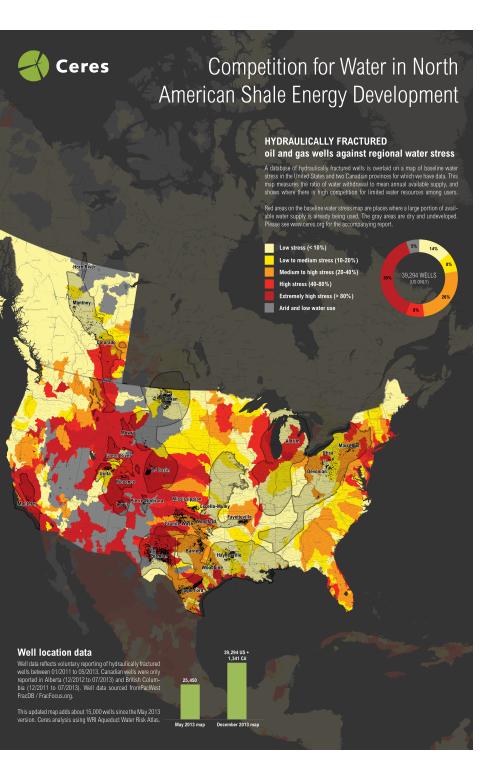
Ceres

Trends in Water Use for Hydraulic Fracturing

Shareholder, Lender & Operator Guide to Water Sourcing

Monika Freyman, Water Program, Ceres October 21 2014





Ceres works with NGO partners, investors and companies to build a thriving and sustainable global economy

Milestones:

- Catalyzed the corporate sustainability reporting movement
- Introduced climate and water risk as key investment considerations
- Mitigate water impacts from company and investor activities and play productive role in water resource protection.

| Ceres | |
|---|---|
| Water & Climate Risks Facing | ŗ |
| U.S. Corn Production | |
| How Companies & Investors Can Cultivate Sustainability | |
| A Cares Report | |
| lane 2014 | |
| Arthoned by Broake Barton Santo Disabeth Disan | |

| WATER RIS | K IN THE |
|---|-------------|
| MUNICIPAI | BOND MARKET |
| A Cares Report October 2010 Authored by Shafene Luurg, Cares Analysis by WATER ASSET MANAGEMENT | |

🛃 Ceres

| A FR 21 st | Aqua G AMEW CENTU MANA | ORK JRY V | VATER |
|---|---------------------------------|--------------|----------------|
| A Ceres Report October 2011 Authord by Ceres: Broke Smnn Berkley Adro Inharis: Dowl Hampton Will Igen | | | |
| in collaboration with: | wbcsd water | | IRBARIS |

| ALLEL DAS | <i>C</i> | | I | |
|----------------------|----------|-----|--------|-----|
| <pre>KHELP></pre> | TOT | exp | lanati | on. |
| | | | | |

Screen Printed

| Sereen Trinee | | | | | | | |
|-----------------------|-------------------------|----------------|--------------|----------------|----------------|---------------|--------------|
| XOM US Equity | 96) Settings | 97) Actio | ns • 98)(| | 9) Feedback | | al Analysis |
| Exxon Mobil Corp | | | | | ods 10 Annua | | rrency USD |
| 1) Key Stats 2) I, | a server a server | 5) Ratios | Ø Segments | | ESG 🛛 🤋 Cus | | |
| | nvironmental 🛛 13) Soci | | | c & Dir Comp | 16) ESG Ratios | | Discl Proj |
| In Millions (except f | Per Share) | FY 2011 | | FY 2009 | FY 2008 | FY 2007 | |
| 12 Months Ending | | 2011-12-31 | 2010-12-31 | 2009-12-31 | | | |
| 💷 ESG Disclosure S | core | 58.51 | 57.26 | 56.43 | 53.11 | 53.11 | 50.62 |
| | | | | | | | |
| Environmental | | | | | | | |
| 💷 Environmental Di | | 57.02 | 54.55 | 52.89 | 46.28 | 46.28 | |
| 💷 Total GHG Emiss | ions | 143,000.00 | 140,000.00 | 139,000.00 | n/a | n/a | n/a |
| MOx Emissions | | 140.00 | 120.00 | 130.00 | 150.00 | 160.00 | 161.00 |
| SO2 Emissions | | 130.00 | 140.00 | 160.00 | 190.00 | 210.00 | 236.00 |
| | | | | | | | |
| 🖬 Total Energy Con | sumption | 430,555.54 | 408,777.77 | 405,638.89 | 416,666.66 | 430,555.54 | |
| 💷 Water Consumpti | | 372,348.24 | 340,392.00 | 347,386.99 | 352,316.01 | 323,000.00 | |
| 🔟 Hazardous Waste | 2 | 190.00 | 130.00 | 80.00 | 40.00 | 168.00 | 246.00 |
| | | | | | | | |
| 🖬 Environmental Fi | | 65 | 83 | n/a | n/a | n/a | |
| 🖬 Environmental Fi | nes \$ | 1.30 | 11.00 | 5.10 | 13.00 | 3.80 | 12.80 |
| | | | | | | | |
| Social | | | | | | | |
| Social Disclosure | | 53.13 | 53.13 | 53.13 | 53.13 | 53.13 | |
| Mumber of Emplo | | 82,100 | | 80,700 | 79,900 | 80,800 | |
| ■ % Women in Worl | dorce | 26.00 | | 26.00 | 25.00 | 25.00 | |
| ut & Women in Mat | | 14_00 | 14 00 | 13.00 | 12.00 | 12.00 | 12.00 |
| | | | | | | Zoom - | + 100% |
| - Australia 61 2 977 | 7 8600 Brazil 5511 304 | 48 4500 Europe | 44 20 7330 7 | '500 Germanu 4 | 9 69 9204 121 | 0 Hona Kona 8 | 52 2977 6000 |

Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000 Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2013 Bloomberg Finance L.P. SN 458588 H454-4109-0 12-Mar-13 15:26:13 EDT GMT-4:00

Shareholder and Lender Concerns

- U.S, and Canada over 40 shareholder resolutions filed with companies primarily requesting greater transparency and data reporting on environmental and social impacts and policies to mitigate risks. Many more backroom conversations.
- U.S. Security and Exchange Commission sent over 70 letters to companies to improve disclosure related to environmental risks related to use of hydraulic fracturing and horizontal drilling technologies.
- Globally one of the most active investor issues with United Nations Principals for Responsible Investors coordinating corporate engagement.
- Transparency and disclosure the biggest investor requests.
- Loss of social license to operate.

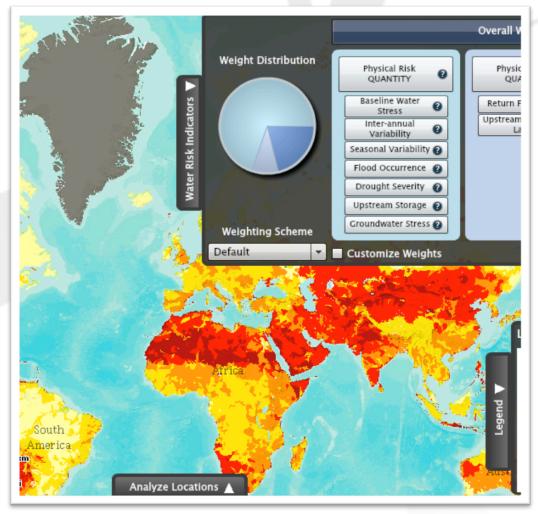


Well Locations + Water Stress Maps...



+ WRI Aqueduct Water Risk Atlas* +

Drought & Groundwater Data**



*Francis Gassert, Matt Landis, Matt Luck, Paul Reig and Tien Shiao, "Aqueduct Metadata Document, Aqueduct Global Maps 2.0," World Resources Institute, January 2013.

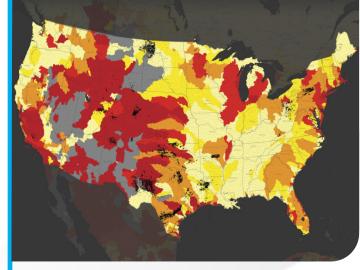
** Konikow Groundwater Depletion Study USGS Study, Report 2013-5079

United States

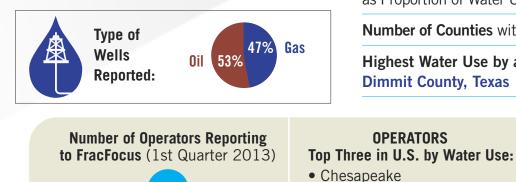
Ceres

www.ceres.org/shalemaps

Water Use Trends for Hydraulic Fracturing



OPERATING TRENDS



U.S. Data Summary (January 1, 2011 - May 31, 2013) as reported by FracFocus

WATER USE TRENDS

| Number of Wells | |
|--------------------------------------|--------------|
| Used to Calculate Water Volume Data: | 39,294 |
| Total Water Use (gallons): | 97.5 billion |
| Average Water Use (gallons/well): | 2.5 million |

EXPOSURE TO WATER RISKS

| Proportion of Wells in High or Extreme Water Stress: | 48% |
|---|-----|
| Proportion of Wells in Medium or Higher Water Stress: | 73% |
| Proportion of Wells in Drought Regions (as of Jan. 7, 2014): | 56% |

LOCAL WATER USE IMPACTS

• EOG

• XTO

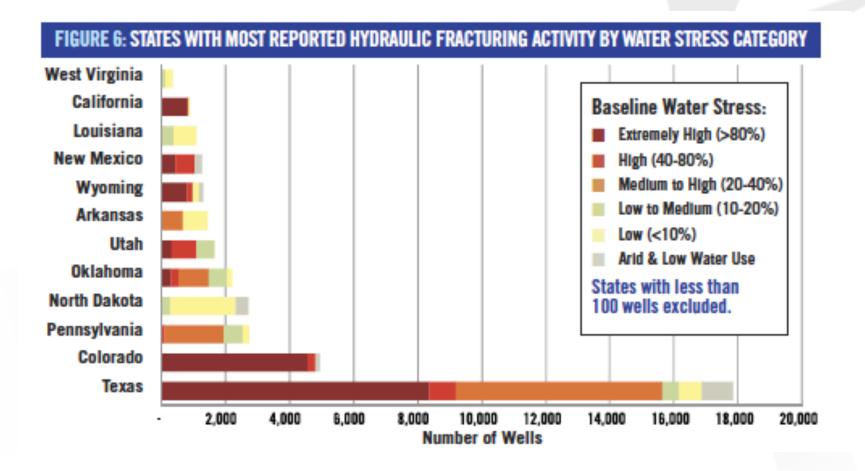
| Water Use in Top 10 Coun as Proportion of Water Use | | | 20% |
|--|--------------------------|--------------|-----------|
| Number of Counties with | Hydraulic Fracturi | ng Activity: | 402 |
| Highest Water Use by a C Dimmit County, Texas | County (gallons): | 2 | l billion |
| OPERATORS | SERVICE | PROVIDERS | |

SERVICE PROVIDERS Top Three in U.S. by Water Use:

- Halliburton
- Schlumberger
- Baker Hughes

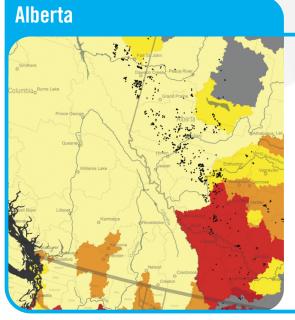


State Trends

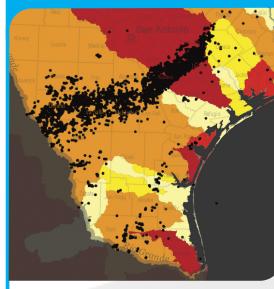




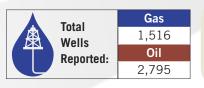
REGIONAL CASE STUDIES



Eagle Ford



OPERATING TRENDS



Alberta Data Summary (January 1, 2011 - May 31, 2013)

EXPOSURE TO WATER RISKS

- Proportion of Wells in High or Extreme Water Stress: 14%
- Proportion of Wells in Medium or Higher Water Stress: 20%

OPERATING TRENDS



| Eagle Ford Data Summary (January 1, 2011 - May 31, 201 | .3) | |
|---|-----------|---------|
| WATER USE TRENDS Total Water Use (gallons): | 19.2 t | oillion |
| Average Water Use (gallons/well): | 4.5 m | nillion |
| EXPOSURE TO WATER RISKS Proportion of Wells in High or Extreme Water S | Stress: | 28% |
| Proportion of Wells in Medium or Higher Wate | r Stress: | 98% |
| Drought Region as of January 7, 2014 (yes or | no): | Yes |
| Groundwater Challenges (yes or no): | | Yes |

LOCAL WATER USE IMPACTS

Concentration of Water Use: Top Three Water Use Counties as a Proportion of Total Water Use in Play

52%

Number of Operators OP in Region: Top Three

68

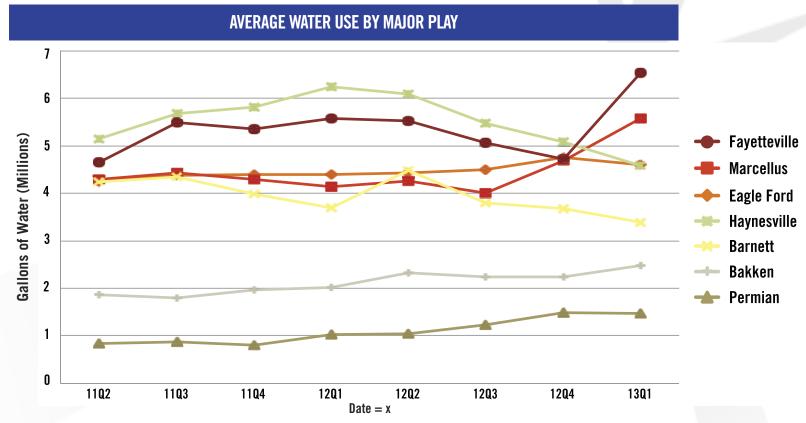
OPERATORS Top Three by Water Use

- Chesapeake
- Anadarko
- Anauari
 EOG

SERVICE PROVIDERS Top Three by Water Use

- Halliburton
- Schlumberger
- C&J

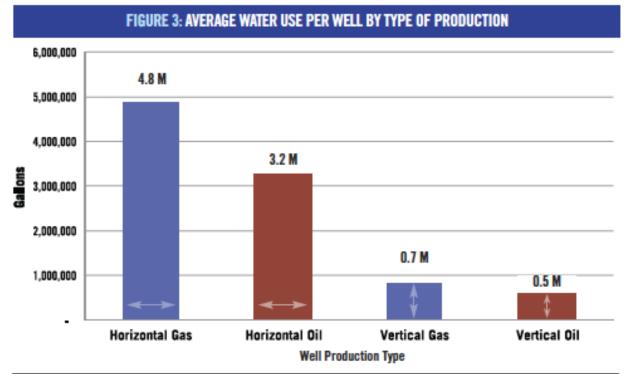




Average water use for major plays/basins from the first quarter of 2011 to end of the first quarter of 2013. Average water use can increase due to technical or geologic factors, movement from vertical to horizontal drilling or increasing length of pipes used in horizontal drilling.

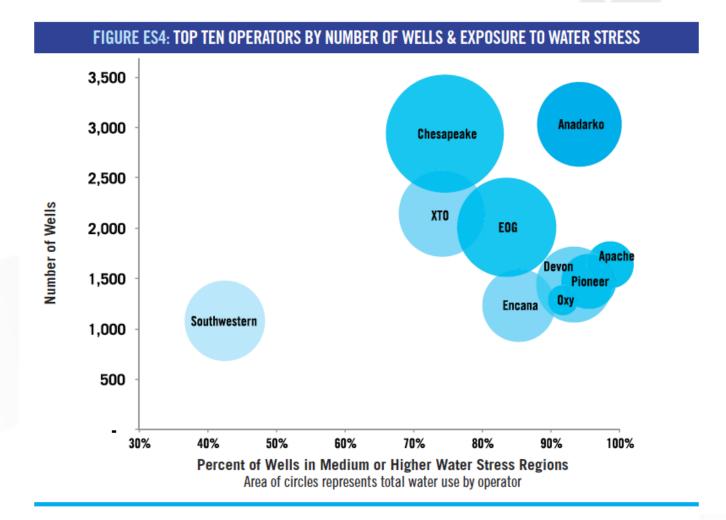
Source: Ceres analysis using PacWest FracDB from FracFocus.org.





Source: Ceres analysis using PacWest FracDB from FracFocus data from wells drilled January 2011-May 2013.

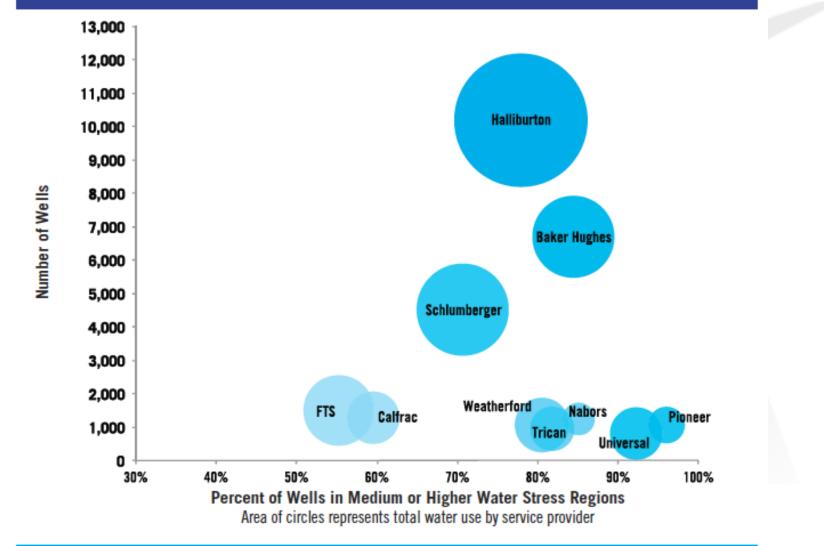






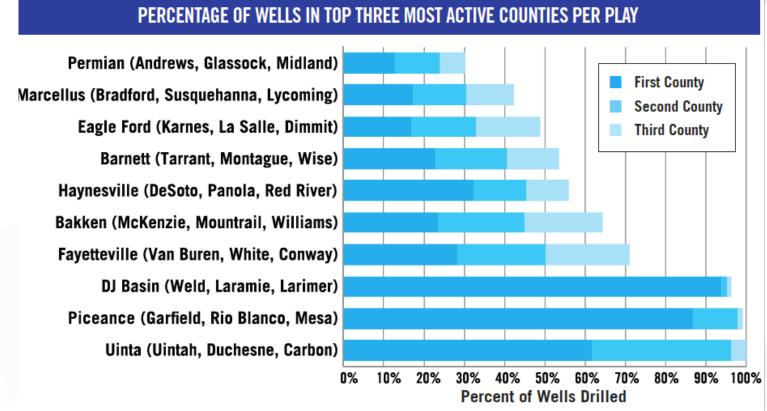
Corporate Exposure: Service Providers

FIGURE ES5: TOP TEN SERVICE PROVIDERS BY WATER USE & WATER STRESS CATEGORY





Development and Water Use Very Localized

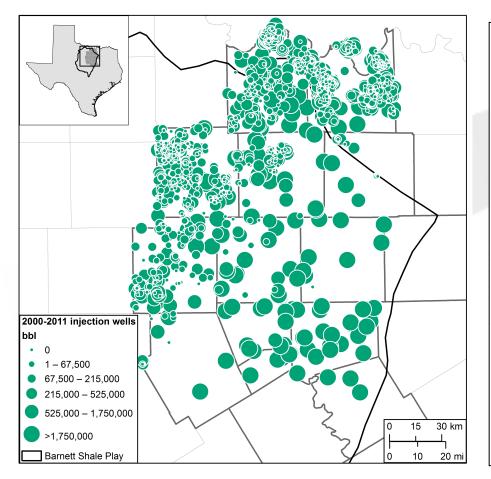


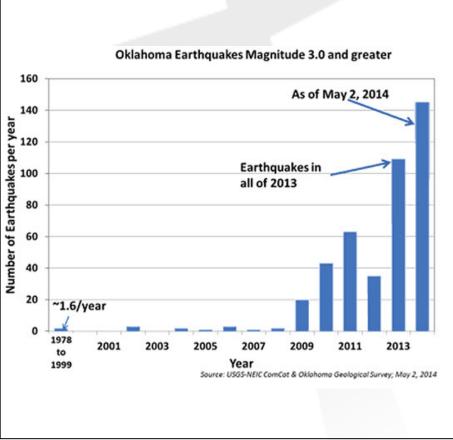
Proportion of wells developed in top three counties by activity versus all wells developed for entire play/basin.

Wastewater Management and Ceres Disposal Wells

Barnett Disposal Volumes

Earthquakes and Disposal Wells





Source: Jean-Philippe Nicot, Bridget R. Scanlon, Robert C. Reedy, and Ruth A. Costley, Source and Fate of Hydraulic Fracturing Water in the Barnett Shale: A Historical Perspective, S38 (Nov. 29, 2013).





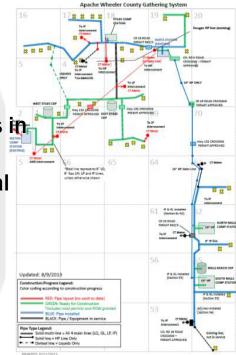
Water Sourcing and Governance

- Transparency in current AND FUTURE regional water requirements in context of local needs (amounts and sources)
- Transparency in current AND FUTURE regional wastewater disposal requirements (amounts and fate)
- Proactive stakeholder engagement
- Recycling and beneficial reuse careful management
- Better Groundwater management
- Brackish groundwater use risks
- Stakeholder issues consult versus consent
- Wastewater management and deep well injection issues.
- Water Allocation and Better Management: groundwater, surface water, cumulative impacts, population growth, climate change.

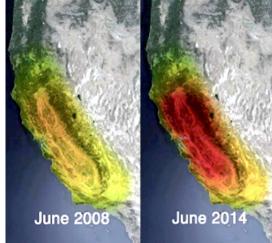
<image>

Ground water change in California, Nasa's GRACE

USGS National Brackish Grondwater Assessment



Apache's Water Network







Monika Freyman, Ceres' Water Program freyman@ceres.org