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Prospect Generation with Fuzzy Logic and Neural Networks, Northeast Lea Example

A dataset consisting of 520 Lower Brushy Canyon wells located on a 64,000 40-ac-grid map was used to generate a predicted oil rate map for the Delaware Basin. Fuzzy ranking was used to prioritize attributes generated from regional gravity, structure, aeromagnetic and thickness maps for use as inputs to a neural network that was trained to correlate the input attributes with the first years oil production. The neural network training dataset consisted of 520 wells with production varying from less than 500 bbl/mo to 6500 bbl/mo. Thus, a regional map was available to compare to local information available on a well scale.

It is difficult to estimate water saturation in the thin-bedded turbidites that make up the Delaware formation. Since 1990 many operators have based their completion decisions on sidewall core porosity and oil saturation measurements. A neural network was developed to correlate open-hole logs with bulk volume oil as measured in samples from 200 ft of whole core taken from the Lower Brushy Canyon interval in a well 30-miles from NE Lea. The trained neural network was used to generate pseudo-BVO logs in the NE Lea wells.

Pseudo-BVO logs were generated for 34 wells producing from the LBC throughout the region. The statistics of the BVO logs were correlated with the respective first years oil producing rate. The correlation was used to forecast the first years oil rate from the NE Lea wells. A 65% agreement was observed between the local and regional estimates.