

Toxic Sites Identification Program

Screening Toxic Hotspots from Mining, Ore Processing and Smelting in Transitioning Economies



Andrew McCartor • Regional Program Director, Blacksmith Institute • drew@blacksmithinstitute.org

Program partners:

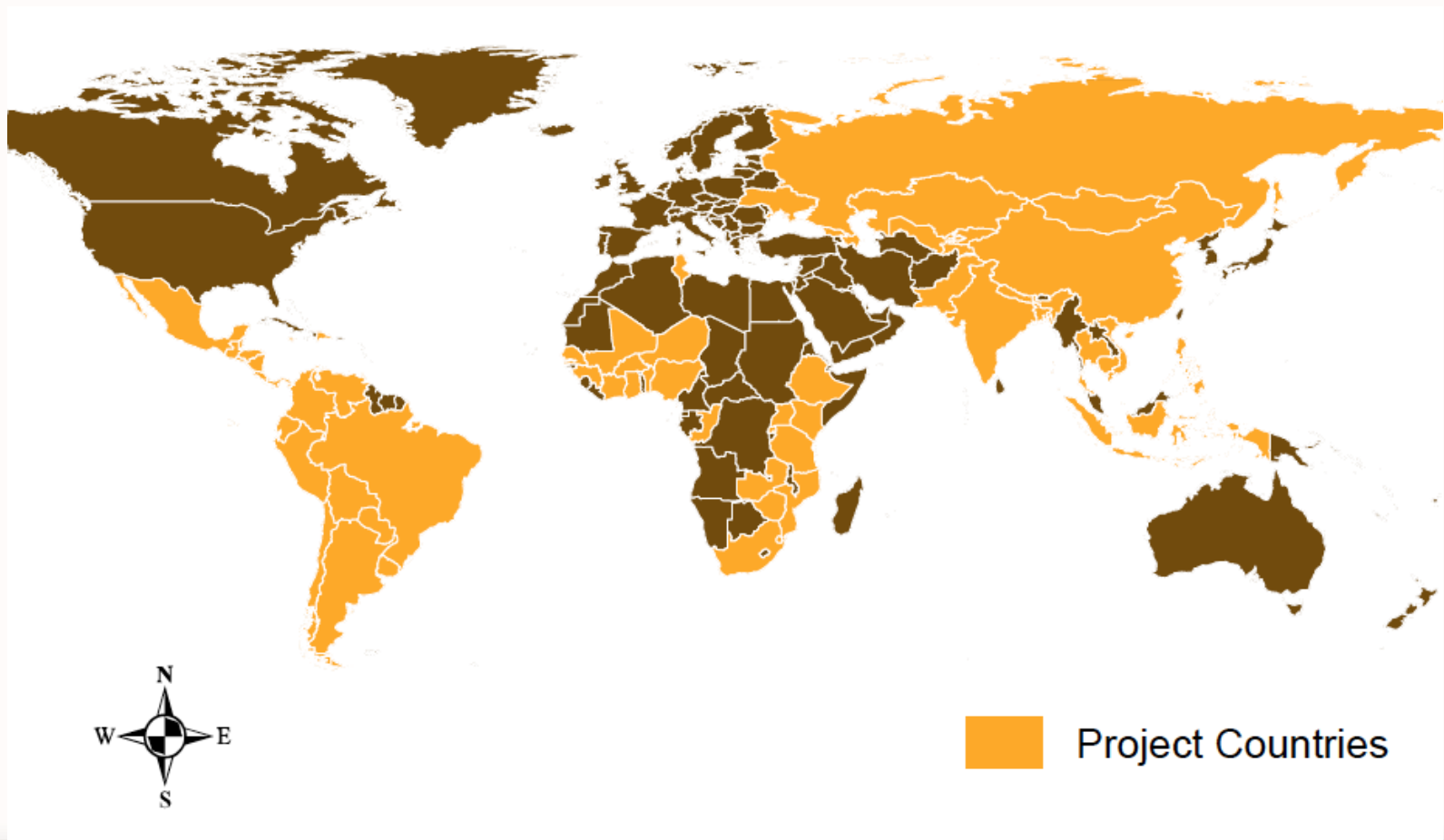


Toxic Sites Identification Program

- Started 2009
- Implemented with the United Nations Industrial Development Organization and supported by World Bank, Asian Development Bank and European Commission
- In Armenia, the program is managed by American University of Armenia
- **Scope:**
 - “Toxic” pollutants
 - Heavy metals, radionuclides, pesticides, PCBs, VOCs, PAHs, dioxins, etc.
 - Not including: greenhouse gasses, sewage, non-toxic municipal waste
 - From a point-source (no distributed air pollution)
 - In low- and middle-income countries (as defined by World Bank)
 - Creating a potential human health risk
- **Goals:**
 - Increase understanding of the scope of the problem
 - Provide data to decision-makers
 - Increase global funding for remediation
 - Prioritize resources to address human health risks

Geographic Scope

- Since 2009, the Program has expanded to 65 low- and middle-income countries

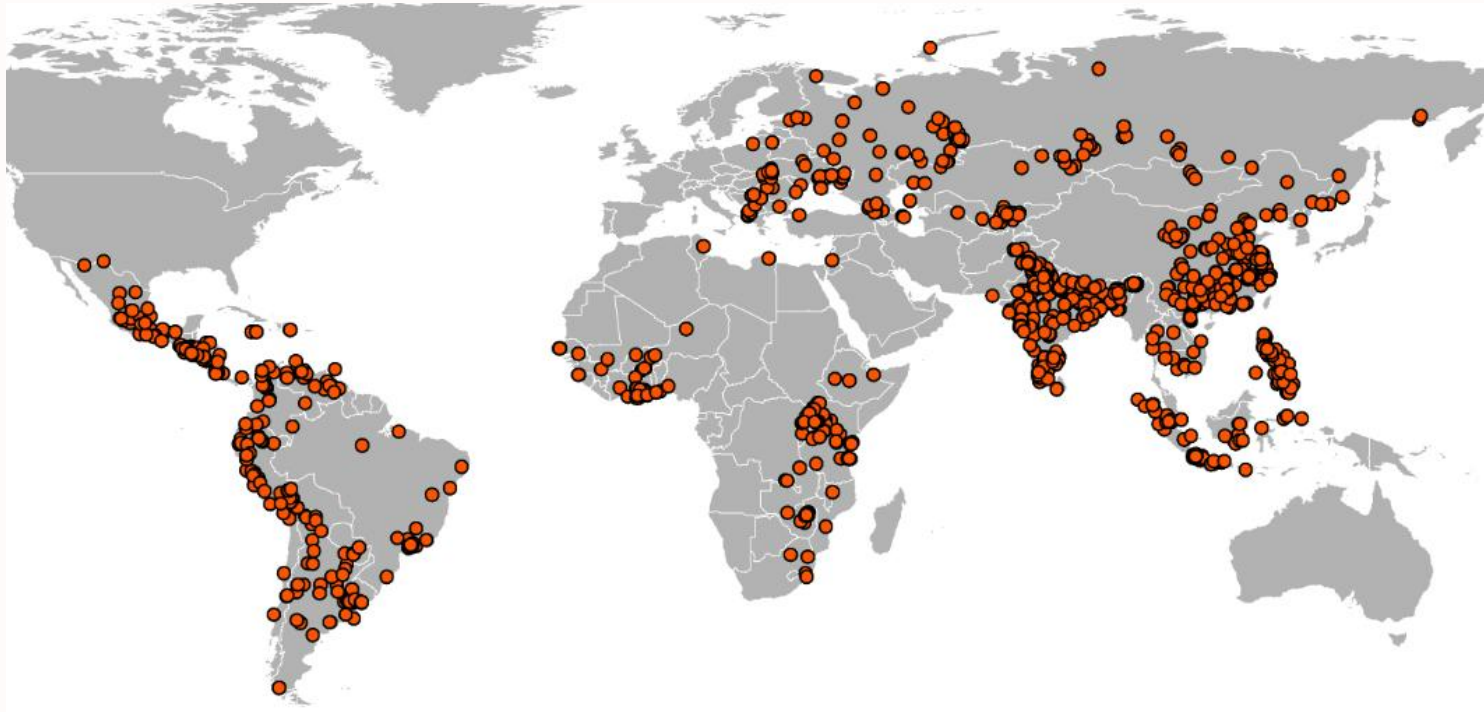


Methodology

- Building a global database of hotspots
 - In each country, the program is implemented by a Country Coordinator and team of Site Investigators
 - Two-day training in the program's site screening methodology
 - Local team identifies sites to screen
 - Investigators conduct rapid a 1-2 day "initial site screening" at each site
 - Photos; environmental sampling; estimation of population at risk; interviews; collection of pre-existing health data; observations regarding pollution source, pollution migration path and media, geography, climate, social patterns, etc.
- A rapid screening tool used to prioritize further study
 - Not a detailed site "assessment" as required for remediation

Methodology

- The database:
 - 2,870 sites identified
 - 1,830 screenings completed



Site Prioritization – Blacksmith Index

- How do we compare relative health risks between sites?
- Site data generates a relative risk score from 0-10 called the “Blacksmith Index”
- Simplified version on “source – pathways – receptor” models used by US Superfund and other programs
 - Index inputs:
 - Estimated population at risk
 - Severity: pollutant concentration/screening threshold level
 - Persistence factor: if half life > 1 year
- **Blacksmith Index = Log(pop) + Log(sev) + Persistence**

Estimated Population at Risk

- Site is divided into “sectors” by land use
- Target and composite samples are taken in each sector
- Population in each sector that may come into contact with the sampling media is estimated
- Total Population at Risk = populations from each sector where samples exceed screening threshold
- **Blacksmith Index = $\text{Log}(\text{pop}) + \text{Log}(\text{sev}) + \text{Persistence}$**

Sector Sampling

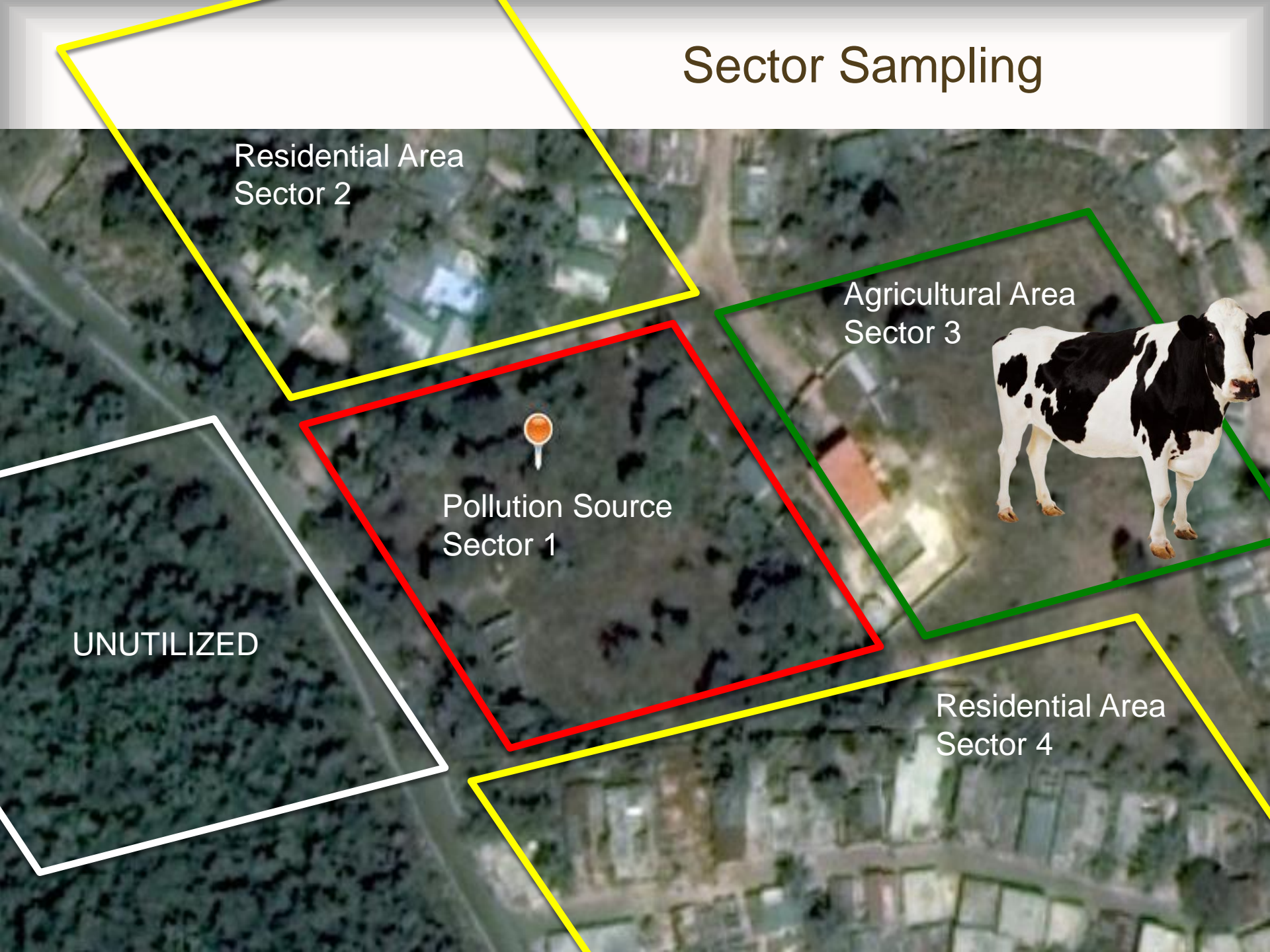
Residential Area
Sector 2

Agricultural Area
Sector 3

Pollution Source
Sector 1

UNUTILIZED

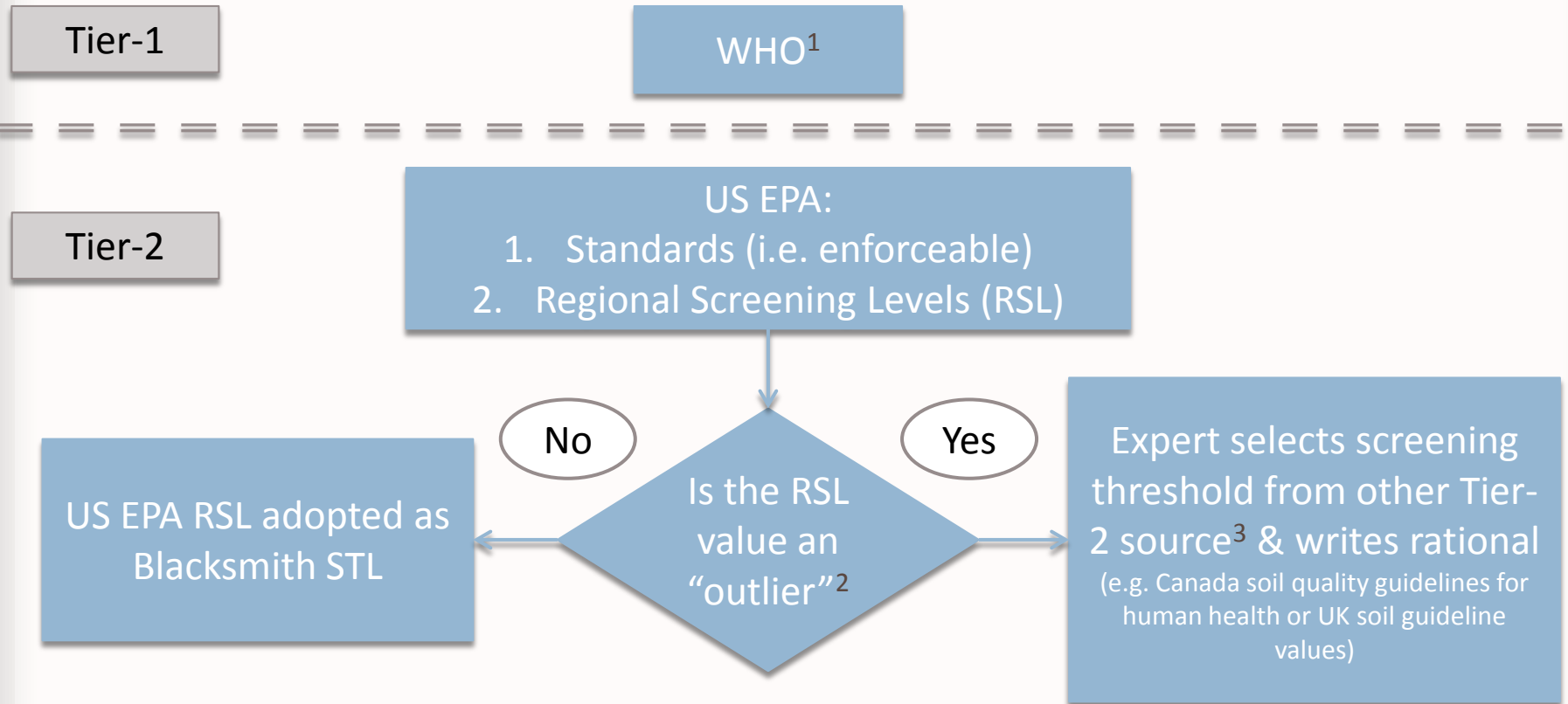
Residential Area
Sector 4



Severity- Screening Threshold Levels

- Using national standards vs. a uniform standard
- The goal of the Index is to compare the relative risk of all sites, therefore uniform threshold levels from internationally accepted guidelines are required
 - Standards are not necessarily “clean up” levels
- **Blacksmith Index = $\text{Log}(\text{pop}) + \text{Log}(\text{sev}) + \text{Persistence}$**

Choosing Screening Threshold Levels

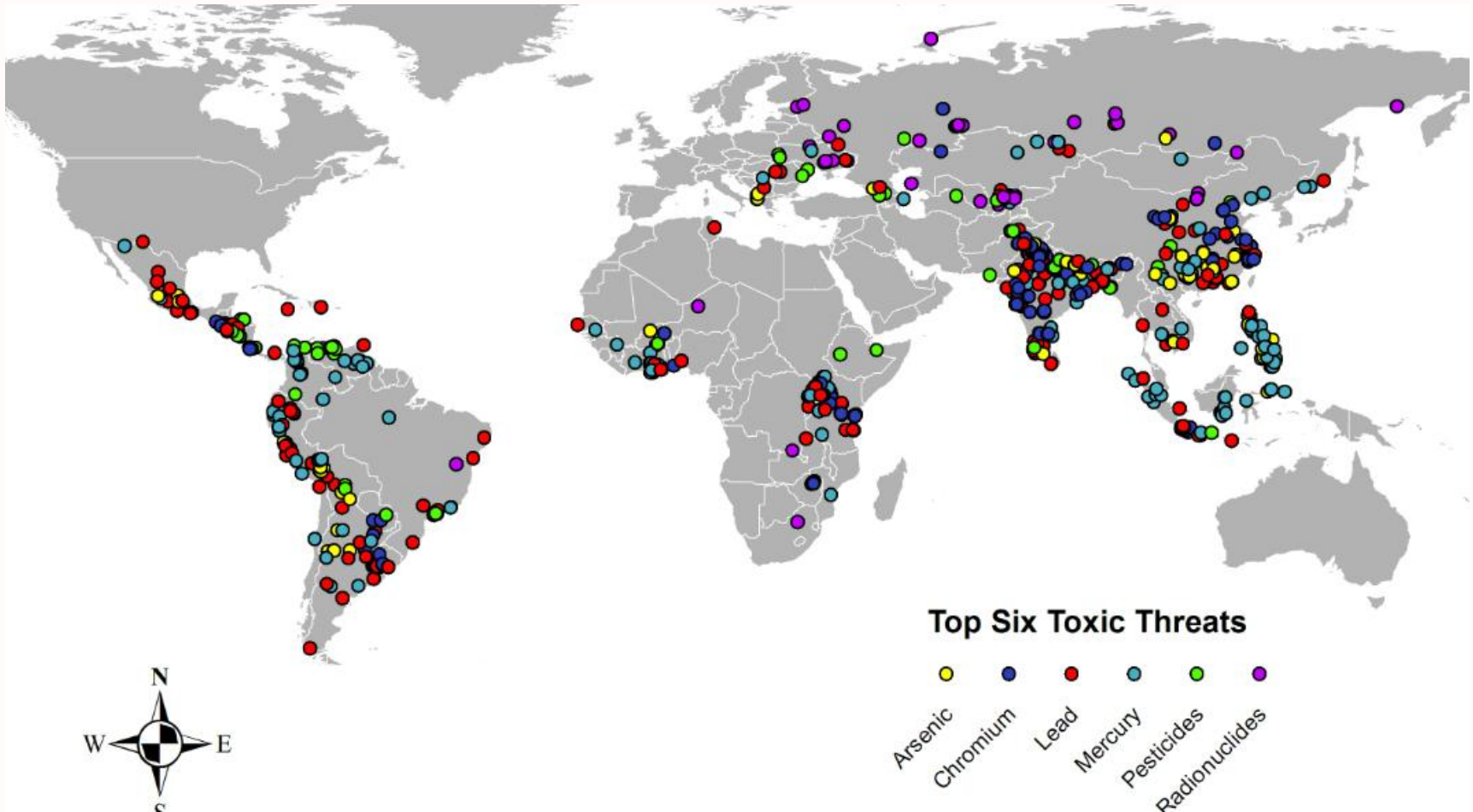


¹ WHO does not have guidelines for soil

² EPA "outliers" are at least one order of magnitude lower than comparable values from other Tier-2 systems (typically for carcinogens)

³ Criteria for Tier-2 source: values are health-based; divided by land-use; adopted by other other countries for soil guideline systems

Global Data



Global Data

Pollutant	Estimated Pop. At Risk from Mining, Ore Processing and Smelting	Estimated Pop. At Risk from All Sources
Lead	3,688,000	14,400,000
Mercury	2,870,000	11,000,000
Cadmium	792,000	4,780,000
Chromium	741,000	9,700,000
Radionuclides	512,000	4,300,000
TOTAL	8,603,000	44,180,000

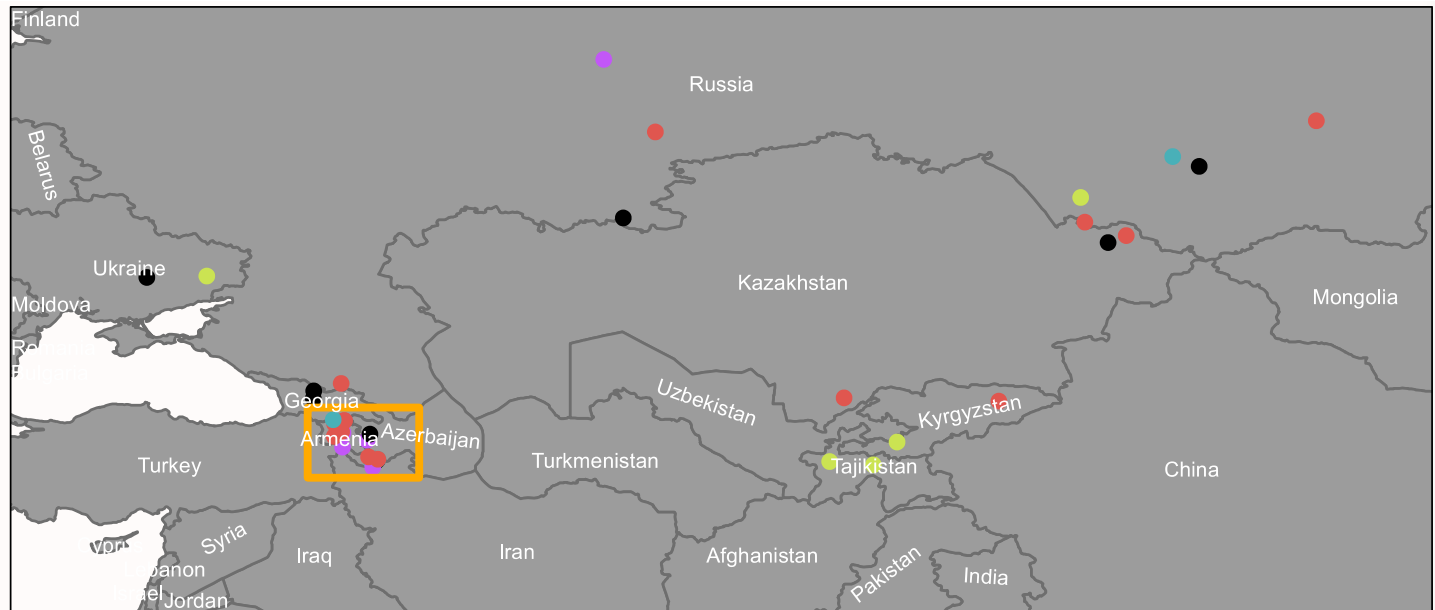
Preliminary data

Regional Data – Former Soviet States

- Activities to date:
 - Russia and Ukraine – 4 years of screening activities
 - Armenia, Azerbaijan, Kyrgyzstan and Tajikistan – 1 year of screening activities
 - 2013 - screening continues in all countries above, and begins in Kazakhstan, Uzbekistan (and non-FSU countries, e.g. Mongolia)

Regional Data – Former Soviet Union

Heavy Metals Sites from Mining and Smelting in FSU by Pollutant



Legend

Key Pollutant

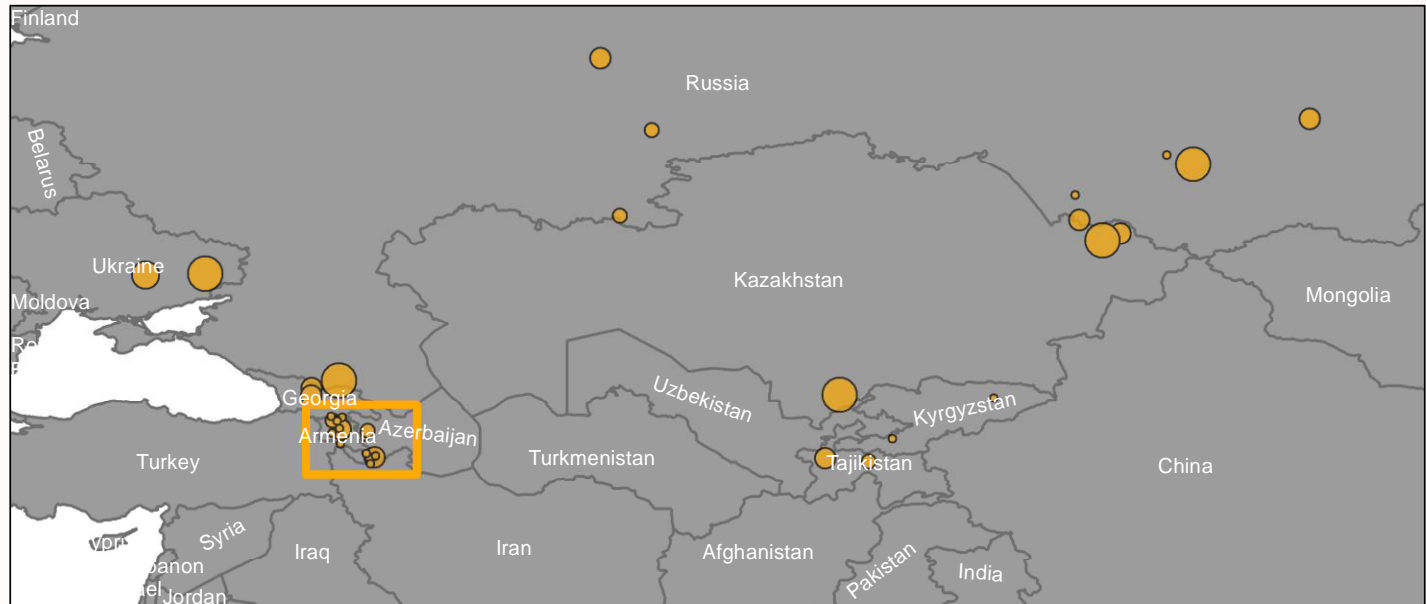
- Other
- Cadmium
- Chromium (Total)
- Lead
- Mercury - elemental



(Sorry about the borders!)

Regional Data – Former Soviet States

Heavy Metal Sites in FSU from Mining and Smelting by Estimated Population at Risk

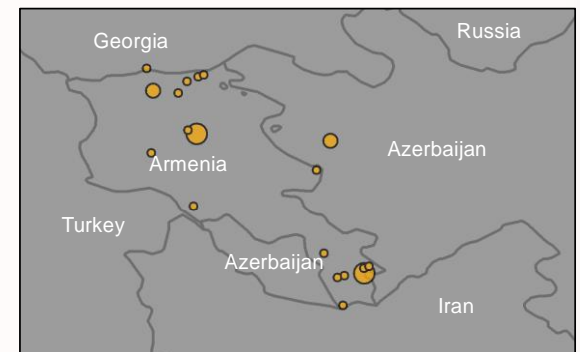


Dot size shows relative population at risk, not size of contaminated area

Legend

Estimated Population at Risk

- 0.000000 - 10000.000000
- 10000.000001 - 20000.000000
- 20000.000001 - 50000.000000
- 50000.000001 - 250000.000000
- 250000.000001 - 1000000.000000



(Sorry about the borders!)

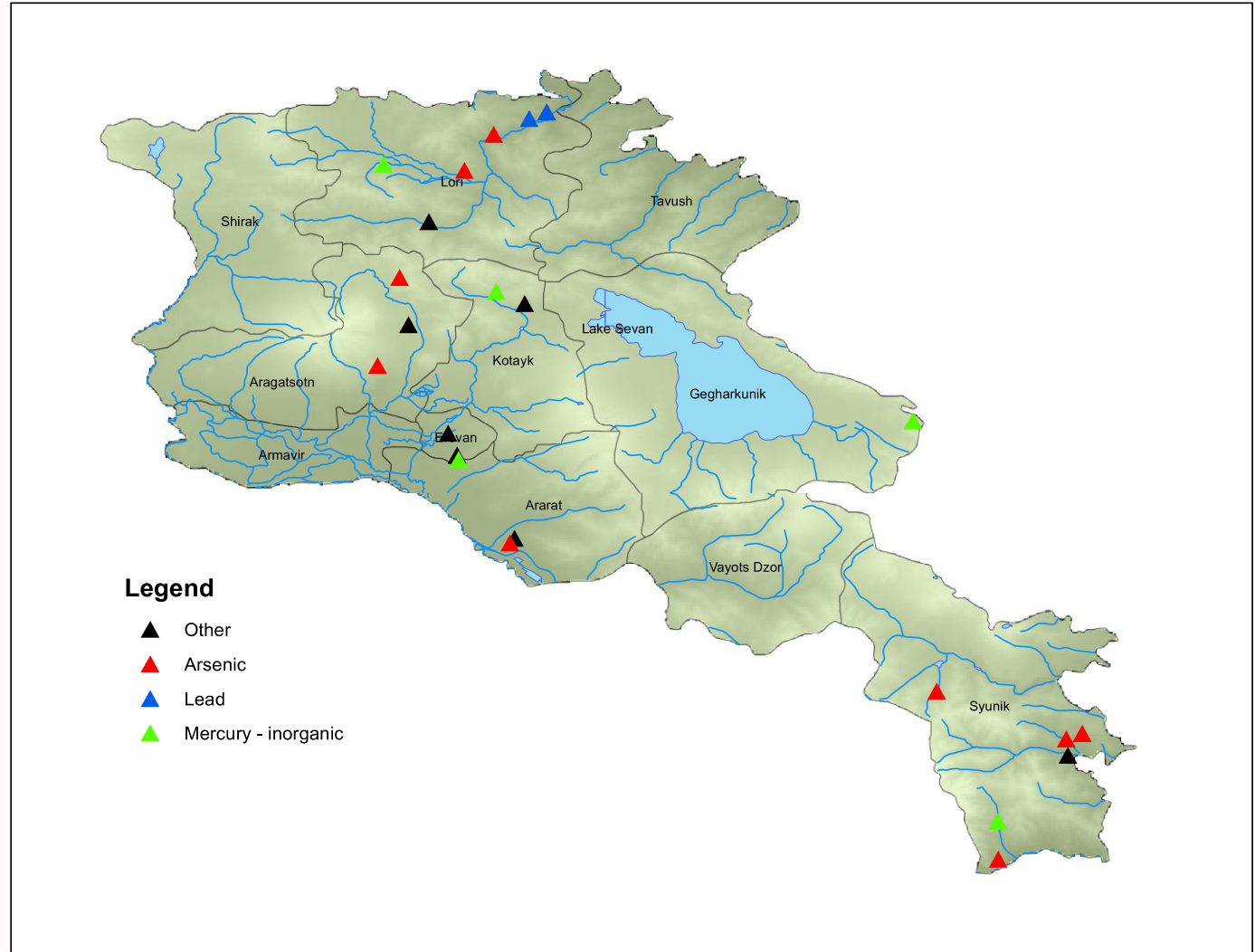
Regional Data – Former Soviet States

Pollutant	Estimated Pop. At Risk from Mining, Ore Processing and Smelting	Estimated Pop. At Risk from All Sources
Lead	1,200,000	1,454,000
Mercury	455,000	1,185,000
Chromium	351,000	1,157,000
Radionuclides	347,000	1,667,000
Cadmium	132,000	452,000
TOTAL	2,353,000	5,463,000

Preliminary data

Country Level Data - Armenia

Sites by Pollutant



Key Findings

1. Lead is the key pollutant among Former Soviet States
2. Most sources are old or abandoned
3. Public awareness of the problem is usually low
4. Governments are often not aware of, or not willing to acknowledge, contaminated sites within their borders

How Do We Use This Data to Help?

At the global level:

- Share data with top decision-makers from donor agencies to show the magnitude of the issue and the need for increased funding
 - (They don't understand the scale yet, but they believe it is much larger than previously understood. That is why they fund this project)

At the country level:

- Share data with governments and help develop national strategies to address toxic hotspots that prioritize sites for remediation and outline roles and funding strategies
 - (donors requested this)

At the project level:

- Used data to select high-priority pilot remediation projects to demonstrate remediation technologies and build local capacity

Next Steps

- Our #1 goal is reducing health risks
- In 2013, Blacksmith Institute and American University of Armenia will:
 1. Continue screening sites with more detailed assessments
 2. Work to identify one site in Armenia for a demonstration remediation project
 3. Collaborate with relevant Armenian Ministries to develop a strategy to increase funding for future cleanup projects
 1. Create list of priority sites
 2. Explore funding options for cleanup