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Red Queen effect can make production slow down in a hurry

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A Petrohawk Energy natural gas drilling site in the Eagle Ford Shale is shown in September 2009. (Jake Lacey/Houston Chronicle file photo)

SAN ANTONIO — In the early days of the Eagle Ford Shale, one of Petrohawk's wells in McMullen County came in big.

It was the fall of 2009 and about a year after the company had announced its first successful well in neighboring La Salle County, setting off a mineral-leasing frenzy that swept across South Texas like a vast dust devil.

Petrohawk's McMullen County well had initial production of 1.39 million cubic feet of gas per month.

By October 2010, the Petrohawk well was making 24 million cubic feet of gas per month.

This year, the same well is making around 8.9 million cubic feet of gas, according to the Texas Railroad Commission.

Companies have since switched to hunting crude oil, but the huge drop off in Eagle Ford well production hasn't changed.

Eagle Ford wells come in producing large amounts of oil or gas, but drop like a roller coaster after a year — a more than 60 percent dip that experts say is inherent to shale production.

Getting closer: [Eagle Ford producers shift gears on well spacing](#)

That sharp decline is one of the reasons — along with high profits — that tens of thousands of wells are predicted for South Texas: Companies must keep drilling to keep replacing their production.

It's called the Red Queen, named after the character in Lewis Carroll's "Through the Looking-Glass" who tells Alice she must run, "Faster! Faster!"

"Now, here, you see, it takes all the running you can do, to keep in the same place," the Red Queen says. "If you want to get somewhere else, you must run at least twice as fast as that!"

Fred Wang, research scientist with the Bureau of Economic Geology at the University of Texas at Austin, said a 60- to 80 percent decline curve is simply characteristic of shale, a tight rock that requires hydraulic fracturing to produce oil and gas. Fracturing pumps a mix of water and chemicals at high pressure to break the rock. Then sand is added to the fluid in increasing amounts to hold open the rock fissures, letting oil and gas flow up the well to the surface.

"These decline curves are normal. You can't do anything about it," Wang said. "You have to drill. There's no other choice. You've got to keep drilling."

Decline rates vary based on the quality of the rock, the effectiveness of the frac and the production rate, Wang said. Most companies now "choke down" a well, reducing the initial flow rate. It may help improve ultimate recovery from the well, and also makes it easier for companies to deal with transportation issues such as pipelines that aren't yet connected.

"In the beginning of a shale development, company operators like to use large choke size. You can report really large production. It's good for the stock; it's not good for ultimate recovery," Wang said. "These days, people try to choke down the size a little bit."

Companies have to find the balance between making money upfront or over time.

Oil boom: [Eagle Ford oil expected to surpass 1 million barrels per day next year](#)

Phani Gadde, a U.S. shale analyst with Wood Mackenzie in Houston, said most Eagle Ford wells drop off between 70 and 80 percent in the first year. And while there's well-by-well variation in South Texas and within every shale field, no place is immune to a steep decline curve.

"Typically, beyond the second year, they really start to flatten out," Gadde said. "The idea is these wells will live on for at least two to three decades."

Gadde said the theory is that choking a well could improve long-term recovery between 10 and 15 percent over a 30-year period. "If you let a well flow at its full potential, the high pressure drops can damage the well itself," he said.

Operators that want immediate cash flow don't choke their wells and are the ones that report the biggest initial rates of production, often reporting wells that come in at thousands of barrels per day. Others, such as BHP Billiton or ConocoPhillips, "won't make the headlines" because they're concerned with long-term production, Gadde said. They choke their wells.

Some see the decline rates as a fatal flaw of shale fields.

A February report from the Post-Carbon Institute said the Eagle Ford and North Dakota's Bakken Shale would be part of a 10-year shale bubble.

"The U.S. cannot drill and frack its way to 'energy independence.' At best, shale gas, tight oil, tar sands, and other unconventional resources provide a temporary reprieve from having to deal with the real problems: fossil fuels are finite, and production of new fossil fuel resources tends to be increasingly expensive and environmentally damaging," the report said.

It estimated that more than 6,000 U.S. wells would be needed each year to offset declines, at an annual cost of \$35 billion, including more than 1,500 wells in the Eagle Ford and Bakken.

Gadde said he sees the decline curves as a fact of production that companies are dealing with by getting more cost efficient and faster.

"It's a different resource than what we're used to," Gadde said. "It's a different paradigm. We have to drill more wells than we were used to drilling in the past."

Crossing the border: [Eagle Ford's future might lie in Mexico's demand](#)

More than 11,100 wells have been permitted in the Eagle Ford since 2008, but the research firm DrillingInfo estimates there are around 85,000 more wells left to drill in the field.

The Red Queen isn't unique to shale. All oil and gas wells, including conventional ones that don't require fracturing, decline over time.

Allen Gilmer, chairman and CEO of DrillingInfo, said that companies have to improve their production with more efficient operations or by adding crews and equipment.

"Unconventionals have higher initial declines but much longer tails," Gilmer said. "And there are tens to hundreds of thousands of these."

Eagle Ford drillers have started 3,266 new wells so far this year, according to the latest Baker Hughes Well Count.

"These wells can produce 30 to 40 years," Wang said. "They taper for a long, long time."



(Jerry Lara / San Antonio Express-News)

Warning signs are required around the wellhead during a frac job at a well on a ranch southwest of Ben Bolt, Texas. The well, located near the Jim Wells and Duvall County line, was drilled to a depth of over one mile.



(Jerry Lara / San Antonio Express-News)

Storage tanks with fracturing material are lined up at a well on a ranch southwest of Ben Bolt, Texas. The well, located near the Jim Wells and Duvall County line, was drilled to a depth of over one mile.