DOE Annual Meeting August 5-6, 2024

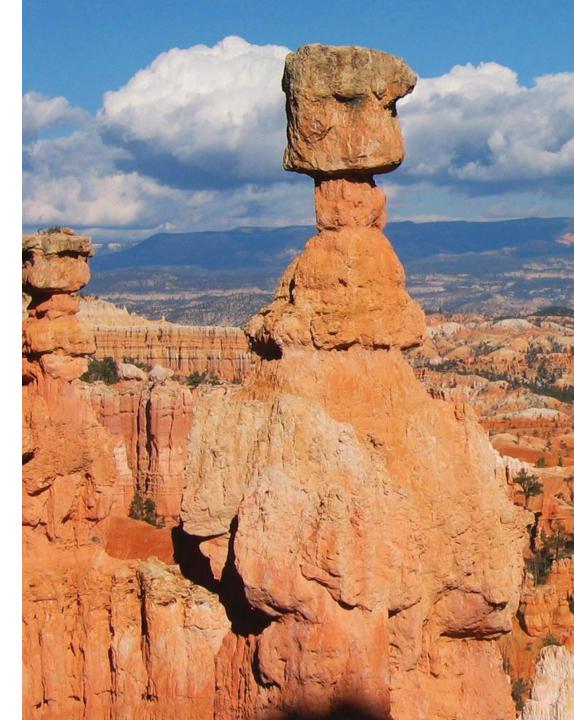
Utah Geological Survey

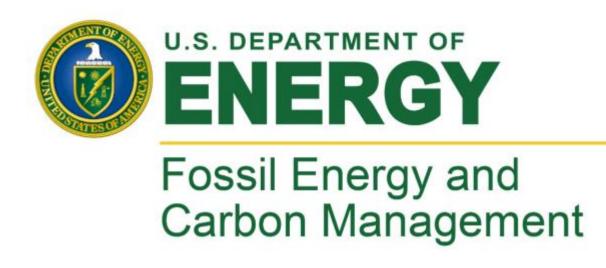
Utah Statewide Carbon Storage Assessment: Geological Data Gathering, Analysis, Sharing, and Engagement



Michael Vanden Berg, P.G. & Gabi St Pierre, Ph.D.

Utah Geological Survey





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Project Overview:

- Aggregate, produce, analyze, and disseminate organized and accurate geological data for effective carbon storage (CS) in the state of Utah
- Create an interactive website application ("Web App") that allows the visualization, storage, and systematic download of CS assessments
- Strongly consider societal and environmental impacts
- Include social justice frameworks in all tasks and interactions
- Set the stage for future business investment in Utah

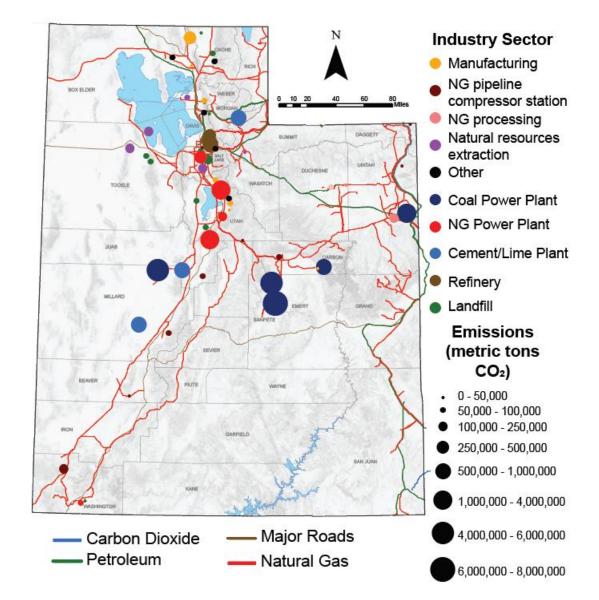




Project Overview

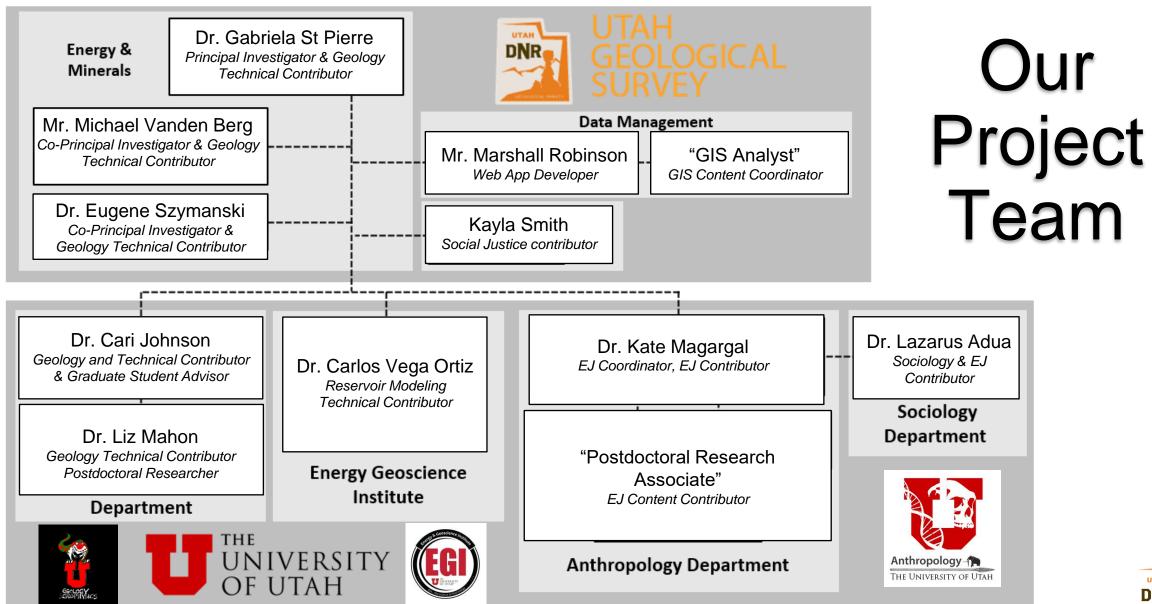
- There are limited CO₂ sources in Utah
 - Coal fired power plants, natural gas power plants
- Most sources are concentrated near population centers
 - E.g., Wasatch Front
- Likely a need for storage away from primary CO₂ sources
 - Direct Air Capture (DAC)
 - Carbon transport via pipelines

"sinks in search of sources"



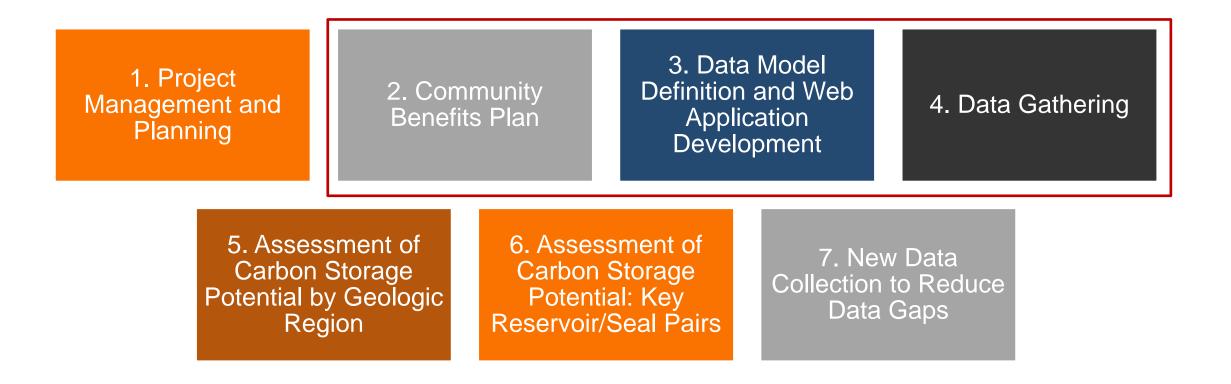
2022 EPA flight data; https://ghgdata.epa.gov/ghgp/







Project Plan



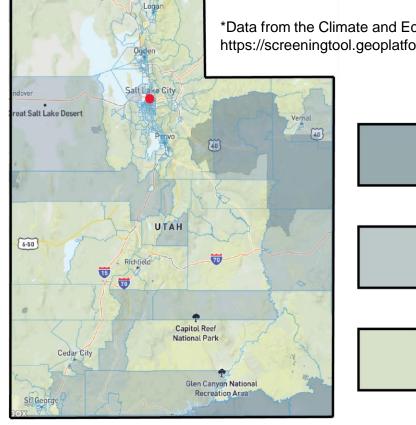


2. Community Benefits Plan

- The overarching intention of our CBP is to build relationships that can serve as the foundation for future planning.
- The primary benefit to the community is to be prioritized in decision structures that value community-held knowledge and lived experiences of community members.

CBP analyses will take a two-pronged approach:

- 1. Statewide Scale: assess an average or control condition among the population of Utah
- 2. Community scale: assess specific environmental justice dynamics (including identifying geospatial overlap with disadvantaged communities, or DACs) of potentially affected communities based on geoscience findings



*Data from the Climate and Economic Justice Screening Tool https://screeningtool.geoplatform.gov/en/#4.89/39.04/-116.27

- DAC: Meets >1 burden threshold and the socioeconomic threshold
- DAC: Meets 1 burden threshold and the socioeconomic threshold





2. Community Benefits Plan

Secondary and primary, qualitative and quantitative data will be gathered as part of the CBP plan. These data will be analyzed and synthesized into indexes intended to characterize the vulnerability of communities to climate change and energy justice.

	Secondary	Primary
Quantitative	Census Data	Frequencies of attitude categories, response counts from household surveys
Qualitative	Characterizations of existing CM communities in US, identified DACs	Quotes and insights from interviews, public comment during forums

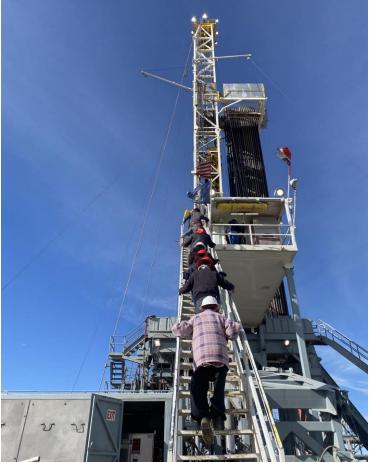
Outcomes: Maps of focal communities, information supporting community participation in CM future that includes index assessments.



2. Community Benefits Plan

Groups targeted for relationshipbuilding are defined as:

- 1. Leaders from tribal and municipal governments
- 2. Representatives of non-profit organizations and corporations with a vested interest in energy projects, including CS
- 3. Community members at large and private land holders



OUINTAH BASIN ENERGY SUMMIT

Uinta Basin Energy Summit happens each year in Vernal, UT

University of Utah students visit a drill rig in the Uinta Basin, a region we expect will be identified for public outreach.



Diversity, Equity, Inclusion, and Accessibility Plan*

Specific efforts as applied to this research include:

- Information accessibility:
 - Translating our press release into Spanish
 - Survey Notes article on our project for September issue
 - Creating project webpage on UGS Energy and Minerals website
- Indigenous inclusion: land acknowledgements, indigenous place-names
- *Team accountability*: everyone needs to attend a relevant educational event
- Mentorship: intentionally target early-career folks for training and involve them in the publication process

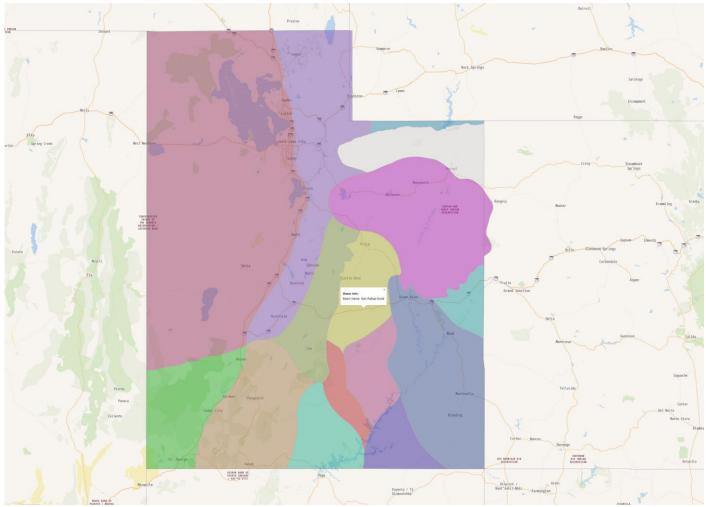
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The foundational geologic work will be a collaboration between the UGS Energy & Mill Program, the University of Utah Decery & Geoscience Institute, and the University of Utah Department to Geology & Geoscience Institute, and the University of Utah Department to Geology & Geoscience Institute, and the University of Utah Department to Geology & Geoscience Institute, and the University of Utah Department to Geology & Geoscience Institute, and the University of Utah Department to Geology & Geoscience Institute, and the University of Utah Department to Geology & Geoscience Institute, and the U	APPS CCUS PROJECT Ush Statewide Carbon Storage Assessment: Geological Data Cathering, Analysis, Sharing, and Eng The Ush Ceological Survey (UCS) was awarded a \$11 million grant from the U.S. Department of Energy (DOE) to study th potential across the state of Utah. 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Carbon storage (CS), more commonly known as Carbon Capture, Utilization, and Storage (CCUS), is a used to capture carbon dioxide emitted by an industrial or energy source (e.g., a coal-fired power plant) and transport it to a location wit be stored underground for significantly long time periods, such as within a deep, confined (sealed by impermeable rock), saltwater-bear formation (also known as a rock reservoir). The goal of this project is to provide a geologic assessment of the carbon storage resources a Utah and to display that assessment and the underlying data in a user-friendly public web application. All data and geologic analyses w published in a user-friendly geospatially enabled database available for download. 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*This plan is required to meet federal DOE grant obligations



Task 3: Data Model Definition and Web App Development

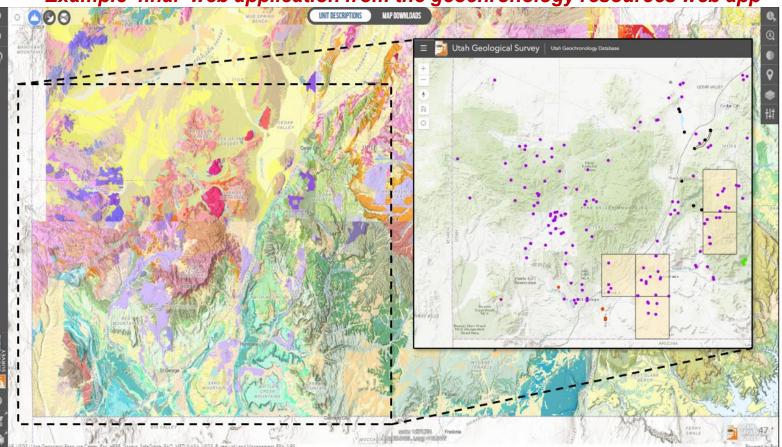
- Geospatial Database Development
- Web Application Development
 - Collected most of the basic data that will be shared in the web application, and have it published in PostGIS
 - Wells, cores, cuttings, georegions, infrastructure, etc
 - Created a very basic testing application that displays the data on an interactive map





Task 3: Data Model Definition and Web App Development Example 'final' web application from the geochronology resources web app

- Geospatial Database Development
- Web Application Development
 - Collected most of the basic data that will be shared in the web application, and have it published in PostGIS
 - Wells, cores, cuttings, geo-regions, infrastructure, etc
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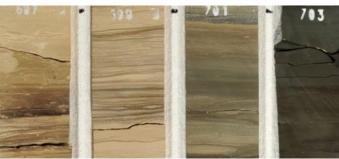
https://geology.utah.gov/apps/intgeomap/?view=scene&scale=1813311&zoom=8.35&lat=39.48501&lng=-111.56892&layers=footprints%2C500k%2C100k%2C24k&tilt=1&heading=358&elev=613560&exag=2.5&base=ustopo

Task 4: Data Gathering

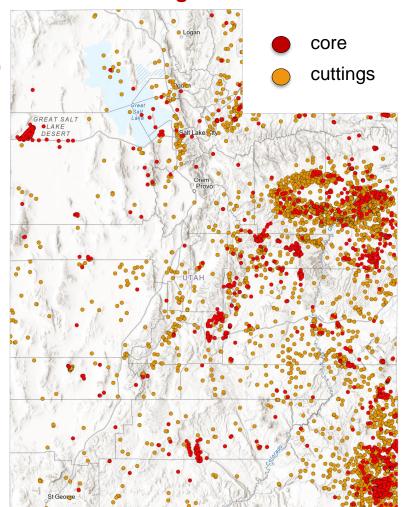
- Integration of Existing Carbon Storage Data
 - Well logs, petrophysical data (e.g., porosity, permeability)
 - Cores, cuttings
 - Outcrop data (e.g., measured stratigraphic columns)
- Identification of Data Gaps and Limitations

Utah Core Research Center (UCRC)



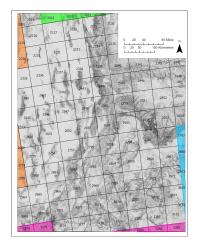


Core and Cuttings Available at UCRC



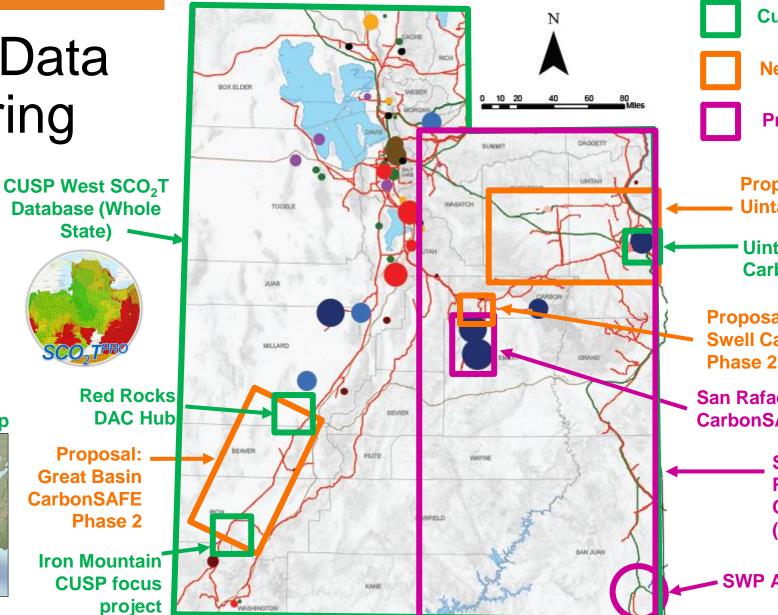


Task 4: Data Gathering



CUSP West Partnership





Currently Funded Projects New Proposals In Progress

Previous Work

Proposal: RITAP FOA: Uinta-Piceance Region

Uinta Basin CarbonSAFE Phase 2

Proposal: San Rafael Swell CarbonSAFE Phase 2

San Rafael Swell CarbonSAFE Phase 1

> Southwest Partnership (SWP): Colorado Plateau (NATCARB)

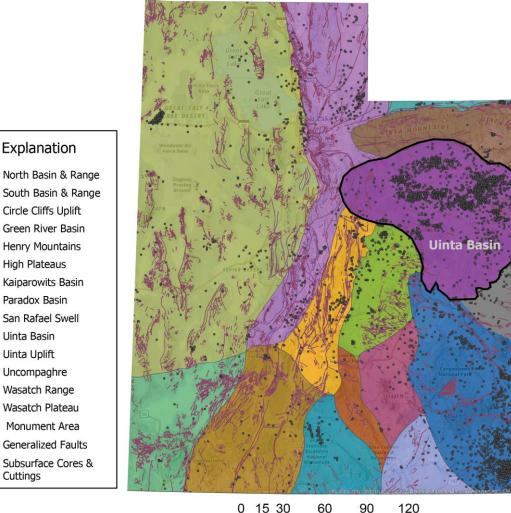
SWP Aneth CO₂ EOR



Utah Geological Survey

Task 5: Assessment of Carbon Storage Potential by Geologic Region

- Objective: Create a high-level summary so non-experts can understand the CS potential of each region
- Current tasks:
 - Review of Existing Carbon Storage and Geologic Data by Georegion
 - Adding Relevant Data into the Web Application
 - Modeling initial carbon storage resource estimate and cost
- End Deliverable: Regional Assessment Report





geology.utah.gov

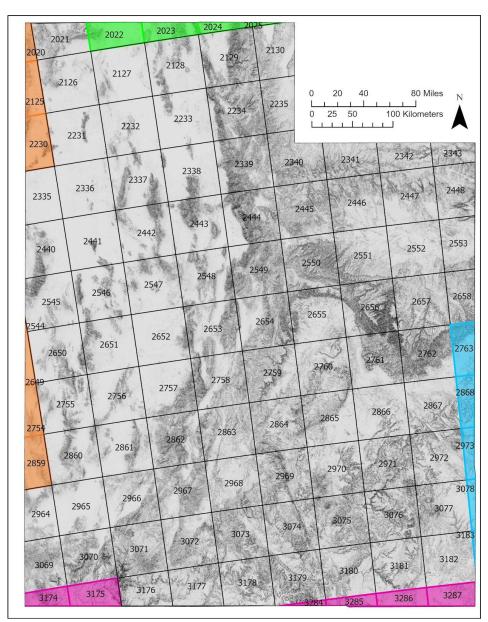
Miles

Cost and CO_2 Storage Resource Assessment: SCO_2T^{PRO}

- SCO₂T^{PRO} is a new software package that uses machine learning to simulate CO₂ storage in saline aquifers
- Key Geologic parameters:
 - Formation
 - Thickness
 - Depth
 - Permeability
 - Porosity
 - Pressure
 - Temperature/temperature gradient
- Key Engineering/Cost parameters:
 - Max injection rate
 - Number of injection wells
 - Injection well diameter
 - Old oil and gas wells
 - Injection period and rate









Cost and CO₂ Storage Resource Assessment: SCO₂T^{PRO}

Geo_Region	Reservoir Name	Depth (ft)	Depth Source	Net Thickness (ft)	Net Thickness Source	Permeab ility (mD)	Permeability Source	Porosity (%)	Porosity Source	Arec
High Plateuas	Dakota Sandstone	6,500	Panguitch #1 Well; API 430:	200.0	Hintze and Kowallis	0.08	Ava from PP datab		Avg from PP datak	109.
High Plateuas	Kaibab Limestone	10280	Panguitch #1 Well; API 430.	170.0	Hintze and Kowallis	281	From AAPG Oil and		From Fed Apple 22	
High Plateuas	Navajo Sandstone	8,960	Dixie Unit 2; API 430173010	1600.0	Hintze and Kowallis	80	Sprinkel et al 2007	8.00	Iron Mnt project	186
High Plateuas	None	None	None	None	None	None	None	None	None	0.
High Plateuas	Kaibab Limestone	11,500	Panguitch-1 Well	100.0	estimate	281	From AAPG Oil and	17	From AAPG Oil and	58
High Plateuas	Navajo Sandstone	6,000	Well Report	1500.0	Hintze and Kowallis :	80	Sprinkel et al 2007	12.00	Sprinkel et al 2007	583
High Plateuas	Kaibab Limestone	7,000	Johns Valley Unit 2	170.0	120-230 ft thick (Fror	281	From AAPG Oil and	17	From AAPG Oil and	250
High Plateuas	Navajo Sandstone	4200	only in NE and NW corners;	1600	Estimated from Hintz	80	Sprinkel et al 2007	12.00	Sprinkel et al 2007	61
High Plateuas	White Rim Sandstone	7,200	Wells - depths go from 420	170.0	Estimated from Hintz	1.58	*Avg from Weber i	15	Copied from From B	954
High Plateuas	none	none	none	none	none	none	none	none	none	0
High Plateuas	none	none	none	none	none	none	none	none	none	0



0 15 30

60

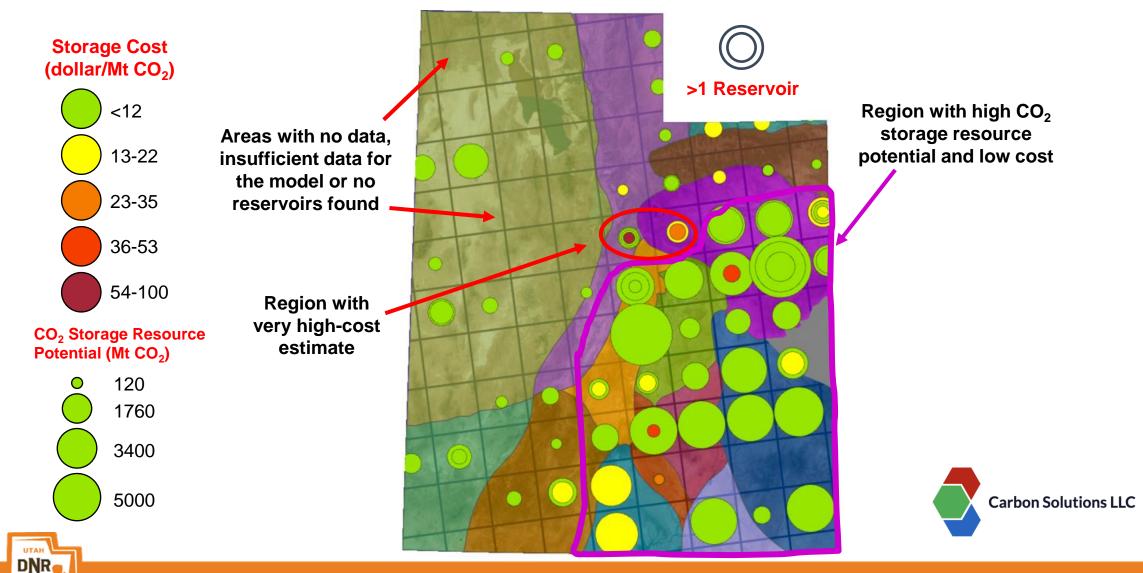
90

120 Miles

Utah Geological Survey



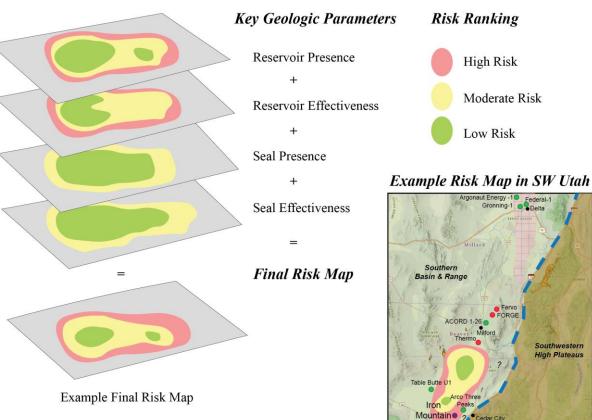
Cost and CO₂ Storage Resource Assessment: Results





Task 6: Assessment of Carbon Storage Potential: Key Reservoir/Seal Pairs

- 1. Reservoir & Seal layer mapping
- 2. CS Prospect Risking and Favorability Ranking
- 3. Carbon Storage Resource Polygons
- 4. Highlight regions with few, or no existing geologic data
- 5. Publish in the Web Application (Production Release)

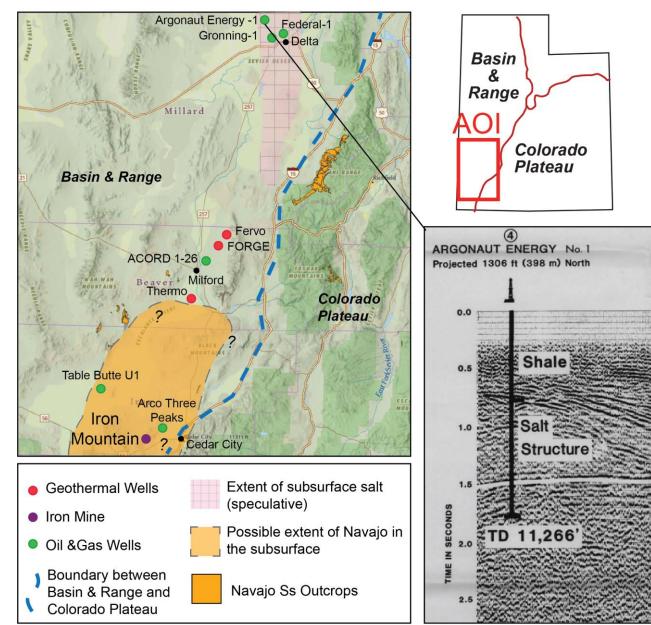


https://www.gis-pax.com/play-mapping/traffic-light-maps-vs-split-risking-maps/



Example

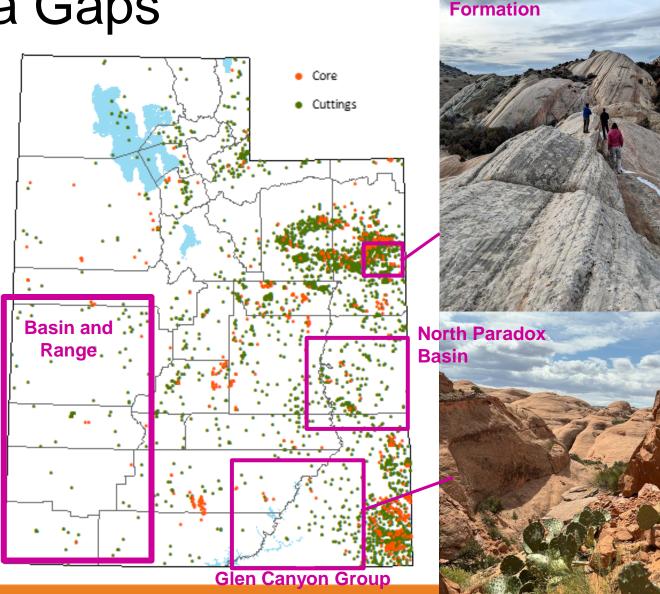
- Possible reservoirs:
 - Basalts
 - Beneath salt domes
 - Navajo, White Rim, Cedar Mesa Sandstones
 - Kaibab, Leadville/Redwall Limestone etc.
- Polygon attributes could include:
 - reservoir thickness
 - subsurface depth
 - dominant fracture sets
 - paleo-depositional environment
 - stratigraphic architecture
 - rock property information such as porosity, permeability, framework mineralogy, and geochemistry





Task 7: Reducing Data Gaps

- Data Gap Reduction through New Data Collection
 - University of Utah GG: Currently investigating the Navajo Sandstone across UT and other potential Glen Canyon Group reservoirs
- Petrophysical and Fluid Property Assessment
 - EGI is investigating the northern Paradox Basin
- Reservoir Modeling for Regional CO₂ Volume Estimates
- Add New Geologic Data into Web Application (Production Release)



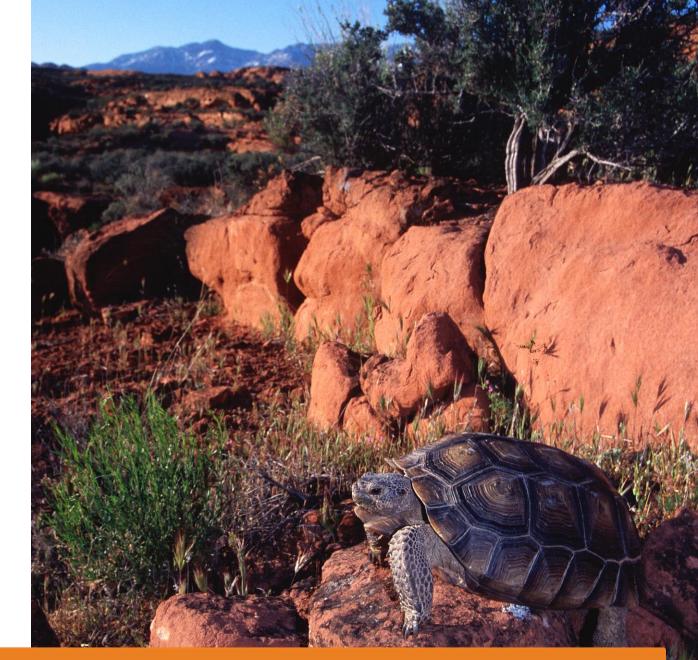
Uinta Basin:

Entrada

DNR

Next Steps:

- Continue updating webapp and database with new data
- Send state-wide survey to the public to evaluate their opinions on CCUS and energy transitions in Utah
- Survey Notes Article, September 2024
- Begin carbon storage analysis by geo-region
- Continue identifying areas with data gaps that need to be filled







Thank you.

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https://geology.utah.gov/

