ANTHROPOGENIC IMPACTS ON THE RIO GRANDE DELTA: SEDIMENT, FLOW, AND PRECIPITATION IN THE DELTA

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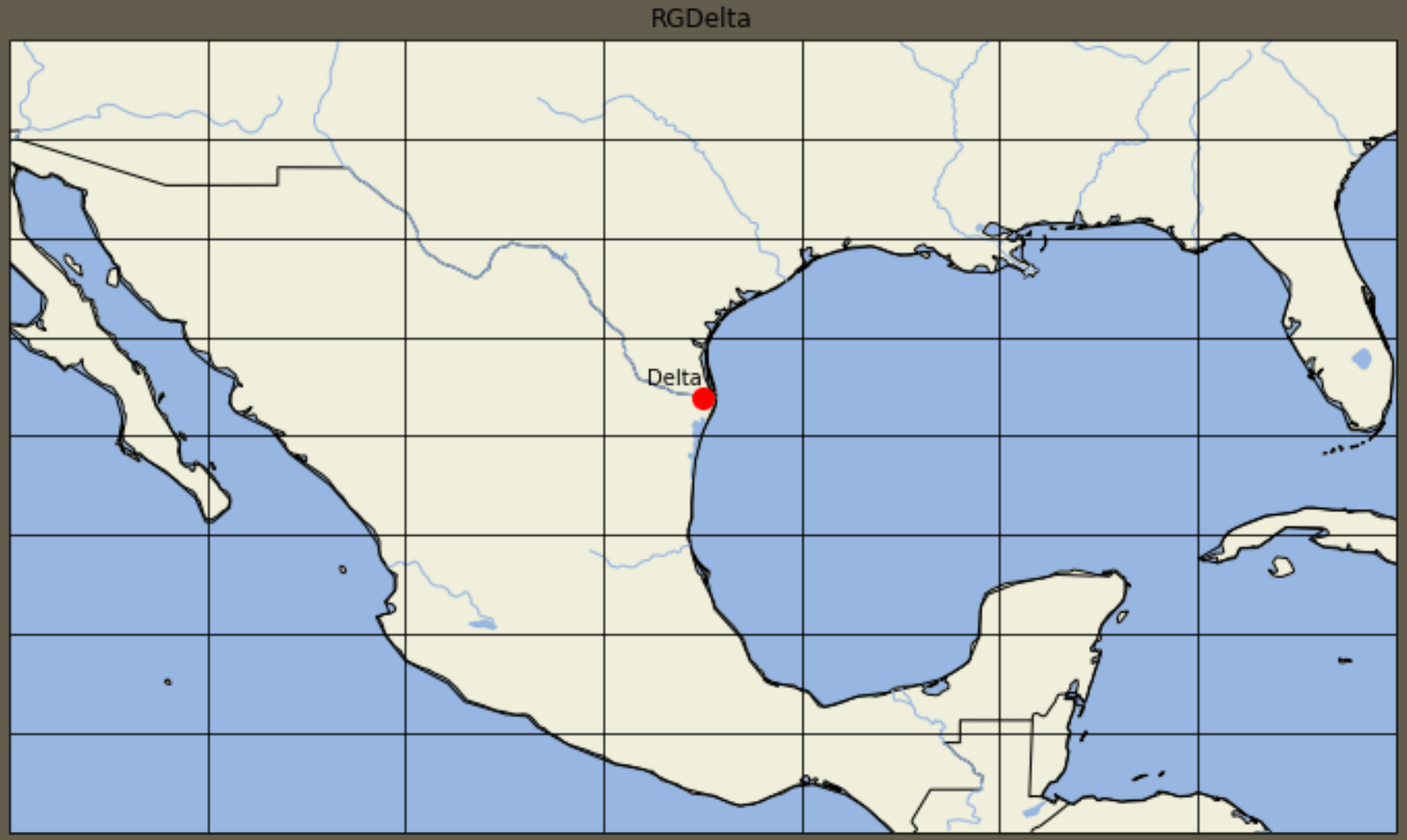
MARS 5170

RIO GRANDE DELTA



- River length: 90 km
- Delta area: 7,770 Km
  - Starts at the boundary line between Cameron county and Hidalgo county (90 km from the mouth)
  - Shoreline: 300 km
- Population: 600,000

HUMAN ACTIVITY IN RIO GRANDE DELTA

- Increasing necessity of water management encouraged U.S Congress to approve the construction of the first dam on the Rio Grande
  - In 1916, Elephant Butt Dam was completed
- In 1944, Mexico and the United States signed a new treaty allowing both countries to build and operate dams on the Rio Grande
  - In total, 13 major dams and diversions have been built; many more exist in the tributaries.
- Falcon Dam and Amistad Dam are located two of the biggest dams in the Rio Grande and are located new near the delta, which is an unusual place for dams.

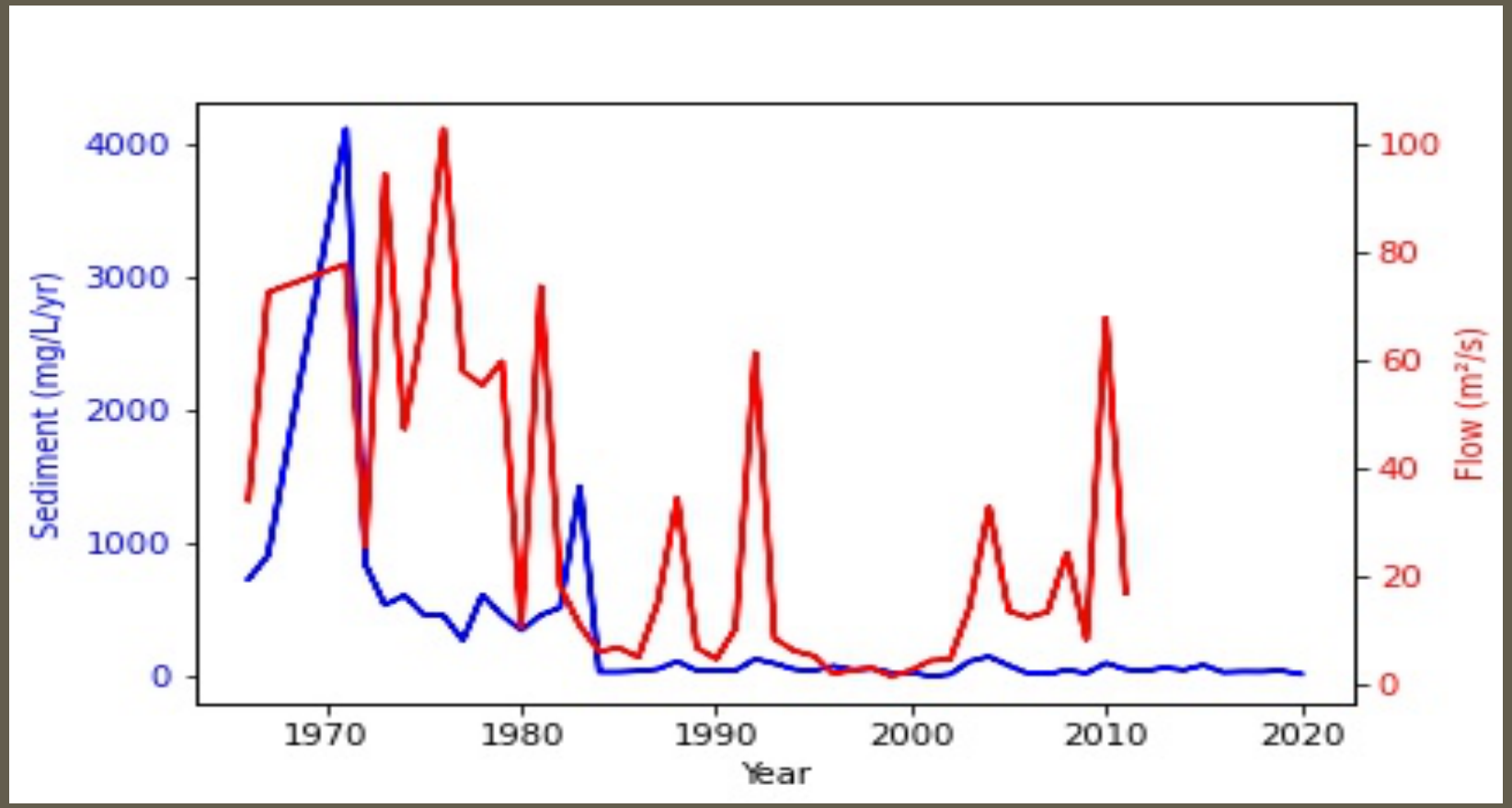
HYPOTHESIS

- The dramatic growth of human activity on the Rio Grande basin has resulted in a decline in sediment concentration and water discharge reaching the Rio Grande delta

METHODS

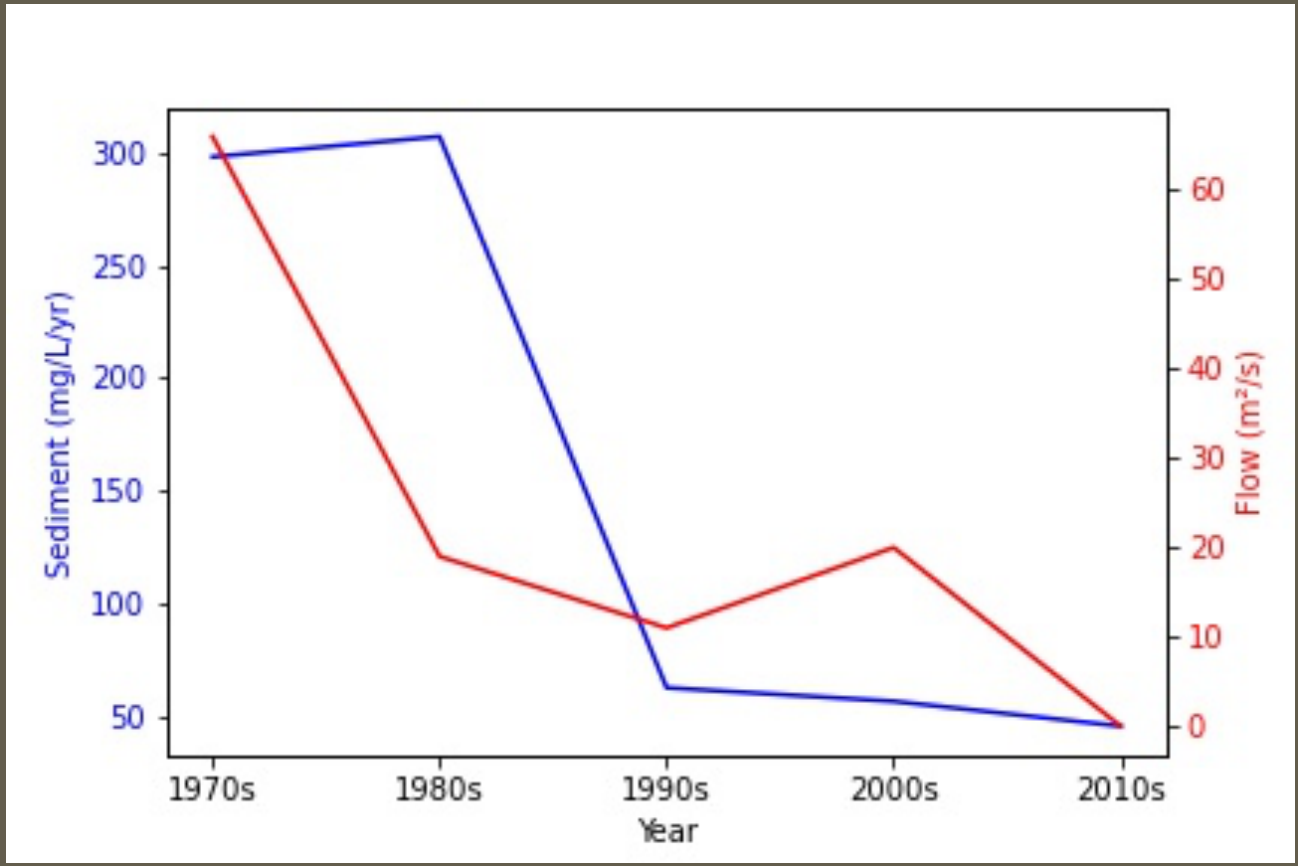
- Discharge data was obtained from the International Boundary and Water Commission
- Suspended sediment data was obtained from the USGS National Water Information System
- Precipitation data was obtained from NOAA.
- Python was used to analyzed data from the Rio Grande Delta and precipitation
  - Grouped data by decades to see a simplified result
  - Execute simple statistical analysis on sediment and flow data to understand the magnitude of the change.
  - Look at precipitation data as a possible explanation for the decline in water discharge

RIVER DATA



SSC 82% reduction – Flow 99% reduction

RESULTS
REDUCTION OF SEDIMENT CONCENTRATION AND FLOW

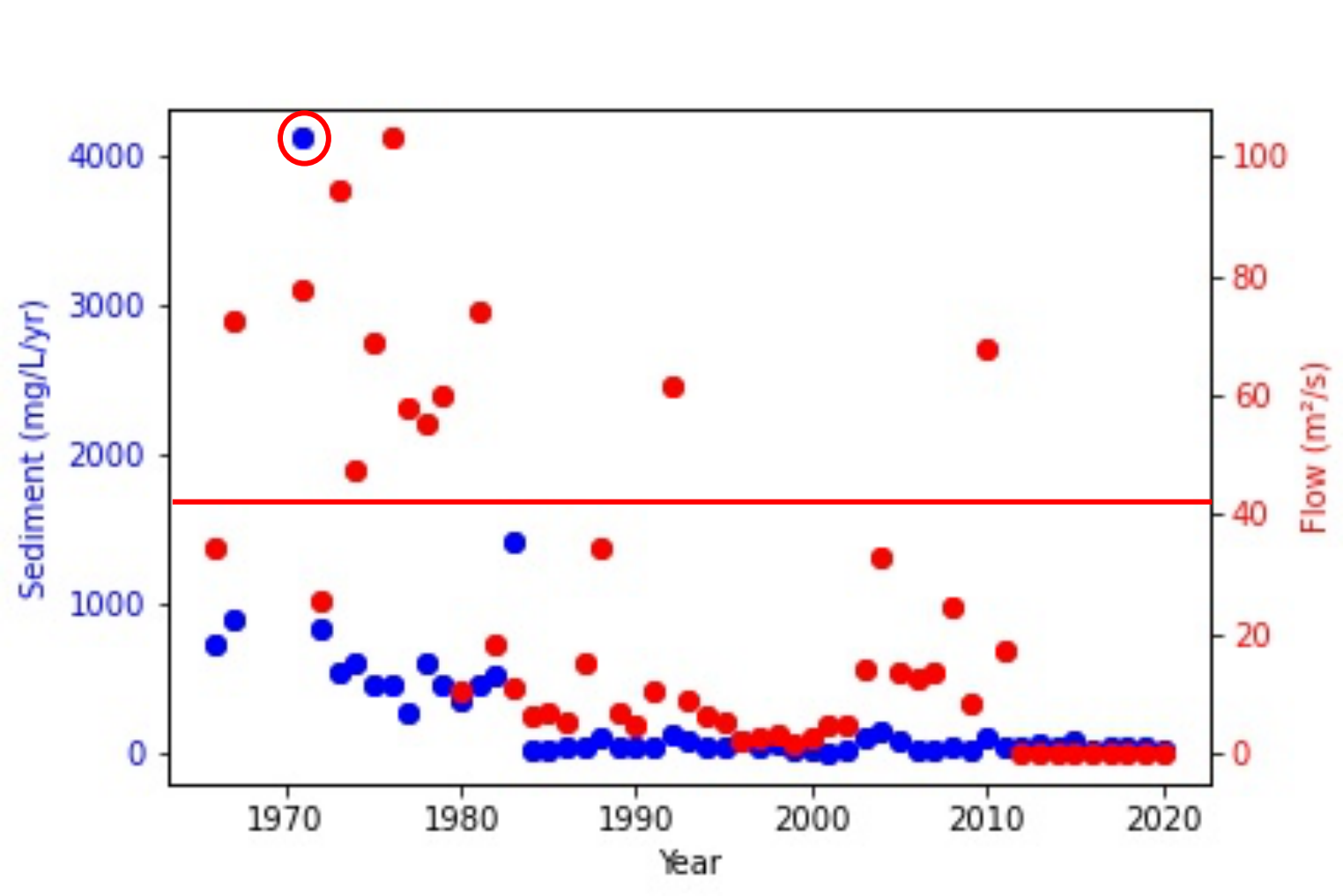


	DecadesSSC	DecadesFlow
1970s	298	66.0
1980s	307	19.0
1990s	63	11.0
2000s	57	20.0
2010s	46	0.0

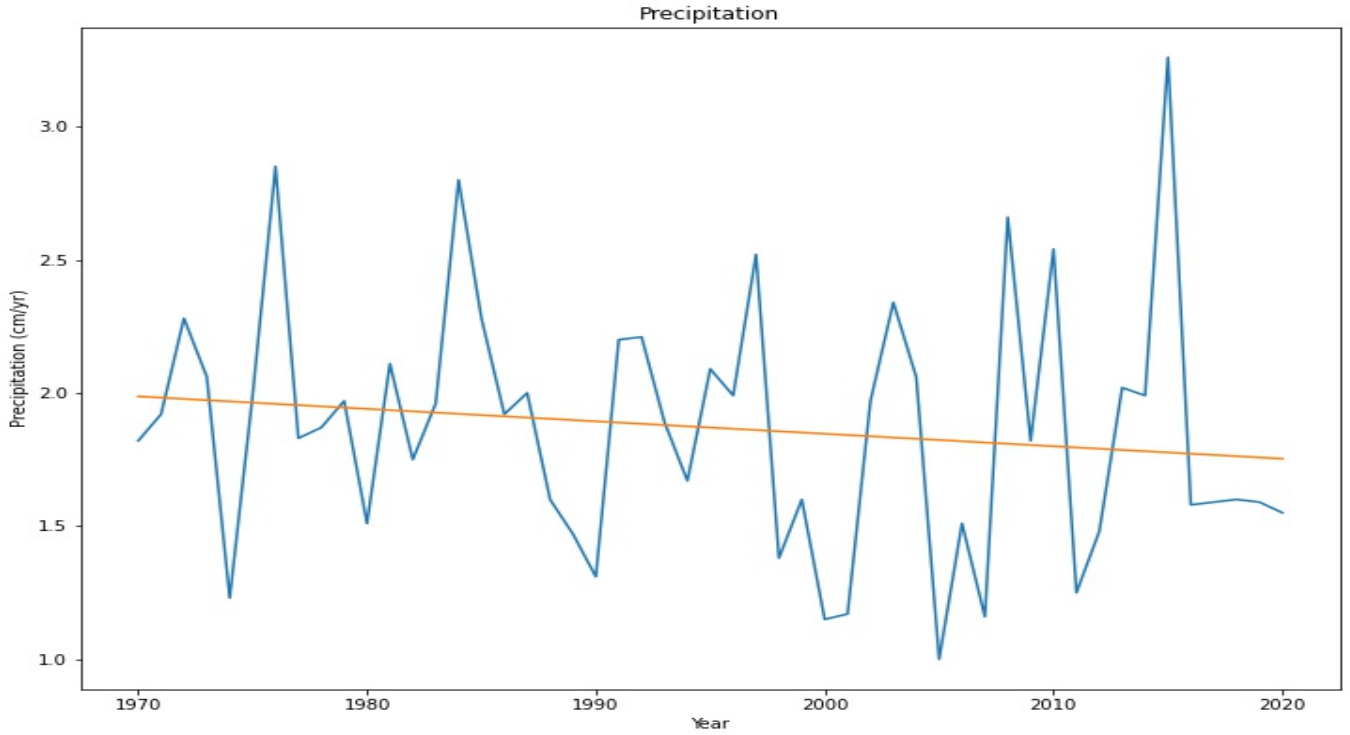
- Overall average: 283 SSC and 28 Flow

RESULTS
SECONDARY FINDINGS

- Sediment
  - Standard deviation: 609
  - Variance: 370934
- Flow
  - Standard deviation: 28
  - Variance: 810

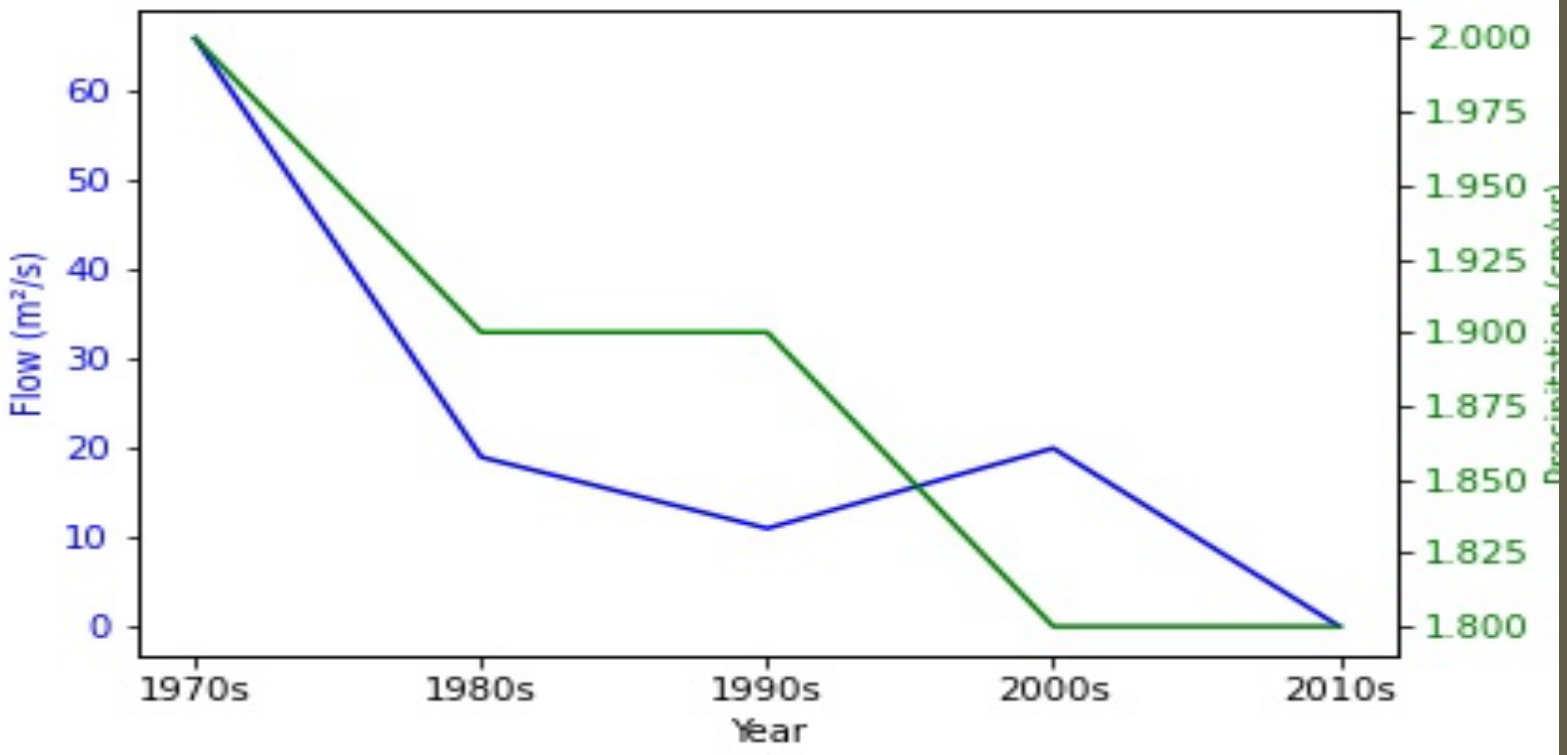


PRECIPITATION IN THE RIO GRANDE DELTA



- Precipitation has been in declined since the 1970s
  - Relatively small decline, still of great concern
- Most likely due to human activity
- Possible cause for the decline in flow?

RESULTS
FLOW AND PRECIPITATION



- Precipitation and flow have been in declined in a similar pattern
- They have not decline in same pattern, but still can be a major cause

DECLINE IN SSC, FLOW, PRECIPITATION

River Data

	DecadesSSC	DecadesFlow	DecadesRain
1970s	298	66.0	2.0
1980s	307	19.0	1.9
1990s	63	11.0	1.9
2000s	57	20.0	1.8
2010s	46	0.0	1.8

% River Data:

	DecadesSSC	DecadesFlow	DecadesRain
1970s	-0.029316	2.473684	0.052632
1980s	3.873016	0.727273	0.000000
1990s	0.105263	-0.450000	0.055556
2000s	0.239130	inf	0.000000

- Missing flow data keeps from creating a real comprehensive assessment
- Decline in precipitation is of only .2 in the since the 1970s
- Flow increased from the 1990s to the 2000s
  - Precipitation kept decreasing
- Greatest declines was seen in SSC

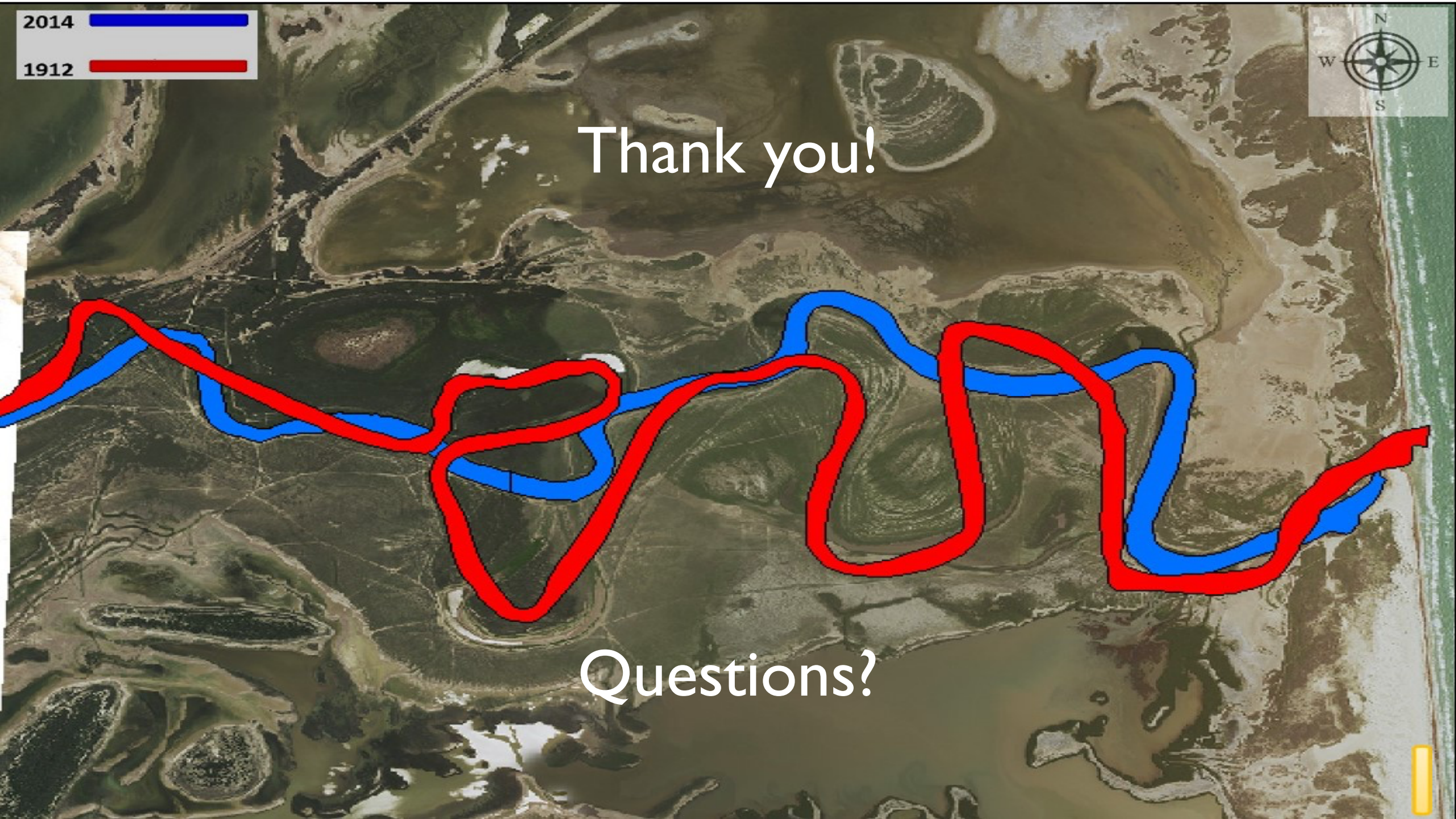
CONCLUSION

- Suspended Sediment and Discharge have been declining since the 1970s as a result of human activity (Dams)

- Precipitation declined only .2 from 1970s to 2010s
  - Still, it is an important declines that could be a major driver of decline in flow
  - Reductions is not parallel to that of flow.

- Although flow and precipitation have both being in decline, they follow different patterns.
  - Decline in precipitation was not as extreme as flow's
  - Flow actually increased its rate between 1990s and 2000s

- Most importantly, it is clear that humans have played a major role in the decline of SSC, Flow, and Precipitation.
  - Although precipitation could be considered the major driver of flow decline, humans are still the source of this decrease.



Thank you!

Questions?