

Fracking and Water Resources in Texas

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Background

Over the past few years, hydraulic fracturing (“fracking”) of shale deposits has revolutionized the energy industry in the U.S. However, fracking poses several concerns related to water resources, stemming from the large quantities of water required for the fracking process, the disposition of wastes from drilling sites, and potential groundwater contamination. These water requirements are especially problematic in Texas, which in the current drought is already struggling to develop adequate water supplies for urban and agricultural needs. This project aims to use ArcGIS to understand the impacts of fracking on water resources in Texas.

The sections below describe the steps I have taken thus far in the analysis; they are followed by an appendix of figures.

Shale Resources in Texas

I began by attempting to get an idea of the big picture of shale resources in Texas, and their impacts on groundwater resources. To do so, I first downloaded shapefiles of shale basins and shale plays throughout the U.S. from the U.S. Energy Information Administration (EIA).¹ A shale basin is the deposit of shale under the surface, whereas a shale play is an area where exploration and production activity is actually taking place. Therefore, the shale plays are the more heavily impacted areas. Figure 1 in the appendix shows the locations of shale plays in Texas.

Impacted Texas Aquifers

Next, I explored the impact of Texas shale plays on major aquifers in Texas. I obtained a shapefile of major Texas aquifers from the Texas Water Development Board.² Figure 2 shows that most Texas shale plays lay over major aquifers. For example, the Eagle Ford Shale overlaps with the Gulf Coast and Carrizo aquifers.

Barnett Shale Play

To get a clearer picture of the impact of fracking on water resources, I decided to zoom in on one specific play in Texas that is being heavily developed – the Barnett Shale. The Barnett shale play is located in the Fort Worth Basin, and is located in the Dallas-Fort Worth area. The Fort Worth basin overlays the Edwards, Trinity, Edwards-Trinity, and Seymour aquifers. This information is displayed in Figure 3.

Groundwater Wells Data

Next, I downloaded well data from the Texas Water Development Board,³ and used the tools in ArcGIS to create a new layer with only the wells located in the Fort Worth Basin. This data is displayed in Figure 4. There are 18,720 groundwater wells in the Fort Worth Basin.

¹ U.S. Energy Information Administration. Maps: Exploration, Resources, Reserves, and Production.” Accessed from http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/maps/maps.htm.

² Texas Water Development Board. GIS Data. Accessed from <http://www.twdb.state.tx.us/mapping/gisdata.asp>.

³ Texas Water Development Board. GIS Data. Accessed from <http://www.twdb.state.tx.us/mapping/gisdata.asp>.

Groundwater Monitoring Data

I downloaded the database of groundwater measurements from the Texas Water Development Board.⁴ I am currently reading the documentation for the Access database containing the observations and determine whether there is an efficient way to match the observations to the well locations. I will also need to determine whether there is sufficient water quality monitoring data available in the Forth Worth basin to consider brine and methane, in addition to water levels. I will also need to be able to compare the observations to their levels prior to any fracking activities.

Shale Production Data

There is no straightforward way to download maps of wells in Texas from the Texas Railroad Commission without purchasing their data. However, the Railroad Commission does allow queries of oil and gas production by county.⁵ For the level of this analysis (i.e., the Barnett shale play), such data may be sufficient. I will download data on production in each of the counties in the Barnett shale play to get an overall idea of the relationship between production and water impacts.

Next Steps

In addition to the next steps for groundwater monitoring and production data, I also hope to incorporate the following data into my analysis:

- **Minor aquifers.** In addition to the major aquifers affected in the Barnett shale, I will also download TWDB data for minor aquifers to identify any additional impacted groundwater resources. For each impacted aquifer, I hope to be able to examine the impacts on water levels and water quality using the TWDB monitoring data, especially if there are particularly sensitive aquifers (i.e., impacted by drought, home to endangered species) in the area.
- **Hydrologic data.** I would also like to consider what watersheds are in the Barnett shale, and whether any of these are particularly sensitive watersheds. I will download HUC data for Texas from the Texas Water Development Board and use the National Hydrography Dataset (NHDPlus) to study this.
- **Land use and population data:** At the end of the project, I also hope to incorporate data on the locations of population centers and industries to identify competing uses of water in the area and get a picture of how fracking has impacted the overall water supply in a climate of drought.

The next steps for this project are therefore to extract groundwater monitoring data from the TWDB database, download shale production data by county from the Texas Railroad Commission, and include additional groundwater, hydrological, and socioeconomic data in order to get a full picture of the water resources and water uses potentially impacted by fracking in the Barnett Shale.

⁴ Texas Water Development Board. Groundwater Database Reports. Accessed from <http://www.twdb.state.tx.us/groundwater/data/gwdbbrpt.asp>.

⁵ Texas Railroad Commission. Oil and Gas Data Query: General Production Query Criteria. Accessed from <http://webapps2.rrc.state.tx.us/EWA/productionQueryAction.do>

Appendix of Figures

Figure 1

Shale Plays in Texas

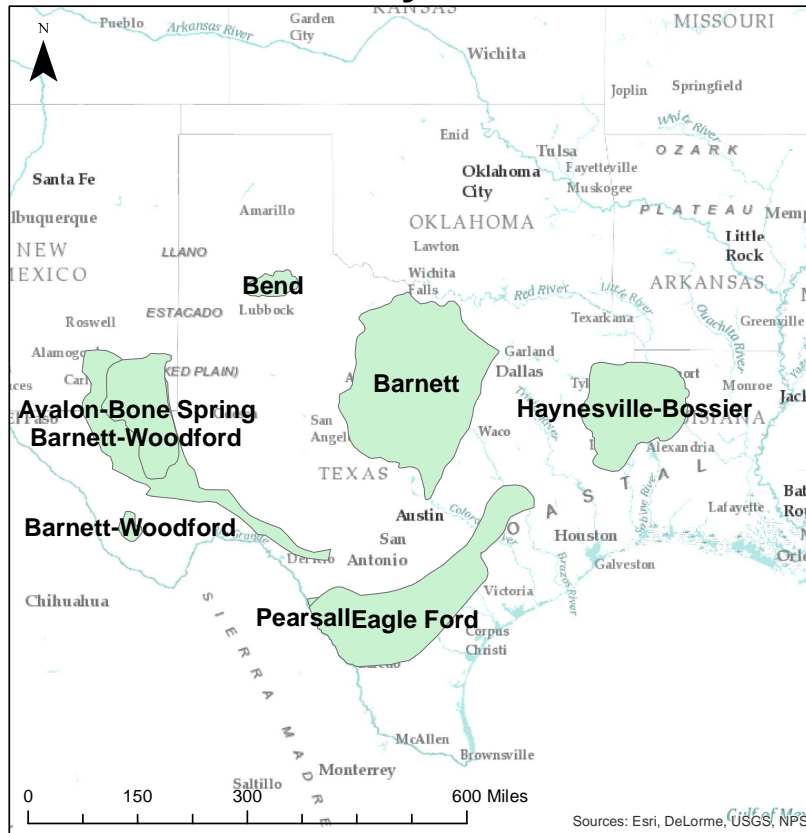


Figure 2

Shale Plays and Major Aquifers in Texas

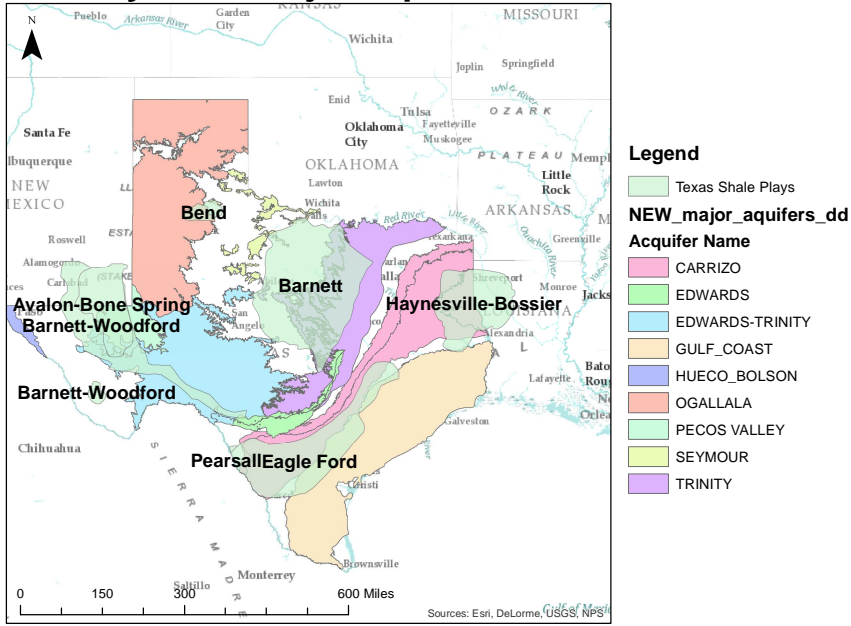


Figure 3

Aquifers in the Fort Worth Basin

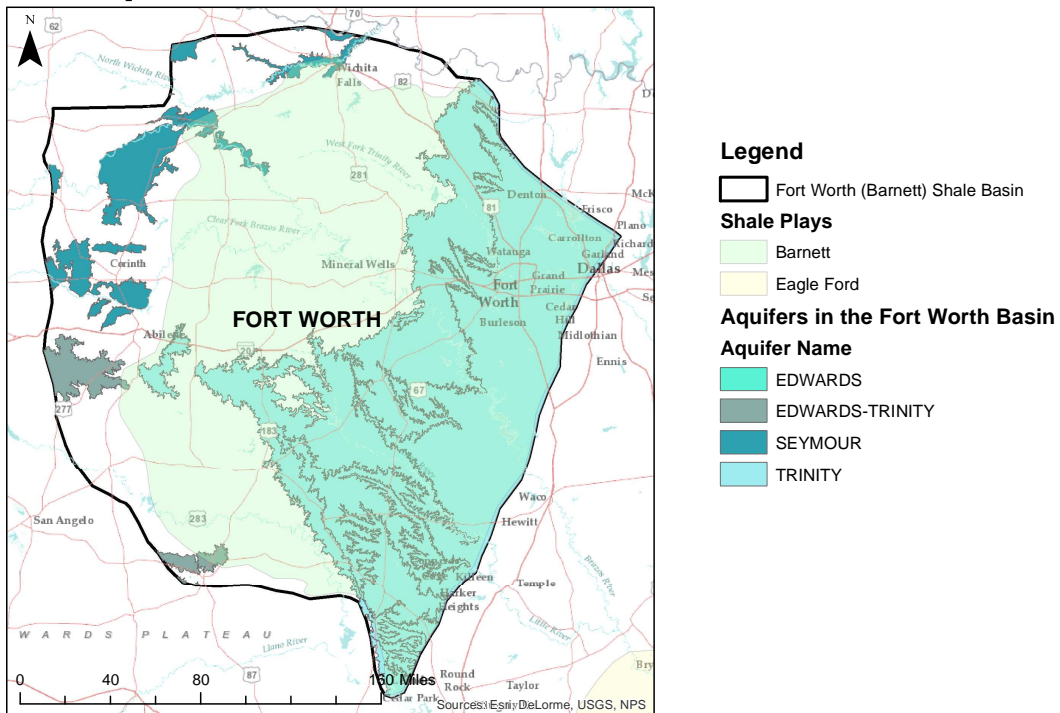


Figure 4

Groundwater Wells in the Fort Worth Basin

