CE 394 GIS in Water Resources

Term Project Proposal

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Project Name

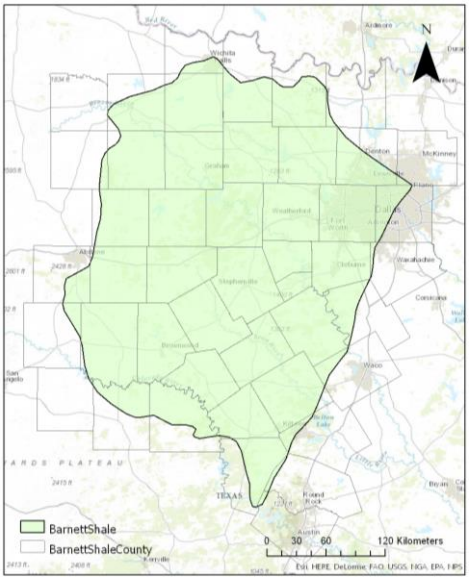
3-D Imaging of Barnett Shale and Groundwater Contamination Risk

Current Progress

1. Barnett Shale Geologic and Geographic Information

The 2-D map of Barnett Shale area projected in Albers Conical Equal Area Coordinate System was made, shown as the figure below. The official geological data on Barnett Shale can be obtained in Railroad Commission of Texas, at http://www.rrc.state.tx.us/about-us/resource-center/research/data-sets-available-for-purchase/digital-map-data/. However, the digital data in RRC require ordering, they were not used in this project update.

Texas counties' boarders were also plotted in the following Graph. There are 46 Texas counties or part of the counties that are within the Barnett Shale area. The basemap is a topographic map provided by ESRI.



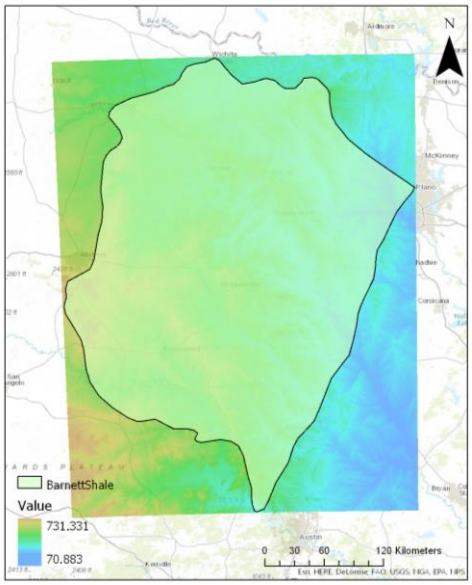
2. Surface Properties of Barnett Shale

The digital elevation model of the Barnett Shale is obtained at using ArcGIS server URL http://elevation.arcgis.com/arcgis, which provides a 30 meters DEM. Then elevation data in the Barnett Shale was cut out using Extract by Mask function. A 1 kilometer buffer area outside of the original Barnett Shale area was made and then used as the feature mask in this function.

From the extracted elevation data, shown in the map below, we can see the maximum elevation within Barnett Shale is around 731 meter while the minimum elevation is around 71 meter. The elevation in the east is generally higher than that in the west of Barnett Shale.

Landcover information of Barnett Shale is shown in the map below. National Land Cover Database (NLCD) is used, accessed in Multi-Resolution Land Characteristics Consortium. There are 15 classes of landcover in the Barnett Shale, listed in Table 1. From the table we can see the classes with largest area is developed (open area to low intensity), forest, Shrub/Scrub and Grassland/Herbaceous.

Map of Barnett Shale Elevation



Map of Barnett Shale LandCover

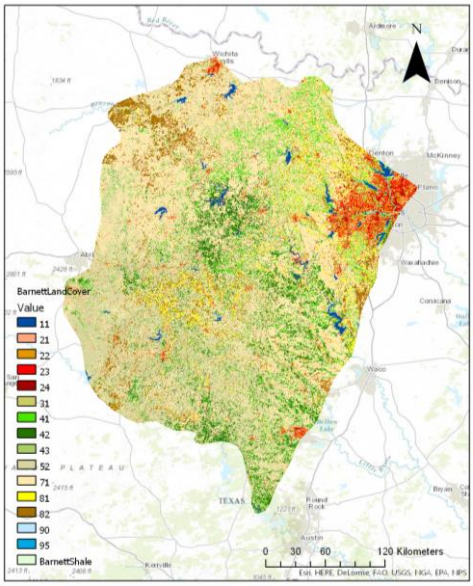


Table 1 Landcover in Barnett Shale

Value	Class	Area (sqkm)	Area Percent (%)
11	Open Water	979.6833	1.4141
21	Developed, Open Space	4035.1563	5.8243
22	Developed, Low Intensity	1346.4657	1.9435
23	Developed, Medium Intensity	839.5515	1.2118
24	Developed High Intensity	430.3872	0.6212
31	Barren Land	135.4977	0.1956
41	Deciduous Forest	5078.3166	7.3300
42	Evergreen Forest	5001.2109	7.2187
43	Mixed Forest	3.1176	0.0045
52	Shrub/Scrub	15821.8641	22.8370
71	Grassland/Herbaceous	28950.7707	41.7871
81	Pasture/Hay	2192.4423	3.1645
82	Cultivated Crops	3976.1316	5.7391
90	Woody Wetlands	449.7075	0.6491
95	Emergent Herbaceous Wetlands	41.3739	0.0597
	Sum	69281.6769	

Future Plan

1. Obtain geological information on hydraulic fracking wells, as well as water level monitoring wells and aquifers.
2. Learn Arc Hydro Groundwater Model
3. Generate underground 2-D cross section images.
4. Transform the available data to 3D GeoSection.
5. Analyze the risk of groundwater contamination by hydraulic fracking.

Data Sources

1. The geological location of Barnett Shale

   ArcGIS server URL https://services.arcgis.com/9dTWrhPzuDPnUVXr/arcgis/rest/services/Barnett_Shale.gdb/FeatureServer/0, provided by Cody.Yates_dentontxgis in ArcGIS online.

2. The boarders of all counties in Texas

   ARcGIS server URL http://tiles.arcgis.com/tiles/nzS0F0zdNLvs7nc8/arcgis/rest/services/US_Counties_basemap_lightgray_anno/MapServer, provided by Web map for Smithsonian shale gas story in ArcGIS online.

3. Digital Elevation Model

   ArcGIS server URL http://elevation.arcgis.com/arcgis

4. National Land Cover Database (NLCD)

   http://www.mrlc.gov/nlcd2011.php