



# BAKKEN PETROLEUM SYSTEM SUMMARY

## DRILL STEM TESTS AND PRODUCTION MAPPING

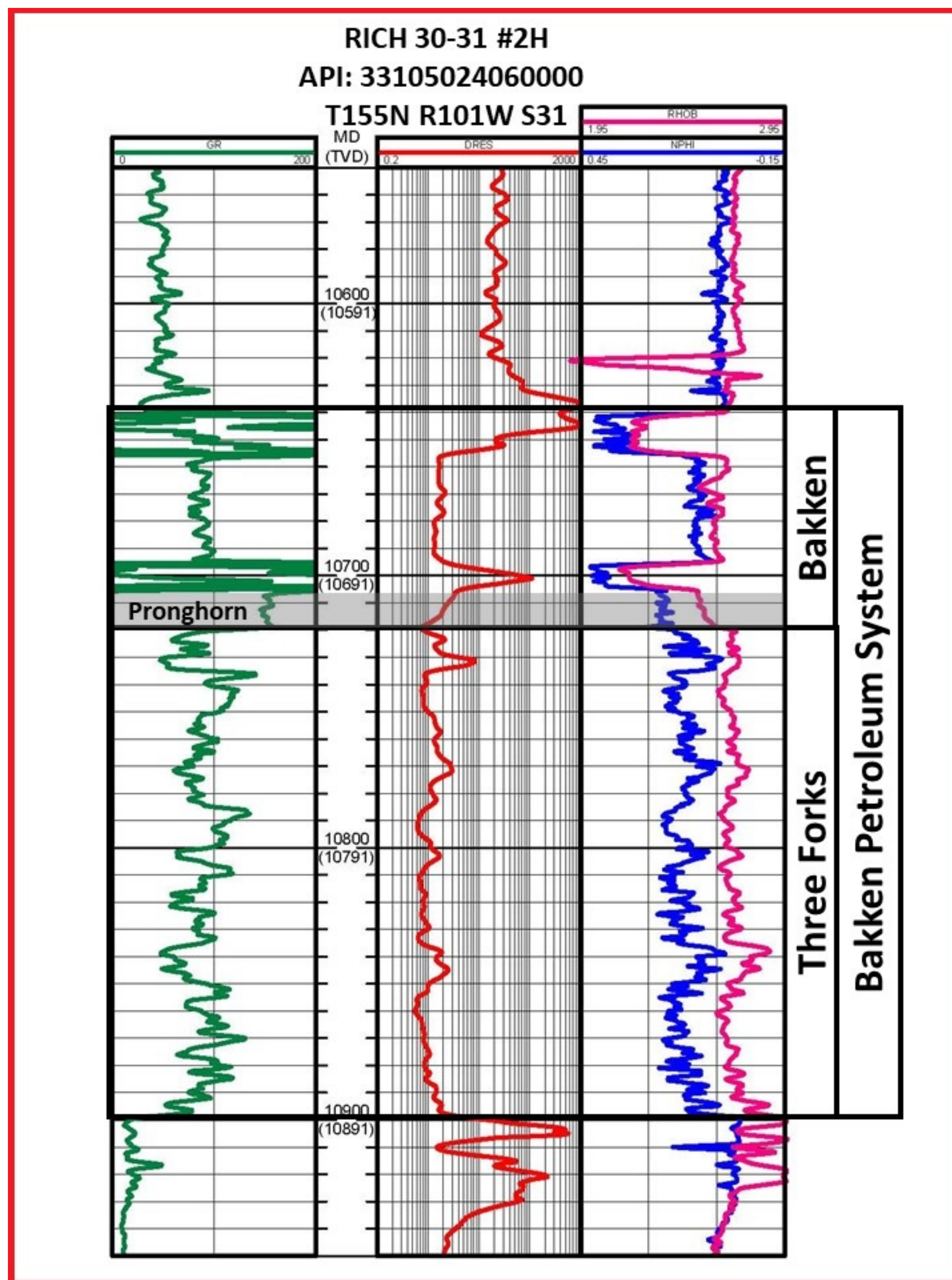
Travis D. Stoll Dorf  
2020

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.



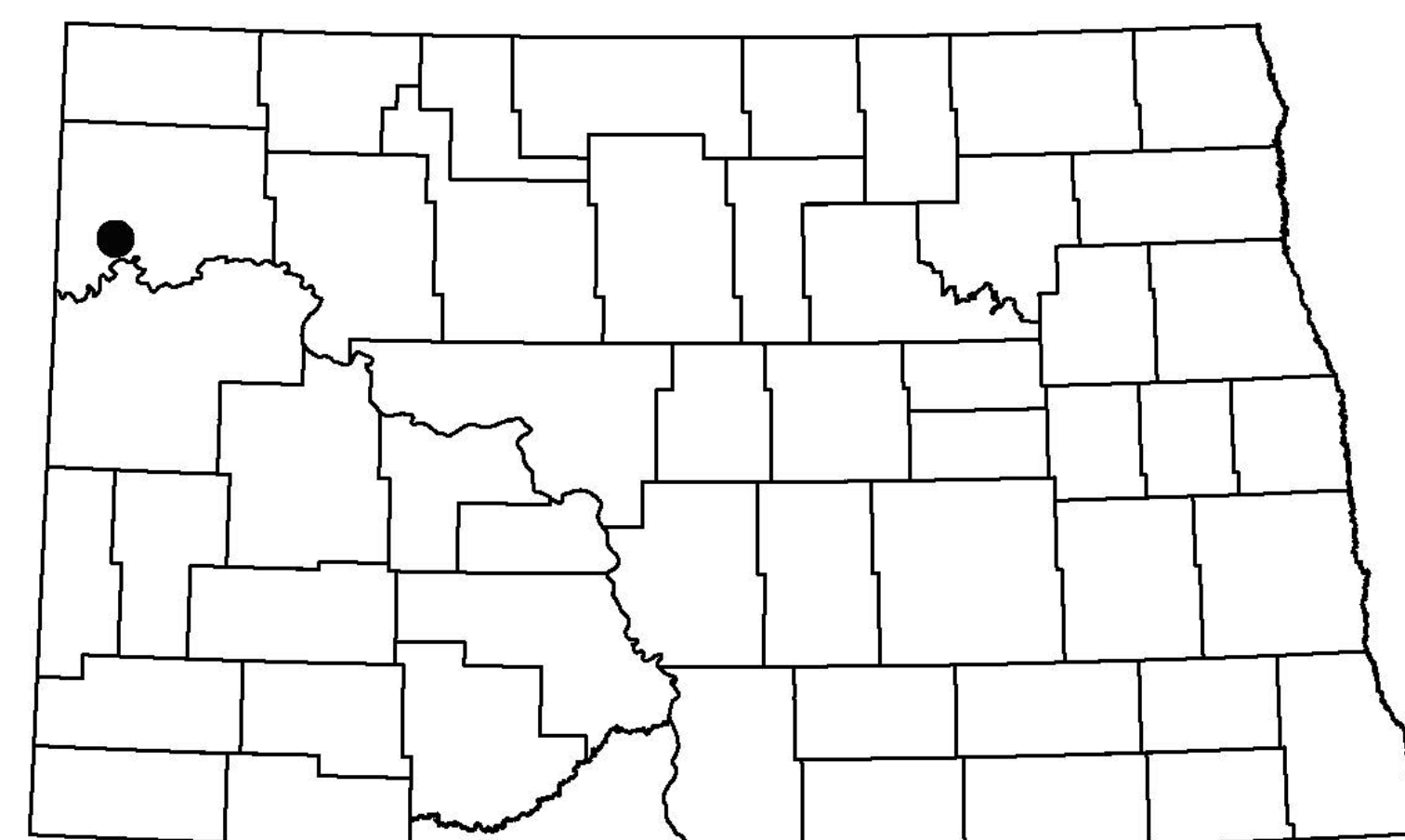
The Bakken Petroleum System is comprised of the Bakken and Three Forks Formations as well as the lowermost portion of the Lodgepole Formation where hydrocarbon charged from the underlying Bakken Formation. This study deals with data exclusively from the Bakken and Three Forks Formations. All Lodgepole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

### References

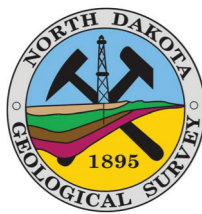
Murphy, E.C., Nordeng, S.H., Juenker, B.J., and Hoganson, J.W., 2009, North Dakota Stratigraphic Column, North Dakota Geological Survey, MS-91, 1p.

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



AGE (MILLIONS OF YEARS BEFORE PRESENT)	ERA/THEM	SYSTEM		SEQUENCE	ROCK UNIT															
		SERIES	GROUP		FORMATION	MEMBER														
0.01	CENOZOIC	QUATERNARY	Holocene	TEXAS	OAH	RIVERDALE	PICK CITY													
Pleistocene						WEST CENTRAL	EASTERN	AGUE BRONX	MALDEN ISLAND											
		Pliocene	COLEHARBOR		SHREVE	POPULAR SPRING														
Miocene					ARIKAREE	DEBENA	FAUCONER REEF													
5.3	NEOGENE	Oligocene	WHITE RIVER	BRULE	SOUTH HEART	CHALMERS BUTTES														
Eocene					CHADRON	CAMELS BUTTE	BEAR DEN													
	TERTIARY	PALEOGENE	Paleocene	FORT UNION		SENTINEL BUTTE	BULLION CREEK	SLOPE												
CANNONBALL					LUDLOW															
CRETACEOUS					Upper		MONTANA	PIERRE	HELL CREEK	BREKEN										
									FOX HILLS	COLGATE S. DUNTON										
									PIERRE	TIMBER LAKE										
									PIERRE	TRAIL CITY										
									PIERRE	ODANAH										
									PIERRE	DEGREY										
									PIERRE	GREGORY										
									PIERRE	PEMBINA										
	PIERRE	GAMBON																		
	PIERRE	GAMBON																		
MESOZOIC	Lower	COLORADO	NIORRARA	CARLILE	GREENHORN															
				BELLE FOURCHE	MOWRY															
				NEWCASTLE	SKULL CREEK															
				INYAN KARA	SWIFT															
				JURASSIC	TRIASSIC	SPEARFISH	MINNEKAHTA	RIERDON	ROBES											
								PIPER	FERGUSON											
								PIPER	LAMPICO											
								PIPER	KLENE											
								PIPER	PICARD											
								PIPER	FOE											
PIPER	SUNNAM																			
PIPER	SAUDE																			
PIPER	PINE																			
PIPER	BELFIELD																			
PALEOZOIC	PERMIAN	BROOM CREEK	OPECHE	MADISON	MISSION CANYON															
					Lodgepole	ALASKA BENCH														
					CARBONIFEROUS	MISSISSIPPIAN	BIG SNOWY	KIBBEY	MADISON	CHARLES										
										JEFFERSON	DUPEROW									
										MANITOBA	SOURIS RIVER									
										MANITOBA	DAWSON BAY									
										ELK POINT	MOONSHAW									
										ELK POINT	BELLE PLAINE									
										ELK POINT	ESTERHAY									
										ELK POINT	WINNIEGOSIS									
ELK POINT	ASHERN																			
ELK POINT	INTERLAKE																			
PALEOZOIC	DEVONIAN	BIG HORN	RED RIVER	BIG HORN	STONEWALL															
					STONY MOUNTAIN	GUNTON														
					ROUGHLOCK	ICEBOX														
					ROUGHLOCK	BLACK ISLAND														
					PALEOZOIC	SILURIAN	WINNIPEG	DEADWOOD	WINNIPEG	ROUGHLOCK										
										ICEBOX	BLACK ISLAND									
										PALEOZOIC	ORDOVICIAN	SAUK	DEADWOOD	SAUK	DEADWOOD					
															DEADWOOD	DEADWOOD				
															PRECAMBRIAN	WYOMING PROVINCE	TRANS-HUDSON OROGEN	SUPERIOR PROVINCE	WYOMING PROVINCE	WYOMING PROVINCE
																				TRANS-HUDSON OROGEN



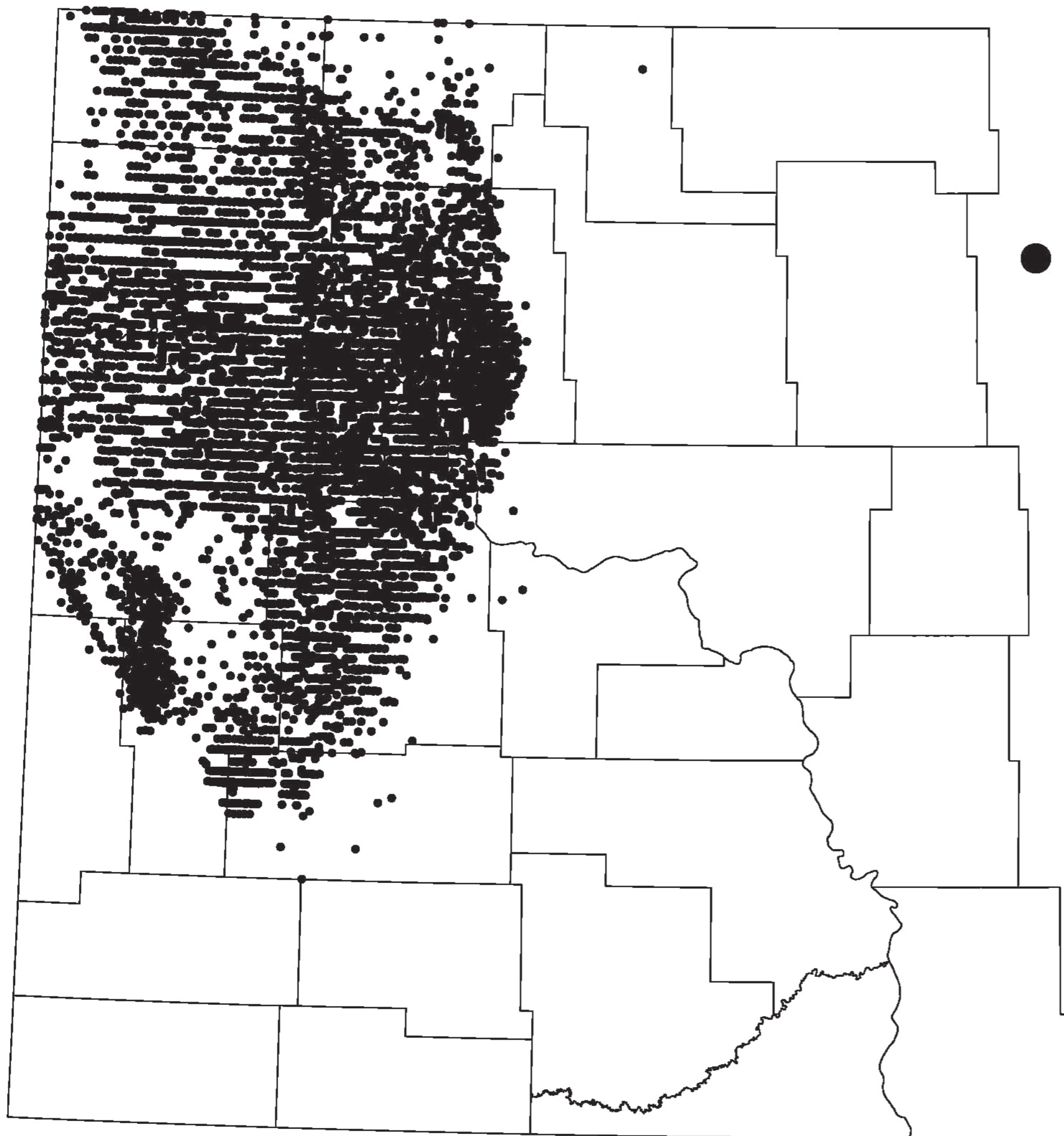
# BAKKEN PETROLEUM SYSTEM OIL PRODUCTION

Travis D. Stolldorf  
2020

● Bakken Petroleum System Production

NDIC Production Pools Utilized

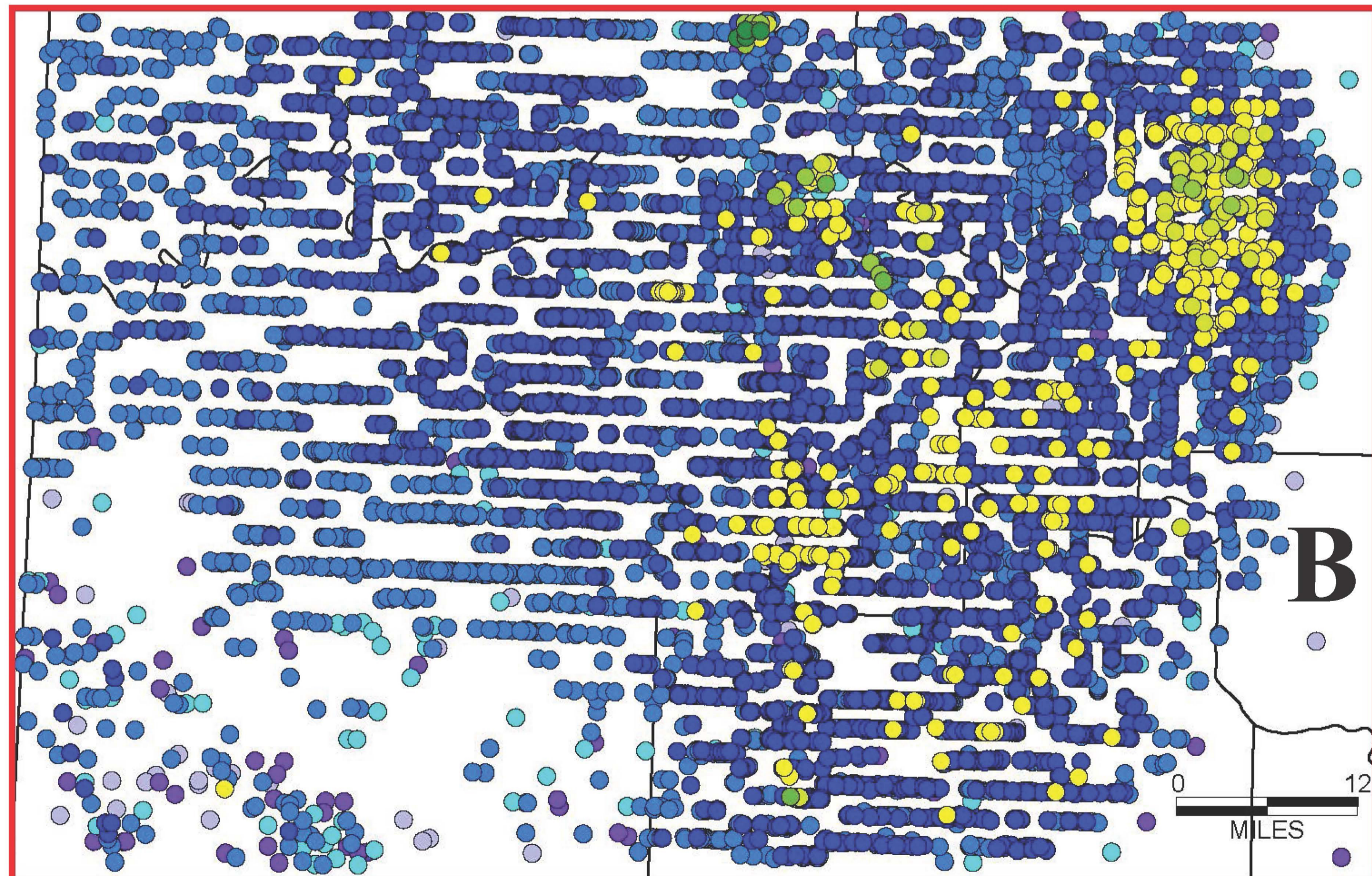
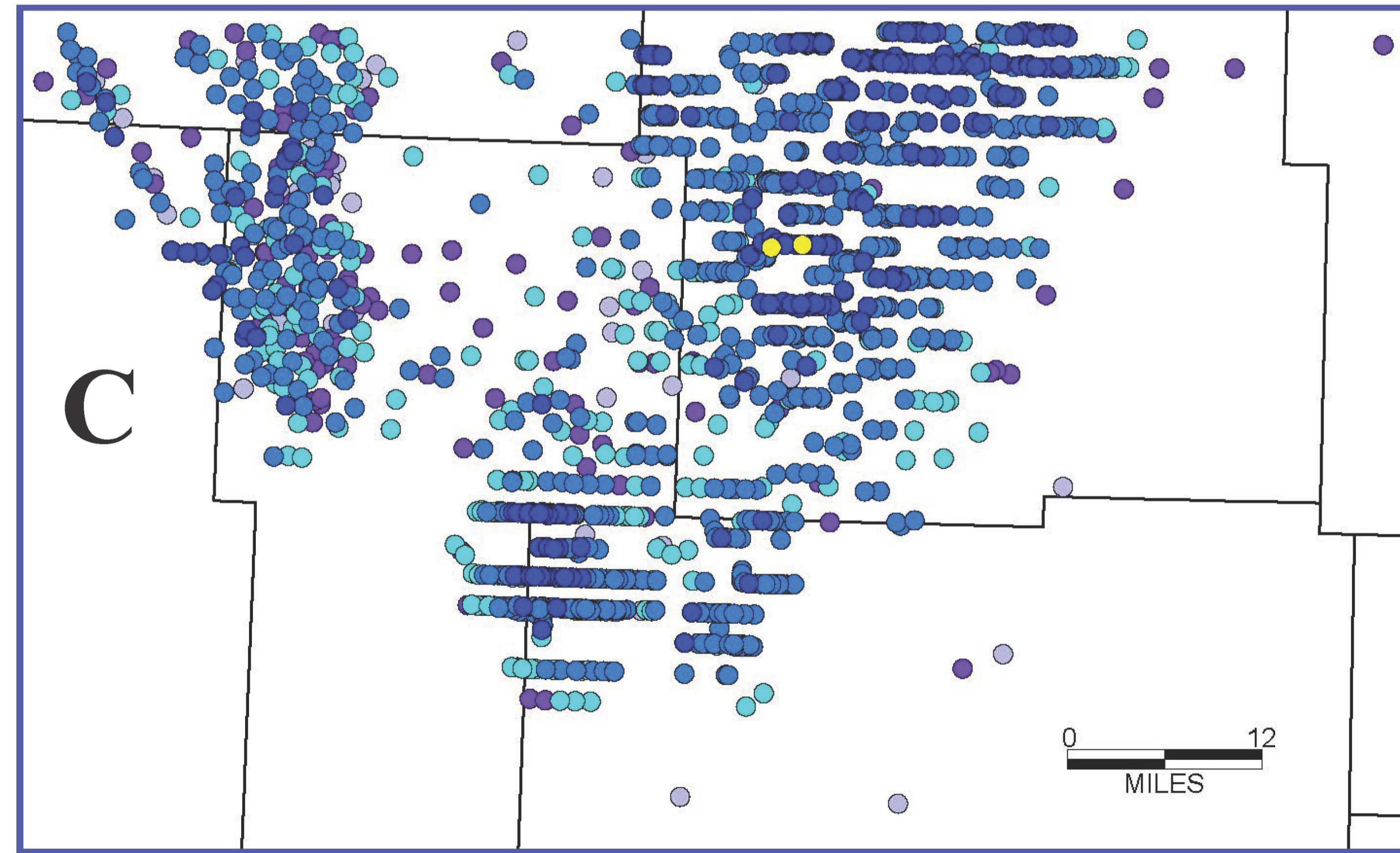
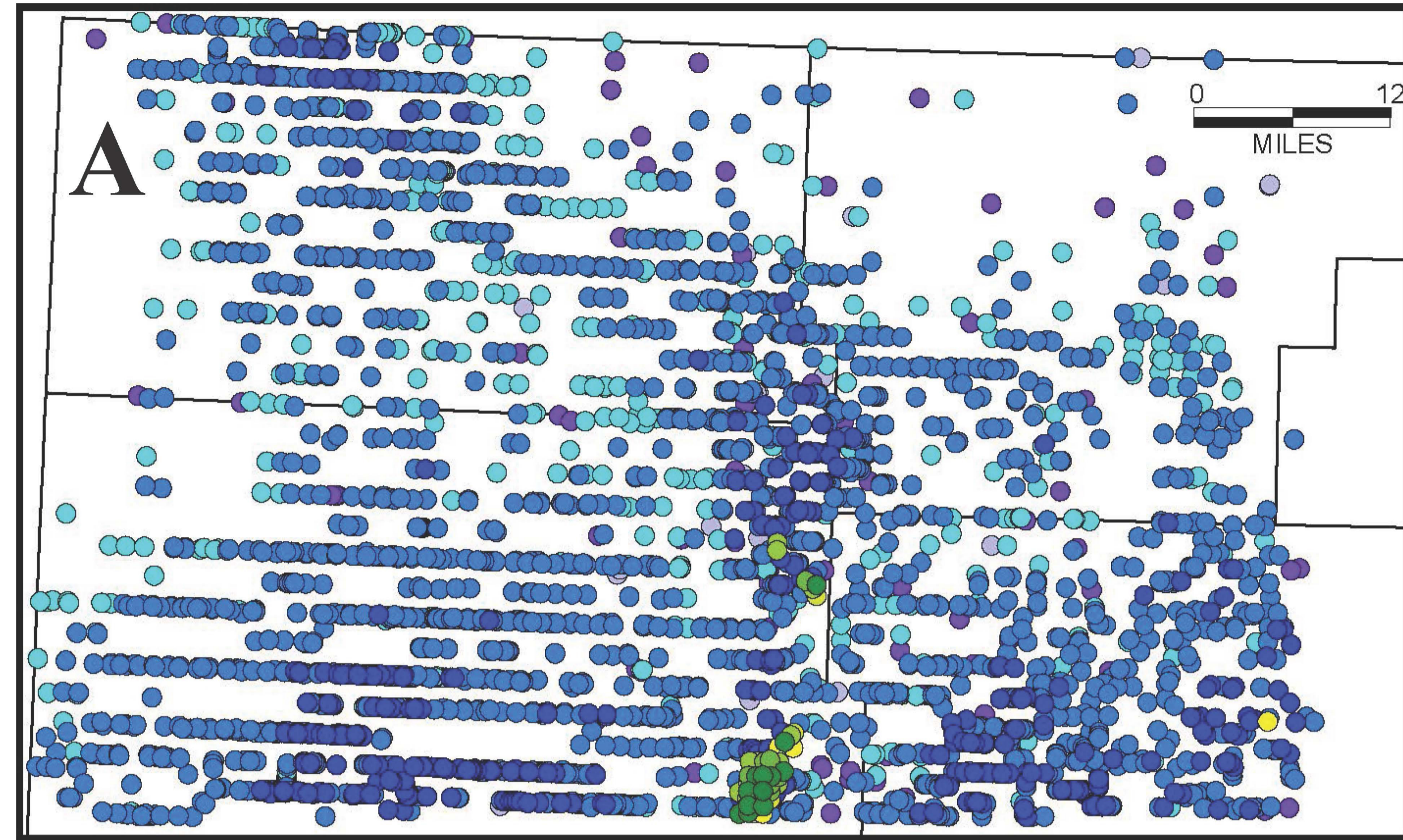
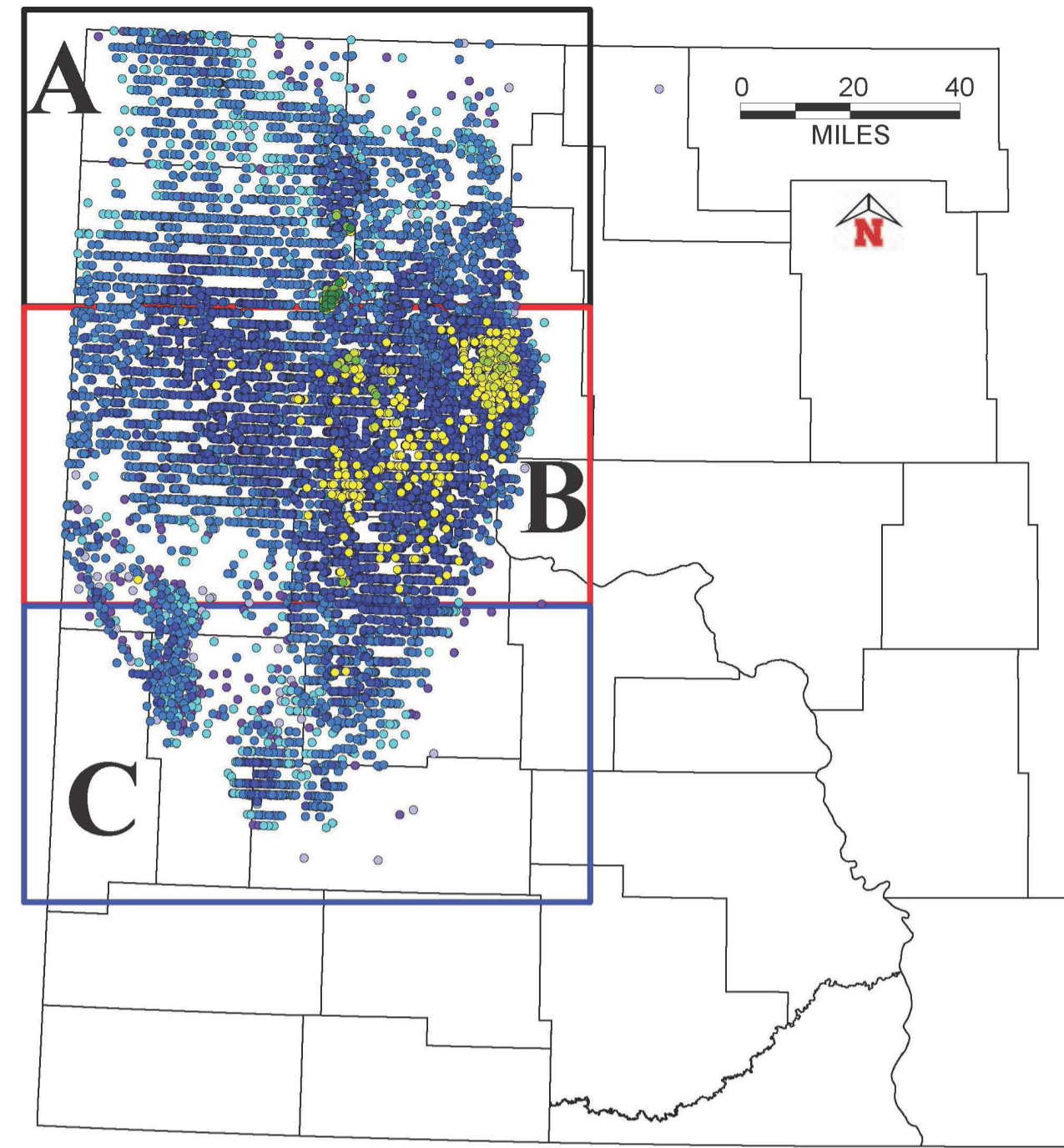
- Bakken
- Bakken/Three Forks
- Lodgepole/Bakken
- Three Forks
- Sanish (Pronghorn Sands)



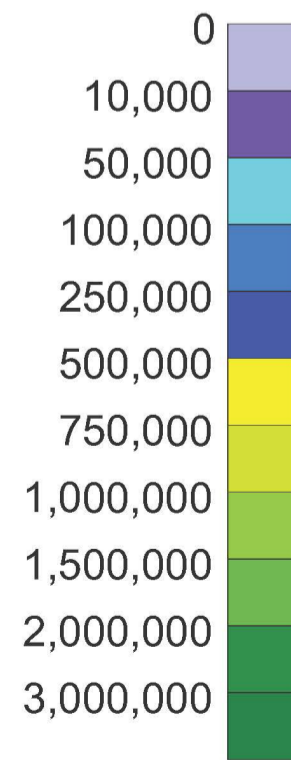


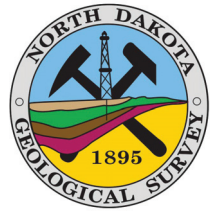
# BAKKEN PETROLEUM SYSTEM CUM OIL PRODUCTION

Travis D. Stoll Dorf  
2020



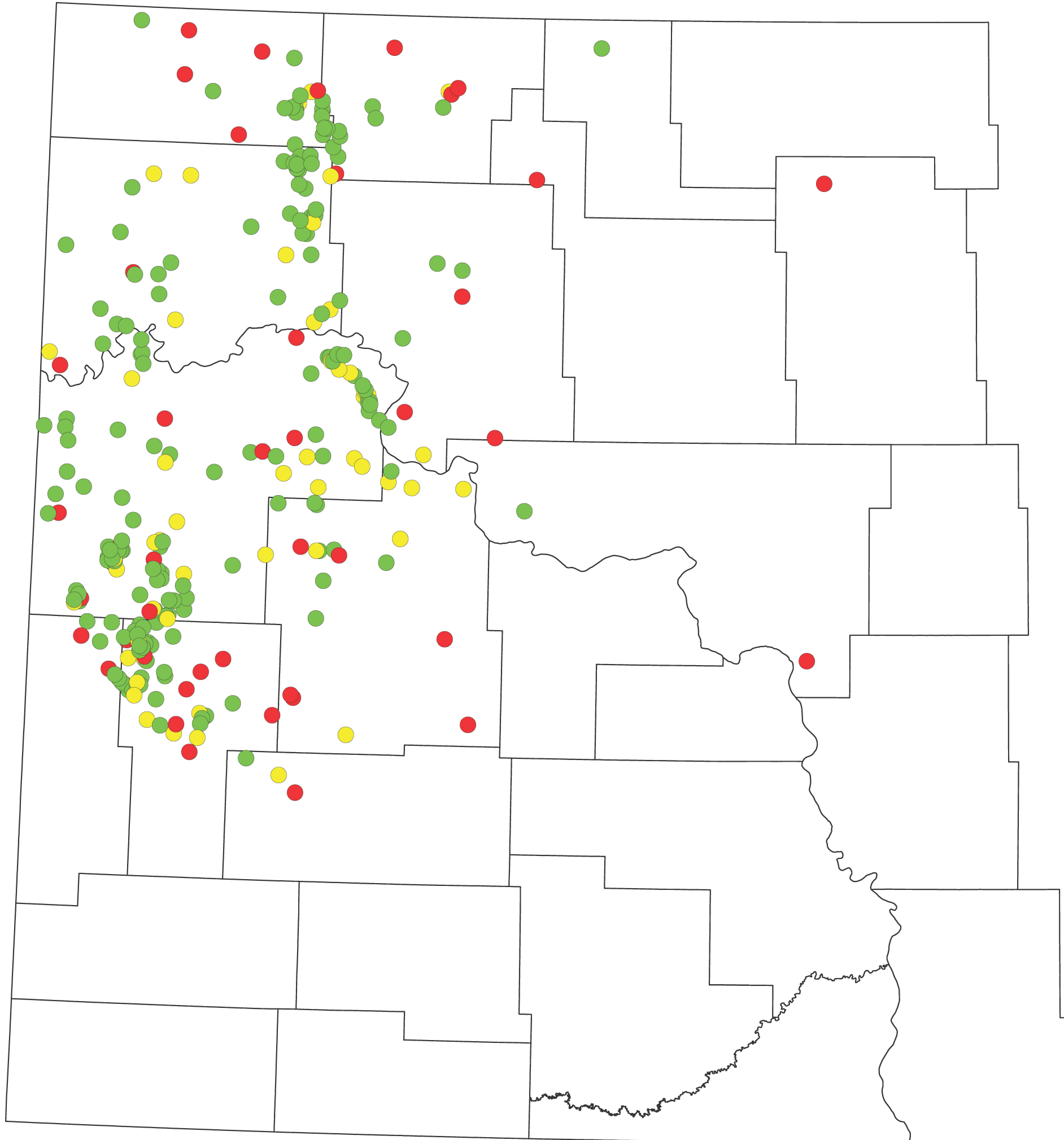
CUM OIL  
(BBLs)








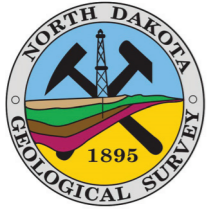
# BAKKEN DRILL STEM TEST RESULTS

Travis D. Stollendorf  
2020



-  **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





# BAKKEN OIL PRODUCTION

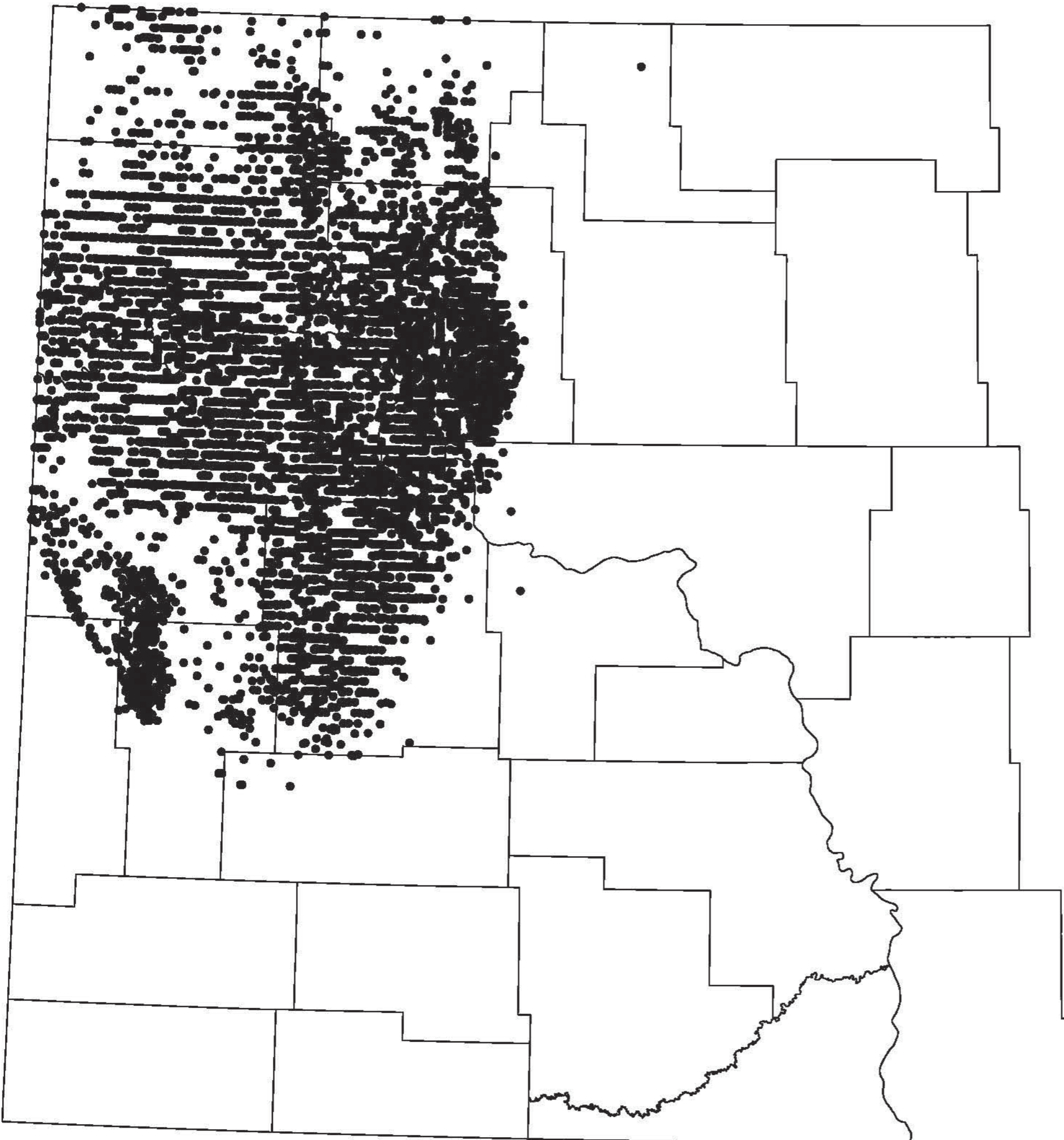
Travis D. Stolldorf  
2020

● Bakken Production

NDIC Production Pools Utilized  
Bakken



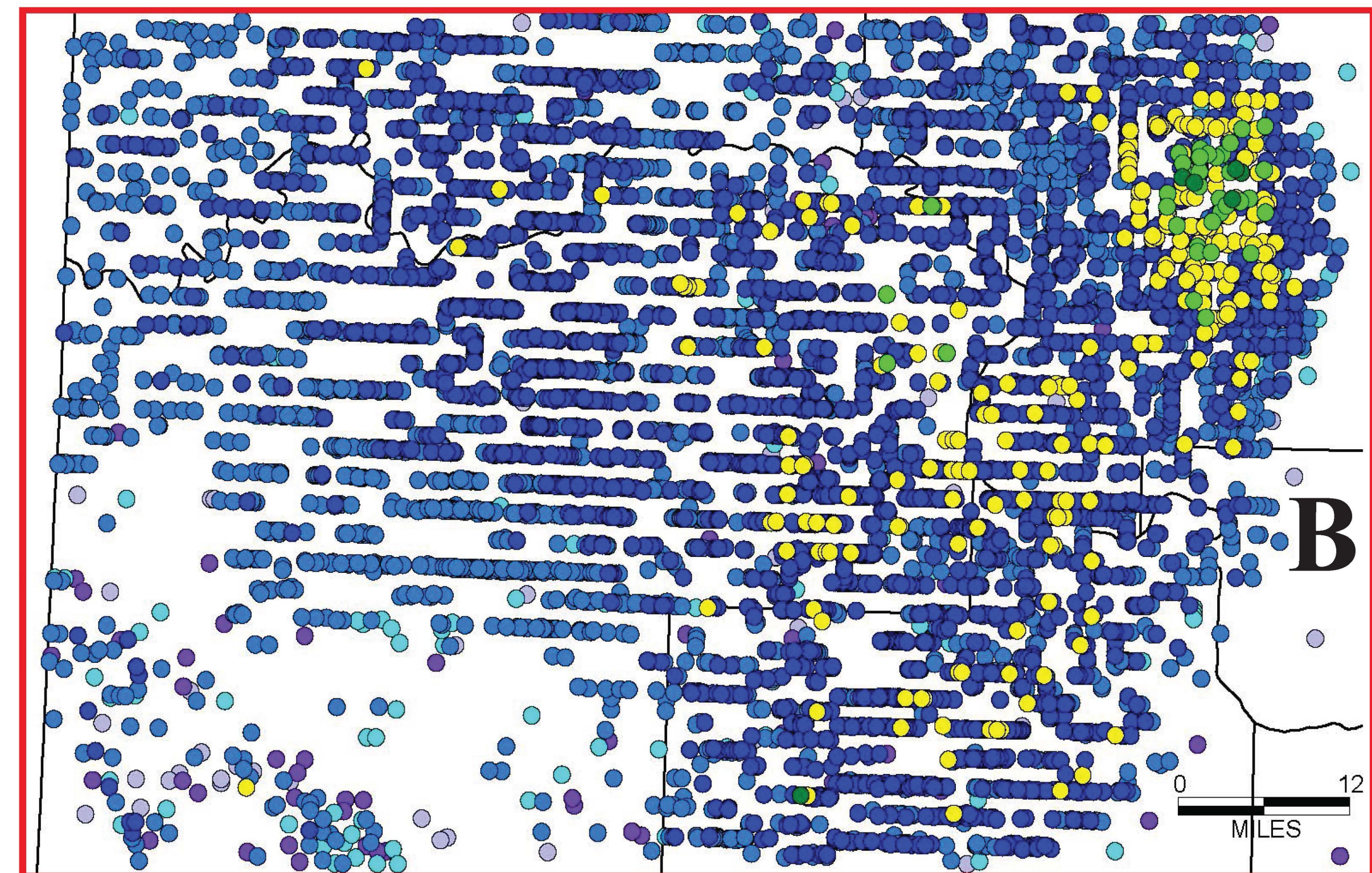
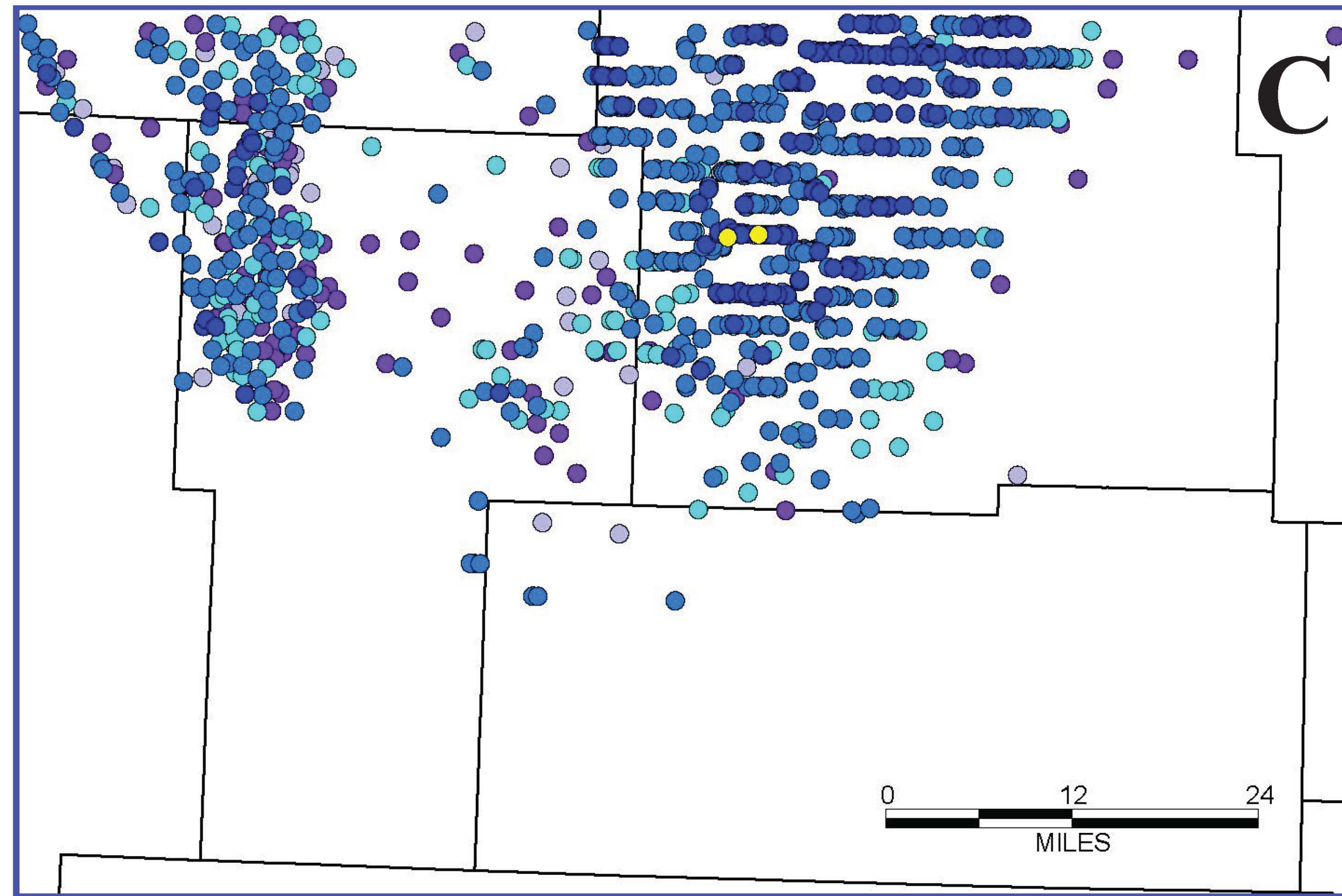
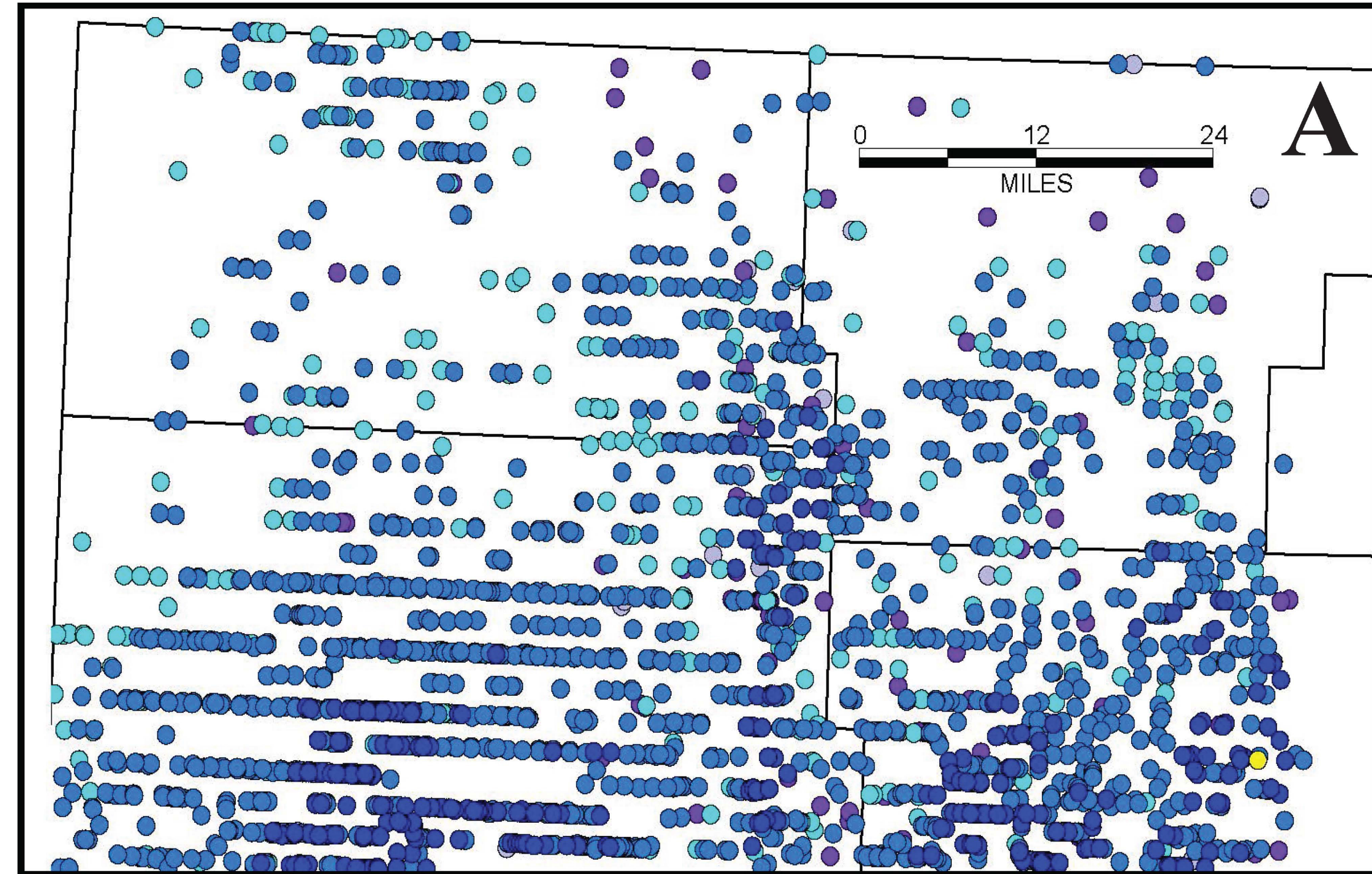
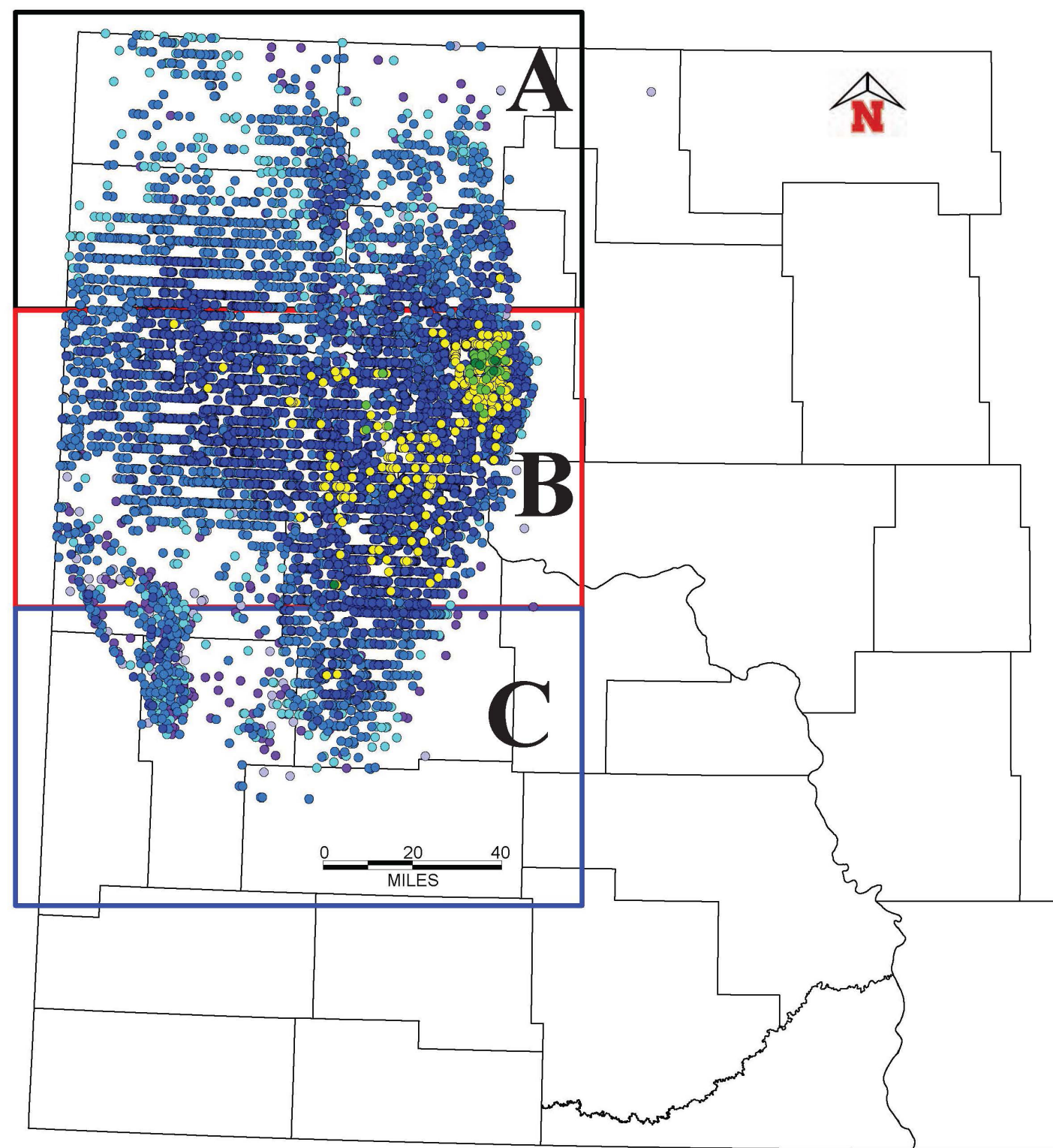
0 20 40  
MILES



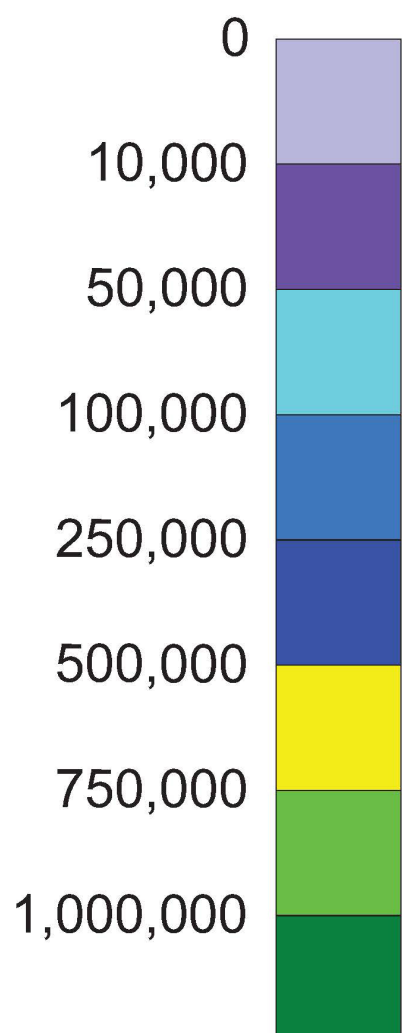


# BAKKEN CUM OIL PRODUCTION

Travis D. Stolldorf  
2020



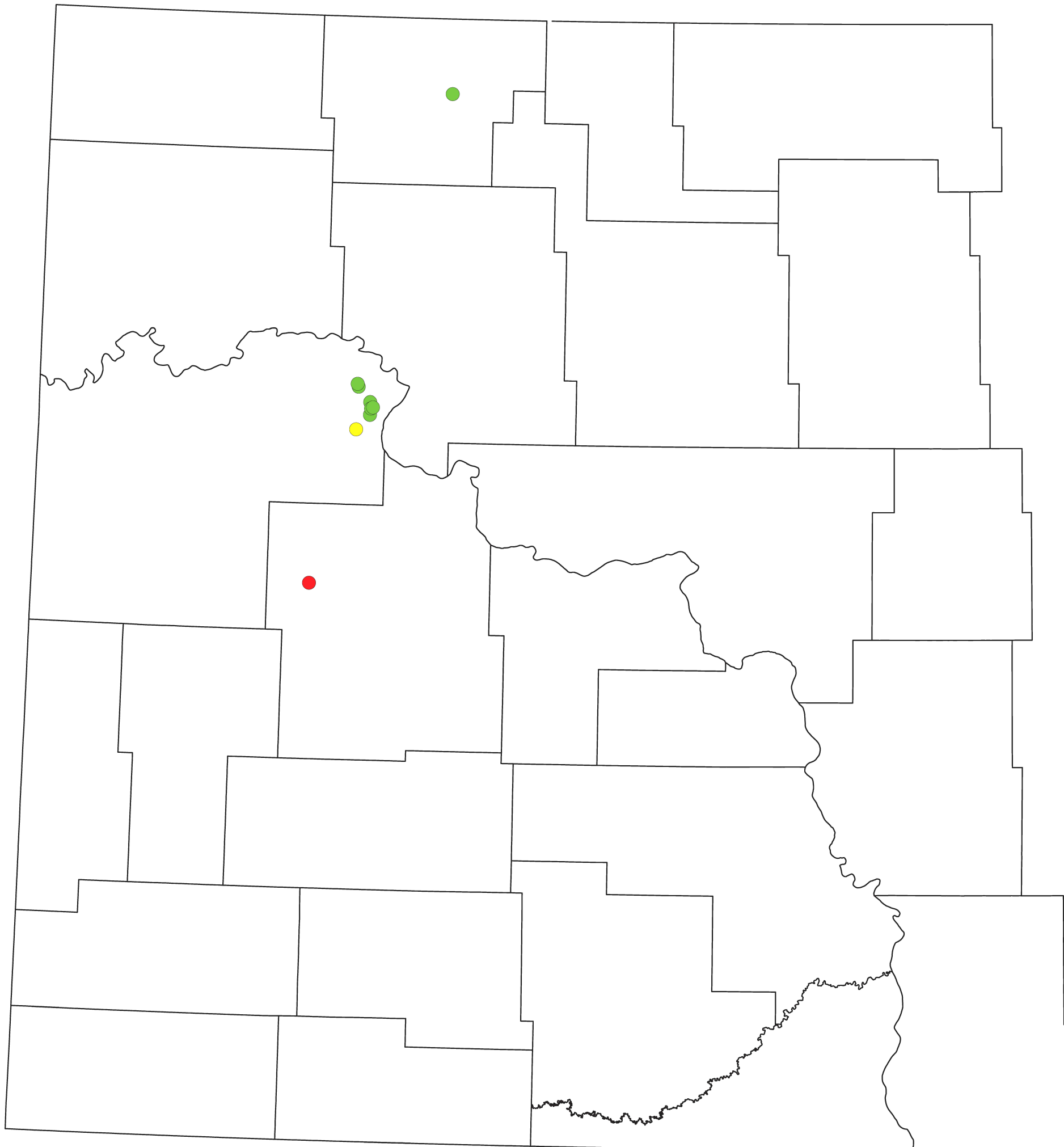
CUM OIL  
(BBLS)





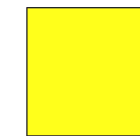
# SANISH (Pronghorn Sands) DRILL STEM TEST RESULTS

Travis D. Stolldorf  
2020



### 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



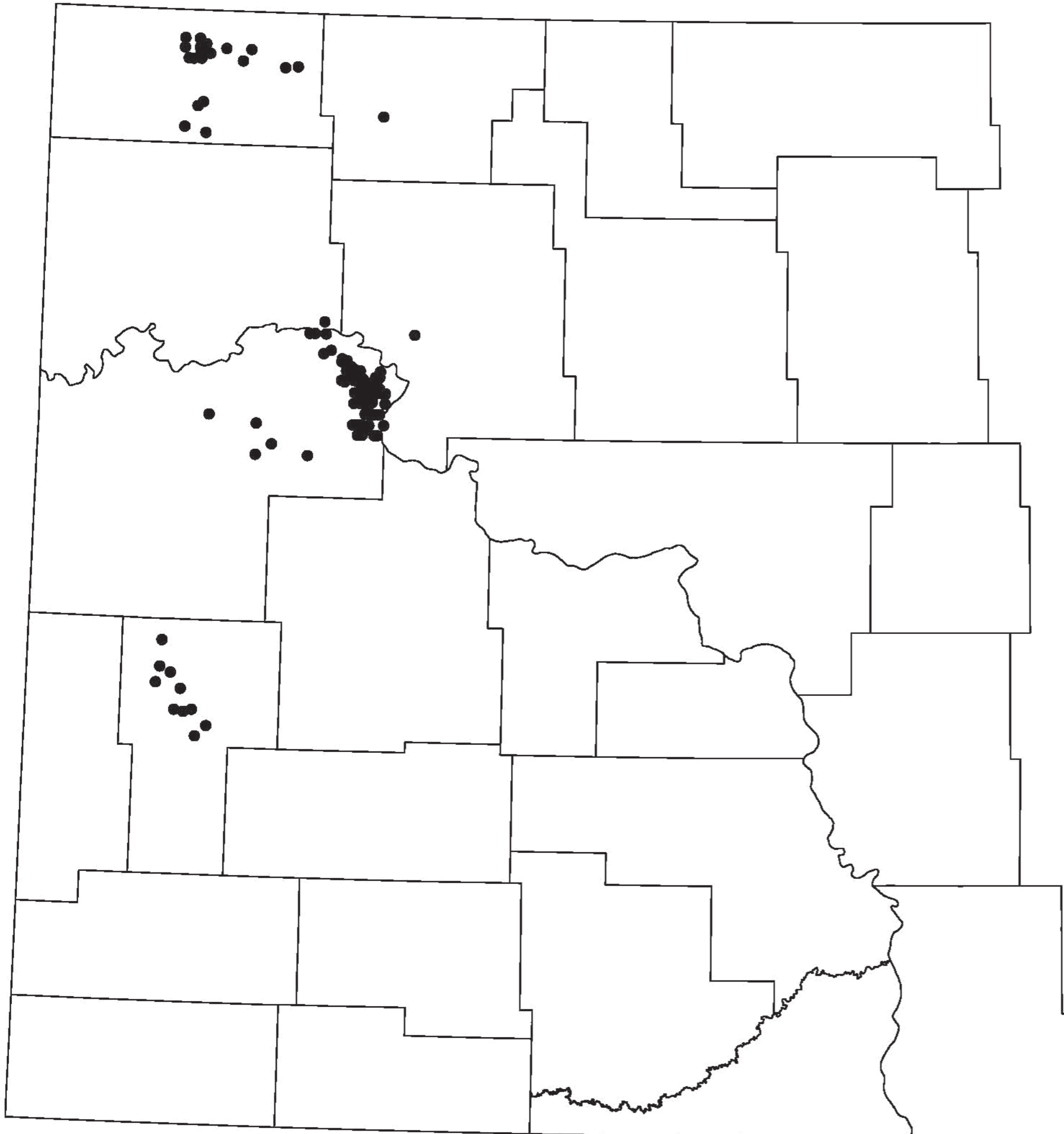


# SANISH (Pronghorn Sands) OIL PRODUCTION

Travis D. Stollendorf  
2020

● Sanish Production  
(Pronghorn Sands)

NDIC Production Pools Utilized  
Sanish

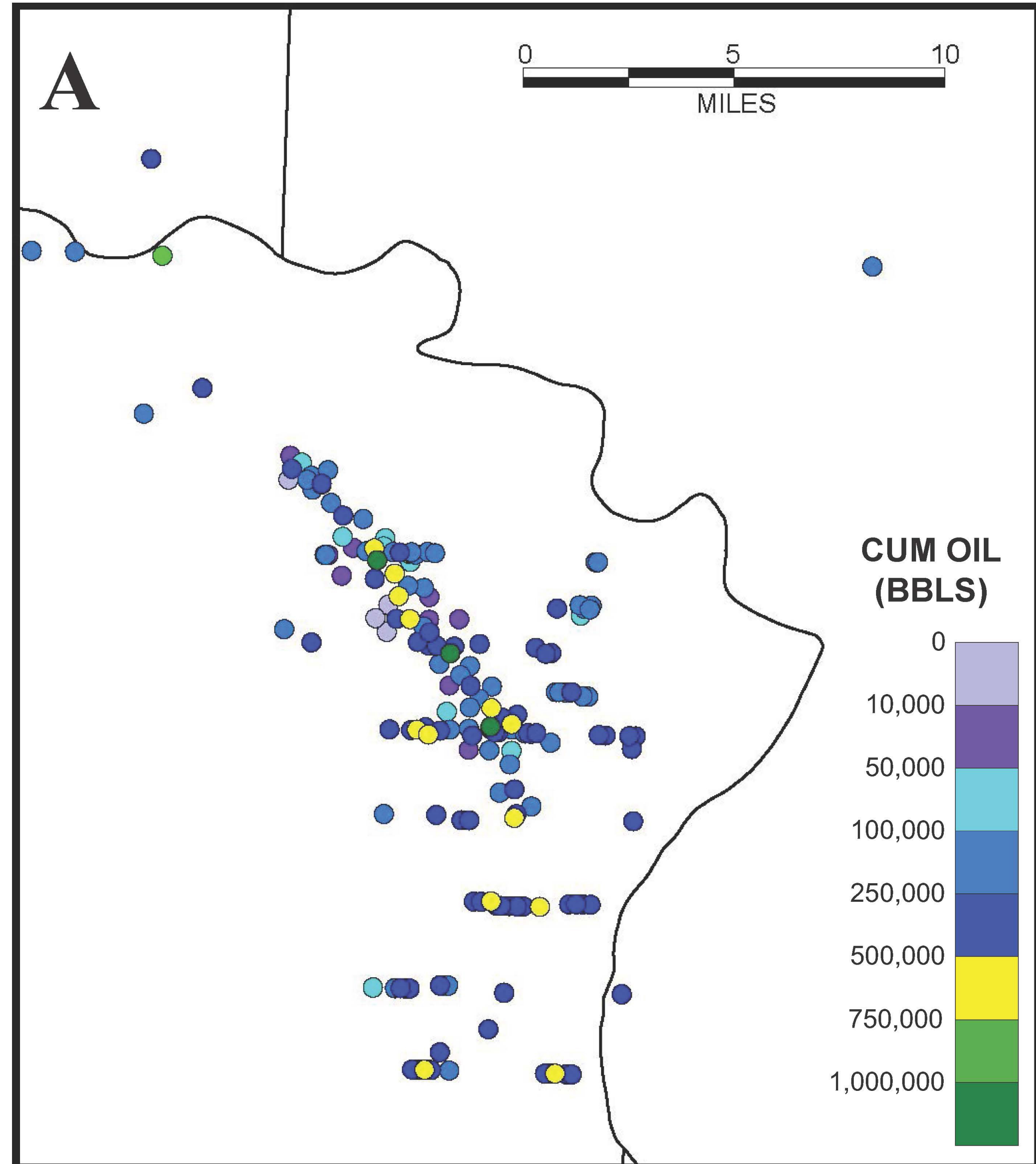
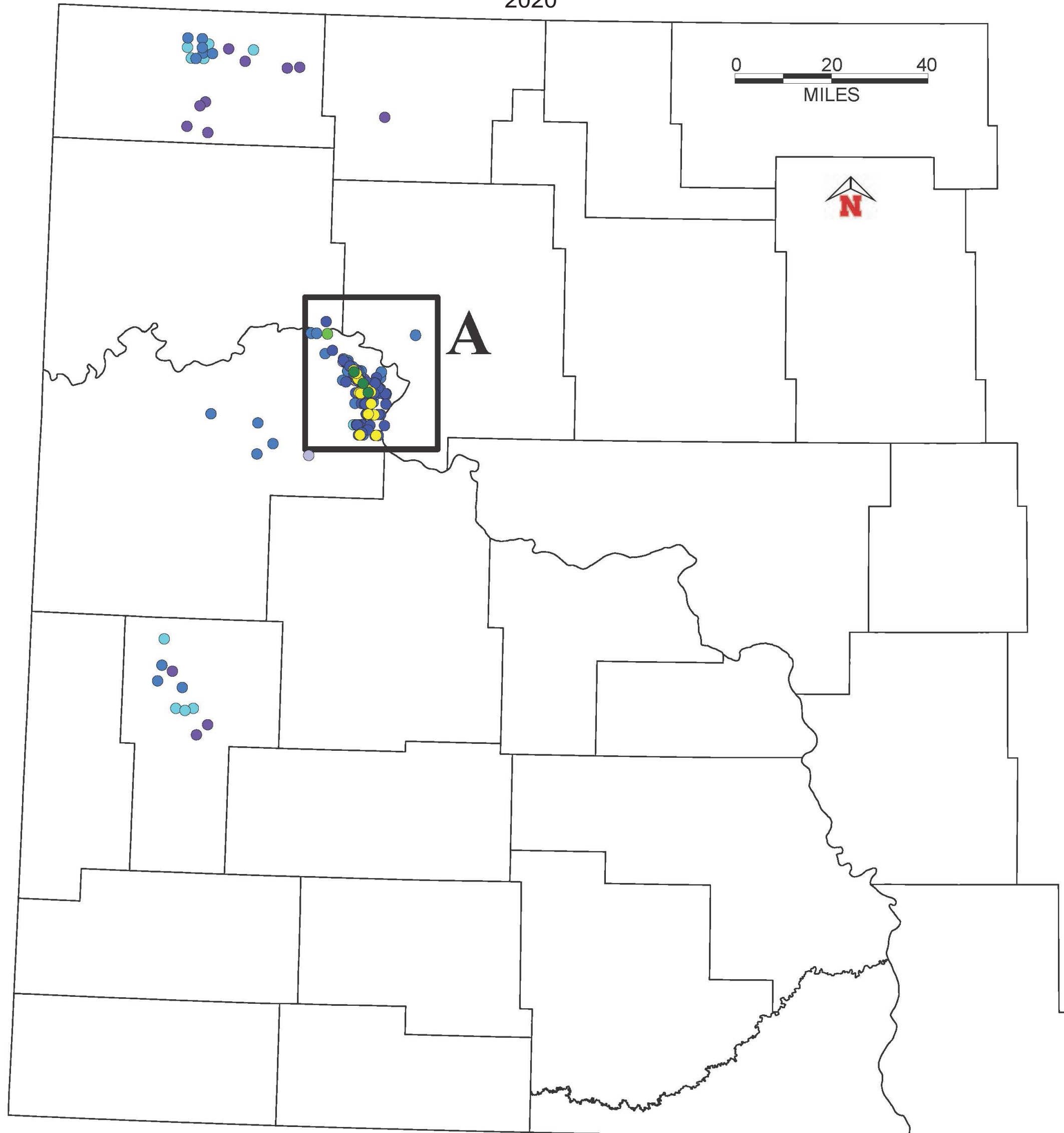






# SANISH CUM OIL PRODUCTION (Pronghorn Sands)

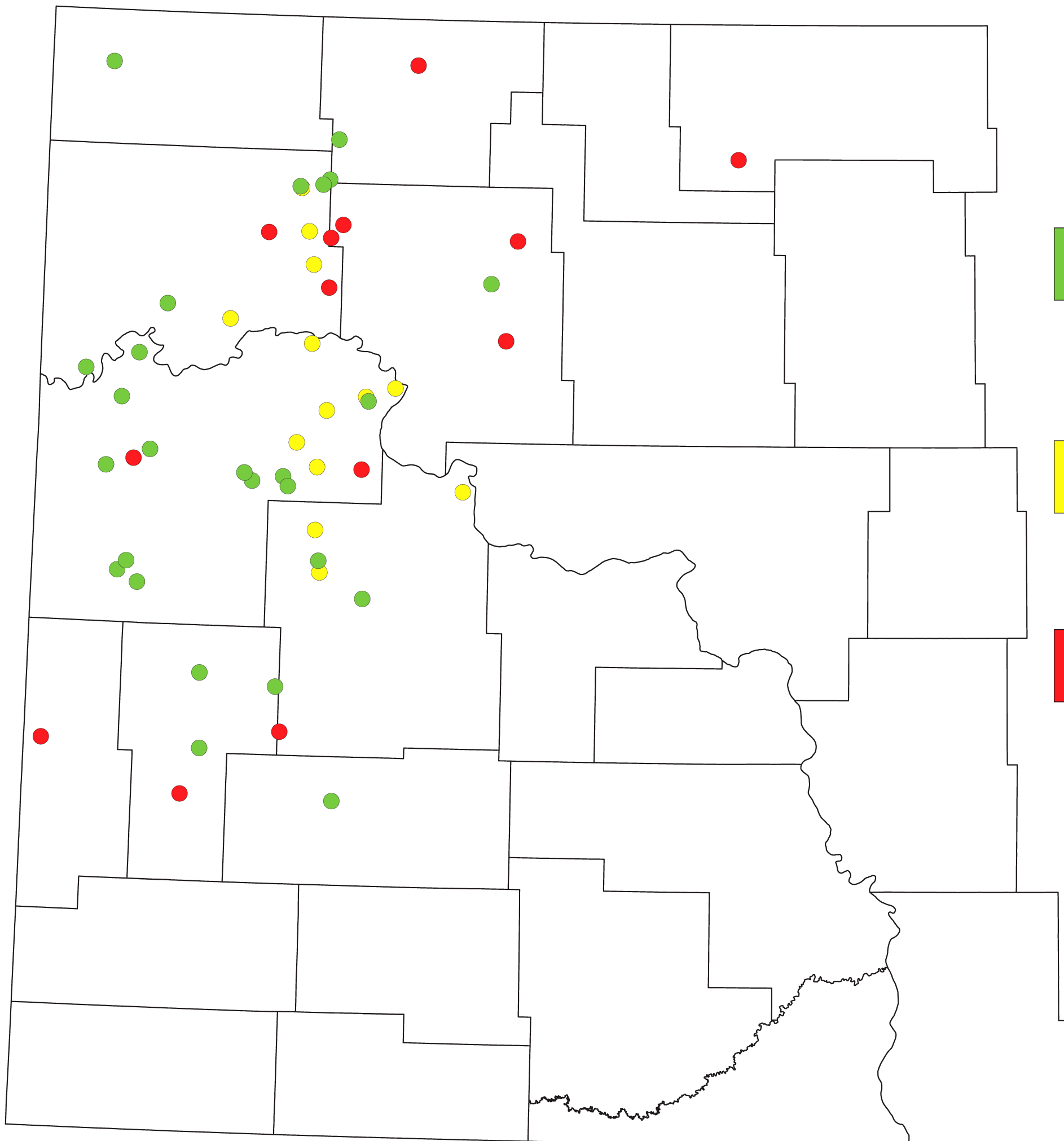
Travis D. Stollendorf  
2020


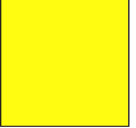





# THREE FORKS DRILL STEM TEST RESULTS

Travis D. Stolldorf  
2020



-  **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



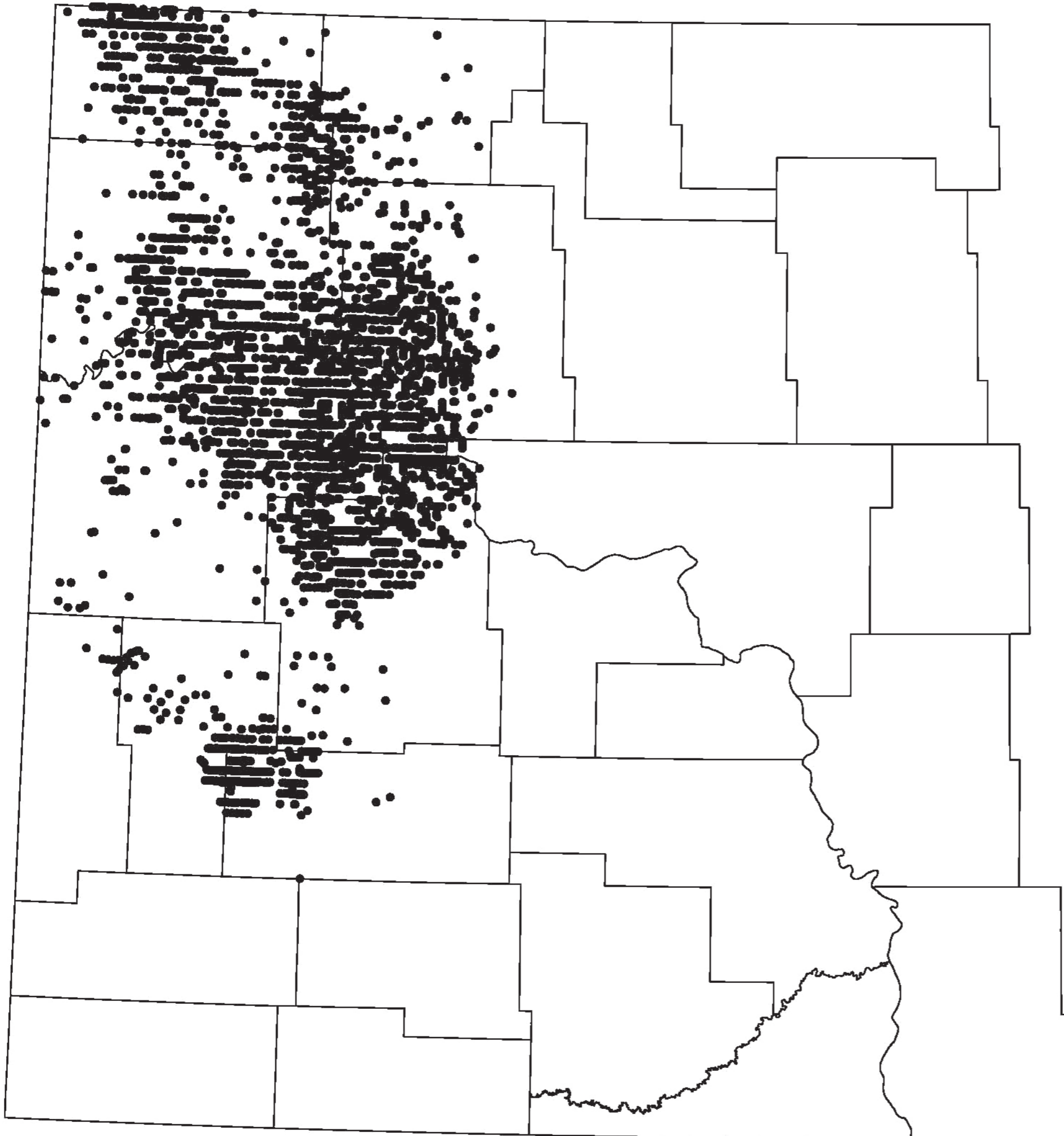


# THREE FORKS OIL PRODUCTION

Travis D. Stollendorf  
2020

● Three Forks Production

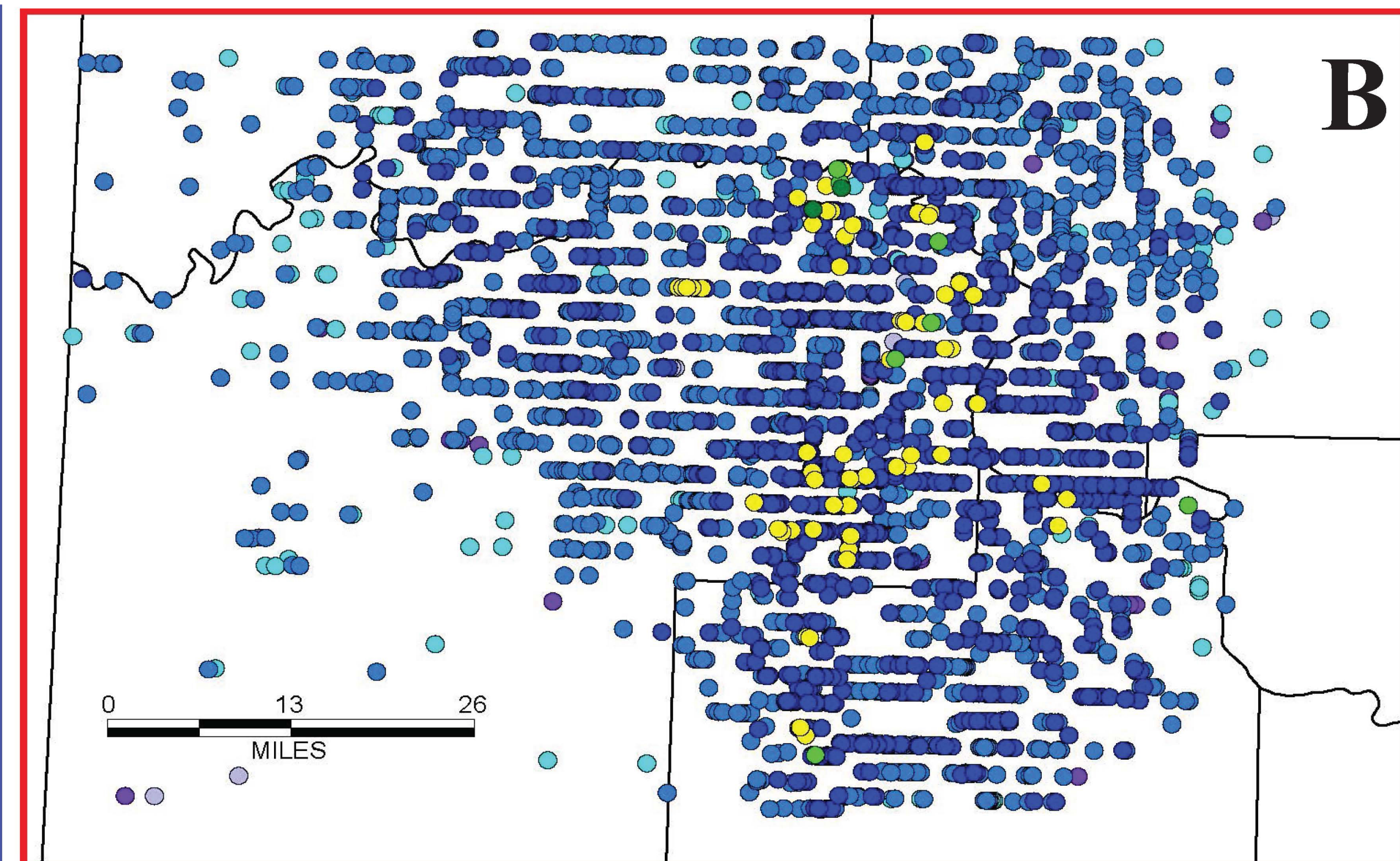
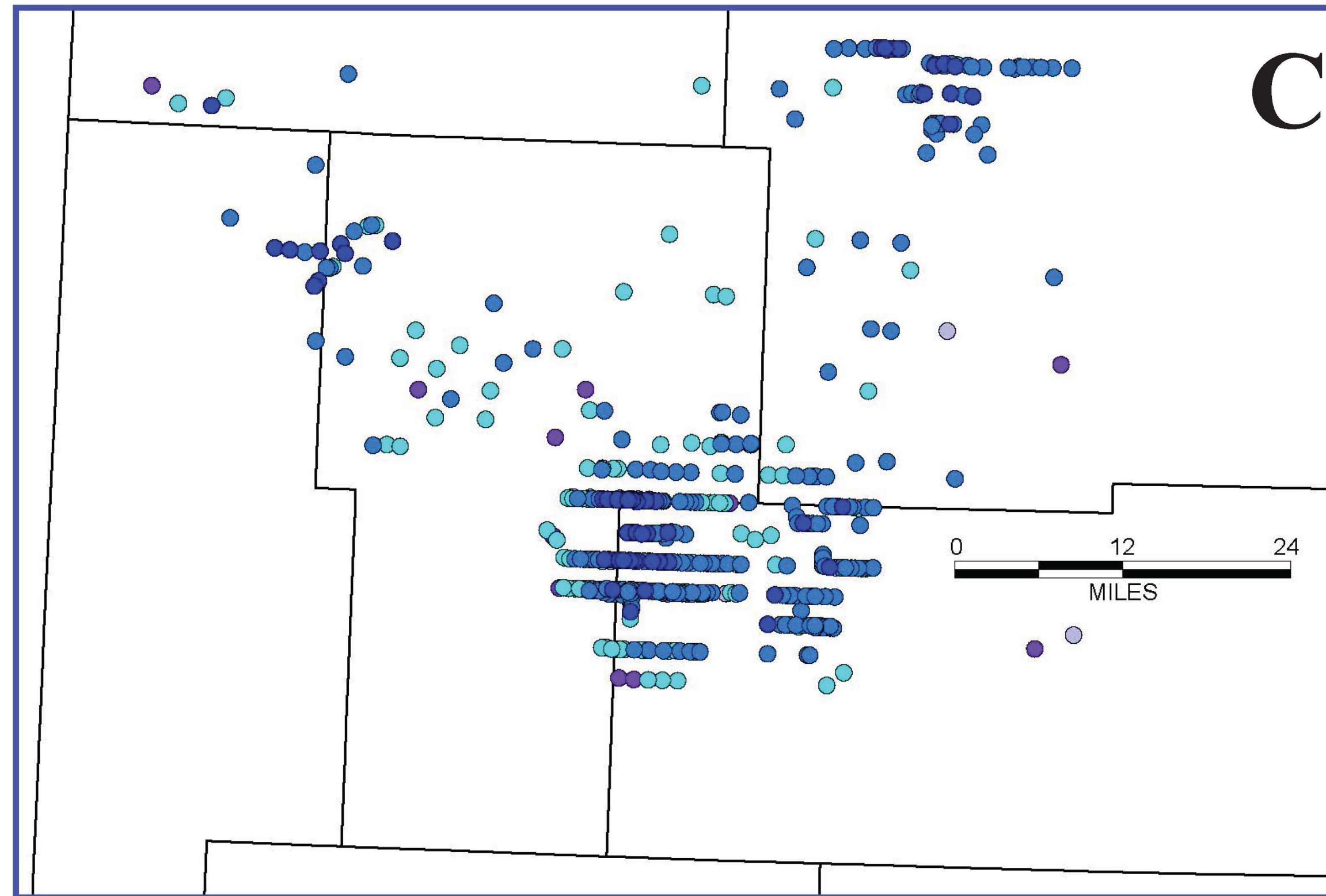
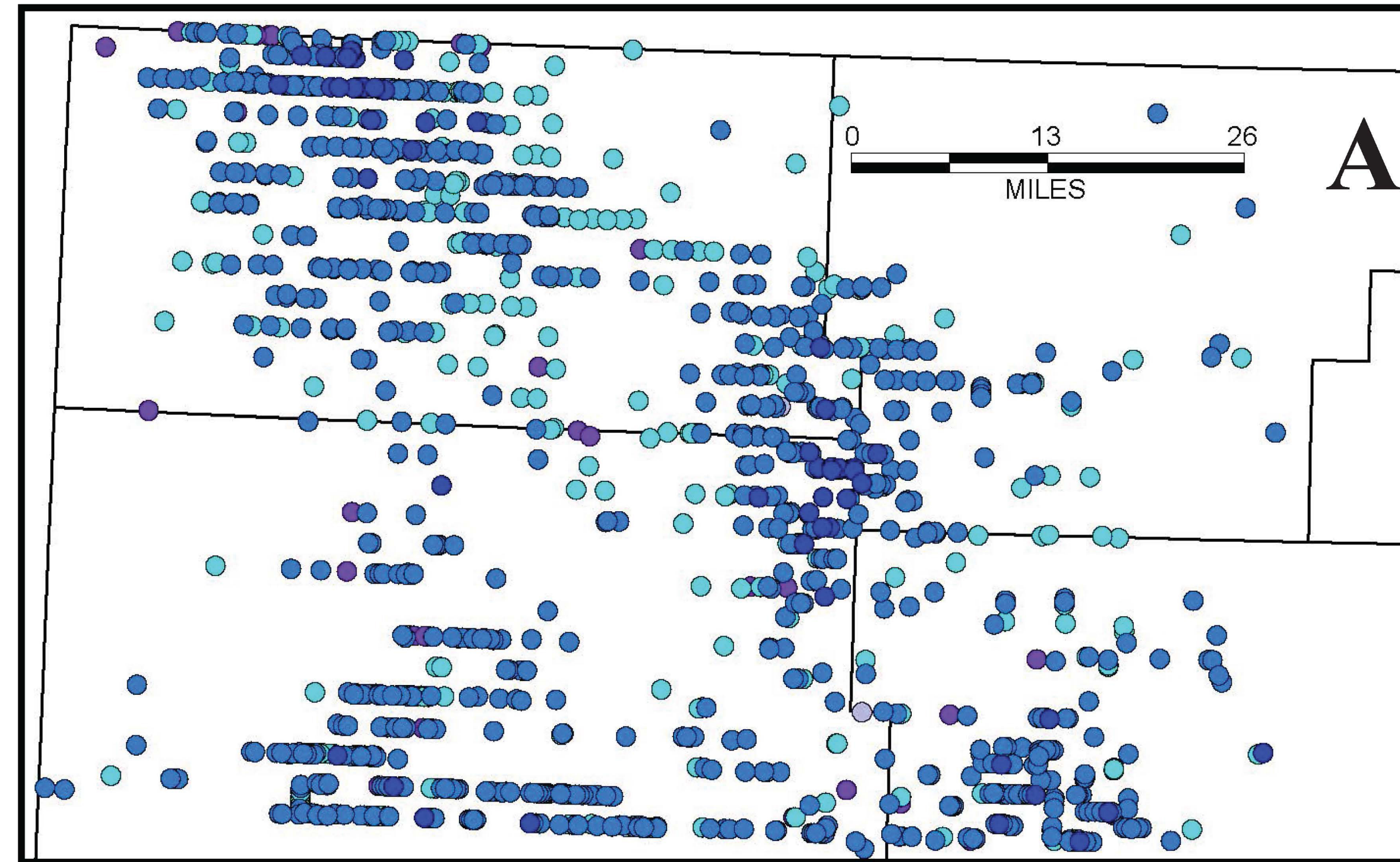
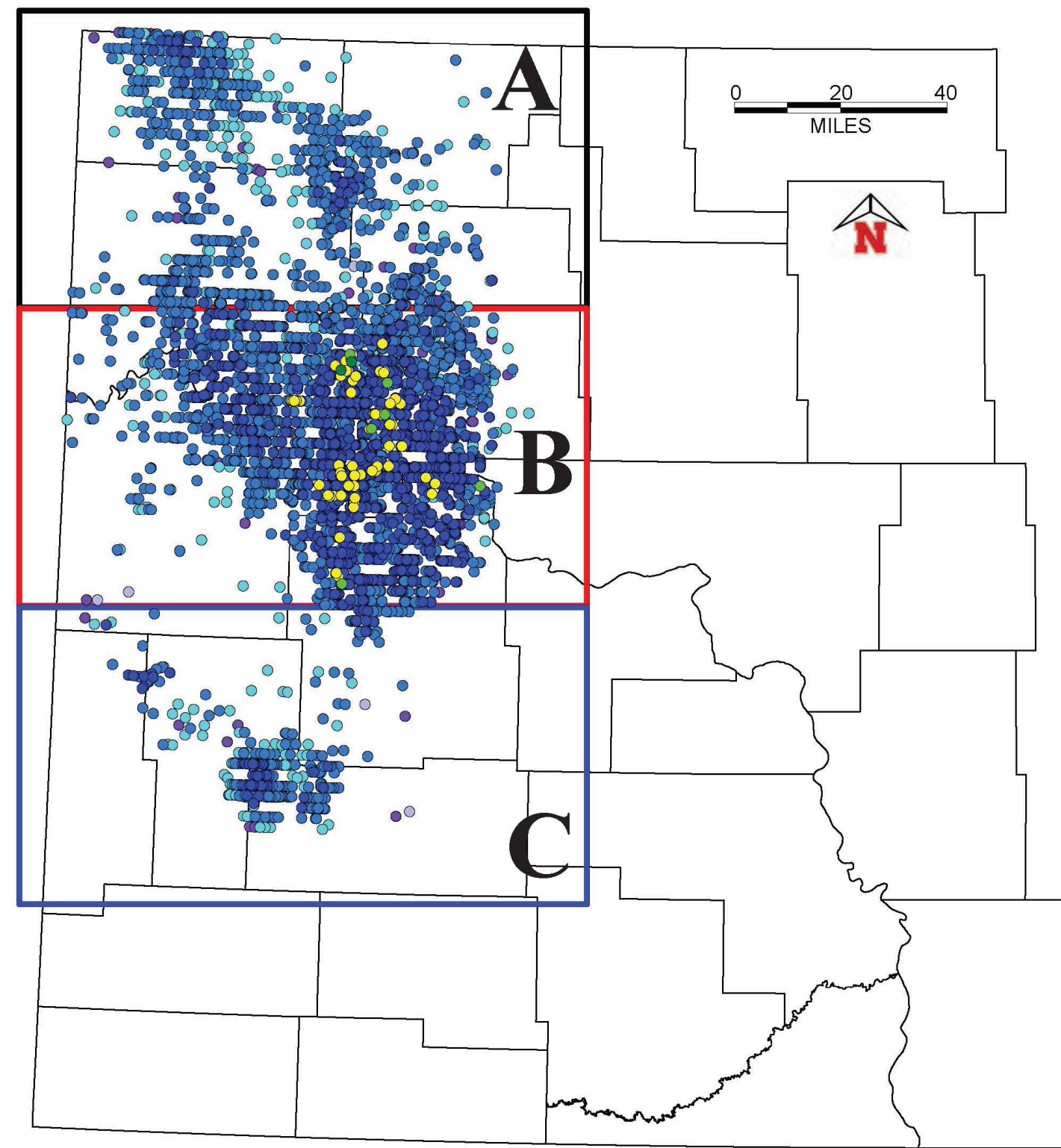
NDIC Production Pools Utilized  
Three Forks





# THREE FORKS CUM OIL PRODUCTION

Travis D. Stollendorf  
2020



CUM OIL  
(BBLs)

