Benefits from Remediation, Restoration, and Revitalization

SHC 9.3

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U.S. Environmental Protection Agency

Output

Contribution of Site Remediation and Restoration to Revitalizing Communities and Improving Well-being (Report)

Partner Needs

- Evidence linking environmental condition of restored sites to human health and well-being

- Metrics and methods to demonstrate linkages between remediation or restoration and redevelopment

- Integrating community priorities, redevelopment goals, and human health and well-being impacts into remediation and restoration decisions

Output

Contribution of Site Remediation and Restoration to Revitalizing Communities and Improving Well-being

Scientific Challenge

- Implementing interdisciplinary and translational social-ecological systems research at remediation and restoration sites
- Leveraging an improved understanding of human communities to improve remediation and restoration outcomes

Output Structure

Products 1 and 2	Products 3 and 4	Products 5 and 6
Innovative metrics Natural hazards *risks* and resilience	*Ecosystem-health relationships* *Economic valuation*	*Case studies*

Assessing Ecosystem Services and Human Well-being Indicators (SHC 9.3.1)

Partner Challenge

- Links between the 3 Rs poorly documented with limited data
- Partners lack practical indicators

Addressing the Challenge

- Research will validate indicators of human well-being
- Collaborative, retrospective analysis of completed projects

Short-term Goals

- Reports and briefing documents on validated indicators
- Estimate the economic value of cleanup at contaminated sites.
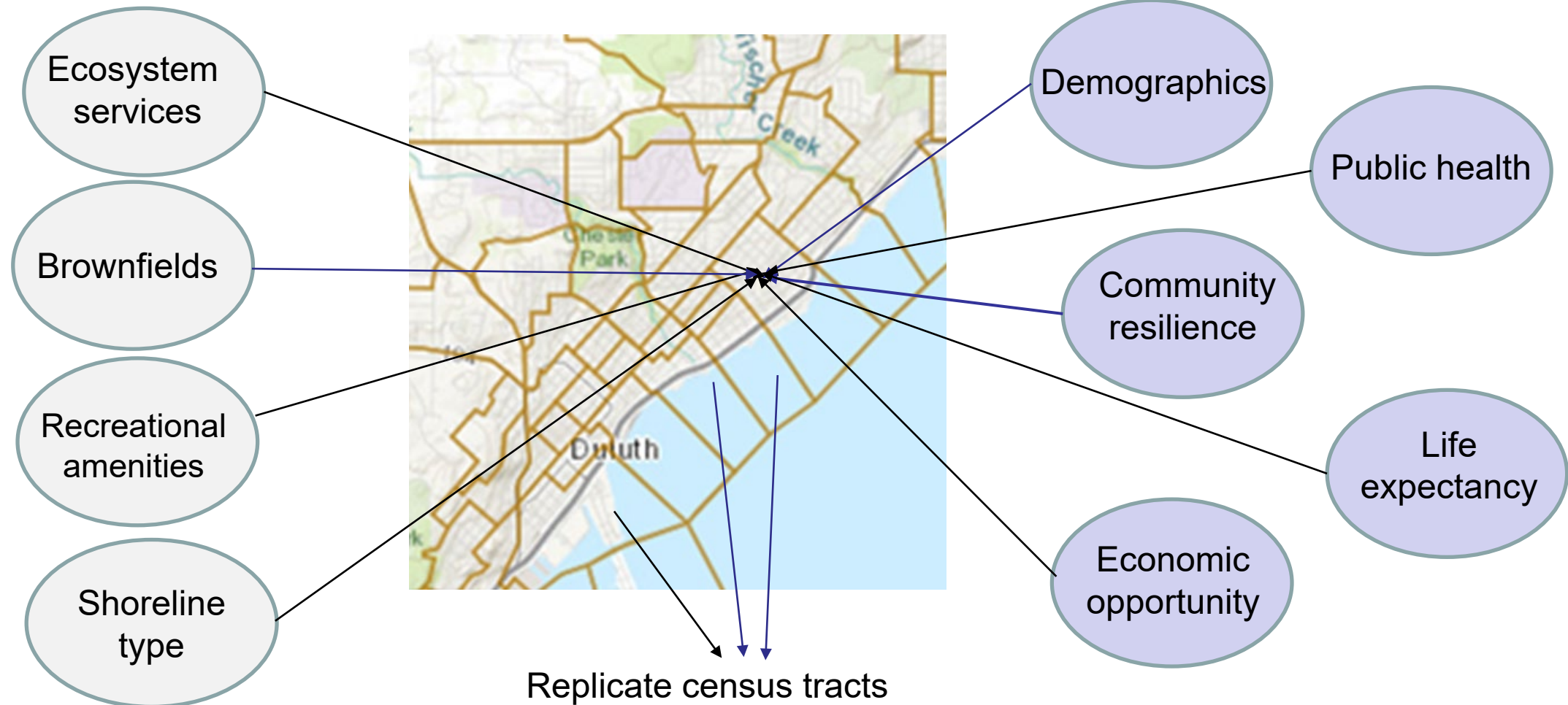
Long-term Goal

- Provide a science-based approach to assess revitalization outcomes in the AOC context

Credit: Detroit Riverfront Conservancy

Validation of Waterfront Revitalization Indicators at Community Scale

Waterfront attribute indicators

Human well-being indicators

- Ecosystem services
- Brownfields
- Recreational amenities
- Shoreline type

- Demographics
- Public health
- Community resilience
- Life expectancy
- Economic opportunity

Replicate census tracts

Data sources: EPA EnviroAtlas, EPA ACRES, Centers for Disease Control, US Census Bureau, NOAA, Openstreetmap, Opportunity Atlas

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Product 1

Conceptual Model for Quantifying Revitalization

Remediation

- Dredging
- Construction of aquatic habitats

Restoration

- Restoration of fish and wildlife habitats

Revitalization

Use values
- Recreational fishing

Non-use values
- Existence values

- Degraded Fish and Wildlife Populations

Removed Beneficial Use Impairments

- Number of fish caught by anglers

Linking the Environment and Human Benefit

- Recreation demand model
- Stated preference
- Benefit transfer

Economic Valuation Method

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Product 1

- EPA Great Lakes National Program Office

- States

  "The importance of research demonstrating how community investment in revitalization is linked to the on-going environmental clean-up efforts can't be overstated. Indicators [developed by EPA] of waterfront revitalization will help document a comprehensive view of an estuary in recovery. Having access to EPA scientific expertise and their technical briefings on revitalization indicators will fulfill MPCA's data-driven mission of informing decisions and help delist the St. Louis River AOC. Our progress and overall success is directly enhanced by their participation and expertise."

  Doug Wetzstein, Acting Director of Industrial / Remediation Divisions, Minnesota Pollution Control Agency (excerpt from letter to Michael Slimak and Andrew Geller)

Product 1

Impacts of Natural Disasters on R2R2R (SHC 9.3.2)

Partner Challenge

- "Superfund does not only seek to clean up sites— we want to see sites back in productive use serving their local community." (Larry Zaragoza, OLEM/Superfund February, 2020; Resilience Workshop)

- Sustainable, resilient projects

- Contaminated sites plan in the context of potential exposure to natural hazards

- Partners: Office of Land and Emergency Management (OLEM), Regions, communities
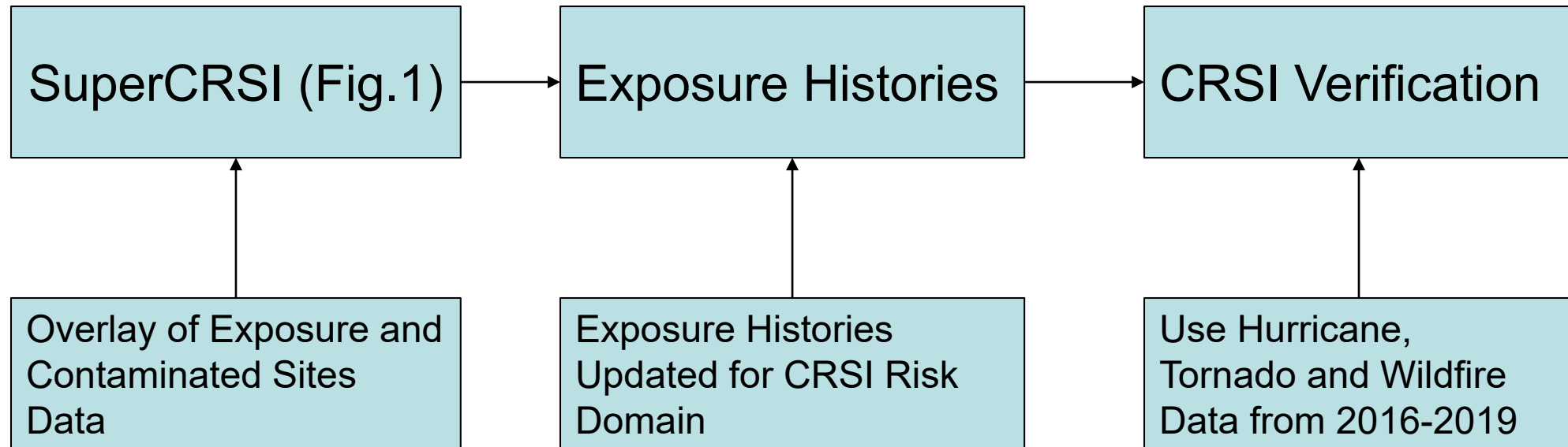

Image credit: The Bay City Times
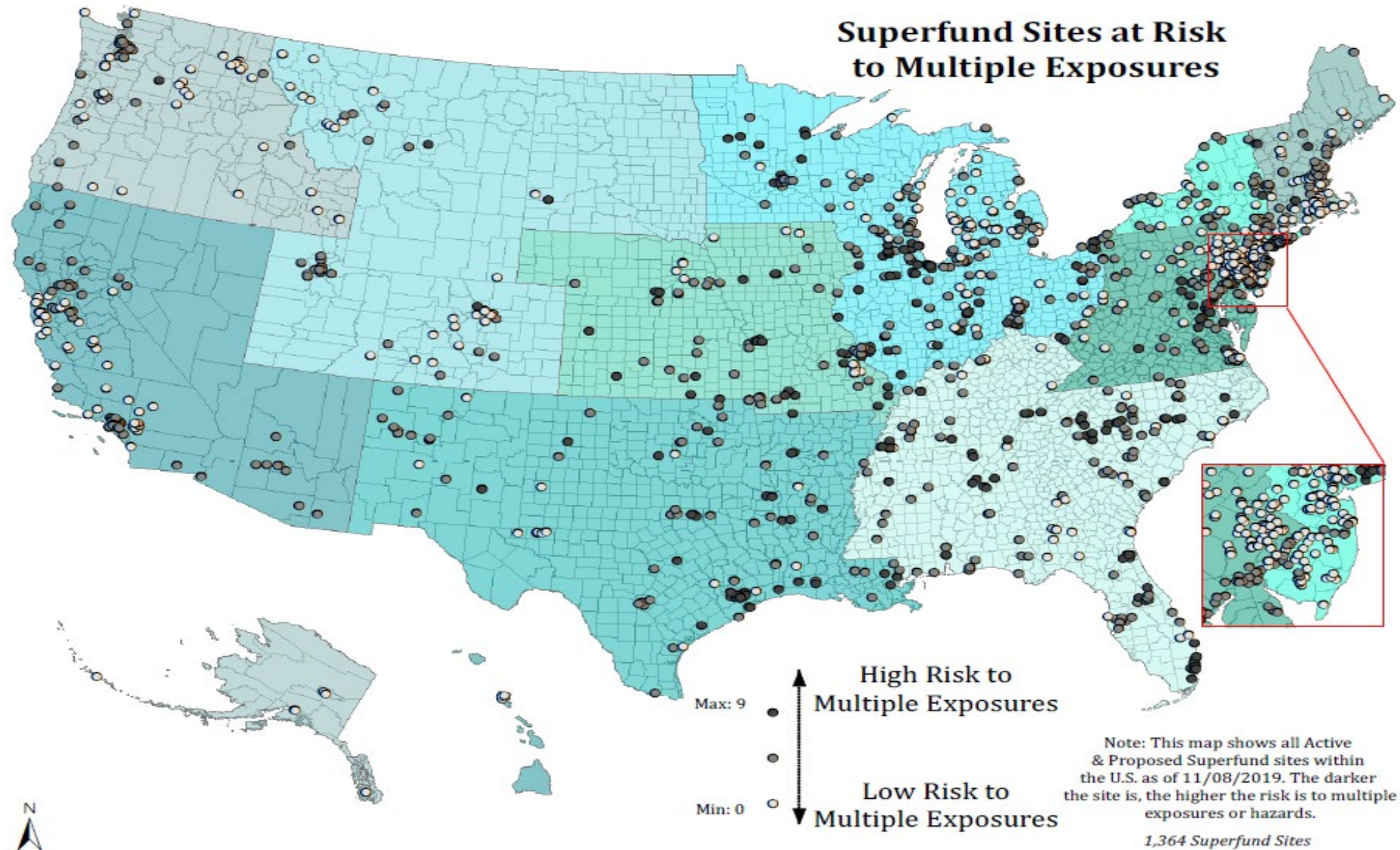
Addressing the Challenge

- The Cumulative Resilience Screening Index (CRSI) provides natural hazard exposure information:
  - Hurricanes
  - Tornadoes
  - Coastal Flooding
  - High Temperatures

  - Drought
  - High Winds
  - Landslides
  - Low Temperatures

  - Inland Flooding
  - Hail
  - Earthquakes
  - Wildfires

- Information at the county level and in some cases by latitude-longitude

Product 2

Research Activities – 2020-2022

| SuperCRSI (Fig.1) | → | Exposure Histories | → | CRSI Verification |

| Overlay of Exposure and Contaminated Sites Data | Exposure Histories Updated for CRSI Risk Domain | Use Hurricane, Tornado and Wildfire Data from 2016-2019 |

Long-term Goal: EPA Office of Land and Emergency Management and Regions will use in developing restoration or revitalization plans

Product 2

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Superfund Sites at Risk to Multiple Exposures

High Risk to Multiple Exposures

Max: 9

Min: 0

Low Risk to Multiple Exposures

Note: This map shows all Active & Proposed Superfund sites within the U.S. as of 11/08/2019. The darker the site is, the higher the risk is to multiple exposures or hazards.

1,364 Superfund Sites

Product 2

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Assessing How Human Health and Well-being is Affected by Site Remediation and Restoration (SHC 9.3.3)

Partner Challenges

1. Identify changes in community and individual health related to ecosystem goods and services (EGS) and contaminated site revitalization

    EPA Partners: Region 3, Region 4, Office of Environmental Justice, Brownfields Program, and Office of Land and Emergency Management

    Deliverables: Reports, webinars, peer-reviewed publications, and databases of health effects

2. Quantify the health benefits of R2R2R

    EPA Partners: Region 2, Region 4, Office of Environmental Justice, Great Lakes National Program Office, and Office of Land and Emergency Management

    Deliverables: Reports, peer-reviewed publications

Identify Changes in Community and Individual Health

Three projects

1. Impact of EGS and Brownfields on Vulnerable Populations

2. Public Health Benefits of Revitalizing Brownfields

3. Health Benefits of Greenspace Access for Patients with Diabetes
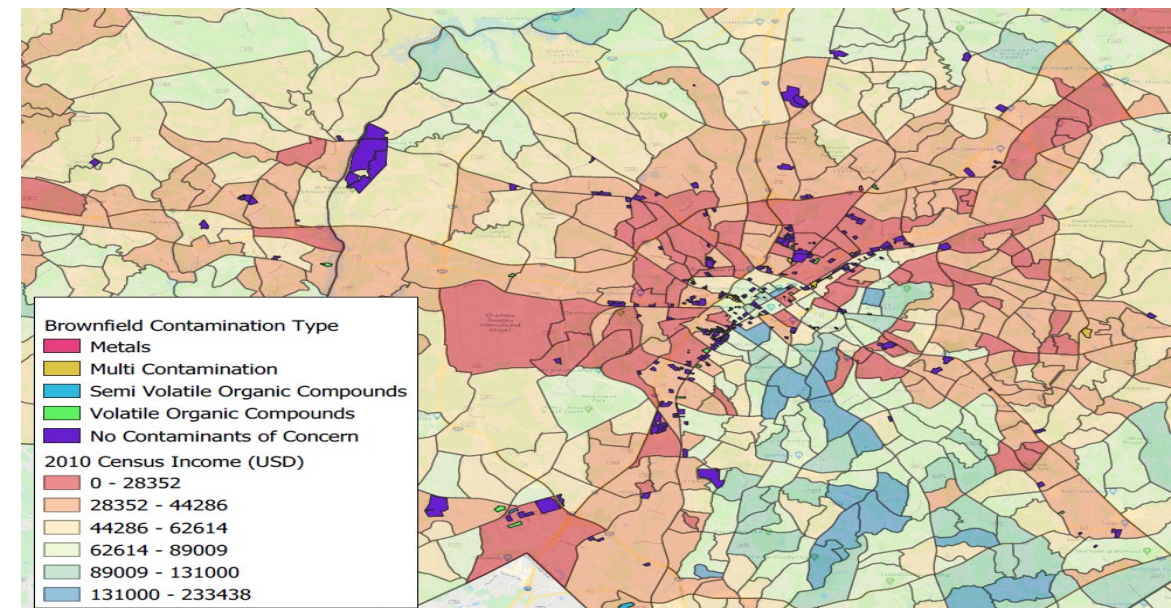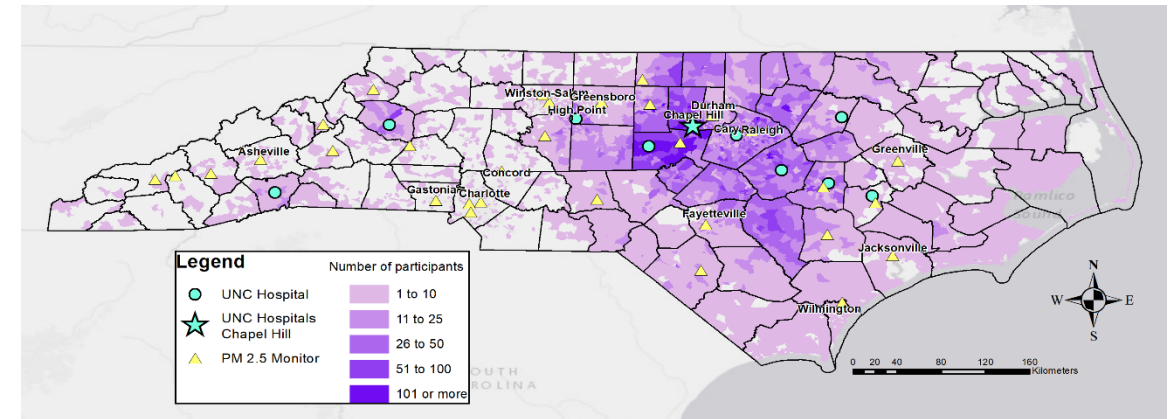
Impact of EGS and Brownfields on Vulnerable Populations
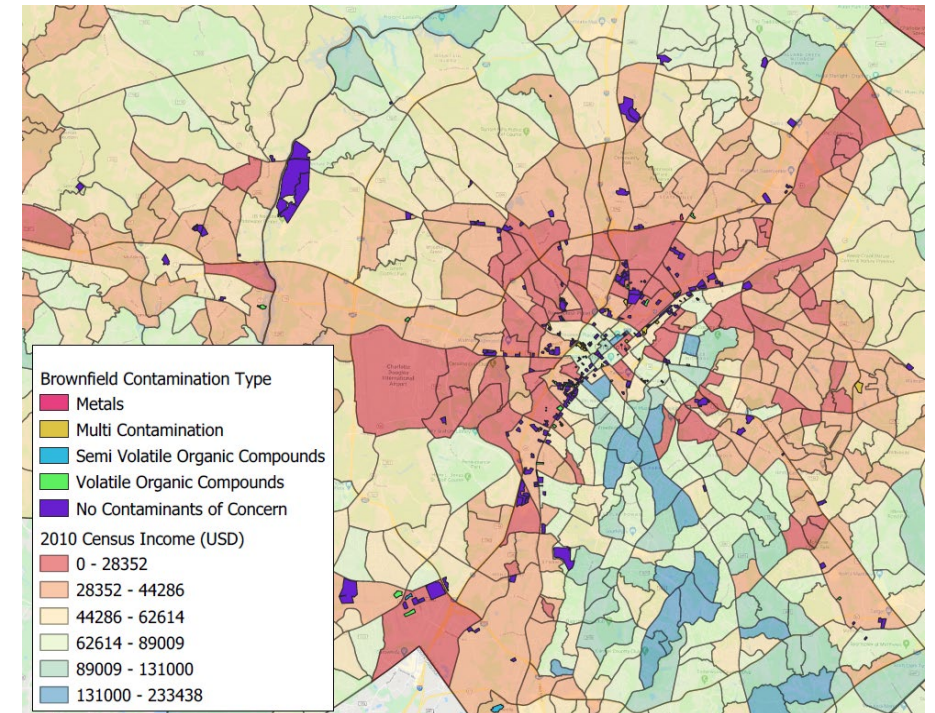
Addressing the Challenge

- Associate adverse health effects of brownfields and health benefits of EGS in vulnerable, patient populations

Short-term Goals

- Classify current brownfield status
- Create integrated database of brownfields, EGS, and health records

Partner Impact

- Evidence of health effects of active brownfields and of local EGS

Brownfield Contamination Type
- Metals
- Multi Contamination
- Semi Volatile Organic Compounds
- Volatile Organic Compounds
- No Contaminants of Concern

2010 Census Income (USD)
- 0 - 28352
- 28352 - 44286
- 44286 - 62614
- 62614 - 89009
- 89009 - 131000
- 131000 - 233438

Public Health Benefits of Revitalizing Brownfields

Addressing the Challenge

- Associate health biomarkers to community changes
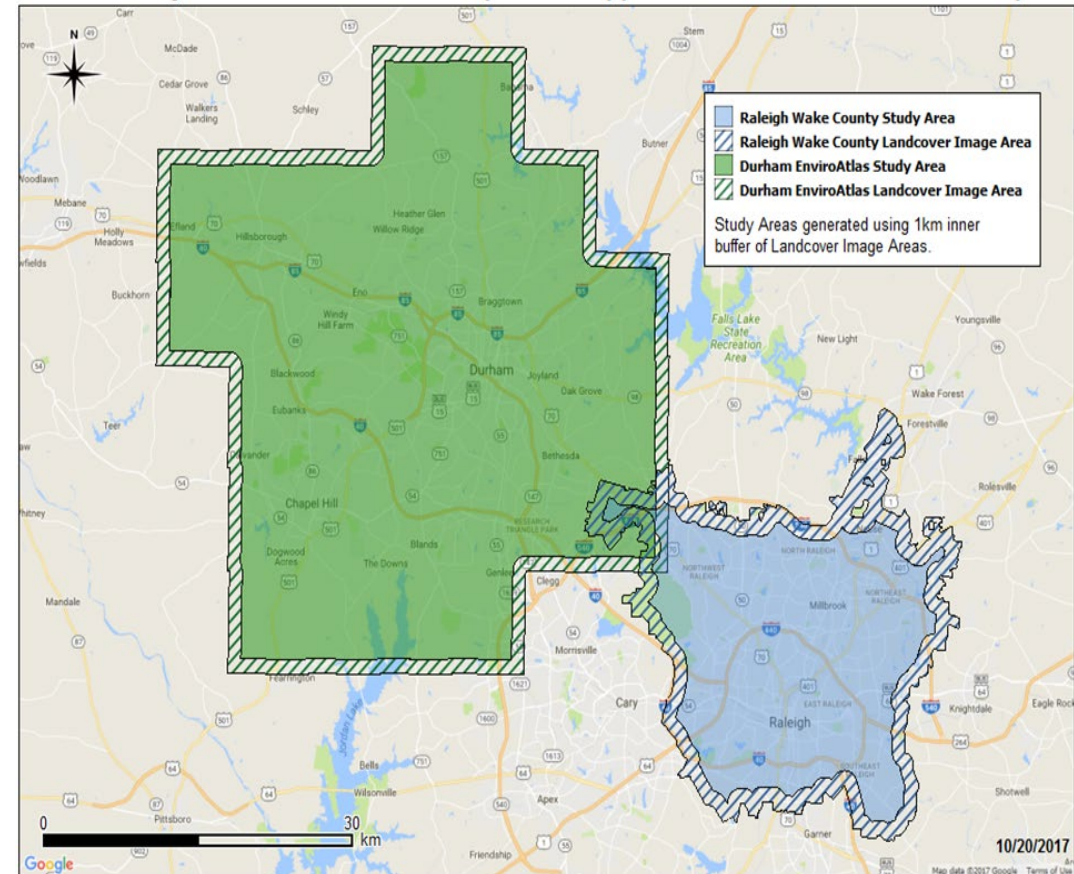- Relate well-being indicators to environmental improvements in R2R2R framework

Short-term Goal

- Collect, scale, and utilize health and well-being indicators at local and national levels

Partner Impact

- Improved communication on health benefits of brownfields revitalization

Renaldi Study Area for ArcGIS EPA Geoplatform Application - Renaldi Address Lookup

Raleigh Wake County Study Area
Raleigh Wake County Landcover Image Area
Durham EnviroAtlas Study Area
Durham EnviroAtlas Landcover Image Area

Study Areas generated using 1km inner buffer of Landcover Image Areas.

10/20/2017

Health Benefits of Greenspace Access for Patients with Diabetes

Addressing the Challenge

- Model health benefits of local greenspace for pre-diabetic and diabetic individuals

Short-term Goal

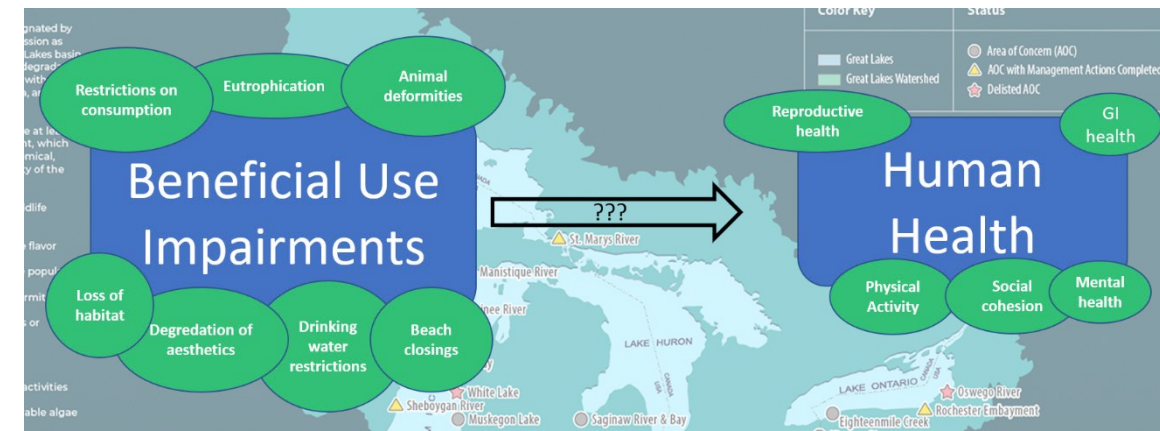- Merge greenspace access data with health records of diabetes patients

Partner Impact

- Support of health impact assessments for health-oriented urban policy interventions
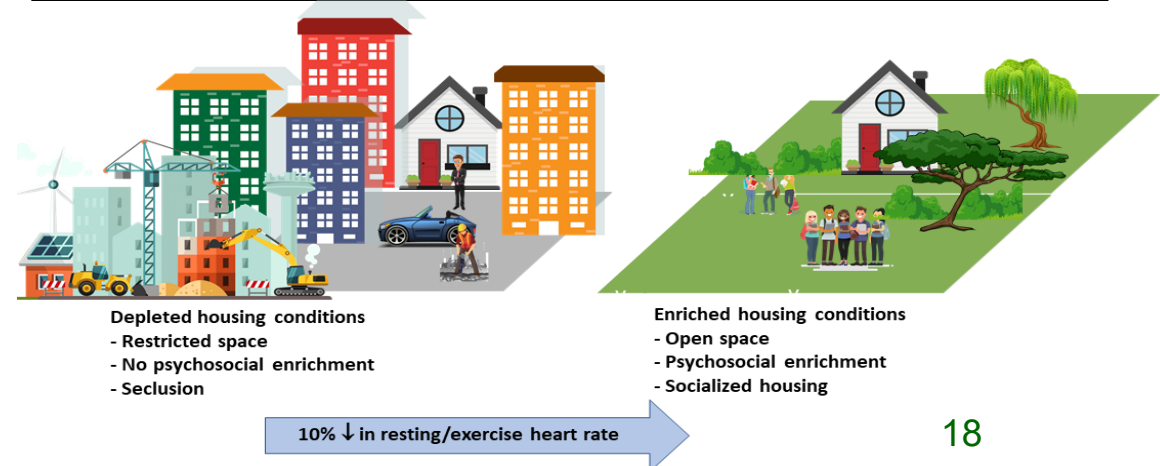

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Product 3

Quantify the Health Benefits of R2R2R

Three projects

1. Benefits of removing impairments at remediation sites

2. Benefits of environmental rejuvenation on vulnerable populations

3. R2R2R as a natural experiment for human health and well-being

Environmental/housing enrichment improves cardiovascular function and response to exercise

Depleted housing conditions
- Restricted space
- No psychosocial enrichment
- Seclusion

Enriched housing conditions
- Open space
- Psychosocial enrichment
- Socialized housing

10% ↓ in resting/exercise heart rate

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Product 3

Benefits of Restoring Ecological Impairments at Remediation Sites

Addressing the Challenge

- Systematic review of BUI (e.g., aesthetic degradation) and human health linkages

Short-term Goal

- Develop communication tools on impact of removing beneficial use impairments (BUI) for Great Lakes coastal communities

Partner Impact

- Support of health impact assessments for health-oriented urban policy interventions

Benefits of Environmental Rejuvenation on Vulnerable Populations

Addressing the Challenge

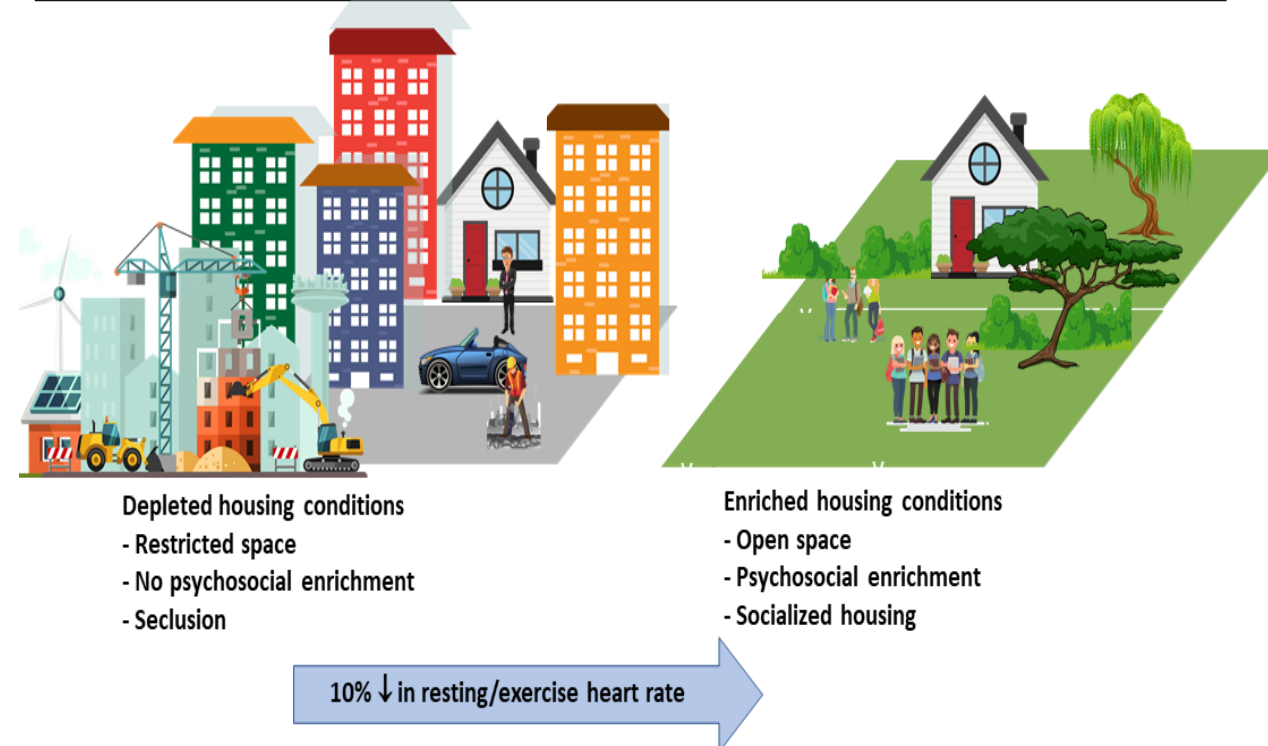- Assess impact of environmental rejuvenation on physiological and behavioral endpoints

Short-term Goal

- Evaluate cardiometabolic benefits of environmental rejuvenation

Partner Impact

- Provides key information on the benefits of environmental rejuvenation

Environmental/housing enrichment improves cardiovascular function and response to exercise

Depleted housing conditions
- Restricted space
- No psychosocial enrichment
- Seclusion

Enriched housing conditions
- Open space
- Psychosocial enrichment
- Socialized housing

10% ↓ in resting/exercise heart rate

20

Product 3

R2R2R as a Natural Experiment for Human Health and Well-being

Addressing the Challenge

- Natural experiments using completed site rejuvenation

Short-term Goal
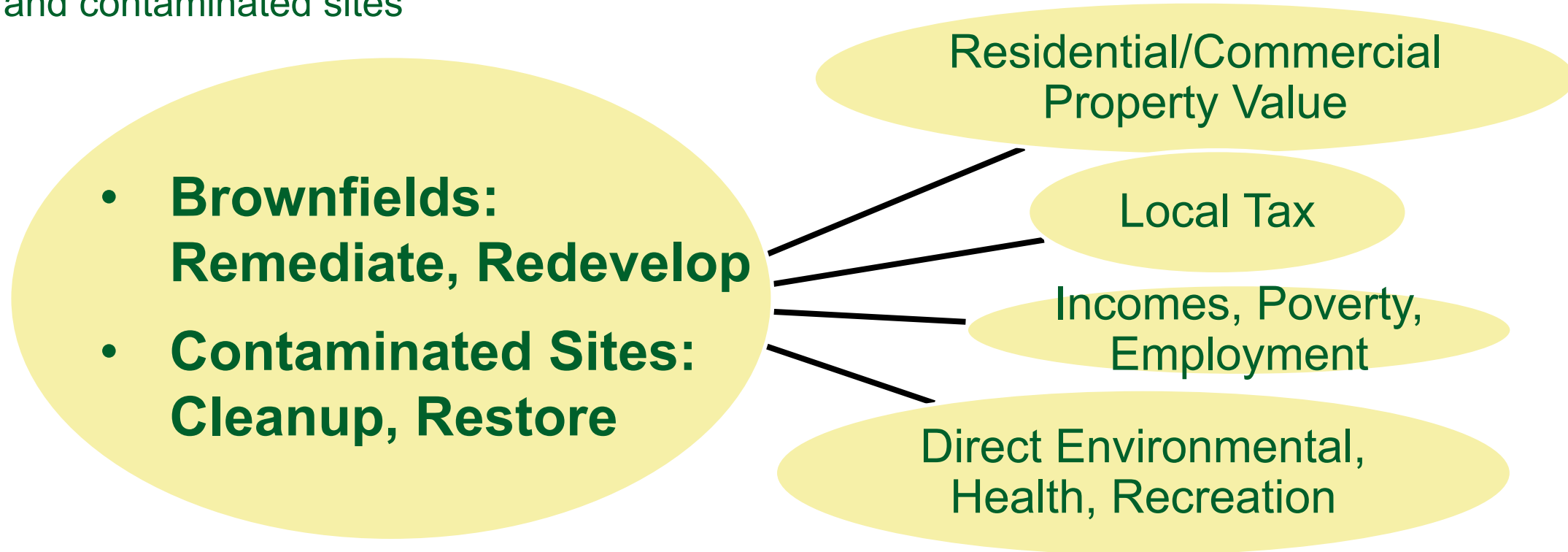
- Select initial study areas and analytic methods

Partner Impact

- Improved data on benefits and impacts of clean-up processes

Product 3

Economic Evaluation of Contaminated Site and Brownfields Remediation (SHC 9.3.4)

Partner Challenge: Estimate the economic impacts of remediation and restoration of brownfields and contaminated sites

- **Brownfields: Remediate, Redevelop**
- **Contaminated Sites: Cleanup, Restore**

Residential/Commercial Property Value

Local Tax

Incomes, Poverty, Employment

Direct Environmental, Health, Recreation

Data Sources: American Community Survey, Zillow, EJScreen Tool, EnviroAtlas

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Region 4: Interested in demonstrating the economic impacts of land cleanup

Addressing the Challenge

- Quantitatively evaluate the economic impacts of brownfield and/or superfund cleanup and restoration (market and non-market valuation)

- Region 4 potential study sites: Atlanta, GA; Orlando, FL; Tampa, FL; Gainesville, FL

- Output: Presentations, data, models, peer-reviewed publications, report

Short-term Goal

- Identify case study site

Before

After

Gainesville, FL Depot Park brownfield project

Product 4

GLNPO: Interested in the economic impact of remediation and restoration of Great Lakes Areas of Concern (AOCs)

Addressing the Challenge

- Quantify the economic benefits of remediation and restoration (removal of Beneficial Use Impairments)
- Spatial and panel data will be collected at active clean-ups and de-listed AOCs
- Research Output: Data, maps, report, and peer-reviewed publications

Short-term Goal

- Identify prospective and retrospective study sites

US Steel Superfund and Legacy Act Site Duluth, MN

Product 4
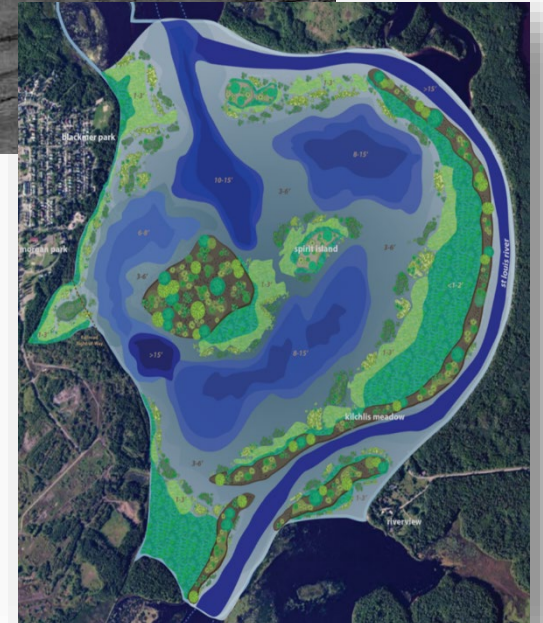
Where to work? Development of Remediation and Restoration Strategies (SHC 9.3.5)

Goal: Demonstrate watershed-scale strategies for determining where and how to implement contaminated site remediation and restoration practices

- Great Lakes communities
- Puget Sound communities
- San Juan Bay, Puerto Rico

Work with long-standing partners (federal, state, tribal, community)

Puget Sound

Great Lakes

San Juan Bay

Remediation → **R**estoration → **R**evitalization

Great Lakes Communities
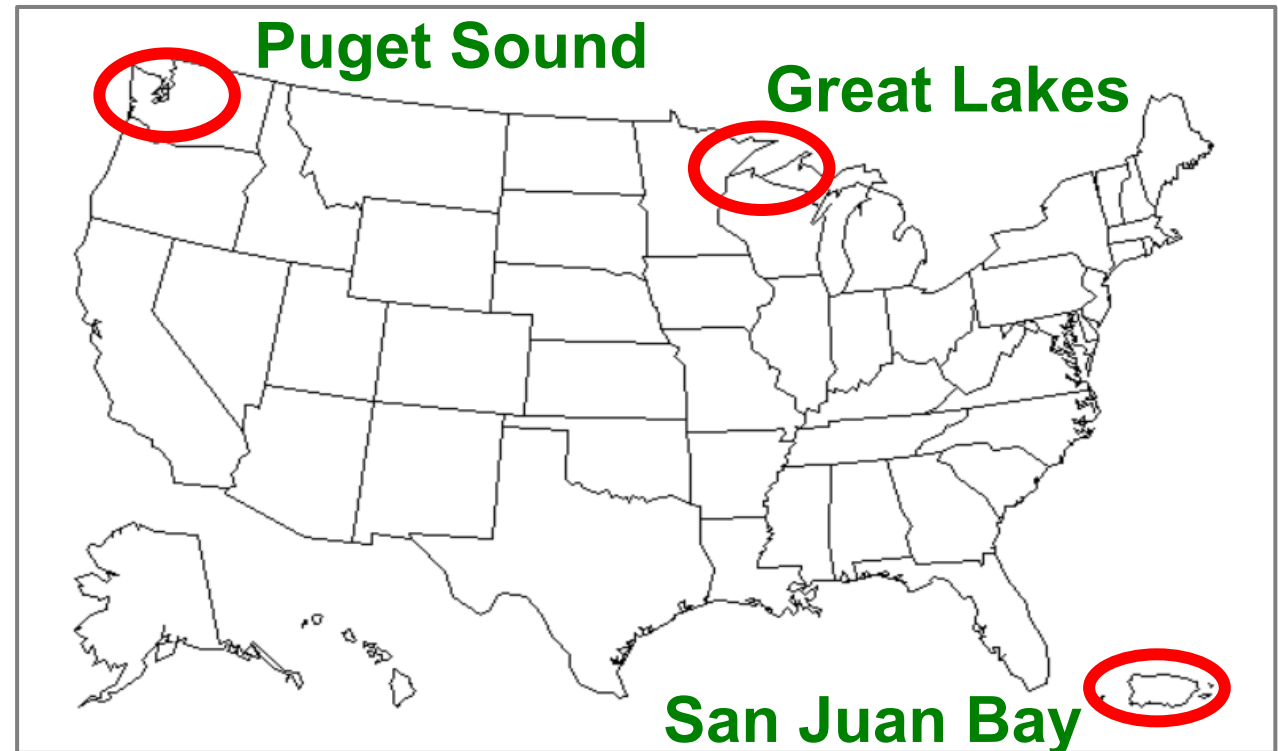
Partner Challenge

- Spatial distribution of contaminant-related risks
- Watershed strategies to protect remediation, restoration progress

Addressing the Challenge

- Implement hydro-biogeochemical models of contaminant fate, transport, and bioaccumulation
- Identify land-use strategies for reducing contaminant impacts

Short-term Goal

- Test strategy for bioaccumulation-related risk (based on a recently completed model)

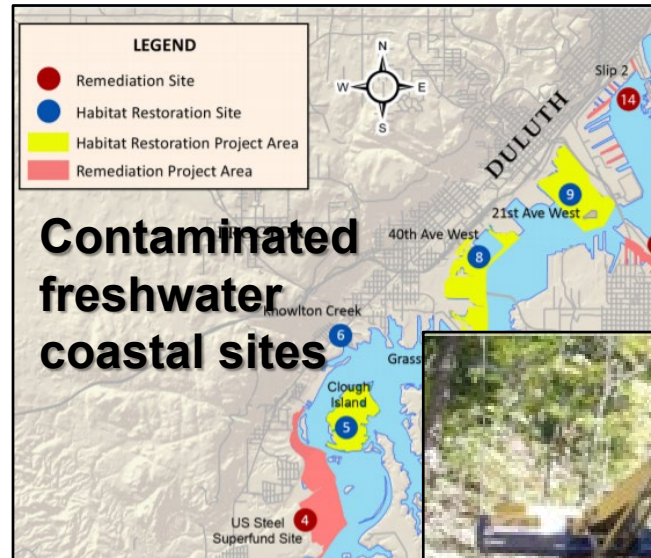*Product 5*

Contaminated Sites

- Brownfields
- Superfund
- Stormwater runoff

R2R2R
Remediation
Restoration
Revitalization
Methods

Revitalized communities

- Improved ecosystem services
- Improved human health

Revitalized waterfront

Contaminated freshwater coastal sites

LEGEND
- Remediation Site
- Habitat Restoration Site
- Habitat Restoration Project Area
- Remediation Project Area

Remediation, Restoration

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Puget Sound Communities

Partner Challenge

- Reducing contaminant loads in urban stormwater
- Quantify link between condition (toxics in fish) and human health
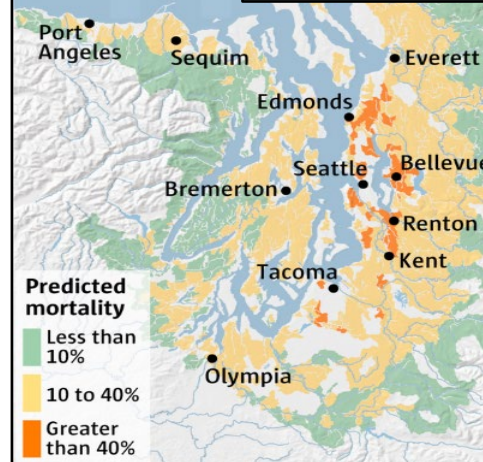
Addressing the Challenge

- Identify green and gray infrastructure best practices (VELMA, Aquatox)
- Provide partners science-based strategies to mitigate stormwater

Short-term Goals

- Green infrastructure modeling demos for Seattle area communities
- Begin partner and community outreach workshops (DASEES)

Product 5

Contaminated Sites
- Brownfields
- Superfund
- Stormwater runoff

R2R2R
Remediation
Restoration
Revitalization
Methods

Revitalized communities
- Improved ecosystem services
- Improved human health

City of Olympia, WA

Death by pollution
Coho are dying before they can even spawn as they encounter the pollution in urban streams.

Predicted mortality
- Less than 10%
- 10 to 40%
- Greater than 40%

Healthier Ecosystem and Communities

Green Infrastructure

Toxic Stormwater, Fish and Shellfish

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San Juan Bay, Puerto Rico

Partner Challenge

- identify areas most vulnerable to flooding with contaminated water
- Spatial patterns of emerging contaminants and ecological impairment

Addressing the Challenge

- Database: frequency, duration, and extent of neighborhood flooding
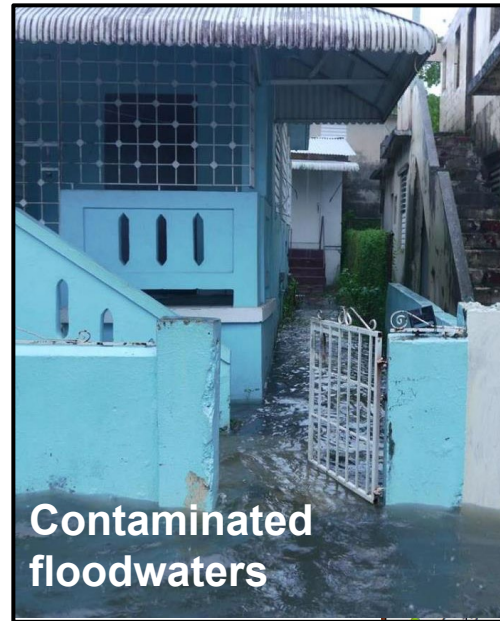- Identify hot-spots

Short-term Goals

- Develop community flood maps
- Identify emerging contaminants of greatest concern

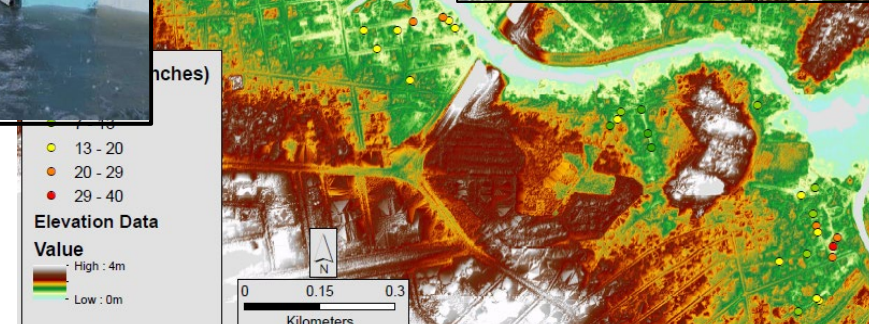**Contaminated Sites**

- Brownfields
- Superfund
- Stormwater runoff

R2R2R
Remediation
Restoration
Revitalization
Methods

Revitalized communities

- Improved ecosystem services
- Improved human health

Contaminated floodwaters

Communication and education

Tirar Basura Aqui es tirarla en tu Casa
Amig@s del Caño

(inches)
7 - 13
13 - 20
20 - 29
29 - 40
Elevation Data
Value
High : 4m
Low : 0m

0   0.15   0.3
Kilometers

Identify vulnerable urban neighborhood and fishing areas

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Product 5

Thank you

Product Leads

9.3.1 Ted Angradi, Tammy Newcomer-Johnson

9.3.2 Kevin Summers, Kyle Buck, Andrea Lamper

9.3.3 Cavin Ward-Caviness

9.3.4 Bayou Demeke

9.3.5 Bob McKane, Autumn Oczkowski, Joel Hoffman