Navigating Data Linkages in Environmental Health Research with CHORDS: Connecting Health Outcomes Research and Data Systems

Aubrey K. Miller[1], Darius Bost[1,3], Adam Burkholder[1], Trisha Castranio[1], David Fargo[1], Ann Y. Liu[1,2],
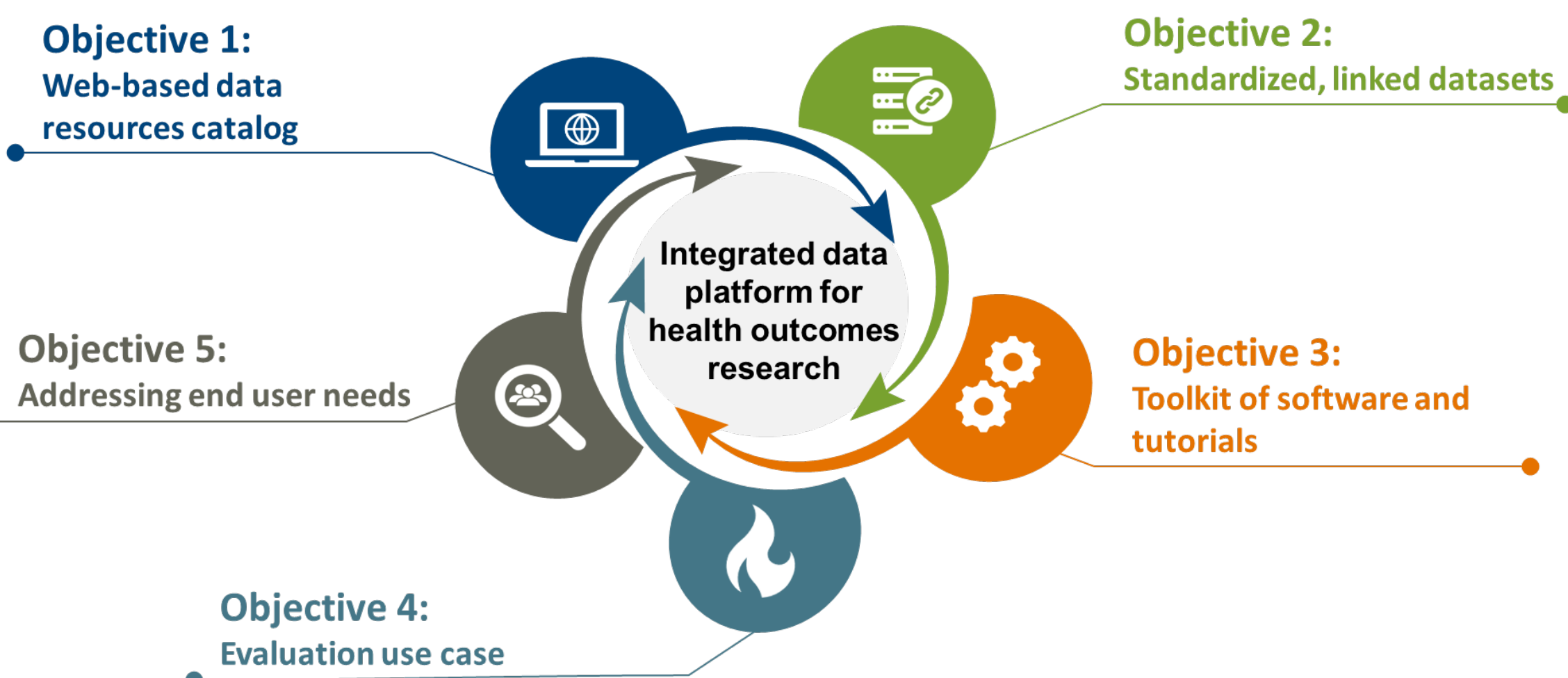Kyle Messier[1], Alison Motsinger-Reif[1], David Reif[1], Charles Schmitt[1]

[1]National Institute of Environmental Health Sciences, Research Triangle Park, NC;
[2]Kelly Government Solutions, Rockville; MD [3]GAP Solutions, Durham, NC
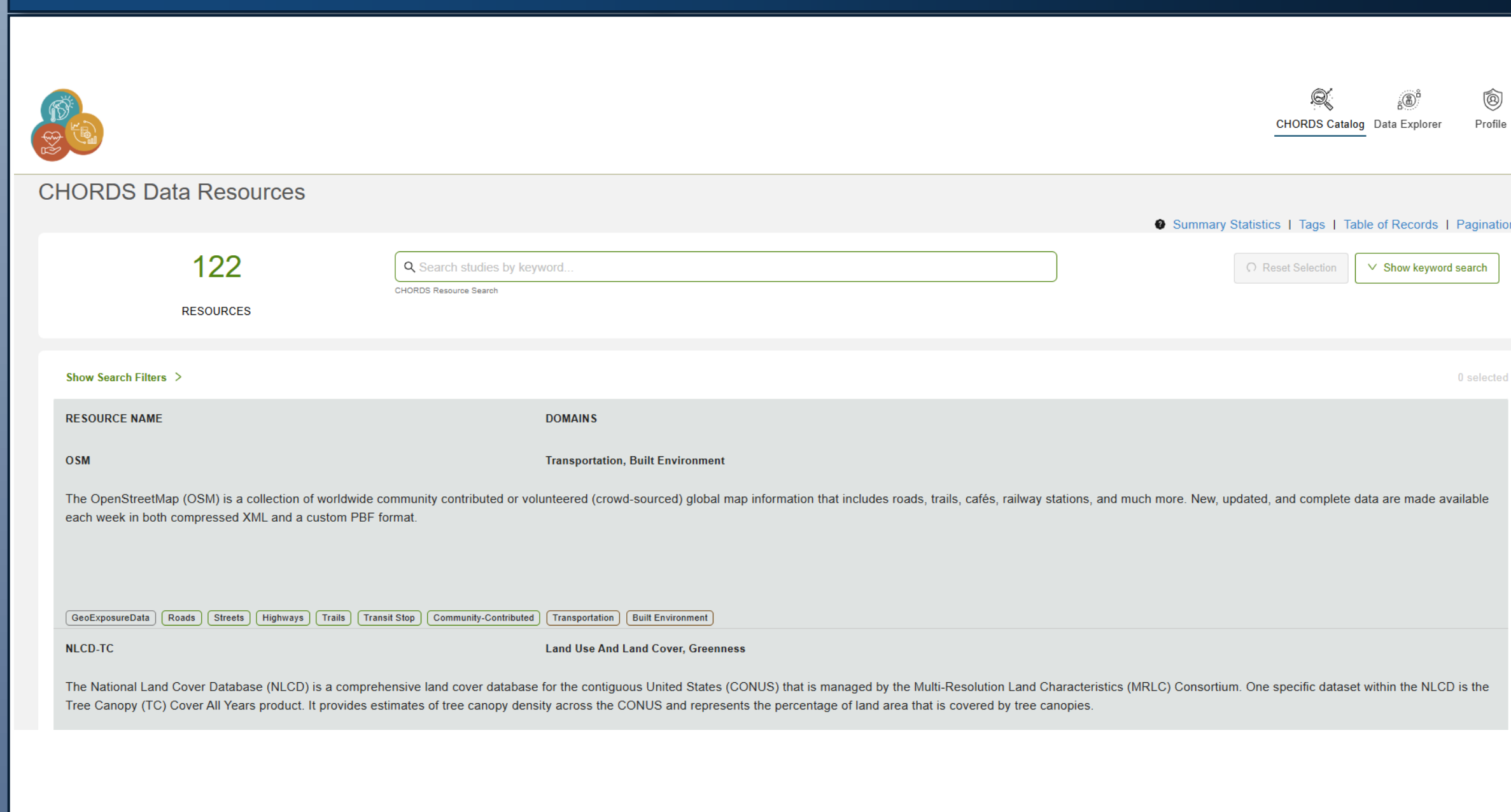
Background

The CHORDS project **strengthens data infrastructure to facilitate research connections** between environmental exposures and health outcomes. Exposures such as poor air and water quality, extreme temperatures, and natural disasters can cause both short-term health effects, like asthma attacks and heat stroke, and long-term conditions such as heart disease and cancer. By **providing accessible, interoperable data and analytical resources**, CHORDS supports researchers, health practitioners, and public officials in assessing environmental health risks, developing evidence-based interventions, and anticipating future health challenges to better protect communities.

CHORDS Objectives and Deliverables

Objective 1: Web-based data resources catalog

Objective 2: Standardized, linked datasets

Objective 5: Addressing end user needs

Objective 3: Toolkit of software and tutorials

Objective 4: Evaluation use case

Integrated data platform for health outcomes research

Data Resources Catalog

Open-source Software Tools

Amadeus ↗
repo status Active
Machine for Data, Environments, and User Setup for common environmental and climate health datasets is an R package developed to improve and expedite users' access to large, publicly available geospatial datasets.
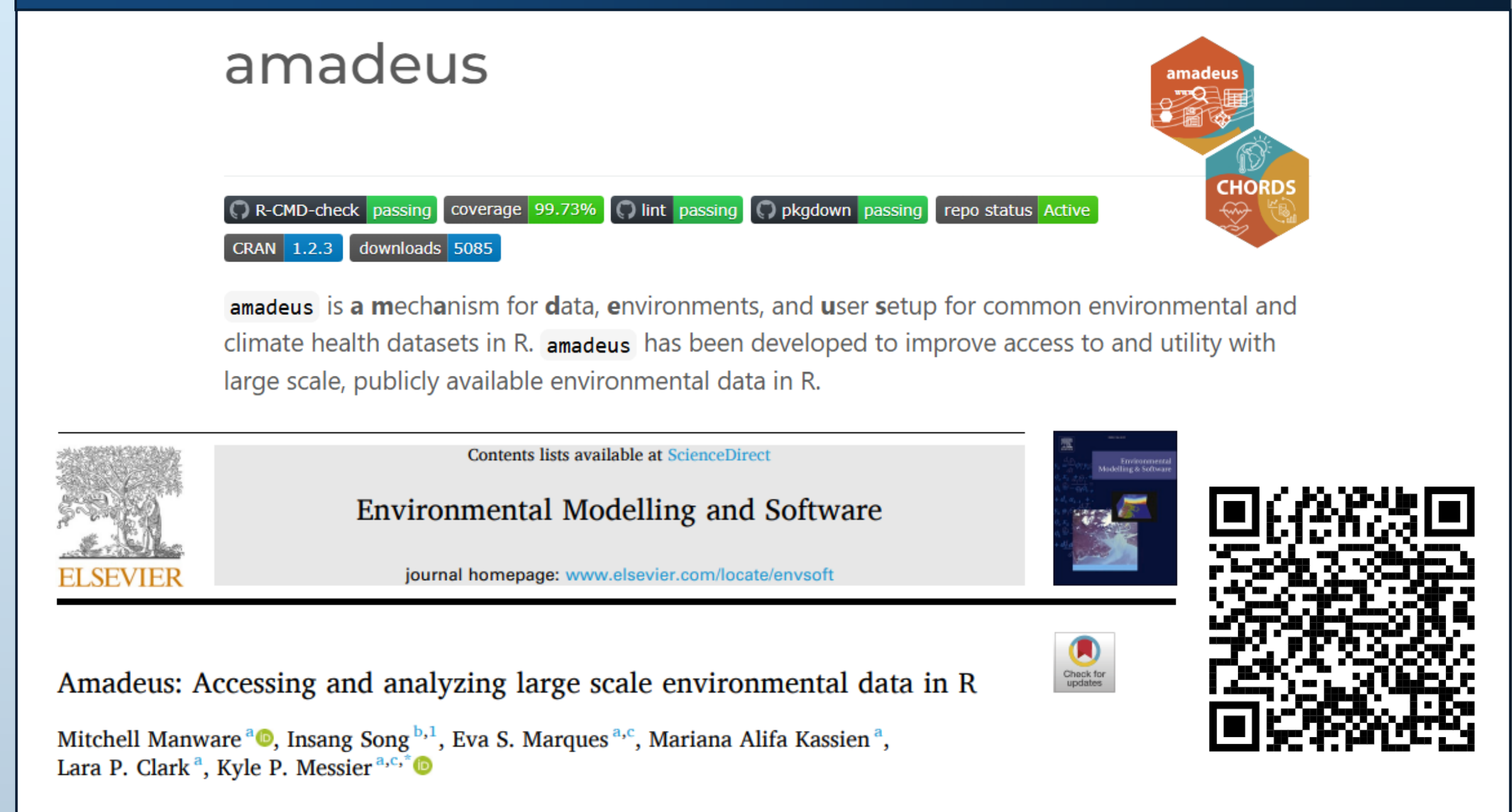
Beethoven ↗
repo status WiP
Building an Extensible, Reproducible, Test-driven, Harmonized, Open-source, Versioned, Ensemble model for air quality is an R package developed to facilitate the development of ensemble models for air quality.

Chopin ↗
repo status WiP
Computation of Spatial Data by Hierarchical and Objective Partitioning of Inputs for Parallel Processing.

Adameus Software

amadeus is a **m**echanism for **d**ata, **e**nvironments, and **u**ser **s**etup for common environmental and climate health datasets in R. **amadeus** has been developed to improve access to and utility with large scale, publicly available environmental data in R.

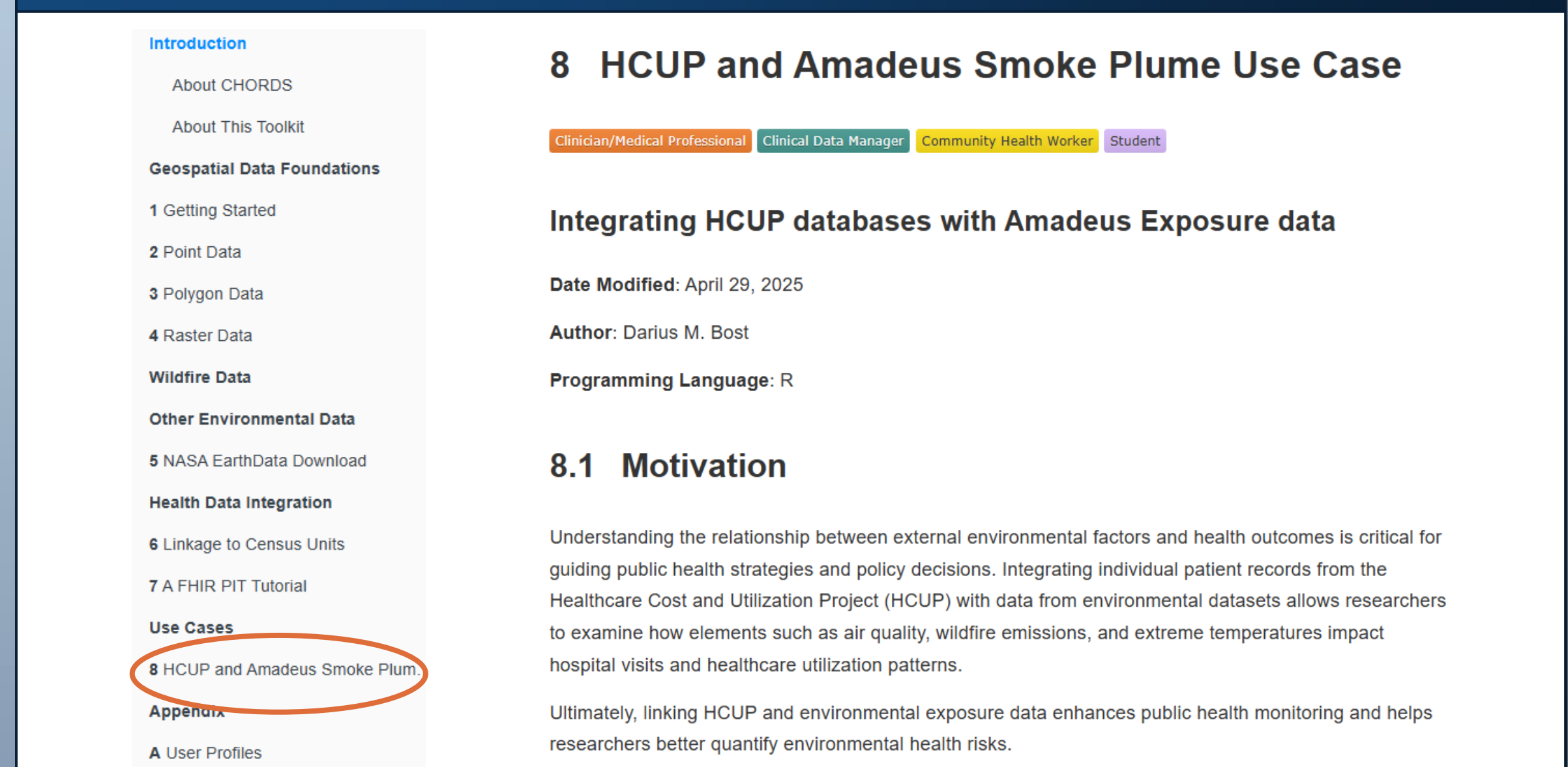Contents lists available at ScienceDirect

Environmental Modelling and Software

journal homepage: www.elsevier.com/locate/envsoft

Amadeus: Accessing and analyzing large scale environmental data in R

Mitchell Manware [a] ⓘ, Insang Song [b,1], Eva S. Marques [a,c], Mariana Alifa Kassien [a], Lara P. Clark [a], Kyle P. Messier [a,c,*] ⓘ

Training and Tutorials

8 HCUP and Amadeus Smoke Plume Use Case

Clinician/Medical Professional   Clinical Data Manager   Community Health Worker   Student

Integrating HCUP databases with Amadeus Exposure data

Date Modified: April 29, 2025

Author: Darius M. Bost

Programming Language: R

8.1 Motivation

Understanding the relationship between external environmental factors and health outcomes is critical for guiding public health strategies and policy decisions. Integrating individual patient records from the Healthcare Cost and Utilization Project (HCUP) with data from environmental datasets allows researchers to examine how elements such as air quality, wildfire emissions, and extreme temperatures impact hospital visits and healthcare utilization patterns.
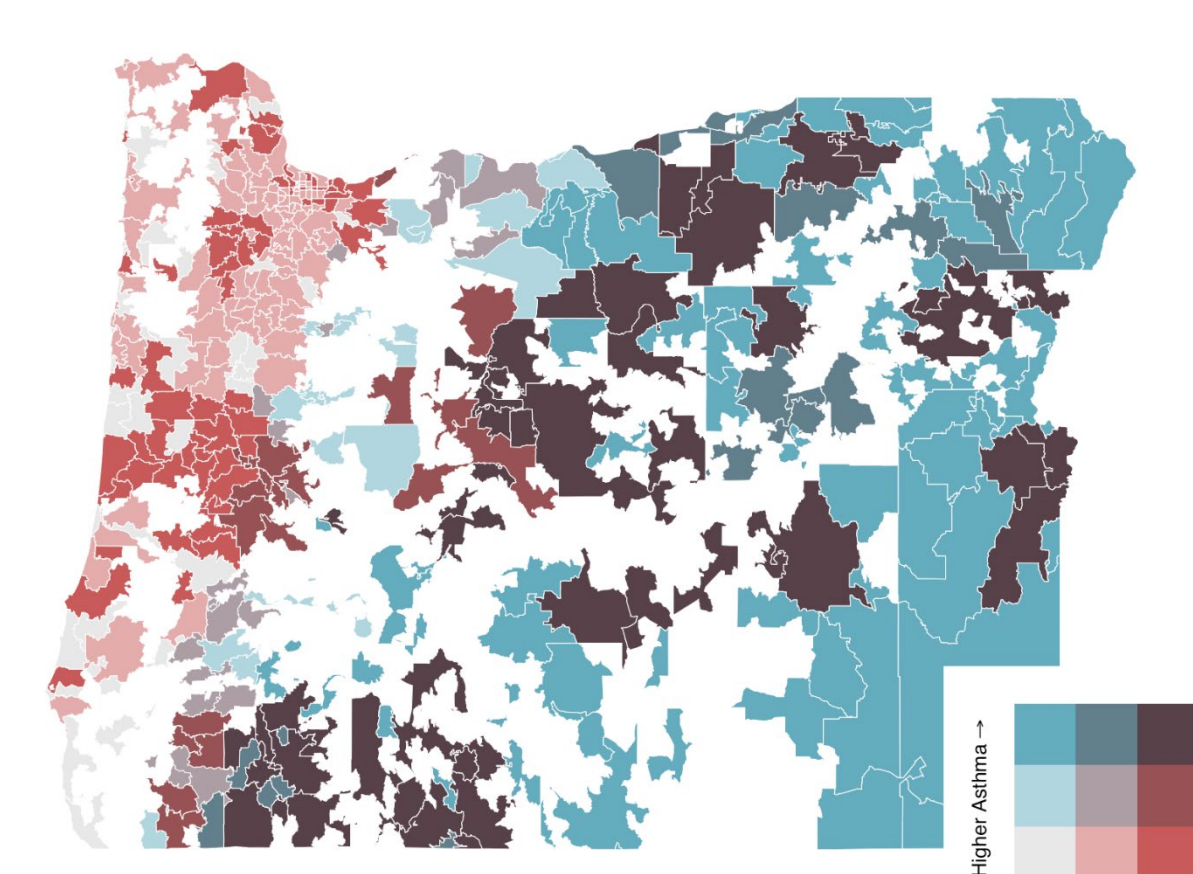
Ultimately, linking HCUP and environmental exposure data enhances public health monitoring and helps researchers better quantify environmental health risks.

Wildfire Use Case with HCUP Data (Oregon, 2021)

- Logistic regression model: exposure to medium and heavy smoke significantly increases the odds of asthma diagnosis

- Demonstrates utility of amadeus software in processing NOAA HMS wildfire smoke data

- Combining environmental and clinical data can support targeted public health interventions

Asthma Prevalence vs Heavy Smoke Exposure by ZIP Code
Bivariate map showing intersection of health and environmental burden

Legend:
X-axis (**red**): higher smoke exposure
Y-axis (**blue**): higher asthma

Color interpretations:
– **Dark red**: high smoke, low asthma
– **Dark blue**: high asthma, low smoke
– **Dark purple**: high smoke, high asthma
– **Light gray**: low smoke, low asthma

Source: HCUP-Amadeus

Conclusion

By building a data ecosystem of evolving publicly available resources, CHORDS aims to empower a diverse group of end users – including researchers, health care providers, policy and decisionmakers, and community groups – seeking to examine and mitigate the adverse health consequences of wildfires and other environmental health disasters and emergencies.