

# RESULTANTS

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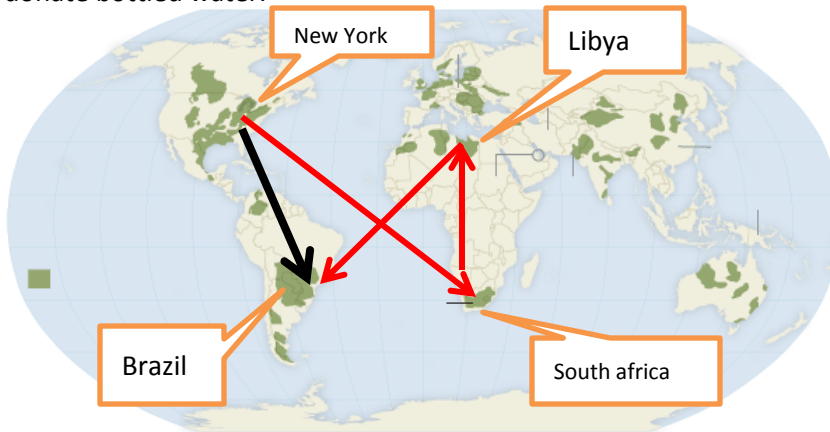
DRILLING DOWN

## Hunt for Gas Hits Fragile Soil, and South Africans Fear Risks



Chris Hayward, a South African farmer, says, "If our government lets these companies touch even a drop of our water, we're ruined."

KAROO, South Africa — When a drought dried up their wells last year, hundreds of farmers and their families flocked to local fairgrounds here to pray for rain, and a call went out on the regional radio station imploring South Africans to donate bottled water.



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### Major Shale Gas Basins

**INTRODUCTION:** New York to South Africa is 9000 miles  $50^\circ$  South of east = vector A . South Africa to Libya is 5000 miles due north = vector B, Libya to Brazil is 7000 miles  $45^\circ$  south of west = vector C. **QUESTION:** Find resultant displacement ( $R=A+B+C$ ) New York to Brazil? Be sure to find magnitude and direction.

**ANSWER:** 6895 mi @  $7^\circ$  east of south

Covering much of the roughly 800 miles between Johannesburg and Cape Town, this arid expanse — its name means “thirsty land” — sees less rain in some parts than the Mojave Desert. Even so, Shell and several other large energy companies hope to drill thousands of [natural gas](#) wells in the region, using a new drilling technology that can require a million gallons of water or more for each well. Companies will also have to find a way to dispose of all the toxic wastewater or sludge that each well produces, since the closest landfill or industrial-waste facility that can handle the waste is hundreds of miles away. “Around here, the rain comes on legs,” said Chris Hayward, 51, a brawny, dust-covered farmer in Beaufort West, quoting a Karoo saying about how rare and fleeting precipitation is in the area.