Title: Systematic approach to source-sink matching for geological carbon capture and sequestration

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Problem Statement: Success of geological carbon capture and sequestration (CCS) is dependent on appropriate pairings of sources and sinks. Factors to consider for appropriate pairing include distance from source to sink, availability of existing CO_2 pipelines, depth and geologic attributes of the source, population distribution near proposed projects, nearness to parks and vulnerability of overlying freshwater aquifers. Ambrose et al (2009)* documented geographic distribution of point and geologic sources of CO_2, brine aquifers, CO_2 pipelines and geologic sinks for CCS in the continental United States, focusing on The Texas Gulf Coast and Permian Basin. This project aims to incorporate distribution of freshwater aquifers, population and national/state parks in Texas to this data set to develop a more in-depth approach to source sink matching through ArcGIS software.

Purpose: This project will enhance established data sets for CCS source-sink matching and demonstrate how to use ArcGIS software to delineate potential CCS projects based on established criteria for source-sink appropriateness.

Method:

Step 1: Obtain data

- Geological sources of CO_2 such as coal, lignite, oil and gas. Data will be sourced from the United States Geological Survey (USGS)
- Anthropogenic CO_2 point sources such as refineries, power plants, iron and steel foundries, ammonia, cement and hydrogen plants. Data will be sourced from the International Energy Agency (IEA)
- Brine formations that are the correct depth, salinity, thickness, porosity etc to act as CO_2 sinks. Data will be sourced from the Bureau of Economic Geology (BEG) and United States Geological Survey (USGS).
- Existing CO_2 pipelines. Data will be sourced from the USGS, IEA, BEG and Railroad Commission of Texas (RRC).
- Fresh water aquifers in the U.S. Data will be sourced from the USGS and the Texas Water Development Board (TWDB).
- Population density throughout Texas. Data will be sourced from the US Census Bureau.
- Parks and other protected areas. Data will be sourced from
- Other potential data sources include the Ambrose et al (2009) paper and Texas Natural Resources Information System (TNRIS) website.

Step 2: Establish criteria

First order criteria will be established in order to minimize distance between sources and sinks, maximize access to existing CO_2 pipelines. This will identify source-sink pairings that will go through further review. Second order criteria will minimize risk to freshwater aquifers and maximize distance from protected areas and sites of high population density.

Step 3: Rank potential source/sink matches according to criteria

Source-sink pairs that match established criteria will be ranked according to risk to potential aquifers and protected areas as well as nearness to major population hubs.

Step 4: Produce maps and tables to display data:

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* Ambrose, W.A., Breton, C., Holtz, M.H., Nunez-Lopez, V., Hovorka, S.D., Duncan, I.J. 2009. CO_2 source-sink matching in the lower 48 Unite States, with examples from the Texas Gulf Coast and Permian Basin.

I expect my final product to include several maps of sources and sinks paired with pipelines, aquifers, parks and population. I expect to create a flowchart to demonstrate criteria and choosing potential. I expect to identify several source-sink pairs that match my criteria.