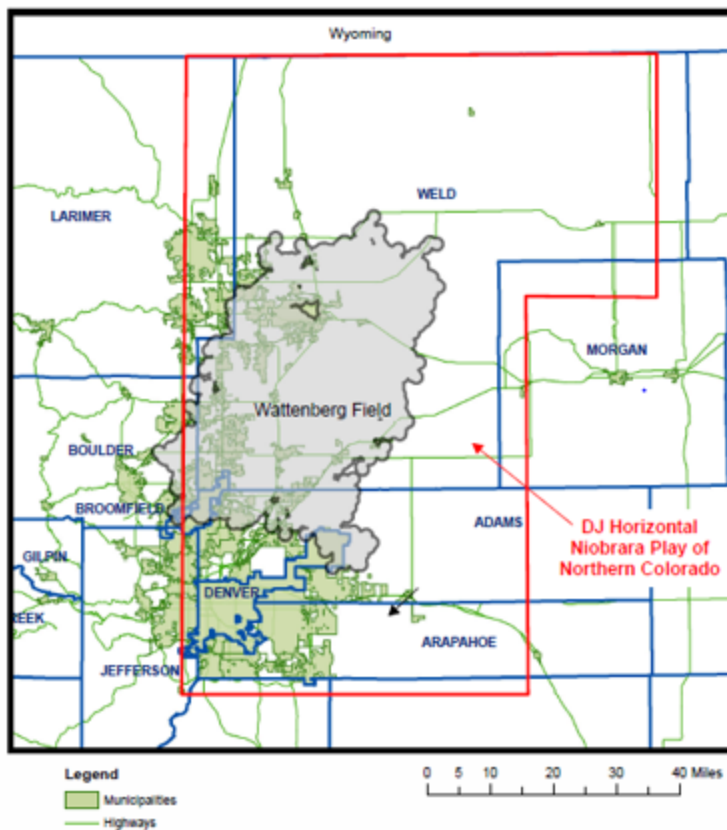


## Objective

As we browse through the data there are a couple of use cases that come to mind. But the main use case seems to be the one drafted below:

*For a given well A and for a given point X in its life cycle, predict the probability of its permanent abandonment in the next N years. The study will focus on horizontal wells the Denver-Julesburg Basin drilled in the Niobrara, Codell, or other formations and the study area will cover the following area of interest (approximate) where horizontal well drilling is occurring.*



From Milne, 2014

## The Client

The client could be a landowner who has leased out the mineral rights to an operating company to drill horizontal well(s) on their property. This information would help the landowner with financial planning (understand how long they can expect to receive payments). Or how likely the well is to be an economic success in the first place. Landowners are not necessarily privy to the confidential information that an operating company would have to help answer this question.

The client could also be a company who is operating in or has an interest in operating in the basin. While operating companies have geoscientists and engineers who are working to answer this question the approach is typically handled in a more traditional and technical way with proprietary data that is not immediately available and costly to obtain. The traditional approach would be to use a combination of log and production data to establish an estimate of hydrocarbon in place and expected ultimate recovery. Our approach is a more 'top-down' statistical analysis performed with only free and publicly available data.

### **Data and Data Sources**

- Monthly Production data by Well (obtained from the Colorado Oil and Gas Conservation Commission website)
  - Data points to be extracted; these data will be the primary data and will provide historical production, well status, and producing formation for all the horizontal wells in the study area.
    - Well Identifier (API number – short for American Petroleum Institute)
    - Well Operator Code
    - Well Status – producing, shut-in, etc.
    - Monthly Production Volumes (oil, gas, and water) From Completion Date to Present
    - Producing Formation code (formation that the well is producing from)
    - No of days on production for each month
    - Pressure Data (not sure how we will use this yet)
    - Performance data
    - Observation data
    - Objective definition to understand A and N
    - Basin exploitation data (Understanding abuse) - used to understand the exploitation scores
- Well Surface, Trajectory and Bottomhole Location Shapefiles (obtained from the Colorado Oil and Gas Conservation Commission website)
  - Data points to be extracted; these data will provide location data (X) of each well
    - Well Identifier (API number – short for American Petroleum Institute)
    - Well Operator Code and Name
    - Well Status – producing, shut-in, etc.
    - Surface Location of Each Well
    - Bottomhole Location of Each Well
    - Well Trajectory of Horizontal Wells (currently there is no depth information associated with this data source – I am requesting this information from the COGCC)
    - Basin exploitation data (Understanding abuse) - used to understand the exploitation scores
- Geological data
  - Understand geological characteristics of Well A and the surroundings of well A

- Analyse depth vs # of Wells vs Strata characters (could be tied to the exploitation scores)
- These data will be obtained from published shapefiles or maps that have been georeferenced, digitized, and converted to grids
  - Structural Depth of the Producing Formation - required
  - Thickness of the Producing Formation (or possibly formation subunit) - required
  - Regional Lineaments (faults and fault systems) - required
  - Maximum Resistivity (a proxy for hydrocarbon saturation – nice to have)
  - Temperature Gradient ( a proxy for hydrocarbon generation potential) – nice to have
  - Vitrinite Reflectance (a measure of thermal maturity – nice to have)
  - Seismic data to extract other parameters – not likely
  - Log data to extract parameters directly – not enough time – maybe for future work
- Other time series Data (one of the feature engineered data) – these will come by combining the production and location data
  - Trends of other wells operating before the current well was drilled;
  - Trends of new wells operating after the current well was drilled
  - Trends of neighboring wells with respect to their abandonment rates

**Other objectives:** (Tied to the current objective - some of which could be used for Capstone 2)

- The standardization of wells in a basin
  - Create exploitation scores for reference - ultimately can be used an exploratory factor to understand well performance
  - Create well segmentation study - To generate segments using all of the data above to create rank ordered segments of wells each of which have unique properties in terms of \$value, production volumes, lifecycle properties etc.

**Deliverables: (all uploaded to GitHub)**

- Code
- Final Report
- Slide Deck