



U.S. Department of the Interior Carbon Storage Project

COP-15 | Copenhagen, Dec. 7-18, 2009

SECRETARIAL ORDER NO. 3289

“Addressing the Impacts of Climate Change on America’ Water, Land, and Other Natural and Cultural Resources”

September 14, 2009



THE MANDATE

- *“Establishes Department-wide approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts on tribes and on the land, water, ocean fish and wildlife, and cultural heritage resources that the Department manages.”*



- S.O. 3289 establishes the *Climate Change Response Council* - within office of the Secretary - to execute a coordinated Department-wide strategy to increase scientific understanding and development of adaptive management tools to address the impacts of climate change.



- The Council is implementing DOI climate change activities through:

- 1) *Climate Change Response Planning Requirements*
- 2) *DOI Regional Climate Change Response Centers*
- 3) *Landscape Conservation Cooperatives*
- 4) *DOI Carbon Storage Project*
- 5) *DOI Carbon Footprint Project*



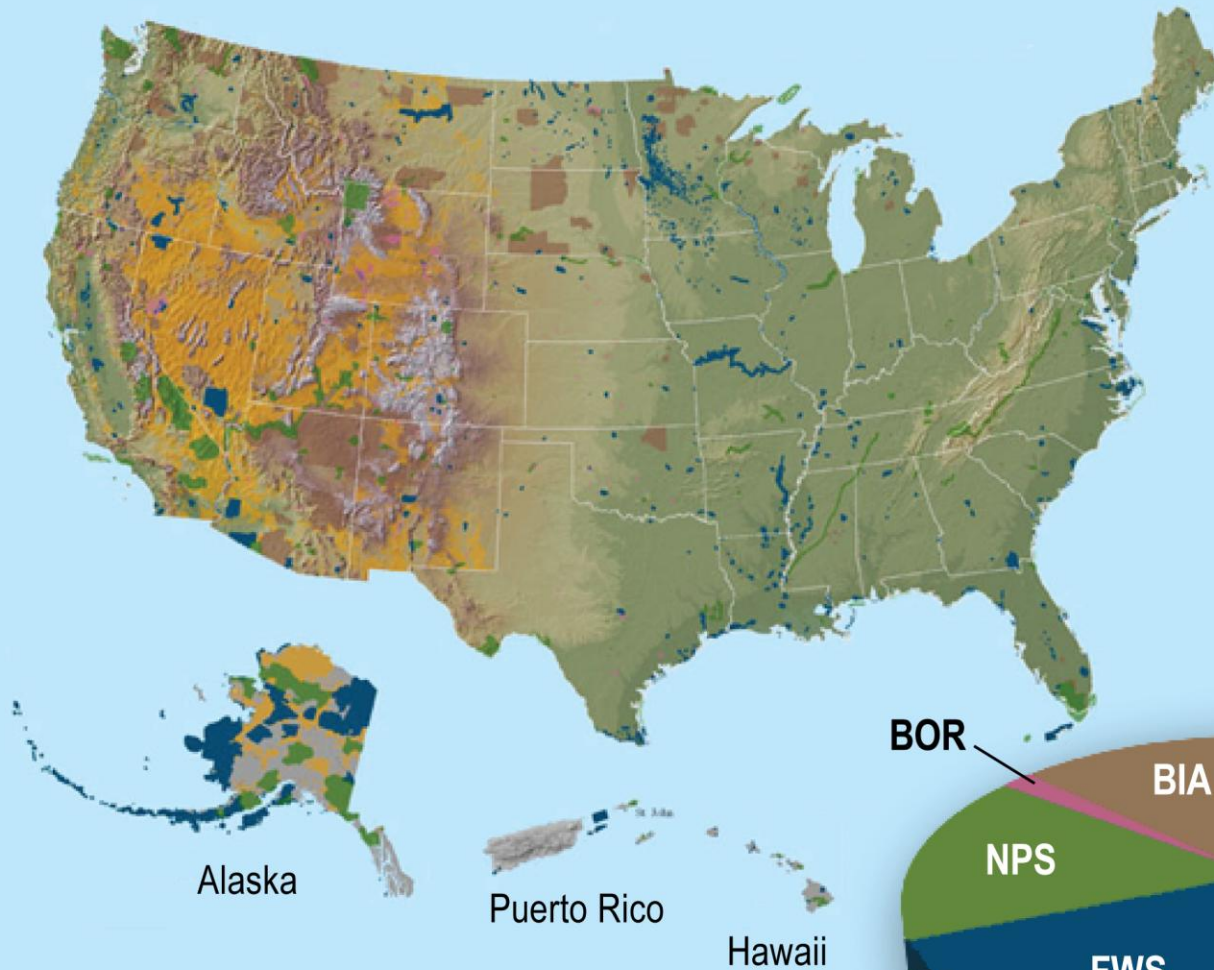


Through Secretary Salazar's vision, as articulated in Secretarial Order 3289, the *Department of the Interior* (DOI) is responding to climate change impacts in all 50 states, through:

- Adaptive management of our land, water, fish and wildlife, cultural heritage and tribal resources
 - *Synthesize climate impact data*
 - *Develop adaptation tools*
 - *Coordinate actions on a landscape level*
- Action to mitigate climate change
 - *Development of renewable energy*
 - *DOI Carbon Storage Project (biological and geological)*
 - *DOI Carbon Footprint Project*

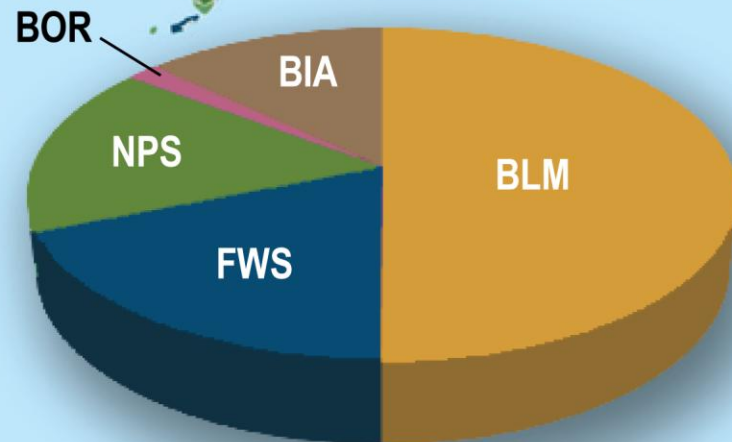


U.S. Department of Interior Land Ownership



DOI manages 500 million acres of surface land, or about one-fifth of the land in the United States, including:

-  Bureau of Land Management, 256 million acres
-  Fish and Wildlife Service, 96.2 million acres
-  National Park Service, 84.6 million acres
-  Bureau of Reclamation, 8.7 million acres
-  Bureau of Indian Affairs, 66 million acres



Rapid Assessment of Biological Carbon Sequestration Potential

Products as of December 2009:

- Estimates of current biological carbon storage in soils and plants
 - across the nation
 - specifically on DOI lands
- Estimates of how much more biological carbon could be stored under a range of idealized disturbance conditions
 - across the nation
 - specifically on DOI lands

Products as of Spring 2010:

- Final report of current and potential biological carbon storage in soils and plants



Possible Future Carbon Sequestration Across the Conterminous U.S.

Existing land cover (millions hectares)	Existing Soil Carbon (PgC)	Existing Plant Carbon (PgC)	Range of Possible Additional Carbon Storage in Plants (PgC)
Total (811)	73.42	15.28	4.38 – 12.84
Forests (266)	25.13	14.46	-1.57 – 3.07
Agriculture/developed (221)	27.42	0.42	5.12 – 7.45
Shrublands (159)	9.67	0.26	0.32 – 1.15
Other (165)	11.20	0.14	0.46 – 1.17
Total DOI lands (91.6)	3.48	0.66	0 – 0.49

Biological Carbon Sequestration can:

Enhance adaptation and mitigation of climate change impacts

Improve/Preserve ecosystem services and sustainable development objectives

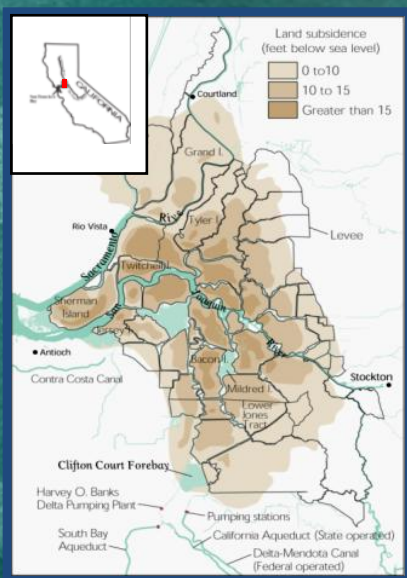
Foster international collaboration and partnerships

- new DOI technology can help measure and mitigate carbon emissions nationally and globally

DOI stands ready to offer technical assistance in these areas and to learn from other nations.



Carbon Benefits of Natural Landscapes



- Plants and soils store carbon naturally in many ecosystems – *e.g. forests, grasslands, wetlands* -- and can help:
 - mitigate climate change
 - restore and improve the health of ecosystems
 - facilitate adaptation to climate change
 - create economic growth engines and green jobs.
- Projects designed to sequester carbon should be science-based and provide net positive benefits:
 - Carbon storage, clean water, clean air, habitat, biodiversity, open space, recreation and **green jobs**.
- Sequestering carbon on public lands may be more durable than other types of land ownership.

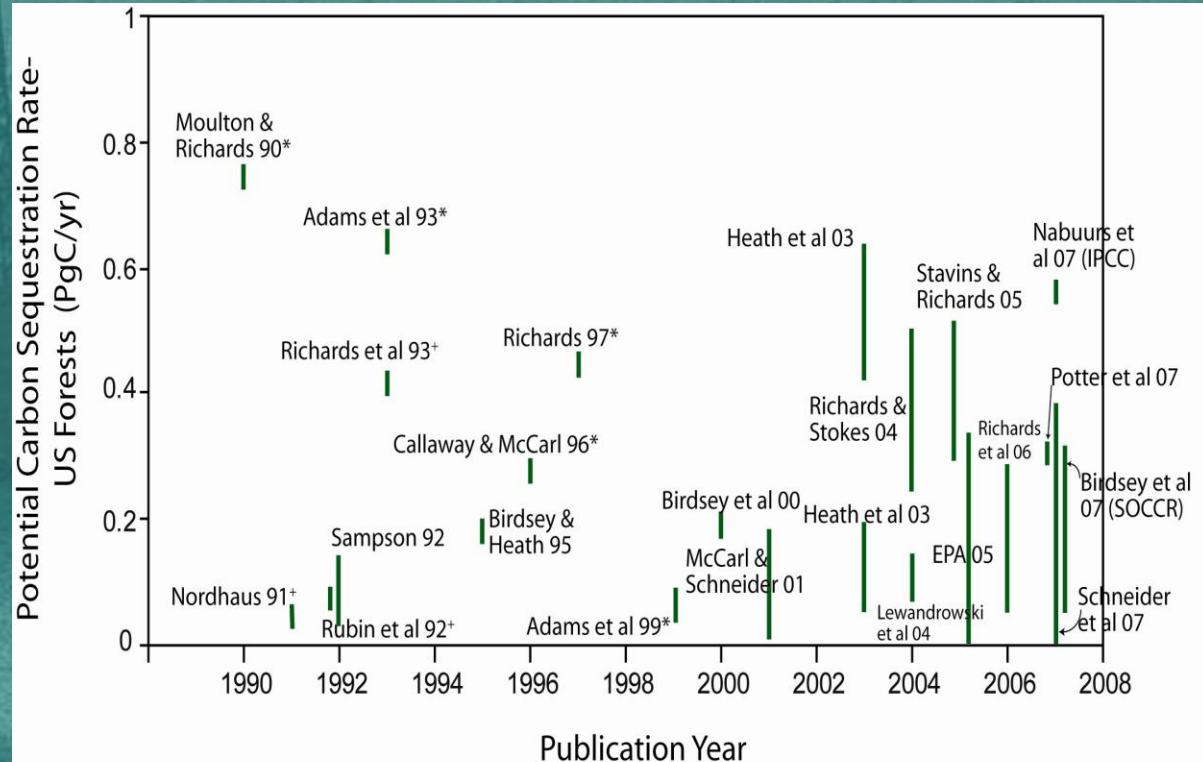


DOI Science Is Improving Our Understanding Of Biological Carbon Sequestration

The wide range of published estimates of potential carbon sequestration rates in U.S. forests

Published estimates:

- Are the methods consistent?
- Are costs considered?
- Are practical limitations considered?
- What are the probabilities within the range of estimates?



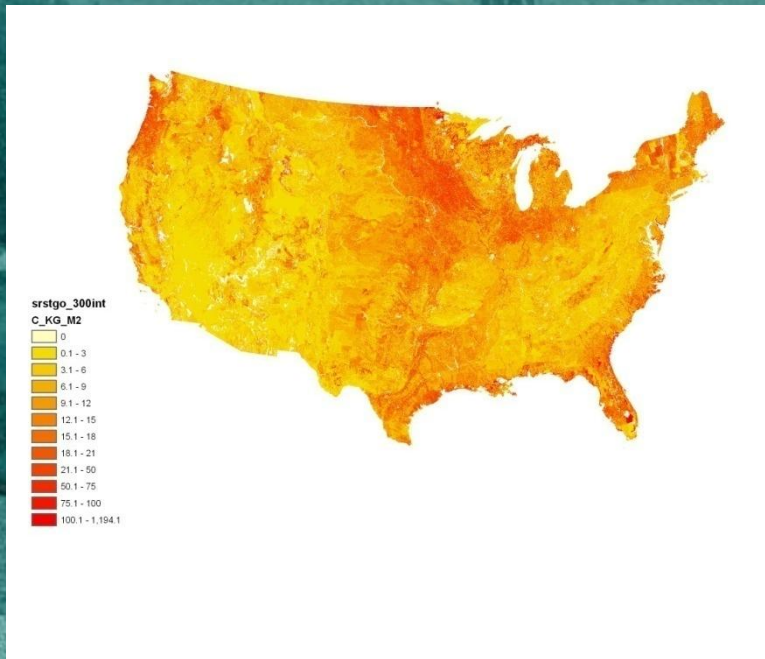
* as stated in Richards and Stokes 2004, and Stavins and Richards 2005

+ as stated in Stavins 1999



DOI Science Is Improving Our Understanding Of Biological Carbon Sequestration

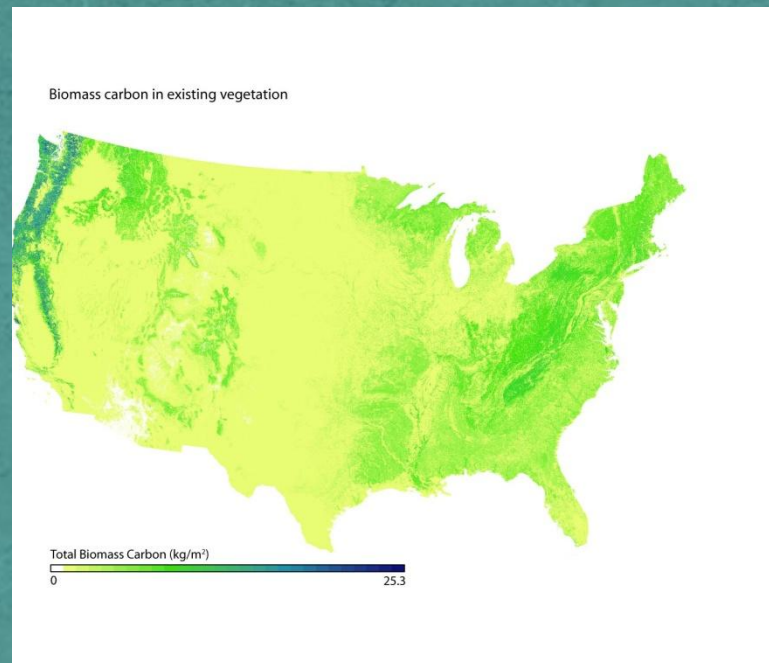
Current Soil Carbon



Total 73.4 billion tons

DOI is conducting national assessments of biologic carbon sequestration, ecosystem carbon and greenhouse gas fluxes, and best management practices

Current Carbon Stored in Plants



Total 15.3 billion tons



Biological Carbon Sequestration & Sustainable Landscapes – Domestic and International

DOI scientists & resource managers have the expertise & credibility

- Current DOI carbon sequestration projects on public lands
- Remote sensing (*e.g., Landsat and Landfire*) to detect global changes in forest cover
- Environmental credibility
 - *Science-based measurement and verification*
 - *Management for permanence of carbon storage*
 - *Management for multiple ecosystem co-benefits in addition to carbon sequestration*

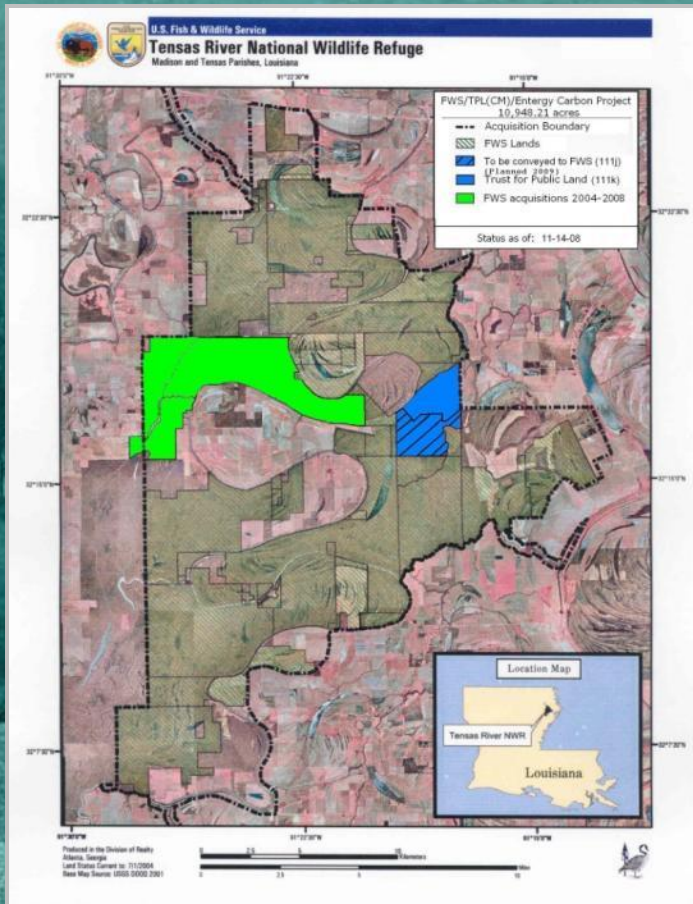
Benefits of DOI cooperation on global carbon management:

- Significant mitigation potential
- Projects designed to both sequester carbon & adapt to climate change
- Valuable co-benefits (*e.g., habitat, clean water*)
- Balance trade-offs (*e.g., land use, fire control*)
- Based on scientific assessments



Examples of Biological Carbon Sequestration on DOI Lands





Reforestation in Tensas River National Wildlife Refuge, Louisiana

More than two dozen energy companies, four conservation groups, and the states joined with DOI to sequester Carbon in Tensas River Refuge.

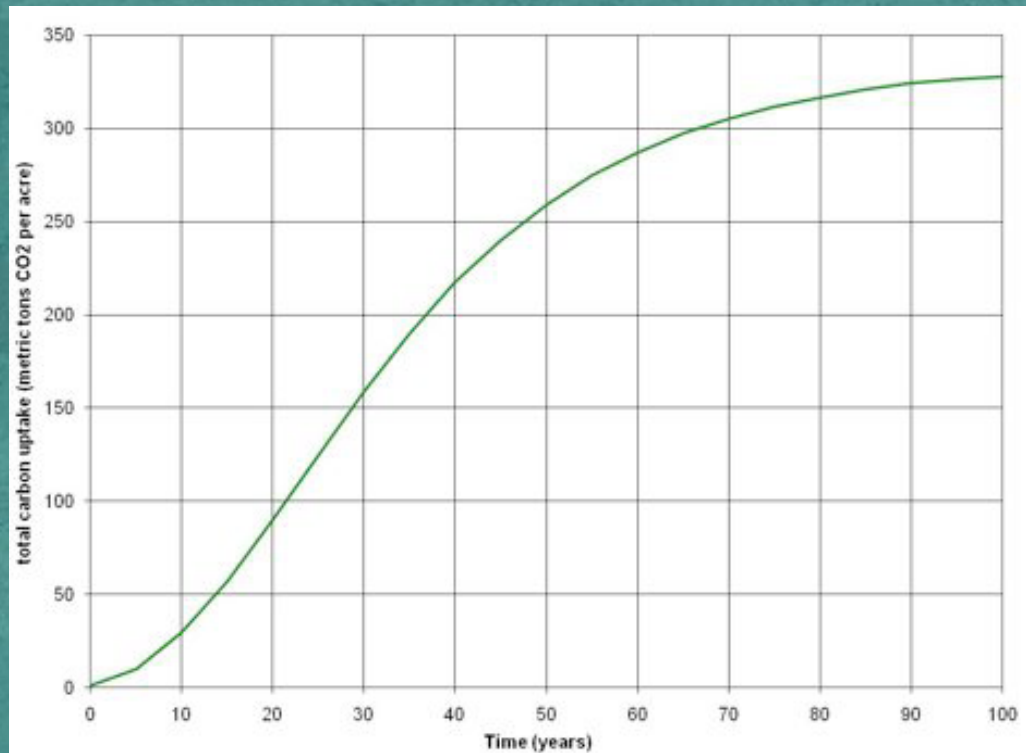
- Total reforested acres conveyed through March 2009 = 6,333 acres
- 80,000 acres restored, supporting fish and wildlife population objectives
- 22 million trees planted, projected to capture more than 33 million tons of carbon over 90 years
- Anticipated completion of project in 2010



Carbon Analysis – *Sequestration Curve*

100-year Carbon Sequestration Curve for Bottomland Hardwoods, Lower Mississippi Valley

- The soils, climate, and growing conditions result in carbon sequestration rates that are among the highest of any region in the U.S.*



Source: ESI-led research in collaboration with conservation partners

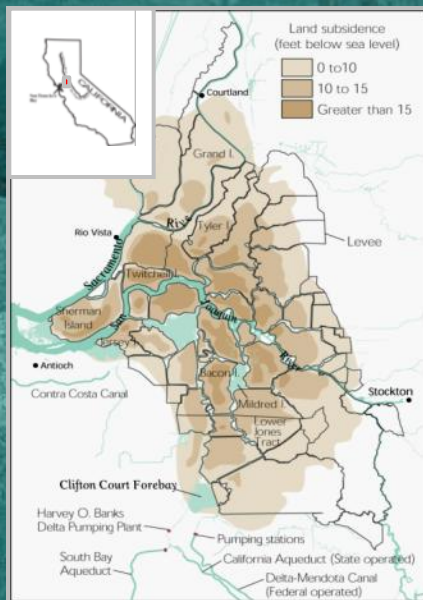


Carbon Capture Wetland Farms, Sacramento-San Joaquin Delta, CA



Challenge: *The oxidation of drained, agricultural peat soils emit massive CO₂ into the atmosphere. Peat oxidation has caused Delta islands to subside >25 ft below land surface, causing levee vulnerability, increasing flood potential and shutting down California's water supply system.*

USGS Twitchell Island Pilot Study, CA: *Beginning in 1996, native wetland, plant and soil were restored*

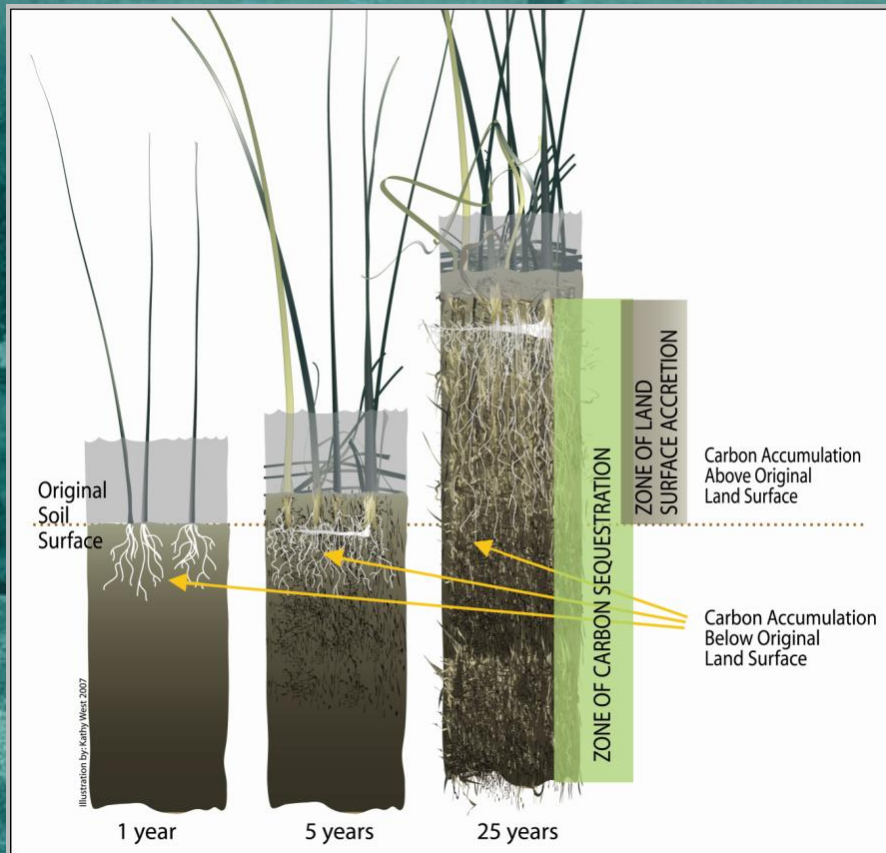


Solutions through Management:

- *Stop and reverse land subsidence raising peat soil surface 4 ft.*
- *Increase levee stability*
- *Increase water supply reliability*
- *Capture and sequester CO₂ in greater amounts than other land uses*



How Carbon Capture Farming Works



- Native plants planted submerged about 1 ft
- Low oxygen
- Balance between plant growth and organic matter decomposition

25 metric tons of CO_2 *per acre* could be removed from the atmosphere and stored in organic matter every year in the California Delta



Redwood Forests Watershed Restoration and Carbon Sequestration



Heavy equipment excavating an abandoned, failing logging road

Challenge: *Ancient redwood forests within Redwood National and State Parks are surrounded by over 75,000 acres of disturbed land.*

Carbon sequestration is hindered in these overcrowded forests that lack understory vegetation and inhibit biological diversity.

Solutions:

Forest thinning *will promote forest growth, improve structural complexity, and enhance wildlife habitat*

Removal of failing logging roads *(and their associated sediment) will preserve salmon stream habitat, improve water quality, prevent landslides, and recover displaced top soil allowing for recovery of redwood forests.*



Recovering second growth redwood forest following thinning treatment



DOI has a special relationship with Indian Tribes, holding in trust over 56 million acres for them while supporting tribal sovereignty and rights of self-determination.

Agricultural Conversion



Tribal Experience *In Carbon Sales*

- Project Development & Carbon calculations
- Working with Carbon Aggregators & Brokers
- Carbon Sales Contracts
- 3rd Party Certification of Sustainable Management
- Carbon Accounting Auditing & Verification (*3rd Party*)





DOI's Role in Geologic Carbon Sequestration



Geologic Storage of CO₂



- Geologic storage:

- CO₂ is compressed to a liquid for pipeline transport and injected at depths of ~1,000 to 4,000 meters
- CO₂ displaces existing fluid (*water, oil, gas*)
- Storage formation must be sealed to retain buoyant CO₂ phase
- Storage volume large enough for commercial project



Source: DOE/NETL

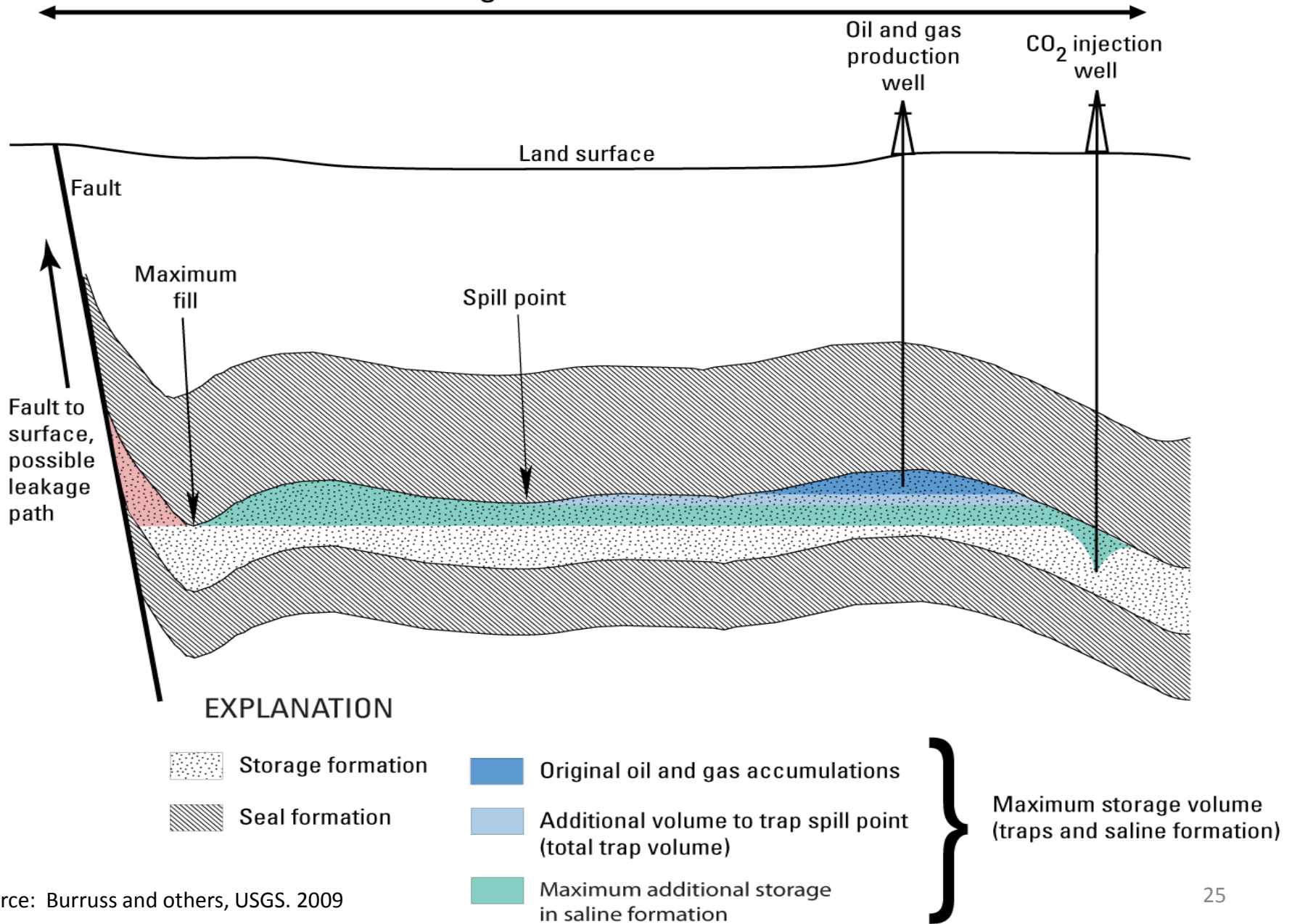


DOI Activities

- CO₂ storage capacity: estimation methodology and national assessment
 - *Multi-year national assessment*
- Complementary and necessary research
- Leasing of federal land for sequestration projects
- Permitting of enhanced oil recovery using CO₂ on federal land
- Coordination with other Federal and State agencies



Fill and Spill Model for Assessment Storage Assessment Unit



New DOI Methodology

- Geologically based, statistically sound hypotheses for quantities of storage potential
- Comprehensive & consistent treatment (*so assessment of each area is compatible/comparable to assessments in other areas*)
- Transparent – methodology, assumptions
- Probabilistic – range of values to reflect uncertainty
- Storage potential in oil and gas reservoirs and saline formations
- External expert input



New Methodology Process Flow

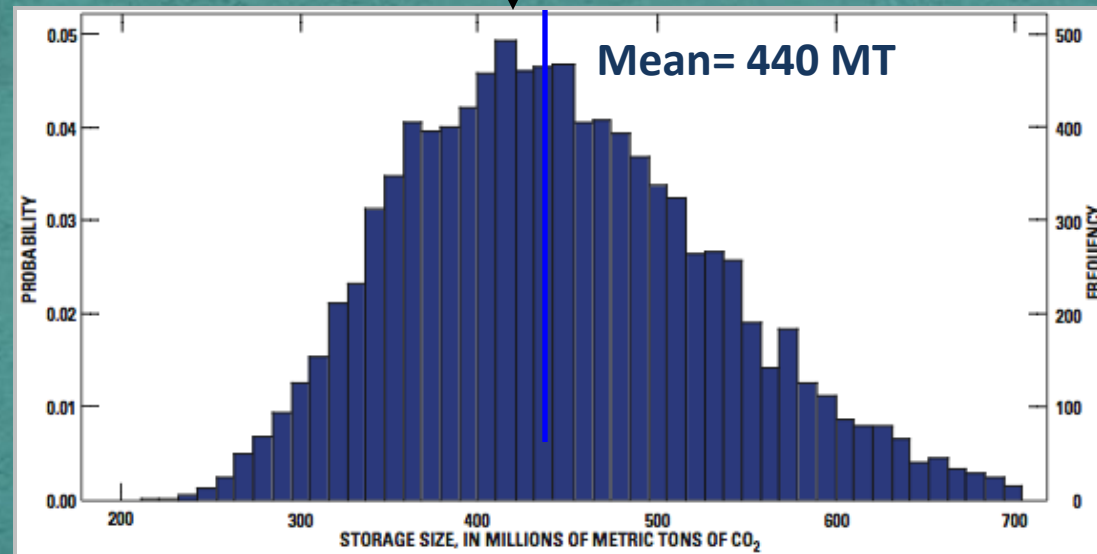
Geologic model

Risk (*probability of success*)

Consider:

- depth to top of storage
- confining layer characteristics
- natural seismic risk
- reservoir architecture
- drive mechanism
- reactivity
- geologic age
- extent of diagenesis
- formation water composition
- mineral composition
- CO₂-brine-mineral interactions at T and P
- formation water salinity

Probabilistic calculations of various parameters for statistical distribution of storage resource (*based on oil and gas methodology*)





DOI's International Role in Climate Change



DOI International Programs

DOI cooperates with over 100 countries worldwide to:

- Support and coordinate with White House and State Department foreign policy initiatives;
- Fulfill treaty obligations and Congressional mandates
 - *E.g., conservation of endangered species and world heritage sites;*
- Accomplish domestic responsibilities
 - *E.g., migratory species, transboundary rivers and ecosystems; and*
- Conduct scientific research on national priorities relating to energy, climate, natural resources and the environment.

DOI's existing relationships can help provide expertise to the global climate change negotiations and implementation of global policy.



DOI International Technical Assistance Program (*ITAP*)



- Established in 1995
- Funded through Interagency Agreements (*IAA*) with USAID and the State Department
- Provides multi-bureau teams to provide training and technical assistance in all areas of DOI expertise

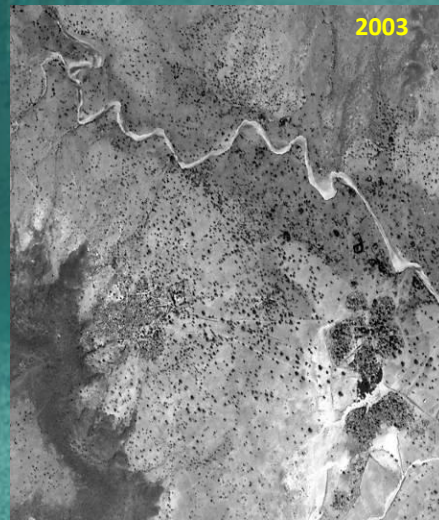




DOI: International prevention of deforestation and investments in afforestation/reforestation

Farmer managed forest restoration in Niger – 200 million trees in 20 years

What induced farmers in Niger to protect and manage on-farm natural regeneration?



- The environmental (*drought*) and economic crisis of the 1970s and 80s
- The increasing population pressure on natural resources
- A perceived change in ownership of trees since the mid-1980s
- The multiple benefits generated by on-farm trees
- Improved soil fertility and increased fodder production

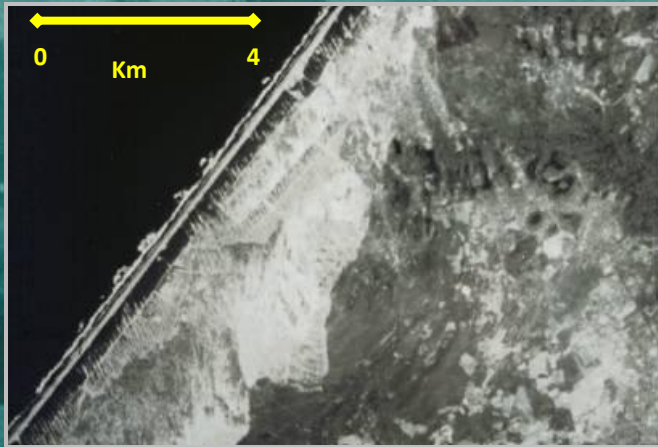


Coastal Senegal: *DOI Supported Dune Stabilization and Reforestation*



Landsat ETM 1999

Aerial view 1984



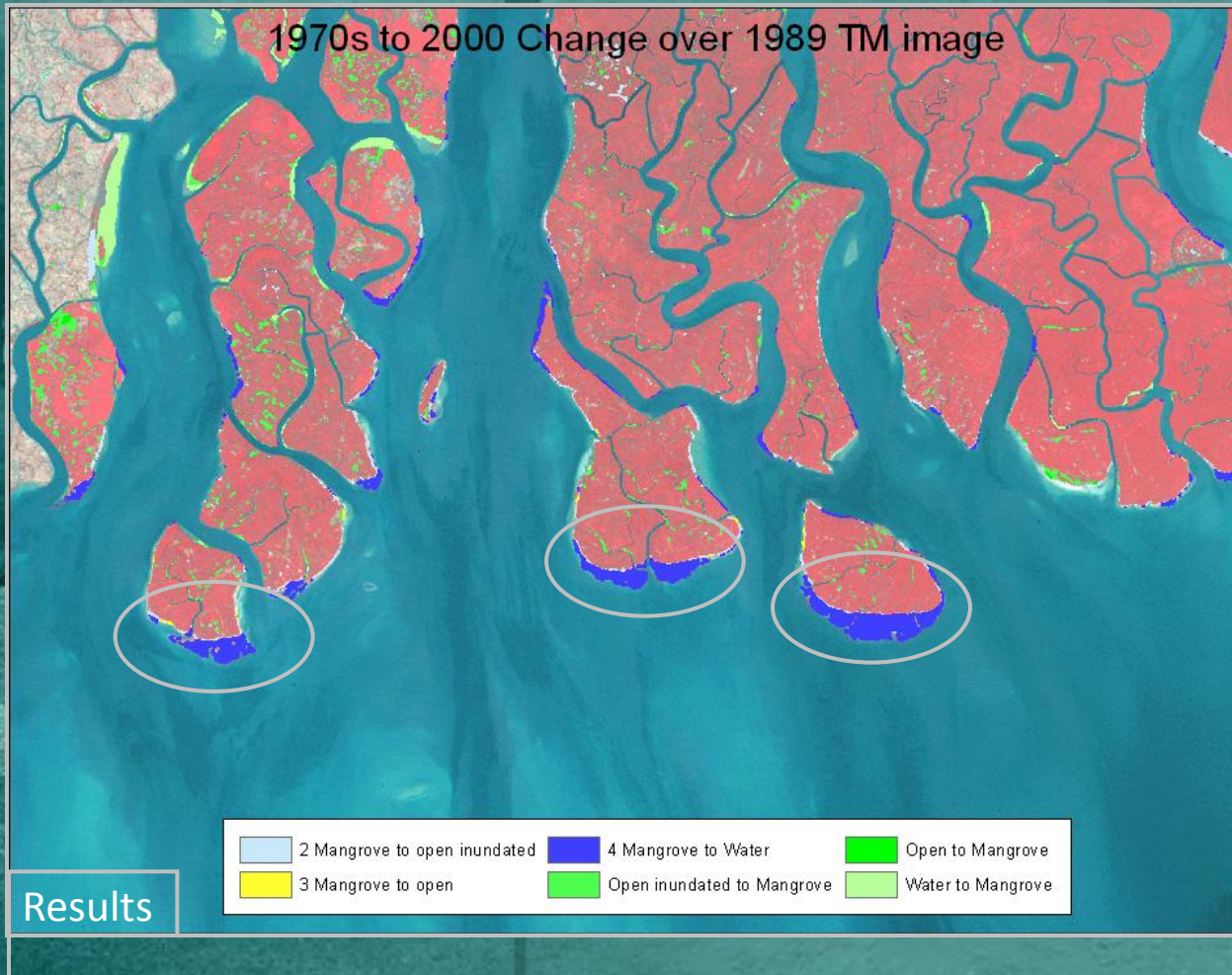
Aerial View 1994



Aerial View 1997



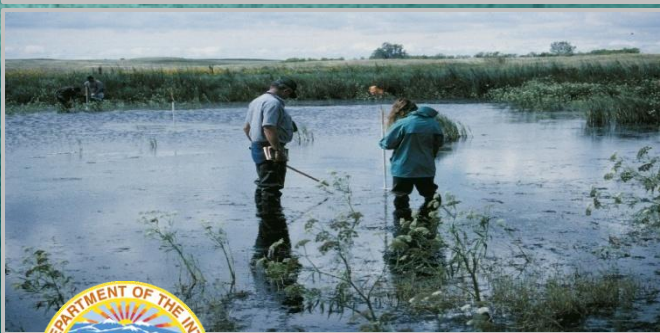
DOI Science: Mangrove Cover in Bangladesh & India



The extent of the mangrove forest of the Sundarbans has not changed significantly (*approximately 1.2%*) in the last 25 years.

However, the forest is constantly changing its structure due to erosion, aggradation, deforestation and mangrove rehabilitation programs.





Carbon sequestration projects can:

- *Enhance adaptation and mitigation of climate change impacts*
- *Increase ecosystem services*
- *Further sustainable development objectives*
- *Foster international collaboration and partnerships*

DOI stands ready to offer technical assistance in these areas and to learn from other nations

