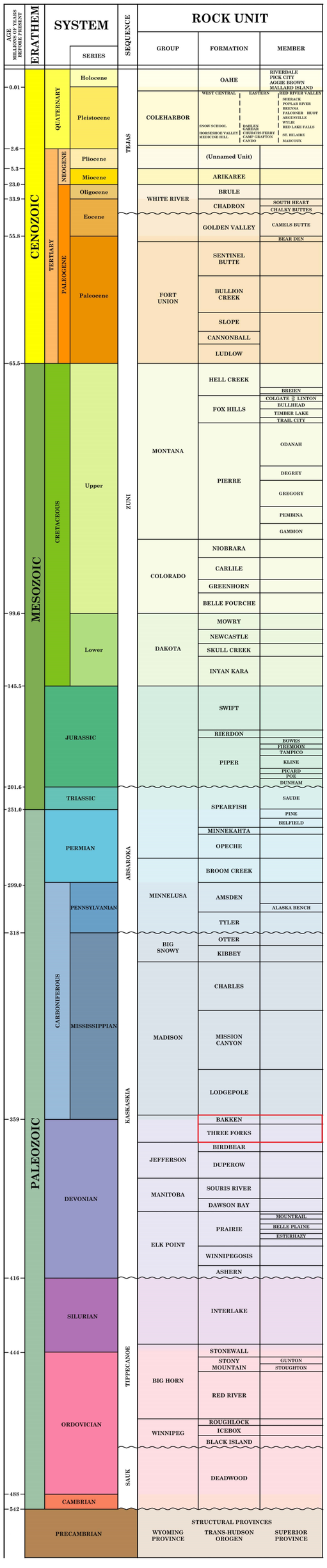
North Dakota Geological Survey
Geologic Investigations No. 238

Edward C. Murphy, State Geologist
Lynn D. Helms, Director Dept. Mineral Resources

NORTH DAKOTA STRATIGRAPHIC COLUMN



BAKKEN PETROLEUM SYSTEM SUMMARY

DRILL STEM TESTS AND PRODUCTION MAPPING

Travis D. Stolldorf

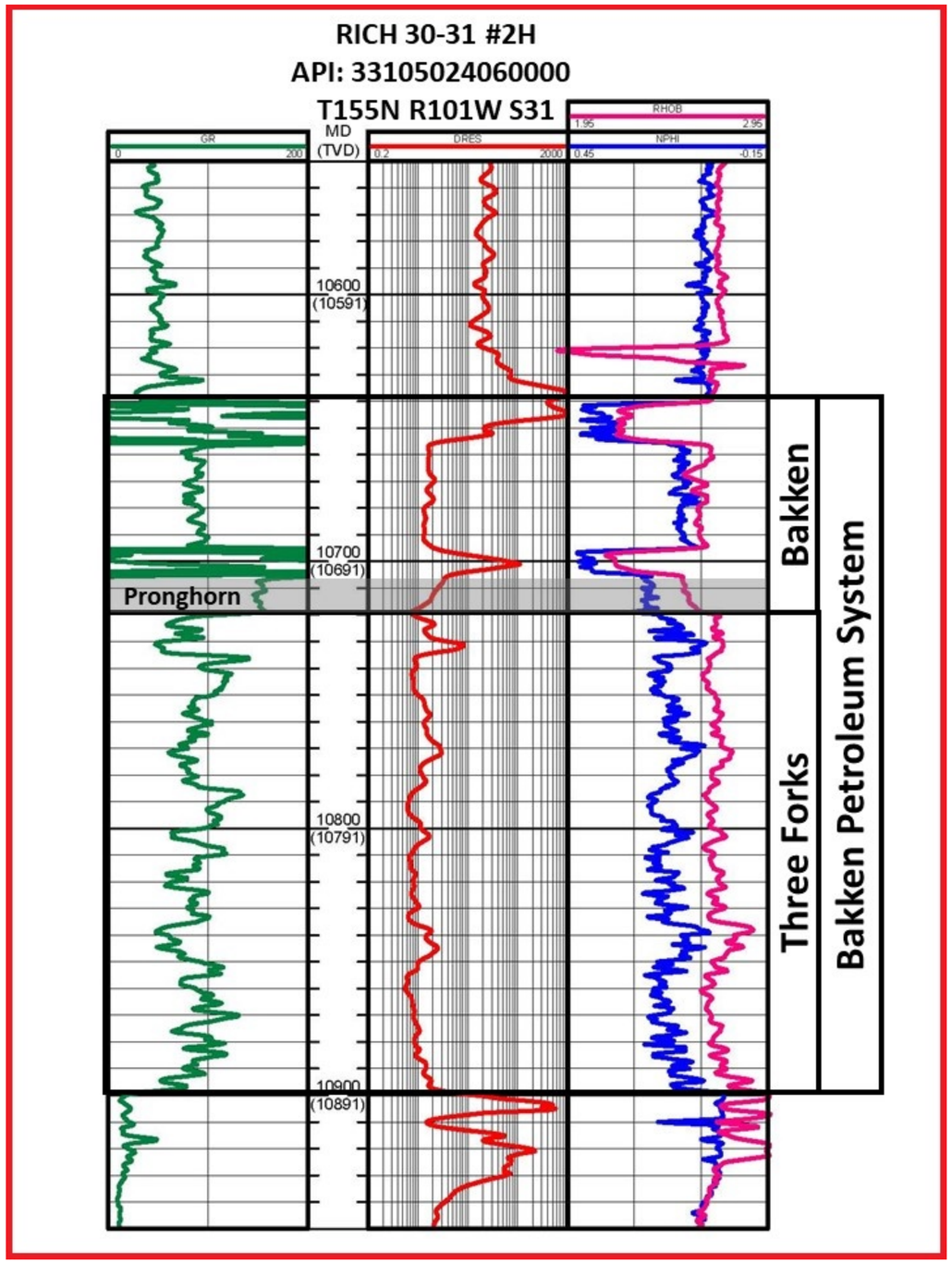
2020

In order to better facilitate petroleum exploration and development in the Williston Basin, the North Dakota Geological Survey (NDGS) has published a series of production-related maps and corresponding data sets. These maps sets include production and drill stem test (DST) results with an accompanying spreadsheet for easy data extraction. The primary goal of this project is to create a database showing the distribution of hydrocarbons within each productive unit.

Prior to this project, over 55% of the DST results in the state did not have an associated geologic interval. The NDGS utilized a series of filters in Petra and Excel to unite formation tops with DST results. Now over 95% of DST results are associated with a geologic interval. After removing failed (misrun) DSTs, the remaining DST results were then separated into three groups. The first group (Positive DSTa) contains wells that have recovered oil or gas (in either the drill pipe or the sampler), or those that list oil or gas as the primary component of the fluid/gas mixture (e.g. 10’ mud cut oil) in the description. Secondly, Positive DSTb wells display results for oil or gas as the secondary component of the fluid/gas mixture (e.g. 50’ gas cut mud). Although Positive DSTb wells do show signs of hydrocarbons, the hydrocarbon signal is considered weaker than those in the Positive DSTa group. Lastly, the Negative DST results have no indication of hydrocarbons. Detailed information for each DST (time-pressure data, interval depths, fluid and gas recovery information) can be accessed through the well file database maintained by the North Dakota Industrial Commission (NDIC) Oil and Gas Division.

Production for each well was determined using the NDIC's Production Pools and associated monthly production totals. The production pools utilized are shown on the Production Map for each interval. Cumulative production for each well was calculated through September 2019.

This project is a summary of the Bakken Petroleum System's production and drill stem test results. Map sets include a production map, cumulative production map and DST results in North Dakota’s portion of the Williston Basin. The Bakken Petroleum System is highlighted by the red box on the North Dakota Stratigraphic Column on the left. A representative log of the Bakken Petroleum System is shown below along with a map showing the well’s approximate location.



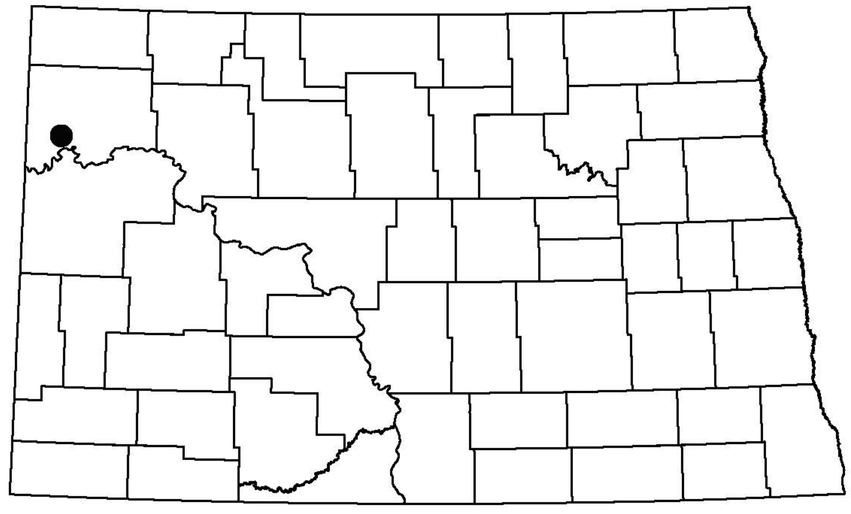
The Bakken Petroleum System is comprised of the Bakken and Three Forks Formations as well as the lowermost portion of the Lodgepole Formation where hydrocarbon charged from the underlying Bakken Formation. This study deals with data exclusively from the Bakken and Three Forks Formations. All Lodgepole Formation data are available within the Madison Group products.

References

Murphy, E.C., Nordeng, S.H., Juenker, B.J., and Hoganson, J.W., 2009, North Dakota Stratigraphic Column, North Dakota Geological Survey, MS-91, 1p.

North Dakota Industrial Commission, Department of Mineral Resources, Oil and Gas Statistics, retrieved October 2019, https://www.dmr.nd.gov/oilgas/

NORTH DAKOTA LOCATION MAP



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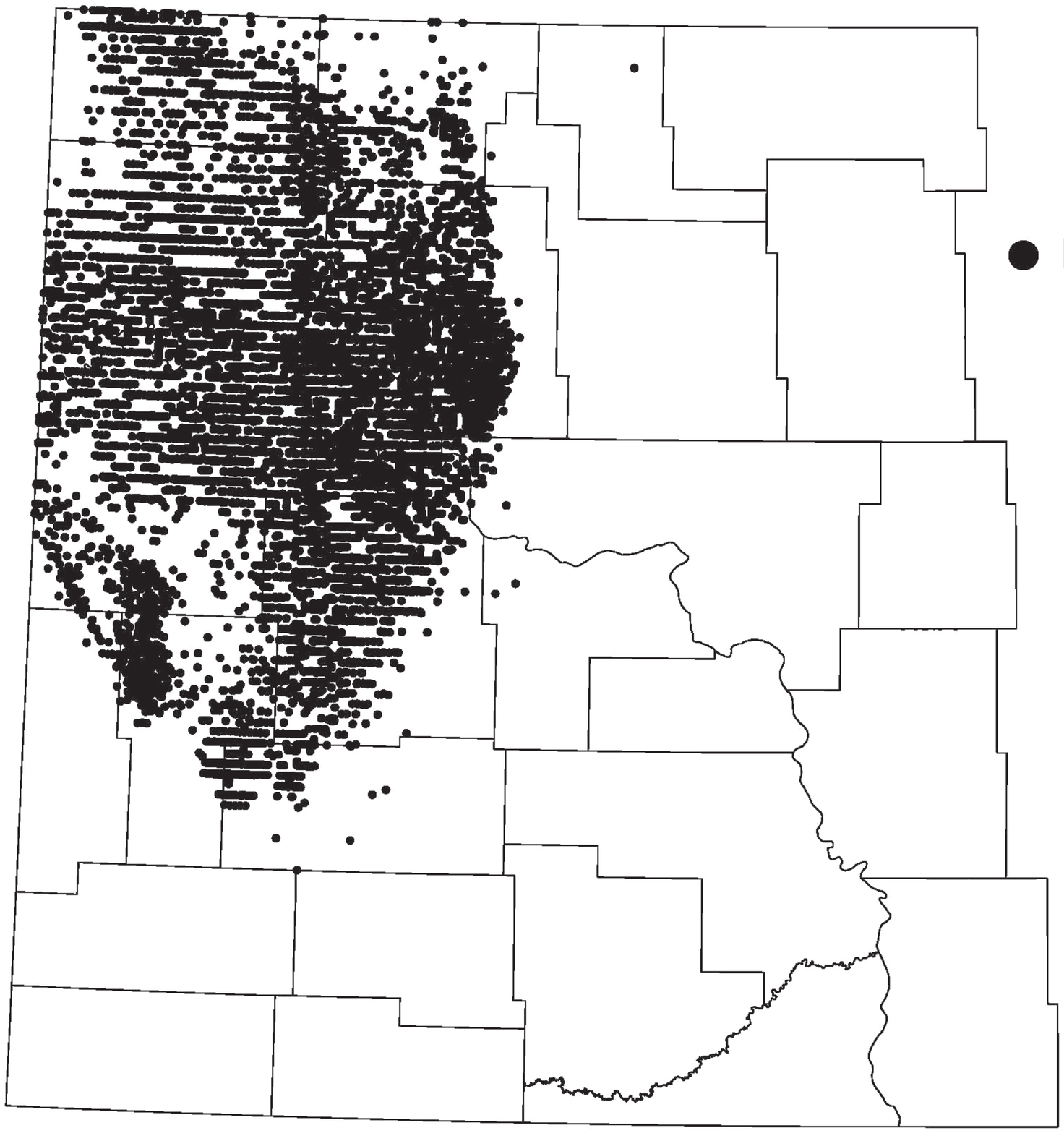
BAKKEN PETROLEUM SYSTEM OIL PRODUCTION



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● Bakken Petroleum System Production

NDIC Production Pools Utilized

Bakken
Bakken/Three Forks
Lodgepole/Bakken
Three Forks
Sanish (Pronghorn Sands)

N

0 20 40
MILES

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BAKKEN PETROLEUM SYSTEM CUM OIL PRODUCTION

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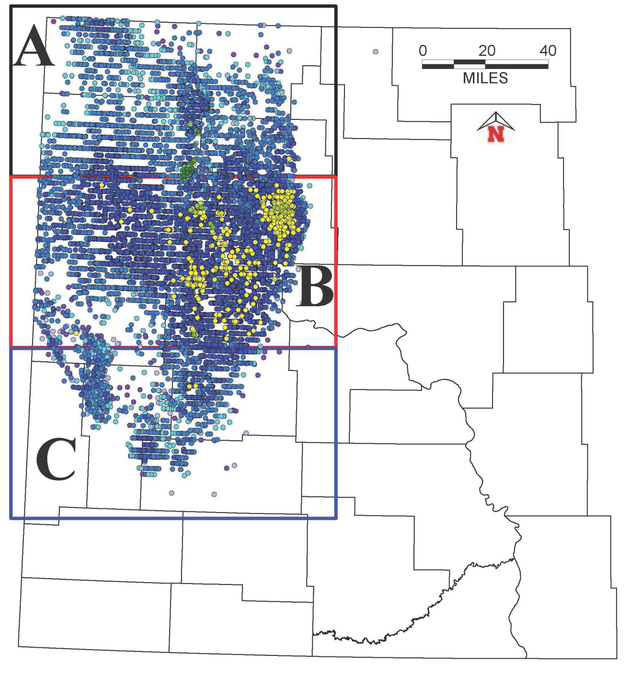
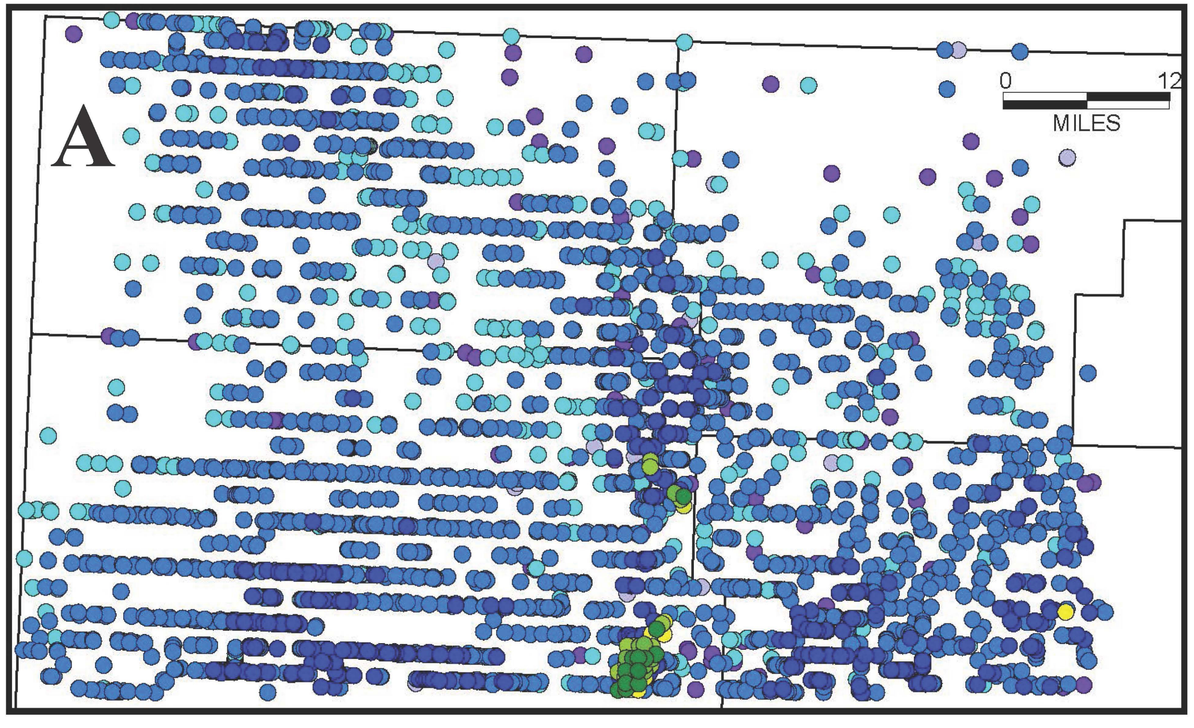
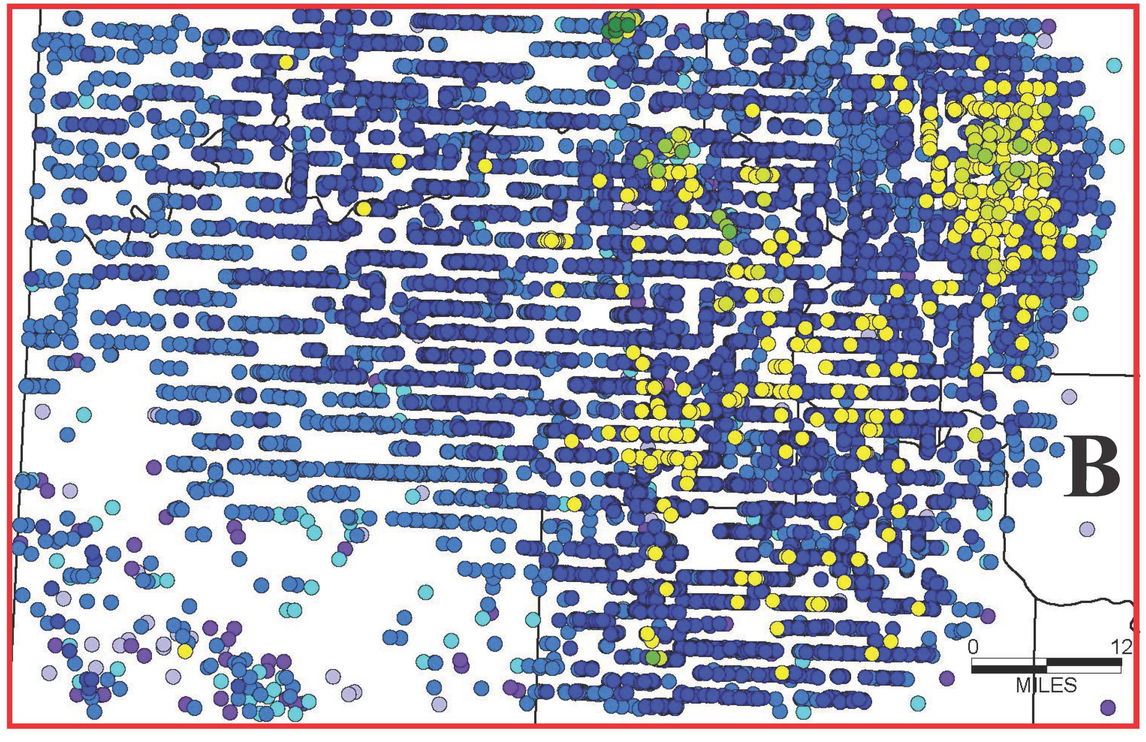
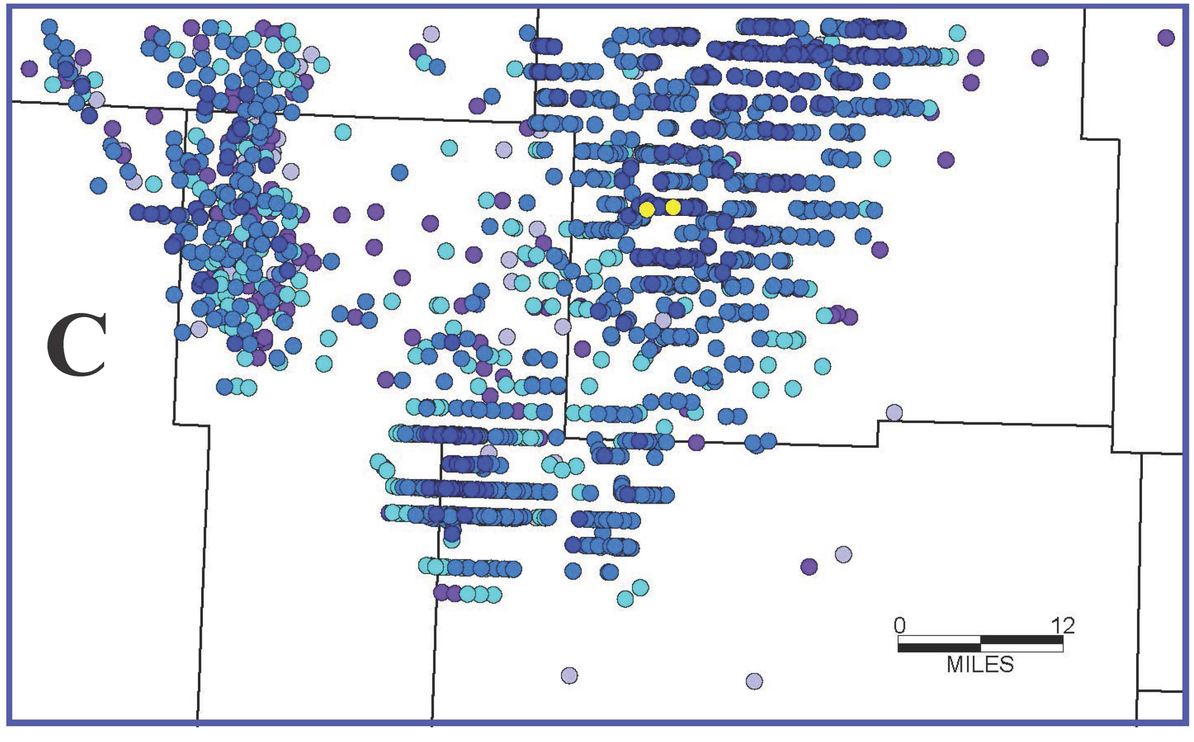




CUM OIL (BBLS)

0
10,000
50,000
100,000
250,000
500,000
750,000
1,000,000
1,500,000
2,000,000
3,000,000





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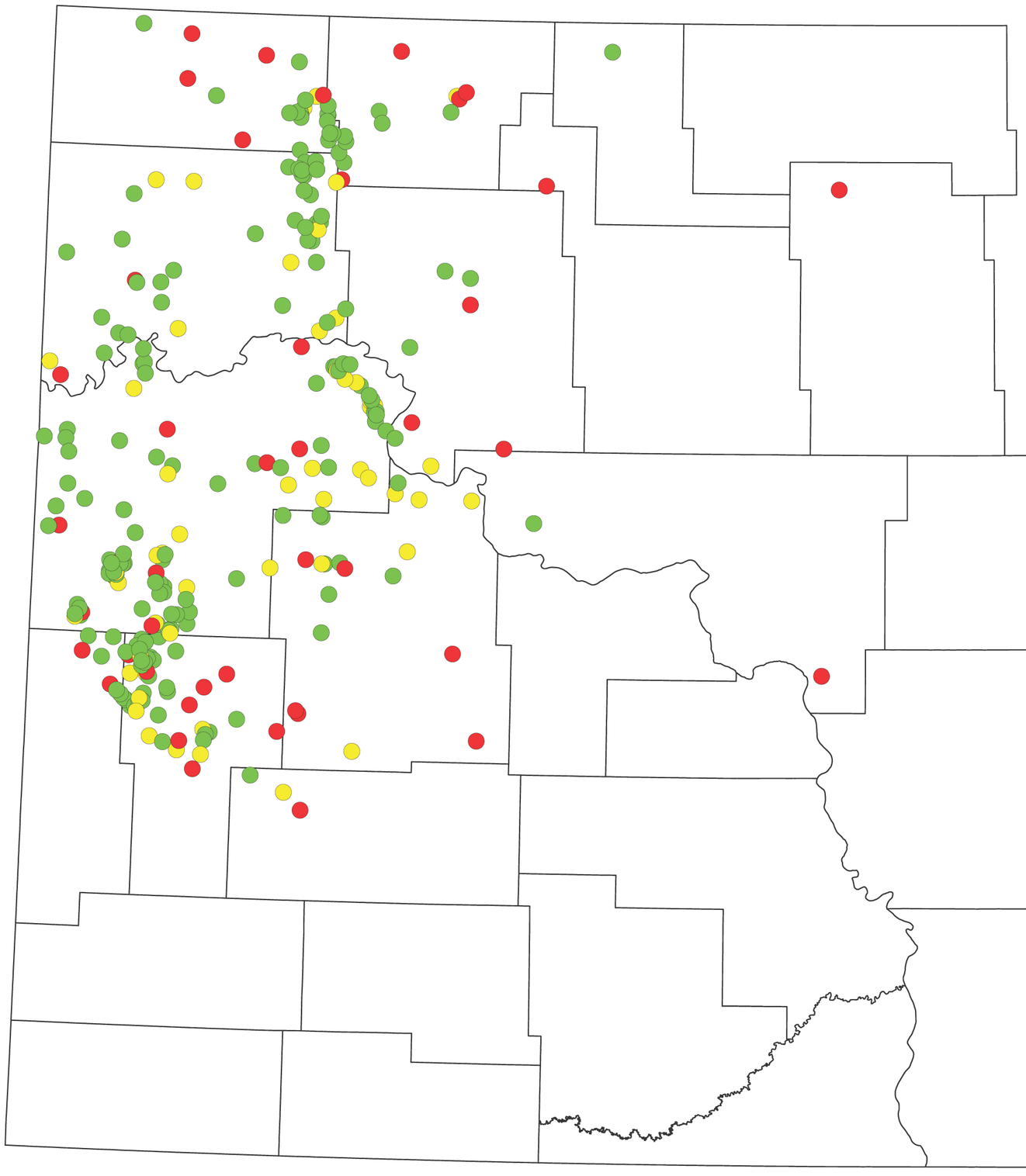
BAKKEN DRILL STEM TEST RESULTS



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POSITIVE DSTa
(1) Oil or gas recovered in sampler and/or pipe (e.g. 275' Free Oil)
(2) Description with oil or gas as the primary component of fluid/gas mixture (e.g. 150' mud cut Oil)

POSITIVE DSTb
(1) Description with oil or gas as the secondary component of fluid/gas mixture (e.g. 150' Gas cut mud)
(2) Hydrocarbons present but a weak indication in DST

NEGATIVE DST
(1) No Oil or Gas reported

0 20 40
MILES

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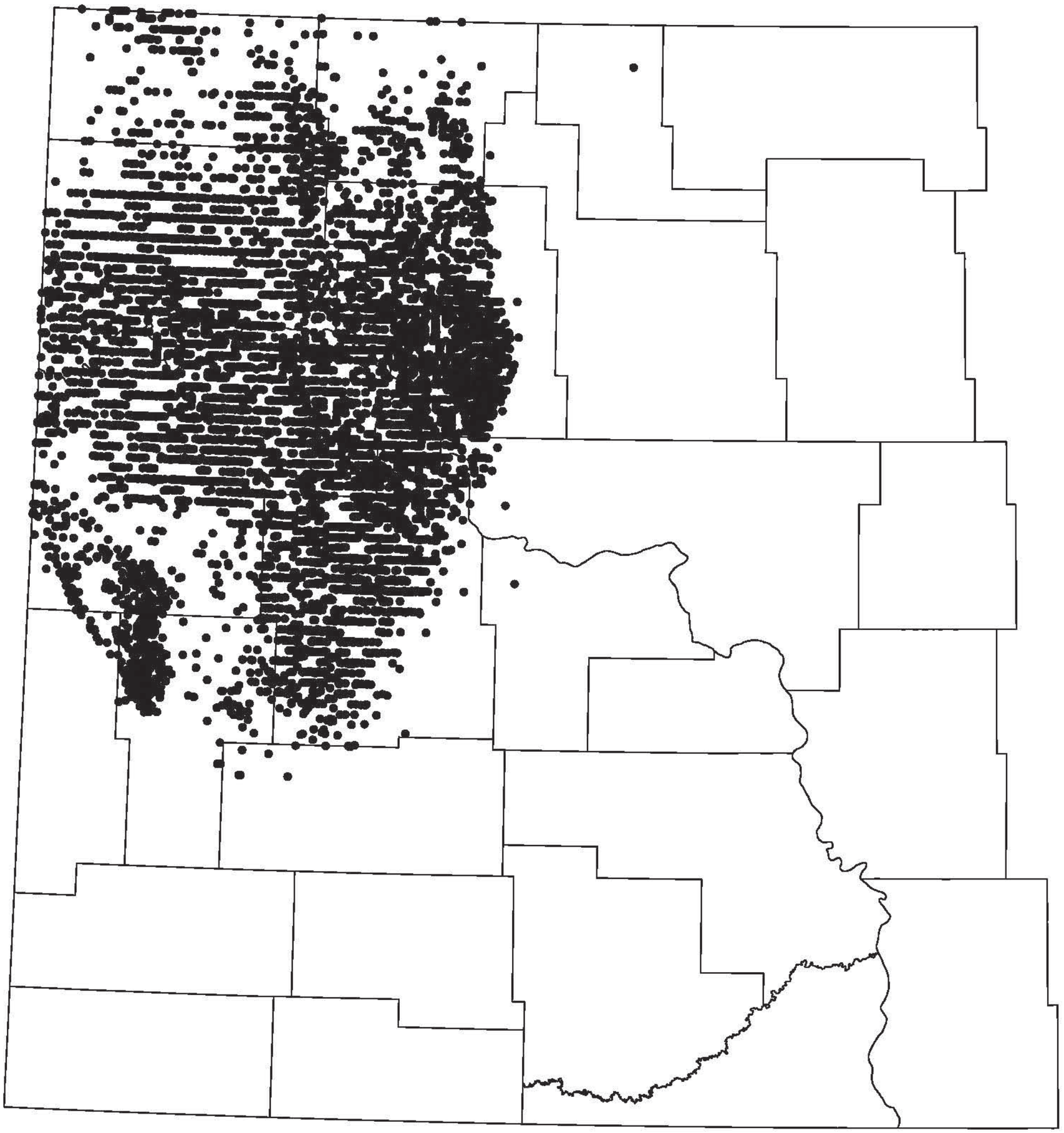
BAKKEN OIL PRODUCTION



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● Bakken Production

NDIC Production Pools Utilized
Bakken

N

0 20 40
MILES

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BAKKEN CUM OIL PRODUCTION

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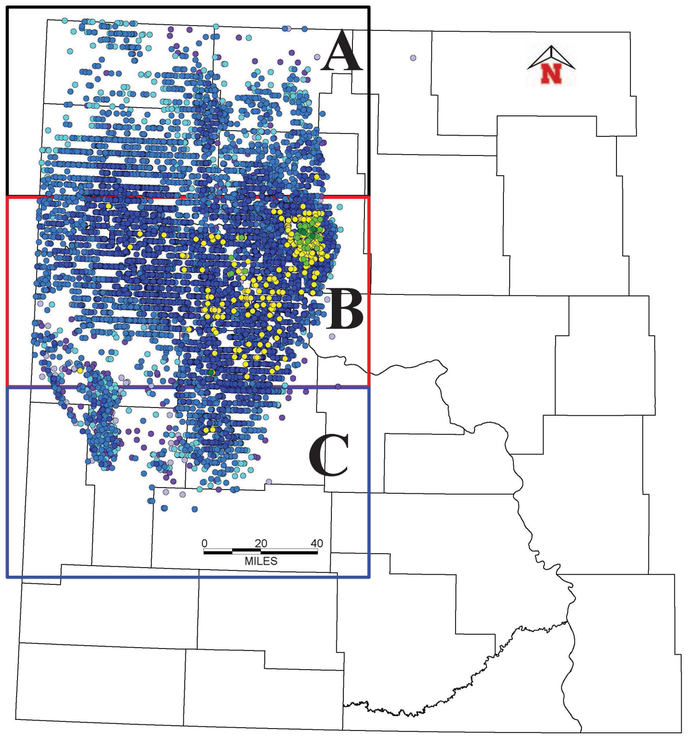
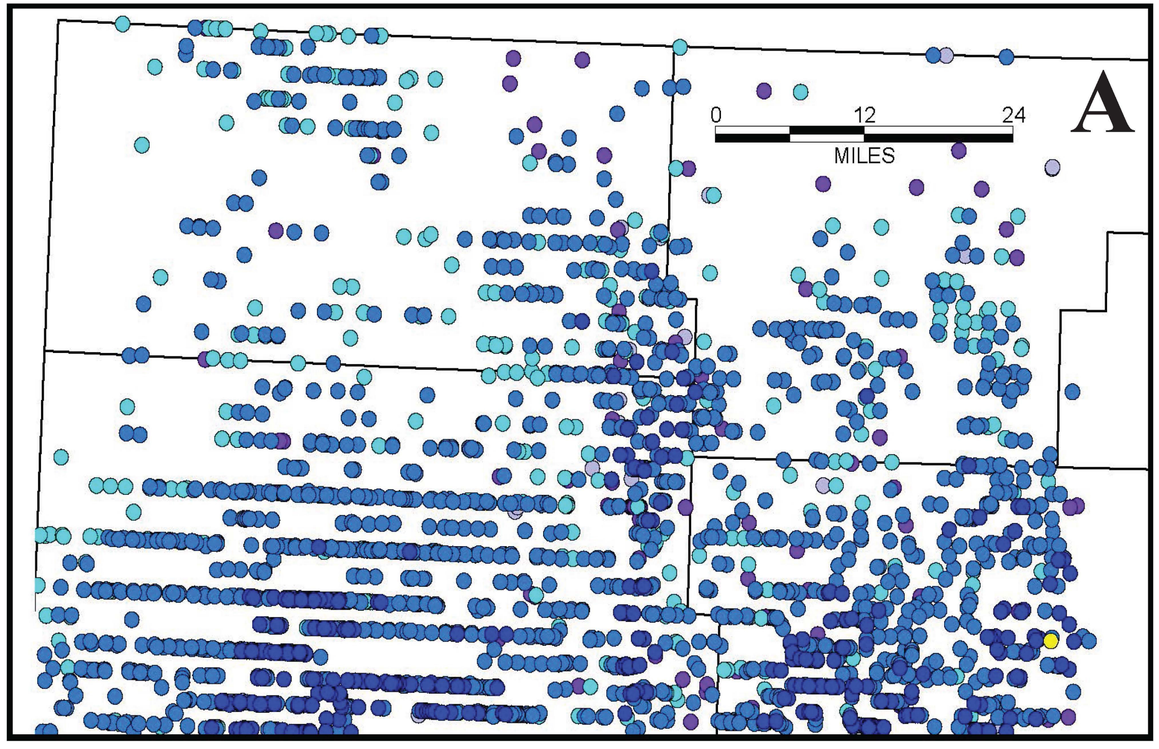
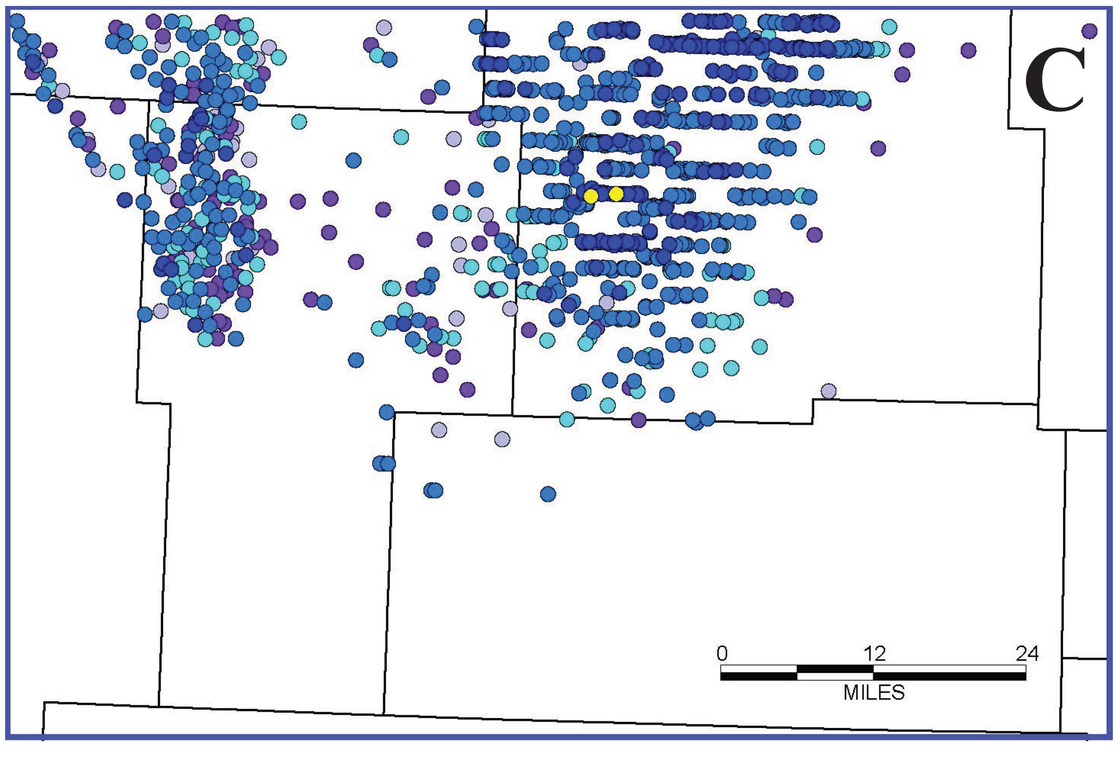
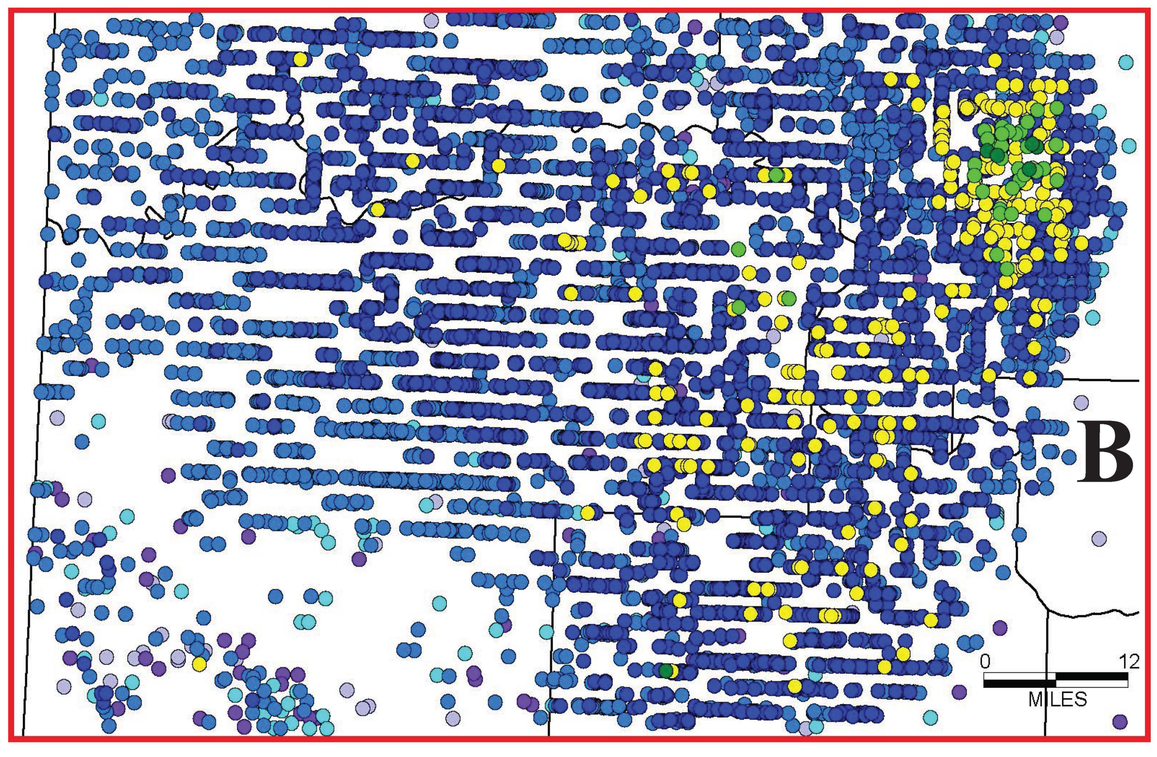




CUM OIL (BBLS)

0
10,000
50,000
100,000
250,000
500,000
750,000
1,000,000





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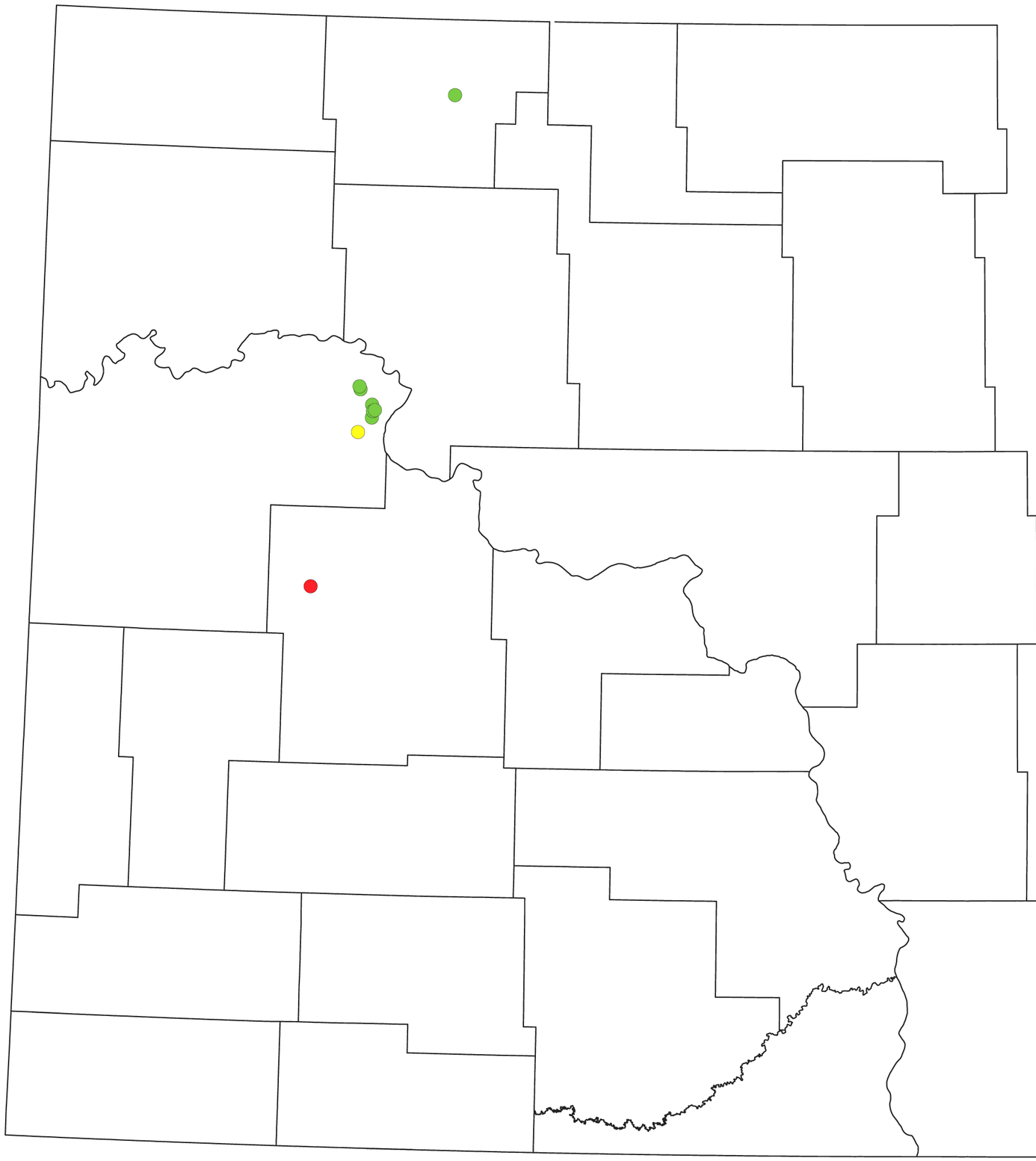
SANISH (Pronghorn Sands)
DRILL STEM TEST RESULTS



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2020

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(1) Description with oil or gas as the secondary component of fluid/gas mixture (e.g. 150' Gas cut mud)
(2) Hydrocarbons present but a weak indication in DST

NEGATIVE DST
(1) No Oil or Gas reported

0 20 40
MILES

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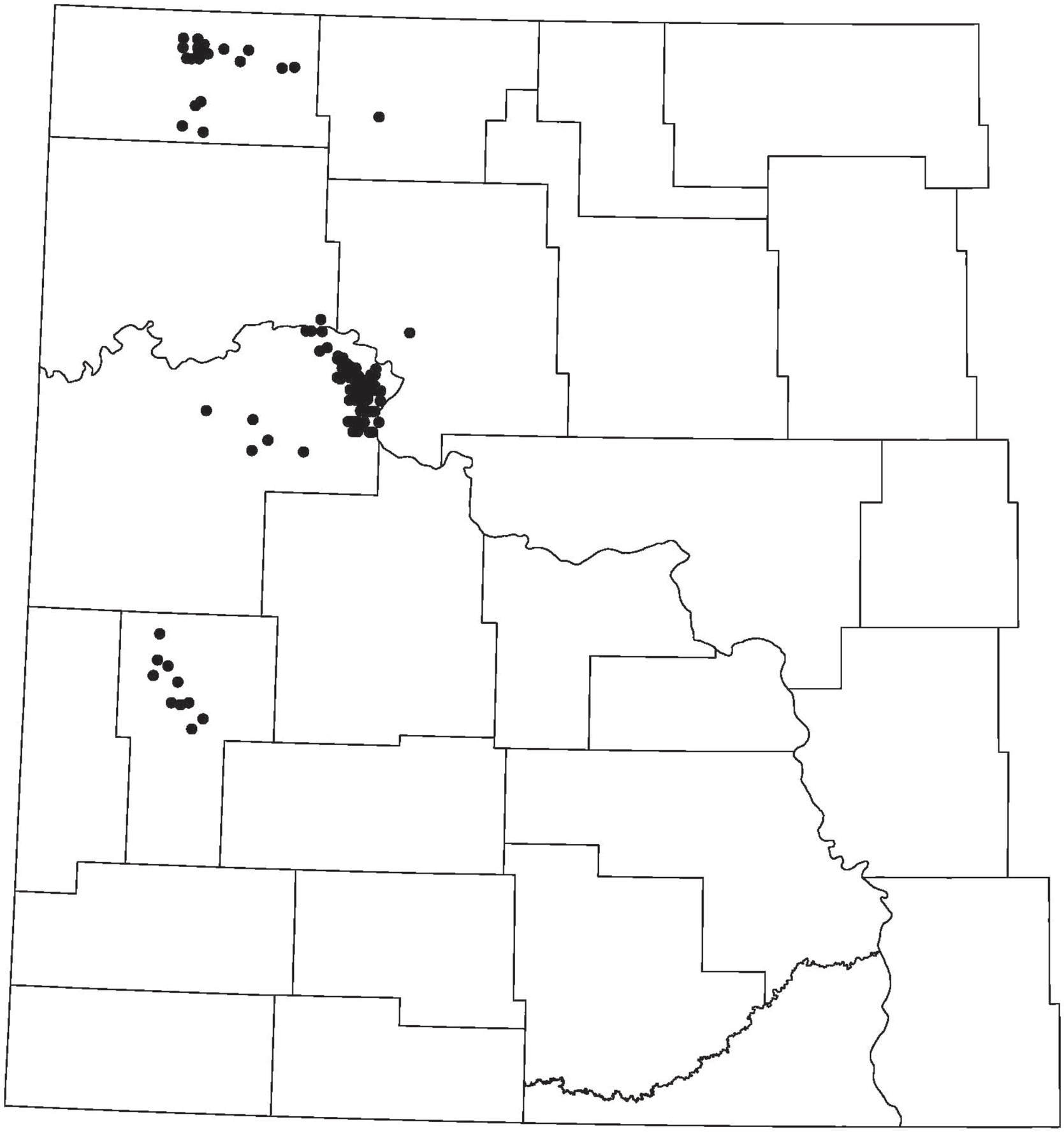
SANISH (Pronghorn Sands) OIL PRODUCTION



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● Sanish Production (Pronghorn Sands)

NDIC Production Pools Utilized
Sanish

0 20 40
MILES

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SANISH CUM OIL PRODUCTION (Pronghorn Sands)

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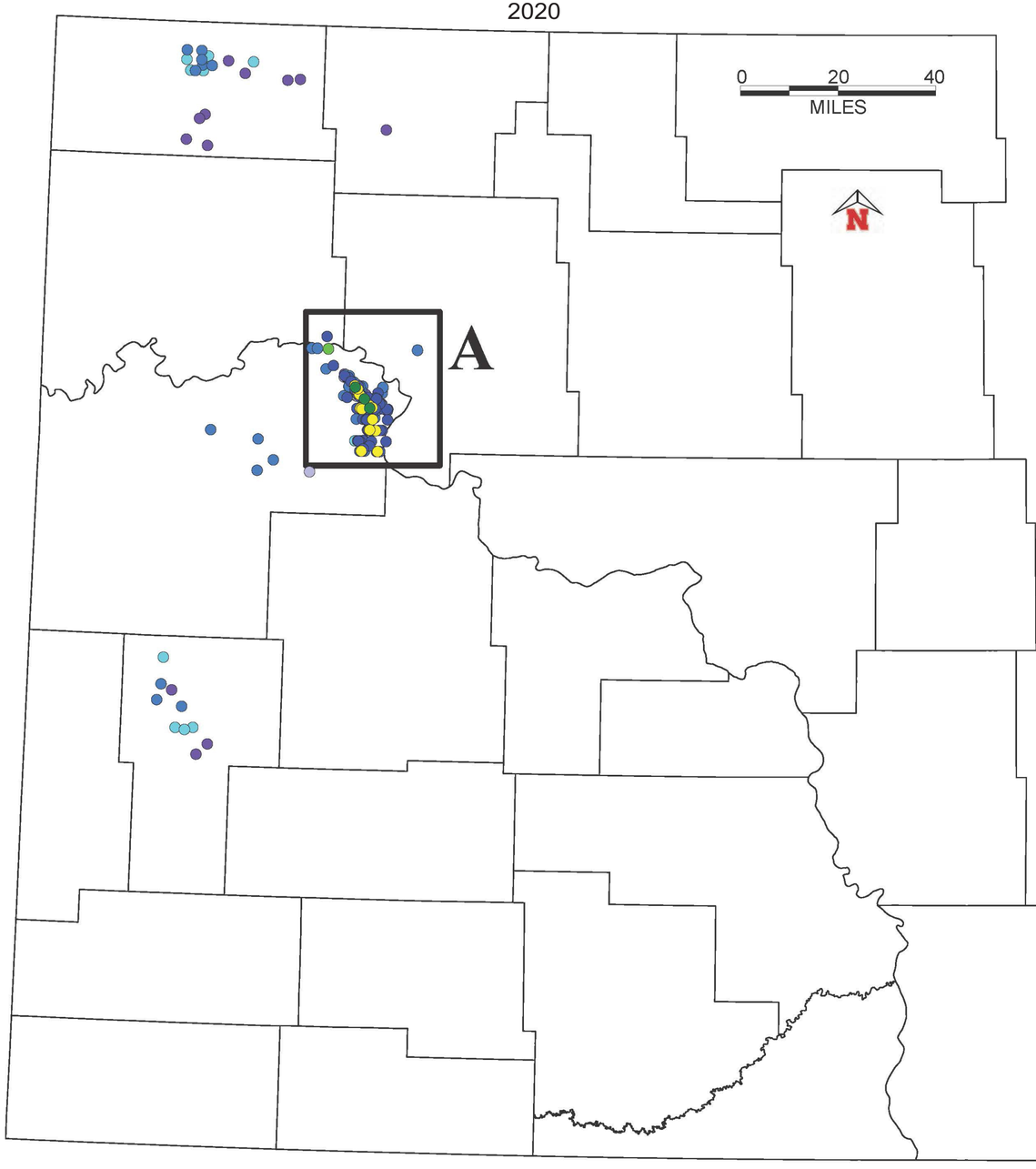
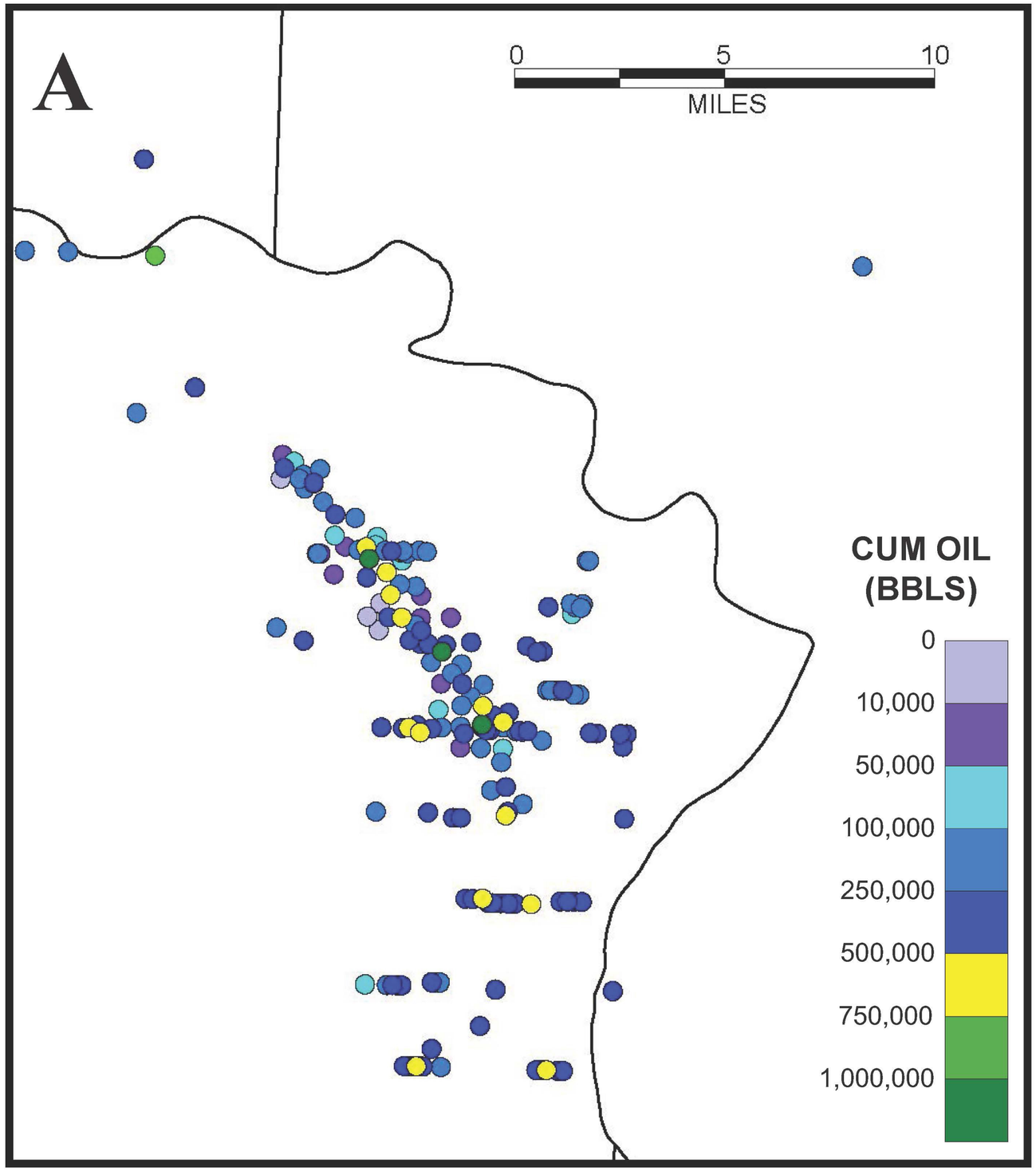
2020





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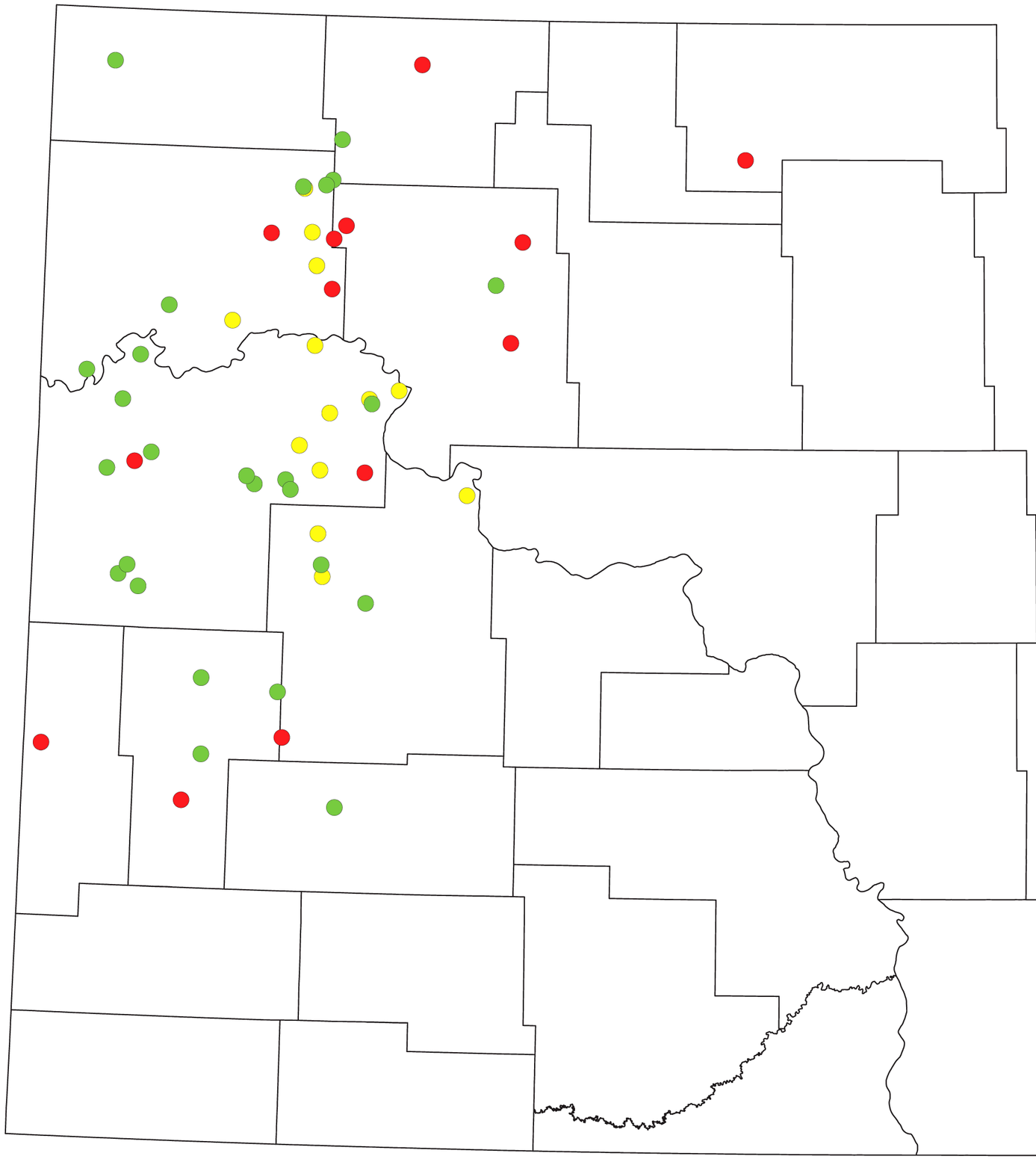
THREE FORKS DRILL STEM TEST RESULTS



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(1) Description with oil or gas as the secondary component of fluid/gas mixture (e.g. 150' Gas cut mud)
(2) Hydrocarbons present but a weak indication in DST

NEGATIVE DST
(1) No Oil or Gas reported

0 20 40
MILES

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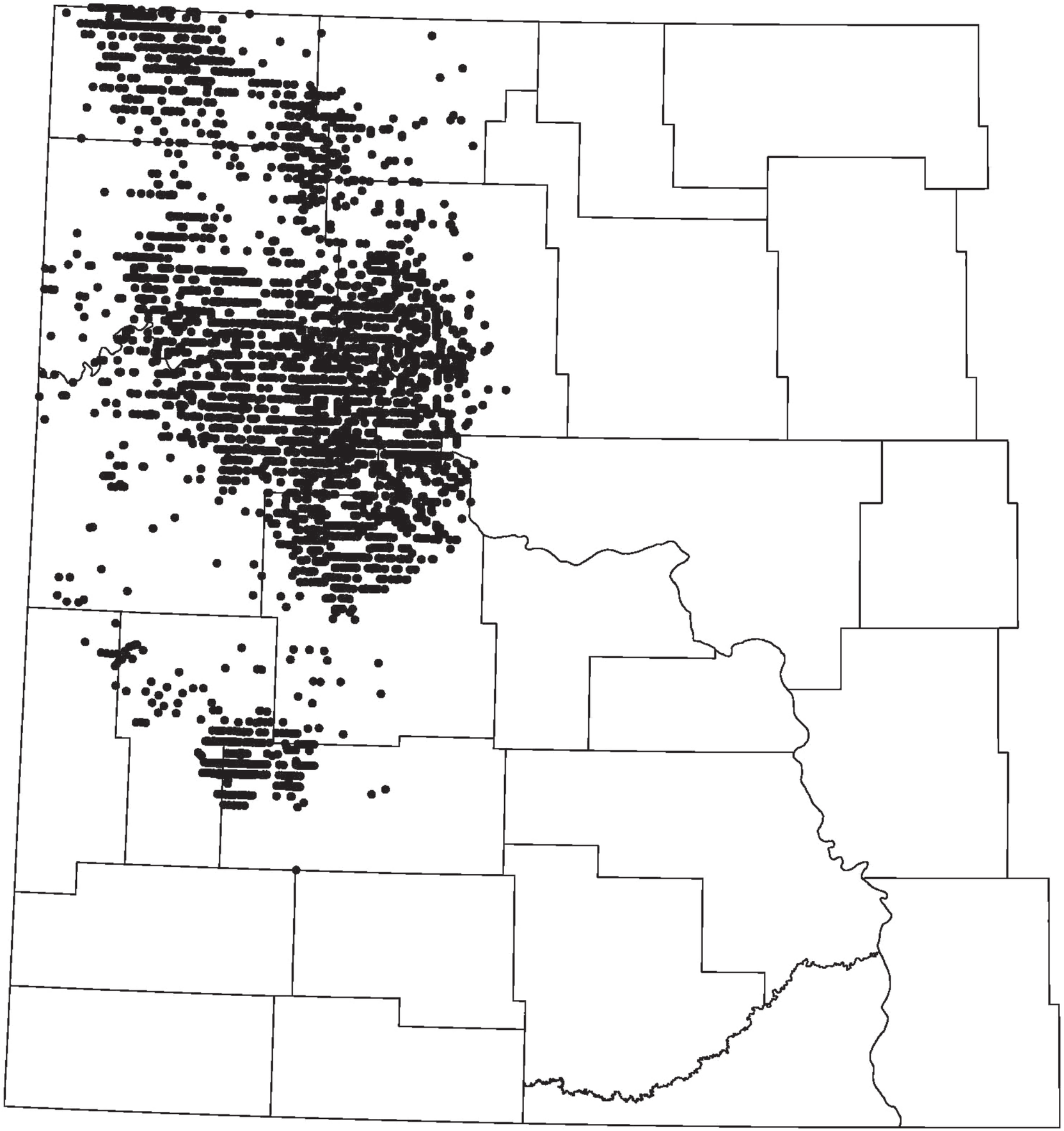
THREE FORKS OIL PRODUCTION



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●Three Forks Production

NDIC Production Pools Utilized
Three Forks

N

0 20 40
MILES

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THREE FORKS CUM OIL PRODUCTION

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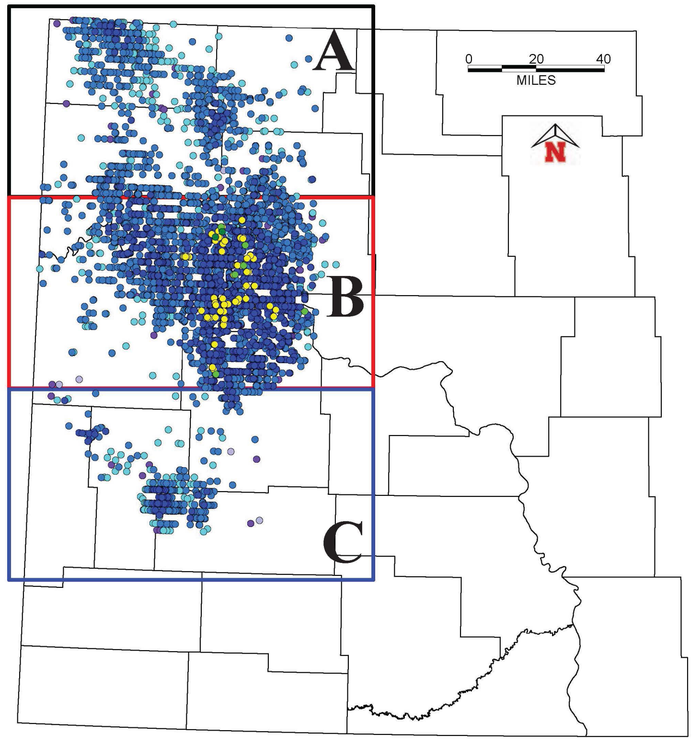

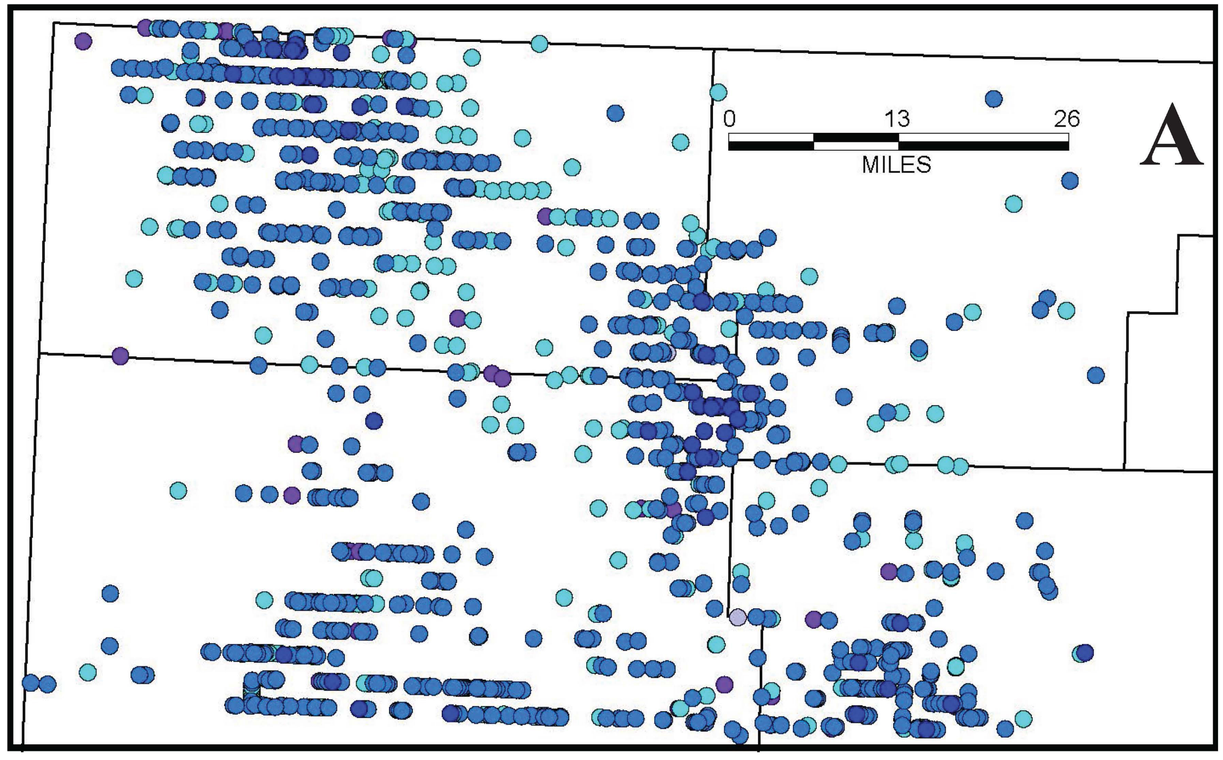

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