Acid Rain Pollutants: Anthropogenic Causes, Effects, and Socioeconomic Factors

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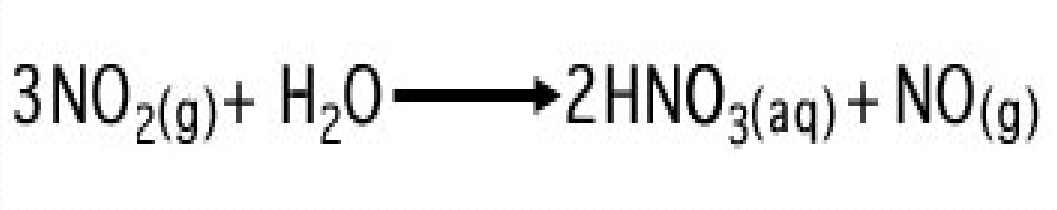
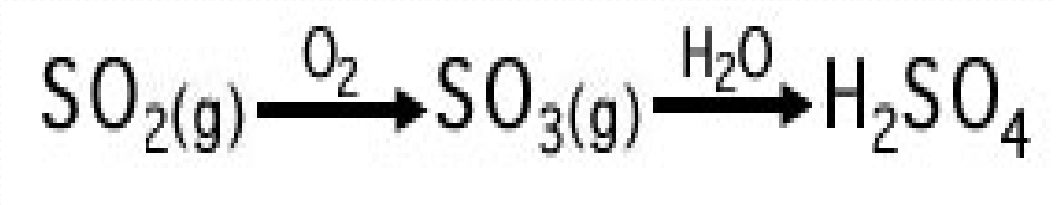
Introduction

- Acid Rain
- Importance to CAMA counties
- Environmental Kuznets Curve
- Gini Coefficient
- Hypothesis
- Methods
- Results
- Discussion
- Conclusions

Acid Rain

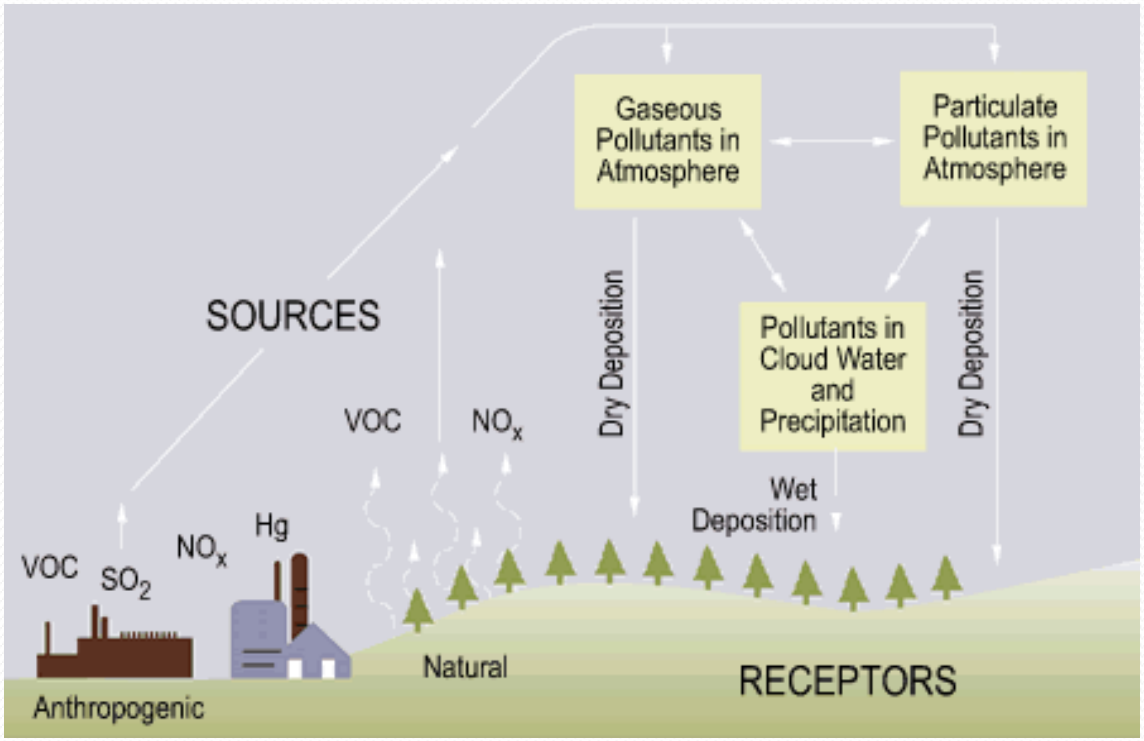
- Gases enter the atmosphere and react with water and oxygen to produce acidic compounds





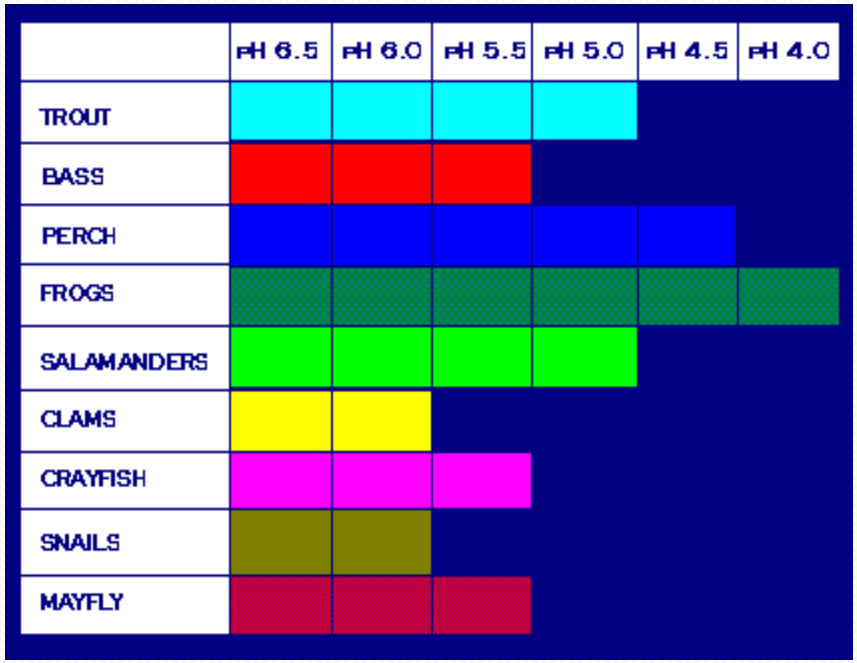
Acid Rain

- Acid deposition
  - Wet
  - Dry
- Nitrogen oxides
  - Hogs
- Sulfur Dioxide
  - Ships



Acid Rain

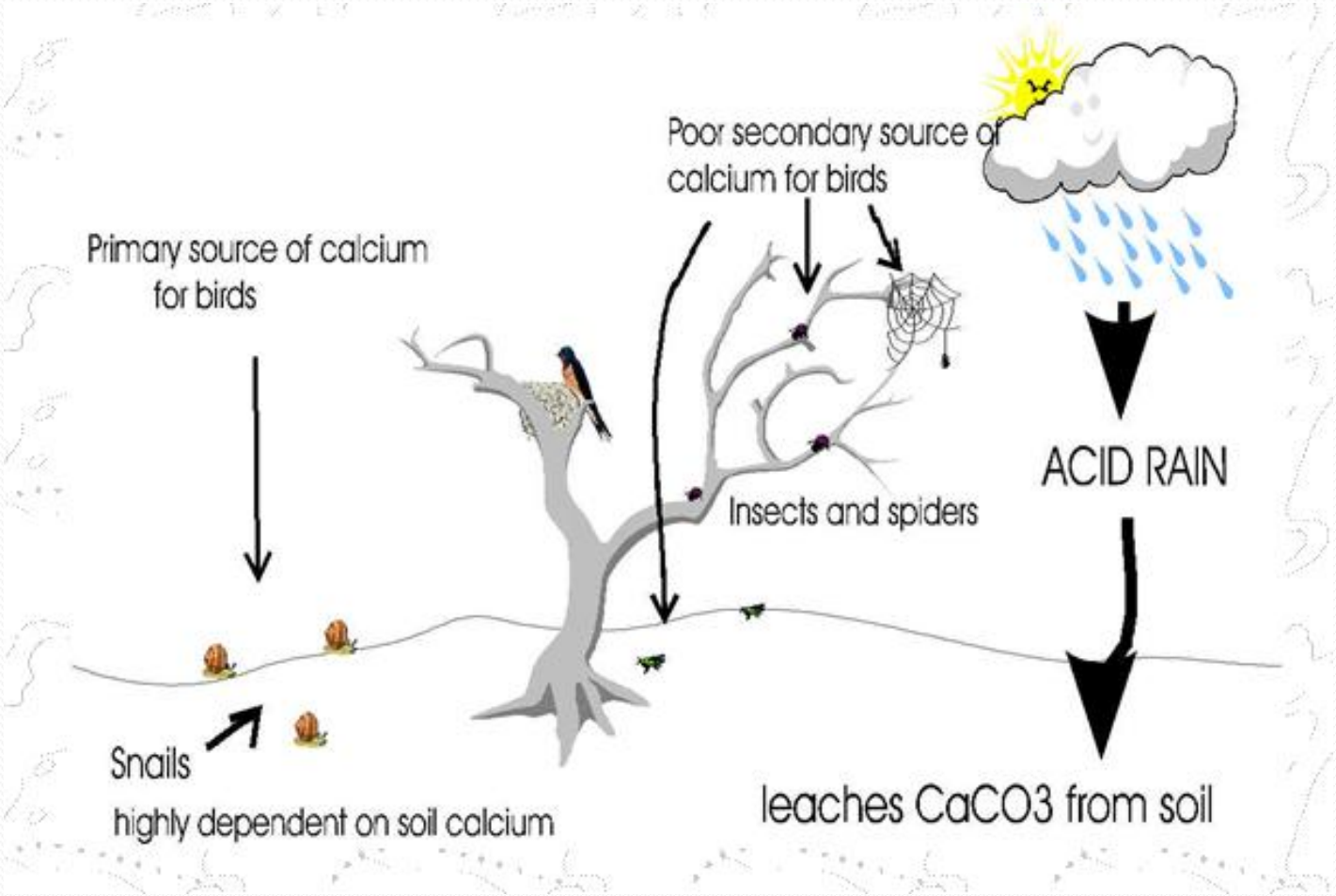
- Aquatic habitats
  - Effects pronounced
- Decrease biodiversity, reduce, or kill
- Canadian study - lakes with pH <5 ->diversity zooplankton 1-7 species compared to the 9 – 16 species present in a pH > 5



Acid Rain

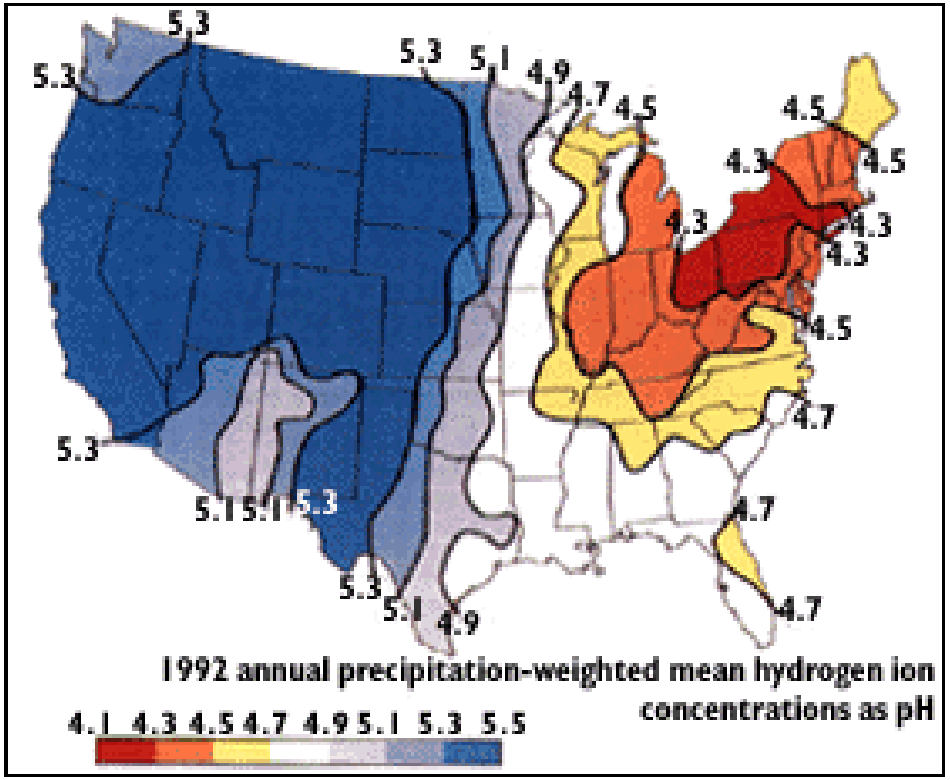
- Young susceptible
  - pH less than 5, fish eggs harmed
- Stress and low bodyweight
- Leaching of Al and $CaCO_3$
- Shells of mollusks
- Increase periphytic algae -> number of microbial and invertebrate herbivores dropped due to acidification
- Ramifications through the food web

Acid Rain


Poor secondary source of calcium for birds
Primary source of calcium for birds
Insects and spiders
ACID RAIN
Snails
highly dependent on soil calcium
leaches CaCO3 from soil

Importance to CAMA counties

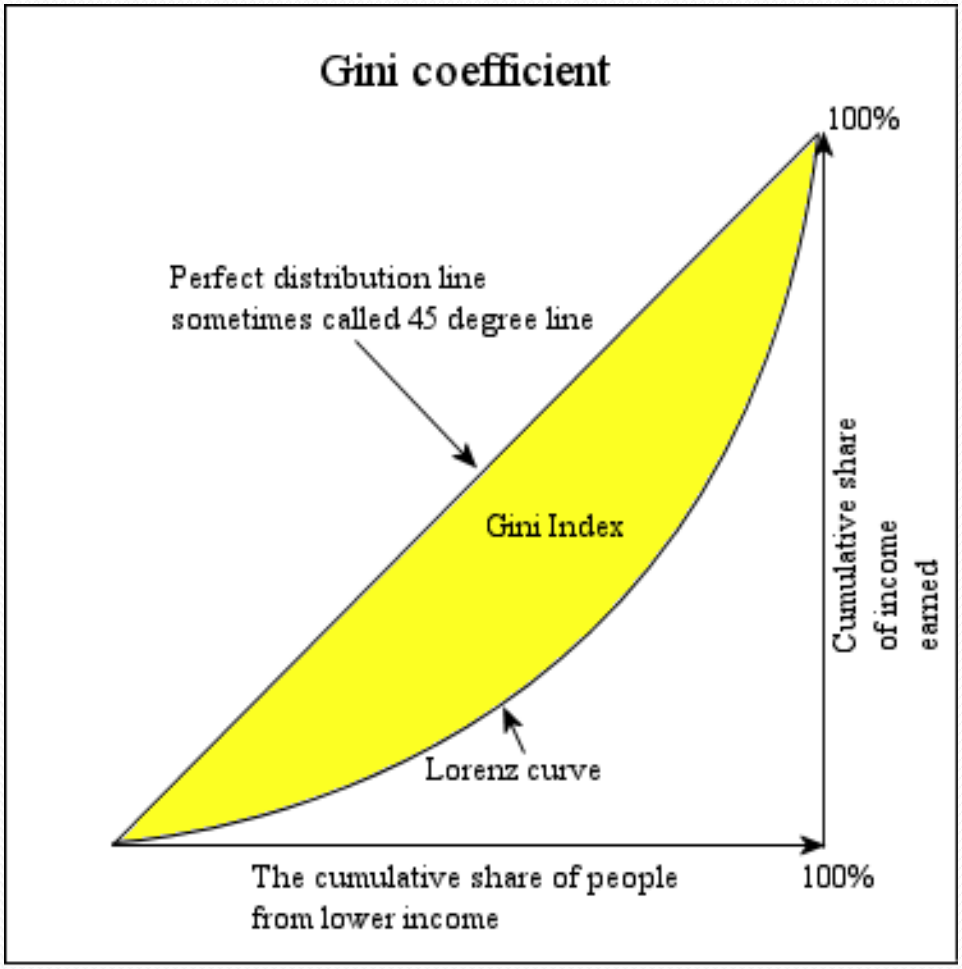
- North Carolina ranks 13th and 14th highest in sulfur dioxide and nitrogen oxides
- 3rd highest band of pH for annual precipitation
- Acid rain in CAMA counties
  - Disproportionate effect on coastal areas
  - CAMA legislature



Environmental Kuznets Curve

- Scale effect
- Movement out of sectors
- Production strategies

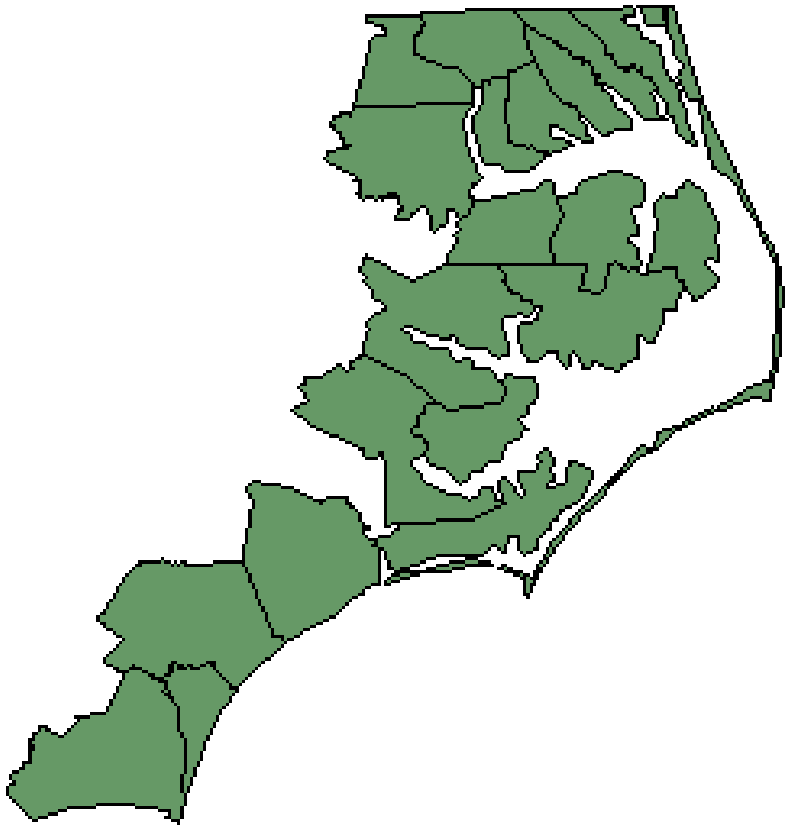
Gini Coefficient



Gini Coefficient

Hypothesis

- Null Hypothesis
  - Income per capita and the Gini coefficient have no relationship to the pollution emitted
- Test area
  - 20 CAMA counties



Methods

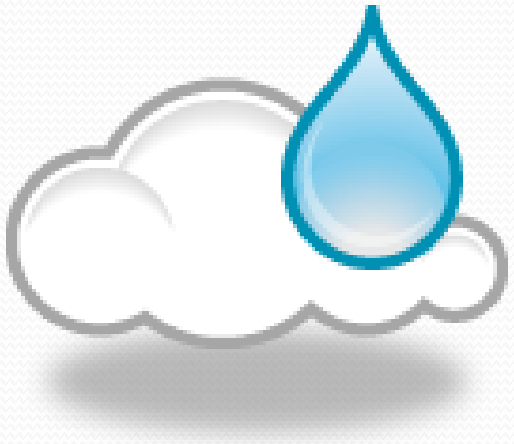
- SPSS: Quadratic Regression
  - $NOpercapita = \beta_{1*}Incomepercapita^2 + \beta_{2*}Incomepercapita + \beta_{3*}Gini + \varepsilon$
  - $SO2percapita = \beta_{1*}Incomepercapita^2 + \beta_{2*}Incomepercapita + \beta_{3*}Gini + \varepsilon$
- ArcGIS
  - Moran's I

Results

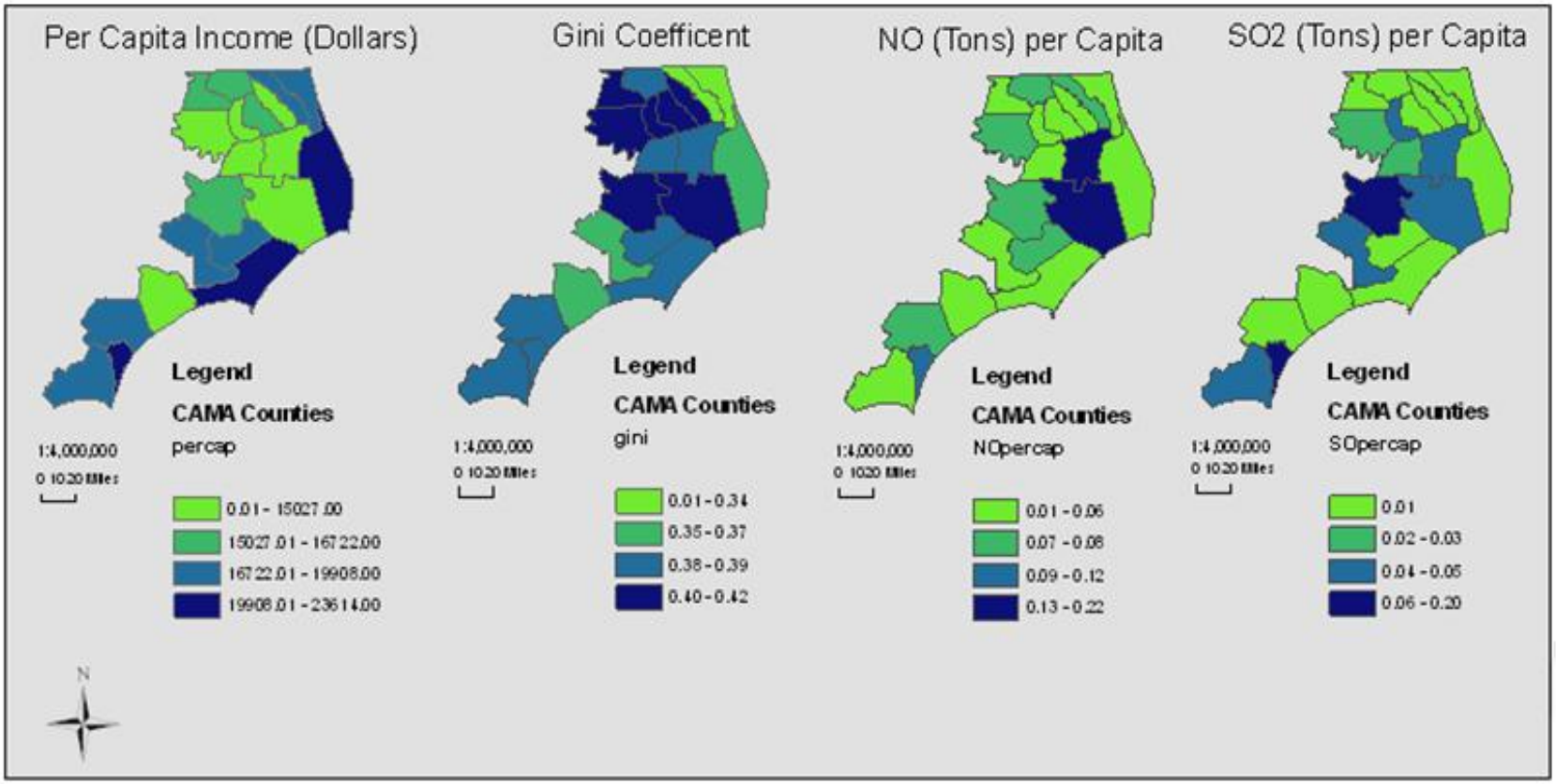
- Nitrogen oxides
  - that Incomepercapita (β_1= -2.756, p= 0.014) and Incomepercapita^2 (β_2= 2.673, p= 0. 017) are highly statistically significant, and Gini is not statistically significant
- Sulfur dioxide
  - Incomepercapita, Incomepercapita^2, and Gini are not statistically significant
- No evidence of Environmental Kuznets Curve
  - Require a negative square term and a positive linear term
- Gini Coefficient not statistically significant

Results

- For nitrogen oxides, there was a less than 1% likelihood that the levels were clustered by chance (Moran's I = 0.12, Z score =4.21 s.d.)
- For sulfur dioxide, there was a less than 5% likelihood that the pattern occurred by chance (Moran's I = 0.02, Z score =2.08 s.d.)



Results


Per Capita Income (Dollars)
Legend
CAMA Counties
percap
0.01 - 15027.00
15027.01 - 16722.00
16722.01 - 19908.00
19908.01 - 23614.00
Gini Coefficent
Legend
CAMA Counties
gini
0.01 - 0.34
0.35 - 0.37
0.38 - 0.39
0.40 - 0.42
NO (Tons) per Capita
Legend
CAMA Counties
NOpercap
0.01 - 0.06
0.07 - 0.08
0.09 - 0.12
0.13 - 0.22
SO2 (Tons) per Capita
Legend
CAMA Counties
SOpercap
0.01
0.02 - 0.03
0.04 - 0.05
0.06 - 0.20

Discussion

- Augment the conventional Environmental Kuznets Curve by spatially weighted values of the dependent and independent variables in the future
- Income within the CAMA counties may not have varied enough to show the full range of the Environmental Kuznets Curve
- omitted variable bias may have affected the analysis as three explanatory economic variables probably were not sufficient to capture the entire relationship
- Increase the sample size and changing the scale to state or country level data

Conclusion

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Questions?