Assessment of Potential impacts on water resources posed by Hydraulic Fracturing in San Juan County, New Mexico

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Introduction

- New Mexico has and is a major producer of Natural gas and Crude Oil.
- Virtually all Natural Gas and Crude oil wells are in the Northwestern and Southeastern corners of the State.
- My area of focus, San Juan County is home to a portion of the Navajo Reservation and is a hotbed for Oil and Natural Gas extraction and production.
- Hydraulic fracturing (commonly known as fracking) is a mining process which uses large amounts of water to fracture harden earth.
- Fracking is a highly effective way to mine for natural gas and oil, but the process consumes large amounts of water and has been a potential threat to water quality.
- Slide 3 display a base map of my project.
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Legend
- Grandpa’s Agriculture field
- Farmington City Limits
- Bloomfield City Limits
- Aztec City Limits
- San Juan County, NM
- Navajo Nation
Background

- Fracking has occurred in the San Juan Basin since the 1940s.
- 90% of oil and gas wells in NM use fracking techniques.
- From 1980s-2003, a reported 7,000 cases of soil and water contaminations; 400 cases of underground water confirmation.
- The BLM has taken most of the criticism for allowing leasing and drilling to occur on its multi-use public lands.
- Total of 87 wells exist within a 10 mile radius – 58 wells are managed by BLM, 15 wells are located on tribal allotted land, and 14 wells are located on state land.
Project Objectives Statement

- The Objective of my project is to map and document all natural gas wells including fracking, (specifically those implementing hydraulic fracturing) within the San Juan County Area. Also to determine potential impact to local water resources (both surface and underground sources.)
Natural Gas and Crude Oil wells.

- NM is ranked 7th in natural gas production
- NM ranked 6th in crude oil production
- San Juan county (San Juan basin) made 81.3 Million $
- Lea County (Permian basin) made 134.0 Million $
- Estimated over 110,000 wells drilled in NM
- 90% of wells utilize the fracking process (Bureau of Land Management)
Hydraulic Fracturing ("fracking")

- A typical well can range from 3,000 to 15,000 feet below the ground.
- The horizontal drilling can extend up to 2 miles.
- Fracking can use 300,000 to 8,000,000 gallons of water.
- San Juan county used 1.7 billion gallons in 2013.
  - Less than 1 percent of fresh water use in comparison to total NM use.
How does fracking effect us?

- It takes 1-8 million gallons of water for each Hydraulic Fracturing process.
- Approximately 40,000 gallons of chemical is used per process.
- Up to 600 chemicals used including (Lead, Uranium, Mercury, Radium, Methanol, Formaldehyde).
- Only 30-50% of “produced water” is recovered, the rest is left in the ground and is not biodegradable.
- Methane concentrations are 17x times higher in drinking water wells.
- Over 1000 Documented cases of water contaminations near areas of oil and gas drilling wells.
- Less than %15 of produced water is recycled or reused, most is “stored”.
Irrigation canal, Community water tank, Wildlife and livestock.
Fracking activity
Data Resources

- Navajo Nation Shapefile from Eastern Land Development Commission
- River stream data of San Juan River from RGIS UNM.
- The distance of Fracking activity from the three major townships in San Juan County.
- NAIP air photo (USGS earth explorer)
- Latest data points of fracturing wells (2011-2015) from the FracFocus website.
Methodology

- Locate and download data related to Fracking wells in San Juan County
  - Collected data for fracking well up to 2011
  - Received second layer with fracking wells through 2015
- Develop base map including San Juan County as Study area
- Determine factors for hopeful classification mapping of fracking sites
- Determine water source for fracking in San Juan County
- Download NAIP 2014 imagery for San Juan County
  - Downloaded at Haskell Indian Nations University
  - Tried to mosaic and export but too large for Haskell computers
  - Over 100 NAIP Images
  - Ended up mosaicking portions (Only partially successful needed a bigger computer to run)
  - Only ran north half of county and broke it into west, central and east sections
- Ran ISO unsupervised classification (15 classes) on each section to determine feasibility
- Compared ISO results to determine ability to discriminate Fracking wells
- Determine next steps
Project Results

- Was my objectives met?
  - Based on the result, Iso Classification data is inadequate for conducting a supervise classification to identify fracking activity in the San Juan County.
  - Town of Shiprock, surface water is being monitor and kept clean.
  - City of Farmington utilizes underground water sources.
  - Primary underground water sources:
    - Turtle Mountain wells
    - Trading Post wells

- What did I learn?
  - I experience the benefits of using Geospatial data by pursuing intellectual work that is true, challenging, and significant, and prepared me to share the knowledge and experience with the community of Shiprock, NM.

- What does your map accomplish? Show that the misclassification which leads into the close up map. Point hydraulic fracturing activity within the San Juan County.
Results/ Discussion

Iso Cluster Unsupervised Classification within the Central San Juan County, New Mexico

Class 15 of Iso Classification

1  2  3  4  5  6  7  8  9  10  11  12  13  14  15
San Juan County, NM
Result/Discussion

Iso Cluster Unsupervised Classification within the Central San Juan County, New Mexico

Class 15 of Iso Classification

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San Juan County, NM

Hydraulic Fracking

Map of the United States showing the location of San Juan County, NM.
Next step, further work

- Underground wells usage
- Water rights for the fracking companies.
  - There are two environmental Protection Act that control water quality and banned underground fluid injection but hydraulic fracturing is exempt.
    - Safe Drinking Water Act
    - Clean Water Act
- Number of leases (new fracking wells) coming online and their impact on water resources
  - This past May, four newest wells has startled operating and online.
Literature Review

- United States Environmental Protection Agency. “Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources – Executive Summary” United States Environmental Protection Agency (EPA). June 2014
- San Juan Water Commission. “San Juan Hydrologic Unit Regional Water Plan.” San Juan Water Commission. 4 October 2003
Bitsoi, Alastair Lee. “Udall and Connor visit Chaco, seek to amend resource management plan.” Navajo Times. 9 July 2015

Landry, Alysa. “New rules to address fracking on Indian Land.” Navajo Times. 23 May 2013

Paskus, Laura. “New Mexico’s “Fracking” Legacy”. KUNM. 11
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