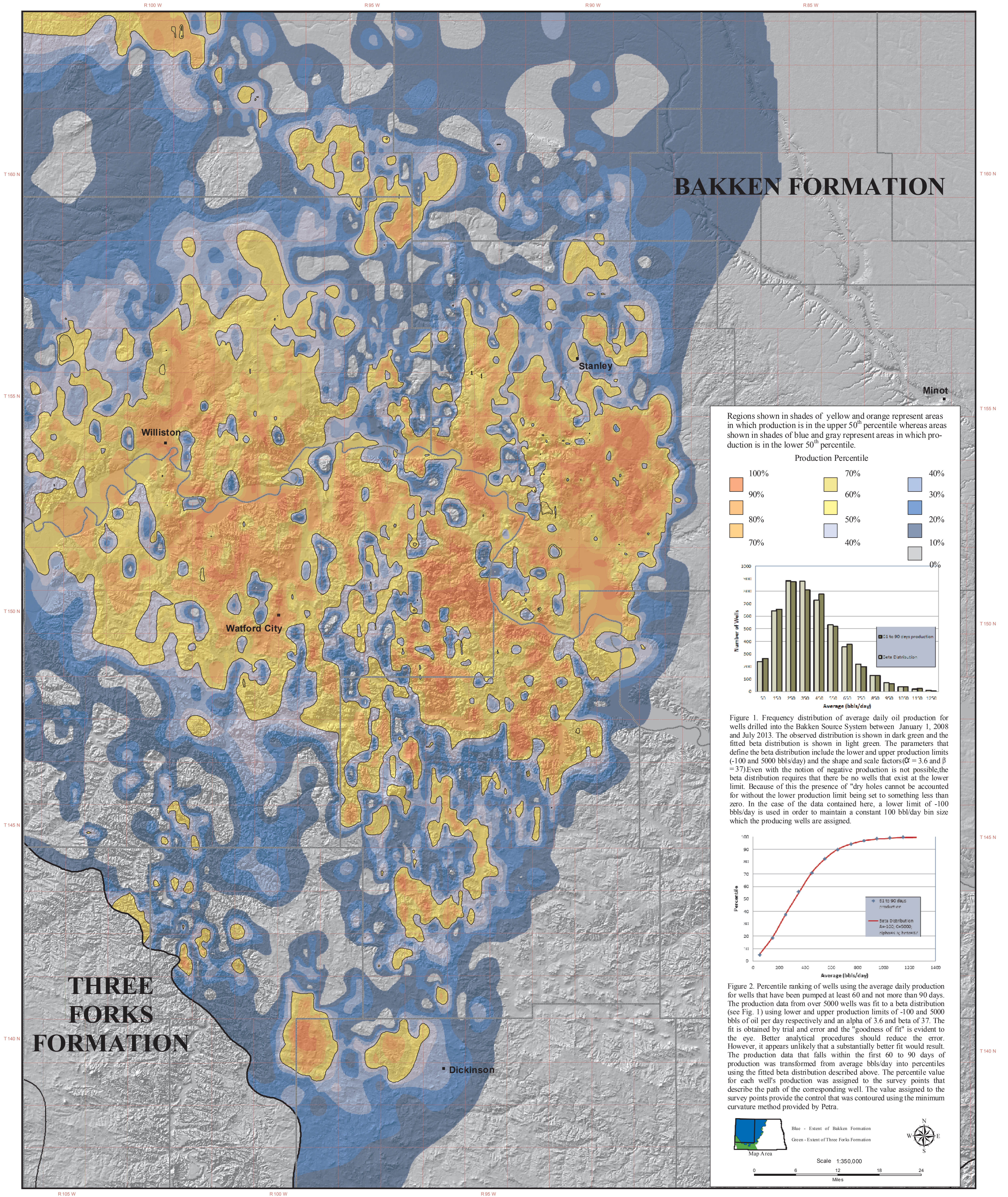
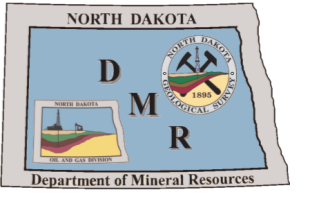


# Bakken - Three Forks Percentile Ranked Production (60-90 Days)

S. H. Nordeng

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## BAKKEN FORMATION

Regions shown in shades of yellow and orange represent areas in which production is in the upper 50<sup>th</sup> percentile whereas areas shown in shades of blue and gray represent areas in which production is in the lower 50<sup>th</sup> percentile.

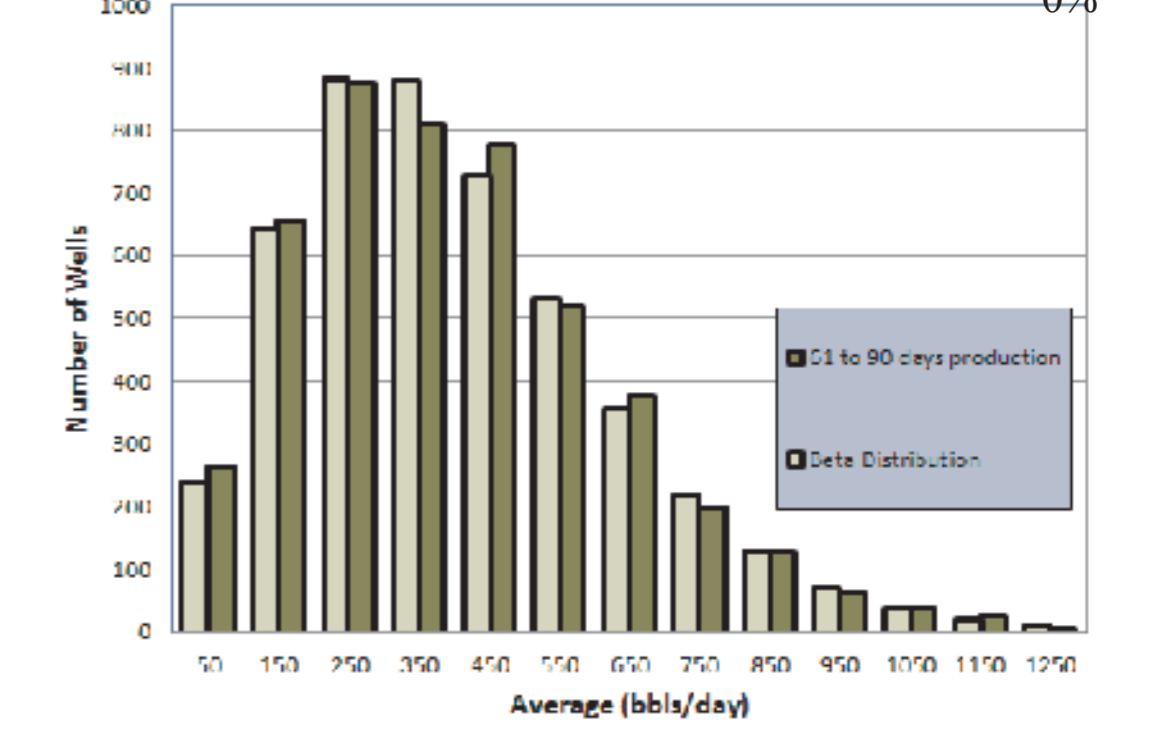
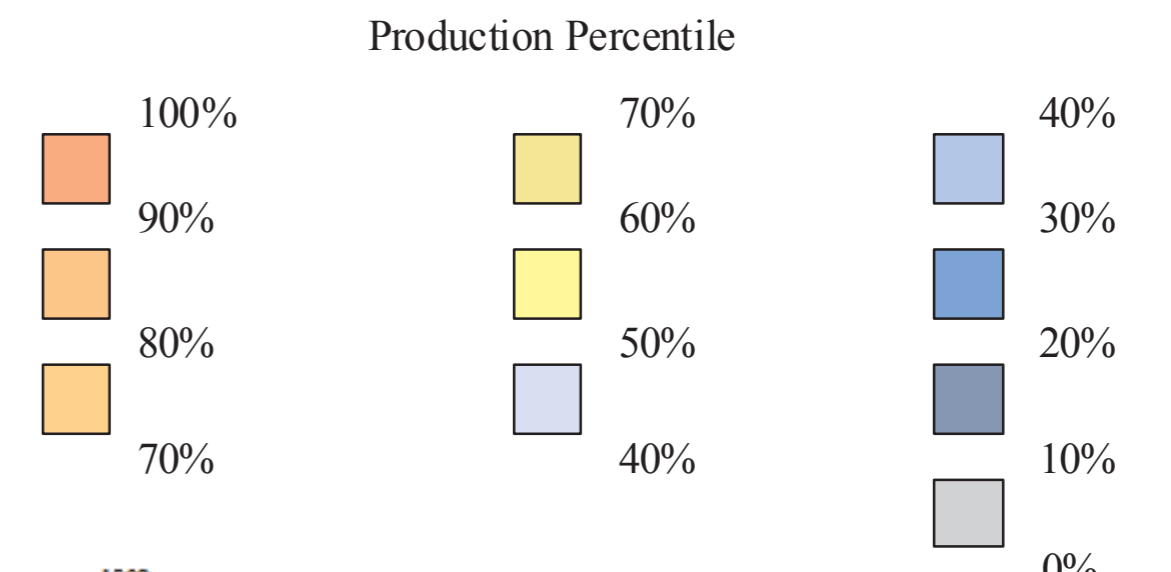


Figure 1. Frequency distribution of average daily oil production for wells drilled into the Bakken Source System between January 1, 2008 and July 2013. The observed distribution is shown in dark green and the fitted beta distribution is shown in light green. The parameters that define the beta distribution include the lower and upper production limits (-100 and 5000 bbls/day) and the shape and scale factors ( $\alpha = 3.6$  and  $\beta = 37$ ). Even with the notion of negative production is not possible, the beta distribution requires that there be no wells that exist at the lower limit. Because of this the presence of "dry holes" cannot be accounted for without the lower production limit being set to something less than zero. In the case of the data contained here, a lower limit of -100 bbls/day is used in order to maintain a constant 100 bbl/day bin size which the producing wells are assigned.

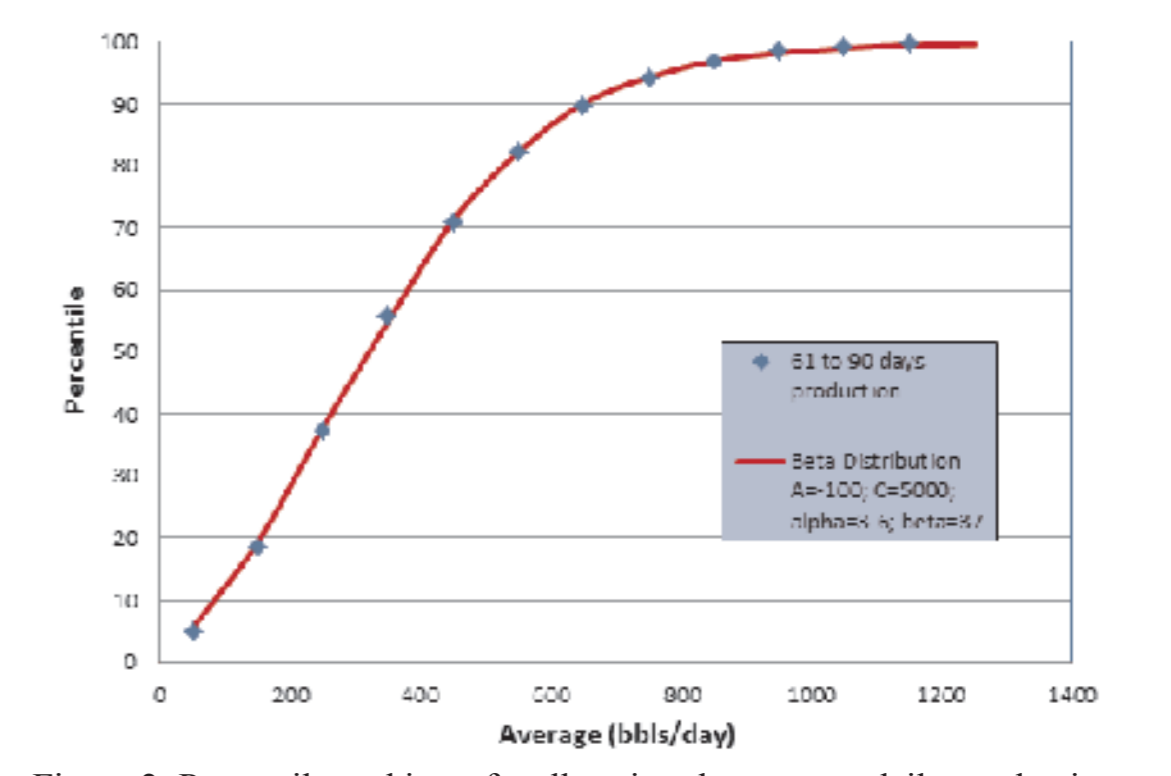


Figure 2. Percentile ranking of wells using the average daily production for wells that have been pumped at least 60 and not more than 90 days. The production data from over 5000 wells was fit to a beta distribution (see Fig. 1) using lower and upper production limits of -100 and 5000 bbls of oil per day respectively and an alpha of 3.6 and beta of 37. The fit is obtained by trial and error and the "goodness of fit" is evident to the eye. Better analytical procedures should reduce the error. However, it appears unlikely that a substantially better fit would result. The production data that falls within the first 60 to 90 days of production was transformed from average bbls/day into percentiles using the fitted beta distribution described above. The percentile value for each well's production was assigned to the survey points that describe the path of the corresponding well. The value assigned to the survey points provide the control that was contoured using the minimum curvature method provided by Petra.

