EERC

EERC Technology… Putting Research into Practice

Plains CO_2 Reduction (PCOR) Partnership

Terrestrial Field Validation Test
Kickoff Meeting

Bismarck, North Dakota
July 26, 2005

PCO2R Partnership

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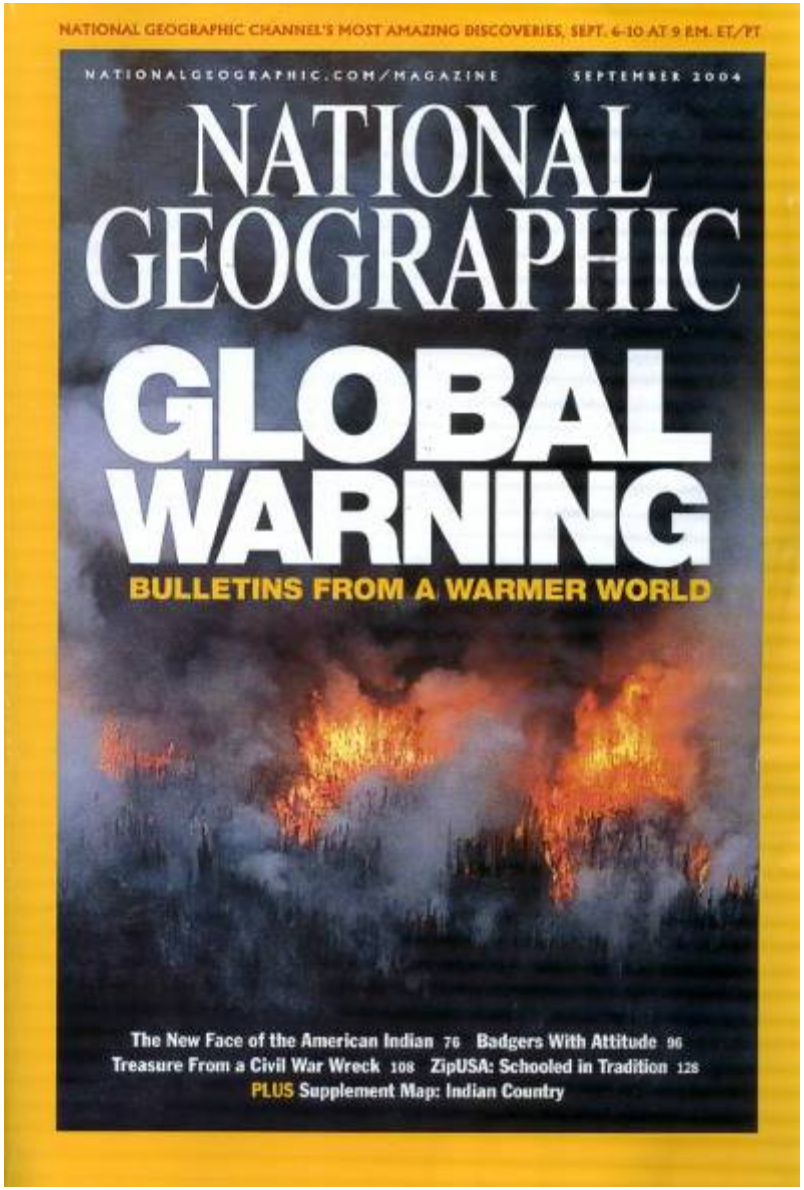

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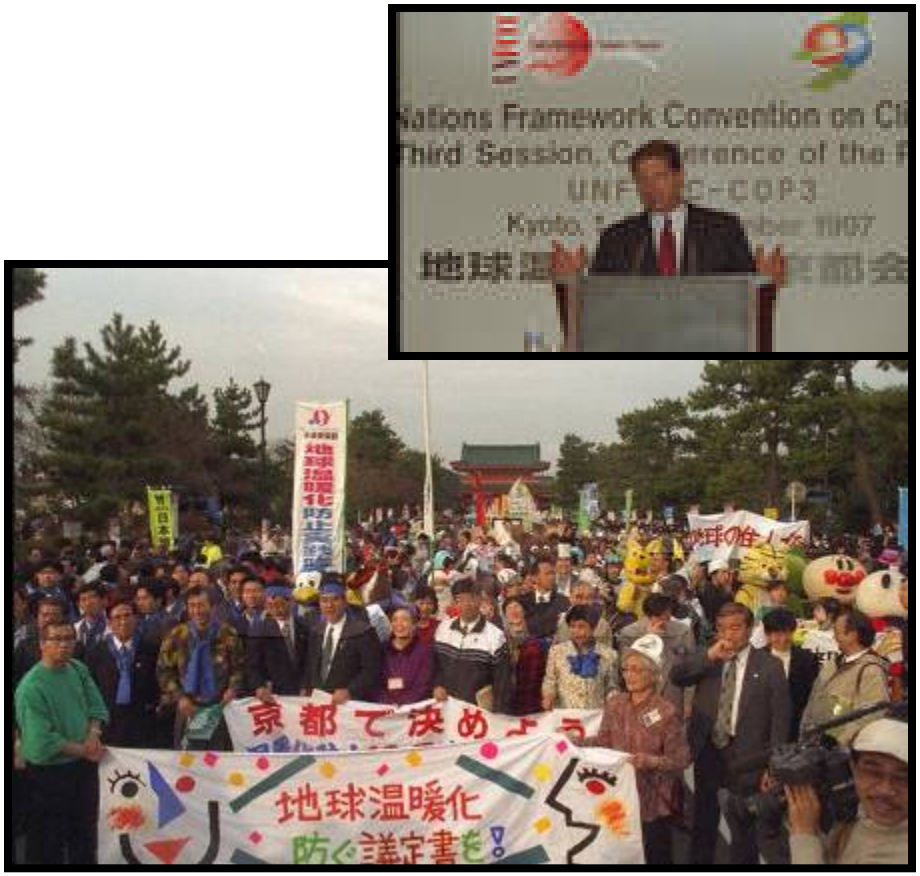
International Attention

- 1992 United Nations Framework Convention on Climate Change.
- 1997 Kyoto Protocol calls for a 7% reduction of carbon equivalent-emissions from 1990 levels.



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U.S. Activities

- The United States did not ratify the Kyoto Protocol.
- President Bush's Global Climate Change Initiative calls for an 18% reduction in CO_2 intensity by 2012.

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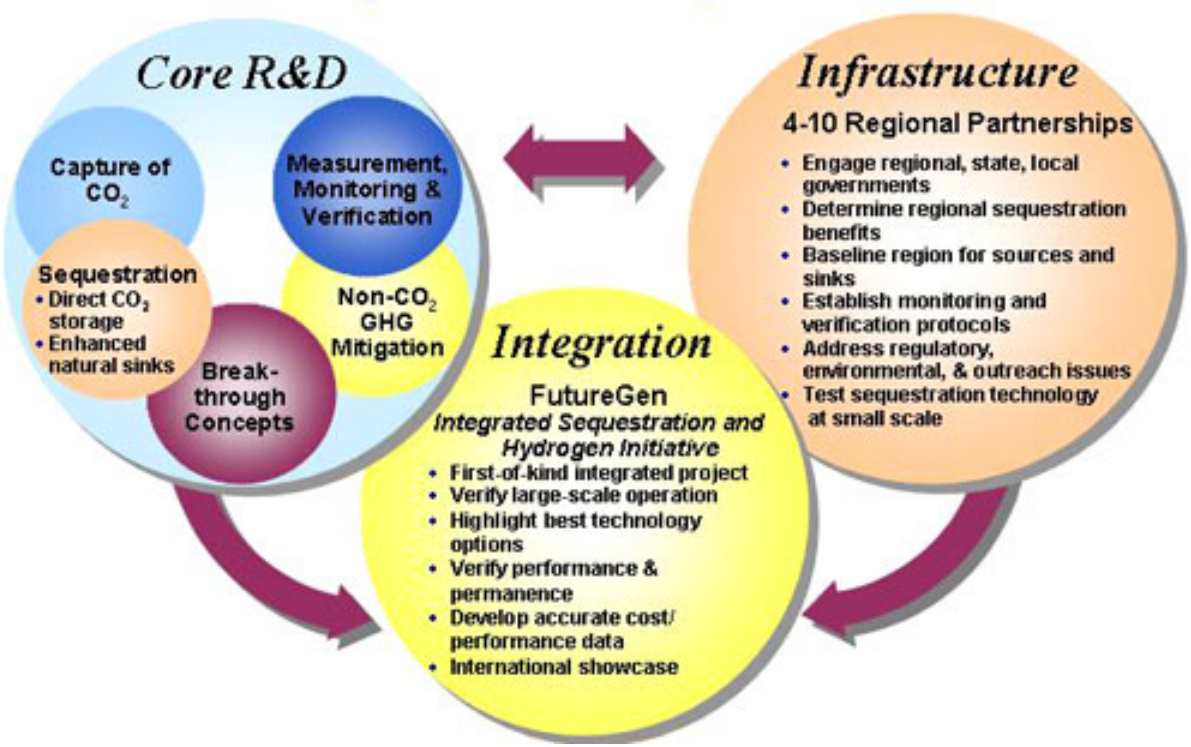
U.S. Department of Energy (DOE) Greenhouse Gas Emissions Program



Source: http://www.netl.doe.gov/coalpower/sequestration/index.html

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CO_2 Sequestration Global Energy Backdrop

- Human population ***quadrupled*** and energy consumption ***increased 16-fold*** in the 20th century.

- Primary power consumption today is approximately 85% fossil-fuel derived.

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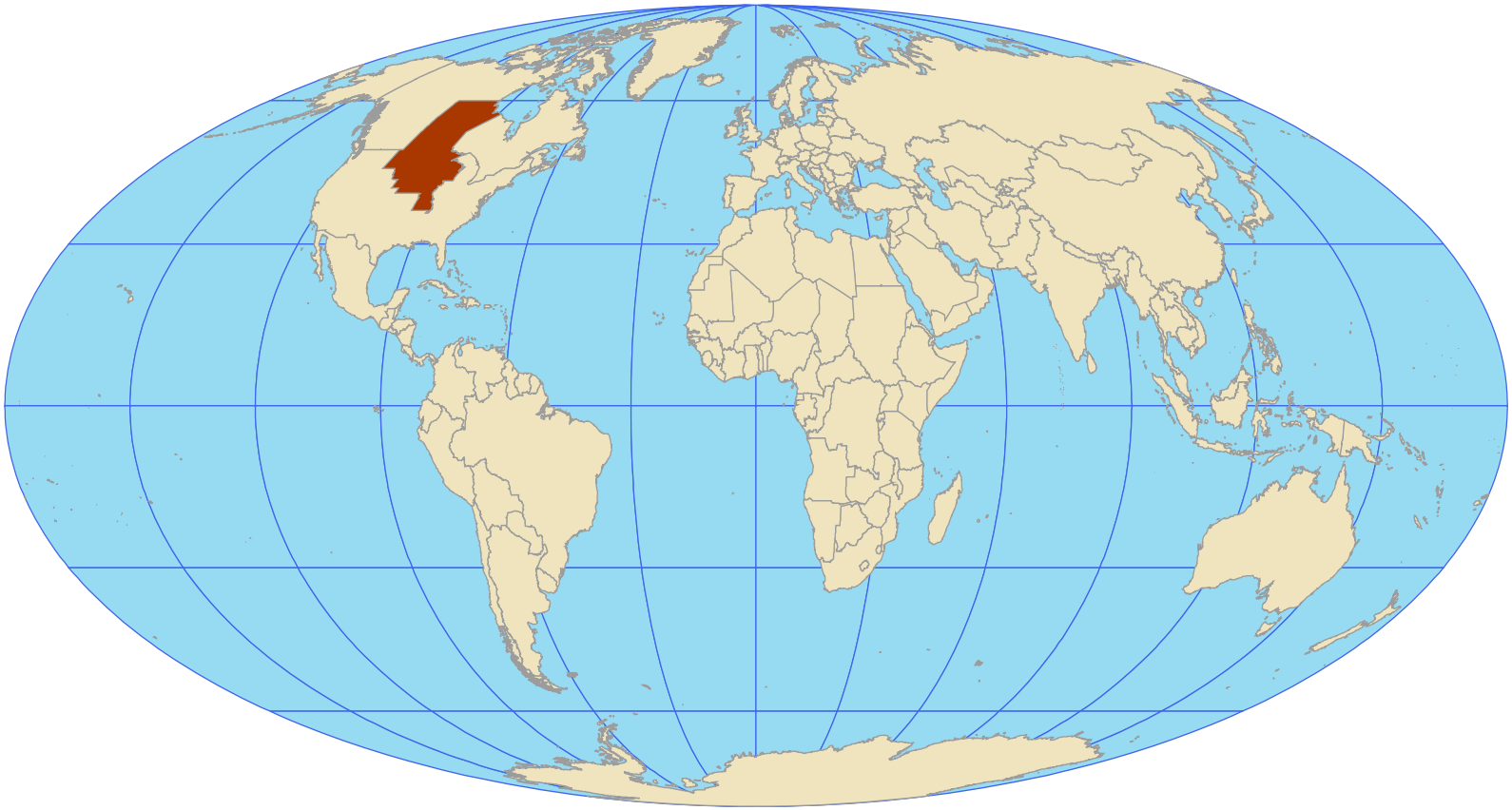
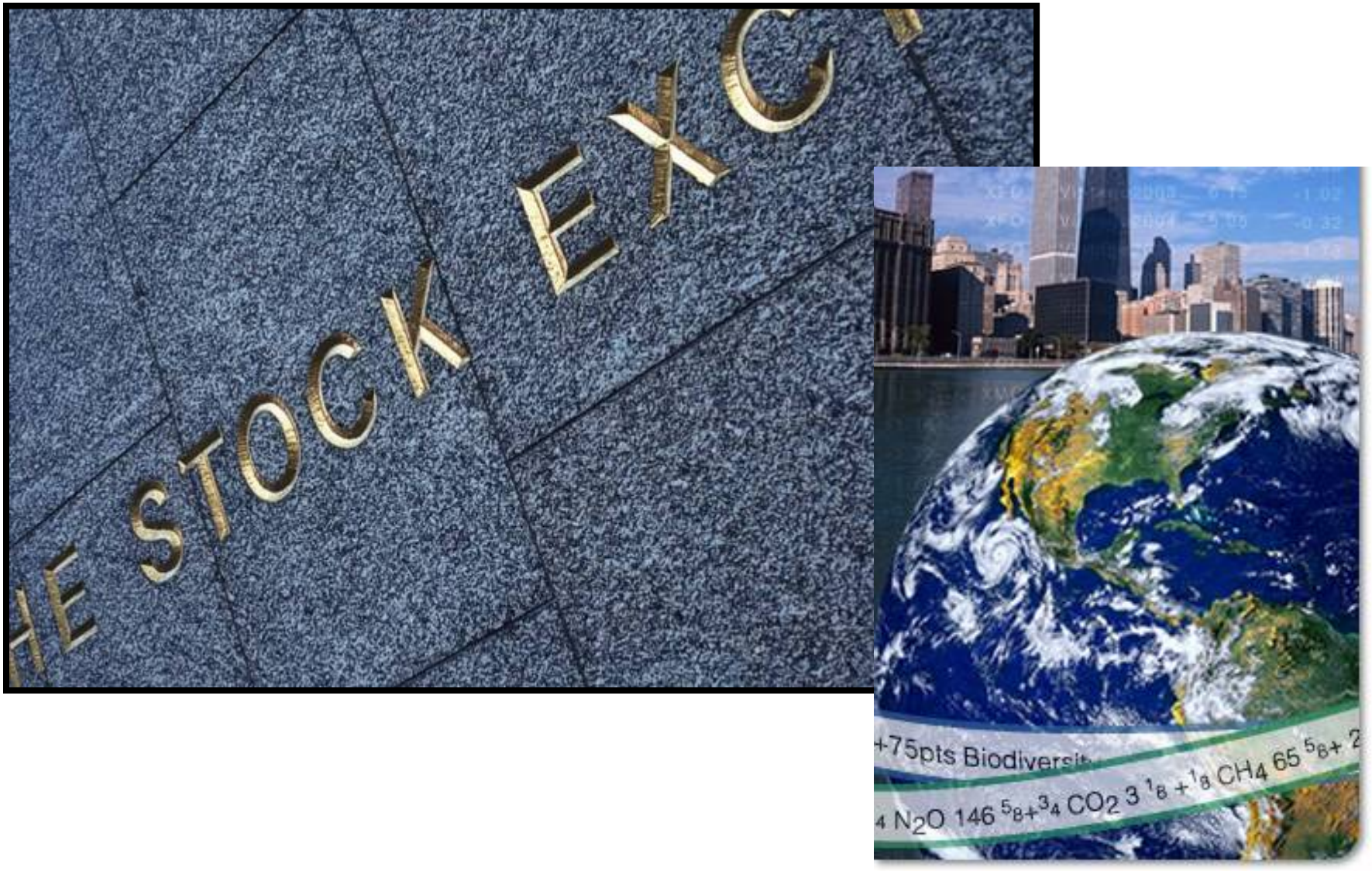
“We are moving into a *carbon-managed* world, not a *carbon-constrained* world."

— *R. Patrick*



Rick Patrick, Vice President, Planning, Environment and Regulatory Affairs, SaskPower, personal communication (2004)



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PCOR Partnership Region

Nine states and three provinces

1,362,089 square miles

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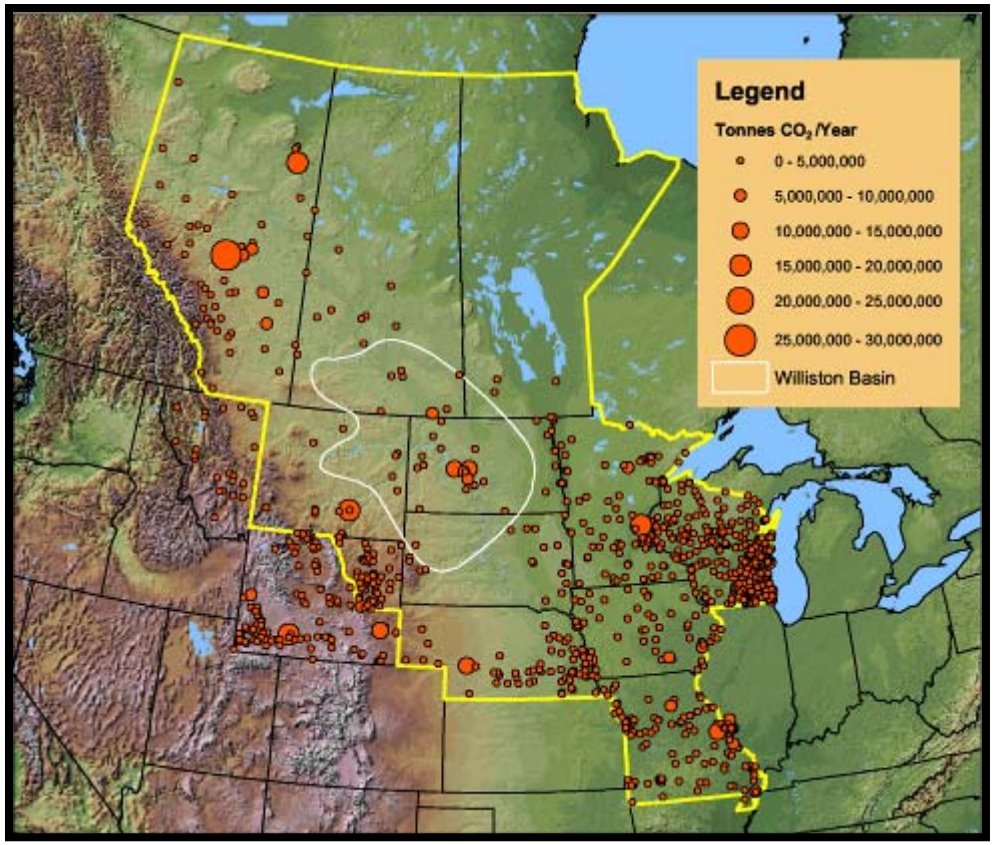
PCOR Partnership Phase I Partners

PCOR Partnership

- Phase I
  - Gauge public understanding.
  - Develop database for:
    - Sources.
    - Sinks.
    - Separation and transportation options.
    - Regulatory and permitting requirements.
    - Environmental benefits and risks.
  - Identify opportunities and conduct public outreach campaign.
  - Develop action plan for Phase II (demonstrations).



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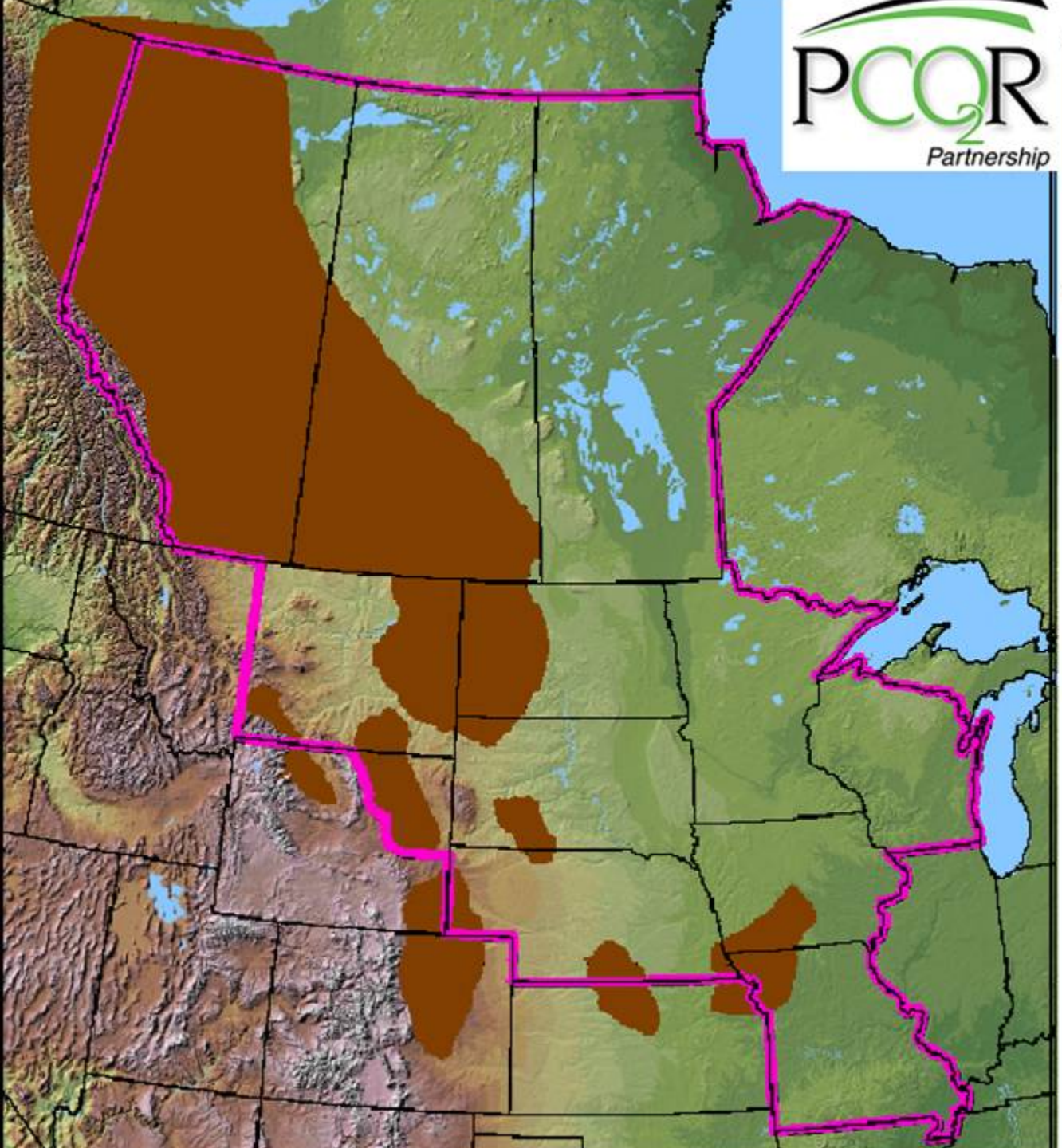

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Sedimentary Basins

440,828 square miles

32% of region

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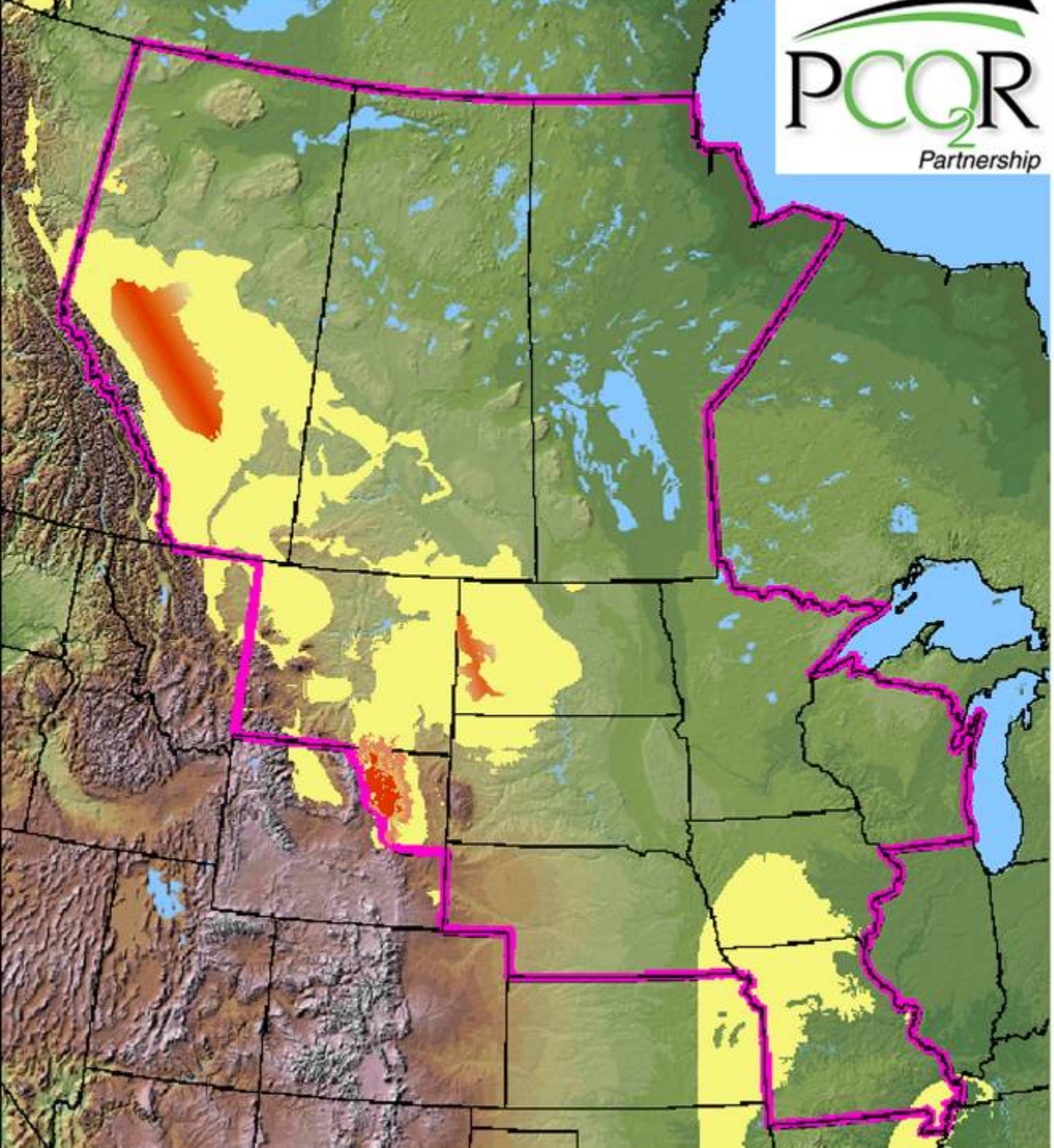

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Coal Fields

292,006 square miles.

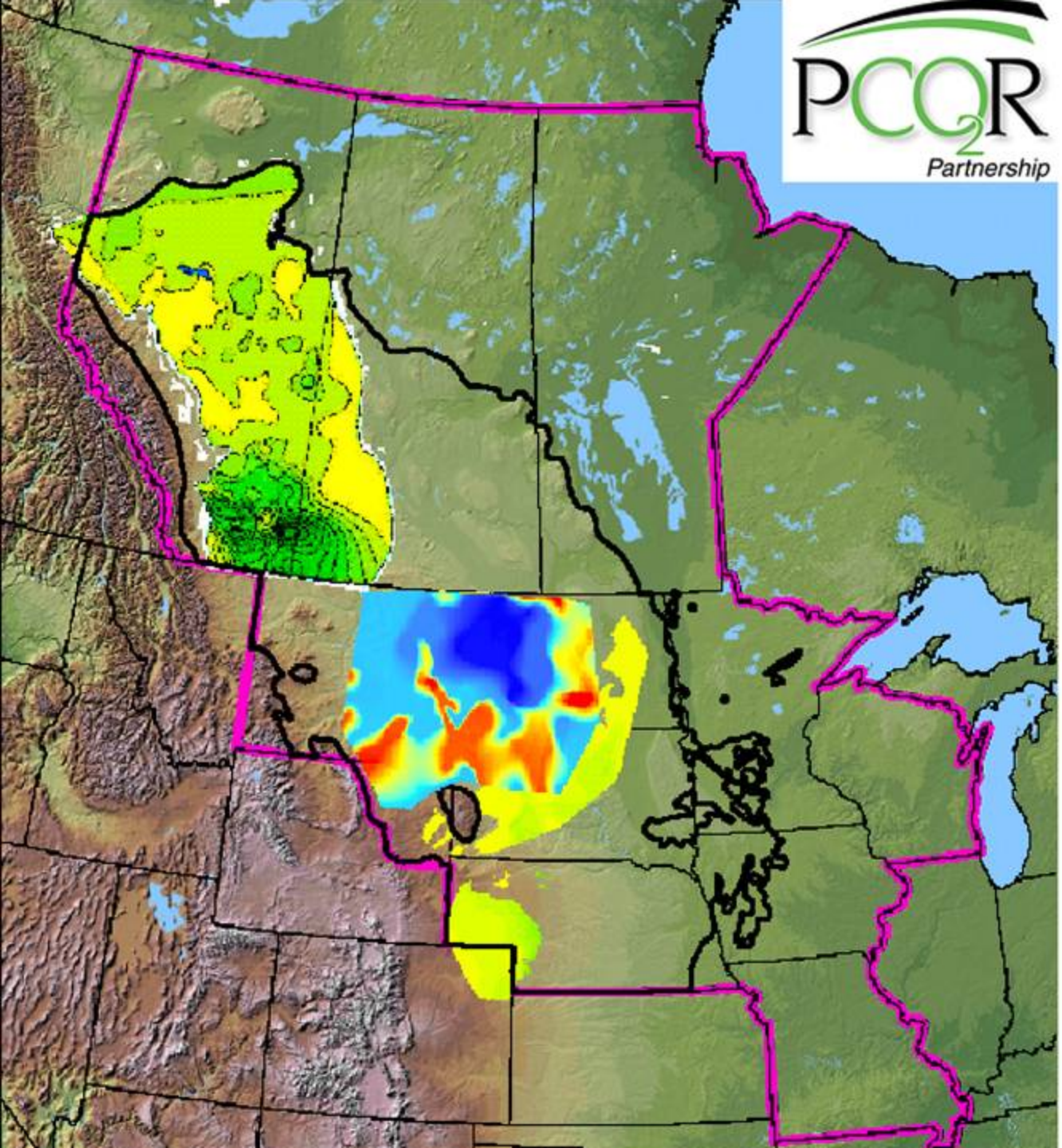
21% of region.

Evaluated Wyodak–Anderson, Ardley, and Fort Union coals.

CO_2 sequestration capacity estimated to date: >8 billion tons.

PCOR Partnership Region

Geological CO_2 sequestration capacity estimated to date: >8 billion tons.



PCO2R Partnership

Saline Aquifers

645,677 square miles.
47% of region.

Evaluated the Lower Cretaceous and the Mississippian Madison aquifer systems.

CO_2 sequestration capacity estimated to date:
>200 billion tons.

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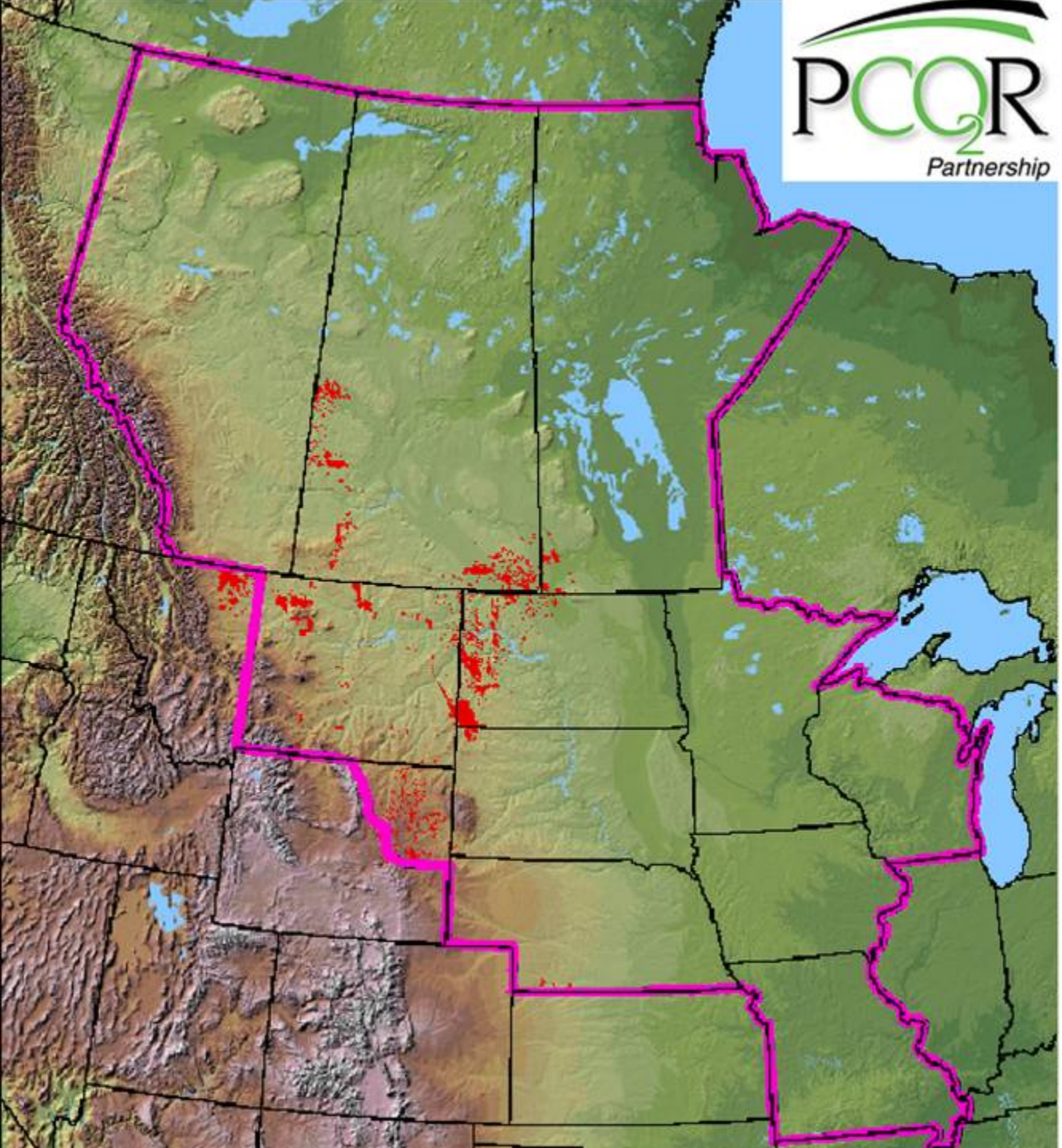
Geological CO_2 sequestration capacity evaluated to date:
>208 billion tons.



PCO2R Partnership

Oil Fields

2000+ fields evaluated.

Volumetric CO_2 sequestration capacity estimated to date: >10 billion tons.

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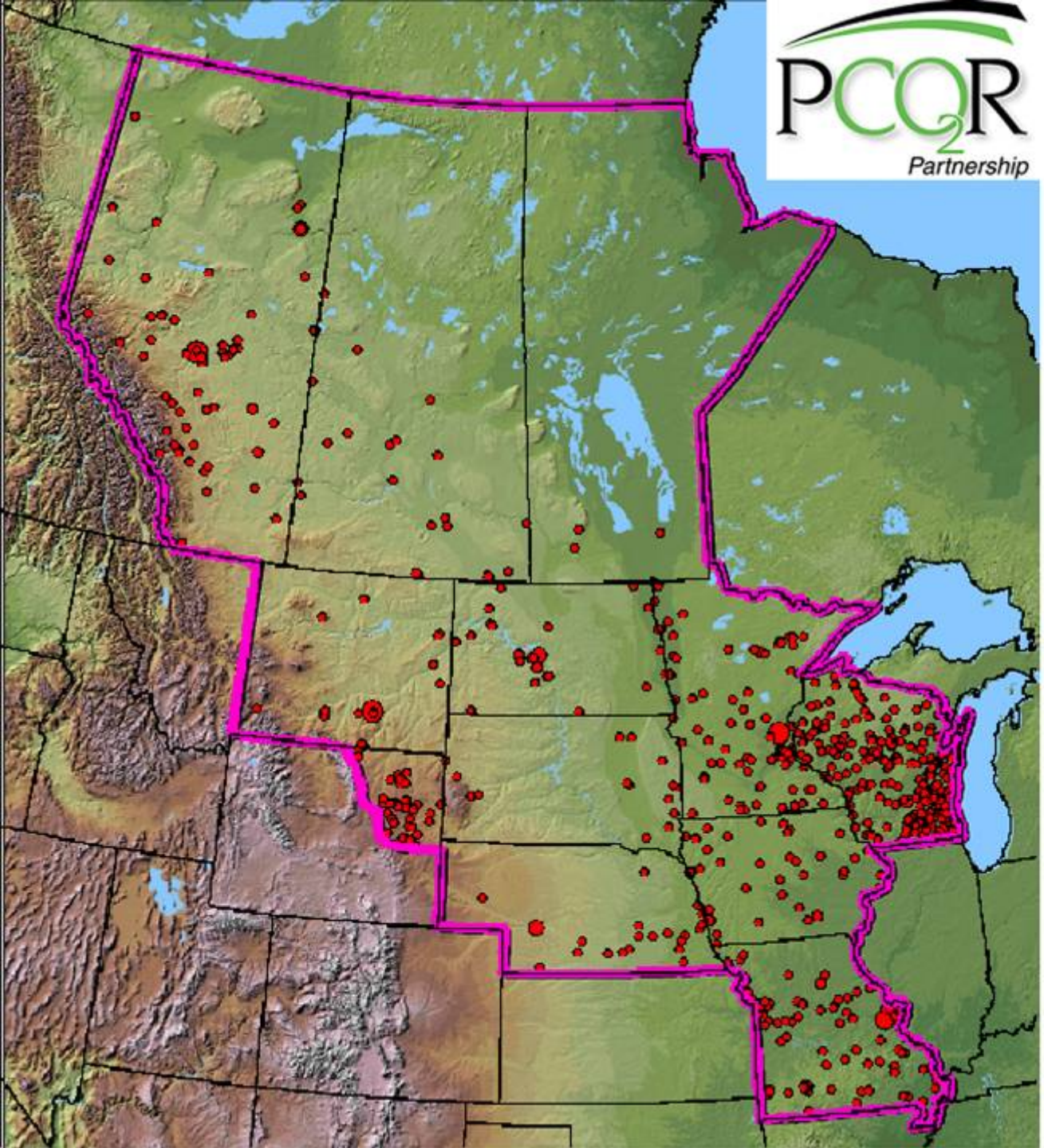
Geological CO_2 sequestration capacity estimated to date: >218 billion tons.



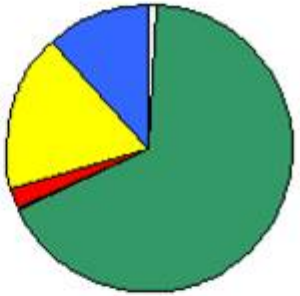
PCQR Partnership

Sources

1367 stationary sources

Total CO_2 emissions:
619 million tons/yr

Emissions by Industry Category



- Ag Processing (1%)
- Electric Utility (67%)
- Ethanol (3%)
- Industrial 17%)
- Petroleum and Natural Gas (12%)

Summary of Phase I Source and Geologic Characterization

In the PCOR Partnership region, 619 million tons of CO_2 emitted annually from stationary sources

<u>Assuming a 20% sequestration goal:</u>

- Oil fields alone can get you to the Year 2085.
- Coal fields alone can get you to the Year 2070.
- Saline aquifers alone can get you to the Year 3620.

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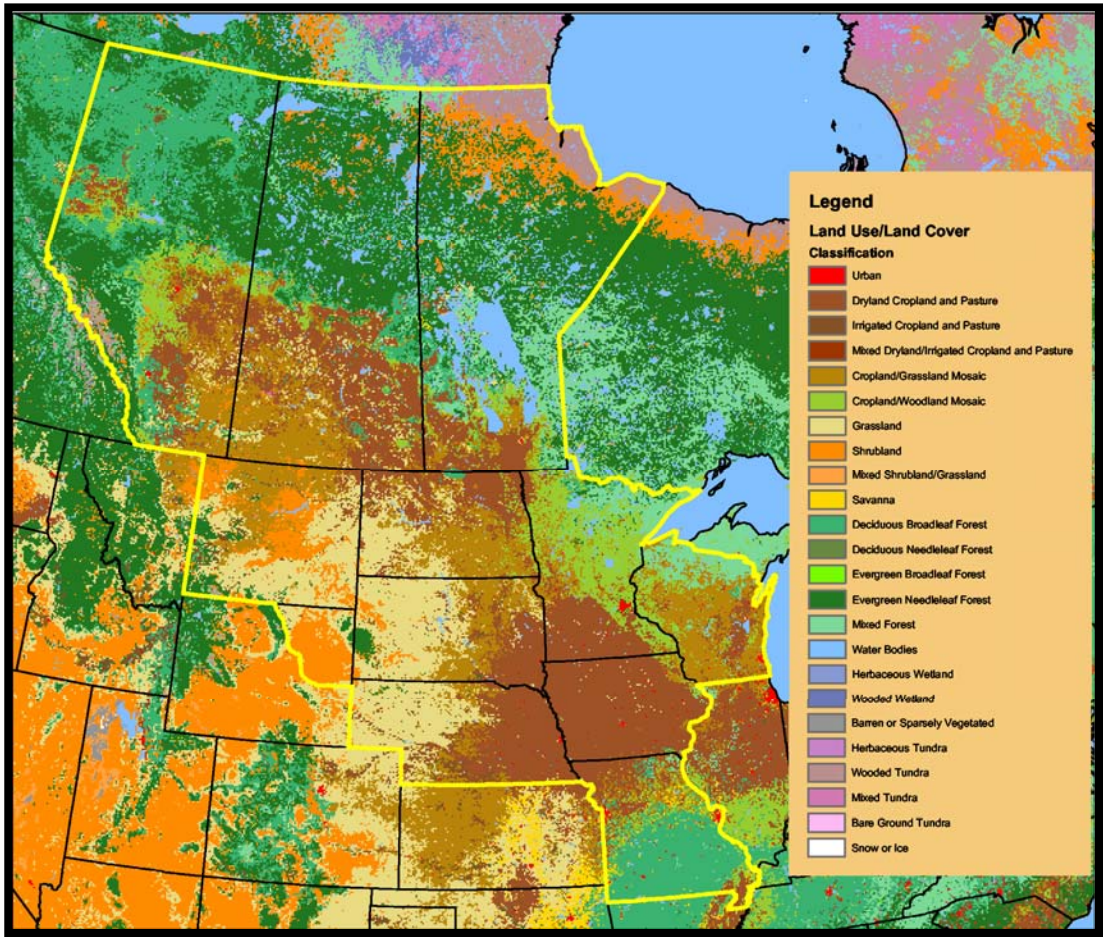
Terrestrial Sequestration

- North Dakota State University – low-moisture land management practices for carbon sequestration
- Ducks Unlimited Canada (DUC) and U.S. Geological Survey (U.S.G.S.) – wetlands sequestration
- Regional assessment of land uses



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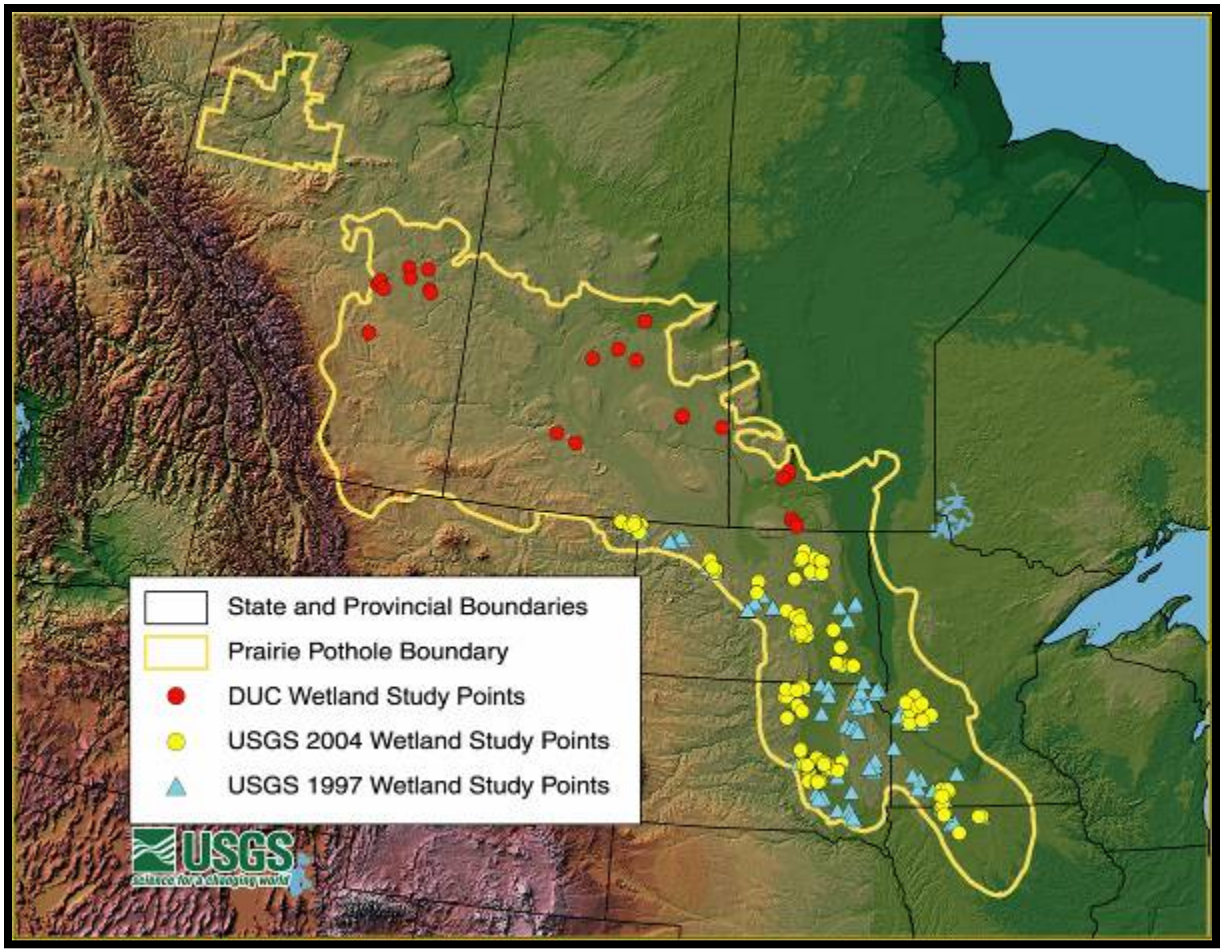
Study Sites in the Prairie Pothole Region



Estimated CO_2 sequestration potential for Prairie Pothole Region is

7 million tons CO_2/yr.

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Nature in the Balance – CO_2 Sequestration

Produced for a general audience, "Nature in the Balance: CO_2 Sequestration" provides a 30-minute introduction to CO_2 management with a focus on the North American heartland. The video introduces audiences to the U.S. Department of Energy (DOE) National Energy Technology Laboratory's (NETL's) seven Regional Carbon Sequestration Partnerships and describes their role in assessing opportunities for carbon sequestration across North America.

"Nature in the Balance" was produced by Prairie Public Television, Fargo, North Dakota, in collaboration with the Plains CO_2 Reduction (PCOR) Partnership led by the University of North Dakota's Energy & Environmental Research Center (EERC). The PCOR Partnership represents more than 40 public and private sector partners located in nine states and three Canadian provinces in the heartland of North America. Funding is provided by DOE's NETL and program partners. To learn more about CO_2 sequestration, visit the PCOR Partnership Web site at www.undeerc.org/PCOR.

Nature in the Balance (May 2005) 30 minutes.

Executive Producers – Edward Steadman and Robert Dambach
Videographer/Editor – Eric Carlson
Writers – Charlene Crocker and Daniel Daly
Narration – Hope Deutscher

Cover photograph: Antelope Valley Station Unit 2, Beulah, North Dakota, Basin Electric Power Cooperative

Nature in the Balance – CO_2 Sequestration

Nature in the Balance – CO_2 Sequestration

EERC | NETL | PCOR | Prairie Public Television

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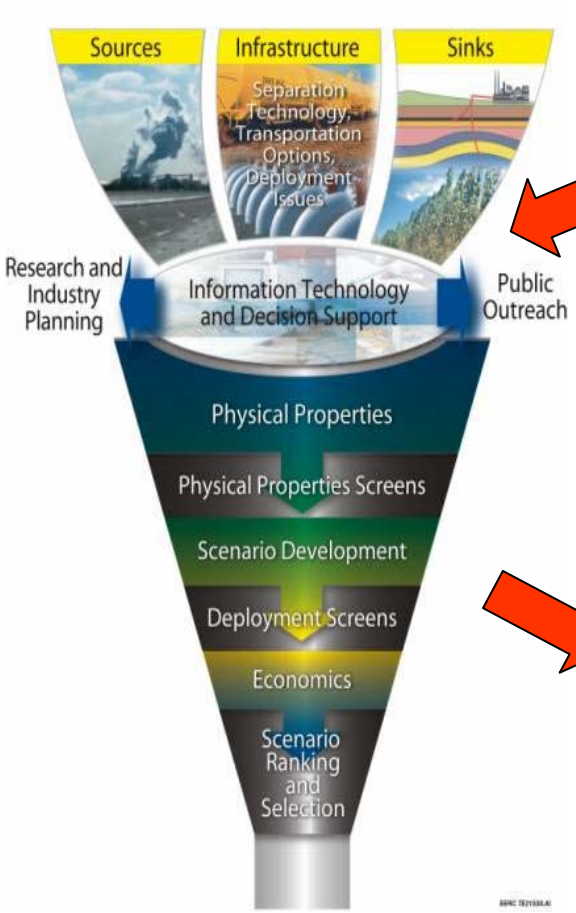
Identifying CO_2 Sequestration Opportunities



Partners

- Injection into a deep carbonate system for enhanced oil recovery (EOR)
- Acid gas injection into a carbonate system for EOR
- Injection into a lignite seam for enhanced coalbed methane (ECBM)
- Wetland/grassland terrestrial sequestration

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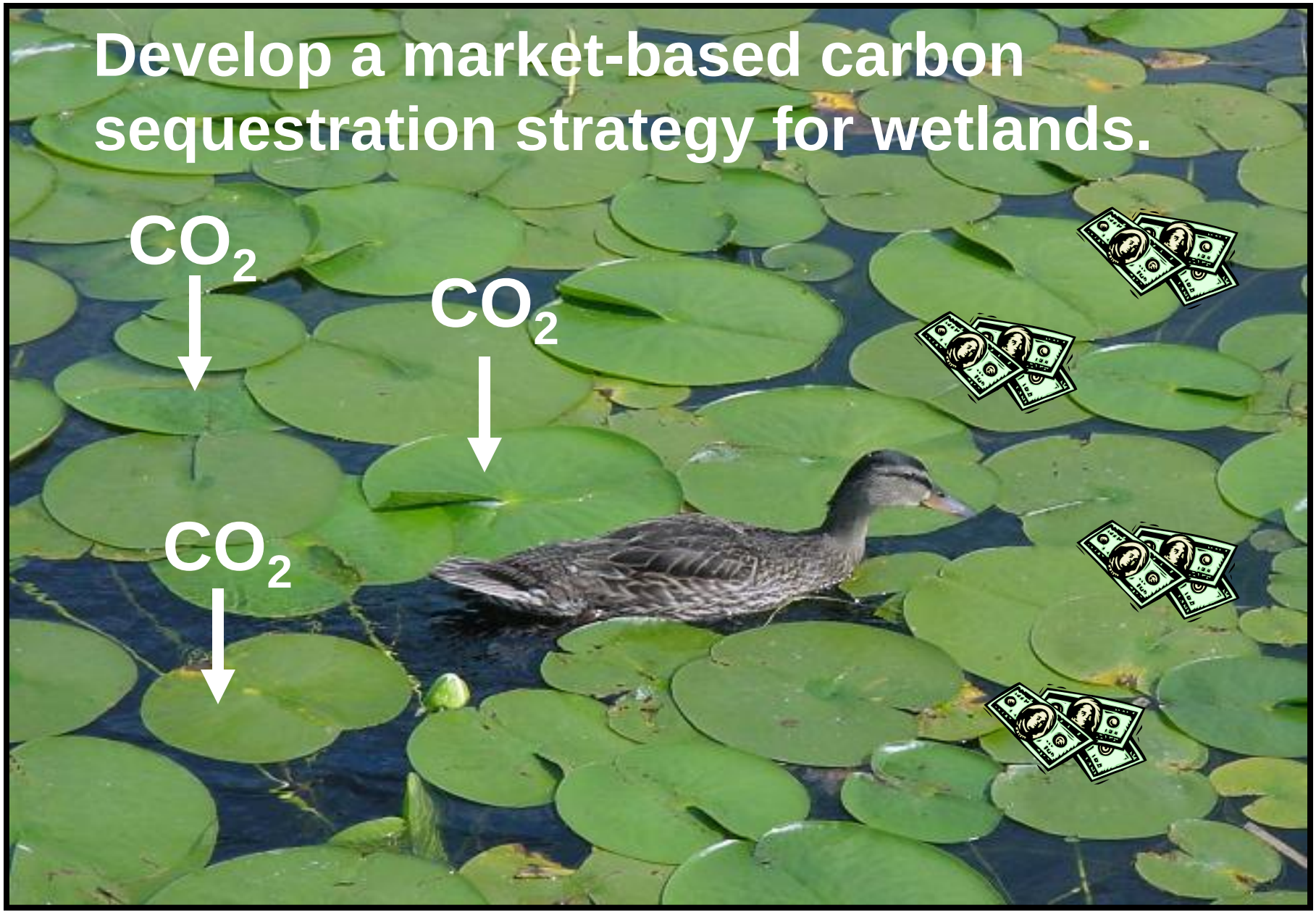
Field Validation Test Goals
Let's Get Started!

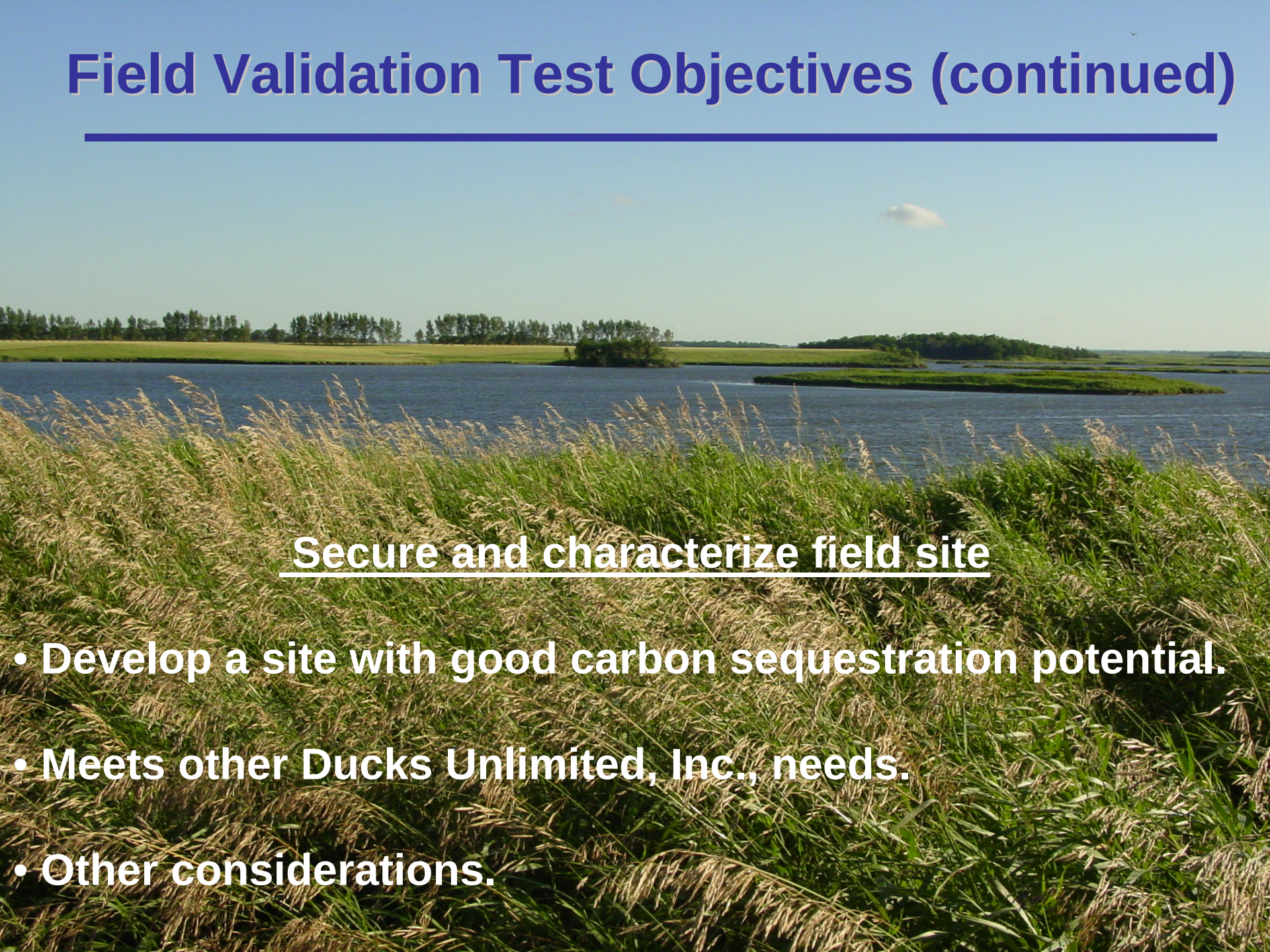
Field Validation Test Goals



Field Validation Test Objectives

- Secure and Characterize Field Site
- Site Development and Management
- Carbon Sequestration MM&V
- Development of Carbon Offset Protocols and Standards
- Economic Analysis

Field Validation Test Objectives (continued)



Secure and characterize field site

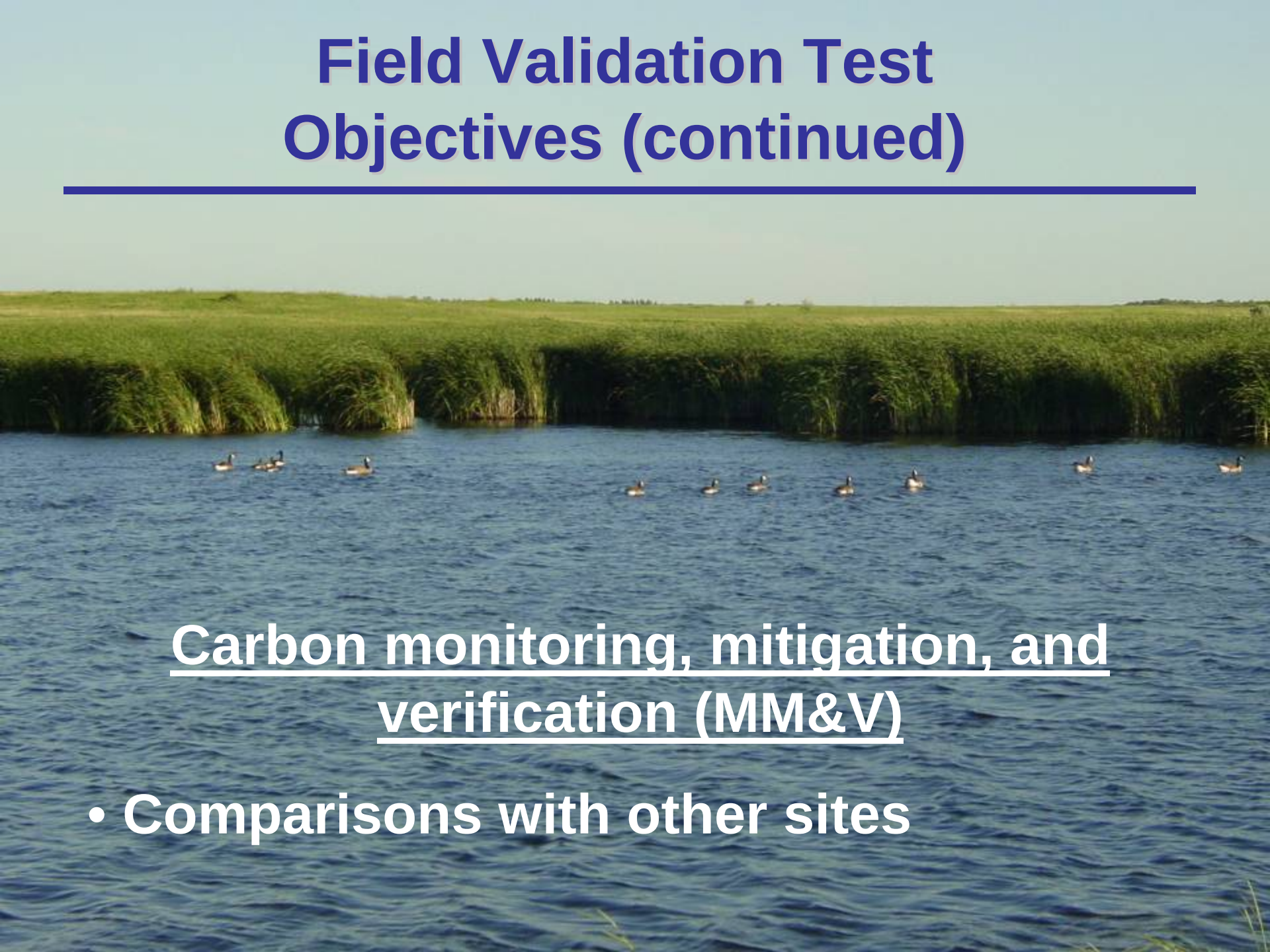
- Develop a site with good carbon sequestration potential.
- Meets other Ducks Unlimited, Inc., needs.
- Other considerations.

Field Validation Test Objectives (continued)

Site development management

- Develop wetland management practices.

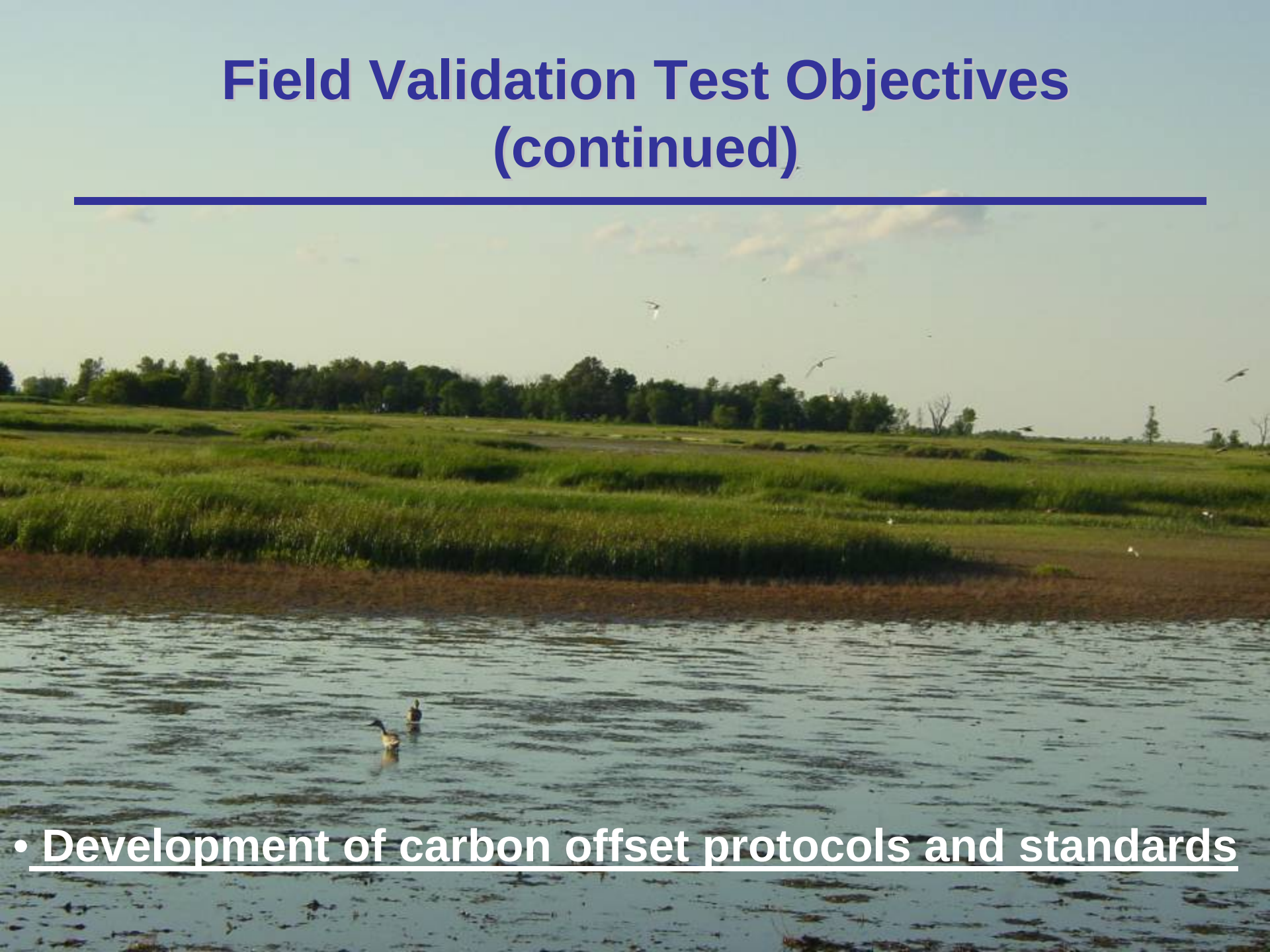
Field Validation Test Objectives (continued)



Carbon monitoring, mitigation, and verification (MM&V)

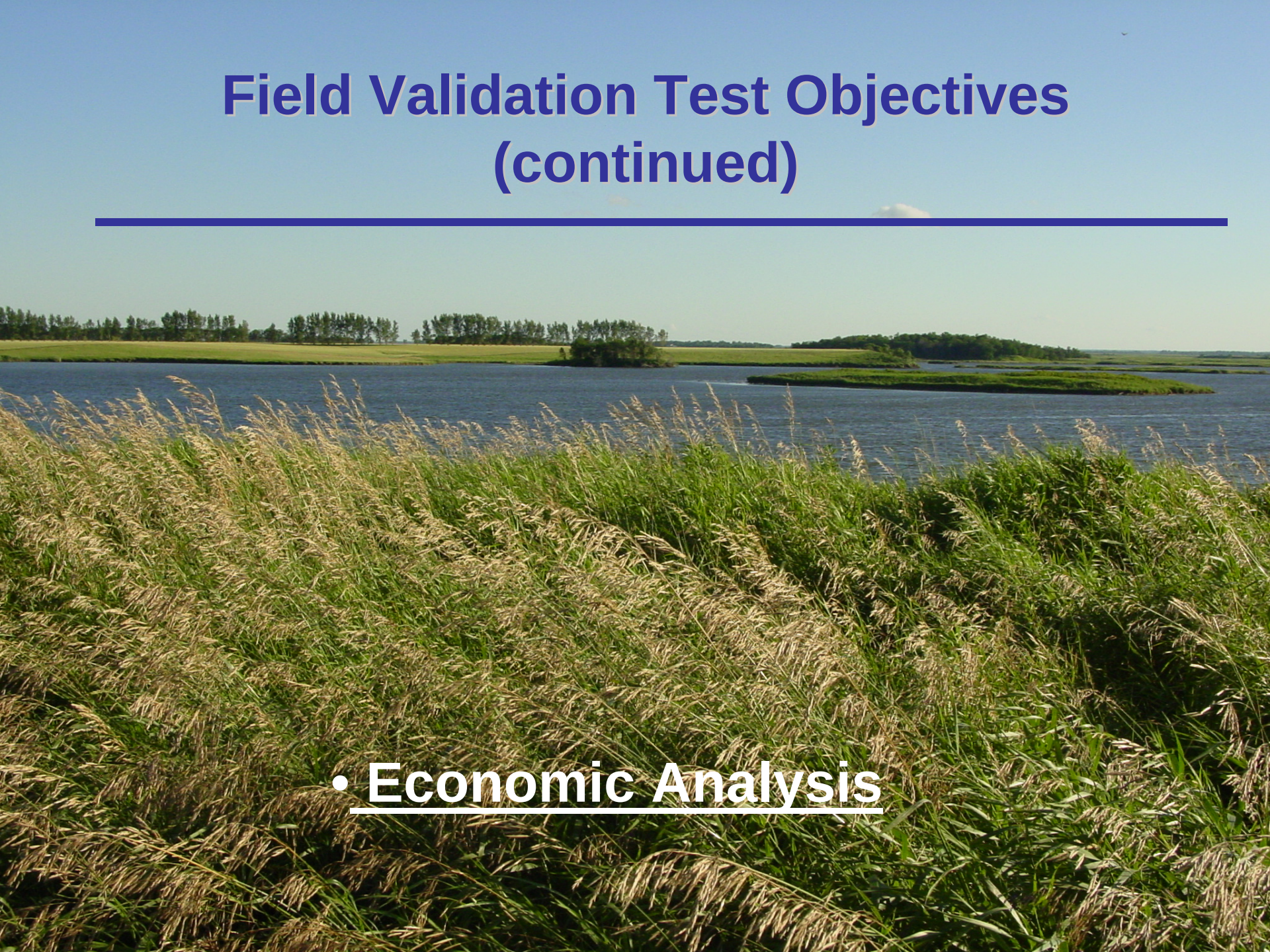
- **Comparisons with other sites**

Field Validation Test Objectives (continued)



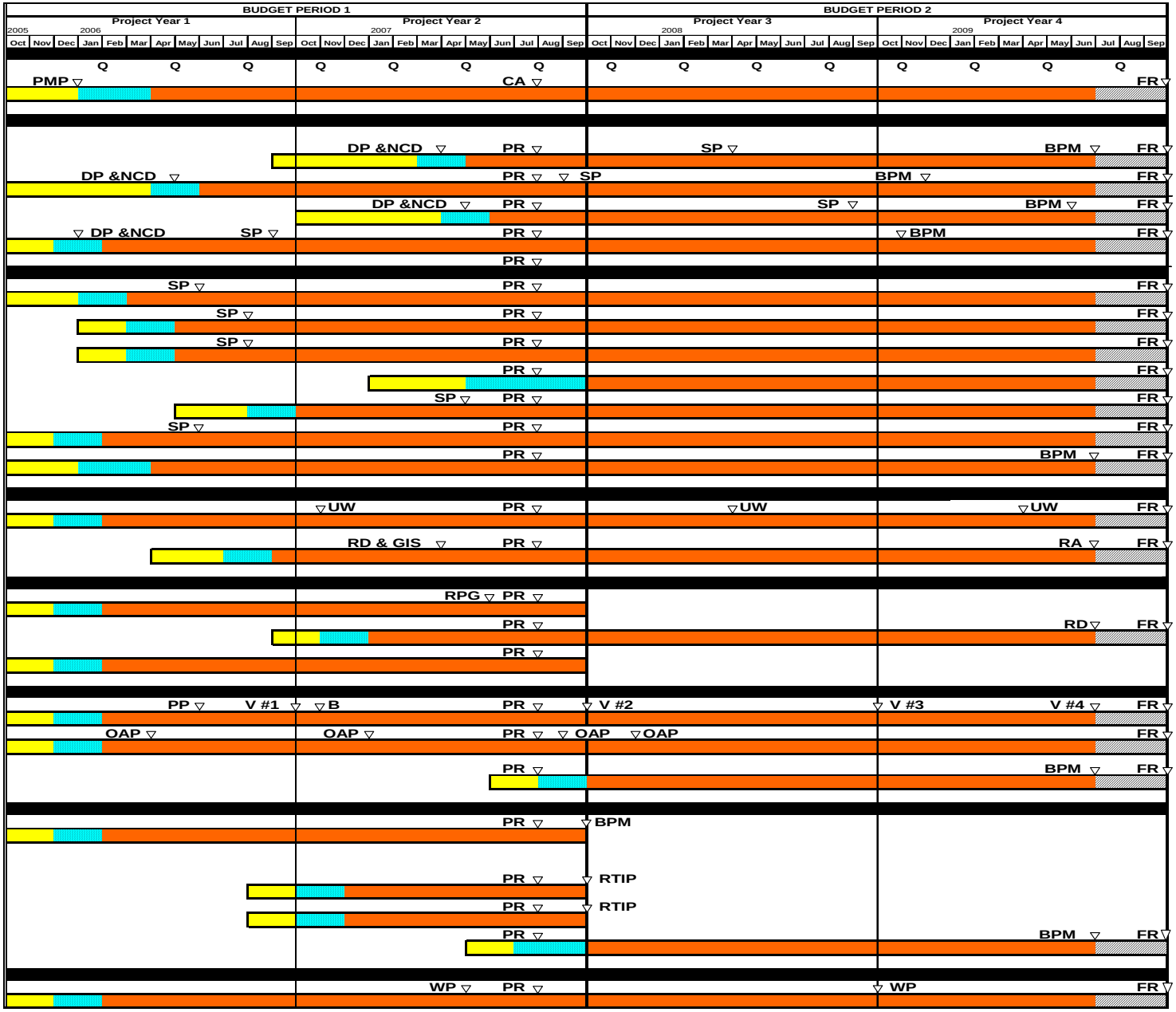
- **Development of carbon offset protocols and standards**

Field Validation Test Objectives (continued)



- Economic Analysis

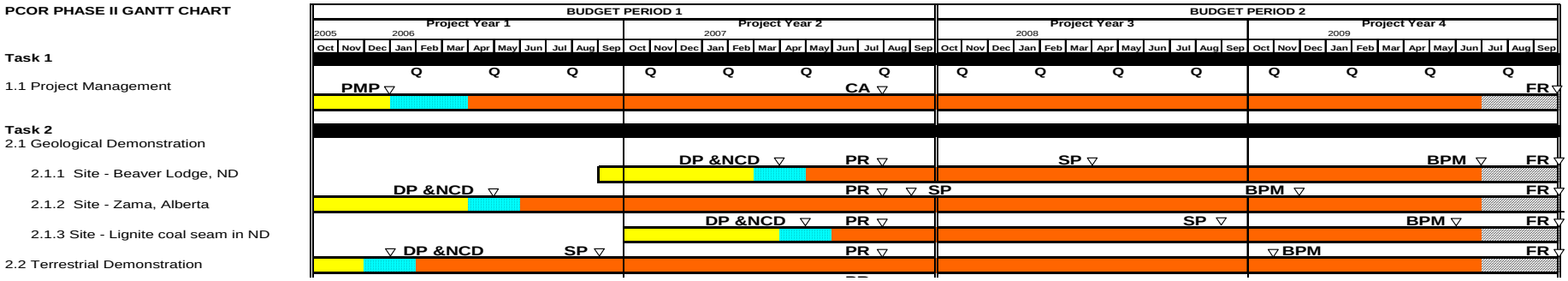
PCOR PHASE II GANTT CHART

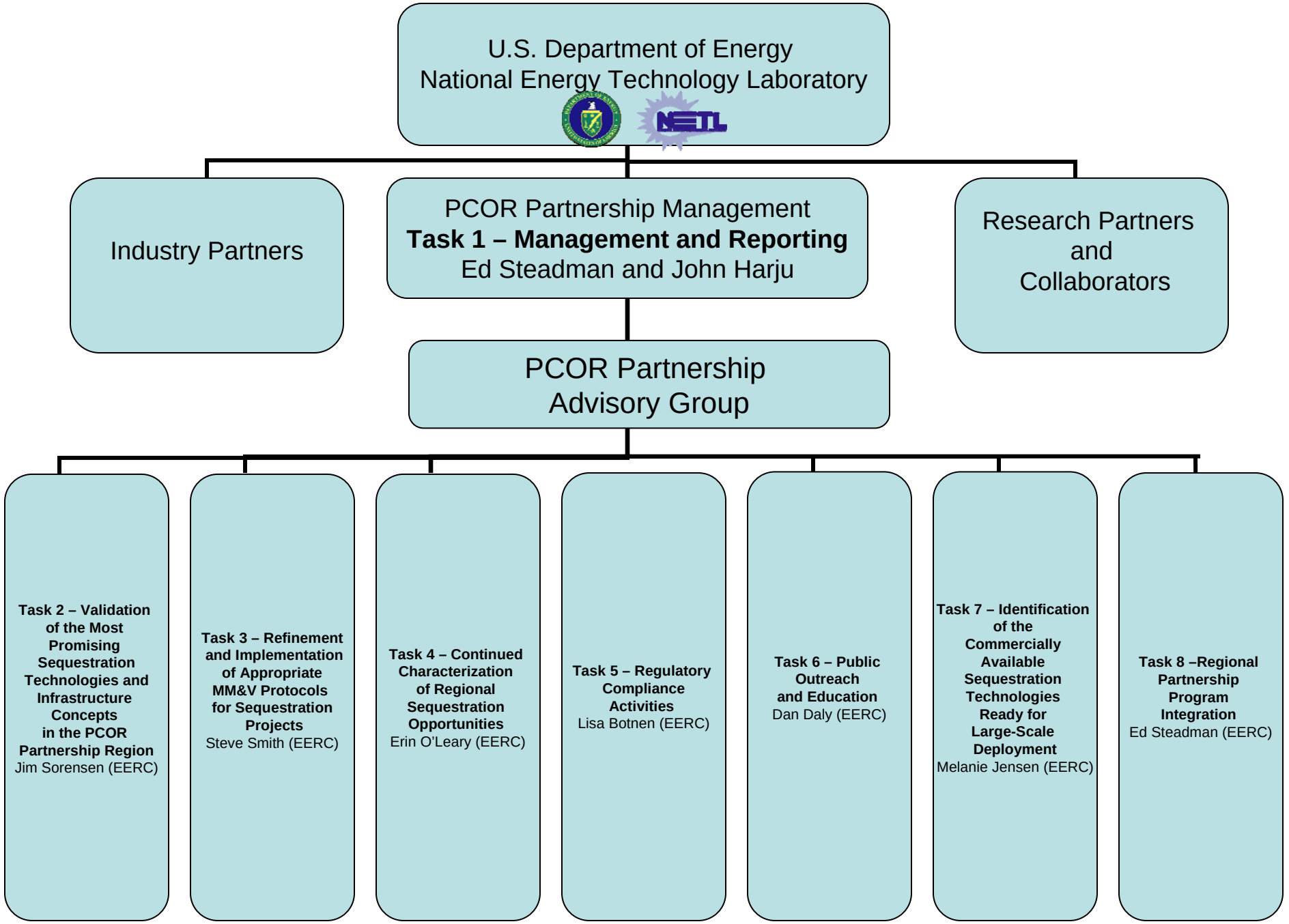


BPM = Best Practice Manual
CA = Continuation Application
DP = Design Package
B = Booth
FR = Final Report
NCD = NEPA Compliance Doc.
OAP = Outreach Action Plan
OB = Outreach Booth
PP= PowerPoint Present.
PR = Progress Report - BP1
Q = Quarterly Reports
RA = Regional Atlas
RD = Roadmap Document
RPG = Regulatory Permitting Guidelines
RTIP = Regional Technology Implementation Plan
SP = Sampling Protocols
UW = Update Web site
V = Video
WP = White Paper

Summary Task | Design Phase | Implementation Phase | Operations Phase | Closeout/Reporting Phase | Milestone

Terrestrial Demonstration




U.S. Department of Energy
National Energy Technology Laboratory
Industry Partners
PCOR Partnership Management
Task 1 – Management and Reporting
Ed Steadman and John Harju
Research Partners and Collaborators
PCOR Partnership Advisory Group
Task 2 – Validation of the Most Promising Sequestration Technologies and Infrastructure Concepts in the PCOR Partnership Region
Jim Sorensen (EERC)
Task 3 – Refinement and Implementation of Appropriate MM&V Protocols for Sequestration Projects
Steve Smith (EERC)
Task 4 – Continued Characterization of Regional Sequestration Opportunities
Erin O'Leary (EERC)
Task 5 – Regulatory Compliance Activities
Lisa Botnen (EERC)
Task 6 – Public Outreach and Education
Dan Daly (EERC)
Task 7 – Identification of the Commercially Available Sequestration Technologies Ready for Large-Scale Deployment
Melanie Jensen (EERC)
Task 8 –Regional Partnership Program Integration
Ed Steadman (EERC)

PCOR Partnership Phase II Partners

- University of North Dakota - Energy & Environmental Research Center (EERC)
- Alberta Energy and Utilities Board
- Amerada Hess Corporation
- Apache Canada Ltd.
- Basin Electric Power Cooperative
- Center for Energy and Economic Development (CEED)
- Dakota Gasification Company
- Ducks Unlimited Canada
- Ducks Unlimited, Inc.
- Eastern Iowa Community College District
- Encore Acquisition Company
- Environment Canada
- Excelsior Energy Inc.
- Fischer Oil and Gas, Inc.
- Great Northern Power Development, L.P.
- Great River Energy
- Interstate Oil and Gas Compact Commission
- Lignite Energy Council
- Minnesota Power
- Minnkota Power Cooperative, Inc.
- Montana Department of Environmental Quality
- Nexant, Inc.
- North Dakota Department of Health
- North Dakota Geological Survey
- North Dakota Industrial Commission Lignite Research, Development and Marketing Program
- North Dakota Industrial Commission Oil and Gas Division
- North Dakota Industrial Commission Oil and Gas Research Council
- North Dakota Petroleum Council
- North Dakota State University
- Otter Tail Power Company
- Petroleum Technology Transfer Council
- Prairie Public Television
- SaskPower
- Saskatchewan Industry and Resources
- Iowa Department of Natural Resources
- Wisconsin Department of Agriculture, Trade and Consumer Protection
- U.S. Geological Survey Northern Prairie Wildlife Research Center
- Western Governors' Association
- Xcel Energy

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Logistics

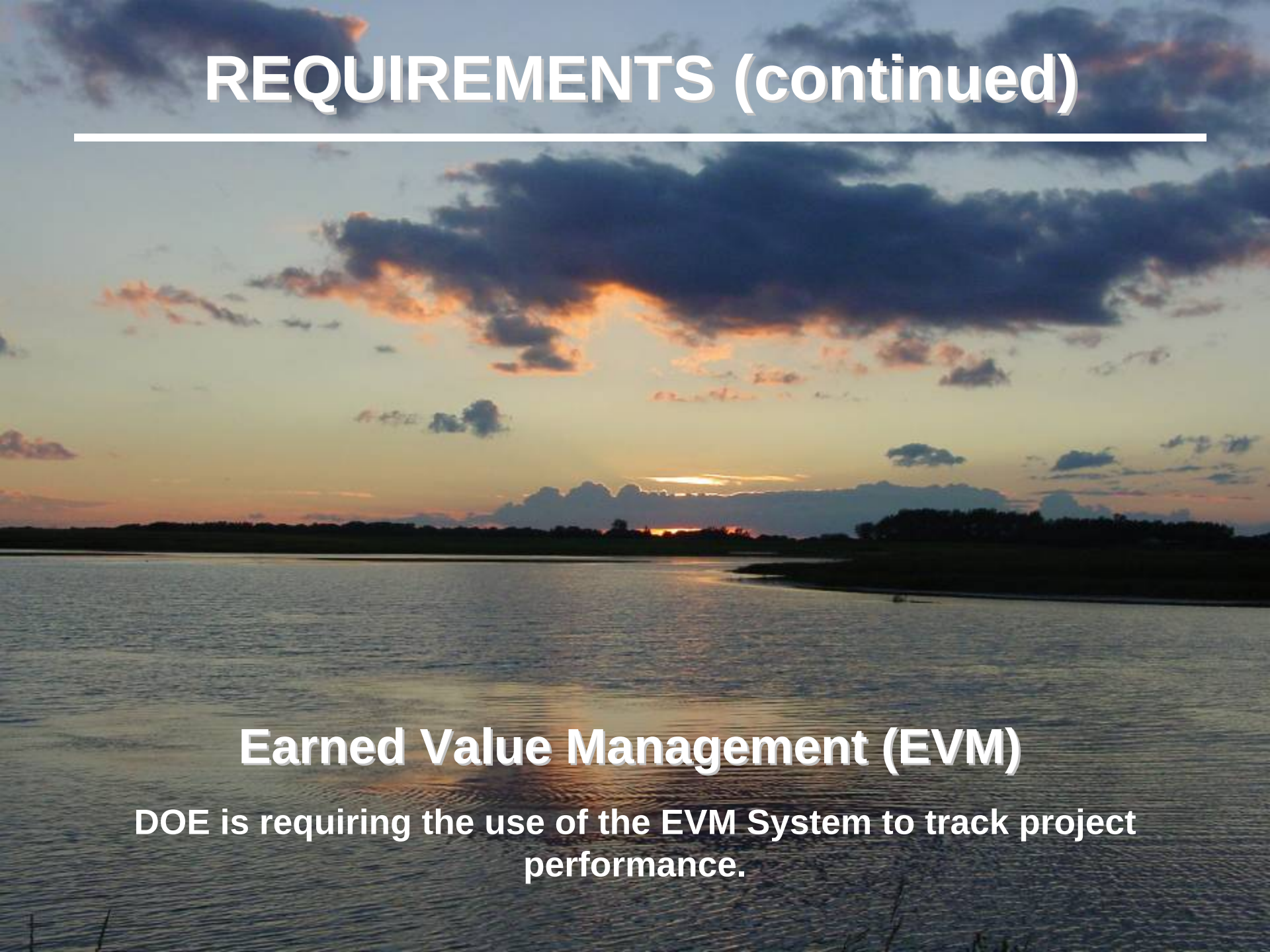
Requirements

- Monthly reports
- Weekly highlights
- Quarterly reports

REQUIREMENTS (continued)

- NEPA Compliance Document
- Design package
- Sampling protocols
- Best management practices manual
- Final report

REQUIREMENTS (continued)



Earned Value Management (EVM)

DOE is requiring the use of the EVM System to track project performance.

EVM (continued)

EVM is used to measure and communicate the real time physical progress of a project taking into account :

- **Work completed.**
- **Time taken to complete the work.**
- **Cost incurred to complete the work.**

EVM helps evaluate and control project risks by measuring progress in monetary terms.

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EVM (continued)

In order for the EERC to use EVM, all subcontractors must provide input to the EERC.

Before the project starts, provide a baseline plan that will include:

- **Expected expenses by task by quarter for the period 10/1/05 – 9/30/07.**
- **Milestones and deliverables for the same time period.**

On a quarterly basis (2 weeks after the end of each quarter) provide:

- **Actual expenses by task.**
- **Percentage of work completed by task.**
- **Corrective action if there is a variance from the baseline plan.**

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LET’S GO!

Ed Steadman
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