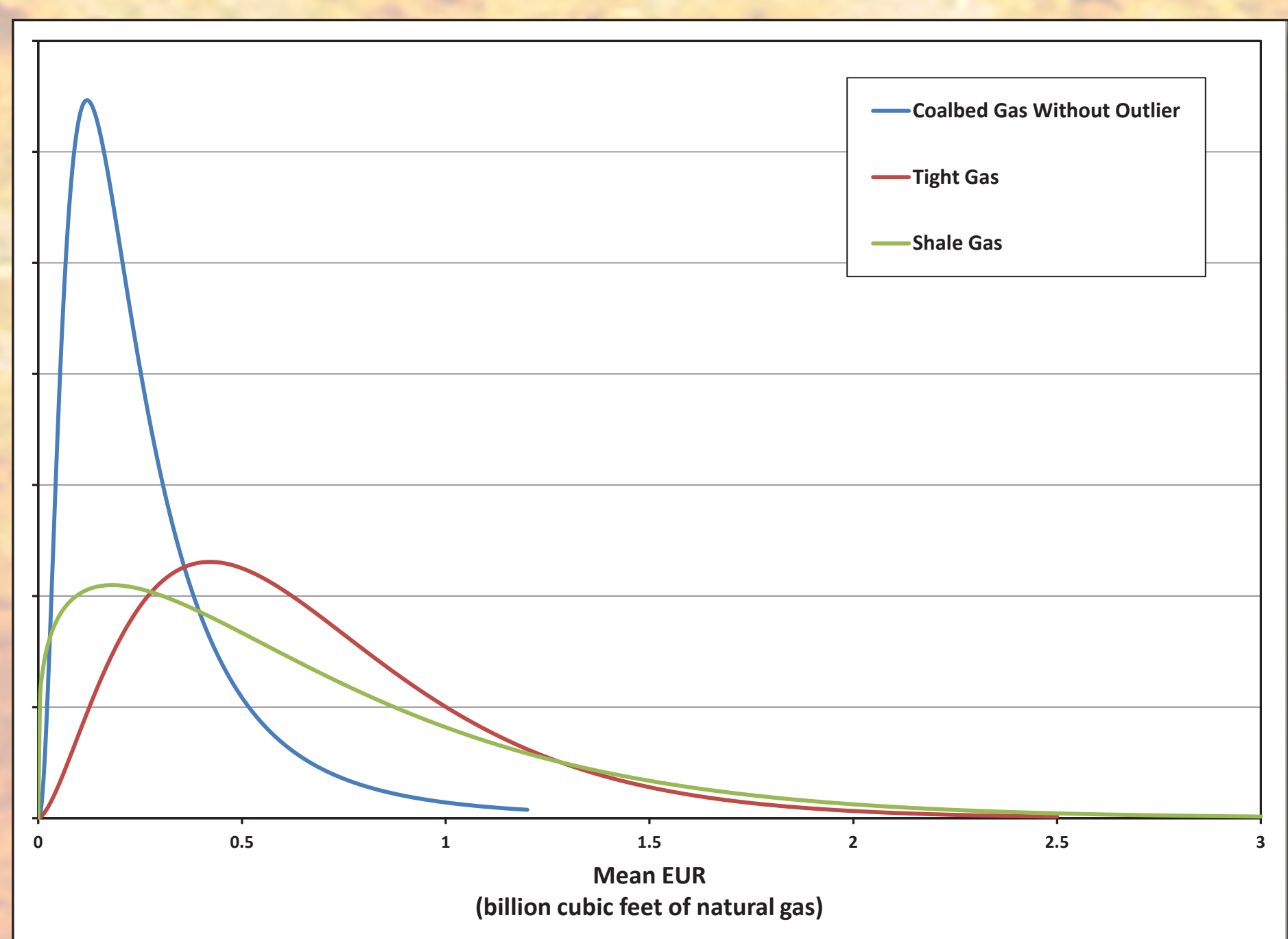


Figure 13.

Figures 12–13. A good way to compare the three clouds for gas resources (coalbed gas, tight gas, and shale gas) is by comparing the distributions of their means. For each set, a best-fit distribution was calculated for the mean EURs. These three distributions are plotted together in figure 12. Note the close similarity between the distribution of means for tight gas and for shale gas, and how coalbed gas generally has much lower means (but a high tail). Eliminating the coalbed-gas outlier changes this little. Figure 13 shows the same distributions for tight gas means and shale gas means, along with a recalculated distribution of coalbed gas means (without the outlier). The recalculated distribution of coalbed gas means is almost the same as the previous one, but without the extreme value. Because all the means from figures 8 through 10 are now less than 3, figure 13 has been rescaled.

Drilling Down Into Assessment Unit Variability Top-Level Variability

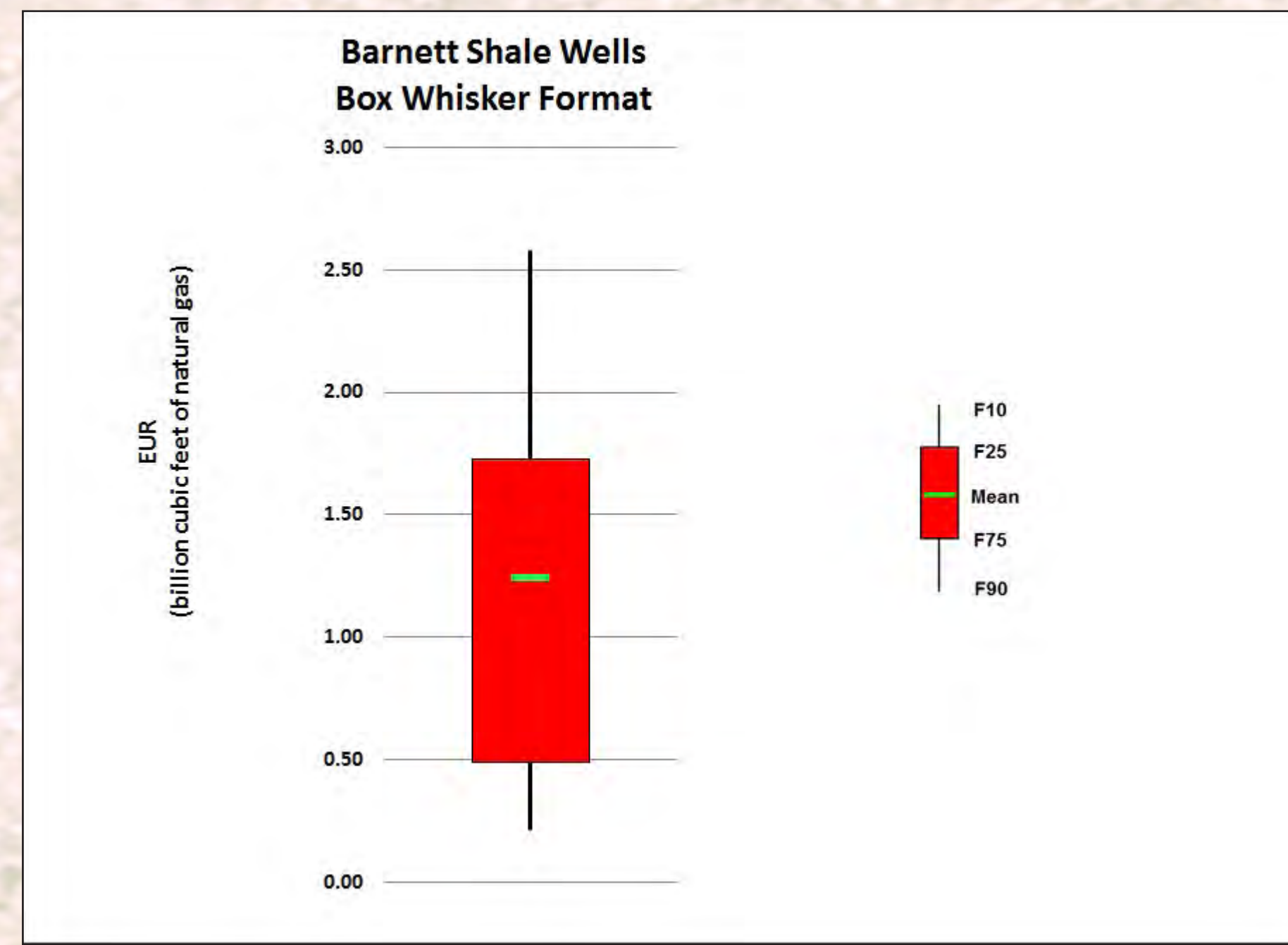


Figure 14. This box-whisker plot presents the EURs for all Barnett Shale wells drilled through October of 2009.

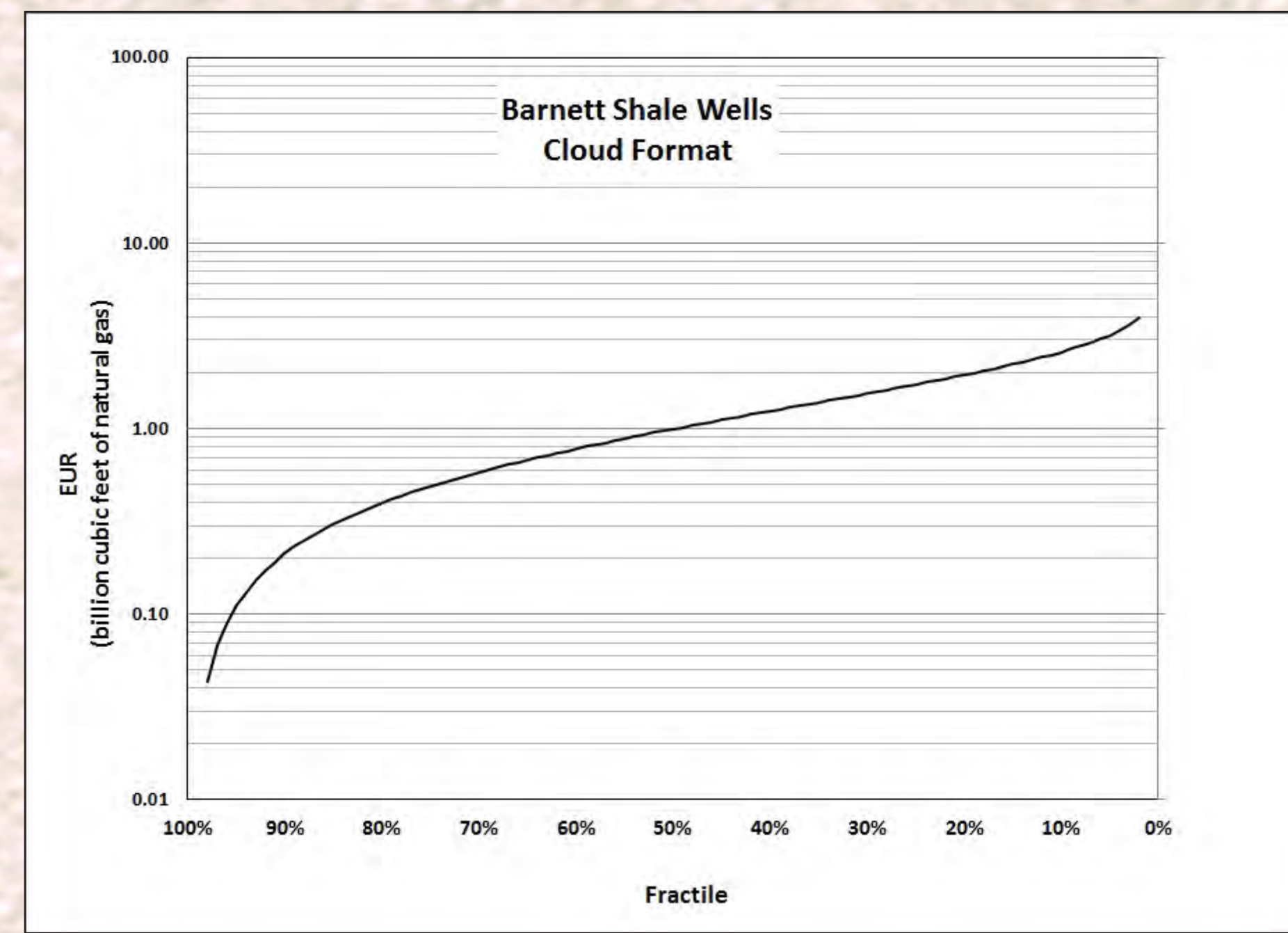


Figure 15. This cloud plot presents the EURs for all Barnett Shale wells drilled through October of 2009 (the same data used for figure 14). The fractiles indicate what percent of the wells have an EUR of at least the indicated amount. Note that the range of EURs is approximately two orders of magnitude.

2nd Order Variability

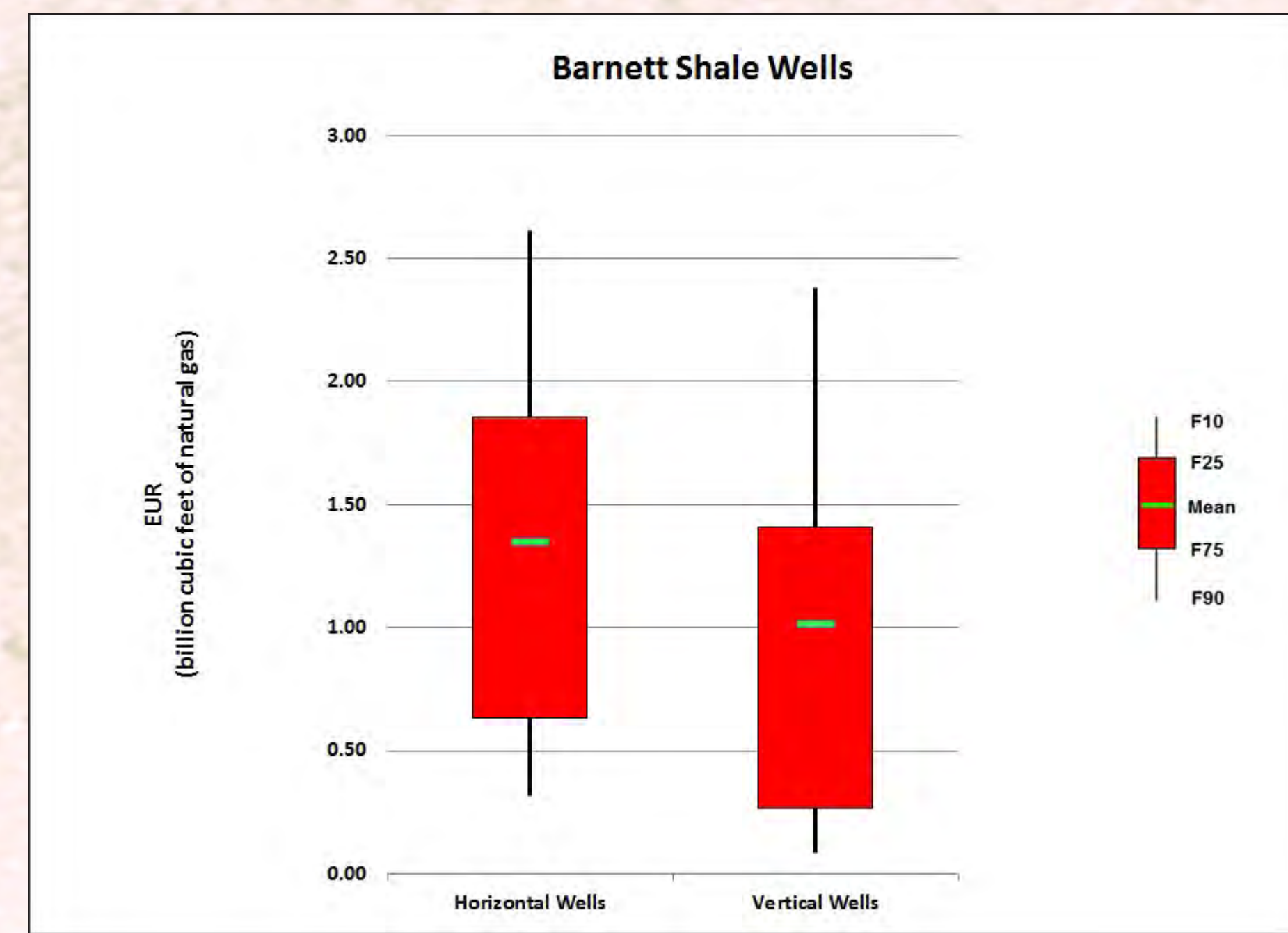


Figure 16. A comparison of EUR between horizontal and vertical Barnett Shale wells.

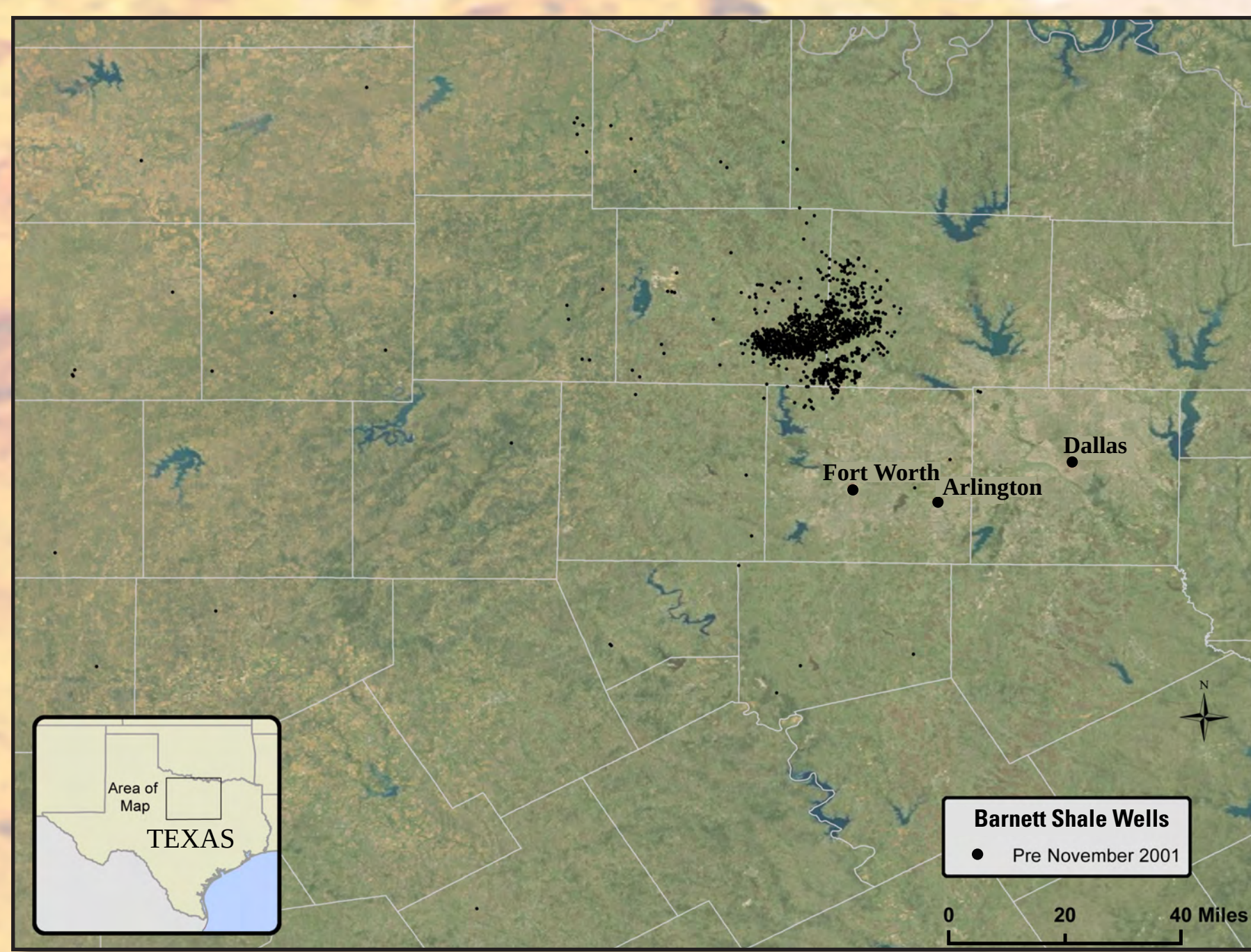


Figure 17. All Barnett Shale wells drilled through November 2001

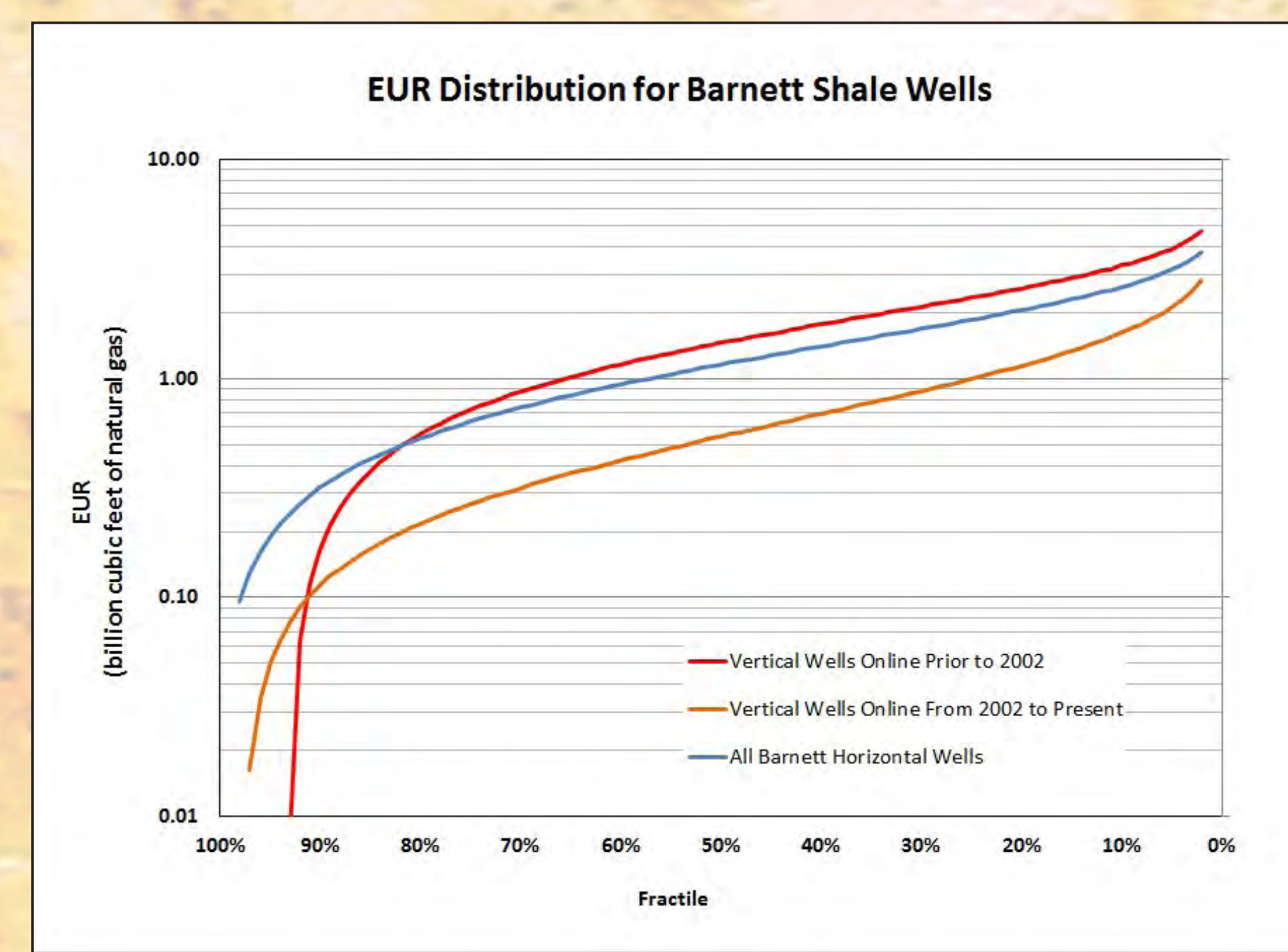


Figure 18. A comparison of Barnett Shale vertical wells drilled before and after January, 2002, to all horizontal wells. Of note is the major change in distribution of EUR when a majority of vertical wells were drilled outside of the original sweet spot.

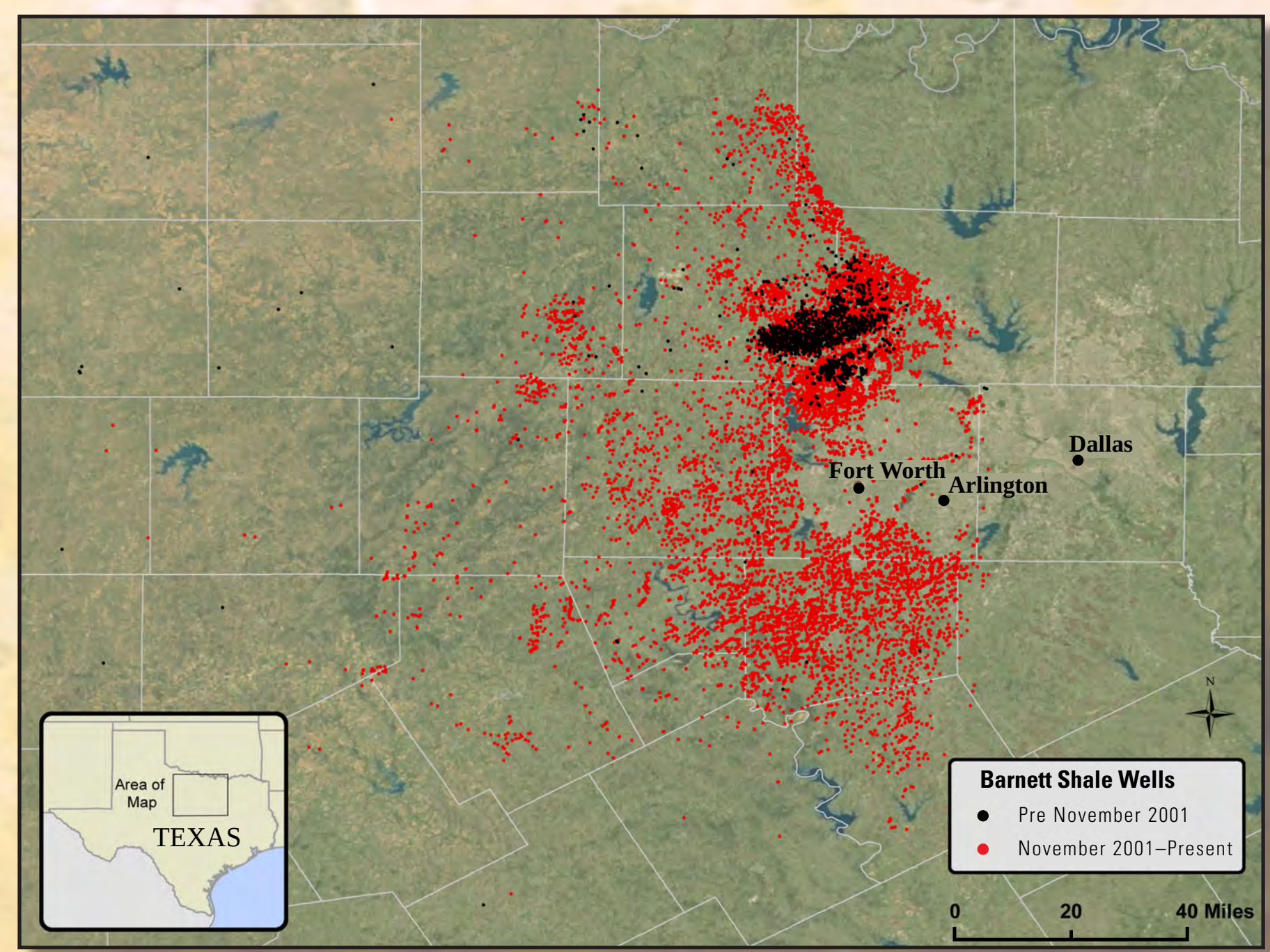


Figure 19. All Barnett Shale wells drilled through November 2009.