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Gas-to-oil ratios in U.S. primary oil-producing regions

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Gas-to-oil ratios in U.S. primary oil-producing regions

This *Drilling Productivity Report* (DPR) supplement describes the gas-to-oil ratio (GOR), explains its principal use in differentiating oil from natural gas wells, and examines how GORs have changed over the years in U.S. primary oil-producing DPR regions.

GOR is the amount of natural gas produced with some amount of crude oil or hydrocarbon liquid, created by dividing the natural gas volume by the oil volume. This ratio can range from zero or near zero (little or no natural gas produced with oil) to infinity (no hydrocarbon liquids or oil of any kind produced with the natural gas). This ratio is used as an indicator of how *wet* or *dry* a particular rock formation is.

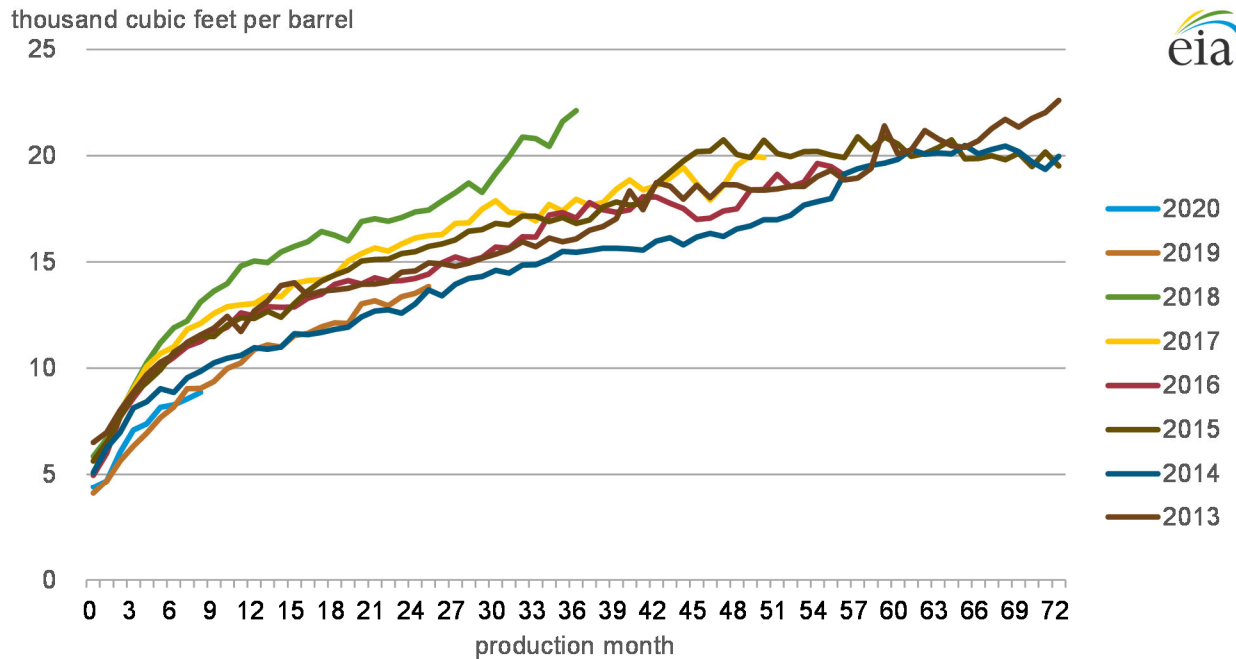
We use a GOR of 6,000 cubic feet (cf) of natural gas to 1 barrel (b) of oil (cf/b) for each year's total well production as a threshold to classify whether a well is an oil well or natural gas well. If the GOR for a year of production is equal to or less than 6,000 cf/b, then we define the well as an oil well. Any natural gas produced from this well we consider *associated gas*. If the GOR is greater than 6,000 cf/b, then we define the well as a natural gas well. We update the [U.S. Oil and Natural Gas Wells by Production Rate](#) report, which lists all U.S. wells by production.

Another important characteristic of production from all oil and natural gas wells, including those wells within the DPR regions, is the decline rate. Most new wells within DPR regions are horizontal wells, drilled and completed by hydraulic fracturing in low permeability (tight) geologic formations. These tight formations consistently produce early high decline rates determined by underlying rock properties and the reservoir dynamics of artificial pathways created by hydraulic fracturing. Over time, these high decline rates moderate until they reach lower and more stable decline rates that define the remainder of their expected production profiles. We have published examples of these crude oil and natural gas decline rates for DPR regions in both [oil](#) and [natural gas](#) *Today in Energy* articles.

Figures 1–5 illustrate how vintage GOR values can change over time. Each curve represents the average GOR of all wells starting production in a given year from U.S. primary oil producing regions—the Anadarko, Bakken, Eagle Ford, Niobrara, and Permian regions. Across these regions, the GOR ratio commonly increases over time, so we reclassify wells from oil wells to natural gas wells in our annual wells report to reflect this shift. We estimate that we reclassified more than 9,000 wells from oil wells to natural gas wells as a result of higher natural gas production in 2020 in these U.S. primary oil-producing regions.

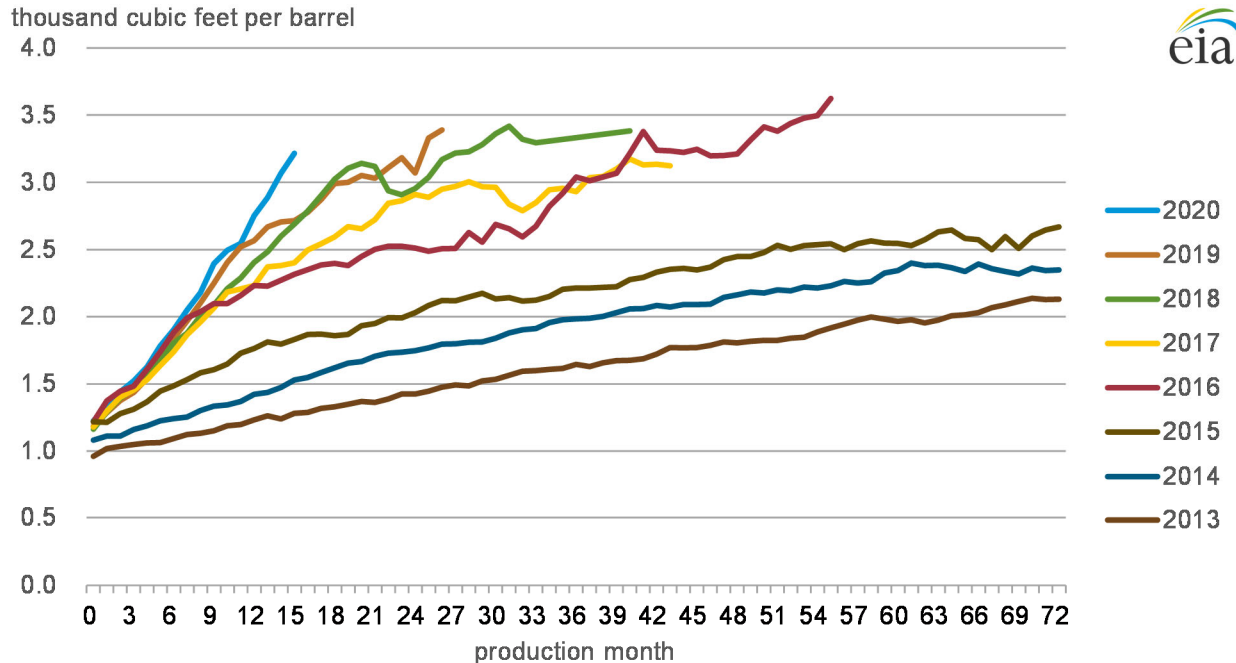
Appendix A shows the most recent oil decline curves in all DPR regions. Appendix B shows the most recent natural gas decline curves in the same regions.

Figure 1. Vintage gas-to-oil ratio from all Anadarko region wells



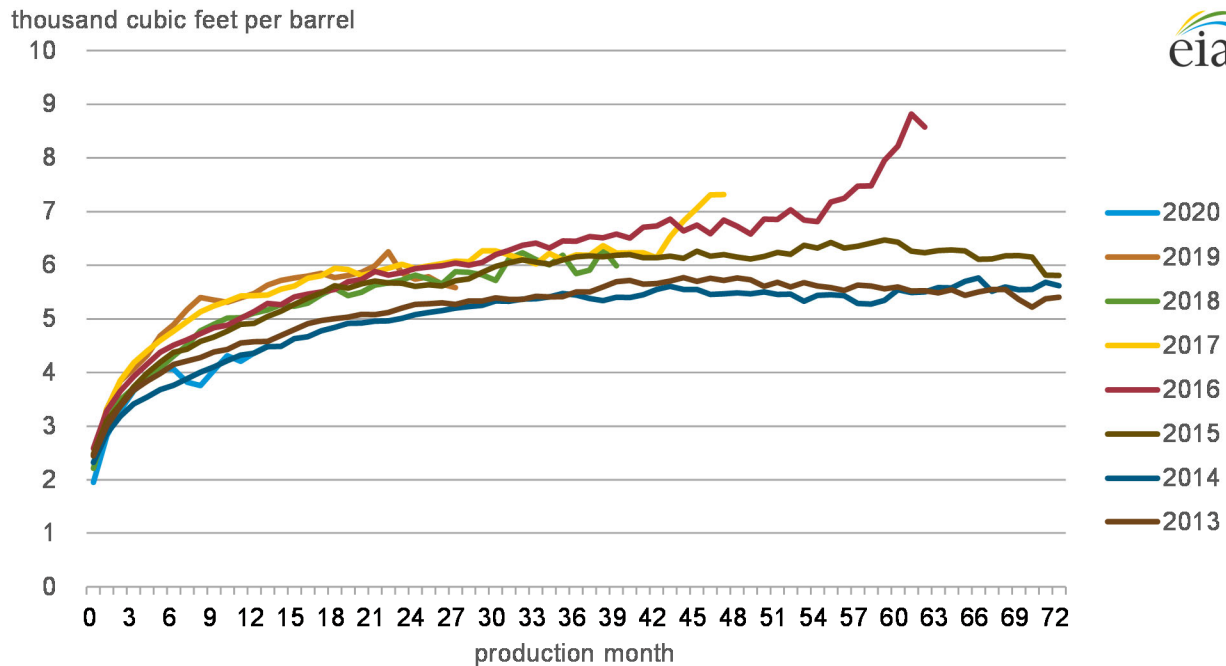
Source: U.S. Energy Information Administration, *Drilling Productivity Report*
 Note: Each curve represents average GOR of all wells starting production in a given year.

Figure 2. Vintage gas-to-oil ratio from all Bakken region wells



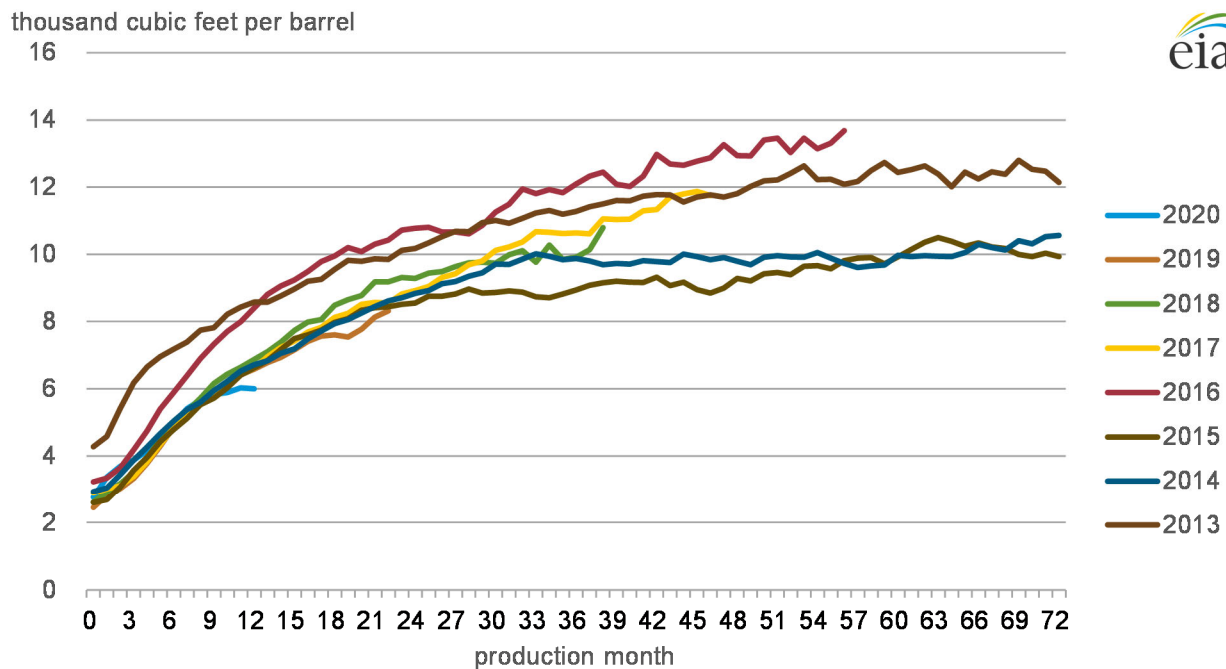
Source: U.S. Energy Information Administration, *Drilling Productivity Report*
 Note: Each curve represents average GOR of all wells starting production in a given year.

Figure 3. Vintage gas-to-oil ratio from all Eagle Ford region wells



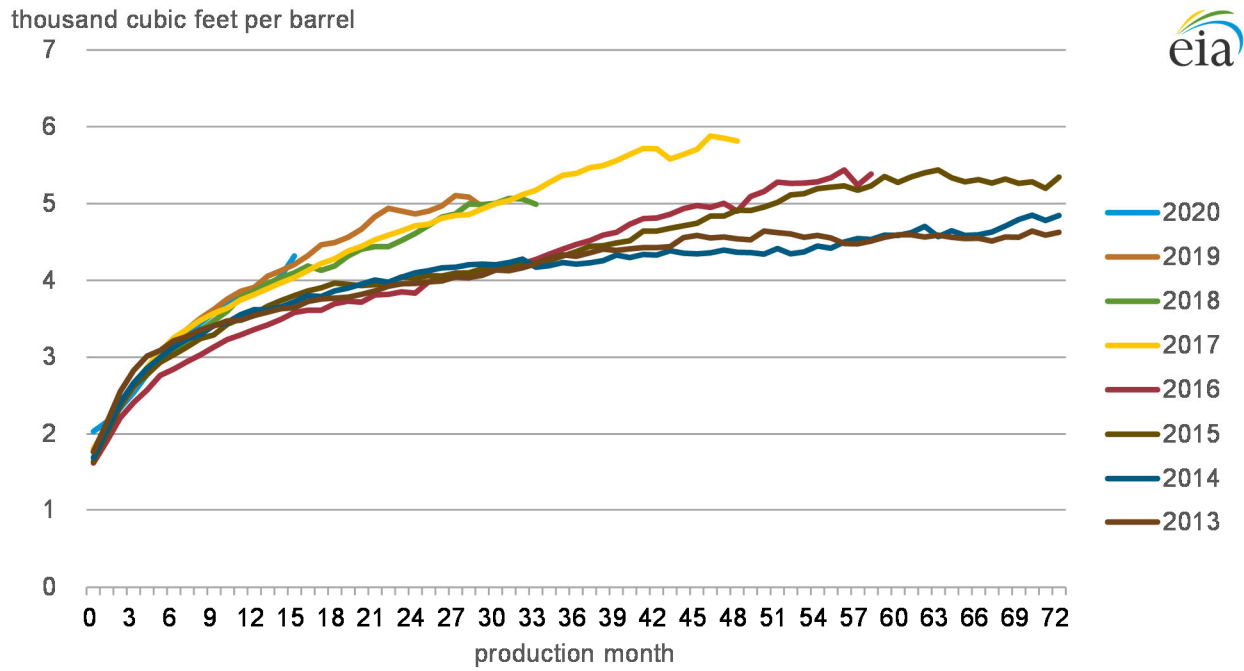
Source: U.S. Energy Information Administration, *Drilling Productivity Report*
 Note: Each curve represents average GOR of all wells starting production in a given year.

Figure 4. Vintage gas-to-oil ratio from all Niobrara region wells



Source: U.S. Energy Information Administration, *Drilling Productivity Report*
 Note: Each curve represents average GOR of all wells starting production in a given year.

Figure 5. Vintage gas-to-oil ratio from all Permian region wells

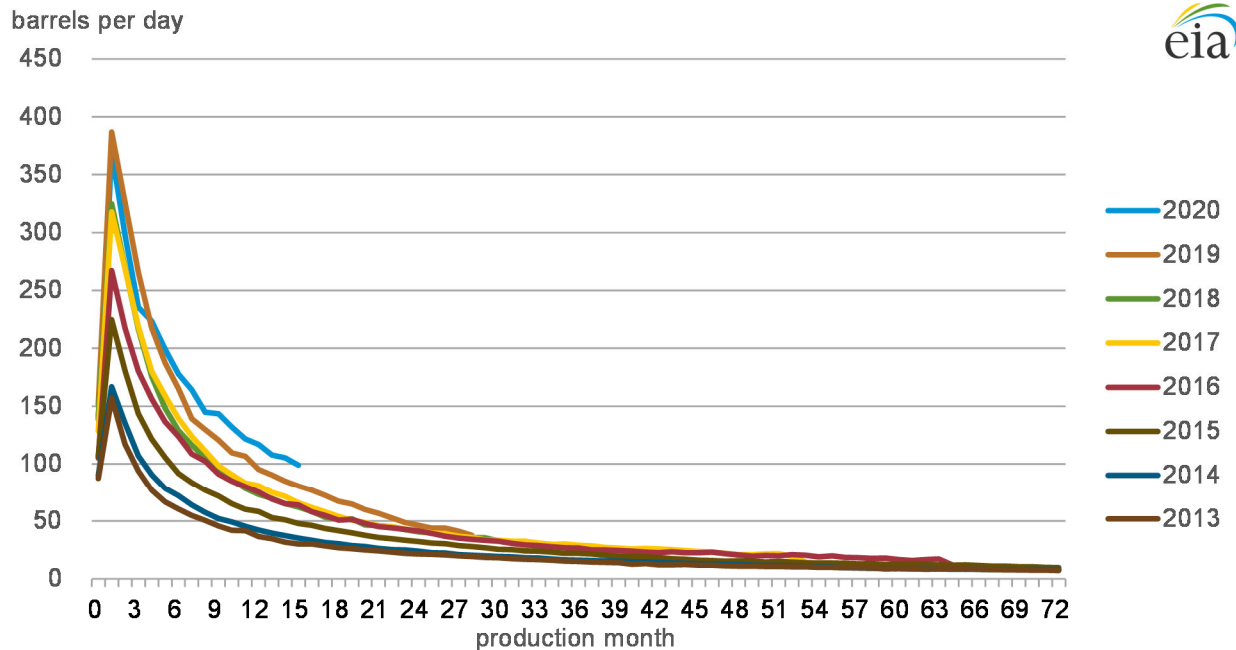


Source: U.S. Energy Information Administration, *Drilling Productivity Report*

Note: Each curve represents average GOR of all wells starting production in a given year.

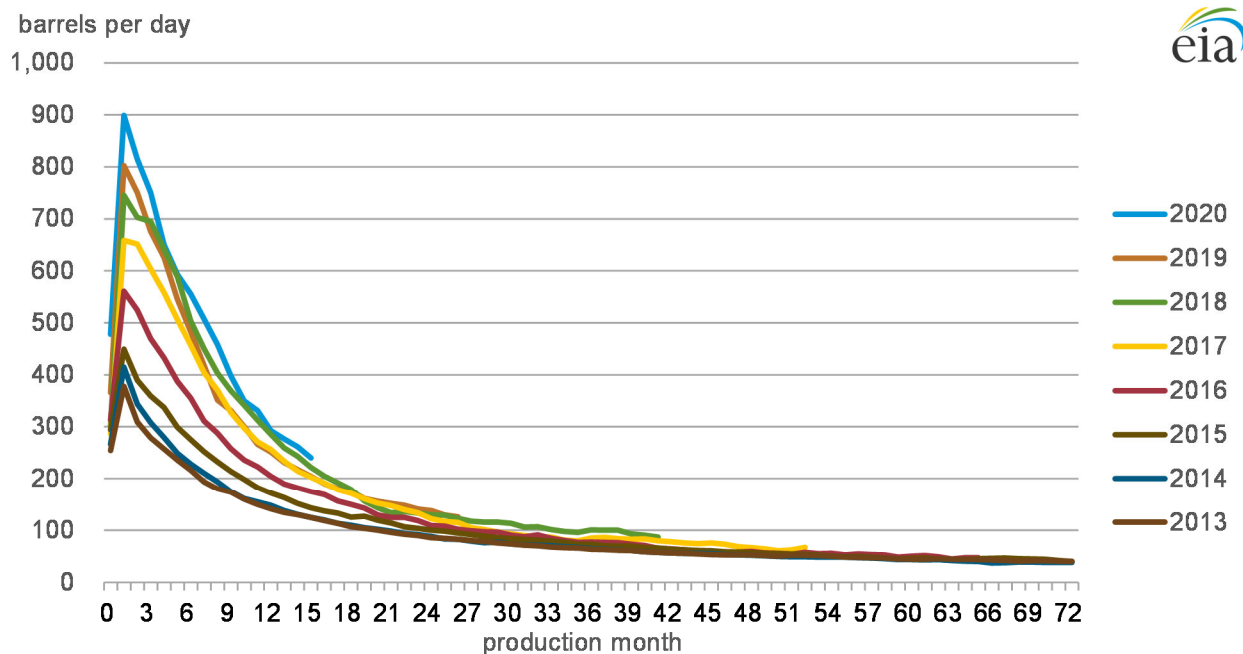
Appendix A. Oil Decline Rates

Figure 6. Oil decline curves from new wells in the Anadarko region



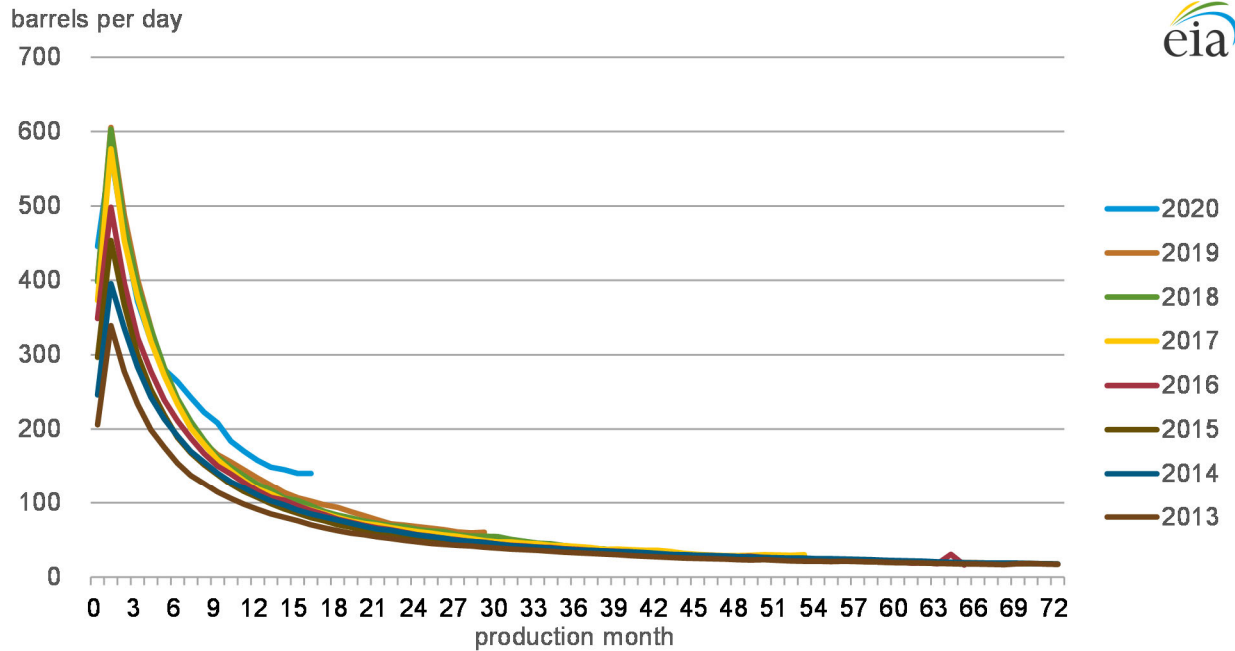
Source: U.S. Energy Information Administration, *Drilling Productivity Report*
 Note: Each curve represents average oil production of all wells starting production in a given year.

Figure 7. Oil decline curves from new wells in the Bakken region



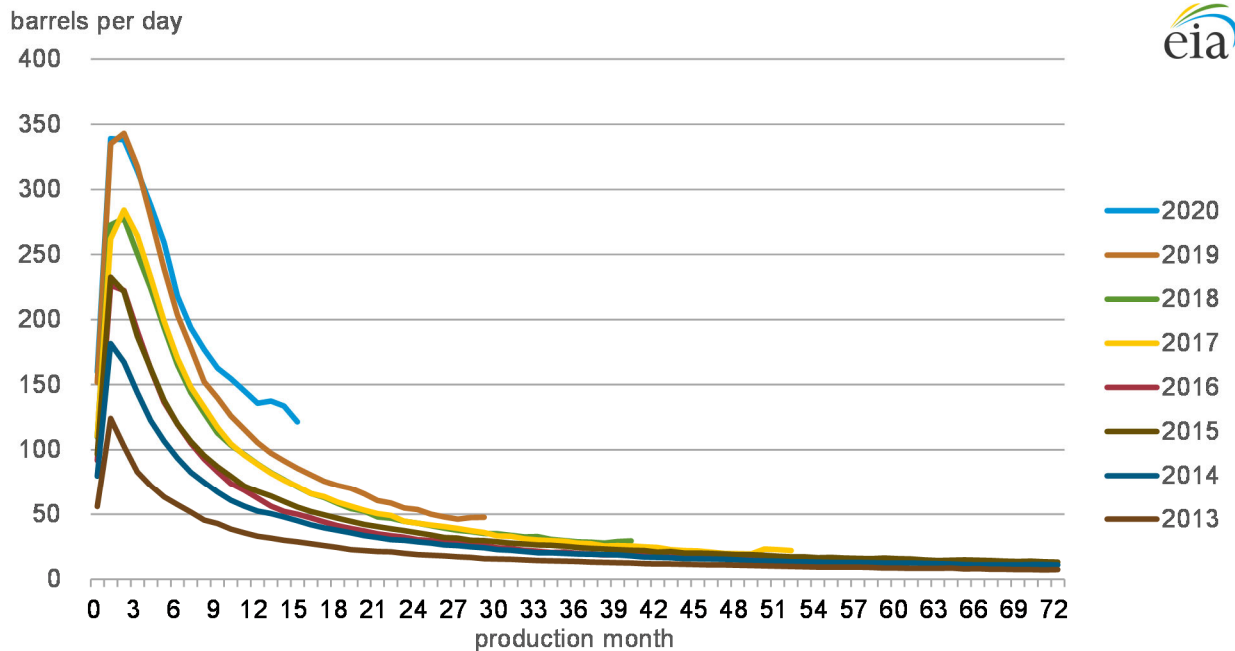
Source: U.S. Energy Information Administration, *Drilling Productivity Report*
 Note: Each curve represents average oil production of all wells starting production in a given year.

Figure 8. Oil decline curves from new wells in the Eagle Ford region



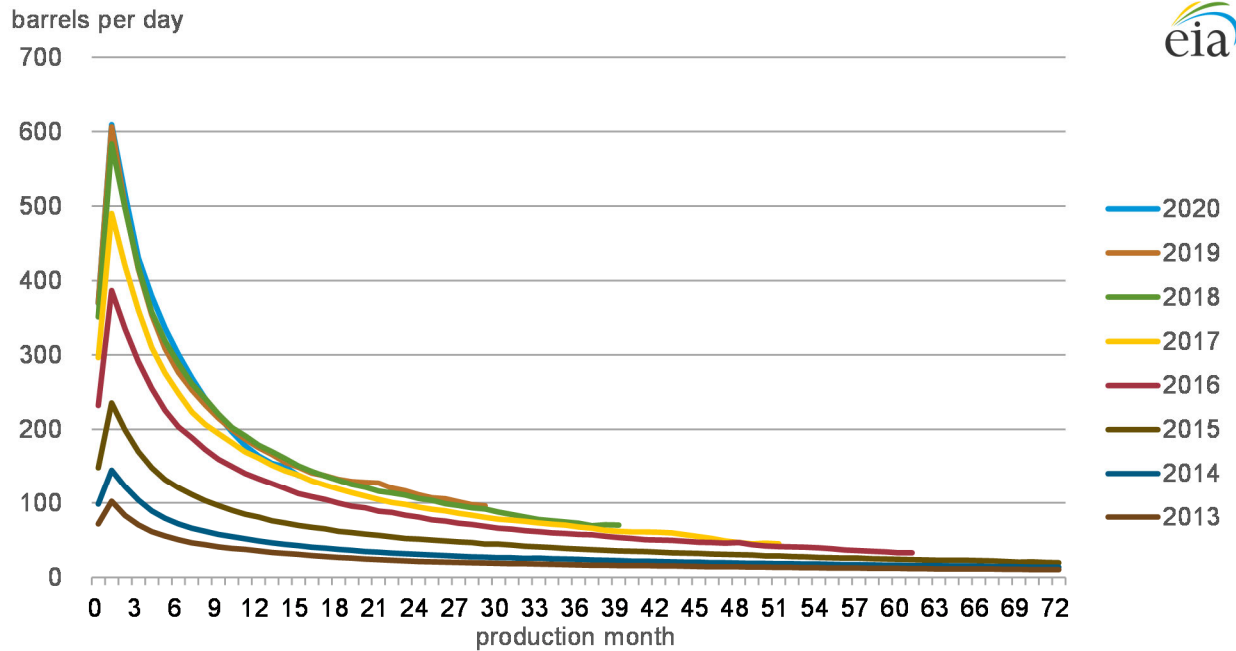
Source: U.S. Energy Information Administration, *Drilling Productivity Report*
 Note: Each curve represents average oil production of all wells starting production in a given year.

Figure 9. Oil decline curves from new wells in the Niobrara region



Source: U.S. Energy Information Administration, *Drilling Productivity Report*
 Note: Each curve represents average oil production of all wells starting production in a given year.

Figure 10. Oil decline curves from new wells in the Permian region

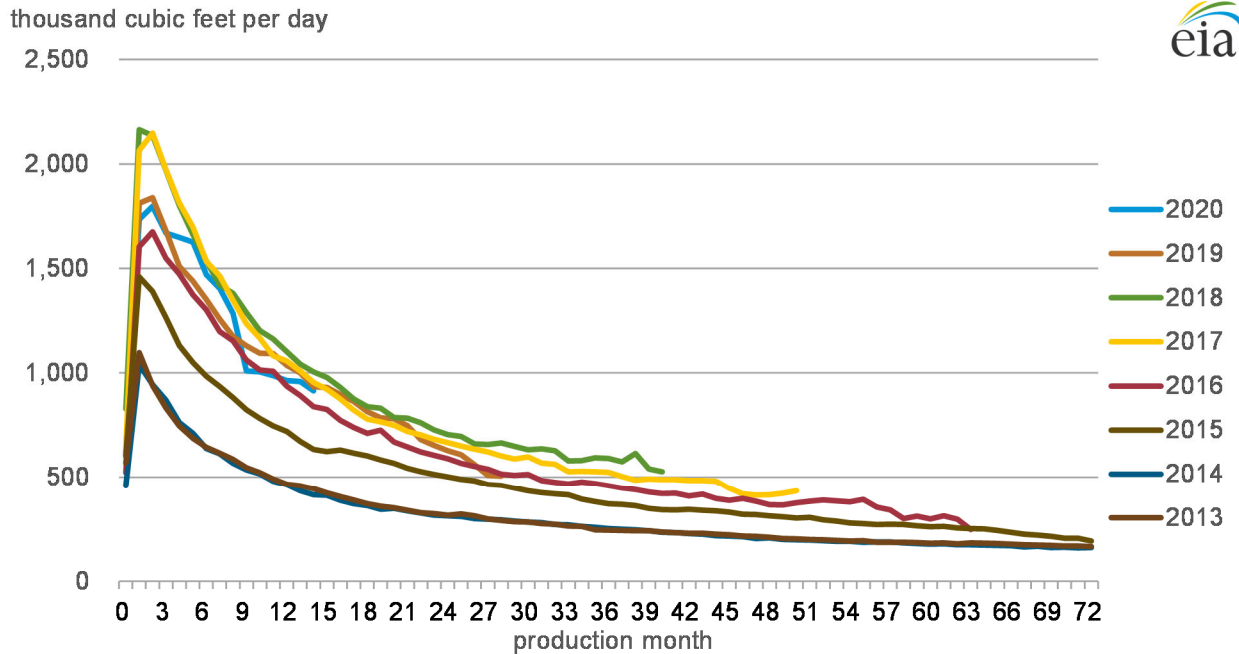


Source: U.S. Energy Information Administration, *Drilling Productivity Report*

Note: Each curve represents average oil production of all wells starting production in a given year.

Appendix B. Natural Gas Decline Rates

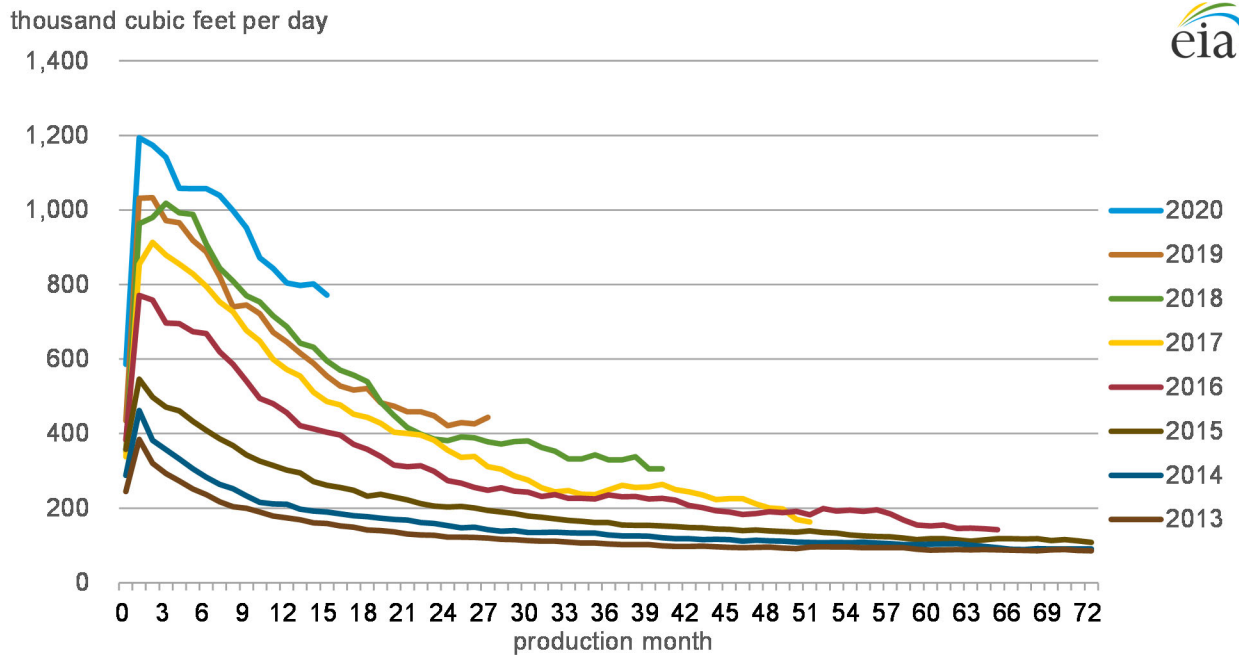
Figure 11. Natural gas decline curves from new wells in the Anadarko region



Source: U.S. Energy Information Administration, *Drilling Productivity Report*

Note: Each curve represents average natural gas production of all wells starting production in a given year.

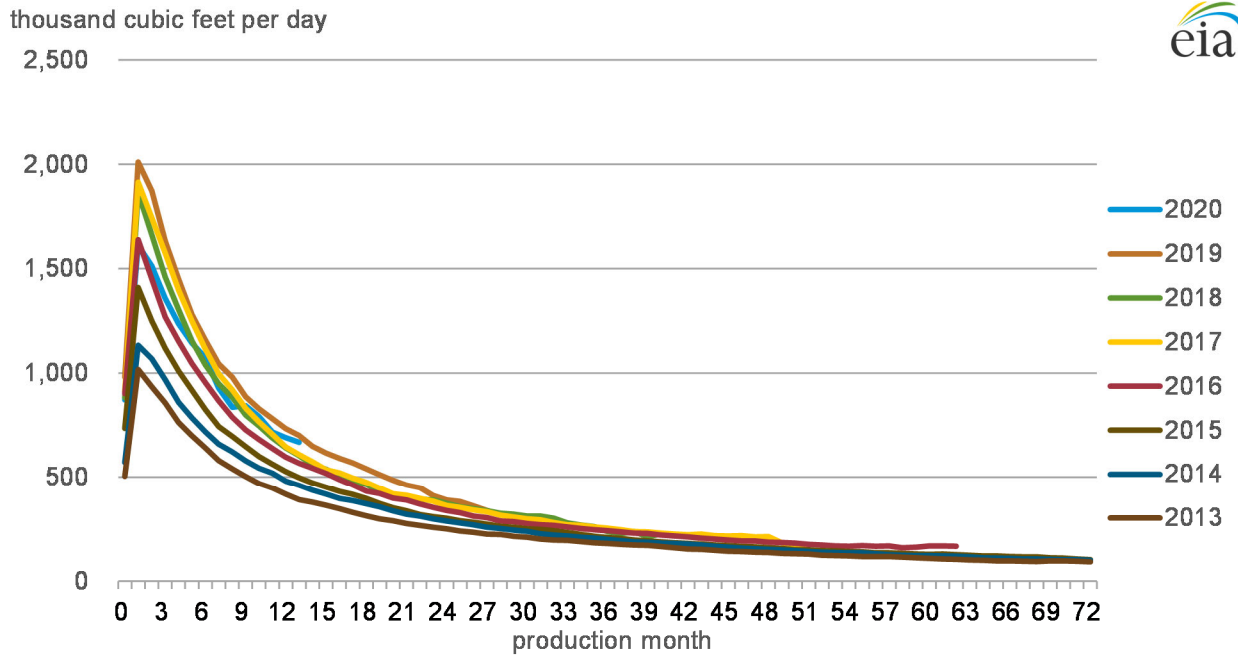
Figure 12. Natural gas decline curves from new wells in the Bakken region



Source: U.S. Energy Information Administration, *Drilling Productivity Report*

Note: Each curve represents average natural gas production of all wells starting production in a given year.

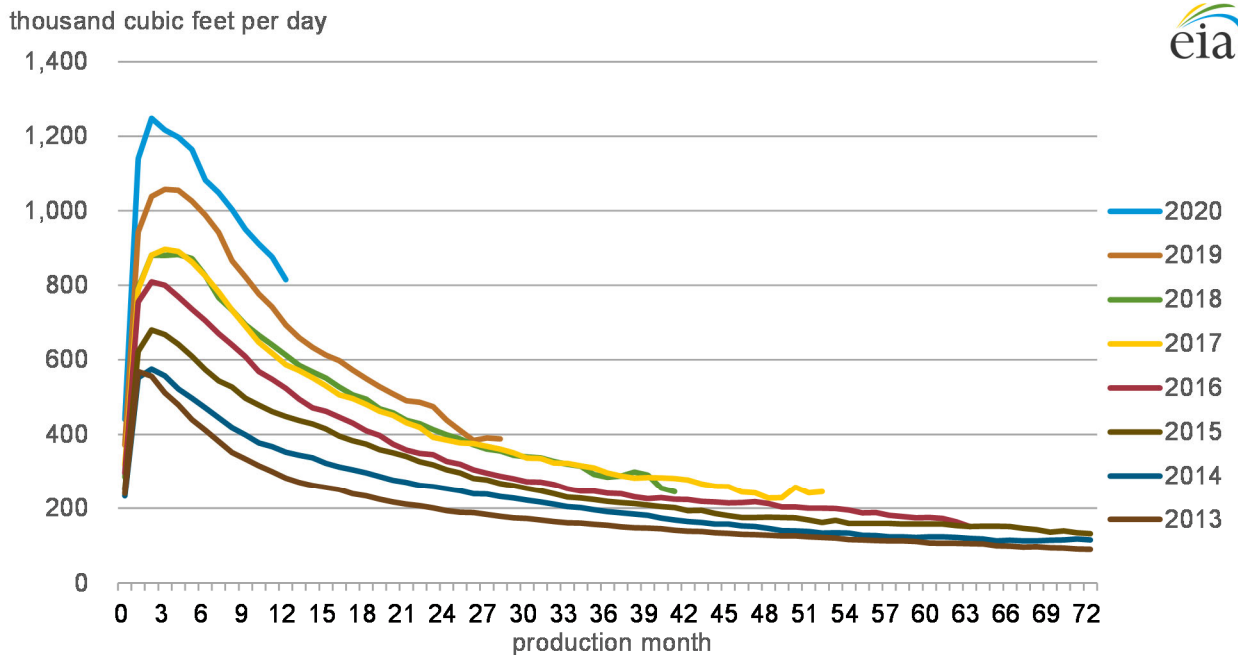
Figure 13. Natural gas decline curves from new wells in the Eagle Ford region



Source: U.S. Energy Information Administration, *Drilling Productivity Report*

Note: Each curve represents average natural gas production of all wells starting production in a given year.

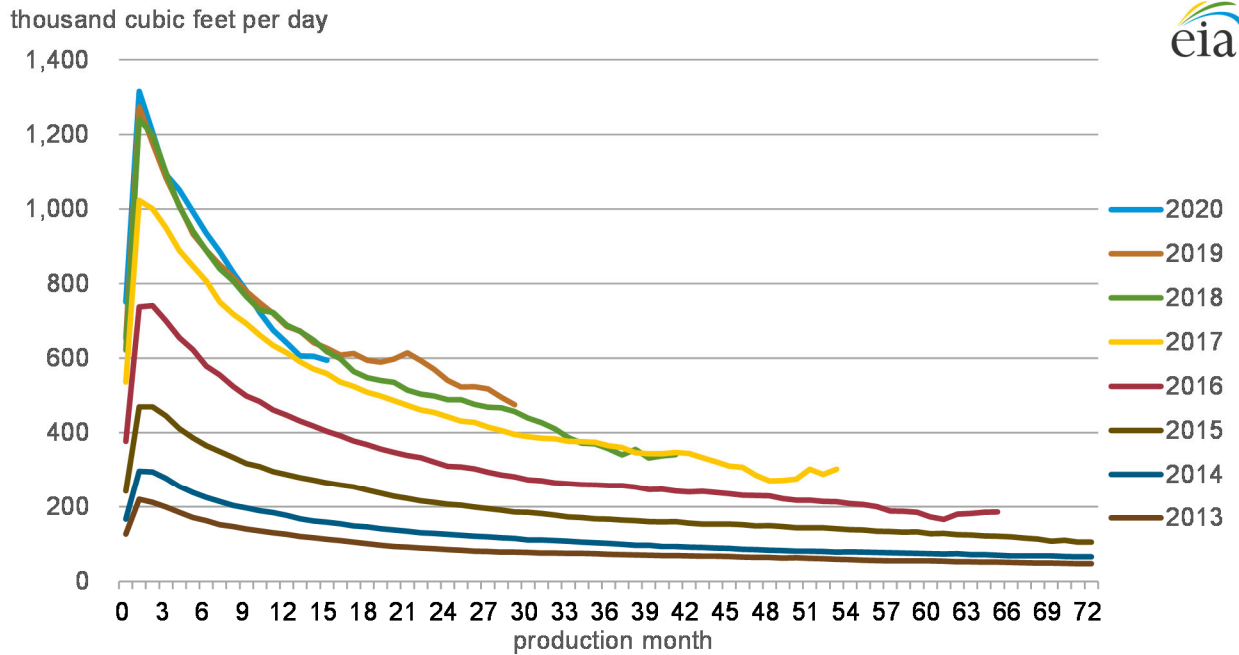
Figure 14. Natural gas decline curves from new wells in the Niobrara region



Source: U.S. Energy Information Administration, *Drilling Productivity Report*

Note: Each curve represents average natural gas production of all wells starting production in a given year.

Figure 15. Natural gas decline curves from new wells in the Permian region



Source: U.S. Energy Information Administration, *Drilling Productivity Report*

Note: Each curve represents average natural gas production of all wells starting production in a given year.