Governing Unconventional Legacies

Lessons from the Coalbed Methane Boom in Wyoming

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Mitigating destructive legacies: Reclamation of natural gas production sites

Why timely and effective reclamation matter

Ecological restoration is beneficial for nature and society as projects increase the supply and quality of ecosystem services, improve hydrology, reduce soil erosion, encourage the presence of native species, and aid in carbon sequestration (Aronson et al. 2010)

Reclamation failures can result in a 50% cost increase over initiating proper reclamation techniques from project implementation (Chenoweth et al. 2010)

If proper reclamation is not conducted, the host state can be left to fund clean-up efforts using taxpayer dollars – The case of Wyoming's Powder River Basin Coalbed Methane

Existing legal frameworks

- The responsibility of state's to govern the natural gas industry has yielded vast differences in shale gas regulation from state-to-state

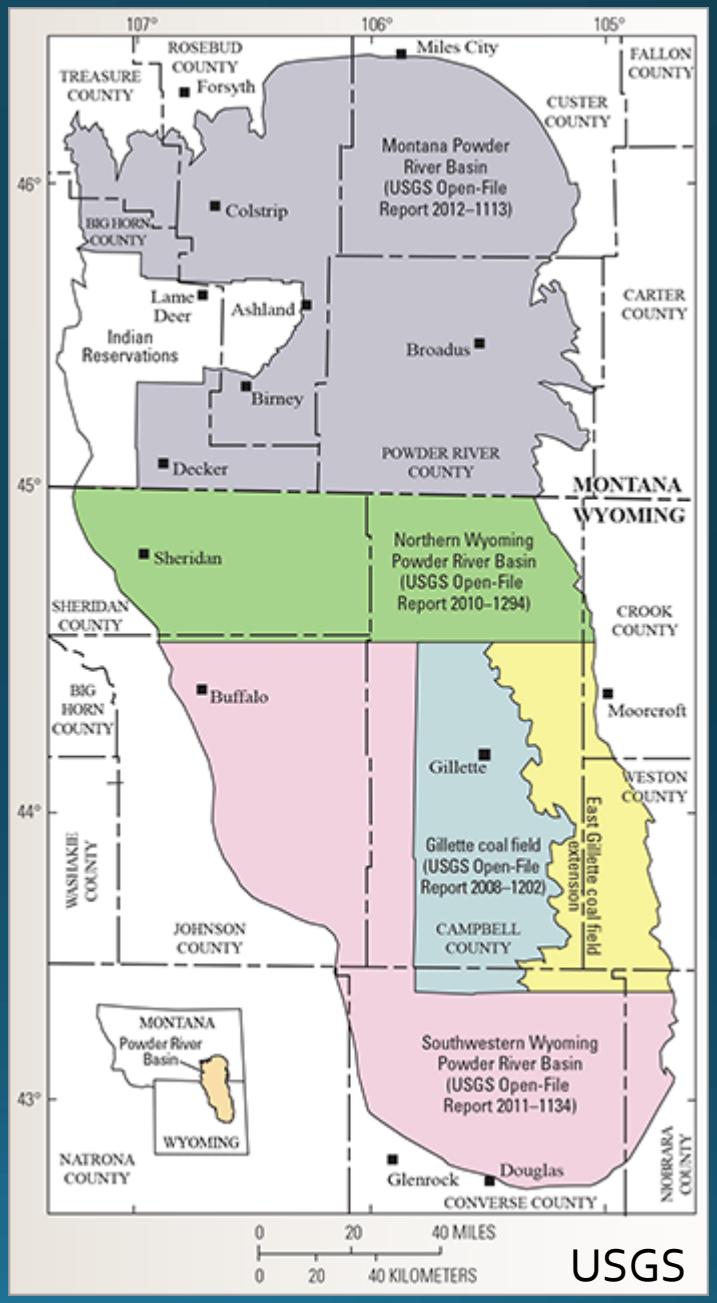
- "The federal government has largely and deliberately cut itself out of the regulatory picture in ways that are seemingly more conducive to the big business interests in the states and the states themselves" (Warner and Shapiro 2013, 475).

Stringency of Unconventional Oil and Gas Regulations by State (*Source*: Zirogiannis 2016)

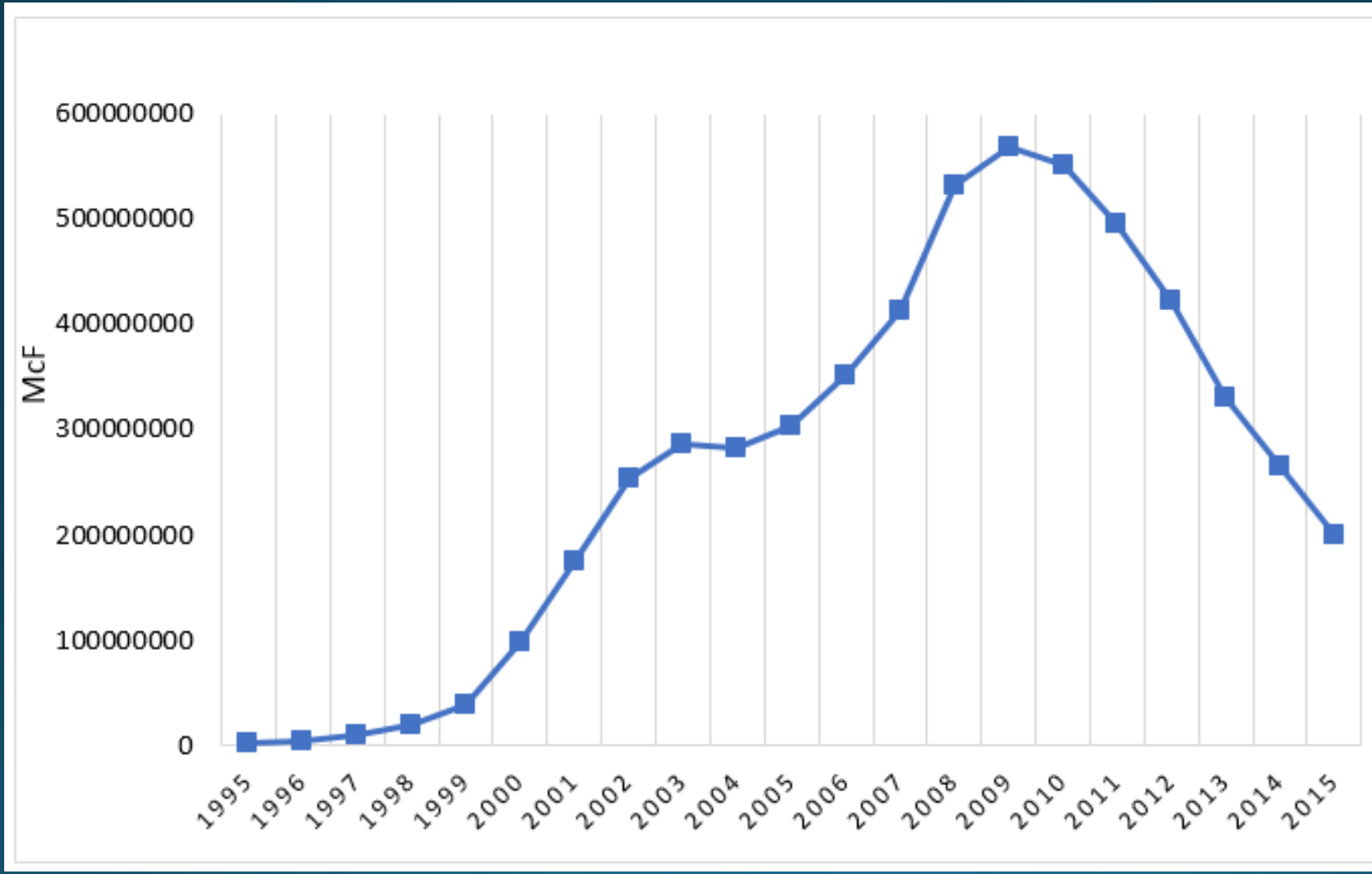
Most Stringent Regulatory Environment		
West Virginia	Colorado	Louisiana
New Mexico	Pennsylvania	New York
Somewhat Stringent Regulatory Environment		
Arkansas	Indiana	Kansas
Kentucky	Michigan	North Dakota
Ohio	Oklahoma	Texas
Utah	Virginia	Wyoming
Least Stringent Regulatory Environment		
California	Tennessee	Mississippi
Montana		

Case Study PRB CBM

- 20,000 square miles of semi-arid grassland used primarily for livestock
- 40% of U.S. coal production occurs on massive strip mines in the region
- Technological innovation around CBM recovery accelerated in the 1990s and led to a CBM boom between 1998-2008
- At least 16,000 CBM wells were drilled
- At least 4,000 orphaned wells remain



Wyoming CBM Production

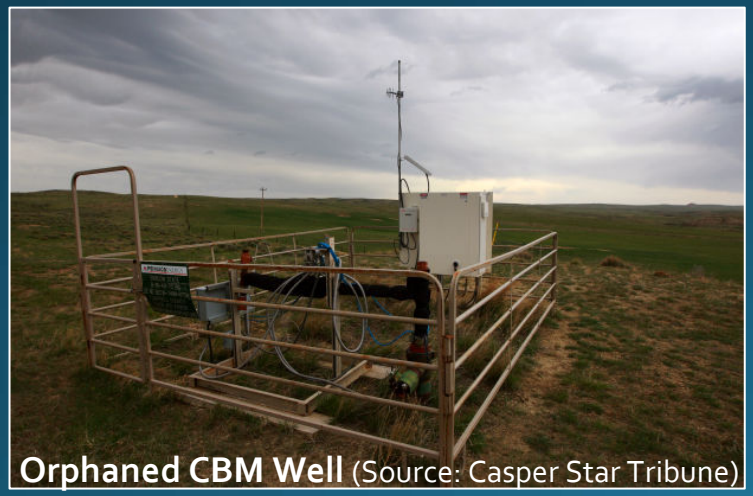


CBM Reclamation

CBM Water Reservoir, Sheridan County, WY

Development Characteristics

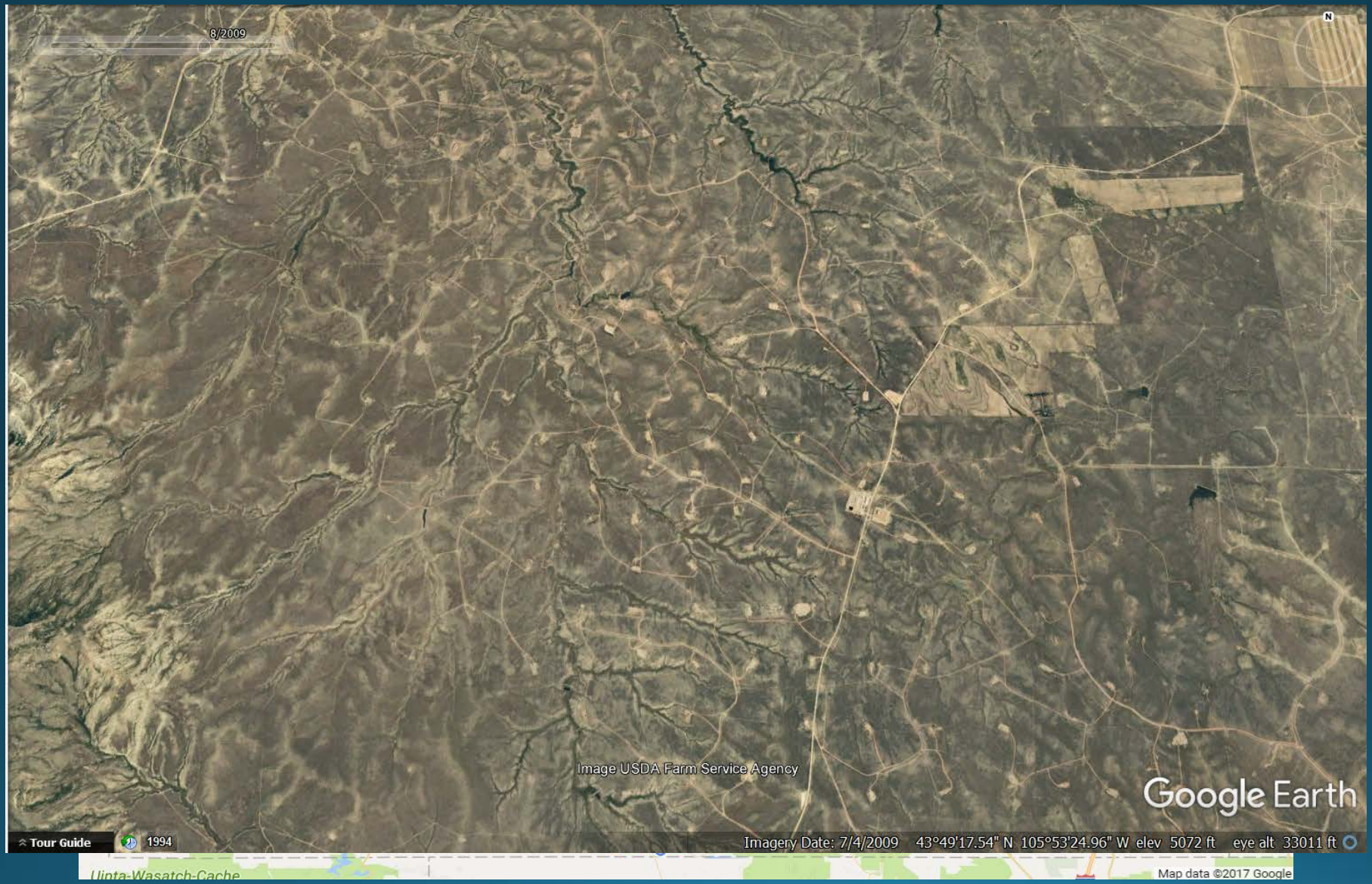
- Pace and scale of development - horizontal drilling
- Extensive water infrastructure is required
- Geographic footprint
- In grasslands, unassisted recovery is unlikely (Nasen et al. 2011)



Orphaned CBM Well (Source: Casper Star Tribune)

CBM Compressor Station, Sheridan County, WY

Campbell County, WY



Methods

Literature Review

Scientific studies that address the definition and measurement of success in reclamation

Policy Analysis

Of developing regulatory and governance issues in Wyoming

Federal reclamation policy of onshore oil and gas production sites

Interviews

19 semi-structured interviews with stakeholders in the Powder River Basin including:

- Landowners
- County Commissioners
- Agency Officials (WY DEQ)
- Oil and Gas attorney

Three key factors: Reclamation as a highly complex governance challenge

Absence of clear guidance from the scientific lit about what constitutes successful reclamation

Complexity of both the jurisdictional environment and oil and gas sector in the CBM space

Lack of political will in the state of WY to engage in pre-emptive environmental regulation

Reclamation Science: Natural Gas Production Sites

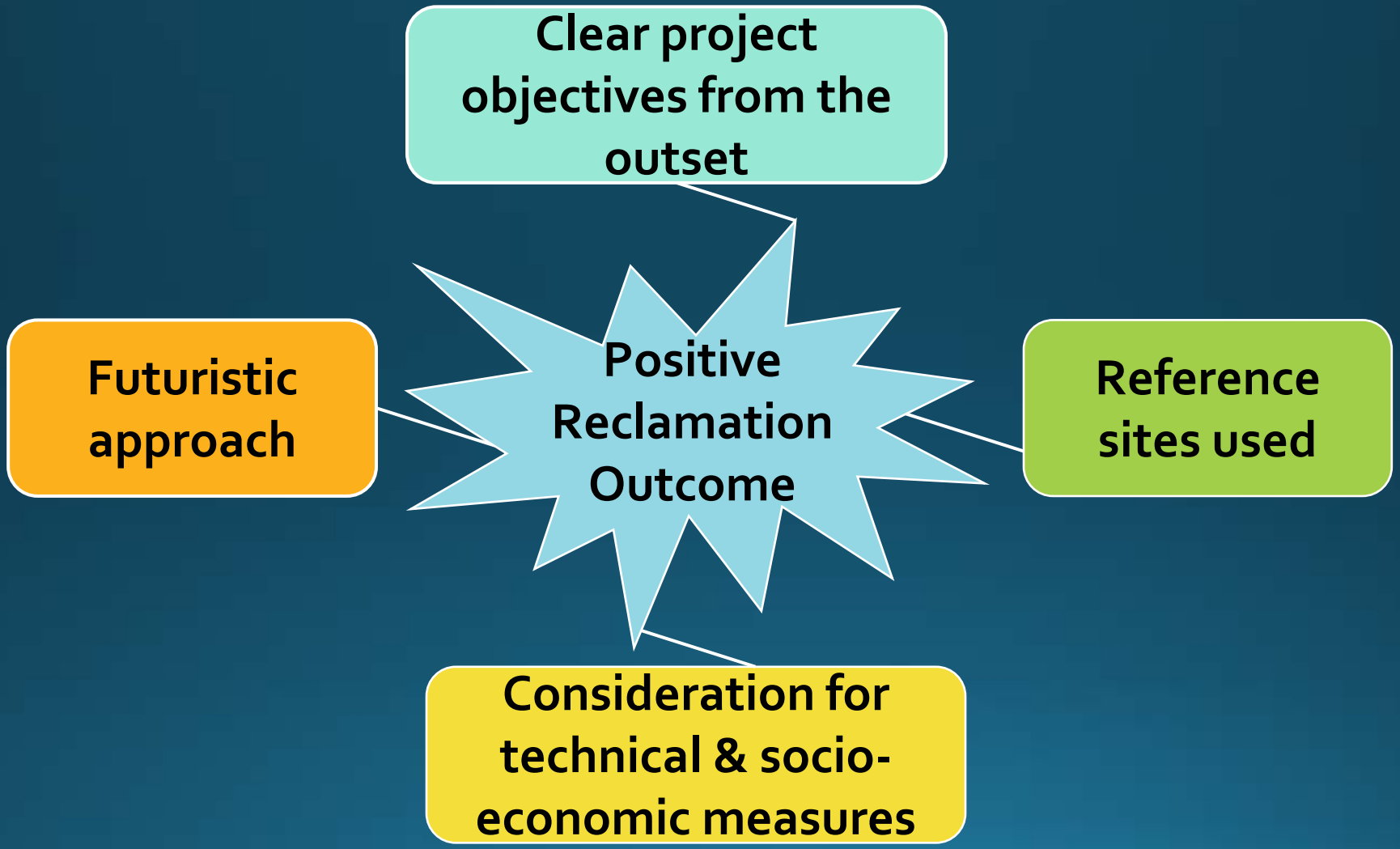
- The environmental science literature provides only a murky understanding of what constitutes a positive reclamation outcome
  - Common methods and standards to assess success have not been established

- Technical considerations dominate the majority of restoration science research to the neglect of complex social factors

- There has been a growing body of lit that links the work of restoration theory to the practice of reclamation practitioners in the field – but nothing similar to link with policymakers

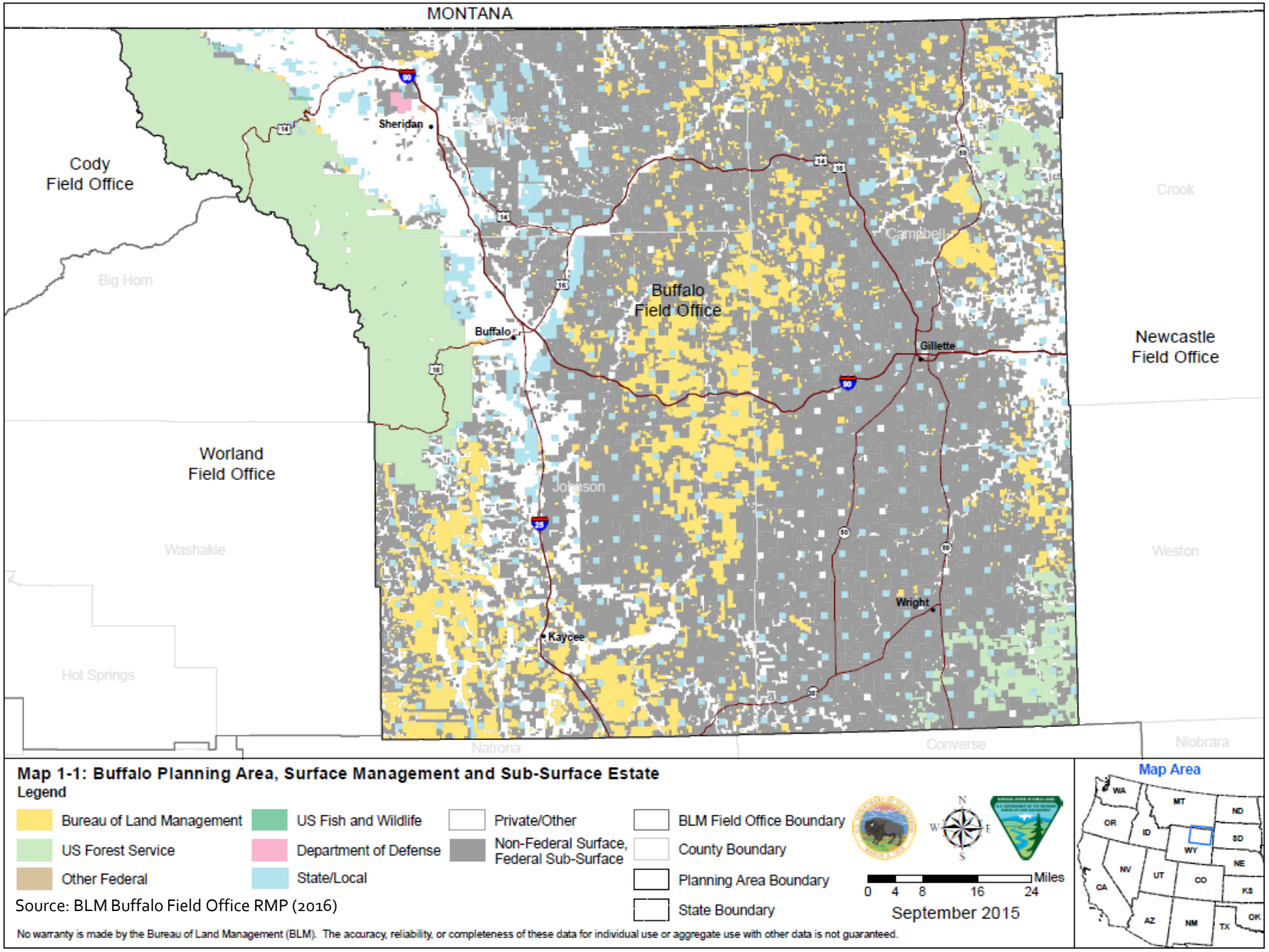
- Reclamation science not well communicated to decision-makers
  - Historic vs. futuristic paradigms of restoration

What the literature tells us: Ingredients for a positive reclamation outcome

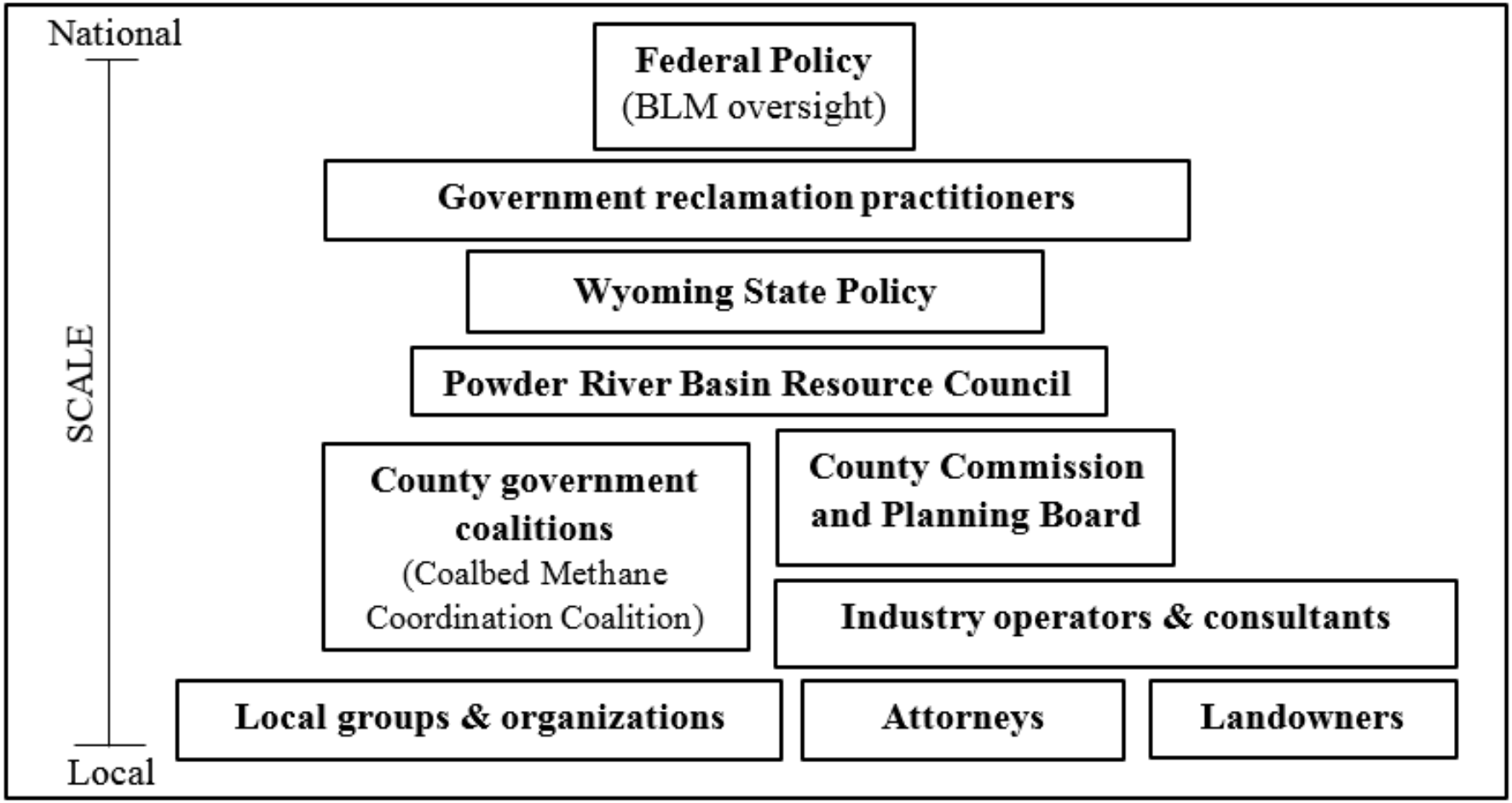


Complex jurisdictional environment

1. Complicated jurisdictional and ownership regimes of land and minerals in Wyoming
2. Multitude of stakeholders involved in development, production and reclamation phases of extraction
3. The organization and operational structure of industry companies doing the extracting


MONTANA
Cody
Field Office
Buffalo
Field Office
Worland
Field Office
Newcastle
Field Office
Sheridan
Buffalo
Gillette
Wright
Kaycee
Big Horn
Washakie
Hot Springs
Johnson
Campbell
Crook
Weston
Niobrara
Converse
Natrona
Map 1-1: Buffalo Planning Area, Surface Management and Sub-Surface Estate
Legend
Bureau of Land Management
US Forest Service
Other Federal
US Fish and Wildlife
Department of Defense
State/Local
Private/Other
Non-Federal Surface, Federal Sub-Surface
BLM Field Office Boundary
County Boundary
Planning Area Boundary
State Boundary
Miles
0 4 8 16 24
September 2015
Source: BLM Buffalo Field Office RMP (2016)
No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.
Map Area

Actors contributing to reclamation outcomes in the PRB, Wyoming



Jurisdictional Complexity

- Unevenness in reclamation success evaluation among the 10 BLM regional field offices in Wyoming
- At least … o states operate… gh turnover
  - Each …

Wyoming's political environment

- Wyoming is one of the last U.S. states that remains significantly dependent on natural resource development relative to the U.S. economy. In 2016:
  - Cut funds to school districts by $36 million
  - Cut funds to Univ. of WY by $34 million
  - Cut funds to Dept. of Corrections by $18 million

- Although the state of Wyoming was first, ahead of federal regulators, to create fracking regulations, this was only done to, "preempt federal regulators on fracking to maintain state control over this policy area (Cook 2014, 107)

Conclusions

- The same three challenges: scientific, jurisdictional, and political, exist in the context of shale gas regulation
- Evaluative criteria should be equivalent as consistency among different levels of government could enable easier adherence and better promote successful restoration
- Literature provides recommendations for how the regulatory environment can improve to better facilitate reclamation:
  - Maximum Allowable Disturbed Acreage
  - Interim reclamation (Igarashi et al. 2014)

Acknowledgements & References

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(1) Aronson et al. 2010. Are Socioeconomic Benefits of Restoration Adequately Quantified? A Meta-analysis of Recent Papers (2000-2008) in Restoration Ecology and 12 Other Scientific Journals. *Restoration Ecology, 18*(2), 143-154; (2) Casper Star Tribune. http://trib.com/business/energy/wyoming-effort-to-plug-orphaned-coal-bed-methane-wells-ahead/article_623c8412-7aed-5d22-a950-c28636194fe3.html (last accessed 16 March 2017); (3) Chenoweth et al. 2010. *Economic Benefits of Completing Reclamation Successfully for the First Time for Oil and Gas Sites.* Paper presented at the 41st International Erosion Control Association, Dallas, TX; (4) Igarashi et al. 2014. *Economics of oil and gas development in the presence of reclamation and bonding requirements*. Paper presented at the 2014 Annual Meeting of the Agricultural & Applied Economics Association, Minneapolis, MN; (5) Nasen et al. 2011. Environmental effects of oil and gas lease sites in a grassland ecosystem. *Journal of Environmental Management*, 92, 195-204; (6) Rabe, B. G. 2014. Shale play politics: The intergovernmental odyssey of American shale governance. *Environmental Science and Technology*, 48, 8369-8375; (7) United States Geological Survey. 2015. *Powder River Basin, Wyoming and Montana*. http://energy.usgs.gov/RegionalStudies/PowderRiverBasin.aspx#3832131-overview (last accessed 16 March 2017); (8) Warner, B. & Shapiro, J. 2013. Fractured, fragmented federalism: A study in fracking regulatory policy. *Publius: A Journal of Federalism, 43*(3), 474-496; (9) Zirogiannis et al. 2016. State regulation of unconventional gas development in the U.S.: Am empirical evaluation. *Energy Research and Social Science*, 11, 142-154.

Any questions?

Reclamation Bonding

The backbone of federal and state reclamation policy is environmental assurance bonding

Federal Bond Requirements for Onshore Oil and Gas Production Sites

Bond Type	Bond Amount
Individual lease bond	$10,000
Statewide (blanket) bond	$25,000
Nationwide (blanket) bond	$150,000

State of Wyoming Environmental Bonding System, effective February 1, 2016

Bond Type	Bond Amount
Individual well	$10 per foot of depth
Multiple wells (blanket bond)	$100,000

Map showing mineral ownership and well density in central Campbell County, 2004 (USGS 2004)

Producing wells – 198
Nonproducing wells – 265
TOTAL - 463