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## Environmental Justice in the US: Fracking and Nuclear Plant Site Location and Their Spatial Relationship to Low-income Communities

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# Environmental Justice in the US: Fracking and Nuclear Plant Site Location and Their Spatial Relationship to Low-income Communities

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## Introduction

The first influential environmental justice case in the United States occurred in the early 1980s, when a Polychlorinated biphenyl (PCB) landfill was created in Warren County, NC, where most residents were primarily African American (Gen *et al.*, 2012). Thirty years later, those communities (which are still composed of a large percentage of minority groups, low-income, and indigenous population) still experience a disproportionately large number of environmental health incidents due to a combination of poor socioeconomic condition and little access to healthcare (EPA, 2011).

The goal of this project is to explore to what extent underprivileged communities are affected by environmental problems relative to the whole population. Fracking and nuclear plant sites will be used in this analysis as proxies to environmental risks. Data from the US National Census will be used to map the distribution of poverty and communities with a large percentage of minority groups. The social/economic spatial distributions will be compared to the density of fracking sites as well as nuclear plant locations to explore the spatial relationship between the two.

## Method

**Study area**  
The study area encompasses US states, including Puerto Rico; however, due to the lack of fracking site records, states of Maryland and North Carolina were removed for fracking site analysis.

**Data collection**  
Poverty ratio and racial minority ratio data are collected from the Census Bureau’s 2010 ACS census data. US oil and gas well GIS data are downloaded from Fractraker.org (current as of February 2014). These data are complete censuses of oil and gas wells for each state, except for Maryland and North Carolina, which obtain 106 wells combined and do not affect on fracking sites density significantly. The following states have been verified not to have any active wells : CT, DE, DC, GA, HI, IA, ME, MA, MN, NH, NJ, RI, SC, VT, and WI. Texas’ well data are obtained from Texas general land office. The data for nuclear plants is obtained from MapCruzin.com, which derived the data from U.S. Government sources.

**Poverty ratio data**  
Households living in poverty for more than one year are used in computing the ratio. All counties are categorized as low ratio (less than 5%), moderate ratio(5-10%), medium ratio(10-20%), and high ratio (more than 20%) according to Gen, *et al*’s research.

**Racial minority ratio**  
Population who identify with one or more minority races are included in the analysis. All counties are categorized as low ratio (less than 4%), moderate ratio(4-13%), medium ratio(13-38%), and high ratio (more than38%) according to Henry, *et al*’s research.

**Fracking sites density**  
The kernel density layer was created from fracking sites using a search radius of 200 km. The counties are categorized into six levels from non-affected area to highly affected area.

**Nuclear power plant density**  
The counties that have access to major lake, river and ocean are the communities that be compared for the requirement of nuclear power plant sites construction. A kernel density layer was created from nuclear power plant sites using a search radius of 50 miles. The counties are categorized into six levels from non-affected area to highly affected area.

**ANOVA analysis**  
Data statistical analysis was done using Stata 13 software. One-way ANOVA would be used to compare the effect in different treatments, with a various P value to determine the significant difference.

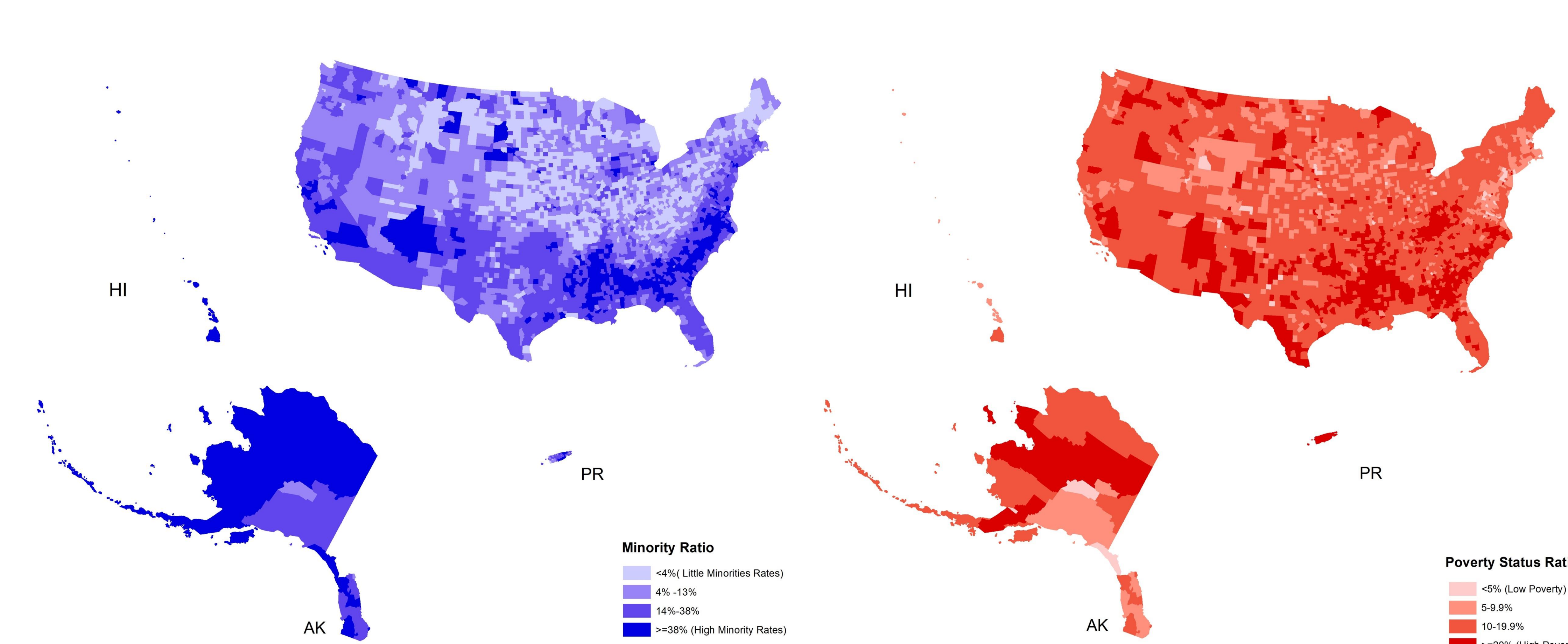


Figure 1. Data collected on racial minority ratio across country.

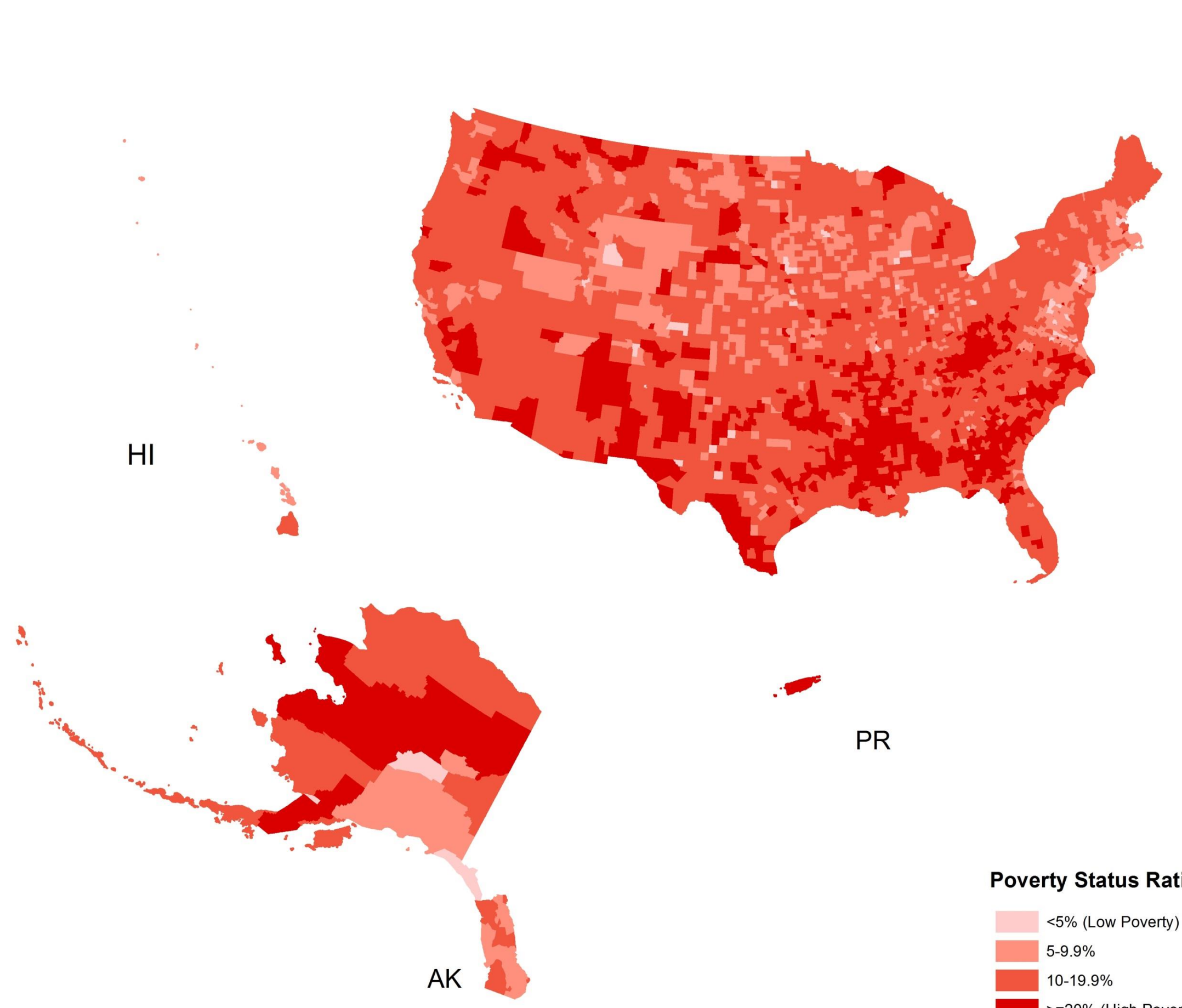


Figure 2. Data collected on poverty ratio across country.

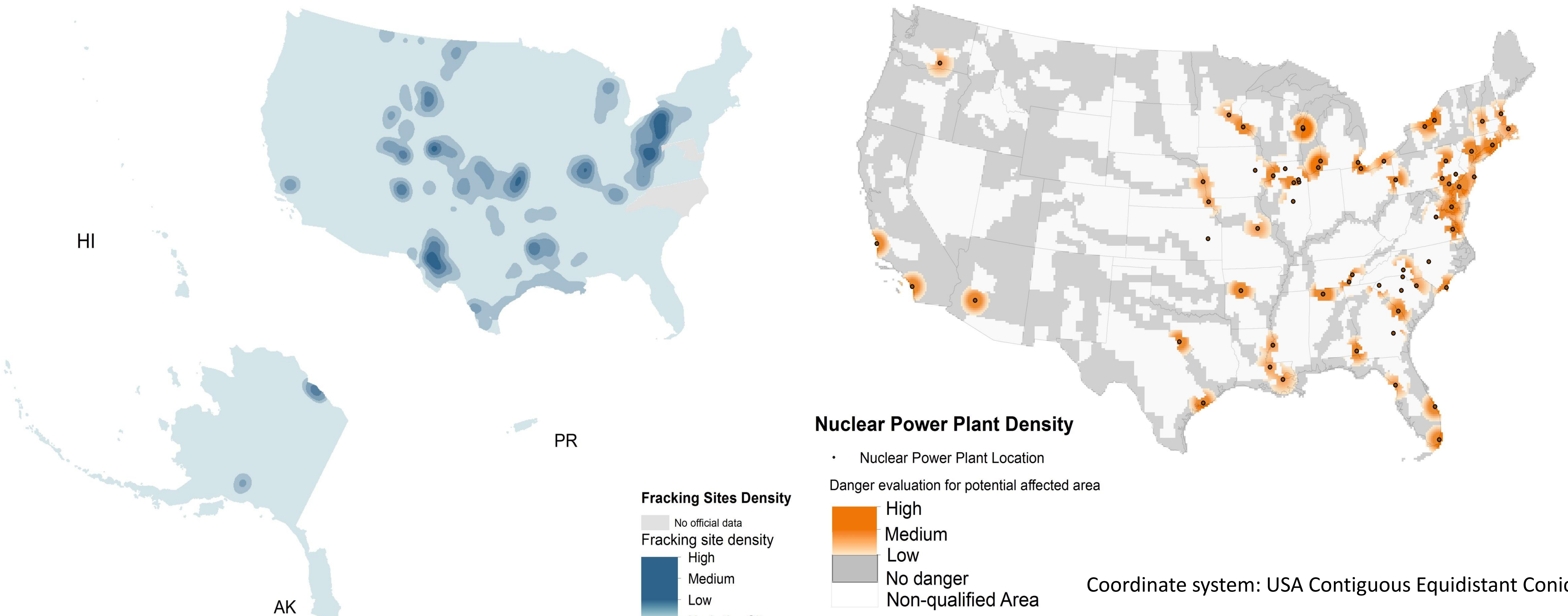


Figure 3. Kernel Density of fracking sites in US.

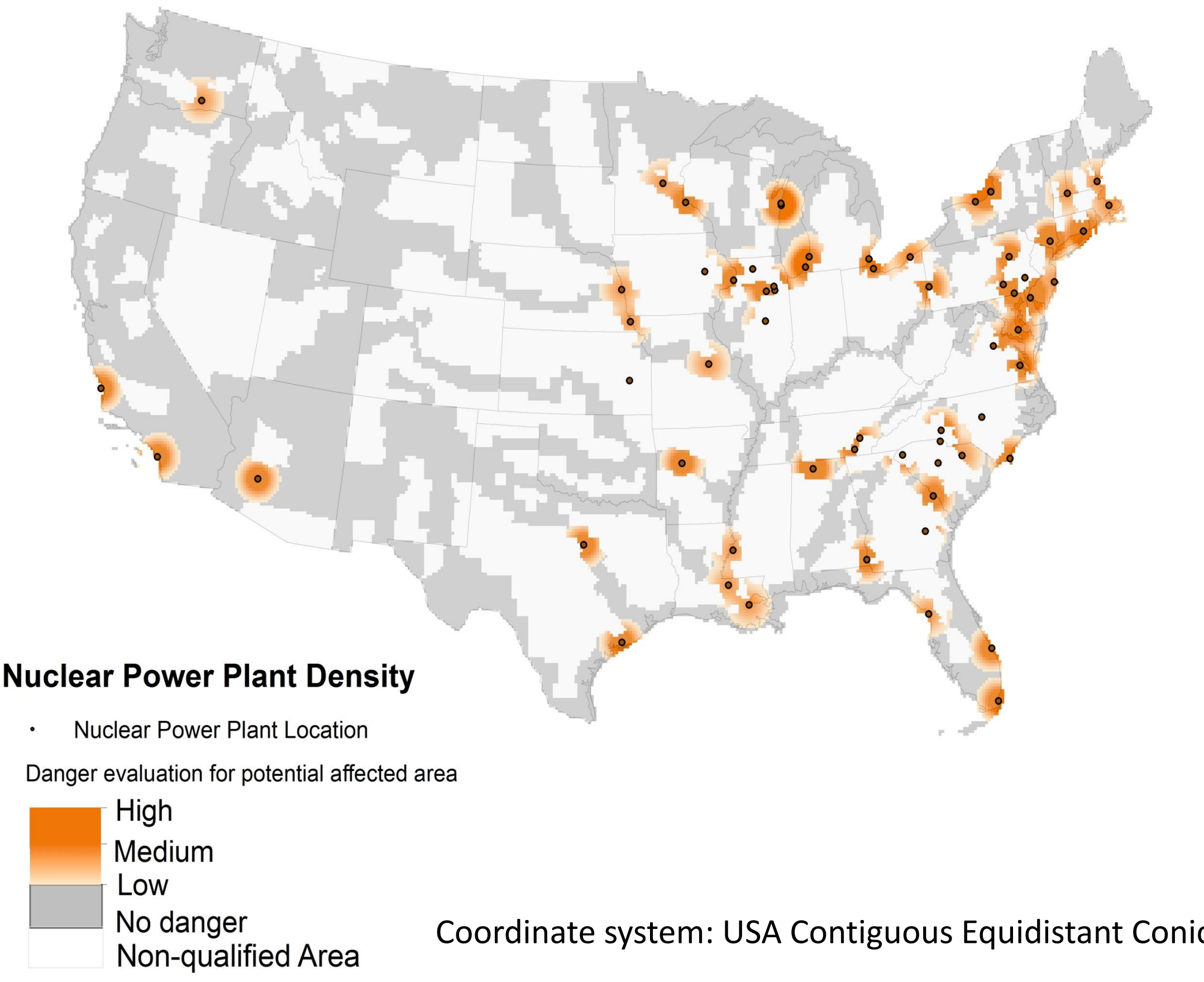


Figure 4. Kernel Density of nuclear power plant sites in US. The white area are not used for comparison because they are not ideal for nuclear power plant construction.

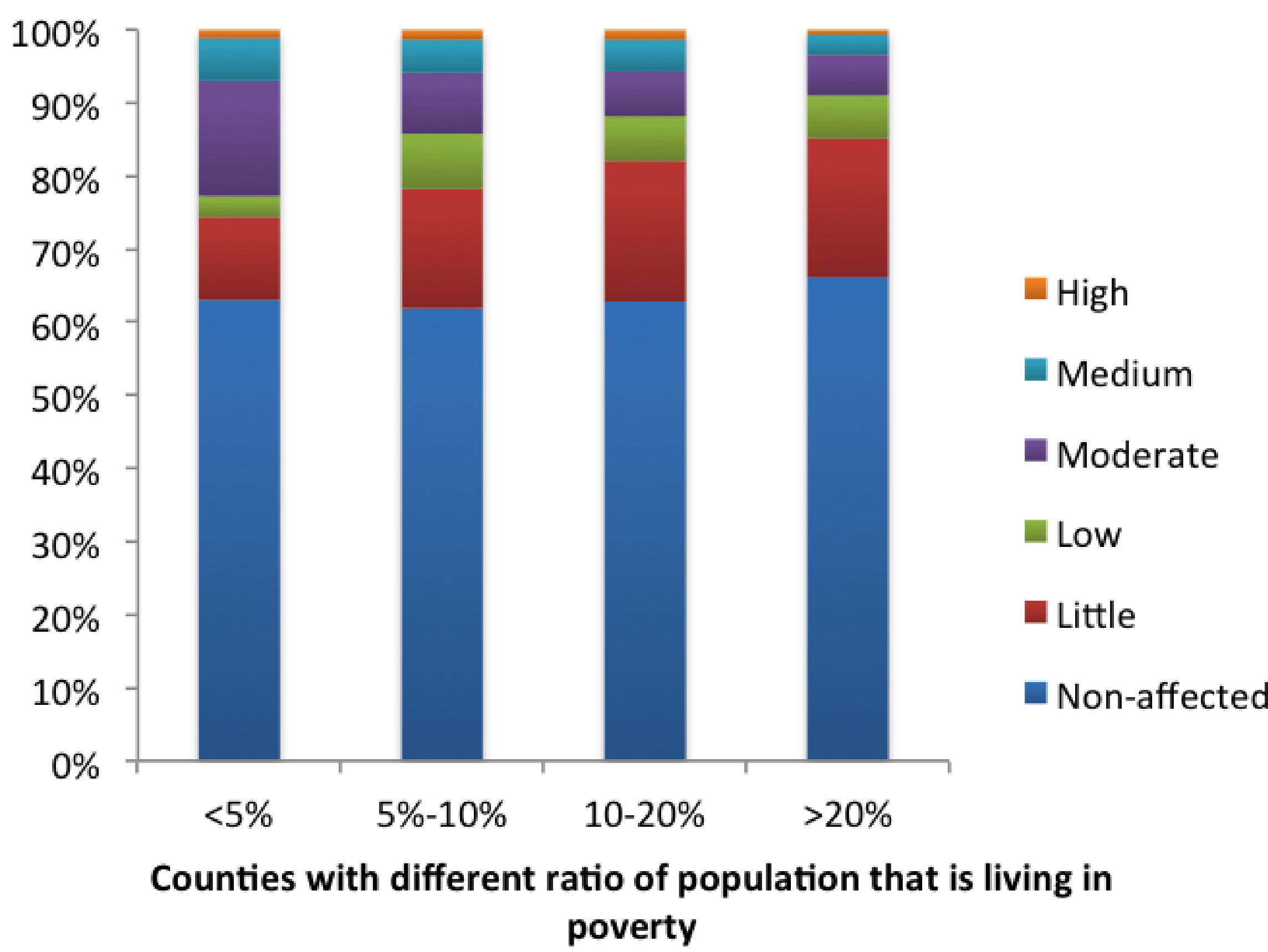


Figure 5. Composition of counties with different ratio of poverty in different level of affected area.

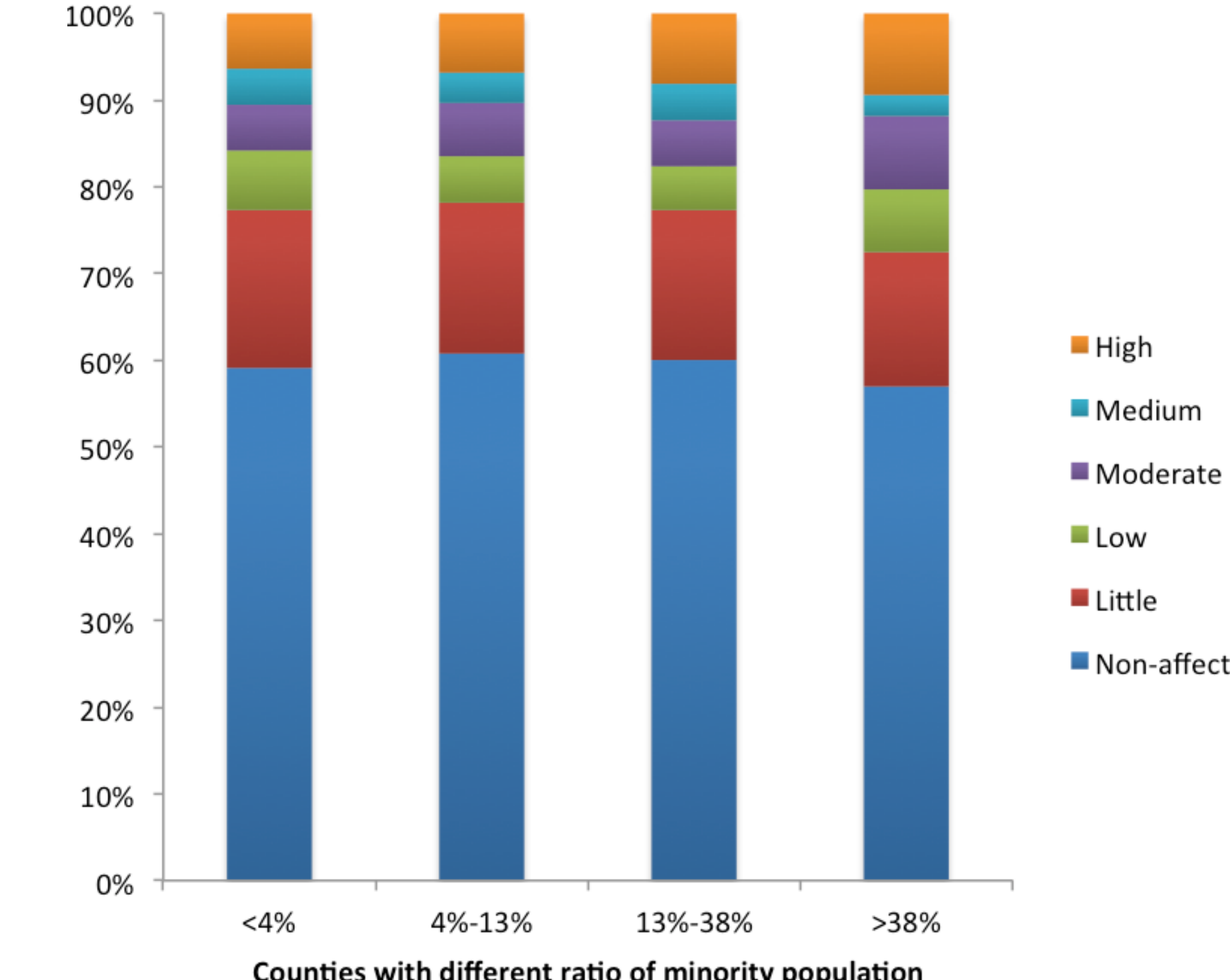


Figure 6. Composition of counties with different racial minority ratio in different level of affected area.

## Result

- According to ANOVA analysis, numbers of counties with low poverty ratio population are significantly lower than the rest of counties in the highly impacted area of both fracking sites and nuclear power plant sites (20% significance level, P=0.187 ); numbers of counties with high and medium poverty ratio are significantly lower than the rest of counties in low impacted area (80% significance level, P=0.587 ). The rest of comparisons indicate no significant difference.
- Numbers of counties with high minority population ratio are significantly higher than the rest of counties in high and medium impacted area (80% significance level, P=0.743 ). The rest of comparisons indicate no significant difference.

## Conclusion

- Communities with less poverty population are affected less by nuclear power plants and fracking sites problems than the rest of communities.
- Communities of colors are affected more by environmental degradation problems than the communities that contain less racial minority.

## Discussion

- The extent is because that I hope to address more environmental health issues, including landfill, dam, deforestation and more. However, I had a difficulty to search for inclusive data that are nationwide.
- I hope conduct more research on how the intersection of race and class has been affected by environmental justice, which is needed to be discussed to find approach to solve environmental injustice.

## Reference

EPA . “Plan EJ 2014”. (2011) Retrieved from <http://www.epa.gov/environmentaljustice/resources/policy/plan-ej-2014/plan-ej-2011-09.pdf>  
Gen, Sheldon, Holley Shafer, and Monique Nakagawa. "Perceptions Of Environmental Justice: The Case Of A US Urban Wastewater System."Sustainable Development 20.4 (2012): 239-250.  
Henry, Kevin A., et al. "The Joint Effects Of Census Tract Poverty And Geographic Access On Late-Stage Breast Cancer Diagnosis In 10 US States." Health & Place 21.(2013): 110-121.  
13 Steve, Sternberg.(n.d.) "Five U.S. reactors in quake zones."

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