

Center for Native Environmental Health Equity Research

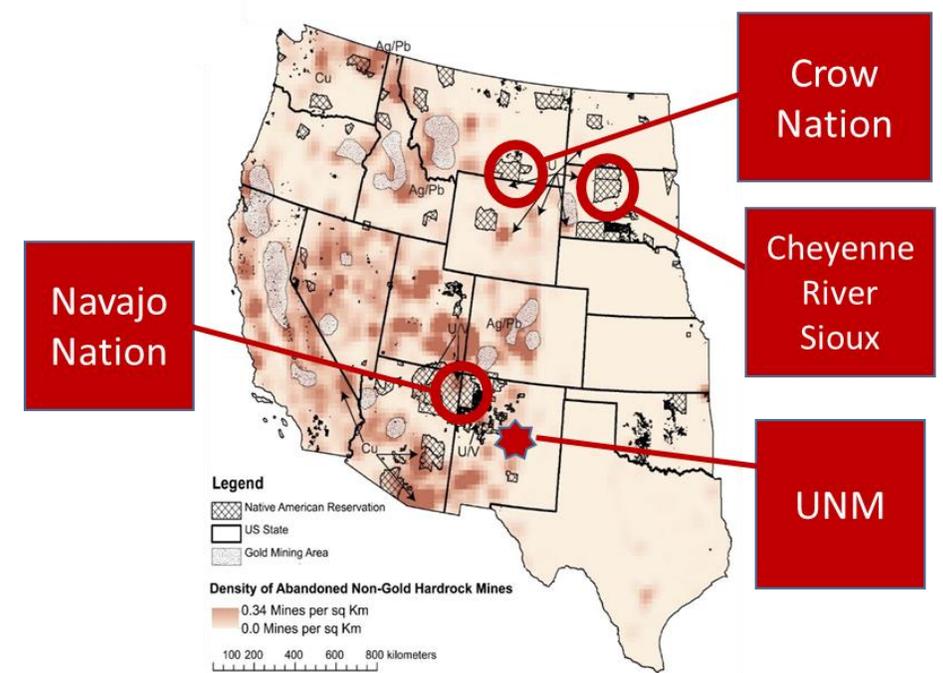
(MPIs Drs. Johnnye Lewis, Debra Makenzie, Joseph Hoover)

Community-informed practices for assessing exposure to pollutants generated from inadequate solid waste management

Presented by CEDC: Esther Erdei, Melissa Gonzales, and Joseph Hoover

Community partners

- Navajo Nation (Blue Gap/Tachee Community)
- Cheyenne River Sioux Tribe (Missouri Breaks)
- Apsáalooke (Crow) - (Crow Environmental Health Steering Committee & Little Big Horn Tribal College)



Academic Partners

University of New Mexico Health Sciences Center

Montana State University (Bozeman and Billings Campuses)

Oklahoma State University



Need to address multi-faceted sources of exposure

Rural and tribal communities have exposure to chemicals at comparable levels to urban areas but are less frequently investigated (Gonzales et al 2018; Hoover et al 2019)

Phase I (MPIs Lewis and Gonzales) - Center established in 2015 to address health concerns related to environmental metals exposures

Phase II aims expanded to consider other potentially synergistic or confounding environmental exposures that disproportionately affect tribal communities

Community-identified exposure sources of concern

- Lack of adequate solid waste management infrastructure common on tribal lands
- Open dumping and burning of waste
 - Generation of microplastics and toxics (VOC, semi-VOC, PAH, PBDE's and dioxins)
 - Exacerbation of health disparities against the background of high metals exposures.



Figure. Trash burning in an open dump. Photo Credit. Latasha James, community partner and CDC research team member

Need to address multi-faceted sources of exposure



Figure. Trash burning in an open dump. Photo Credit. Latasha James, community partner and CDC research team member

Phase II evaluates the relative health disparities associated with mine waste and trash dumping exposures to inform mitigation strategies

Spontaneous and uncontrolled burn events occur close to communities



Trash smoke visible at night under street lamps. Photo Credit John Doyle, August 2021



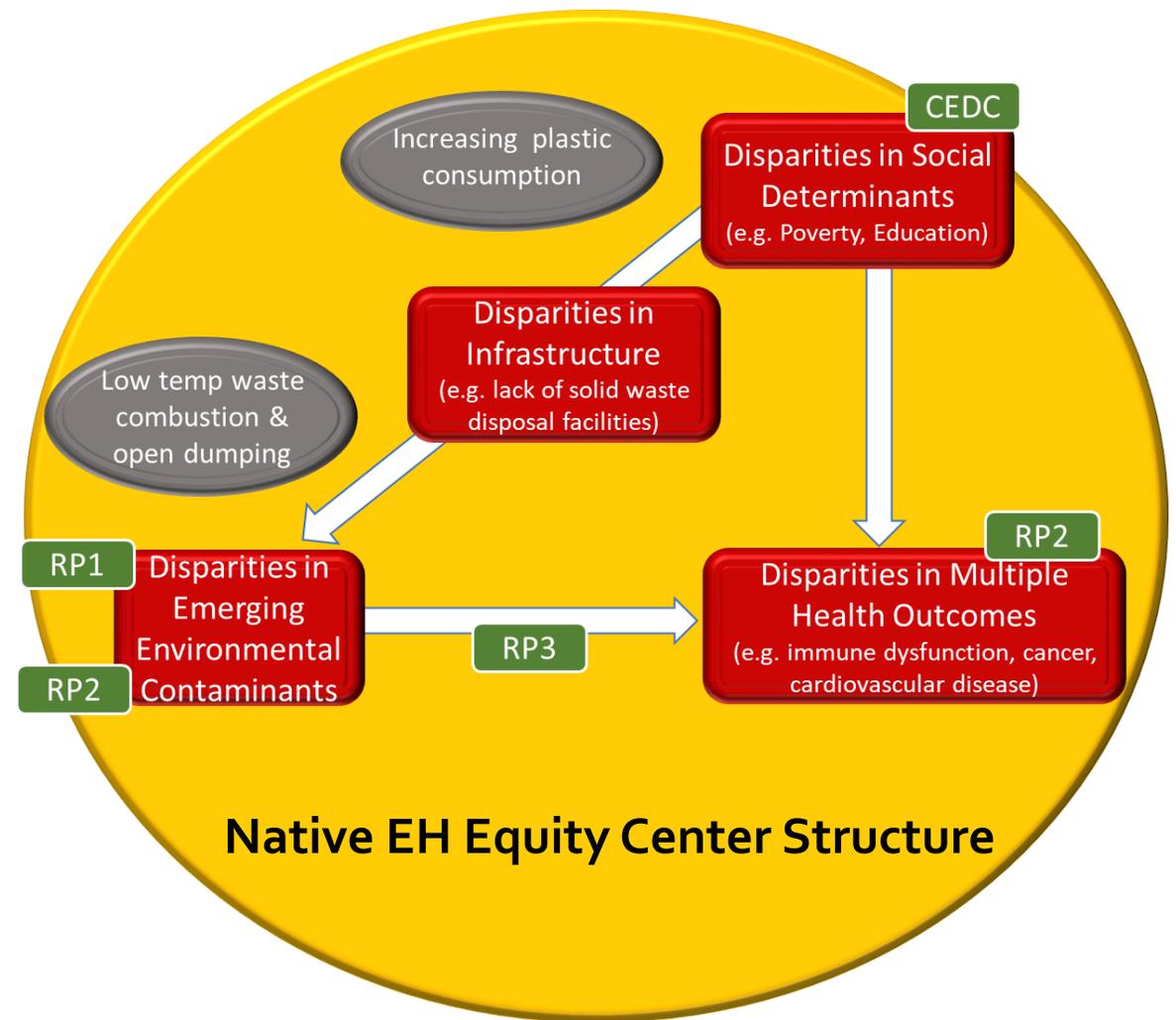
Photo Credit – John Doyle, community partner and CEDC team member

Community Engagement and Dissemination Core (CEDC) is central to the function of research projects

Community engagement critical for

- Relationship building
- Capacity growth and training
- Site identification
- Participant recruitment
- Community report back of results and feedback for next steps

Iterative process linking research project team members with community partners to facilitate conversation



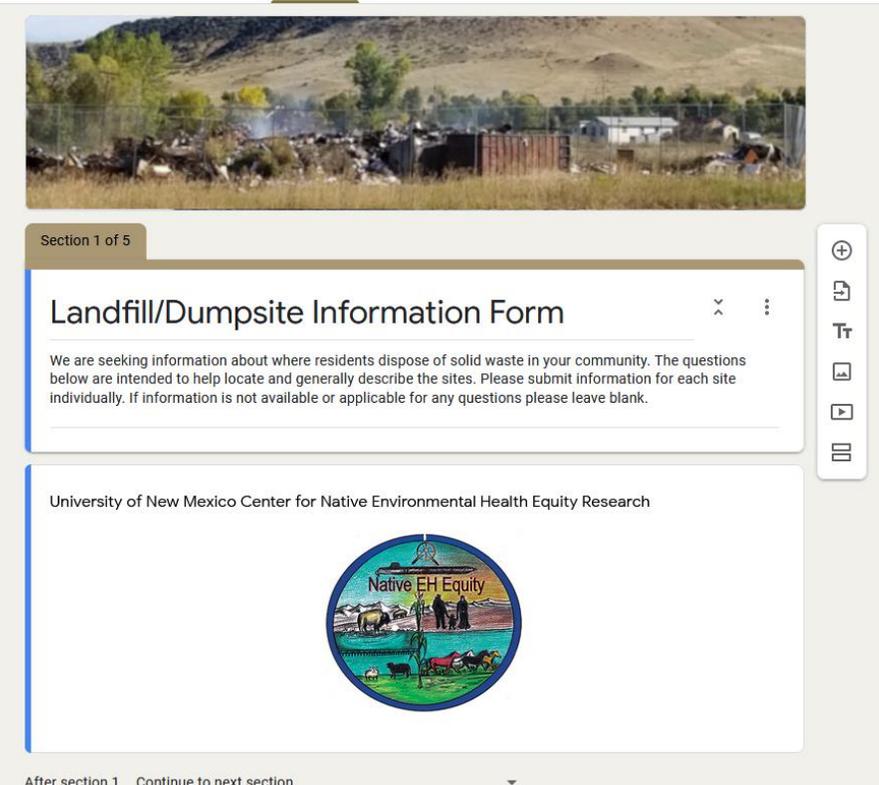
Community-Engaged and Informed Research

1. Identifying sampling sites

With community partners, CEDC organized and facilitated virtual meetings with key stakeholders in multiple communities

- Location and site description (GPS or from Google Maps)
- Number of people impacted (work or live near the site)
- Dumping and burning frequency, extent, and intensity
- Environmental sampling
 - Water, soil, sediment or plants on or near the site for sampling
- Site management (if any) and accessibility

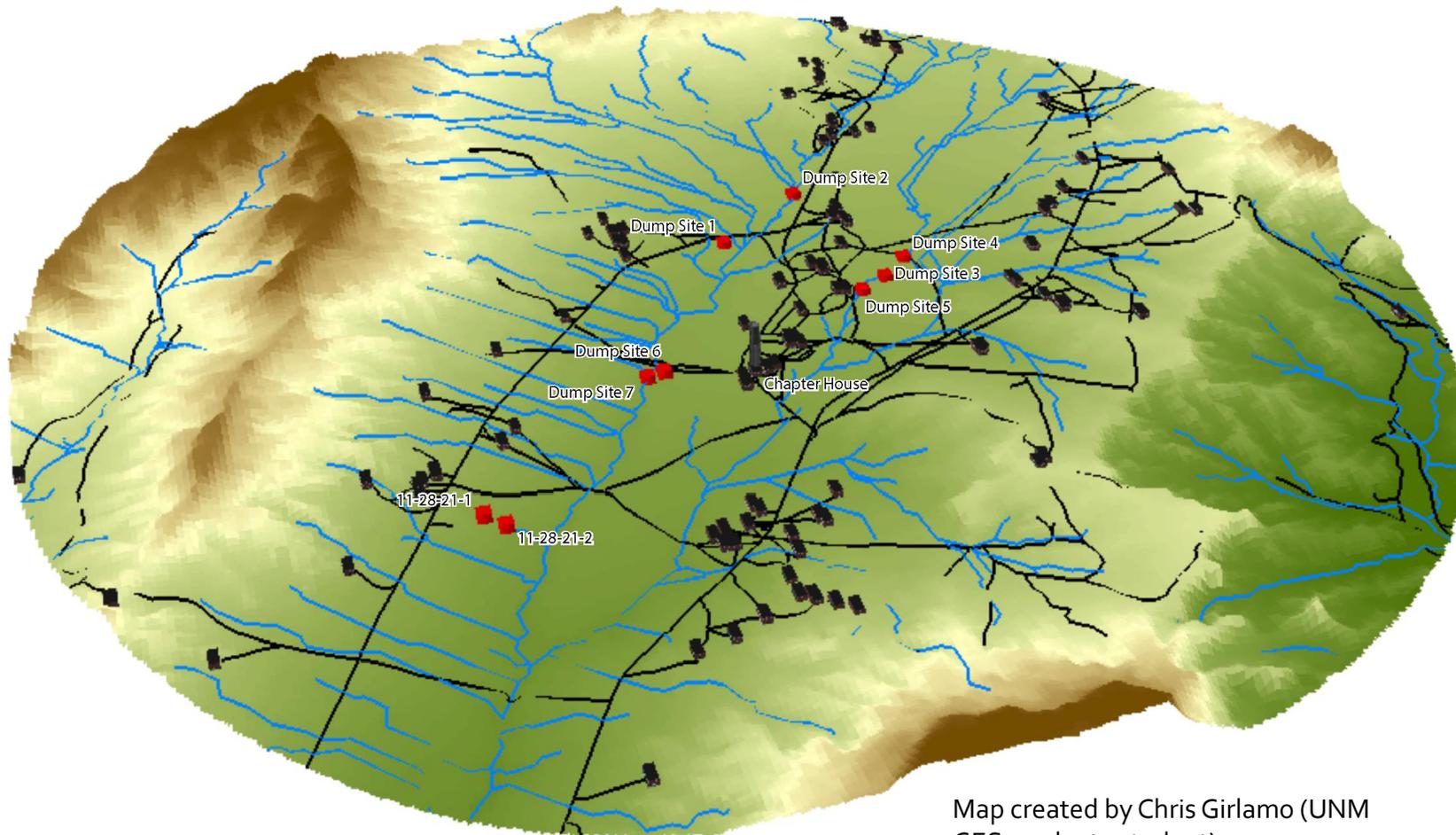
Outcome – identification of dumping sites for environmental sampling by each partner community



The screenshot shows a Google Form interface. At the top, there are tabs for 'Questions', 'Responses' (with a count of 8), and 'Settings'. Below the tabs is a header image of a landfill site. The form is titled 'Landfill/Dumpsite Information Form' and is labeled as 'Section 1 of 5'. The introductory text reads: 'We are seeking information about where residents dispose of solid waste in your community. The questions below are intended to help locate and generally describe the sites. Please submit information for each site individually. If information is not available or applicable for any questions please leave blank.' Below the text is a logo for the 'University of New Mexico Center for Native Environmental Health Equity Research' featuring a circular emblem with the text 'Native EH Equity' and an illustration of a landscape with people and animals. At the bottom of the form, there is a navigation bar with the text 'After section 1 Continue to next section'.

Guided conversations and developed a Google form for data collection

Example of mapping results



Community	Identified and mapped dump sites
1	6
2	7
3	9

Black lines = road; black rectangles = buildings; red polygon = dump sites

After identifying dumping sites

2. Prioritize sites for sampling based on

- Proximity to people and communities
- Burn frequency and intensity
- Accessibility
- Environmental media (e.g., soil, water, sediment, or plants)

3. Time to sample!

3a. Chemicals from trash burning

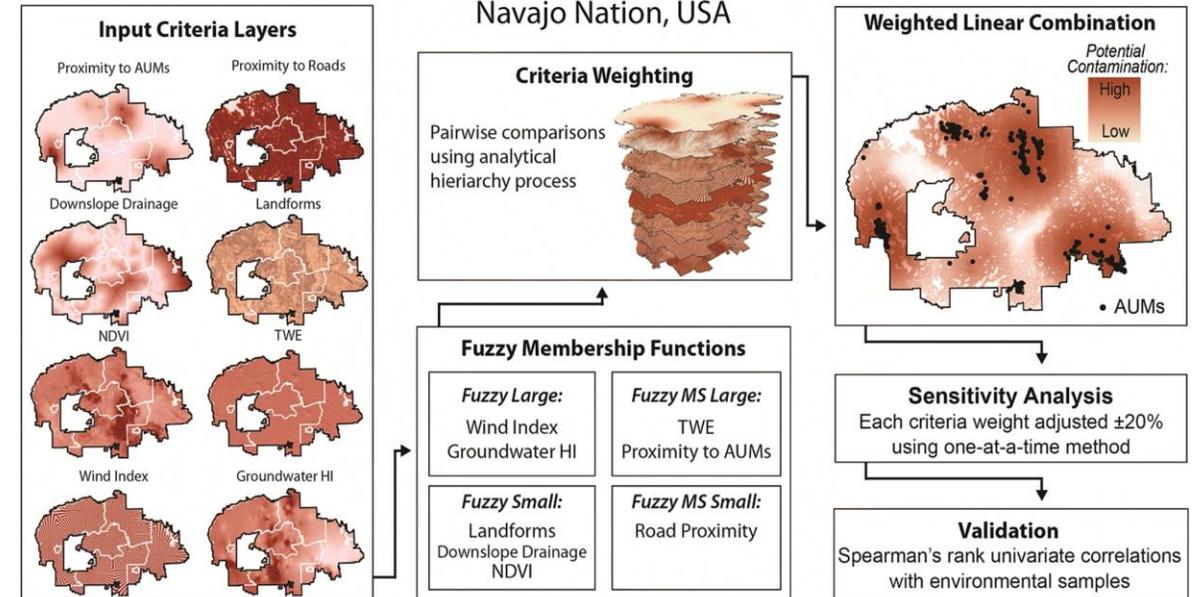
- Passive silicone bands

3b. Soil, sediment, water and plants

- Microplastic generation, transport, and uptake

Example of Multicriteria Decision Analysis Modeling

GIS Modeling Potential for Abandoned Uranium Mine Contamination on the Navajo Nation, USA



* AUM: abandoned uranium mine; NDVI: normalized differential vegetation index; TWE: topographical wind exposure; HI: hazard index; MS: mean/standard deviation

Geospatial modeling and analysis of dumping sites

(Project Co-PIs Hoover and Lin)

- Multicriteria decision analysis (Lin et al 2020)
- AERMOD to model dispersion of particulate matter
- Satellite detection and machine learning

Sampling

3a. Training and Band Site Selection Criteria

Organized phone calls and virtual meetings to discuss

- How the bands function
- Provide training for placement, quality control, chain of custody, shipping (Drs. Erdei and MacKenzie and Tamara Anderson)

Band Site Selection Criteria

1. Avoid VOC sources - truck stops, gas stations and other places vehicles may idle (e.g., garages) if possible
2. Security - Place bands in an unobstructed location but be aware of other people seeing and investigating the bands
3. Topographic considerations - Sample location should consider topography and elevation, such as upwind and downwind, in and out of the swales, and the bottom and top of valley
4. Proximity to people (work or residence)
5. Quality control - For every 10 samples, include at least 1 field blank and 1 duplicate.

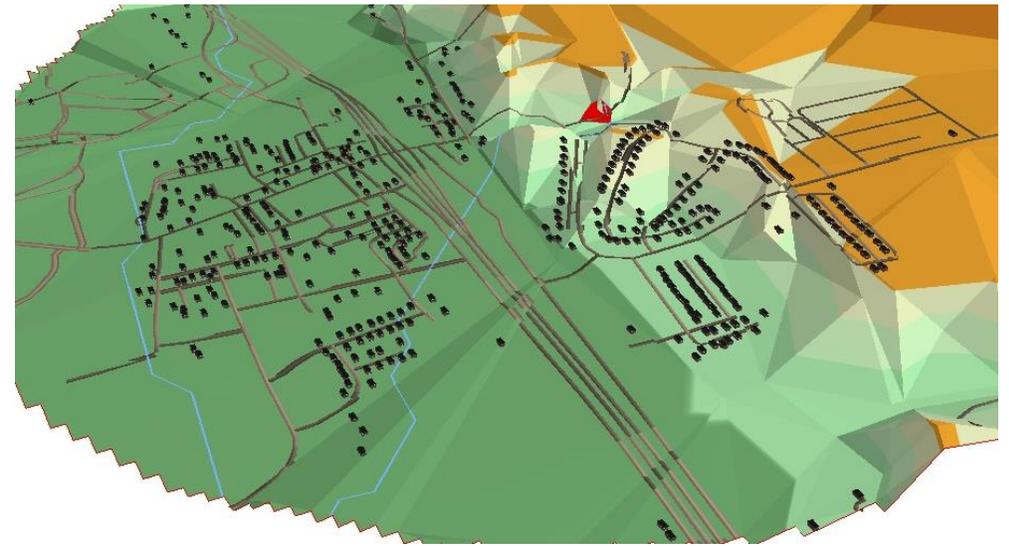


Figure. Example of how GIS and maps were used to guide site selection. Each black icon represents a structure and the red polygon is the dump location

A Quick Guide to Using MyExposome wristbands

Please follow the instructions for the wristbands (monitoring devices) below:

Wristbands are to be placed at each of the environmental sites for a duration of 1 week (7 consecutive 24 hour days). Wristbands are to remain in the same location during the weeklong exposure.

Wristbands can be secured at the site with the zip ties. Wristbands should be stored in a cool, dry place when not in use.

1. When ready to place the wristband, open the pouch, and put the silicone wristband at the environmental site location. You can use the included zip ties to secure the wristband at the site if needed. Please record if you use zip ties on excel spreadsheet. We have provided the Participant Number on each bag.



Caption Example of developed training materials



Community partner placed passive sampling bands at sites around the dumpsite



Photo Credits – John Doyle, community partner and CEDC team member

MyExposome Passive Silicone Bands to detect chemicals released from burn sites

Gathering results and interpreting

Field work and data collection phase – environmental sampling; 10 sites and 2 controls
Fall 2021 and Spring 2022

- **Public presentation of results will occur after community report back meetings**
- **Community meetings depend on COVID-19 situation in each community and will happen when appropriate**

Identify priority contaminants based on potential health effects

- USEPA Integrated Risk Information System dataset
- IARC database and publication carcinogenic chemicals – presentation was requested

Sampling in two other communities will start in Summer 2022

Sampling

3b. Investigate generation of microplastics from incomplete combustion of waste on tribal lands. (PI: Gonzales-Estrella, [NIEHS/USEPA P50 CDI](#))

SECONDARY MICROPLASTICS INTERACTIONS IN THE ENVIRONMENT ?



Dumping/burning of mixed waste common practice in isolated communities.

Microplastic
(similar bulk characteristics)

Partially
combusted
microplastic

Degradation rates

Synergy with other contaminants (heavy metals?)

Leaching of constituent monomers

Transport

Soil-air systems

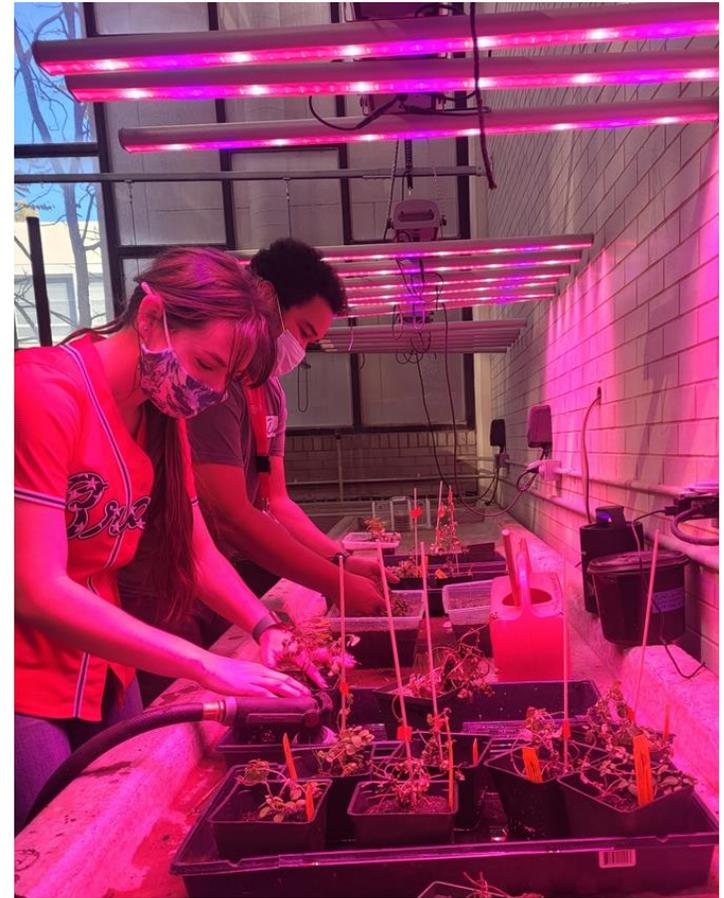
Community-based pilot project with Little Big Horn College (Crow)

Microplastics pollution from dumping and burning activities: implications for soil, roots microbiome and native plants (PI El Hayek, Co-I Plaggemeyer (LBHC), Gonzalez Estrella (OK State) and DePree (UNM))

Next Steps

Report Back Letter – community level reporting

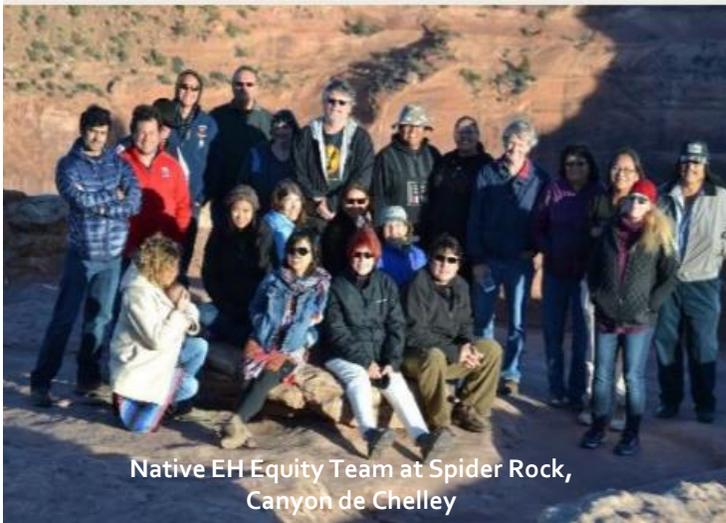
- Based on previously successful communication tools
- Specific updates on **individual report backs** - letter format, colors used & text for Tribe-specific and culturally appropriate layman terms
- Working with Research Project 1 to investigate physical and chemical characteristics of microplastics
- Plant uptake of microplastics
- Occurrence of microplastics in environmental media around dumping and burning sites



Greenhouse experiments with the wild plant (*Mentha arvensis*) to prepare the seedlings for controlled exposure experiments to understand plastics interaction with soil and the living systems, specifically plants that are of importance to our communities.

Thank You For Your Attention

This work would not be possible without the support from Native EH Equity Center community partners including the Crow Environmental Health Steering Committee, John Doyle, Mari Eggers, Cathy Gray, Latasha James, Rae O'Leary, Marcia O'Leary, Missouri Breaks Research Industries, and Randolph Runs After



Native EH Equity Team at Spider Rock,
Canyon de Chelly



For more information please contact one of the Center for Native Environmental Health Equity Research MPIs or CEDC

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Disclaimers

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