



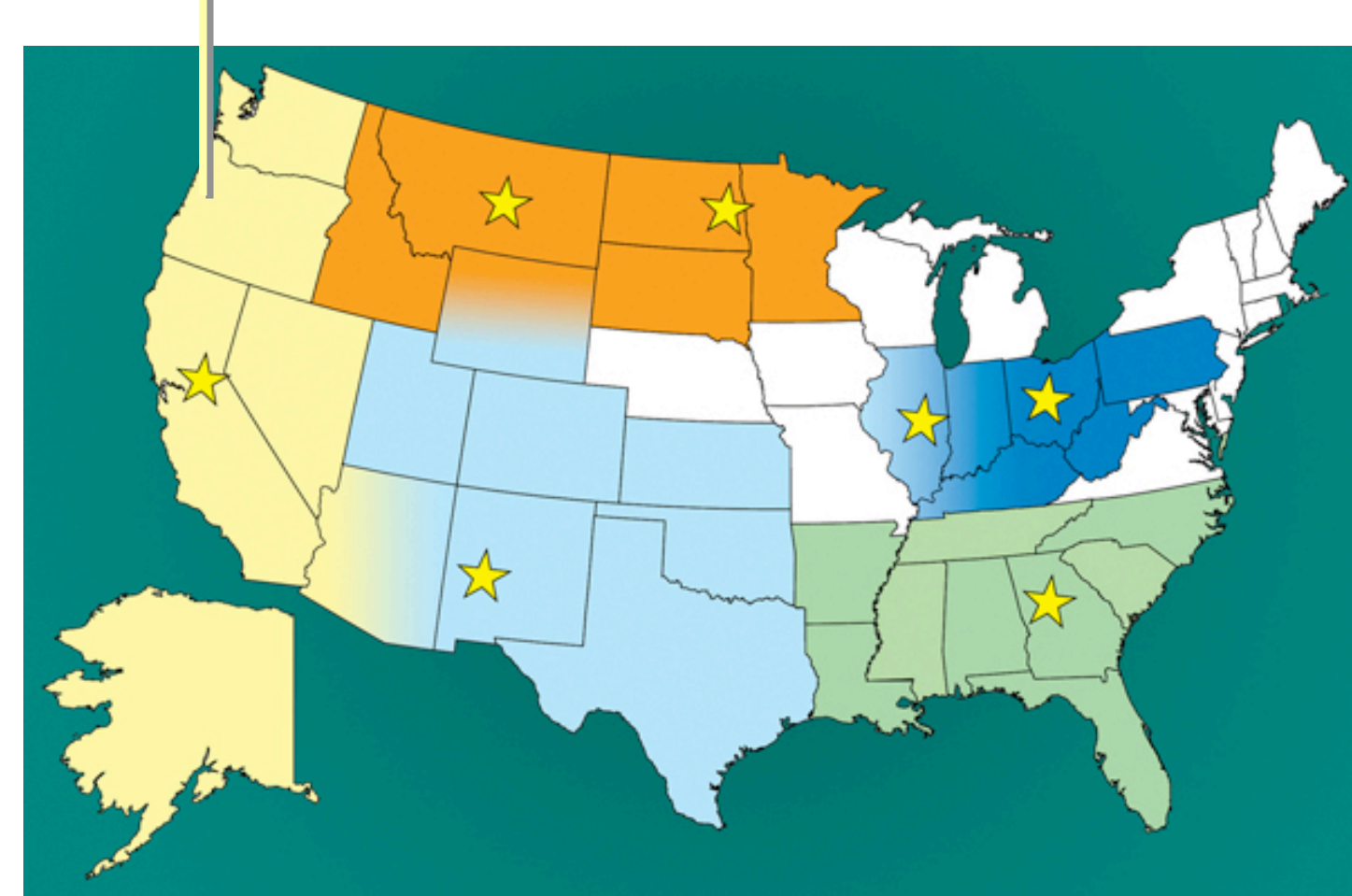
# WESTCARB: Developing Sequestration Options for California and the West Coast

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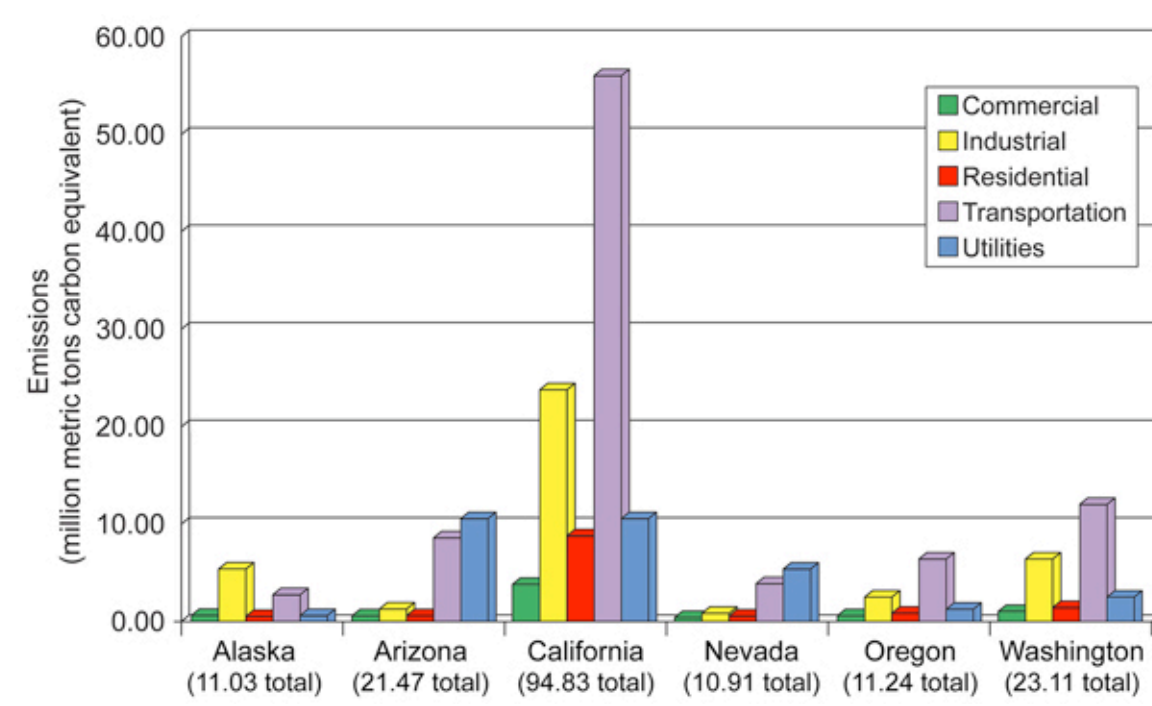
<sup>1</sup> University of California, Office of the President & Lawrence Berkeley National Laboratory; <sup>2</sup>California Energy Commission

## WESTCARB

is 1 of 7 Research Collaboratives Cofunded by DOE to Evaluate U.S. Regional Options for Carbon Sequestration

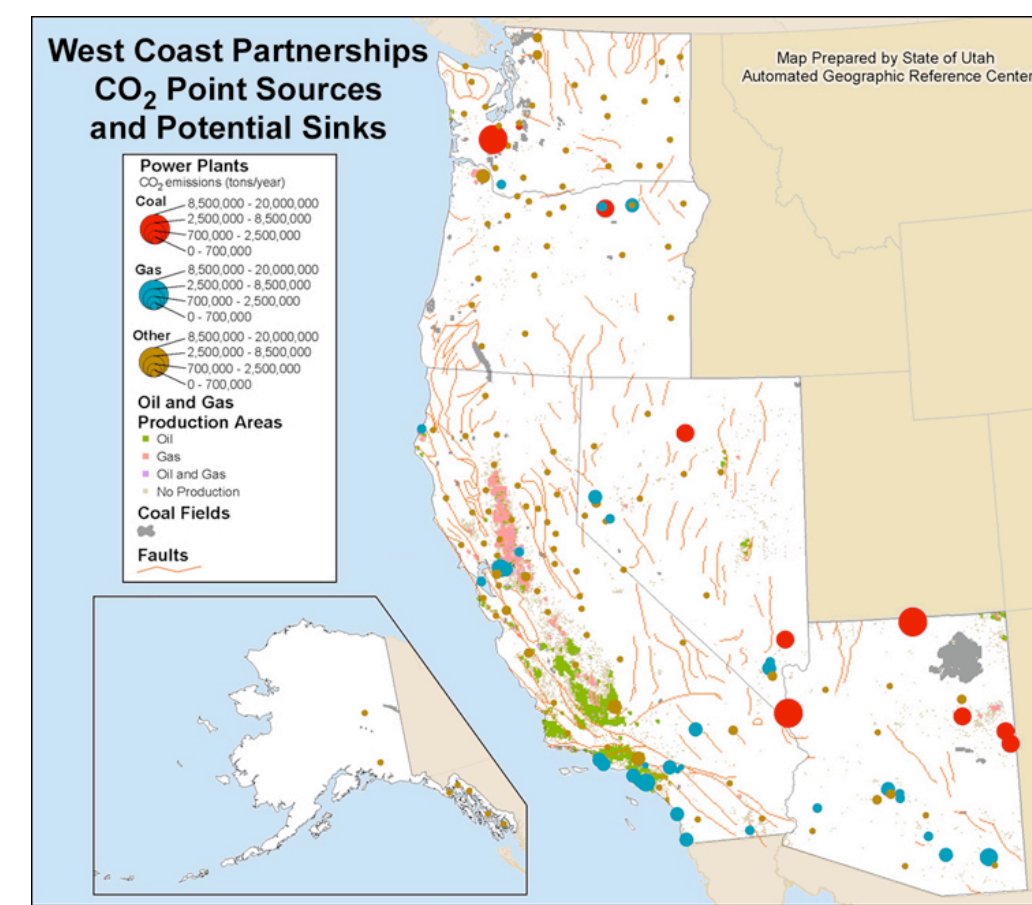


## WESTCARB States Account for 11% of U.S. CO<sub>2</sub> Emissions



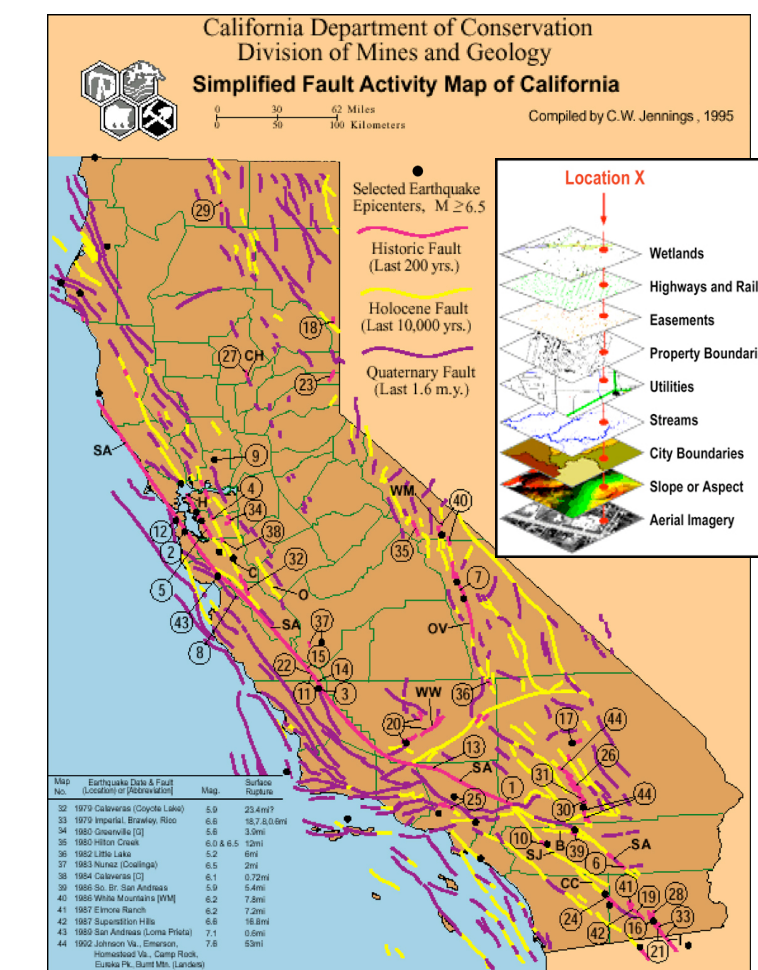
- California is second in nation in CO<sub>2</sub> emissions
- Largest point sources are power plants, oil and gas producing field operations, oil refineries, and cement plants
- Mobile sources are predominant CO<sub>2</sub> emitters

## Characterizing CO<sub>2</sub> Point Sources, Potential Geologic Sinks, and Other Relevant Features



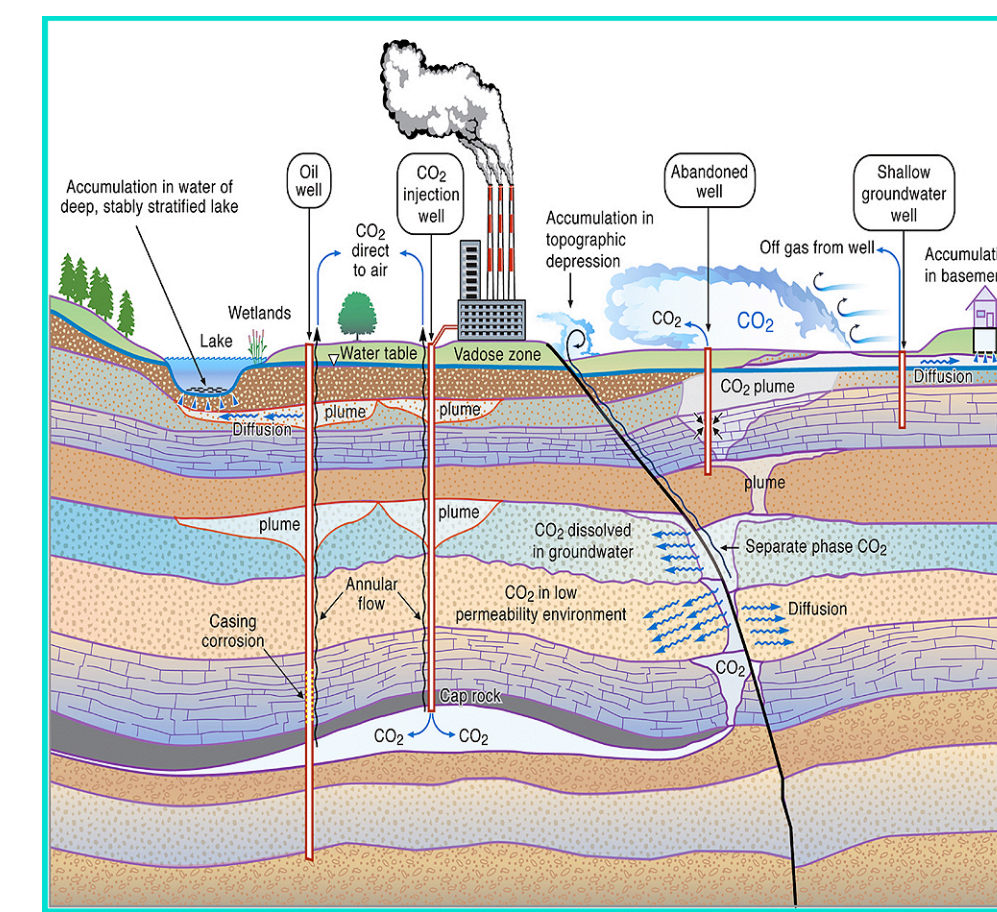
- Data collected for large existing and planned utility and industrial sources
- Data collected for candidate sedimentary basins
- Available rock and fluid properties of reservoirs
- Gross sand and shale thickness maps for basins
- Data collected for active faults and other features potentially affecting project siting

## Formatting Characterization Results as GIS Data Layers



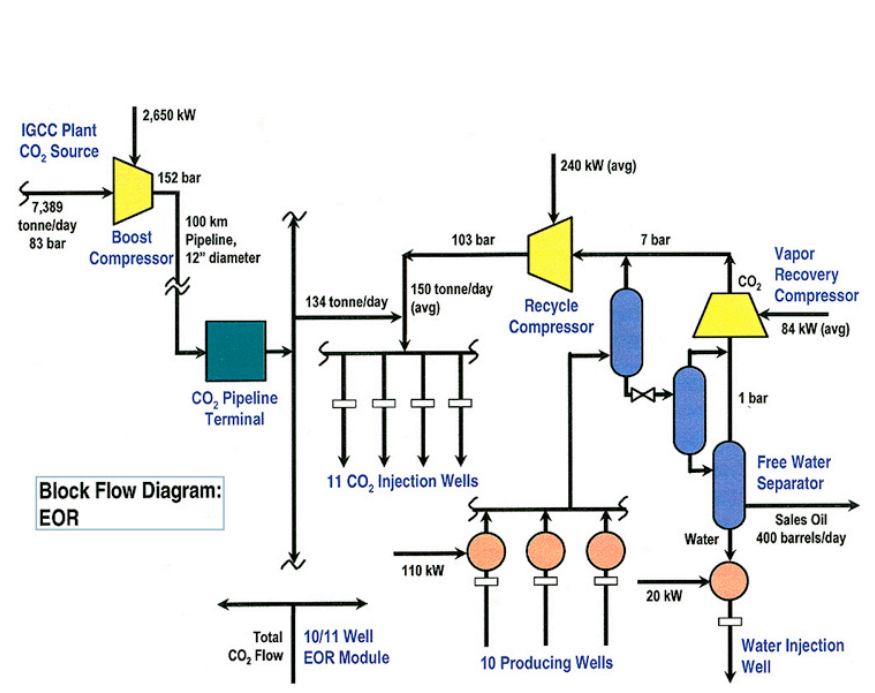
- Primary layers contain outline of basins and reservoirs and their attributes; point source locations; rights-of-way
- Other layers denote faults, population centers, parks, mines, etc., that could affect siting or cost
- Public access through Internet Mapping Site at Utah AGRC
- Supports "national carbon atlas" proposed by DOE

## Developing Robust Methodology for Assessing Risk



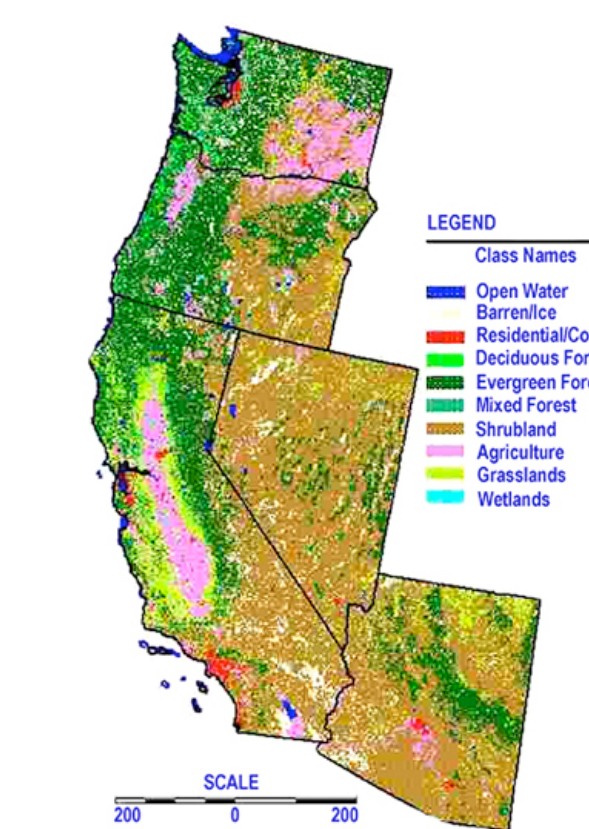
- Focus on risk of leakage from geologic storage projects
- WESTCARB approach builds upon identified features, events, and processes
- Results help screen candidate sinks and promote public discourse

## Determining Industrial CO<sub>2</sub> Capture, Transportation, and Sequestration Economics



- CO<sub>2</sub> capture costs based on industrial separation processes
- Transportation and geologic storage alternatives screened using GIS database
- Consider up to 5 options for each major point source
- Use pipeline and oil & gas or mining industry analogs to estimate cost; include MM&V
- Potential for offsetting costs with EOR, EGR, or ECBM
- Consider intangibles: risk, public opinion, other externalities

## Characterizing Potential Terrestrial Sinks: Forests, Rangelands, and Agriculture



- Region diverse in forests, rangelands, and agricultural lands
- Forest sequestration options include riparian management, conversion of rangeland/marginal land, enhancement of large wood, fire management
- 2.6x more carbon in agricultural soil than in vegetation; changes in tillage, fertilization, and crop rotation can boost soil storage
- Terrestrial storage options ranked by cost (\$/ton) to form carbon storage "supply curves"
- California characterization draws heavily on forestry and soil carbon R&D by CEC

## Promoting Public Education and Participation

Our website: [www.westcarb.org](http://www.westcarb.org)  
 Employ existing agency channels:  
 Cal-EPA, CDF, DOGGR  
 Develop classroom materials;  
 collaborate with educators  
 Hold stakeholders' meetings  
 Engage NGOs and industry  
 Determine applicable regulations and uncertainties; compare to established rules for enhanced oil recovery, natural gas storage, and underground waste injection  
 Develop protocols for CO<sub>2</sub> storage measurement, monitoring, and verification (MM&V)

