



pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Oil and Gas Management



DEP Legacy Well Emissions Study

May 17, 2016

Climate Change Advisory Committee Meeting
Presentation

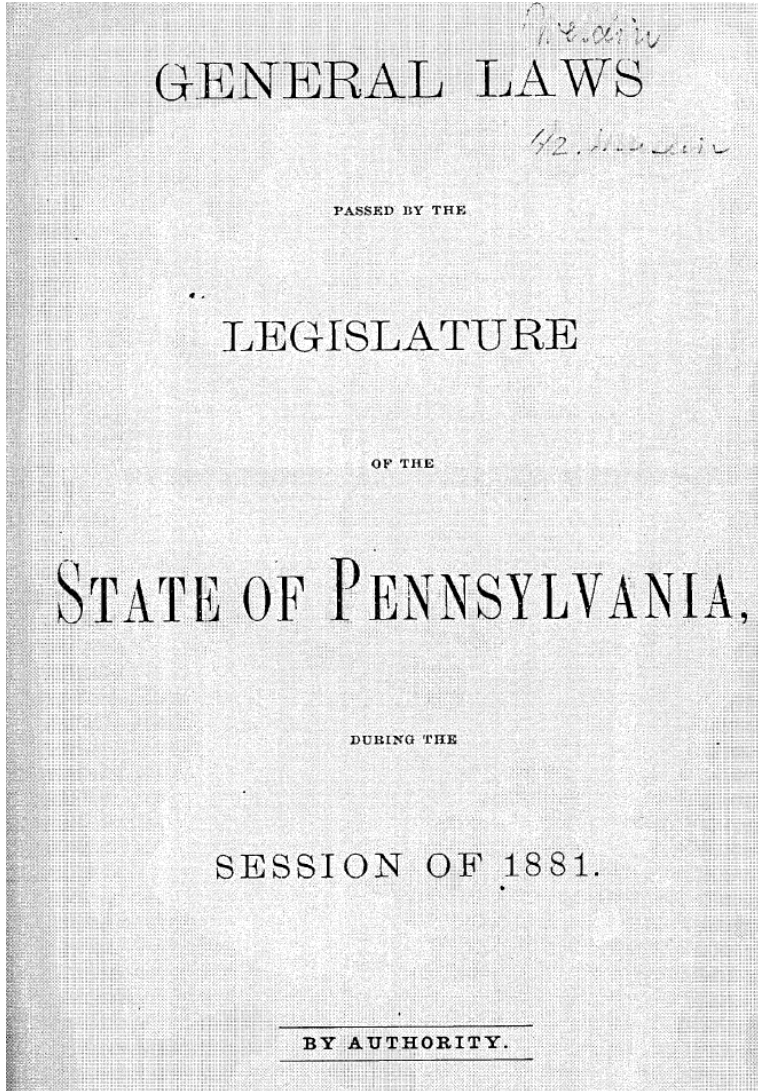
Presentation Outline

- Regulatory History of Well Plugging
- Purpose of Study
- Study Methods
- Preliminary Results

Regulatory History of Well Plugging

- **1859** – First well drilled, “Drake well”, Titusville, PA
- **1878** – Wells first required to be plugged with wood and sediment
- **1881** – Plugging requirements updated: Fill well with sand or rock sediment and wooden plugs above third producing sand
- **1921** – Plugging requirements updated
 - Fill with sand or rock sediment and each producing strata plugged with wood plug
 - Requires venting of wells through coal layers
- **1952** – API standards for cement and well plugging published
- **1956** – Well permitting begins; modern plugging requirements
- **1984** – Modern environmentally-minded plugging requirements
- **1989** – First well plugged in DEP plugging program

▶ Regulatory History of Well Plugging



No. 101.
AN ACT
Regulating the mode of plugging abandoned oil wells, and providing a penalty for the violation thereof.

SECTION 1. *Be it enacted, &c.*, That whenever any well shall have been put down for the purpose of exploring for and producing oil, upon abandoning or ceasing to operate the same, the owner or operator shall, for the purpose of excluding all fresh water from the oil-bearing rock and before drawing the casing, fill up the well with sand or rock sediment to the depth of at least twenty feet above the third sand or oil-bearing rock, and drive a round, seasoned, wooden plug at least two feet in length, equal in diameter to the diameter of the well below the casing, to a point at least five feet below the bottom of the casing, and, immediately after the drawing of the casing, shall drive a round wooden plug into the well at the point just below where the lower end of the casing shall have rested, which plug shall be at least three feet in length, tapering in form and to be of the same diameter at the distance of eighteen inches from the smaller end as the diameter of the well below the point at which it is to be driven; after it has been properly driven shall fill in on top of same with sand or rock sediment to the depth of at least five feet.

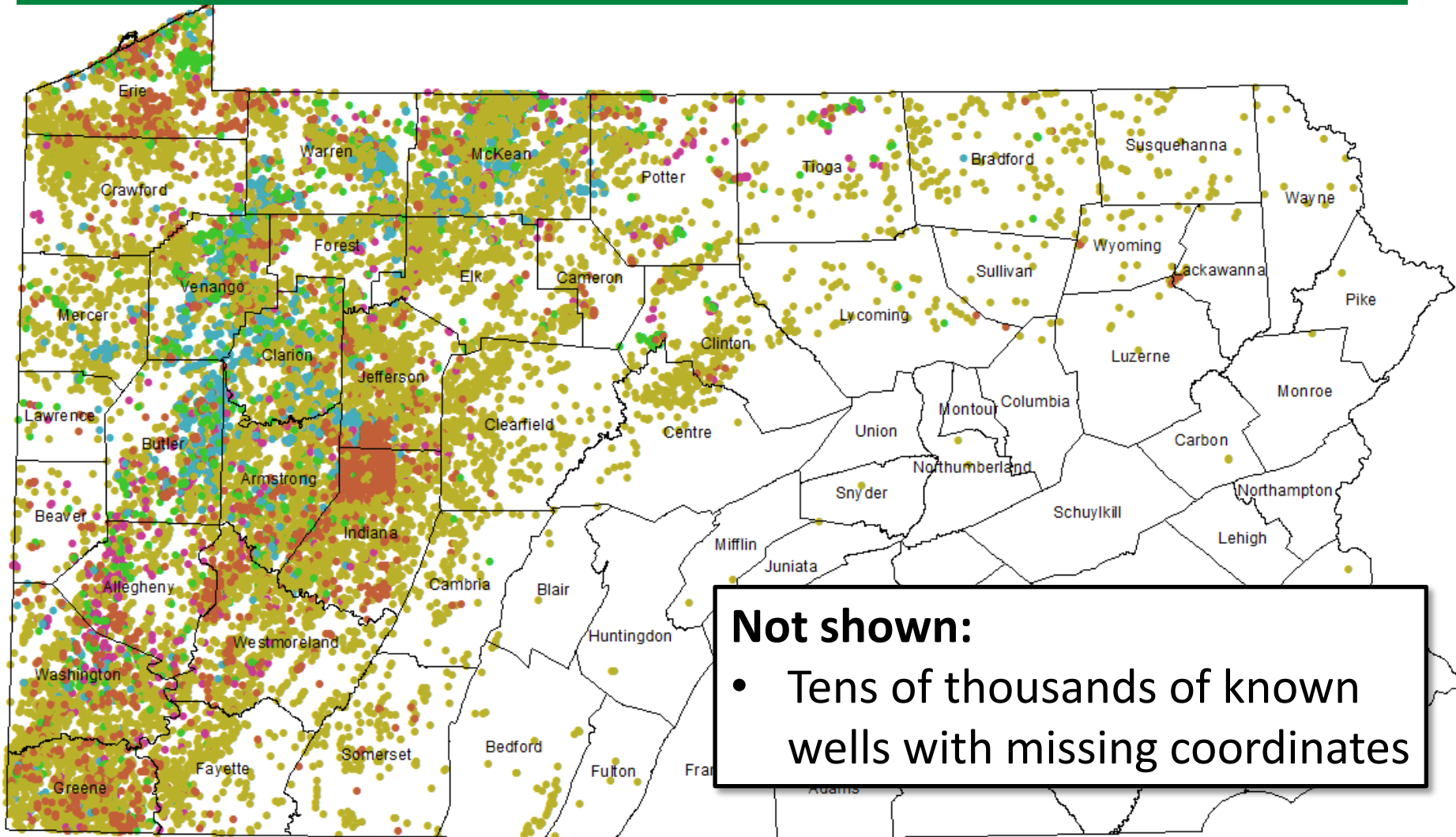
Abandoned oil wells to be plugged.



▶ Regulatory History of Well Plugging



Legacy Oil and Gas Wells



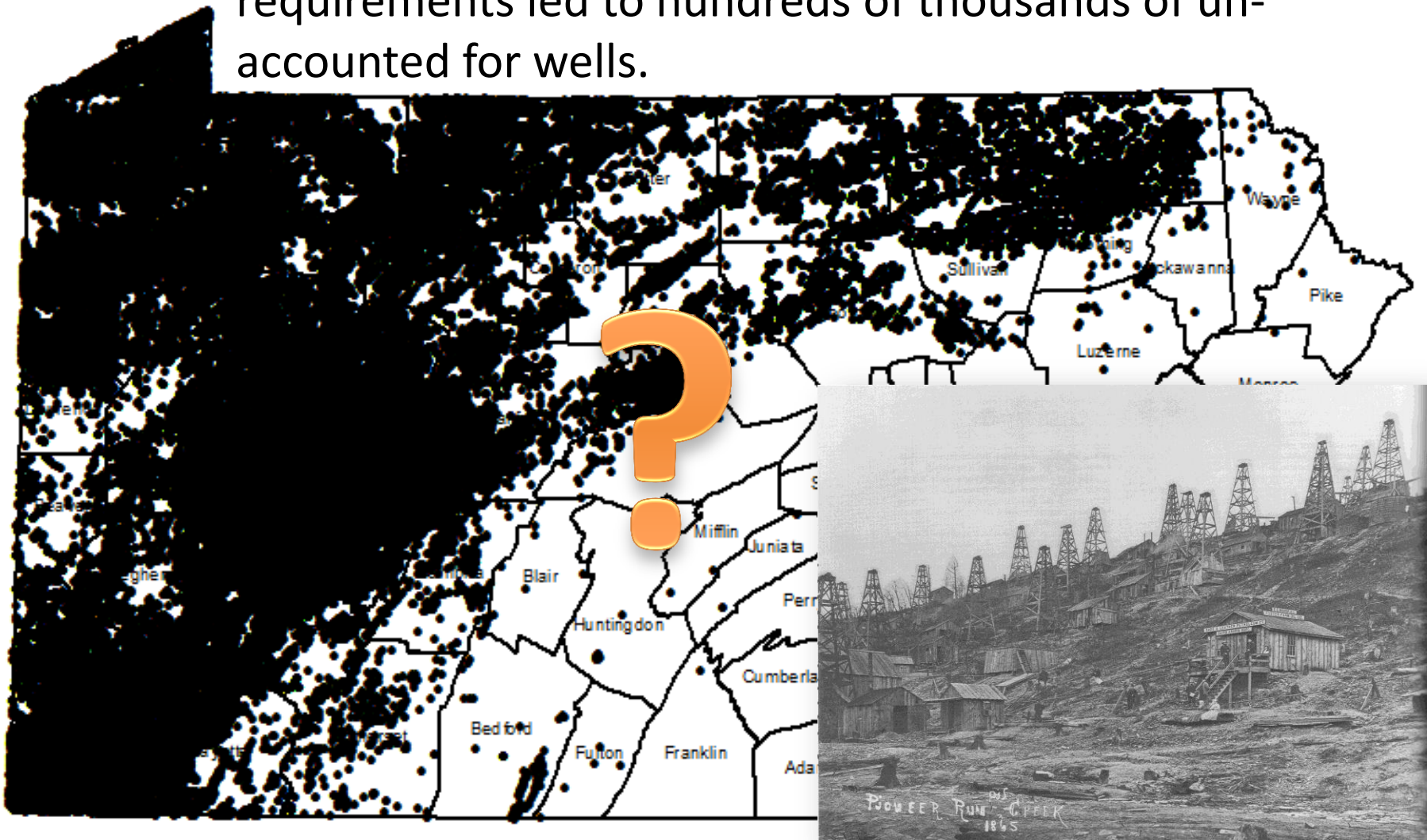
Not shown:

- Tens of thousands of known wells with missing coordinates

- Abandoned (2,451)
- DEP Orphan List (5,946)
- Plugged OG Well (23,760)
- DEP Abandoned List (2,291)
- DEP Plugged (3,274)

▶ Legacy Oil and Gas Wells

A century of development prior to permitting requirements led to hundreds of thousands of unaccounted for wells.



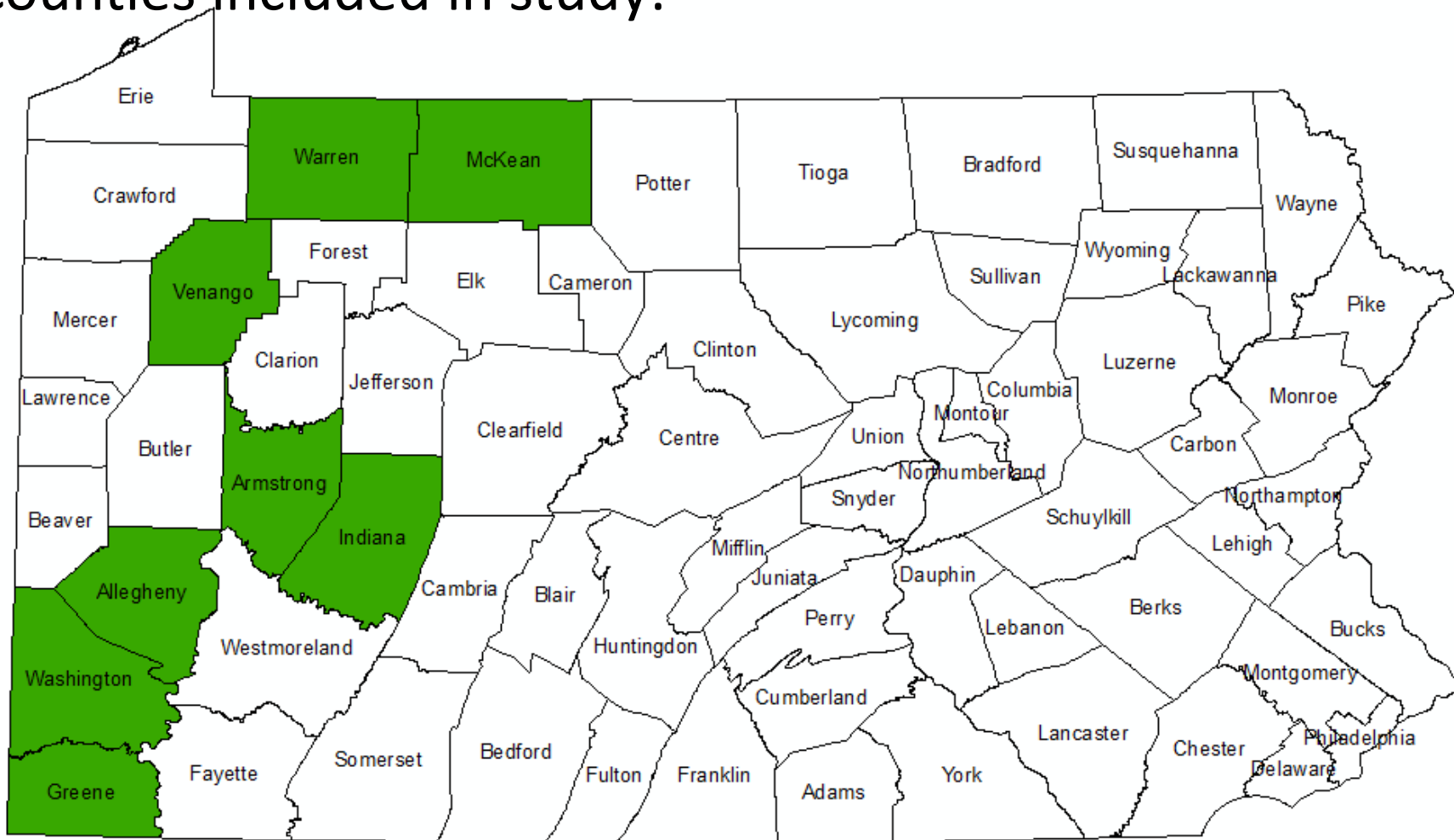
Study: Purpose

Inspect *representative* sample of abandoned, orphan, and plugged wells, and assess well integrity in order to:

- Provide insight into environmental hazards associated with legacy wells (greenhouse gas emissions, impacts to surface and groundwater by discharge of brine/oil/gas)
- Quantify agency plugging liability
- Inform future regulatory changes
- Help us understand database accuracy issues

Study Methods

Counties included in study:



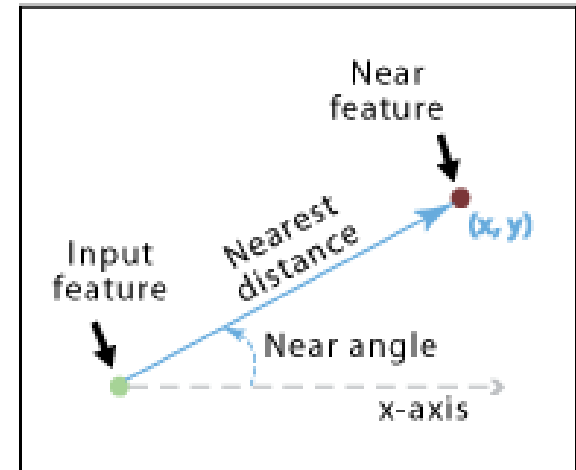
Study Methods

- Wells located on public lands are proposed in Northwest District for ease of access
- Wells located on both public and private lands are proposed in the Southwest District to increase population size
- Well types considered in study:
 - Oil, gas, combination, undetermined

Study Methods

Data cleanup:

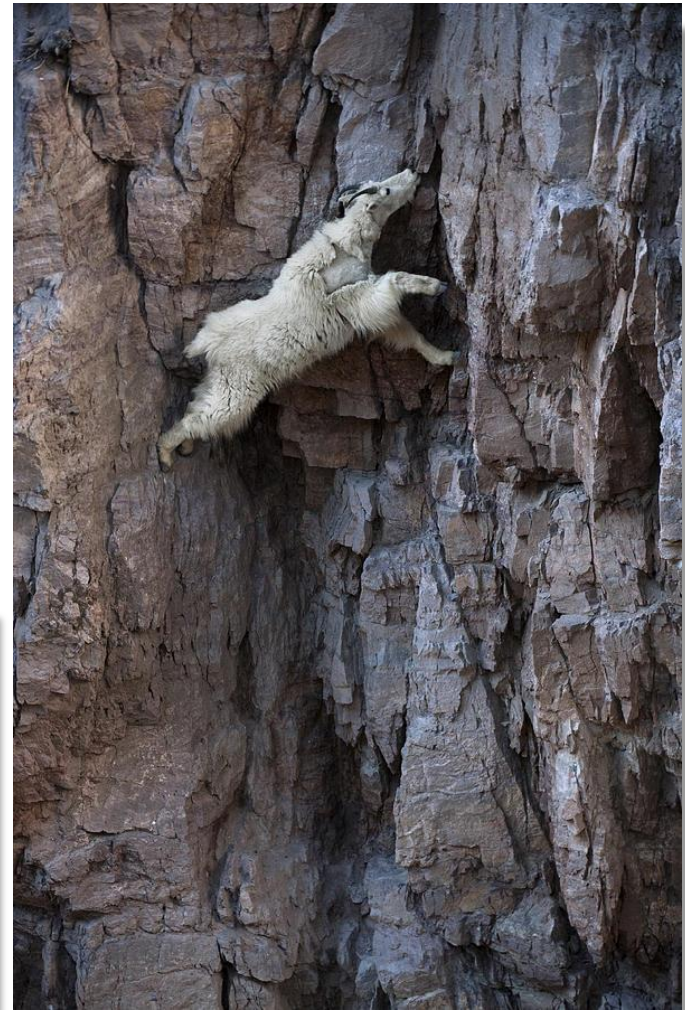
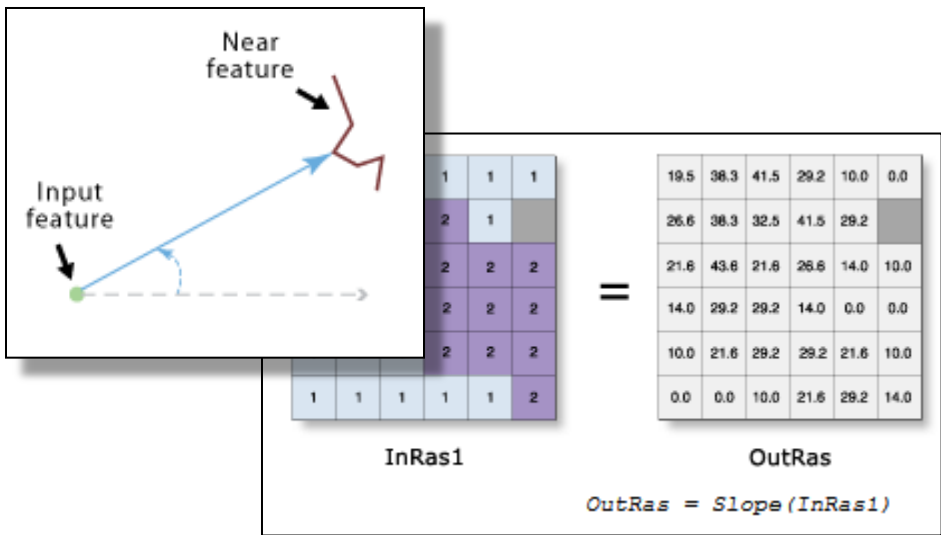
- 2 databases compared for spatial discrepancies
 - WIS (DCNR) and eFACTS (DEP)
 - Locational discrepancies > 50 ft. removed from study



Study Methods

Well site accessibility:

- Included only wells located within ¼ mile of roads, and generally on a grade of less than 10%

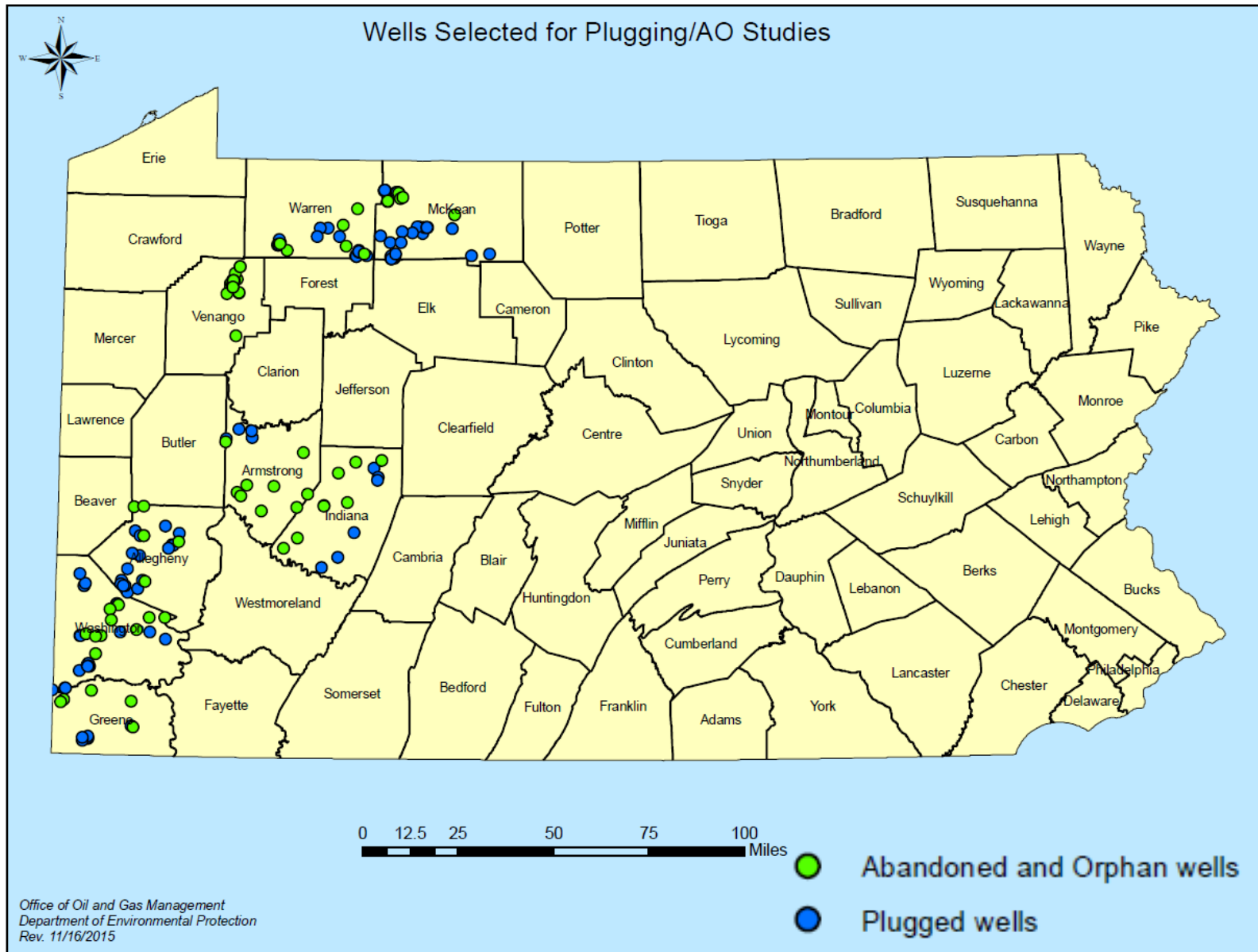


Study Methods

Sample size was selected to balance statistical significance with available resources.

Region	Sample Size
Northwest	114
Southwest	94

Study Methods



Study Methods

Field Observations:

- Methane concentrations
- Flow rate
- Oil, brine discharges
- Well condition
- Verify coordinates

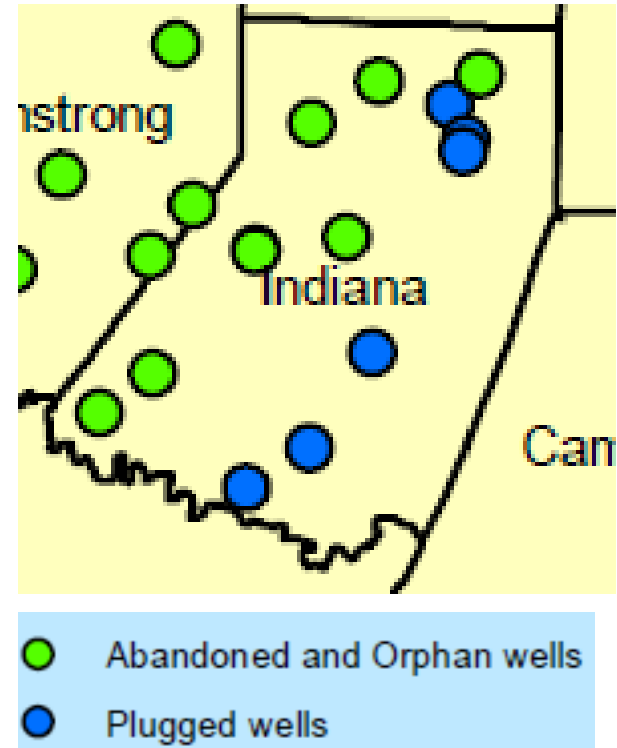


Study Methods



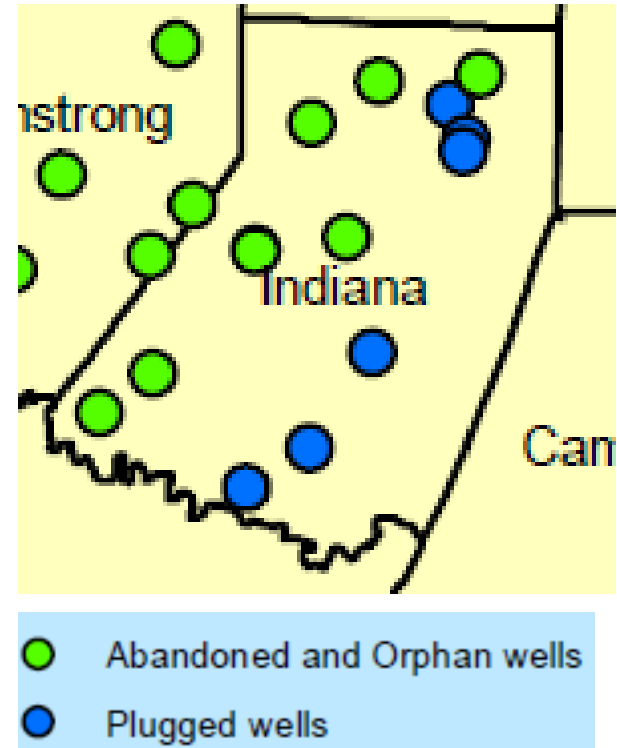
▶ Preliminary Findings – Indiana Co.

- Total wells selected: 14
 - 6 A/O
 - 7 Plugged
 - 1 status changed to Active, 063-26473, removed from study
- Total wells inspected: 10
- Total wells not located: 2 plugged
- 1 well has not been visited as of 5/2/2016



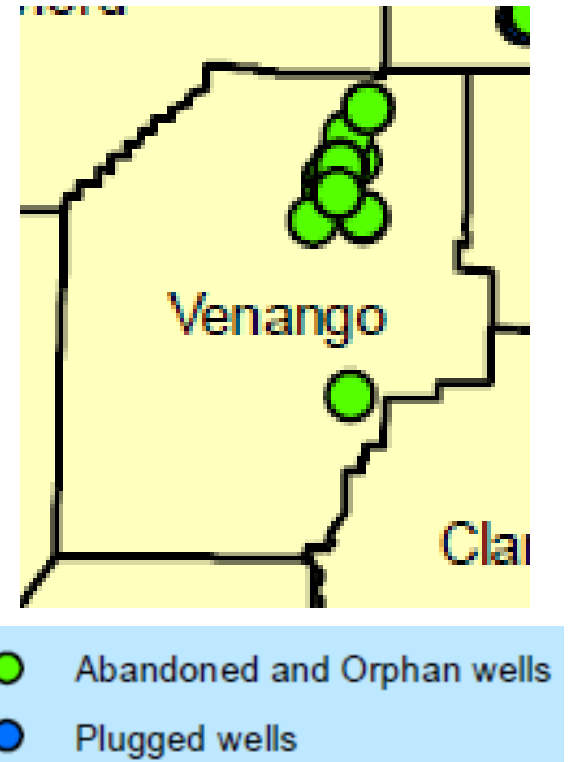
▶ Preliminary Findings – Indiana Co., cont.

- 3 wells had detectable concentrations of gas
 - 1 Plugged
 - 2 Abandoned
- 2 of those wells had measureable flow
 - 1 Plugged (1.8 cfd)
 - 1 Abandoned (1456 cfd)
- 1 orphan well was discharging water to a wetland at approximately 4 gpm, no apparent impact to vegetation



▶ Preliminary Findings – Venango Co.

- Total wells selected: 26
 - 26 A/O
- Total wells inspected: 7
- Total wells positively identified: 4
- 3 well locations had no casing, just hole in the ground
- No discharges of gas, oil, brine detected
- 19 well has not been visited as of 5/13/2016



Conclusion

- Preliminary Results:
 - Contrast between wells in SW and NW
 - SW: Greater density of legacy gas wells. Wells located and identified with relative ease. Gas emissions and water discharges already noted.
 - NW: Greater density of legacy oil wells. Wells difficult to locate, missing casings. No discharges noted as of yet.
 - 19 wells down, 189 to go!

Conclusion

- Hundreds of thousands of legacy wells are potential sources of environmental impacts (methane emissions, oil/brine/gas to surface and groundwater)
- Legacy Well Emissions Study Aims to:
 - Provide insight into environmental impacts
 - Assist in identifying any needed changes in regulations
 - Quantify agency plugging liability
 - Equipment investment needs



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Thank You! Questions?

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