Nanoremediation: Will Equity Concerns Arise?

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UC CEIN Center for Environmental Implications of Nanotechnology

Mission and Objectives

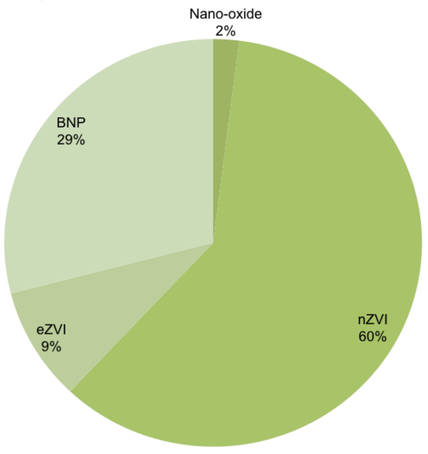
Our Center's goal is: *To ensure that nanotechnology is introduced in a responsible and environmentally compatible manner*.

- It is important to consider both potential and existing nanotechnology applications.
- This study looks at the siting of current nanoremediation projects in terms of the sociodemographic composition of the local communities.

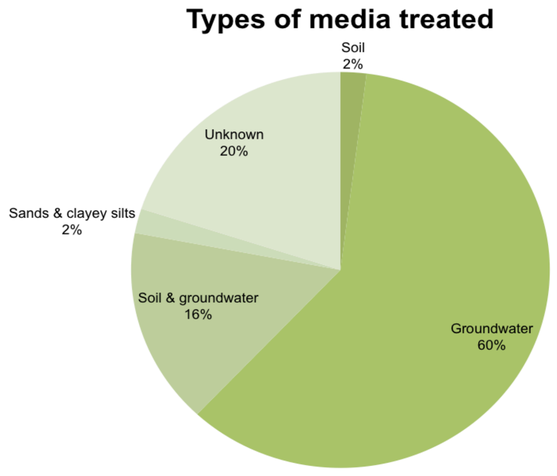
Nanoremediation Basics

Definition: The application of reactive nanomaterials for transformation and detoxification of pollutants.

Types of nanoparticles used



Types of media treated



The figures above show the types of nanoparticles that are used for nanoremediation and the types of media treated. (Karn et al. 2009)

Background and Literature

US Public Environmental Risk Perception Survey

&

US Experts' Perceptions of Nanotechnologies: Benefits Risks, and Bias

Environmental Risk Perception

2008 public survey as baseline—calls for the need to *understand how application domains with markedly different benefit-risk profiles are likely to influence perceptions of emerging nanotechnologies.* (Satterfield, et al. 2009)

When asked to make a risk judgments, experts rank nanoremediation as comparatively less risky than other applications – this speaks largely to perception given the absence of toxicology studies. (Beaudrie, et al. *in progress)*

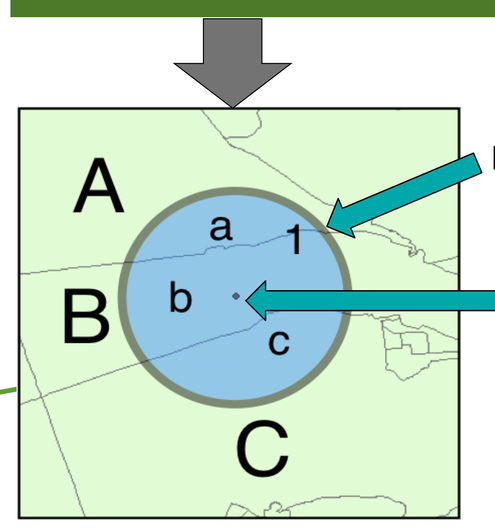
Although nanoremediation could be less expensive and more effective, environmental and human health risks remain poorly understood.

Populations living close to such sites could be viewed as being subject to either potentially adverse exposures *or* as lucky beneficiaries of the latest advances in modern clean up technology.

Methods

According to the Project on Emerging Nanotechnologies (PEN), there are 50 sites in the United States using *in situ* nanoremediation. The geographic location for each site was linked with community demographics from the 2000 US Census.

How to Define a Nanoremediation Community



Let $a \subset A$, $b \subset B$, and $c \subset C$ be the area of census tracts A, B, and C that intersect the community 1.

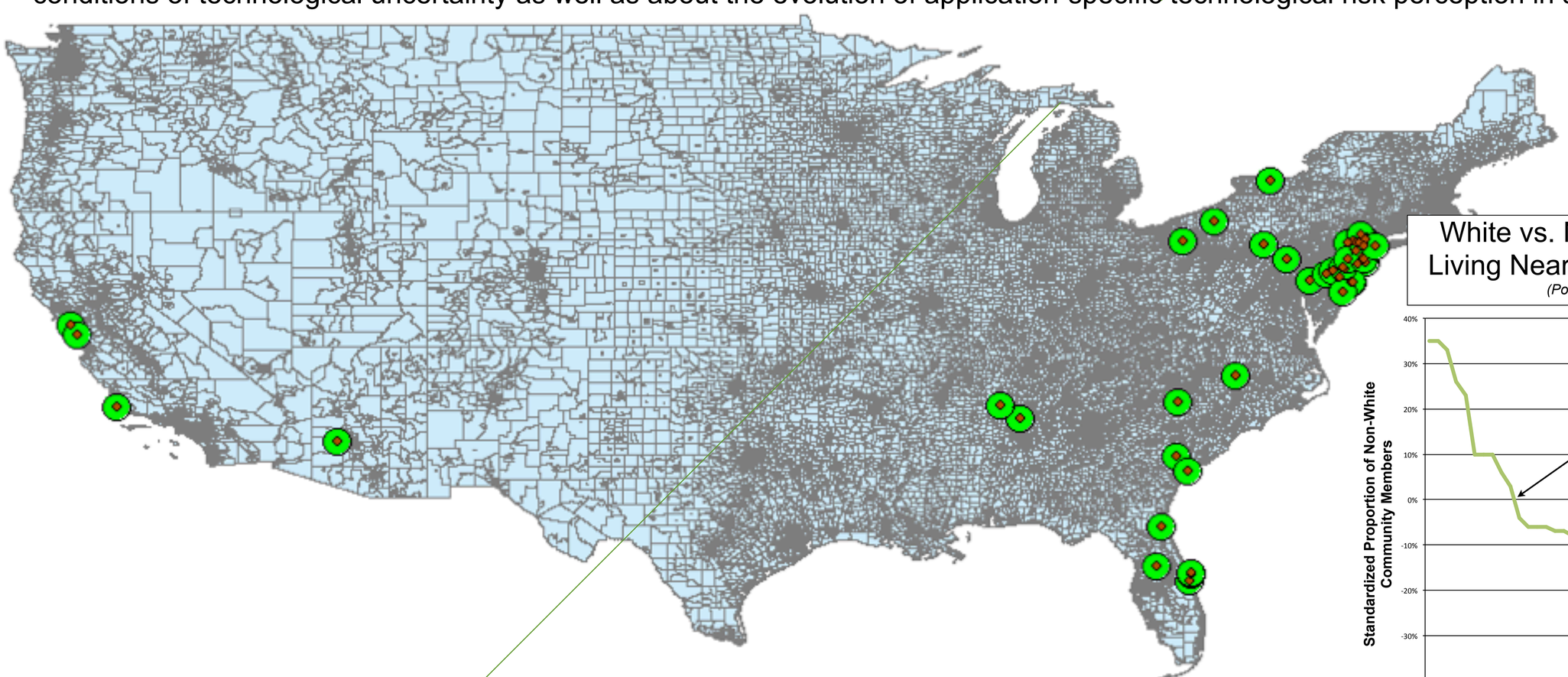
$\alpha_{1A} = a/A$ is the percentage of census tract A that lies within community 1.

Therefore, $Population_1 =$

$$\alpha_{1A} \times Pop_A + \alpha_{1B} \times Pop_B + \alpha_{1C} \times Pop_C$$

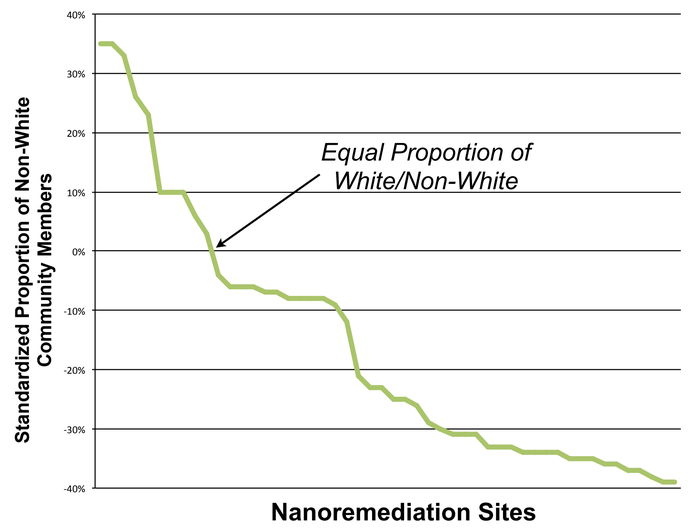
Results

In this study, there appears to be a general balance in the distribution of nanoremediation related risks/benefits across different types of communities (race, class, etc). This study raises questions about the proper role of communities in local environmental decision making under conditions of technological uncertainty as well as about the evolution of application-specific technological risk perception in society.



White vs. Non-White Populations Living Near Nanoremediation Sites

(Population Differences Shown)



Future Work

Looking at nanoremediation sites with a more specific spatial unit definition (census blocks, etc.) may show differences that were not detected at the census tract level. Further, since nanoremediation is used to address groundwater issues, including a layer with groundwater plume modeling may allow for more accurate potential exposure estimations.

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