


## WESTCARB Annual Business Meeting

### Carbon Sequestration Atlas of the United States and Canada: version 2.0

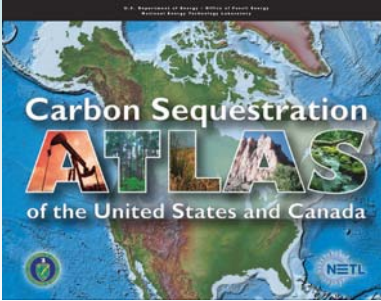
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Anchorage, AK  
October 1–2, 2008




### Carbon Sequestration Atlas, v. 1 (2007)

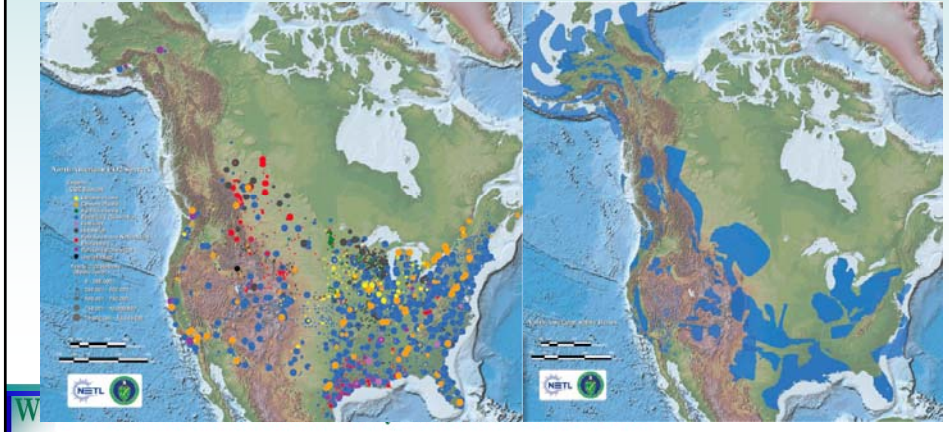
- Developed by DOE jointly with the Regional Carbon Sequestration Partnerships (RCSP), and the National Carbon Sequestration Database and Geographical Information System (NATCARB)
  - Provided an overview of the lifecycle of CO<sub>2</sub> through the capture and sequestration processes
  - Summarized the Energy Department's activities in sequestration research and development
  - Presented information about RCSP activities



WEST COAST REGIONAL CARBON SEQUESTRATION PARTNERSHIP



- Identified stationary sources >3.8 Gt/yr CO<sub>2</sub> and storage capacity >3,500 Gt
- Hard copy versions sold out quickly, digital version available online at [http://www.netl.doe.gov/technologies/carbon\\_seq/refshelf/atlas/](http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlas/) and <http://www.natcarb.org/>



## Carbon Sequestration Atlas, v. 2 (2008)

- Refined reporting methodology for potential storage locations: “Methodology for Development of Geologic Storage Estimates for Carbon Dioxide”, included as appendix to Atlas
- Focus of update
  - add additional basins and formations to the CO<sub>2</sub> storage portfolio
  - document methodologies completely
  - provide definitions of CO<sub>2</sub> resource that reflect the uncertainty of geologic resource estimates for CO<sub>2</sub>
- In preparation; expected release November 2008



## Carbon Sequestration Atlas, v. 2 (2008)

- Data collected by the RCSPs beginning in 2003 are used to estimate the CO<sub>2</sub> storage quantities for Atlas II
- Diverse data from three types of geologic formations in the subsurface are summarized, interpolated, averaged, or generalized by each of the seven RCSPs to calculate CO<sub>2</sub> storage potential
- Methodologies presented describe calculations and assumptions used for CO<sub>2</sub> storage resource estimates
  - CO<sub>2</sub> storage **resource** estimate—“volume of porous and permeable sedimentary rocks that is most likely accessible to injected CO<sub>2</sub> via drilled and completed wellbores”
  - CO<sub>2</sub> **capacity** estimate—includes economic or regulatory constraints



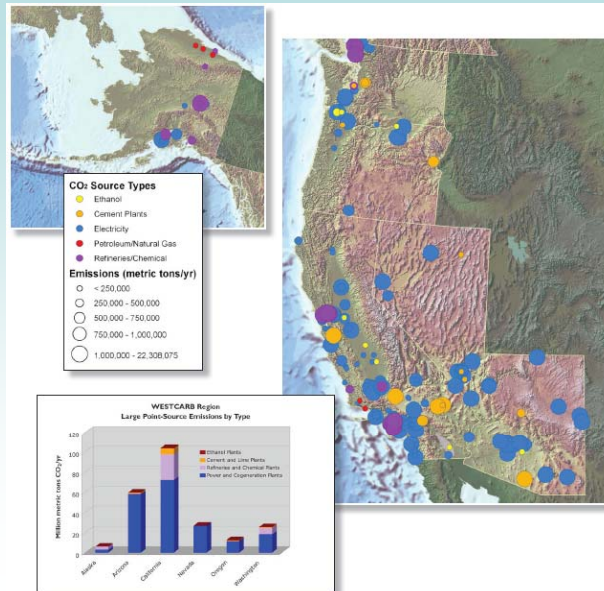
## WESTCARB submission to Atlas 2: sinks

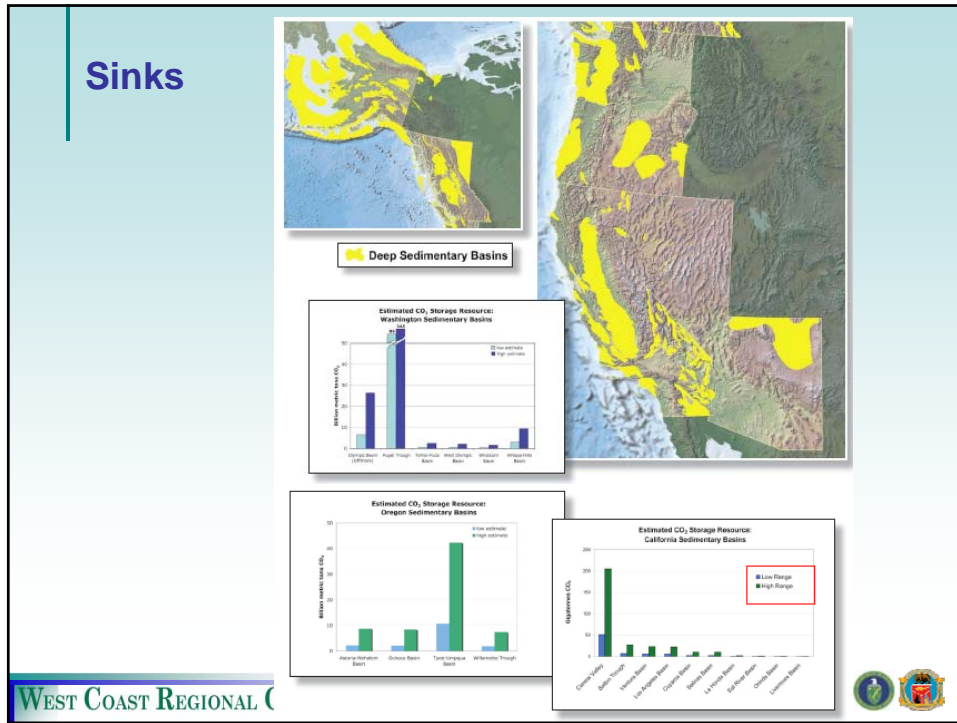
Province / State(s)	Sedimentary Basins	Oil/Gas Fields	Coal Basins
Alaska	Basin potential not yet assessed, CO <sub>2</sub> storage resource not yet assessed. Same GIS data as 2007.	Field potential not yet assessed, CO <sub>2</sub> storage resource not yet assessed. Same GIS data as 2007.	Basin potential not yet assessed, CO <sub>2</sub> storage resource not yet assessed. Same GIS data as 2007.
Arizona	Basin potential preliminarily assessed, CO <sub>2</sub> storage resource not yet assessed. New polygon from 2007.		
British Columbia	CO <sub>2</sub> storage resource not assessed. Same GIS data as 2007.	CO <sub>2</sub> storage resource not assessed. Same GIS data as 2007.	CO <sub>2</sub> storage resource not assessed. Same GIS data as 2007.
California	Basin potential assessed, preliminary CO <sub>2</sub> storage resource estimates available. Same GIS data as 2007.	Field potential assessed, preliminary CO <sub>2</sub> storage resource estimate available. Same GIS data as 2007.	
Nevada	Basin potential assessed, CO <sub>2</sub> storage resource estimated as not large enough for commercial scale sequestration. GIS file submitted: 1K_GOOD from Price et al., 2008 (different from 2007 submission).		
Oregon/Washington	Basin potential assessed, preliminary CO <sub>2</sub> storage resource estimates available. Same GIS polygons as 2007, modified resource estimates.		Basin potential not yet assessed, CO <sub>2</sub> storage resource not yet assessed. Same GIS data as 2007.

no shapefile/data



## Sources





## Field Tests

### WESTCARB Terrestrial Field Validation Tests

WESTCARB's terrestrial carbon sequestration field tests are under way in Shasta County, California, and Lake County, Oregon.

In Shasta County, afforestation activities entail restoring native conifer and oak species to rangelands and fire-damaged forest lands on about a dozen plots ranging from 10 to 100 acres each.

In Lake County, researchers are studying the feasibility of establishing plantations of fast-growing trees, such as hybrid poplars, on suitable agricultural or grazing land, which could be harvested on short rotations to fuel biomass power plants.

Both the California and Oregon pilots also involve research into carbon sequestration coupled with fire risk management through forest fuel reduction. Fire-prone forests are being treated to restore forest health by removing understorey trees, brush, and other "ladder fuels" that could contribute to catastrophic wildfires and the associated large GHG emissions. Where feasible, the removed fuel in Shasta County is being transported to a local biomass power plant to generate electricity, which can offset power demand that may otherwise be met by fossil fuel combustion.

The Shasta County pilot also features a conservation-based forest management project where a conservation group and timber company are working together to restore and maintain high-quality forest habitats and test the practicality and effectiveness of forest carbon accounting protocols.

Measuring and monitoring activities are an important component of all WESTCARB terrestrial sequestration field tests. Overall objectives are to quantify the CO<sub>2</sub> emission reductions/sequestration attributable to each activity; gather information on costs and benefits to landowners; design measurement, monitoring, and verification methods; evaluate the practicality of existing reporting protocols to capture verifiable reductions; and explore questions of market validation for terrestrial sequestration activities.

Shasta County Terrestrial Sequestration Sites

Lake County Terrestrial Sequestration Plots

Measuring and monitoring activities establish carbon baselines and quantify carbon stored through terrestrial sequestration projects.

Replanting after a fire can re-establish a forest (left side of fence) and prevent colonization by invasive brush (right side of fence).

WEST COAST REGIONAL CARBON SEQUESTRATION PARTNERSHIP

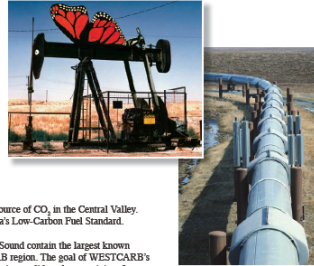
## Commercial Opportunities

### Commercial Opportunities for CCS in the WESTCARB Region

A strong commitment to mitigating climate change is evidenced within the WESTCARB region. Some WESTCARB states have policies to lower greenhouse gas emissions, and most are active in various climate change initiatives and in efforts to spur clean energy technology development. As the western region strives to meet emission targets in the coming years, commercial deployment of geologic and terrestrial carbon sequestration stands to become increasingly important.

With this setting in mind, WESTCARB has sited its geologic field tests in areas suitable for commercial deployment of CCS. This involves consideration of the potential storage capacity of geologic formations, their proximity to major sources, and possible economic co-benefits such as ECBM production, EOR, and enhanced natural gas recovery (EGR).

For example, WESTCARB has studied the potential for CO<sub>2</sub> storage in the depleting oil and natural gas fields in California's Central Valley. Enhanced recovery techniques are already being deployed in many of these fields, and even greater recovery rates may be realized through injection of CO<sub>2</sub>. Recently, two power generators have announced plans to build plants with CO<sub>2</sub> capture in Kern County, and it is anticipated that CO<sub>2</sub> EOR will receive a boost once local supplies of CO<sub>2</sub> become available.



Fuels removed from forests to help prevent catastrophic wildfires can be used by biomass power plants to generate electricity.



Biofuel plants may also provide a readily captured source of CO<sub>2</sub> in the Central Valley. Several have been proposed in response to California's Low Carbon Fuel Standard.

California's Central Valley and Washington's Puget Sound contain the largest known saline formation storage potential in the WESTCARB region. The goal of WESTCARB's Large-Volume Geologic Storage Test in Kern County is to validate the storativity of a typical Central Valley saline formation at a scale that will demonstrate how a commercial operation would function.

WESTCARB examined the Pacific Coal Region in Washington to identify areas with the potential for ECBM production. More detailed characterization of CO<sub>2</sub> storage capacity estimates for coal bearing sub basins in the Puget Sound in Washington is still being carried out. ECBM in this area could be facilitated by the proximity of a major point source for CO<sub>2</sub>.

The western region affords significant potential for increased terrestrial carbon sequestration, and WESTCARB has been working with state entities in Oregon and California to develop protocols for terrestrial carbon sequestration projects. Research into the costs and carbon storage rates associated with afforestation, forest conservation, and forest fuels reduction to prevent catastrophic wildfires helps lay the groundwork for the introduction of these types of projects into carbon credit markets. Fuels removed from forests can also be used for biomass electricity generation, thereby decreasing fossil fuel consumption.

