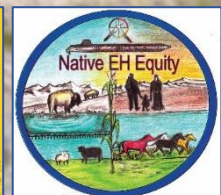


Community Engaged Research: Crow Water Quality Project



Myra Lefthand, Chief Judge, Crow Tribal Courts
John Doyle, Crow Water Quality Project Director
Mari Eggers, Associate Research Professor, MSU
* Crow Environmental Health Steering Committee *



MONTANA
STATE UNIVERSITY

Center for Biofilm
Engineering



Crow Reservation, Montana



- Reservation centered in Tribe's original homelands
- About 7900 of Tribe's enrollment of ~ 14,000 people live here
- Homes then and now along the rivers and streams
- Home wells and indoor plumbing reached rural areas in 1960s



2005 Indian Country Environmental Health Assessment Program (ICEHAP - EPA)



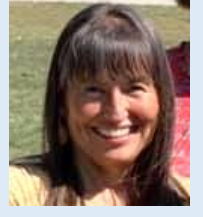
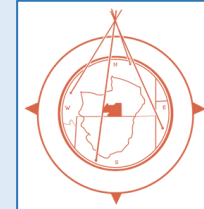
- After a week's work, we prioritized water contamination as our most serious environmental health issue
- *Communities must set their own research priorities, academic partners can support this with research expertise.*

Crow Environmental Health Steering Committee (CEHSC)

2005 - present



PDCDC



Community-led participatory research: CEHSC, Little Big Horn College, Apsáalooke Water and Wastewater Authority, Plenty Doors Community Development Corporation (PDCDC), Montana State University, US Geological Survey, NIH's Rocky Mountain Laboratories, University of New Mexico, U Arizona & other partners

Our culture, a lot of it, depends on our land, our relationship to our land; we are always connected to our land. In the old days it was the buffalo and the elk, the animals for everything. It's still like that... we are tied closely to our land.



Apsáalooke
Water &
Wastewater
Authority

- We recognized connection between water and community health
- Formed the CEHSC to address water contamination & health
- Research on & mitigation of rivers, springs and home wells since '05
 - How is climate change impacting surface & groundwater?
- Mentoring Tribal College & MSU Crow research interns
- Collaborating on youth educational programs in local schools
- Sharing research results with the community, primarily one-on-one

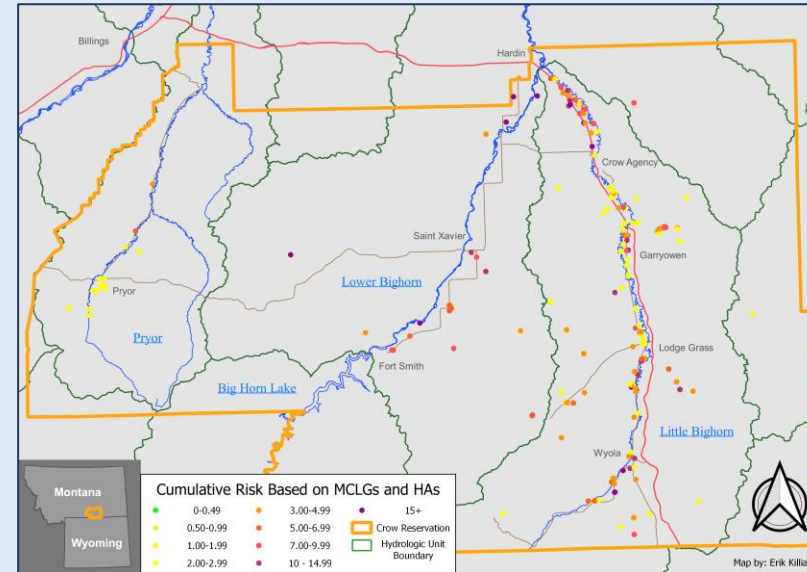
Our primary water and health research initiatives



Understanding **climate change impacts**: increased spring flooding, late summer drought, water insecurity, ecosystem changes



Cumulative health risk from uranium, arsenic, nitrate and manganese in **home well water**. We mitigate with well testing, home water coolers and more.



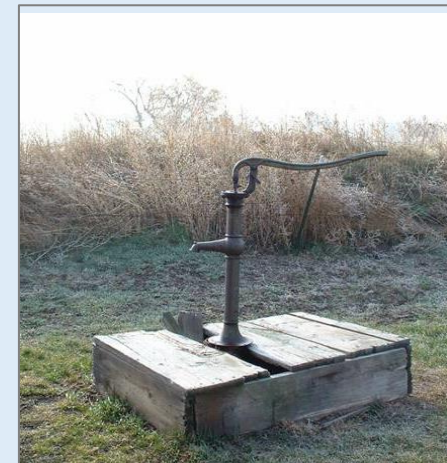
Deteriorating **public water and wastewater infrastructure**. Our research supports our Tribe's Water and Wastewater Authority, which has made \$20M worth of progress.



In depth **water quality research** with the USGS national Environmental Health Program & Rocky Mountain Laboratories, NIH.



Failing home plumbing, including wells and septic systems. We collaborate with PDCDC on funding home repairs and Midwest Assistance on capacity building.

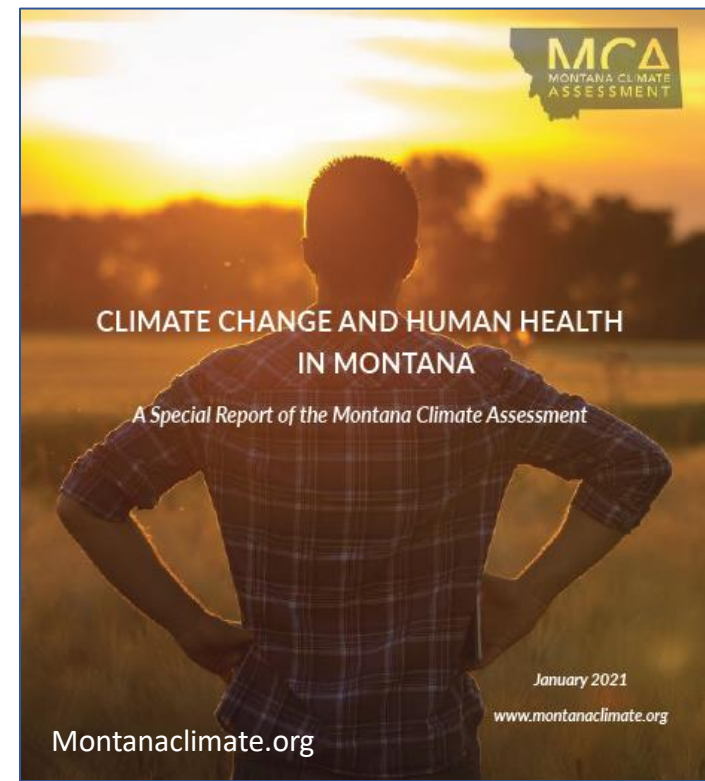




Climate change, water & health



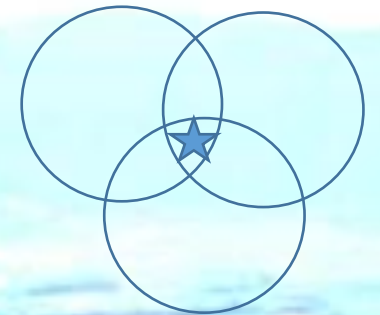
- Traditional Ecological Knowledge (TEK) and Western science concur on many changes in climate.
- TEK includes awareness of additional ecological changes and human impacts, going beyond what Western science has ever measured in our region.
- We must prepare for late summer droughts becoming increasingly worse.



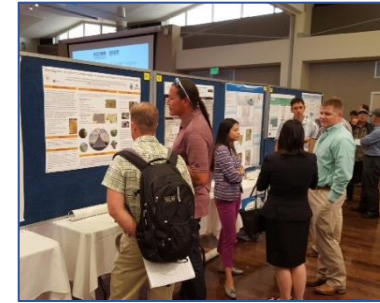
Installing weather station for Crow

What have we learned?

- *Maintaining connection to our community is vital.*
- Working together to conduct our initial Reservation-wide environmental health assessment, and concurring that water contamination was our top priority, has made all the difference (EPA ICEHAP).
- Research must serve our communities.
- Data sharing & dissemination agreements are critical.
- Mentoring students -> increasing capacity -> sustainability
- Venn diagram of community priorities, available funding and our capabilities



We present and publish as a team



- Martin C, Simonds VW, Young SL, Doyle J, Lefthand M, Eggers MJ. [Our Relationship to Water and Experience of Water Insecurity among Apsáalooke \(Crow Indian\) People, Montana.](#) Int J Environ Res Public Health. 2021 Jan 12;18(2). doi: 10.3390/ijerph18020582. PubMed PMID: 33445579; PubMed Central PMCID: PMC7827827.
- Adams A, Byron R, Maxwell B, Higgins S, Eggers M, Byron L, Whitlock C. Climate Change and Human Health in Montana 1 ed. Bozeman, MT: Montana Institute on Ecosystems; 2021. 216p.
- Doyle J, Martin C, Young SL, Lefthand MJ, Three Irons E, Eggers MJ. Graduate Research Serving Apsáalooke Communities. In: Atalay S, McCleary A, editors. The Community-Based PhD 1 ed. Tucson, AZ: University of Arizona Press; 2021. Chapter 15; p.in press.
- Martin C, Doyle J, LaFrance J, Lefthand MJ, Young SL, Three Irons E, Eggers MJ. Change Rippling through Our Waters and Culture. Journal of Contemporary Water Research and Education. 2020; 169:61-78.
- Hamner S, Brown BL, Hasan NA, Franklin MJ, Doyle J, Eggers MJ, Colwell RR, Ford TE. [Metagenomic Profiling of Microbial Pathogens in the Little Bighorn River, Montana.](#) Int J Environ Res Public Health. 2019 Mar 27;16(7). doi: 10.3390/ijerph16071097. PubMed PMID: 30934749; PubMed Central PMCID: PMC6479903.
- Richards CL, Broadway SC, Eggers MJ, Doyle J, Pyle BH, Camper AK, Ford TE. [Detection of Pathogenic and Non-pathogenic Bacteria in Drinking Water and Associated Biofilms on the Crow Reservation, Montana, USA.](#) Microb Ecol. 2018 Jul;76(1):52-63. doi: 10.1007/s00248-015-0595-6. Epub 2015 Mar 22. PubMed PMID: 25796498; NIHMSID:NIHMS674577.
- Doyle JT, Kindness L, Realbird J, Eggers MJ, Camper AK. [Challenges and Opportunities for Tribal Waters: Addressing Disparities in Safe Public Drinking Water on the Crow Reservation in Montana, USA.](#) Int J Environ Res Public Health. 2018 Mar 21;15(4). doi: 10.3390/ijerph15040567. PubMed PMID: 29561815; PubMed Central PMCID: PMC5923609.
- Eggers MJ, Doyle JT, Lefthand MJ, Young SL, Moore-Nall AL, Kindness L, Medicine RO, Ford TE, Dietrich E, Parker AE, Hoover JH, Camper AK. [Community Engaged Cumulative Risk Assessment of Exposure to Inorganic Well Water Contaminants, Crow Reservation, Montana.](#) Int J Environ Res Public Health. 2018 Jan 5;15(1). doi: 10.3390/ijerph15010076. PubMed PMID: 29304032; PubMed Central PMCID: PMC5800175.
- Eggers, M.J., Moore-Nall, A.L., Doyle, J.T., Lefthand, M.J., Young, S.L., Bends, A.L., Crow Environmental Health Steering Committee, Camper, A.K. 2015. Potential Health Risks from Uranium in Home Well Water: An Investigation by the Apsaalooke (Crow) Tribal Research Group. Geosciences. 5:67-94. doi:10.3390/geosciences5010067.
- McOliver CA, Camper AK, Doyle JT, Eggers MJ, Ford TE, Lila MA, Berner J, Campbell L, Donatuto J. [Community-based research as a mechanism to reduce environmental health disparities in american Indian and alaska native communities.](#) Int J Environ Res Public Health. 2015 Apr 13;12(4):4076-100. doi: 10.3390/ijerph120404076. PubMed PMID: 25872019; PubMed Central PMCID: PMC4410234.
- Hamner S, Broadway SC, Berg E, Stettner S, Pyle BH, Big Man N, Old Elk J, Eggers MJ, Doyle J, Kindness L, Good Luck B, Ford TE, Camper AC. [Detection and source tracking of Escherichia coli, harboring intimin and Shiga toxin genes, isolated from the Little Bighorn River, Montana.](#) Int J Environ Health Res. 2014 Aug;24(4):341-62. doi: 10.1080/09603123.2013.835030. Epub 2013 Sep 17. PubMed PMID: 24044742.
- Doyle JT, Redsteer MH, Eggers MJ. ["Exploring Effects of Climate Change on Northern Plains American Indian Health".](#) Clim Change. 2013 Oct;120(3). doi: 10.1007/s10584-013-0799-z. PubMed PMID: 24265512; PubMed Central PMCID: PMC3831579.
- Cummins C, Doyle J, Kindness L, Lefthand MJ, Bear Dont Walk UJ, Bends AL, Broadway SC, Camper AK, Fitch R, Ford TE, Hamner S, Morrison AR, Richards CL, Young SL, Eggers MJ. [Community-based participatory research in Indian country: improving health through water quality research and awareness.](#) Fam Community Health. 2010 Jul-Sep;33(3):166-74. doi: 10.1097/FCH.0b013e3181e4bcd8. PubMed PMID: 20531097; PubMed Central PMCID: PMC3070444.

It takes a whole
community
to mentor
future leaders

Our thanks and appreciation to the
many dedicated community
members who contribute to this
work.



Thank you to our collaborators

Crow Environmental Health Steering Committee

John Doyle – EPSCoR PI/PD Little Big Horn College (LBHC)

Myra Lefthand, MSW – Chief Judge, Crow Courts

Sara Young, MEd – NAU Tribal research consultant

Christine Martin, MS – USDA PI/PD LBHC

Mari Eggers, PhD – MSU, Non-voting member

JoRee LaFrance – Student rep, Crow doctoral candidate at University of Arizona

Plenty Doors Community Development Corporation

Charlene Johnson, PDCDC Executive Director

Charitina Fritzler, PDCDC Program Director

Little Big Horn College

President David Yarlott PhD, Dean Bullchief, Dean Old Coyote, CFO Aldean Good Luck, CIO Frank Cooper & many dedicated staff

25+ LBHC Science majors over past years

MSU Bozeman Collaborators

Dr. Vanessa Simonds, Health & Human Development

Dr. Stephanie Ewing, Land Resources Environmental Science

Dr. Rob Walker, Chemistry & MT EPSCoR team

Dr. Julia Haggerty, Earth Sciences Dept

Dr. Brent Peyton, Center for Biofilm Engineering

Dr. Sandra Halonen, Microbiology and Cell Biology

MSU Howard Hughes Medical Institute IE3 team: Forecki, Hecker, Kelly, Perry, Simonds, Tsosie, Windchief

Other Principal Investigators/Collaborators

Dr. Esther Erdei, Dr. Debra Mackenzie et al., NIH P50 Center for NA Environmental Health Equity, University of New Mexico

Dr. Joseph Hoover, University of Arizona

Dr. Douglas Stevens, NEHR Consulting – NIH NARCH

Dr. Paul Bradley & Kelly Smalling, USGS

Dr. Crystal Richards, Dr. Ashley Groshong & others, NIH Rocky Mountain Laboratories

Thank you to our funders

- **Environmental Protection Agency (EPA): National Center for Environmental Research (RD83559401-0); STAR Fellowships** Research Assistance Agreements #FP91674401; **NCER STAR (RD83370601-0)**
- Center for Native Environmental Health Equity Research, NIH Center of Excellence on Environmental Health Disparities Research, **National Institute of Environmental Health Sciences, National Institutes of Health (NIH) & EPA (1P50ES026102-01)**, Subawards to MSU Bozeman. **National Institute of Minority Health and Health Disparities, NIH (P20MD002317)**
- **INBRE, National Institute of General Medical Sciences, NIH.** Grants (P20 RR-16455-04 Subaward, Little Big Horn College; P20GM103474)
- Montana EPSCoR, **National Science Foundation**
- **Howard Hughes Medical Institute**, Inclusive Excellence 3
- **National Institute for Food and Agriculture, USDA**

The content is solely the responsibility of the authors; it has not been formally reviewed by any of the funders and does not necessarily represent the official views of the National Institutes of Health or of the Environmental Protection Agency. The EPA does not endorse any of the products mentioned.

