MONTANA INBRE

THE PAST AND FUTURE OF WILDFIRE IN MONTANA

Photo courtesy of Rob Maher

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Newsletter

IDeA Network of Biomedical Research Excellence

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MONTANA INBRE

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P.O. Box 173500
Montana State University
Bozeman, MT 59717-3500

www.inbre.montana.edu

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THIS ISSUE

Editor & Design
William Stadwiser

Assistant Editors
Brian Bothner, Ph.D., Ann Bertagnolli, Ph.D., Cori Huttinga

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The Bridger Foothills Fire's first plume of smoke on Sept. 4, 2020. Photo taken from MSU campus and provided courtesy of Rob Maher, Ph.D., who is a professor of electrical & computer engineering in MSU's College of Engineering and an affiliate professor of music technology in MSU's School of Music

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Ben Jacobsen Photo

THE PAST AND FUTURE OF WILDFIRE IN MONTANA

How Changes in Climate, Fuels and Human Activity are Driving Longer, More Destructive Fire Seasons – and health implications for those living in the West.

by Bill Stadwiser

If the frequency of headlines declaring "Worsening Wildfires" "Wildfires at a 10-Year High" and (yikes!) "Zombie Fires in the Arctic" are any measure, wildfires must be getting pretty bad – maybe even apocalyptic.

Insofar as avoiding clickbait has become an essential life skill, references to the undead might understandably prompt a skeptic to wonder whether some intrepid marketing agency had convinced newsrooms to repackage the old formula "if it bleeds, it leads" into a new, seasonally repeatable version branded, "if it burns, it earns."

Yet, look past the scorched-Earth imagery and some of the underlying numbers actually are a little scary.

According to data supplied by the National Interagency Fire Center, wildfire severity in the United States has been increasing since 1980. During this 40-year period, the ten worst fire seasons measured by acres burned have occurred in the past 16 years, and of those, the three worst years on record are all disturbingly recent. The 2021 season is currently making a run at the record books, as well.

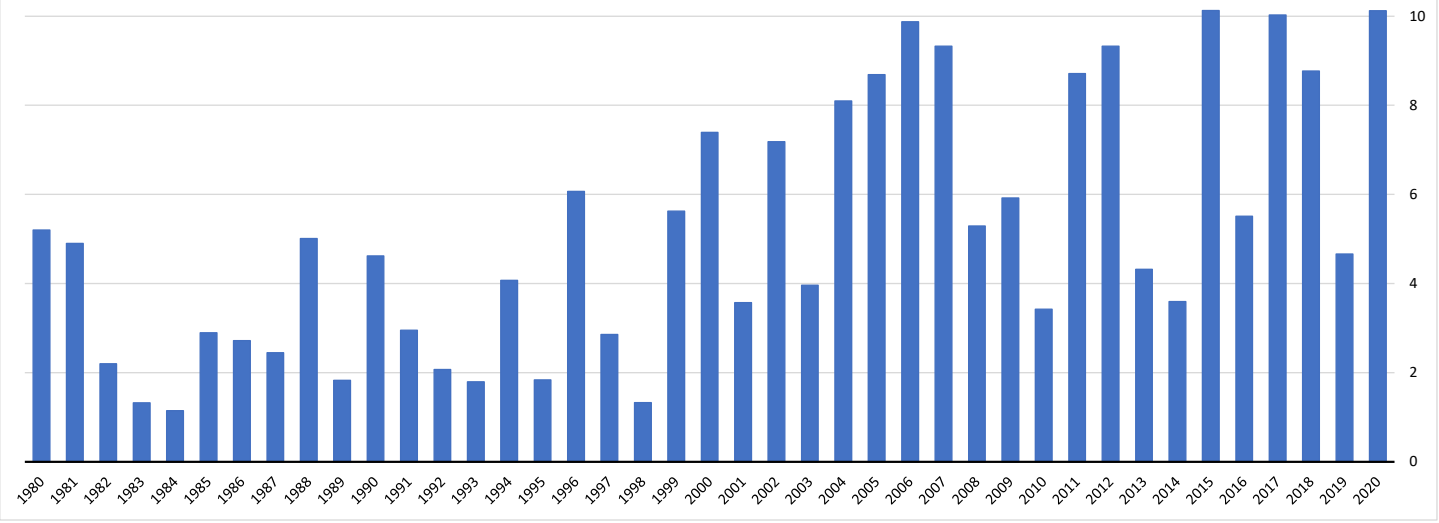
While comparing trends from the last 40 years is as easy as interpreting a graph, analyzing older trends involves a little more skill and determination.

For one thing, prior to the 1983, U.S. federal wildland fire agencies did not track wildfire data with unified reporting processes, making midcentury data less immediately useful. Earlier in the 20th Century, catastrophic blazes such as the Big Blow Up of 1910 received special attention and resources, but an untold number of smaller, less headline-worthy fires of that era barely registered on the national level. Rewind only a few hundred years, and one can imagine fires in remote, seasonally inhabited areas that came and went without any written records at all.

Without a graph referencing tidy, GPS-informed data, how is it that scientists can compare current wildfire conditions with those occurring hundreds or even thousands of years ago?

The answer requires a little digging.

Annual acres burned in US wildland fires, 1980-2020 (in millions)



Data source: National Interagency Fire Center.

THE FIRE TRIANGLE

In the waning days of August 2020, a lightning bolt briefly joined Montana's famously big sky with the Bridger Mountains some 600 yards north of the giant white "M" that overlooks Bozeman. The electrical charge left behind glowing embers in the mountainside's dry vegetation that, on September 4th, seeded a small wildfire.

The next day, amid 99-degree temperatures and 14-percent humidity, Bozeman residents watched as the small fire erupted into a fierce blaze. Strong afternoon winds pushed the growing fire upslope towards mixed conifer stands. Upon cresting the ridgeline, the flames swelled, sending an immense, volcano-like plume of smoke thousands of feet into the air and prompting a National Type-1 Incident Management Team response. The fire would eventually consume roughly 8,200 acres and destroy 30 homes before a barrage of smokejumpers, helicopters, air tankers and mop-up crews could contain the destruction.

While the hot and dry conditions driving the Bridger Foothills Fire might at first sound unusual for a snowy, northern state, some experts think that uncharacteristic heat and dryness are becoming the norm for late-summer months in places like southwestern Montana.

"We're often lucky that we don't have more fires take off like that," said Dave McWethy at a Café Scientifique community event hosted by Montana INBRE in April 2021. "We certainly have the conditions for that to happen again."

McWethy, an associate professor in Montana State University's Department of Earth Sciences, researches how changes to Earth's vegetation and climate can impact wildfires over time. McWethy says it's helpful to think of wildfire as emerging from three factors – something researchers call the fire triangle.

"Wildfires have three main drivers, each representing a component of the fire triangle," he said. "Those include climatic conditions, human and natural ignitions, and the type of vegetation present that can fuel a fire."

Examining how these factors have changed over time can unlock clues about fire seasons from long ago.

"Understanding how climate, ignitions and fuel conditions have changed over centuries and millennia can help us better understand why fire seasons in Montana have been getting worse and lend important context to [current] events," he said.

MSU researcher, **Dave McWethy**.
Image courtesy of MSU News Service.

Bridger Foothills Fire on Sept. 4, 2020. Photo courtesy of Rob Maher

To piece together the complex history of a region's climate, vegetation and wildfire trends, paleoecologists and fire ecologists like McWethy literally dig for clues in order to reconstruct a picture of past environments and fires.

"Scientists can extract and examine things like centuries-old pollen buried in lake sediments, look at fire scars in tree samples and even examine glacial ice cores to piece together the climatic and vegetative history of a particular region or ecosystem," he said. "These records show how components of the fire triangle change over time and impact fire activity."

The key insight gained from data spanning the last 12,000 years is this: since the Last Glacial Period ended, as Earth's temperatures warmed and more vegetation grew, evidence of fire has increased in lockstep with higher temperatures.

"That's a really important relationship that remains relevant today and will be in the future," McWethy said. "Hotter temperatures in forested ecosystems mean more fire."

> We're often lucky that we don't have more fires like [the Bridger Foothills Fire]. We certainly have the conditions for that to happen again.

CLIMATE, HEALTH, & MEGAFIRES

Yellowstone National Park is sometimes revered as a national time capsule or museum, preserving the look and feel of the way things once were in the American West. Though pleasingly nostalgic, that interpretation is lacking in at least one crucial way according to a new assessment of how climate change is affecting the Greater Yellowstone area.

Published in June 2021 and coauthored by scientists at Montana State University, the U.S. Geological Survey and the University of Wyoming, "The Greater Yellowstone Climate Assessment" reports that the average temperatures in Yellowstone National Park, nearby Grand Teton and the surrounding forests, ranchlands and towns like Bozeman have already increased by 2.3 degrees Fahrenheit since 1950. What's more, the assessment predicts even hotter temperatures, more drought and less seasonal snowpack in years to come.

According to the authors, if warming trends continue, the Greater Yellowstone area's surrounding high country may eventually lose much of its snowpack by 2100 – a loss that would affect wildlife, agricultural economies and urban areas that rely on the natural water reservoir that mountain snow provides.

Of more immediate concern, the assessment claims that less moisture and more heat in the intervening years will increase the likelihood of large wildfires. In other words, as warming trends intensify, the dice get a little more weighted towards large fires occurring with each passing year.

Another report published in 2020 by a group of Montana University System scientists and Montana-based physicians claims that climate change is already driving more wildfires and affecting Montanans' health. "Climate Change and Human Health in Montana: A Special Report of the Montana Climate Assessment," or C2H2, cites research

projecting higher temperatures, drought conditions and increased wildfire risk for significant portions of Montana in years to come. It specifically calls out wildfire smoke as a threat to Montanans' health.

Wildfire smoke, the report claims, contains components hazardous to human health. Exposure to smoke, the authors state, can result in emergency room visits for newly caused or aggravated asthma, chronic obstructive pulmonary disease and cardiovascular conditions, including stroke, heart attack and heart failure.

A larger concern alluded to by the Greater Yellowstone Climate Assessment and C2H2 and shared by McWethy is that continued warming might lead to not merely an increase in garden-variety wildfires in Montana but an increase in megafires – extraordinarily large and intense wildfires that can devastate vast areas.

"If we really want to avoid an increase in megafires, we have to slow climate warming," said McWethy. "It's important to understand that average summer fire conditions projected for the not-too-distant future are actually worse than what was in place during the disastrous 1988 [Yellowstone] fires," he added, referencing the largest, most destructive wildfire ever recorded in Yellowstone National Park.

Incidentally, the reflections of those who faced the Yellowstone fires early in their firefighting careers offer a unique insight into the pace of change since the 1980s. In a 30-year retrospective on the Yellowstone fires originally published in the *Jackson Hole News and Guide*, wildfire specialist, Andrew Norman, is quoted as saying,

"We always joked that everybody who lived through '88 - that we lived through a once-in-a-lifetime experience, and now a lot of us have had quite a few other once-in-a-lifetime experiences since then."

In other words, a cohort of wildland firefighters who originally thought of the 1988 Yellowstone fires as a one-off event wound up confronting more destruction during their careers than anticipated. Connect the dots between the regional climate reports and the lived experience of responders like Norman, and it's fair to wonder whether those twentieth-century anomalies were foreshadowing a new twenty-first century status quo.

> If we really want to avoid an increase in megafires, we have to slow climate warming.

IF FIRE IS INEVITABLE ...

If more hot, dry summers are coming for the American West in general and Montana in particular, what can individuals and communities do to prepare for these longer, more destructive fire seasons? McWethy believes the conversation begins with resolving to live alongside fire.

"Wildfire is a natural process that shapes our Western landscapes, and the communities in the Western U.S. that have made the biggest advances toward mitigating the negative impacts of fire have all started by acknowledging that fire is inevitable," he said. "There is a lot that we can do to better safeguard communities from the impact of wildfires, but it all begins with accepting wildfires as an inescapable part of living in the West."

One way that McWethy thinks communities can plan to live alongside fire is to locate housing away from the riskiest areas.

"The risk of losing homes to wildfire can be lessened by building housing away from fire-prone areas like the foothills of dry, forested mountains and other wilderness-interface locations," he said. "Unfortunately, these exact areas can be more desirable due to scenery and wildlife, so there's a tension for communities to navigate between the economic incentives and an area's overall risk profile."

For communities already located in fire corridors, the National Fire Protection Association provides a set of guidelines for protecting homes against wildfire. Those recommendations include removing trees, dead brush and other flammable materials near the home's exterior.

McWethy agrees that removing flammable material around homes is a good start, but he takes the idea a step farther by suggesting that communities should work together to craft even larger buffer zones.

"A fuel is anything that can burn, including a home," he said. "Communities that have been successful in better preparing for fire think about all the potential fuel sources surrounding them and managing those together so that if there is a fire, firefighters have a better chance of protecting people."

Although discussions about individual preparedness often begin with safeguarding one's home and having an emergency plan, C2H2 offers a broader range of strategies and actions. Report authors devote a chapter discussing how people can prepare for extreme events such as fires, dangerous heat, poor air quality, flood and drought conditions and food insecurity that can arise during an emergency.

From a health standpoint, C2H2 authors recommend that people minimize their exposure to wildfire

smoke. The authors note that smoke's fine particulate is too small to be effectively filtered by common dust masks or loose-fitting scarves and bandanas. They instead advise individuals to avoid extended periods and rigorous actives outside during smoke events and to make use of indoor spaces with filtered air.

Montana Technological Institute professor, Dan Autenrieth, agrees that reducing exposure to smoke is a crucial step for those who find themselves downwind of a fire. For those without access to clean, filtered indoor air, he recommends portable room air cleaners. Autenrieth's current Montana INBRE-funded research is testing whether an inexpensive, homemade device that combines a box fan with an ordinary household air filter can be effective at removing smoke particulate from small rooms.

"Not everyone has a central air system, and commercial indoor air filters capable of reducing smoke particulate can be prohibitively expensive for some or may not be available at the exact moment you need it," he said. "Our preliminary findings indicate that these inexpensive DIY devices can offer some benefit."

According to the C2H2 report, forced-air filters rated to Minimum Efficiency Reporting Value (MERV) 13 or higher have filtration small enough to remove the fine particulate in smoke as air passes through. The report claims that more times air circulates through a MERV 13 filter the cleaner it becomes but notes that these higher-rated MERV filters may have to be changed more frequently due to the amount of material that accumulates.

Autenrieth agrees that higher-rated filters are more efficient but claims that lower-rated filters aren't totally useless when it comes to filtering out smoke.

CONTINUED READING AND RESOURCES

- Visit the National Interagency Fire Center's website: https://www.nifc.gov/
- Learn how to better protect your home from wildfire with these tips from the National Fire Prevention Association: https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Preparing-homes-for-wildfire
- Access the 2017 Montana Climate Assessment: http://montanaclimate.org/chapter/title-page
- Access the Montana Climate Assessment (C2H2) special report: https://scholarworks.montana.edu/xmlui/handle/1/16028
- Visit the 2021 Greater Yellowstone Climate Assessment website: https://www.gyclimate.org/
- Do DIY smoke filters work? Learn about Daniel Autenrieth's INBRE research: https://inbre.montana.edu/current-research/daniel_autenrieth.html
- Watch Dave McWethy's 2021 Café Scientifique presentation: https://www.youtube.com/watch?app=desktop&v=2BYiJfD1zBQ
- Read a New York Times article featuring MSU's Dave MeWethy: https://www.nytimes.com/2020/09/10/climate/wildfires-climate-policy.html

"Our early research indicates that DIY air cleaners with only a MERV 7 filter provide some reduction in smoke particulate matter concentrations, but MERV 11, 13 and 14 filters perform substantially better," he said.

McWethy acknowledges that escaping smoke-related impacts can be challenging, but points towards recent research showing that prescribed fires during cooler, shoulder-season months tend to produce less smoke with fewer harmful components than larger, uncontrolled wildfires.

"When it comes to managing smoke exposure and wildfire risk, we have to think about tradeoffs and ask ourselves whether it's better to get used to a small level of periodic smoke from prescribed fires verses long periods of bad air quality from the really big damaging fires," he said.

In the end, this notion of navigating tradeoffs may be the operative take-home message when it comes to living alongside fire. Learning how to make wiser decisions cooperatively within a landscape of imperfect choices is among the core challenges humans have always faced. Modernity and the scientific method lend tools and insights, but, in the end, the way forward has always been through education, innovation and conversation. ■

Watch Dave McWethy's 2021 Café Scientifique presentation at:

www.youtube.com/watch?v=2BYiJfD1zBQ

From internet forums and social media posts to an INBRE-funded research project: can simple, homemade air-filtration systems effectively remove wildfire smoke particulate from indoor spaces? Montana Technological University Investigator, **Dan Autenrieth**, aims to find out.

Citizen-Inspired Science

How did you first become interested in these DIY box fans and where did the idea originate?

I've tried to trace the idea of DIY air cleaners back to its source, and the best I can figure is that the idea originated among the general public and spread via social and popular media. There are many designs out there, but in all of them you basically take a filter designed for something else, like a furnace filter or vacuum filter, and pair that with a fan to pull contaminated room air through it in an effort to provide cleaner air to breathe on the other side. I wish I could take credit because the idea is so cool and simple, but alas, I am really just trying to take an existing design that a co-worker shared with me and see how well it works in office environments.

Office environments interest me as an occupational and environmental health scientist and because these are settings where the occupants spend a large portion of their day, and yet they often have very limited control of their wildfire smoke exposures in terms of the natural and mechanical ventilation of the building.

> This is an exciting topic because a more affordable air cleaner solution means greater accessibility and thus greater agency for individuals to take health-protective measures into their own hands

Prior to your research, was there any evidence that box fans and furnace filters together might be effective at reducing smoke exposure?

There are lots of anecdotal reports of their effectiveness. In the peer-reviewed literature, I am only aware of a few studies that have been published using a DIY air cleaner, including one that evaluated the use of DIY air cleaners in hostels in Europe. The few published results I've seen are very exciting because they suggest that these devices may indeed work as well as the more expensive commercial room air cleaners that are available on the market. Very recently, I have also seen some anecdotal reports of using DIY air cleaners to control exposure to infectious aerosols during the COVID-19 pandemic, so I think this is a very exciting time to see so much interest in improving indoor air quality.

Montana Tech investigator, Dan Autenrieth

How do you think that these DIY devices will perform in comparison to more expensive, commercially available machines?

We're still collecting data and analyzing our results, but early indications are that the DIY air cleaners do a pretty good job at controlling smoke exposures if equipped with a relatively high-efficiency filter.

The ability of any air cleaner to remove smoke particulate matter from the air is a function of both the particulate removal efficiency of the air filter and the amount of air moved through the filter. This information is provided by many commercial air cleaner manufacturers in the form of a "clean air delivery rate" or "CADR". This is a fancy term that describes the volumetric flow rate of cleaned air that the machine provides. With improvised DIY air cleaners, such manufacturer ratings are not available, so part of our work is characterizing how well they perform at reducing smoke particulate matter concentrations as compared to commercially available units.

This is an exciting topic because a more affordable air cleaner solution means greater accessibility and thus greater agency for individuals to take health-protective measures into their own hands.

How have folks in Montana responded to your research ideas and approach so far?

One thing that is very exciting about this project is the high level of interest and engagement whenever we discuss this project with people. Right now, we are partnering with Dr. Clay Comstock

Editor's note: *Popular Mechanics* offers a tutorial on building your own deluxe system using a wooden frame.

https://www.popularmechanics.com/home/how-to-plans/how-to/a21300/diy-air-filter/

at Salish Kootenai College to see how well these DIY air cleaners perform in different types of office settings and ambient smoke exposure environments. Before we began our work this summer, the Confederated Salish and Kootenai Tribal Council approved the portions of the project we are conducting at SKC and on the Flathead Reservation, and the Council Members we heard from expressed enthusiasm for our work.

We've also been approached by MSU Extension, Silver-Bow Health Department, researchers in Oklahoma, and even a school district in Colorado, who want to learn more about monitoring and controlling wildfire smoke exposures with DIY air cleaners. So, there really is a lot of interest in this work right now.

What's the best way for someone to build their own device at home?

Great question! There have actually been many DIY air cleaner designs described on social media, but the most common one, and the one we're studying, simply involves attaching a twenty-by-twenty-inch furnace filter to a twenty-by-twenty-inch box fan. These box fans are the basic square fans you can find at Walmart or Home Depot, usually for under 20 bucks. The furnace filters we use are an inch thick.

A box fan has an inlet side, where air flows in, and an outlet side where air flows out. The filter is placed on the inlet side of the fan with the filter's airflow indicator pointing toward the fan. When the fan is on, you know you're on the right side because the filter will suction onto the box fan rather than be blown away from it.

Although that is where some folks leave it, we've found it is best to then duct tape the filter to the fan to cover any gaps and make sure that all the air passing through the fan first passes through the filter.

Are there common pitfalls or hidden dangers to watch out for?

The fan you're using should be manufactured after 2012, as these have safety features to prevent fire.

Two other considerations for homemade air cleaners are noise and durability. The DIY air cleaners we're using are noticeably louder than the commercial models we've tested. Part of our work this summer involves characterizing the flow resistance, energy consumption, and noise produced by the DIY air cleaners as compared to a popular commercial model.

It is probably best that you run a DIY unit only while you are physically present because you are adding additional airflow resistance to the fan beyond what it was originally designed to overcome. This could theoretically cause the unit to fail prematurely or to overheat, so we think it is best not to leave them running while you are not at home or not at the office.

> If your home or office doesn't have forced air cooling, portable room air cleaners can provide good supplemental control in the areas where they are most needed [like a] bedroom ... or [small] office.

Is the kind of air filter you use important, or will any air filter do?

Furnace filters are sold with another rating from manufacturers called a "MERV" rating which stands for "minimum efficiency reporting value." Any reputable filter brand should be fine provided they post a MERV rating on their filters. The lower the MERV rating, the less efficient the filter is at removing smoke and other very small forms of particulate matter. A MERV 7 filter, for example, has rather large pores and can be partially seen through if you look through it, whereas a MERV 13 or 14 filter has smaller pores and cannot be seen through.

Our research indicates that even DIY air cleaners with only a MERV 7 filter provide some reduction in smoke particulate matter concentrations, but MERV 11, 13, and 14 filters perform substantially better. The cost of these filters increases as the MERV rating goes up, so it is important for us to find out if the level of exposure control differs significantly between the DIY air cleaners equipped with these higher MERV rated filters. MERV 13 or higher filters are recommended by the American Society of Heating and Air-Conditioning Engineers for using in building HVAC systems during wildfire smoke events.

For people wanting to limit exposure to smoke during fire season, are there steps or precautions you would recommend?

My advice is similar to that provided by public health agencies across the state. On days where the air quality index is in the yellow or orange range due to wildfire smoke in the ambient air, folks who are very sensitive to smoke or those with underlying health conditions such as asthma or cardiovascular disease should consider reducing exercise outdoors. As air quality worsens and we get into purple and maroon ranges, avoiding outdoor activity and reducing levels of smoke indoors becomes more important for everyone.

The air quality index in your area can be found by downloading the EPA's AirNow app to your smartphone or by visiting the Montana Wildfire Smoke organization's "Air Quality Today" website. Note that these sources rely on data from a small number of air monitoring stations throughout the state, and part of our research is focused on determining if the addition of a small network of low-cost air pollution

sensors can provide more accurate wildfire smoke exposure information for individuals living in Montana.

One thing that helps reduce indoor smoke particulate matter concentrations is to keep windows and doors closed. That can, however, be difficult during the summer months when the weather is hot and when we are most likely to have wildfire smoke in our ambient air. If you have a central forced air fan or air conditioning, buying a high MERV rated filter that fits your HVAC system is a great way to reduce particulate exposures indoors. If that does not provide enough control, or if your home or office doesn't have forced air cooling, portable room air cleaners can provide good supplemental control in the areas where they are most needed. For example, in your bedroom, your living room, or in your office at work.

In what ways has Montana INBRE helped support or enable this research?

Montana INBRE investigators and their vast network of research experts have really helped me and my colleagues pursue these exciting research questions. A specific callout I'd like to make is the Statistical Consulting and Research Services lab within the Bioinformatics/Biostatistics Core. I have studied biostatistics for years as part of my environmental health training, and I even teach a basic research statistics course for graduate students here at Montana Tech. Despite this background, I am well aware of the limits of my statistical knowledge, and I was ecstatic to meet with the SCRS faculty and students over at MSU. They can provide assistance on everything from basic data visualization to modeling to inferential hypothesis testing to deep machine learning. They were eager to collaborate with me from conception of your idea to proposal submission to publication, and I encourage everyone needing some statistical expertise to reach out to these folks.

Another shout out I'd like to make is to the Montana IDeA Community Engagement Core. Core Director, Ann Bertagnolli, has maintained a stellar network of resources for investigators interested in community-based research projects. Through the shared Core's partnership with MSU's Center for American Indian and Rural Health Equity (CAIRHE), I was able to work with Niki Graham, a Community Research Navigator, who helped us to ensure we used cultural humility and a spirit of service when we approached the Confederated Salish and Kootenai Tribes to conduct research at SKC and on the Flathead Reservation. We also received helpful advice navigating the SKC Institutional Review Board requirements for working with human subjects in research.

The Community Engagement Core is also helping us spread the word about our research. We're very excited to be showing off these DIY air cleaners and some of our research findings during Shakespeare in the Parks on August 27th in St. Ignatius and September 2nd in Butte using Montana INBRE's and CAIRHE's shared Health Education and Research Bus. This is a recreational vehicle decked out with a ton of goodies to facilitate community-based research and outreach including mobile laboratory equipment.

As an early career researcher, I've found it tremendously helpful to be connected with an experienced NIH researcher and mentor. My mentor, Dr. Amy Kuenzi, at Montana Tech has a wealth of knowledge and she's always been happy to discuss my career and even review my research proposals and provide substantive feedback. Montana INBRE facilitates these sorts of mentoring relationships for individuals who are awarded research funding, so I encourage all faculty interested in conducting research to advance the health and wellbeing of Montanans to watch for the call for faculty research proposals each fall. ■

Learn more about Dan Autenrieth's Montana INBRE-supported research at:

https://inbre.montana.edu/current-research/daniel_autenrieth.html

DATA CHALLENGES LEAD TO AN UNEXPECTED DISCOVERY

Montana State University Billings investigator, Sarah Keller, reflects on overcoming data challenges and how a recent publication represents the culmination of nearly a decade's work on suicide prevention.

> Don't give up! Engage others to find new ways of looking at the data. These new perspectives may reveal findings that are more important than the results you originally hoped to see.

In June 2021 the *International Journal of Environmental and Public Health Research* published my research group's most recent paper titled, The Perceived Stigma Reduction Expressed by Young Adults in Response to Suicide Prevention Videos. This article is the fourth peer-reviewed publication to emerge from my Montana INBRE-funded research and represents the culmination of nearly a decade's worth of work on suicide prevention among young adults in Eastern Montana.

And yet, there were moments when I didn't think this paper would ever see the light of day. Writing the manuscript turned out to be particularly laborious because our data didn't match the standard models, and, at first, we didn't understand why. With persistence and assistance, though, rather than discovering errors on our end, statistical analysis uncovered flaws in the traditional ways in which researchers have measured significance in this area. In consultation with the Statistical and Consulting Research Services (SCRS) group at Montana State University, we were able to compare our qualitative and quantitative outcomes and key in on the ways that the standard scales used to measure stigma didn't seem to fit our data – particularly when it came to the qualitative reports. In the end, not only does this new article raise questions about the arbitrariness of standard levels of statistical significance used in much social science and public health research, but it also raises questions about the utility of widely accepted scales, particularly when it comes to measuring an individual's sometimes messy feelings in relation to complicated and unpleasant mental-health concerns.

Montana INBRE support over the years has been instrumental in many ways, and the statistical consulting resources it provided proved essential. I greatly appreciate the contributions and mentorship of former director, Megan Higgs, and the assistance and expertise of former postdoctoral statistician, Tan Tran, of the Montana INBRE-funded SCRS group at MSU. Dr. Higgs served as a mentor in interpreting our findings and suggesting new ways to look at the data. Dr. Tran performed multiple analyses on our various waves of data and helped us apply benchmarks derived from the literature to compare various levels of change in the reported outcomes of our key variables. Montana INBRE support also allowed me to fund a graduate student to help build surveys, analyze the qualitative data and interpret the findings. My collaborator and coauthor, Vanessa McNeill, a former Montana INBRE-funded researcher in the psychology department at Montana State University Billings, was also instrumental in this effort. The tables in our article reflect both McNeill's and Tran's dedicated work.

Though this publication marks the end of a long chapter in my life, I have been able to use experiences and connections gained via Montana INBRE's support to develop new research opportunities, including a new collaborative research project beginning this month. I recently received funding from the National Science Foundation's Innovations in Graduate Education (IGE) award to co-lead a study across three Montana campuses – MSU Billings, the University of Montana, and Montana Technological University – aimed at improving STEM graduate student and faculty well-being. This new project is called, Collaborative Research: Mental Health Opportunities for Professional Empowerment in STEM (HOPES) and will continue for the next three years. ■

MONTANA INBRE FUNDING CONTRIBUTES TO NEW NSF GRANT

Montana State University investigator, Chelsea Heveran, leverages preliminary data from a Montana INBRE pilot grant to receive a new three-year National Science Foundation Collaborative Research grant.

> It is thrilling to receive this new NSF award [and] to ask these research questions with more depth. My goal is to build towards understanding how interventions throughout life can contribute to more healthy bone cells and tougher bone in aging.

I am the principal investigator for the Montana component of a new National Science Foundation Collaborative Research grant titled, "Determining the effects of lacunar-canalicular remodeling on bone fracture toughness." This new project builds on preliminary data gathered and relationships established previously as a Montana INBRE pilot grant awardee. Joining me on this NSF award is my Montana State University co-investigator, Lewis Cox, and collaborating PI, Dr. Vanessa Sherk, who is with the University of Colorado School of Medicine.

In this work we intend to assess the impact of osteocyte health and remodeling activity on the fracture resistance of bone tissue. In other words, we're trying to figure out how to keep bones strong and healthy as people age. Evidence is increasing that certain bone cells called osteocytes contribute to overall bone mineralization and quality. Because osteocyte health declines as we age or experience certain diseases, it is important to evaluate how much of a role these cells have on their surrounding bone tissue quality and fracture resistance.

Montana INBRE support was very helpful in bringing about this new NSF grant. My one-year INBRE pilot grant provided essential funding and resources for collecting preliminary data used to support the NSF grant application. Reviewer comments I received when applying for Montana INBRE funding were also extremely helpful in helping me scale-up my ideas.

Aside from funding preliminary experiments, Montana INBRE support helped me forge productive collaborations with other faculty, including my eventual collaborators on this new NSF grant. INBRE's close connection to MSU's Center for American Indian and Rural Health Equity (CAIRHE) allowed me to find another excellent collaborator in Steven Martin, the lab director for CAIRHE's Translational Biomarkers Core. I have also consulted with the INBRE-supported Statistical Consulting and Research Services group for aspects of data analysis for this project. Montana INBRE Student Programs support for undergraduate research at MSU has also helped me to explore these ideas and generate data.

It is thrilling to receive this new NSF award. I am beyond excited to have funding to ask these research questions with more depth. My goal is to build towards understanding how interventions throughout life can contribute to more healthy bone cells and tougher bone in aging. ■

COMMUNITY ENGAGEMENT CORE COMPLETES 2020-21 WEBINAR SERIES

by James Burroughs

Montana INBRE and its partners the Center for American Indian and Rural Health Equity (CAIRHE) and the American Indian/Alaska Native Clinical and Translational Research Program recently completed their 2020-21 Webinar Series.

Organized and hosted by **Sue Higgins,** MS, a community research associate in the Community Engagement Core, the webinars examined a variety of issues important to faculty involved in community-based research. The six events were:

- "Food Security in Montana," featuring **Carmen Byker Shanks,** Ph.D., RDN (CAIRHE), and **Michelle Grocke,** Ph.D. (MSU Extension). June 4, 2020.
- "Biomarkers in Health Equity Research," featuring **Selena Ahmed,** Ph.D., and **Stephen Martin,** Ph.D., leaders of the CAIRHE Translational Biomarkers Core. November 12, 2020.
- "Montana INBRE Bioinformatics and Biostatistics Services: A Valuable Resource for Your Research Program," featuring **Carl Yeoman,** Ph.D. (Director, Montana INBRE Bioinformatics & Biostatistics Core). January 21, 2021.
- "Climate Change and Human Health in Montana: A Special Report of the Montana Climate Assessment," featuring **Alexandra Adams,** M.D., Ph.D. (Director, CAIRHE); **Robert Byron,** M.D. (Montana Health Professionals for a Healthy Climate); **Lori Byron,** M.D. (Montana Health Professionals for a Healthy Climate); and **Mari Eggers,** Ph.D. (Research Scientist, MSU). February 17, 2021.
- "How to Win, Sustain, and Leverage Your NIH R15 Grant," hosted by **Brian Bothner,** Ph.D. (PI, Montana INBRE), and featuring **Jason Carter,** Ph.D. (MSU Vice President for Research, Economic Development, and Graduate Education). February 23, 2021.
- "The Good Medicine Series: A Response to Trauma in Native Communities Due to COVID-19," featuring **LeeAnn Bruised Head,** MPH, and **Cynthia Chapman,** Ph.D. (Indian Health Service) May 20 2021.

Recordings on CAIRHE's website include the June 4, 2020, webinar on "Food Security in Montana" *(top)* and the February 17, 2021, webinar on "Climate Change and Human Health in Montana."

"We've enjoyed some truly fascinating presentations from researchers and partners alike, and hope to expand topics next season," Higgins said. "We like to think of the Health Equity Webinars as a place for public health and research to meet for good information and conversation. I'm also happy that we're able to post these presentations for later viewing."

Webinars are available as videos on CAIRHE's website at: https://www.montana.edu/cairhe/news-events/video.html

Note: A similar version of this story originally appeared in CAIRHE's spring 2021 newsletter

MONTANA'S TWO NEWEST SEPA GRANTS BRINGS STATEWIDE TOTAL OF ACTIVE SEPAs TO FIVE

Each project is unique - one even features a full rock band and interpretive dancers - yet all share the vision of improving STEM education opportunities for underserved K-12 students in Montana.

by Brian Bothner and Bill Stadwiser with contributions from Marissa Pedulla, Jamie Cornish and Matt Queen

Over the past fifteen years, Montana has emerged as a national leader in SEPA programs. Since 2005, Montana has been the home for 12 different SEPA projects, five of which remain active in 2021. This growing constellation of SEPA programs in Montana represent a network aimed at increasing the quality of K-12 STEM experiences and expanding participation in the sciences among underrepresented students.

Sponsored by the NIGMS division of NIH, the Science Education Partnership Award (SEPA) Program funds innovative K-12 STEM educational projects which forge partnerships among researchers, teachers, schools and other educational organizations. Two recent awards bring the total number of active SEPA programs in Montana to five.

SEPA projects share parallel long-term objectives with INBRE programs, particularly when it comes to strengthening a state's biomedical research capacity and workforce pipeline. It's no surprise then that Montana INBRE actively cultivates connections with SEPA projects across the state and currently collaborates with three SEPA grants, including two awarded earlier this year.

Current SEPA projects partnering with Montana INBRE include, *Phages Helping Acquire Genuine Experiences in Science (PHAGES)*, *My Home, My Health: Place-Based Public Health-Resources for Rural Educators (MHMH)*, and *Authentic Community Engagement in Science (ACES)*.

Each project is unique – one even features a full rock band and interpretive dancers – yet all share the vision of improving STEM education opportunities for underserved K-12 students in Montana. Over the following pages, we invite you to learn more about these SEPA programs and what makes each one tick.

PHAGES HELPING ACQUIRE GENUINE EXPERIENCES IN SCIENCE (PHAGES)

Lead by Marissa Pedulla, Ph.D.
Lead Institution Montana Technological University
Target Audience K-12 classrooms throughout Montana
Funded since 2019


Marissa Pedulla

The PHAGES program allows Montana's K-12 students and teachers to engage in a relevant citizen science project called "phagedigging," during which students attempt to discover viruses that infect bacteria, known as bacteriophage, which are new to science. Students collect soil and water samples from their local environments and test their samples for phages capable of infecting a bacteria known as *Mycobacterium smegmatis*. Students who discover a phage get to choose its name, which is later added to the phagesdb.org database. The PHAGES program serves K-12 teachers and students in school districts throughout Montana.

This project is a model for developing teachers as leaders as who can mentor and assist peers within their districts to enable more students to experience an authentic science research project and build a research culture within their schools. Participating students and teachers engage in genuine research—citizen science bacteriophage discovery—and contribute to the scientific community's collection of known bacteriophages. Developing the

PHAGES CONTINUED …

capacity for teachers to deliver the program independent of university staff (including the establishment of satellite labs for independent preparation of materials and delivery of the program) ensures its sustainability and provides a model to expand phage discovery to K-12 teachers and students throughout the nation.

The Most Rewarding Part: "Classroom visits are certainly a highlight of the PHAGES project for our team, and we are enthusiastically received by students. During one of our class visits, a student made the discovery of a new-to-science phage, Mycobacteriophage Elbell. We have received hundreds of thank-you letters from the participating students." – Marissa Pedulla

In the News: https://helenair.com/news/local/phage-hunting-helena-students-search-for-virus-that-could-help/article_8c41bb36-ca48-5493-920f-86262e8150e4.html

Video: A video capturing the students' excitement during the classroom visits can be viewed at https://www.youtube.com/watch?v=0XwzWcWyERY

MY HOME, MY HEALTH (MHMH): PUBLIC HEALTH RESOURCES FOR RURAL EDUCATORS

Lead by	Jamie Cornish, Ph.D., Becky Hammack, Ph.D., Selena Ahmed, Ph.D., Robert Peterson, Ph.D.
Lead Institution	Montana State University
Target Audience	Underserved middle-school youth
Funded since	2021


Jamie Cornish

Overview: The My Home, My Health program is comprised of three tribal colleges and 30 researchers across the Montana INBRE network, and its goal is to build a model for how INBRE networks can train researchers to reach underserved youth. This project involves designing activity kits and science lessons for middle school youth that draw on the research of INBRE investigators. The kits contain place-based, regionally relevant hands-on activities designed to attract underserved audiences to STEM. The kits are designed to immerse students in ongoing research projects relevant to bioscience professions and develop INBRE researchers' and informal educators' effectiveness at engaging students in place-based disease ecology investigations. The project team also intends to train 50 informal educators from around Montana on how to use the project's lessons, which is intended to improve the educators' content knowledge of disease ecology.

The Most Exciting Part: "This project involves a diverse team of researchers from a variety of institutions and disciplines, including three tribal colleges, as well as Montana INBRE investigators. Engaging collaborators and working together to build the vision for this project has been really exciting." – Jamie Cornish

In the News: An article detailing the new SEPA can be found at https://www.montana.edu/news/21405

Contact: jcornish@montana.edu

AUTHENTIC COMMUNITY ENGAGEMENT IN SCIENCE (ACES)

Lead by Matt Queen, Ph.D.
Lead Institution Montana State University Billings
Target Audience Rural elementary schools in eastern Montana
Funded since 2021

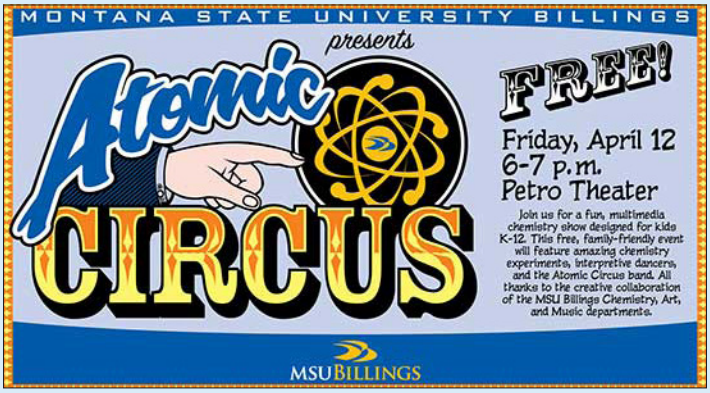

Matt Queen

Overview: Research shows that students who encounter instances of science being relevant to their everyday lives at an early age are more likely to pursue the classes that put them on track for the biomedical careers of the future. The ACES project aims to expose elementary-age students of Eastern Montana to STEM, scientific concepts and biomedical careers while helping them recognize and understand the pathways to future employment in biomedical fields. The program builds on MSUB's "The Atomic Circus," which over the past several years has worked towards bringing every fifth grader in the Billings Public School System to the MSU Billings campus for a fully scripted and immersive stage show. The show features a full rock band, interpretive dancers and a host of biochemistry demonstrations that leave audiences in awe of the power of science. The new NIH-funded SEPA project seeks to expand this experience through a collaboration with local teachers to develop a place-based curriculum that accompanies the show. Now SEPA funding is making it possible to take the show on the road and work with rural communities in eastern Montana to develop individualized curricula for each show location. The ultimate aim is to help elementary school students discover how biomedical research is relevant to their lives on a local level.

The Most Exciting Part: "Obviously the Atomic Circus stage is exciting because it's part rock concert, part interpretive dance and part biochemistry demonstration. But the new NIH-funded project designed to scale and expand this experience as well as develop place-based curriculum to accompany it is what is going to allow us to take it to an entirely different level. I'm STOKED!" – Matt Queen

Contact: matt.queen1@msubillings.edu

> "I actually heard about the SEPA program as a Montana INBRE investigator while attending a Western Regional IDeA Conference. Our SEPA program integrates INBRE's Health Education and Research Bus into our rural community nights where we open the doors of our traveling science circus to the community."




Matt Queen recieves MSU-B's 2019 Faculty Excellence Award

IDeA Network of Biomedical Research Excellence

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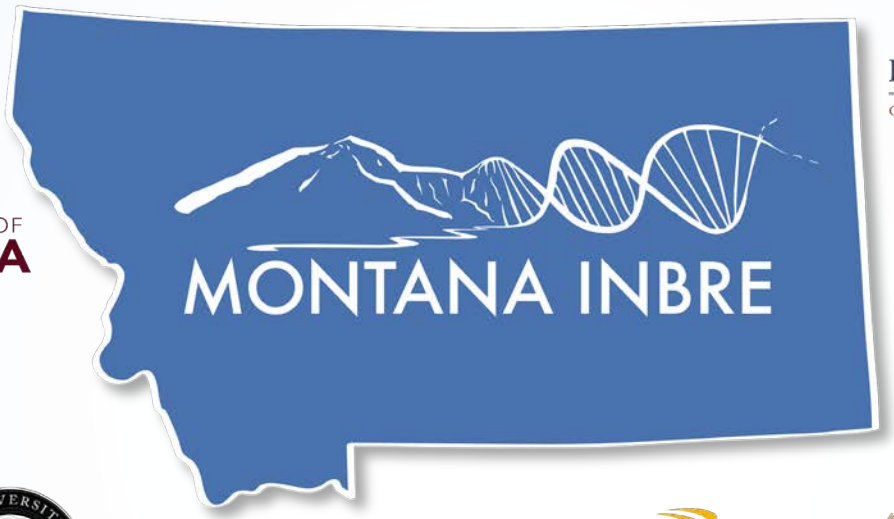

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Montana's biomedical research network

P.O. Box 173500
Montana State University
Bozeman, MT 59717-3500
406-994-3360

www.inbre.montana.edu