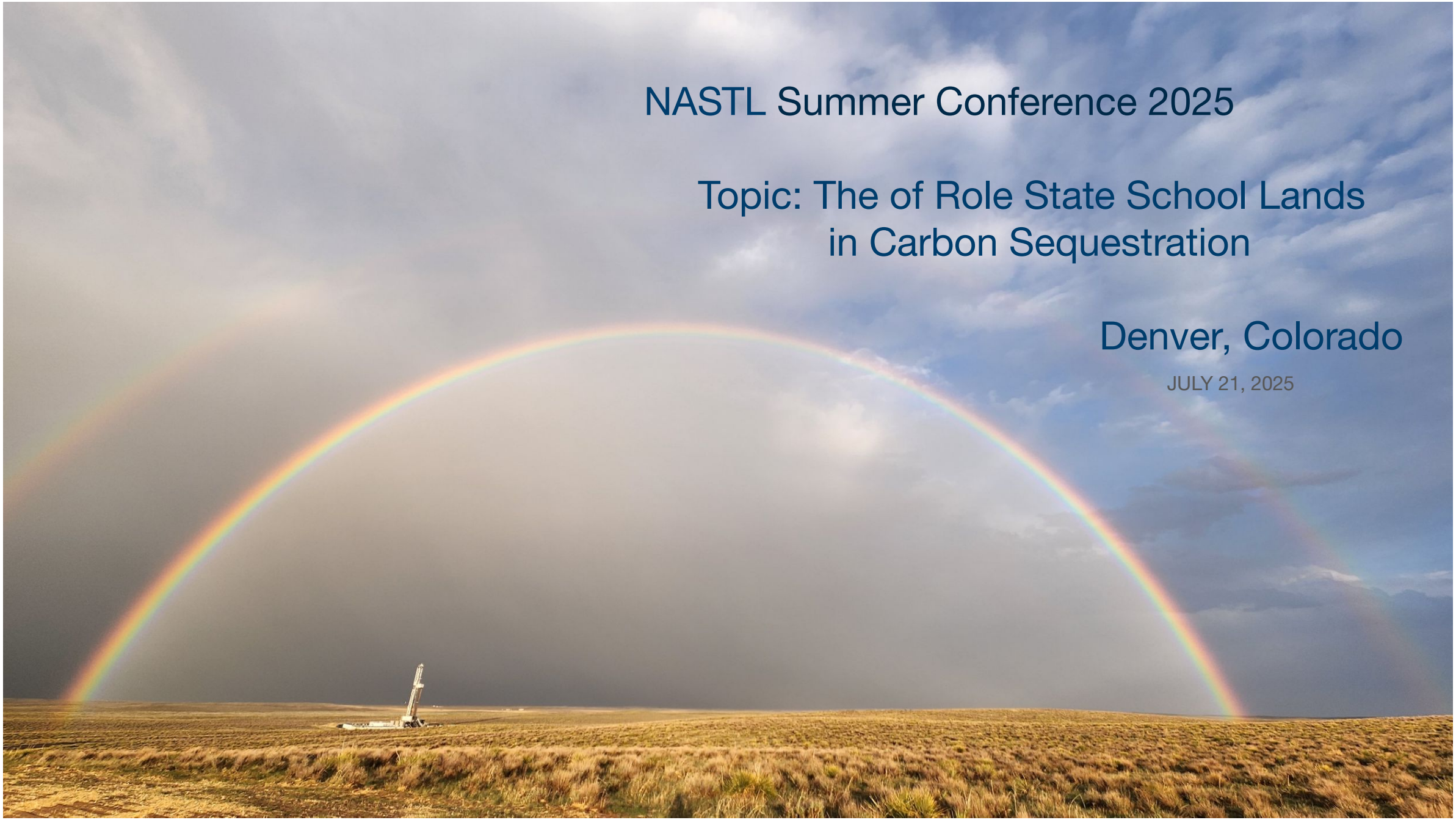


NASTL Summer Conference 2025

Topic: The of Role State School Lands in Carbon Sequestration

Denver, Colorado

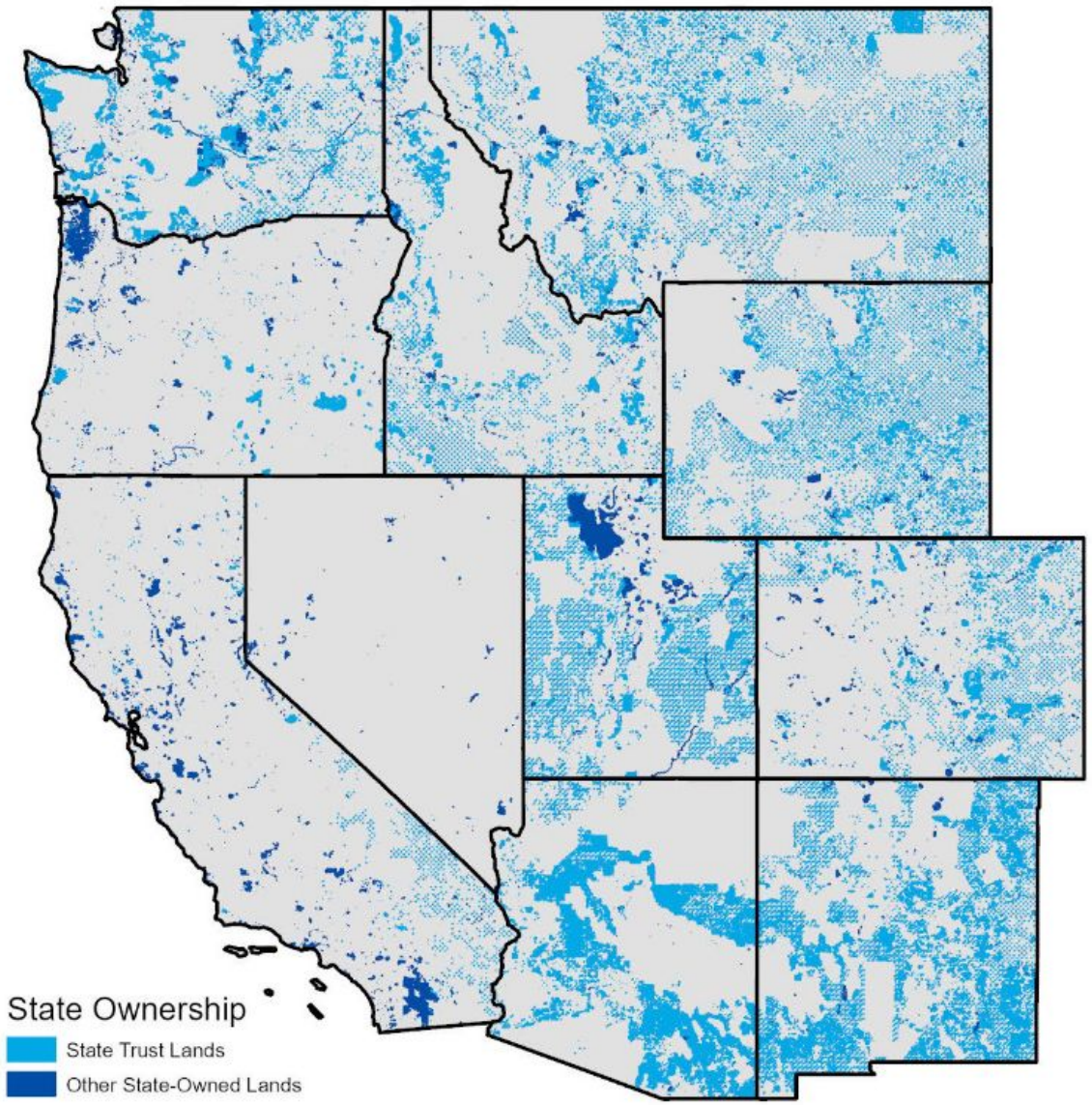
JULY 21, 2025

Presentation Overview

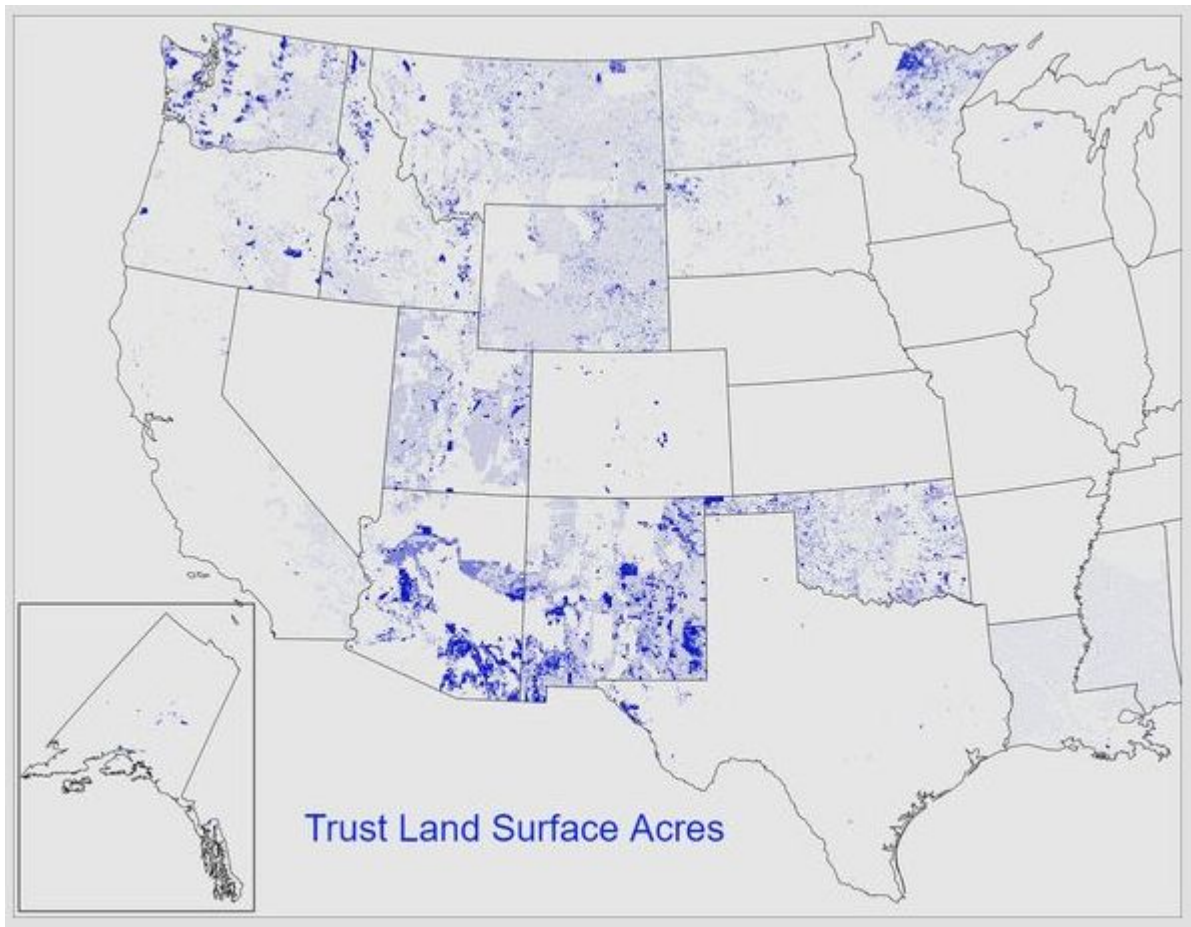
- What is the role state lands can play in geologic carbon sequestration?

- To understand the role you can play, you need to get a big-picture view of how a project would move forward. This requires a clear-eyed assessment of project effects and risks:
  - **Project siting and physical environment**
  - Regulatory and legal environment
  - Financial aspects
  - **Cultural aspects**

State trust land holdings are extensive. The 11 western states host 40 million acres of state trust lands.[2] One in every 20 acres in the West is state trust land.



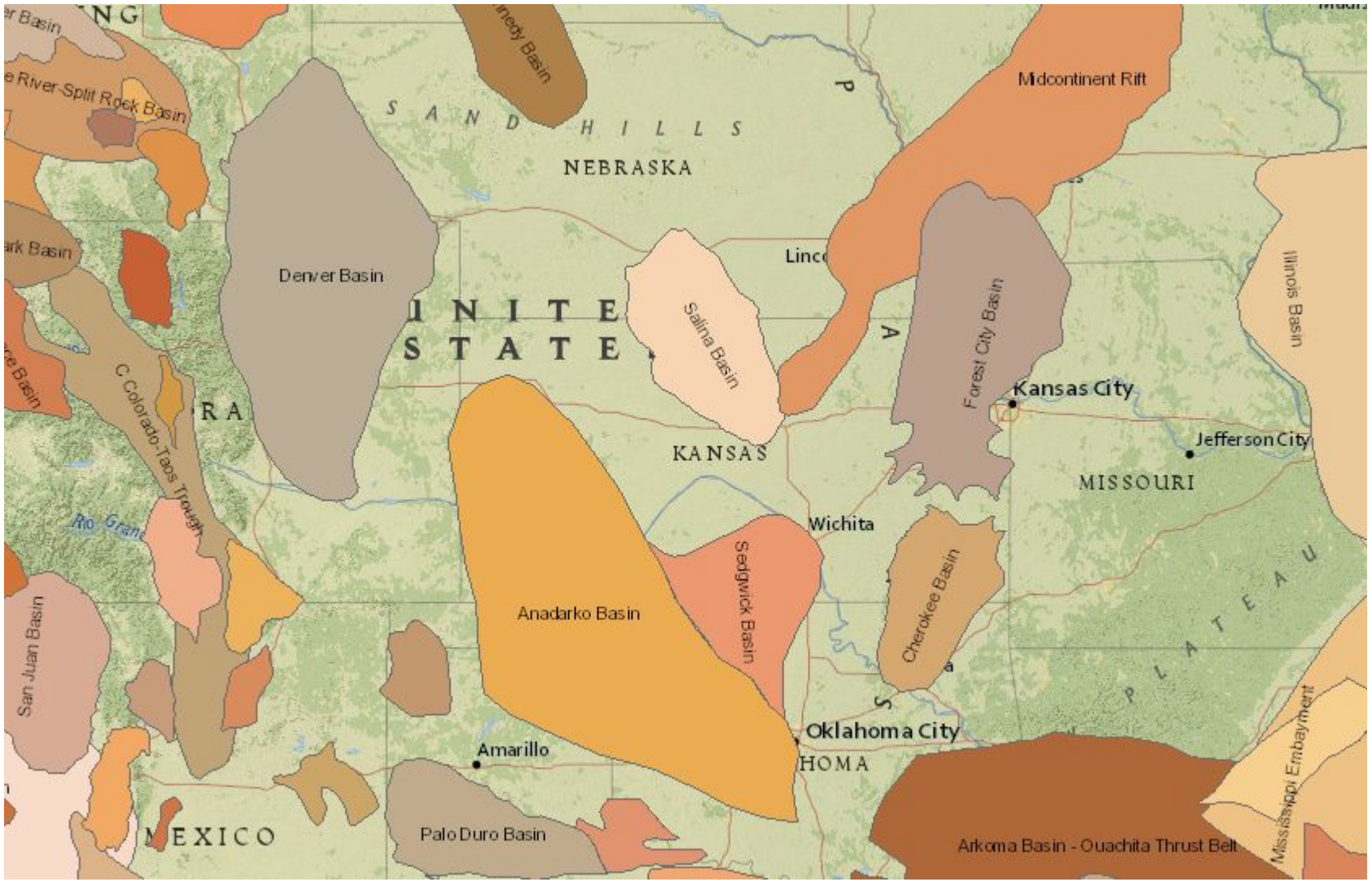
Wow! That's a lot!



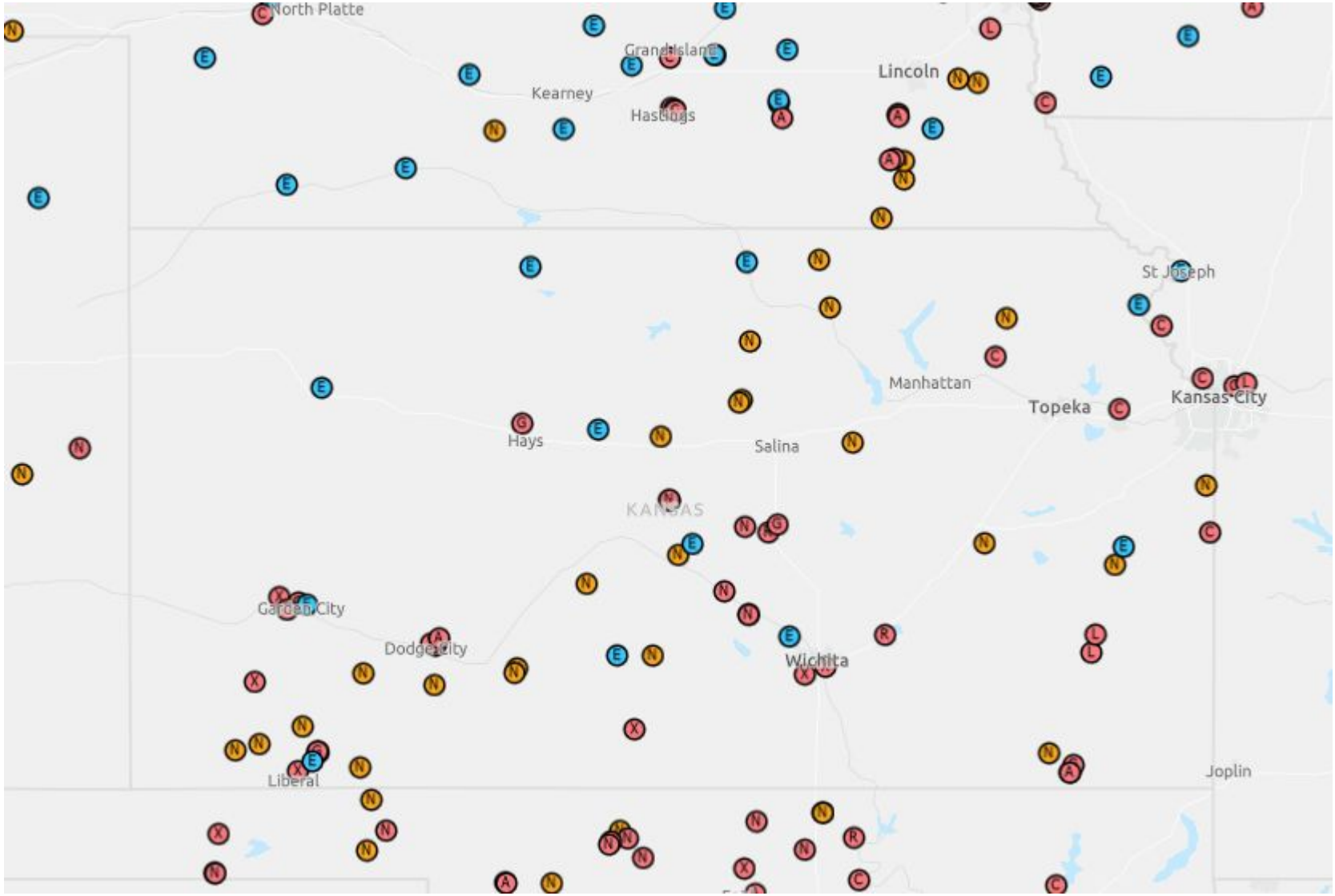
Project Siting and Physical Environment

- How does a developer choose a sequestration location?
  - Intersection of:
    1. Geology / reservoir
    2. Emitters
    3. Property Rights / Surface Use

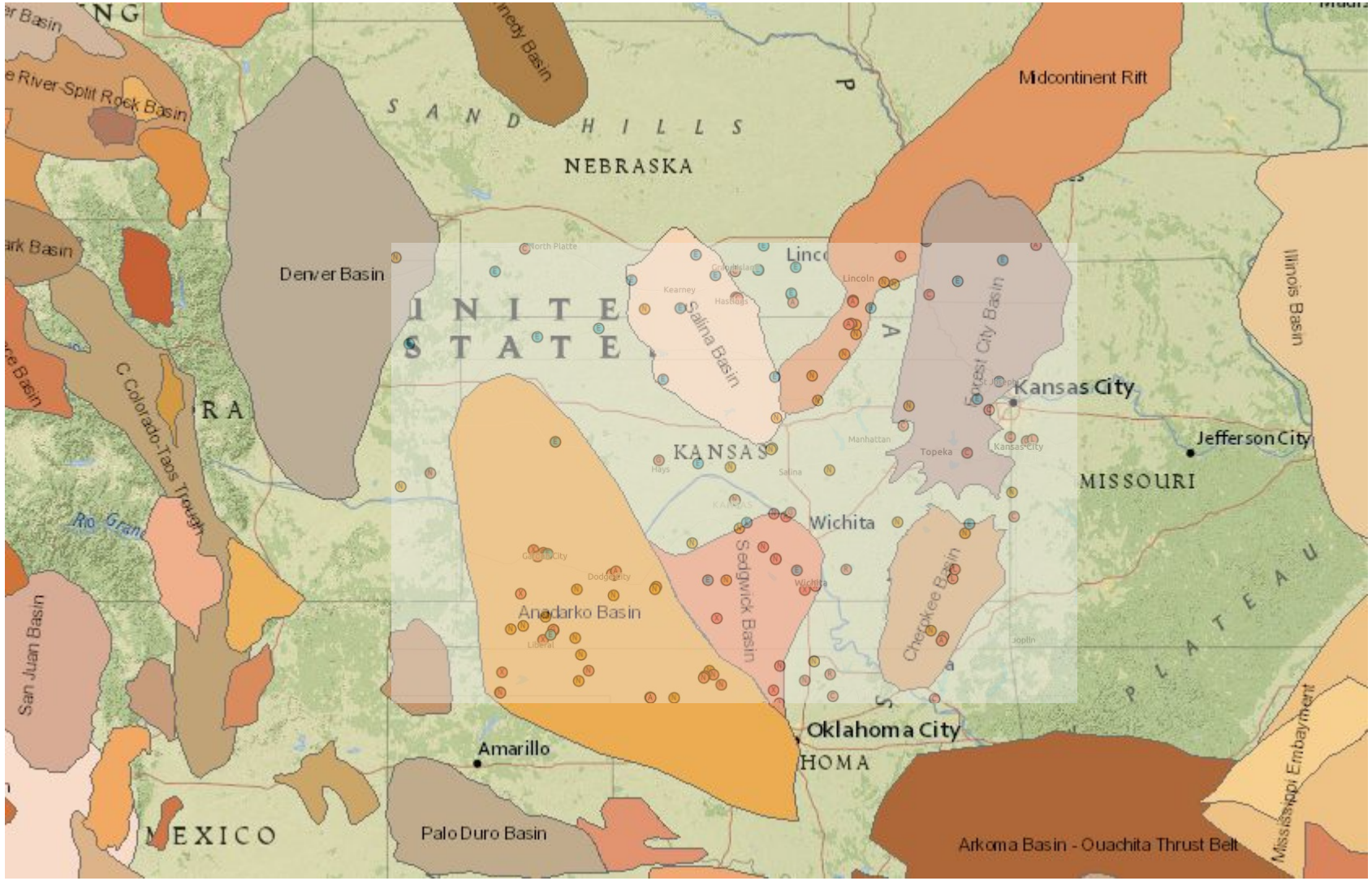
1. Geology and reservoir



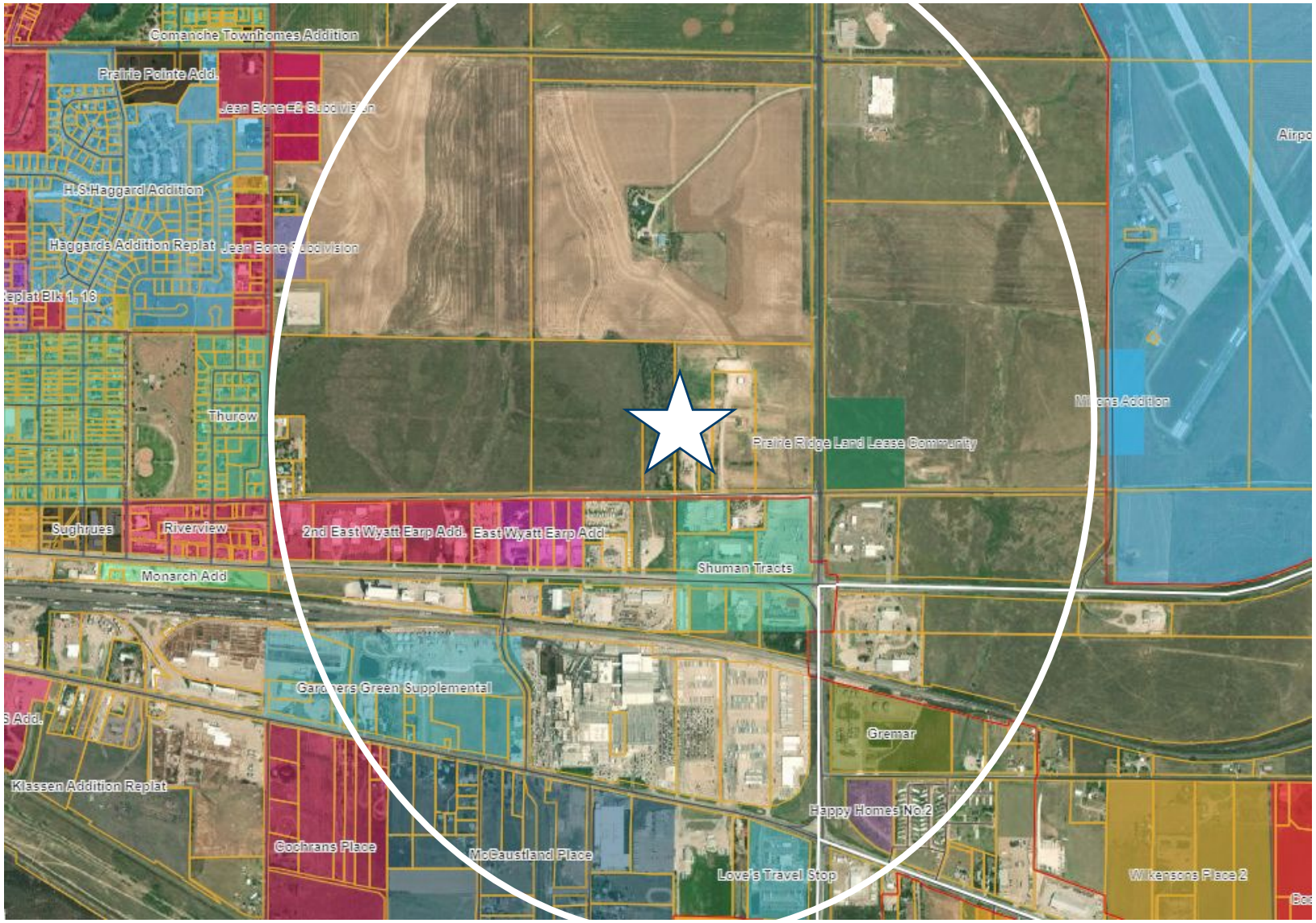
2. Emitter locations



Geology + emitters

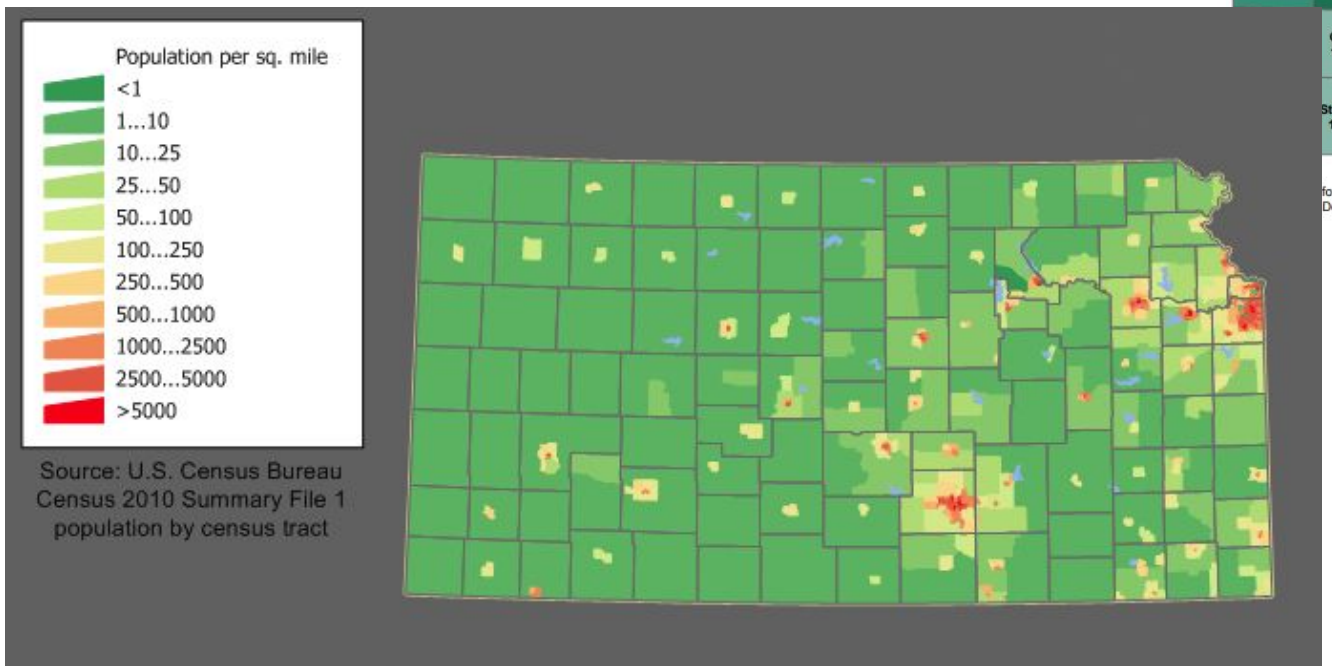


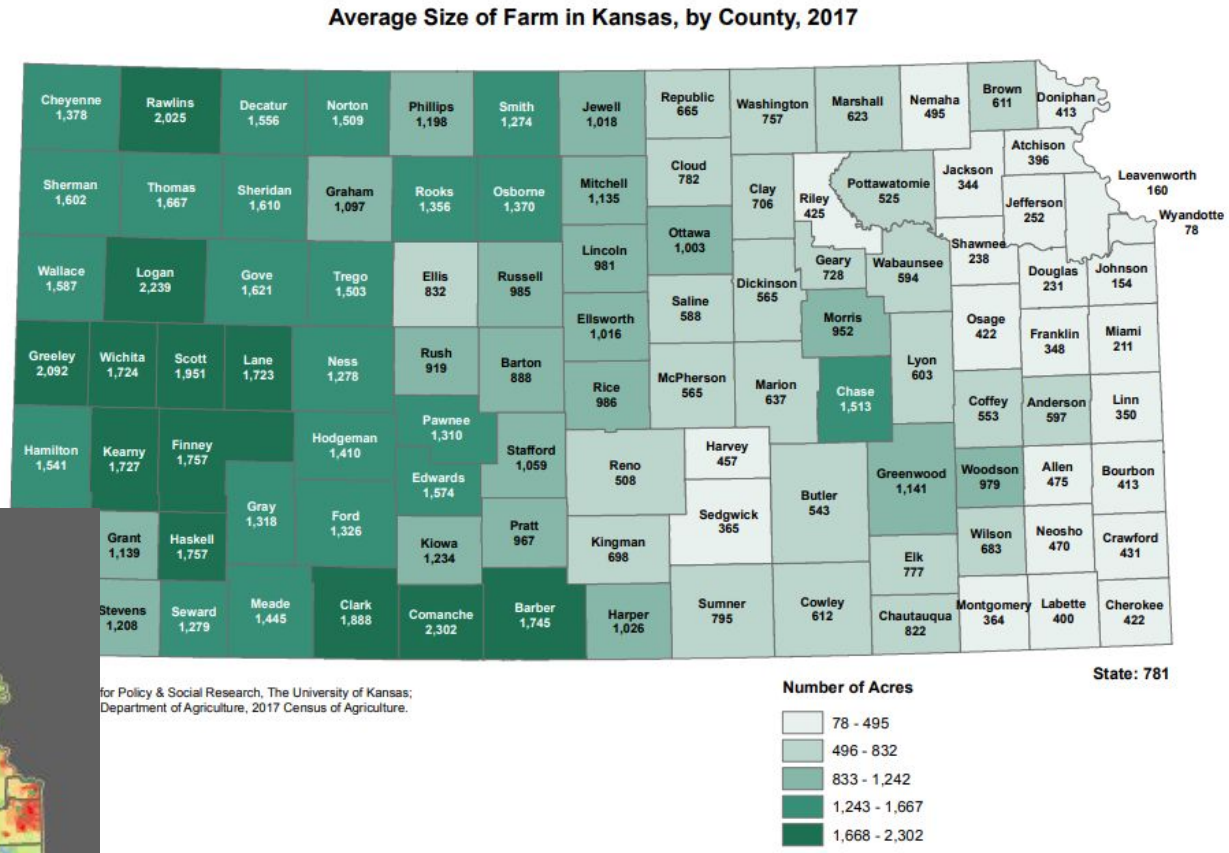
Property Rights: storage (pore space)



Storage rights:

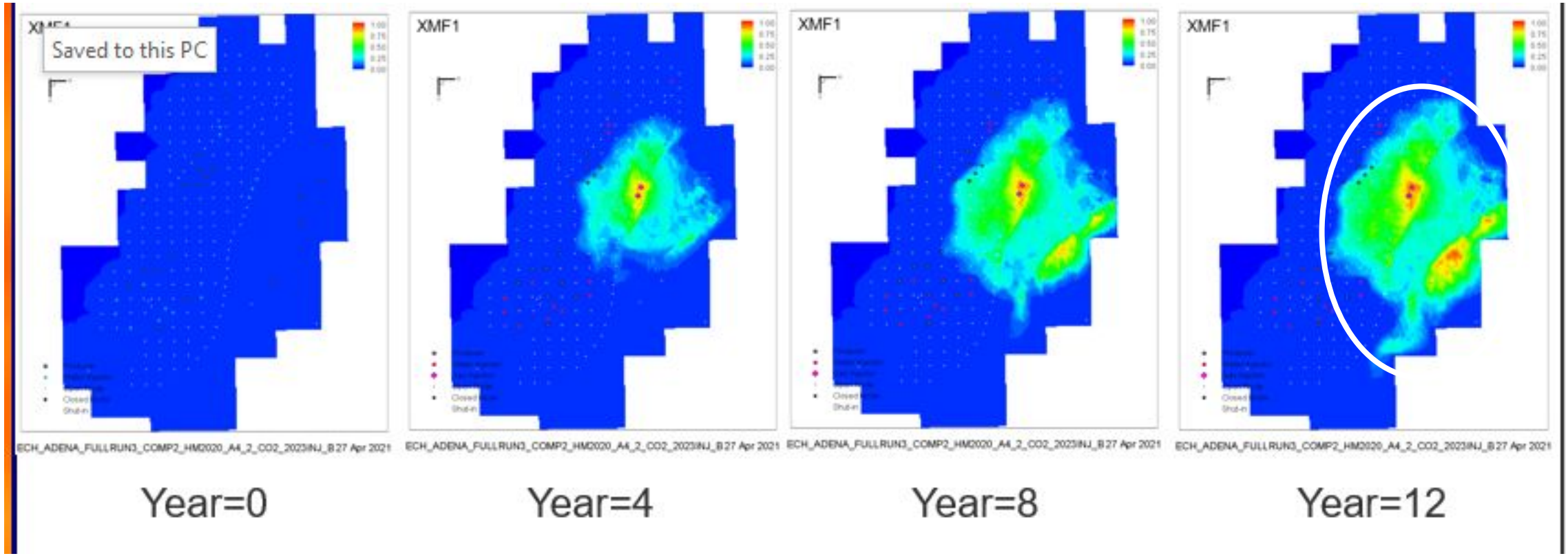
- Pore space is attached to surface until severed (if possible)
- Think about what this means in an area with many small farms--or subdivisions!
- A larger number of tracts in a storage unit will make it harder to assemble all the rights needed





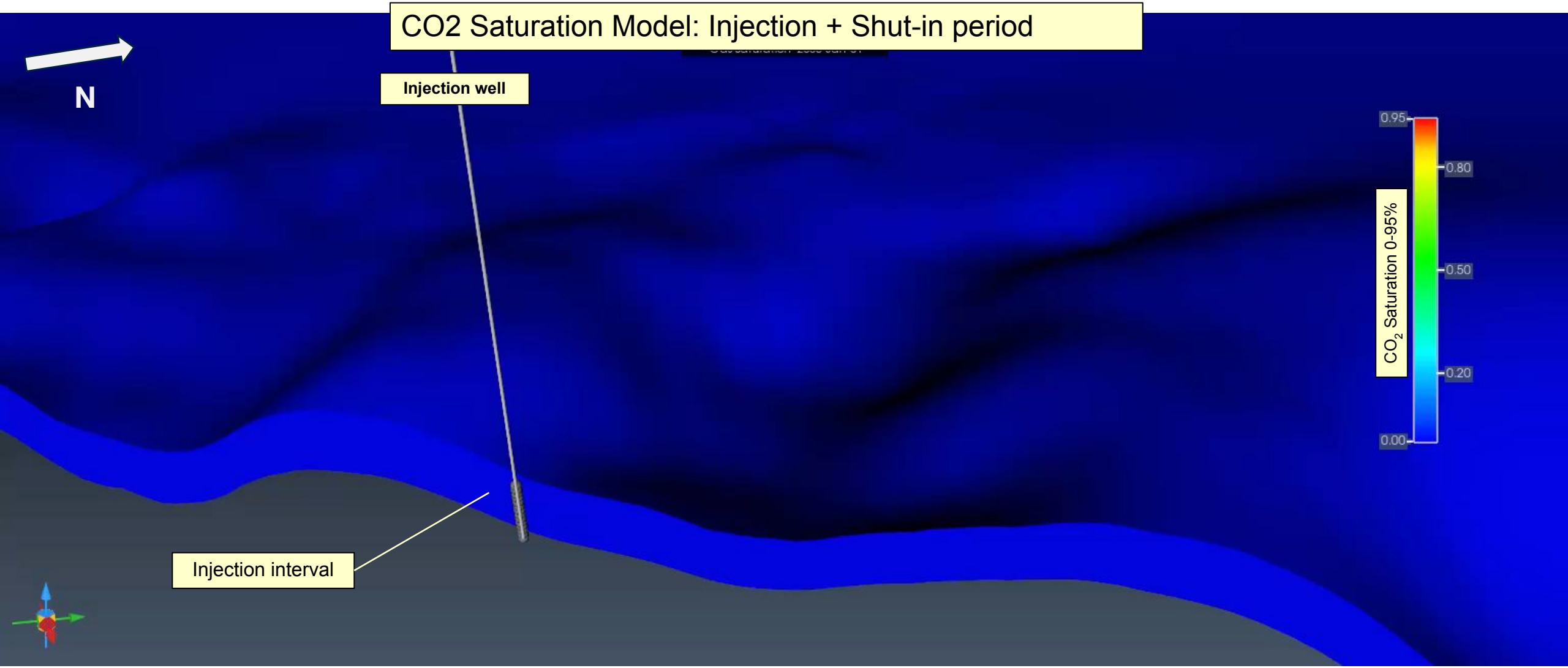
How much underground space does a project need?

Pore space models and injection simulations:



3D Seismic Guided CO2 Injection Modeling

Post strat-well modeling and flow simulation



Property Rights: surface characteristics

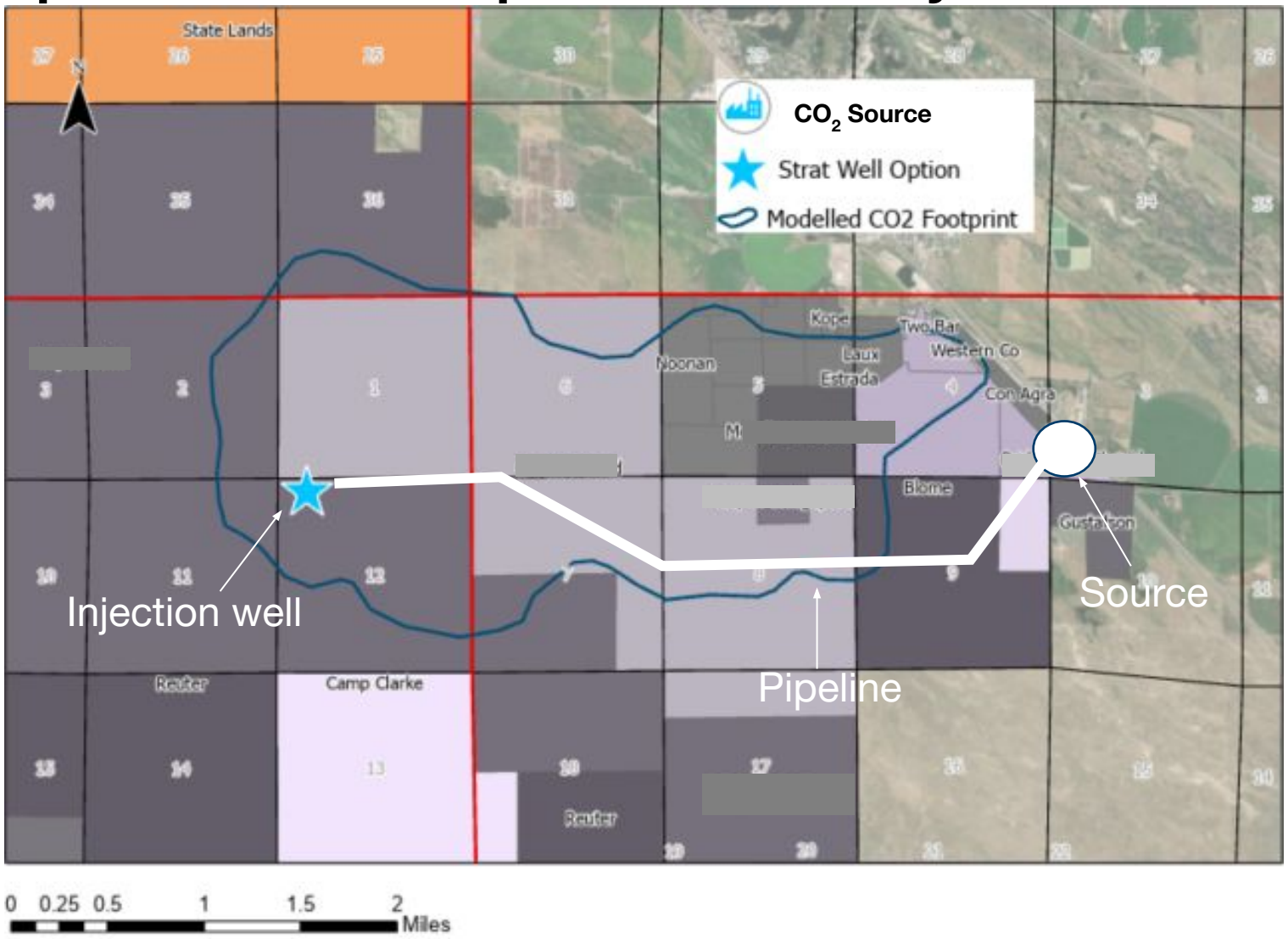
- ✔ Proximity to carbon dioxide source
- ✔ Large contiguous acreage
- ✔ Low visibility to surrounding population
- ✔ Favorable topography
- ✔ Limited environmental sensitivities for surface locations and seismic
- ✔ Low risk of oil and gas development

Surface Use: capture, transport and injection

1. Capture equipment installed at source: 1 to 3 acres

2. Pipeline: >2000psi
   - Small emitters:
     ethanol plant 4-6”
   - Mid-range emitters:
     cement, gas processing 6-8”
   - Large emitters:
     thermal power plant, hubs >8”

3. Well pad and access road
   - Typically 100 yards square for drilling rig space
   - Much smaller for operations
   - No surface facilities on pad
   - Inspection weekly to monthly not daily
   - No hauling



Surface Use: you won’t see this!

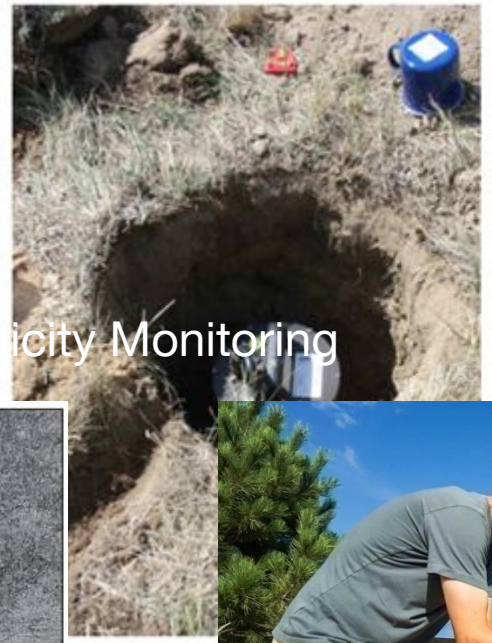
Single injector + single monitor well can accommodate 1,000,000 metric tons per year

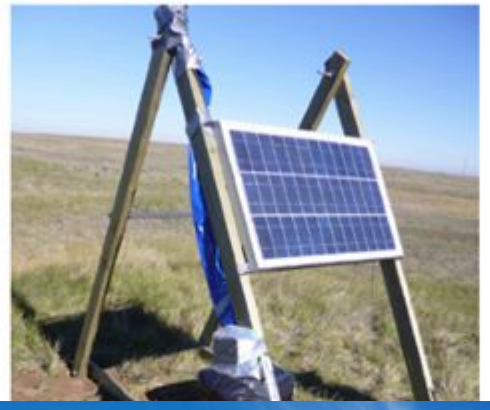
Equivalent to:

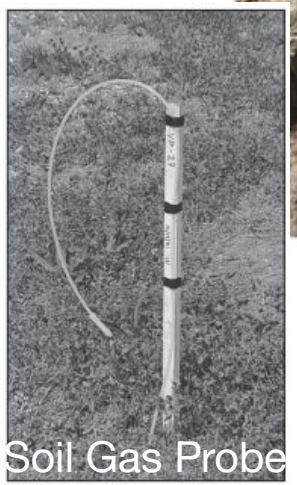
- multiple ethanol plants
- several industrial sources
- small thermal power plant

Surface Use: well pad and wellhead

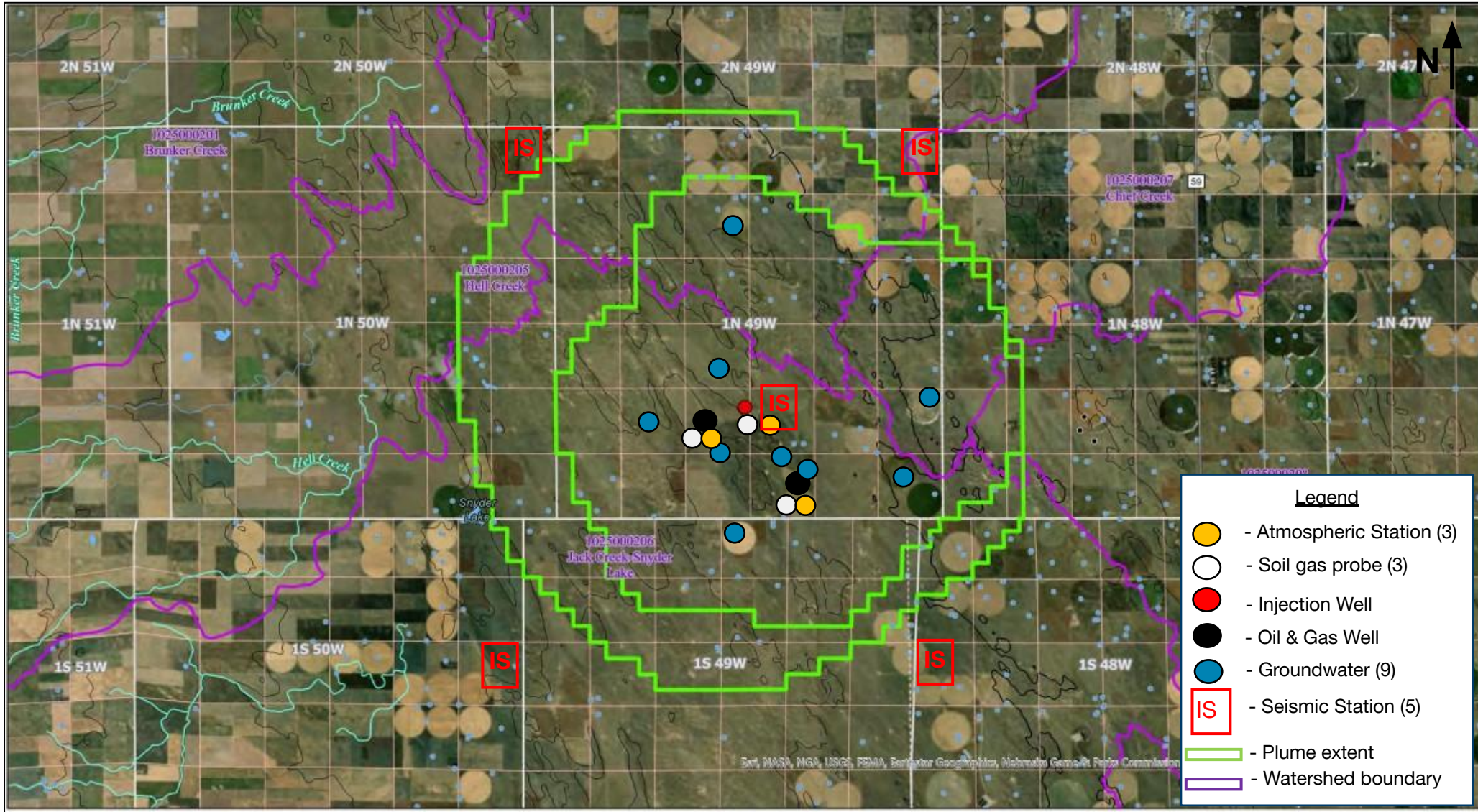
Surface Use: monitoring equipment







Surface Use:
Seismicity & Environmental Monitoring Installations



Surface Use: well pad

Wellsite and Access Road Construction

Earthmoving Equipment

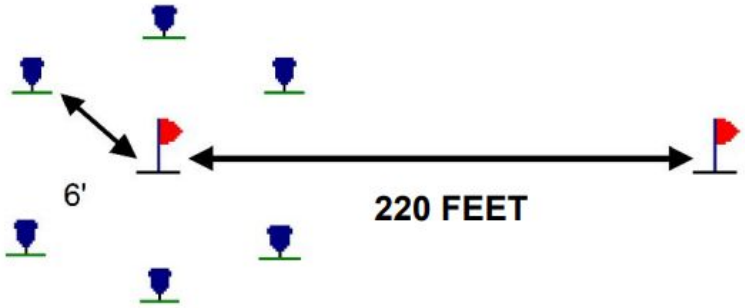
Trucks with Aggregate

Wellsite Setup (~1 week)

Drilling Operations (~5 weeks)

Surface Use: 4-inch Pipeline and Surface Reclamation

Surface Effec smic



3-5 year intervals

GEOPHONE TRUCK

RECORDING TRUCK

GEOPHONES and DATA STORAGE BOX

Regulatory and legal environment

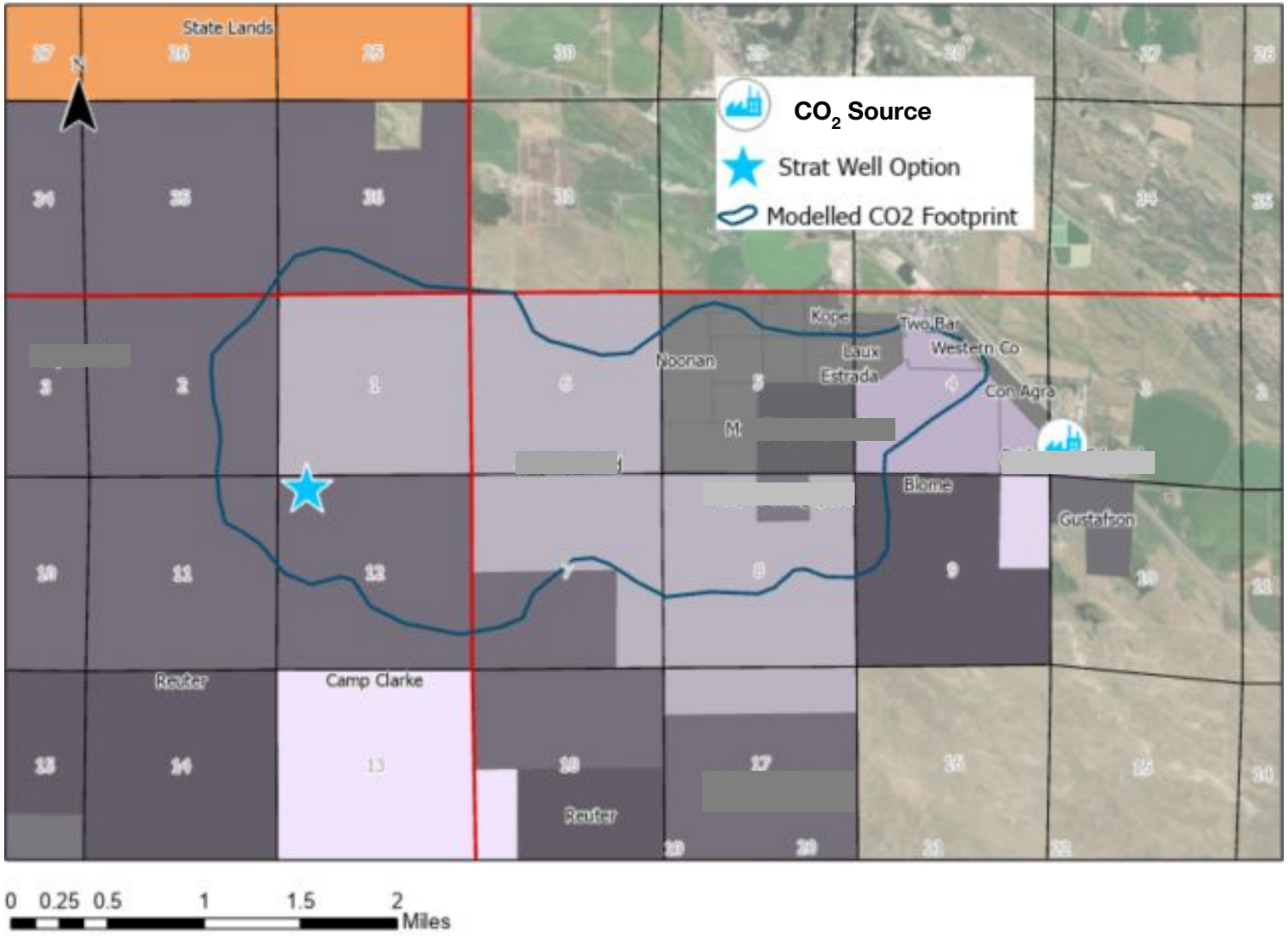
- Understand the regimes in YOUR state and the resulting risks to a project when considering a CCS storage proposal.
- Sequestration physical regulation:
  - EPA
  - State primacy
  - Nothing
- Property rights regime:
  - Pooling
  - Eminent domain

Subsurface regulation slide

- Oil & gas related, usually
- Permitting
  - Surface use (about surrounding owners and intersection with other uses)
  - Drilling
  - Injection
    - monitoring
    - Reporting
    - Safety & security

Property rights: pooling

- Injection in 1 or more deep formations
- In this example, 4,000-acre total CO_2 footprint
- Owners are paid proportionate to their percentage of unit ownership



Eminent domain / pipeline

Kansas


Grand Island
Lincoln
Kearney
Hastings
St Joseph
Manhattan
Topeka
Kansas City
Hays
Salina
KANSAS
Garden City
Dodge City
Wichita
Liberal
Joplin
Enid
Rogers

KS with pipelines

Property use concerns

- Future construction
- Water and electric lines

Safety education:
CO_2 is

- Colorless
- Odorless
- Non toxic

Dispersion modeling

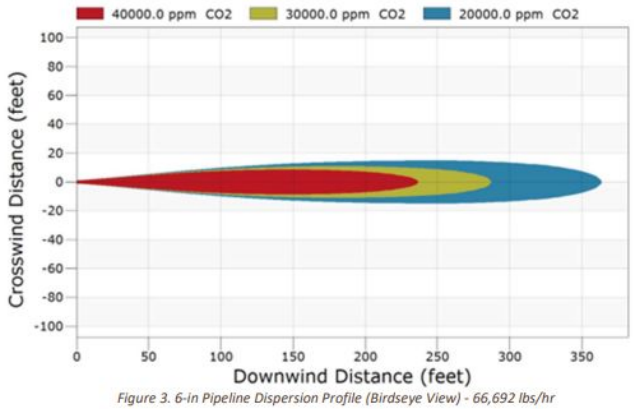
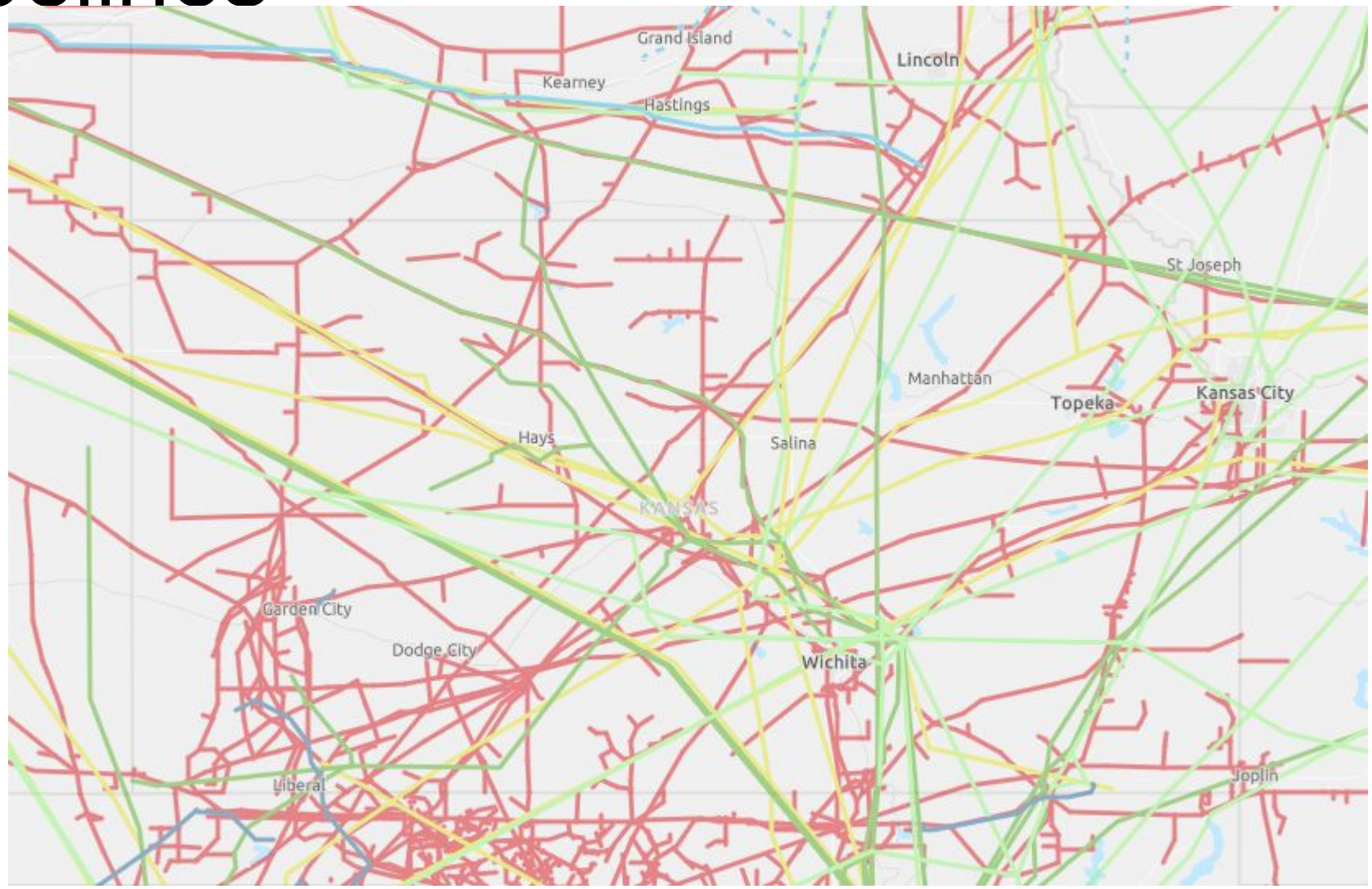


Figure 3. 6-in Pipeline Dispersion Profile (Birdseye View) - 66,692 lbs/hr



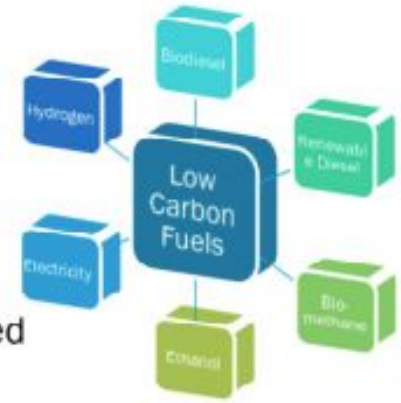
Financial aspects

- Do your homework!
- Chances of project success
  - Who is supporting it?
  - Financial backing to permit, construct and begin injection
    - 5+ years
  - Assurance

- State support:
  - LCFS
  - Carrot or stick? E.g. GEM rule

State carrots: LCFS for ethanol

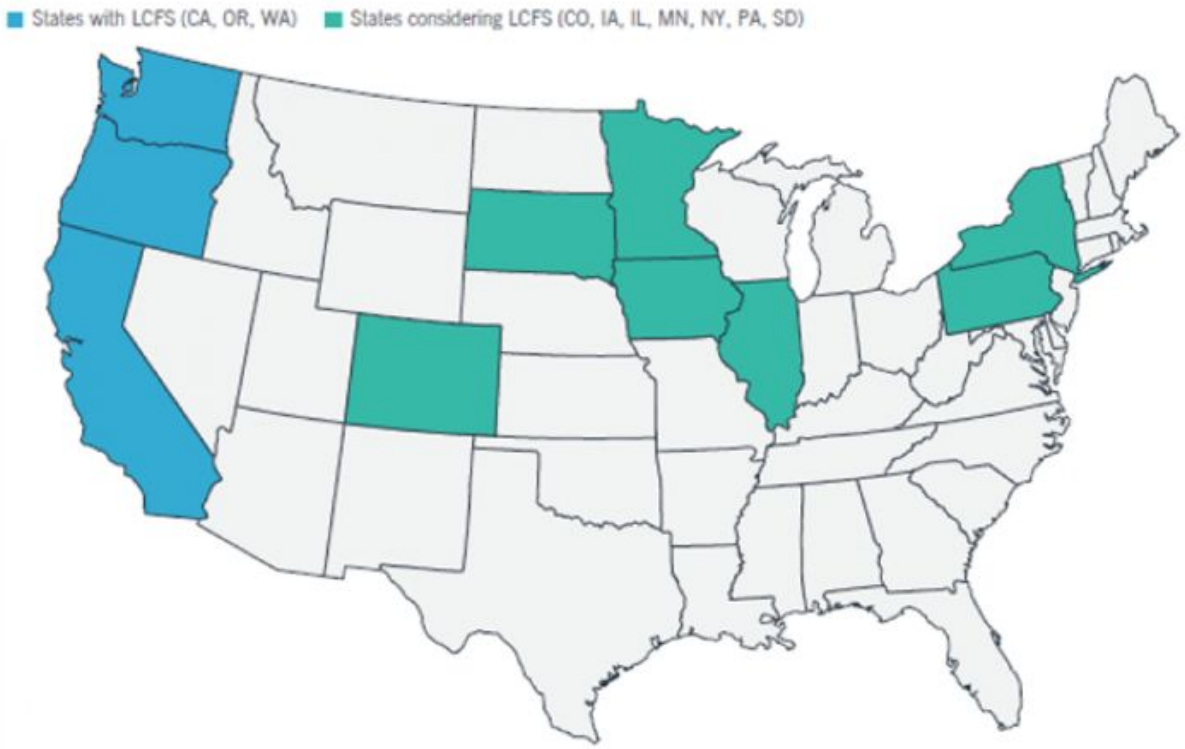
LCFS History



- Key Milestones:
  - Original adoption in 2009, amended in 2011, re-adopted in 2015, amended in 2018
- Goal: Reduce carbon intensity (CI) of transportation fuel pool by at least 20% by 2030
- Expected benefits:
  - Complement other AB 32 measures
  - Transform and diversify fuel pool
  - Reduce petroleum dependency
  - Reduce emissions of other air pollutants

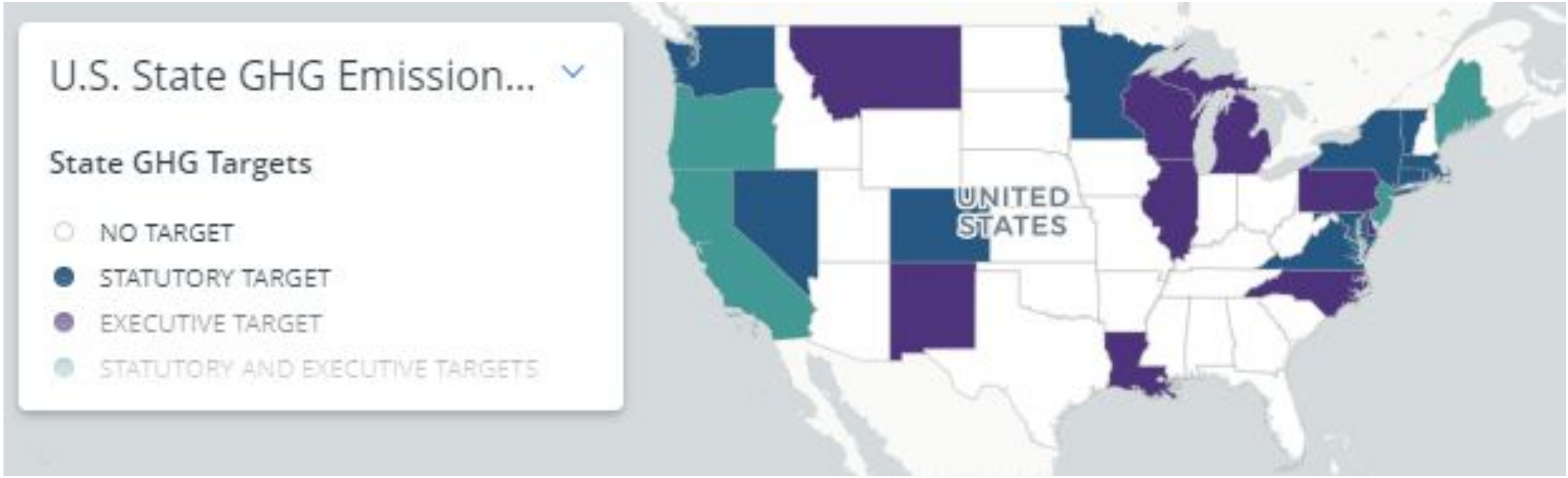
CALIFORNIA AIR RESOURCES BOARD

3



Source: Westchester analysis

State greenhouse gas targets: stick vs. carrot



Note: the federal government does have a stick in some cases.
example: Colorado Front Range emissions limits (GEM rule)

Cultural aspects

- Know your neighbors:
  - Generally supportive or skeptical?
  - Rational or emotion based?

Summary: what role can state lands play in a carbon sequestration project?

- **Project siting and physical environment:**
  - Typically large parcels
  - No competing use

- **Cultural aspects:**
  - Act as a centerpiece to build community acceptance
    - Geology
    - Surface use
    - Pipeline
  - Clear eyed scientific review
  - Ability of review by sister agencies (CPW, CDPHE, ECMC etc.)
  - Reduce emotional reaction (successful multi-generational independent business)

- What are the advantages to the state?
  - No competing use
  - Revenue vs surface impact is a good ratio
  - Does not prevent long term other uses

Carbon America

Safety and Security: none of this is new!

- Over **40-year-old process** used in oil recovery is the basis of CO2 injection techniques for sequestration (hundreds of CO_2 injection wells in US)
- **21 large-scale projects** under development in the U.S.
- **No loss of life** or significant environmental incidents
- Over **5,000 miles** of CO_2 pipeline in the US
- **Regulated by the EPA** and other federal, state and local agencies
- Well known geology in most basins:
  - **141,000 wells** in Carbon America's database just for the DJ Basin!

fin

- Questions?