

Rangeland Reclamation: Regulating Two Energy Industries in North Dakota for Success

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Management of Rangeland Ecosystems

The Society believes that rangeland ecosystems should be managed to provide optimum sustained yield of tangible and intangible products and benefits for human welfare. This can only be achieved through the sound use of ecological and economic principles.

– *Society for Range Management*

Management of Rangeland Ecosystems

Multiple Use of Rangeland Resources

The Society supports managing combinations of rangeland uses, which best meet the needs and desires of people and are compatible with the sustainability and adaptability of the land.

– *Society for Range Management*

Management of Rangeland Ecosystems

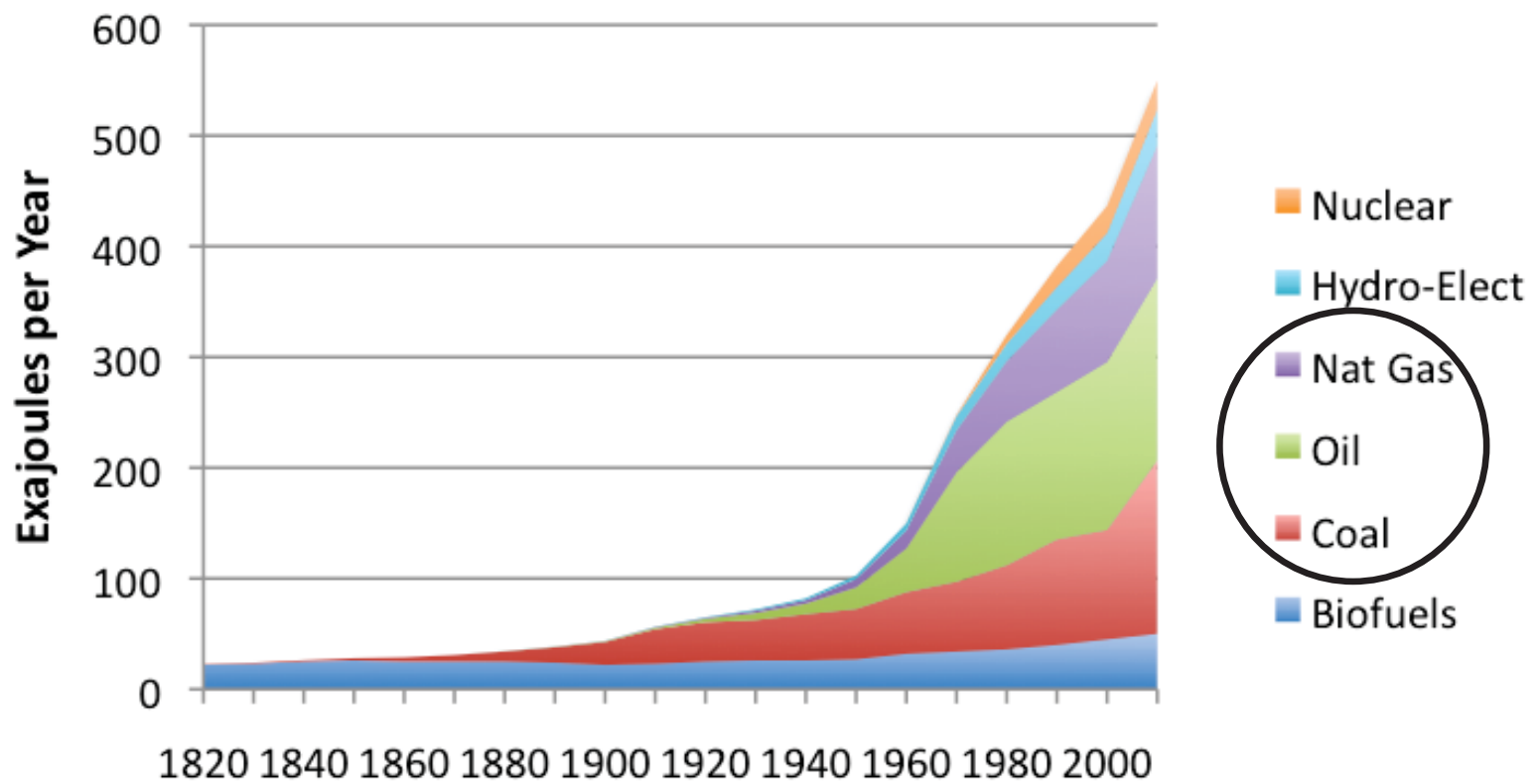
Multiple Use of Rangeland Resources

Biological Diversity

The Society for Range Management affirms that consideration of biological diversity is important and appropriate when developing land management objectives.

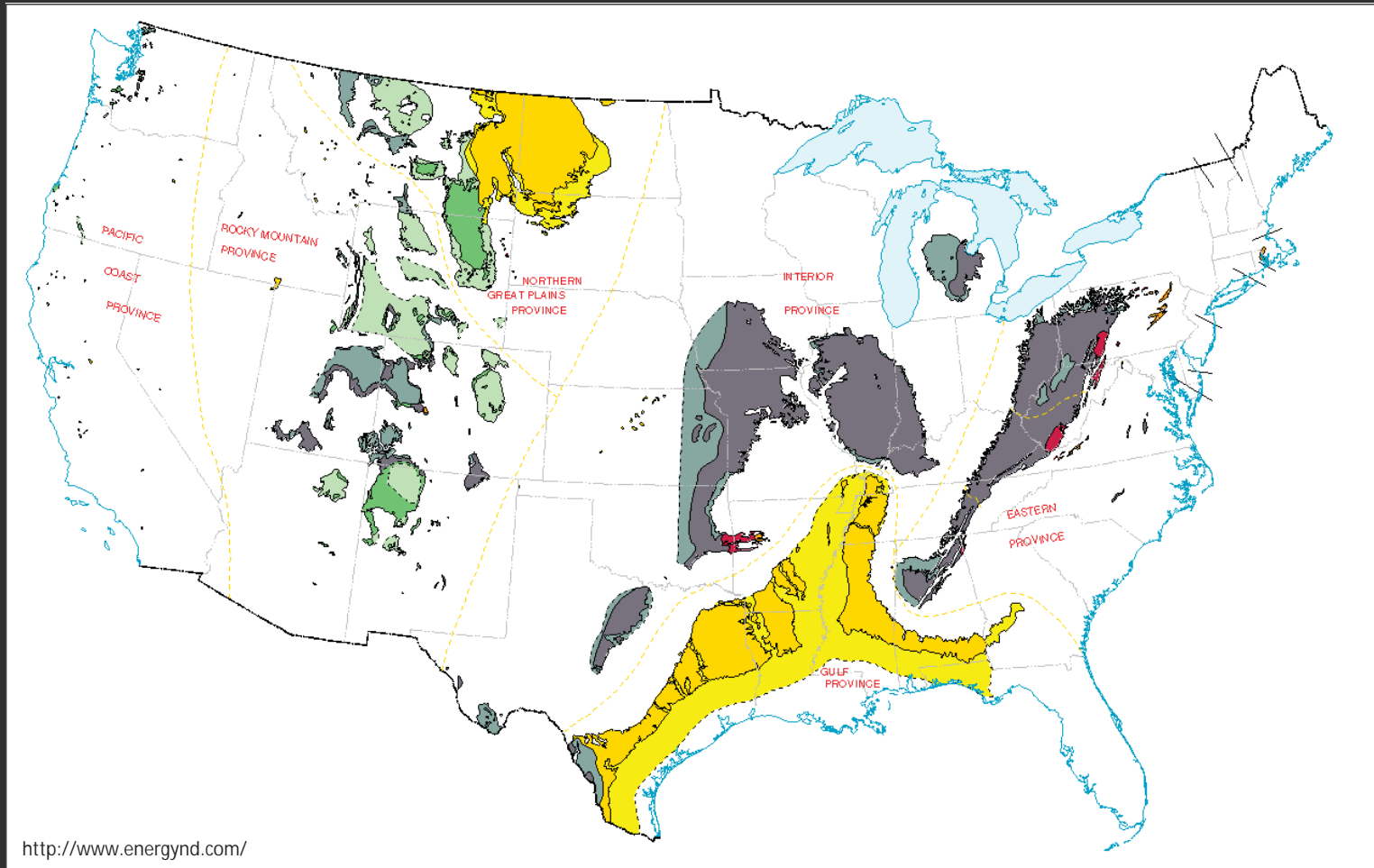
– *Society for Range Management*

World Energy Consumption

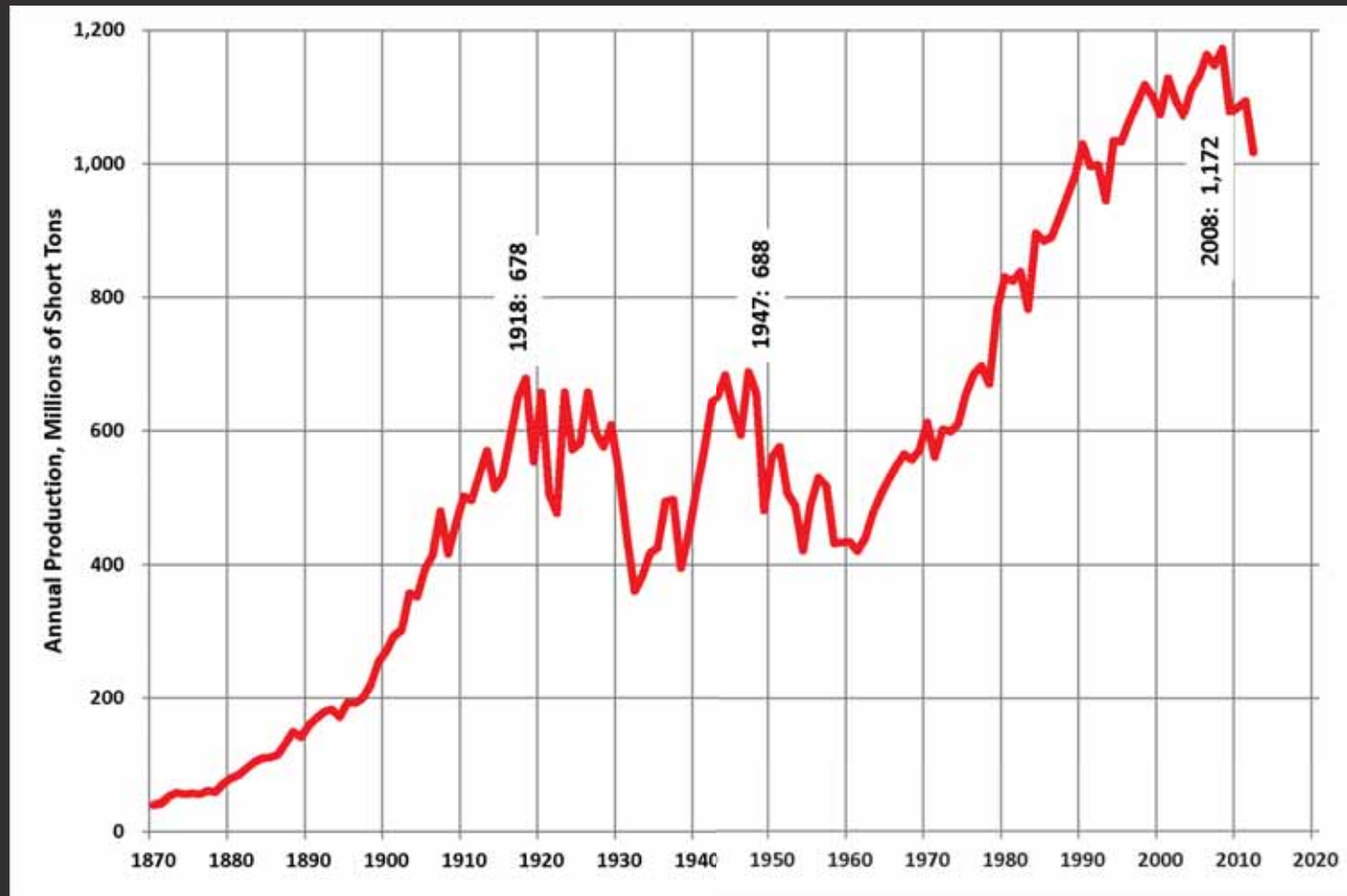


Smil 2010, eia.gov

United States Coal Reserves



History of Coal Mining in the United States

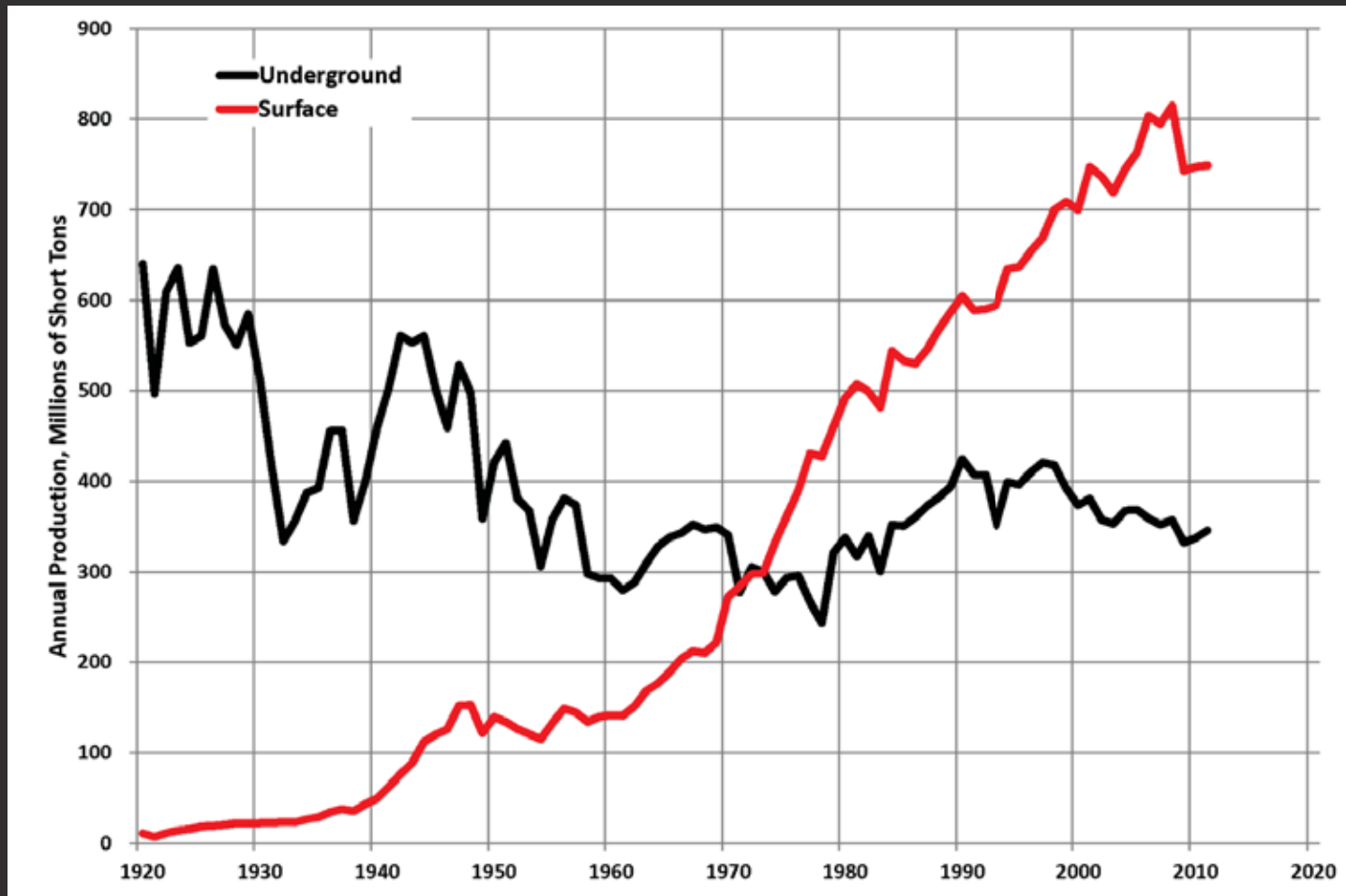


Subsurface Coal Mines



Andrew Lichtenstein

Mining Transition in the United States



Surface Coal Mines (Rangeland)



Unreclaimed Surface Mines



www.ndstudies.gov



www.dmr.nd.gov

1977 Surface Mining Control and Reclamation Act (SMCRA)

Federal/State Partnership

Standards of Performance

Soil and Vegetation (Crop, Hay, Native...)

Permitting – Bonding – Inspection/Enforcement

Protects landowners (Private, State, and Federal)

Abandoned Mine Land Fund (AML)



Coal Mine Reclamation Success



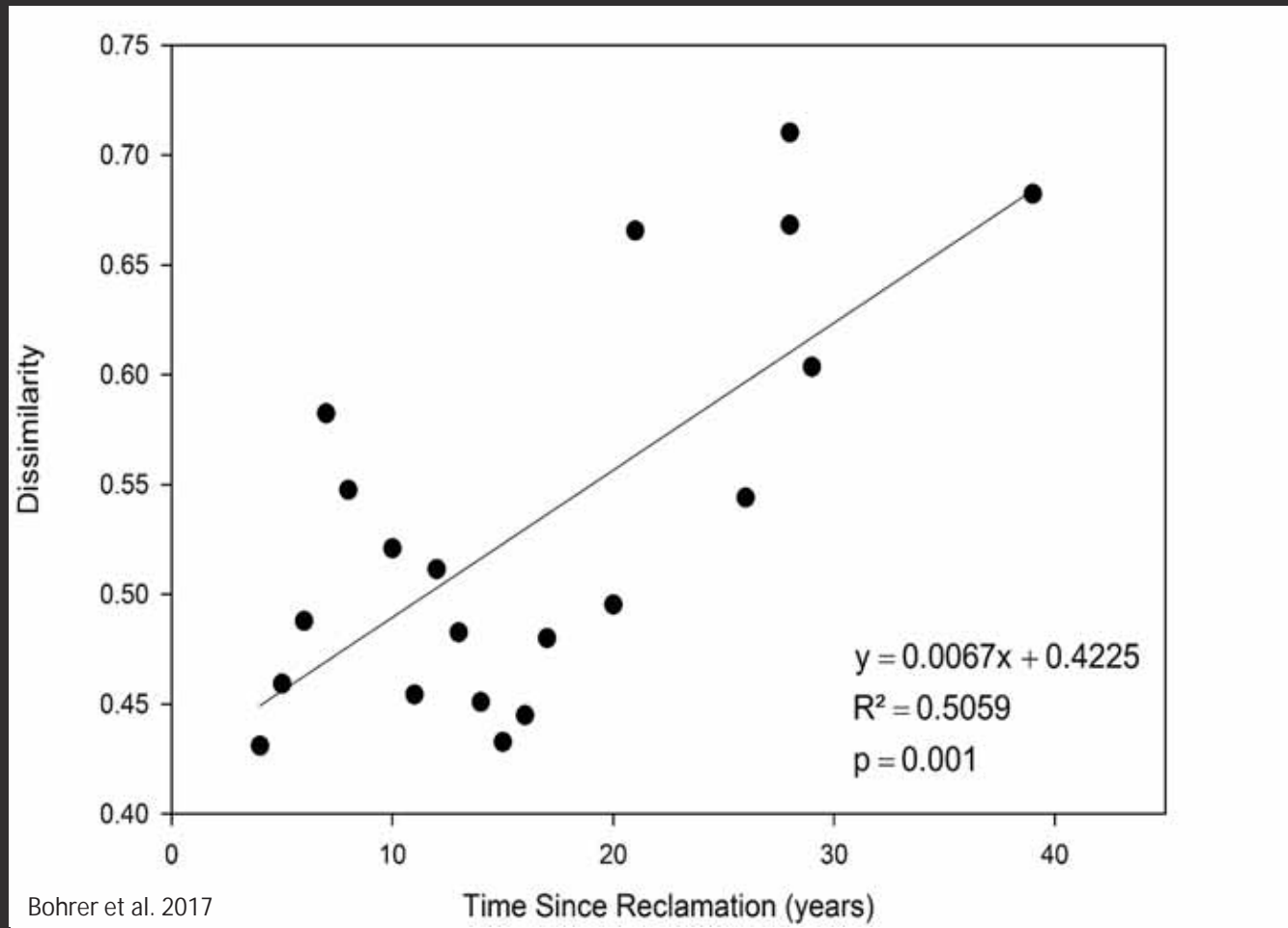
Native

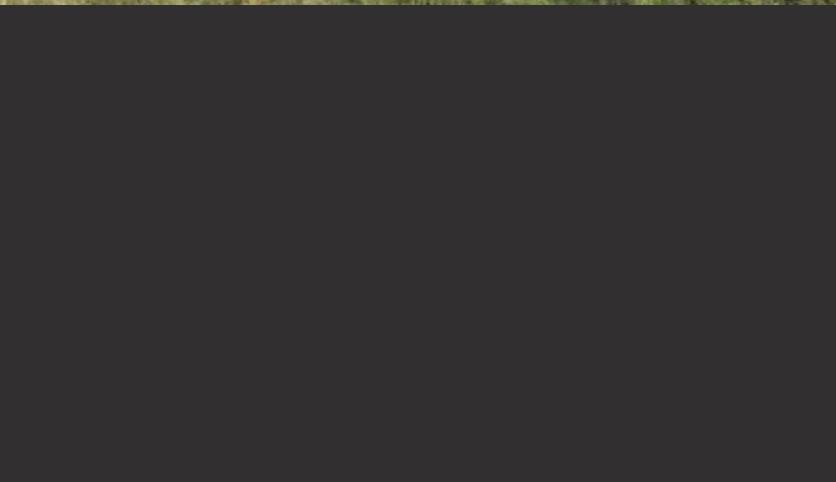


Hay



Surface Coal Reclamation Challenges

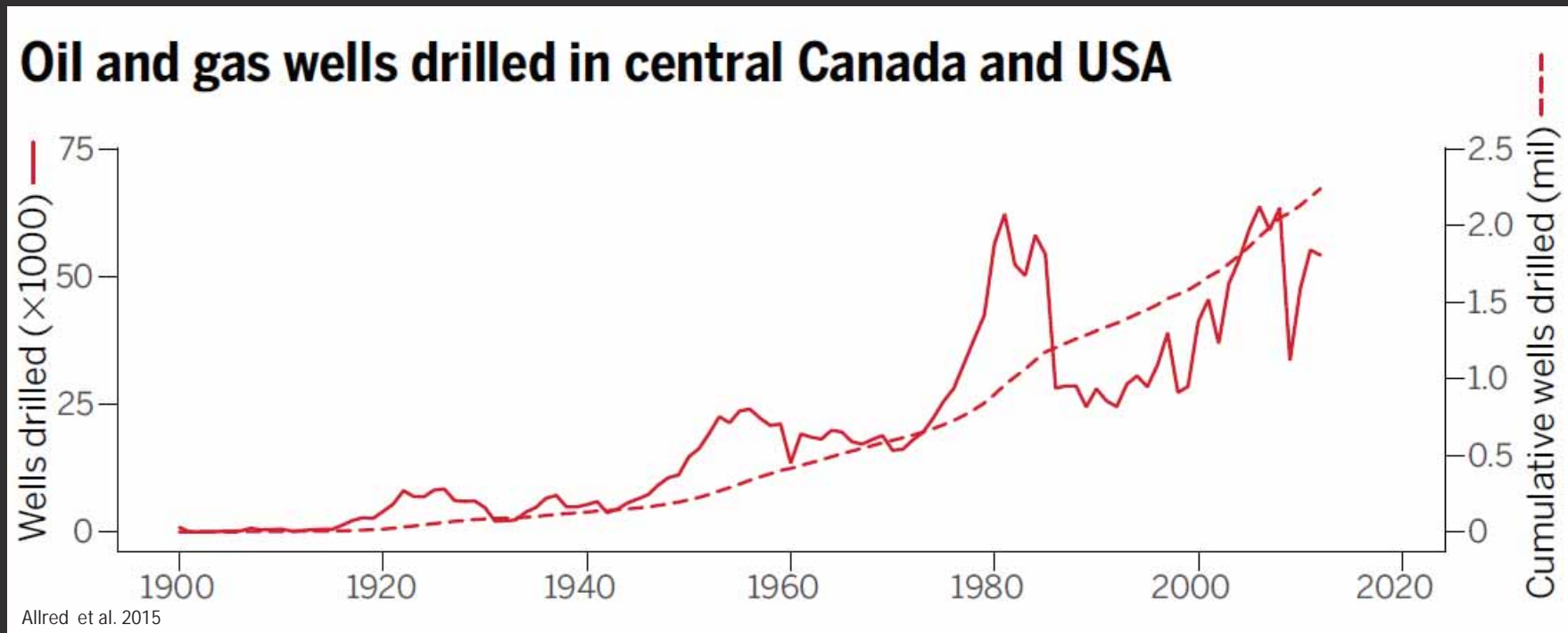




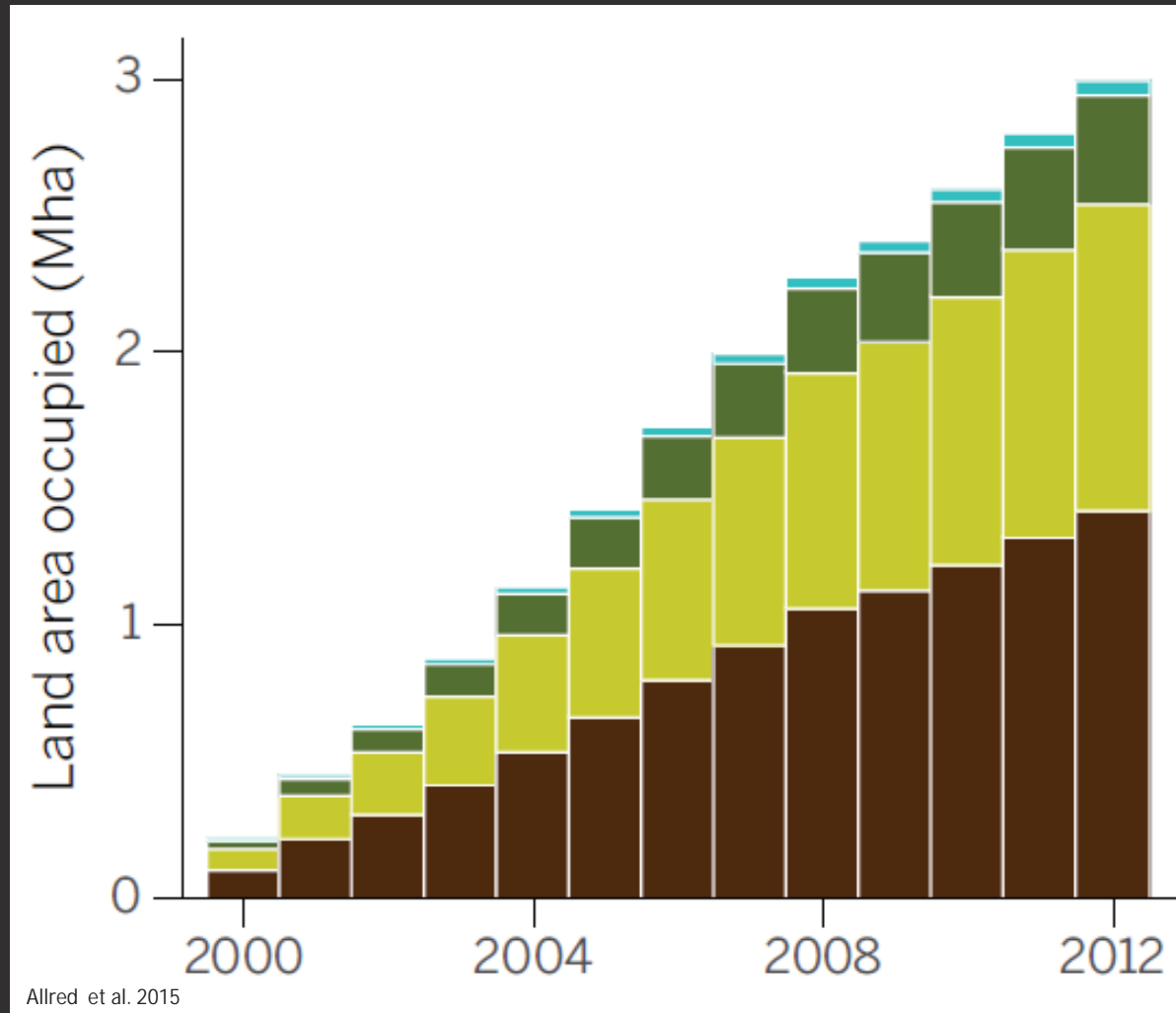
United States Petroleum Reserves



History of Petroleum Exploration in North America



History of Petroleum Exploration in North America





Unreclaimed Legacy Oil/Gas Sites



Reid Southwick, Calgary Herald



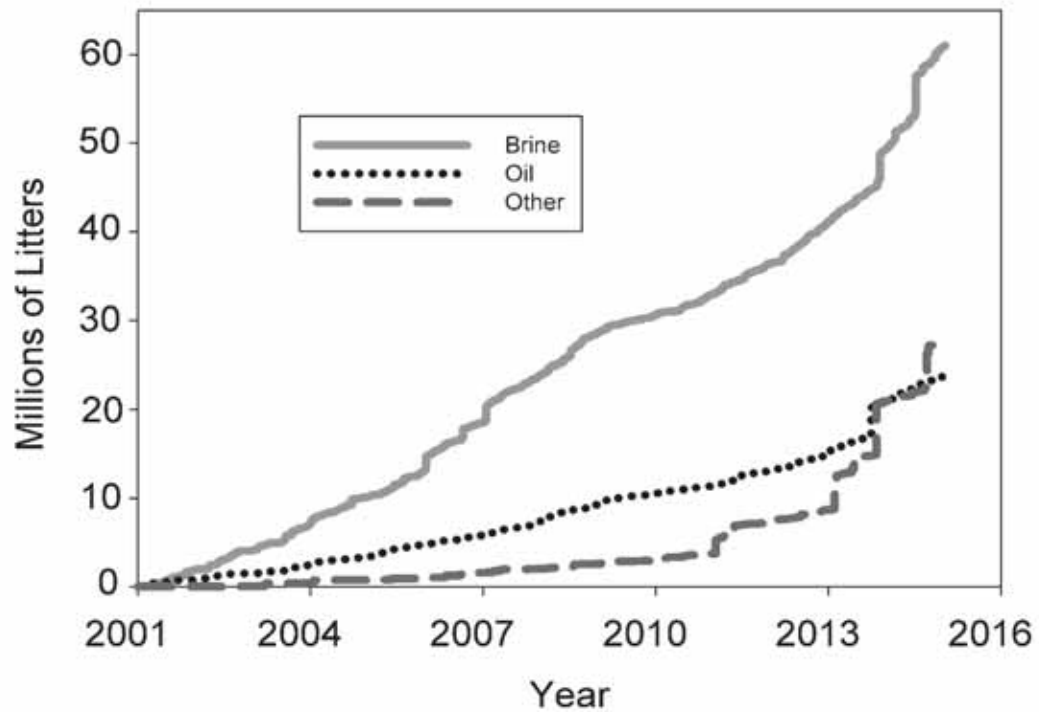
Spencer Johnson

New Oil/Gas Sites

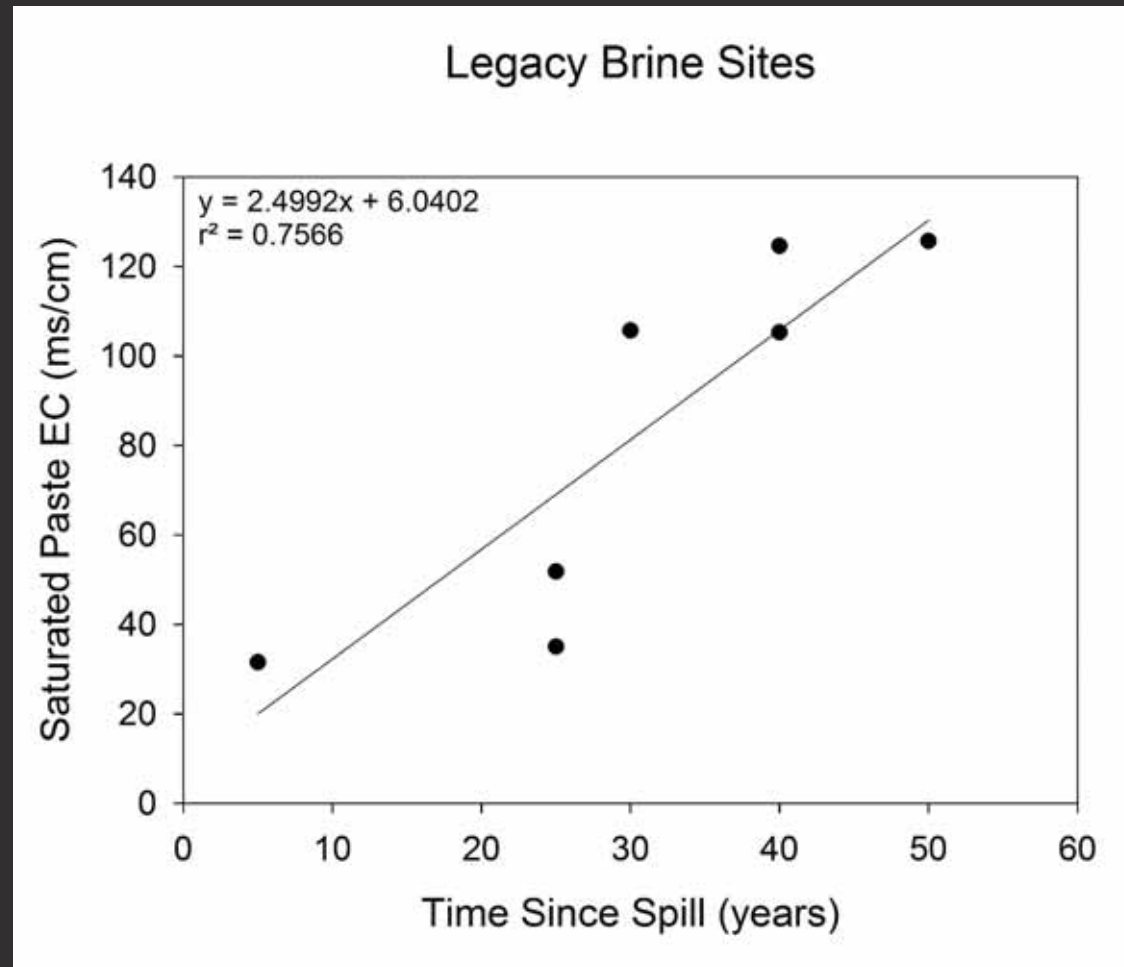


Bruce Oksol

Brine contamination



Do Nothing Approach



Treatment options on recent brine spills

In situ



Chemically amended (Ca^{2+}) and subsequent leaching

Ex situ



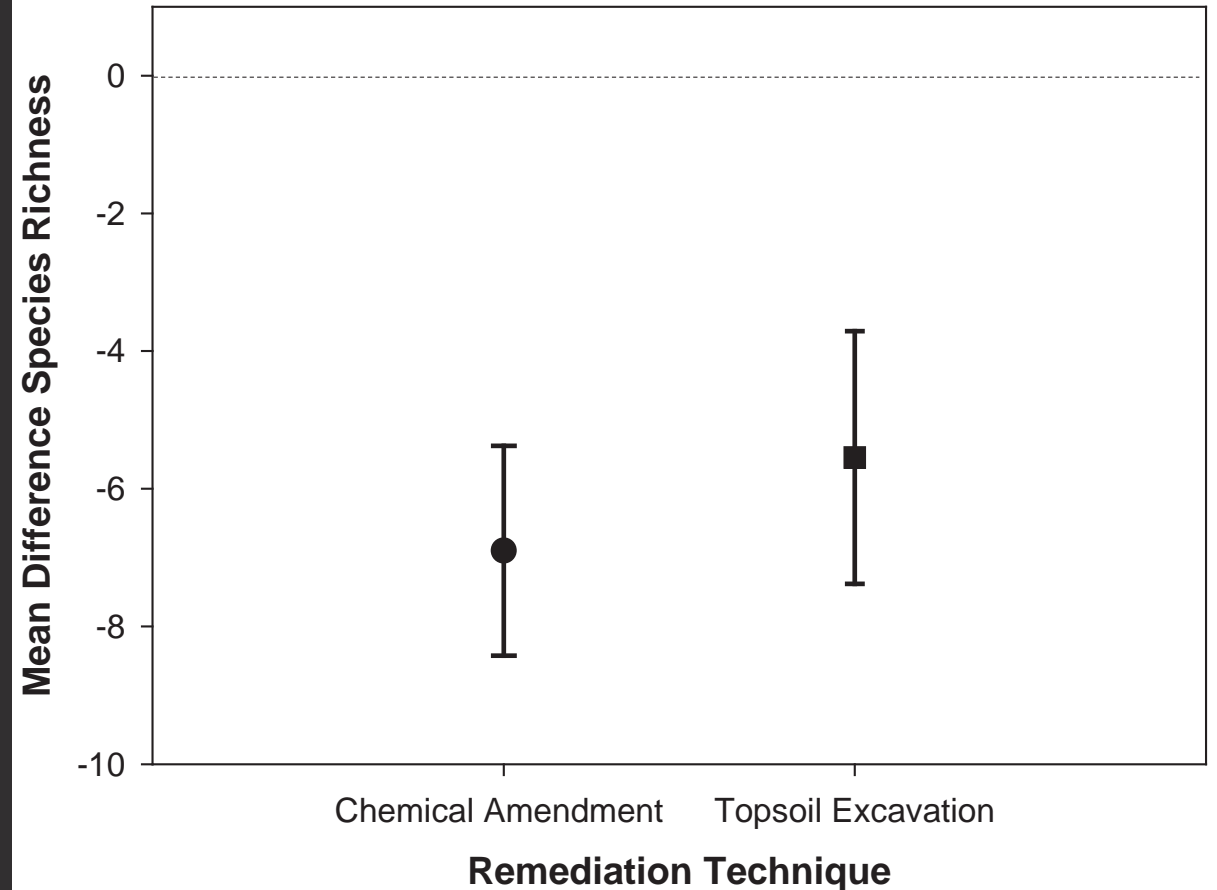
Topsoil excavation with soil replacement

Diversity Indices

Species Richness

REF \neq REM

REM_{chem} = REM_{top}

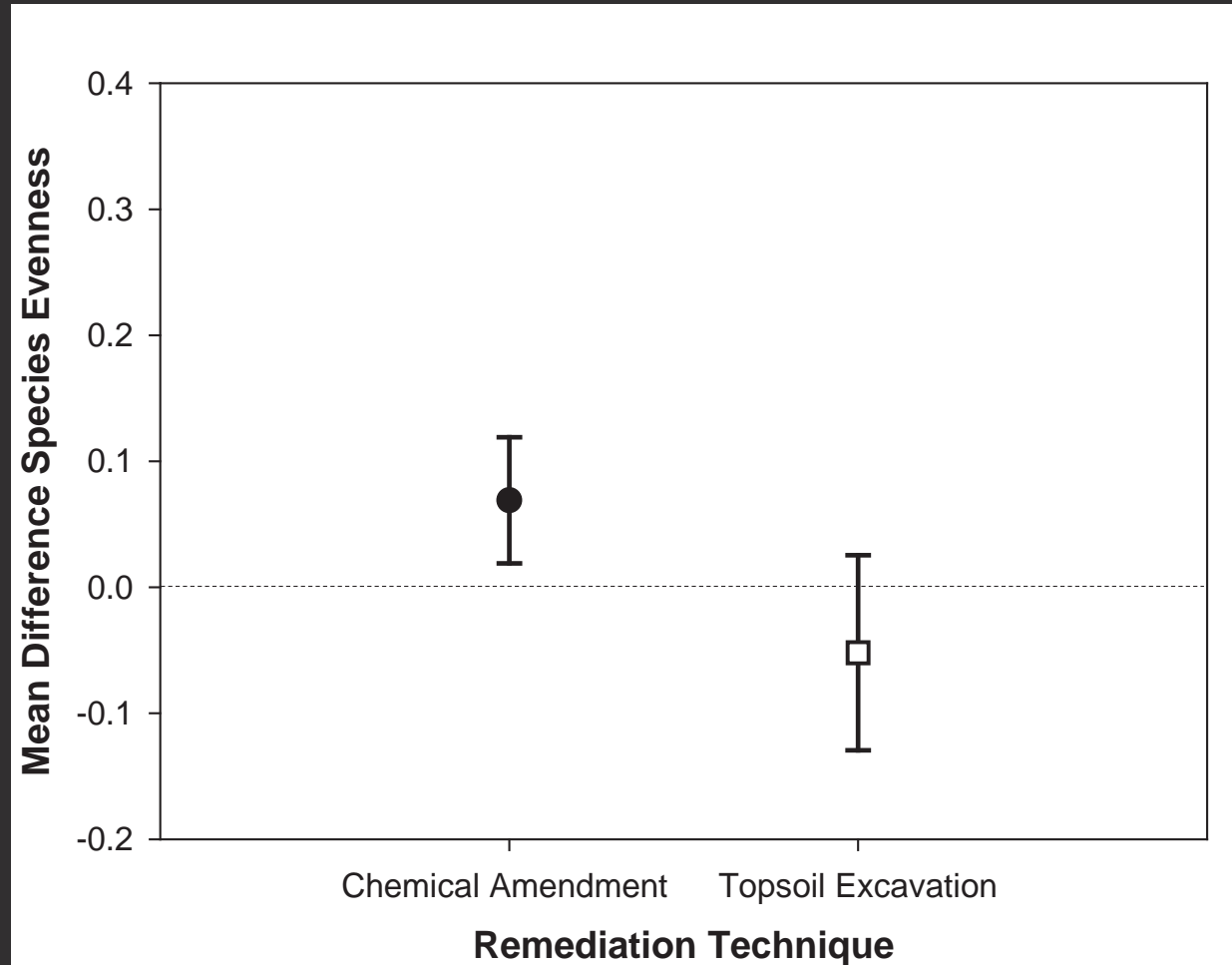


Diversity Indices

Species Evenness

$$\text{REF} = \text{REM}$$

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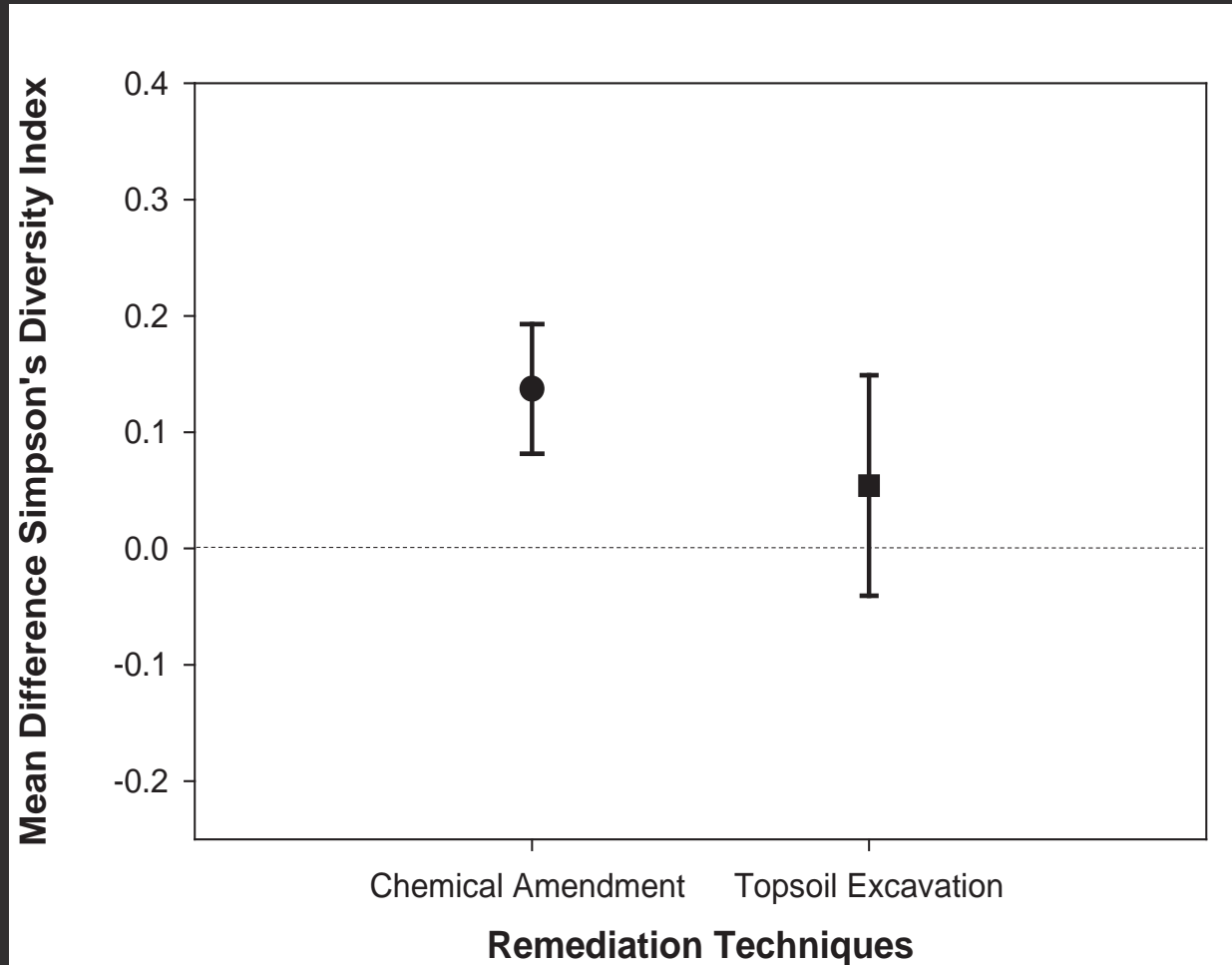


Diversity Indices

Simpson's Diversity

$$REF = REM$$

$$REM_{chem} = REM_{top}$$

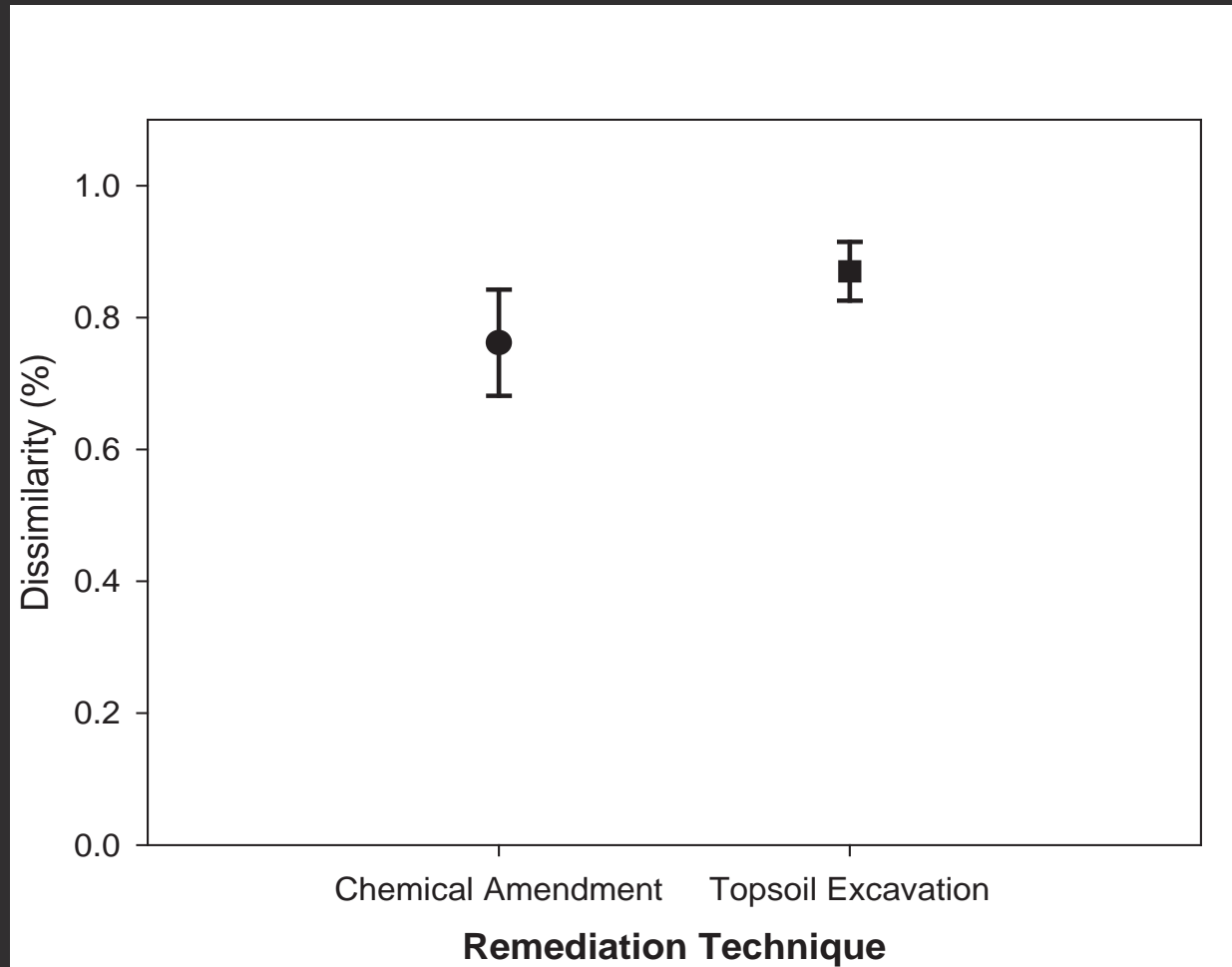


Species composition

The Sørensen
Dissimilarity Index

$REF \neq REM$

$REM_{chem} = REM_{top}$

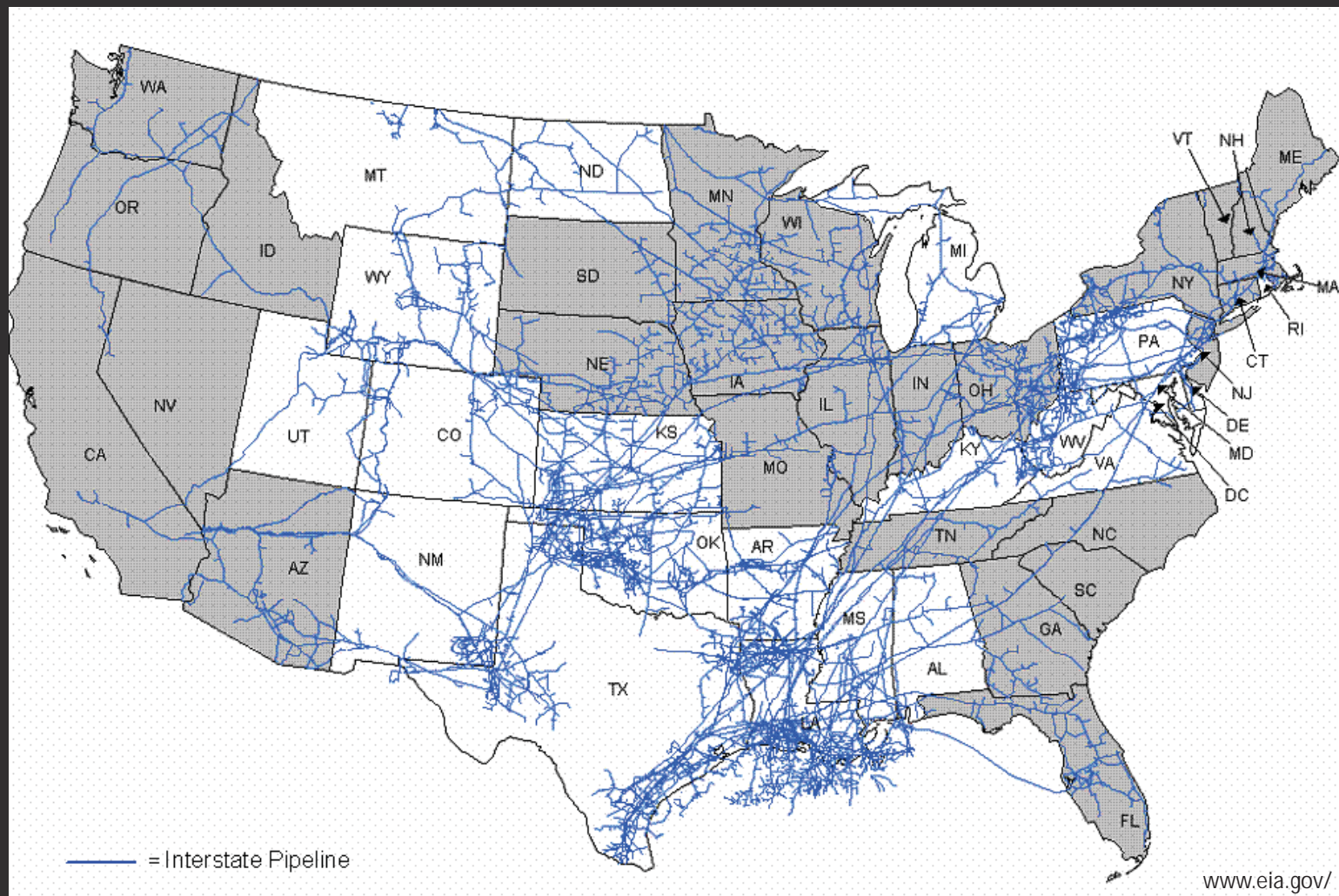


Failed Restoration Attempts

0% Native Species

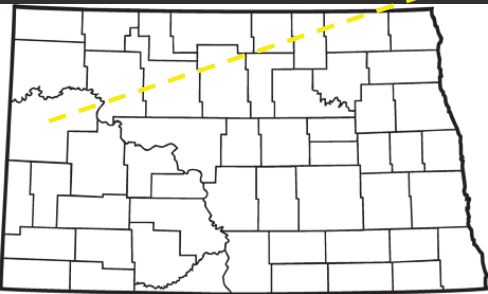
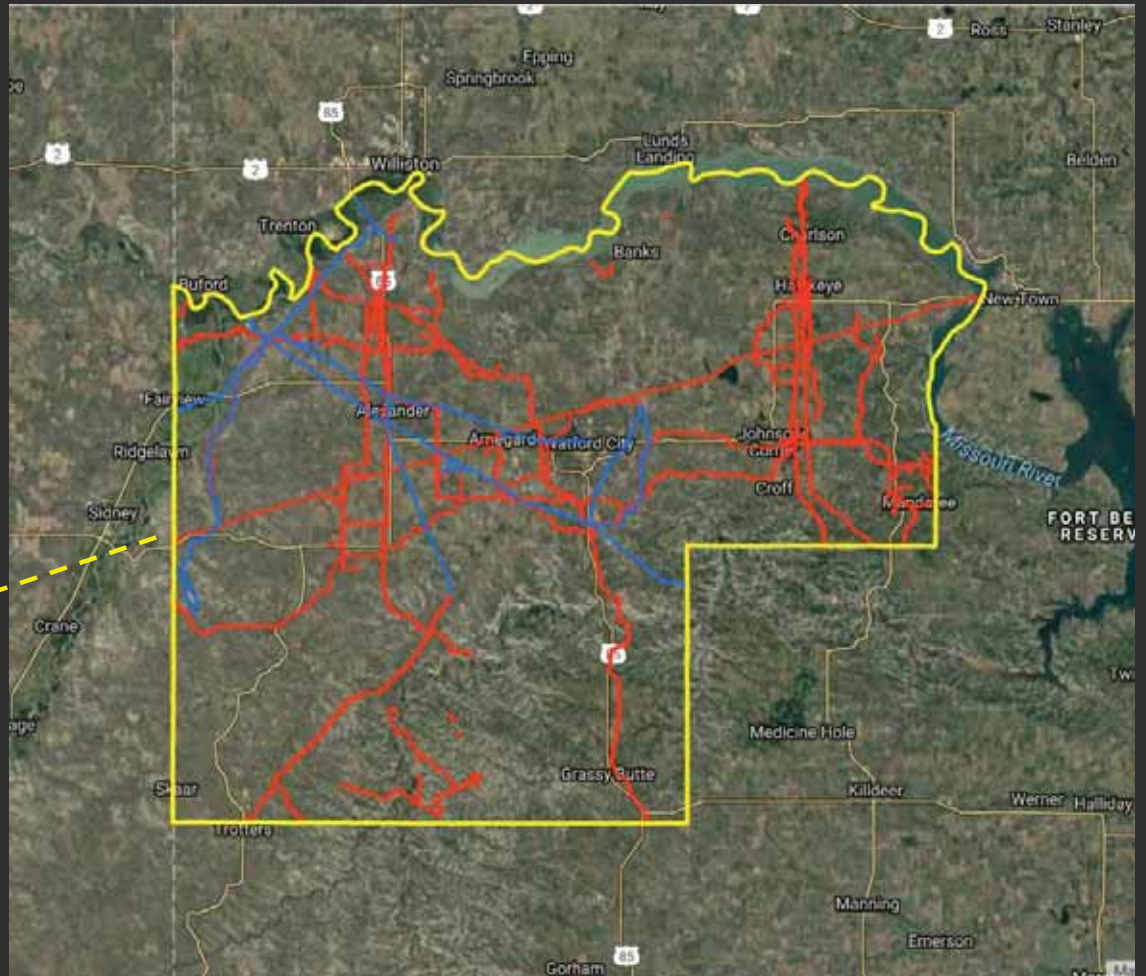


Major Petroleum Pipelines in United States



Petroleum Pipelines in North Dakota

7,000 mi pipelines
38,000+ ac



Failed Restoration Attempts



Well pad



Pipeline

Proposed Seed Mixes for Reclamation Projects

Access road ROW

Smooth Brome.....	22.5kg/ha
Western Wheatgrass.....	11.2 kg/ha
Tall Wheatgrass.....	11.2 kg/ha
Intermediate Wheatgrass..	5.6 kg/ha
Alfalfa.....	2.3 kg/ha
Yellow Sweet Clover.....	1.1 kg/ha

Pipeline

Rye Grass.....	4.5kg/ha
Kentucky Bluegrass...	6.7 kg/ha
Slender Wheatgrass..	6.7 kg/ha
Smooth Bromegrass..	6.7 kg/ha

2015 North Dakota Legislative Secession

Requirement for reclamation of sites (pads, pipelines, roads, etc.)

- Topsoil preservation, native species when possible
- Reclamation plan approval

Bond for all new projects

Energy Development and Reclamation in North Dakota

Opportunities for Improvement

Thank you

